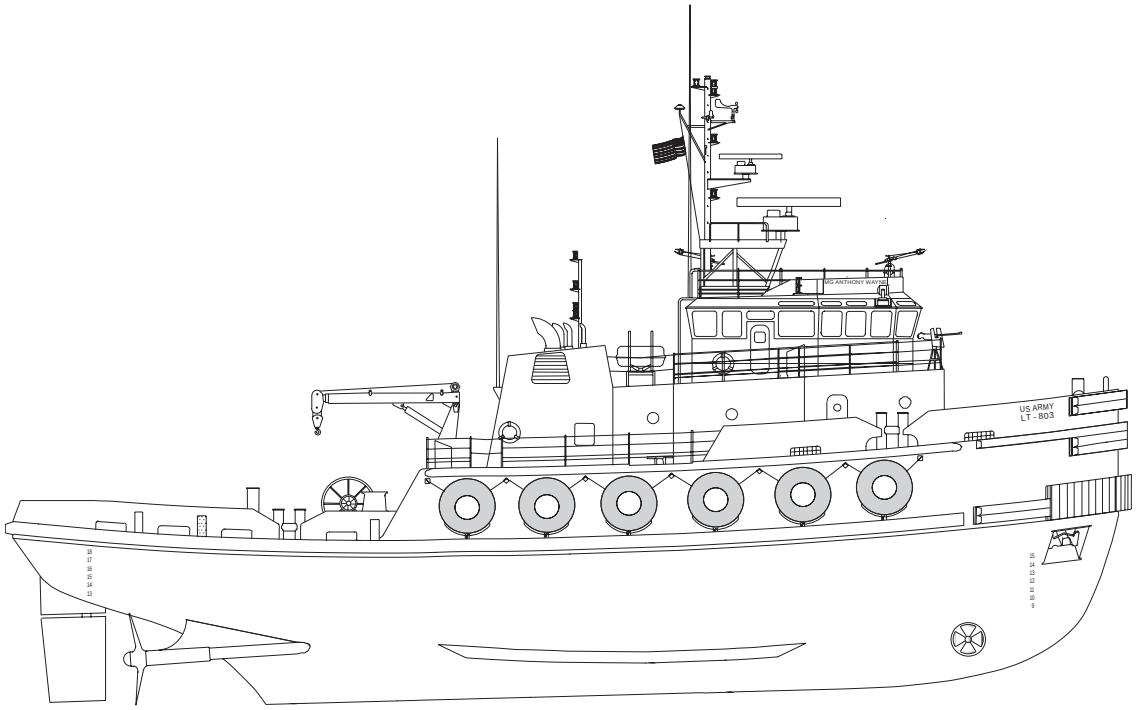
TM 55-1925-273-10-1

This manual supersedes TM 55-1925-207-10-1, dated 16 August 1991

TECHNICAL MANUAL

OPERATOR'S MANUAL
FOR
INLAND AND COASTAL LARGE TUG (LT)
NSN 1925-01-509-7013 (EIC XAG)



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HEADQUARTERS, DEPARTMENT OF THE ARMY

30 NOVEMBER 2005

WARNING SUMMARY

FIRST AID

Although the 128' Large Tug is normally assigned a medic, first aid is still an important skill for all crewmembers. The ability to promptly administer first aid to another crewmember could mean the difference between life and death for that crewmember. First aid procedures for soldiers are contained in FM 4-25.11.

WARNING SUMMARY CONTENT

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this vessel and its equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and of hazardous materials used within the technical manual.

CHLORINE AND BROMINE STORAGE AND HANDLING

Chlorine and the Water Demineralizer Cartridge (NSN 4610-01-022-9970) which contains the chemical Bromine may not be stored together. Both chemicals, Chlorine and Bromine, must follow the Federal HAZCOM standard (29 CFR 1910.1200) along with the Material Safety Data Sheet (MSDS) for each chemical. Failure to comply could result in injury or death.

GALLEY NOISE HAZARD

All crewmembers working in the galley area must wear Army Hearing Protection Devices (HPDs) and ensure that the galley doors remain closed. Failure to comply could result in injury.

GAYLORD VENTILATION AND FIRE SUPPRESSION SYSTEM

In the event that the Gaylord Ventilation and Fire Suppression system is activated and exposure to the fire suppressant occurs, all personnel exposed should immediately wash out the eyes and shower to remove residual material. Failure to comply could result in injury or death.

MACHINE GUN NOISE HAZARD

During M2 caliber 0.50 weapons firing, all personnel standing outside on deck must wear Army Hearing Protection Devices (HPDs). Failure to comply with this warning could result in serious injury.

RADIATION, RADIO ANTENNAS

Inspecting antennas with the INSA, radars, transceivers and receiver-transmitters turned on presents a radiation hazard. Ensure all transceivers and receiver-transmitters are turned off prior to inspecting antennas. Ensure that the appropriate circuit breaker has been secured, locked out, and tagged out (see WP 0008) in accordance with FM 55-502. Failure to comply could result in injury or death.

SAFETY HARNESS

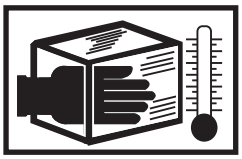
Ensure that a safety harness is worn when inspecting antennas. Failure to comply could result in injury or death.

SEWAGE

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source. Avoid open flames and prolonged breathing of fumes. Failure to comply could result in injury or death.

EXPLANATION OF SAFETY WARNING ICONS

CHEMICAL - drops of liquid on hand show that the material will cause burns or irritation to human skin or tissue.



CRYOGENIC - hand in block of ice shows that the material is extremely cold and can injure human skin or tissue.

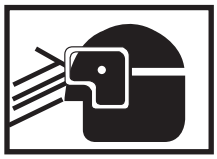
DROWNING - a figure drowning in water indicates that the danger of by death by drowning exists.

EAR PROTECTION - headphones over ears show that noise level will harm ears.

ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.

ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.

EXPLOSION - rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition, or high pressure.



EYE PROTECTION - person with goggles shows that the material will injure the eyes.

FIRE - flame shows that a material may ignite and cause burns.

EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)

FALLING PARTS - arrow bouncing off human shoulder and head shows that falling parts present adanger to life or limb.

FLYING PARTICLES - arrows bouncing off of face show that particles flying through the air will harm face.

FLYING PARTICLES - arrows bouncing off face with face shield show that particles flying through the air will harm face.

HEAVY OBJECT - human figure stooping over heavy object shows physical injury potential from improper lifting technique.

HEAVY PARTS - hand with heavy object on top shows that heavy parts can crush and harm.

HEAVY PARTS - foot with heavy object on top shows that heavy parts can crush and harm.

HEAVY PARTS - heavy object on human figure shows that heavy parts present a danger to life or limb.

HEAVY PARTS - heavy object pinning human figure against wall shows that heavy, moving parts present a danger to life or limb.

HELMET PROTECTION - arrow bouncing off head with helmet shows that falling parts present a danger.

EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)

HOT AREA - hand over object radiating heat shows that part is hot and can burn.

MOVING PARTS - human figure with an arm caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS - hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS - hand with fingers caught between rollers shows that the moving parts of the equipment present a danger to life or limb.

RADIO TRANSMISSION WARNING - Radiating lines from a radio antenna indicate the danger of radiation and electric shock hazards are present.

SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

SHARP OBJECT - pointed object in foot shows that a sharp object presents a danger to limb.

SLICK FLOOR - wavy line on floor with legs prone shows that slick floor presents a danger for falling.

VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

Date of original issue for this manual is:

Original 30 NOVEMBER 2005

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 62 AND TOTAL NUMBER OF WORK PACKAGES IS 165, CONSISTING OF THE FOLLOWING:

* Zero in this column indicates an original page or work package

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WP 0079 00 (26 pgs)	0
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* Zero in this column indicates an original page or work package

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 NOVEMBER 2005

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

INLAND AND COASTAL LARGE TUG (LT)
NSN 1925-01-509-7013 (EIC XAG)

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 (Recommended Changes to Equipment Technical Publications) through the Internet on the Army Electronic Product Support (AEPS) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or e-mail your letter or DA Form 2028 directly to: AMSTA-LC-LPIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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WP Sequence No.

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HOW TO USE THIS MANUAL

USING THIS MANUAL

When using this manual, read and understand the entire maintenance action before performing the task. Also, read and understand all warnings, cautions, and notes as well as general safety precautions that apply to the task to be performed. The warning summary will inform personnel of hazards associated with the equipment to be worked on. However, the summary is not all inclusive and personnel should be aware at all times of hazardous conditions that may arise.

ACCESSING INFORMATION

Information is accessed by referring to the table of contents, located in the front of this manual, or by looking in the alphabetical index, located in the back of this manual.

To locate information using the table of contents, first scan the chapter titles to determine the general area in which your information will be contained. After locating the proper chapter, look beneath the chapter title to find the desired informational or procedural work package title. To the right of the work package title is a work package sequence number. This work package sequence number will direct you to the proper work package. Work packages are arranged in numerical order in this manual.

To locate information using the alphabetical index, look down the subject column on the left side of the page until you find the desired subject. To the right of the subject is the work package sequence number and page number. Go to the indicated work package and indicated page number to find the desired information.

INITIAL SETUP

Initial setup requirements are located directly above many of the procedures in this manual. The information is given to ensure all materials, expendables, tools and any other equipment necessary are readily available for use. The initial setup will be accomplished prior to starting the actual steps of each maintenance procedure. There are five basic headings listed under the initial setup:

Tools and Special Tools: This section lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from table 2 of the Maintenance Allocation Chart (MAC).

Materials/Parts: This section lists all of the materials and parts required to perform the task. If the material or part is needed each time to work package is used, then it is listed here. If the part is optional, replaced on a conditional basis, or is only needed for certain specific procedures within the work package it is not listed.

Personnel Required: This section lists all personnel necessary to perform the task. When a specific MOS or other personnel qualification is required, this MOS or additional requirement is also indicated.

Equipment Conditions: This section notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number that contains the required maintenance task.

References: This section lists any other publications necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the Supporting Information chapter at the rear of this manual.

ILLUSTRATIONS

Various visual methods are used to locate and repair components. Locator illustrations in Controls and Indicator tables, Preventive Maintenance Checks and Services (PMCS) tables, exploded views, and cut-away diagrams make the information in the manual easier to understand and follow.

LOCATING MAJOR COMPONENTS

This work package gives a brief description of the major components, and provides illustrations showing the location of the components. Knowing the major components of the system is the first step to understanding system operation and maintenance.

THEORY OF OPERATION

This work package contains the theory of operation for the system. Theory of operation is provided to familiarize the user system operating principles. Once the operating principles are understood, the user is better equipped to operate, troubleshoot, and maintain the system.

DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

This work package describes all of the operator controls and indicators contained in the system. Use of the operator controls and indicators is also described. Turn to the figure that shows the desired control or indicator. Note the key number corresponding to the control or indicator. Refer to the table below the illustration and find the desired key number in the column on the far left hand side. The center column contains the name of the control or indicator and the right hand column briefly describes the control or indicator's function.

OPERATOR INSTRUCTIONS

Work packages are included in this manual to describe operation under usual conditions as well as operation under unusual conditions. Prior to performing any operating procedure, perform the initial setup by obtaining the expendables, tools, materials and other items listed prior to starting the task. Always perform the listed steps in the listed order.

TROUBLESHOOTING PROCEDURES

A troubleshooting index work package is contained in this manual to permit easy location of troubleshooting procedures. Full directions for using the troubleshooting index and the accompanying troubleshooting procedures are contained in the troubleshooting index work packages. The troubleshooting procedure work package(s) immediately follow the troubleshooting index.

ALPHABETICAL INDEX

The Alphabetical Index, located in the back of this manual, contains an alphabetical list of all sections of this manual. For example, Location and Description of Major Components is found in section L. The work package sequence number is found on the right side of the title where the Location and Description of Major Components is located. Turn to the work package indicated to find the description and location of each component.

Chapter 1

General Information, Equipment Description, and Theory of Operation for Inland and Coastal Large Tug (LT)

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
GENERAL INFORMATION

SCOPE

The information in this manual applies to all Large Tug (LT) vessels with the lowered pilothouse configuration. The primary mission of the Army LT consists of ocean and coastal towing as well as docking and undocking operations with large ocean vessels. The vessel's secondary mission is to perform general purpose harbor duties such as positioning floating cranes, etc. The LT is also equipped to provide firefighting duties, a significant capability where ammunition ships are in work. The vessel can be used to perform salvage and recovery operations on disabled or damaged watercraft in coastal or port operational areas. The LT operates in coastal, harbor, and inland waterways, as well as in the open ocean.

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, Functional Users Manual for The Army Maintenance Management System (TAMMS).

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

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 (Recommended Changes to Equipment Technical Publications) through the Internet on the Army Electronic Product Support (AEPS) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or e-mail your letter or DA Form 2028 directly to: AMSTA-LC-LMIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem 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 a corrosion problem is identified, it can be reported using SF 368 (Product Quality Deficiency Report). Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA PAM 738-750.

OZONE DEPLETING SUBSTANCES

There are no ozone depleting substances (ODS) aboard the LT. During the CFC changeout program, all ODS were eliminated and the systems that contained them appropriately modified.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For procedures to destroy this equipment to prevent its use by the enemy, refer to TM 750-244-6, Procedures for Destruction of Tank--Automotive Equipment to Prevent Enemy Use.

PREPARATION FOR STORAGE OR SHIPMENT

Detailed procedures for preparing the LT for storage or shipment are contained in TB 740-97-4, Preservation of Vessels for Storage and TM 38-470, Storage of Army Prepositioned Stock Materiel.

WARRANTY INFORMATION

Unit maintenance maintains records of the warranty status of equipment on the LT. The warranty starts on the date found in block 23 of DA Form 2408-9 (Equipment Control Record). Report all defects to your supervisor, who will take appropriate action.

LIST OF ABBREVIATIONS/ACRONYMS

Abbreviation/Acronym	Name
°C	Degrees Centigrade
°F	Degrees Fahrenheit
A	Amp(s)
AAL	Additional Authorization List
ac	Alternating Current
AEPS	Army Electronic Product Support
AFFF	Aqueous Film Forming Foam
AMS	Auxiliary Machinery Space
BERP	Bolted Equipment Removal Plate
BII	Basic Issue Items
C2	Command and Control
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance
CAPSAT	Coordinated Algebra (II) and Physics Simulated Satellite
CCW	Counterclockwise
CEN	Communication, Electronic, and Navigation
CHT	Sewage Collection, Holding, and Transfer
cm	Centimeter(s)
COEI	Components of End Item
COTS	Commercial Off the Shelf
CPC	Corrosion Prevention and Control
CPU	Central Processing Unit
CW	Clockwise
DA	Department of the Army
dB	Decibel
d/b	Distribution box
dc	Direct Current
DC	Damage Control
Dia	Diameter
DGPS	Differential Global Positioning Sensor
DSC	Digital Selective Calling
ECDIS	Electronic Chart Display and Information System
EDG	Emergency Diesel Generator
EIR	Equipment Improvement Recommendations
EOS	Enclosed Operating Station
EOT	Engine Order Telegraph
EPA	Environmental Protection Agency
EPIRB	Emergency Position Indicating Radio Beacon
EPR	Eductor Pressure
ERWWS	Engine Room Water Washdown System
ESD	Electrostatic Discharge
ETI	Elapsed Time Indicator

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
FM	Frequency Modulation
ft	Foot(feet)
ft²	Square foot(feet)
ft³/min	Cubic feet per minute
g	Gram(s)
gal	Gallon(s)
gal/min	Gallons Per Minute
GFE	Government Furnished Equipment
GMDSS	Global Marine Distress Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GSS	General Service System
HCFC	Hydrochlorofluorocarbon
HF	Hydrogen Fluoride; High Frequency
hp	Horsepower
HPU	Hydraulic Power Unit
HSLT	High Speed Low Torque
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IBS	Integrated Bridge System
IFF	Identification Friend or Foe
in	Inch(es)
in³	Cubic Inch(es)
INMARSAT	International Maritime Satellite Organizational System
JLOTS	Joint Logistics Over the Shore
kg	Kilogram
kg/cm²	Kilograms per Square Centimeter
kHz	Kilohertz
km	Kilometer(s)
km/hr	Kilometers per hour
kW	Kilowatt(s)
L	Liter(s)
lb	Pound(s)
lb-ft	Pounds-Feet (torque)
lb-in	Pounds-Inch(es)
LED	Light Emitting Diode
L/min	Liters per minute
LMI	Load Moment Indicator
LOS	Line Of Sight
L/sec	Liters per second
LSHT	Low Speed High Torque
LST	Line of Sight Tactical
LT	Large Tug
m	Meter(s)
m²	Square meter(s)
M2HB	Browning M2 Heavy Barrel .50 Caliber Machine Gun
MAC	Maintenance Allocation Chart
mb	Millibar

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
MCR	
MF	Medium Frequency
MHz	Megahertz
mL	Millileter(s)
mm	Millimeter(s)
MOPP IV	Mission Oriented Protective Posture IV
MOS	Military Occupational Specialty
MSD	Marine Sanitation Device
mW	Milliwatt
NAVTEX	Navigation Telex Receiver
NBC	Nuclear, Biological, and Chemical
NCO	Noncommissioned Officer
NDT	Non-Destructive Testing
NFPA	National Fire Protection Agency
Nm	Newton Meter
nmi	Nautical mile(s)
No.	Number
NUC	Not Under Command
OBA	Oxygen Breathing Apparatus
OCM	Oil Content Monitor
ODS	Ozone Depleting Substance(s)
OWS	Oil Water Separator
oz	Ounce(s)
PA	Public Address
PLGR	Precision Lightweight Global Positioning System Receiver
PMCS	Preventive Maintenance Checks and Services
PPE	Personal Protective Equipment
PPM	Parts Per Million
PSI	Pounds per Square Inch
PTO	Power Take-Off
QAWT	Quick-Acting Watertight Door
qt	Quart(s)
r/min	Revolutions per minute
RAI	Rudder Angle Indicator
RF	Radio Frequency
ROWPU	Reverse Osmosis Water Purification Unit
SAR	Search and Rescue
SART	Search and Rescue Transponder
sec	Second(s)
SINCGARS	Single Channel Ground and Airborne Radio
SNAP	Significant New Alternativs Policy
SOLAS	Safety of Life at Sea
SOTM	Satellite-On-The-Move
SSB	Single Sideband
SSDG	Ship's Service Diesel Generator
STBD	Starboard
STU	Secure Telephone Unit

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
t	tonne (metric)
TACSAT	Tactical Satellite
TAMMS	The Army Maintenance Management System
TFT	Thin Film Transistor
TLI	Tank Level Indicator
TMDE	Test, Measurement, and Diagnostic Equipment
TV	Television
UHF	Ultra High Frequency
UPS	Uninterruped Power Supply
USCG	United States Coast Guard
UVA	Ultrasonic Vibrator Assembly
Vac	Volts, Alternating Current
VCR	Video Cassette Recorder
Vdc	Volts, Direct Current
VHF	Very High Frequency
VICS	Vessel Information and Communication System; Vehicular Interface Control Station
W	Watt(s)
WWS	Water Washdown System
WDCM	Washdown Counter Measure
XMTR	Transmitter
yd	Yard(s)

QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this manual. If quality of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

SAFETY, CARE, AND HANDLING

The following procedures should be observed when handling all Electrostatic Discharge (ESD) sensitive components and units containing such components. Failure to observe all of these precautions can cause permanent damage to the electrostatic device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

1. Turn off and /or disconnect all power, signal sources, and loads used with the unit.

2. Place the unit on a grounded, non-conductive work surface.

3. Ground the repair operator using a non-conductive wrist strap or other device using 1 megaohm series resistor to protect the operator.

4. Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

5. All electrostatic sensitive replacement components are shipped in non-conductive foam or tubes and must be stored in the original shipping container until installed.

6. When these devices and assemblies are removed from the unit, they should be placed on the non-conductive work surface or in non-conductive containers.

7. When not being worked on, place disconnected circuit boards in plastic bags that have been coated or impregnated with a non-conductive material.

8. Do not handle these devices unnecessarily or remove them from their packages until actually used or tested.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The Large Tug (LT) is used for coastal and ocean towing, docking and undocking operations with large ocean vessels such as the SL-7 (FFS), LASH, and SEABEE vessels. The LT is capable of producing 54 long tons of bollard pull. It can tow five 231 A type barges with a payload capacity of 733 long tons per barge or five 231 B type liquid cargo barges with a payload capacity of 578 long tons per barge. The LT can sustain a minimum speed of 5 knots in Sea State 4 when under full tow as described above.

The LT is capable of self-delivery to overseas locations. It has a maximum range of 5000 nautical miles with 25 percent fuel reserve. The LT can handle high side, high flare ships.

The LT is capable of providing limited firefighting, salvage, and rescue help to other ships and shore installations. The vessel has control stations in the pilothouse and auxiliary operating stations located aft on the 01 Level (near the tow winch control station) and on the port and starboard bridge wings. Each auxiliary control station contains engine speed and steering controls, bow thruster controls, and rudder angle indicator. Included in each control station are the indicators necessary for the safe operation of the LT.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
MAIN DECK EXTERIOR

MAIN DECK EXTERIOR

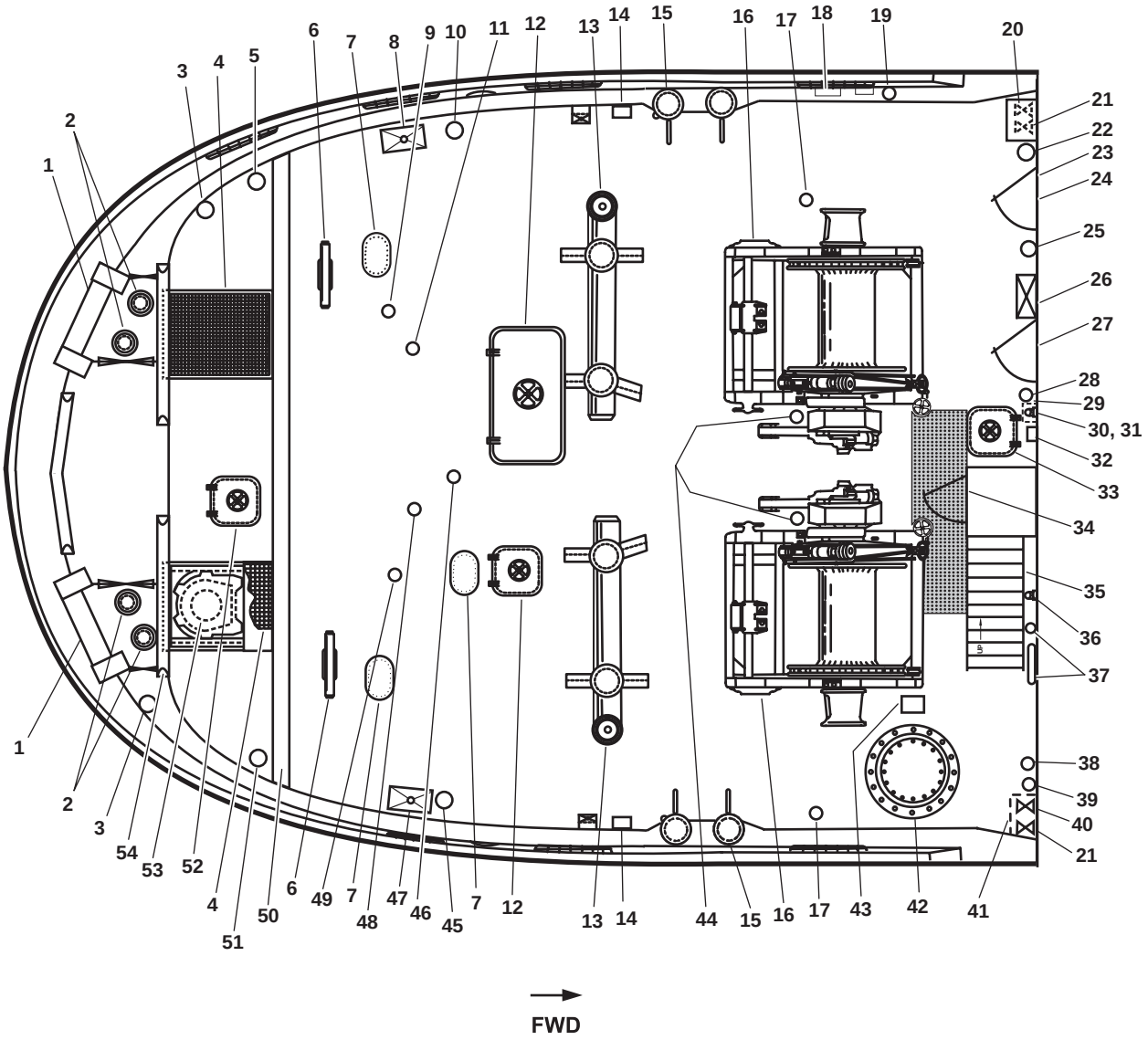


Figure 1. Main Deck Exterior

1. Tow roller (figure 1, item 1). Tow rollers reduce friction on the towing hawsers.

2. Retractable tow pins (figure 1, item 2). Pins guide the lines and hawsers to a desired location.

3. Steering gear compartment vent (figure 1, item 3). The steering gear compartment vent vents the steering gear compartment to weather.

4. Polyfiber grating (figure 1, item 4). The polyfiber grating protects the rudder motors from damage by the towing hawser.

5. Fuel oil tank 4P vent and spill container (figure 1, item 5). The fuel oil tank 4P vent vents fuel oil tank 4P to weather. The spill container contains spillage from accidental overfilling.

6. Cleat (figure 1, item 6). The cleat is used to secure lines. It maintains lateral control of the towing machine wire rope by providing an attachment point for the hawsing strap.

7. Flush manhole (figure 1, item 7). The flush manhole provides access to the void and the fuel oil tanks.

8. Tow gear locker natural air vent (figure 1, item 8). This vent provides fresh air ventilation to the port side of the tow gear locker.

9. Fuel oil tank 4P cutoff valve (figure 1, item 9). This valve provides remote cutoff for fuel oil tank 4 port.

10. Ballast tank 2P vent (figure 1, item 10). This vent provides ventilation for the port aft ballast tank.

11. Fuel oil tank 4P sounding tube (figure 1, item 11). This sounding tube permits measurement of the fuel level in fuel oil tank 4 port.

12. Hatch (figure 1, item 12). The hatch provides access to towing gear locker.

13. H-bitt (figure 1, item 13). The H-bitt fixture is used to secure the towing hawser.

14. Tow pin control (figure 1, item 14). The tow pin control raises and lowers the tow pins.

15. Double bitt (figure 1, item 15). The double bitt is used to secure (moor) the Large Tug (LT). The double bitt is also used for ship handling.

16. Towing machine (figure 1, item 16). The hydraulically powered towing machine is used for towing other vessels and barges.

17. Countermeasure washdown sprinkler (figure 1, item 17). This sprinkler uses raw water for removing Nuclear, Biological and Chemical (NBC) contamination from exterior surfaces.

18. Sound powered telephone with stowage (figure 1, item 18). The sound powered telephone is used for intraship communications.

19. High level sea chest vent (figure 1, item 19). The high level sea chest vent allows trapped air to be released to the atmosphere.

20. Portable water fill connection (figure 1, item 20). This connection permits filling of the potable water tanks from a shore supply source.

21. Sewage shore connection (figure 1, item 21). This quick disconnection is used for sewage transfer to shore facilities.

22. Port shaft seal vent (figure 1, item 22). This vent vents the port shaft seal to weather.

23. Vent trunk (figure 1, item 23). The vent truck provides ventilation to the fan room.

24. Watertight door (figure 1, item 24). This door provides access to the fan room.

25. Shore power connection (figure 1, item 25). This connection provides a power connection from the shore to the vessel.

26. Fire station 4 (figure 1, item 26). The firefighting station uses raw water for firefighting. The firefighting station is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

27. Watertight door (figure 1, item 27). This door provides access to the vestibule.

28. Aft sea chest vent (figure 1, item 28). The aft sea chest vent allows trapped air to be released to the atmosphere.

29. Refrigerant vent (figure 1, item 29). This vent allows the refrigeration and environmental control systems discharge valves to discharge refrigerant to weather.

30. Exterior lighting (figure 1, item 30). The exterior lighting illuminates the aft main deck area.

31. FM-200 exterior manual pull box (figure 1, item 31). The FM-200 exterior manual pull box is a watertight enclosure. When the exterior manual pull box is activated, the FM-200 fire exinguishing agent is discharged into the engine room and AMS 1 within 60 seconds.

32. FM-200 alarm bell (figure 1, item 32). The FM-200 alarm bell sounds 60 seconds prior to the discharge of the FM-200 fire extinguishing agent into the engine room alerting the crewmembers of an emergency situation.

33. Escape hatch (figure 1, item 33). The escape hatch provides an escape access from the AMS 2.

34. Hydraulic pipework guard raised treadplate (figure 1, item 34). This treadplate provides damage protection for the towing machine piping.

35. Garbage stowage racks (figure 1, item 35). The garbage stowage racks provide storage for garbage cans beneath the ladder.

36. Waste oil drain tank vent (figure 1, item 36). This vent vents the waste oil drain tank to weather.

37. Life ring and personal distress light marker (figure 1, item 37). The life ring is an emergency personal flotation device. The distress light marker is a life saving device that emits a high intensity strobe light. It can also operate in the infrared mode to alert allies when concealment from hostile forces is necessary. The personal distress light marker is designed to flash continuously in either mode for a minimum of 8 hours.

38. Starboard shaft seal vent (figure 1, item 38). This vent vents the starboard shaft seal to weather.

39. FM-200 CO_2 vent (figure 1, item 39). The FM-200 vent vents CO_2 from the FM-200 system to weather.

40. Oily waste discharge shore connection (figure 1, item 40). This connection provides a portal for oily waste discharge.

41. Vent trunk (figure 1, item 41). The vent trunk provides an exhaust access to weather from AMS 2.

42. Capstan (figure 1, item 42). The hydraulically powered capstan is used to work lines during mooring and ship handling.

43. Capstan control station (figure 1, item 43). The capstan control station provides controls to operate the capstan.

44. Potable water tank vents (figure 1, item 44). These vents vent the potable water tank to the weather.

45. Ballast tank 2S vent (figure 1, item 45). This vent provides ventilation for the starboard aft ballast tank.

46. Frame 6-7 void sounding tube (figure 1, item 46). This sounding tube permits sounding of the 6-7 frame void.

47. Tow gear locker natural air vent (figure 1, item 47). This vent provides fresh air ventilation to the starboard side of the tow gear locker.

48. Fuel oil tank 4S sounding tube (figure 1, item 48). The fuel oil tank 4S sounding tube is provided to measure the level of fuel oil in fuel oil tank 4S.

49. Fuel oil tank 4S cutoff valve (figure 1, item 49). This valve provides remote cutoff for fuel oil tank 4 starboard.

50. Tow bar (figure 1, item 50). The tow bar protects the polyfiber grating and rudder motors from damage caused by contact with the towing hawser(s).

51. Fuel oil tank 4S vent and spill container (figure 1, item 51). This vent vents fuel oil tank 4S to weather. The spill container contains spillage from accidental overfilling.

52. Hatch (figure 1, item 52). This hatch provides access to the steering gear compartment.

53. Rudder motor (figure 1, item 53). The rudder motors move the rudders into the requested position as directed by the helm or auxiliary control stations.

54. Chafing bar (figure 1, item 54). The chafing bar protects the polyfiber grating and the rudder motors from damage caused by contact with the towing hawser(s).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
01 LEVEL EXTERIOR

01 LEVEL EXTERIOR

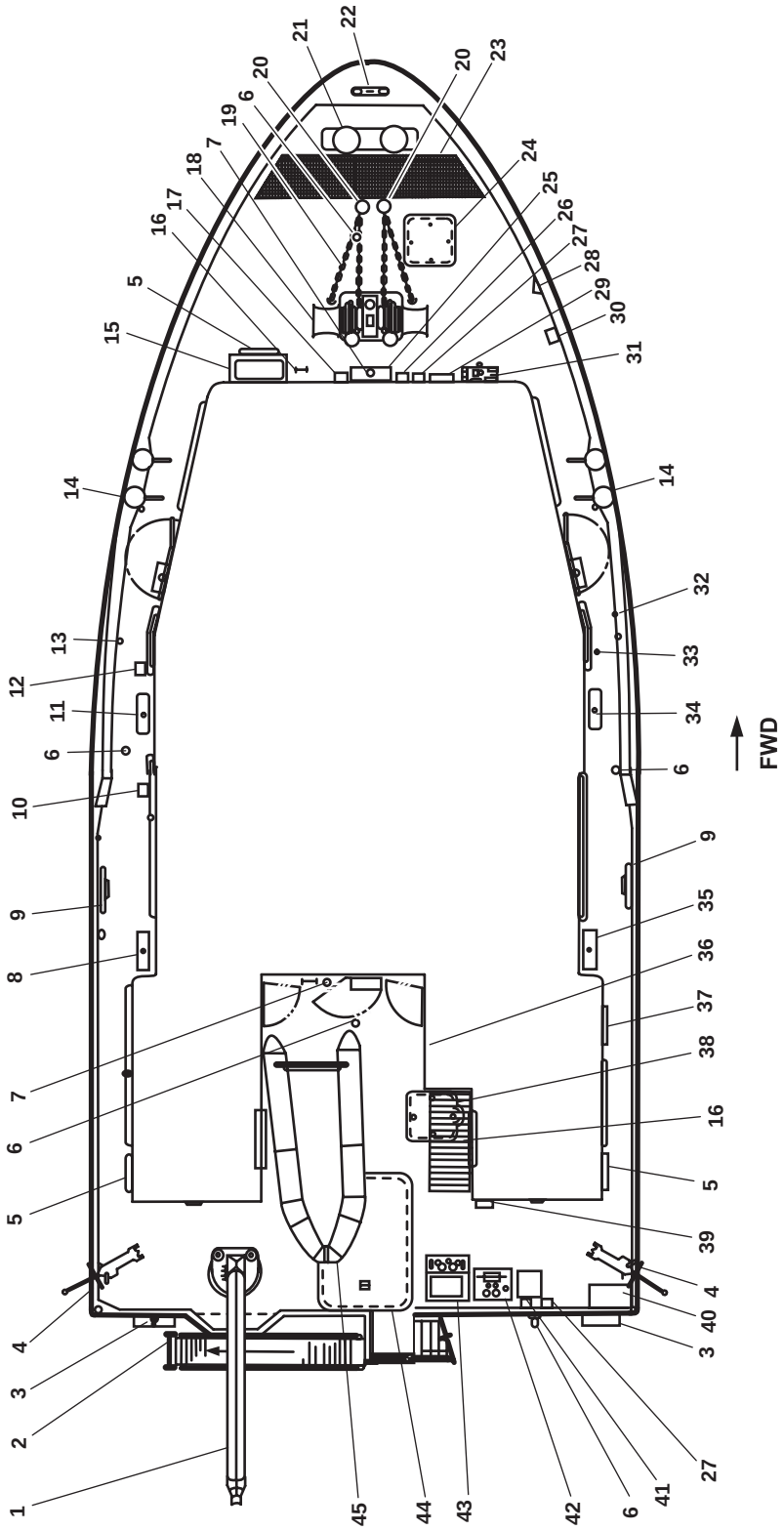


Figure 1. 01 Level Exterior

1. Crane (figure 1, item 1). The hydraulically powered crane is used to deploy and recover the workboat, to install or stow the accommodation ladder, and to handle towing gear.

2. Accommodation ladder (figure 1, item 2). When installed, the accommodation ladder provides easy access from the shore or another vessel.

3. Floodlight (figure 1, item 3). The halide floodlight provides illumination for the fantail.

4. 50 Cal. machine gun mount (figure 1, item 4). The mount supports the air cooled, belt-fed heavy machine gun (M2HB) used for vessel protection.

5. Life ring (figure 1, item 5). The life ring provides an emergency personal flotation device.

6. Countermeasure washdown sprinkler (figure 1, item 6). The countermeasure washdown sprinkler uses raw water to remove Nuclear, Biological, and Chemical (NBC) contamination.

7. Floodlight (figure 1, item 7). The adjustable 200-watt incandescent floodlight provides illumination for the aft 01 level weather deck.

8. Vent for fuel oil tank 3C and fuel oil day tank with the spill container (figure 1, item 8). The vent ventilates the oil and fuel tanks to weather. The spill container catches any overfill of fuel.

9. Cleat (figure 1, item 9). The cleat is used to secure lines.

10. Lube oil fill connection (figure 1, item 10). The lube oil fill connection provides a portal for lube oil transfer to the tanks.

11. Vent for lube oil tank, fuel oil tank 2P, and hydraulic oil tank with the spill container (figure 1, item 11). The vent ventilates the oil and fuel tanks to weather. The spill container catches any overfill of the lube oil, fuel oil, and hydraulic tank.

12. Hydraulic oil fill connection (figure 1, item 12). The hydraulic oil fill connection provides a portal for the hydraulic oil transfer to tank.

13. Lube oil tank sounding tube (figure 1, item 13). The lube oil tank sounding tube determines the level of lube oil present in the storage tank.

14. Double bitt (figure 1, item 14). The double bitt is used for towing operations and for securing (mooring) the vessel.

15. Deck locker (figure 1, item 15). The deck locker provides storage for boatswain's gear.

16. Ladder (figure 1, item 16). The ladder provides access to the 02 level weather deck.

17. Ship's bell (figure 1, item 17). The ship's bell is used for audible signaling under specified conditions.

18. Anchor windlass (figure 1, item 18). The hydraulically powered windlass is used to lower and raise the anchors. An extended shaft drives the wildcat and gypsey.

19. Chain stopper (figure 1, item 19). The chain stopper secures the anchor chain in place.

20. Hawse pipe (figure 1, item 20). The hawse pipe runs through the deck and into the anchor pocket. The hawse pipe guides the anchor chain. When the anchors are hawsed, their shanks are stored in the hawse pipe.

21. H-Bitt (figure 1, item 21). The H-bitt fixture is used to secure towing hawser or mooring lines.

22. Bull nose (figure 1, item 22). The bull nose is a metal fitting at the bow used to guide the towing hawser or mooring line.

23. Hawser drying rack (figure 1, item 23). The hawser drying rack is used for drying the hawser.

24. Watertight hatch (figure 1, item 24). The watertight hatch provides access to the boatswain's store.

25. Vents for fuel oil tank 1P and 1S with the spill container (figure 1, item 25). The vent ventilates the oil and fuel tanks 1P and 1S tanks to weather. The spill container catches any overfill of the 1P and 1S tanks.

26. Intercom (figure 1, item 26). The intercom provides intraship communications.

27. Sound powered telephone with bell (figure 1, item 27). The sound powered telephone provides intraship communications.

28. Ballast tank 1 vent (figure 1, item 28). The vent ventilates the ballast tank to weather.

29. Fire station 9 (figure 1, item 29). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

30. Sound powered telephone stowage box (figure 1, item 30). The sound powered telephone stowage box provides storage for the sound powered telephone.

31. Anchor windlass control station (figure 1, item 31). The anchor windlass control station provides controls for the anchor windlass.

32. Oily waste tank sounding tube (figure 1, item 32). The oily waste tank sounding tube determines the level of oil waste present in the storage tank.

33. Aqueous Film Forming Foam (AFFF) storage tank vent (figure 1, item 33). The AFFF storage tank vent vents the AFFF tank to weather.

34. Vents for oily waste tank and fuel oil tanks 3C and 2S with the spill container (figure 1, item 34). The vents ventilate the oily waste tank and fuel oil tanks 3C and 2S to weather. The spill container catches any overfill of the oily waste tank and fuel oil tanks 3C and 2S .

35. Emergency Diesel Generator (EDG) day tank and fuel oil day tank vents (starboard), spill container, and fill connections (figure 1, item 35). The vents ventilate the EDG day tank and fuel oil day tanks to weather (starboard). The spill container catches any overfill of the day tanks.

36. Louver vent (figure 1, item 36). The louver vent provides passive ventilation for the emergency diesel generator room.

37. EDG engine radiator exhaust louver (figure 1, item 37). The EDG engine radiator exhaust louver provides air exhaust access from the EDG compartment.

38. Flush watertight hatch (figure 1, item 38). The flush watertight hatch provides access to the galley.

39. Fire station 7 (figure 1, item 39). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

40. Gasoline can quick jettison rack (figure 1, item 40). The gasoline can quick jettison rack provides storage for three 5-gallon (19 liter) gasoline cans.

41. Ammunition locker (figure 1, item 41). The ammunition locker provides storage for the .50 cal. machine gun ammunition.

42. Aft auxiliary control station (figure 1, item 42). The aft auxiliary control station provides speed and directional control for the main propulsion system and steering control for the rudders.

43. Towing machine control station (figure 1, item 43). The towing machine control station provides controls for the port and starboard towing machine and tow pins.

44. Soft patch (figure 1, item 44). The soft patch is a watertight bolted panel that can be removed to allow large machinery removal.

45. Work boat (figure 1, item 45). The work boat is a seven-person, 13 ft (3.9 m) long, rigid bottom, inflatable boat. The workboat is equipped with a console steering unit and a 40 hp (29.8 kW) outboard motor.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
02 LEVEL EXTERIOR

02 LEVEL EXTERIOR

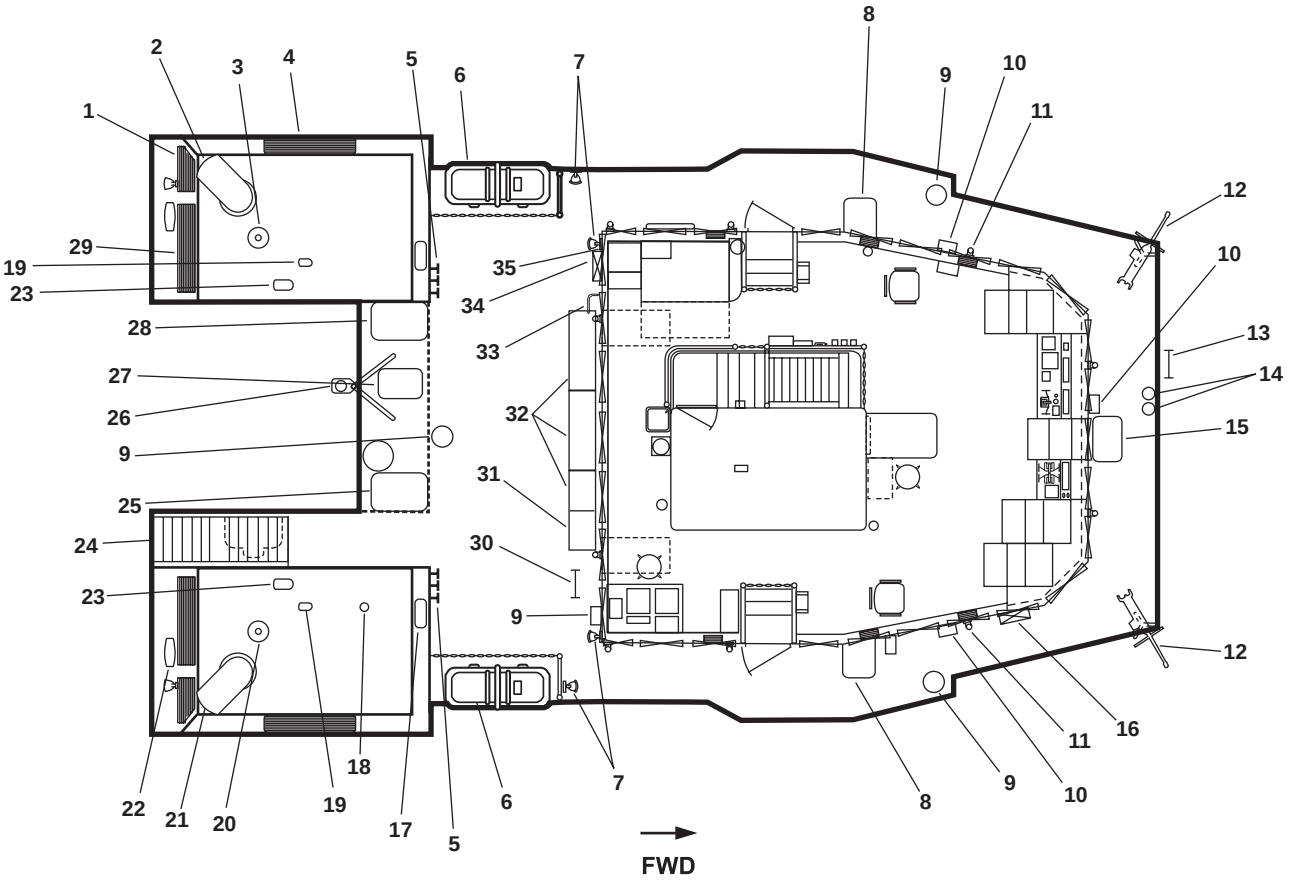


Figure 1. 02 Level Exterior

1. Main engine combustion air intake (figure 1, item 1). The main engine combustion air intake provides fresh air to the main engine's combustion system.

2. Port main engine exhaust (figure 1, item 2). This exhaust discharges the port main engine's exhaust to weather.

3. Medium Frequency (MF), High Frequency (HF), Global Maritime Distress Safety System (GMDSS) whip antenna, model, 5300 (figure 1, item 3). This antenna is coupled to the MF/HF tranceiver for the GMDSS. Refer to TM 55-5821-311-10 for details.

4. Engine room vent air exhaust (figure 1, item 4). The engine room vent air exhaust provides exhaust for the engine room.

5. Engine room ventilation damper handles (figure 1, item 5). These three ventilation damper handles OPEN and CLOSE the main engine intake, the engine room ventilation intake, and the engine room exhaust vent.

6. Life raft (figure 1, item 6). The inflatable life raft provides holding capacity for 25 crewmembers.

7. Flood light (port and starboard) (figure 1, item 7). The flood light provides illumination for night towing operations.

8. Bridge wing control station (port and starboard) (figure 1, item 8). The bridge wing control station provides auxiliary control of steering, propulsion engines, and the bow thruster engine.

9. Column bearing repeater stand (figure 1, item 9). The bearing repeater stand is a compass repeater for the gyrocompass system.

10. Sound powered telephone (figure 1, item 10). The sound powered telephone provides communication to various areas of the vessel.

11. Deck light (figure 1, item 11). The deck light provides illumination for 02 deck and surrounding area.

12. Air cooled, belt-fed heavy machine gun (M2HB) (port and starboard) (figure 1, item 12). The M2HB is provided for vessel and crew defense.

13. Vertical ladder (figure 1, item 13). The vertical ladder provides access to the 01 deck.

14. Bow thruster and pump drive engine crankcase ventilation tubes (figure 1, item 14). These tubes vent the bow thruster and the pump drive engine crankcases to weather.

15. Ammunition locker (figure 1, item 15). The ammunition locker provides secure storage for ammunition.

16. Fire station 11 (figure 1, item 16). Firefighting station 11 uses raw water. This fire station is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

17. Port and starboard upper stack access hatch (figure 1, item 17). The upper stack access hatch provides access to the upper stack.

18. Emergency Diesel Engine (EDG) exhaust (figure 1, item 18). This exhaust discharges the EDG's exhaust to weather.

19. Bow thruster engine exhaust (figure 1, item 19). This exhaust discharges the bow thruster's engine exhaust to weather.

20. HF whip tactical antenna, model 4201N (figure 1, item 20). This antenna is coupled to the receiver-transmitter. Refer to TM 55-5825-311-10 for details.

21. Starboard main engine exhaust (figure 1, item 21). This exhaust discharges the starboard main engine's exhaust to weather.

22. Lower stack access hatch (figure 1, item 22). The lower stack access hatch provides access to the lower stack.

23. Ship Service Diesel Generator (SSDG) exhaust vent (figure 1, item 23). This vent discharges the SSDG engine's exhaust to weather.

24. 01/02 deck level ladder (figure 1, item 24). The 01/02 deck level ladder provides access between the 01 and 02 decks.

25. Paint locker (figure 1, item 25). The paint locker provides storage for the vessel's paint and associated supplies. The paint locker is properly outfitted for hazardous materials.

26. Aft mast (figure 1, item 26). The mast provides mounting for many of the vessel's navigation lights and for various antennae.

27. Grenade locker (figure 1, item 27). The grenade locker provides secure storage for grenades.

28. Pyrotechnic locker (figure 1, item 28). The pyrotechnic locker provides secure storage for pyrotechnic materiel.

29. Engine room vent air intake (figure 1, item 29). The engine room vent air intake provides fresh air to the engine room.

30. Vertical ladder (figure 1, item 30). The vertical ladder provides access to the pilothouse top.

31. Battery box (figure 1, item 31). The battery box provides dry storage for batteries.

32. Emergency gear storage locker (figure 1, item 32). The emergency gear storage locker provides storage for emergency gear.

33. Compressed air weather tool connection (figure 1, item 33). This connection provides a quick disconnect for compressed air.

34. Fire station 10 (figure 1, item 34). Firefighting station 10 uses raw water. This fire station is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

35. Potable water bibb (figure 1, item 35). This hose bibb supplies potable water to the 02 deck level.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
PILOTHOUSE TOP AND MASTS

PILOTHOUSE TOP

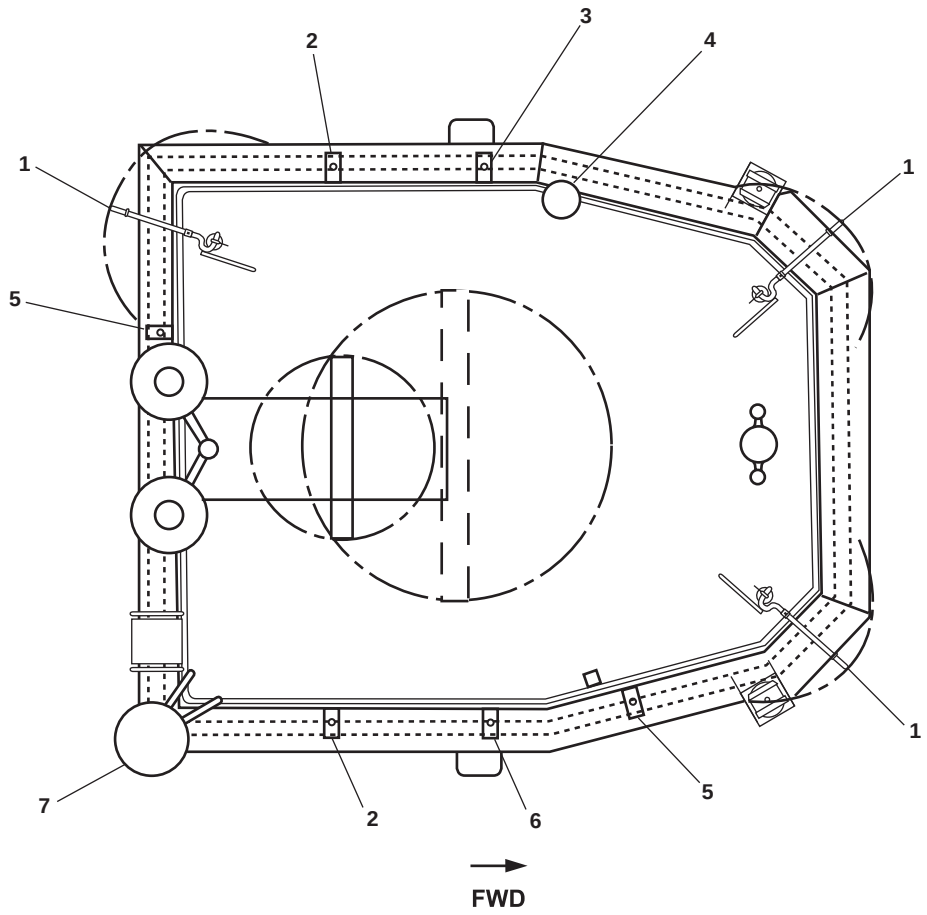


Figure 1. Pilothouse Top

1. Fire monitors (figure 1, item 1). The fire monitors supply water for fighting fires on the vessel, but are used primarily for other vessels.

2. Multimission tactical, multiband (Shakespeare SF3512/VRC) whip antenna (figure 1, item 2). This antenna is coupled to the vessel's Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) system. Refer to TM 55-5825-311-10 for details.

3. Watch receiver antenna (Shakespeare 390) (figure 1, item 3). This antenna is coupled to the High Frequency (HF) vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.

4. Television (TV) and radio antenna (Naval Electronics Mk 12) (figure 1, item 4). This antenna is coupled to the vessel's entertainment TV.

5. VHF whip (5225-XT) (figure 1, item 5). This antenna is coupled to the vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.

6. Navtex receiver antenna (Shakespeare 390) (figure 1, item 6). This antenna is coupled to the vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.

7. Radio Frequency (RF) transceiver fleet 77 antenna (TT-3008C) (figure 1, item 7). The antenna is couple to International Maritime Satellite Organization (INMARSAT) System. Refer to TM 55-5825-311-10 for details.

MAST: AFT

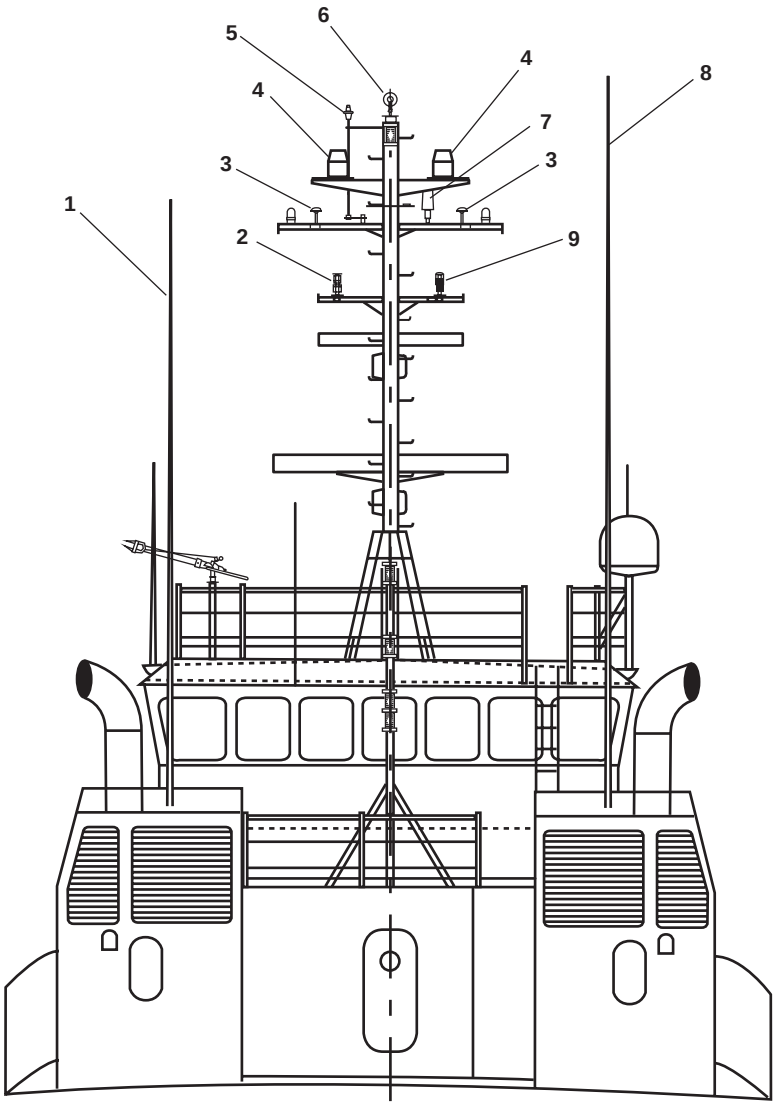


Figure 2. Mast: Aft

1. Medium Frequency (MF)/High Frequency (HF) Global Maritime Distress Safety System (GMDSS) model, 5300 antenna (figure 2, item 1). This antenna is coupled to the MF/HF transceiver for the GMDSS. Refer to TM 55-5825-311-10 for details.

2. Barometric pressure sensor (61202) (figure 2, item 2). This sensor detects exterior atmospheric pressure.

3. Global Positioning System (GPS)/Differential Global Positioning Sensor (DGPS) antenna (figure 2, item 3). This antenna is coupled to the Integrated Bridge System (IBS). Refer to TM 55-5825-311-10 for details.

4. Tactical Satellite (TACSAT) Satellite-On-The-Move (SOTM) GV-2432 antenna (figure 2, item 4). This antenna is coupled with the UHF radio set. Refer to TM 55-5825-311-10 for details.

5. GMDSS J8 INMARSAT Coordinated Algebra (II) & Physics Simulated Satellite (CAPSAT) antenna (figure 2, item 5). This antenna is coupled to the GMDSS. Refer to TM 55-5825-311-10 for details.

6. Marine wind tracker (model 06206) (figure 2, item 6). The marine wind tracker provides windspeed and direction display. The marine wind tracker also provides detailed information on relative wind angle.

7. IFF antenna (AS-1778/UPX) (figure 2, item 7). This antenna is coupled to the vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.

8. HF whip tactical (4201N) antenna (figure 2, item 8). This antenna is coupled to the tactical HF radio system. Refer to TM 55-5825-311-10 for details.

9. Humidity and temperature sensor (figure 2, item 9). The humidity and temperature sensor detects exterior atmospheric humidity and temperature.

NAVIGATION LIGHTS AND RADARS: STARBOARD

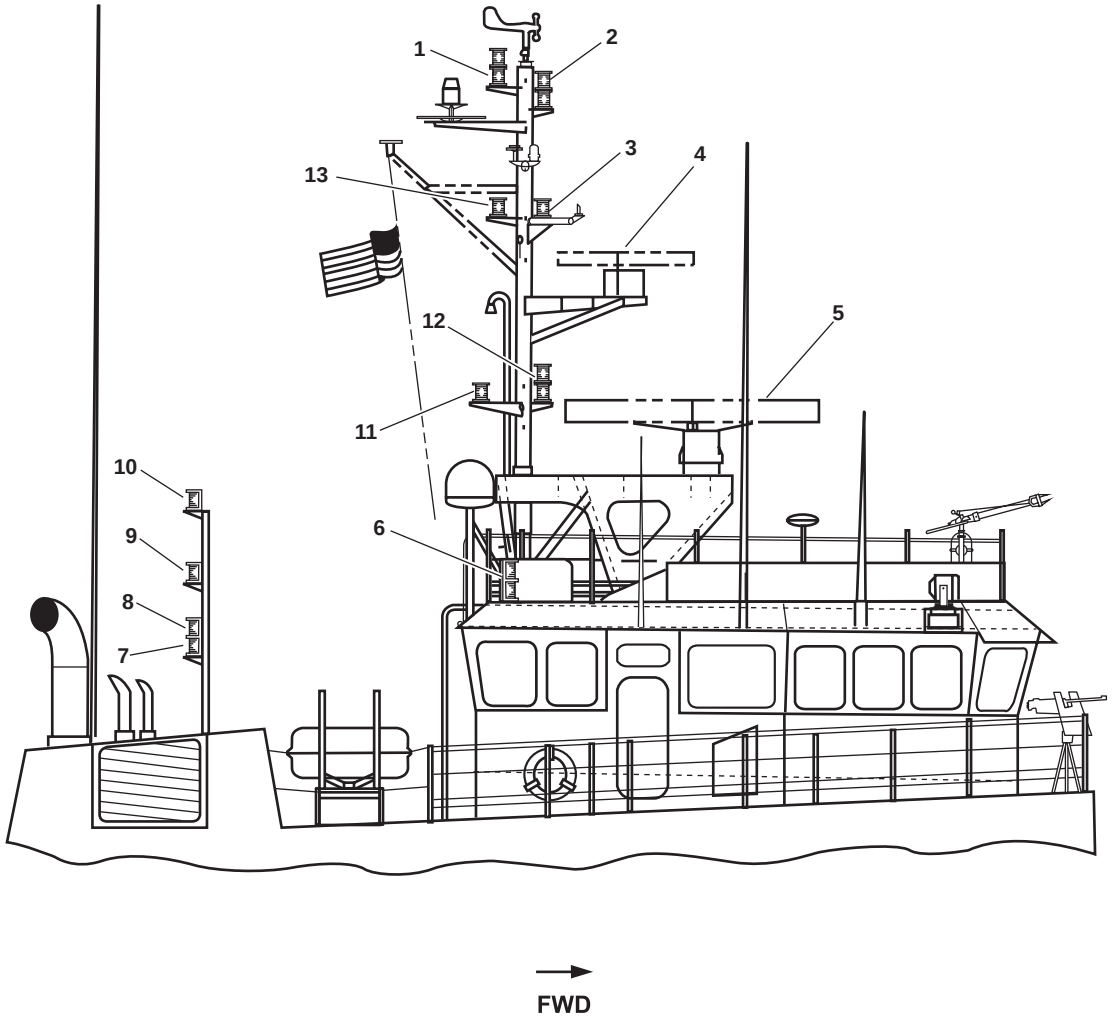


Figure 3. Navigation Lights, And Radars: Starboard View

1. Restricted in ability to maneuver and not under command (top light red) and anchor (bottom light white) lights (figure 3, item 1). The top light illuminates when the vessel has restricted maneuverability. The bottom light illuminates when the vessel's anchor is lowered. Both lights are visible for 360°.

2. Towing (white top light) and steaming (white bottom light) lights (figure 3, item 2). This light illuminates when the vessel is towing and/or steaming. The towing and steaming light provides a 225° arc of white light.

3. Towing and restricted in ability to maneuver white light (figure 3, item 3). This light illuminates when the vessel is towing and/or the vessel has restricted maneuverability. The towing and restricted in ability to maneuver light provides a 225° arc of yellow light.

4. X-Band radar Raytheon M28342 (figure 3, item 4). This radar provides transmission and reception of X-Band radar waves. The X-Band radar communicates imagery to the X-Band modulator XMTR receiver. The X-Band radar is used for prevention of collisions between vessels and as an aid to navigation when close to shore.

5. S-band radar Raytheon M28346 (figure 3, item 5). This radar provides transmission and reception of S-Band radar waves. The S-Band radar communicates imagery to the S-Band modulator XMTR receiver. The S-Band radar assures target detection in adverse weather where X-Band radars are heavily affected by sea or rain clutter.

6. Side lights (figure 3, item 6). The side lights provide a 112.5° arc of light. The port side lights are red and the starboard side lights are green.

7. Stern light (figure 3, item 7). The stern light provides a 135° arc of white light visible from astern the vessel.

8. Towing stern light (figure 3, item 8). The towing stern light provides a 135° arc of yellow light visible from astern the vessel.

9. Inland side tow light (figure 3, item 9). The inland side tow light provides a 135° arc of yellow light visible from astern the vessel.

10. Towing/pushing light (figure 3, item 10). The towing/pushing light provides a 135° arc of yellow light visible from astern the vessel.

11. Restricted in ability to maneuver and not under command red light (figure 3, item 11). This light illuminates when the vessel has restricted maneuverability and is visible for 360°.

12. Towing (top white) and restricted in ability to maneuver and not under command (bottom red) lights (figure 3, item 12). The top white light is illuminated during towing operations, and is visible for 225°. The bottom red light is illuminated during restricted maneuverability and is visible for 360°.

13. Restricted in ability to maneuver white light (figure 3, item 13). This light illuminates when the vessel has restricted maneuverability and is visible for 360°.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
PILOTHOUSE INTERIOR

PILOTHOUSE INTERIOR (PLAN VIEW)

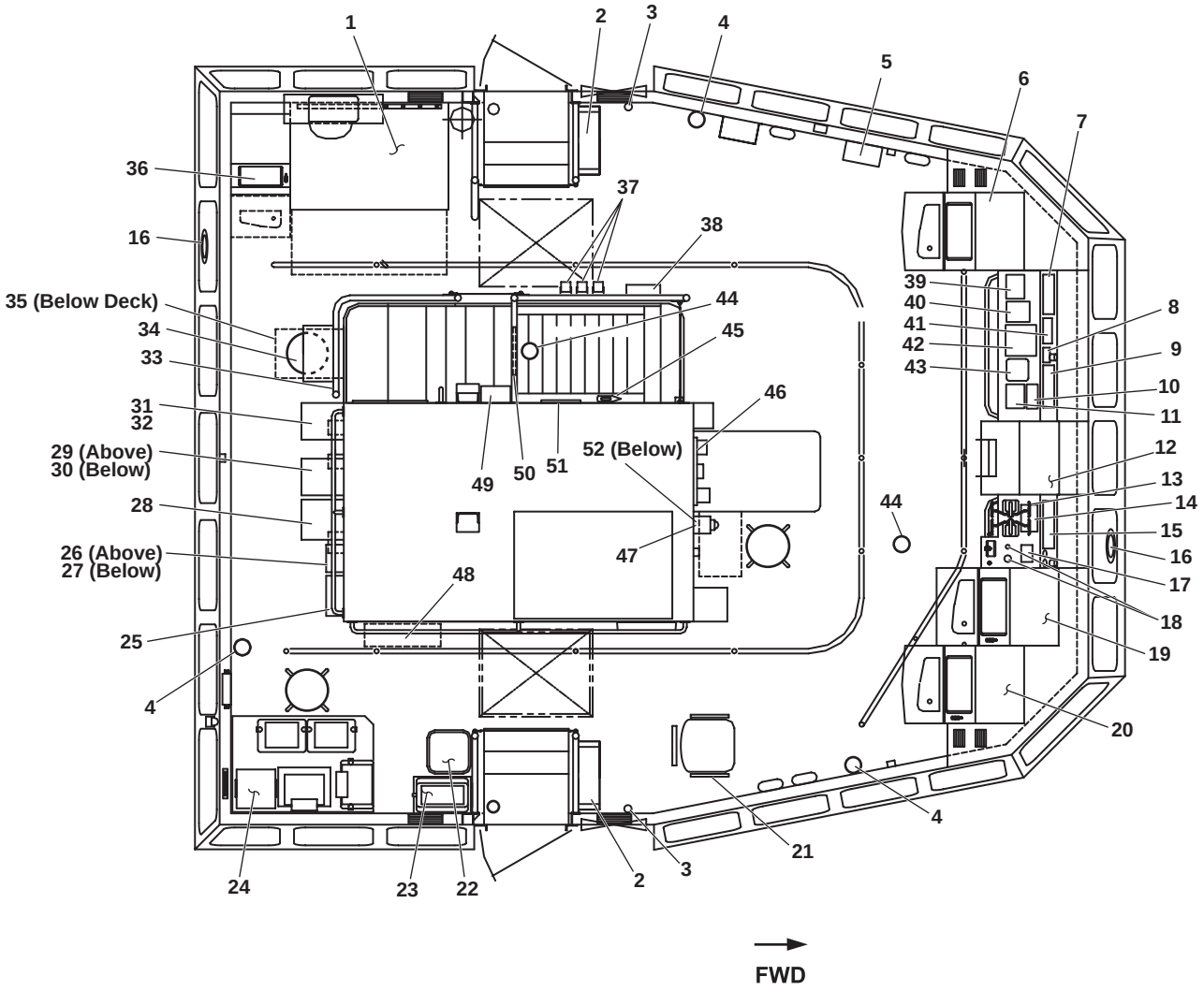


Figure 1. Pilothouse Interior (Plan View)

1. Chart table (figure 1, item 1). The chart table provides open working space for navigation charts.

2. Life preserver storage (figure 1, item 2). Storage is provided for four life preservers. Two are stowed on the port side and two on the starboard side.

3. Search And Rescue Transponder (SART) (figure 1, item 3). Two SARTs are provided, one for each life raft. The SART aids rescue personnel in locating the life rafts.

4. Fire extinguisher (figure 1, item 4). Three 10-pound dry chemical fire extinguishers are located in the pilothouse to permit extinguishing of small fires.

5. Door alarm switchboard (figure 1, item 5). The door alarm switchboard alerts pilothouse personnel to open door conditions for the radio room, arms locker, and main deck fan room. The door alarm switchboard also alerts the pilothouse personnel when the arms locker raw water drenching system has been activated.

6. X Band radar display (figure 1, item 6). The X band radar display is used for navigation.

7. Pilothouse port Heating, Ventilation, and Air Conditioning (HVAC)/fresh air panel (figure 1, item 7). The pilothouse HVAC/fresh air panel provides controls for the port side pilothouse rooftop air conditioning unit and for the pilothouse fresh air fans.

8. Engine Order Telegraph (EOT) power failure panel (figure 1, item 8). The EOT power failure panel notifies pilothouse personnel when an EOT power failure has occurred.

9. EOT transceiver (figure 1, item 9). The EOT transceiver transmits and receives engine order commands between the pilothouse and the EOS.

10. Deck/console lighting panel (figure 1, item 10). The deck/console lighting panel provides controls for deck and console lighting.

11. Starboard searchlight control station (figure 1, item 11). The starboard searchlight control station provides controls for the starboard searchlight.

12. Steering stand (figure 1, item 12). The steering stand provides helm controls for the vessel.

13. Port and starboard main engine throttles (figure 1, item 13). The port and starboard main engine throttles control the speed of the main engines and the direction of rotation of the propeller shafts.

14. Pilothouse starboard HVAC panel (figure 1, item 14). The pilothouse starboard HVAC panel provides controls for the starboard side pilothouse rooftop air conditioning unit.

15. Remote propulsion indicator panel (figure 1, item 15). The remote propulsion indicator panel provides instrumentation for the main engines and for the bow thruster.

16. Clearview screen (figure 1, item 16). Two clearview screens are provided to maximize pilothouse visibility in rain, snow, and sleet. One clearview screen is mounted forward, the other aft.

17. Bow thruster START/STOP controls (figure 1, item 17). The bow thruster START/STOP controls permit pilothouse personnel to START and STOP the bow thruster engine.

18. Bow thruster control (figure 1, item 18). The bow thruster control permits pilothouse personnel to control the speed and direction of the bow thruster.

19. Primary Electronic Chart Display and Information System (ECDIS) display (figure 1, item 19). The primary ECDIS display provides an interface between key navigation components permitting pilothouse personnel to perform trip planning and navigation tasks.

20. S Band radar display (figure 1, item 20). The S band radar display is used for navigation.

21. Navigator's chair (figure 1, item 21). The navigator's chair provides seating for the navigator.

22. Drinking fountain (figure 1, item 22). The drinking fountain provides chilled potable water for personal consumption by pilothouse personnel.

23. Coffee maker (figure 1, item 23). The coffee maker brews coffee and maintains the brewed coffee at an acceptable temperature.

24. Global Maritime Distress and Safety System (GMDSS) suite (figure 1, item 24). The GMDSS suite provides emergency and distress communication between the Large Tug (LT), other vessels, and shore stations.

25. 120V radar power distribution panel (figure 1, item 25). The 120V radar power distribution panel provides circuit breakers for the X band and S band radars.

26. Uninterrupted Power Supply (UPS) bypass and disconnect switch box. (figure 1, item 26). The UPS bypass and disconnect switch box permits bypassing or disconnection of the UPSs for the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) gear.

27. Radar distribution panel isolation transformer (figure 1, item 27). The radar distribution panel isolation transformer protects the radar gear from electrical anomalies.

28. 24V general alarm battery charger (figure 1, item 28). The 24V general alarm battery charger maintains the charge for the general alarm battery bank.

29. 24V GMDSS battery charger (figure 1, item 29). The 24V GMDSS battery charger maintains the charge for the GMDSS battery bank.

30. GMDSS disconnect switch (figure 1, item 30). The GMDSS disconnect switch secures power to the 24V GMDSS battery charger.

31. 12V marine radio battery charger (figure 1, item 31). The 12V marine radio battery charger maintains the charge for the 12V marine radio battery.

32. 12V disconnect switch (figure 1, item 32). The 12V disconnect switch secures power to the 12V marine radio battery charger.

33. Gyrocompass control unit (figure 1, item 33). The gyrocompass control unit provides controls for the gyrocompass.

34. Gyrocompass (figure 1, item 34). The gyrocompass provides accurate directional data to pilothouse personnel and to key navigational gear.

35. Integrated Bridge System (IBS) UPS units (figure 1, item 35). The IBS UPS units provided uninterrupted power to the IBS gear.

36. Backup ECDIS display (figure 1, item 36). The backup ECDIS display provides a second ECDIS work station.

37. Survival radios (figure 1, item 37). Three survival radios are provided to enable the life rafts to communicate with search and rescue personnel.

38. First aid kit (figure 1, item 38). The first aid kit provides emergency medical supplies.

39. Port searchlight control station (figure 1, item 39). The port searchlight control station provides controls for the port searchlight.

40. Fire pump START/STOP panel (figure 1, item 40). The fire pump START/STOP panel permits pilothouse personnel to START and STOP the fire and general service pumps.

41. Alarm panel (figure 1, item 41). The alarm panel notifies pilothouse personnel of flooding and of power interruption to key battery chargers.

42. 21 MC intercom (figure 1, item 42). The 21 MC intercom provides internal communication between stations located throughout the vessel.

43. Rudder angle indicator (figure 1, item 43). The rudder angle indicator displays the angle and direction of the rudders.

44. Ionization Smoke Detector (figure 1, item 44). Two ionization smoke detectors are mounted in the pilothouse overhead. The ionization smoke detectors activate the fire and smoke alarm system when smoke is detected.

45. Fire axe (figure 1, item 45). The fire axe is used in firefighting and damage control situations.

46. Vehicular Interface Control Station (VICS) (figure 1, item 46). The VICS station permits pilothouse personnel to utilize the tactical radios.

47. Sound powered telephone (figure 1, item 47). The sound powered telephone permits communication among between the pilothouse and the other sound powered telephone stations throughout the vessel.

48. Drawing cabinet (figure 1, item 48). The drawing cabinet provides storage for navigational charts.

49. Navigation light panel (figure 1, item 49). The navigation light panel provides controls and circuit protection for the vessel's navigation lights.

50. Clinometer (heel) (figure 1, item 50). This clinometer indicates the vessel's heel angle.

51. Clinometer (trim) (figure 1, item 51). This clinometer indicates the vessel's trim angle.

52. Damage Control (DC) status board (figure 1, item 52). This board permits pilothouse personnel to post and update the damage control status of the vessel.

PILOTHOUSE INTERIOR (LOOKING TO PORT)

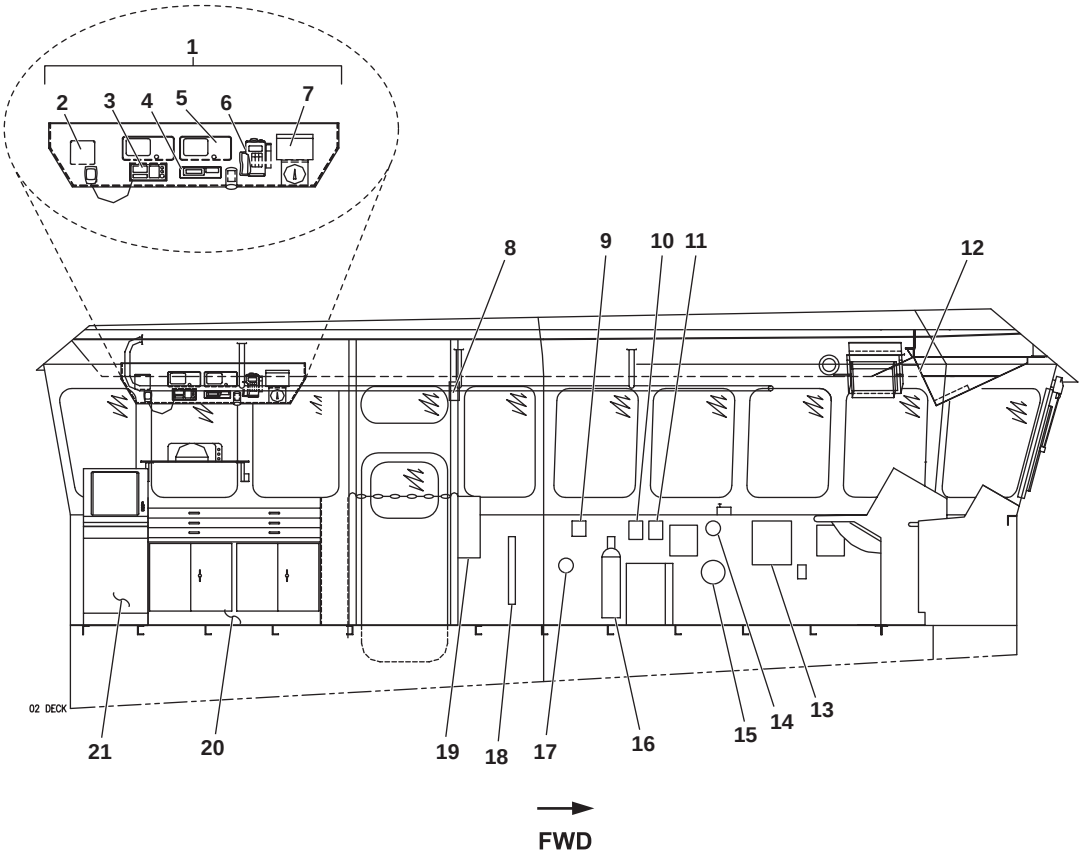


Figure 2. Pilothouse Interior (Looking to Port)

1. Aft chart table overhead console (figure 2, item 1). The aft chart table overhead console contains various pieces of navigation and communication gear including a marine Very High Frequency (VHF) radio, Precision Lightweight GPS (Global Positioning System) Receiver (PLGR), and wind speed/direction readouts.

2. Speaker (figure 2, item 2). This speaker broadcasts output from the marine VHF radio.

3. Marine VHF radio (figure 2, item 3). The marine VHF radio permits communication between the LT and other vessels and shore stations.

4. Wind tracker translator box (figure 2, item 4). The wind tracker translator box receives input from the masthead wind tracker unit and translates that input into a display on the AN/PSN-11 wind tracker.

5. Leica GPS units (figure 2, item 5). These commercial GPS units provide accurate positional information to pilothouse personnel and to various electronic navigational systems.

6. PLGR (figure 2, item 6). This GPS unit provides accurate positional information to pilothouse personnel and to various electronic navigational systems.

7. AN/PSN-11 wind tracker (figure 2, item 7). The AN/PSN-11 wind tracker displays wind speed and wind direction information.

8. Fire alarm pull station (figure 2, item 8). The fire alarm pull station permits pilothouse personnel to manually actuate the fire and smoke detection alarm.

9. Fire detection remote indicator panel (figure 2, item 9). The fire detection remote indicator panel alerts pilothouse personnel to fire and smoke alarm indications from the vessel's four zones.

10. Emergency STOP switch for recirculation fan R01-32-2 (figure 2, item 10). The emergency STOP switch for recirculation fan R01-32-2 permits pilothouse personnel to STOP this fan (located in the 01 level fan room) in an emergency.

11. Emergency STOP switch for exhaust fan E01-44-02 (figure 2, item 11). The emergency STOP switch for exhaust fan E01-44-02 permits pilothouse personnel to STOP this fan (located in the 01 level fan room) in an emergency.

12. IBS distribution panel (figure 2, item 12). The IBS distribution panel provides circuit breakers for the IBS system.

13. Door alarm switchboard (figure 2, item 13). The door alarm switchboard alerts pilothouse personnel to open door conditions for the radio room, arms locker, and main deck fan room. The door alarm switchboard also alerts the pilothouse personnel when the arms locker raw water drenching system has been activated.

14. General alarm contact maker (figure 2, item 14). The general alarm contact maker permits pilothouse personnel to actuate the general alarm system.

15. General alarm bell (figure 2, item 15). The general alarm bell sounds whenever the general alarm system is actuated.

16. Fire extinguisher (figure 2, item 16). Three 10-pound dry chemical fire extinguishers are located in the pilothouse to permit extinguishing of small fires.

17. Fire detector alarm bell (figure 2, item 17). The fire detector alarm bell sounds whenever the fire and smoke alarm system senses an alarm condition in one of its four zones.

18. Search And Rescue Transponder (SART) (figure 2, item 18). Two SARTs are provided, one for each life raft. The SART aids rescue personnel in locating the life rafts.

19. Life preserver storage (port) (figure 2, item 19). Storage is provided for two life preservers.

20. Chart table (figure 2, item 20). The chart table provides open working space for navigation charts.

21. Backup ECDIS display (figure 2, item 21). The backup ECDIS display provides a second ECDIS work station.

PILOTHOUSE INTERIOR (LOOKING TO STARBOARD)

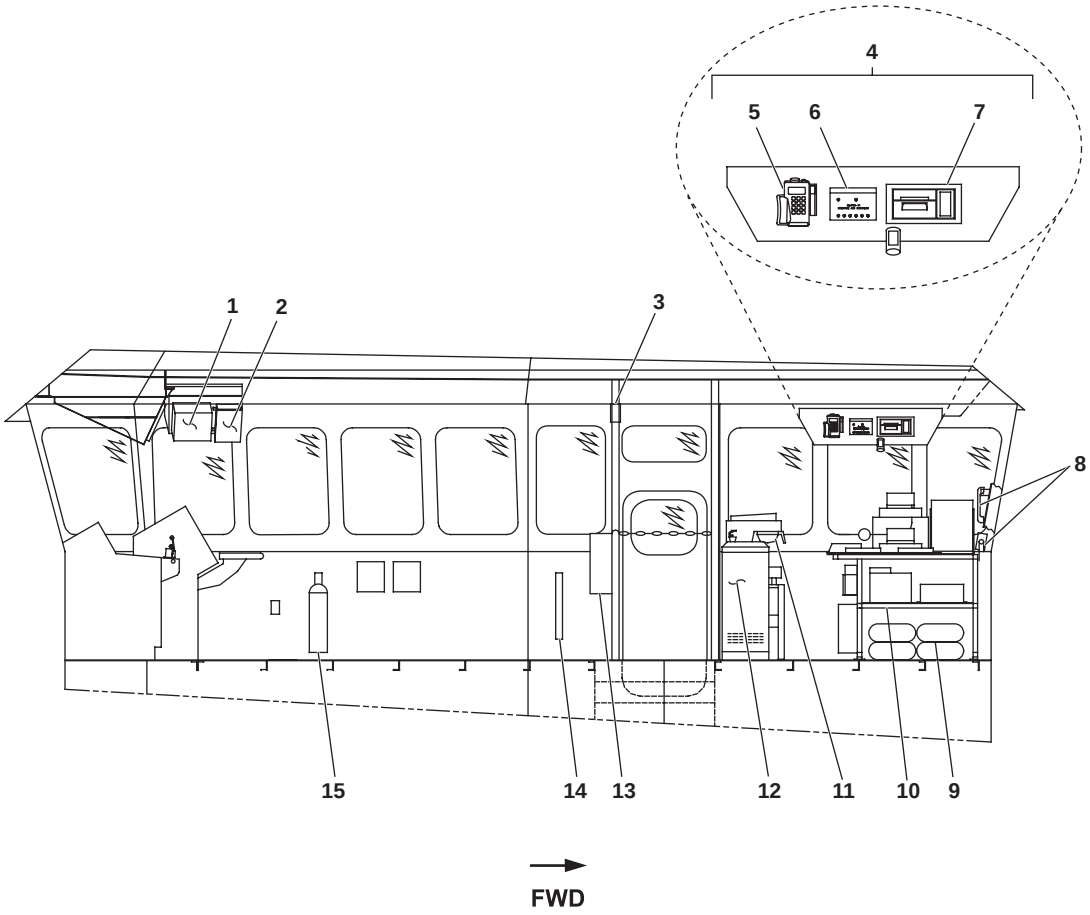


Figure 3. Pilothouse Interior (Looking to Starboard)

1. Towing strain gauge (figure 3, item 1). The towing strain gauge provides a display of the strain on the towing machines' wire ropes.

2. Fog horn timer (figure 3, item 2). The fog horn timer permits pilothouse personnel to select between programmed fog horn signals.

3. Fire alarm pull station (figure 3, item 3). The fire alarm pull station permits pilothouse personnel to manually actuate the fire and smoke detection alarm.

4. GMDSS suite (figure 3, item 4). The GMDSS suite provides emergency and distress communication between the Large Tug (LT), other vessels, and shore stations.

5. PLGR (figure 3, item 5). This GPS unit provides accurate positional information to pilothouse personnel and to various electronic navigational systems.

6. AN/PSN-11 switchbox (figure 3, item 6). The AN/PSN-11 switchbox permits interface between communication and navigation equipment.

7. Navigational Telex (NAVTEX) receiver (figure 3, item 7). The NAVTEX receiver receives and prints out navigational information.

8. High Frequency (HF)/Single Side Band (SSB) radio (figure 3, item 8). The HF/SSB radio provides long distance communication capability for the LT.

9. Survival suits (figure 3, item 9). Four survival suits are stowed beneath the GMDSS table. The survival suits maximize survivability in abandon ship situations.

10. GMDSS table (figure 3, item 10). The GMDSS table holds many components of the GMDSS suite and provides a work area for GMDSS operation.

11. Coffee maker (figure 3, item 11). The coffee maker brews coffee and maintains the brewed coffee at an acceptable temperature.

12. Drinking fountain (figure 3, item 12). The drinking fountain provides chilled potable water for personal consumption by pilothouse personnel.

13. Life preserver storage (starboard) (figure 3 item 13). Storage is provided for two life preservers.

14. Search And Rescue Transponder (SART) (figure 3, item 14). Two SARTs are provided, one for each life raft. The SART aids rescue personnel in locating the life rafts.

15. Fire extinguisher (figure 3, item 15). Three 10-pound dry chemical fire extinguishers are located in the pilothouse to permit extinguishing of small fires.

PILOTHOUSE INTERIOR (LOOKING FORWARD)

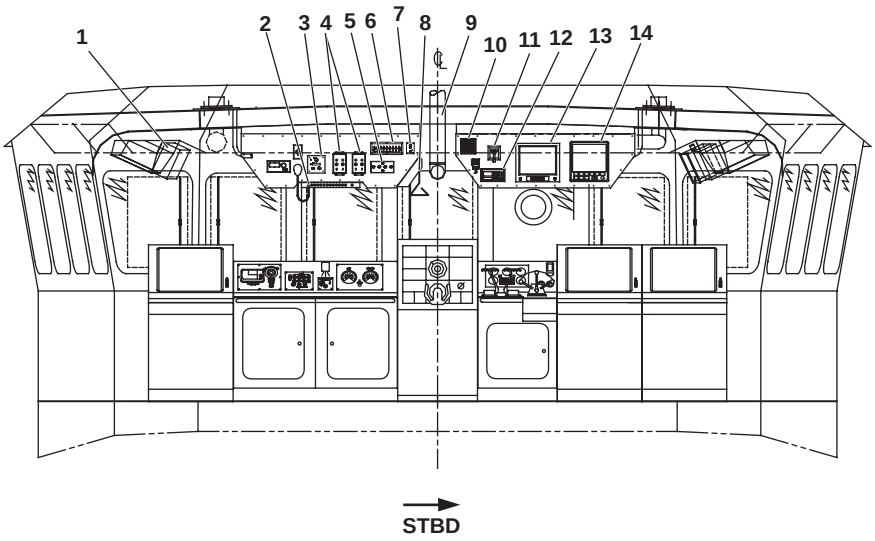


Figure 4. Pilothouse Interior (Looking Forward)

1. Digital Repeater Compass (figure 4, item 1). The digital repeater compass displays vessel heading from the gyrocompass.

2. Public Address (PA) panel (figure 4, item 2). The PA panel controls volume and destination for PA announcements.

3. Speed log (figure 4, item 3). The speed log displays vessel speed.

4. Clearview screen controls (figure 4, item 4). The clearview screen controls provide controls for the forward and aft clearview screens.

5. Windshield wiper control panel (figure 4, item 5). The windshield wiper control panel provides controls for the pilothouse windshield wipers and washers.

6. Window heater switch bank (figure 4, item 6). The window heater switch bank provides individual controls for the heated pilothouse windows.

7. Binnacle light panel (figure 4, item 7). The binnacle light panel provides controls for the binnacle light.

8. Horn pull (figure 4, item 8). The horn pull controls the operation of the ship's whistle (horn).

9. Mirror projection binnacle (figure 4, item 9). The mirror projection binnacle permits the helmsman to view the magnetic compass binnacle mounted on the pilothouse top.

10. Speaker (figure 4, item 10). The speaker broadcasts output from the marine VHF radio.

11. At will and automatic fog whistle controller (figure 4, item 11). The at will and automatic fog whistle controller provides controls for the automatic fog horn and permits selection between at will and automatic operating modes.

12. Marine VHF radio (figure 4, item 12). The marine VHF radio permits communication between the LT and other vessels and shore stations.

13. Nauto conning screen (figure 4, item 13). The nauto conning screen displays navigational information to the helmsman.

14. Depth finder (figure 4, item 14). The depth finder displays the water depth.

PILOTHOUSE INTERIOR (LOOKING FORWARD)

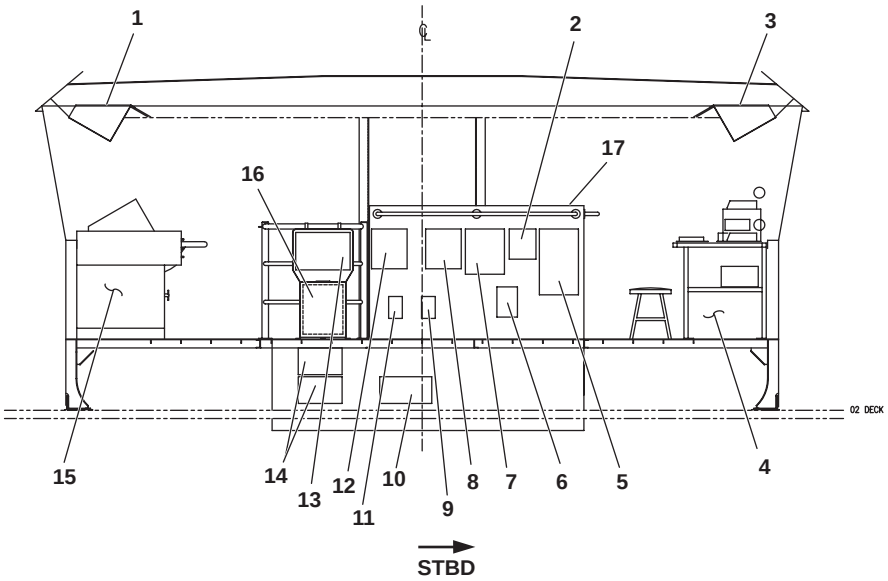


Figure 5. Pilothouse Interior (Looking Forward)

1. Aft chart table overhead console (figure 5, item 1). The aft chart table overhead console contains various pieces of navigation and communication gear including a marine Very High Frequency (VHF) radio, Precision Lightweight GPS (Global Positioning System) Receiver (PLGR), and wind speed/direction readouts. See figure 2 for details.

2. Uninterrupted Power Supply (UPS) bypass and disconnect switch box. (figure 5, item 2). The UPS bypass and disconnect switch box permits bypassing or disconnection of the UPSs for the C4ISR gear.

3. GMDSS table overhead console (figure 5, item 3). The GMDSS table overhead console holds many of the GMDSS components. See figure 3 for details.

4. GMDSS table (figure 5, item 4). The GMDSS table holds many components of the GMDSS suite and provides a work area for GMDSS operation.

5. 120V radar power distribution panel (figure 5, item 5). The 120V radar power distribution panel provides circuit breakers for the X band and S band radars.

6. Radar distribution panel isolation transformer (figure 5, item 6). The radar distribution panel isolation transformer protects the radar gear from electrical anomalies.

7. 24V general alarm battery charger (figure 5, item 7). The 24V general alarm battery charger maintains the charge for the general alarm battery bank.

8. 24V GMDSS battery charger (figure 5, item 8). The 24V GMDSS battery charger maintains the charge for the GMDSS battery bank.

9. GMDSS disconnect switch (figure 5, item 9). The disconnect switch secures power to the 24V GMDSS battery charger.

10. UPS unit (figure 5, item 10). This UPS unit provides uninterrupted power for radio room components.

11. 12 V disconnect switch (figure 5, item 11). The disconnect switch secures power to the 12V marine radio battery charger.

12. 12V marine radio battery charger (figure 5, item 12). The 12V marine radio battery charger maintains the charge for the 12V marine radio battery.

13. Gyrocompass control unit (figure 5, item 13). The gyrocompass control unit provides controls for the gyrocompass.

14. Integrated Bridge System (IBS) UPS units (figure 5, item 14). The IBS UPS units provided uninterrupted power to the IBS gear.

15. Chart table (figure 5, item 15). The chart table provides open working space for navigation charts.

16. Gyrocompass (figure 5, item 16). The gyrocompass provides accurate directional data to pilothouse personnel and to key navigational gear.

17. Radio room (figure 5, item 17). The radio room houses the vessel's secure and tactical communication systems. See figures 7-10 for details.

PILOTHOUSE INTERIOR (LOOKING AFT)

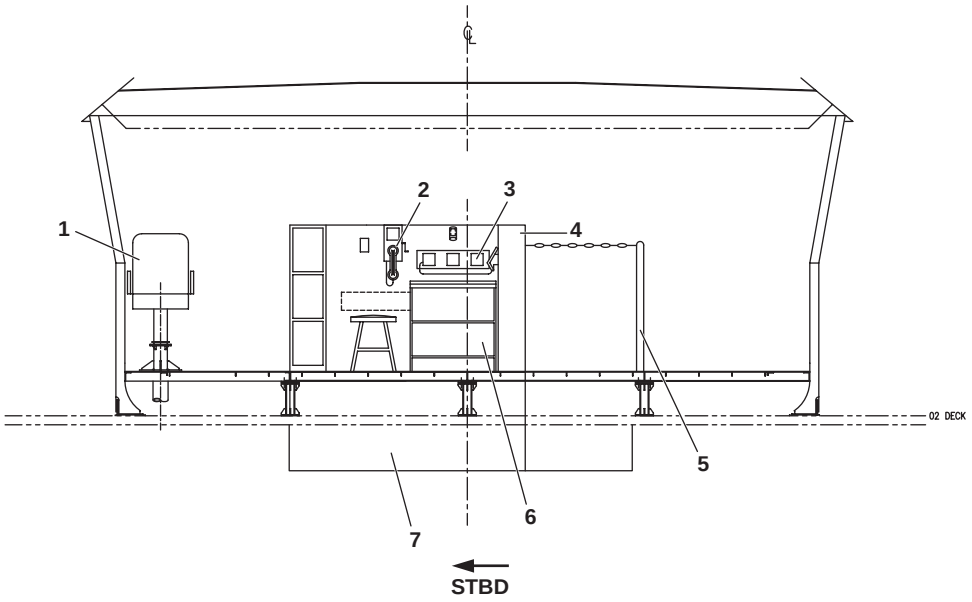


Figure 6. Pilothouse Interior (Looking Aft)

1. Navigator's chair (figure 6, item 1). The navigator's chair provides seating for the navigator.

2. Vehicular Interface Control Station (VICS) (figure 6, item 2). The VICS station permits pilothouse personnel to utilize the tactical radios.

3. Sound powered telephone (figure 6, item 3). The sound powered telephone permits communication among between the pilothouse and the other sound powered telephone stations throughout the vessel.

4. Vent trunk (figure 6, item 4). The vent trunk provides ventilation for the radio room.

5. Guard rail (figure 6, item 5). The guard rail prevents personnel from falling into the ladderwell.

6. Log table book case (figure 6, item 6). The log table book case provides storage for books at the log table.

7. Radio room (figure 6, item 7). The radio room houses the vessel’s secure and tactical communication systems. See figures 7-10 for details.

RADIO ROOM INTERIOR (PORT BULKHEAD)

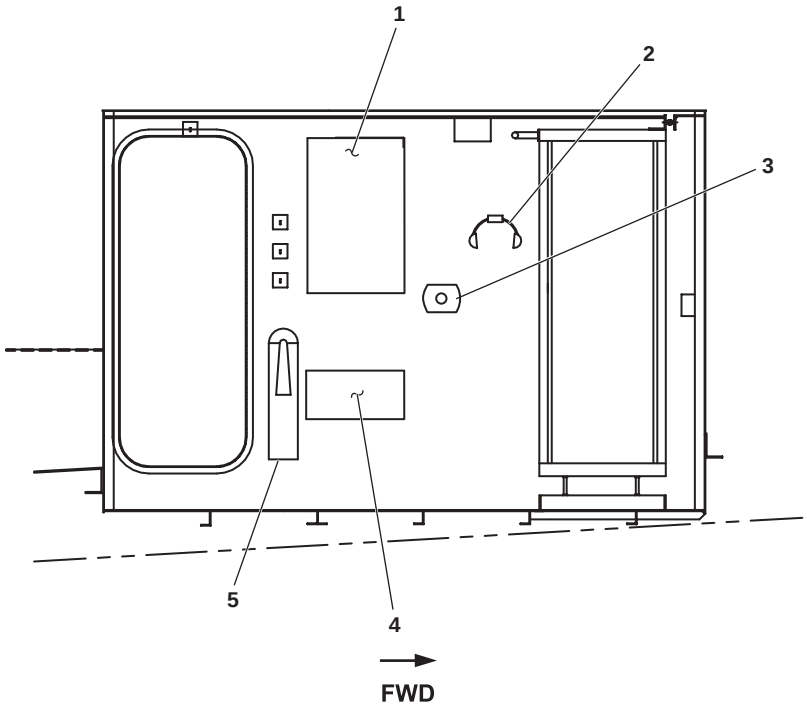


Figure 7. Radio Room Interior (Port Bulkhead)

1. 120V elex distribution panel (figure 7, item 1). The 120V elex distribution panel contains circuit breakers for many of the IBS and C4ISR power supplies.

2. Sound powered telephone headset (figure 7, item 2). The sound powered telephone headset permits the radio operator to communicate via sound powered telephone.

3. Sound powered telephone jack (figure 7, item 3). The sound powered telephone jack provides a connection point for the sound powered telephone headset.

4. General alarm and emergency lighting distribution panel (figure 7, item 4). The general alarm and emergency lighting distribution panel contains circuit breakers for many of the pilothouse 24 Vdc components.

5. Fire extinguisher (figure 7, item 5). A 10-pound dry chemical fire extinguisher is located in the radio room to permit extinguishing of small fires.

RADIO ROOM INTERIOR (AFT BULKHEAD)

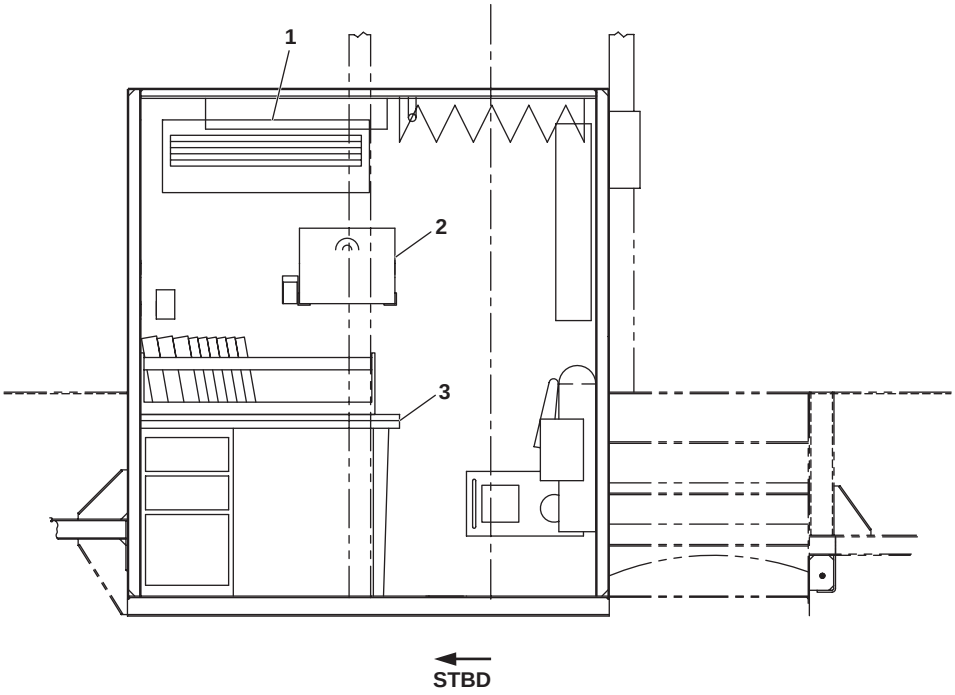


Figure 8. Radio Room Interior (Aft Bulkhead)

1. Air conditioning fan unit (figure 8, item 1). The air conditioning fan unit provides air conditioning for the radio room.

2. Safe (figure 8, item 2). The safe provides secure document storage.

3. Desk (figure 8, item 3). The desk provides a work area in the radio room.

RADIO ROOM FORWARD BULKHEAD (RADIO RACKS)

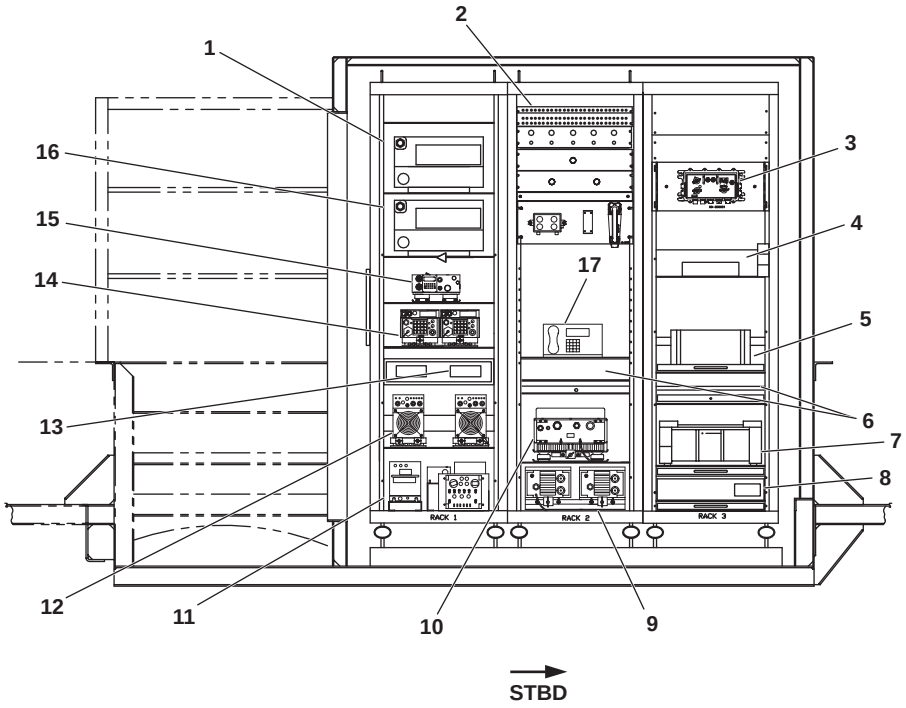


Figure 9. Radio Room Forward Bulkhead (Radio Racks)

1. AN/VRC 103A (figure 9, item 1). The AN/VRC 103A is the tactical radio providing voice and data capability in the 30 to 518 MHz range.

2. DC distribution panel (figure 9, item 2). The dc distribution panel contains circuit breakers for the 24 Vdc communication components located in the radio room.

3. CD-82/VRC (figure 9, item 3). The CD-82-VRC is the interface between the tactical radios and the VICS.

4. Fleet 77 (figure 9, item 4). The Fleet 77 provides satellite communication capability for the vessel.

5. Printer/fax (figure 9, item 5). The printer/fax prints output from the computer and can fax items for transmission.

6. Laptop computers (figure 9, item 6). The laptop computers are used to generate display messages in the C4ISR system.

7. TS-21 (figure 9, item 7). The TS-21 is a tactical secure fax machine.

8. UPS (figure 9, item 8). The UPS provides an uninterrupted power supply for the radio room gear.

9. Power supplies (figure 9, item 9). The power supplies provide power for the AN/VRC 103 radios.

10. Power amp (figure 9, item 10). The power amp is a component of the tactical radios.

11. Identify Friend or Foe (IFF) transceiver (figure 9, item 11). The IFF transceiver permits receipt and transmission of identifying signals.

12. AM 717 (figure 9, item 12). The AM 717s are the power amp and pre-amp for the Line of Sight Tactical (LST) 5D radios.

13. VDC-300 (figure 9, item 12). The VDC-300 is a secure data controller.

14. LST 5D (figure 9, item 14). The LST 5D is a line of sight tactical radio system.

15. AN/PRC 150 (figure 9, item 15). The AN/PRC 150 is a is an HF/VHF tactical radio system.

16. AN/VRC 103B (figure 9, item 16). The AN/VRC 103B is the tactical radio providing voice and data capability in the 30 to 518 MHz range.

17. Secure Telephone Unit (STU) (figure 9, item 17). The STU provides a means of secure landline telephone communication.

RADIO ROOM PLAN VIEW

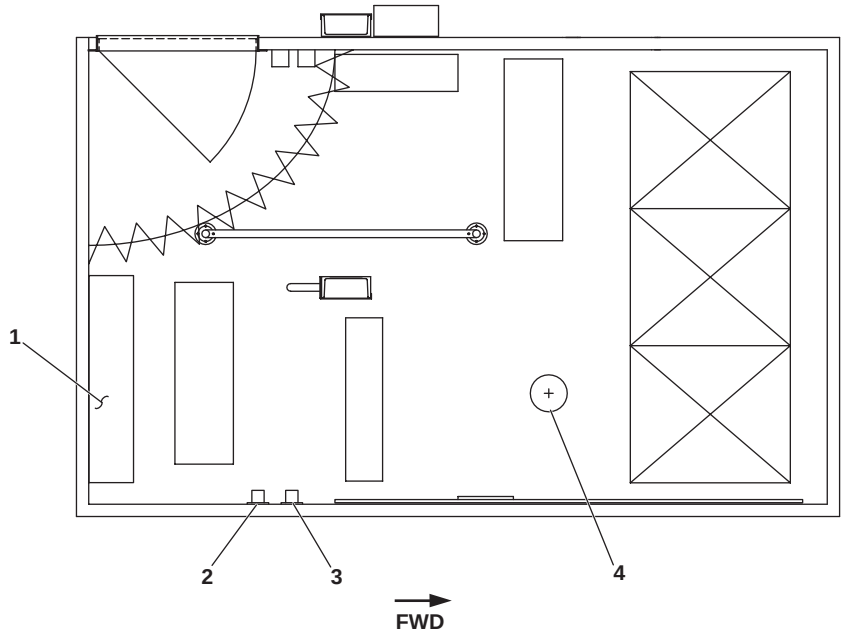


Figure 10. Radio Room Plan View

1. Air conditioning fan unit (figure 10, item 1). The air conditioning fan unit provides air conditioning for the radio room.

2. Fire alarm strobe light (figure 10, item 2). The fire alarm strobe light flashes red when the fire and smoke alarm is activated.

3. General alarm strobe light (figure 10, item 3). The general alarm strobe light flashes amber when the general alarm is activated.

4. Ionization smoke detector (figure 10, item 4). The ionization smoke detector activates the fire alarm system when smoke is detected.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
01 LEVEL INTERIOR

01 LEVEL INTERIOR

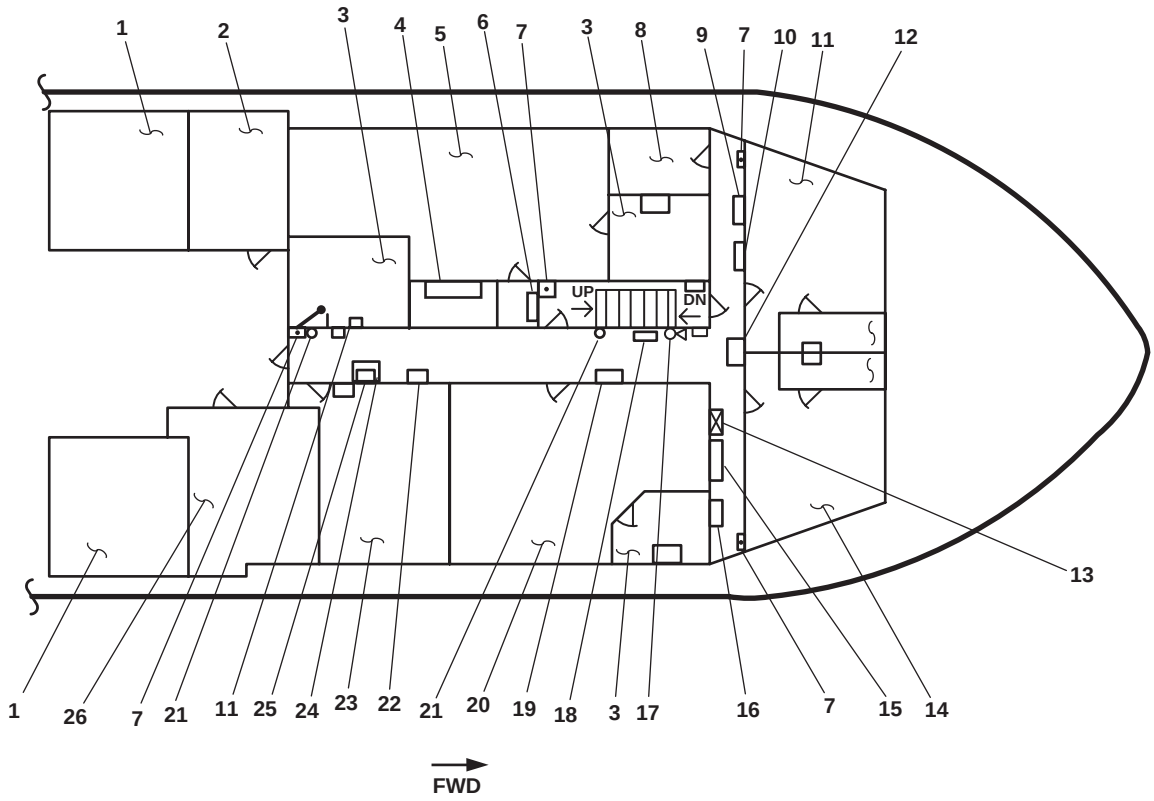


Figure 1. 01 Level Interior

1. Stack (figure 1, item 1). The stack contains the engine exhaust and crankcase vents.

2. Aft fan room (figure 1, item 2). The aft fan room contains Heating, Ventilation, and Air Conditioning (HVAC) and electrical equipment. See figure 2 for details.

3. Sanitary Space (figure 1, item 3). This space contains sanitary facilities, including a water closet, a sink, and a shower.

4. Medical locker (figure 1, item 4). The medical locker provides storage space for medical supplies.

5. Officer's stateroom 2 (figure 1, item 5). The officer's stateroom 2 provides accommodations for four officers. See figure 3 for details.

6. 120V pilothouse emergency distribution panel (figure 1, item 6). This panel provides 120 volts to various navigation system components, the windscreen elements, the intercom system, and the port and starboard search light power supplies.

7. Fire alarm pull station (figure 1, item 7). This fire alarm pull station immediately alerts the crew to the presence of fire when the lever is pulled.

8. Forward fan room (figure 1, item 8). The forward fan room contains HVAC and electrical equipment. See figure 4 for details.

9. 01 & 02 level reheater 120V fuse box No. 1 (figure 1, item 9). This fuse box provides fused protection for 01 and 02 level reheaters.

10. Convector heater 120V fuse box No. 2 (figure 1, item 10). This fuse box provides fused protection for 01 and 02 level convection heaters.

11. Chief Engineer's stateroom (figure 1, item 11). This is the berthing space for the chief engineer. See figure 5 for details.

12. Drinking fountain (figure 1, item 12). The drinking fountain supplies chilled potable water for personal consumption.

13. Fire station 8 (figure 1, item 13). Fire station 8 is equipped with 50 feet (15.2 m) of 1-1/2 inch fire hose and an all-purpose nozzle.

14. Captain's stateroom (figure 1, item 14). This is the berthing space for the vessel master. See figure 6 for details.

15. 120V distribution panel No. 2 (figure 1, item 15). This distribution panel contains circuit breakers for many of the non-critical electrical circuits on the 01 level.

16. 220V air conditioning distribution panel (figure 1, item 16). This distribution panel contains circuit breakers for the pilothouse and radio room rooftop air conditioning units.

17. General alarm bell (figure 1, item 17). The general alarm bell signals various emergency conditions on the vessel.

18. Fire axe (figure 1, item 18). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in the case of fire.

19. Key cabinet (figure 1, item 19). The key cabinet provides secure storage for up to 75 keys.

20. Officer's stateroom 1 (figure 1, item 20). The officer's stateroom 1 provides accommodations for four officers. See figure 7 for details.

21. Fire extinguisher (figure 1, item 21). The portable dry chemical fire extinguisher is used to extinguish fires on the 01 level.

22. 120V exterior emergency lighting panel No. 2 (figure 1, item 22). This panel contains circuit breakers for many of the emergency circuits on the 01 and 02 levels.

23. NCO stateroom (figure 1, item 23). This space provides berthing for two NCOs. See figure 8 for details.

24. General alarm system distribution panel (figure 1, item 24). This panel provides a junction box to interconnect general alarm system cables.

25. General alarm contact maker (figure 1, item 25). The general alarm contact maker controls sounding of the general alarm bells.

26. Emergency Diesel Generator (EDG) room (figure 1, item 26). This space contains the emergency generator and support equipment. See figure 9 for details.

FAN ROOM 01 LEVEL (AFT)

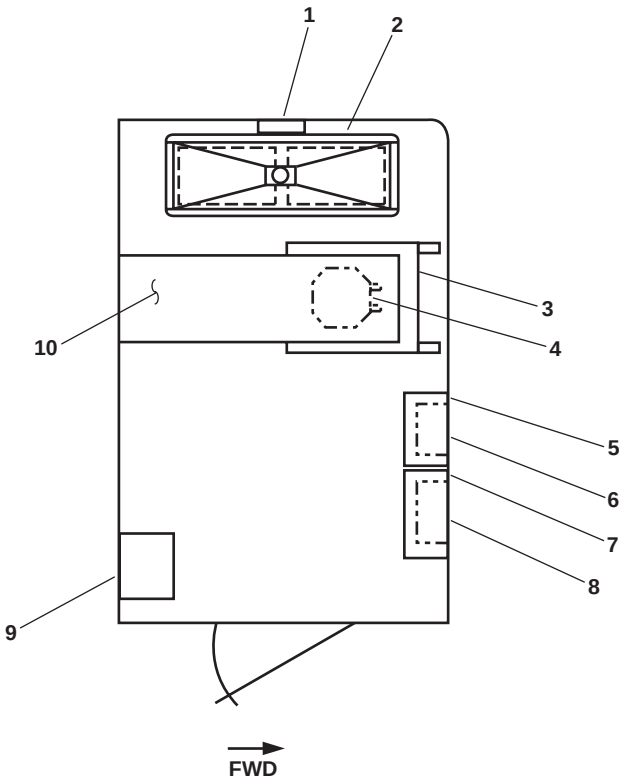


Figure 2. Fan Room 01 Level (Aft)

1. Ventilation fan (figure 2, item 1). This fan removes heat and gases from the battery bank.

2. Battery bank (figure 2, item 2). The battery bank contains two 12 V batteries connected in series to provide emergency 24 Vdc power to various communication and navigation systems.

3. Power supply (figure 2, item 3). The power supply provides power to various 24 Vdc communication and navigation systems, and charges the battery bank.

4. Transformer (figure 2, item 4). The 440V/120V transformer provides 120V power for various communication and navigation systems.

5. 60 amp disconnect switch (figure 2, item 5). This switch disconnects the power supply (figure 2, item 3).

6. HVAC SYSTEM CONTROLLER FOR RHTR 01-32-2 (figure 2, item 6). The controller turns the reheater ON and OFF.

7. 200-amp disconnect switch (figure 2, item 7). This switch disconnects the battery bank.

8. HVAC SYSTEM CONTROLLER FOR PRHTR 01-31-2 (figure 2, item 8). This controller turns the preheater ON and OFF.

9. Preheater (figure 2, item 9). The preheater warms the outside air being drawn into the fan coil unit.

10. Fan coil assemblies for the main deck and the 01 and 02 levels (figure 2, item 10). The fan coil assembly heats and cools the interior spaces on the 01 level. It also provides a portion of the pilothouse heating and cooling.

OFFICER'S STATEROOM 2

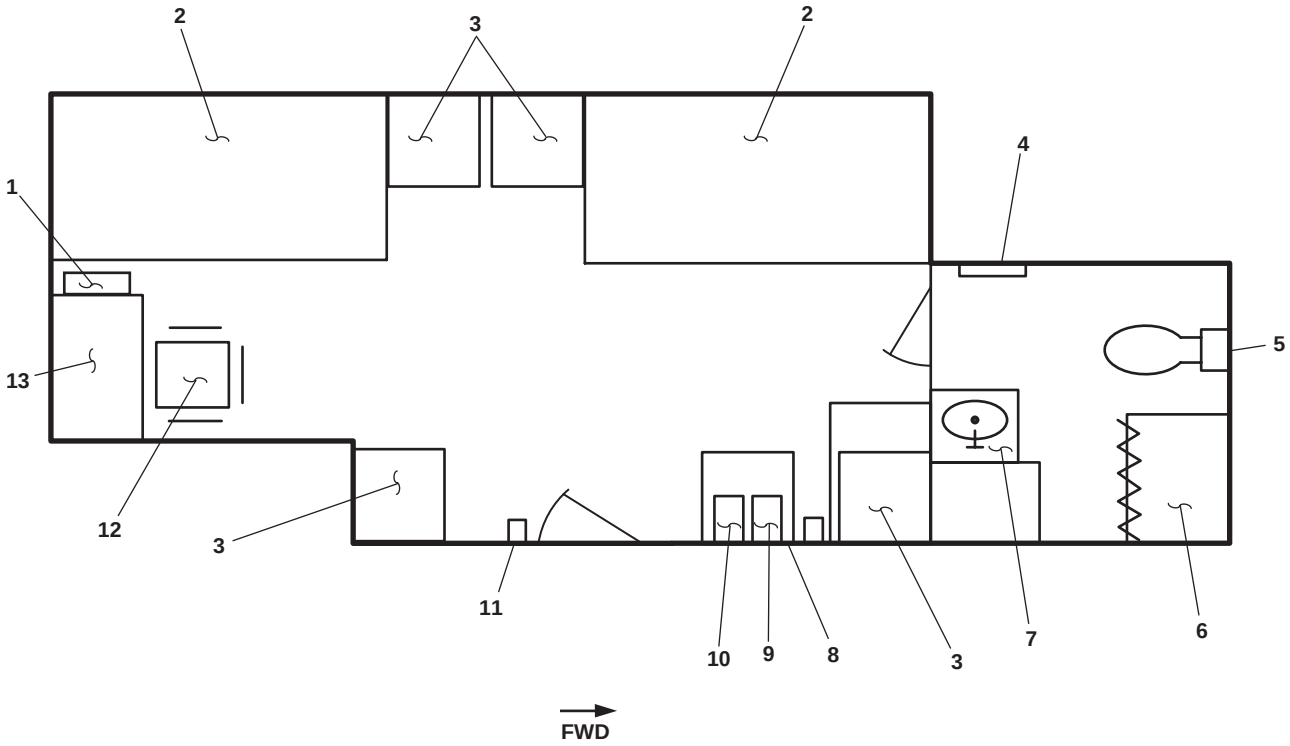


Figure 3. Officer's Stateroom 2

1. Life jacket stowage (figure 3, item 1). The life jacket stowage provides storage for four life jackets.

2. Bunks (figure 3, item 2). The bunks provide sleeping arrangements for two officers.

3. Lockers (figure 3, item 3). The lockers provide personal storage space for each officer.

4. Convection heater (figure 3, item 4). The convection heater supplies supplemental heat to the sanitary space.

5. Water closet (figure 3, item 5). This is the commode for the sanitary space.

6. Shower (figure 3, item 6). The shower is provided for the personnel of officer's stateroom 2.

7. Sink (figure 3, item 7). The sink provides hot and cold potable water for personal hygiene.

8. Refrigerator (figure 3, item 8). A refrigerator is provided for storing perishable goods.

9. Intercom (figure 3, item 9). The intercom provides communication throughout the vessel.

10. Sound powered telephone (figure 3, item 10). The sound powered telephone provides communication with other stations throughout the vessel.

11. Thermostat (figure 3, item 11). The thermostat provides temperature control in the stateroom.

12. Chair (figure 3, item 12). The chair provides a place to sit.

13. Chest/desk combo (figure 3, item 13). The chest/desk combo provides storage space and a desk top for reading or writing.

FORWARD FAN ROOM

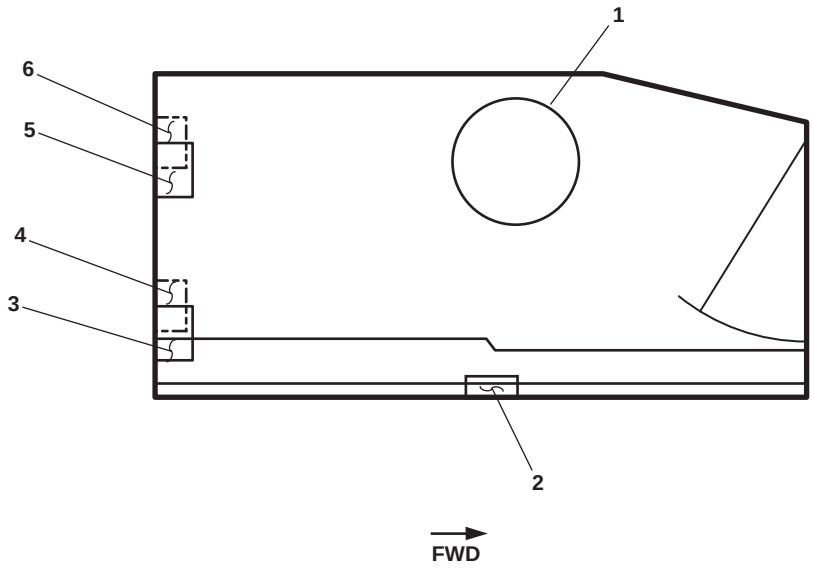


Figure 4. Forward Fan Room

1. AMS 1 supply fan (figure 4, item 1). This fan supplies fresh air to AMS 1.

2. Sanitary spaces exhaust fan (figure 4, item 2). This fan removes foul air from the sanitary spaces.

3. Starboard searchlight power supply (figure 4, item 3) (above). This power supply provides power to the starboard searchlight.

4. Port searchlight power supply (figure 4, item 4) (below). This power supply provides power to the port searchlight.

5. Sanitary spaces exhaust fan (E01-44-2) motor controller (figure 4, item 5) (above). This controller turns the sanitary space exhaust fan ON and OFF.

6. Ship's whistle power supply (figure 4, item 6) (below). This power supply provides power to the ship's whistle (automatic fog horn).

CHIEF ENGINEER'S STATEROOM

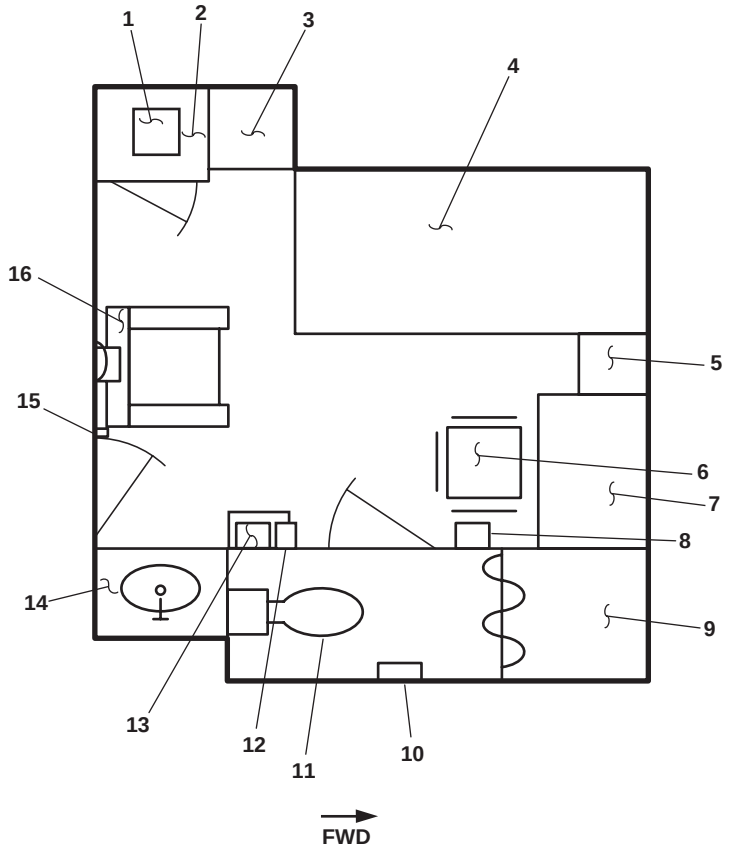


Figure 5. Chief Engineer's Stateroom

1. Refrigerator (figure 5, item 1). The refrigerator provides cold storage for perishable items.

2. File cabinet (figure 5, item 2). The file cabinet with a combination lock provides secure storage for personal items.

3. Safe (figure 5, item 3). The safe provides a secure storage space.

4. Bunk (figure 5, item 4). The bunk provides sleeping arrangements for the chief engineer.

5. Night table (figure 5, item 5). The night table provides storage for miscellaneous items.

6. Chair (figure 5, item 6). The chair provides a place to sit.

7. Chest/desk combo (figure 5, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.

8. Key cabinet (figure 5, item 8). The key cabinet stores keys to gain access to various areas of the vessel.

9. Shower (figure 5, item 9). The shower is provided for the chief engineer.

10. Convection heater (figure 5, item 10). The convection heater supplies supplemental heat to the sanitary space.

11. Water closet (figure 5, item 11). This is the commode for the sanitary space.

12. Intercom and sound powered telephone (figure 5, item 12). The intercom and sound powered telephone provide communication throughout the vessel.

13. Life jacket stowage (figure 5, item 13). The life jacket stowage provides storage for one life jacket.

14. Sink (figure 5, item 14). The sink provides hot and cold potable water for personal hygiene.

15. Thermostat (figure 5, item 15). The thermostat provides temperature control in the stateroom.

16. Reclining lounge chair (figure 5, item 16). This chair is provided for added comfort.

CAPTAIN'S STATEROOM

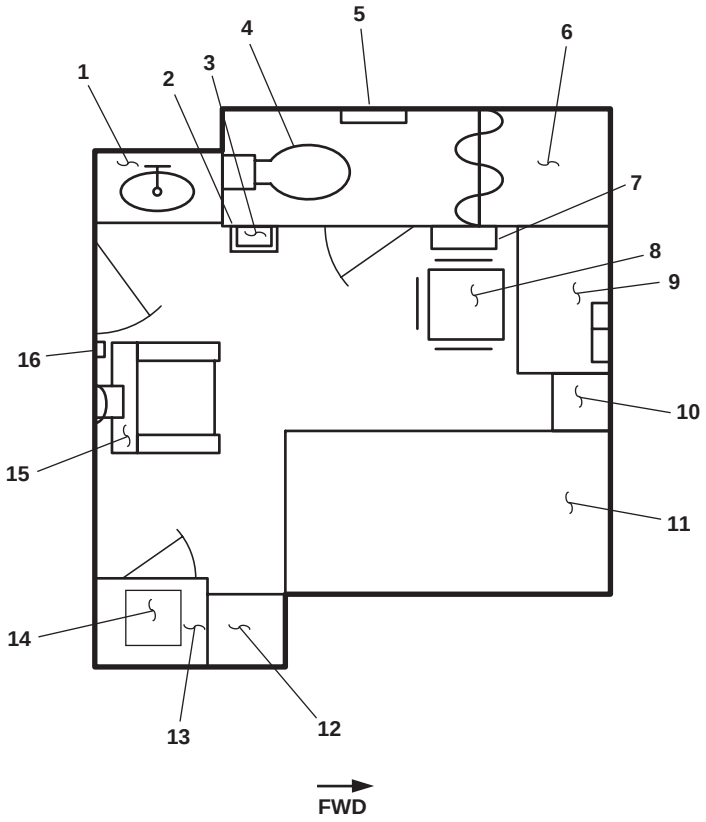


Figure 6. Captain's Stateroom

1. Sink (figure 6, item 1). The sink provides hot and cold potable water for personal hygiene.

2. Intercom and sound powered telephone (figure 6, item 2). The intercom and sound powered telephone provide intraship communication.

3. Life jacket stowage (figure 6, item 3). The life jacket stowage provides storage for one life jacket.

4. Water closet (figure 6, item 4). This is the commode for the sanitary space.

5. Convection heater (figure 6, item 5). The convection heater supplies supplemental heat to the sanitary space.

6. Shower (figure 6, item 6). The shower is provided for the vessel master.

7. Key cabinet (figure 6, item 7). The key cabinet stores keys to gain access to various areas of the vessel.

8. Chair (figure 6, item 8). The chair provides a place to sit.

9. Chest/desk combo (figure 6, item 9). The chest/desk combo provides storage space and a desktop for reading or writing.

10. Night table (figure 6, item 10). The night table provides storage for miscellaneous items.

11. Bunk (figure 6, item 11). The bunk provides sleeping arrangements for the vessel master.

12. Locker (figure 6, item 12). The lockers provide storage space for the vessel master.

13. File cabinet (figure 6, item 13). The file cabinet with a combination lock provides storage for personal items.

14. Refrigerator (figure 6, item 14). The refrigerator provides cold storage for perishable items.

15. Reclining lounge chair (figure 6, item 15). This chair is provided for added comfort.

16. Thermostat (figure 6, item 16). The thermostat provides temperature control in the stateroom.

OFFICER'S STATEROOM 1

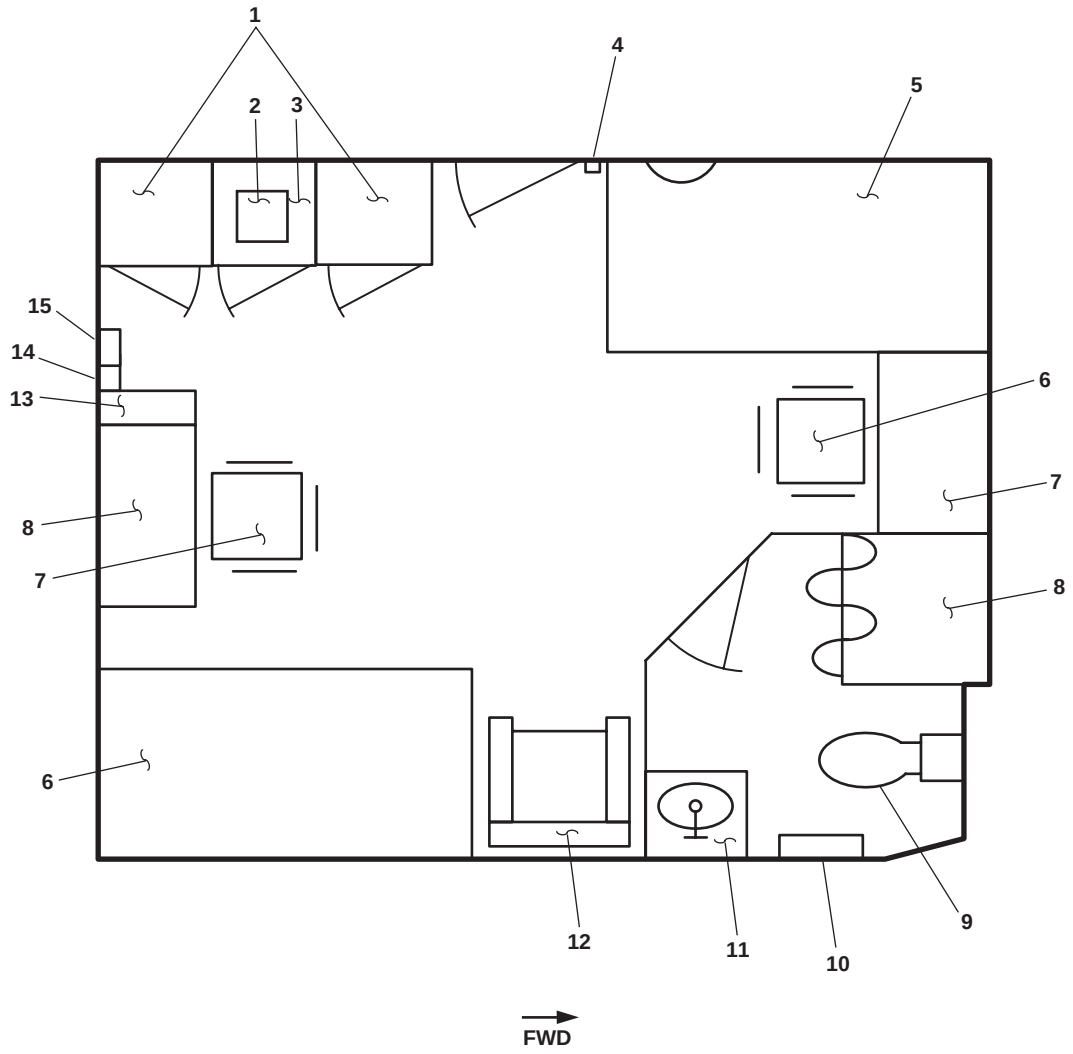


Figure 7. Officer's Stateroom 1

1. Lockers (figure 7, item 1). The lockers provide storage space for personal items.

2. Refrigerator (figure 7, item 2). The refrigerator provides cold storage space for perishable items.

3. File cabinet (figure 7, item 3). The file cabinet with combination lock provides secure storage for personal items.

4. Thermostat (figure 7, item 4). The thermostat provides temperature control in the stateroom.

5. Bunk (figure 7, item 5). The bunk provides sleeping arrangements for two officers.

6. Chair (figure 7, item 6). The chair provides a place to sit.

7. Chest/desk combo (figure 7, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.

8. Shower (figure 7, item 8). The shower is provided for the personnel in officer's stateroom 1.

9. Water closet (figure 7, item 9). This is the commode for the sanitary space.

10. Convection heater (figure 7, item 10). The convection heater supplies supplemental heat to the sanitary space.

11. Sink (figure 7, item 11). The sink provides hot and cold potable water for personal hygiene.

12. Reclining lounge chair (figure 7, item 12). This chair is provided for added comfort.

13. Life jacket stowage (figure 7, item 13). The life jacket stowage provides storage for four life jackets.

14. Intercom (figure 7, item 14). The intercom provides communication throughout the vessel.

15. Sound powered phone (figure 7, item 15). The sound powered phone provide intraship communication.

NCO'S STATEROOM

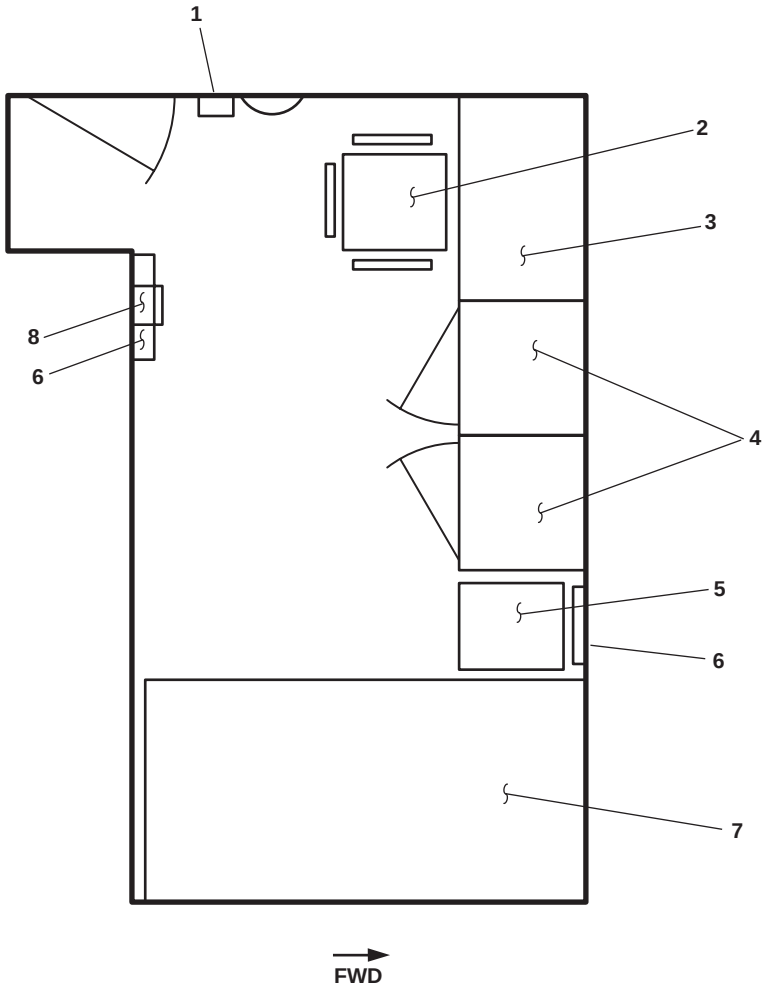


Figure 8. NCO's Stateroom

1. Thermostat (figure 8, item 1). The thermostat provides temperature control in the stateroom.

2. Chair (figure 8, item 2). The chair provides a place to sit.

3. Chest/desk combo (figure 8, item 3). The chest/desk combo provides storage space and a desktop for reading or writing.

4. Lockers (figure 8, item 4). The lockers provide storage space for personal items.

5. Refrigerator (figure 8, item 5). The refrigerator provides cold storage for perishable items.

6. Life jacket stowage (figure 8, item 6). Each life jacket stowage provides storage for one life jacket.

7. Bunks (figure 8, item 7). The bunks provide sleeping arrangements for NCOs.

8. Intercom (figure 8, item 8). The intercom provides intraship communication.

EMERGENCY DIESEL GENERATOR ROOM

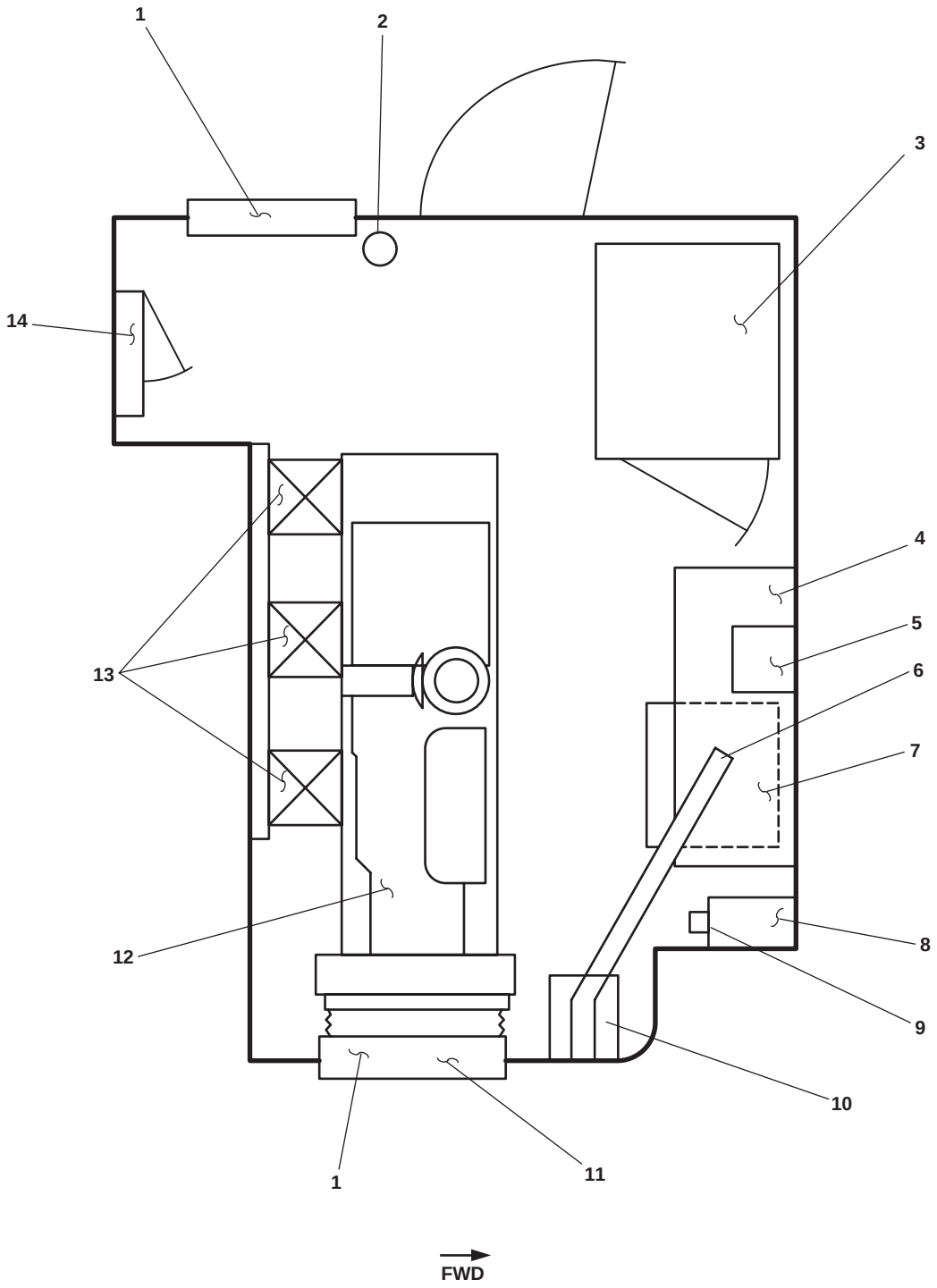


Figure 9. Emergency Diesel Generator Room

1. Fire flap (figure 9, item 1). The fire flap can be manually closed in an emergency to deny oxygen to the space.

2. Fire extinguisher (figure 9, item 2). The portable fire extinguisher is used to put out small fires on the vessel.

3. Emergency switchboard (figure 9, item 3). The emergency switchboard controls various emergency electrical circuits throughout the vessel.

4. Fuel oil day tank (overhead) (figure 9, item 4). The fuel oil day tank stores fuel oil for the emergency diesel generator engine.

5. Intercom (above), sound powered telephone (middle), and telephone storage box (below) (figure 9, item 5). The intercom, sound powered telephone, and telephone storage box provides communication to the rest of the vessel.

6. Battery box vent to atmosphere (figure 9, item 6). The battery box vent vents explosive gases from the battery box to the atmosphere.

7. Battery box (figure 9, item 7). The battery box contains starting batteries for the Emergency Diesel Generator (EDG).

8. Vent trunk (figure 9, item 8). The vent trunk provides a junction where vents from other spaces interconnect.

9. EDG starting battery switch (figure 9, item 9). This switch selects which battery bank starts the EDG.

10. Battery charger (figure 9, item 10). The battery charger maintains the battery charge when the engine is at rest.

11. Air intake supply vent (figure 9, item 11). This vent provides intake air to the diesel engine.

12. Emergency diesel generator set (figure 9, item 12). The emergency diesel generator set provides electrical power to the vessel's emergency circuits in the event of the ship's service diesel generator failure.

13. Transformers (overhead) (figure 9, item 13). The transformers step down 440 Vac to 120 Vac.

14. 120V emergency load center distribution panel (figure 9, item 14). This panel controls the distribution of electrical power to the vessel's 120V emergency lighting and distribution panels as well as to the general alarm battery charger and the EDG jacket water heater.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
MAIN DECK INTERIOR, BERTHING AREAS

MAIN DECK INTERIOR, BERTHING AREAS

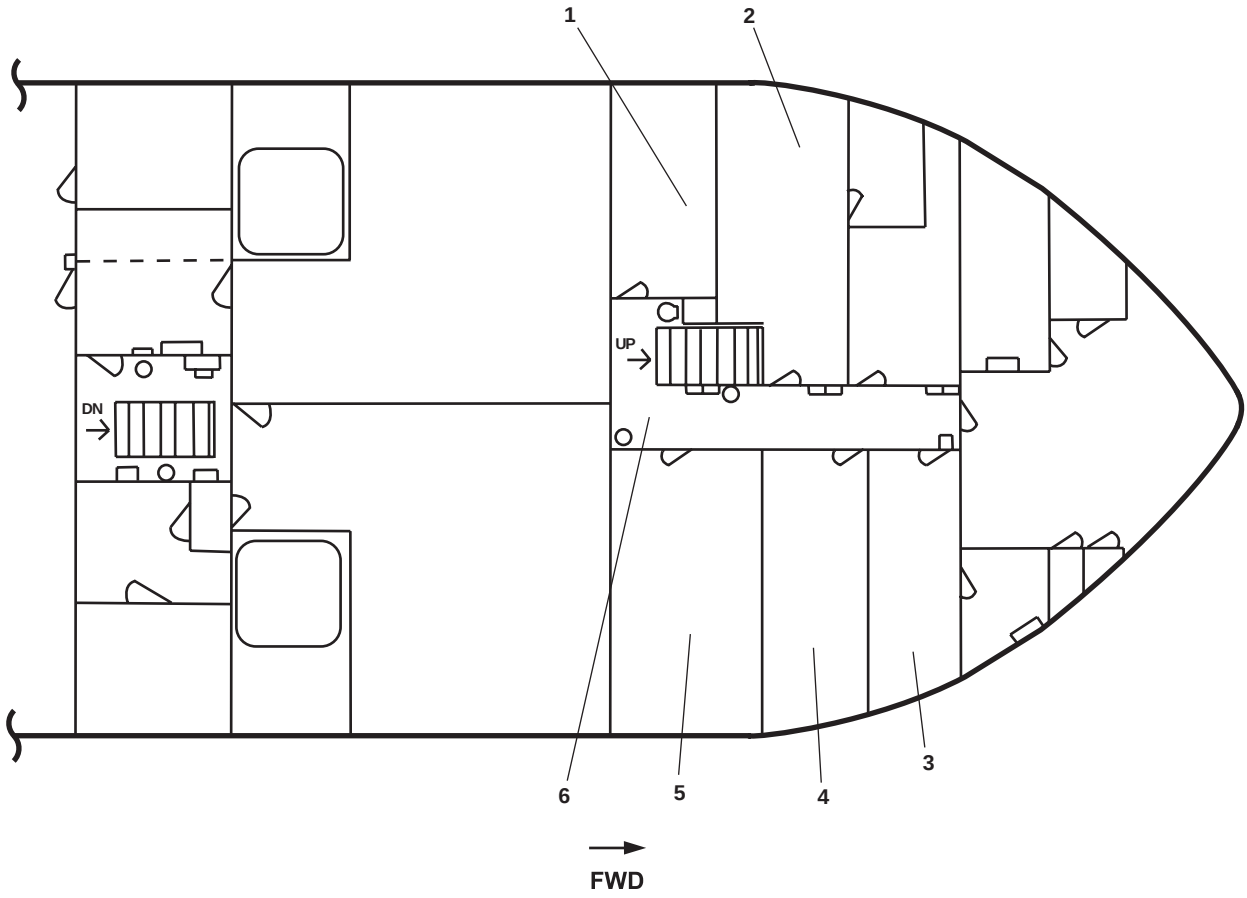


Figure 1. Main Deck Interior, Berthing Areas

1. Sanitary space (figure 1, item 1). The sanitary space includes two showers, two water closets, a convection heater, and two sinks. Details of this space are contained in figure 2.

2. Crew's stateroom 3 (figure 1, item 2). The crew's stateroom 3 contains living accommodations for four crewmembers. Details of this space are contained in figure 3.

3. Crew's stateroom 1 (figure 1, item 3). The crew's stateroom 1 contains living accommodations for two crewmembers. Details of this space are contained in figure 4.

4. Crew's stateroom 2 (figure 1, item 4). The crew's stateroom 2 contains living accommodations for four crewmembers. Details of this space are contained in figure 5.

5. Crew's stateroom 4 (figure 1, item 5). The crew's stateroom 4 contains living accommodations for four crewmembers. Details of this space are contained in figure 6.

6. Passageway (figure 1, item 6). The passageway provides crewmembers an access route to different areas of the vessel.

SANITARY SPACE

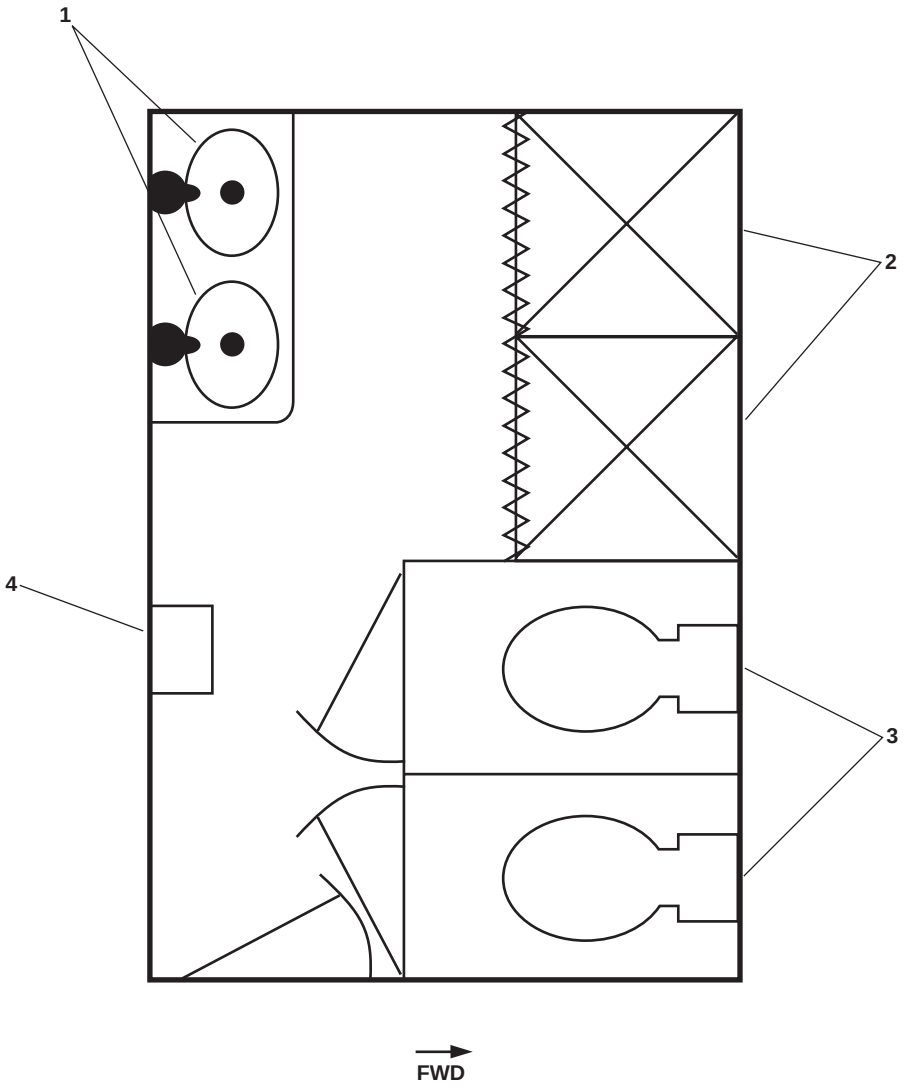


Figure 2. Sanitary Space

1. Sinks (figure 2, item 1). The sinks provide hot and cold potable water for washing and personal sanitation.
2. Showers (figure 2, item 2). The showers provide hot and cold potable water for washing and personal sanitation.
3. Water closets (figure 2, item 3). The water closets are used as toilets by the crew.
4. Convection heater (figure 2, item 4). The convection heater is used to provide supplemental heat to the sanitary space.

CREW'S STATEROOM 3

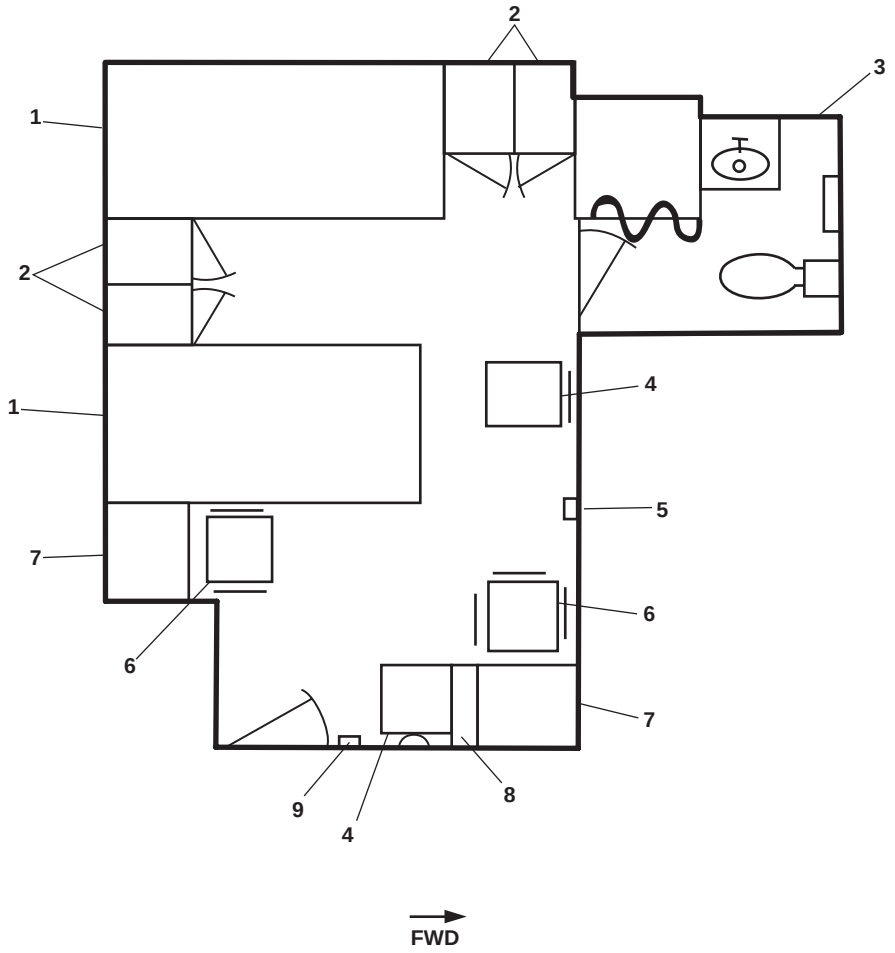


Figure 3. Crew's Stateroom 3

1. Bunks (figure 3, item 1). The bunks provide sleeping structures for four crewmembers.
2. Locker (figure 3, item 2). The lockers provide storage for the crewmembers' clothing and personal items.
3. Sanitary space (figure 3, item 3). The sanitary space includes a sink, water closet, shower, and a convection heater.
4. Night table (figure 3, item 4). The night table provides storage for miscellaneous items.
5. Intercom (figure 3, item 5). The intercom provides communication to the rest of the vessel.
6. Chairs (figure 3, item 6). The chairs provide seating for crewmembers.
7. Chest/desk combo (figure 3, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.
8. Life jacket stowage (figure 3, item 8). The life jacket stowage provides storage for four life jackets.
9. Thermostat (figure 3, item 9). The thermostat provides temperature control in the stateroom.

CREW'S STATEROOM 1

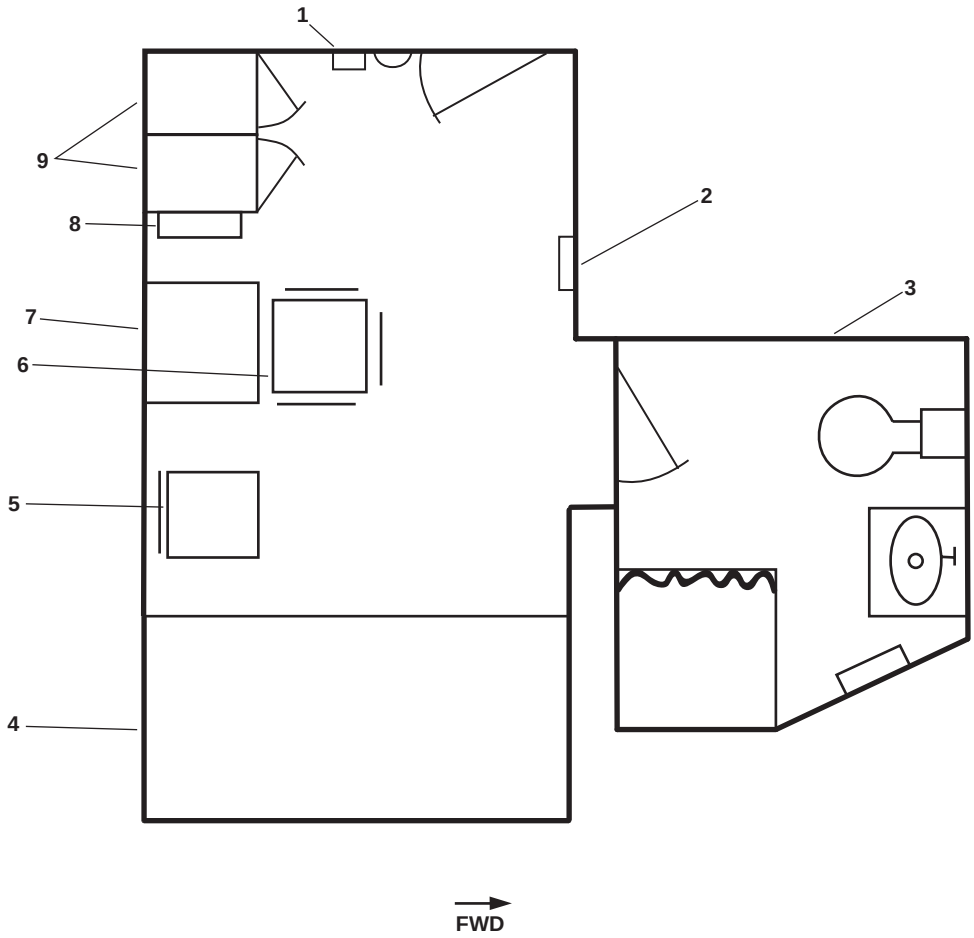


Figure 4. Crew's Stateroom 1

1. Thermostat (figure 4, item 1). The thermostat provides temperature control in the stateroom.
2. Intercom (figure 4, item 2). The intercom provides communication to the rest of the vessel.
3. Sanitary space (figure 4, item 3). The sanitary space includes a sink, water closet, shower, and a convection heater.
4. Bunks (figure 4, item 4). The bunks provide sleeping structures for two officers.
5. Night table (figure 4, item 5). The night table provides storage for miscellaneous items.
6. Chair (figure 4, item 6). The chairs provide seating for crewmembers.
7. Chest/desk combo (figure 4, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.
8. Life jacket stowage (figure 4, item 8). The life jacket stowage provides storage for two life jackets.
9. Locker (figure 4, items 9). The locker provides storage for the crewmembers' clothing and personal items.

CREW'S STATEROOM 2

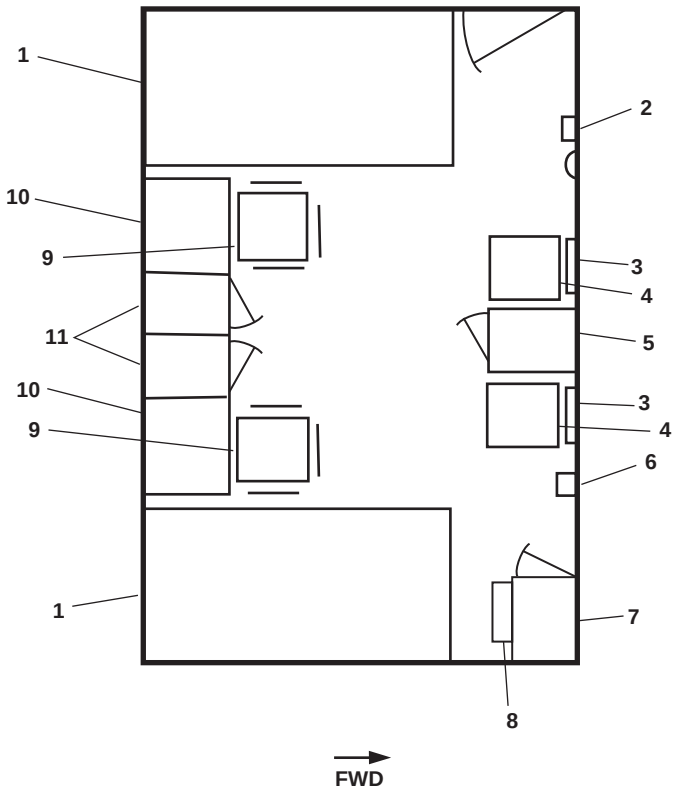


Figure 5. Crew's Stateroom 2

1. Bunks (figure 5, item 1). The bunks provide sleeping structures for two crewmembers.
2. Thermostat (figure 5, item 2). The thermostat provides temperature control in the stateroom.
3. Life jacket stowage (figure 5, item 3). The life jacket stowage provides storage for four life jackets.
4. Night table (figure 5, item 4). The night table provides storage for miscellaneous items.
5. Refrigerator (figure 5, item 5). The refrigerator provides storage for perishable items.
6. Intercom (figure 5, item 6). The intercom provides communication to the rest of the vessel.
7. Locker (figure 5, item 7). The locker provides storage for the crewmembers' clothing and personal items.
8. Life jacket stowage (figure 5, item 8). The life jacket stowage provides storage for four life jackets.
9. Chair (figure 5, item 9). The chair provides seating for crewmembers.
10. Chest/desk combo (figure 5, item 10). The chest/desk combo provides storage space and a desktop for reading or writing.
11. Locker (figure 5, item 11). The locker provides storage for the crewmembers' clothing and personal items.

CREW'S STATEROOM 4

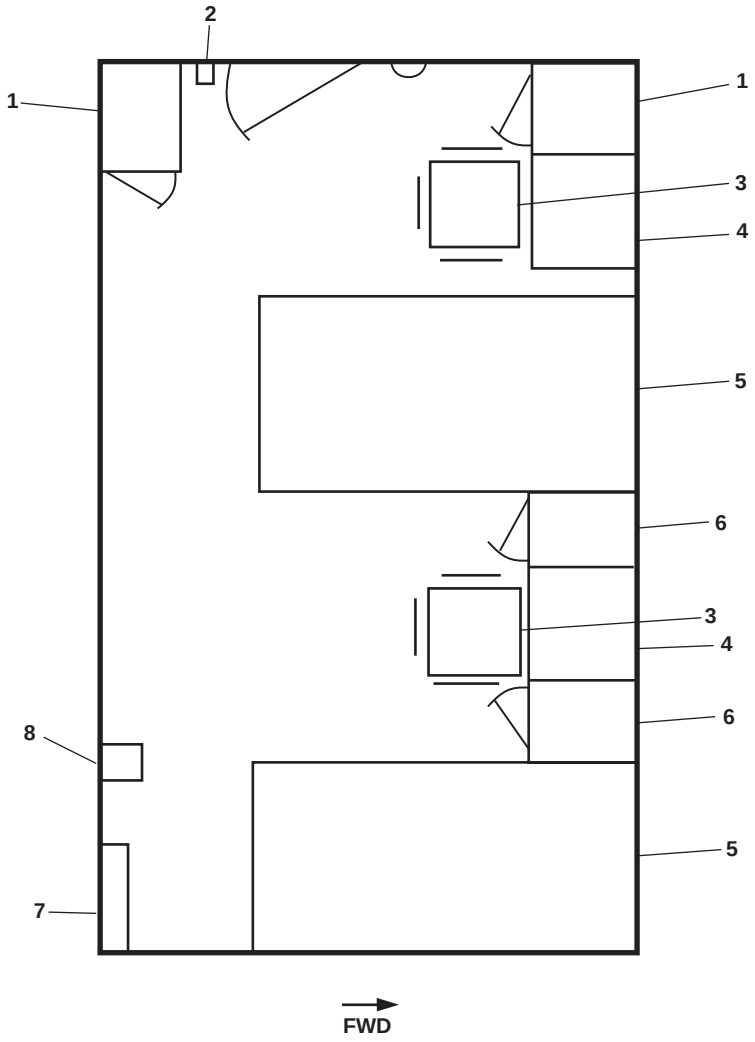


Figure 6. Crew's Stateroom 4

1. Locker (figure 6, item 1). The locker provides storage space for crewmembers' clothing and personal items.
2. Thermostat (figure 6, item 2). The thermostat provides temperature control in the stateroom.
3. Chairs (figure 6, item 3). The chairs provide seating for crewmembers.
4. Chest/desk combo (figure 6, item 4). The chest/desk combo provides storage space and a desktop for reading or writing.
5. Bunks (figure 6, item 5). The bunks provide sleeping structures for four crewmembers.
6. Night table (figure 6, item 6). The night table provides storage for miscellaneous items.
7. Life jacket stowage (figure 6, item 7). The life jacket stowage provides storage for four life jackets.
8. Intercom (figure 6, item 8). The intercom provides communication to the rest of the vessel.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
MAIN DECK INTERIOR, NON-BERTHING AREAS

MAIN DECK INTERIOR, NON-BERTHING AREAS

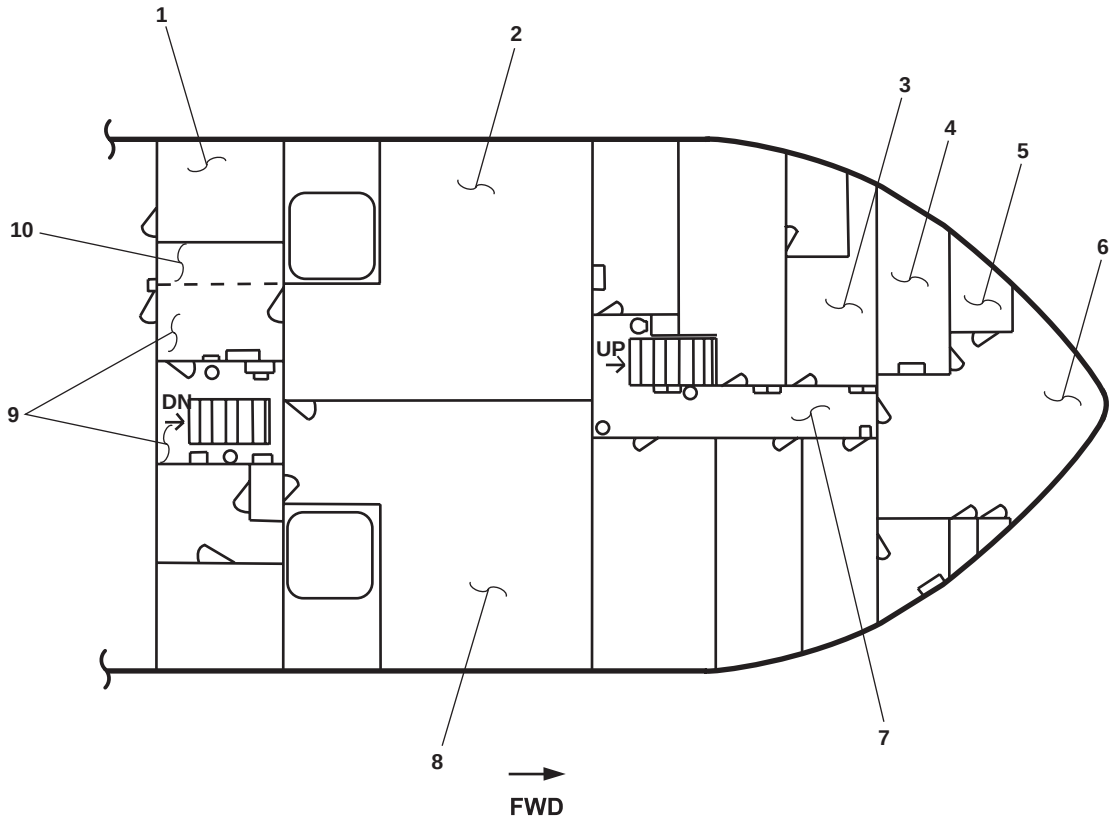


Figure 1. Main Deck Interior, Non-berthing Areas

1. Fan room (figure 1, item 1). This space contains the Heating, Ventilation, and Air Conditioning (HVAC) equipment for the main deck spaces. Details of this space are contained in figure 2.

2. Mess/recreation space (figure 1, item 2). This space is used for feeding the crew and provides a recreation area for watching television and other activities. Details of this space are contained in figure 3.

3. Damage control locker (figure 1, item 3). This space is used for storing much of the vessel's damage control gear. Details of this space are contained in figure 4.

4. Laundry room (figure 1, item 4). This space houses all of the equipment necessary to process the crew's laundry. Details of this space are contained in figure 5.

5. Arms locker (figure 1, item 5). This space provides secure stowage for the vessel's weapons. Details of this space are contained in figure 6.

6. Boatswain's store (figure 1, item 6). This space provides stowage for vessel supplies and equipment. Details of this space are contained in figure 7.

7. Passageway (figure 1, item 7). This space provides passage between the mess/recreation space and the boatswain's store. Access is also provided to the main deck level berthing areas (WP 0009 00). Details of this space are contained in figure 8.

8. Galley (figure 1, item 8). This space contains all of the facilities for storing and preparing food. Details of this space are contained in figure 9.

9. Vestibule (figure 1, item 9). This space provides access between the mess/recreation space (figure 1, item 2), the engine room ladder, and the main deck exterior (fantail). Details of this space are contained in figure 10.

10. Foul weather gear locker (figure 1, item 10). This space provides stowage for the vessel's foul weather gear.

FAN ROOM

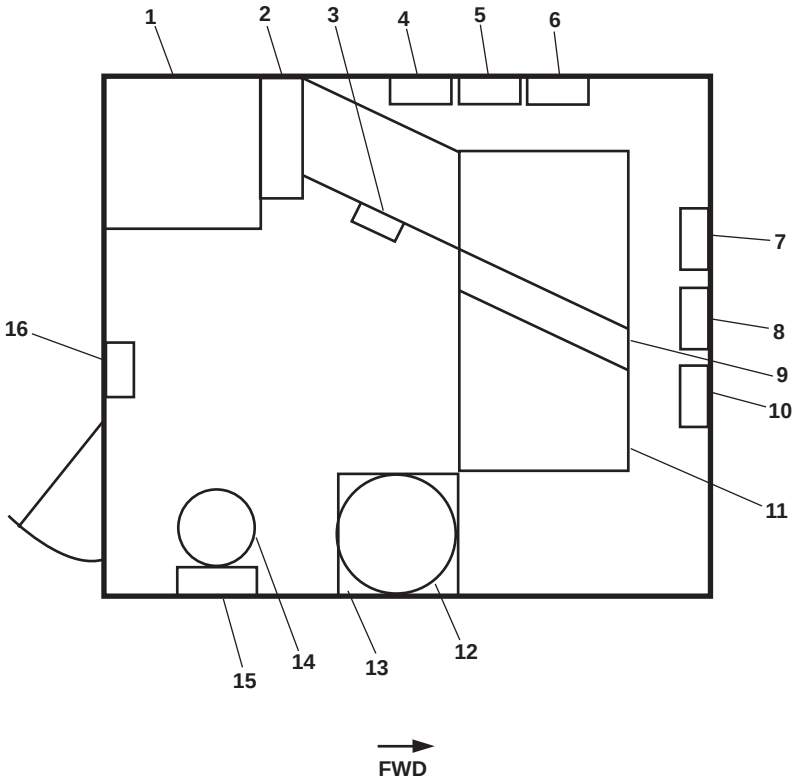


Figure 2. Fan Room

1. Preheater (1-23-2) (figure 2, item 1) (overhead). This electric preheater preheats outside air going to the fan coil unit as required.

2. Manual adjustment dampener (figure 2, item 2) (overhead). The manual adjustment dampener controls the volume of airflow into the ventilation ducting.

3. Thermostat control (figure 2, item 3) (overhead). The thermostat control provides temperature control for the air going to the fan coil unit.

4. Preheater controller (1-23-2) (figure 2, item 4). This controller turns the (1-23-2) preheater ON and OFF.

5. Reheater controller (1-25-2) (figure 2, item 5). This controller turns the (1-25-2) reheater ON and OFF.

6. Preheater controller (1-23-4) (figure 2, item 6). This controller turns the (1-23-4) preheater ON and OFF.

7. Crew's mess fan coil unit (R1-25-2) controller (figure 2, item 7). This controller provides control of fan coil unit (5).

8. Galley supply fan (S1-22-4) motor controller (figure 2, item 8). This motor controller provides control of galley supply fan.

9. Filter supply system (figure 2, item 9) (overhead). The filter supply system provides removal of dirt and foreign particles from the outside air going to the galley supply fan.

10. AMS 2 supply fan (S1-22-2) motor controller (figure 2, item 10). This motor controller provides control for the AMS 2 supply fan.

11. Fan coil unit (R 1-25-2) (overhead) (figure 2, item 11). The fan coil unit provides a circulating fan for main deck spaces and an air conditioning coil for cooling.

12. Galley supply fan (figure 2, item 12). The vaneaxial fan provides makeup air for the galley ventilator hood.

13. Galley reheater (1-23-4) (figure 2, item 13). The (1-23-4) reheater reheats interior air recirculating to the fan coil unit.

14. AMS 2 supply fan (S1-22-2) (figure 2, item 14). The AMS 2 vaneaxial supply fan provides forced air supply to AMS 2.

15. Steering gear oil reservoir (figure 2, item 15) (overhead). The steering gear reservoir has a 15.75 gal (59.6 liter) capacity with a sight glass. This reservoir supplies hydraulic fluid for the steering gear system.

16. Refrigeration valves manifold (figure 2, item 16). The refrigeration valves manifold is a control center for the vessels refrigeration.

MESS/RECREATION SPACE

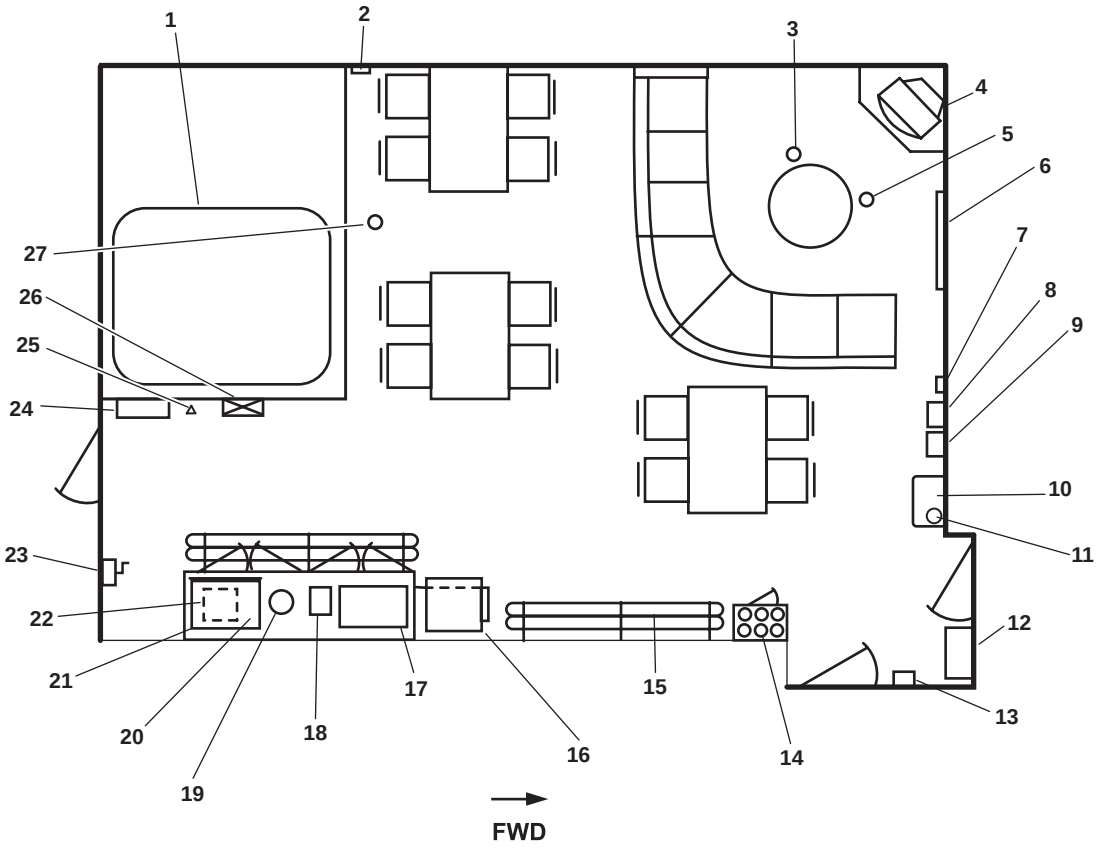


Figure 3. Mess/Recreation Space

1. Stack (figure 3, item 1). The stack contains engine exhaust and crankcase vents.

2. Thermostat (figure 3, item 2). The thermostat provides temperature control for the mess space.

3. Remote valve operator for valve LO-15 (figure 3, item 3). This remote valve operator operates LO-15 LUBO STOR TK OUT storage tank outlet valve.

4. TV and VCR (figure 3, item 4). The TV and VCR provide viewing for entertainment purposes and for work purposes.

5. Remote hydraulic cutoff valve, HO-COV (figure 3, item 5). This remote cutoff valve operates HO-COV for hydraulic oil.

6. Bulletin board (figure 3, item 5). The bulletin board provides postings of articles of interest to all crewmembers.

7. Thermostat (figure 3, item 6). The thermostat provides temperature control for the recreation space.

8. Intercom (figure 3, item 7). The intercom provides communication with other areas of the vessel.

9. Sound powered telephone (figure 3, item 8). The sound powered telephone is used for intraship communication.

10. Drinking fountain (figure 3, item 9). The drinking fountain dispenses cold potable water.

11. General alarm bell (figure 3, item 10). The general alarm bell signals various emergency conditions on the vessel.

12. 440V power panel No. 3 (figure 3, item 11). This power panel provides 440 volt power for the main deck supply and exhaust fans, preheaters, and reheaters.

13. Galley supply fan and crew's mess fan coil unit emergency stop (figure 3, item 12). The galley supply fan and crews mess fan coil unit emergency stop disconnects power to the supply fan and fan coil unit.

14. Cutlery dispenser with cabinet (figure 3, item 13). The cutlery dispenser contains the eating utensils.

15. Serving line (figure 3, item 14). The serving line is located adjacent to the roll-up window. The serving line provides a tray rail for cafeteria-style serving.

16. Mini refrigerator and with icemaker (under) (figure 3, item 15). The mini refrigerator provides cold storage for perishables and produces ice.

17. Milk dispenser (figure 3, item 16). This dispenses cold milk.

18. Beverage dispenser (figure 3, item 17). This dispenses cold beverages.

19. Coffee percolator (figure 3, item 18). The coffee percolator produces and holds hot coffee for consumption.

20. Cabinet (under) (figure 3, item 19). The cabinet provides dry good storage.

21. Microwave (over) (figure 3, item 20). The microwave reheats food and beverages.

22. Toaster (countertop) (figure 3, item 21). The toaster produces toast at various settings.

23. AMS 2 watertight door remote hand pump (bulkhead) (figure 3, item 22). Hand pump to open or close the AMS 2 watertight door.

24. 120V main deck, 01 & 02 emergency lighting panel No. 1 (figure 3, item 23). This panel provides power distribution for main deck, 01, and 02 level emergency interior lighting. It also provides 120 volts for the alarm switchboard and the FM-200 system.

25. Fire axe (figure 3, item 24). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in the case of fire.

26. Fire station 5 (figure 3, item 24). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

27. Remote valve operator for valve FO-2, F.O. DAY TK FILL (figure 3, item 25). This remote valve operator operates the fill valve for the port day tank.

DAMAGE CONTROL LOCKER

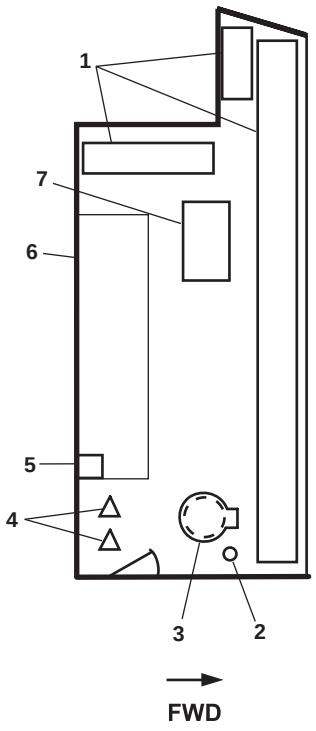


Figure 4. Damage Control Locker

1. Shelves (figure 4, item 1). Shelves provide stowage for damage control lumber and equipment.

2. Hydrogen Fluoride (HF) gas sampling port (figure 4, item 2). This port allows sampling of the atmosphere in AMS 1after the FM-200 system has extinguished a potential fire.

3. Escape hatch (figure 4, item 3). The escape hatch provides an emergency escape from AMS 1.

4. Fire axe (figure 4, item 4). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in case of fire.

5. Sound powered telephone (figure 4, item 5). The sound powered telephone is used for intraship communications.

6. Desk (figure 4, item 6). The desk provides a workspace in the damage control locker.

7. Sound powered telephone system call terminal box (figure 4, item 7). This terminal box provides a junction for many of the vessel's sound powered telephone circuits.

LAUNDRY ROOM

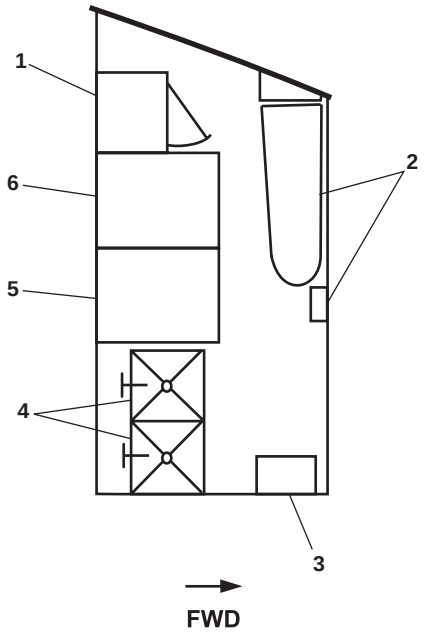


Figure 5. Laundry Room

1. Locker (figure 5, item 1). The locker provides storage for laundry supplies.
2. Iron and ironing board (figure 5, item 2). An iron and a full sized ironing board are provided for garment pressing.
3. Convection heater (figure 5, item 3). The convection heater supplies heat to the laundry room.
4. Deep sinks (figure 5, item 4). Deep sinks are provided for hand laundering and rinsing garments.
5. Washing machine (figure 5, item 5). The washing machine washes garments and washable linens on the vessel.
6. Dryer (figure 5, item 6). The dryer dries garments and linens on the vessel.

ARMS LOCKER

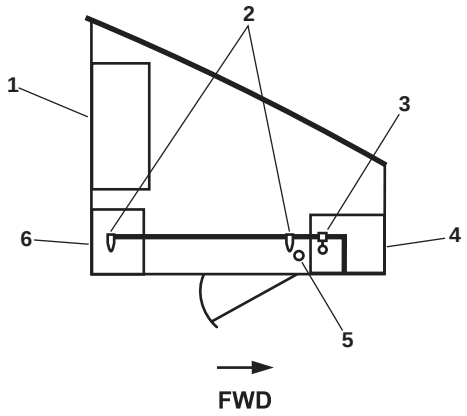


Figure 6. Arms Locker

1. .50 Cal machine gun locker (figure 6, item 1). The .50 cal machine gun locker stores weapons in a secure location.

2. Sprinkler head assembly (figure 6, item 2). The sprinkler head assembly provides raw water to extinguish fires in the arms locker.

3. Water switch assembly (figure 6, item 3). The water switch assembly sends an emergency condition alarm signal to the pilothouse when water flows into the arms locker sprinkler piping system.

4. Small arms locker (figure 6, item 4). The small arms locker provides secure storage for small arms.

5. Temperature switch (figure 6, item 5). The temperature switch sends an emergency condition alarm signal to the pilothouse when the temperature rises above 105 °F (41 °C) in the arms locker.

6. Ammunition locker (figure 6, item 6). The ammunition locker provides storage for small arms ammunition.

BOATSWAIN'S STORE

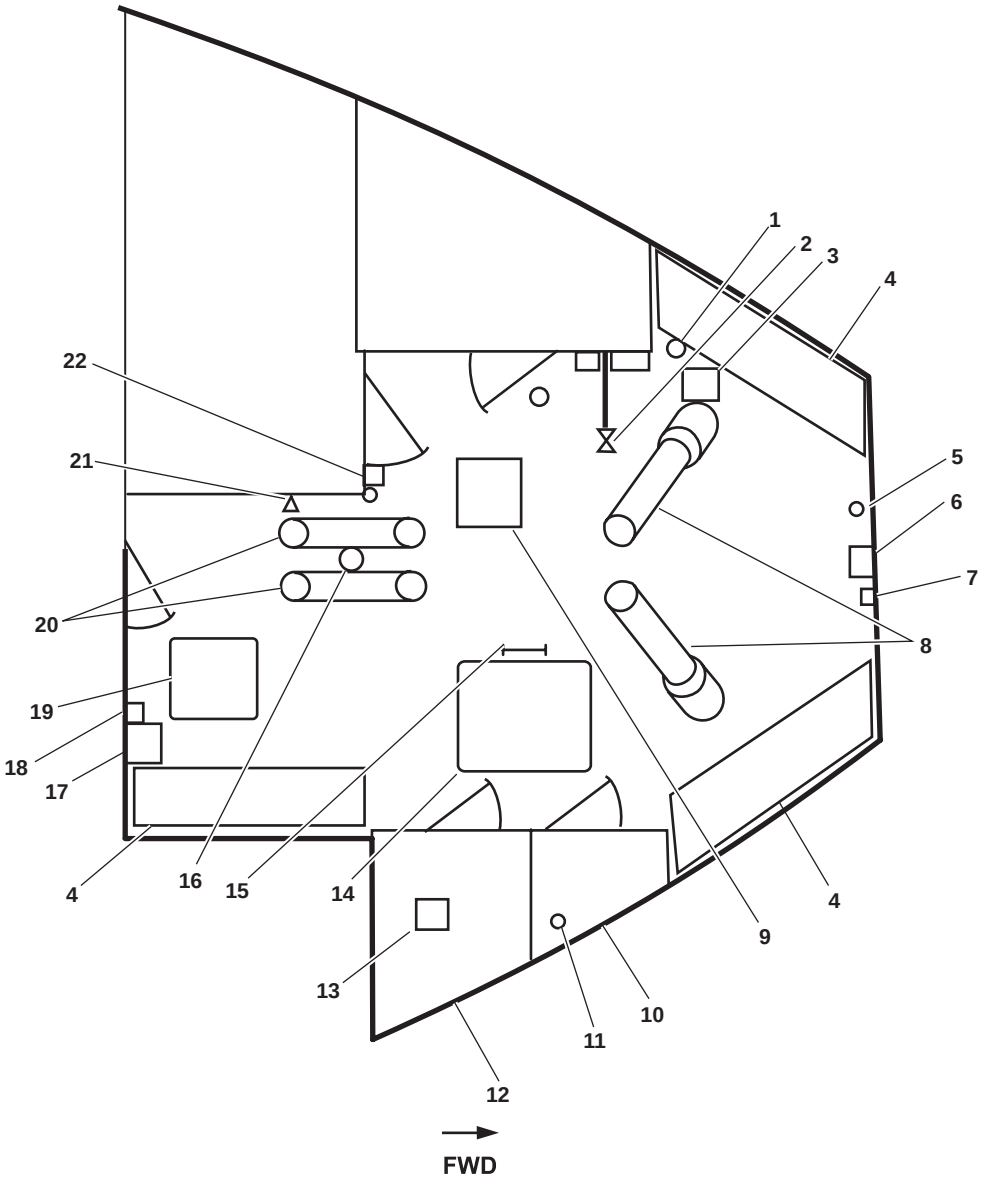


Figure 7. Boatswain's Store

1. Fire extinguisher (figure 7, item 1). The fire extinguisher is used to extinguish small fires on the main deck level.

2. Arms locker sprinkler cutoff valve (figure 7, item 2). The sprinkler cutoff valve controls the supply of raw water to the arms locker drench system sprinkler heads.

3. Arms locker exhaust fan E01-62-2 (figure 7, item 3). The arms locker exhaust fan ventilates the arms locker.

4. Shelves (figure 7, item 4). The shelves provide storage space.

5. General alarm bell (figure 7, item 5). The alarm bell signals various emergency conditions on the vessel.

6. Public Address (PA) speaker volume control (figure 7, item 6). The PA speaker volume control adjusts the volume level of the PA speaker.

7. PA Speaker (figure 7, item 7). The PA speaker amplifies messages throughout the vessel.

8. Hawse pipes (figure 7, item 8). The hawse pipes guide the anchor chains from the anchor windlass to the anchor pocket.

9. Boatswain's store, arms locker, and laundry supply fan (S01-58-1) (figure 7, item 9). This supply fan provides ventilation to the boatswain's store, arms locker, and laundry.

10. Cleaning gear locker (with shelves) (figure 7, item 10). The cleaning gear locker provides storage for cleaning supplies.

11. Remote valve operator. BB-12 (figure 7, item 11). The remote valve operator is a reach rod for operation of BB12, BLST TK 1 SUCT COV.

12. Linen locker (with shelves) (figure 7, item 12). The linen locker provides storage for clean linen.

13. Preheater 1-57-1 thermostat (figure 7, item 13). The thermostat turns the preheater ON and OFF.

14. Hatch (figure 7, item 14). The hatch provides exit to 01 level forward weather deck above.

15. Vertical ladder (figure 7, item 16). The vertical ladder provides access to 01 level forward weather deck.

16. Hydraulic motor and disc brake (figure 7, item 17). The hydraulic motor and disc brake is required to operate the anchor windlass as well as stop the anchor windlass.

17. Boatswain's storeroom supply fan controller and HVAC control (figure 7, item 18). This controller turns the boatswain's storeroom supply fan ON and OFF. The HVAC control turns the HVAC ON and OFF.

18. HVAC system controller for preheater and reheater 1-57-1 (figure 7, item 19). The HVAC system controller for preheater and reheater 1-57-1 provides electrical power to the preheater and reheater.

19. Hatch (figure 7, item 20). This hatch provides access to the bow thruster compartment below.

20. Chain pipes (figure 7, item 21). The chain pipes guide the chain from the anchor windlass to the chain locker.

21. Fire axe (figure 7, item 15). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in the case of fire.

22. Arms locker exhaust fan controller (figure 7, item 22). This controller controls power to the arms locker exhaust fan.

MAIN DECK PASSAGEWAY

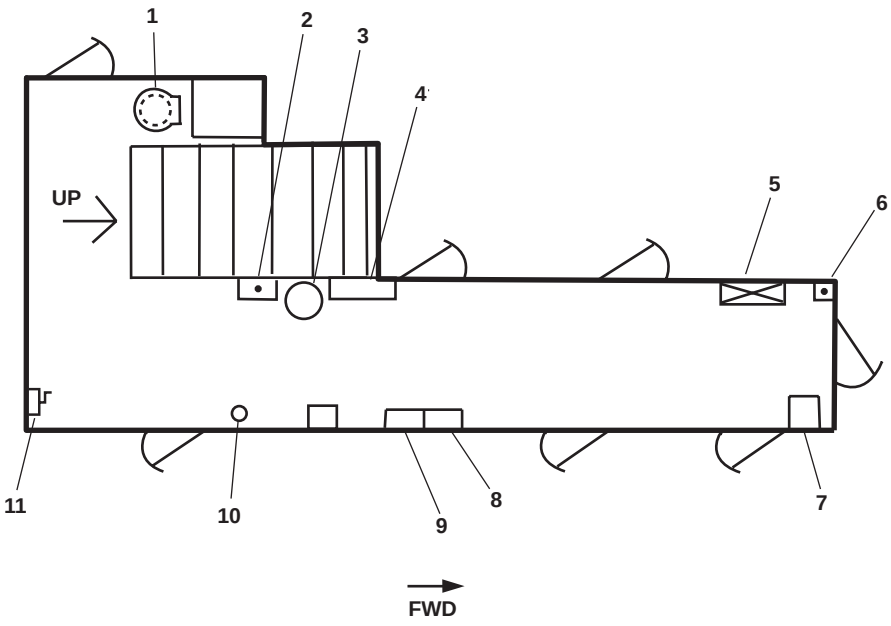


Figure 8. Main Deck Passageway

1. Scuttle (escape hatch) (figure 8, item 1). The scuttle provides an emergency escape from Enclosed Operating Space (EOS).

2. Fire alarm pull station (figure 8, item 2). The fire alarm pull station activates the fire alarm in the EOS and pilothouse when pulled.

3. Fire extinguisher (figure 8, item 3). The fire extinguisher used to extinguish small fires on the main deck level.

4. Life jacket locker (figure 8, item 4). Located under the ladder, the locker provides storage for life jackets.

5. Fire Station 6 (figure 8, item 5). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

6. Fire alarm pull station (figure 8, item 6). The fire alarm pull station activates the fire alarm in the EOS and pilothouse when pulled.

7. Boatswain's store room/arms locker exhaust fan emergency stop (figure 8, item 6). The boatswain's store room/arms locker exhaust fan emergency stop turns OFF ventilation from the arms locker.

8. 120V distribution panel No. 3 (figure 8, item 7). This panel provides 120 volts power for the main deck port and starboard lights, port, starboard and sanitary space electrical receptacles. This panel also provides 120 volts power to the mess room lights, drinking fountain, 01 & 02 level reheater 120V fuse box No. 1, and the Deck Reheater 120V Fuse Box No. 3.

9. Deck Reheater 120V Fuse Box No. 3 (figure 8, item 8). This fuse box provides fuse protection for main deck reheaters.

10. General alarm bell (figure 8, item 9). The general alarm bell signals various emergency conditions on the vessel.

11. AMS 1 Watertight door remote hand pump (bulkhead) (figure 8, item 10). This remote hand pump is used to open or close the AMS 1 watertight door.

GALLEY

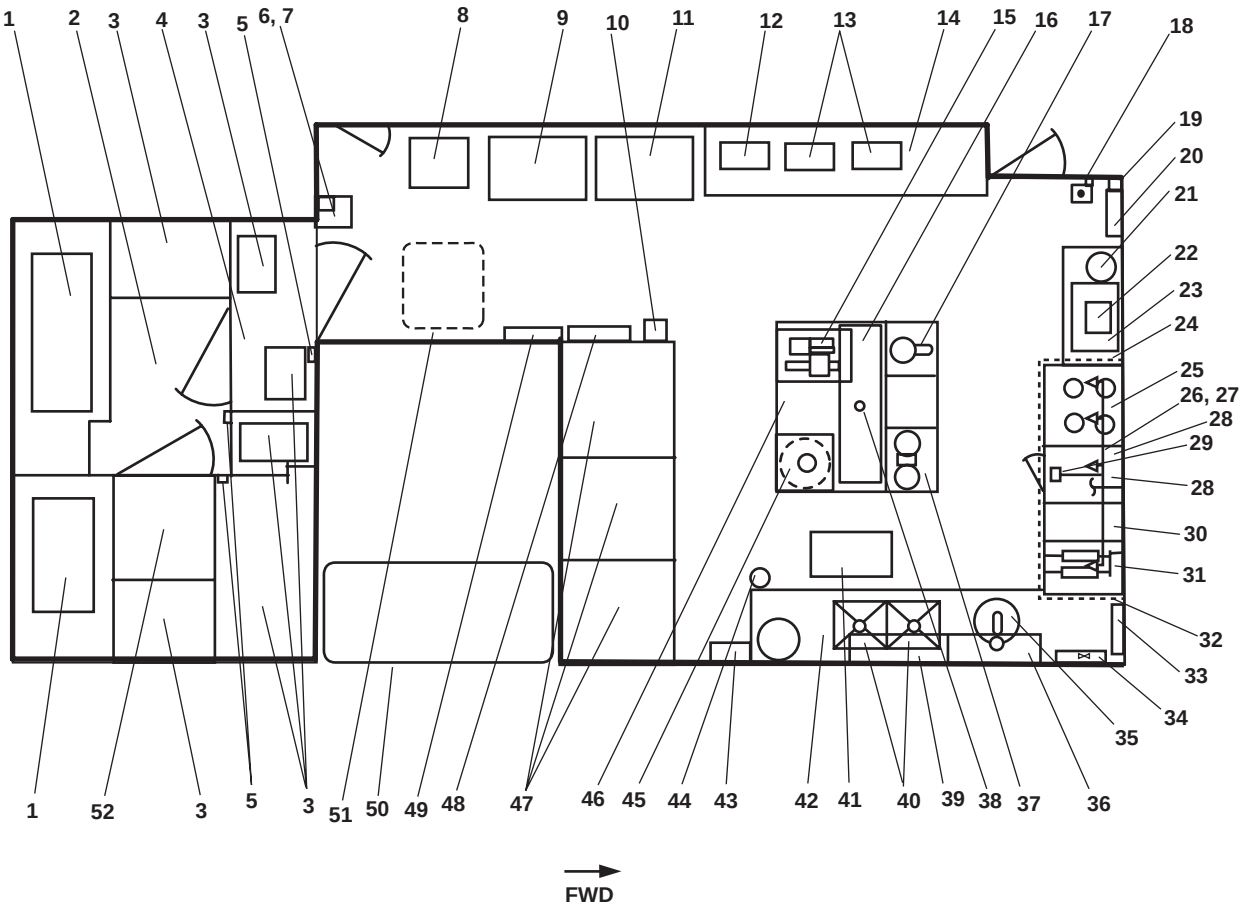


Figure 9. Galley

1. Fan coil unit (figure 9, item 1). One fan coil unit provides cooling capability for the chill box and a second fan coil unit provides cooling capability for the walk-in freezer.

2. Chill box (figure 9, item 2). The chill box is a walk-in refrigerator.

3. Shelves (figure 9, item 3). The shelves are used for storage.

4. Thaw room (figure 9, item 4). The thaw room is used to thaw frozen foods.

5. Freezer alarm switch (figure 9, item 5). The freezer alarm switch is provided in the event a crewmember becomes trapped inside the chill box or freezer. The crewmember can activate the freezer alarm using the freezer alarm switch.

6. Freeze box alarm, freeze box timer, heater connector and disconnect switches (figure 9, item 6). These switches control various functions in the galley reefer area.

7. Defrost heater controller for the vessel's storage refrigerator and freezer system (figure 9, item 7). The defrost heater controller controls the power to the vessel's storage refrigerator and freezer system defroster.

8. Trash compactor and safe (above) (figure 9, item 8). The trash compactor compacts trash, reducing the volume of trash. The safe provides a secured storage area for miscellaneous items.

9. Freezer (figure 9, item 9). The freezer is used for frozen day stores.

10. Sound powered telephone, thermostat (above), and fire extinguisher (below) (figure 9, item 10). The sound powered telephone is used for intraship communications. The thermostat provides temperature control for the galley space. The fire extinguisher is used to put out small fires on the vessel.

11. Refrigerator (figure 9, item 11). Used for day stores requiring refrigeration.

12. Cold well (figure 9, item 12). The cold well is used for serving salads and other cold food.

13. Hot well (figure 9, item 13). The hot well is used for serving hot foods.

14. Steam table (figure 9, item 14). The steam table provides controls for hot wells and dish storage (under).

15. Meat slicer and storage shelves (under) (figure 9, item 15). The countertop mounted meat slicer is used to slice food products. The storage shelves are provided below counter top for storage space.

16. Shelf (over) (figure 9, item 16). The shelf provides storage space.

17. Mixer (figure 9, item 17). The mixer is used to combine ingredients.

18. Manual pull box (figure 9, item 18). The manual pull box allows the crew to manually activate the galley fire suppression system.

19. Thermostat (figure 9, item 19). The thermostat provides temperature control in the galley.

20. 440V power panel No. 2 (figure 9, item 20). This power panel provides 440 volts distribution for the galley equipment.

21. Coffee percolator (figure 9, item 21). Counter top mounted percolator provides hot coffee for the crewmembers.

22. Toaster (figure 9, item 22). Countertop mounted four-slice toaster.

23. Microwave (over) (figure 9, item 23). Microwave oven mounted on shelf overhead is used for quick food preparation.

24. Counter with cabinet (over) (figure 9, item 24). The counter with cabinet is used for storage.

25. Range (figure 9, item 25). Electric range and oven is used for food preparation.

26. Temperature sensing fusible links (within ventilation hood) (figure 9, item 26). The temperature sensing fusible links are the detection portion of the galley fire suppression system. The fusible links allow automatic detection by means of specific alloy melting ratings. When the temperature exceeds the rating of the link, the link separates, allowing the galley fire suppression system to be activated.

27. Distribution nozzles (within ventilation hood) (figure 9, item 27). The distribution nozzles deliver the galley fire suppression extinguishing agent to the galley heat producing equipment.

28. Griddle with cabinet (figure 9, item 28). Electric griddle used for food preparation. Cabinet storage is provided below.

29. Hood damper control knob (figure 9, item 29). The hood damper control knob contains fail-safe circuitry coupled with spring drive, which allows closure of the fire damper even if electrical power is interrupted or turned OFF. The hood damper control knob resets to normal operating position when the fan is restarted.

30. Counter with drawers (figure 9, item 30). The counter with drawers is used for storage.

31. Fryer (figure 9, item 31). The double basket, electric fryer is used for deep fat frying.

32. Ventilator hood (over) (figure 9, item 32). The ventilator hood is provided for the cooking area ventilation. The ventilator hood contains the automatic cleaning system and fire protection system.

33. Gaylord ventilation control cabinet (figure 9, item 33). The ventilator control cabinet houses the controls for ventilator hood cleaning system, the fire cycle water spray, and a pull fire box. The ventilation control cabinet sends wash water to the grease extraction baffles and the second wash manifold in the automatic water wash canopy. The Gaylord ventilation control cabinet also activates the fire cycle water spray to extinguish fires within the ventilation hood protecting the ventilation damper from warping due to excessive heat. The Gaylord ventilation control cabinet fire cycle water wash can also be activated by the pull fire box. The pull fire box functions only for the Gaylord ventilator hood.

34. Galley fire suppression system cabinet (figure 9, item 34). The galley fire suppression system is a wet chemical (Ansulex agent) fire suppressant system designed to constantly monitor the galley's cooking appliances. The galley fire suppression system cabinet is activated by the manual fire pull station or high temperature sensing fusible links located over the deep fryer, the griddle, or the range.

35. Potato peeler (figure 9, item 35). The countertop-mounted electric peeler is used to peel potatoes.

36. Shelf (over and under) (figure 9, item 36). The shelf is used for storage.

37. Baker's scale with drawers (under) (figure 9, item 37). The countertop-mounted scale is used for weighing food. Storage is provided below the counter top.

38. Thermal heat detector (figure 9, item 38). When the area temperature rises to 135 °F (275 °C) or more, the thermal heat detector activates the fire alarm system.

39. Shelves (over and under) (figure 9, item 39). The shelves provide storage space.

40. Double sink with garbage disposal under (figure 9, item 40). The double sink is equipped with a garbage disposal and spray unit.

41. Ventilator hood exhaust fan (overhead) (figure 9, item 41). The ventilator hood exhaust fan vents air from the galley to weather.

42. Dishwasher (under) (figure 9, item 42). The industrial type dishwasher is used for sanitizing dishes and utensils.

43. Galley exhaust fan control panel (figure 9, item 43). The galley exhaust fan control panel houses controls for ventilator hood exhaust fan.

44. Remote valve operator FO-15 (figure 9, item 44). The deck operator for the remote valve provides control of FO-15 valve that controls fuel oil flow from the starboard day tank.

45. Countertop with trash can (under) (figure 9, item 45). The countertop is used for food preparation. The trash can is used to discard trash.

46. Countertop with shelves (under) (figure 9, item 46). The countertop is used for food preparation. Storage is provided below the countertop.

47. Dry provisions storage (figure 9, item 47). The dry provision storage provides storage space for dry food/or supplies.

48. 220/110V distribution panel (figure 9, item 48). This panel provides power distribution for the galley, crew's mess, and laundry spaces.

49. 120V distribution panel No. 1 (figure 9, item 49). This panel contains circuit breakers for various pieces of galley equipment.

50. Stack (figure 9, item 50). The stack contains engine exhaust vents and crankcase vents.

51. Galley hatch (located above) (figure 9, item 51). The galley hatch provides access for loading or unloading galley stores and appliances.

52. Walk-in freezer (figure 9, item 52). The walk-in freezer is used for bulk frozen food storage.

VESTIBULE

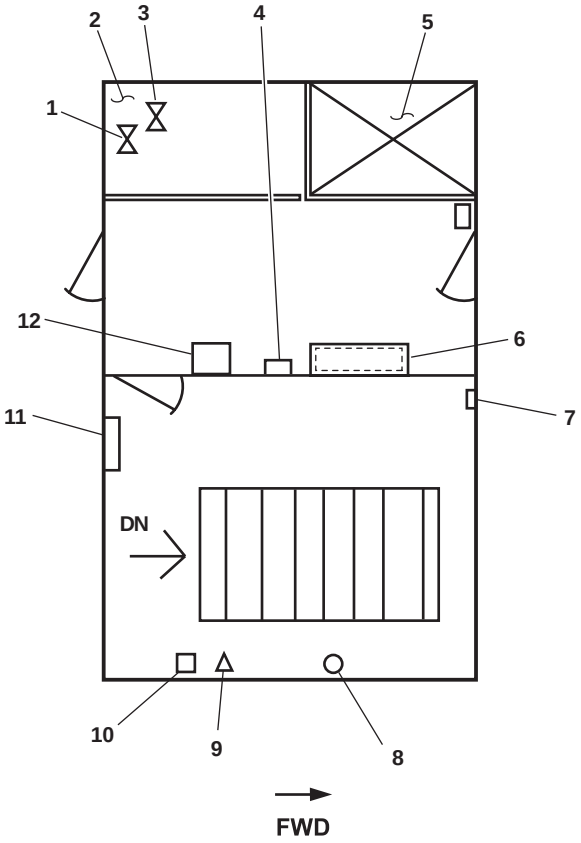


Figure 10. Vestibule

1. FM-55 (figure 10, item 1). Valve FM-55, F STA No. 4 supplies raw water to fire station 4.

2. VIDMAR storage cabinets (figure 10, item 2). The VIDMAR storage cabinets provide stowage for spare and repair parts.

3. Flow control valve (figure 10, item 3). The hydraulic key flow control valve controls the flow of hydraulic fluid to the deck crane.

4. Water Washdown Station (WWS) with HF sampling port (figure 10, item 4). This station permits raw water to flow from the fire main system to the engine room water wash down system. HF gas sampling can also be done at this station.

5. VIDMAR storage cabinets (figure 10, item 5). The VIDMAR storage cabinets provide stowage for spare and repair parts.

6. Fire and emergency stop panel (figure 10, item 6). FM-200 manual pull box (above), HVAC SYS EMER STOP, the FO XFER Pump EMER STOP (below), fire alarm pull station. The FM-20 manual pull box activates the engine room FM-200 system. The EMER STOP boxes shut OFF fuel oil transfer pumps 1 and 2. The HVAC SYS EMER STOP shuts OFF the AMS 1 and 2 supply fans, the engine room exhaust, and supply fans. The fire alarm pull station activates the fire alarm when pulled.

7. AMS 2 watertight door pump and reservoir system (figure 10, item 8). This system is used to OPEN and CLOSE the AMS 2 watertight door.

8. Fire extinguisher (figure 10, item 9). Portable fire extinguisher used to extinguish small fires on the main deck.

9. Fire axe (figure 10, item 10). Used to aid crew in gaining immediate access to a locked or enclosed area in the case of fire.

10. Fire alarm pull station (figure 10, item 11). Pulling the handle of the fire alarm pull station activates the fire alarm system.

11. FM-200 manual pull box (figure 10, item 12). The FM-200 manual box provides a connection to the FM-200 fire activation system in the engine room.

12. Tow machinery control panel (figure 10, item 7). The tow machinery control panel houses the logic control and circuitry connections for the tow machines.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
ENGINE ROOM

ENGINE ROOM, PORT SIDE

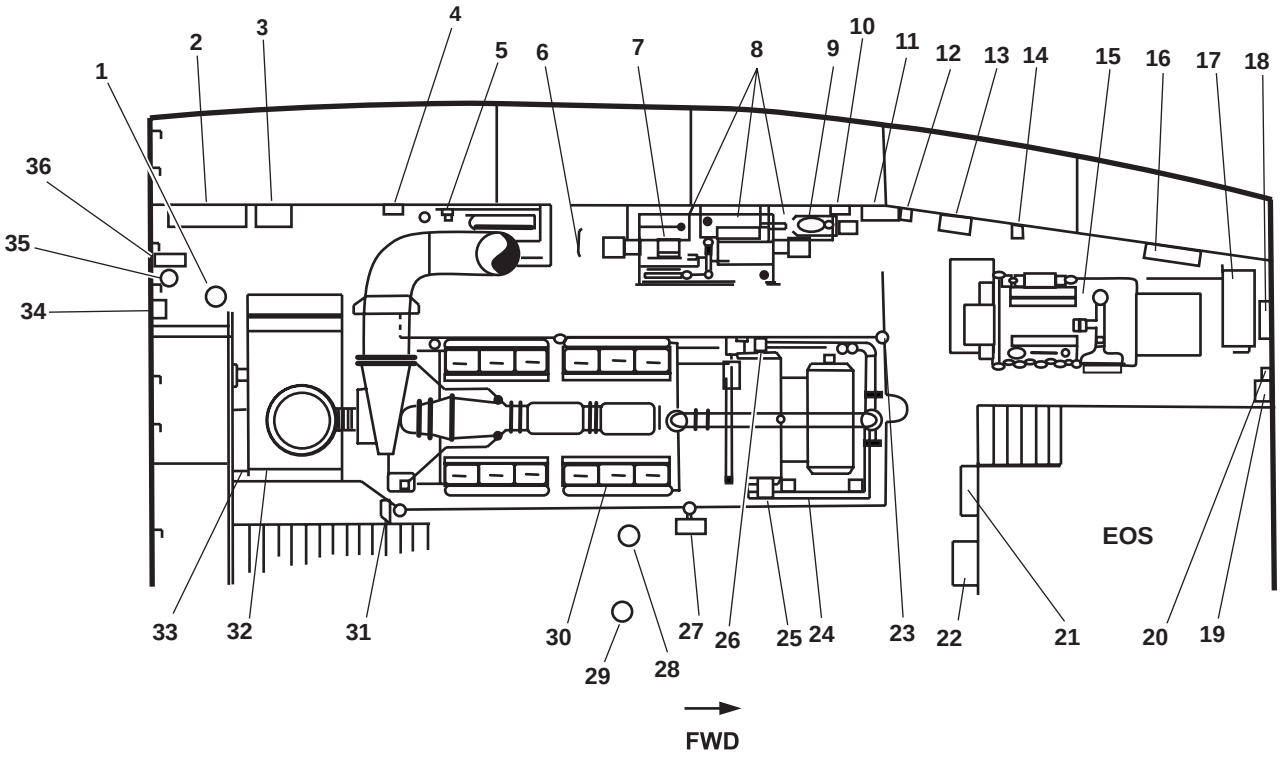


Figure 1. Engine Room, Port Side

1. FM-200 warning light (figure 1, item 1). The FM-200 yellow warning light illuminates when the FM-200 system is activated.

2. Reverse Osmosis Water Purification Unit (ROWPU) battery box (figure 1, item 2). This battery box contains two 12V batteries. The battery bank provides 24 Vdc to the ROWPU to maintain fresh water flush capabilities during vessel layup periods.

3. Drinking fountain (figure 1, item 3). The drinking fountain dispenses cold potable water.

4. ROWPU battery charger (figure 1, item 4). The battery charger maintains the charge of the ROWPU battery bank.

5. Lube oil purifier (figure 1, item 5). The lube oil purifier cleans the lubricating oil for the main engines.

6. Vertical ladder (figure 1, item 6). This ladder provides access to the port fuel oil day tank and the port life boat station on the 02 level.

7. Central hydraulic system hydraulic power unit (figure 1, item 7). The central hydraulic system hydraulic power unit provides hydraulic power for the crane, capstan, anchor windlass, and tow pins. It powers the tow machine when the hydraulic piping is aligned properly.

8. Transformers (figure 1, item 8). Three 440V/120V transformers provide 120V power for the load center distribution panel.

9. Lube oil transfer pump (figure 1, item 9). The lube oil transfer pump is an electrically powered pump used to transfer lube oil within the vessel.

10. Lube oil transfer pump discharge pressure gauge and the lube oil transfer strainer differential pressure gauge (figure 1, item 10). The lube oil transfer pump pressure gauge indicates the discharge pressure of the lube oil transfer pump. The lube oil transfer strainer differential pressure gauge indicates the differential pressure of the strainer.

11. Lube oil manifold (figure 1, item 11). The lube oil manifold provides centralized control of the lube oil piping system.

12. Lube oil transfer pump motor controller (figure 1, item 12). This controller turns the lube oil transfer pump ON and OFF.

13. Lube oil tank level indicator and hand pump (figure 1, item 13). The tank level indicator displays the amount of oil present in the tank. The hydraulic oil hand pump is used to transfer hydraulic oil from the hydraulic oil storage tank.

14. Ship's Service Diesel Generator (SSDG) 2 starting air pressure gauge (figure 1, item 14). This gauge indicates the amount of pressure available to the SSDG 2 starter.

15. SSDG 2 (figure 1, item 15). SSDG 2 is an air-started, fresh water-cooled, diesel engine-driven service generator providing electric power to the main switchboard.

16. Air receiver (figure 1, item 16). The 30 gallon (113.6 liter) air receiver stores air for the control air system.

17. Sewage discharge pump 2 (figure 1, item 17). Sewage discharge pump 2 is an electrically powered pump that pumps the contents of the sewage tank to the sewage shore connection or overboard.

18. Control air dryer (figure 1, item 18). The control air dryer removes moisture from the control air system.

19. Sewage discharge pump 2 motor controller (figure 1, item 19). The sewage discharge pump 2 motor controller turns sewage discharge pump 2 ON and OFF.

20. Sewage discharge pump 2 pressure gauge (figure 1, item 20). This pressure gauge indicates the discharge pressure of sewage discharge pump 2.

21. Engine room distribution panel no. 4 (figure 1, item 21). The engine room distribution panel provides power distribution for engine room equipment.

22. Monitoring system Central Processing Unit (CPU) with 24 volt machinery DC control distribution panel (below) (figure 1, item 22). The monitoring system CPU cabinet contains the central processor for the machinery plant monitoring system. A 24 volt machinery DC control distribution panel provides circuit protection for machinery monitoring, SSDG. 2, FM-200 shutdown, rudder angle, steering gear alarm, pump drive engine, and bow thruster engine.

23. Fire extinguisher (figure 1, item 23). The fire extinguisher is used to extinguish small fires.

24. Engine control panel (figure 1, item 24). This panel provides the controls and status displays for the main engines.

25. Engine alarm horn (figure 1, item 25). The engine alarm horn sounds the engine alarm, indicating various engine conditions and emergencies.

26. Lube oil prime pump and controller (figure 1, item 26). The lube oil prime pump primes the main propulsion engine for operation. Its controller also operates the lube oil pump, permitting the operator to select ON and OFF.

27. Fire station 2 (figure 1, item 27). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

28. Machinery plant alarm rotating beacon (figure 1, item 28). A blue light illuminates and the beacon rotates when the machinery plant alarm is activated.

29. General alarm rotating beacon (above) (figure 1, item 29). A red light illuminates and the beacon rotates when the general alarm is activated.

30. Main engine 2 (figure 1, item 30). Main engine 2 is an air-started, fresh water-cooled, main propulsion engine. Main engine 2 rotates counterclockwise when viewed from the flywheel.

31. Aft sea chest strainer differential pressure gauge (figure 1, item 31). This gauge indicates the differential pressure across the aft sea chest strainer.

32. Reduction gear 2 (figure 1, item 32). Reduction gear 2 transfers power from the main engine and provides directional control to the port propeller shaft.

33. Shaft brake panel 2 (figure 1, item 33). This panel provides control for the port shaft brake.

34. FM-200 alarm horn/strobe (figure 1, item 34). The FM-200 alarm horn/strobe provides a visible and audible warning 60 seconds before the FM-200 fire suppression agent is released.

35. Fuel vent flow indicator (figure 1, item 35). The fuel vent flow indicator is provided to check for fuel oil tank accidental overfill.

36. Fuel oil day tank high level alarm (figure 1, item 36). The fuel oil day tank high level alarm provides a visible and audible alarm when the transfer of fuel oil to the PORT or STARBOARD fuel oil day tanks have exceeded fill levels.

ENCLOSED OPERATING STATION

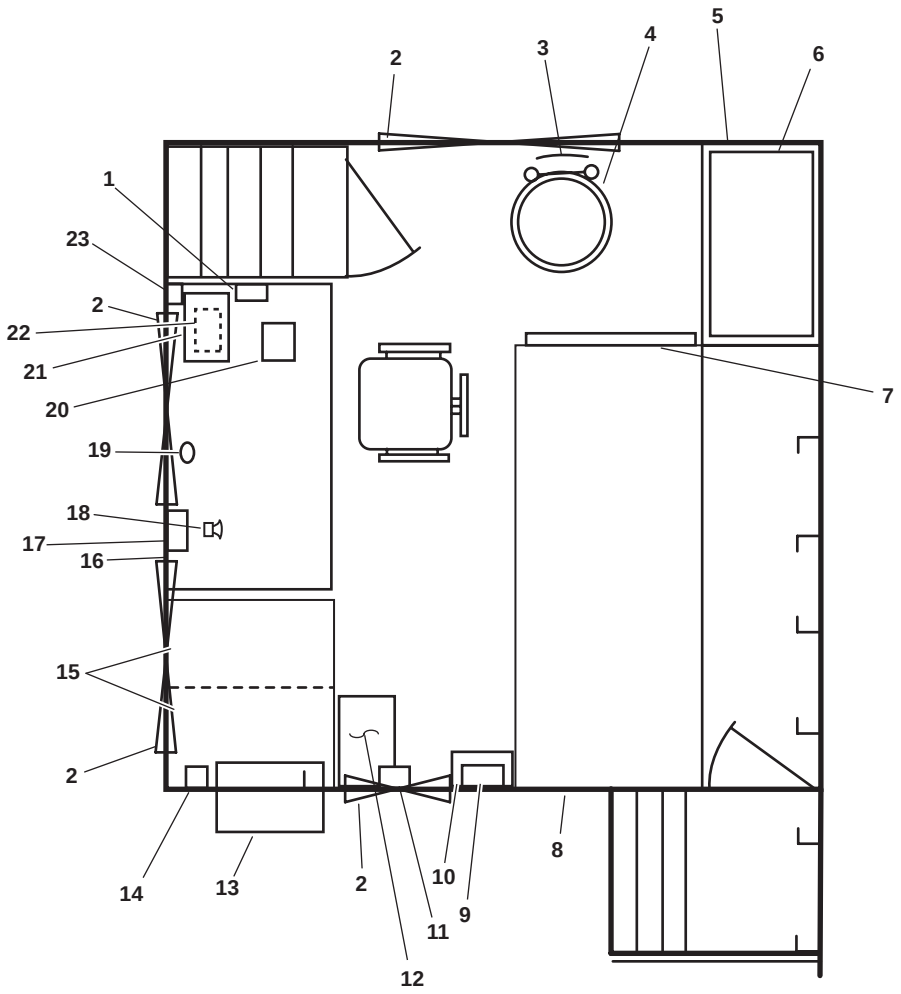


Figure 2. Enclosed Operating Station (EOS)

1. Sound powered telephone (figure 2, item 1). The sound powered telephone provides intraship communications.

2. Window (figure 2, item 2). The window allows observation of the engine room.

3. Vertical ladder (figure 2, item 3). This ladder provides an emergency exit from the EOS to the main deck.

4. Scuttle (escape hatch) (figure 2, item 4). The scuttle provides an emergency exit from the enclosed operating station.

5. Table/book rack (figure 2, item 5). The table/book rack is used for record keeping and storage.

6. Master tank level indicator receiver panel, 7-channel (figure 2, item 6). The master tank level indicator receiver panel has seven meters for remote monitoring of tank levels for the sewage holding tank, oily waste holding tank, potable water tanks, and ballast water tanks.

7. Fire and smoke detection panel, fire alarm bell, and key cabinet (figure 2, item 7). The fire and smoke detection panel provides controls and indicators necessary for controlling and monitoring the fire detection system.

8. Main switchboard (figure 2, item 8). The main switchboard includes facilities for the control of the SSDGs, including paralleling and power distribution (440 Vac).

9. Ship heel clinometer (figure 2, item 9). The ship's heel clinometer indicates the trim angle of the vessel.

10. Key box (figure 2, item 10). The key box provides a storage place for various keys.

11. Remote indicator (alarm) assembly (figure 2, item 11). The remote indicator (alarm) assembly monitors the effluent discharged by the oil water separator. The remote indicator (alarm) assembly emits an audible alarm when the selected alarm value is exceeded.

12. Special tools locker (figure 2, item 12). The special tools locker is located below the engine room EOS. The special tools locker contains shelves for storage of authorized special tools.

13. Air conditioner unit (figure 2, item 13). The air conditioner unit provides air conditioning for the EOS.

14. EOT wrong direction bell (figure 2, item 14). The EOT wrong direction bell indicates that the throttles are not set to desired speed/direction of the pilothouse EOT.

15. File cabinet (figure 2, item 15). The file cabinet provides storage space for records.

16. EOS console (figure 2, item 16). The EOS console houses central controls for the main engines and the machinery plant monitoring system.

17. Ship trim clinometer (figure 2, item 17). The ship's trim clinometer indicates the heel angle of the vessel.

18. Remote loudspeaker station (figure 2, item 18). The loud speaker station amplifies audio messages to the engine room.

19. General alarm bell (figure 2, item 19). The general alarm bell sounds the general alarm, indicating various conditions and emergencies.

20. Intercom (figure 2, item 20). The intercom provides communication from the rest of the vessel.

21. Tank level indicator receiver panel, 11-channel (figure 2, item 21). This panel has 11 meters for remote monitoring of tank levels for the lube oil storage tank, fuel oil storage tanks, and fuel oil day tanks.

22. Steering alarm panel (figure 2, item 22). This panel provides remote indicators for the steering gear system.

23. EOT constant ring bell (figure 2, item 23). The EOT constant ring bell indicates that the pilothouse has changed the desired speed/direction.

ENGINE ROOM, STARBOARD SIDE

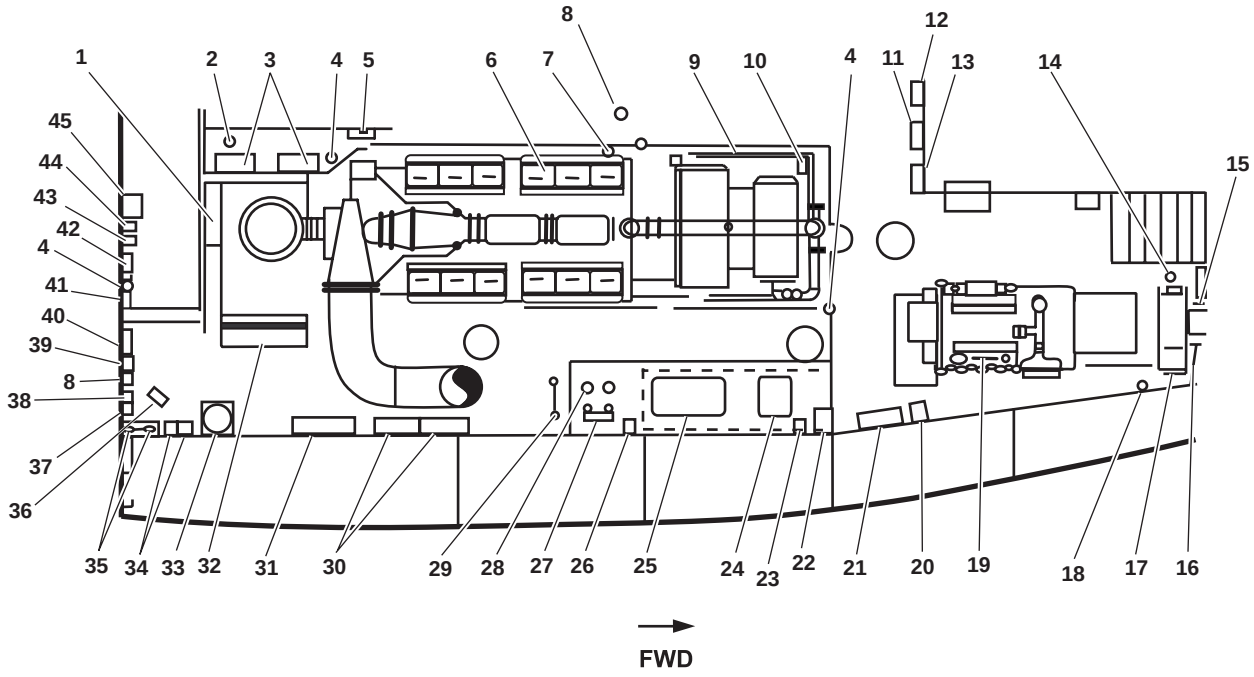


Figure 3. Engine Room, Starboard Side

1. Shaft brake panel 1 (figure 3, item 1). This panel provides control for the starboard shaft brake.

2. Lube oil hand pump (figure 3, item 2). The lube oil hand pump pumps lube oil from the reduction gears to the oily waste system.

3. Reduction gear cooling pumps (figure 3, item 3). The reduction gear cooling pumps are electric pumps that circulate cooling water for the reduction gears.

4. Fire extinguisher (figure 3, item 4). The fire extinguisher is used to extinguish small fires.

5. Fire alarm pull station and reduction gear 1 and 2 fresh water cooling pump pressure gauges (figure 3, item 5). The fire alarm pull station is used to activate the fire alarm. The cooling pump pressure gauges indicate the pressure of the reduction gear coolant.

6. Main engine 1 (figure 3, item 6). Main engine 1 is an air-started, fresh water-cooled main propulsion engine. Main engine 1 rotates clockwise when viewed from the flywheel.

7. General alarm bell (figure 3, item 7). The general alarm bell sounds a general alarm, indicating various conditions and emergencies.

8. General alarm light (figure 3, item 8). The general alarm light illuminates indicating various conditions and emergencies.

9. Engine control panel (figure 3, item 9). The engine control panel houses controls and status displays for the main engines.

10. Engine alarm horn (figure 3, item 10). The engine alarm sounds the engine alarm, indicating various conditions and emergencies.

11. Load center distribution panel (figure 3, item 11). The load center distribution panel supplies 120V to four distribution panels and to the machine shop.

12. Horn and PA speaker with volume control (figure 3, item 12). The horn sounds to alert the crew when the sound powered telephone (in EOS) has an incoming call. The PA speaker with the volume control amplifies messages throughout the engine room.

13. 440V power panel No. 1 (figure 3, item 13). 440V power panel No. 1 provides 440 volt power distribution for engine room equipment.

14. Fire alarm pull station (figure 3, item 14). The fire alarm pull station activates the fire alarm when pulled.

15. Sewage discharge pump 1 motor controller (figure 3, item 15). The sewage discharge pump 1 motor controller turns sewage discharge pump 1 ON and OFF.

16. AMS 1 watertight door hand pump (figure 3, item 16). The AMS 1 watertight door hand pump is used to open and close the AMS 1 sliding watertight door.

17. Sewage discharge pump 1 (figure 3, item 17). Sewage discharge pump 1 is an electrically powered pump that pumps contents of the sewage tank to the sewage shore connection or overboard.

18. Aqueous Film Forming Foam (AFFF) pump suction gauge (figure 3, item 18). This AFFF pump suction gauge indicates the suction pressure of the AFFF pump.

19. Ship's Service Diesel Generator (SSDG) 1 (figure 3, item 19). The SSDG 1 is a battery-started (24 Vdc), fresh water-cooled, diesel engine-driven service generator providing electric power to the main switchboard.

20. Oily waste storage tank level indicator (figure 3, item 20). The oily waste storage tank level indicator displays the amount of oily waste present in the tank.

21. 120V emergency distribution panel No. 1 (figure 3, item 21). The 120 volt emergency distribution panel no. 1 provides emergency power distribution for selected equipment.

22. Battery chargers (figure 3, item 22). Two battery chargers maintain the charge of two battery banks. One charger is for SSDG 1, the other for the machinery plant monitoring system.

23. Oil Content Monitor (OCM) (figure 3, item 23). The OCM monitors the oil content of the effluent discharge from the oil water separator and prevents overboard discharge of contaminated effluent.

24. Battery banks (figure 3, item 24). The upper battery bank provides battery power to start SSDG 1 and the lower battery bank provides power for the machinery plant monitoring system and engine control.

25. Oil water separator (figure 3, item 25). The oil water separator separates oil from water and discharges the water overboard sending only the separated oil back to the oily waste tank.

26. Oily bilge and oil water separator pressure gauges (figure 3, item 26). The oily bilge and oil water separator pressure gauges indicate the amount of pressure within the oily bilge and oil water separators.

27. Oily bilge pump (figure 3, item 27). The oily bilge pump is an air powered pump for removing oily water from bilges and transferring contents of the oily waste drain tank and the oily waste storage tank to the shore connection.

28. Oily bilge strainer (figure 3, item 28). The oily bilge strainer protects the oily bilge pump by removing sediment and debris from the bilge water.

29. Vertical ladder (figure 3, item 29). The vertical ladder provides access to the starboard day tank and the starboard lifeboat station on the 02 level.

30. Fuel oil tank level indicators (figure 3, item 30). The fuel oil tank level indicators display the amount of fuel oil in the various fuel oil storage tanks on the vessel.

31. Fuel oil manifold (figure 3, item 31). The fuel oil manifold provides centralized control for the fuel oil piping system.

32. Reduction gear 1 (figure 3, item 32). Reduction gear 1 transfers power from main engine and provides directional control to the propeller shaft.

33. Fuel filter/water separator (figure 3, item 33). The fuel filter/water separator is used to remove water and solids from the fuel oil.

34. Fuel oil transfer pump 1 and 2 motor controllers (figure 3, item 34). The fuel oil transfer pump 1 and 2 motor controllers control the power to the fuel oil transfer pumps.

35. Fuel oil transfer pumps (figure 3, item 35). The fuel oil transfer pumps are used to transfer fuel within the fuel oil transfer piping system.

36. Space heater (figure 3, item 36). The space heater provides heated air for the engine room.

37. Fuel oil transfer pump pressure gauges (figure 3, item 37). The fuel oil transfer pump pressure gauges indicate the fuel oil pressure being discharged from the fuel oil transfer pump.

38. Fuel oil day tank high level alarm (figure 3, item 38). The fuel oil day tank high level alarm provides a visible and audible alarm when the transfer of fuel oil to the PORT or STARBOARD fuel oil day tanks have exceeded fill levels.

39. FM-200 relay panel box (figure 3, item 39). The FM-200 relay panel box houses the equipment shutdown relays. These relays shut down the engine room exhaust fans, the engine room supply fans, both SSDGs, the bow thruster engine, the AMS 1 supply fan, the fuel oil transfer pumps, and the pump drive engine.

40. Reduction gear 1 cooling water pump motor controller (figure 3, item 40). The reduction gear 1 cooling water pump motor controller controls the power to reduction gear water pump 1.

41. Reduction gear 2 cooling water pump motor controller (figure 3, item 41). The reduction gear 2 cooling water pump motor controller controls the power to reduction gear water pump 2.

42. Reefer refrigerant piping valve system (figure 3, item 42). The reefer refrigerant piping valve system is provided to operate the chill box and walk-in freezer's refrigerating system.

43. Engine room exhaust fan 1 and engine room supply fan 1 motor controllers (figure 3, item 43). The engine room exhaust fan 1 and engine room supply fan 1 motor controllers control the ventilation fans for the starboard side of the engine room.

44. Engine room exhaust fan 2 and engine room supply fan 2 motor controllers (figure 3, item 44). The engine room exhaust fan 2 and engine room supply fan 2 motor controllers control the ventilation fans for the port side of the engine room.

45. AMS 2 watertight door hand pump (figure 3, item 45). The AMS 2 watertight door hand pump is used to OPEN and CLOSE the AMS 2 sliding watertight door.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
AMS 1 AND BOW THRUSTER COMPARTMENT

AMS 1 AND BOW THRUSTER COMPARTMENT

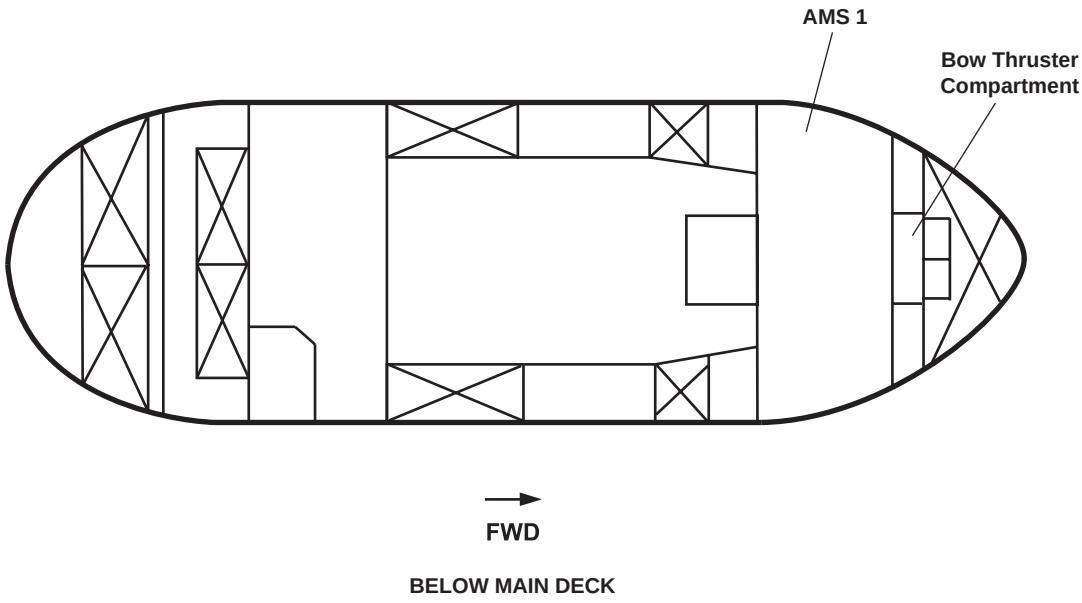


Figure 1. AMS 1 and Bow Thruster Compartment

1. AMS 1 houses the starting air receivers, the bow thruster engine, the pump drive engine, towing machine hydraulic reservoir, Marine Sanitation Device (MSD), and air compressors. Details of this space are contained in figure 2.

2. The bow thruster compartment houses a lube oil reservoir, a general alarm bell, an access hatch, and the bow thruster unit. Details of this space are contained in figure 3.

AMS 1

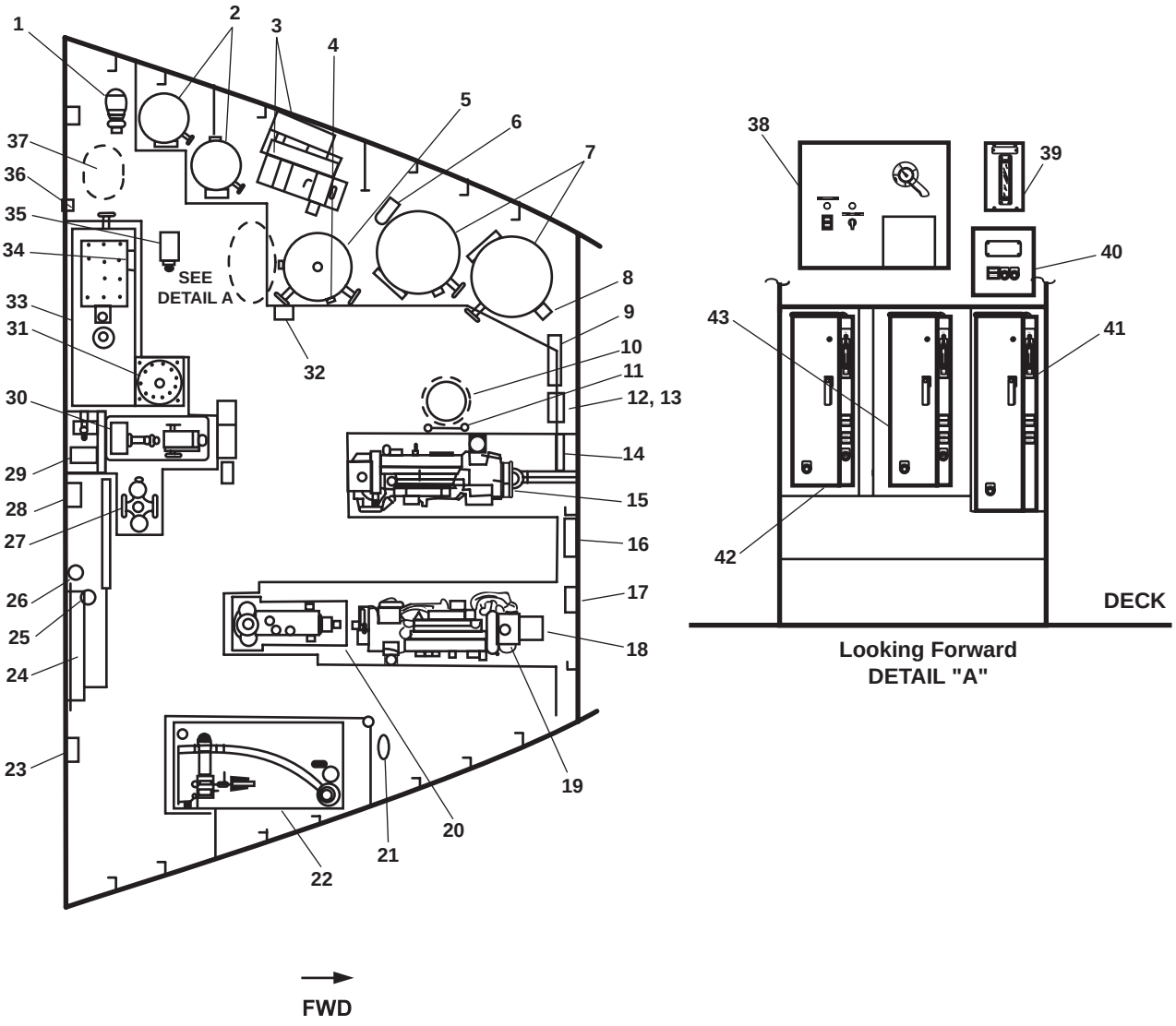


Figure 2. AMS 1

1. Hot water recirculating pump (figure 2, item 1). The hot water recirculating pump provides continuous circulation of hot water in the hot potable water piping system.

2. Hot water heaters (figure 2, item 2). The two hot water heaters provide potable water, heated to the set point temperature, for the hot potable water piping system.

3. Air compressors (figure 2, item 3). The air compressors provide compressed air to the air receivers.

4. Ship's service air pressure gauge (figure 2, item 4). The ship's service air pressure gauge measures air pressure in the ship's service air receiver.

5. Ship's service air receiver (figure 2, item 5). The ship's service air receiver provides storage for the ship's service air.

6. Air compressor 1 and 2 discharge pressure and ship's service air pressure gauges (figure 2, item 6). The air compressor 1 and 2 discharge gauges measure the level of pressure entering the starting air receivers. The ship's service air pressure gauge measures the pressure in the ship's service air receiver.

7. Starting air receiver (figure 2, item 7). The starting air receiver provides storage for diesel engine starting air.

8. Starting air receiver pressure gauge (figure 2, item 8). The starting air pressure gauge measures the air pressure available to the engines' starting motors.

9. 440V power panel No. 4 (figure 2, item 9). This power panel provides 440 volt power distribution for the air compressors 1 and 2, the MSD discharge pump and blower, the hot potable water recirculating pump, the AMS 1 supply fan and the AMS 1 unit heater.

10. Scuttle (escape hatch) (figure 2, item 10). The scuttle provides an emergency escape from AMS 1.

11. Vertical ladder (figure 2, item 11). The vertical ladder leads to the main deck.

12. AMS 1 supply fan motor controller (figure 2, item 12). This controller controls the operation of the AMS 1 supply fan. This controller also permits the operator to select FAST, SLOW, and STOP.

13. BOW THRUSTER BRAKE PANEL (figure 2, item 13). This panel provides local manual control for the bow thruster shaft brake.

14. Space heater (above) (figure 2, item 14). The heater provides heated air for AMS 1.

15. Bow thruster engine (figure 2, item 15). The bow thruster engine drives the bow thruster components.

16. Fire station 3 (figure 2, item 16). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

17. Pump drive engine and bow thruster engine starting air pressure gauges and fire main pressure gauge (figure 2, item 17). The starting air pressure gauges measures the level of air pressure available to the pump drive and the bow thruster starters. The fire main pressure gauge measures the level of pressure available from the firefighting pump.

18. Hydraulic towing machine (figure 2, item 18). The hydraulic oil pump provides pressurized hydraulic oil to power the towing machine, and can be aligned to power the central hydraulic system. It is driven by the pump drive engine.

19. Pump drive engine (figure 2, item 19). The pump drive engine drives the hydraulic towing machine (figure 2, item 17) and the firefighting pump (figure 2, item 20).

20. Firefighting pump (figure 2, item 20). The firefighting pump provides pressurized raw water to the fire monitors located on the pilothouse top. The firefighting pump can also pressurize the fire main.

21. General alarm bell (above) (figure 2, item 21). The general alarm bell sounds indicating various conditions and emergencies.

22. Towing machine hydraulic reservoir (figure 2, item 22). The reservoir provides storage for the towing machine hydraulic system's hydraulic oil.

23. AMS 1 watertight door hand pump (figure 2, item 23). The watertight door hand pump is used to OPEN and CLOSE AMS 1 watertight door.

24. Watertight door (figure 2, item 24). The watertight door provides compartmentalization in emergency situations.

25. General alarm rotating beacon (figure 2, item 25). The general alarm rotating beacon provides a revolving light that indicates a general alarm is in effect.

26. FM-200 alarm (figure 2, item 26). The FM-200 alarm indicates the FM-200 agent is being released into the engine room and AMS 1.

27. Duplex strainer (figure 2, item 27). The duplex strainer removes sediment and other large solids from the raw water used to cool the bow thruster engine (figure 2, item 15) and pump drive engine (figure 2, item 19).

28. Raw water strainer and Aqueous Film Forming Foam (AFFF) proportioner pressure gauges (figure 2, item 28). The raw water strainer differential pressure gauge measures the differential pressure across the raw water strainer. Excessive differential pressure indicates a clogged strainer. The AFFF proportioner pressure gauge indicates the pressure at the AFFF proportioner.

29. MSD blower (figure 2, item 29). This blower aerates the sewage in the MSD to permit decomposition.

30. AFFF pump (figure 2, item 30). The AFFF pump supplies AFFF concentrate from the AFFF storage tank to the proportioner.

31. MSD wet well (figure 2, item 31). The MSD wet well is where the chlorine from the table chlorinator disinfects the effluent discharged from the media tank.

32. Sound powered telephone and storage box (figure 2, item 32). The sound powered telephone provides intraship communication.

33. MSD media tank (figure 2, item 33). The MSD media tank is where sewage is biologically decomposed.

34. MSD discharge pump pressure gauge (figure 2, item 34). This gauge measures the discharge pump pressure.

35. MSD discharge pump (figure 2, item 35). The MSD discharge pump discharges effluent from the wet well overboard after treatment.

36. Hot water recirculating pump pressure differential gauge (figure 2, item 36). This gauge indicates the pressure differential across the hot water recirculating pump.

37. Sewage holding tank (figure 2, item 37). The sewage holding tank (located below tank top level) holds the processed or unprocessed sewage until it is pumped through the shore connection.

38. MSD motor controller (figure 2, item 38). The MSD motor controller provides overload protection and control for the MSD discharge pump and blower.

39. Sewage holding tank level indicator (figure 2, item 39). This tank level indicator indicates the level of matter present in the sewage holding tank.

40. Hot potable water recirculating pump motor controller (figure 2, item 40). This controller turns the hot potable water recirculating pump ON and OFF.

41. AFFF pump motor controller (figure 2, item 41). This controller provides overload protection and control for the AFFF pump.

42. Air compressor 2 motor controller (figure 2, item 42). This controller allows the operator to turn the air compressor 2 ON and OFF and to select AUTOMATIC operation.

43. Air compressor 1 motor controller (figure 2, item 43). This controller allows the operator to turn the air compressor 1 ON and OFF and to select AUTOMATIC operation situations.

BOW THRUSTER COMPARTMENT

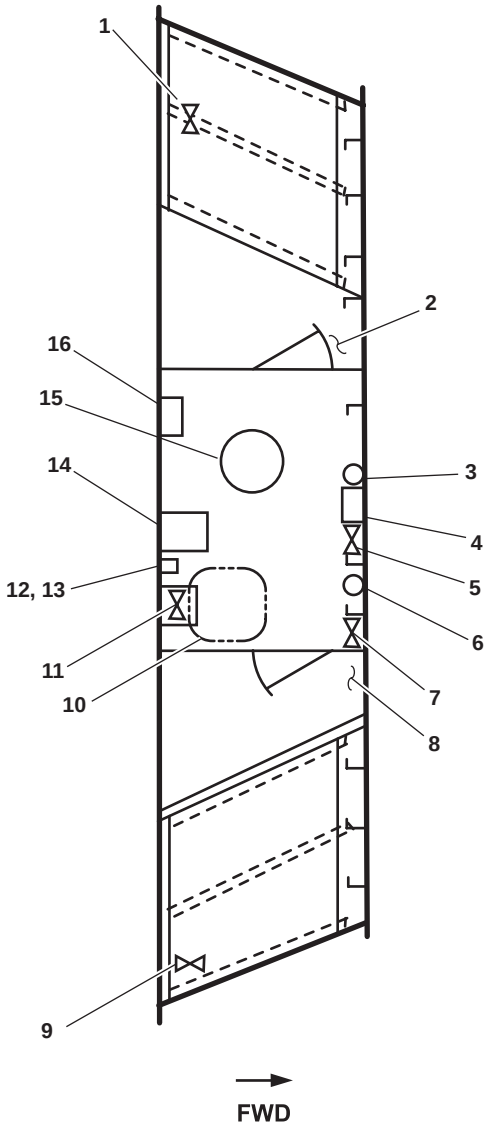


Figure 3. Bow Thruster Compartment

1. OVBD. DISCH . BILGE EDUC valve BB-9 (figure 3, item 1). Valve BB-9 in the OPEN position allows bilge contents to be discharged overboard using eductors.

2. Port stowage locker and shelves (figure 3, item 2). The stowage locker and shelves provide storage space.

3. General alarm bell (figure 3, item 3). The general alarm bell signals various emergency conditions on the vessel.

4. Space heater (figure 3, item 4). The space heater provides heat for the bow thruster compartment.

5. GS-44, BILGE EDUC. shutoff valve (figure 3, item 5). This valve secures the raw water flow from the general service system to the eductors.

6. Eductor pressure gauge (figure 3, item 6). The eductor pressure gauge indicates the general service system pressure available to the eductor.

7. Shutoff valve (figure 3, item 7). This valve secures the general service system pressure to the eductor pressure gauge.

8. Starboard stowage locker and shelves (figure 3, item 8). The stowage locker and shelves provide storage space.

9. Shutoff valve PW-19, C.W. TO W.C. (figure 3, item 9). This valve secures the cold potable water flow to the water closet.

10. Hatch (figure 3, item 10). The hatch provides entrance/exit to the bow thruster compartment from the boatswain's locker space.

11. Vertical ladder and ST-47 upper void FR 54-57 sounding valve (at base of ladder) (figure 3, item 11). The vertical ladder leads to boatswain's locker. The ST-47 upper void FR 54-57 sounding valve is used to sound the void below the bow thruster compartment.

12. Bow thruster lube oil reservoir (figure 3, item 12). The 10.5 gallons (39.8 liters) lube oil reservoir provides lube oil for the bow thruster system.

13. Shutoff valve (figure 3, item 13). This valve secures the flow of lube oil from the bow thruster lube oil reservoir to the bow thruster.

14. Bow thruster (figure 3, item 14). The bow thruster receives power from the bow thruster engine and reversing gear and transmits that power to a propeller that provides athwartships thrust to the vessel's bow during close maneuvering operations.

15. Flush man hole access (figure 3, item 15). The flush manhole access provides access to the void beneath the bow thruster compartment.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
STEERING GEAR COMPARTMENT, TOWING GEAR LOCKER, AND AMS 2

BELOW MAIN DECK, AFT OF ENGINE ROOM

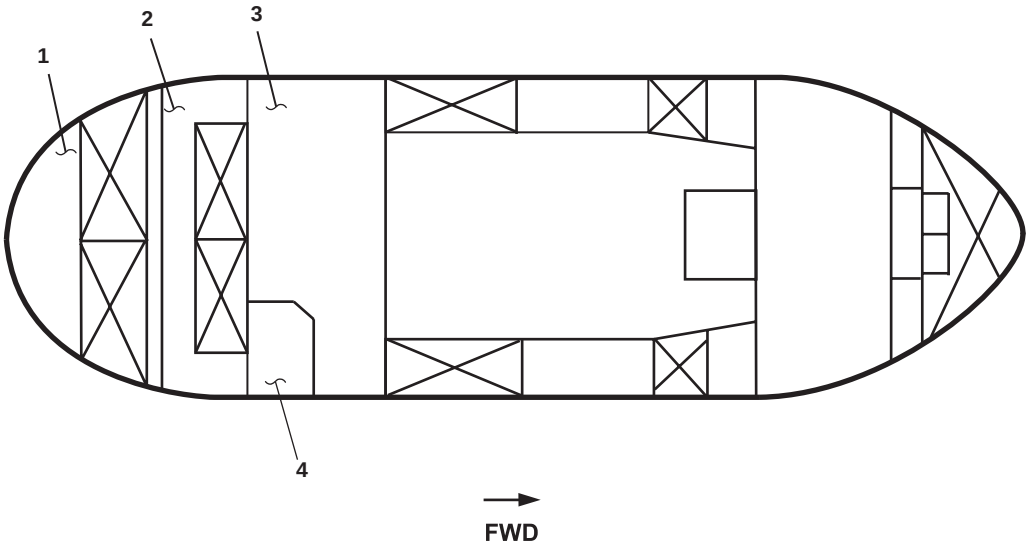


Figure 1. Below Main Deck, Aft of Engine Room

1. Steering gear compartment (figure 1, item 1). This space houses all the equipment necessary to steer the vessel. Details of this space are contained in figure 2.

2. Towing gear locker (figure 1, item 2). This space provides stowage for the vessel's towing gear and equipment. Details of this space are contained in figure 3.

3. AMS 2 (figure 1, item 3). AMS 2 houses the various components and equipment. Details of this space are contained in figure 4.

4. Workshop (figure 1, item 4). The workshop provides workspace and equipment necessary to make on-board repairs. The details of this space are contained in figure 5.

STEERING GEAR COMPARTMENT

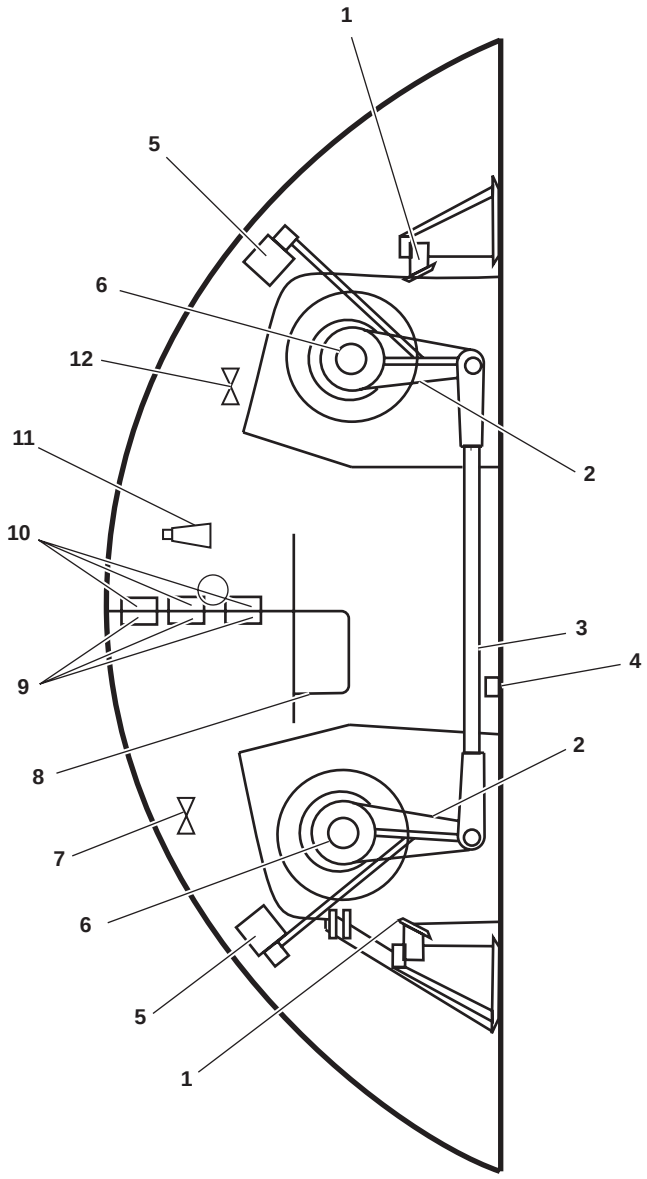


Figure 2. Steering Gear Compartment

1. Rudder stop (figure 2, item 1). The rudder stop limits the swing of the rudder to a maximum of 35 degrees to port or starboard.

2. Tiller arm (figure 2, item 2). The tiller arm connects the rudder post to the tie bar.

3. Tie bar (figure 2, item 3). The tie bar connects the tillers, providing unified tiller movement.

4. Raw water eductor gauge (figure 2, item 4). The raw water eductor gauge indicates the pressure available at the eductor.

5. Steering system rudder feedback unit (figure 2, item 5). The steering system rudder feedback unit displays the status and angle of the rudder.

6. Rudderpost (figure 2, item 6). The rudderpost is the shaft that allows the rudder to pivot 35 degrees to port or starboard.

7. Overboard discharge bilge eductor valve BB-8 (figure 2, item 7). This valve, when OPEN, allows water to be removed from the bilge of the steering compartment to the eductor and overboard.

8. Raised access hatch (figure 2, item 8). The raised access hatch provides entrance/exit to the steering gear compartment.

9. Starboard tow pin control valves (figure 2, item 9). These solenoid valves control the raising and lowering of the starboard tow pins.

10. Port tow pin control valves (figure 2, item 10). These solenoid valves control the raising and lowering of the port tow pins.

11. Eductor (figure 2, item 11). The eductor is part of the bilge ballast general service system. When placed online it can rapidly remove water from a compartment.

12. BB-11, OVBD. DISCH. BILGE EDUC. (figure 2, item 12). This valve secures the overboard flow from the eductor.

TOWING GEAR LOCKER

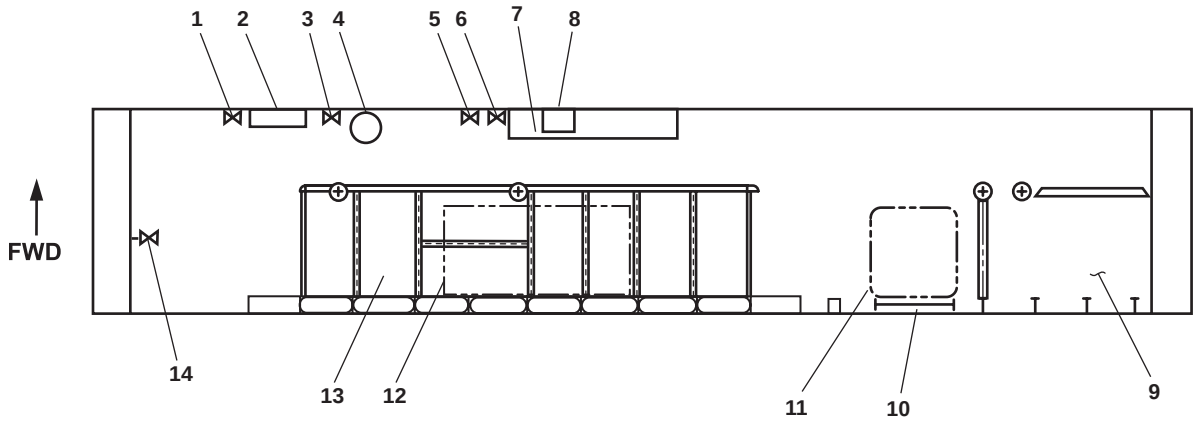


Figure 3. Towing Gear Locker

1. PW-10, POT. WTR. TK. PORT. DR (figure 3, item 1). This valve permits draining of the port potable water tank into the bilge.

2. Eductor valves (figure 3, item 2). The eductor valves control the operation of the eductor for this space.

3. PW-11, POT. WTR. TK. STBD. DR. (figure 3, item 3). This shutoff valve permits draining of the starboard potable water tank into the bilge.

4. General alarm bell (figure 3, item 4). The alarm bell signals various emergency conditions on the vessel.

5. ST-4, BLST TK 2P SNDG. (figure 3, item 5). This valve permits sounding of the port ballast tank.

6. ST-3, BLST TK 2P SNDG. (figure 3, item 6). This valve permits sounding of the starboard ballast tank.

7. Shelving (figure 3, item 7). Shelving provides stowage for towing gear and equipment.

8. Space heater (figure 3, item 8). The space heater provides heat to the towing gear locker.

9. Mooring line stowage bin (figure 3, item 9). The mooring line stowage bin provides storage for mooring lines.

10. Vertical ladder (figure 3, item 10). This ladder provides access to the main deck.

11. Raised access hatch (figure 3, item 11). The raised access hatch provides access to the main deck for personnel.

12. Raised access hatch (figure 3, item 12). The raised access hatch provides access to the towing gear stowage bin for stowing and retrieving gear.

13. Towing gear stowage bin (figure 3, item 13). The towing gear stowage bin provides storage for towing gear and the shore power cable.

14. BB-11, OVBD. DISCH. BILGE EDUC. (figure 3, item 14). This valve secures the overboard flow from the eductor.

AMS 2

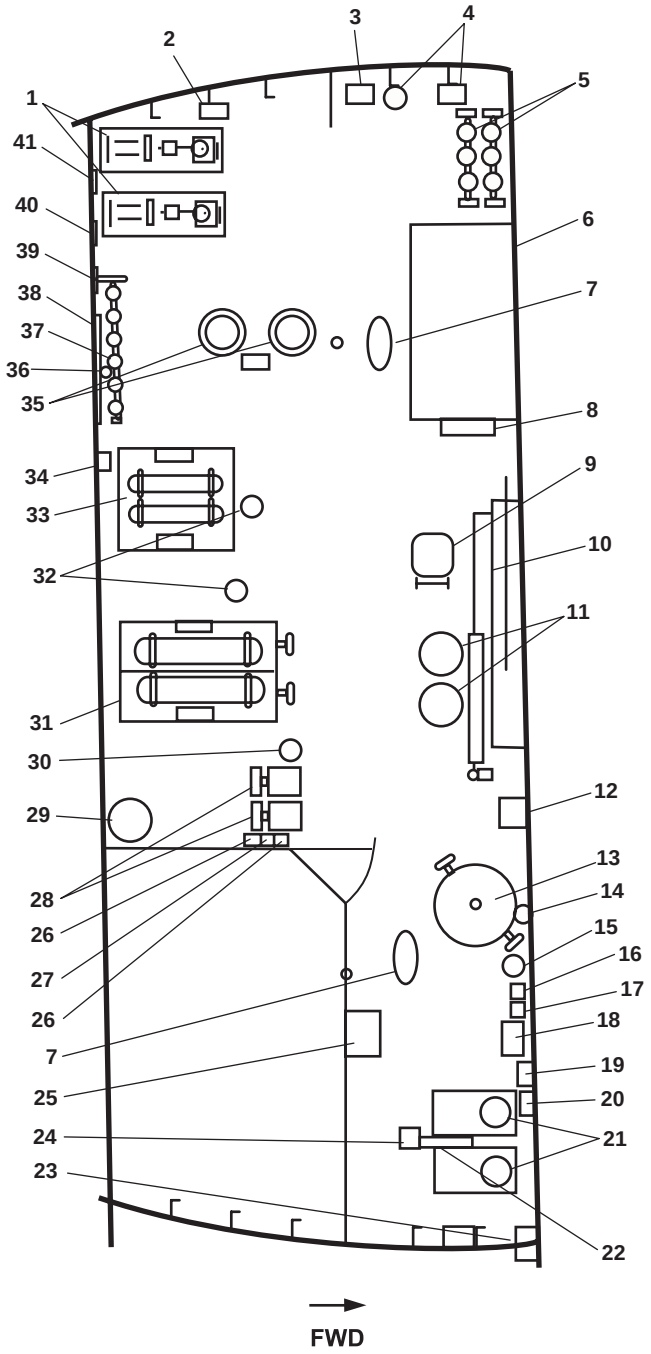


Figure 4. AMS 2

1. Bilge and ballast pumps (figure 4, item 1). The bilge and ballast pumps are electric motor-driven pumps used to pump the bilges and fill or drain the ballast tanks.

2. Bilge and ballast pump pressure gauges (figure 4, item 2). These pressure gauges indicate the dicharge pressure of the bilge and ballast pumps.

3. Ballast tank, tank level indicators (figure 4, item 3). These indicators display the fluid level in the ballast tanks.

4. Brominator system (figure 4, item 4). The brominator introduces bromine into the potable water tanks.

5. Ballast manifold (figure 4, item 5). This duplex manifold provides centralized control of the fluid level within the ballast tanks.

6. Reverse Osmosis Water Purification Units (ROWPU) (figure 4, item 6). Two ROWPUs convert raw water to fresh water at a rate of 33 to 99 gal/hr (125.6 to 250 L/hr). ROWPU 1 converts raw water to fresh water at a rate of 66 gal/hr (249.8 L/hr). ROWPU 2 converts raw water to fresh water at a rate of 33 gal/hr (125.6 L/hr).

7. Access hatch for shaft alleys (figure 4, item 7). The access hatch is a hinged deck plate that provides access to the shaft alleys.

8. 440V power panel No. 5 (figure 4, item 8). This panel provides 440 volts power distribution for AMS 2 equipment.

9. Scuttle (escape hatch) and ladder (figure 4, item 9). The scuttle and ladder provide an emergency escape from AMS 2.

10. Hydraulic sliding watertight door (figure 4, item 10). This door is a hydraulically powered sliding watertight door used to prevent flooding from one compartment to another.

11. Two 600 lb (223.9 kg) FM-200 cylinders (figure 4, item 11). These FM-200 cylinders store the FM-200 extinguishing agent used in the engine room and AMS 1 overhead fire suppression system.

12. Watertight door hydraulic hand pump (figure 4, item 12). This hand pump is used to open and close the engine room sliding watertight door.

13. Potable water hydropneumatic tank (figure 4, item 13). The potable water hydropneumatic tank provides water pressure to the potable water system.

14. FM-200 delay bypass cylinder (figure 4, item 14). When CLOSED, the FM-200 bypass cylinder provides a 60-second delay before the FM-200 extinguishing agent is released. When OPEN, the FM-200 bypass cylinder redirects CO_2 pressure to activate the FM-200 system immediately.

15. CO_2 cylinder (figure 4, item 15). CO_2 cylinders store the CO_2 gas that actuates the FM-200 system.

16. Pressure switch PS-1 (figure 4, item 16). Pressure switch PS-1 shuts down the ventilation fans, SSDG's, bow thruster engine and bow-driven engine, and activates the FM-200 amber strobes in the engine room, AMS 1 and AMS 2. The FM-200 alarm bell on the exterior bulkhead of the engine room vestibule sounds when the FM-200 fire suppressant system is activated.

17. Pressure switch PS-1A (figure 4, item 17). Pressure switch PS-1A activates the FM-200 electric horns in AMS 1 and the engine room when the FM-200 fire suppressant system is activated.

18. Gyro compass repeater (figure 4, item 18). The gyro compass repeater aids steering operations during steering emergencies by displaying the vessel's heading at the emergency steering station. The gyro compass repeater is fed from the vessel's gyro compass located in the pilothouse.

19. Steering gear emergency hand pump (figure 4, item 19). This hand pump provides hydraulic pressure and directional control to the steering gear in an emergency.

20. Rudder angle indicator (figure 4, item 20). The rudder angle indicator displays the position angle of the rudder.

21. Steering hydraulic power pack (figure 4, item 21). These two power packs, each with a motor and an onboard hydraulic pump, provide hydraulic pressure to the steering gear.

22. Steering hydraulic power pack motor controllers (figure 4, item 22). These motor controllers provide electrical protection and control to the steering power pack electric motors.

23. Workshop exhaust fan (figure 4, item 23). The workshop exhaust fan exhausts air from the workshop to the weatherdeck.

24. Sound powered telephone (figure 4, item 24). The sound powered telephone provides intraship communication.

25. Fire station 1 (figure 4, item 25). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

26. Potable water pump motor controllers (figure 4, item 26). These controllers provide control and circuit protection for potable water pumps electric motors.

27. Potable water tank level indicators and potable water pump gauges (figure 4, item 27). The potable water tank level indicators display the level of potable water in the storage tanks. The potable water pump gauges display water pumps 1 and 2 discharge pressures.

28. Potable water pumps (figure 4, item 28). The potable water pumps supply potable water to the potable water hydropneumatic tank.

29. 200 lb (75 kg) FM-200 cylinder (figure 4, item 29). This FM-200 cylinder provides FM-200 extinguishing agent to the bilge in the engine room.

30. General alarm bell (figure 4, item 30). The alarm bell sounds an alarm, indicating various conditions and emergencies.

31. Air conditioning condensing unit (figure 4, item 31). The air conditioning condensing unit is used with the HVAC system.

32. General alarm rotating beacon and FM-200 rotating beacon (figure 4, item 32). The general alarm rotating beacon indicates a general alarm is in effect. The FM-200 revolving yellow light indicates the FM-200 system will be activated within 60 seconds.

33. Refrigeration condensing unit (figure 4, item 33). The refrigeration condensing unit is used with the fan coil units located in the walk-in freezer and chill box located aft of the galley.

34. Stern tube seal pressure gauges (figure 4, item 34). These gauges indicate the air pressure applied to the stern tube seal.

35. Fire and general service pumps (figure 4, item 35). These two pumps provide pressurized raw water to the fire main, general service system, and the washdown countermeasure system.

36. Fire and general service pump pressure gauges (figure 4, item 36). These gauges display the discharge pressure of the fire and general service pumps.

37. Bilge manifold (figure 4, item 37). This simplex manifold provides centralized control for bilge pumping operations.

38. Fire and general service pump 1 motor controller (figure 4, item 38). This motor controller controls the operation of the fire and general service pump 1.

39. Fire and general service pump 2 motor controller (figure 4, item 39). This controller controls the operation of the fire and general service pump 2.

40. Bilge and ballast pump 1 motor controller (figure 4, item 40). This controller controls the operation of the bilge and ballast pump 1.

41. Bilge and ballast pump 2 motor controller (figure 4, item 41). This controller controls the operation of the bilge and ballast service pump 2.

WORKSHOP

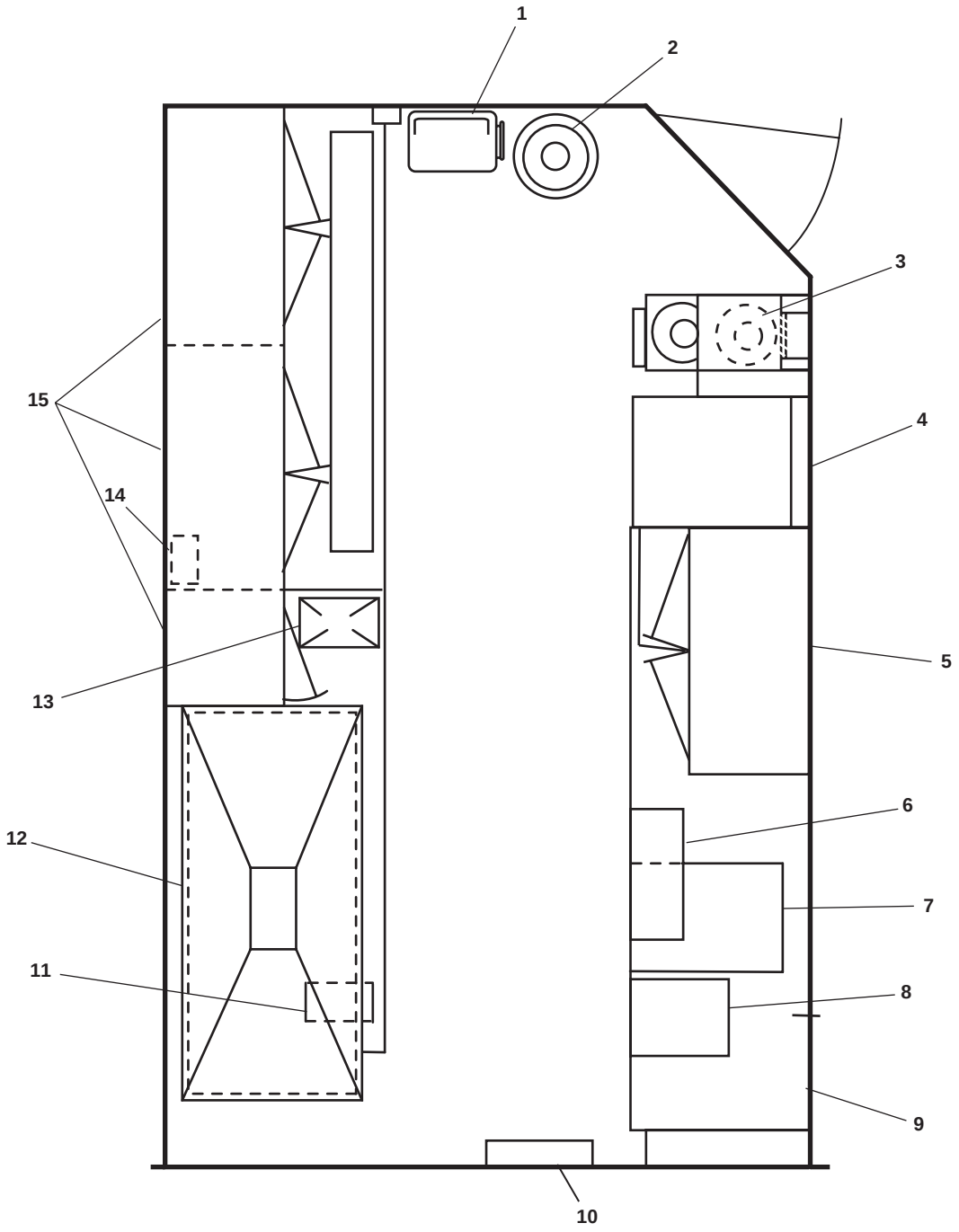


Figure 5. Workshop

1. Hand truck (figure 5, item 1). The hand truck is used to transport heavy items.

2. Waste can (figure 5, item 2). The waste can provides storage for non-toxic waste.

3. Cutting torch outfit (figure 5, item 3). The cutting torch outfit is used for metal cutting and shaping.

4. Wall locker (figure 5, item 4). The wall locker provides storage for tools and equipment.

5. Cabinet (over) (figure 5, item 5). The cabinet provides storage space.

6. Bench grinder (figure 5, item 6). The grinder is used for tool sharpening and various equipment repairs.

7. Arc welder (below) (figure 5, item 7). The arc welder is used for repair of the vessel's equipment.

8. Drill press (figure 5, item 8). The drill press is used for drilling holes for repair of the vessel's equipment.

9. Workbench (figure 5, item 9). The workbench is used as a work area for repair of defective units and components.

10. Space heater (figure 5, item 10). This heater provides heat for the workshop and AMS 2 compartment.

11. Pipe vise (figure 5, item 11). The hinged jaw pipe vise is used for holding equipment or components during repairs.

12. Vent hood (figure 5, item 12). The vent hood and exhaust fan remove air and fumes from the workshop area during welding operations.

13. Bench vise (figure 5, item 13). The bench vise is used for holding equipment or components during repairs.

14. Vent hood exhaust fan controller (figure 5, item 14). The vent hood exhaust fan controller turns the exhaust fan ON and OFF.

15. Cabinet (figure 5, item 15). The cabinet provides storage for tools and equipment.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
SHAFT ALLEYS

STARBOARD SHAFT ALLEY

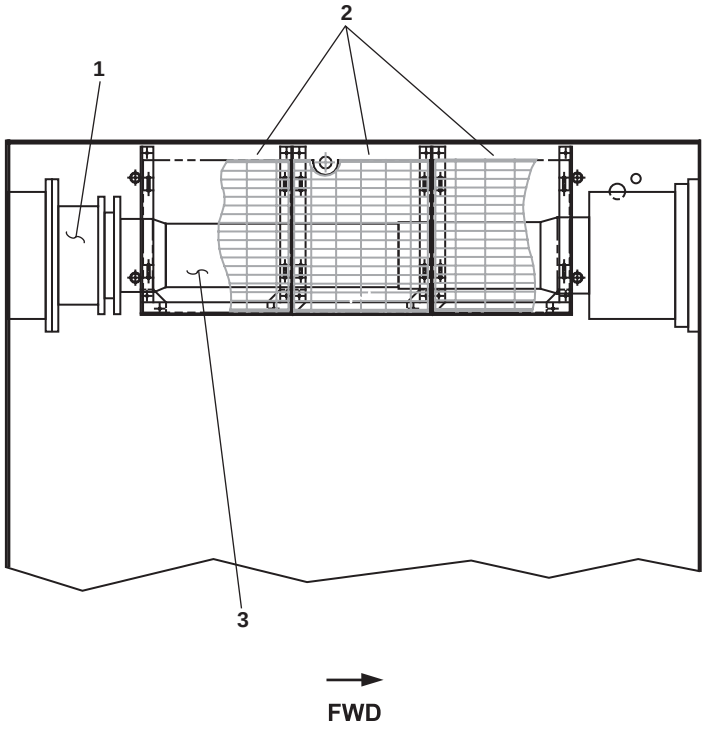


Figure 1. Starboard Shaft Alley

1. Starboard shaft seal (figure 1, item 1). The starboard shaft seal prevents raw water leakage from around the propeller shaft.

2. Grating (figure 1, item 2). Grating is provided to permit personnel access into the starboard shaft alley while the vessel is underway.

3. Starboard propeller shaft (figure 1, item 3). The starboard propeller shaft transmits torque between the reduction gear and the propeller.

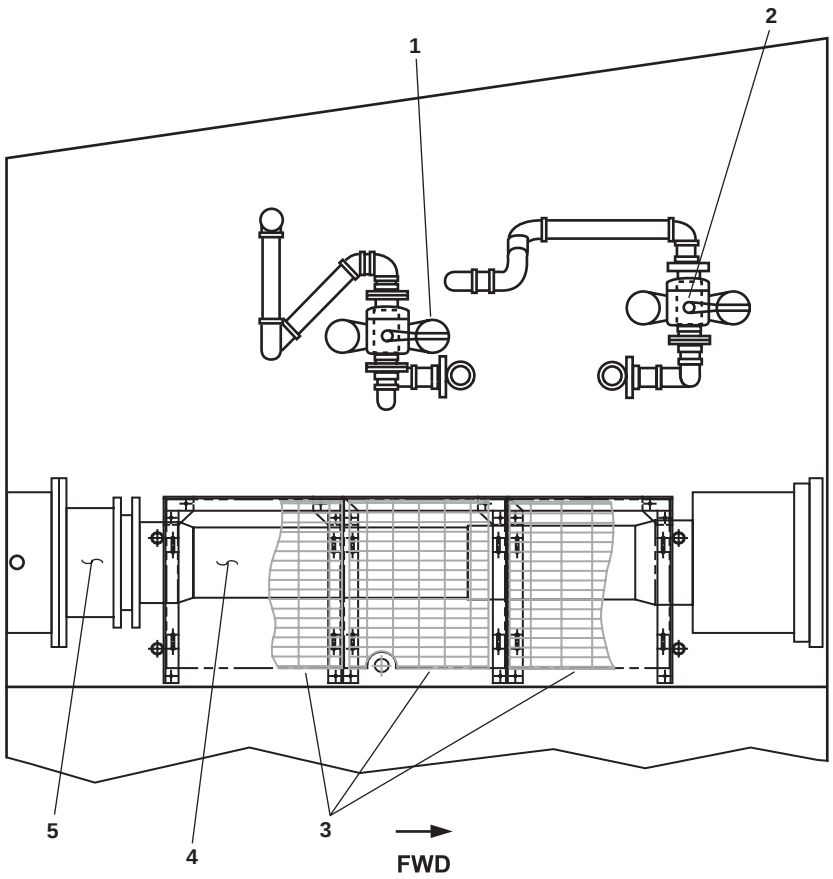


Figure 2. Port Shaft Alley

PORT SHAFT ALLEY

1. Aft duplex strainer (figure 2, item 1). The aft duplex strainer removes large particulates from the raw water suction to fire and general service pump 2.

2. Forward duplex strainer (figure 2, item 2). The forward duplex strainer removes large particulates from the raw water suction to fire and general service pump 1.

3. Grating (figure 2, item 3). Grating is provided to permit personnel access into the port shaft alley while the vessel is underway.

4. Port propeller shaft (figure 2, item 4). The port propeller shaft transmits torque between the reduction gear and the propeller.

5. Port shaft seal (figure 1, item 1). The port shaft seal prevents raw water leakage from around the propeller shaft.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS:
TANKS

TANK LOCATIONS

Refer to figures 1 and 2 for fluid tank locations.

TANK CAPACITIES

Tables 1 and 2 describe the various fluid tanks incorporated into the Large Tug's (LT) hull structure. The Tank column contains the name of the tank. The Item Number column directs the crewmember to the appropriate tank location as shown in figures 1 and 2. The capacity column list each tank's capacity by volume.

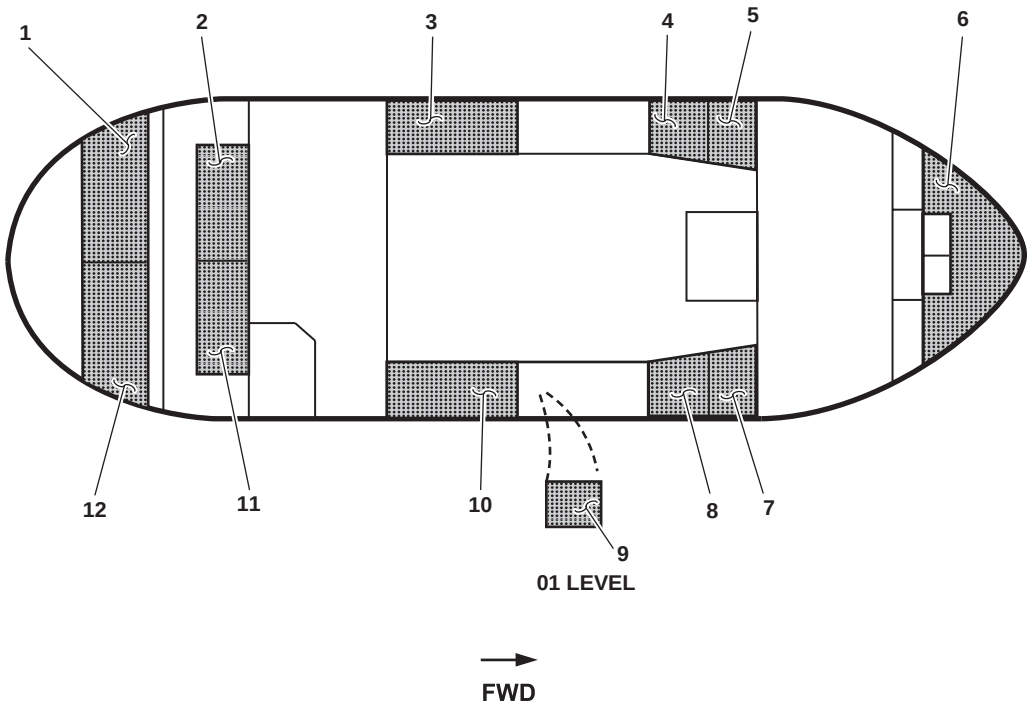


Figure 1. Above Tank Top Level Fluid Tank Locations

Table 1. Above Tank Top Level Fluid Tank Capacities

Tank	Item Number (Figure 1)	Capacity (Gallons/Liters)
Fuel Oil		
FO DAYTANK P	3	4,368/16,535
FO DAYTANK S	10	4,368/16,535
EDG DAYTANK	9	100/379

Table 1. Above Tank Top Level Fluid Tank Capacities (continued)

Tank	Item Number (Figure 1)	Capacity (Gallons/Liters)
Fuel Oil (continued)		
FOT 4P	1	8,018/30,351
FOT 4S	12	8,018/30,351
TOTAL		**24,872/94,151**
Oily Waste		
Oily Waste Storage Tank	8	2,495/9,444
Oil		
Lube Oil Storage Tank	4	2,495/9,444
Hydraulic Oil	5	513/1,942
Potable Water		
Potable Water Tank P	2	3,864/14,626
Potable Water Tank S	11	3,864/14,626
TOTAL		**7,728/29,252**
Ballast Water		
Ballast Water Tank 1	6	11,858/44,887
Miscellaneous		
AFFF Tank	7	525/1,987

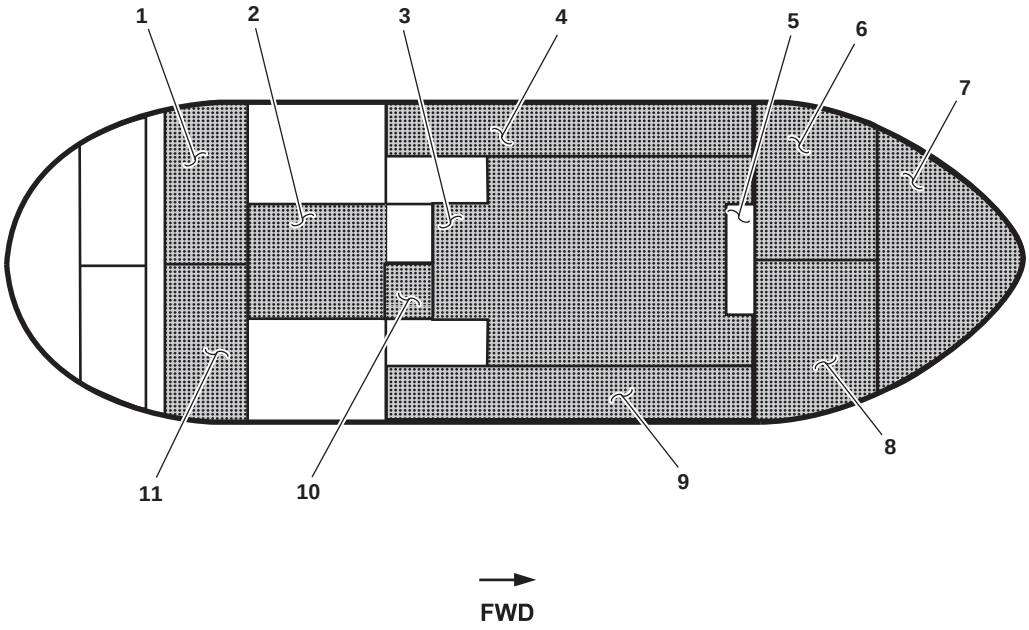


Figure 2. Below Tank Top Level Fluid Tank Locations

Table 2. Below Tank Top Level Fluid Tank Capacities

Tank	Item Number (Figure 2)	Capacity(Gallons/Liters)
Ballast Water		
Ballast Water Tank 2P	1	4,707/17,817
Ballast Water Tank 2S	11	4,707/17,817
TOTAL		**9,414/35,634**
Oily Waste		
Oily Waste Drain Tank	10	513/1,941
Fuel Oil		
FOT 1 P	6	9,364/35,447
FOT 1 S	8	9,364/35,447
FOT 2C	3	17,845/67,551
FOT 2P	4	5,083/19,241

Table 2. Below Tank Top Level Fluid Tank Capacities (continued)

Tank	Item Number (Figure 2)	Capacity (Gallons/Liters)
Fuel Oil (continued)		
FOT 2S	9	5,083/19,241
FOT 3C	2	8,767/33,187
TOTAL		**55,539/210,238**
Miscellaneous		
Sewage Holding Tank	6	2,021/7,650

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
EQUIPMENT DATA

Table 1. Equipment Data

Length	
Overall	128 feet 4 inches (39.1 m)
Between perpendiculars	123 feet 4 inches (37.6 m)
Beam, molded	36 feet 0 inches (10.9 m)
Depth, molded	19 feet 10 inches (6 m)
Draft, designed	15 feet 6 inches (4.7 m)
Light	14 feet 4 inches (4.3 m)
60% Consumables	15 feet 11 inches (4.8 m)
Max load	16 feet 10 inches (5 m)
Displacement	
Designed draft	909 long tons (923.58 metric tonnes)
Light ship	786 long tons (798 metric tonnes)
60% Consumables	951 long tons (966 metric tonnes)
Max load	1057 long tons (1073.96 metric tonnes)
Brake horsepower	5100 bhp (3803 kW)
Speed	
Self delivery	12 knots
Self delivery without tow	13.5 knots @ 85% MCR
Sea state 2 @ max load	12 knots
Under maximum tow	5 knots
Bollard pull	54.6 long tons
Max tow (50 long tons)	5 knots @ 85% MCR
Sea state 4 @ max load	5 knots
Sea state 5 @ max load	maintain steerage-way
Minimum cruising range	500 nautical miles
Propeller	Twin, fixed pitch, 11 feet, 0 inches (3.4 m) diameter
Propulsion engines	2 each; type Turbo, each rated at 2550 bhp/kW @ 900 r/min
Reduction gears and clutch	2 each; two speed Ahead, one speed Astern
Crew	8 officers, 15 enlisted
Emergency generator	65 kW, 440 Vac, 60 Hz
Bow thruster	Fixed pitch (tunnel type) reversible
Towing machine	Twin single drum, side-by-side, each drum fitted with 2500 ft (762 m) of 2 1/4" wire, diesel/hydraulic driven

Table 1. Equipment Data (continued)

Crane	360 degree rotation, telescoping boom, 1500 lb (680 kg) capacity @ max extension
Anchor windlass	Hydraulic powered
Capstan	36 in (0.9 m) diameter
Steering gear	Electro/hydraulic twin powered
Marine sanitation device	One self-contained system capable of supporting the ship's crew
Monitoring system	Computerized system to monitor major machinery and equipment
Pump drive engine	Diesel engine providing power to towing machine and pumps
Air compressors	Two electric powered compressors supply two starting receivers 400 gal (1514 L)
Desalination plant	Reverse osmosis type (TM 55-1925-282-14&P)
Workboat	Inflatable ridged bottom with a 40hp (29.8 kW) engine
Life rafts	Two each, 25 man USCG approved inflatable with hydrostatic release
Tank capacities	See WP 0015 00

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
MAIN PROPULSION ENGINES

PROPULSION PLANT

There are two main propulsion plants installed. Each plant consists of a main engine coupled to a two-speed reversing reduction gear. The output shaft of the reduction gear is coupled to the propeller shaft. Each propeller shaft is equipped with a pneumatically operated shaft brake system. The shaft brake system is designed to lock the shaft when the reduction gear is in neutral. The machinery plant monitoring system monitors the propulsion plant. Operational control is provided by a pneumatic control system.

MAIN PROPULSION ENGINES

Two main propulsion engines are provided. Both engines are marine V-12 cylinders, 2 cycle diesel engines equipped with a turbocharger and an aftercooler. Both engines are air started using compressed air from the air starting system. The port engine is left-hand rotating; the starboard is right-hand rotating.

ENGINE CONTROL PANEL

The engine control panel contains indicators that monitor the operation of both engines. Gauges monitor oil pressure, fuel pressure, air pressure, engine speed, cylinder temperature, and hours of operation. Eight warning lights monitor selected engine parameters. Switches are provided for starting, stopping, and testing alarms.

GOVERNOR

The operator sets the desired engine speed using the throttle control at the station in command. The governor converts the air pressure from the throttle controls to the proper setting of the engine injector rack linkage, which controls fuel to the cylinders. The governor also contains a manual shutdown button mounted on top for shutdown locally or in an emergency situation.

FUEL SYSTEM

The engine fuel oil system consists of four front mounted fuel filter/water separators (figure 1, item 1), a hand pump (figure 1, item 2), an engine mounted duplex fuel filter set (figure 1, item 3), a fuel supply manifold (figure 1, item 4), and fuel return manifold (figure 1, item 5). The fuel pump draws in fuel from the day tank to the engine front mounted fuel filter/water separator (figure 1, item 1). Fuel then passes through the duplex filter element and is sent to the fuel manifold. Fuel in the fuel manifold of the injection pump housing is the supply for the injection pumps. Injection pumps (one per cylinder) send fuel to the fuel injection nozzle. A small amount of fuel is pumped into the cylinder at a very high pressure through the needle valve and the spray tip of the fuel injector (figure 1, item 6). The amount of fuel injected depends upon the position of the plunger, which is controlled by the injector rack and governor. Excess fuel flowing through the fuel return manifold is then returned to the day tank. Excess fuel also cools and lubricates the injectors.

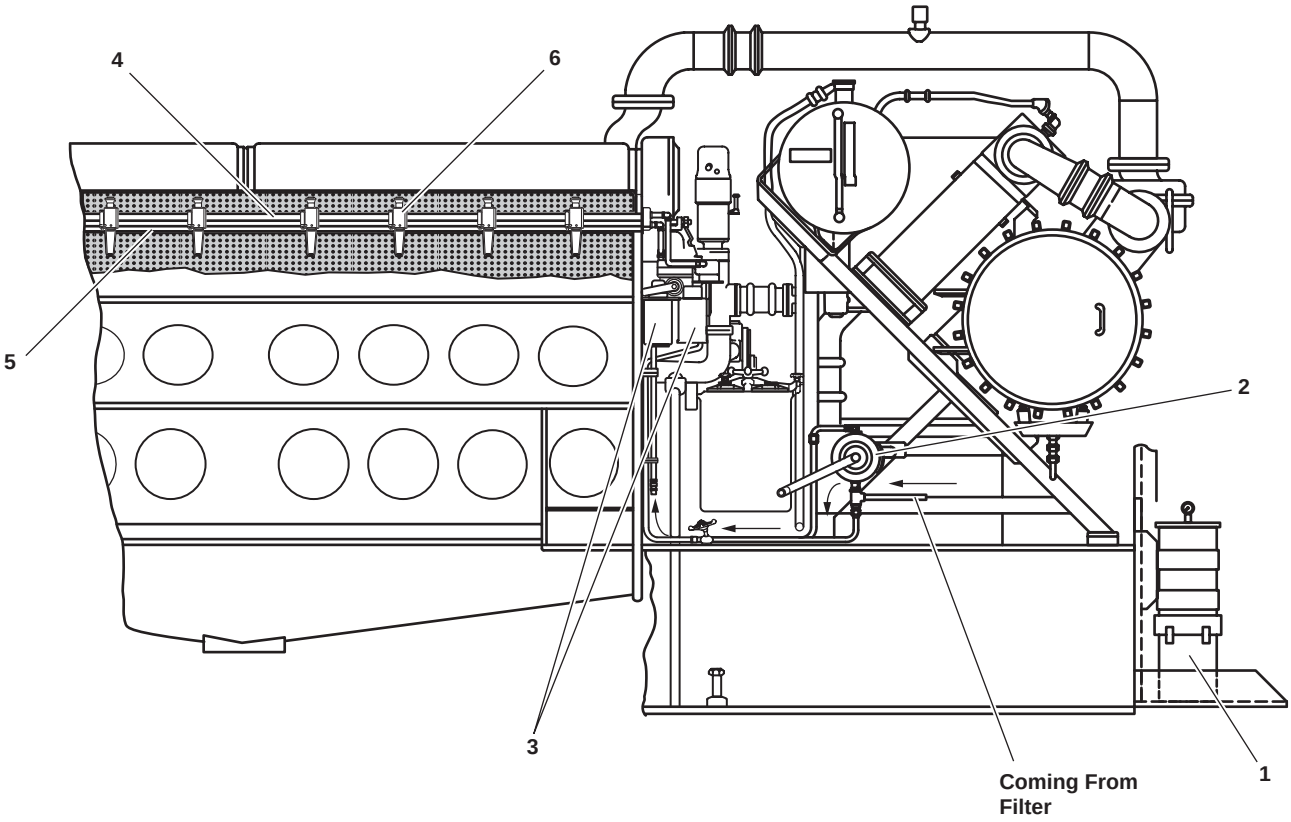


Figure 1. Main Engine Fuel System

AIR INTAKE SYSTEM

Air is ducted from the weather decks to the main propulsion engines. The air is thoroughly cleaned by passing though the air intake filters, protecting the engine from abrasive material as well as protecting the lubricating oil from contaminants. Filtered air is provided to the engine air box (figure 2, item 1) after being pressurized by the turbocharger (figure 2, items 2 and 3).

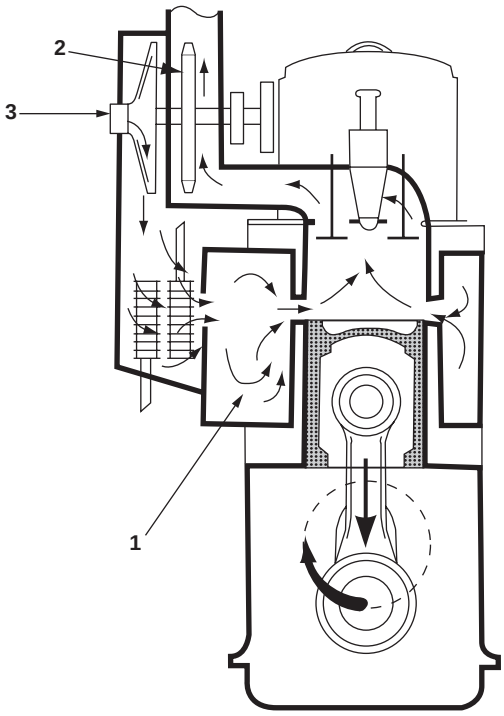


Figure 2. Engine Operation and Air Starting System

ENGINE EXHAUST SYSTEM

Exhaust gases from the engine cylinder are discharged from the cylinder heads into the exhaust manifold and turbocharger turbine (figure 2, item 3). Going through the turbine, the gases pass through the turbocharger ducting, up the stack, and to the atmosphere. The engine exhaust also has condensation drain lines and temperature sensors.

AIR STARTING SYSTEM

The engine air starting system consists of a lower air starting motor (figure 3, item 1), an upper air starting motor (figure 3, item 2), a strainer (figure 3, item 3), a solenoid valve (figure 3, item 4), an air start valve (figure 3, item 5), an air line lubricator (figure 3, item 6), a shutoff valve, and the start button. Compressed air at 200 PSI (14 bar) is supplied from the vessel's starting air system. When the start button is pushed, the solenoid valve is energized (to the OPEN position), allowing air from the starting air system to pass through the solenoid valve and strainer to the pinion gear area of the lower starting motor (figure 3, item 1). A throttle interlock prevents starting of the engine if the throttle is not in the NEUTRAL position. The air entering the pinion gear area moves the pinion gear forward to engage with the engine ring gear. Movement of the pinion gear uncovers a port, allowing air pressure to enter the upper starting motor (figure 3, item 2) which, in turn, engages its pinion gear with the ring gear. With the pinion gears now engaged, air is released from the uncovered port in the upper motor. In addition to maintaining gear engagement, the air opens the air start valve, releasing the main starting air supply. Air passes through the air start valve and into a flexible hose assembly connected to each air starting motor. The multivane motors drive the pinion gears, rotating the ring gear, cranking the engine.

Both pinion gears must be engaged to start the engine. The system is designed so that no attempt can be made to start the engine using one motor. There is also a manual cutoff valve in the system. When maintenance is being performed, the cutoff valve is closed to prevent accidental cranking of the main propulsion engine being serviced.

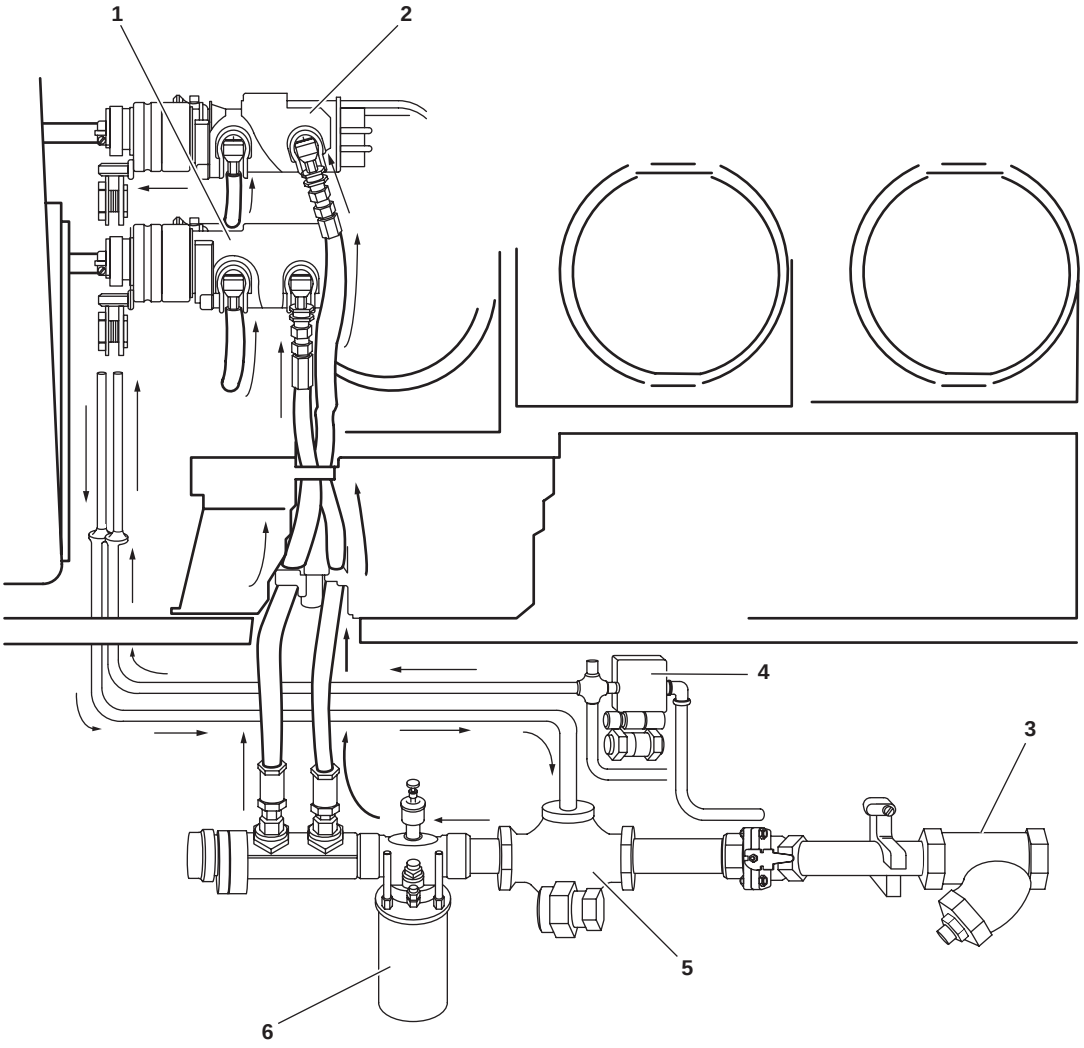


Figure 3. Engine Air Starting System

LUBRICATING OIL SYSTEM

The complete engine lubricating oil system is a combination of five separate systems, holding 125 gallons (473 liters) of lubricating oil. The five separate systems are: the main lubricating system, the piston cooling system, the scavenging oil system, the turbocharger lubrication (soakback) system, and the prelube system. Each system has its own oil pump. The main lube oil pump and main lube oil and piston cooling oil pump (figure 4, item 1), although individual pumps, are both contained in one housing and driven from a common drive shaft. The scavenging oil (figure 4, item 2), soakback, and prelube pumps are separate pumps. All pumps except the soakback and the prelube pumps are driven from the accessory gear train at the front of the engine.

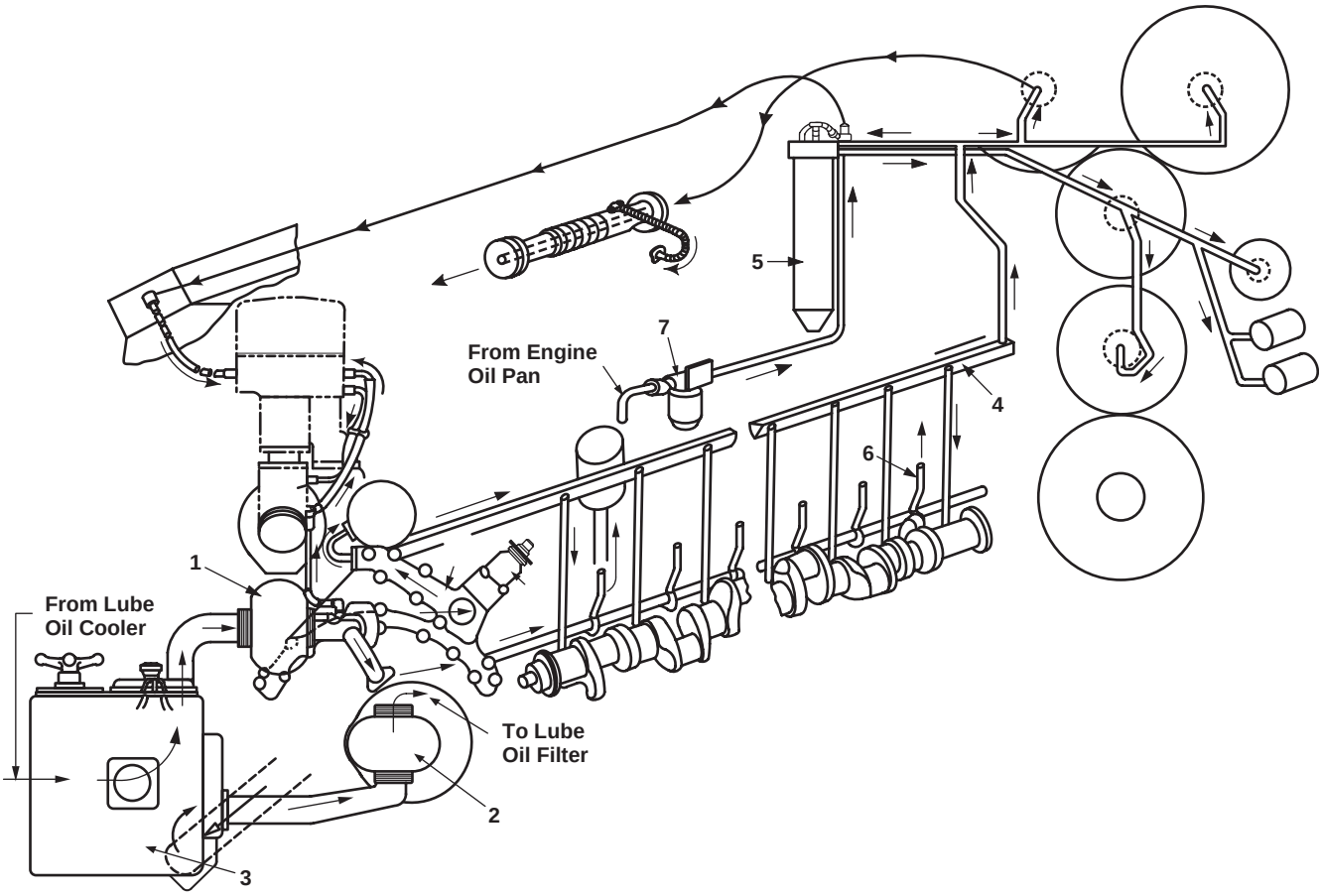


Figure 4. Main Engine Lubrication System

MAIN LUBRICATION OIL SYSTEM

The main lubricating oil system supplies oil under pressure to most of the moving parts of the engine. The main lube oil and piston cooling oil pump (figure 4, item 1) take oil from the strainer housing (figure 4, item 3) at the right front of the engine. Oil from the main lube oil and piston cooling oil pump goes into the main oil manifold (figure 4, items 4), which is located above the crankshaft and extends the length of the engine.

Oil tubes at the center of each main bearing "A" frame conduct oil from the main manifold (figure 4, item 4) to the upper half of the crankshaft bearings. Drilled passages in the crankshaft supply oil to the connecting rod bearings, damper, and accessory drive gear at the front of the crankshaft. Runoff oil from the adjacent main bearings lubricates the crankshaft thrust bearings.

Oil from the main lube oil manifold (figure 4, item 4) enters the gear train at the idler gear stubshaft bracket located at the rear of the engine. Oil passages in the stubshaft bracket distribute the oil. One passage conducts oil to both the right and left bank camshaft drive, gear stubshaft brackets, and to a manifold connected to the turbocharger oil filter (figure 4, item 5). After passing through the turbocharger oil filter, the oil enters the return line in the manifold and flows back to the idler gear stubshaft. A passage in the idler gear stubshaft bracket directs lube oil to the upper and lower stubshaft bearings. Filtered oil enters the turbocharger oil system from the upper idler gear stubshaft.

An oil passage in the turbocharger oil filter (figure 4, item 5) head, parallel to the turbocharger oil filter output line, is connected to a passage in the turbocharger oil manifold. An oil pressure line is connected between the manifold passage and the low oil pressure device in the governor.

Oil enters the hollow bore camshafts from the camshaft drive stubshafts. Radial holes in the camshaft conduct oil to each camshaft bearing. An oil line from one camshaft bearing at each cylinder supplies oil to the rocker arm shaft, the rocker arm cam follower assemblies, the hydraulic lash adjuster, and the injector rocker arm button. Runoff oil returns to the oil pan through passages between the top deck and the oil pan. Passages in the turbocharger conduct oil to the turbocharger bearings, idler gear, planet gear assembly, and auxiliary drive bore.

PISTON COOLING OIL SYSTEM

Internal parts of the piston are lubricated and cooled by the piston cooling oil pump of the main lube oil and piston cooling oil pump (figure 4, item 1). The piston cooling oil pump receives oil from a common suction with the main lube oil pump and routes oil to the two piston cooling oil manifolds extending the length of the engine, one on each side. A piston cooling oil pipe (figure 4, item 6) at each cylinder directs a flow of oil through the carrier to cool the underside of the piston crown and the ring belt. Some of this oil enters the oil grooves in the piston pin bearing and the excess oil drains out through holes in the carrier crown to the sump.

SCAVENGING OIL SYSTEM

The scavenging oil system pump (figure 4, item 2) takes oil through the scavenging oil strainer from the oil pan sump or reservoir. The pump forces the oil through the oil filters and oil cooler that are located forward of engine. Oil then returns to the strainer housing to supply the main lube oil pump and piston cooling oil pump with cooled and filtered oil. Excess oil spills over a dam in the strainer housing and returns to the oil pan.

TURBOCHARGER LUBRICATION (SOAKBACK) SYSTEM

Prior to the engine startup, a soakback pump lubricates the turbocharger. Oil is drawn from the engine oil sump and passes through a soakback pump filter (figure 4, item 7). Oil is then supplied to the turbocharger through external piping, which is connected to the engine-mounted filter housing. In operation, the turbocharger is lubricated by the main oil pressure pump of the main lube oil and piston cooling oil pump (figure 4, item 1) through internal passages within the engine. Before entering the turbocharger, the oil passes through an engine mounted turbocharger filter (figure 4, item 5).

To ensure lubrication of the turbocharger bearings prior to the engine start and the removal of residual heat from the turbocharger after engine shutdown, a separate lube oil pressure source is provided. This pressure is controlled automatically though the engine START and STOP controls. An electrically driven pump drawing lube oil from the oil pan pumps the oil through a soak back oil filter and the head of the turbocharger oil filter directly into the turbocharger bearing area. The motor driven pump and filter are located on the starboard side of the engine.

A pressure relief valve set at 379 PSI (26 bar) is located in the head of the turbocharger oil filter (figure 4, item 5). When the engine starts, and while the motor driven pump is still running, main lube oil pressure from the engine-driven pump becomes greater than the motor driven pump pressure. Since there is no outlet for the lower pressure oil, the relief valve will open when the pressure builds up to 379 PSI (26 bar), and the oil will return to the pan through a passage in the turbocharger oil filter head mounting flange. Also located in the turbocharger oil filter head is a bypass valve, set at 483 PSI (33 bar). This valve will open to permit motor driven pump pressure to bypass a plugged filter element so that lubrication can be supplied to the turbocharger to prevent turbo damage.

TURBOCHARGER OIL FILTER

The turbocharger oil filter (figure 4, item 5) provides additional protection for the high-speed bearings and other lubricated areas of the turbocharger by filtering the oil just before it is admitted to the turbocharger. Oil enters the filter through a cast manifold and, after passing through the filter, returns to the upper idler gear stubshaft and into the turbocharger. The filter element is pleated paper construction, and is disposable. The filter is mounted on the camshaft drive housing at the right bank of the engine.

PRELUBE SYSTEM

The prelube system includes a prelube pump and related piping. The prelube system is used to circulate oil through the piston cooling and main lube oil systems before starting the engine after extended shutdowns or repairs. Oil for the prelube system is drawn from the oil pan.

COOLING SYSTEM

Each main engine cooling system consists of two engine-driven centrifugal water pumps, replaceable inlet water manifolds with an individual jumper line to each liner, cylinder head discharge elbows, an outlet manifold through which water is circulated, and keel coolers. The two centrifugal water pumps are mounted on the accessory drive housing and are driven by the governor drive gear. Engine coolant is also circulated through each aftercooler located in the turbocharger air discharge duct to cool the air before it enters the engine air box. The engine coolant flows through an external piping system to the keel coolers. The keel coolers transfer heat from the engine coolant to the sea. The cooling system is discussed in greater depth in WP 0018 00.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
ENGINE COOLING SYSTEMS

GENERAL

Several different types of engine cooling systems are used on board the LT. Both main engines, and both Ship's Service Diesel Generator (SSDG) engines utilize keel cooler systems (figure 1). The Emergency Diesel Generator (EDG) uses a radiator cooling system (figure 2). The bow thruster and pump drive engines use heat exchanger systems (figure 3). The paragraphs below describe each of these cooling systems in detail.

ENGINE COOLING SYSTEM COMPONENTS

ENGINE COOLANT

All engines described use engine coolant. The engine coolant is a mixture of water and ethylene glycol antifreeze. This mixture of water and antifreeze protects against freezing, overheating, and corrosion. A 50/50 mixture of ethylene glycol antifreeze and water will freeze at –34 °F (-36.7 °C), which is significantly lower than the freezing temperature of water alone. The same 50/50 mixture has a boiling point of up to 276°F (135.6 °C) depending upon cooling system pressure. Ethylene glycol antifreeze also contains additives that help prevent corrosion of system components.

CENTRIFUGAL PUMPS

Centrifugal pumps circulate the engine coolant throughout the cooling system on each engine.

COOLANT PASSAGES

Coolant passages route engine coolant to and around cylinders, cylinder heads, and other vital components.

OIL COOLER

Oil coolers provide cooling for oil that is heated while lubricating the engine.

AFTERCOOLER

Engine coolant is circulated through the aftercooler, which is located in the turbocharger air discharge duct, to cool the intake air before it enters the engine.

EXPANSION TANK

The expansion tank (figure 1, item 1) is a reservoir for the coolant. It is the highest place in the cooling system. The volume of the coolant can change in the expansion tank without affecting the coolant level in the remainder of the cooling system.

PRESSURE CAP

The expansion tank (figure 1, item 1) in conjunction with the pressure cap (figure 1, item 2) controls the pressure of the cooling system. Excessive coolant pressure will vent through the pressure cap.

RAW WATER STRAINER

A raw water strainer filters out large debris that may block or contaminate the cooling systems.

SEACHEST

The seachest is a compartment (three in quantity) located near the center line on the bottom of the vessel. This is where raw water is drawn into the vessel cooling systems to provide firefighting water, and to make fresh water.

RAW WATER PUMP

The raw water pump draws raw water from the sea chest through a duplex raw water strainer. After leaving the duplex raw water strainer, the raw water is routed to the engine's cooling system. There the raw water pump circulates the raw water through the heat exchanger (figure 3, item 1) where it absorbs heat from the engine coolant.

KEEL COOLER

NOTE

Only the main and SSDG engines have keel coolers (figure 1, item 5) as part of their systems.

The keel cooler (figure 1, item 5) is mounted o0n the external hull of the vessel and transfers heat from the engine coolant directly to the sea.

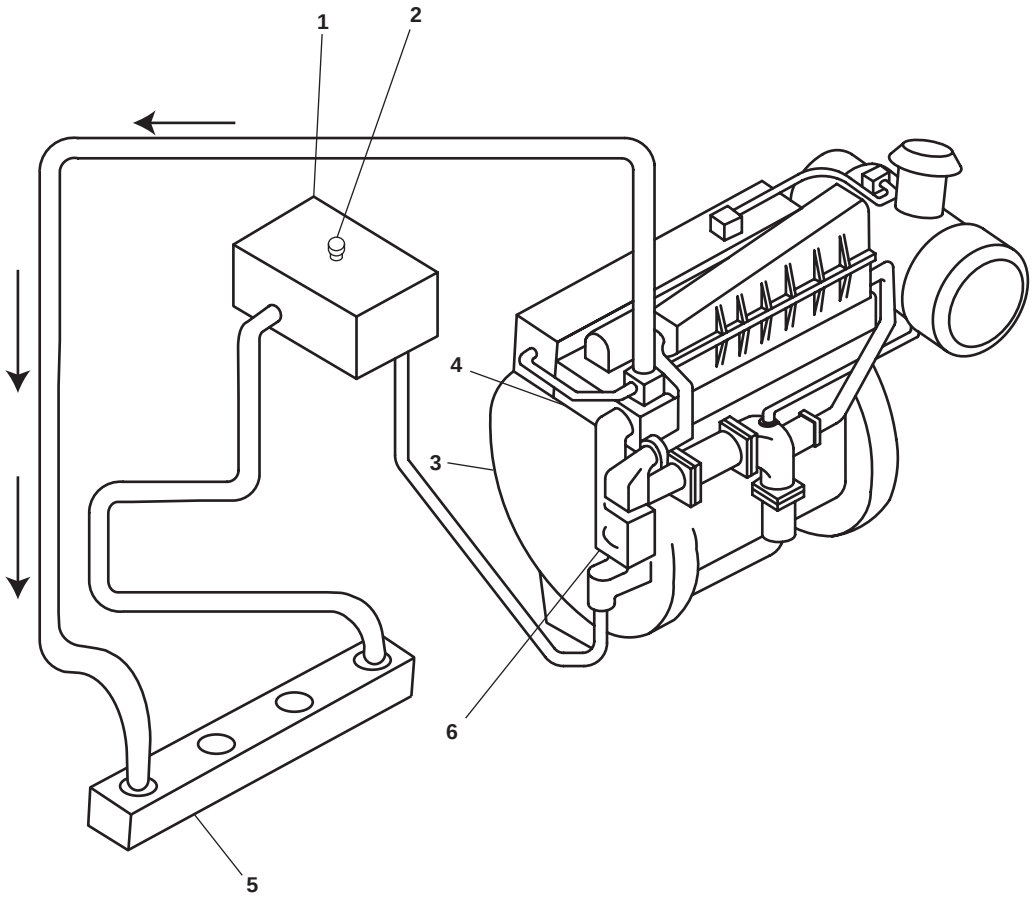


Figure 1. Typical Keel Cooler Engine Cooling System

RADIATOR

NOTE

Only the EDG engine has a radiator as part of its system.

Coolant flows from the EDG's coolant regulator (figure 2, item 1) to the radiator (figure 2, item 2) inlet (figure 2, item 3). The radiator utilizes many cooling fins to dissipate heat from the coolant to the air as it flows through its tubing. When the coolant reaches the bottom of the radiator (figure 2, item 2), the coolant should be cooled significantly before it flows toward the EDG engine water pump (figure 2, item 4).

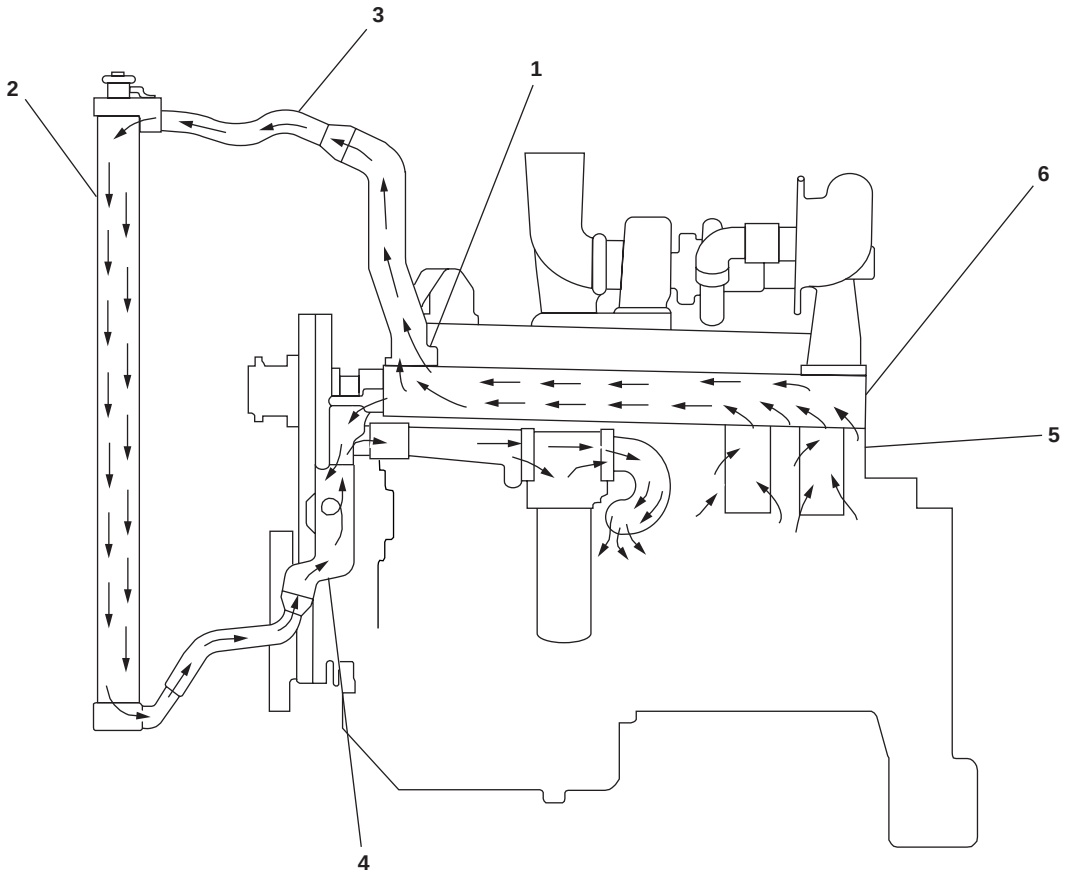


Figure 2. Typical Radiator Engine Cooling System

HEAT EXCHANGER

NOTE

Only the bow thruster and the pump drive engines have heat exchangers.

The heat exchanger (figure 3, item 1) contains a large number of tubes. Engine coolant circulates inside the tubes while raw water circulates outside the tubes. As the engine coolant and raw water flows through the heat exchanger, the raw water absorbs the heat from the engine coolant and carries that heat away.

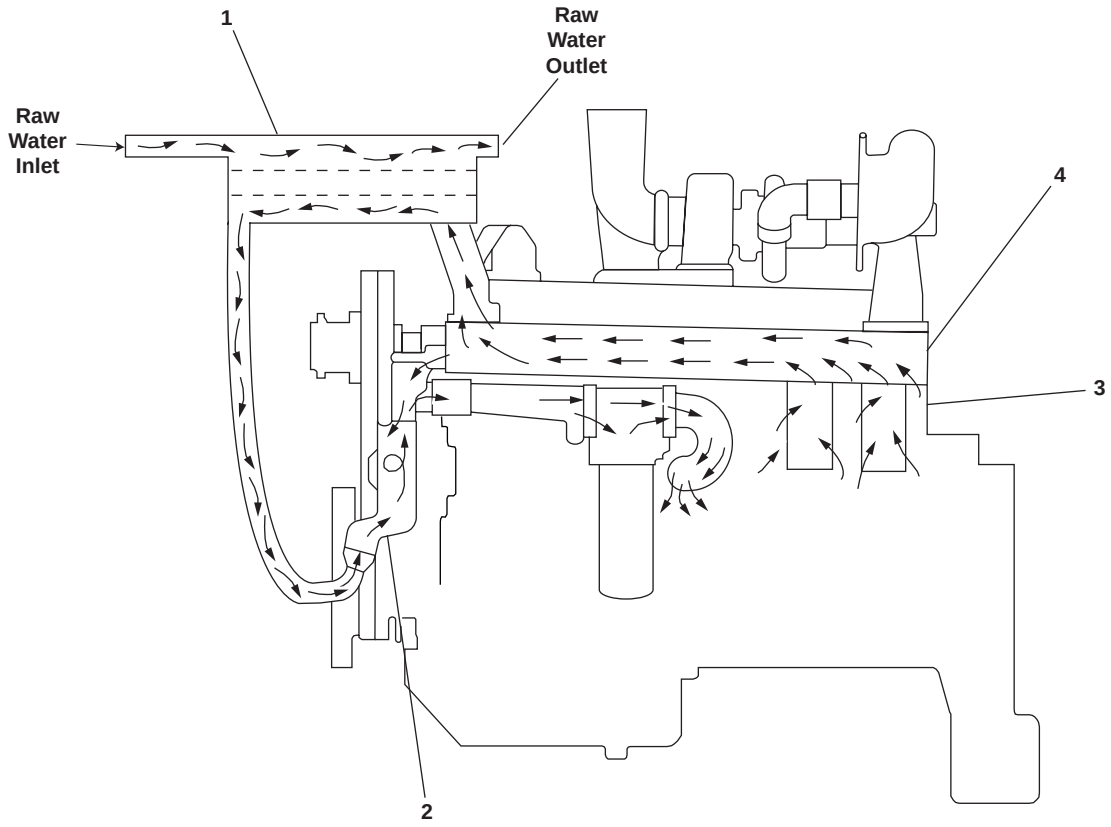


Figure 3. Typical Heat Exchanger Engine Cooling System

KEEL, RADIATOR, AND HEAT EXCHANGER COOLING SYSTEMS OPERATIONS

MAIN ENGINE AND SSDG KEEL COOLED SYSTEMS

The coolant is circulated through the closed-loop cooling system by an engine-driven water pump (figure 1, item 6). As the coolant circulates through the engine, it absorbs heat from the engine's cylinder block (figure 1, item 3), cylinder heads (figure 1, item 4), exhaust manifold surfaces, engine oil, and from the marine transmission oil. After circulating through the engine, the coolant passes through the keel cooler (figure 1, item 5) that is longitudinally recessed in the hull. As the coolant circulates through the keel cooler, the heat absorbed from the engine is transferred to the raw water outside the hull. After the coolant has passed through the keel cooler, it reenters the engine through the water pump (figure 1, item 6) to begin the cooling cycle again.

EDG ENGINE RADIATOR COOLED SYSTEMS OPERATIONS

The coolant is circulated through the closed-loop cooling system by an engine-driven water pump (figure 2, item 4). As the coolant circulates through the engine, it absorbs heat from the engine's cylinder block (figure 2, item 5), cylinder head (figure 2, item 6), exhaust manifold surfaces, and engine oil. After circulating through the engine, the coolant passes through the radiator (figure 2, item 1). As the coolant circulates through the radiator, the heat absorbed from the engine is transferred to the air circulating through the radiator fins. After the coolant passes through the radiator, it reenters the engine through the engine-driven water pump to begin the cooling cycle again.

BOW THRUSTER AND THE PUMP DRIVE ENGINES HEAT EXCHANGER SYSTEMS OPERATIONS

The coolant is circulated through the closed-loop cooling system by an engine-driven water pump (figure 3, item 2). As the coolant circulates through the engine, it absorbs heat from the engine's cylinder block (figure 3, item 3), cylinder head (figure 3, item 4), exhaust manifold surfaces, engine oil, and the marine transmission oil. After circulating through the engine, the coolant passes through the heat exchanger (figure 3, item 1). As the coolant circulates through the heat exchanger, the heat absorbed from the engine is transferred to the raw water circulating through the heat exchanger tubing. After the coolant has passed through the heat exchanger, it reenters the engine through the engine-driven water pump to begin the cooling cycle again.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
REVERSE REDUCTION GEAR SYSTEM

GENERAL

There are two main propulsion plants on the vessel. Each propulsion plant consists of a main engine coupled to a two-speed reversing reduction gear. The output shaft of the reduction gear is coupled to the propeller shaft.

The reverse reduction gear reduces the engine output revolutions per minute (r/min) and reverses rotational direction (when required) to the propeller shaft. Gear ratios are: Ahead 1 4.677:1, Ahead 2 and Astern 5.444:1. Direction of rotation and hydraulic clutch operation of each engine are controlled by a throttle control on the EOS console, pilothouse console, or auxiliary control stations. A shaft brake is designed to lock the shaft when the reduction gear is in neutral.

LUBRICATION SYSTEM

A high-pressure gear pump (figure 1, item 1) is driven at engine speed to provide oil for clutch actuation and lubrication of the reduction gear. A pressure-increasing valve (figure 1, item 2) maintains high oil pressure for clutch lockup. The excess oil that bypasses the pressure-increasing valve is used for lubricating the gears, bearings, and clutch plates. The oil is cooled by a cooler (heat exchanger) (figure 1, item 3). If the oil flow ceases, the flow indicator (flow alarm) (figure 1, item 4) switch will sound an alarm and bring the reduction gear to neutral.

COOLING SYSTEM

A fresh water cooling system (figure 2) transfers heat from the reduction gear lubricating oil through the cooler (heat exchanger) (figure 1, item 3). Water from the cooling system is cooled in turn through keel coolers (figure 2, item 1). Water is circulated by an electric motor-driven coolant pump (figure 2, item 6).

HAND PUMP

A hand pump is provided to drain the PORT and STARBOARD reduction gear sumps.

REDUCTION GEAR RATIO SELECTION

A selector valve in the EOS console allows selection of the desired forward reduction gear ratio. The reduction gear selector will be disabled whenever the throttle control is not in the center (NEUTRAL) position, or command is at a station other than the EOS.

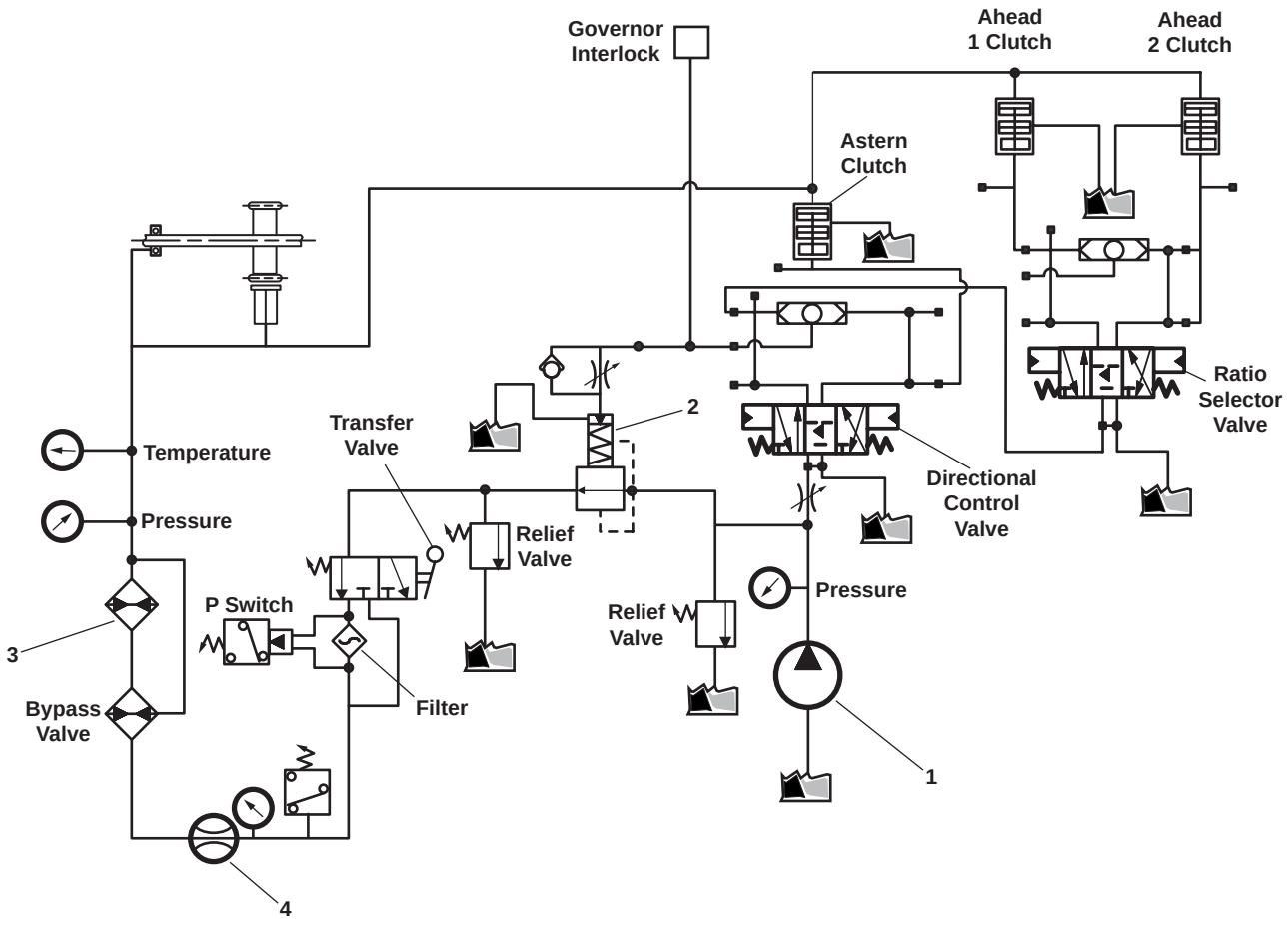


Figure 1. Reverse Reduction Gear Schematic

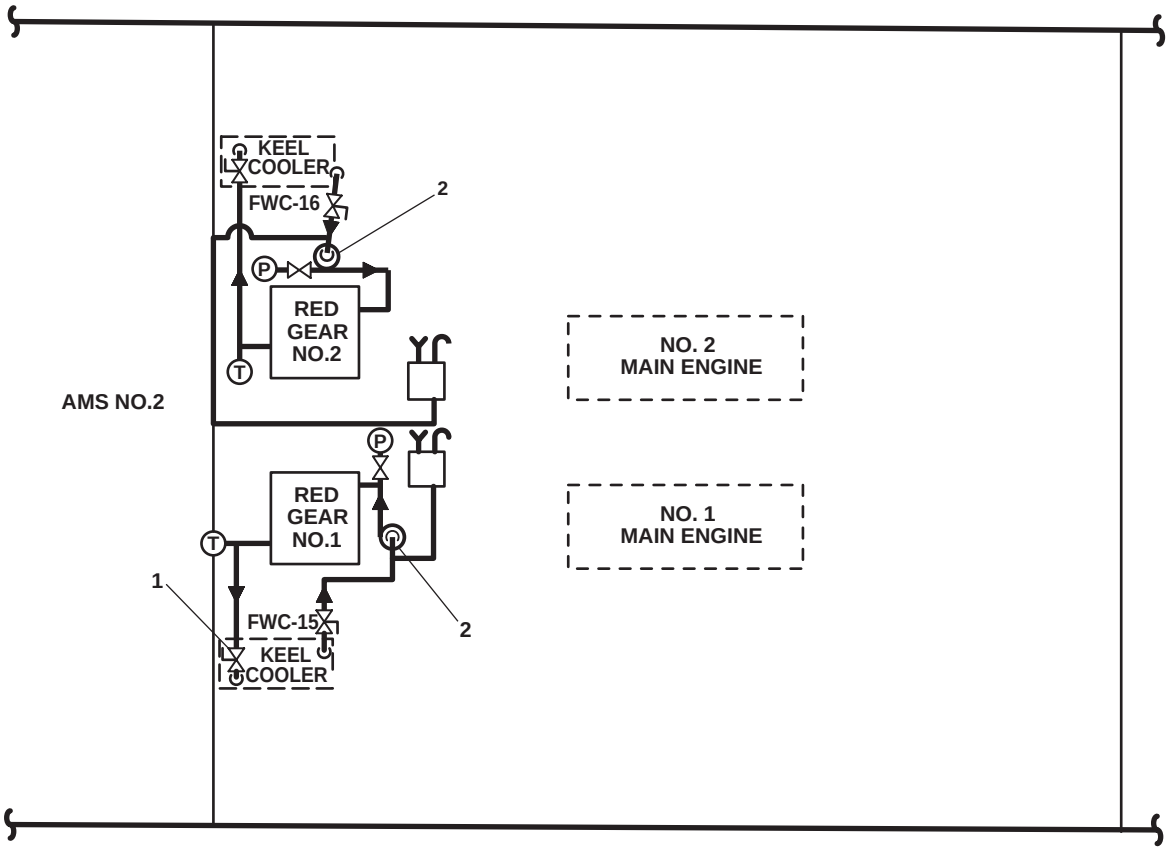


Figure 2. Reduction Gear Fresh Water Cooling System

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
PROPELLER SHAFTS AND PROPELLERS

GENERAL

The propeller shafts (figure 1, item 1) and propellers (figure 1, item 2) create AHEAD or ASTERN thrust for the vessel. The propeller shafts are powered by the main engines (figure 1, item 3) through a two-speed reversing reduction gear (figure 1, item 4). The output shaft of the reversing reduction gear is coupled to one end of each propeller shaft. On the other end of the propeller shaft is the propeller.

PROPELLER SHAFTS

The propeller shafts (figure 1, item 1) transfer torque to the propellers (figure 1, item 2). The torque is generated by the main engines (figure 1, item 3) and is transferred to the propeller shafts by the reversing reduction gears (figure 3, item 4).

PROPELLERS

The propeller (figure 1, item 2) is designed to operate in either a clockwise or counterclockwise direction. Direction of rotation is determined by operator input into the reversing reduction gear (figure 1, item 4). Main engine speed controls the thrust force. Displacement of raw water in a given direction generates an equal recoil force in the opposite direction, moving the vessel.

SHAFT SEAL

Shaft seals (figure 1, item 5) are installed on each propeller shaft (figure 1, item 1). The shaft seal's function is to seal the shaft alleys from leakage. Each shaft seal allows a small amount of raw water to leak past during rotation of the propeller shafts. This leakage prevents the shaft seals from being destroyed by heat. The shaft seals may also be inflated to stop all leakage during periods of extended layup. See figure 2 for details of the shaft seal.

SHAFT BRAKE

Each propeller shaft (figure 1, item 1) is equipped with a hydropneumatically operated shaft brake (figure 1, item 6). The shaft brake system is designed to lock the propeller shaft when the reversing reduction gear (figure 1, item 4) is in NEUTRAL. When placed in NEUTRAL, the shaft brake actuator sends 1200 to 1500 PSI (82.7 to 103.4 bar) of hydraulic pressure to the shaft brake, bringing the propeller shaft and propeller (figure 1, item 2) to a full stop. Movement of the throttle 20 degrees AHEAD or ASTERN causes the shaft brake to immediately release. See figure 3 for details of the shaft brake.

SYSTEM OPERATION

With the shaft seals (figure 1, item 5) manually deflated, and the throttle moved into the ASTERN or AHEAD position, the shaft brakes (figure 1, item 6) are immediately released. The main engines (figure 1, item 3) and reversing reduction gears (figure 1, item 4) plant begins to turn the propellers shafts (figure 1, item 1) and propellers (figure 1, item 2) in the desired direction of rotation, causing the LT to move in the desired direction.

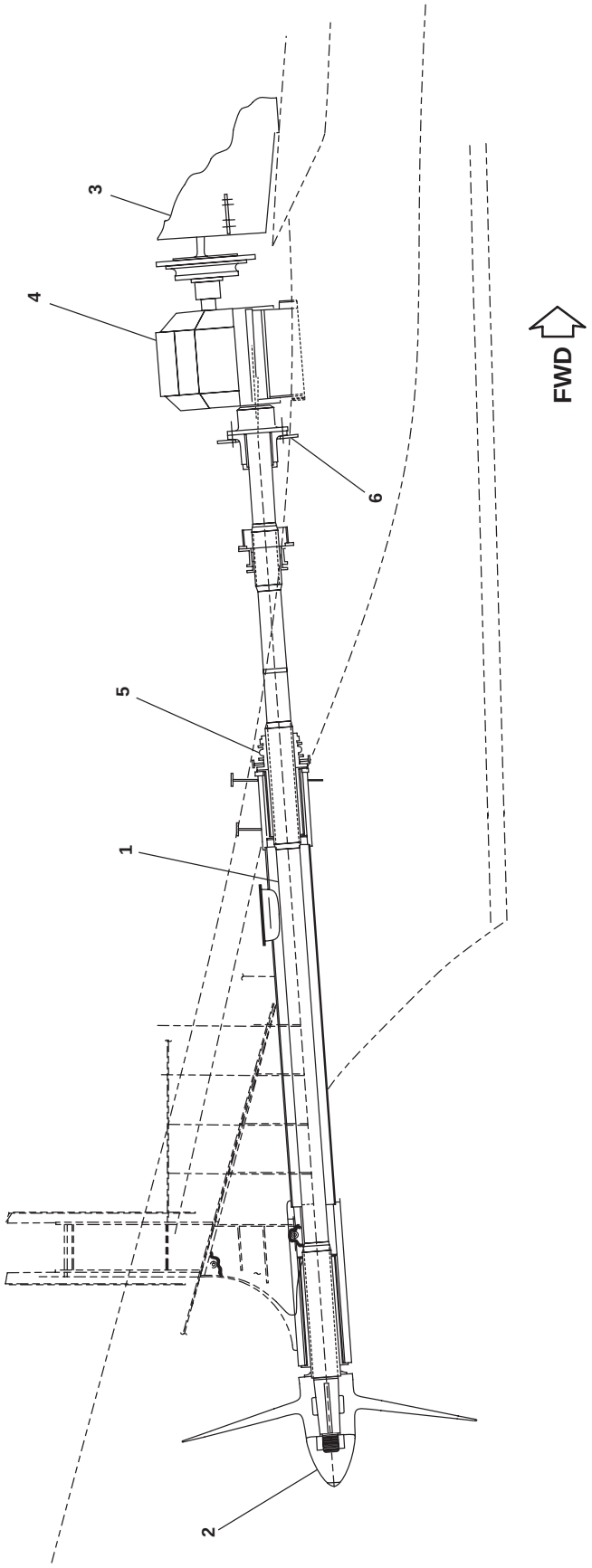


Figure 1. Propeller Shaft and Propellers

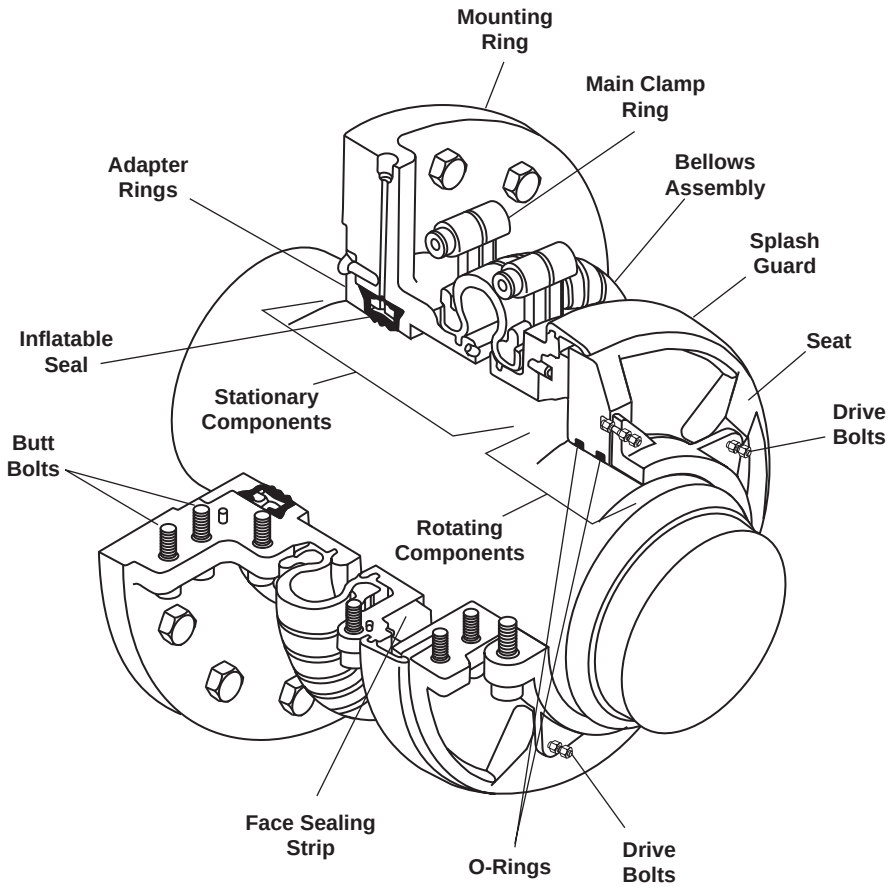


Figure 2. Shaft Seal

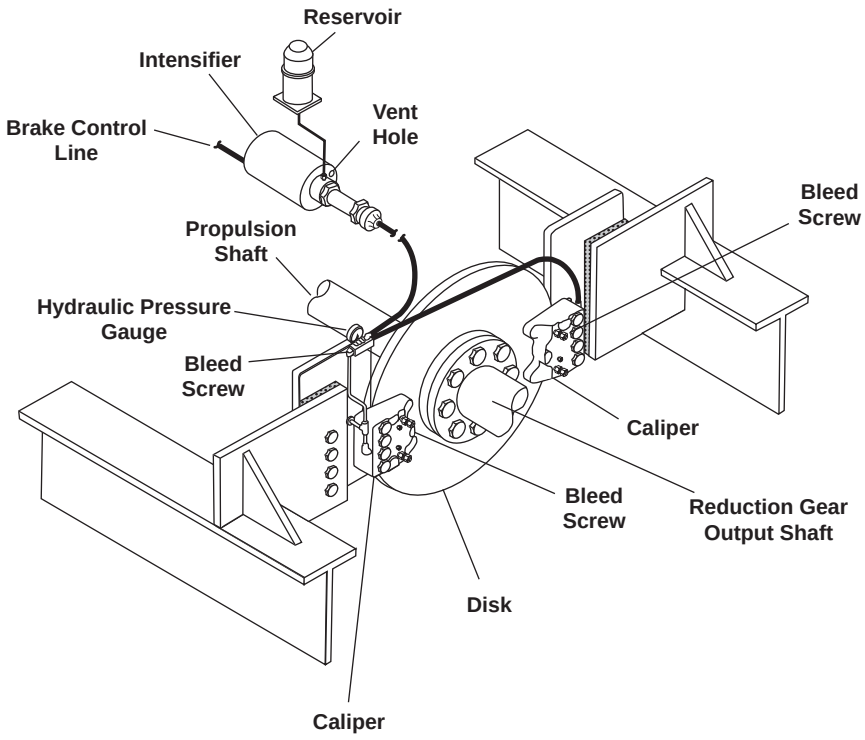


Figure 3. Disk Brakes

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
BOW THRUSTER SYSTEM

GENERAL

The bow thruster system is comprised of a bow thruster set, bow thruster engine, and reduction gear.

BOW THRUSTER SET

The bow thruster is used in combination with the vessel's main propulsion system to give the Large Tug (LT) added maneuverability. A fixed propeller (figure 1, item 1) is driven through a right angle reduction gearbox (figure 1, item 2) by the bow-thruster engine (figure 1, item 3). The propeller is designed to operate in either a clockwise or counterclockwise direction, as selected by the operator on the control panel. Engine speed controls the thrust force. Displacement of raw water in a given direction generates an equal recoil force in the opposite direction, moving the bow of the LT as needed. Control of the bow thruster can be local or remote from the bow thruster control panel on the pilothouse console and auxiliary control stations.

BOW THRUSTER ENGINE

The bow thruster engine (figure 1, item 3) is a turbocharged, 4-cycle, inline 6-cylinder marine diesel engine. The engine is air started. It has its own lubricating oil, cooling, and fuel oil systems. A jacket water heater is provided to ease cold weather starting.

The raw water cooling system consists of a horizontal centrifugal pump driven off the bow thruster engine, a duplex strainer, and a piping system. When the bow thruster engine is operating, the centrifugal pump draws raw water from the sea chest through a duplex strainer. This raw water is routed to the heat exchanger, where the heat from engine coolant is transferred to the raw water. The heated raw water is then pumped overboard (refer to WP 0018 00).

REDUCTION GEAR

A reverse reduction gear (figure 1, item 4) reduces the engine output revolutions per minute (r/min) and reverses rotational direction to the drive shaft (figure 1, item 5). Direction of rotation and hydraulic clutch operation is controlled by a throttle control on the pilothouse console or auxiliary control stations. The reduction gear is equipped with a shaft brake. The shaft brake is designed to lock the drive shaft when the reduction gear is in neutral.

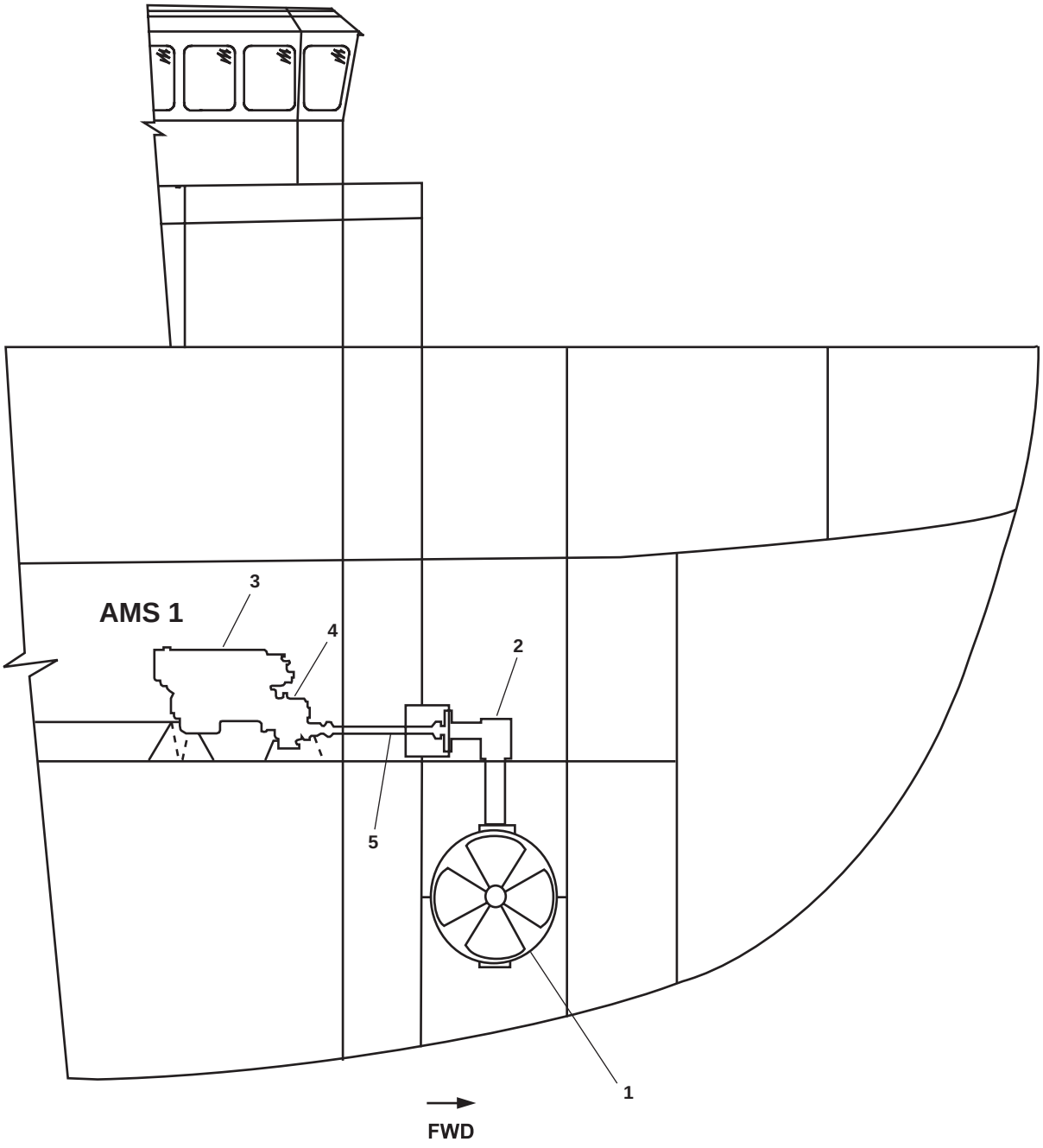


Figure 1. Bow Thruster Components

END OF WORK PACKAGE

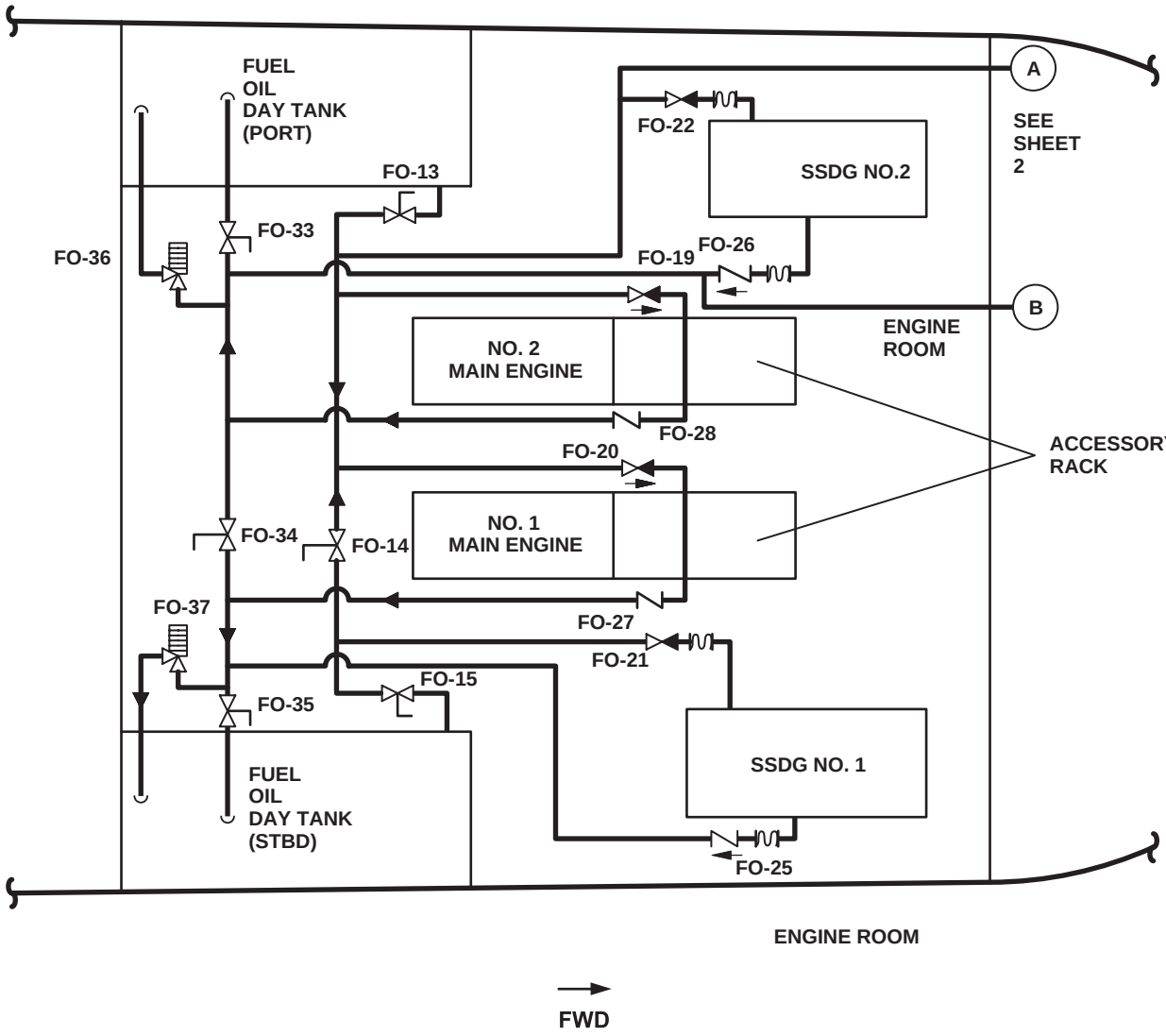
OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
FUEL SYSTEM

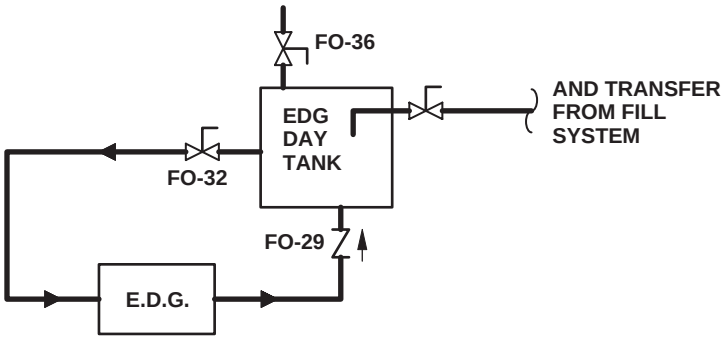
GENERAL

The fuel oil system (figure 1) consists of four front mounted fuel filter/water separators, an engine mounted duplex fuel filter set, a fuel supply manifold, and a fuel return manifold. The fuel pump draws in fuel from the day tank to the engine front mounted fuel filter/water separator. Fuel passes through the filter element set to the fuel manifold of the fuel injection pump housing. Fuel in the fuel manifold of the injection pump housing is the supply for the injection pumps. Injection pumps (one per cylinder) send fuel to the fuel injection nozzle. A small amount of fuel is pumped into the cylinder, at a very high pressure, through the needle valve and the spray tip of the injector. The amount of fuel injected depends upon the position of the plunger, which is controlled by the injector rack and governor. Excess fuel flows through the fuel return manifold and is then returned to the day tank. Excess fuel also cools and lubricates the injector.

FUEL OIL FILL AND TRANSFER PIPING SYSTEM

The fuel oil fill and transfer piping system (figure 2) replenishes the vessel's fuel oil tanks from deck discharge/fill connections. The system also replenishes fuel oil day tanks (PORT and STARBOARD) and the emergency diesel generator day tank by transferring fuel oil from the storage tanks. System control is maintained through a manifold and a combination of valves as shown in figure 2. Fuel oil can be transferred from any storage tank to any day tank and from one storage tank to another. Power to fuel oil transfer pump 1 is supplied by the emergency switchboard and controlled by a local START/STOP pushbutton and an emergency STOP switch located outside the engine room. Power to fuel oil transfer pump 2 is supplied by the main switchboard through 440V power panel No. 1 and is controlled by a local START/STOP pushbutton and an emergency STOP pushbutton located outside the engine room. Each pump shuts down upon activation of any FM-200 pressure switch (refer to WP 0032 00). Fuel oil purification is provided by a fuel filter/water separator between the manifold and the fuel oil transfer pump.





01 LEVEL

Figure 1. Fuel System (Sheet 1 of 2)

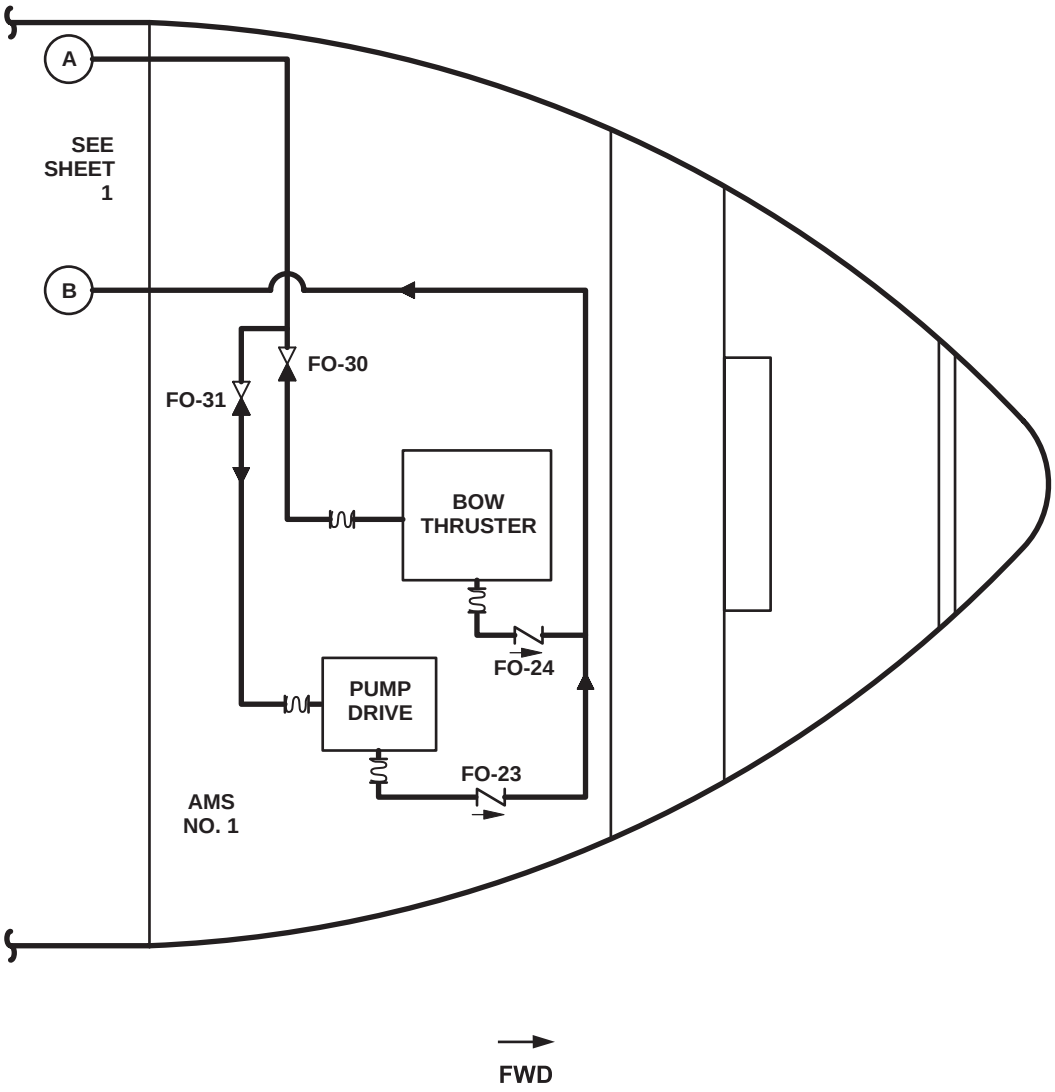


Figure 1. Fuel System (Sheet 2 of 2)

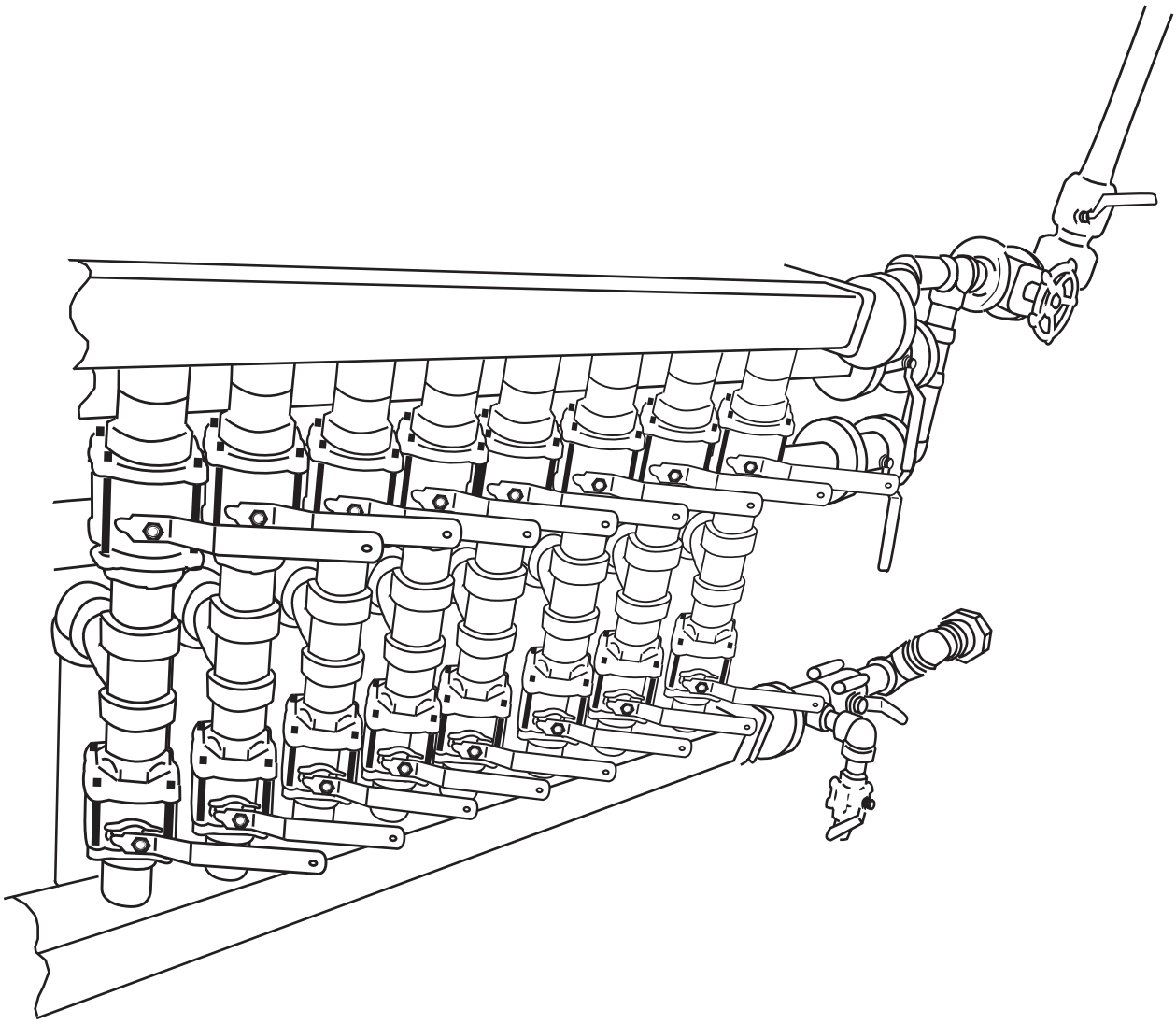


Figure 2. Fuel Oil Fill and Transfer Manifold

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
LUBRICATING AND HYDRAULIC OIL FILL AND TRANSFER SYSTEM

GENERAL

The lubricating oil fill and transfer piping system (figure 1) supplies clean lubricating oil to fill and replenish the main propulsion engines, the Ship's Service Diesel Generators (SSDGs), the pump drive engine and the bow thruster engine.

Major components of the system include the following: a lube oil purifier (figure 1, item 1), a main engine lube oil transfer manifold (figure 1, item 2), a lube oil transfer manifold (figure 1, item 3), a lube oil transfer pump (figure 1, item 4), a lube oil storage tank, an oily waste drain tank (figure 1, item 5), an oily waste storage tank (figure 1, item 6), and a hand pump.

LUBE OIL PURIFIER

The lube oil purifier (figure 1, item 1) separates water from oil and simultaneously removes solids suspended in the oil. Clean oil is returned to the engine sump. Lube oil purifier waste products (water and solids) are pumped to the oily waste drain tank (figure 1, item 5).

MAIN ENGINE LUBE OIL TRANSFER MANIFOLD

The main engine lube oil transfer manifold (figure 1, item 2) is a duplex manifold used to control the flow of lube oil to and from the main engines. Valves are interlocked, so lube oil can only be drawn from one main engine and returned to the same main engine.

LUBE OIL TRANSFER MANIFOLD (3-WAY MANIFOLD)

The lube oil transfer manifold (3-way manifold) (figure 1, item 3) is a simplex manifold used to control the flow of lube oil to the SSDGs, the main engine lube oil transfer manifold (figure 1, item 2), the bow thruster engine (figure 1, item 7), and the pump drive engine (figure 1, item 8).

LUBE OIL TRANSFER PUMP

The rotary vane type lube oil transfer pump (figure 1, item 4) has a rated output of 15 gal/min (68.2 l/minute) at 25 PSI (1.7 bar). The lube oil transfer pump is driven by a 1 hp electric motor. Power is supplied from the main switchboard, through 440V power panel No. 1, to the motor controller.

OILY WASTE DRAIN TANK

The oily waste drain tank (figure 1, item 5) receives and holds the waste discharge from the lube oil purifier (figure 1, item 1) and engine sumps. Oily waste is transferred via the oily bilge piping system to the oily waste storage tank (figure 1, item 6).

OILY WASTE STORAGE TANK

The oily waste storage tank (figure 1, item 6) provides a holding tank that supplies oily water to be processed by the oil water separator. The tank also receives the oil output from the oil water separator. When appropriate, the oily waste discharge pump can empty the oily waste storage tank through the shore connection.

LUBE OIL HAND PUMP

A lube oil hand pump (figure 1, item 9) is provided to drain the port and starboard reduction gear sumps.

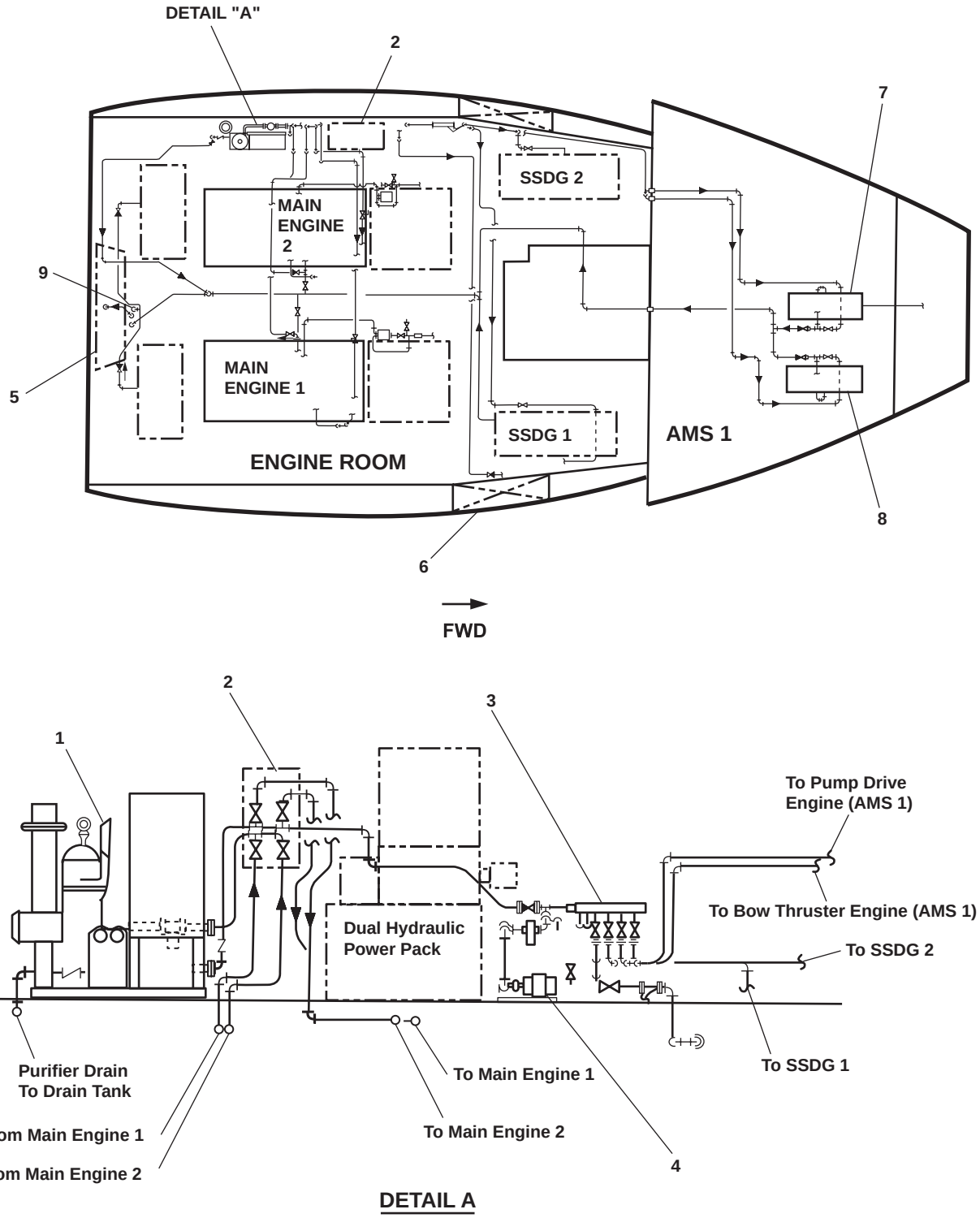


Figure 1. Lubricating Oil Fill and Transfer Piping System

SYSTEM OPERATION

The lubrication oil fill and transfer system transfers lubricating oil from the lube oil storage tank to the main engine, SSDG sumps, bow thruster engine sump, and pump drive engine sump. System alignment is maintained by the lube oil transfer manifold (3-way manifold) (figure 1, item 2) and a combination of valves. A fast lube oil drain system allows dirty oil and sludge to be discharged from the engine sumps to the oily waste drain tank (figure 1, item 5) using gravity drains. Dirty oil from the port and starboard reduction gears is discharged to the oily waste drain tank using the lube oil hand pump (figure 1, item 9). Power for the lube oil transfer pump is supplied from the main switchboard, through 440V power panel No. 1. A lube oil purifier (figure 1, item 1) purifies the lube oil for the main engines. Power for the lube oil purifier is supplied from main switchboard. Each unit has a START/STOP pushbutton adjacent to the unit.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
STEERING SYSTEM

GENERAL

The steering gear system is an electrically driven, hydraulically operated system (figure 1) that positions the rudders in response to steering commands.

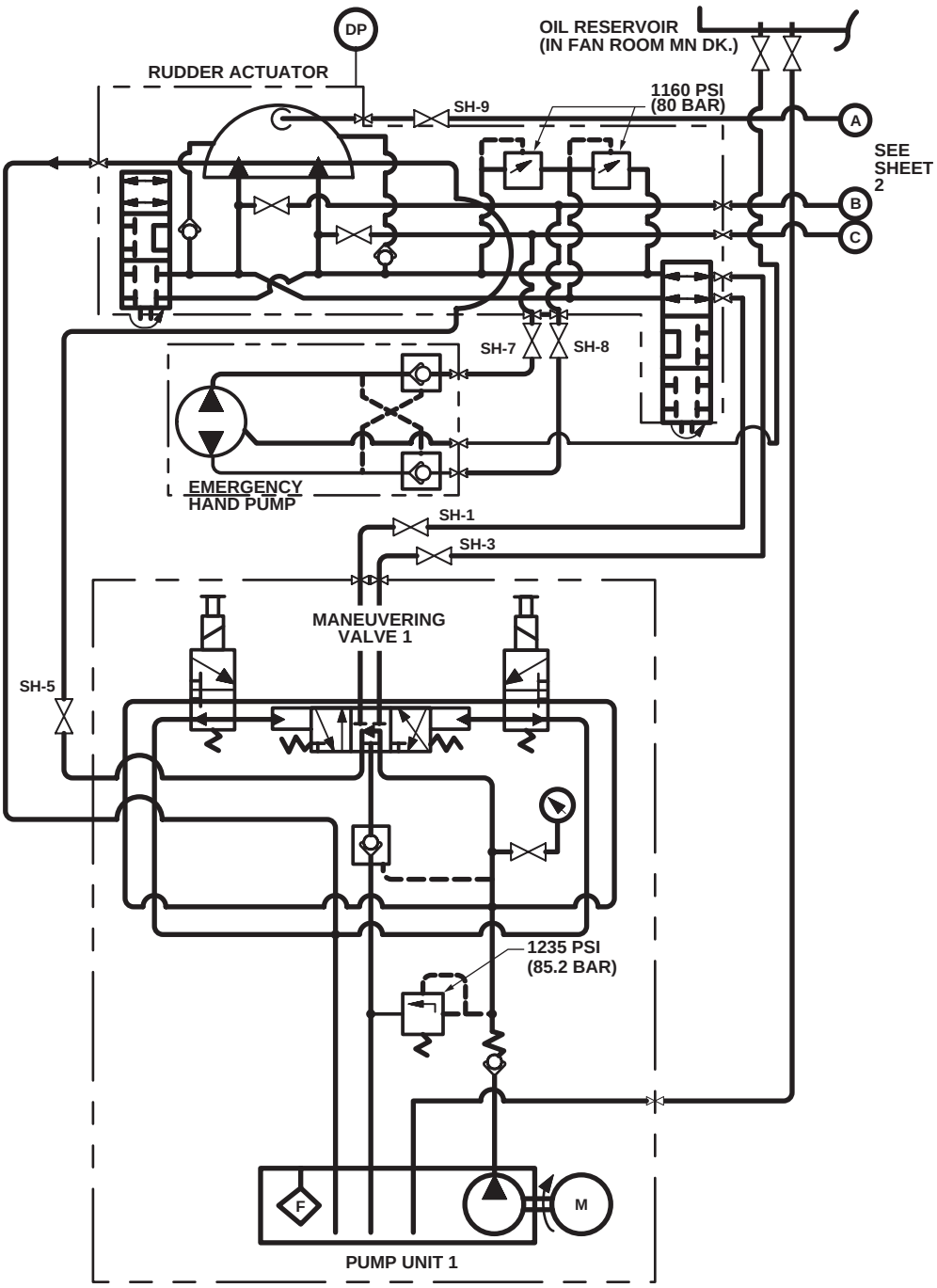


Figure 1. Steering Gear Hydraulic System Schematic (Sheet 1 of 2)

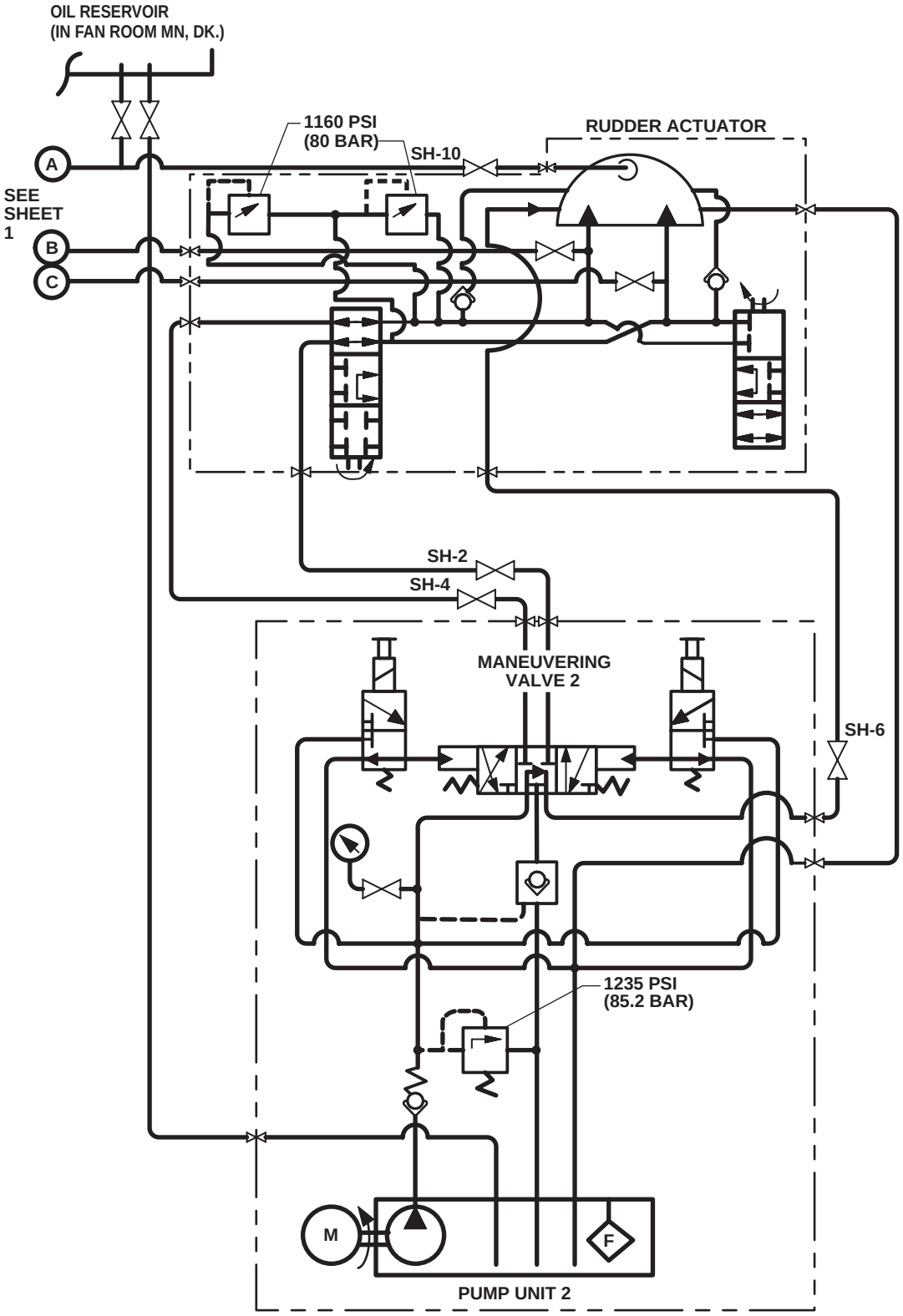


Figure 1. Steering Gear Hydraulic System Schematic (Sheet 2 of 2)

SYSTEM COMPONENTS

OIL RESERVOIR

The oil reservoir (figure 2, item 1) stores the hydraulic oil for the steering gear system.

STEERING GEAR PUMP UNIT

Each steering gear hydraulic pump unit (figure 2, item 2) consists of an electric motor, a hydraulic pump, solenoid actuated hydraulic valves (maneuvering valves), and its own oil tank. The steering gear hydraulic pump units 1 and 2 supply the hydraulic pressure to the rudder actuators (figure 2, item 3) that move the rudders into the commanded position.

SURGE ARRESTOR

The surge arrestor (figure 2, item 4) absorbs pressure fluctuations between the oil reservoir (figure 2, item 1), the steering gear hydraulic pump units (figure 2, item 2), and the rudder actuator (figure 2, item 3) to prevent damage to the steering gear system.

EMERGENCY HAND PUMP

The emergency hand pump (figure 2, item 5) provides manual directional control to the steering gear when electrical control has been lost at the helm or auxiliary stations.

RUDDER ACTUATORS

The rudder actuators (figure 2, item 3) move the rudders into the requested position (port or starboard direction) as directed by the helm or auxiliary control stations.

STEERING SYSTEM STARTER PANEL (PORT AND STARBOARD)

The steering system starter panels (figure 2, item 6) provide electrical power and control to the steering gear hydraulic pump units (figure 2, item 2). The steering gear starter panels turn the steering gear hydraulic pump units (figure 2, item 2) ON and OFF (locally or remotely).

HELM STATION

The helm station is the vessel's main steering control station and is located in the pilothouse.

SOLENOID ACTUATED HYDRAULIC VALVES (MANEUVERING VALVES)

The solenoid actuated hydraulic valves (maneuvering valves) (figure 1) receive input from the helm or auxiliary steering stations. They respond to this input by directing hydraulic pressure to the rudder actuators (figure 2, item 3). Direction and volume of the flow are determined by the input from the helm or auxiliary steering station.

AUXILIARY STEERING STATIONS

Auxiliary stations are used in place of the helm station to provide remote commands to the steering gear system. The auxiliary steering stations consist of the starboard pilothouse wing station, the port pilothouse wing station, and the aft control station.

SYSTEM OPERATION SUMMARY

The commands to move the rudder actuators (figure 2, item 3) originate from movement of the vessel's helm (wheel) or movement of the helm at the auxiliary control stations. This sends a signal to the solenoid actuated hydraulic valves (figure 1) in the hydraulic power unit. The solenoid actuated hydraulic valves direct the flow of hydraulic fluid from the reservoir (figure 2, item 1) to the steering gear hydraulic pump units (figure 2, item 2) and to the rudder actuators (figure 2, item 3). In the event of the loss of all electrical power, the emergency hand pump (figure 2, item 5) provides the steering gear system with hydraulic pressure to resume steering control.

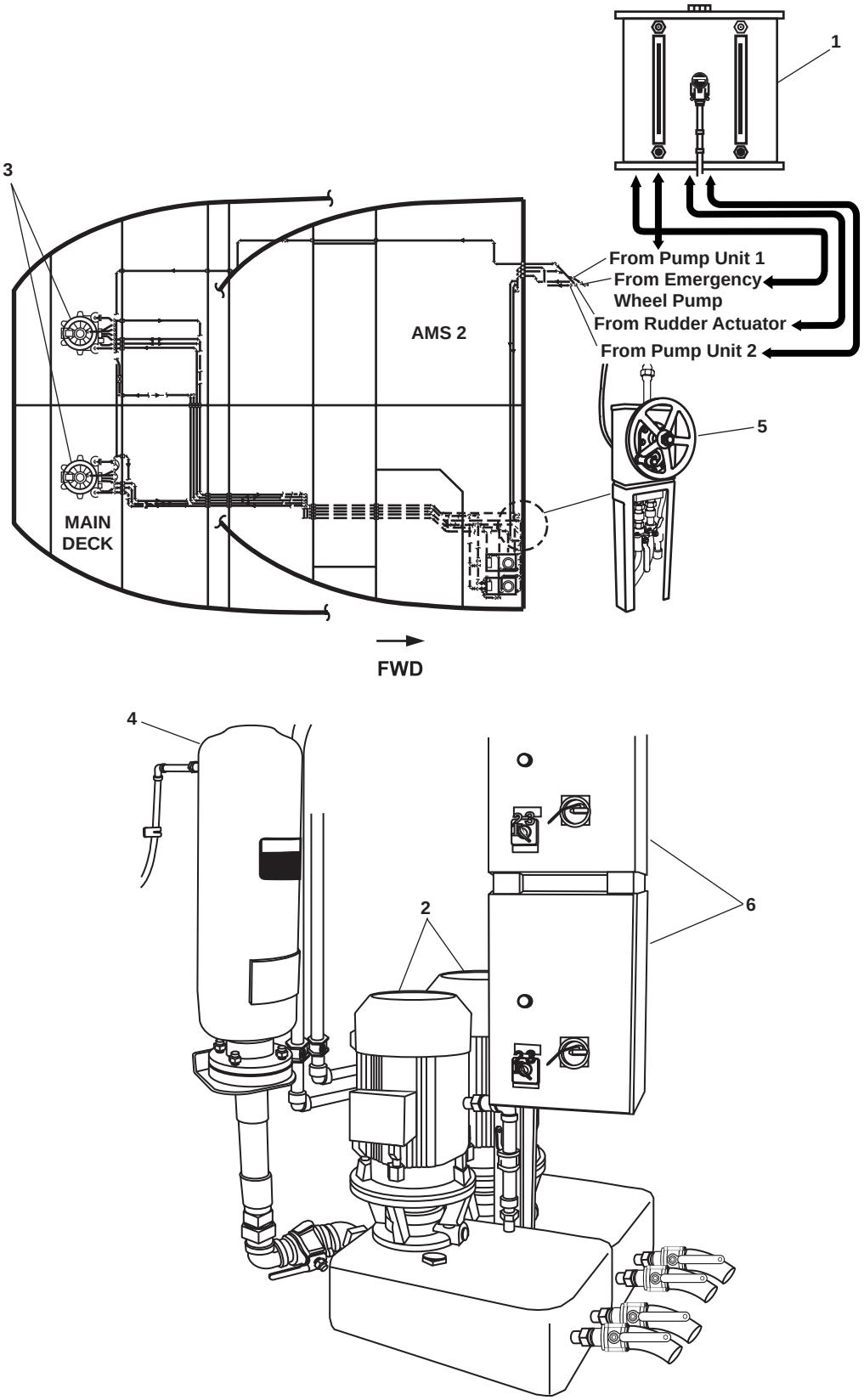


Figure 2. Steering Gear Pump Unit and Hydraulic Layout

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
HYDRAULIC SYSTEMS

GENERAL

The LT is provided with three separate hydraulic systems. These systems are: the steering gear hydraulic system, the central hydraulic system, and the towing machine hydraulic system. Each system has its own pumps, filters, piping, reservoir, and controls.

THE STEERING GEAR HYDRAULIC SYSTEM

The steering gear hydraulic system is an electrically driven system (figures 1 and 2). The main function of the steering gear hydraulic system is to power the rudder actuators in response to steering commands from the helm or auxiliary stations.

The system components of the steering gear hydraulic system consist of: the helm station, an oil reservoir, two unit pumps, a surge arrestor, an emergency hand pump, rudder actuators, solenoid actuated hydraulic valves (maneuvering valves), and three auxiliary steering stations. The emergency hand pump (figure 2) provides hydraulic pressure and directional control to the steering gear when electrical control has been lost at the helm or auxiliary stations. Refer to WP 0024 00 for further details.

THE CENTRAL HYDRAULIC SYSTEM

The central hydraulic system (figures 3, 4, 5) provides hydraulic power for the crane, the capstan, tow pins, and anchor windlass. It may also be aligned to provide hydraulic power to both towing machines. A crossover allows the towing machine hydraulic system (figure 6) to power the central hydraulic system (figure 3) in the event of failure of the central hydraulic system (figure 4) or power pack (figure 6). The central hydraulic system (figure 3, 4, and 5) is comprised of a hydraulic fluid reservoir, two pump units, filter, and control panel. Refer to WP 0039 00 for further details.

TOWING MACHINE HYDRAULIC SYSTEM

The towing machine hydraulic system (figure 6) provides hydraulic power for the port and starboard towing machines. It may also be aligned to provide hydraulic power the central hydraulic system (figures 3, 4, and 5). The hydraulic towing machine system consists of: a diesel engine (pump drive engine), a pump unit, a reservoir, and a hydraulic oil cooler.

PUMP DRIVE ENGINE

The pump drive engine, located in AMS 1 (starboard side), powers a dual pump, open-loop hydraulic system. The maximum hydraulic flow is proportional to the pump drive engine's speed. The hydraulic fluid flow is controlled by a proportional directional control valve (figure 6, item 1) mounted on the towing machine drive motor. The pilot signal to the directional control valve is from the remote control lever located on the operator's console. A crossover allows this hydraulic system (figure 6) to power the central hydraulic system (figures 3, 4, and 5) in the event of failure of the central hydraulic system (figure 4).

OIL RESERVOIR

The oil reservoir stores the hydraulic fluid for the hydraulic towing machine system.

HYDRAULIC OIL COOLER

The hydraulic oil cooler (figure 6, item 2) (located at the reservoir) uses raw water to cool hydraulic fluid that was heated while operating the towing machine.

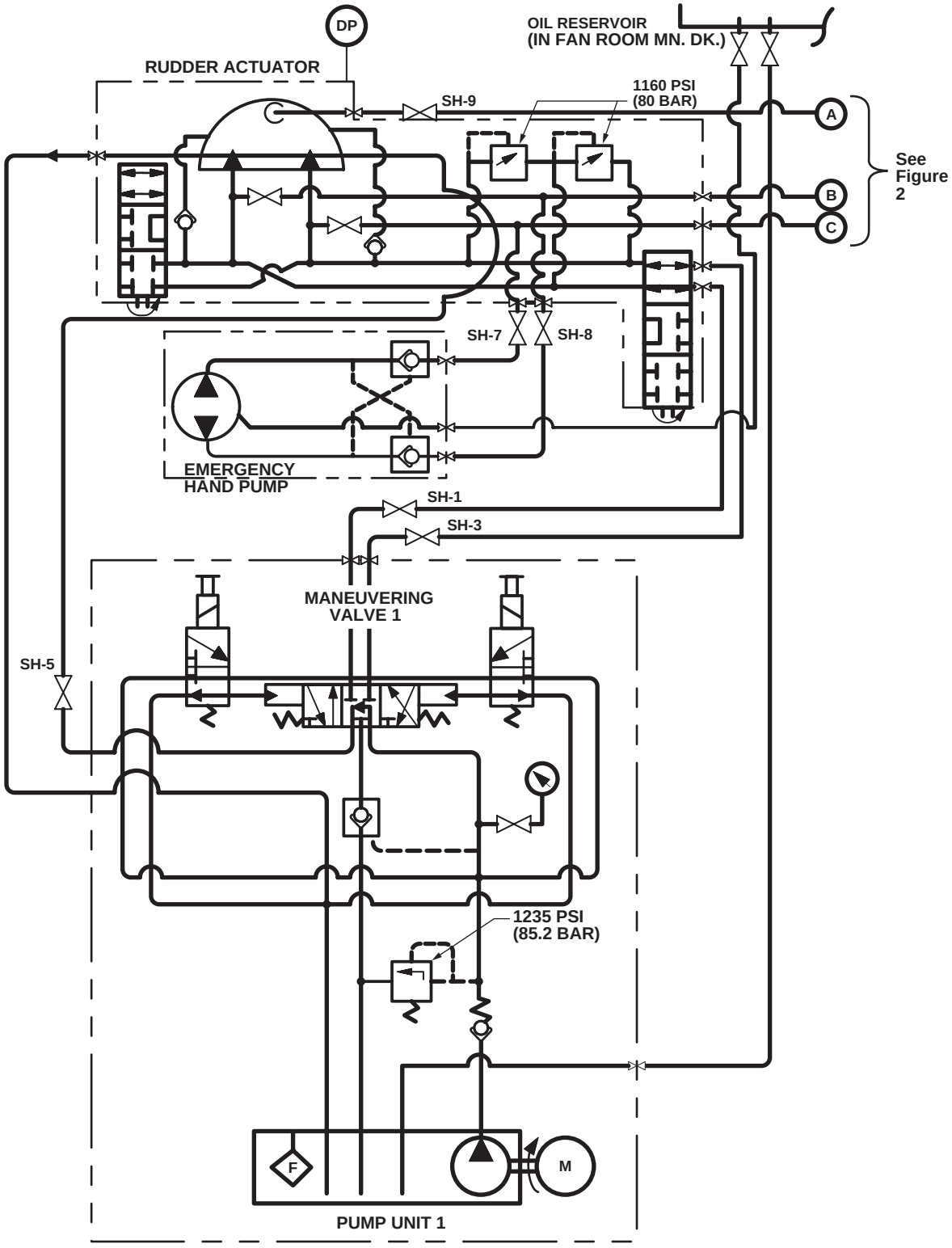


Figure 1. Steering Gear Hydraulic System Schematic (Pump 1)

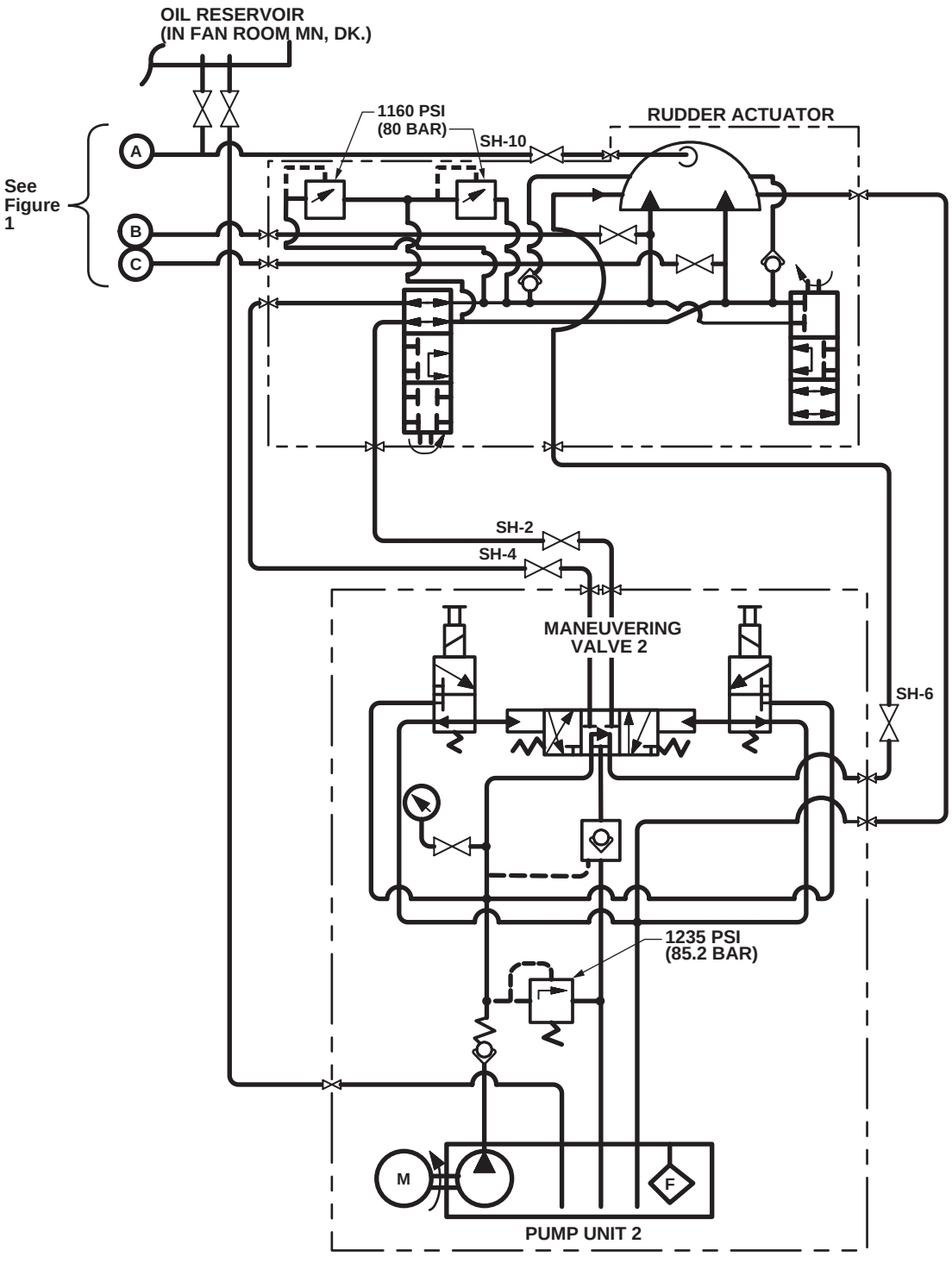


Figure 2. Steering Gear Hydraulic System Schematic (Pump 2)

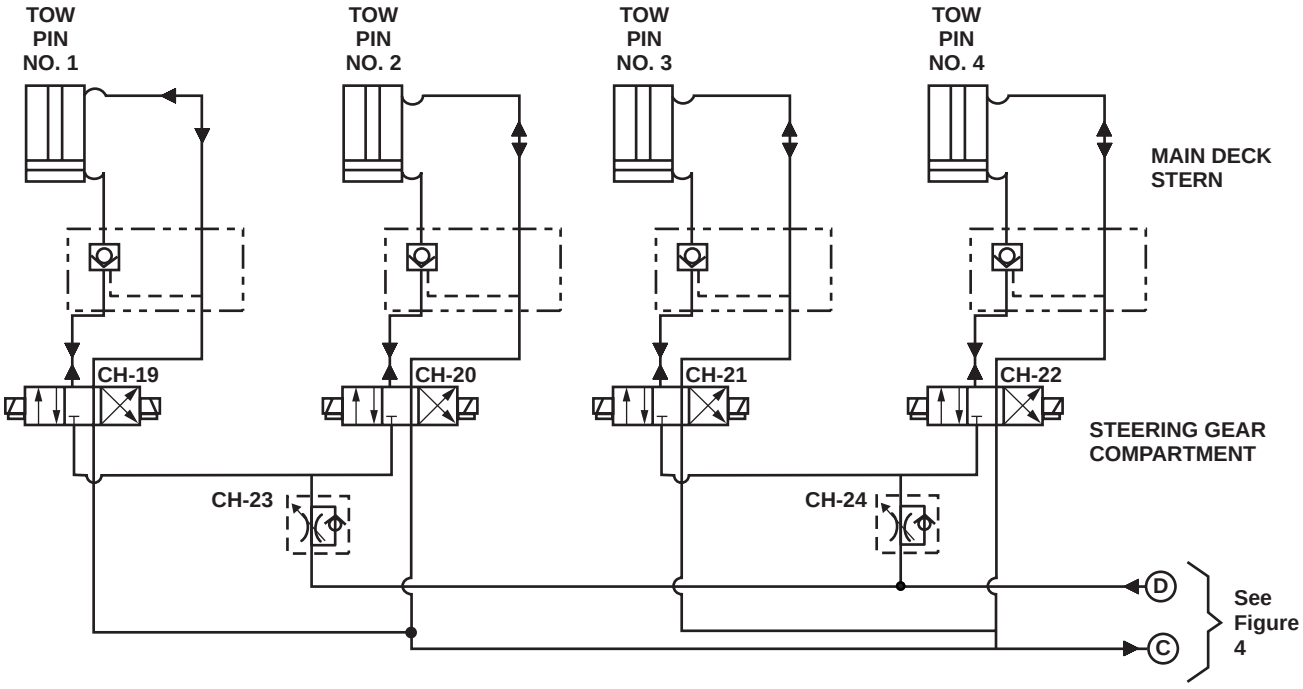


Figure 3. Central Hydraulic System (Main Deck)

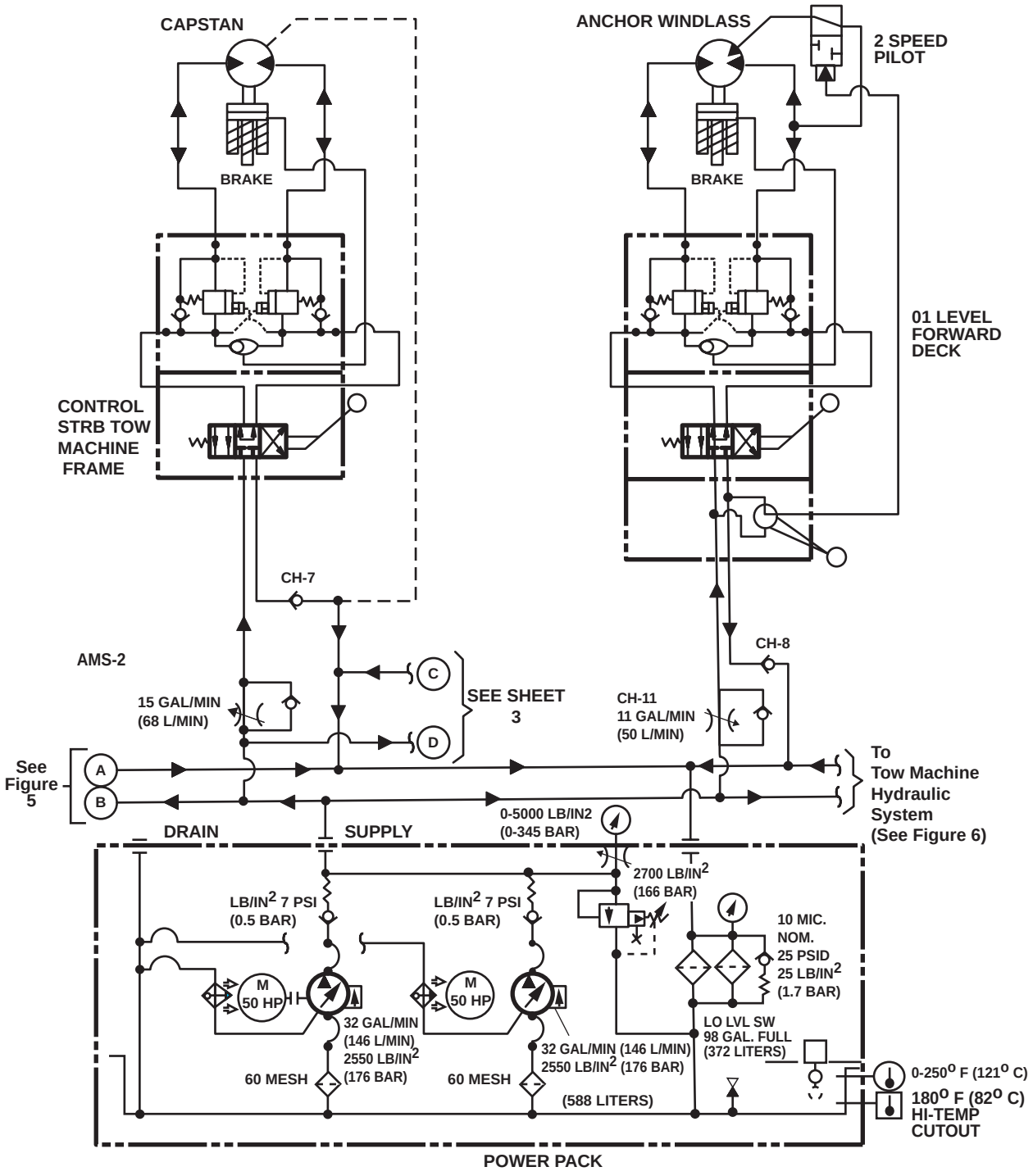


Figure 4. Central Hydraulic System (Power Pack)

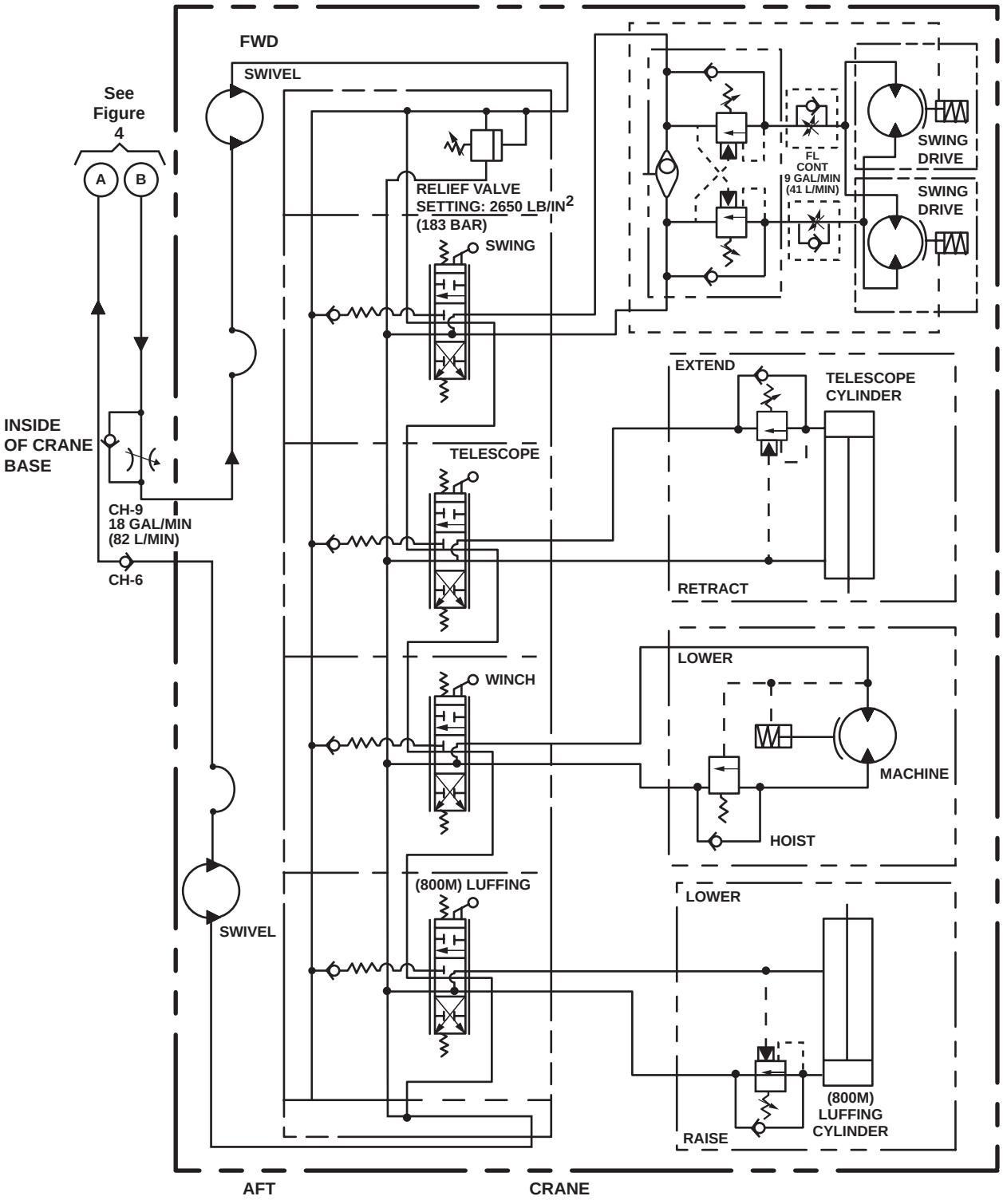


Figure 5. Central Hydraulic System (Crane)

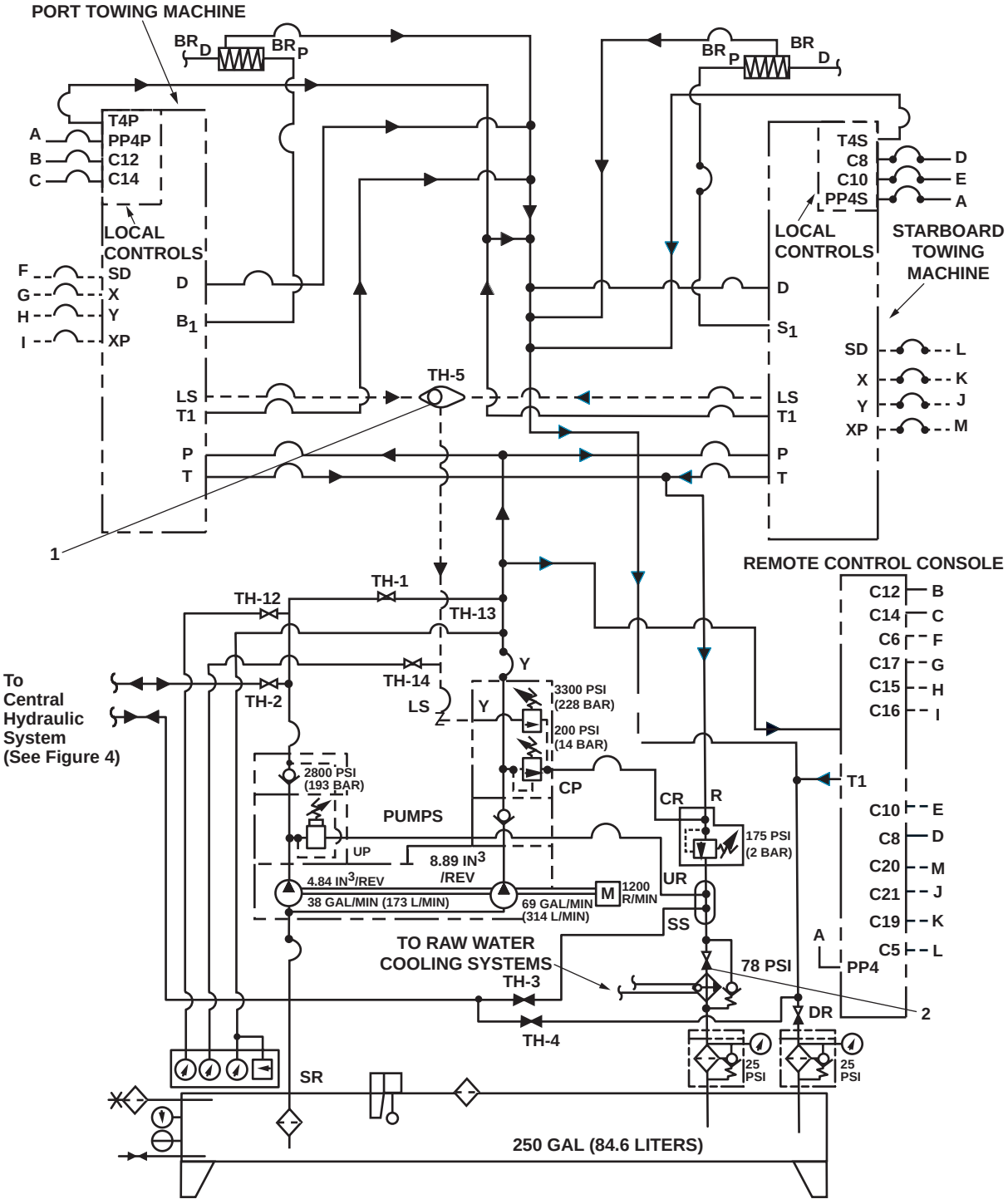


Figure 6. Towing Machine Hydraulic System

PUMP UNIT

The pump unit has a maximum flow of 98 gal/min (371 L/min) at 1,800 r/min and with the pump unloading, the maximum flow is 63 gal/min (238.5 L/min) at 1,800 r/min. The pump flow is proportional to the pump drive engine speed and can be increased or decreased by adjusting the engine speed. The pumps have a displacement of 4.84 in^3/rev (123 mm^3/rev) and 8.89 in^3/rev (225.8 mm^3/rev), and will produce a maximum pressure of 3,500 PSI (241 bar) continuous or 4,000 PSI (275.8 bar) intermittent.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
COMPRESSED AIR SYSTEM

GENERAL

This work package describes the theory of operation for the Inland and Coastal Large Tug's (LT) compressed air system. The theory of operation for the system as a whole is discussed first. Following the system theory of operation, the theory of operation for the air compressor is discussed.

SYSTEM

Two electric powered, two-stage air compressors (figure 1, item 1) compress air for use throughout the vessel. See the Air Compressor paragraph below for theory of operation for the compressors.

After leaving the compressors (figure 1, item 1), the compressed air passes through air dryers (figure 1, item 2). These air dryers remove moisture from the air before the air reaches the starting air receivers (figure 1, item 3). Removal of moisture from the compressed air is necessary to prevent the accumulation of water in the receivers. This accumulated water can corrode the interior of the receivers, and can also travel downstream in the compressed air system damaging components further down the line. Each dryer is equipped with a bypass valve (figure 1, item 4) to permit air to bypass the dryer in the event of a dryer failure.

All air discharged from the air compressors (figure 1, item 1) arrives first at the starting air receivers (figure 1, item 3). Here, the air is stored at 250 PSI (17.2 bar) to ensure that an adequate supply of compressed air is on hand for use in starting the main engines, the bow thruster engine, the pump drive engine, and the engine for SSDG 2. SSDG 1 is equipped with an electric starter, and does not require compressed air.

Compressed air for ship's service use (air tools, ship's whistle, sea chest blowdowns, etc.) is stored in the ship's service air receiver (figure 1, item 5). This receiver is supplied from the starting air receivers (figure 1, item 3) through a regulator (figure 1, item 6). This regulator reduces the starting air pressure to 125 PSI (8.6 bar) before the air is permitted to enter the ship's service air receiver. A bypass valve (figure 1, item 7) permits manual filling of the ship's service air receiver in the event of a regulator failure.

All three receivers (figure 1, items 3 and 5) are equipped with relief valves (figure 1, item 8), local pressure gauges (figure 1, item 9), manual drain valves (figure 1, item 10), and automatic drain valves (figure 1, item 11). The relief valves prevent overpressurization of the receivers, which could result in catastrophic failure. The relief valve for the starting air system is set at 275 PSI (19.0 bar) and the relief for the ship's service system is set for 137.5 PSI (9.5 bar). The manual drains permit manual draining of water from the receivers. They also permit the system to be drained when receiver or compressed air system maintenance is required. The automatic drains open on a preset schedule, keeping the receivers drained under normal operating conditions.

Although the starting air is stored at 250 PSI (17.2 bar), this pressure is too high for the engines' starters to accommodate without damage. Therefore, each engine's starting air piping is fitted with a regulator. The regulator for the bow thruster engine (figure 1, item 12) and the pump drive engine (figure 1, item 13) each reduces the starting air pressure to 125 PSI (8.6 bar). The regulators (figure 1, item 14) for the main engines each reduce the engines' starting air pressure to 200 PSI (13.8 bar).

Additional regulators are provided for the forward (figure 1, item 15) aft (figure 1, item 16) and high level (figure 1, item 17) sea chest blowouts. These reducing valves reduce the ship's service air to 25 PSI (1.7 bar) to prevent damage to the sea chests.

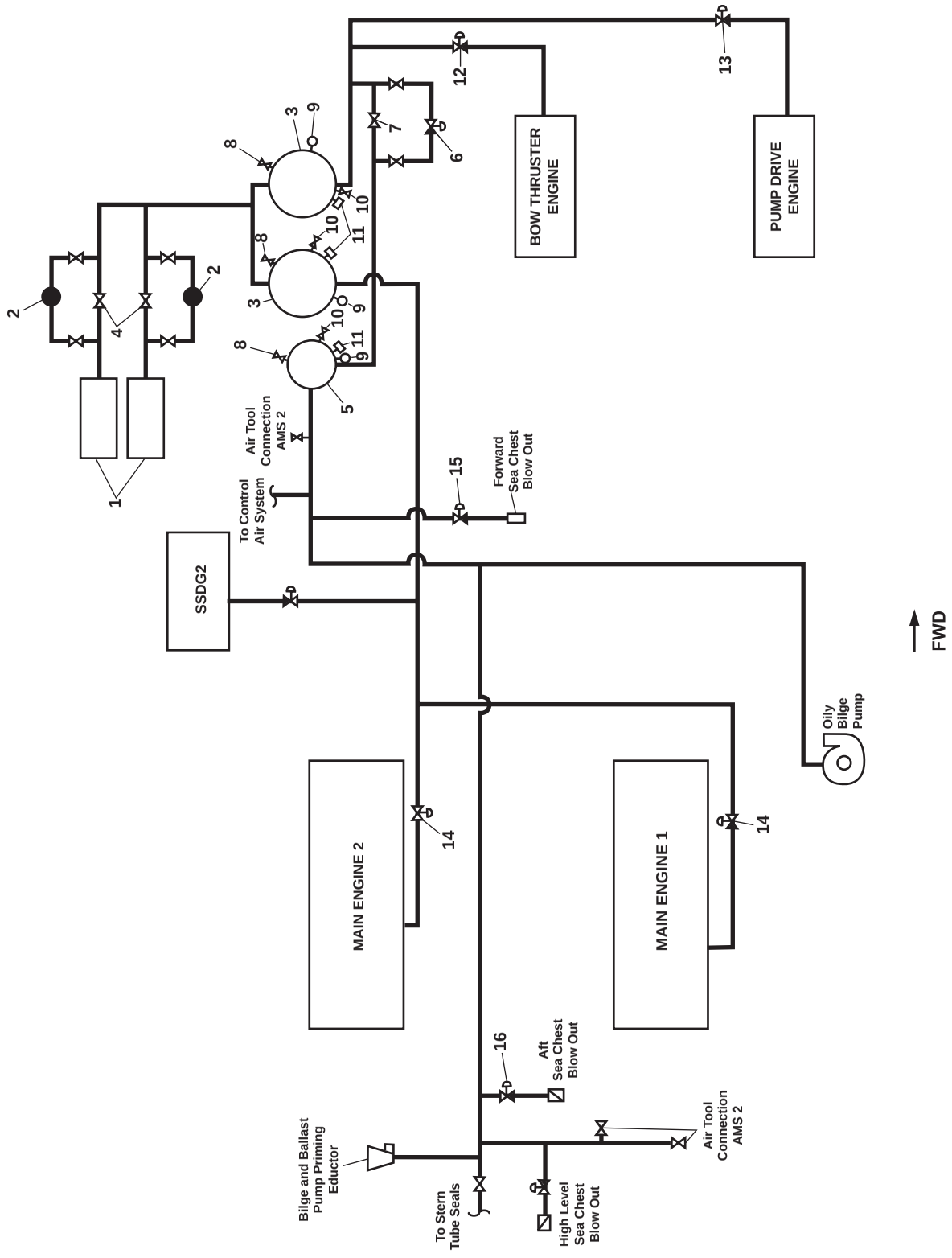


Figure 1. Compressed Air System Simplified Schematic

AIR COMPRESSOR

COMPRESSION

The compressor's crankshaft (figure 2, item 1) is turned by an electric motor, via a V-belt drive. As the crankshaft turns, the pistons move up and down. During the downstroke of the low-pressure piston (figure 2, item 2), air is drawn through an intake valve in the head of the compressor into the low-pressure cylinder (figure 2, item 3). During the upstroke of the piston, this air is compressed.

The air that was compressed by the low-pressure piston (figure 2, item 2) is then released through a discharge valve in the head of the compressor to a finned tube intercooler where the heat resulting from compression is allowed to dissipate. The cooler compressed air is then drawn into the high-pressure cylinder by the downstroke of the high-pressure piston (figure 2, item 4). On the upstroke of the high-pressure piston, the air is further compressed before being discharged through a discharge valve in the compressor head. At this point, the compressed air enters the vessel's compressed air piping system enroute to the starting air receivers.

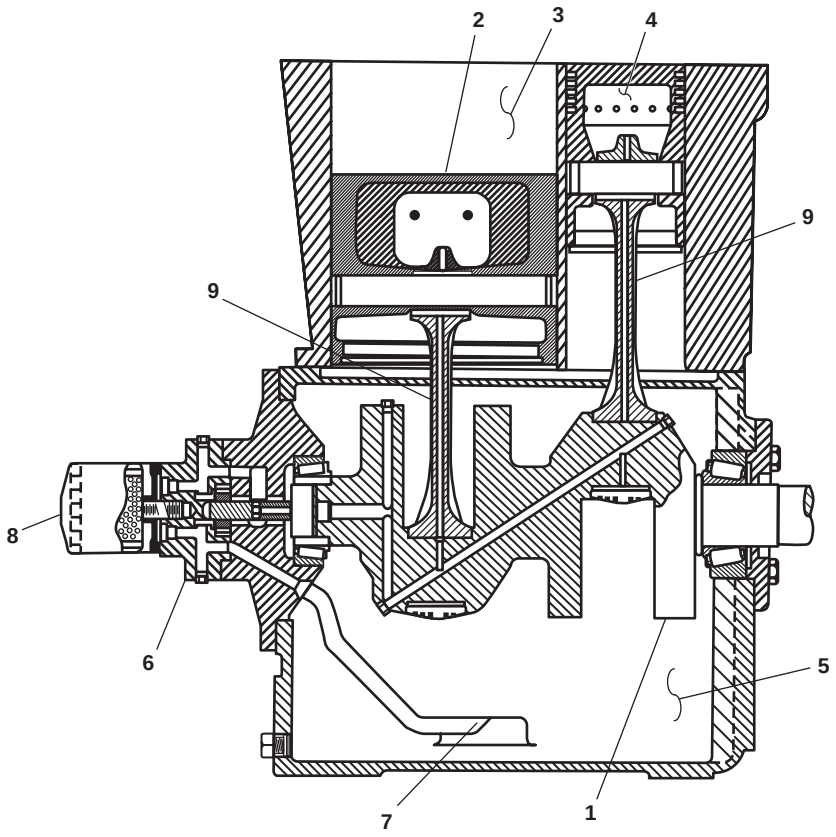


Figure 2. Air Compressor

LUBRICATION

The air compressor is pressure lubricated. The moving parts within the crankcase (figure 2, item 5) are supplied with lubrication by a positive displacement, gerotor type oil pump (figure 2, item 6). Oil is drawn up from the bottom of the crankcase to the oil pump through an oil sump strainer screen (figure 2, item 7). The oil is then forced under pressure through the oil filter (figure 2, item 8). After being filtered, the oil travels under pressure through drilled journals in the crankshaft (figure 2, item 1) and connecting rods (figure 2, item 9) to lubricate crankshaft bearings, wrist pin bearings, and the cylinder walls.

COOLING

The fan blades of the compressor pulley force ambient air across the fins of the cylinder heads and intercooler fins to cool the compressor.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
CONTROL AIR SYSTEM

GENERAL

The control air system provides dry compressed air to the throttles and transfer valves in the pilothouse control console (figure 1, item 1) and auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) of the Large Tug (LT). The control console and auxiliary control stations are where the commands to maneuver the vessel originate.

The major components of the control air system consist of an air dryer (figure 1, item 3), pilothouse control console (figure 1, item 1), auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2), the EOS console (figure 1, item 4), the reduction gear ratio selector, and indicator system.

AIR DRYER

The air dryer removes the moisture from the compressed air before it is supplied to the control consoles and auxiliary control stations.

CONTROL CONSOLES

The control console is the main control station where commands originate to engage the main propulsion and the bow thruster engine.

AUXILIARY CONTROL STATIONS

The auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) are standby control stations where commands originate to engage the main propulsion and the bow thruster engines in place of the main control console (pilothouse) (figure 1, item 1).

EOS CONSOLE

The EOS control console (figure 1, item 4) contains the controls for selection of reduction gear ratios and engine throttle controls. Pneumatic valves in each console and control station provide the necessary control of the system.

REDUCTION GEAR RATION SELECTION

A selector in the EOS control console (figure 1, item 4) allows selection of the desired forward reduction gear ratio. The reduction gear selector will be disabled whenever the throttle control is not in the center or the NEUTRAL position, or command is at a station other than the EOS control console.

IN COMMAND INDICATORS

The pilothouse control console (figure 1, item 1) and the EOS control console (figure 1, item 4) have indicators to show which of the five stations has command and which clutch(es) are selected. The auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) have a single indicator to show when that station is in command.

CONTROL AIR SYSTEM OPERATION

The transfer of command to the pilothouse console (figure 1, item 1) or one of the auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) is initiated from the EOS console (figure 1, item 4). An engine room watchstander positions the EOS COMMAND TRANSFER control from the EOS to the REMOTE position. At the selected station, the operator pulls up and holds the COMMAND TRANSFER plunger until air (compressed) pressure is indicated on the CONTROL AIR PRESSURE gauge. Once the gauge indicates air pressure, transfer is complete and all other control stations are disabled. Transfer between the pilothouse console and an auxiliary control station is accomplished by pulling up the COMMAND TRANSFER plunger at the desired station until air pressure is indicated on the CONTROL AIR PRESSURE gauge

at approximately 110 to 120 PSI (7.58 to 8.27 bar). This also disables all other stations. The throttle and transfer valve become active at the directed control station. The EOS may regain control at any time by placing EOS COMMAND TRANSFER control to the EOS position. Main engine starting circuits are disabled whenever a clutch is selected or command is at a station other than EOS.

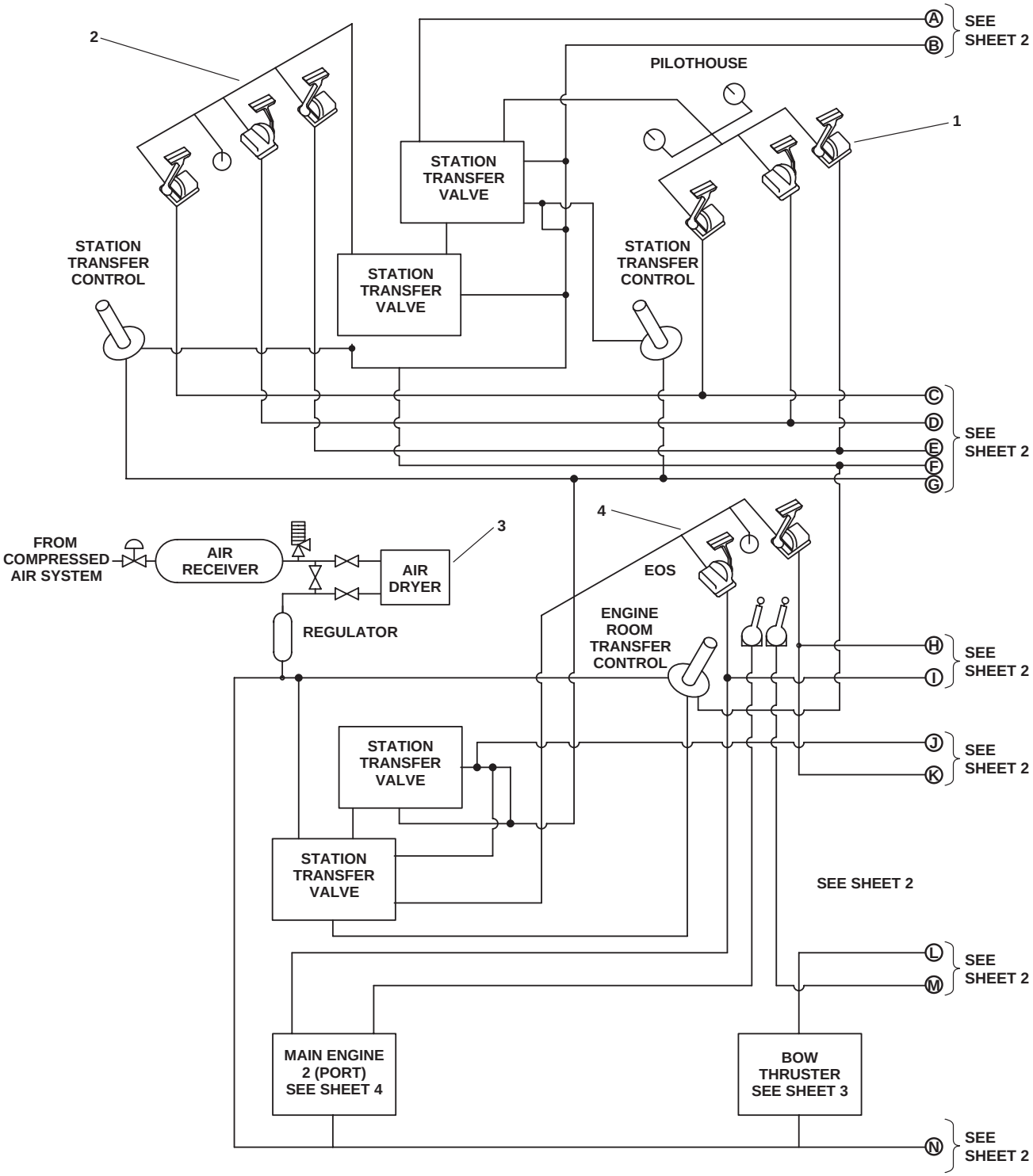


Figure 1. Control Air System (Sheet 1 of 4)

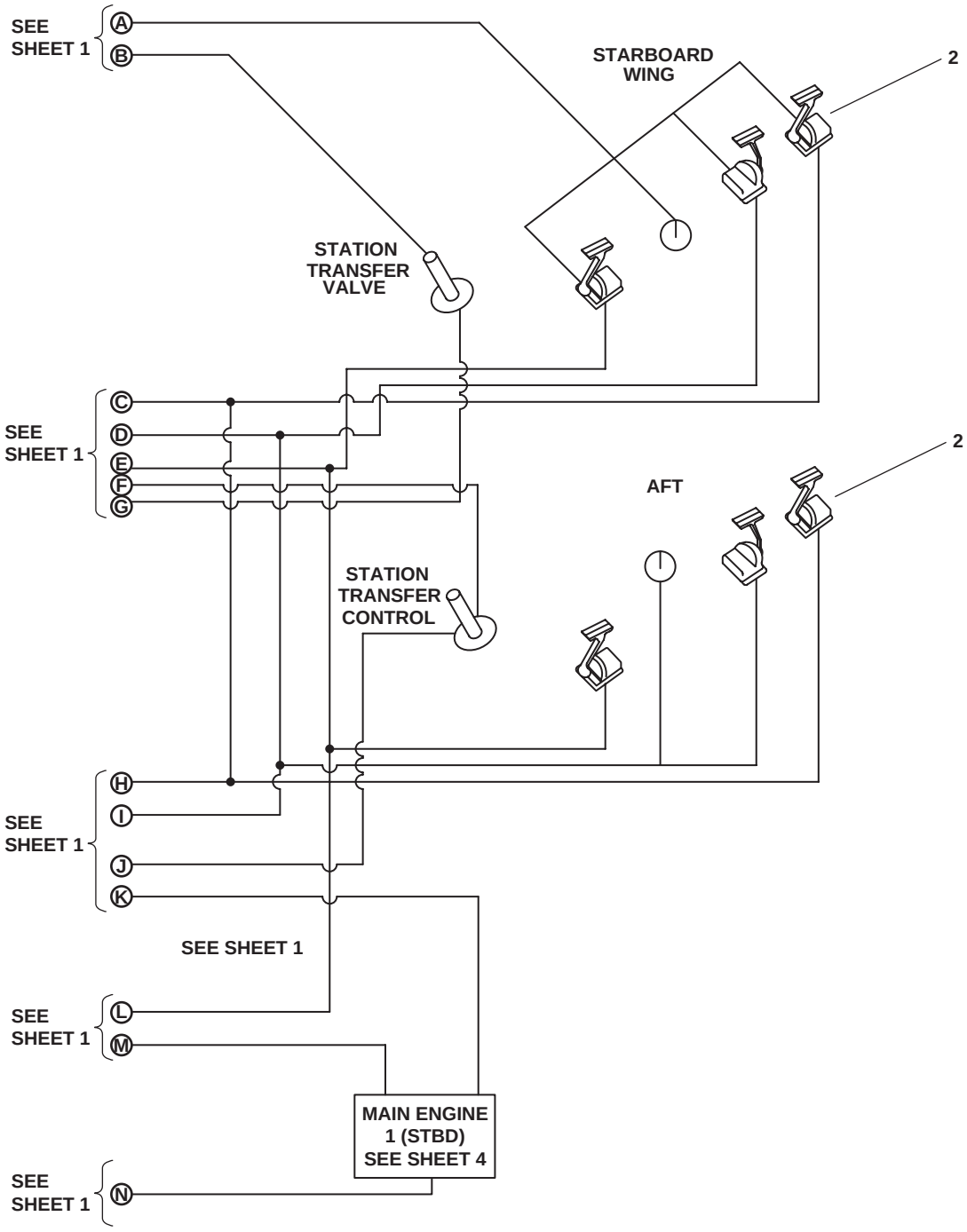


Figure 1. Control Air System (Sheet 2 of 4)

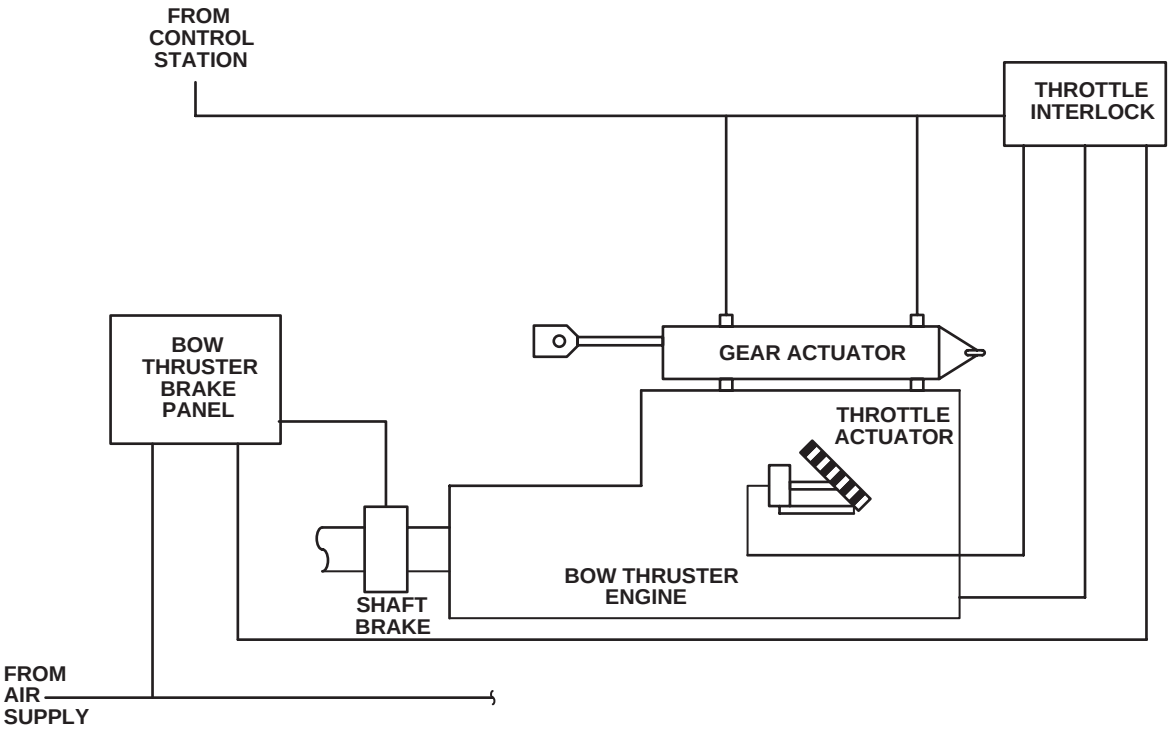


Figure 1. Control Air System (Sheet 3 of 4)

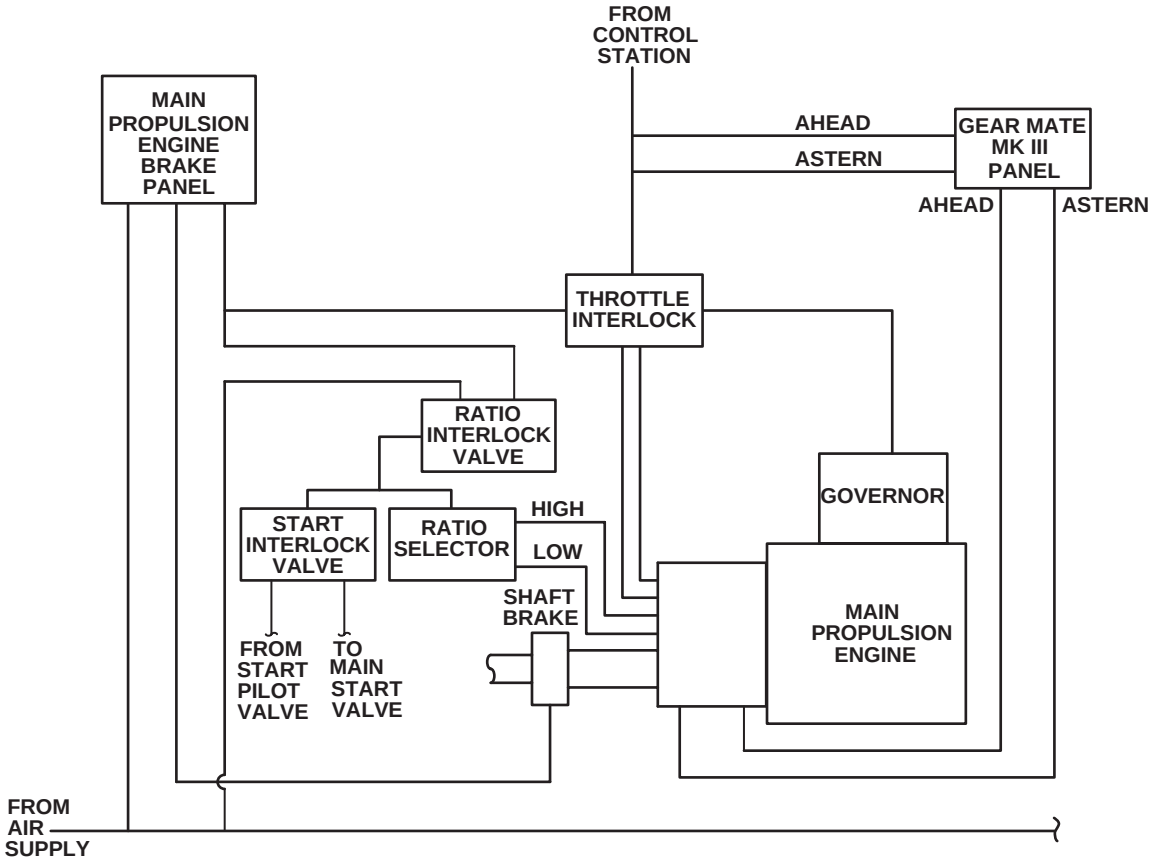


Figure 1. Control Air System (Sheet 4 of 4)

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
POTABLE WATER SYSTEM

GENERAL

The potable water system supplies cold and hot water to the galley, drinking fountains, showers, toilets, sinks, hot water heaters (figure 1, item 1), and other areas throughout the LT. The potable water system also supplies potable water to replenish the coolant in the engine cooling piping systems.

The potable water system consists of two potable water tanks (figure 2, item 1), two reverse osmosis water purification units (figure 2, item 2), a proportioning bromine feeder (figure 2, item 3), two potable water pumps (figure 2, item 4) a hydropneumatic tank (figure 2, item 5) with pressure switches, two potable hot water heaters and a hot potable water recirculating pump (figure 1, item 2).

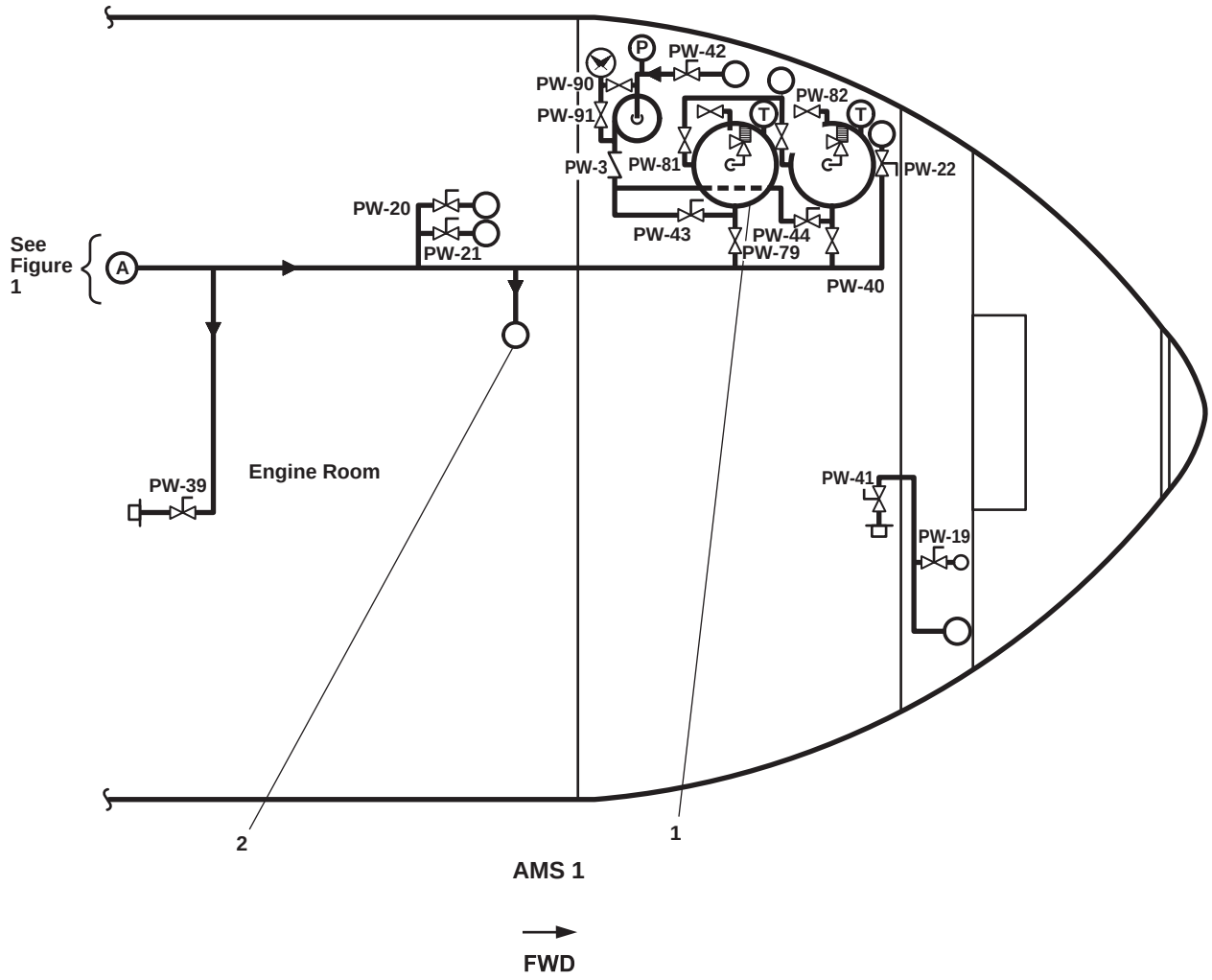


Figure 1. Potable Water System (AMS 1)

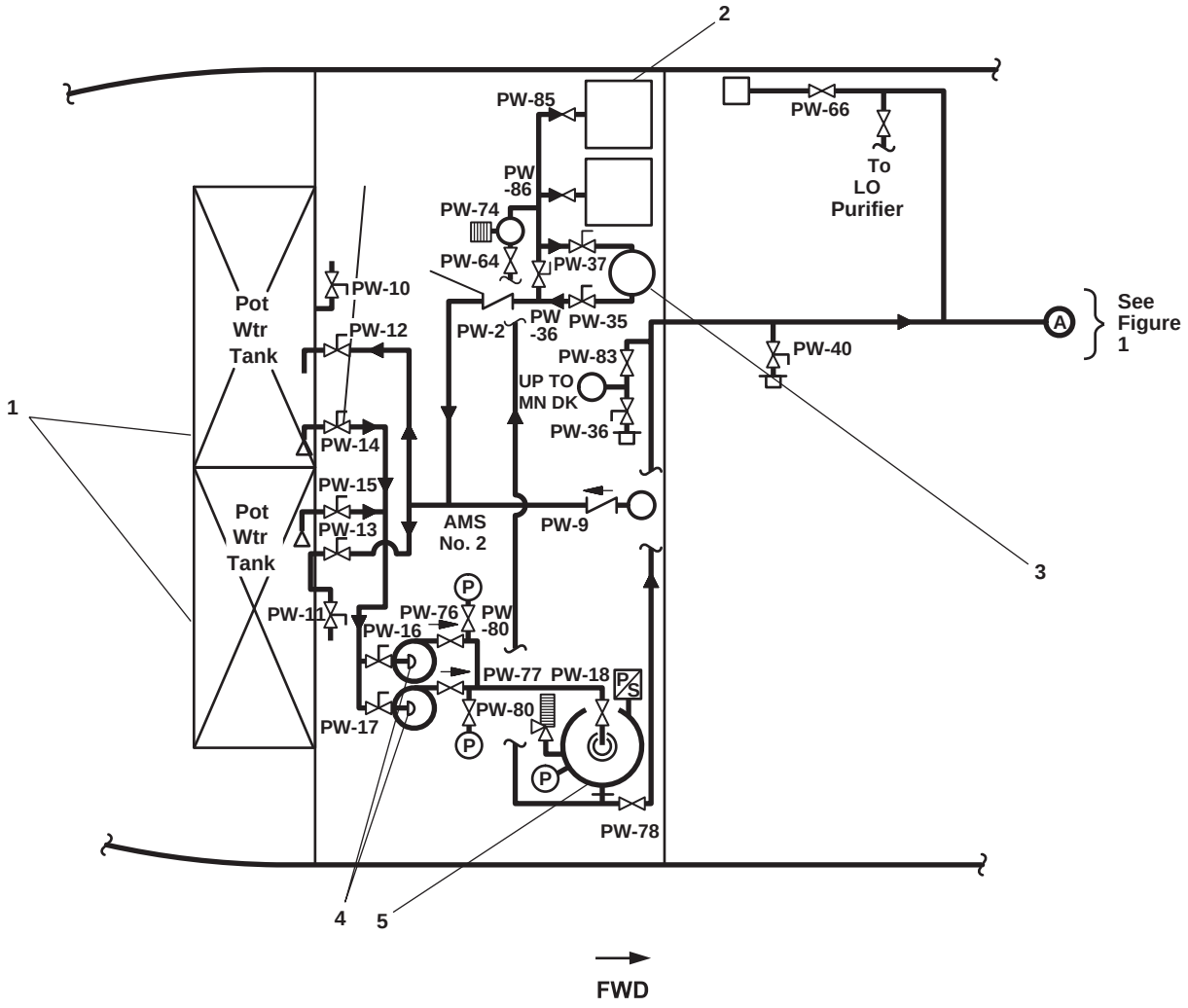


Figure 2. Potable Water System (AMS 2)

POTABLE WATER TANKS

Two potable water tanks (figure 1, item 1) (port and starboard) are mounted in a watertight void between frames 14 and 25. The potable water tanks are used to store potable water. These tanks have fill connectors and a piping vent on the main deck. The potable water tank levels are monitored by Tank Level Indicators (TLIs) located in AMS 2 and the EOS.

VENT

The potable water tank vent has an inverted check valve. This vent provides ventilation to the tank as the tank level changes. The inverted check valve opening is protected by a screen to keep insects and other contaminants from entering the system.

FILL CONNECTORS

The fill connectors (figure 3, items 1 and 2) allow the potable water tanks (figure 2, item 1) to be filled from an external source of treated water.

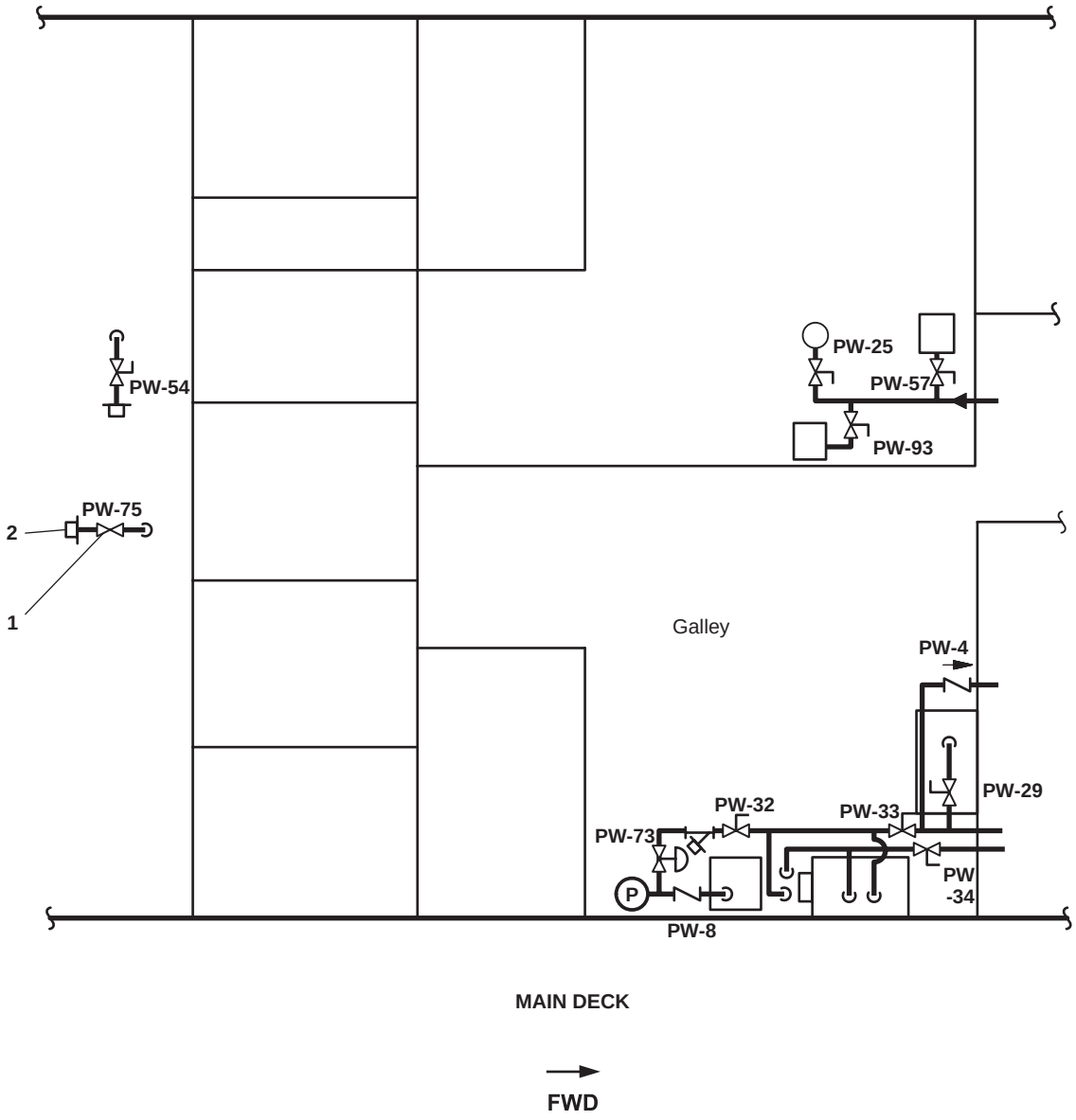


Figure 3. Potable Water System (Main Deck Galley)

POTABLE WATER PUMPS 1 AND 2

Two horizontal centrifugal potable water pumps draw potable water from either the port or starboard potable water tanks. The potable water is routed, under pressure, to the hydropneumatic tank. Both pumps are rated for 15 gal/min (68.2 Liter/minute) at 60 PSI (4.1 bar). Both pumps are driven by an electric 3 hp motor. Power to both potable water pumps is supplied from 440V power panel No. 5. Both potable water pumps are controlled by a pressure switch.

PRESSURE SWITCH

The potable water pump pressure switch automatically turns on the pump in use when pressure drops to 40 PSI (2.76 bar) in the hydropneumatic tank. The pressure switch de-energizes the pump in use when pressure reaches 60 PSI (4.1 bar).

PROPORTIONING BROMINE FEEDER

The proportioning bromine feeder (figure 2, item 3) treats potable water by adding a predetermined quantity of bromine to

disinfect the water (ensure than the water supplied to the potable water tanks is bacteriologically safe for human consumption) as the water is being discharged from the reverse osmosis water purification units (figure 1, item 1) to the potable water storage tanks (figure 2, item 1). The quantity of bromine added depends on the raw water intake to the reverse osmosis water purification units (figure 2, item 2). If the raw water is considered non-contaminated, a low feed rate is used. If the raw water is considered contaminated, a high feed rate is used. The feed rate is manually selected. The bromine feeder also injects bromine as water recirculates to and from the potable water tanks.

HYDROPNEUMATIC TANK

The hydropneumatic tank is a pressurized potable water tank; it maintains potable water supply pressure for the potable water system. Pressurized potable water is supplied from the hydropneumatic tank to the potable water heaters and various areas throughout the vessel. The initial charging of the hydropneumatic tank to 60 PSI (4.1 bar) is accomplished using the compressed air system. Once charged, the pressure switch activates the potable water pumps (figure 1, item 4) to maintain water pressure.

HOT WATER HEATER

Two hot water heaters (figure 1, item 1) are provided to supply hot water to the galley, all faucets, showers, and the laundry compartment. The hot water heaters heat the potable water supply and maintain a setpoint temperature. Power for the hot water heaters is supplied from the main switchboard.

HOT WATER RECIRCULATING PUMP

A hot water recirculating pump (figure 1, item 2) operates continuously to recirculate hot water throughout the potable water system. The pump is rated for 10 gal/min (45.5 L/minute) at 20 PSI (1.4 bar), and is driven by a 440 Vac, 2 hp motor.

ROWPU THEORY OF OPERATION

PRINCIPLES OF REVERSE OSMOSIS

The specific process through which osmosis occurs is called ion exclusion. A concentration of ions at the membrane surface forms a barrier that allows pure water molecules to pass while excluding molecules of foreign materials.

OSMOSIS

Osmosis is the diffusion of two mixable solutions through a semi-permeable membrane in such a manner as to equalize their concentrations. Natural osmosis occurs when a substance of lesser salinity naturally diffuses through a membrane into a higher concentration salinity. Cellular functions in the human body function in this manner. The process is very energy efficient in that it requires very little heat or pressure. However, the warmer the liquids, the more efficient the process due to the activity of the molecules. It is a natural function for liquids of unequal density to try to equalize themselves with one another when they are in molecular contact. In natural osmosis, liquids that are less saline attempt to equalize pressure by becoming more saline. The membrane of a living cell (figure 4, item 1) passes lower density saline solution (figure 4, item 2) into higher density saline solutions (figure 4, item 3). This happens because the lower density solution (figure 5, item 1) inside the cell naturally moves to equilibrium with the higher density solution (figure 5, item 2) the cell is located in. The cell membrane (figure 5, item 3) allows liquid to pass, but it prevents particles (figure 5, item 4) from passing.

REVERSE OSMOSIS

Osmosis is an important process to life, but it does not produce water that is palatable to humans. In order to produce water, the osmosis process must be reversed. The same principles apply, but some form of energy is necessary to force osmosis reversal. Thus, the process called ‘reverse osmosis’ was engineered to overcome the natural phenomenon of osmosis. Reverse osmosis works by forcing water of a higher salinity content through some type of semi-permeable membrane in an effort to remove the impurities. Salt is one of the impurities that is removed during the reverse osmosis process, and this makes it possible to create potable drinking water from undrinkable water sources.

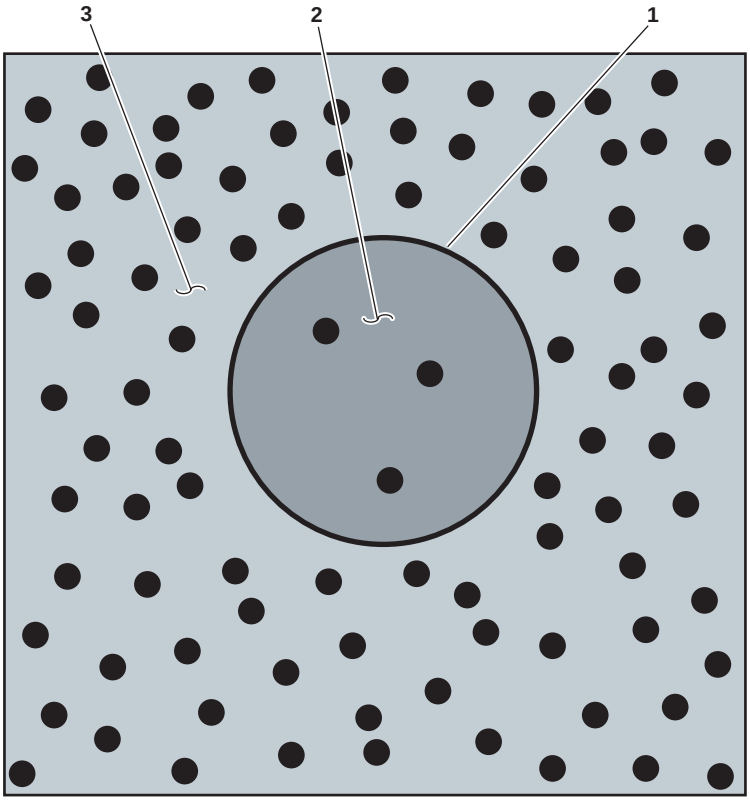


Figure 4. Living Cell Prior to Naturally Occurring Osmosis

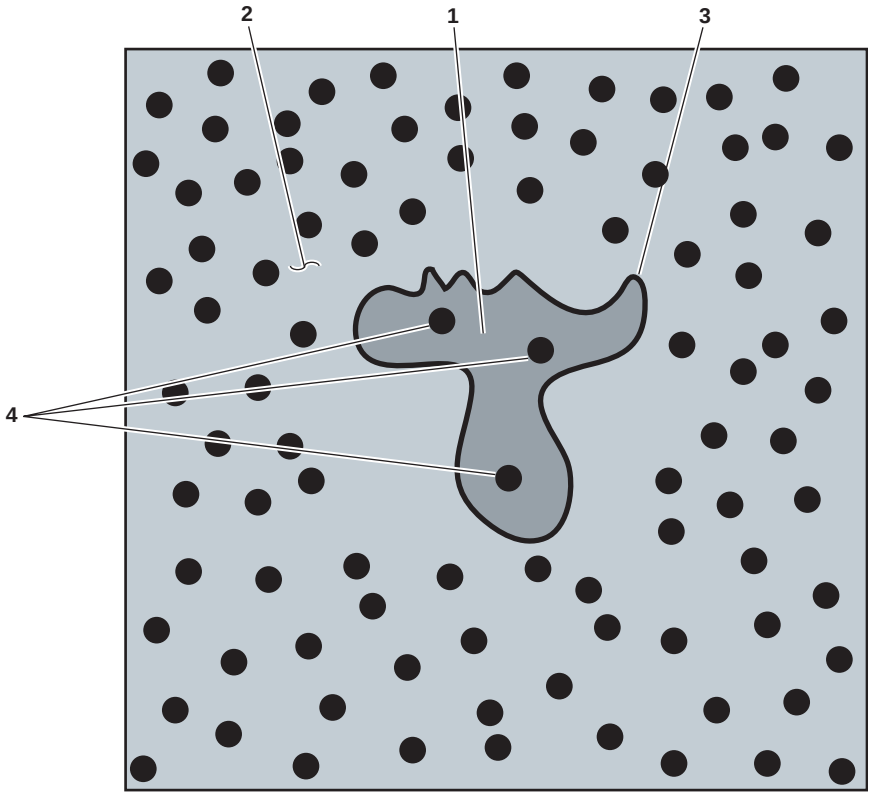


Figure 5. Living Cell After Naturally Occurring Osmosis

PRINCIPLES OF REVERSE OSMOSIS

Osmosis is defined as the spontaneous passage of a liquid from a diluted solution to a more concentrated solution across a semi-permeable membrane. This allows the passage of the solvent (water), but halts the dissolved solids (solutes). In naturally occurring osmosis, this transfer of water from one side of the membrane to the other will continue until the pressure is equalized on both sides of the membrane. When at equilibrium, the quantities of liquid passing in either direction is equal. The force created that causes osmosis to occur is called 'osmotic pressure'. In natural occurring functions, fluids will flow from the purer side to the saline side of the membrane until the osmotic pressures are equalized. If the osmotic pressure on the saline side of the membrane is higher, fluid is forced to flow through the membrane in reverse. This is how the solution containing the higher salt concentration flows into the solution with the lower salt concentration. This process is called Reverse Osmosis (RO).

SPIRAL WOUND MEMBRANE

Reversing a natural occurring process requires solutions to many problems. The first problem is how to efficiently recreate the effect so that a sufficient quantity of fresh water can be produced. Natural osmosis occurs at the cellular level. This means that since there are billions of cells in the body using osmosis, there must be billions of reactions occurring at the same time. All these reactions occur in a relatively small space. We can't create billions of cells, but we can create one large one that does the same thing. So, the solution is to increase the surface area using one giant cell. The giant cell theory led to the development of the spiral wound membranes that are used in the ROWPU.

If each side of the membrane were unrolled and laid flat, they would cover an area of fifteen square acres. The membrane sheets are only two molecules thick, and they are rolled into spirals and placed into tubes that are about four feet long and three inches in diameter. Reverse osmosis requires the membranes to be very thin, and they are delicate and sensitive to damage when mishandled. The membranes are also very sensitive to clogging. In natural osmosis, the fluids do their job by going back and forth. When water is made for potable use, the fluid only flows one way. This causes clogs due to the build up of solids, so the solids must be removed.

The solids are washed away by allowing more water to flow past the saline side of the membranes than is allowed to pass through the membrane. The ratio for the ROWPU is five gallons of raw water used for every two gallons of fresh water produced. Mechanically, the membranes act as filters to keep the salt and other impurities from passing to the fresh water side. If the solids were not removed, the membranes would quickly clog. The raw water is also passed through various filters that remove impurities down to 5 microns in size. This results in greatly increasing the life of the membranes and a cost effective and low maintenance unit.

WATER TEMPERATURE EFFECT

Water flow through the membrane is significantly affected by the water temperature. The higher the water temperature, the more active the water molecules. The more active the water molecules, the easier it is to push them through the membranes. This means that at any given pressure, the flow rate will increase as water temperature increases. When the temperature is reduced, the flow rate for a given pressure is reduced. The operating pressure also has a direct effect on product water quantity. It takes less pump pressure to achieve the unit's rated capacity in warmer water. In order to reach the rated service life of the membranes, the system must be operated at the lowest pressure necessary to achieve the designed product water flow rate. In warm water, the system will easily make more water than rated capacity. However, exceeding rated capacity will shorten the service life of the membranes.

REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) OPERATING PRINCIPLES

The LT's General Service (GS) system provides raw water to the ROWPU. ROWPU 1 can make 1500 gallons (5678 liters) a day, and ROWPU 2 can make 800 gallons (3028 liters) a day. These values are easily achievable if the high pressure pumps do not exceed 900 PSI (62 bar) and if overall differential pressure never exceeds 25 PSI (1.7 bar). The raw water entering the system passes through three filtering cycles so that solids no larger than 5 microns will enter the membranes. After being filtered, the raw water is pressurized and directed to a semi-permeable membrane. The semi-permeable membrane permits the passage of water and rejects the other contaminants. After passing through the membrane, waste water is expelled via the general service system overboard discharge, and potable water is sent to the brominator for chemical treatment before being discharged to the potable water tanks.

COMPONENTS OF THE ROWPU

Table 1 outlines the major functional components of the ROWPU system. The item number corresponds to the callouts in figure 6. The components are outlined in a logical fashion that will allow the reader to understand the basic operating principles of the ROWPU. The ROWPU contains two units. ROWPU 1 (the starboard unit) is fitted with two reverse osmosis membranes, and ROWPU 2 (the port unit) has only one membrane.

Table 1. Major Functional Components of the ROWPU System (Refer to Figure 6)

Item No. (Refer to Figure 6)	Nomenclature	Description
1	ROWPU System General Service Pressure Reducing	The pressure reducing valve ensures that overall general service system pressure is maintained at a maximum of 60 PSI (4.1 bar). Valve
2	ROWPU System Raw Water Cutout Valve	The cutout valve allows the operator to secure raw water to the ROWPU system.
3	ROWPU System Raw Water Pressure Regulator	The pressure regulator maintains the raw water supply to the ROWPU system at a constant pressure of 40 PSI (2.8 bar).
4	ROWPU System Pressure Relief Valve	The pressure relief valve protects the ROWPU system by providing pressure relief when raw water pressure exceeds 50 PSI (3.4 bar).
5	ROWPU System Media Filter	The media filter uses sand as a substrate to remove larger particles that would cause clogging of the 20-micron pre-filter. The substrate in the media filter requires very infrequent change out due to the ability to back flush. During back flushing, the media filter is completely isolated from the rest of the ROWPU system, while raw water from the general service system cleans and flushes debris overboard. The media filter prolongs the service life of the 20-micron filter.
6	20-micron Filter	The 20-micron pre-filter removes all particulate in the raw water not removed by the media filter down to particles 20 microns in size. This filter serves to prolong the service life of the 5-micron pre-filter.
7	5-Micron Filter	The 5-micron pre-filter removes all particulate in the raw water not removed by the 20-micron pre-filter down to particles 5 microns in size. This filter serves to prolong the service life of the reverse osmosis membranes.
8	High Pressure Pumps	The high pressure pumps provide a source of low volume, high pressure raw water to the reverse osmosis membranes. The high pressure pumps are rated to deliver 4 gallons (15.1 liters) of filtered raw water per minute, at a maximum operating pressure of 900 PSI (62 bar). The high pressure pumps provide the fluid energy necessary to cause the osmosis process to be reversed in the membranes.

Table 1. Major Functional Components of the ROWPU System (continued) (Refer to Figure 6)

Item No. (Refer to Figure 6)	Nomenclature	Description
9	Reverse Osmosis Membranes	The membranes convert filtered raw water into drinking water by allowing only water molecules to pass through its spiraled membrane. The high pressure/low volume pumps push raw water through the membranes to make fresh water, and they push the brine out of the membranes and overboard.
10	Solenoid Operated 3-Way Diverter Valve	The solenoid operated 3-way diverter valves are controlled by the system controllers (figure 6, item 14). The controllers sense the salinity of the product water output by the membranes. If the product water salinity is within tolerances, the product water is sent to the brominator and on to the potable water tanks. If product water salinity is too high, the product water is diverted and sent overboard as ROWPU system product brine.
11	ROWPU System Product Brine Discharge	Brine is the by-product of reverse osmosis. The brine is pumped overboard via the general service system overboard discharge. The ROWPU system is protectedfrom the general service system by means of a check valve that acts as a backflow preventor.
12	Fresh Water Flush Pump	The fresh water flush pump is a low pressure pump that is used to clean and to prepare the ROWPU system for use. It is a 24 Vdc pump controlled by the system controller. The fresh water pump uses filtered potable water to purge raw water from the filtration system and from the raw water side of the reverse osmosis membranes. When the ROWPU is not in use, the system controllers automatically perform a fresh water flush once a week. The fresh water flush serves to prolong the life of the membranes, and it eliminates the need to 'pickle' the membranes for layup.
13	Charcoal Filters	The charcoal filters remove sediment and foul odors from the potable water used during flushing cycles. Thecharcoal filters also block bromine and chlorine from passing into the reverse osmosis membranes. The charcoal filters are secured when the ROWPU is making product water, and are protected by cutoff valves and a backflow preventor.
14	System Controllers	The system controllers are microprocessor-based water purification monitors and controllers. They control power to the pumps, monitor the quality of the output potable water, and monitor system operating pressures. The system controller turns the high pressure and fresh water flush pumps ON and OFF as required by system demands and operating conditions. The system controller also measures the salinity of the product water and controls the position of the solenoid operated 3-way diverter valve accordingly. Finally, the system controllers monitor system operating pressures. Any system pressure out of tolerance will cause the controller to stop the process and indicate an alarm. Power input to the system controllers is 450 Vac and 24 Vdc.

Table 1. Major Functional Components of the ROWPU System (continued) (Refer to Figure 6)

Item No. (Refer to Figure 6)	Nomenclature	Description
15	ROWPU System 24 Vdc Control Panel	The breaker and meter provide the operator with a means of monitoring and securing 24 Vdc to the ROWPU locally. The battery will still maintain a charge even if this switch is OFF. This switch must be ON in order for the ROWPU to monitor the system and conduct fresh water flushes.
16	ROWPU 24 Vdc Fuse Box	The fuse box provides 24 Vdc circuit protection in the event of a battery bank or battery charger casualty.
17	ROWPU System 24 Vdc Battery Bank	The battery bank provides power to the controllers and to the fresh water flushing pump during layup periods. A properly maintained and charged battery will provide adequate power to maintain the weekly fresh water flushing cycle for up to 90 days without recharging.
18	ROWPU System 24 Vdc Battery Charger/Power Supply	The battery charger/power supply provides 24 Vdc to recharge the battery, and it provides 24 Vdc during normal ROWPU operation.

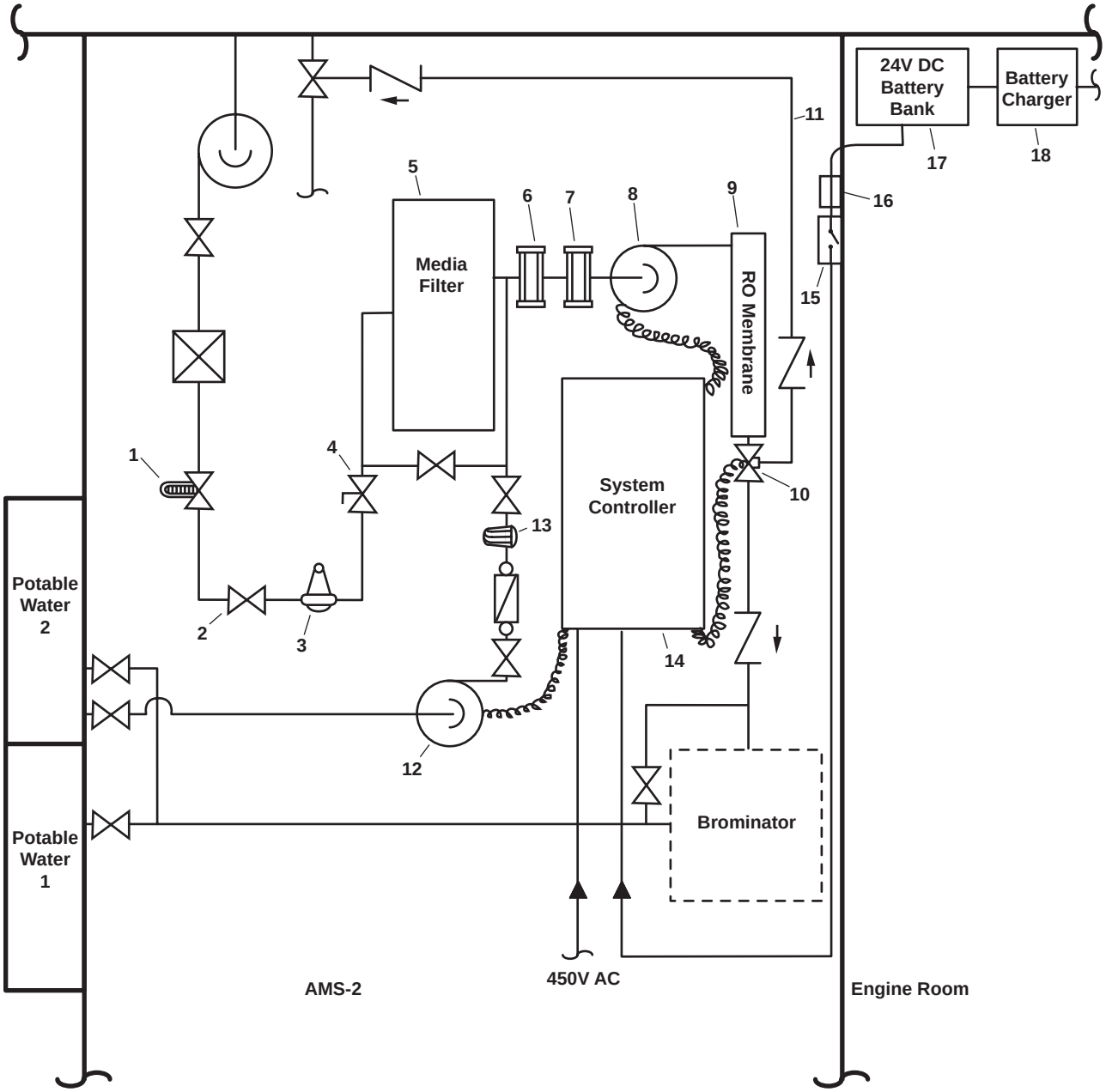


Figure 6. ROWPU System Diagram

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
BILGE AND BALLAST SYSTEMS

GENERAL

The bilge system removes liquid from the vessel's bilges, preventing the Large Tug (LT) from flooding or causing flood damage during rough sea conditions where bilge fluids could wash onto deck plates or onto vital equipment in the engine room. An oily water system is also installed as a part of the bilge system. The oily water system pumps, stores, and treats oily water from the engine room and AMS 1 bilges.

The ballast system maintains stability of the vessel by transferring raw water to and from the vessel's three ballast tanks.

THE BILGE SYSTEM

The bilge system consists of: eductors, bilge, and ballast pumps (figure 1, item 1), bilge manifold, and bilge piping.

EDUCTORS

Eductors are jet-type pumps that contain no moving parts. An eductor moves liquid from one place to another by entraining the pumped liquid in a rapidly flowing stream of liquid utilizing the venturi effect.

BILGE AND BALLAST PUMPS

The bilge and ballast pumps (figure 1, item 1) are horizontally mounted, self-priming, centrifugal pumps, each with a rated output of 100 gal/min (379 L/minute) at 50 PSI (3.46 bar). The bilge and ballast pumps are driven by a 5 hp electric motor. Electric power for bilge and ballast pump 1 is provided from the emergency switchboard. Electric power for bilge and ballast pump 2 is provided from the main switchboard. Discharge from the pumps can be directed either overboard or to the duplex ballast manifold (figure 1, item 2).

BILGE MANIFOLD

The bilge manifold (figure 1, item 3) provides selection and control of piping alignment. The bilge manifold is connected to a simplex strainer (figure 1, item 4) on the suction side of the bilge and ballast pumps (figure 1, item 1).

BILGE PIPING

Six piping branches are provided from the bilge manifold (figure 1, item 3), two each to the engine room and AMS 1, and one each to the shaft alley (PORT) and shaft alley (STARBOARD). Each piping branch is equipped with a check valve and bellmouth at its end.

OILY WATER SYSTEM

The oily water system components consists of: an oily waste drain tank (figure 2, item 1), an oily waste storage tank (figure 2, item 2), an oily waste discharge pump (figure 2, item 3), an Oil Water Separator (OWS) (figure 2, item 4), and an Oil Content Monitor (OCM).

OILY WASTE DRAIN TANK

The oily waste drain tank (figure 2, item 1) receives and stores waste discharge from the lube oil purifier and engine sumps. Oily waste is transferred to the oily waste storage tank (figure 2, item 2).

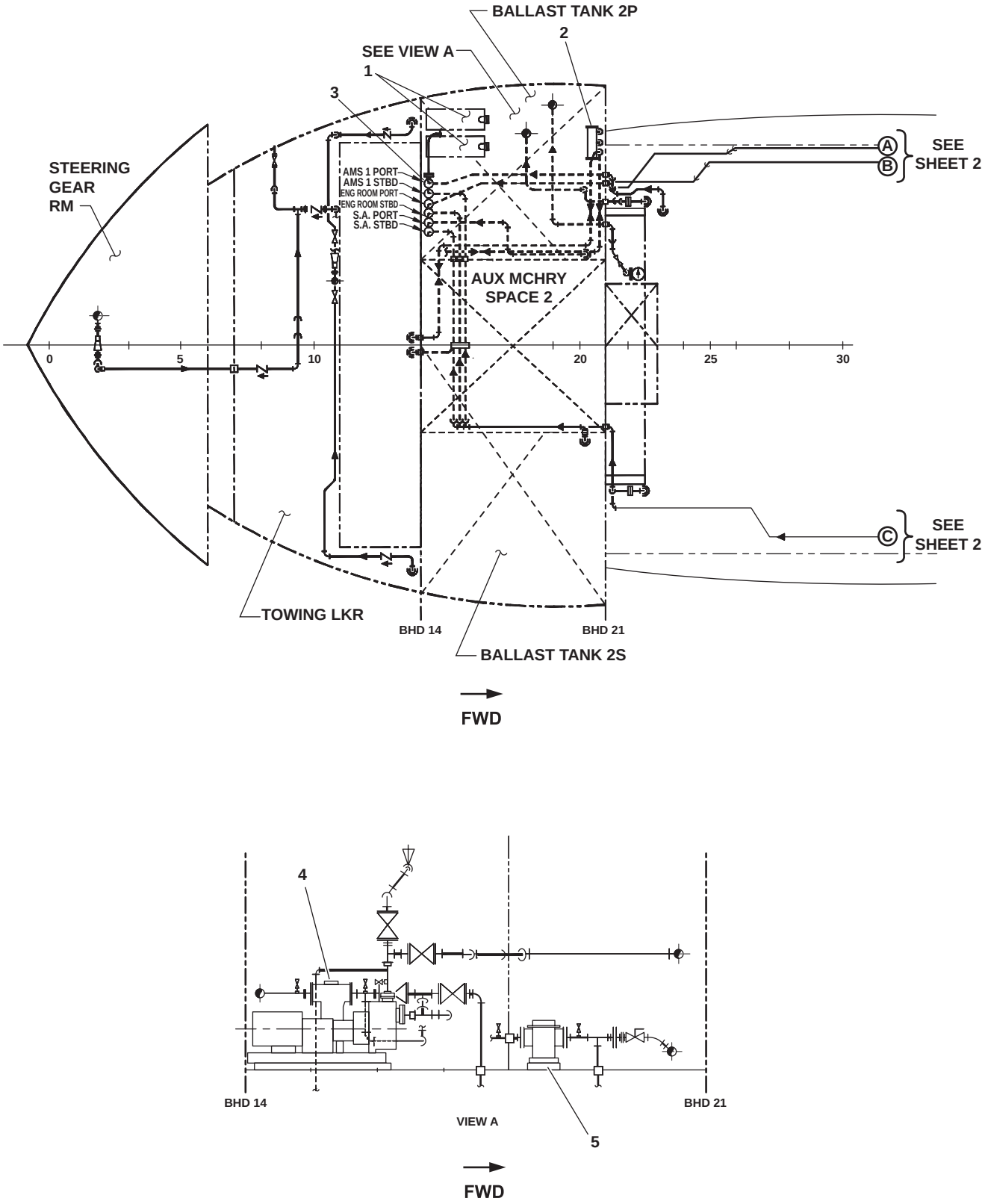


Figure 1. Bilge and Ballast Systems (Sheet 1 of 2)

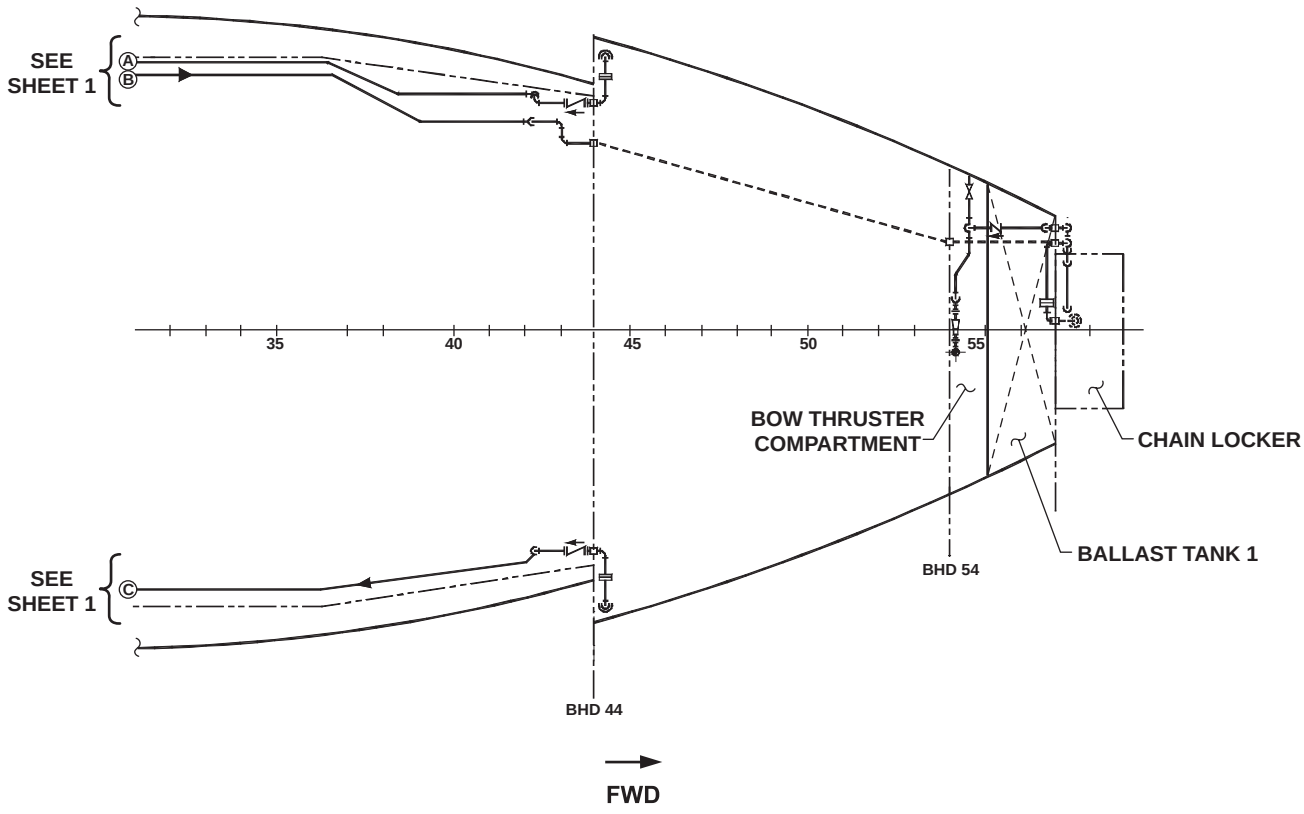


Figure 1. Bilge and Ballast Systems (Sheet 2 of 2)

OILY WASTE STORAGE TANK

The oily waste storage tank (figure 2, item 2) provides a holding tank that supplies oily water to be processed by the OWS (figure 2, item 4). The oily waste storage tank also receives the oil output from the OWS. When appropriate, the oily waste discharge pump (figure 2, item 3) can empty the oily waste storage tank through the shore connection (figure 2, item 5).

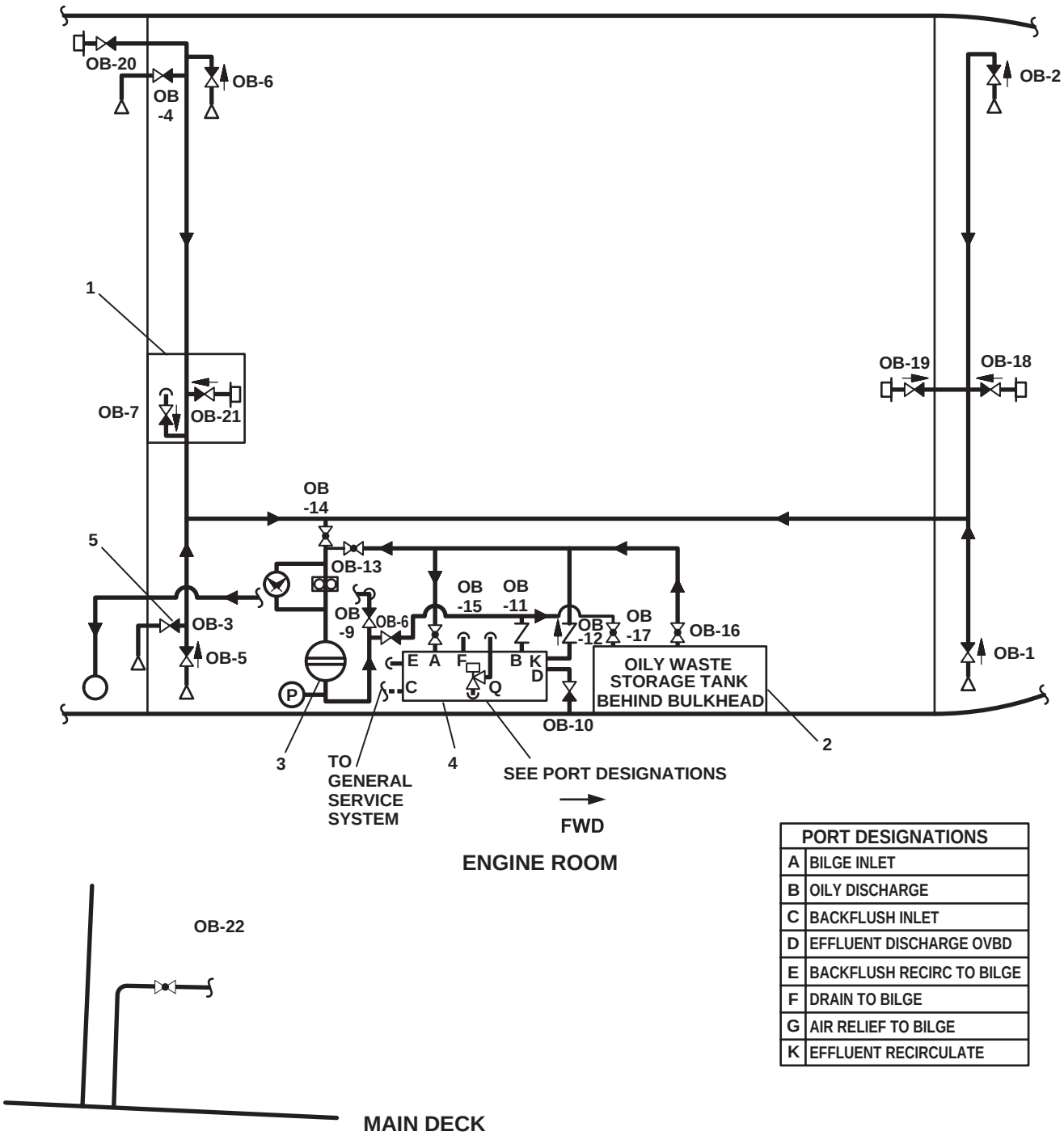
OILY WASTE DISCHARGE PUMP

The oily waste discharge pump (figure 2, item 3) is an air powered diaphragm pump. The compressed air used to drive the pump is provided by the ship's service air system. The oily waste discharge pump's suction can be directed to either the piping system or the oily waste drain tank (figure 2, item 1). The oily waste discharged pump's suction can also be used for removing oily water from the bilges and to transfer the contents of the oily waste drain tank or the oily waste storage tank (figure 2, item 2) or to a shore connection.

OIL WATER SEPARATOR

The OWS (figure 2, item 4) separates and removes oil from bilge water. Two outputs from the OWS are provided. Power is supplied to the OWS from the main switchboard. The oil-water separation is accomplished in two stages.

The inlet baffle redirects the flow of oil droplets away from the upper coalescer bed. The inlet weir separates the oil accumulated in the tank from the inlet flow. Oil droplets that flow past the inlet baffle accumulate on the polypropylene granules (beads) in the coalescer beds. The polypropylene granules attract oil and repel water (oleopylic-hydrophobic), allowing water to flow through while the oil remains are temporarily trapped in the coalescer granules. The lower coalescer bed functions like the upper coalescer bed but is thinner and acts like a polishing bed. The water space between these beds isolates them, preventing contamination of the lower by the upper. The clarified effluent, having passed through both coalescer beds, is drawn through the outlet in the OWS's (figure 2, item 4) bottom.



PORT DESIGNATIONS	
A	BILGE INLET
B	OILY DISCHARGE
C	BACKFLUSH INLET
D	EFFLUENT DISCHARGE OVBD
E	BACKFLUSH RECIRC TO BILGE
F	DRAIN TO BILGE
G	AIR RELIEF TO BILGE
K	EFFLUENT RECIRCULATE

Figure 2. Oily Bilge System

Clean water enters the OWS's (figure 2, item 4) tank bottom, back flushing the coalescer beds and displacing the accumulated oil in the upper tank zone. This oil is discharged through the oil discharge check valve. Oily waste is pumped into the oily waste storage tank (figure 2, item 2). Clear water is discharged overboard. When the oil content in the overboard discharge exceeds acceptable standards, the water discharge is automatically redirected to the oily waste storage tank (figure 2, item 2).

OIL CONTENT MONITOR

An Oil Content Monitor (OCM) is provided inline the OWS's (figure 2, item 4) discharge line. When the oil content in the overboard discharge exceeds acceptable standards, the water discharge is automatically redirected to the oily waste storage tank (figure 2, item 2) for retreatment. The oil content level is preset. A solenoid-activated valve determines the discharge direction of the overboard discharge.

SYSTEM OPERATION

The oily waste drain tank (figure 2, item 1) receives and holds the waste discharge from the lube oil purifier and engine sumps. Oily waste is transferred via the oily bilge piping system and the oily waste discharge pump (figure 2, item 3) to the oily waste storage tank (figure 2. item 2). The oily waste storage tank supplies oily water to be processed by the OWS (figure 2, item 4). The oily waste storage tank also receives the oil discharged from the OWS. The eductor discharges the treated water overboard. When appropriate, the oily waste discharge pump can empty the oily waste storage tank through the shore connection (figure 2, item 5). If the OCM detects that the oil content in overboard discharge exceeds (the preset) acceptable standards, the water discharge is automatically redirected back to the oily waste storage tank.

THE BALLAST SYSTEM

The ballast system consists of: the bilge and ballast pumps (figure 1, item 1), duplex strainer, (figure 1, item 5) ballast duplex manifold (figure 1, item 2), ballast piping (see figure 1), and the ballast tanks (see figure 1).

BALLAST MANIFOLD

A duplex ballast manifold (figure 1, item 2) provides selection and control of the ballast system piping alignment. The ballast manifold is connected through a simplex strainer (figure 1, item 4) to the suction side of the bilge and ballast pumps (figure 1, item 1).

BALLAST TANK SYSTEM OPERATION

The ballast system transfers raw water to and from ballast tanks (see figure 1) utilizing and the ballast duplex manifold (figure 1, item 2), bilge and ballast pumps (figure 1, item 1), and ballast piping to maintain balance of the vessel. Discharge from the bilge and ballast pumps can be directed either overboard or to the ballast tanks (see figure 1).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
MARINE SANITATION DEVICE

GENERAL

The Marine Sanitation Device (MSD) receives, treats, and discharges all sewage generated aboard the LT. The system is comprised of a vented media tank, chlorinator, wet well, discharge pump, and blower.

SYSTEM

All raw sewage from the water closets on the main deck and 01 level flows to the media tank (figure 1, item 1). Potable water for flushing carries waste from the toilets to the media tank using 4" drain lines and 1 ½" vents.

The water level in the media tank is maintained at a constant level. As raw sewage enters the media tank via the 4" inlet (figure 1, item 2), an equal volume of treated clear effluent is displaced into the spillover pipe (figure 1, item 3). This effluent passes through the tablet chlorinator (figure 1, item 4), where it is disinfected.

As the water passes through the tablet chlorinator (figure 1, item 4), calcium hypochlorite tablets are dissolved, releasing chlorine into the effluent. The amount of chlorine released is proportional to flow. A full feed tube (figure 1, item 5) holds 20 five-ounce tablets, equaling 6.25 lb (2.83 kg). Expected tablet consumption is determined by water usage. Leaking fixtures will greatly increase water usage and tablet consumption.

Clear and odorless water flows from the media tank (figure 1, item 1) through the spillover pipe (figure 1, item 3) and trap into the wet well (figure 1, item 6). The wet well is a retention tank sized for adequate disinfection time during peak flow periods. The wet well vent (figure 1, item 7) is open to the immediate environment. The disinfected water is discharged overboard by the discharge pump (figure 1, item 8).

The discharge pump (figure 1, item 8) handles the peak flows expected for the system. The pump assembly includes a pump, isolation valve, discharge pressure gauge, float switch for automatic operation, motor, and a motor starter. As the water level in the wet well rises, the "pump on" float switch automatically starts the discharge pump, which discharges the water overboard. When sufficient effluent is discharged from the wet well, the float switch stops the discharge pump.

A separate sewage holding tank holds sewage during maintenance or transfer of sewage or graywater to a shore connection. Piping is provided to bypass the Marine Sanitation Device (MSD), sending sewage and graywater (wastewater system) directly to the holding tank. Two pumps are provided for the sewage holding tank (SEWAGE DISCHARGE PUMP NO. 1 and SEWAGE DISCHARGE PUMP NO. 2) so that the tank contents can be pumped overboard or to shore. A connection is also provided between the MSD media tank and the sewage holding tank, allowing the contents of the media tank to be drained by gravity to the sewage holding tank for maintenance.

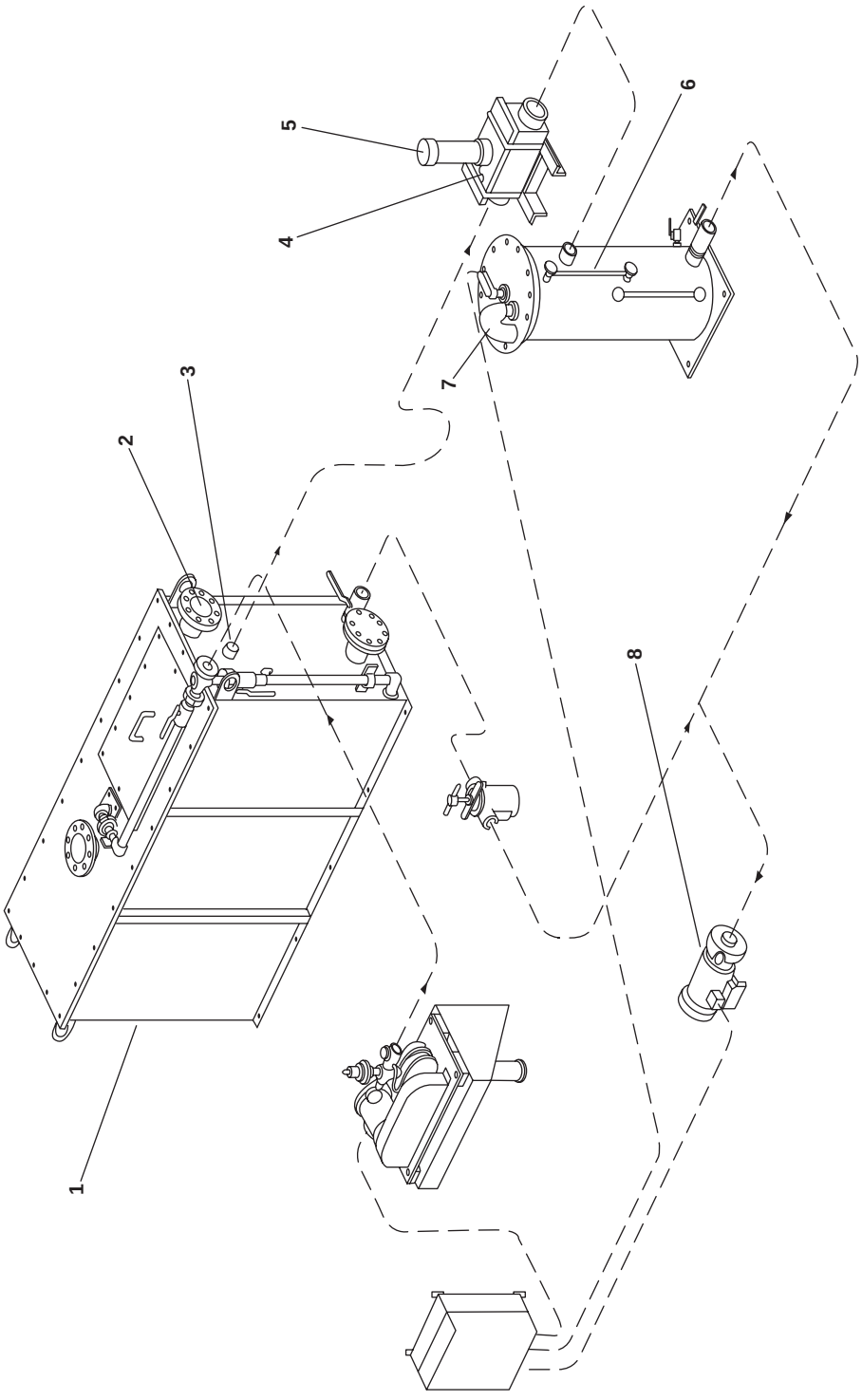


Figure 1. MSD Schematic

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
FIRE MAIN, WASHDOWN, AND SPRINKLER SYSTEMS

GENERAL

The fire main, arms control room sprinkler, general service and fire fighting system, and the Engine Room Water Washdown System (ERWWS) protect the LT from fire damage. The ERWWS is designed to be used in conjunction with the FM-200 fixed fire extinguishing system. Refer to WP 0032 00 for details on the FM-200 fire suppression system. The Wash Down Counter Measure (WDCM) aides in eliminating Nuclear, Biological, and Chemical (NBC) contamination from the vessel's exterior.

FIRE MAIN

The fire main is made up of two electrically driven pumps and one diesel engine-driven pump. The two electric fire pumps, located in AMS 2, are rated at 250 gal/min (946 L/min) with a discharge pressure of 125 PSI (8.6 bar). The diesel engine-driven fire pump is located in AMS 1. It is rated at 1000 gal/min (3785 L/min) with a discharge pressure of 125 PSI (8.6 bar). A local start/stop control for all pumps is provided, and each pump can be controlled from the pilothouse.

FIRE MONITORS

Three fire monitors (figure 1) are provided primarily to fight fires on other vessels when rendering aid. The monitors are located on the top of the pilothouse to provide 360 degree coverage of the vessel. Each monitor is rated at 500 gal/min (1893 L/min) with a 100 PSI (6.9 bar) discharge pressure. The monitors are capable of directional and elevation control, and they can dispense both raw water and Aqueous Film-Forming Foam (AFFF). The diesel engine-driven pump is required when operating more than one fire monitor.

AFFF is also known as "light water." It is synthetic, film-forming foam designed for use in shipboard firefighting systems. When used properly, it provides a vapor seal over a fuel spill, and it is designed to extinguish class BRAVO fires. AFFF is a highly effective extinguishing agent for smothering large fires, particularly those in oil, gasoline, and jet fuels. The foam proportioning equipment in combination with the fire monitors and diesel engine-driven pump generate a very effective foam blanket. AFFF is equivalent to raw water when it is used to extinguish class A fires.

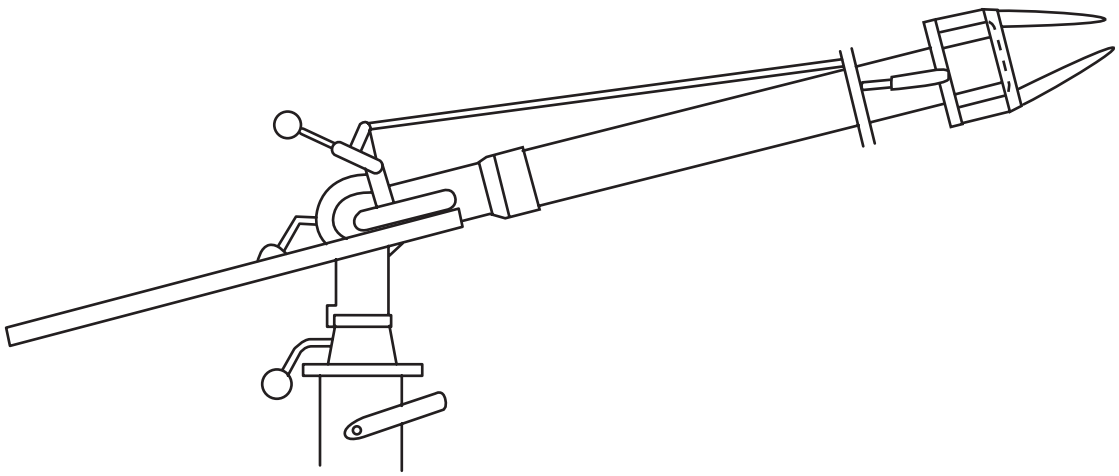


Figure 1. Fire Monitor

The unique action of AFFF stems from its ability to make a lightwater film float on flammable fuels. As foam is applied over the flammable liquid surface, an aqueous solution drains from the foam bubbles. The aqueous solution then floats out over the surface of the flammable liquid to provide a vapor seal. This aqueous film-forming action enhances extinguishment and prevents reflash, even when the foam blanket is disturbed. Flammable liquids such as fuel that have not been ignited can be protected with this action. AFFF can be used alone or in combination with dry chemical powder.

FIRE STATIONS

There are 11 fire stations located throughout the vessel. Each is provided with 50 feet (5.2 meters) of 1-1/2 inch diameter high pressure fire hose (figure 2, item 1), a spanner wrench (figure 2, item 2), and an all-purpose nozzle (figure 2, item 3).

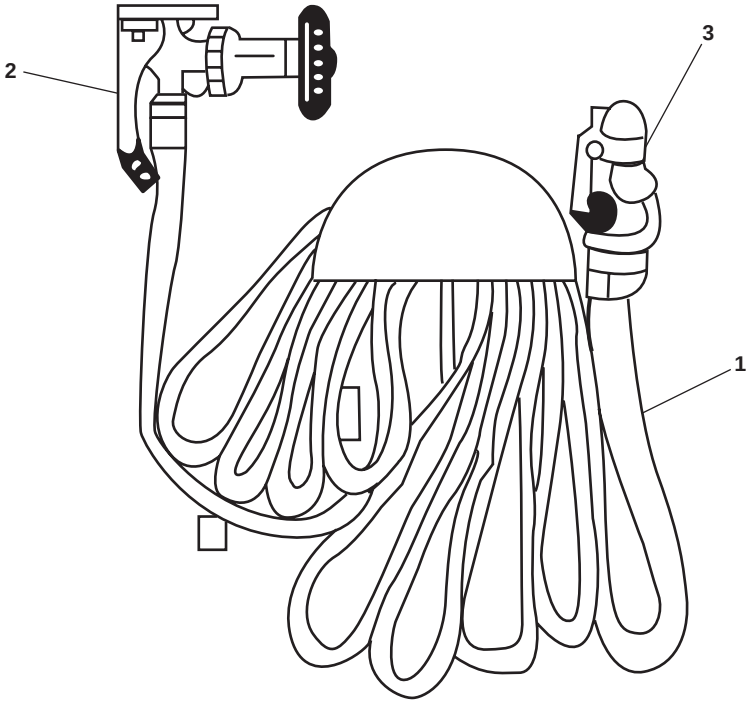


Figure 2. Fire Station

The purpose of the fire stations is to make pressurized firefighting water available to multiple locations on the vessel. The fire stations are capable of shooting 70 gallons (265 liters) of water per minute (in a solid stream) about 75 feet (23 meters) when pressurized to 100 PSI (6.9 bar). Refer to table 1 and figures 3 and 4 for fire station locations.

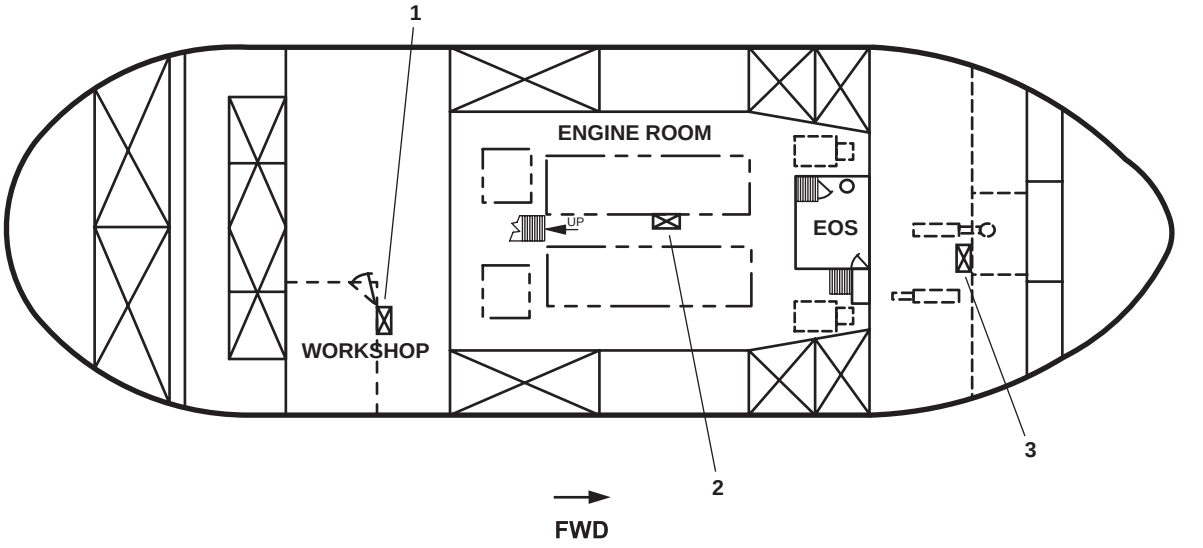
Table 1. Fire Station Locations

Interior fire stations:

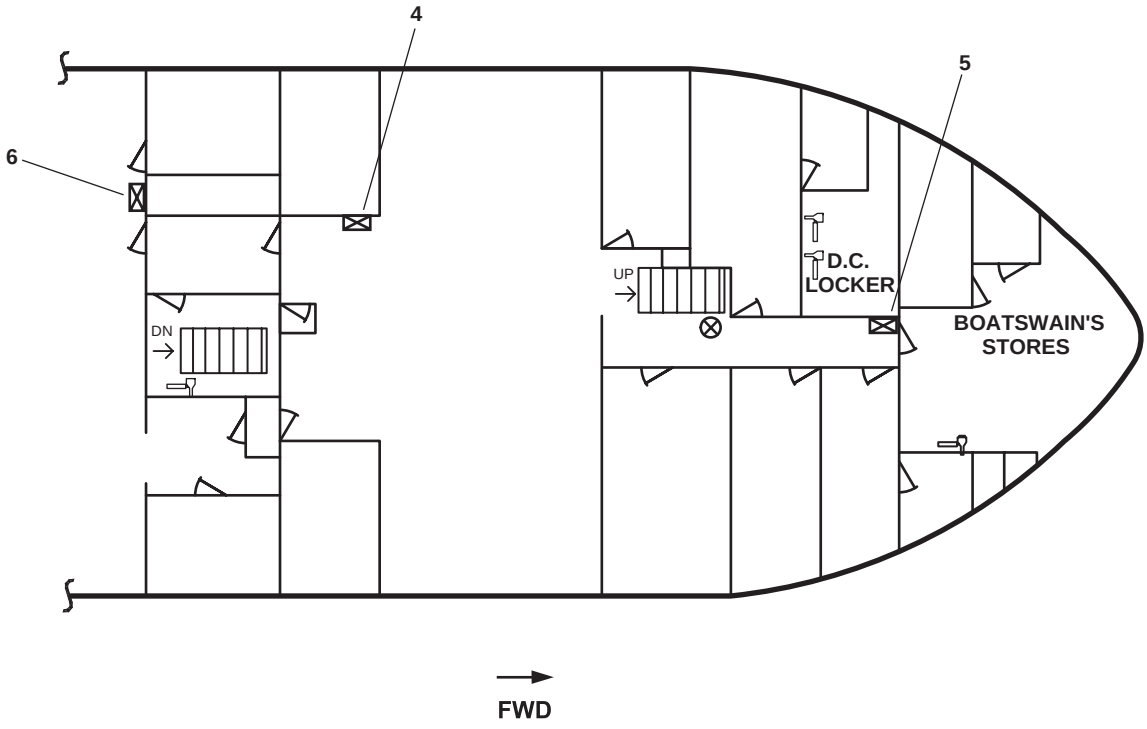
Number	Location
1 (figure 3, item 1)	AMS-2, Starboard side aft of steering hydraulic station, Frame 14
2 (figure 3, item 2)	Engine room, amidships between main engines, Frame 32
3 (figure 3, item 3)	AMS-1, forward bulkhead between auxiliary engines, Frame 54
5 (figure 3, item 4)	Main deck, crew's mess, frame 28
6 (figure 3, item 5)	Main deck, amidships outside damage control center, frame 53
8 (figure 4, item 1)	01 level, starboard side aft of captain's cabin, frame 45

Exterior fire stations:

Number	Location
4 (figure 3, item 6)	Main deck, weather, port side below stack, frame 21
7 (figure 4, item 2)	01 level, weather, starboard side aft of stack, frame 24
9 (figure 4, item 3)	01 level, weather, starboard, frame 54 (removed when underway)
10 (figure 4, item 4)	02 level, weather, port side aft of pilothouse, frame 37
11 (figure 4, item 5)	02 level, weather, starboard side, frame 50 secured.

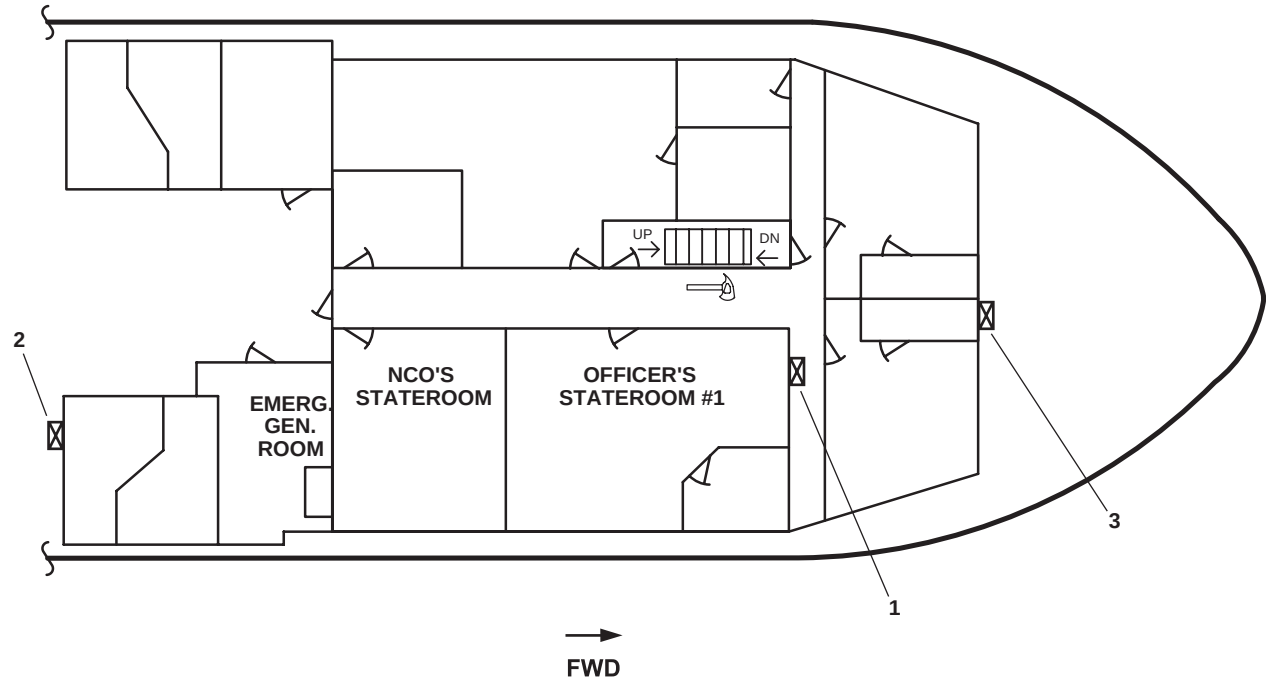


BELOW MAIN DECK



MAIN DECK

Figure 3. Main Deck and Below Main Deck Fire Station Locations



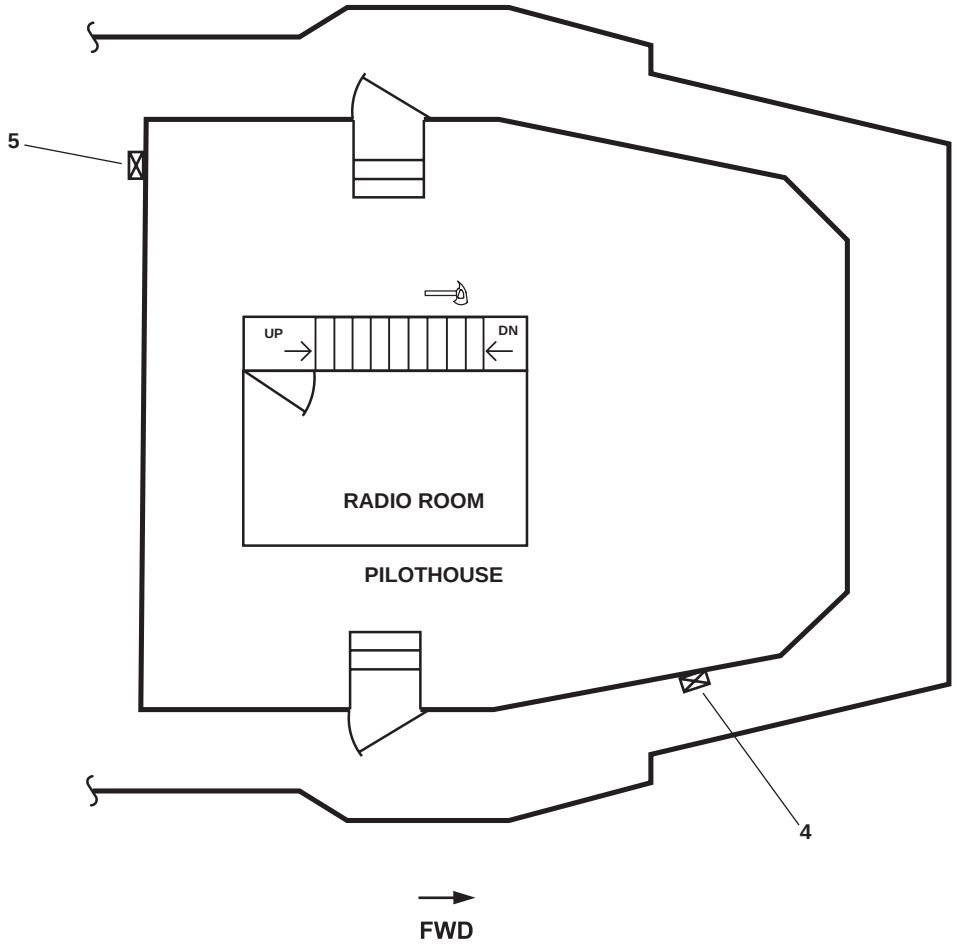


Figure 4. Pilothouse and 01 Level Fire Station Locations

AQUEOUS FILM FORMING FOAM (AFFF) PUMP

The AFFF pump (figure 5) is located in AMS 1. It is a horizontal gear pump with a rated capacity of 60 gallons (227.1 liters) per minute. Normal operating pressure is 125 PSI (8.6 bar). The AFFF pump is part of a system that includes a ready service tank, the AFFF pump, a proportioner, and piping specifically suited for the delivery of AFFF. AFFF can only be expended from the fire monitors. AFFF is stored in its own tank in concentrate form. The pump is used to force AFFF concentrate through the proportioner into the fire main at a rate of 6 parts foam concentrate to 94 parts raw water. When in use, the 525-gallon tank is capable of producing 13,344 gallons of AFFF. One or more fire monitors shooting AFFF will expend the ready service tank in less than nine minutes.

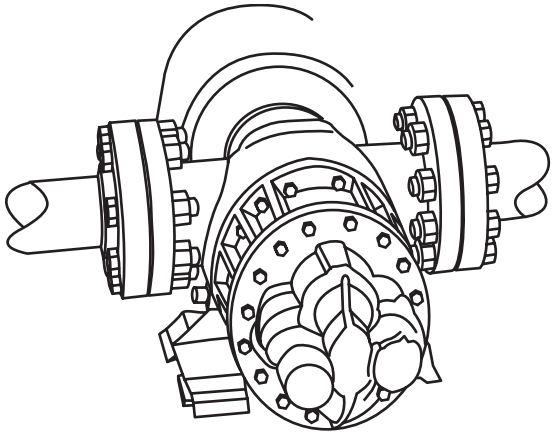


Figure 5. AFFF Pump

DIESEL ENGINE-DRIVEN FIREFIGHTING PUMP

The diesel engine-driven firefighting pump (figure 6) is located in AMS 1. Its rated capacity is 1000 gal/min (3785 L/min) with a discharge pressure of 125 PSI (8.6 bar). Its primary purpose is to provide raw water to the fire monitors. The secondary purpose of the pump is to pressurize the fire main and general service system in the event of a malfunction of the fire and general service pumps.

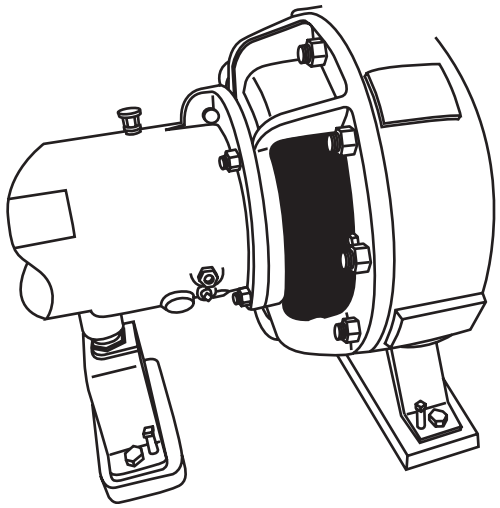


Figure 6. Diesel Engine-Driven Firefighting Pump

WASHDOWN COUNTERMEASURE (WDCM) SYSTEM

The vessel has an installed WDCM system that is capable of forming a protective umbrella of raw water over the superstructure of the vessel. It is designed for protection against Nuclear, Biological, and Chemical (NBC) contaminants. If time allows, the vessel should be wet down before an NBC attack. NBC agents would then be washed immediately overboard. The WDCM system is more effective as a preventive measure than as a decontamination measure. Another benefit of using the WDCM system is that it cools the external superstructure of the vessel. This can aid in removing excess heat from the vessel in the event of fire.

SPRINKLER SYSTEMS

AMMUNITION STORAGE LOCKERS

The arms and ammunition storage locker is equipped with a flooding system designed to cool the contents in case of fire in, near, or around the locker. However, if the surrounding area becomes heated, maintain a safe distance from the source of the fire while applying high velocity water fog.

Temperature stability in ammunition and pyrotechnic storage areas is essential to prevent decomposition and deterioration of stored devices. Ready service lockers and other ammunition stowage spaces are designed to maintain temperatures within prescribed limits under normal operating conditions. The stability of smokeless powder decreases at temperatures in excess of 100 °F (37.8 °C). Stowage in airtight spaces at temperatures of 70 °F (21.1 °C) or less is necessary to ensure normal life of any service ordnance. Mechanical cooling is necessary if temperatures will exceed 100 °F (37.8 °C). If mechanical cooling is not provided, artificial methods, such as water spray or wet canvas covers can be used to reduce the high temperature.

ARMS LOCKER DRENCHING SYSTEM

The arms locker drenching system is connected to the fire main system. The system is designed to provide raw water to the arms locker in the event of a fire or excessive high temperature. The arms locker drenching system has to be manually activated. The system can be activated in the boatswain's locker (local) or from the 01 level (remote) at the bow by means of a reach rod valve system.

System activation occurs when the thermal heat detector (figure 7, item 1) senses a temperature above 105 °F (40.5 °C). The thermal heat detector sends an alarm signal to the pilothouse indicating a high temperature situation in the arms locker. The crew would then investigate the situation and if necessary, the fire main system would be charged. Once it is determined that the alarm condition exists and the fire main system is charged, the manual activation valve (figure 7, item 2) is OPENED either locally or remotely. As raw water enters the piping system in the arms locker, a pressure switch (figure 7, item 3) activates an alarm in the pilothouse to indicate that the arms locker drenching system has been activated. The raw water from the fire main flows into the arms locker and out of two sprinkler heads (figure 7, item 4). Once activated, the system will continue the flow of raw water into the arms locker until the manual activation valve is closed, or the fire main system is secured.

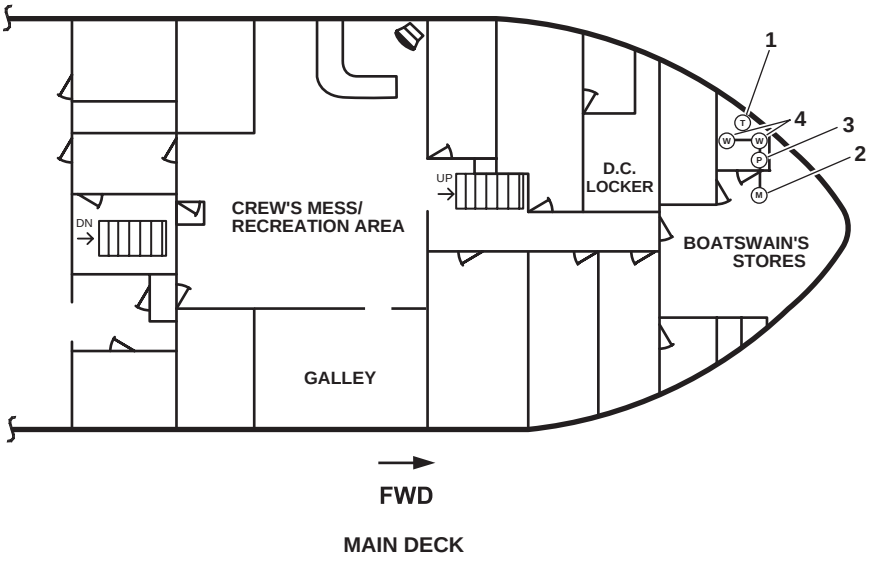


Figure 7. Arms Locker Drenching System

ENGINE ROOM WATER WASHDOWN SYSTEM (ERWWS)

The purpose of the ERWWS (figure 8) is to quickly reduce the temperature in the protected space to minimize the production of Hydrogen Fluoride (HF) gas generated as a result of FM-200 agent contact with hot surfaces and flame above 1,300 °F (704.4 °C). The sprinkler water also acts to keep smoke particulate down and expedites ventilation of the compartment when the fire is extinguished. The ERWWS is not designed or intended to be a stand-alone fire extinguishing system. It is designed to be used in conjunction with the installed FM-200 fire suppression system. Use of the ERWWS reduces the risk of HF exposure by reducing temperatures within the protected space.

The ERWWS is constructed of all stainless steel components. In order to operate the ERWWS, the fire main must be charged and, at a minimum, fire and general service pump 1 must be online at maximum operating pressure. To provide an adequate volume of raw water for the ERWWS, valves FM-17, FIRE/G.S. PMP. No. 1 DISCH. TO GS. and FM-15, FIRE/G.S. PMP. No. 2 DISCH. TO GS. must be CLOSED prior to activation of the ERWWS. The ERWWS requires a minimum of 145 gal/min (548.9 L/min) at 104 PSI (7.17 bar) to operate as intended.

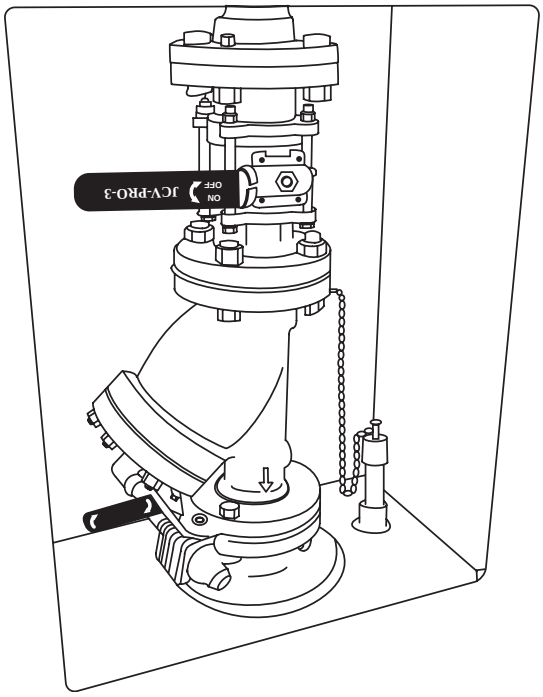


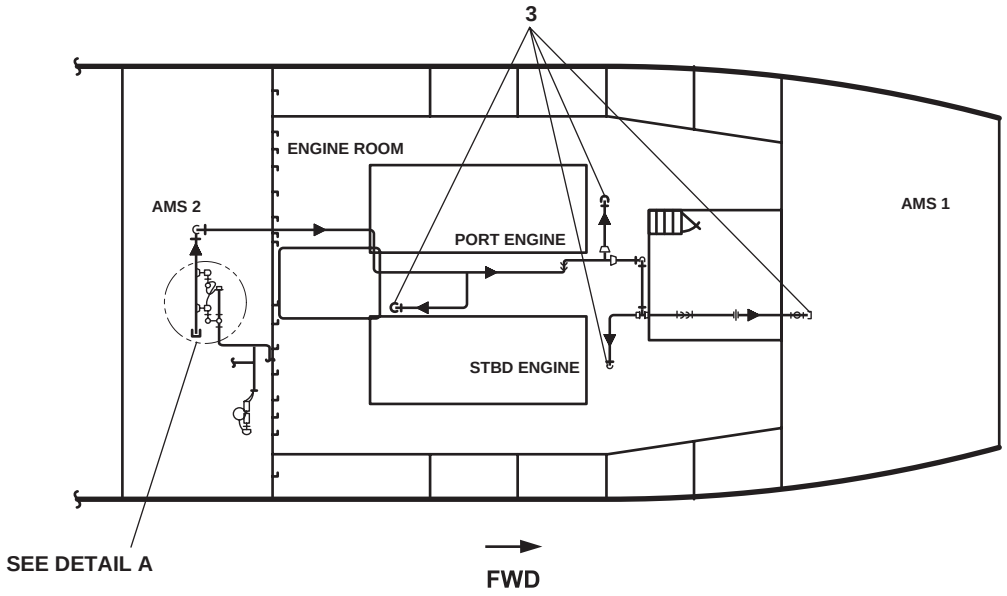
Figure 8. Engine Room Water Washdown Station

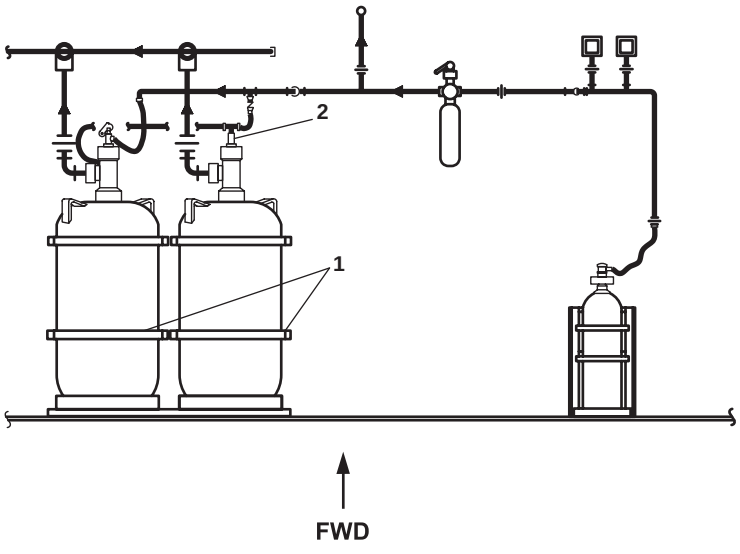
END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
FIRE SUPPRESSION SYSTEMS (FM-200, GALLEY GAYLORD, AND PORTABLE)

FM-200 FIRE SUPPRESSION SYSTEM

The engine room and AMS 1 are fitted with a FM-200 fire suppression system. The system is a manually actuated, stand-alone, total flooding fire suppression system. The system is capable of extinguishing Class A, Class B, and Class C fires when properly deployed. The system consists of two 600 lb (272 kg) FM-200 cylinder assemblies (figure 1, item 1), a 200 lb (91 kg) FM-200 cylinder assembly (figure 2, item 1), control heads (figures 1 and 2, item 2), discharge nozzles (figures 1 and 2, item 3), and FM-200 pull boxes (figures 3 and 4).





DETAIL A

Figure 1. FM-200 Component Locations (Overhead Systems)

When the FM-200 system is actuated, ventilation to and from the engineering spaces, the ship's service diesel generators, and the bow thruster and pump drive engines are automatically shut down to prevent FM-200 gas from being extracted from the spaces. When a FM-200 pull box is actuated, horns sound, strobes flash, and the FM-200 alarm bell sounds to alert personnel to evacuate the space. A 60-second delay is provided before the FM-200 agent is released to allow evacuation of the engineering spaces.

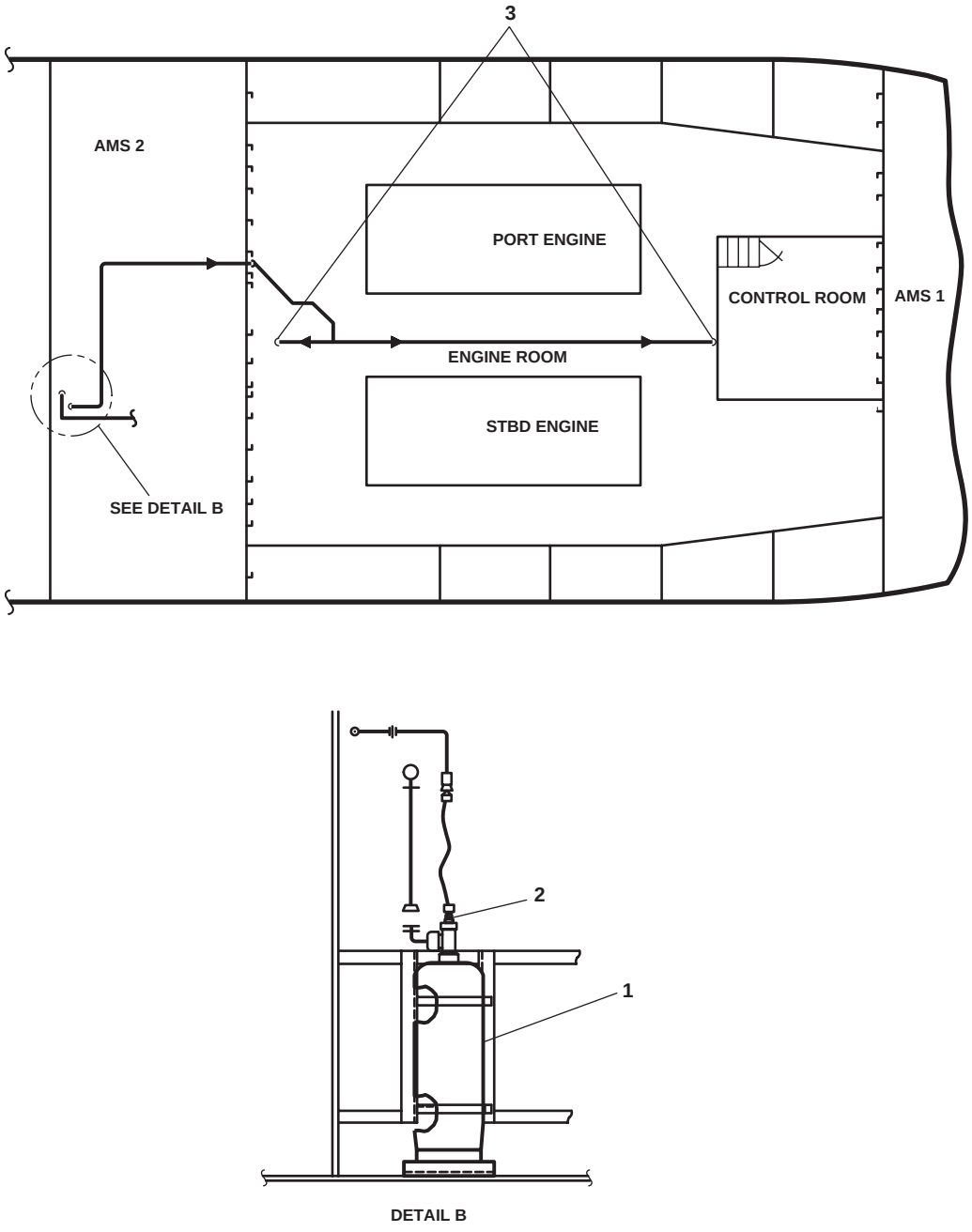


Figure 2. FM-200 Component Locations (Bilge Systems)

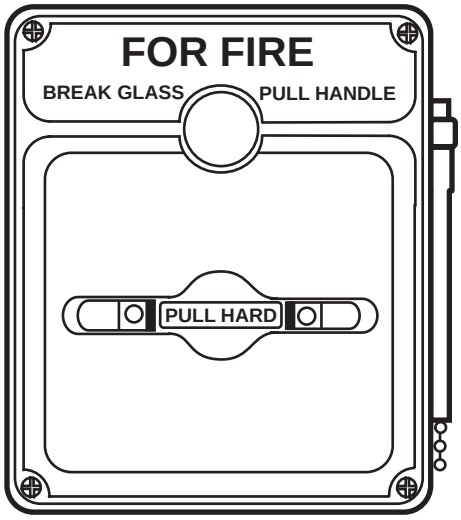


Figure 3. Interior FM-200 Pull Box

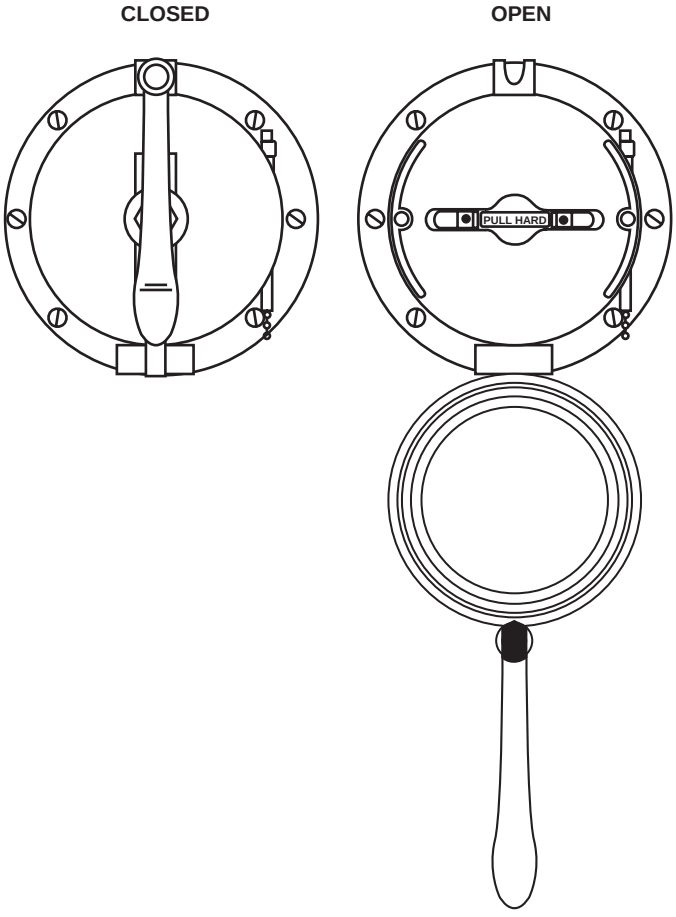


Figure 4. Exterior FM-200 Pull Box

FM-200 FIRE SUPPRESSION ALARM SYSTEM

The purpose of the FM-200 fire suppression alarm system is to warn personnel on the hold deck (AMS 1, engine room, and AMS 2) that the FM-200 fire suppression system is actuating. When the FM-200 fire suppression alarm sounds, personnel have 60 seconds to evacuate the spaces before the FM-200 system is discharged.

The fire suppression alarm system is needed because the FM-200 agent produces Hydrogen Fluoride (HF) gas when exposed to temperatures at or above 1,300 °F (704.4 °C). When the FM-200 system is actuated, ventilation to and from the engineering spaces, the ship's service diesel generators, the fuel oil transfer pumps, and the bow thruster and pump drive engines are automatically shut down to prevent the FM-200 agent from being extracted from the spaces. Although the FM-200 agent itself is breathable, the atmosphere in the engineering spaces will rapidly degrade to a casualty condition as HF gas may be present. Personnel in these spaces must have warning to evacuate or make preparations to find breathable air.

The FM-200 fire suppression alarm system is an automatically actuated alarm system. When the FM-200 system is actuated, pressurized CO_2 from the system's actuating circuit closes the alarm switch. This switch in turn energizes the strobe lights, horns, and bell. Locations of the strobe lights, horns, and bell are illustrated in figure 5. Once the alarm begins to sound, the occupants of the engine room and AMS 1 have 60 seconds before FM-200 agent is released. The FM-200 fire suppression alarm system consists of five amber strobe lights, two horns, and one bell. Three strobe lights are mounted in the engine room, and one each in AMS 1 and AMS 2. The alarm system bell is mounted on the weather deck aft of the engine room access vestibule.

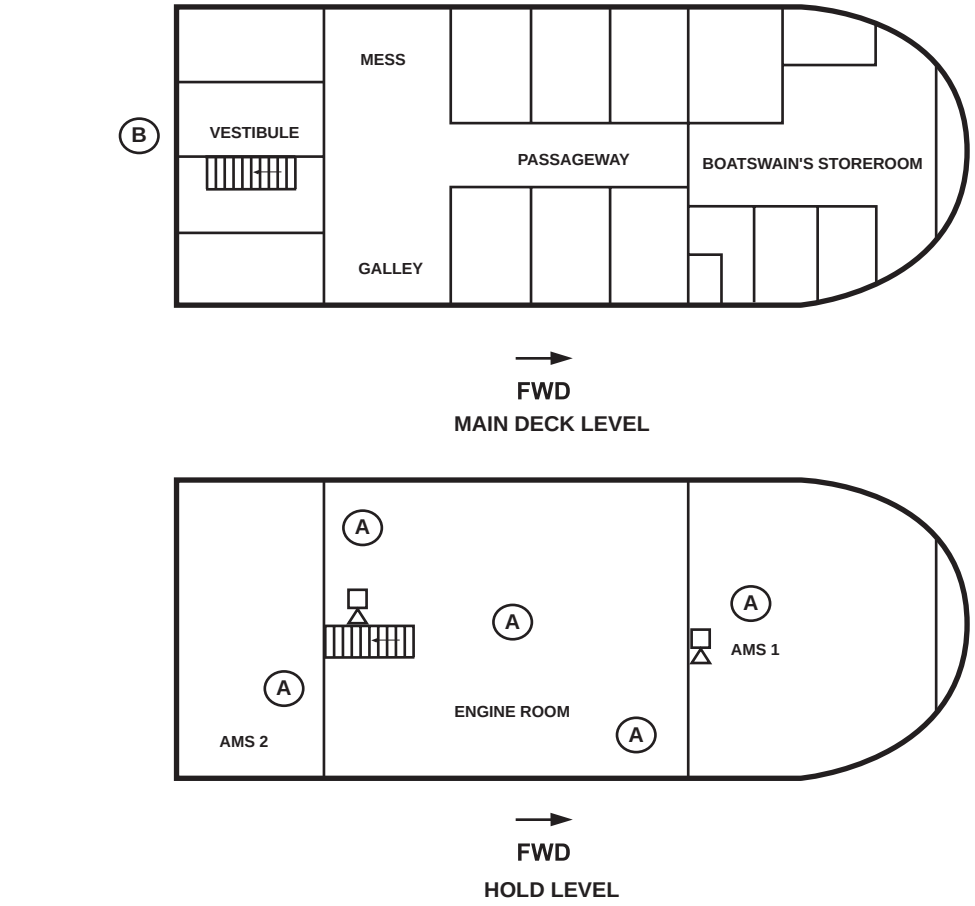


Figure 5. Components by Locations of the FM-200 Fire Suppression Alarm System

The strobe lights and bell are powered by 120V emergency lighting panel No. 1 via pressure switch PS-1 (figure 6, item 1). The fire suppression alarm system has two horns. One horn is mounted in the engine room and the other in AMS 1. The horns are powered by the emergency generator battery charger circuit via pressure switch PS-1A (figure 6, item 2). As illustrated in figure 6, the use of two separate power sources provides greater assurance that personnel in the hold level will be warned if the FM-200 fire suppression system is activated.

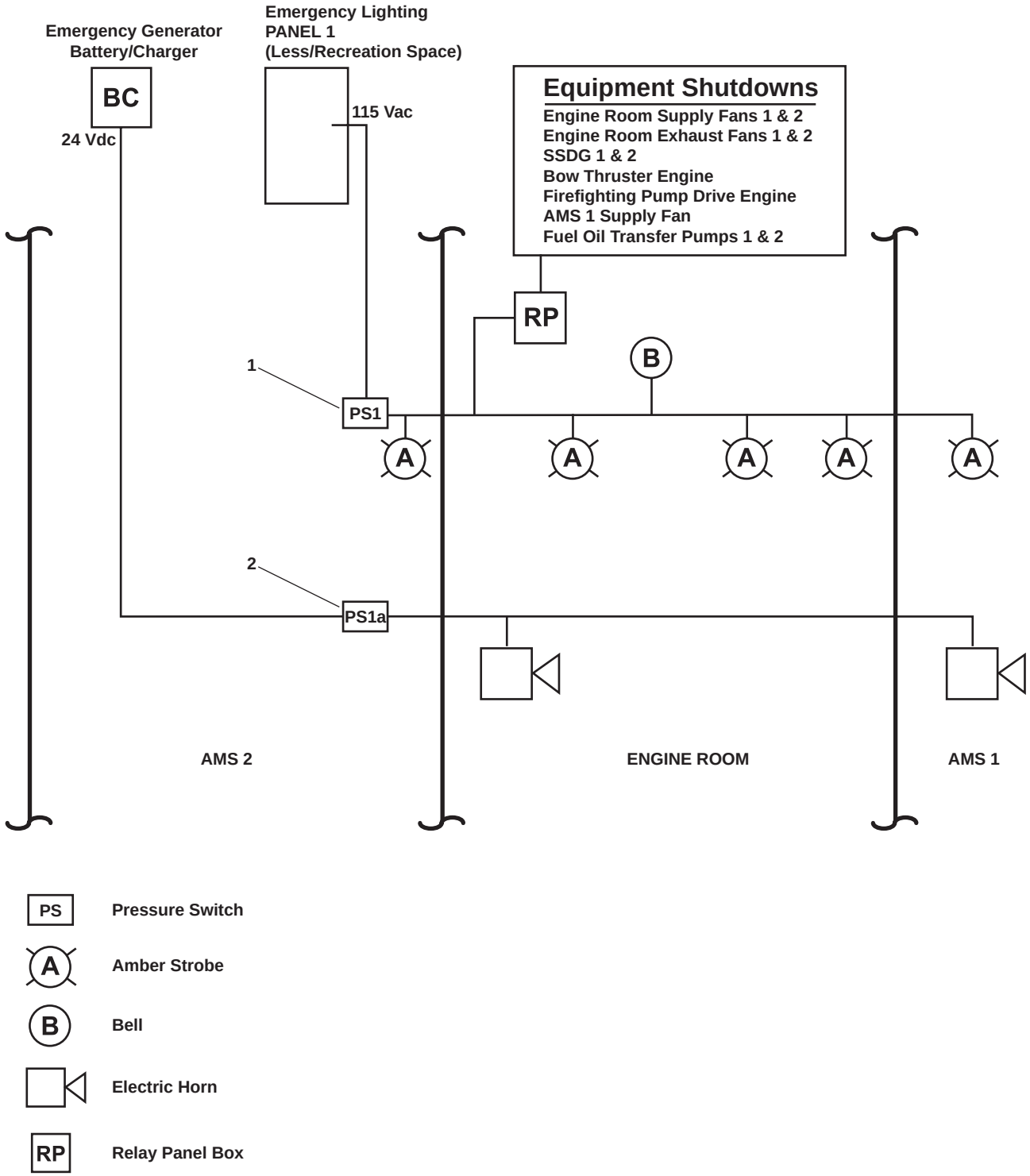


Figure 6. Fire Suppression Alarm System Schematic

ENGINE ROOM WATER WASHDOWN SYSTEM (ERWWS)

The purpose of the ERWWS is to quickly reduce the temperature in the protected space to minimize the production of Hydrogen Fluoride (HF) gas generated as a result of FM-200 agent contact with hot surfaces and flame above 1,300 °F (704.4 °C). The sprinkler water also acts to keep smoke particulate down and expedites ventilation of the compartment when the fire is extinguished. The ERWWS is not designed or intended to be a stand-alone fire extinguishing system. It is designed to be used in conjunction with the installed FM-200 fire suppression system. Use of the ERWWS reduces the risk of HF exposure by reducing temperatures within the protected space.

The ERWWS is constructed of all stainless steel components. In order to operate the ERWWS, the fire main must be charged and, at a minimum, fire and general service pump 1 must be online at maximum operating pressure. To provide an adequate volume of raw water for the ERWWS, valves FM-17, FIRE/G.S. PMP No. 1 DISCH TO GS and FM-15, FIRE/ G.S. PMP. No. 2 DISCH TO GS. must be CLOSED prior to activation of the ERWWS. The ERWWS requires a minimum of 145 gal/min (548.9 L/min) at 104 PSI (7.17 bar) to operate as intended.

Activation of the ERWWS is accomplished by opening WWS-1 (figure 7, item 1). WWS-1 is located in the engine room vestibule on the main deck at frame 25. The ERWWS shall be activated prior to actuation of the FM-200 fire suppression system. The ERWWS is a Hydrogen Fluoride (HF) gas mitigating water washdown system that provides general overhead coverage to the protected spaces. The ERWWS consists of simple overhead sprinkler heads (figure 8) piped directly to the fire main. The ERWWS receives raw water directly from fire and general service pump 1. Fire and general service pump 1 is powered by the Emergency Diesel Generator (EDG) switchboard and will have to be restarted remotely from the pilothouse once the EDG comes online.

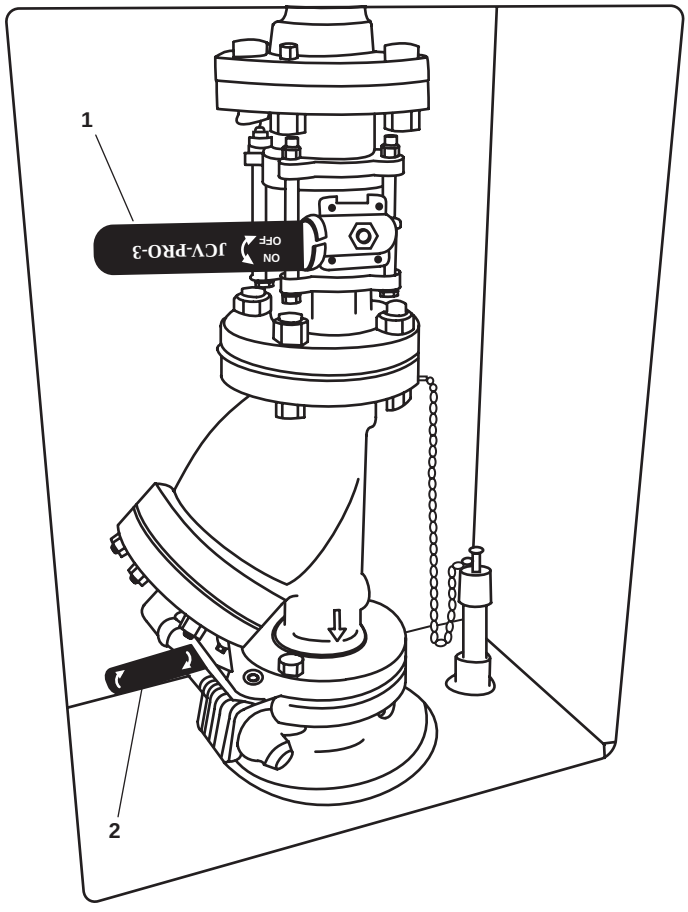


Figure 7. Engine Room Water Washdown Station

When the FM-200 fire suppression system is actuated to extinguish a fire, allow the ERWWS to operate for a minimum of fifteen minutes. During the ERWWS operating period, valve WWS-2 (figure 7, item 2) should be OPENED for ten seconds every three minutes. WWS-2 is the ERWWS strainer blow off and will flush foreign matter from the inline strainer basket during operation of the ERWWS. The ERWWS operating instructions (figure 9) are posted above the ERWWS station valves in the main deck vestibule.

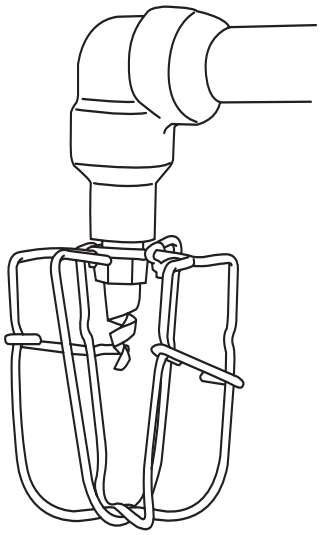


Figure 8. Engine Room Water Washdown System Sprinkler Head

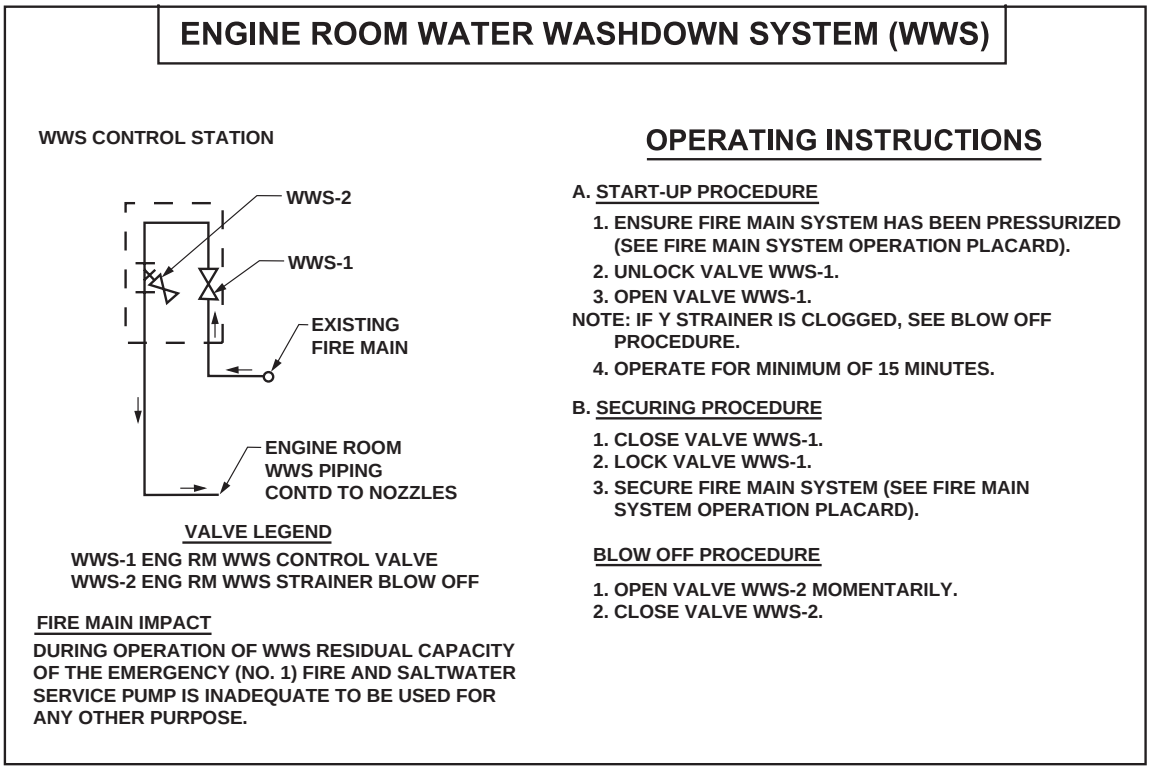


Figure 9. Engine Room Water Washdown System Operating Instructions

GALLEY FIRE SUPPRESSION SYSTEM

The galley fire suppression system is designed to extinguish fires that originate in the galley and the galley cooking equipment. The galley fire suppression system is a pre-engineered, wet chemical, cartridge operated, regulated pressure type extinguishing system. The system is capable of manual activation through the use of a manual pull box (figure 10, item 1) or automatic actuation through the use of fusible links (figure 10, items 2 and 3) rated at 500 °F (260 °C) and 360 °F (182 °C), respectively.

The extinguishing agent is formulated with an aqueous solution of organic salts with a ph range between 7.8 and 8.2. It is designed for flame knock down and foam coverage of grease related fires. The wet chemical agent is stored in a 3-gallon (11.3 liter) carbon steel tank housed in a stainless steel enclosure (figure 10, item 4) mounted on the starboard bulkhead of the galley. The storage tank has a working pressure of 100 PSI (6.9 bar). The extinguishing agent is propelled by the use of a gas cartridge of carbon dioxide or nitrogen gas and delivered to the distribution nozzles (figure 10, item 5). The distribution nozzle tips have blow off caps to keep the nozzle orifices free of cooking grease buildup.

Activation of the galley fire suppression system is accomplished manually by pulling the manual pull box (figure 10, item 1) or automatically by the melting of a fusible link (figure 10, items 2 and 3). Once the system has been manually or automatically activated, the gas charge propels the extinguishing agent (figure 10, item 4) to the distribution nozzles (figure 10, item 5). The electrical source for the protected equipment is not shut off, and the agent and the hot grease mix to form foam. This foam temporarily seals the combustible vapors, helping to inhibit re-ignition. The crew must secure the galley heat producing equipment. Once the galley fire suppression system has been activated, the Gaylord washdown system (figure 10, item 6) is activated in the fire cycle and sprays water into the Gaylord hood ventilation ductwork. Ventilation ducts are automatically secured by the activation of the Gaylord washdown system.

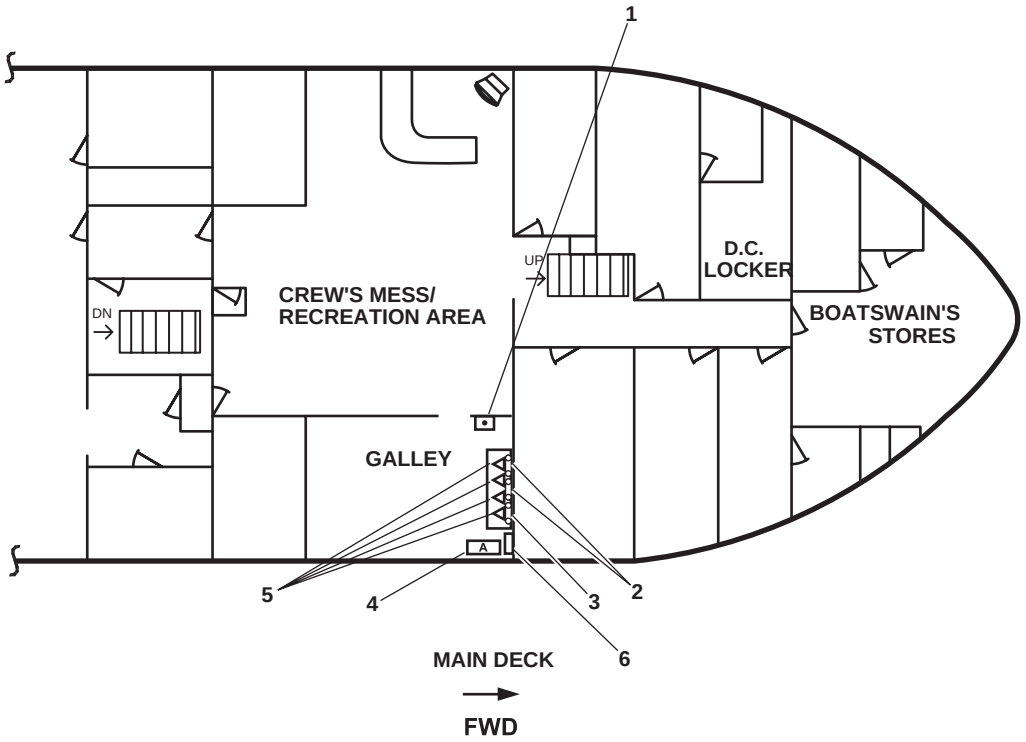


Figure 10. Galley Fire Suppression System

ARMS LOCKER DRENCHING SYSTEM

The arms locker drenching system is connected to the fire main system. The system is designed to provide raw water to the arms locker in the event of a fire or excessive high temperatures. The arms locker drenching system must be manually activated once the fire main has been charged. The system can be activated in the boatswain's locker (local) or from the 0-1 level (remote) at the bow by means of a reach rod valve system.

System activation occurs when the thermal heat detector (figure 11, item 1) senses a temperature above 105 °F (40.5 °C). The thermal heat detector sends an alarm signal to the pilothouse indicating high temperature conditions in the arms locker. The crew shall then investigate the situation and, if necessary, the fire main system would be charged. Once it is determined that the alarm condition exists and the fire main system is charged, the manual activation valve (figure 11, item 2) is OPENED either locally or remotely. As raw water enters the piping system in the arms locker, a pressure switch (figure 11, item 3) activates an alarm in the pilothouse to indicate that the arms locker drenching system has been activated. The raw water from the fire main flows into the arms locker and out of two sprinkler heads (figure 11, item 4). Once activated, the system will continue the flow of raw water into the arms locker until the manual activation valve is closed or the fire main system is secured.

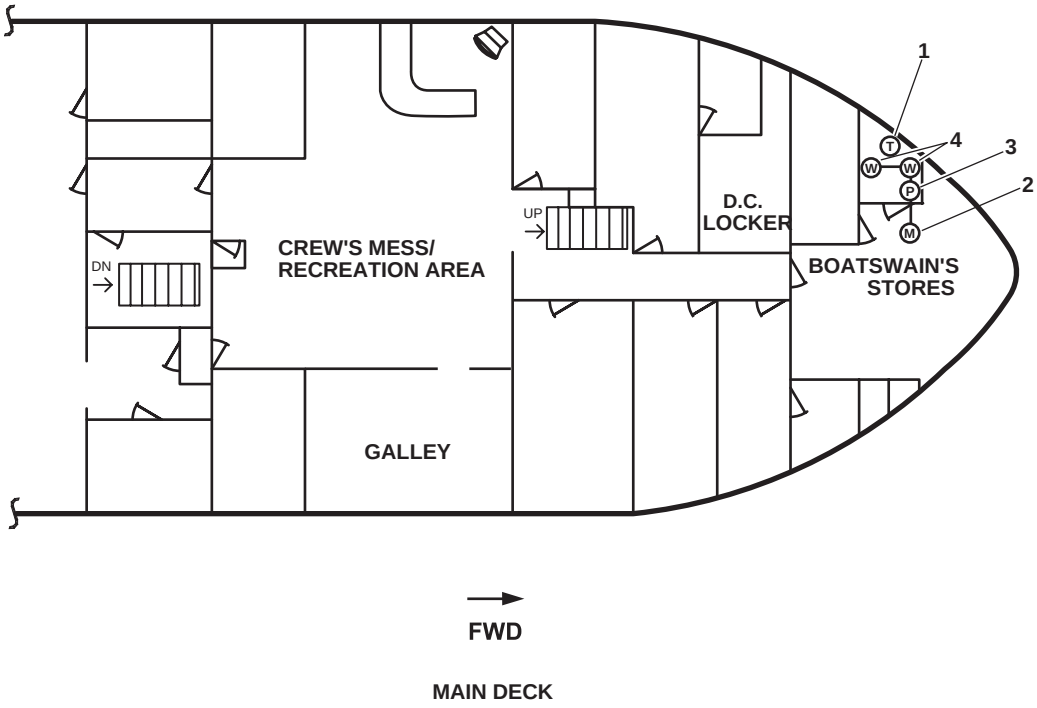


Figure 11. Arms Locker Drenching Systems

EXTINGUISHING AGENTS

DRY CHEMICAL

The extinguishing agent dispensed from portable hand-held equipment used on the LT is dry chemical based (figure 12). Dry sodium bicarbonate chemical is non-toxic, non-corrosive, and non-abrasive. It can be used effectively on oil fires, and it is four times more effective than equal weights of CO_2 in extinguishing a flammable liquid fire. Dry chemical is also effective on electrical fires. Because the agent has little effect on the removal of heat, repeated applications may be required to prevent the fire from reflashing. Dry chemical is the most effective hand held extinguisher in combating an oil spray fire. The effective range of this agent is 13 to 22 feet (4 to 6.7 meters). Dry chemical can cover a large area, but the residue left behind is difficult to remove.

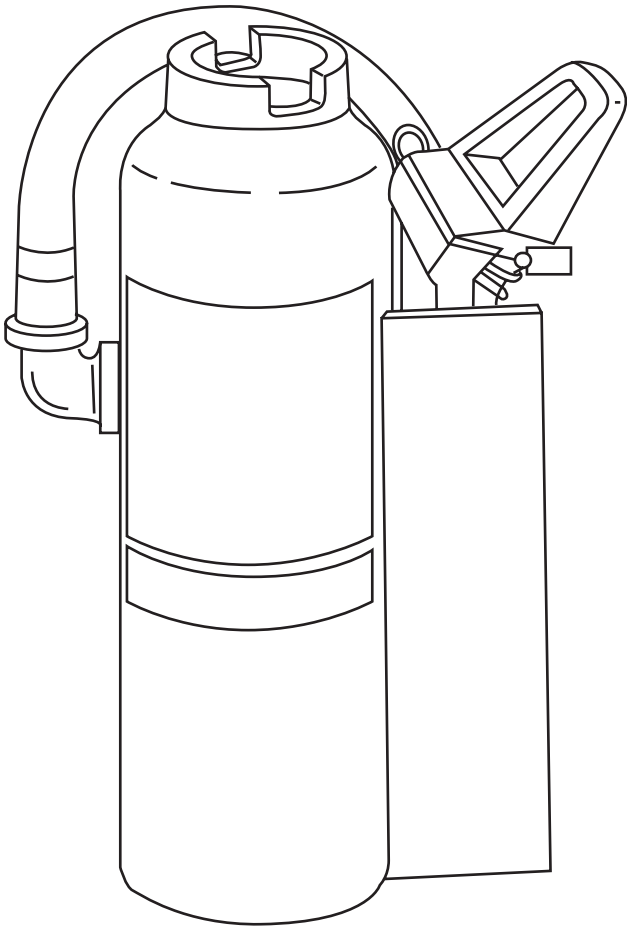


Figure 12. Portable Dry Chemical Extinguisher

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
POWER GENERATION SYSTEM

GENERAL

The power generation system provides the LT with service power of 440 Vac, 3-phase, 60 Hz, 275 kW and emergency power of 440 Vac 3-phase, 60 Hz, 65 kW. Service power is generated by one or both of the ship's service diesel generator (SSDG) sets. The SSDG supplies power to the main switchboard and the emergency switchboard through a bus tie circuit breaker. The emergency diesel generator produces emergency power for continued operation of vital systems and equipment should loss of service power occur. Refer to figure 1 for an overall block diagram of the power generation system.

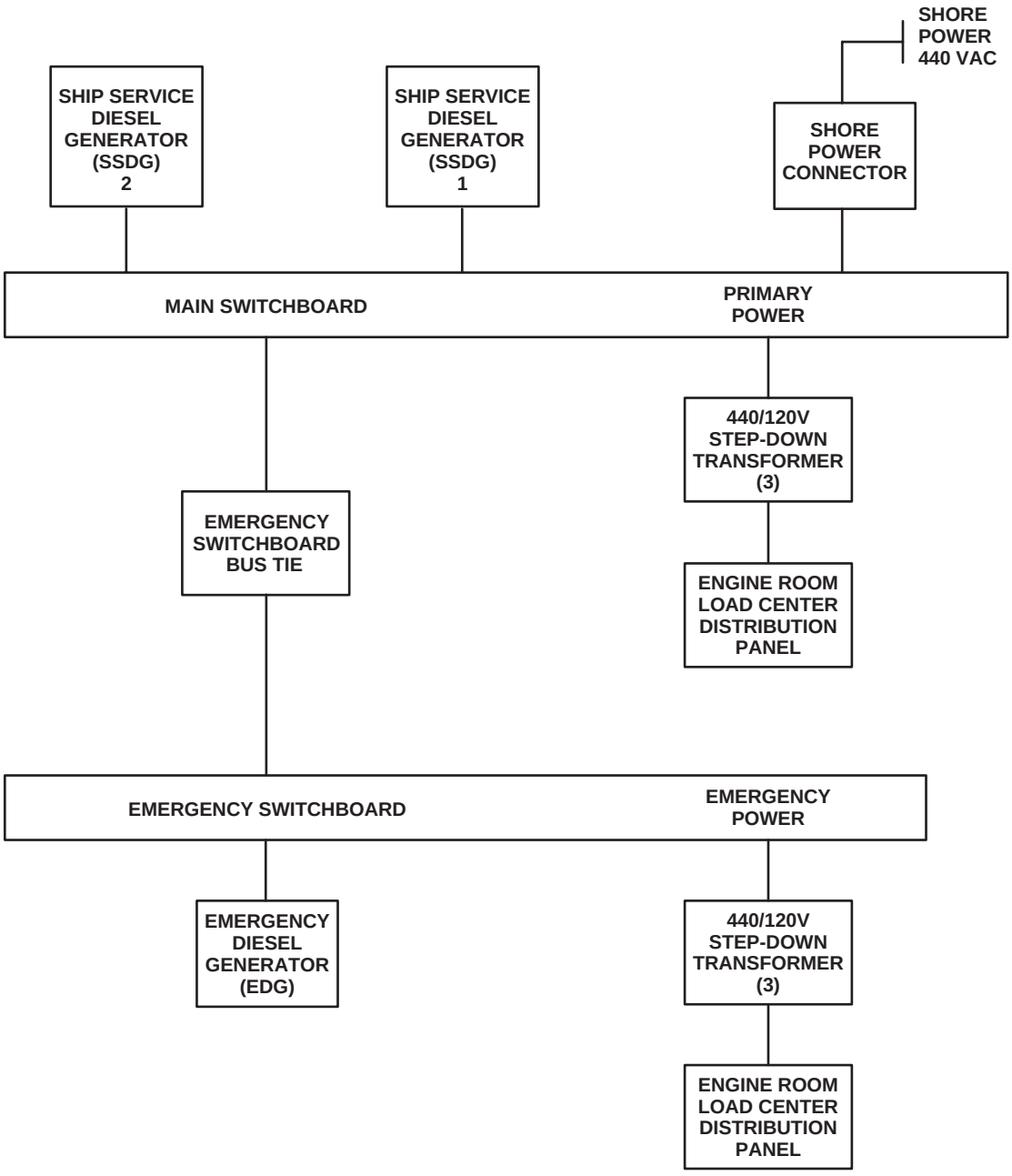


Figure 1. Power Generation System Block Diagram

A bus tie transfer breaker isolates the emergency switchboard from the main switchboard upon loss of service power. The bus tie breaker is located in the emergency switchboard and allows emergency power to be supplied through the emergency switchboard.

In port, the LT is capable of receiving 440 Vac shore power through a shore power cable terminating at a shore power connector. When connected, the shore power cable supplies both the main switchboard and the emergency switchboard.

SHIP'S SERVICE DIESEL GENERATOR (SSDG) SET

GENERAL

Each ship's service generator consists of a diesel engine, which is directly coupled to its generator. The engine and generator are mounted on a common foundation.

SHIP'S SERVICE DIESEL GENERATOR ENGINE

A turbocharged V8 diesel engine provides power to the generator. The port ship's service diesel generator engine 2 is air-started while the starboard diesel generator engine 1 is electrically started. Engine control and monitoring are provided from the EOS and local control panel.

SHIP'S SERVICE DIESEL GENERATOR

Two 275-kW brushless exciter generators provide 440 Vac, 3-phase, 60 Hz power to the main switchboard. Each generator is capable of providing 110 percent of the necessary at-sea load for the propulsion and safety of the vessel under normal conditions. The generators may be operated in parallel; however, normal operation has one generator on line. For parallel operation, controls necessary to parallel the generators are provided on the main switchboard, located in the EOS.

EMERGENCY DIESEL GENERATOR (EDG) SET

General

The emergency diesel generator set consists of a diesel engine that is directly coupled to the emergency generator. The engine and generator are mounted on a common foundation.

EMERGENCY DIESEL GENERATOR ENGINE

An in-line 4-cylinder diesel engine provides power to the emergency generator. The engine is electrically started (24 Vdc), has its own lubricating oil, cooling and fuel oil systems. The engine is cooled by a fresh water cooling system utilizing a radiator for heat transfer. Jacket water heater is provided for cold weather starting. Switchboard automatic bus transfer equipment automatically opens the bus tie circuit breaker, starts the engine, and closes the emergency generator breaker when power is lost from the main switchboard.

EMERGENCY DIESEL GENERATOR

The emergency diesel generator provides power (440 Vac, 3-phase, 60 Hz, 65 kW) to the emergency switchboard within 20 seconds of a ship's service power system failure.

SHORE POWER CONNECTOR

A shore power connector (440 Vac, 400 amps) is located on the main deck, aft of the exterior bulkhead. The shore power connector provides the capability of connecting the vessel's electrical system to a shore power source.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
ELECTRICAL SYSTEM

GENERAL

The 128' Large Tug (LT) uses alternating current (440 Vac, 220 Vac, and 120 Vac) and direct current (24 Vdc) electrical systems. These electrical systems supply all of the electrical needs of the LT vessel.

The alternating current electrical system uses a 3-phase system. The 440 Vac (volts alternating current) system has two power sources. Power may be derived from the diesel generator or from an outside power source via the shore power receptacle and the shore power cable. The 220 and 110 Vac systems receive power through step-down transformers.

The direct current electrical system is a two-wire isolated ground system. A 24 Vdc (volts direct current) supplies many of the lighting, communication, and accessory systems for the LT.

The main components of the vessel's electrical system consist of the ship's service main switchboard, the emergency switchboard, load centers, power panels, motor controllers, and related wiring. The system distributes 440 Vac, 220 Vac, 120 Vac, and emergency power throughout the vessel. Power (440 Vac, 3-phase, 60 Hz) is received from the power generation system and routed via the main switchboard and emergency switchboard to the selected equipment and panels.

ALTERNATING CURRENT ELECTRICAL SYSTEM

The alternating current electrical system consists of the ship's service main switchboard, the emergency switchboard, transformers, distribution panels, motor controllers, and related wiring.

MAIN SWITCHBOARD

The main switchboard is located in the EOS and provides the generator selection, shore power selection, and power distribution for the ship's service 440 Vac. Refer to figure 1 for a block diagram of the main switchboard. The main switchboard consists of transformers, as well as ammeters, voltmeters, kilowatt meters, frequency meters, a phase rotation meter, and a synchronization meter that provides power monitoring.

Controls are provided for the automatic generator voltage regulation and the generator engine speed regulation. The switchboard motorized bus tie breaker also serves as an emergency 440 Vac power feedback source for the main switchboard from the emergency switchboard to the power selected equipment systems during emergency power conditions. An interlock system is incorporated into the switchboard to prevent damage to the switchboard by not allowing power from two sources to be supplied at the same time (see table 1).

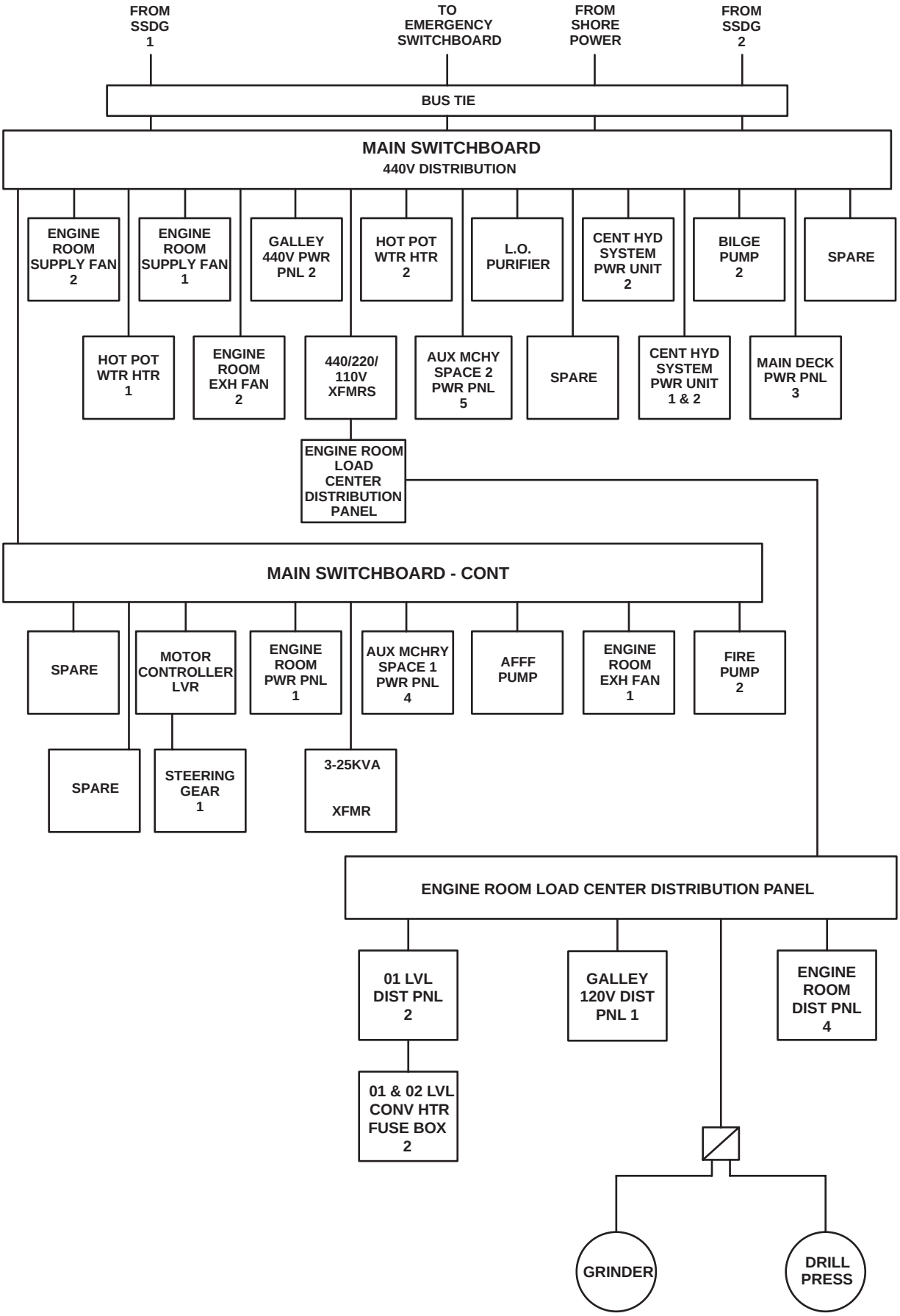


Figure 1. Main Switchboard Block Diagram (Sheet 1 of 2)

Table 1. Main Switchboard Interlocks

NOTE

The following interlock conditions occur when the SSDG 1, SSDG 2, or shore power is feeding the main switchboard, the main bus tie is closed, and the FEEDBACK switch is in the NORMAL position:

Circuit Breaker Closed	Cannot Close
SSDG 1 Circuit Breaker	Shore Power Circuit Breaker
SSDG 2 Circuit Breaker	Shore Power Circuit Breaker
Shore Power Circuit Breaker	SSDG 1 Circuit Breaker
Shore Power Circuit Breaker	SSDG 2 Circuit Breaker
Main Bus Tie Circuit Breaker (Emergency Switchboard)	EDG Circuit Breaker
1S/E Bus Tie Circuit Breaker	2S/E Bus Tie Circuit Breaker
2S/E Bus Tie Circuit Breaker	1S/E Bus Tie Circuit Breaker

NOTE

The following interlock conditions occur when the Emergency Diesel Generator is running, and the FEEDBACK switch is in the NORMAL position:

Circuit Breaker Closed	Cannot Close
EDG Circuit Breaker (Emergency Switchboard)	Main Bus Tie Circuit Breaker

NOTE

The following interlock conditions occur when the EDG is running, and the FEEDBACK switch is in the FEEDBACK position:

Circuit Breaker Closed	Cannot Close
EDG & Main Bus Tie Circuit Breaker (Emergency Switchboard)	SSDG #1 Circuit Breaker
EDG & Main Bus Tie Circuit Breaker (Emergency Switchboard)	SSDG #2 Circuit Breaker
EDG & Main Bus Tie Circuit Breaker (Emergency Switchboard)	Shore Power Circuit Breaker

EMERGENCY SWITCHBOARD

The emergency switchboard is located in the emergency generator room and normally receives 440 Vac primary power from the main switchboard through the bus tie. Refer to figure 2 for a block diagram of the emergency switchboard. The emergency switchboard bus tie provides 440 Vac to the emergency switchboard. Upon loss of the ship's service power from the main switchboard, a bus tie transfer breaker located within the emergency switchboard isolates the emergency switchboard and provides automatic or manual starting of the emergency generator. A voltmeter, ammeter, and a frequency meter provide the power monitoring capability.

A main switchboard bus tie circuit breaker and feedback switch permit the distribution of emergency power (440 Vac) to the main switchboard. The EDG circuit breaker is prevented from being closed by an interlock system when primary power is being provided through the bus tie circuit breaker. Power distribution (440 Vac) is accomplished through circuit breakers on the switchboard.

TRANSFORMERS

The LT contains three step-down transformers that are located in the engine room and convert 440 Vac to 220/110 Vac. The transformers provide 120 Vac for the engine room load center. The LT also contains three step-down transformers, located in the emergency generator room (overhead), that provide 120 Vac power to the EMERG LOAD CTR DISTRIBUTION PANEL.

DISTRIBUTION PANELS

There are several distribution panels located throughout the LT. The following paragraph describes the essential distribution panels used within the alternating current electrical system. The distribution panels house the circuit breakers and the fuses that control and protect the circuits throughout the vessel.

The engine room load center distribution panel supplies 120 Vac to several power panels, and workshop equipment. The EMERG LOAD CTR DISTRIBUTION PANEL provides 120 Vac emergency power distribution to numerous emergency distribution panels, in addition to the battery chargers. The 220/110 V distribution panel provides power distribution for the galley, the crew's mess, and laundry spaces. The ENG RM DIST PNL NO. 4 provides power distribution for the engine room equipment, the welder, refrigerated stores controls, emergency generator strip heater and emergency switchboard heater. The radio room electronics distribution panel provides 120 Vac power to the communications equipment and battery charger.

MOTOR CONTROLLERS

There are eight types of motor controllers that provide the start and stop function of the motor and overload protection for the motor, as well as the status of the motor operation via the power available indicators and motor operating speed indicators.

DC ELECTRICAL SYSTEM

The direct current electrical system consists of the battery chargers, battery banks, and distribution panels.

STORAGE BATTERIES

Six independent 24 Vdc battery banks are provided. Refer to figure 3 for a block diagram of the battery power distribution system. One set of batteries provides starting power for the EDG engine. The second set provides starting power for SSDG 1. The third set of batteries provides power for the general alarm system. A fourth set of batteries provides power to the radio room DC panel, which supplies selected Communication, Electronic, and Navigation (CEN) equipment. Set five provides power (24 Vdc) for the machinery plant monitoring system and engine control. The sixth set of batteries provides 24 Vdc for the Reverse Osmosis Water Purification Unit (ROWPU).

BATTERY CHARGERS

Battery chargers for each battery bank are provided. The battery chargers are supplied 120 Vac from the emergency load center distribution panel (see figure 2 for the emergency switchboard block diagram). One charger is for the SSDG 1, and the other charger is for the machinery plant monitoring system and engine control.

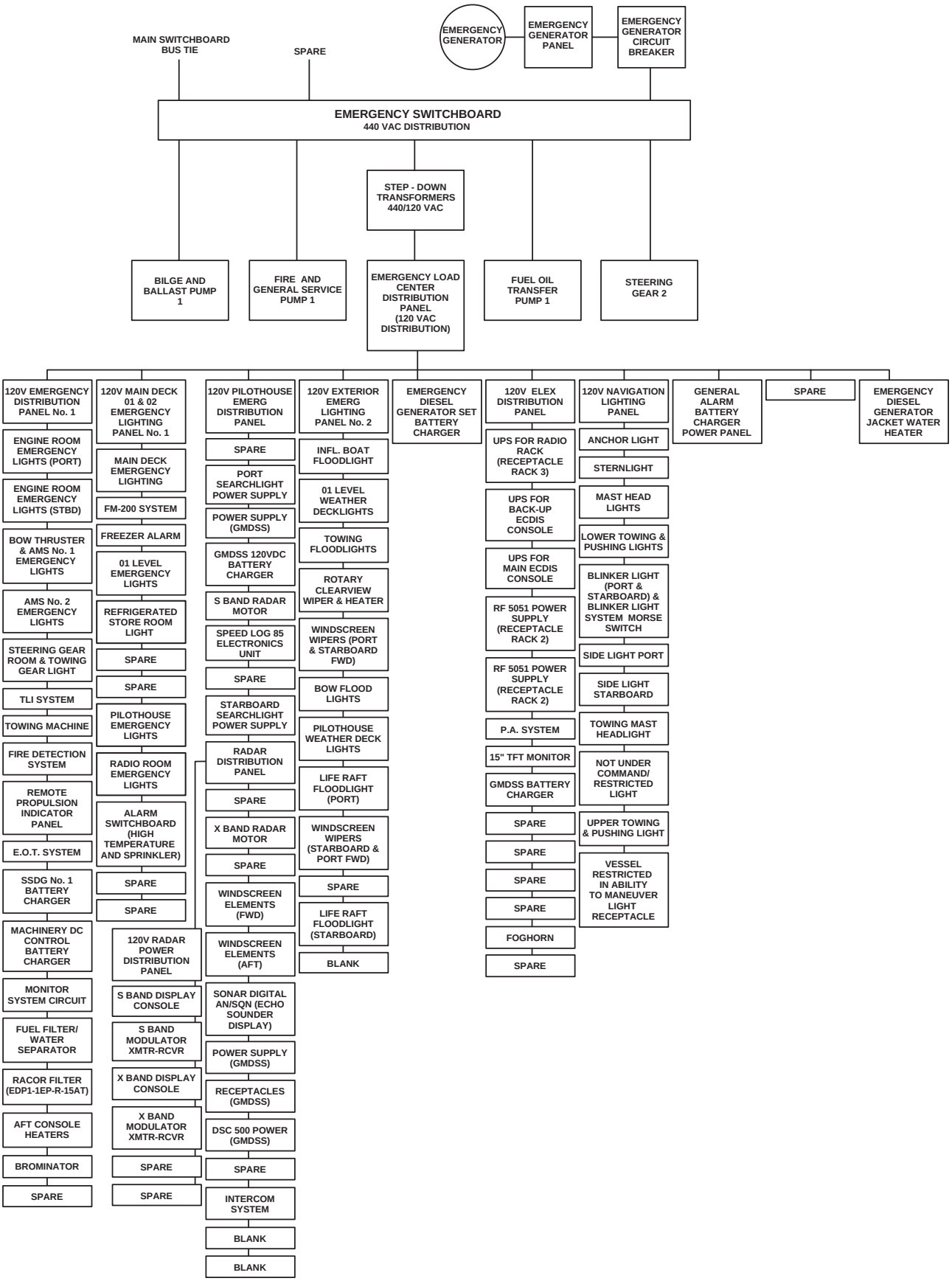


Figure 2. Emergency Switchboard Block Diagram

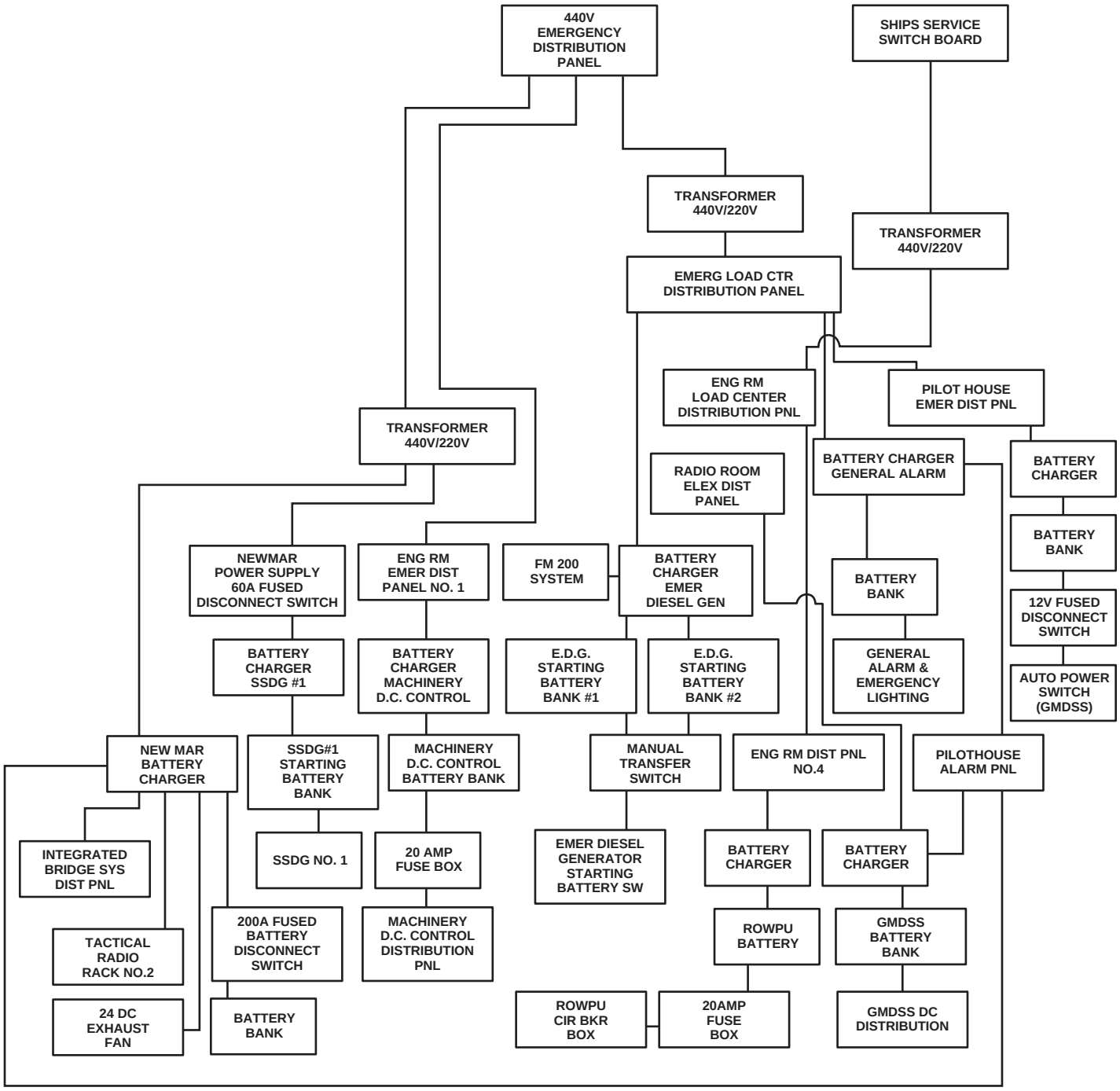


Figure 3. Battery Power Distribution System Block Diagram

BATTERY BANKS

Battery banks provide battery power to start the SSDG 1 and provide power for the machinery plant monitoring system and engine control.

DISTRIBUTION PANELS

There are distribution panels located throughout the LT that are provided for Vdc electrical system operation. The distribution panels house the circuit breakers and the fuses that control and protect the circuits throughout the vessel.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
INTERNAL COMMUNICATION SYSTEMS

GENERAL

The Large Tug (LT) has three independent interior communication systems. The systems can be grouped into two types: voice communication and non-voice communication. The voice communication system consists of the sound powered telephone system and the intercommunication (intercom) system. The non-voice communications system consists of the Engine Order Telegraph (EOT).

INTERCOMMUNICATION (INTERCOM) SYSTEM

The intercom system is a 20-station system that requires 120 Vac power. The 120 Vac power is provided from the pilothouse emergency distribution panel. The intercom system is a party-line type voice communication system. When it is used, other stations may join the discussion, but they cannot initiate a second discussion. Refer to table 1 for a list of intercom stations.

Table 1. Intercom Stations

Station Number	Location
1	PILOTHOUSE TOP
2	PILOTHOUSE
3	PORT BRDG WING
4	STBD BRDG WING
5	FWD 02 WEATHER DECK
6	AFT 02 WEATHER DECK
7	FORE DECK
8	CH ENG. S.R.
9	CAPTAIN'S S.R.
10	OFFICER S.R. 1
11	OFFICER S.R. 2
12	EMER GEN ROOM
13	AFT COUNT & GUNNER
14	D.C. LOCKER
15	CREW MESS
16	GALLEY
17	FANTAIL

Table 1. Intercom Stations (continued)

Station Number	Location
18	BOW THRUSTER
19	E.O.S.
20	EMGR STEERING GR.

SOUND POWERED TELEPHONE SYSTEM

The sound powered telephone system provides voice communications throughout the vessel by means of fixed phone stations and portable units. Since the system is powered by voice only, it is functional even when a loss of power occurs. There are two circuits within the sound powered telephone system. One circuit is a dedicated line between the pilothouse and the radio room. The other circuit provides communication throughout the LT. Refer to figure 1 for a simplified functional diagram of the sound powered telephone system.

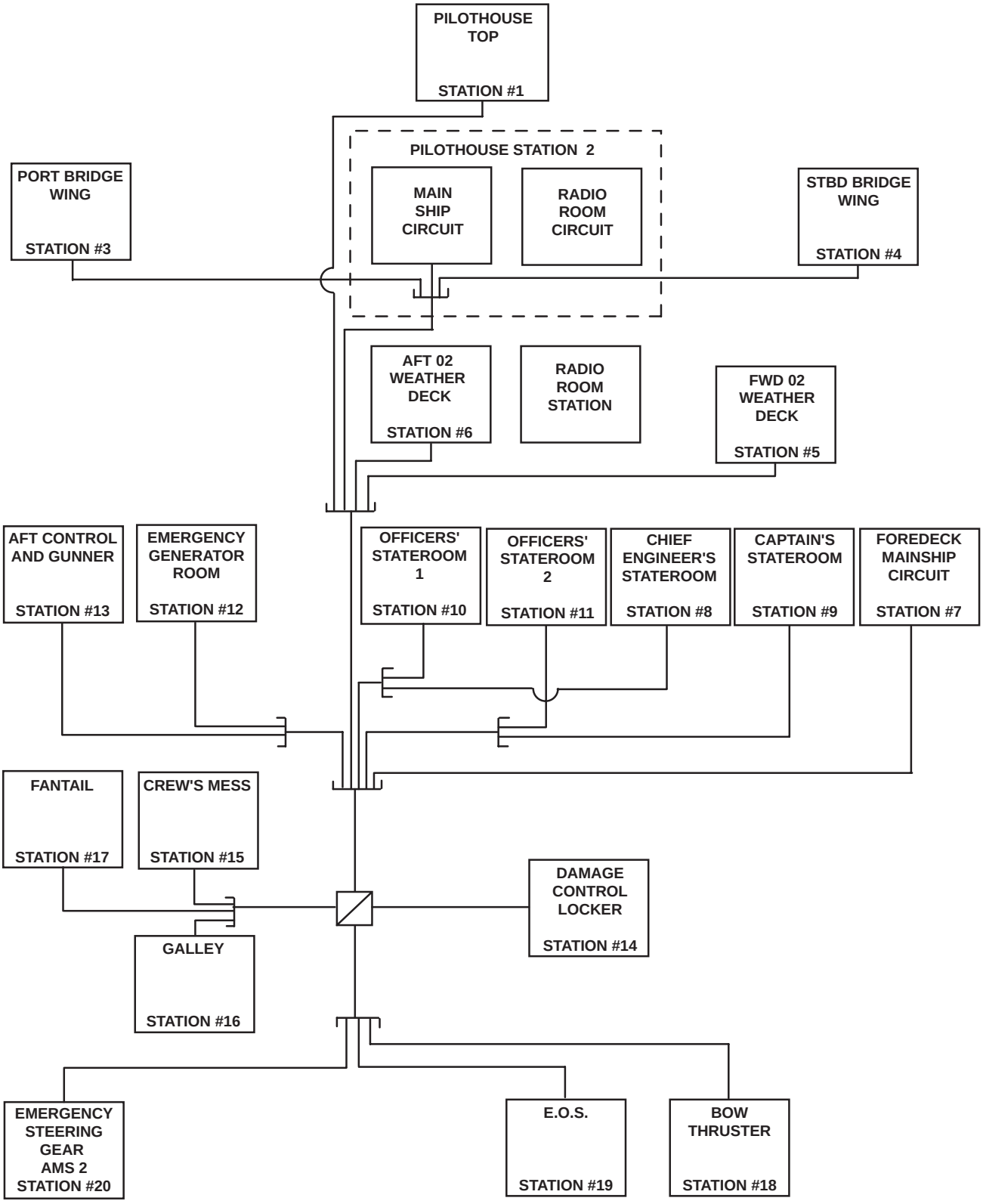
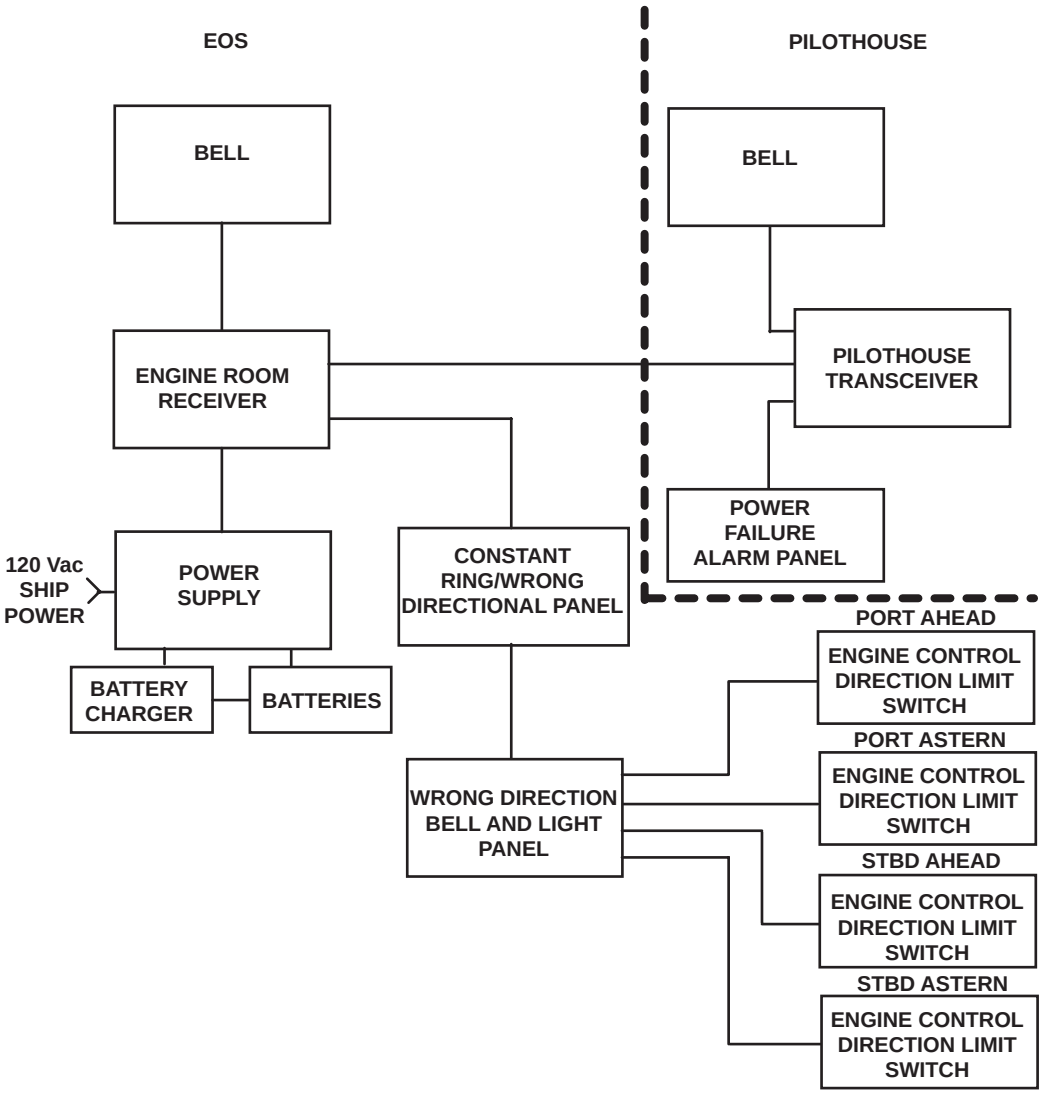


Figure 1. Sound Powered Telephone System Functional Diagram

ENGINE ORDER TELEGRAPH (EOT)

The EOT system is a 24 Vdc system used to transmit command from the pilothouse to the EOS. The EOT is used when the pilothouse is not in control of the propulsion plant. An alarm bell sounds to notify the operator if controls are not set to provide requested speed and direction. The power supply incorporates an internal battery charger and backup battery. Refer to figure 2 for a simplified block diagram of the EOT.



END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
ALARM SYSTEMS

GENERAL

The LT is equipped with four alarm systems. The fire alarm system alerts the crew when a fire is detected via sensors located throughout the LT. The general alarm system is used to alert the crew to a general alarm condition. The door alarm system consists of alarms located in various locations throughout the LT to alert the crew of entry into certain spaces within the LT, or not to enter when high temperature has been detected, or when a sprinkler system has been activated. The FM-200 fire suppression system gives the crew a 60-second warning prior to discharge of the FM-200 system.

FIRE ALARM SYSTEM

GENERAL

The fire alarm system alerts the crew to the presence of a fire by sounding an alarm via sensors located throughout the LT or when it has been manually activated through a fire alarm pull station. See figure 1 for a schematic diagram of the fire alarm system.

The fire alarm system consists of the fire and smoke detection panel located in the EOS; a remote indicating panel located in the pilothouse; a terminal box, heat rise detectors (thermostats), infrared detectors, and smoke detectors located in various compartments; fire alarm pull stations; and a 10 inch (254 mm) bell. The heat detectors are arranged in various zones throughout the vessel. When a fire condition is detected, the associated sensor sends an alarm signal via a zone module located in the fire and smoke detection panel to the applicable fire control panel indicators. When pulled, the fire alarm pull station also sends an alarm signal via the zone module to the applicable fire detector panel indicators.

FIRE AND SMOKE DETECTION PANEL

The fire and smoke detection panel is located in the EOS and alerts the crew to any fire detector faults in the fire detection system as well as alarm indications via LED indicators. See figure 2 for a depiction of the fire and smoke detection panel.

The panel contains indicator lights that illuminate when a fire is detected within the applicable zone area. The POWER FLASHING indicator illuminates to indicate that power is being supplied to the fire and smoke detection panel. The WHEN ON BATTERY indicator will flash when the fire and smoke detection panel is on battery power. The ALARM FLASHING WHEN SILENCED indicator illuminates when an alarm for one or more zones has been detected and will flash after the audible alarm has been silenced. The DC VOLTS meter indicates the dc voltage of the fire and smoke detection system while the DC AMPS meter indicates the fire and smoke detection system dc amperage. BATTERY TROUBLE indicator will be illuminated when the system detects a low charge in the battery system.

REMOTE INDICATING PANEL

The remote indicating panel is located in the pilothouse and alerts the pilothouse crew to the presence of fire. The panel contains four indicators that will illuminate the appropriate zone indicator for which the fire or smoke is detected.

HEAT RISE DETECTORS

There are three thermal heat detectors that are mounted in the 01 level passageway and in the boatswain's store and passageway. The heat detectors send a signal to the remote indicating panel when fire is detected, triggering the appropriate alarm.

SMOKE DETECTORS

There are 15 smoke detectors located in various locations throughout the LT. The smoke detectors contain a set of normally open contacts that close when smoke is detected. When the contacts are closed, a signal is sent to the remote indicating panel that will sound the appropriate alarm.

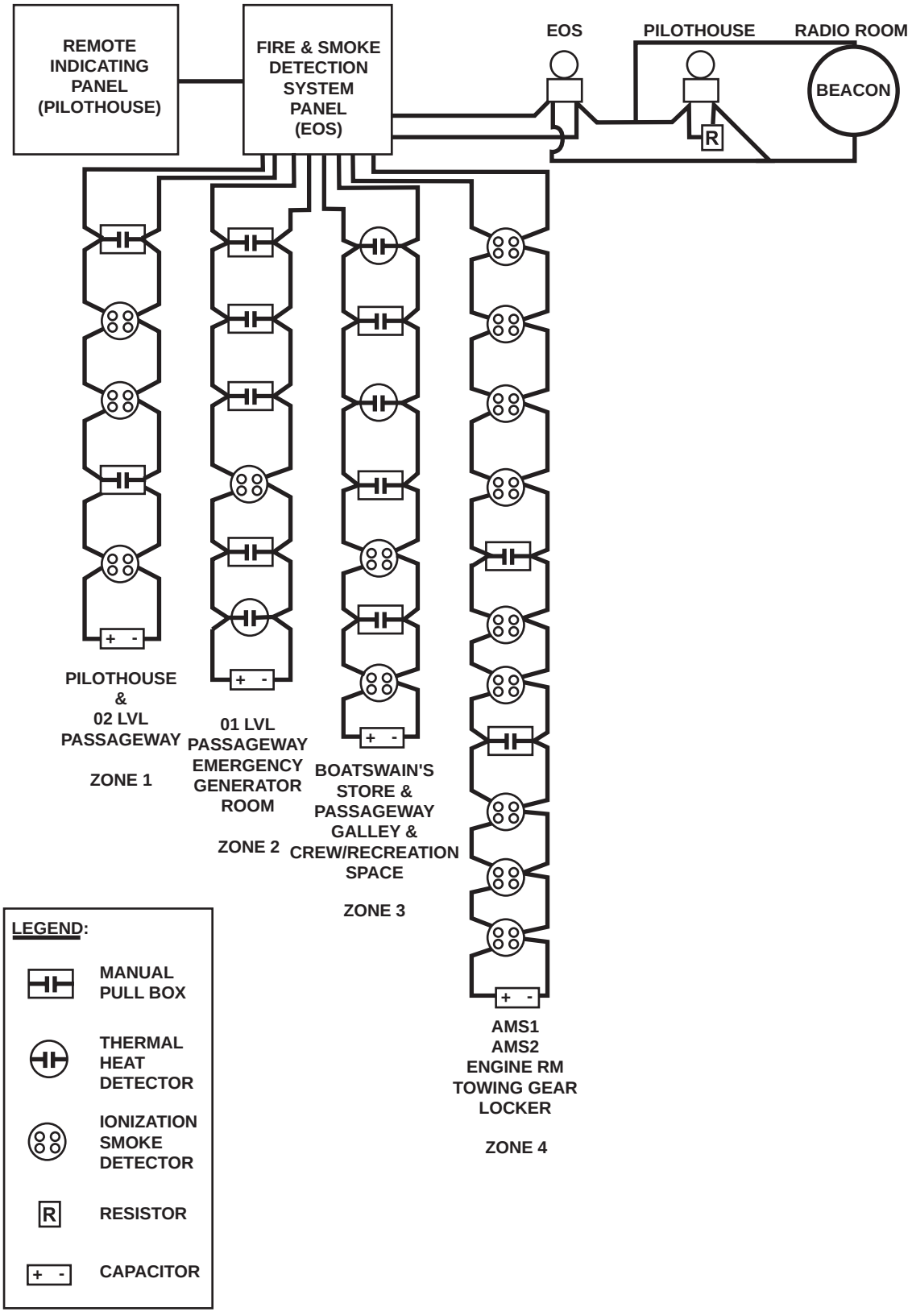


Figure 1. Fire Alarm System Schematic

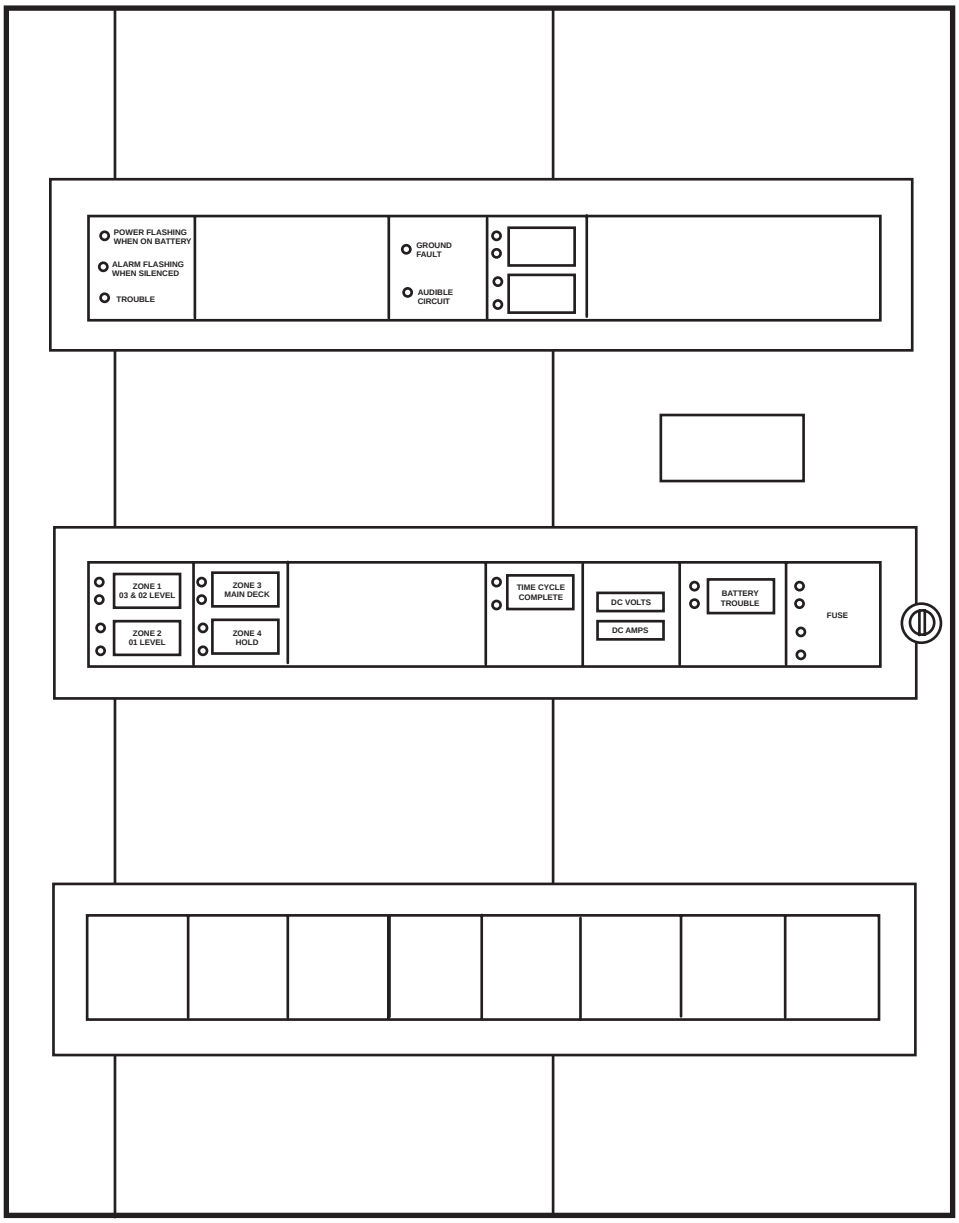


Figure 2. Fire and Smoke Detection Panel

GENERAL ALARM SYSTEM

GENERAL

The general alarm system is used to alert the vessel's crew to general alarm conditions. The system is controlled from the pilothouse and the 01 level passageway by contact makers located in the pilothouse and the 01 level passageway. When activated, alarm bells sound in various places throughout the LT. The general alarm system is powered by a 24 Vdc power supply via the general alarm battery bank. In the auxiliary machinery spaces and in the engine room, the system is equipped with relays that provide 120 Vac to rotating lights during alarm conditions. A simplified block diagram of the general alarm system is provided in figure 3.

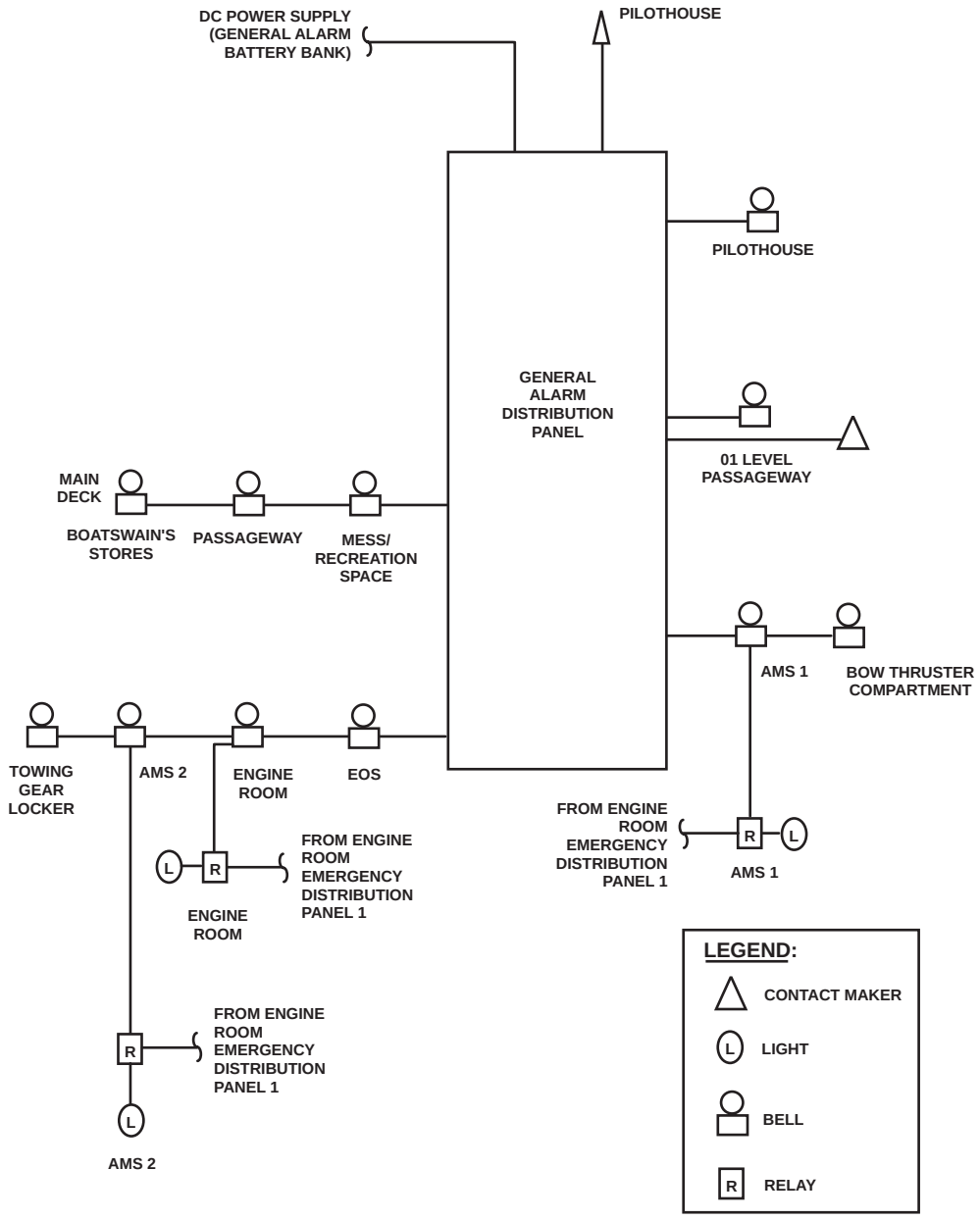


Figure 3. General Alarm System Simplified Block Diagram

ALARM BELLS

The general alarm system has 11 alarm bells located throughout the vessel. When the pilothouse switch or 01 level passageway switch is closed (ON), current flows to the alarm bells and they ring.

CONTACT MAKER

Contact makers located in the pilothouse and in the 01 level passageway control the general alarm system. When the switches are closed (ON), current flows to the alarms bells and they sound.

GENERAL ALARM DISTRIBUTION PANEL

The general alarm distribution panel, located in the 01 level passageway, is a junction box that is used to interconnect the general alarm system cables and to connect the contact makers and the alarm bells. The junction box also contains 12 fuses that protect the system from damage due to overload.

DOOR ALARM SYSTEM

GENERAL

The door alarm system consists of alarms located in the radio room, arms stowage room, the main deck fan room, and the freezer. The radio room door and arms stowage alarms alert the pilothouse to entry to the radio room or fan room, high temperature in the arms stowage room, or activation of the arms stowage room sprinkler system. The freezer alarm alerts the crew when the freezer alarm has been activated. Refer to figure 4 for a block diagram of the radio room, arms stowage, and the main deck fan room door alarms and figure 5 for a block diagram of the freezer alarm.

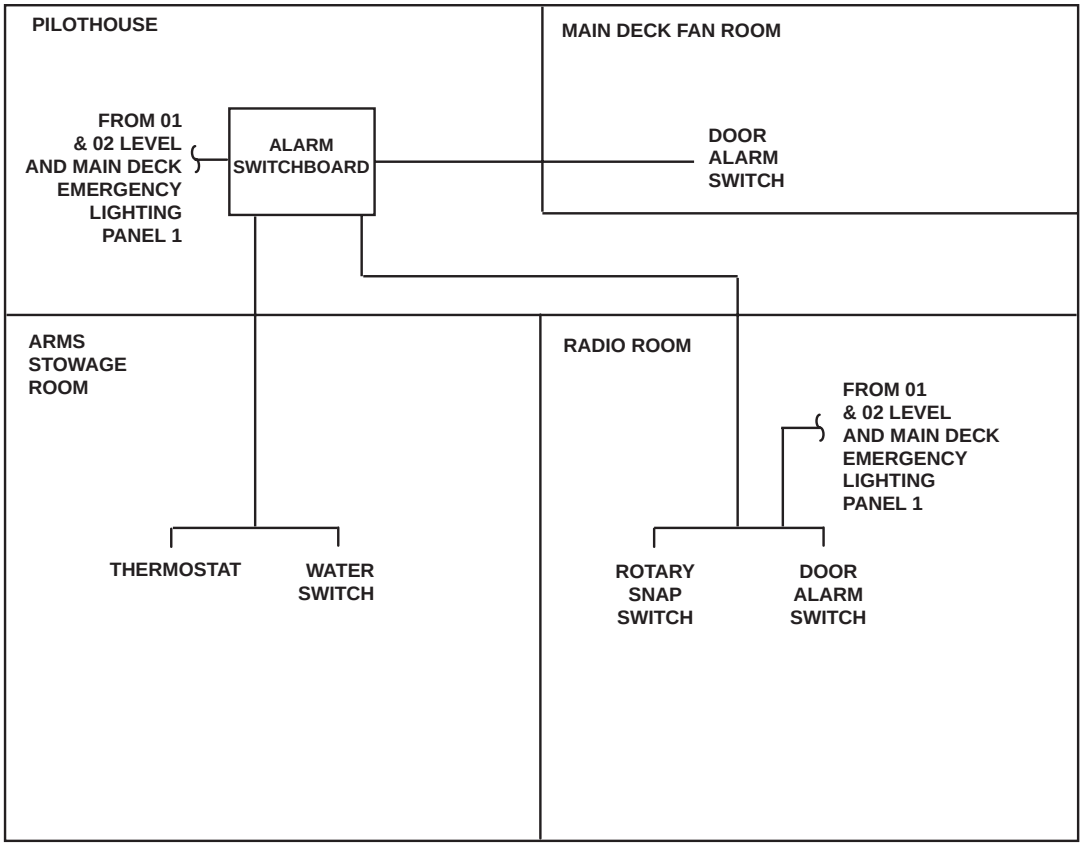


Figure 4. Radio Room, Arms Stowage, and Main Deck Fan Room Door Alarm Block Diagram

RADIO ROOM DOOR ALARM SYSTEM

The radio room door alarm system uses 120 Vac supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. When the door to the radio room is open, an alarm buzzer and indicator on the alarm switchboard located in the pilothouse is activated. A manual rotary snap switch is provided inside the radio room to disable the radio room door alarm.

ARMS STOWAGE ALARM SYSTEM

The arms stowage alarm system is a 120 Vac alarm system. Power is supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. Two sensors are provided, a high temperature sensor and a sprinkler sensor. The high temperature sensor detects unusually high temperature in the arms stowage room and activates the pilothouse sprinkler system alarms. The sprinkler sensor is a water flow switch that is installed on the downstream side of the sprinkler control valve. When the sprinkler control valve opens, water passes through the sprinkler control valve and through the water switch to the sprinklers. Water passing through the water switch activates the pilothouse alarms. Both audible and visual alarms are provided in the pilothouse at the alarm switchboard.

MAIN DECK FAN ROOM ALARM SYSTEM

This alarm system is a 120 Vac alarm system. Power is supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. When the main deck fan room door is open, an alarm buzzer and light on the alarm switchboard in the pilothouse is activated. There is no local switch to disable the alarm.

FREEZER ALARM SYSTEM

The freezer alarm system consists of three pilot lights, switches, and a buzzer. The system power is supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. The switches are located in the thaw room, chill room, and freezer room. When operated, the switches energize the buzzer in the galley to alert personnel that someone is trapped in the room. Refer to figure 5 for the freezer alarm block schematic.

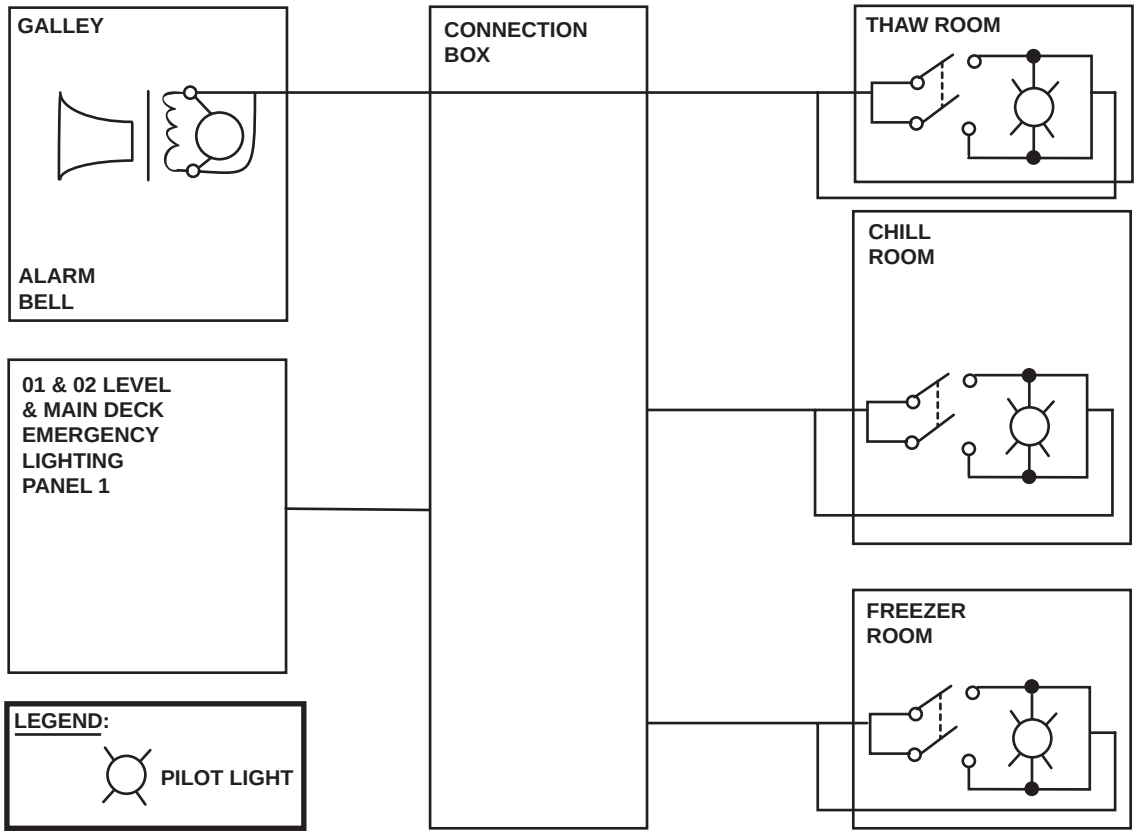


Figure 5. Freezer Alarm Block Diagram

FM-200 FIRE SUPPRESSION ALARM SYSTEM

GENERAL

The FM-200 fire suppression alarm system is a manually actuated, stand-alone total flooding fire suppression system. The engine room and AMS 1 are equipped with the FM-200 fire suppression system. The FM-200 fire suppression alarm system consists of two pressure actuated switches, amber strobe lights, electric horns, and an alarm bell. Refer to figure 6 for the FM-200 fire suppression alarm system schematic.

When the FM-200 system is actuated, pressurized CO_2 from the system's actuating circuit closes the alarm system's pressure actuated switch. These switches, in turn, energize the alarm system's strobe lights, horns, and bell. Once the alarm begins sounding, the occupants of the engine room and AMS 1 have 60 seconds to evacuate the space prior to discharge of the FM-200 fire suppression agent.

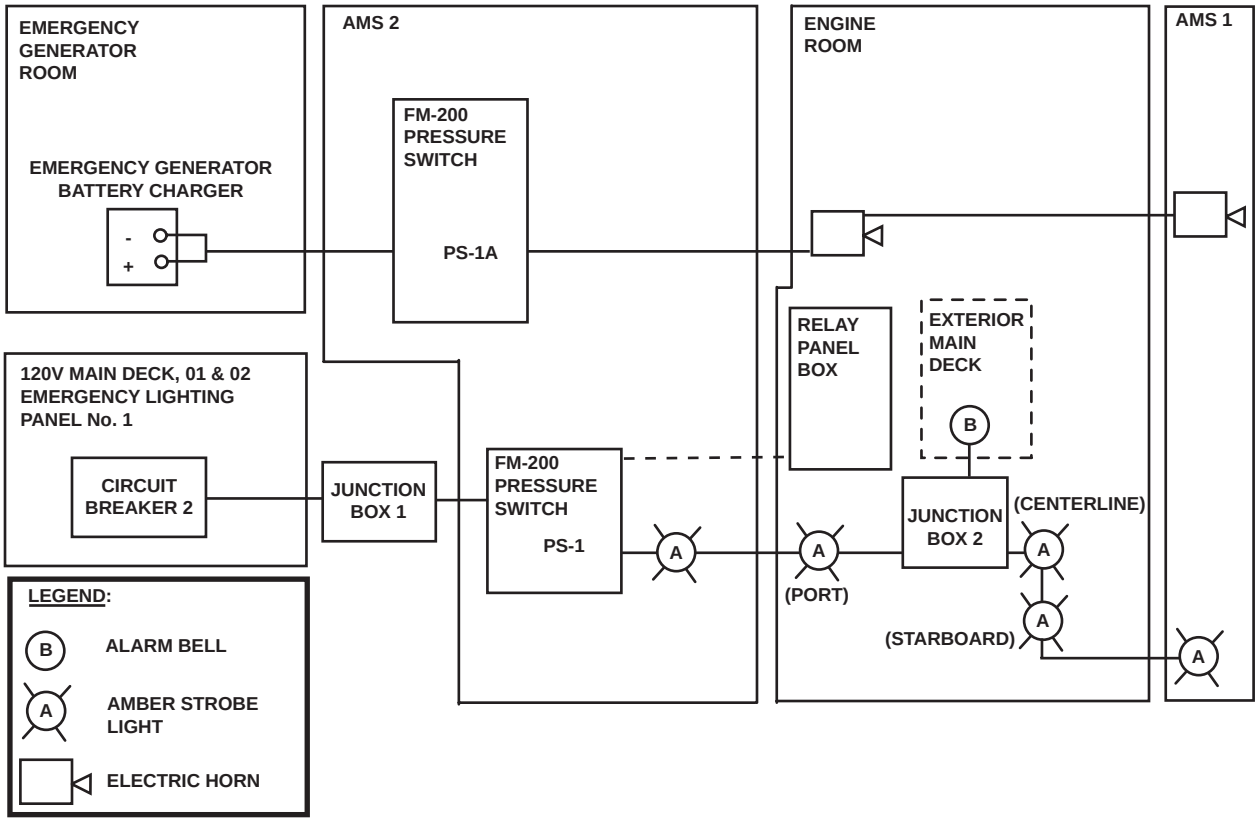


Figure 6. FM-200 Fire Suppression Alarm System Schematic

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEMS

GENERAL

The Heating, Ventilation, and Air Condition system (HVAC) supplies the Large Tug (LT) with controlled heat and conditioned air. The HVAC system also controls the exhaust and vented air circulation in appointed areas on the vessel (figures 1, 2, 3, and 4). Major components of the HVAC system include the following:

DUCT HEATERS

Duct heaters are flange mounted electric heaters installed in ducting. These heaters are referred to as preheaters or reheaters depending on their application.

PREHEATER

The preheater heats outside air before distribution.

REHEATER

The reheater ensures that air supplied to a compartment is at the proper temperature.

CONVECTION HEATER

The convection heaters are convection type electric space heaters. They are used in the laundry spaces and sanitary spaces.

SPACE HEATERS

The space heaters are forced air electric space heaters. The space heaters are used in machinery spaces, laundry spaces, and the bow thruster compartment and towing gear locker.

NATURAL SUPPLY AND EXHAUST VENTS

Natural supply vents are provided in the towing gear locker, emergency generator room, and bow thruster compartment. Exhaust vents are provided in AMS 1 and AMS 2.

VENTILATION FANS

All ventilation fans are vaneaxial direct drive, with electric motors that provide forced air ventilation. The galley supply fan, galley ventilator hood exhaust fan, sanitary space exhaust fans, and workshop exhaust fan are single speed fans. All other workspace fans are 2-speed fans.

FAN COIL UNITS

Fan coil units contain a coil for cooling (air conditioning); a preheater (for heating the spaces); and a single speed electric motor, belt-driven centrifugal fan. Two horizontal fan coil units are provided on the LT. One unit serves the main deck spaces, the other serves the 01 level and above.

EOS AIR CONDITIONER

The EOS air conditioner supplies heated or cooled air. An integral fan provides forced air.

AIR CONDITIONING CONDENSER UNITS

The vessel's two fan coil units are supplied with refrigerant by two condensing units located in AMS 2. Each condensing unit has a capacity of 14. 6 tons of refrigeration under normal operating conditions. Controls are provided for automatic operation and capacity variation for light loads. Refer to WP 0038 00 for condensing unit details.

PILOTHOUSE ROOFTOP AIR CONDITIONING UNITS

Two heating and cooling units provide conditioned air to the pilothouse. The two units are mounted on the pilothouse rooftop and are controlled by separate programmable thermostats located on the pilothouse console. Each unit has a washable filter in the return duct.

RADIO ROOM ROOFTOP AIR CONDITIONING UNIT

The radio room rooftop air conditioning unit provides conditioned air to the radio room. The condenser unit is mounted on the pilothouse rooftop and the fan cooling unit is mounted in the radio room. The radio room rooftop air conditioning unit is controlled by a remote control programmable thermostat located in the radio room.

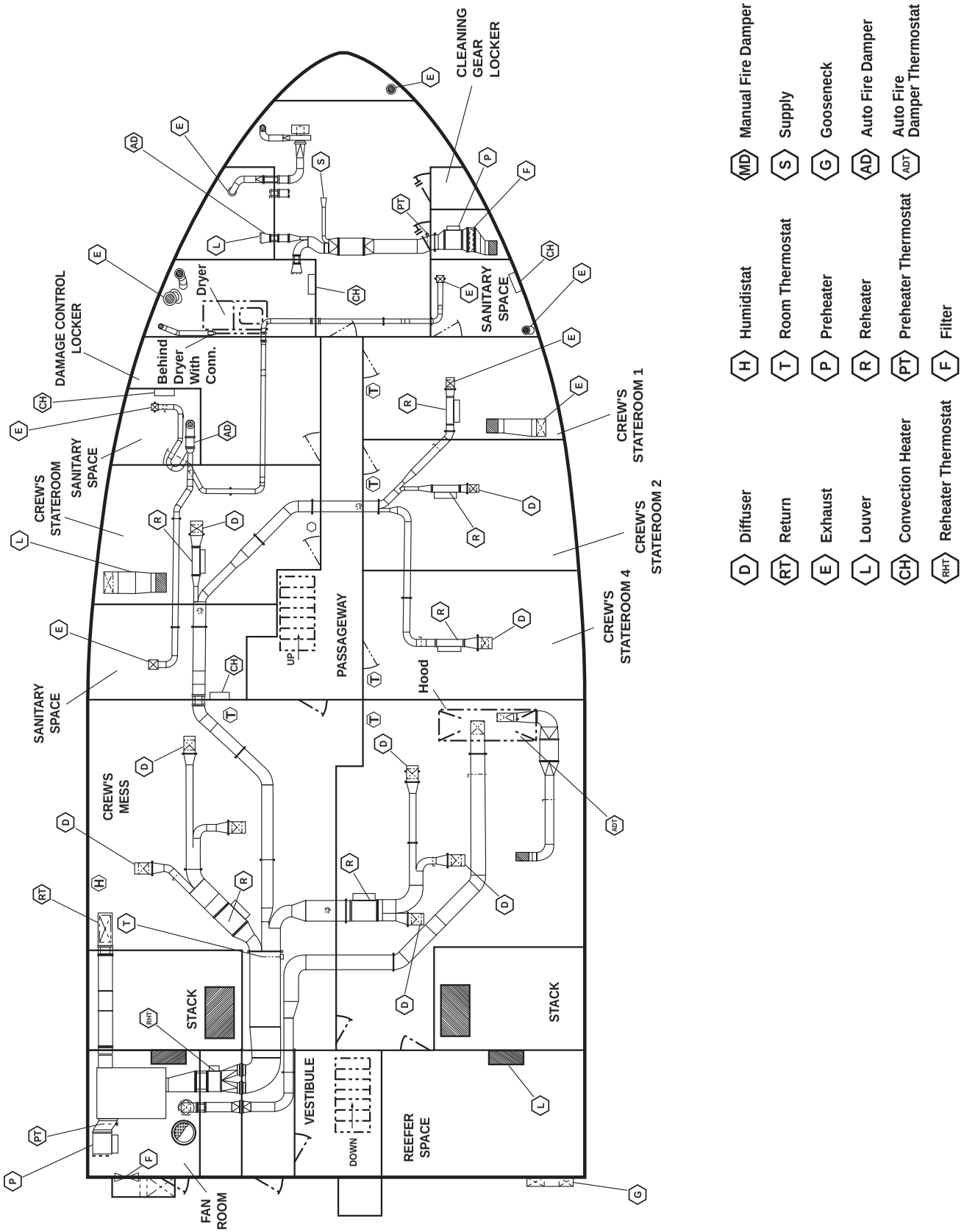


Figure 1. Main Deck

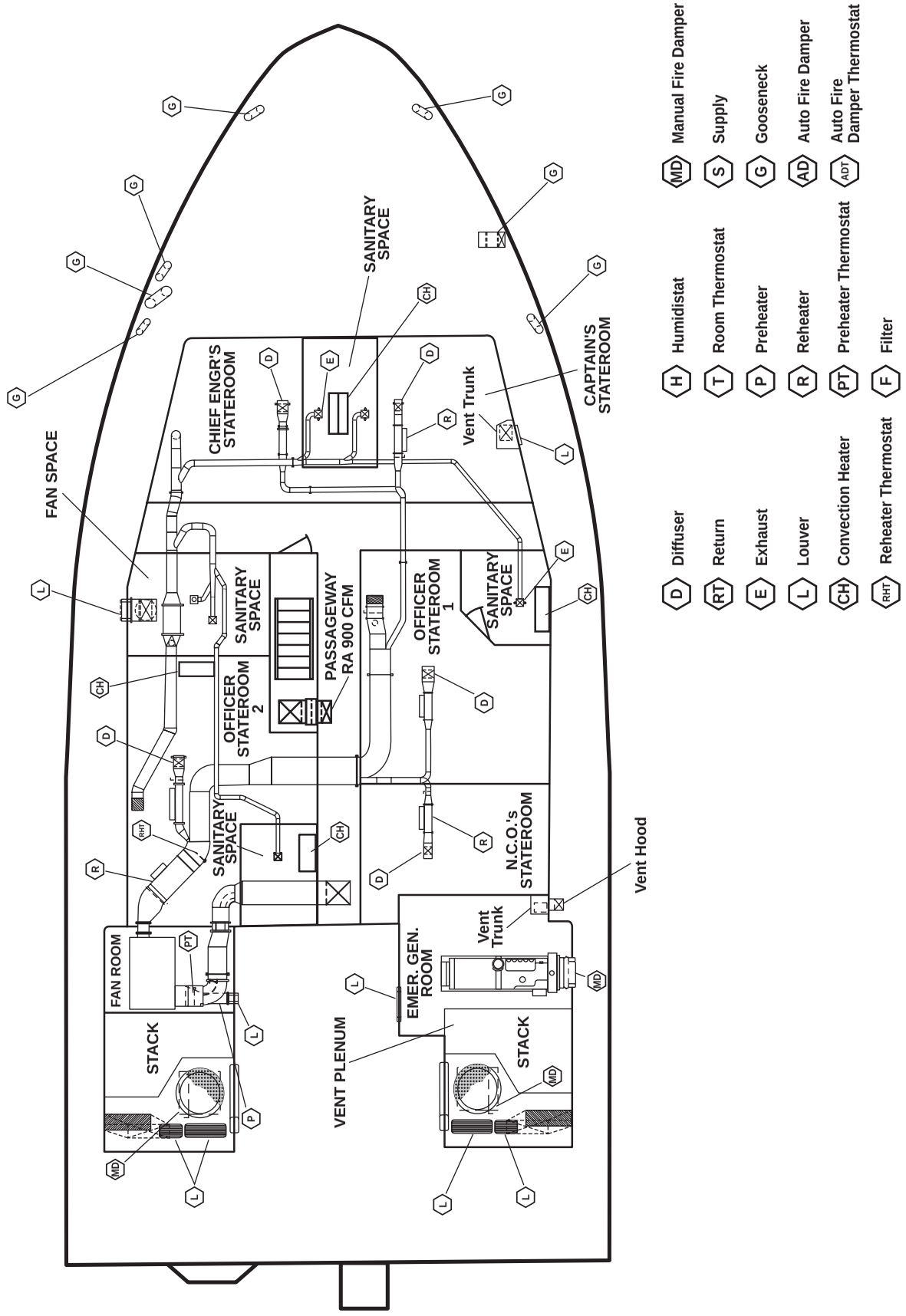
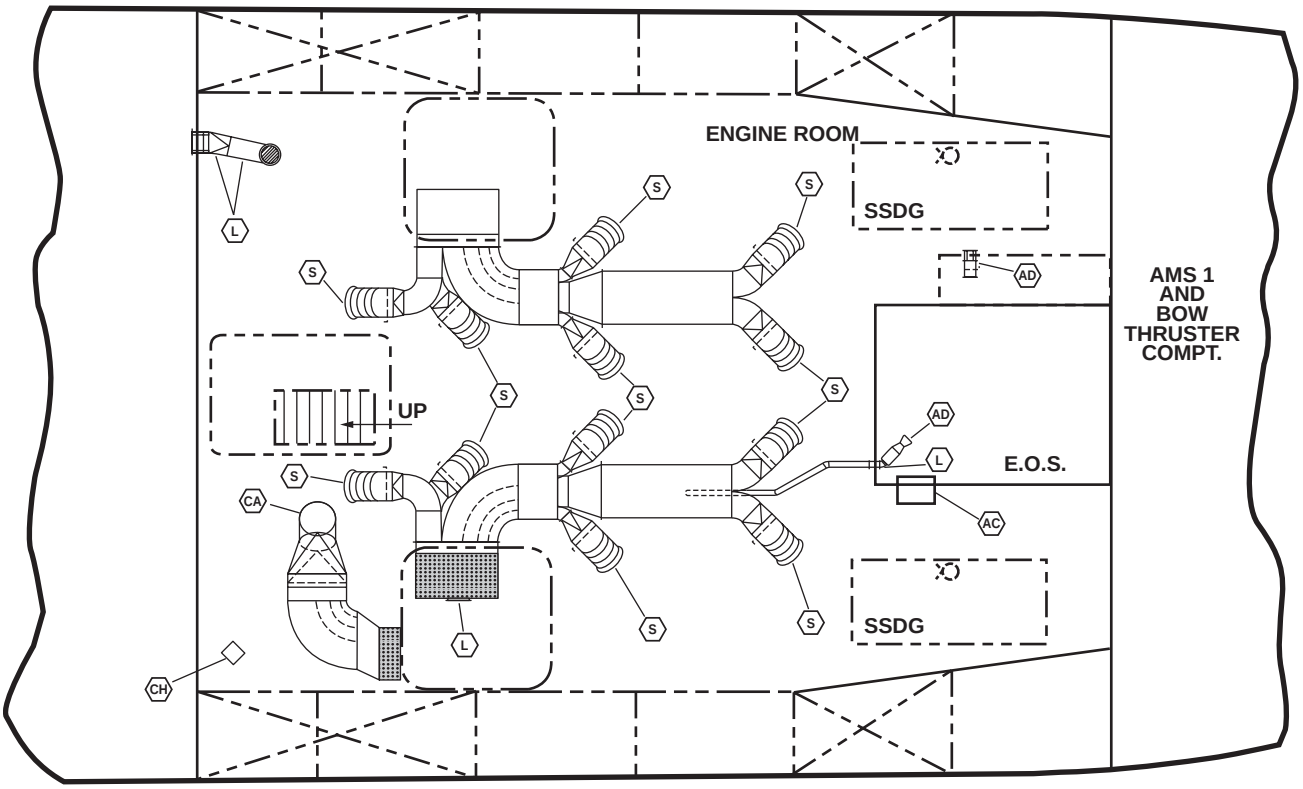
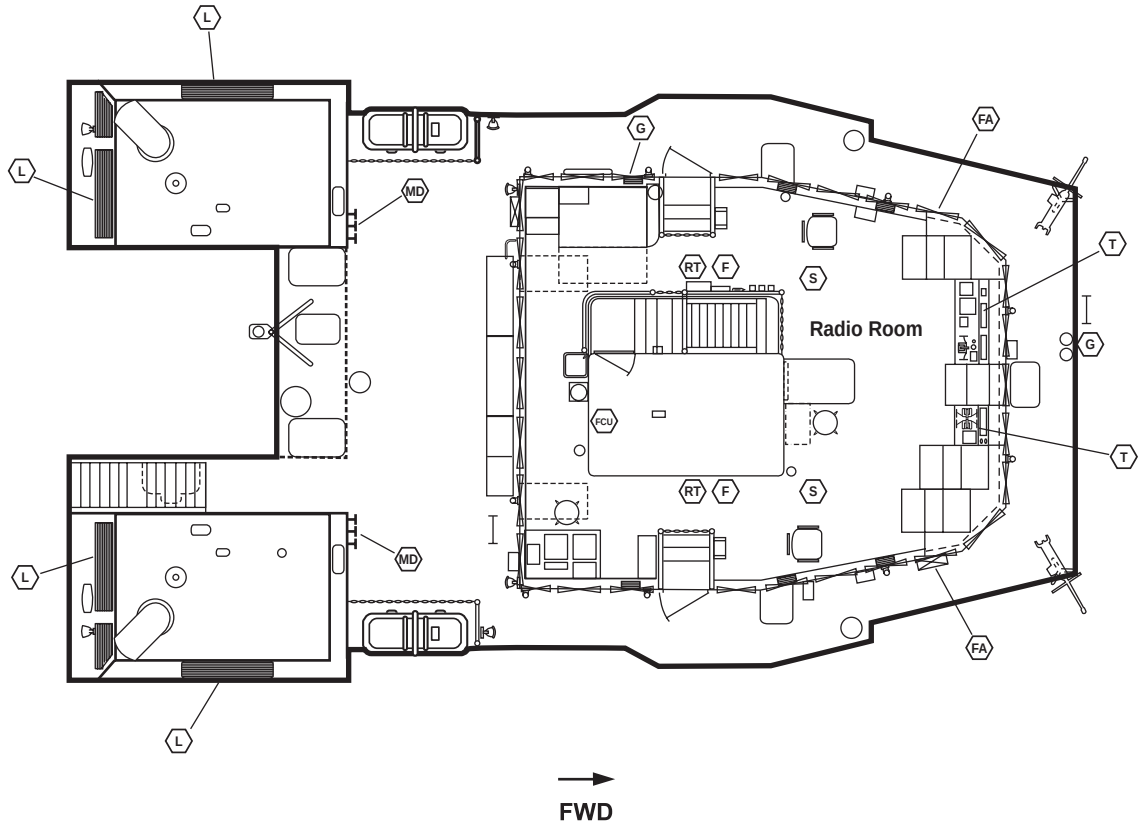


Figure 2. 01 Level



D Diffuser	H Humidistat	MD Manual Fire Damper
RT Return	T Room Thermostat	S Supply
E Exhaust	P Preheater	G Gooseneck
L Louver	R Reheater	AD Auto Fire Damper
CH Convection Heater	PT Preheater Thermostat	ADT Auto Fire Damper Thermostat
RHT Reheater Thermostat	F Filter	AC EOS AC Unit
CA Main Engine Combustion Air		

Figure 3. Engine Room



D	Diffuser	H	Humidistat	MD	Manual Fire Damper
RT	Return	T	Room Thermostat	S	Supply
E	Exhaust	P	Preheater	G	Gooseneck
L	Louver	R	Reheater	AD	Auto Fire Damper
CH	Convection Heater	PT	Preheater Thermostat	ADT	Auto Fire Damper Thermostat
RHT	Reheater Thermostat	F	Filter	RHT	Fan Cooling Unit
FA	Fresh Air				

Figure 3. 02 Level

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
REFRIGERATION SYSTEM

The Large Tug (LT) refrigeration system provides cooling for the chill box, walk-in freezer, and thaw room (refer to figures 1 and 2). Major components of the refrigeration system include: two condensing units (figure 2) two unit coolers (figure 2), an expansion valve (figure 2), compressor (figure 2), condenser (figure 2), receiver (figure 2), local controls and indicators, and control box (figure 2).

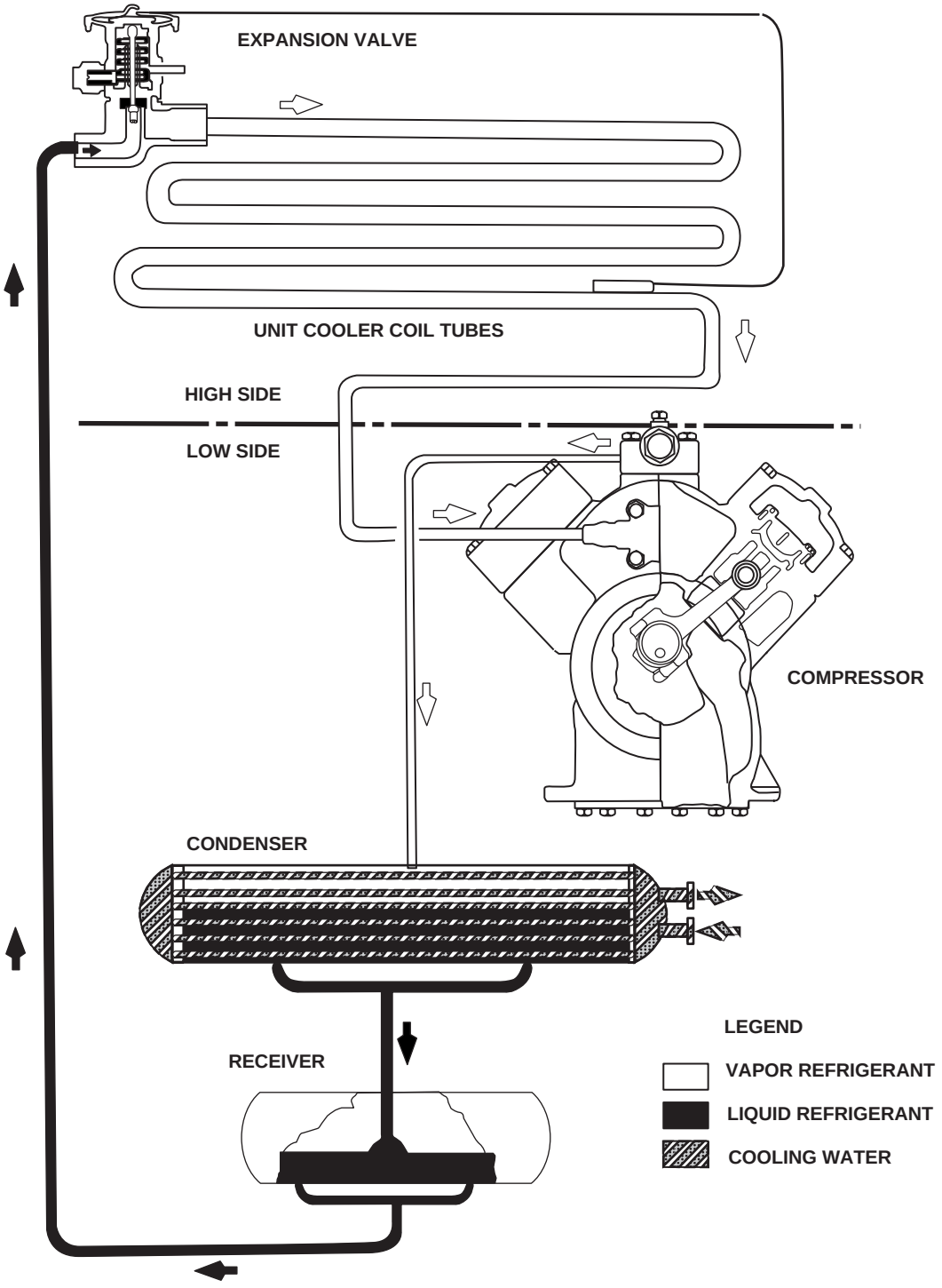
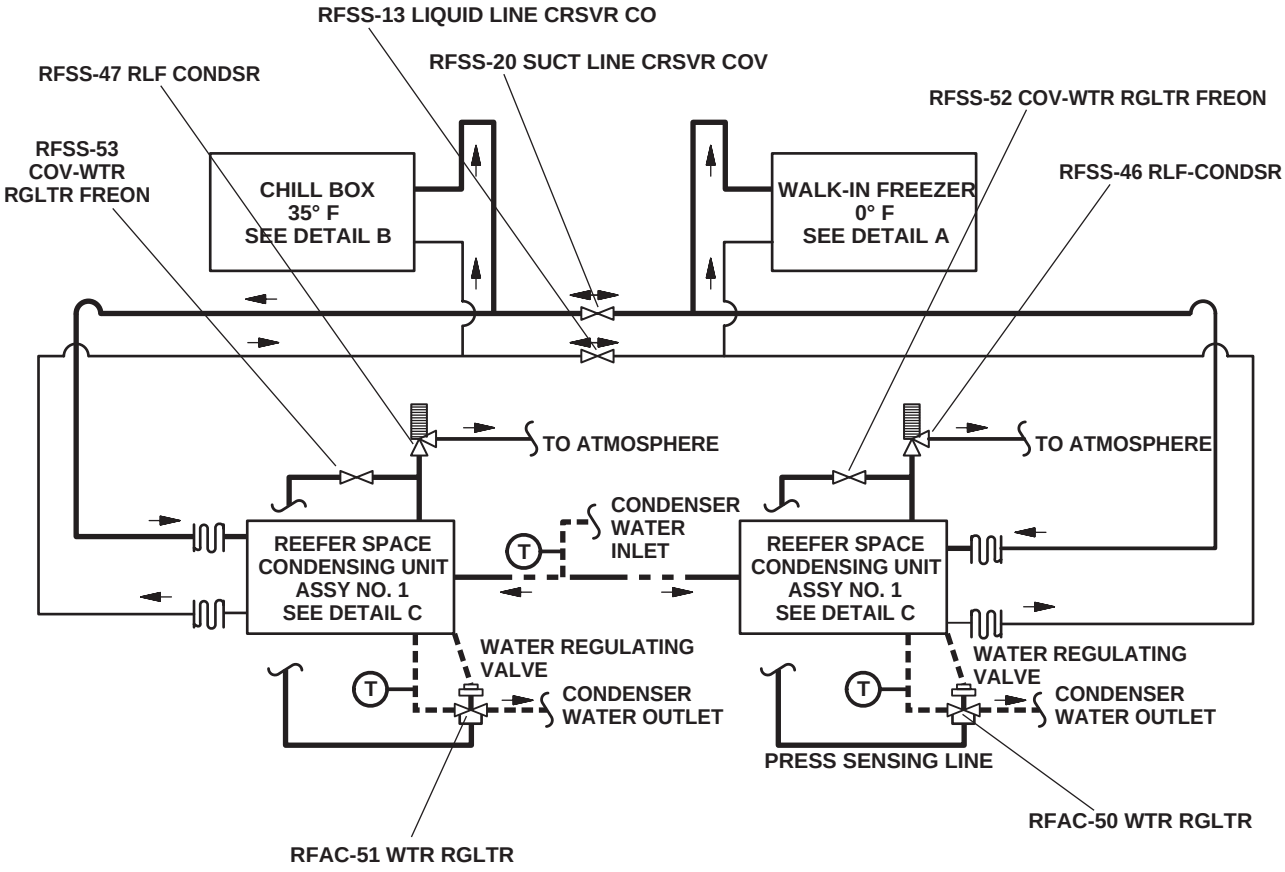


Figure 1. Typical Refrigeration Cycle

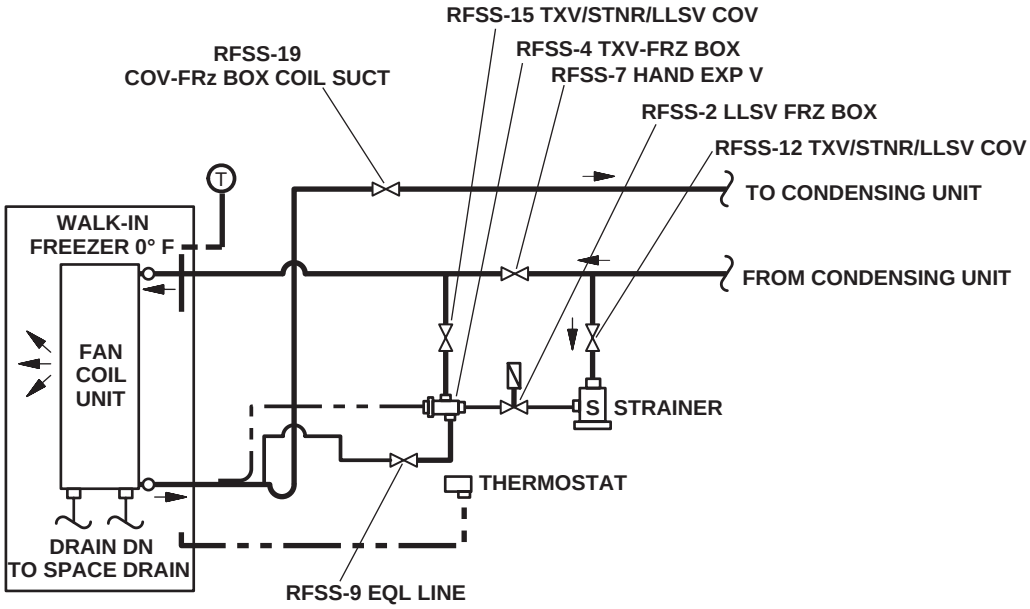


AMS-2 INTERCONNECTING PIPING

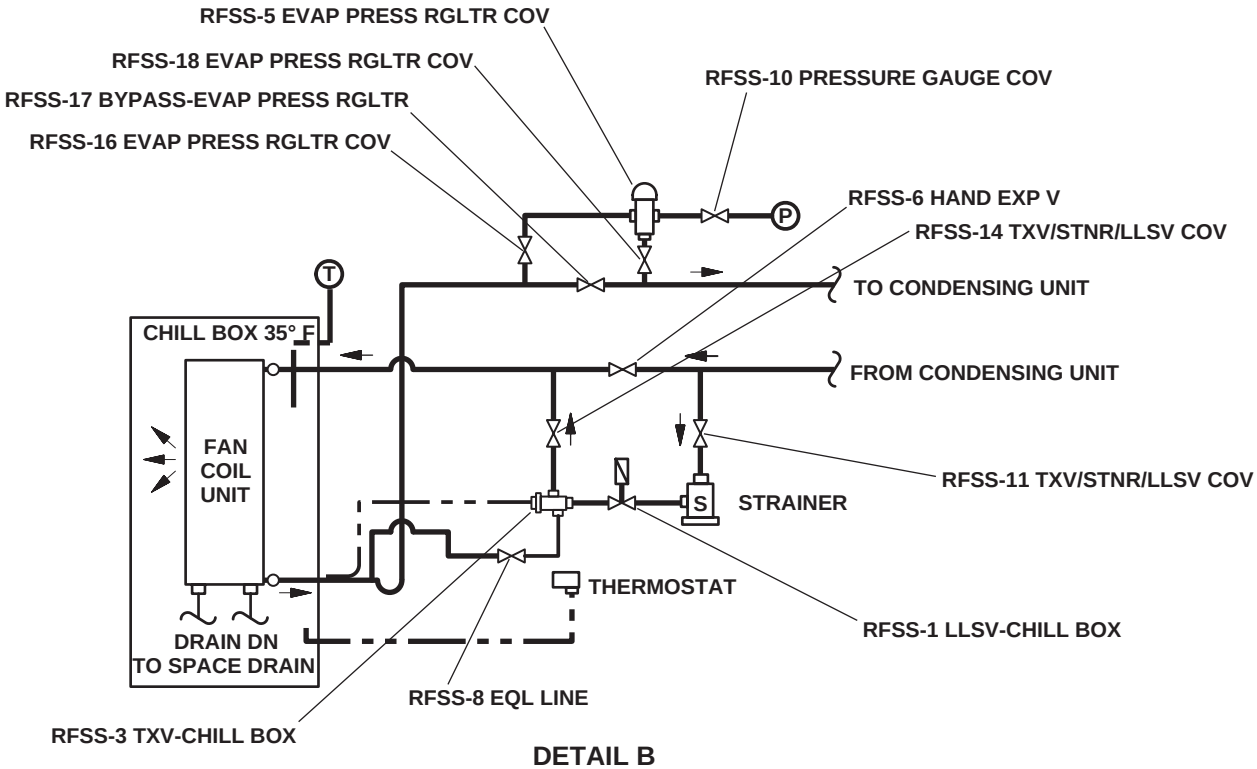
Abbreviations/Acronyms

COV	Cutoff Valve
EQL	Equalizing
EVAP	Evaporator
EXP	Expansion
FRZ	Freeze
LLSV	Liquid Line Solenoid Valve
PRESS	Pressure
RFSS	Refrigeration, Ship's Service
RGLTR	Regulator
STNR	Strainer
SUCT	Suction
TXV	Thermal Expansion Valve
V	Valve

Figure 2. Refrigeration System (Sheet 1 of 3)



DETAIL A
WALK-IN FREEZER



DETAIL B
CHILL BOX

Figure 2. Refrigeration System (Sheet 2 of 3)

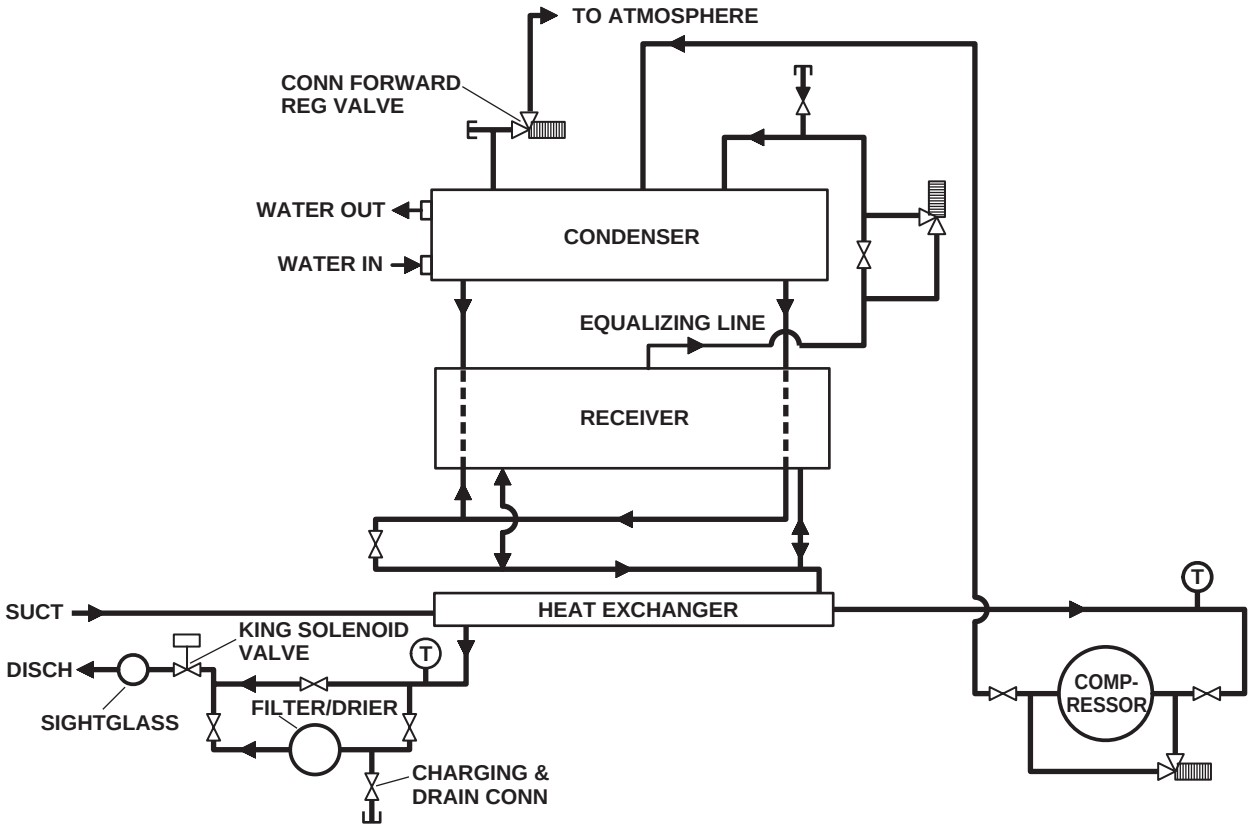


Figure 2. Refrigeration System (Sheet 3 of 3)

CONDENSER UNIT

The condenser unit is the system's heat exchanger. It transfers heat from the refrigerant to raw water circulated by the general service system.

UNIT COOLER

The unit cooler contains coils that transfer heat from the air to the refrigerant. Two fans circulate air across the coils to improve heat transfer. A timer provides timed defrost cycles for the freeze room unit to clear the coils of frost buildup. This circuit is also fitted with a "fail safe" feature to prevent the defrost cycle from running too long. Water generated from the defrost cycle drains to a drip pan (figure 2) and into drain lines. Drain lines within the refrigerated spaces are fitted with heat tape to prevent freezing.

EXPANSION VALVE

The expansion valve (figures 1 and 2) regulates the amount of refrigerant delivered to the cooling coil. The amount of refrigerant needed in the coil depends on the temperature of the space being cooled.

COMPRESSOR

The compressor compresses heated refrigerant from the unit cooler to improve heat transfer in the condenser.

RECEIVER

The receiver serves as a liquid refrigerant reservoir. It receives liquid refrigerant from the condenser unit and supplies it to the expansion valve.

CONTROL BOX

A control box, mounted on the condenser, provides controls and indicators necessary for operation of the condenser unit.

LOCAL CONTROLS AND INDICATORS

Local controls and indicators include a defrost timer for the freezer room, thermostats for the chill room and freezer room, and temperature gauges for the chill room, freezer room, and thaw room.

REFRIGERANT SYSTEM OPERATION

The local controls and indicators on the control box communicate the desired temperatures and functions for the chill room, freezer room, and thaw room. The local controls and indicators also indicate the current temperatures for the chill room, freezer room, and thaw room. Liquid refrigerant is supplied to the unit cooler tubes (figure 1) by the expansion valve (figure 1), which is actuated by both pressure and temperature of the refrigerant in the system. The refrigerant then flows through unit cooler tubes where it evaporates (figure 1). As the refrigerant evaporates, it absorbs heat from the air passing over the unit cooler tubes. After leaving the unit coolers, the gaseous refrigerant is routed to the compressor. On the down stroke of the compressor's (figure 1) piston, refrigerant vapor flows into the compressor (figures 1 and 2). The compressor (figure 1) compresses this refrigerant vapor, raising its temperature and pressure. The compressor (figure 1) discharges the now high-pressure, superheated refrigerant vapor to the condenser (figure 1), where it flows around the tubes through which raw water is being circulated. As the refrigerant vapor transfers its heat to the raw water, the temperature of the refrigerant vapor drops to the condensing point, turning the refrigerant vapor into liquid. The refrigerant, now in liquid form, is sub-cooled slightly below its condensing point. The refrigerant liquid flows on to the receiver (figure 1). The receiver (figure 1) acts as a temporary storage space and surge tank for the liquid refrigerant. The receiver also serves as a vapor seal to keep vapor out of the liquid line to the expansion valve. The refrigerant begins its cooling cycle again.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
DECK MACHINERY

CENTRAL HYDRAULIC POWER UNIT (HPU)

Under usual conditions the central hydraulic system HPU supplies hydraulic power to the anchor windlass, the capstan, the deck crane, and the tow pins. The central HPU can also be aligned to power the towing machines in an emergency. The central hydraulic system HPU is comprised of two electric motor-driven hydraulic pumps, a system relief valve, a system pressure gauge, a reservoir, suction and return filters, safety monitoring and shutoff devices, and a central hydraulic power unit motor controller. Each component is described in greater detail in the paragraphs below. Following the description of the components, an overview of the unit's operation is presented.

HYDRAULIC PUMPS

Two hydraulic pumps (figure 1, item 1) provide hydraulic pressure and flow to the central hydraulic system. Each pump is rated at 32 gal/min (121 L/min) at 2550 PSI (176 bar). Each pump is driven by its own 50 horsepower (37.3 kW) electric motor (figure 1, item 2). During normal operation, only one pump is operated. Under special circumstances, when hydraulic flow demands are high, both pumps may be operated. However, the hydraulic fluid temperature must be closely monitored during two-pump operation to prevent overheating of the system. Spring loaded check valves (figure 1, item 3) are provided at the outlet of each pump to prevent backflow through the idle pump when only one pump is in use. The spring loaded check valves are permanently set to OPEN at 7 PSI (0.5 bar) to provide minimal restriction to hydraulic flow.

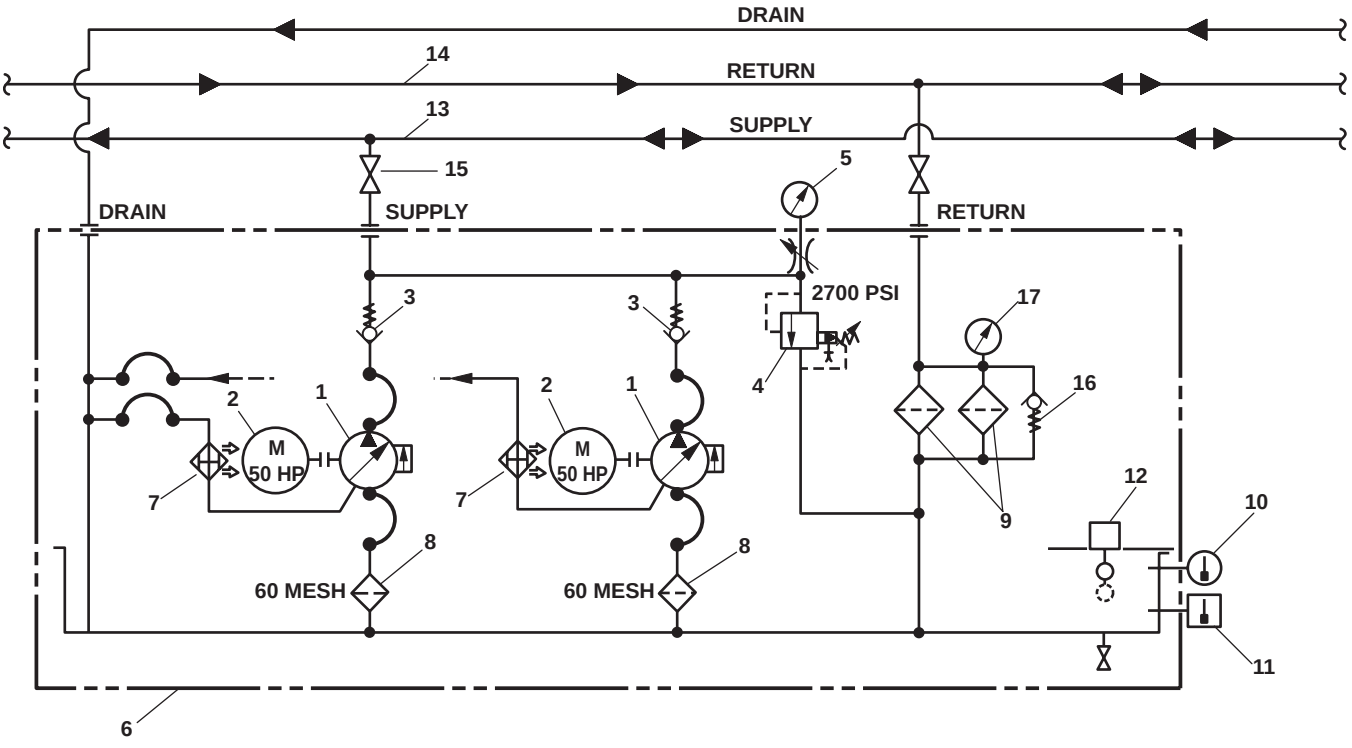


Figure 1. Central Hydraulic Power Unit Hydraulic Schematic

SYSTEM RELIEF VALVE

A single system relief valve (figure 1, item 4) provides protection against overpressurization of the central hydraulic system. If the system pressure exceeds 2700 PSI (186 bar), the relief valve opens and vents the excess pressure back to the reservoir.

SYSTEM PRESSURE GAUGE

A system pressure gauge (figure 1, item 5) provides a direct indication of the system's operating pressure. The gauge reads from 0 to 5000 PSI (0 to 345 bar).

RESERVOIR

A 150 gallon (568 liter) reservoir (figure 1, item 6) stores the hydraulic fluid for the central hydraulic system. The reservoir also provides a mounting location for most of the central HPU's components. The central hydraulic system's fluid is cooled by dissipating its heat through the walls of the reservoir to the air in the engine room. Hydraulic fluid coolers (figure 1, item 7) are provided for the hydraulic pump drain fluid. These hydraulic fluid to air coolers are mounted inboard of the electric motors.

SUCTION AND RETURN FILTERS

Suction strainers (figure 1, item 8) are provided at the inlet for each hydraulic pump (figure 1, item 1) to remove large particulate matter from the hydraulic fluid before it enters the hydraulic pump. Return filters (figure 1, item 9) are also provided for the system. The return filters are rated at 10 microns and remove small particulate matter from the hydraulic fluid as it is returned to the reservoir.

SAFETY MONITORING AND SHUTOFF DEVICES

A 0-250 °F (-17 to 121 °C) temperature gauge (figure 1, item 10) is provided to monitor hydraulic fluid temperature in the reservoir. The temperature gauge is supplemented by a 180 °F (82 °C) high temperature cutoff switch (figure 1, item 11). When the hydraulic fluid temperature exceeds 180 °F (82 °C), the cutoff switch illuminates the HIGH OIL TEMP lamp, sounds an alarm, and secures power to the hydraulic pumps' electric motors (figure 1, item 2). The central hydraulic system is also protected by a low level switch (figure 1, item 12). This switch indicates either FULL or LOW for the reservoir fluid level. When the hydraulic fluid level reaches the LOW mark (98 gallons (371 liters)), the switch illuminates the LOW OIL LEVEL lamp, sounds an alarm, and secures the power to the hydraulic pump's electric motors.

CENTRAL HYDRAULIC POWER UNIT MOTOR CONTROLLER

The central hydraulic power unit motor controller (figure 2, item 1), mounted forward and above the system's reservoir, provides the primary source of control for the central hydraulic system. Remote START/STOP control of the system is also provided via controls on the EOS console (figure 3).

The central hydraulic power unit motor controller contains a REMOTE/OFF/ON selector switch (figure 2, item 2). This switch permits the operator to determine whether the ON/OFF control will be achieved locally (OFF and ON positions) or remotely (REMOTE position) from the EOS. The P1/P2/P1&P2 selector switch (figure 2, item 3) permits the operator to select which pump(s) will operate when the system is turned ON. The MAIN SWITCH (figure 2, item 4) is the primary power disconnect for the system's electric power. READY (figure 2, item 5) and RUNNING (figure 2, item 6) indicator lights are provided for each pump to indicate the pump's condition. LOW OIL LEVEL (figure 2, item 7) and HI OIL TEMP (figure 2, item 8) lights are also provided to signal these alarm conditions. The final components of the control panel are the reset switches (figure 2, item 9). These pushbutton switches permit the operator to reset the electric motor(s) after the thermal resets have tripped.

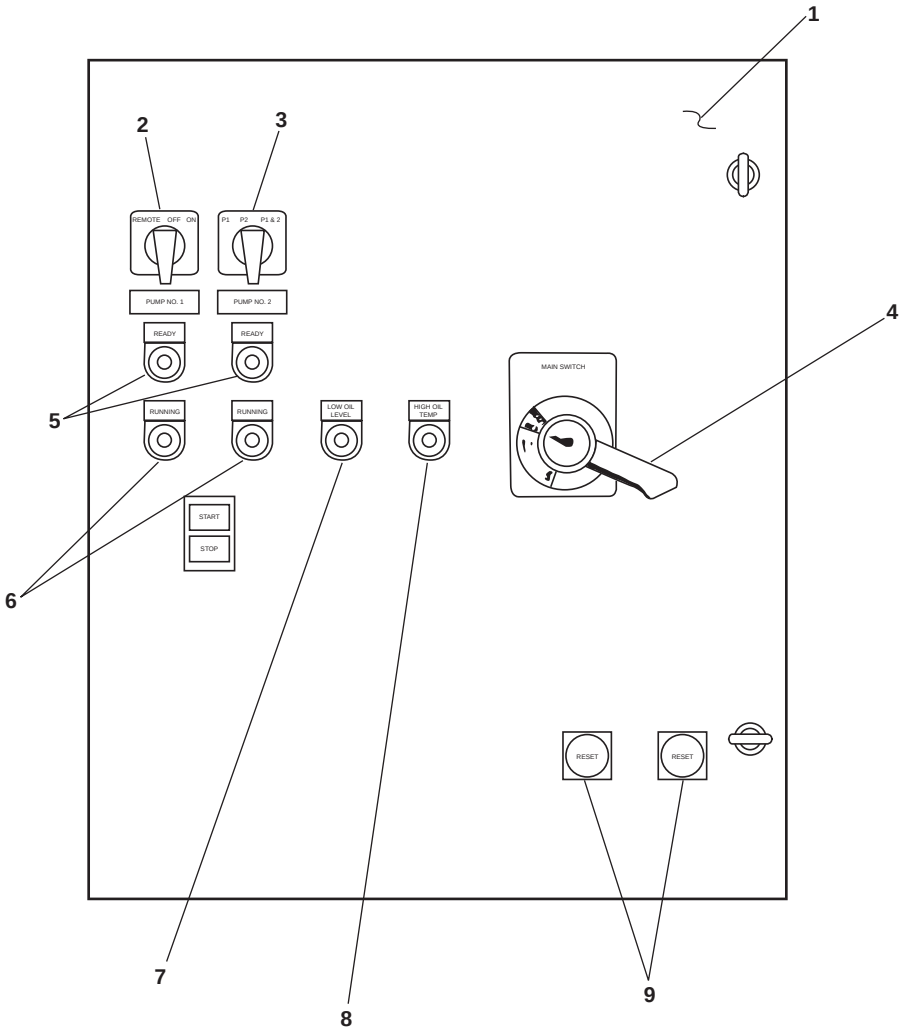


Figure 2. Central Hydraulic Power Unit Motor Controller

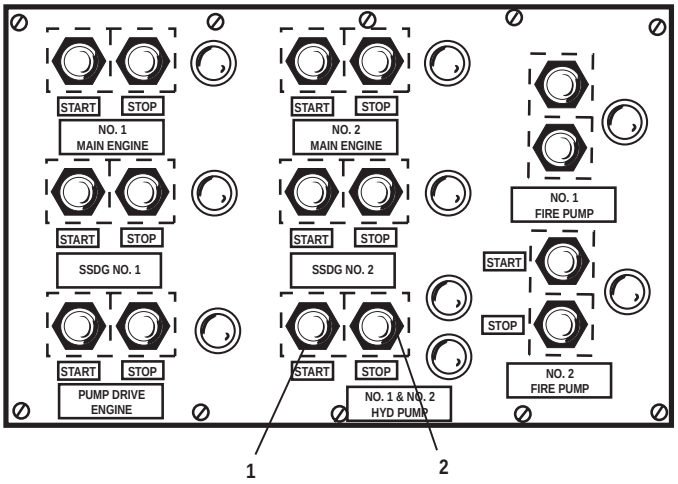


Figure 3. Machinery Control Panel in EOS

HYDRAULIC OPERATION

When the operator powers up one or both hydraulic pumps, power is sent to the electric motor(s) (figure 1, item 2) for the selected hydraulic pump(s) (figure 1, item 1). Once the hydraulic pump is turning, it draws hydraulic fluid through the suction strainer (figure 1, item 7) and into the hydraulic pump. The hydraulic pump pressurizes the hydraulic fluid in response to the amount of restriction on the system. If the restriction is low (no load applied), system pressure is very low. If the restriction is high (load applied), the system pressure will vary in response to the load. The pressurized hydraulic fluid exits the hydraulic pump and flows through the supply piping (figure 1, item 13) to the downstream components (capstan, anchor windlass, deck crane, and tow pins), where the hydraulic pressure and flow are transformed into physical work. Hydraulic fluid exiting the downstream components returns to the reservoir (figure 1, item 6) through the return piping (figure 1, item 14) and the return filters (figure 1, item 9).

If the restriction is extraordinarily high due to an overloaded downstream component or a closed cutoff valve (figure 1, item 15), the system relief valve opens at 2700 PSI (186 bar) to vent hydraulic fluid back to the reservoir (figure 1, item 6). This prevents catastrophic damage to the hydraulic pump, piping, and other hydraulic components.

The return filters (figure 1, item 9) are provided with a bypass valve (figure 1, item 16) and a restriction gauge (figure 1, item 17). If the filter restriction rises above 25 PSI (1.7 bar), the bypass valve opens, permitting hydraulic fluid to bypass the filters and to return to the reservoir (figure 1, item 6). Because permitting unfiltered hydraulic fluid to return to the reservoir opens the door to eventual system failure, the restriction gauge is provided to enable timely return filter changes. Performing regular filter changes helps to ensure that the central hydraulic system and its components enjoy a long service life.

ELECTRICAL OPERATION

When the main disconnect switch (figure 4, item 1) is CLOSED (ON), power is supplied to the control panel (figure 2, item 1).

Power (440 Vac) from the main disconnect switch (figure 4, item 1) flows through a transformer (figure 4, item 2) where it is converted to a lower voltage for the control circuitry. Leaving the transformer, the power is supplied to the REMOTE/OFF/ON switch (figure 4, item 3), to the low oil level switch (figure 4, item 4), and to the thermal overload reset switches (figure 4, item 5).

If the REMOTE/OFF/ON switch (figure 4, item 3) is in the OFF position, the switch is OPEN and no power is supplied to the low oil level switch's (figure 4, item 4) Normally Closed (NC) contacts. If the switch is in the ON position, the switch is CLOSED between terminals 13 and 14, supplying power to the low oil level switch's NC contacts. If the switch is in the REM position, the switch is CLOSED between terminals 21 and 22, supplying power to the REMOTE/OFF/ON switch (figure 4, item 3) in the EOS console. When the START pushbutton (figure 3, item 1) is pressed, the switch CLOSES, supplying power to the low oil level switch's NC contacts. When the STOP pushbutton (figure 3, item 2) is pressed, the switch is OPEN, securing power to the low oil level switch's NC contacts.

When power is supplied from the REMOTE/OFF/ON switch (figure 4, item 3), and when the low oil level switch's (figure 4, item 4) NC contacts are CLOSED (hydraulic fluid level is above the low mark), power is supplied to the high temperature cutoff switch (figure 4, item 6). The high temperature cutoff switch has both NC and Normally Open (NO) contacts. The NC contacts supply power to the P1/P2/P1&P2 (figure 4, item 7) switch, while the NO contacts supply power to the HIGH OIL TEMP light (figure 4, item 8).

When the P1/P2/P1&P2 switch (figure 4, item 7) is in the P1 position, the switch is CLOSED between terminals 1 and 2 and OPEN between all other terminals. This supplies power to the pump 1 control relay (figure 4, item 9). When the pump 1 control relay is powered, it CLOSES between terminals 9 and 5 and OPENS between terminals 9 and 1. This powers the pump 1 starter (figure 4, item 10) and the pump 1 RUNNING light (figure 4, item 11). When the pump 1 control relay is not powered, it CLOSES between terminals 9 and 1 and OPENS between terminals 9 and 5. This illuminates the number 1 pump READY light (figure 4, item 12) and secures power to the motor by opening the pump 1 starter.

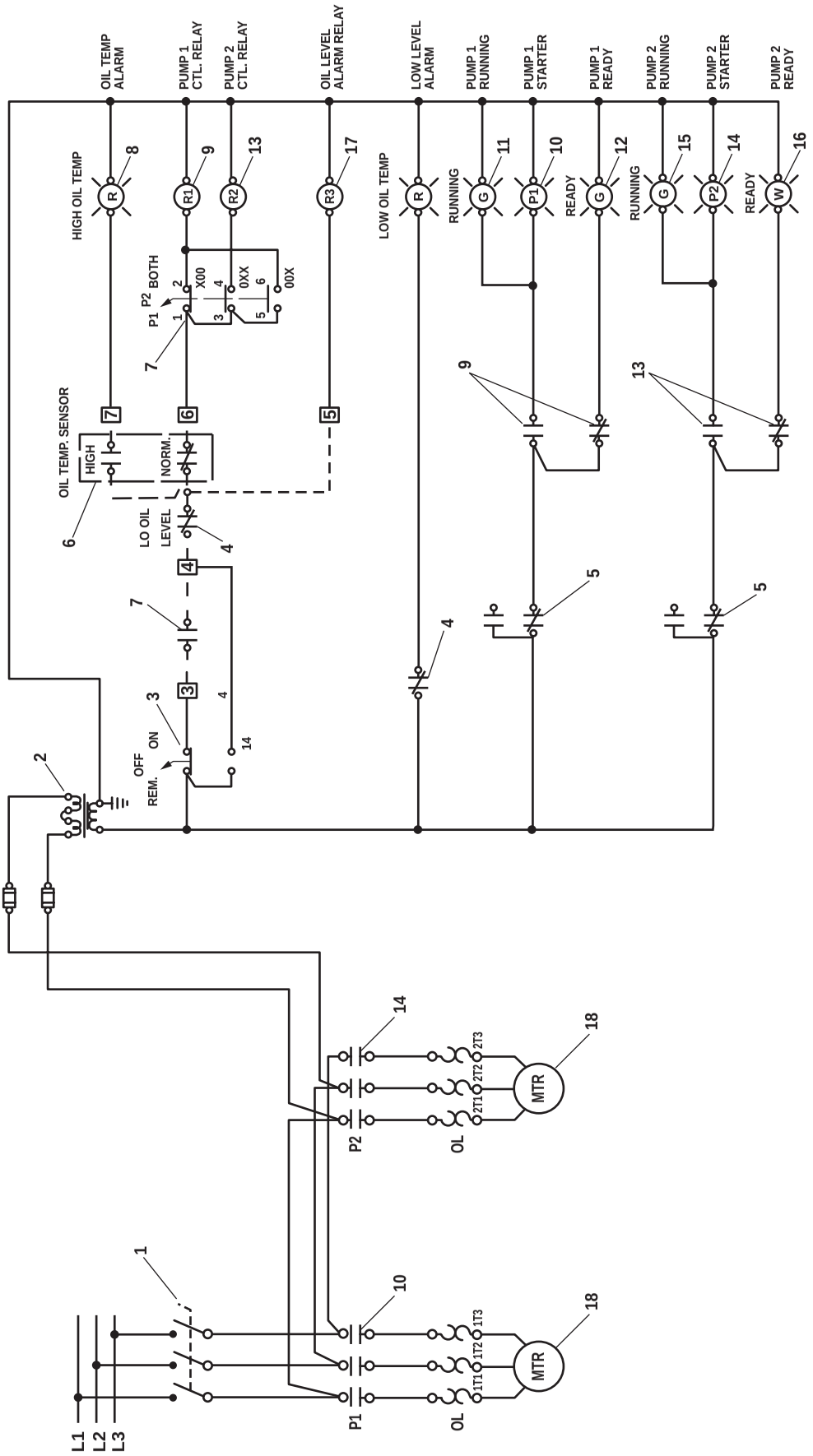


Figure 4. Central Hydraulic Power Unit Electrical Schematic

When the P1/P2/P1&P2 switch (figure 4, item 7) is in the P2 position, the switch is CLOSED between terminals 3 and 4 and OPEN between all other terminals. This supplies power to the pump 2 control relay (figure 4, item 13). When the pump 2 control relay is powered, it CLOSES between terminals 9 and 5 and OPENS between terminals 9 and 1. This powers the pump 2 starter (figure 4, item 14) and the pump 2 RUNNING light (figure 4, item 15). When the pump 2 control relay is not powered, it CLOSES between terminals 9 and 1 and OPENS between terminals 9 and 5. This illuminates the number 2 pump READY light (figure 4, item 16) and secures power to the motor by opening the pump 2 starter.

When the P1/P2/P1&P2 switch (figure 4, item 7) is in the BOTH position, the switch is CLOSED between terminals 3, 4, 5, and 6, and OPEN between terminals 1 and 2. This supplies power to both control relays (figure 4, items 9 and 13) and both starters and lights are powered as described in the two preceding paragraphs.

The low level switch (figure 4, item 4) has both NO and NC contacts. The NO contacts supply power to the LOW OIL LEVEL light (figure 4, item 17) while the NC contacts supply power to the high temperature cutoff switch (figure 4, item 7). When the hydraulic fluid level in the reservoir drops below 98 gallons (371 liters), the NO contacts CLOSE, illuminating the LOW OIL LEVEL light, and the NC contacts OPEN, securing power to the pump motors (figure 4, item 18).

TOWING MACHINE HYDRAULIC SYSTEM

The towing machine hydraulic system provides the primary power for the towing machines. In emergency situations, the towing machine hydraulic system can also be aligned to supply hydraulic power to the central hydraulic system. The towing machine hydraulic system is comprised of a diesel engine, a hydraulic pump, relief valves, a reservoir, a heat exchanger, suction and return filters, and gauges and indicators. Each of these components, except the diesel engine, is described in the paragraphs below. The diesel engine has its own technical manual (TM 55-1925-211-24). Following the description of the components, the operation of the towing machine hydraulic system is described.

HYDRAULIC PUMP

A diesel engine-driven, dual vane, hydraulic pump (figure 5, sheet 1, item 1) provides the hydraulic power for the towing machine hydraulic system. The hydraulic pump is actually two hydraulic pumps in one housing. One hydraulic pump section is rated at 69 gal/min (261 L/min) at 1800 r/min while the other hydraulic pump section is rated at 38 gal/min (144 L/min) at 1800 r/min. This dual vane hydraulic pump arrangement permits the towing machine hydraulic system, when properly configured, to supply the central hydraulic system and the towing machine hydraulic system simultaneously. Each dual vane section is provided with its own check valve (figure 5, sheet 1, item 2). The check valves prevent one vane section from backfeeding into the other during hydraulic pump operation.

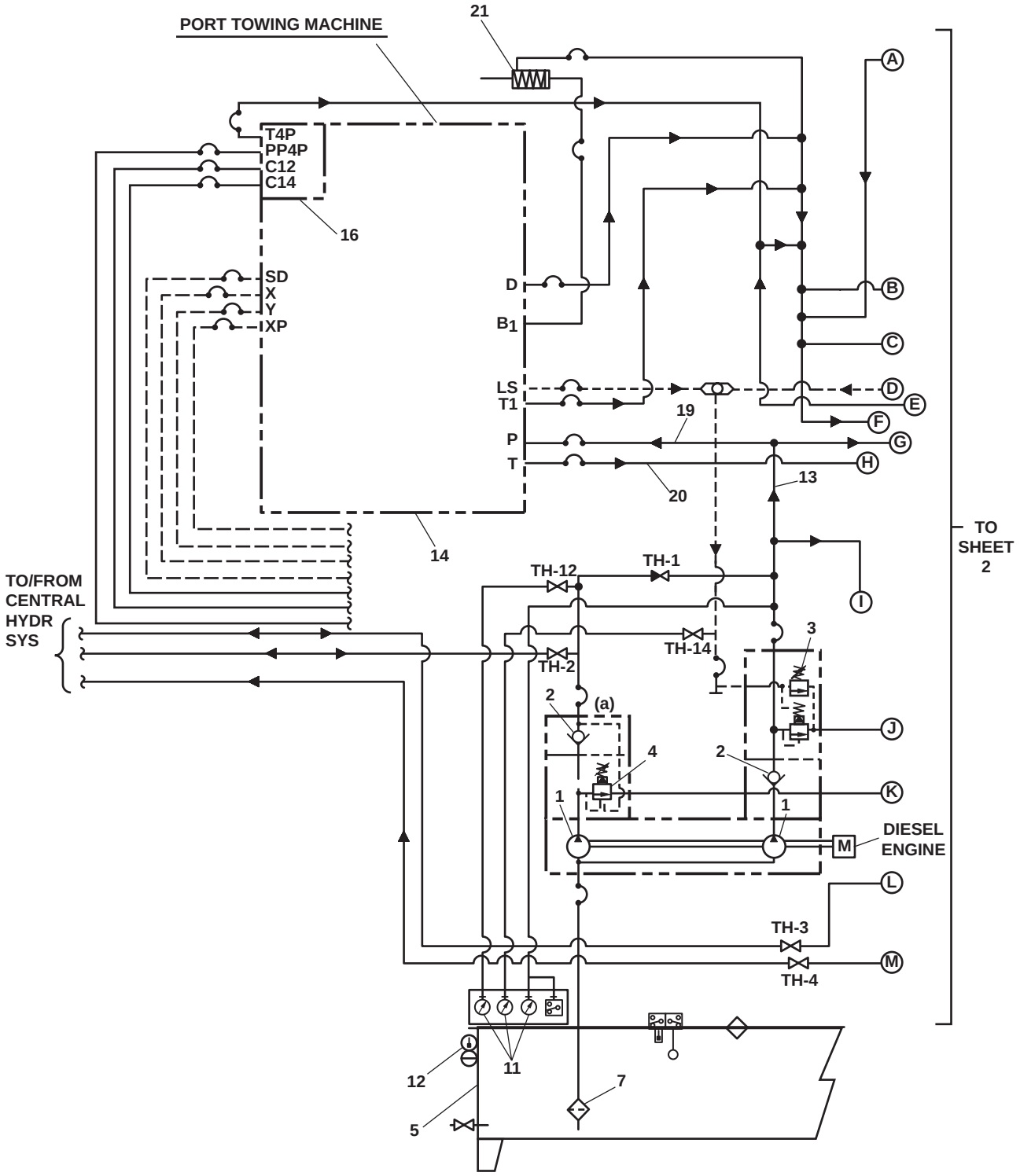


Figure 5. Towing Machine Hydraulic System (Sheet 1 of 2)

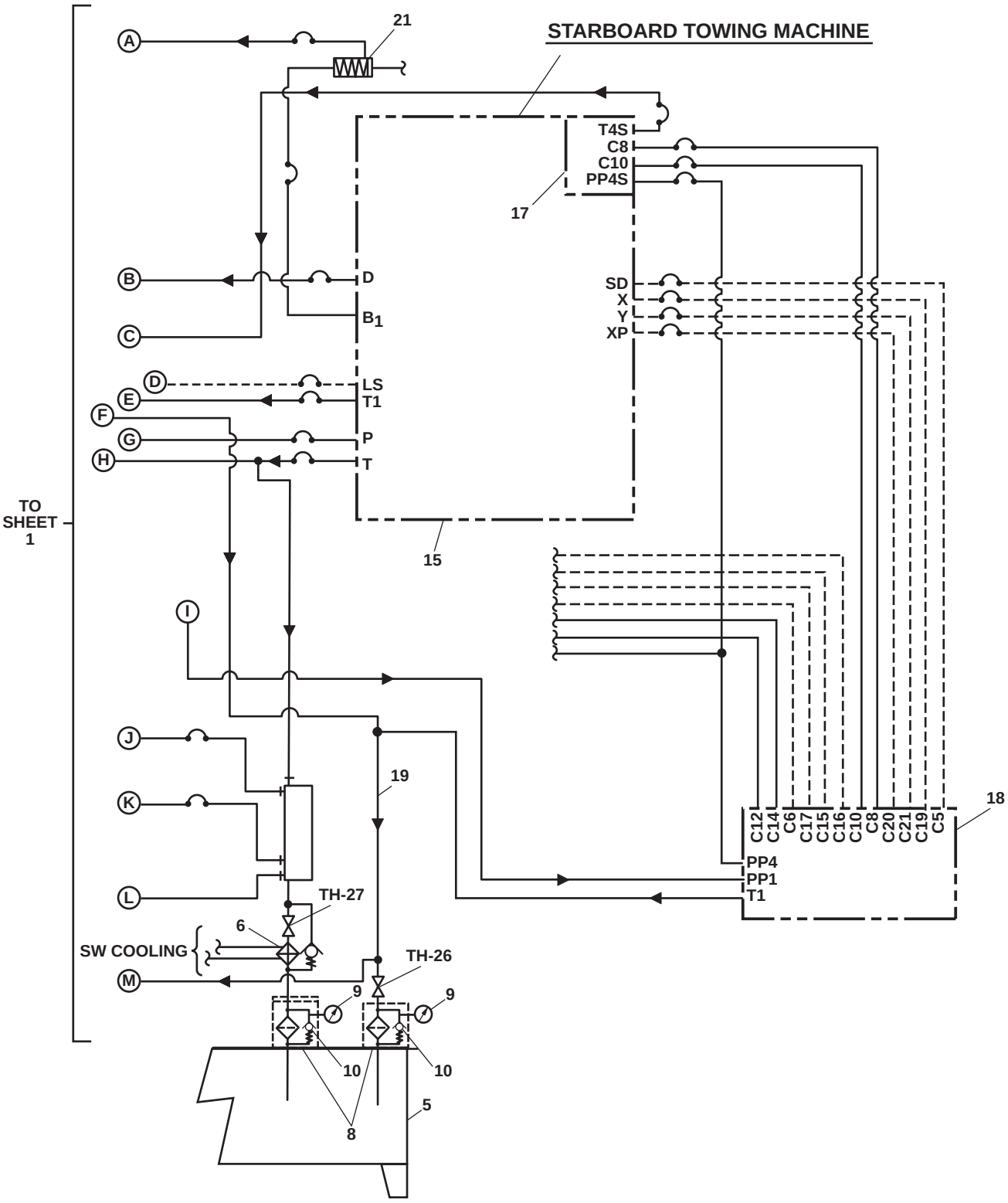


Figure 5. Towing Machine Hydraulic System (Sheet 2 of 2)

RELIEF VALVES

Two relief valves are installed in the towing machine hydraulic system. The first relief valve is the system relief (figure 5, sheet 1, item 3). This valve is set to open at 3300 PSI (228 bar) to prevent overpressurization of the towing machine hydraulic system. The second relief valve (figure 5, sheet 1, item 4) is set to open at 2800 PSI (193 bar). Under heavy system loading, this valve opens and permits the flow from the lower volume vane section to flow unrestricted back to the reservoir. This action effectively unloads the lower volume vane section, preventing the hydraulic pump from overloading the diesel engine.

RESERVOIR

A 350 gallon (1325 liter) reservoir (figure 5, sheets 1 and 2, item 5) contains the hydraulic fluid for the towing machine hydraulic system. The reservoir also acts as a mounting point for the heat exchanger, the filters, and the gauges and indicators for the towing machine hydraulic system.

HEAT EXCHANGER

A heat exchanger (figure 5, sheet 2, item 6) is provided to cool the hydraulic fluid. As the hydraulic fluid returns to the reservoir (figure 5, sheets 1 and 2, item 5), it flows through the heat exchanger where its heat is dissipated to the raw water that is pumped through the heat exchanger. A solenoid actuated valve controls raw water flow to the heat exchanger. The valve permits raw water to flow through the heat exchanger when the hydraulic fluid is hot and secures the flow when it is cold. Additional hydraulic fluid cooling is also provided by dissipation of heat through the walls of the reservoir to the air in AMS 1.

SUCTION AND RETURN FILTERS

A suction strainer (figure 5, sheet 1, item 7) is located in the hydraulic pump (figure 5, sheet 1, item 1) suction line. This suction strainer removes the larger particulate contaminants from the hydraulic fluid before it enters the hydraulic pump. Two return filters (figure 5, sheet 2, item 8) remove smaller particulate contaminants, down to 10 microns, from the hydraulic fluid before it is returned to the reservoir (figure 5, sheets 1 and 2, item 5). Each return filter is fitted with a restriction gauge (figure 5, sheet 2, item 9) and a bypass valve (figure 5, sheet 2, item 10). If the filter restriction rises above 25 PSI (1.7 bar), the bypass valve opens, permitting hydraulic fluid to bypass the filters and return to the reservoir. Because permitting unfiltered hydraulic fluid to return to the reservoir opens the door to eventual system failure, the restriction gauge is provided to enable timely return filter changes. Performing regular return filter changes helps to ensure that the central hydraulic system and its components enjoy a long service life.

GAUGES AND INDICATORS

Pressure gauges (figure 5, sheet 1, item 11) are installed to provide an indication of the system operating pressure. The gauges measure pressure from both dual vane sections of the hydraulic pump (figure 5, sheet 1, item 1) as well as drain pressure. A combination hydraulic fluid level/hydraulic fluid temperature indicator (figure 5, sheet 1, item 12) is also installed to permit monitoring of hydraulic fluid level and temperature.

SYSTEM OPERATION

When the diesel engine is started, the hydraulic pump (figure 5, sheets 1 and 2, item 1) begins turning. As it turns, it draws hydraulic fluid from the reservoir (figure 5, sheets 1 and 2, item 5) through the suction strainer (figure 5, sheet 1, item 7) and into the vane sections' inlets. The hydraulic pump pressurizes the hydraulic fluid in response to the amount of restriction on the system. If the restriction is low (no load applied), system pressure is very low. If the restriction is high (load applied), the system pressure will vary in response to the load. The pressurized hydraulic fluid exits the pump and flows through the supply piping (figure 5, sheet 1, item 13) to the towing machines (figure 5, sheet 1, item 14; figure 5, sheet 2, item 15) and their controls (figure 5, sheet 1, item 16; figure 5, sheet 2, items 17 and 18) where the hydraulic pressure and flow are transformed into physical work. Hydraulic fluid exiting the downstream components returns to the reservoir through the return piping (figure 5, sheet 2, item 19) and the return filters (figure 5, sheet 2, item 8).

CAPSTAN

The capstan (figure 6) receives its hydraulic power from the central Hydraulic Power Unit (HPU).

Both the supply (figure 6, item 1) and return (figure 6, item 2) lines flow through the capstan control valve (figure 6, item 3). When the capstan control valve is in the NEUTRAL position, the supply line is CLOSED, and no supply flow is permitted to enter the capstan motor (figure 6, item 4). At the same time, both sides of the capstan motor are OPEN to the return piping. When the capstan control valve is shifted toward the return spring, the supply is routed to the right side of the capstan motor (figure 6, item 5) and return flow comes from the left side of the capstan motor (figure 6, item 6), causing capstan motor rotation. When the capstan control valve (figure 6, item 3) position is reversed, flow to the capstan motor is reversed, reversing the direction of motor rotation.

Supply flow is controlled by a flow control valve (figure 6, item 7) that permits a maximum of 15 gal/min (57 L/min) to enter the capstan control valve (figure 6, item 3). This flow control valve prevents overspeed operation of the capstan.

Counterbalance valves (figure 6, item 8) are installed between the capstan control valve (figure 6, item 3) and the capstan motor. The counterbalance valves act as a hydraulic brake to prevent the capstan from overrunning the hydraulic motor. The counterbalance valves also ensure that the capstan motor (figure 6, item 4) will only turn when pressure is applied from the capstan control valve.

A fail safe brake (figure 6, item 9) is fitted between the capstan's gear train and the capstan motor (figure 6, item 4). This brake is a spring-applied, pressure-released design. In this design, an internal spring assembly applies the brake until hydraulic pressure is applied to release it. In the capstan circuit, hydraulic pressure is supplied to the fail safe brake assembly any time that the capstan control valve (figure 6, item 3) is moved away from the NEUTRAL position. When the capstan control valve (figure 6, item 3) is returned to the neutral position, the pressure is removed from the fail safe brake and the springs apply the brake, providing a mechanical braking action to the capstan motor output shaft.

A shuttle valve (figure 6, item 10) is provided to prevent fail safe brake pressure from returning directly to the reservoir at the counterbalance valves (figure 6, item 8).

The capstan motor (figure 7, item 1) drives the capstan through a double reduction planetary gear assembly (figure 7, item 2). The fail safe brake (figure 7, item 3) is fitted between the capstan motor and the double reduction planetary gear assembly. The double reduction planetary gear assembly decreases the speed and increases the torque of the capstan motor output shaft and transmits that torque to the double reduction planetary gear assembly output shaft (figure 7, item 4) and its attached pinion gear (figure 7, item 5). The pinion gear, in turn, drives the capstan ring gear (figure 7, item 6), further reducing output speed and increasing output torque. The ring gear is directly connected to the capstan drum (figure 7, item 7), thus ring gear rotation yields capstan drum rotation.

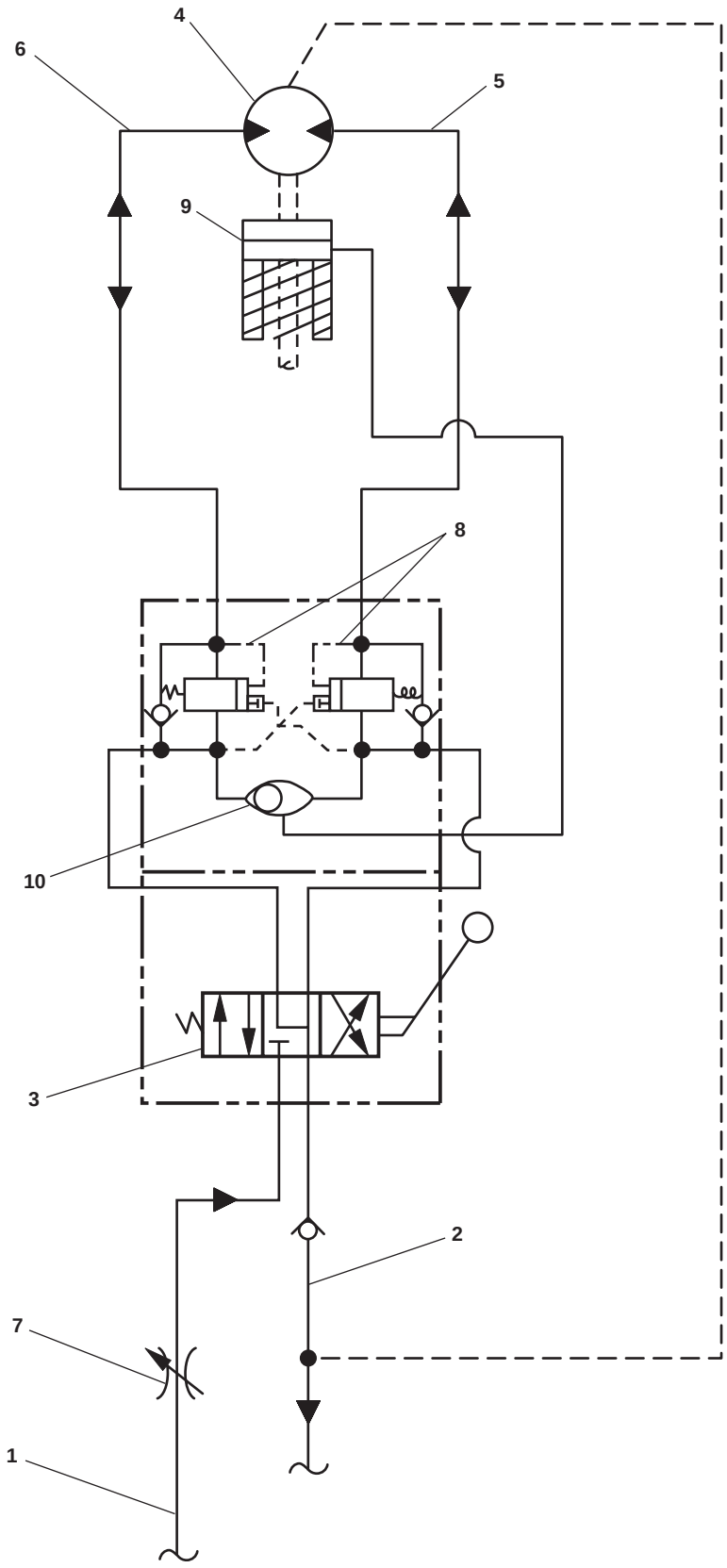


Figure 6. Capstan Hydraulic System

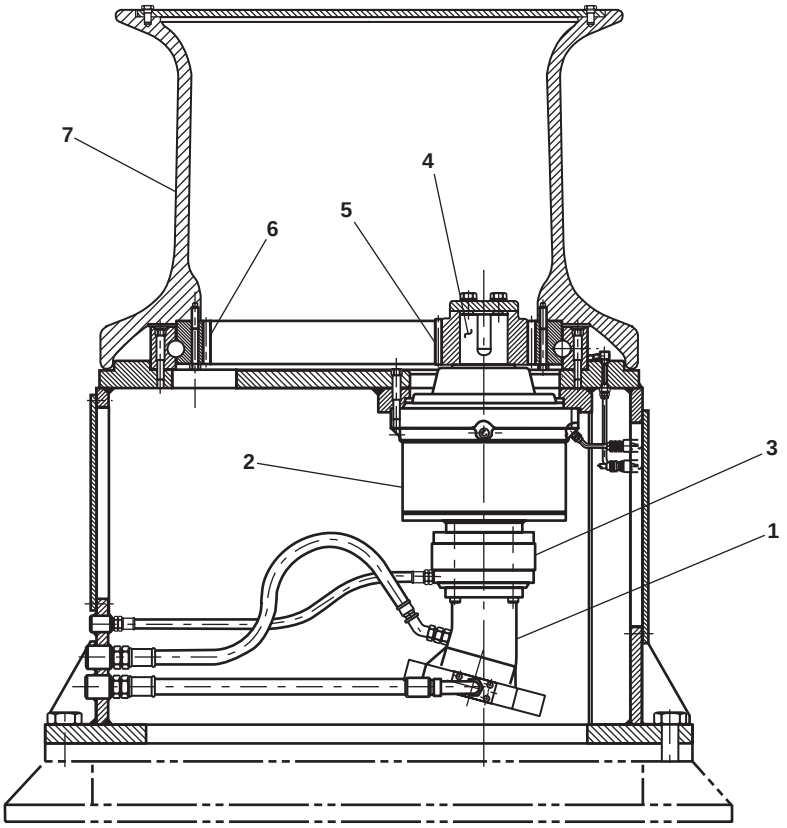


Figure 7. Capstan Mechanical Operation

ANCHOR WINDLASS

During operation under usual conditions, the anchor windlass is powered by the central hydraulic system.

Supply pressure comes into the anchor windlass control valve (figure 8, item 1) through a flow control valve (figure 8, item 2). The flow control valve is set to permit 11 gal/min (42 L/min) to enter the anchor windlass control valve. This prevents overspeed operation of the anchor windlass.

The anchor windlass control valve (figure 8, item 1) is comprised of a HIGH/LOW speed selector valve (figure 8, item 3), a directional control valve (figure 8, item 4), and a counterbalance valve (figure 8, item 5).

When the HIGH/LOW speed selector valve (figure 8, item 3) is in the LOW speed position, pressure is removed from the two speed pilot valve (figure 8, item 6) that removes pressure from the pilot port (figure 8, item 7) of the anchor windlass motor (figure 8, item 8). When pressure is removed from the pilot port, the anchor windlass motor is in the Low Speed, High Torque (LSHT) mode. When the HIGH/LOW speed selector valve is in the HIGH position, pressure is applied to the two speed pilot valve that supplies pressure to the pilot port of the anchor windlass motor. When pressure is applied to the pilot port, the anchor windlass motor shifts into High Speed, Low Torque (HSLT) mode. In this mode, the anchor windlass motor speed is roughly doubled and torque roughly halved.

ANCHOR WINDLASS

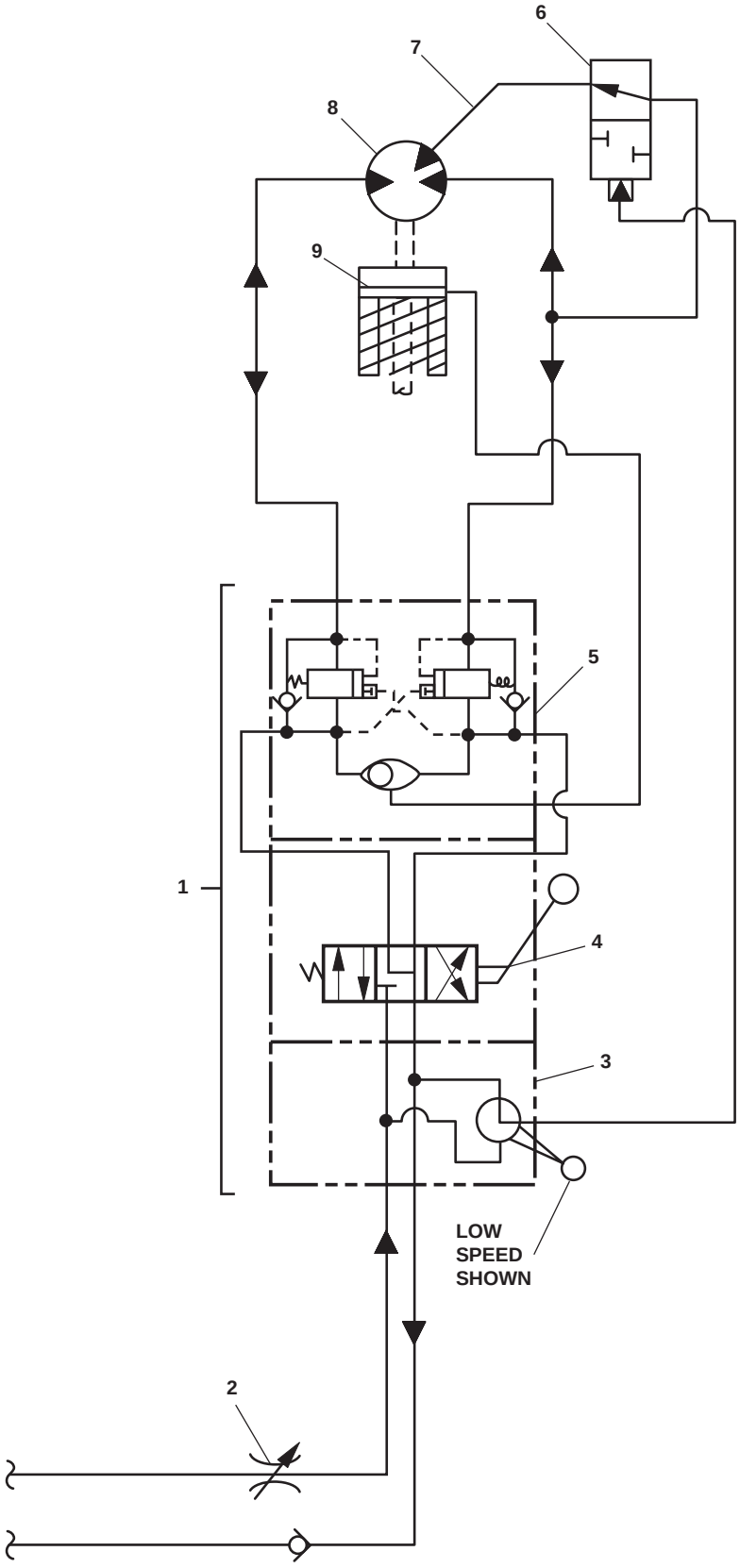


Figure 8. Anchor Windlass Hydraulic System

The directional control valve (figure 8, item 4) permits the operator to choose the direction of rotation of the anchor windlass as well as its speed of rotation. When the directional control valve (figure 8, item 4) is in the NEUTRAL position, the supply line is CLOSED, and no supply flow is permitted to enter the anchor windlass motor (figure 8, item 8). At the same time, both sides of the anchor windlass motor are OPEN to the return piping. When the directional control valve (figure 8, item 4) is shifted toward the return spring, the supply is routed to the right side of the anchor windlass motor and the return flow comes from the left side of the anchor windlass motor, causing motor rotation. When the directional control valve position is reversed, flow to the anchor windlass motor is reversed, reversing the direction of anchor windlass motor rotation.

A counterbalance valve (figure 8, item 5) is installed between the directional control valve (figure 8, item 4) and the anchor windlass motor (figure 8, item 8). The counterbalance valves act as a hydraulic brake to prevent the anchor windlass from overrunning the anchor windlass motor. The counterbalance valves also ensure that the anchor windlass motor will only turn when pressure is applied from the directional control valve.

A fail safe brake (figure 8, item 9) is fitted between the anchor windlass gear train and the achor windlass motor (figure 8, item 8). This fail safe brake is a spring-applied, pressure-released design. In this design, an internal spring assembly applies the fail safe brake until hydraulic pressure is applied to release it. In the anchor windlass circuit, hydraulic pressure is supplied to the fail safe brake assembly any time that the directional control valve (figure 8, item 4) is moved away from the NEUTRAL position. When the directional control valve is returned to the NEUTRAL position, the pressure is removed from the fail safe brake and the springs apply the brake, providing a mechanical braking action to the anchor windlass motor output shaft.

Output from the anchor windlass motor (figure 9, item 1; figure 8, item 8) goes through the fail safe brake (figure 9, item 2; figure 8, item 9) and to the driveshaft (figure 9, item 3). The driveshaft turns the input shaft (figure 9, item 4) of the worm gear (figure 9, item 5) that rotates the anchor windlass main shaft (figure 9, item 6). The main shaft is permanently fixed to the gypsey heads (figure 9, item 7), therefore the gypsey heads rotate whenever the anchor windlass motor (figure 9, item 1; figure 8, item 8) rotates. The wildcats (figure 9, item 8) can be connected to the main shaft via a dog clutch (figure 9, item 9). The dog clutch permits the gypsey heads to rotate separately from the wildcats, thus the lines can be handled by the gypsey heads without disturbing the anchor chains.

Manual braking is provided for the wildcats (figure 9, item 8) by band brakes (figure 9, item 10). Each wildcat is provided with a band brake providing individual control for each anchor chain. The band brakes are actuated by turning the brake handwheel (figure 9, item 11). The brake handwheel tightens the brake band around the wildcat drum (figure 9, item 12), slowing or stopping wildcat rotation.

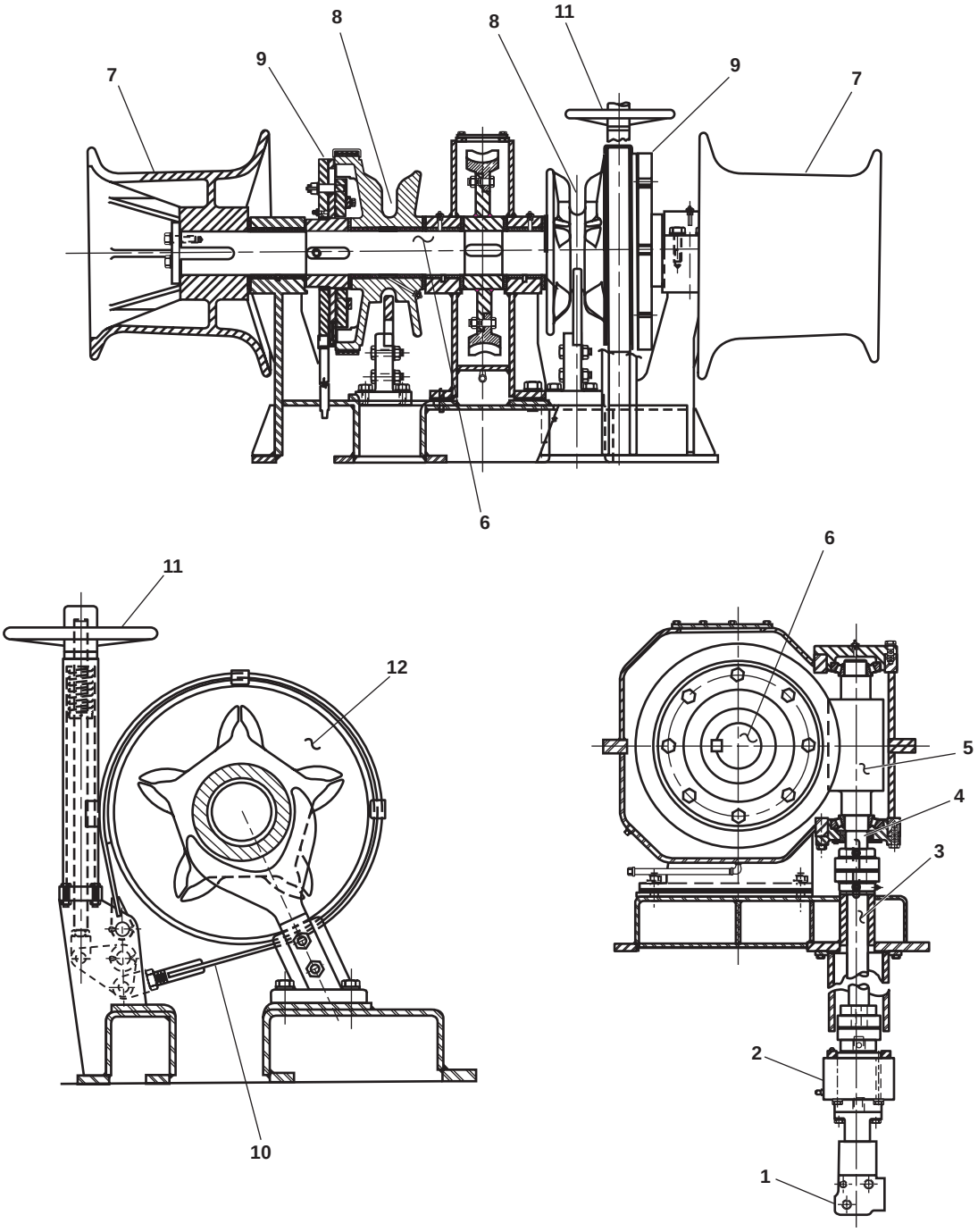


Figure 9. Anchor Windlass Mechanical Operation

CRANE

During operation under usual conditions, the crane is powered by the central hydraulic system.

Supply and return flow for the crane passes through a swivel (figure 10, item 1) before arriving at the control valve bank (figure 10, item 2). The swivel permits hydraulic fluid to flow to and from the crane's controls as the crane rotates.

The control valve bank (figure 10, item 2) is made up of a relief valve (figure 10, item 3), directional control valves for the swing (figure 10, item 4), telescope (figure 10, item 5), winch (figure 10, item 6), and luffing (figure 10, item 7) functions. The relief valve is set for 2650 PSI (183 bar) and prevents overpressurization of the crane's hydraulic components. The directional control valves are all manually operated via control handles. These directional control valves control the direction and volume of hydraulic fluid flowing to the swing motors (figure 10, item 8), the telescope cylinder (figure 10, item 9), the winch motor (figure 10, item 10), and the luffing cylinder (figure 10, item 11).

The swing motors (figure 10, item 8) are protected by a double counterbalance valve (figure 10, item 12) and by two flow control valves (figure 10, item 13). The double counterbalance valve prevents the swing motors from turning unless hydraulic pressure is applied to rotate them. The double counter balance valve also prevents a load from overriding the swing motors and swinging the boom uncontrollably. The flow control valves, each set for 9 gal/min (34 L/min), prevent the boom from swinging too quickly.

The swing motors (figure 10, item 8) are also provided with fail safe brakes (figure 10, item 14). These brakes are spring-applied, and pressure-released and provide the primary braking method for the swing system.

Both the telescope (figure 10, item 9) and luffing cylinders (figure 10, item 11) are equipped with holding valves (figure 10, item 15). The holding valves prevent the telescope and luffing cylinders from retracting until pressure is supplied to the rod side of the cylinder. When no pressure is applied to the rod side of the cylinder, a check valve (figure 10, item 16) inside the holding valve prevents return hydraulic fluid from exiting the piston side of the cylinder. If this return hydraulic fluid cannot exit, the cylinder cannot retract. When pressure is applied to the rod side of the cylinder, a portion of this pressure is routed through the internal pilot line to open the holding valve. Once the holding valve is OPEN, return flow is permitted from the piston side of the cylinder, and retraction occurs.

The winch motor (figure 10, item 10) is also equipped with a holding valve (figure 10, item 17). This valve operates just like the holding valve described above, except that it prevents return flow from the winch motor when the motor is operating in the LOWER direction. This prevents the load from overrunning the motor and causing uncontrolled lowering of the load. The winch motor is also fitted with a fail safe brake. Like the winch motor brakes, this brake is spring-applied and pressure-released, and provides the primary braking method for the winch.

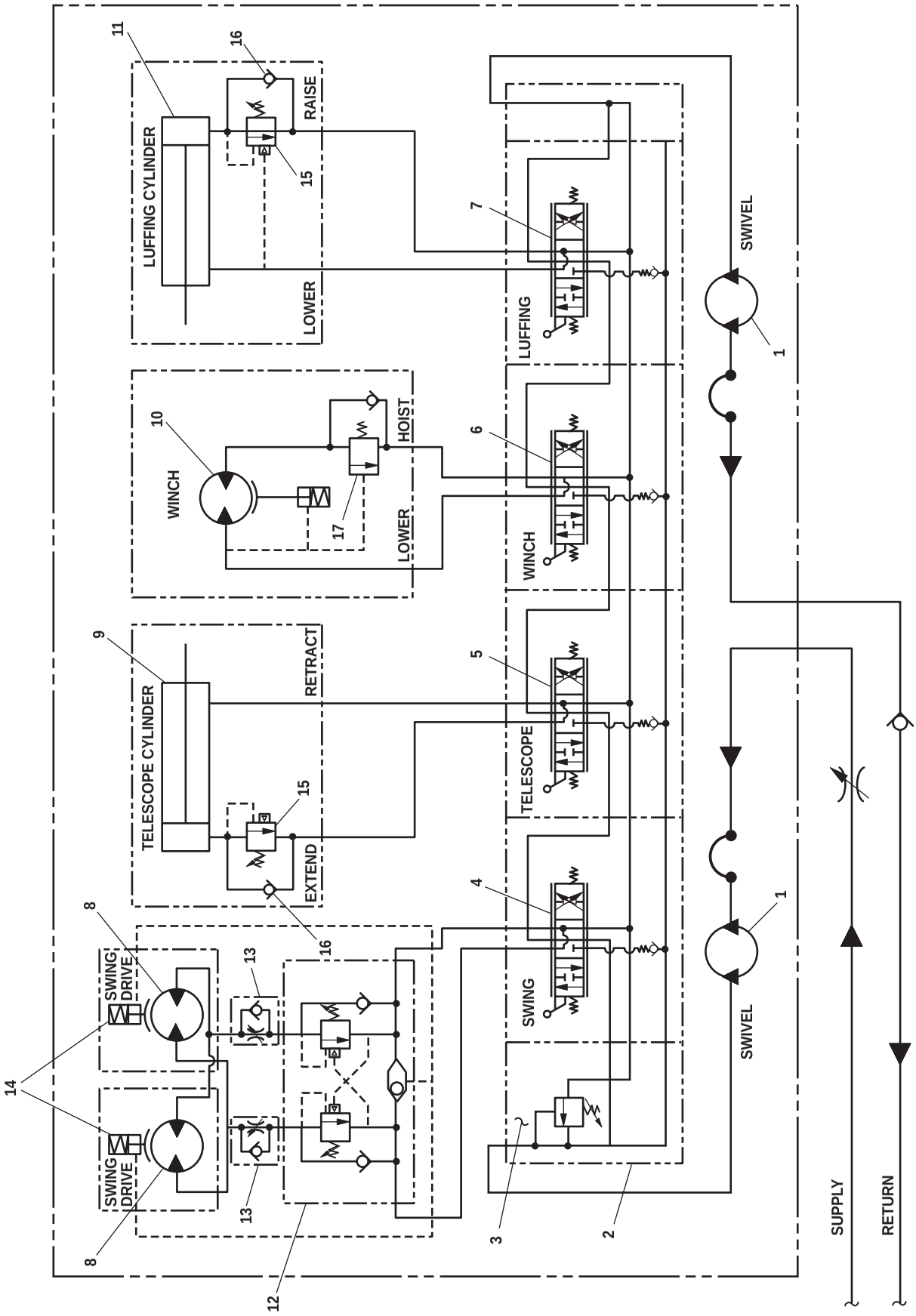


Figure 10. Crane Hydraulic System

TOW PINS

During operation under usual conditions, the tow pins are powered by the central hydraulic system.

Each tow pin is raised and lowered by its own hydraulic cylinder (figure 11, item 1). The cylinders are extended or retracted by supplying pressurized hydraulic fluid to the rod side (retract) or to the piston side (extend) of the hydraulic cylinder.

Movement of the hydraulic cylinders (figure 11, item 1) is controlled by solenoid operated directional control valves (figure 11, item 2), one valve for each cylinder. When the directional control valve is in the NEUTRAL position, the supply line is blocked and both sides of the hydraulic cylinder are OPEN to the reservoir (return). When the hydraulic control valve is shifted to the right (right solenoid energized), hydraulic pressure is directed to the piston side of the hydraulic cylinder and the cylinder extends. During extension, the hydraulic fluid forced out of the rod side of the hydraulic cylinder passes through the directional control valve and back to the reservoir.

When the directional control valve (figure 11, item 2) is shifted to the left (left solenoid energized), hydraulic pressure is directed to the piston side of the hydraulic cylinder (figure 11, item 1) and the cylinder retracts. Retraction of the cylinder is further controlled by the holding valve (figure 11, item 3). Holding valve operation is explained below.

In order to prevent uncontrolled or undesired retraction of the tow pins, each hydraulic cylinder (figure 11, item 1) is provided with a holding valve (figure 11, item 3). The holding valve prevents the cylinder from retracting until pressure is supplied to the rod side of the cylinder. When no pressure is applied to the rod side of the cylinder, a check valve (figure 11, item 4) inside the holding valve prevents return hydraulic fluid from exiting the piston side of the cylinder. If this return hydraulic fluid cannot exit, the cylinder cannot retract. When pressure is applied to the rod side of the cylinder, a portion of this pressure is routed through the internal pilot line (figure 11, item 5) to OPEN the holding valve. Once the holding valve is OPEN, return flow is permitted from the piston side of the cylinder and retraction occurs.

Supply to each pair (port and starboard) of tow pin cylinders (figure 11, item 1) is restricted by a flow control valve (figure 11, item 6). The flow control valve ensures that the tow pin cylinders extend and retract at a controlled rate of speed.

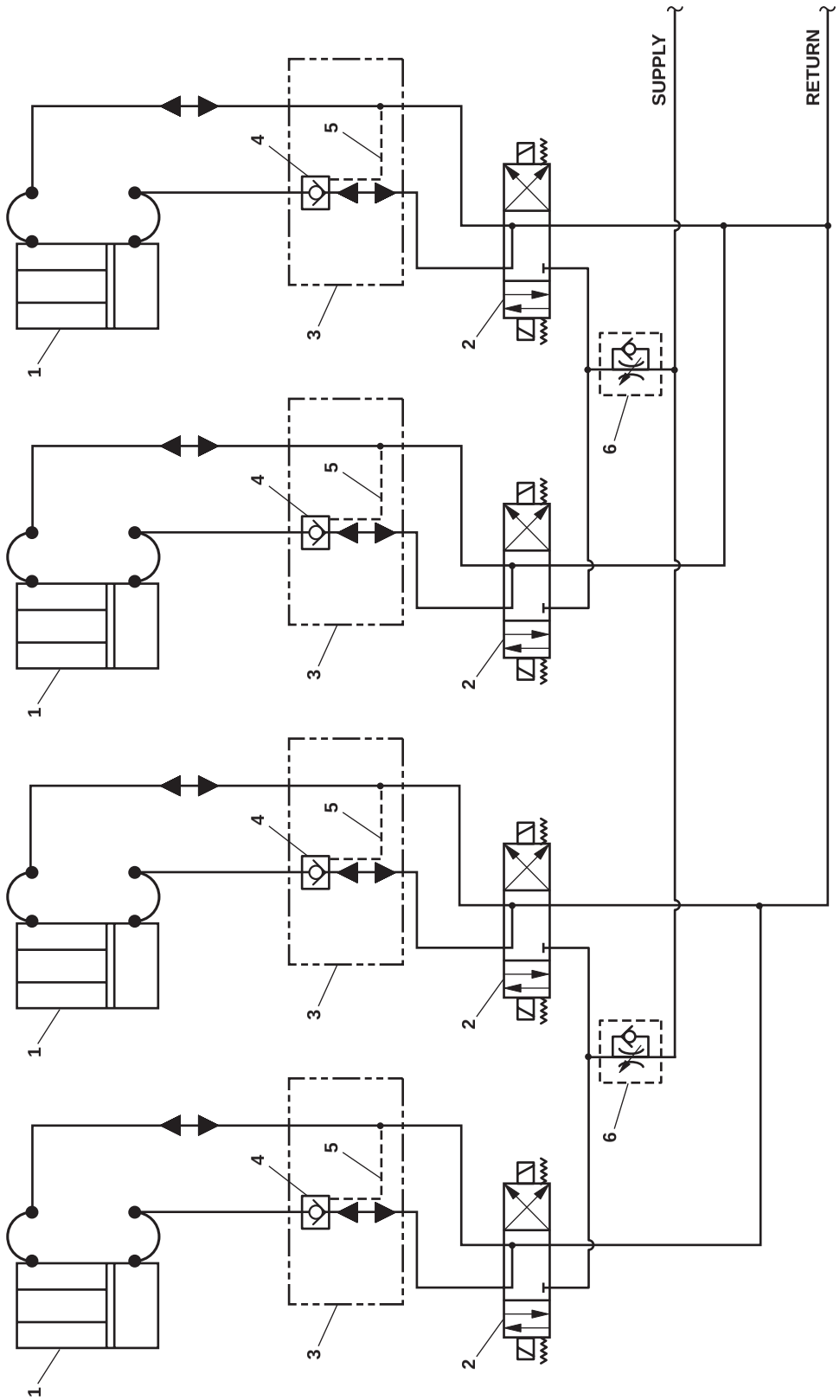


Figure 11. Tow Pin Hydraulic System

TOWING MACHINES

HYDRAULIC/MECHANICAL OPERATING THEORY

Under operation under usual conditions, the towing machines are powered by the towing machine hydraulic system. Hydraulic fluid flows to and from the towing machines (figure 5, sheet 1, item 14; figure 5, sheet 2, item 15) by the supply (figure 5, sheet 1, item 19) and return (figure 5, sheet 2, item 20) lines. Once at the towing machines, the hydraulic flow is controlled by the manually operated local controls, or by solenoid operated remote control valve. Hydraulic power operates the hydraulic motors (figure 12, item 1) and the hydraulic brake cylinders (figure 5, sheets 1 and 2, item 21; figure 12, item 2). All other operations are controlled mechanically.

When the manual or remote control valve directs hydraulic flow to the hydraulic motor (figure 12, item 1), pressure is also applied to release the hydraulic brake cylinders (figure 5, sheet 1, item 21; figure 12, item 2). The main shaft then rotates in the desired direction as decided by the direction of hydraulic fluid flow. If the operator desires the drum (figure 12, item 3) to rotate when the main shaft rotates, the clutch band brake must be applied. See the paragraph below for an explanation of this brake.

In addition to the hydraulic braking described above, both a clutch band brake and an auxiliary brake assembly are installed. The clutch band brake is operated by the outboard control handle (figure 12, item 4) and the auxiliary (figure 12, item 5) brake is operated by the inboard control handle. The auxiliary brake provides primary braking for the drum (figure 12, item 3). It brakes nothing else. The clutch band brake's primary function is to lock the drum to the main shaft. Its secondary function is as a brake for the drum.

In order to lock the drum (figure 12, item 3) to the main shaft, the clutch brake lining acts on the surface of the outer (orbit) gear assembly of a planetary reduction gear. When the sun gear (figure 13, item 1), which is attached to the main shaft (figure 13, item 2) rotates, the planet gears (figure 13, item 3) rotate, too. If the orbit gear (figure 13, item 4) is held stationary, in this case by the clutch band brake, the carrier (figure 13, item 5) will rotate in the same direction as the main shaft, but at a lower speed. In the towing machine, the carrier is attached directly to the drum (figure 12, item 3), so carrier rotation equals drum rotation. If the main shaft is held stationary by the hydraulic brake, the clutch band brake acts as a drum

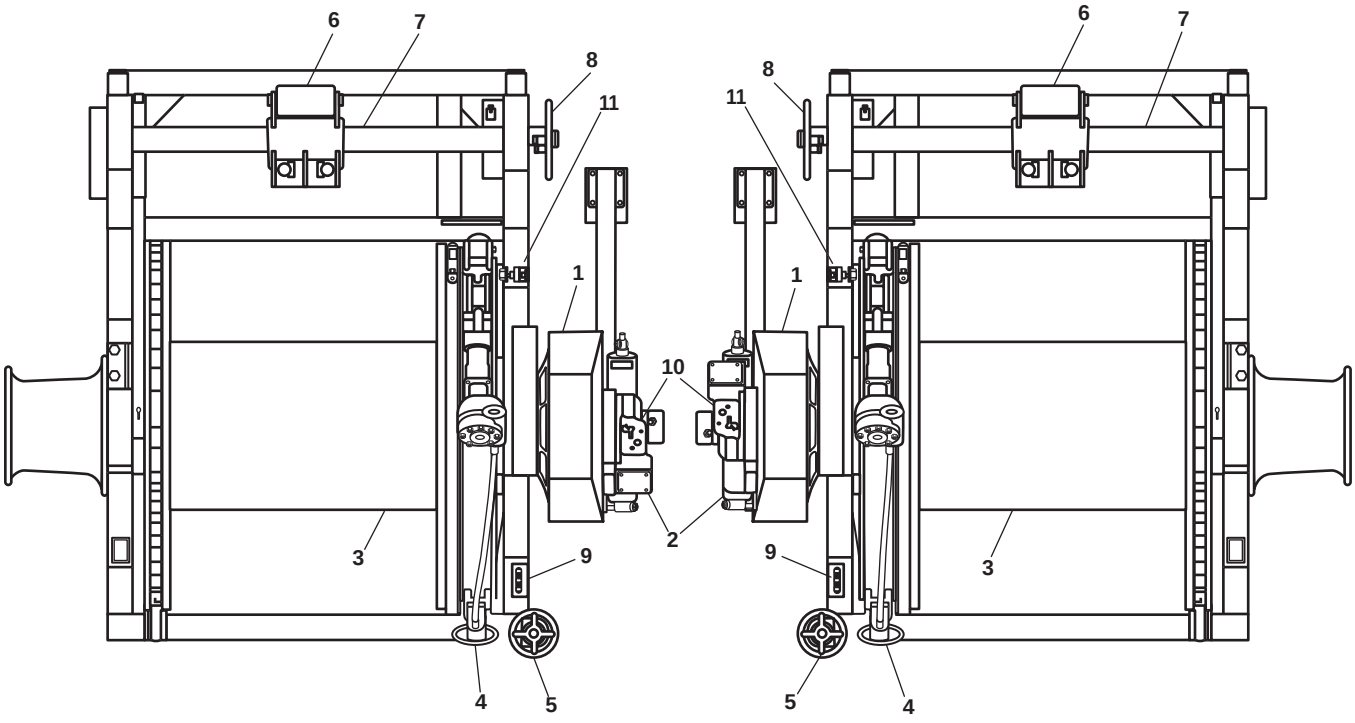


Figure 12. Towing Machine Mechanical Operation

brake, because the carrier cannot rotate against a stationary main shaft unless the orbit gear is also permitted to rotate. Thus, braking of the orbit gear results in braking of the drum.

During certain operating modes, for example use of the gypsey heads, the drum (figure 12, item 3) must remain stationary while the main shaft rotates. The auxiliary brake (figure 12, item 5) secures the brake drum during these operations. This braking action is accomplished by pulling a friction-lined brake band tight against the outer diameter of the drum.

A level wind assembly (figure 12, item 6) is provided on each towing machine. The level wind assembly is driven by a worm gear shaft (figure 12, item 7) that rotates in response to drum (figure 12, item 3) rotation. This assembly helps to ensure that the wire rope always winds evenly onto the drum. Alignment and adjustment of the level wind assembly is accomplished with the adjusting wheel (figure 12, item 8).

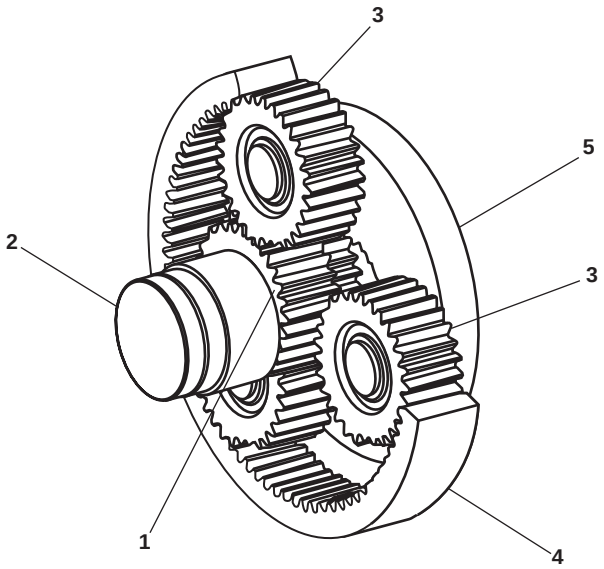


Figure 13. Planetary Reduction Gear Operation

ELECTRICAL OPERATING THEORY

Primary control of the towing machines is from the towing machine control panel (operator) on the 01 level aft. This operating location places the operator safely away from the towing machines and wire ropes during towing operations. The local control stations (figure 12, item 9) are provided only for emergency or maintenance operation.

Towing machine main shaft rotation is controlled by the PAYOUT/HEAVE lever (figure 14, item 1). This lever controls a solenoid-operated valve which, in turn, controls the flow of hydraulic fluid to the hydraulic motor (figure 12, item 1).

Two speed control for the towing machine hydraulic motor (figure 12, item 1) is controlled by the speed control switch (figure 14, item 2). This switch energizes and deenergizes a solenoid-controlled pilot valve that shifts the hydraulic motor between low and high speed.

Remote shutdown of the pump drive engine is controlled by the HYDRAULIC PUMP ENGINE SHUTDOWN switch (figure 14, item 3). When CLOSED, this switch enables pump drive engine operation. When OPEN, the pump drive engine and central hydraulic power unit are both shut down.

Each towing machine is provided with a CABLE OFF indicator (figure 14, item 4) that also stops the central hydraulic motors. This indicator receives input from a worm gear-driven sensor (figure 12, item 10). This sensor measures drum (figure 12, item 3) rotation and converts this rotation into feet of cable payed off. The sensor input is directed though the

towing machine control panel mounted on the starboard bulkhead of the main deck vestibule. There the input is analyzed and output to the CABLE OFF indicator.

A LINE PULL meter (figure 14, item 5) is also installed for each towing machine. This meter measures the amount of strain present on the wire rope. This meter receives its input from a torque strain sensor mounted on the towing machine's main shaft. The sensor input is directed though the towing machine control panel mounted on the starboard bulkhead of the main deck vestibule. There the input is analyzed and output to the line tension meter.

It is important for the operator to know if the clutch brake is slipping. Clutch brake slippage means that additional cable is paying off the drum, causing a potential for trouble. To alert the operator to clutch brake slippage, a CLUTCH BRAKE SLIPPAGE alarm (figure 14, item 6) is installed. When excessive slippage occurs, the alarm sounds a warning horn and

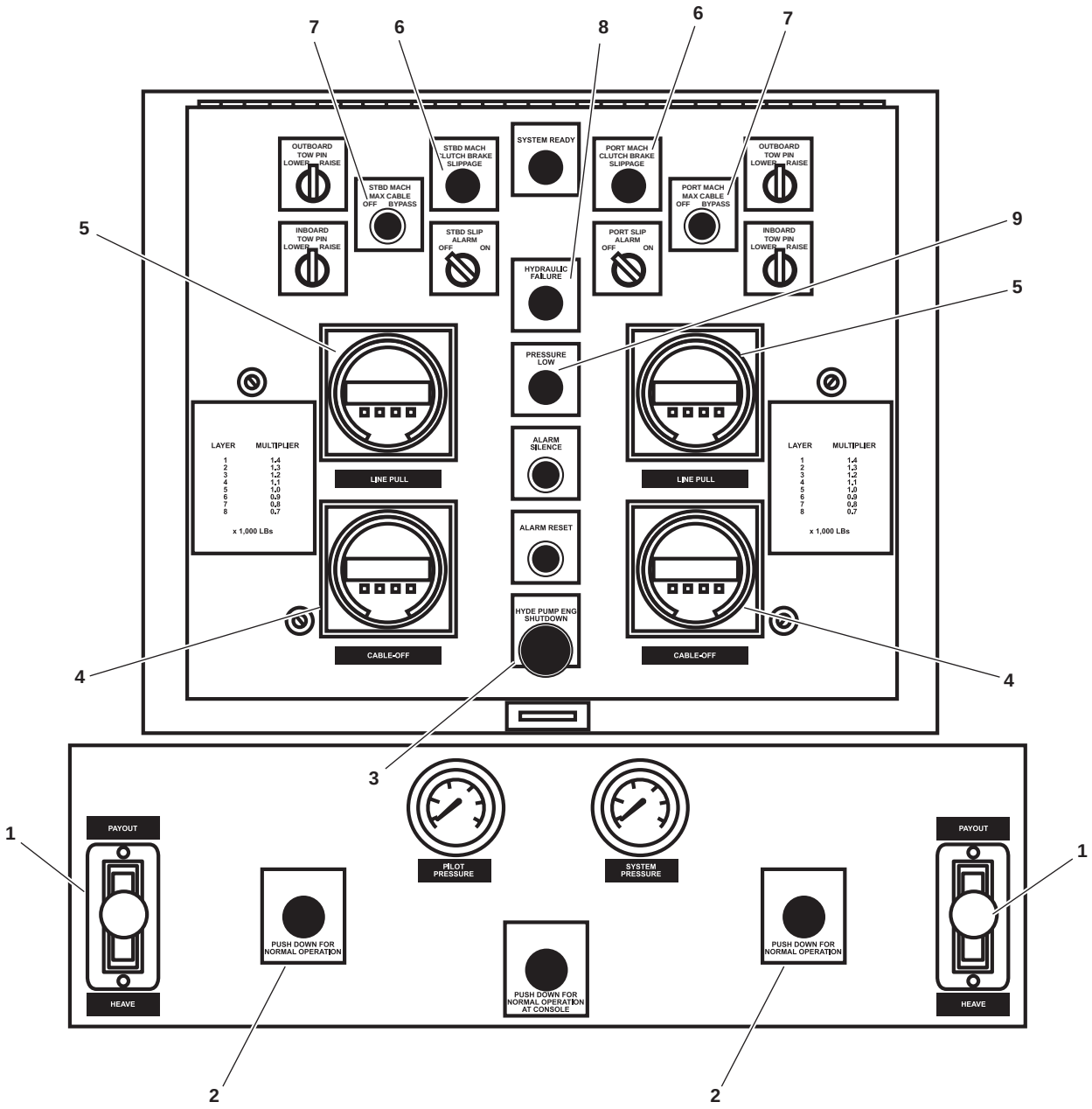


Figure 14. Towing Machine Control Panel (Operator), 01 Level

illuminates a light on the towing machine control panel (operator) on the 01 level. A similar alarm indicator is also installed in the pilothouse. The alarm operates by means of a proximity switch (figure 12, item 11). When a hub member passes close by the proximity switch, the switch closes. When the hub member passes away, the switch opens. The signal from this switch is routed to the towing machine control panel mounted on the starboard bulkhead of the main deck vestibule. There the input is analyzed and when the signal reaches the predetermined limit for excessive slippage, the alarm light is illuminated, and the alarm horn sounds.

Operating with too little cable on the drum can cause loss of the tow cable. To prevent this, a maximum cable OFF shutdown is installed. When the cable OFF indicator system indicates that less than 300 feet (91 meters) of cable remains on the drum, the payout function of the towing machine is disabled and the STBD or PORT MACH MAX CABLE OFF BYPASS pushbutton indicator (figure 14, item 7) illuminates. This function operates by deenergizing the solenoid operated directional control valve that controls the paying out of the tow cable. If it is desired to pay off cable beyond the automatic cutoff point, the operator can press the STBD or PORT MACH MAX CABLE OFF BYPASS pushbutton indicator to bypass the cutoff.

The operator is alerted to the presence of towing machine hydraulic system faults (low hydraulic fluid level, high hydraulic fluid temperature) by an indicator light (figure 14, item 8) and alarm horn. The alarm is indicated at the towing machine control panel (operator) and in the pilothouse. These alarm conditions are activated by Normally Open (NO) switches for hydraulic fluid level and hydraulic fluid temperature. When the hydraulic fluid level falls too low or its temperature rises too high, the appropriate switch closes, and the alarm is activated.

A similar alarm is activated when the system hydraulic fluid pressure falls too low. This alarm also lights a lamp (figure 14, item 9) and sounds the horn when the Normally Open (NO) system hydraulic fluid pressure switch closes.

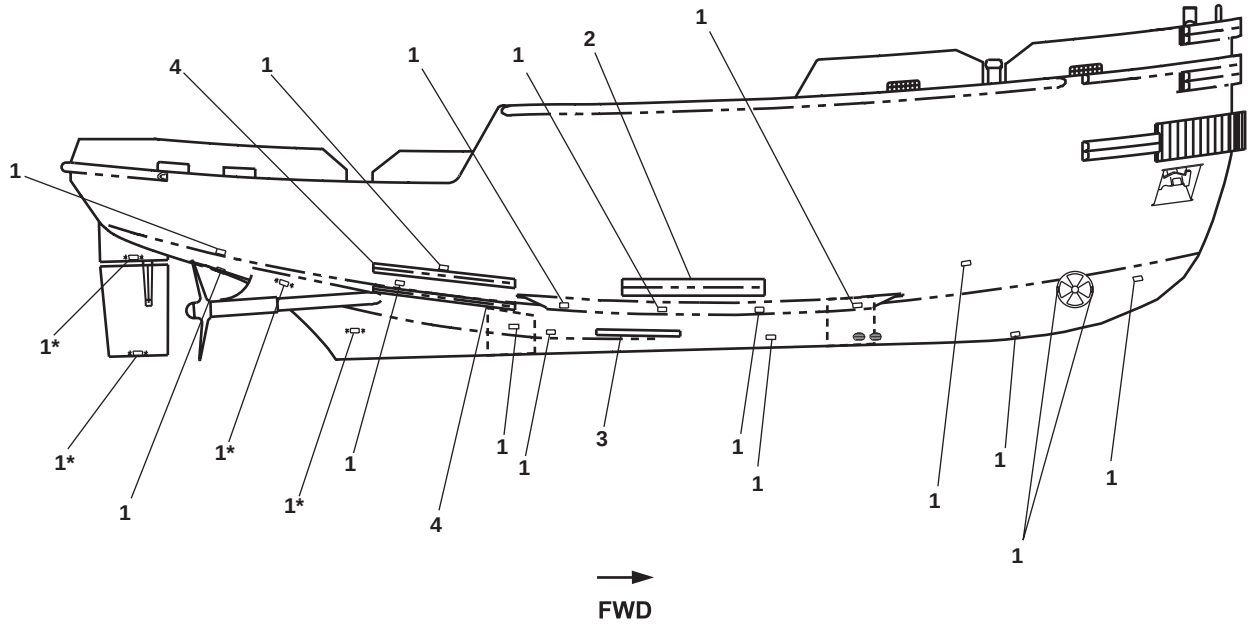
END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
CATHODIC PROTECTION SYSTEM

GENERAL

Galvanic corrosion is one common form of corrosion in marine environments. It occurs when two dissimilar metals are brought into electrical contact under water. When a galvanic couple form, one of the metals in the couple becomes the anode (figure 1, item 1) and corrodes faster than it would all by itself, while the other becomes the cathode and corrodes more slowly than it would alone. Either (or both) metals in the couple may or may not corrode by itself (themselves) in raw water. When contact with a dissimilar metal is made, however, the self-corrosion rates will change: corrosion of the anode will accelerate; corrosion of the cathode will decelerate or even stop.

The Large Tug (LT) hull is fitted with a series of zinc sacrificial anodes (figure 1, item 1) to protect the vessel from galvanic corrosion. The location of the zinc sacrificial anodes is shown is figure 1. When galvanic corrosion occurs on the vessel, the zinc anode erodes, protecting the vessel's hull and components (cathodes). Sacrificial zinc anodes are also installed in the cooling system for the SSDG (figure 1, item 2), reduction gears (figure 1, item 3), and main engines, figure 1, item 4).



*** Anodes At Same Position On Both Sides Of Rudder.**

Figure 1. Cathodic Protection System

END OF WORK PACKAGE

Chapter 2

Operator Instructions-- Description and Use of Operator Controls and Indicators for Inland and Coastal Large Tug (LT)

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
ENGINE ROOM: MAIN ENGINES AND SHIP'S SERVICE
DIESEL GENERATORS (SSDGs)

ENGINE ROOM: MAIN ENGINES AND SSDGs

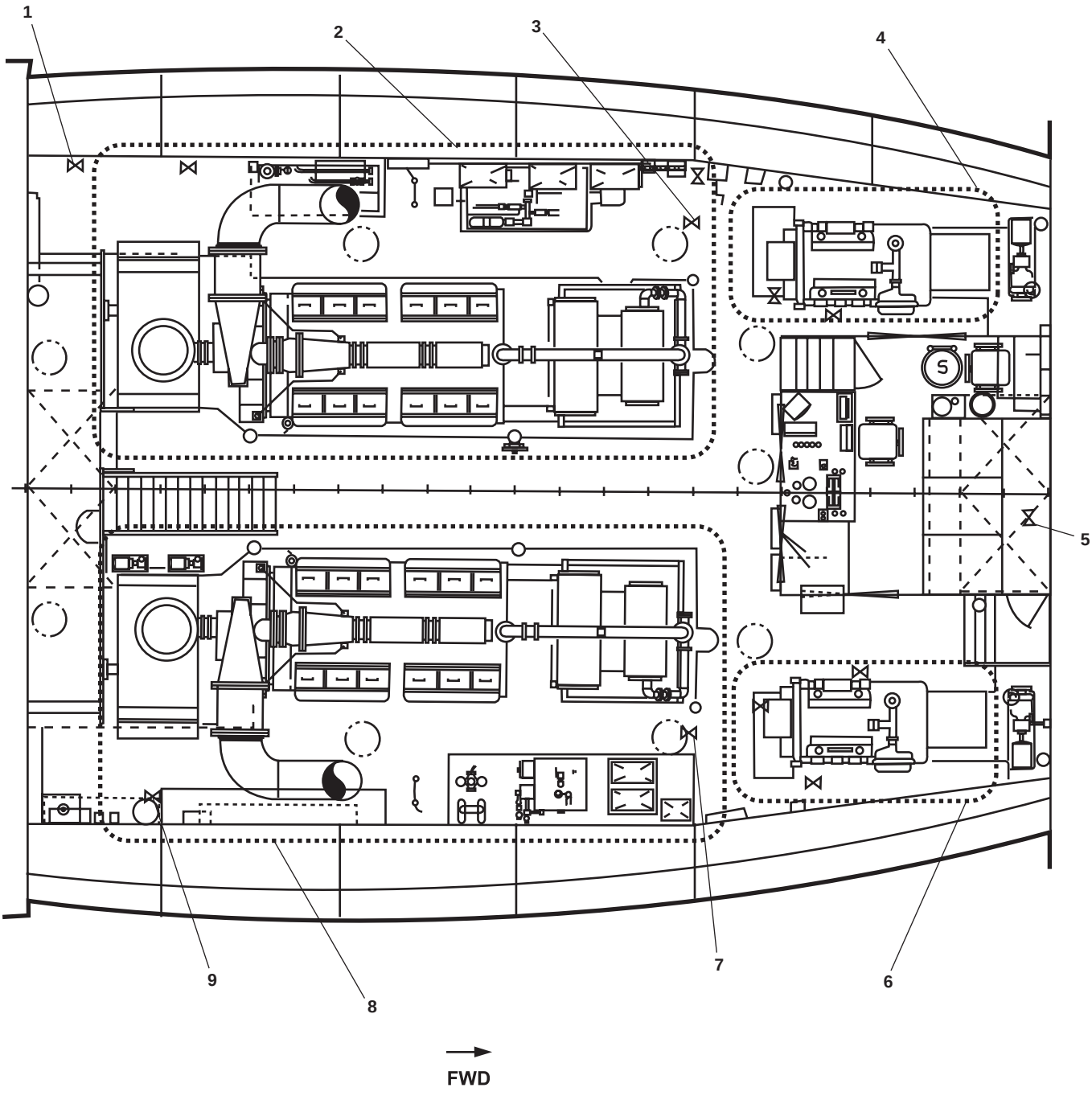


Figure 1. Engine Room: Main Engines and SSDGs

Table 1. Engine Room: Main Engines and SSDGs (refer to figure 1)

Key	Control/Indicator	Function
1	Fwc-4, F.W. FR. M.E. No. 2 TO KEEL CLR. Valve	This valve secures the flow of engine coolant through main engine 2's keel cooler.
2	Main Engine 2	Main engine 2 provides propulsive power to drive the port propeller. See figure 11 for details.
3	Fwc-12, F.W. FR. S.S.D.G. No. 2 TO KEEL CLR. Valve	This valve secures the flow of engine coolant through SSDG 2's keel cooler.
4	SSDG 2	SSDG 2 is one of two ships service diesel generators that provide the primary source of vessel power. See figure 20 for details.
5	Asw-17, SEA SUCTION S.W. COOLING Valve	This valve secures the flow of raw water to the bow thruster and pump drive engines.
6	SSDG 1	SSDG 1 is one of two ships service diesel generators that provide the primary source of vessel power. See figure 13 for details.
7	Fwc-11, F.W. FR. S.S.D.G. No. 1 TO KEEL CLR. Valve	This valve secures the flow of engine coolant through SSDG 1's keel cooler.
8	Main Engine 1	Main engine 1 provides propulsive power to drive the starboard propeller. See figure 2 for details.
9	Fwc-3, F.W. FR. M.E. No. 1 TO KEEL CLR. Valve	This valve secures the flow of engine coolant through main engine 1's keel cooler

MAIN ENGINE 1, GENERAL ARRANGEMENT

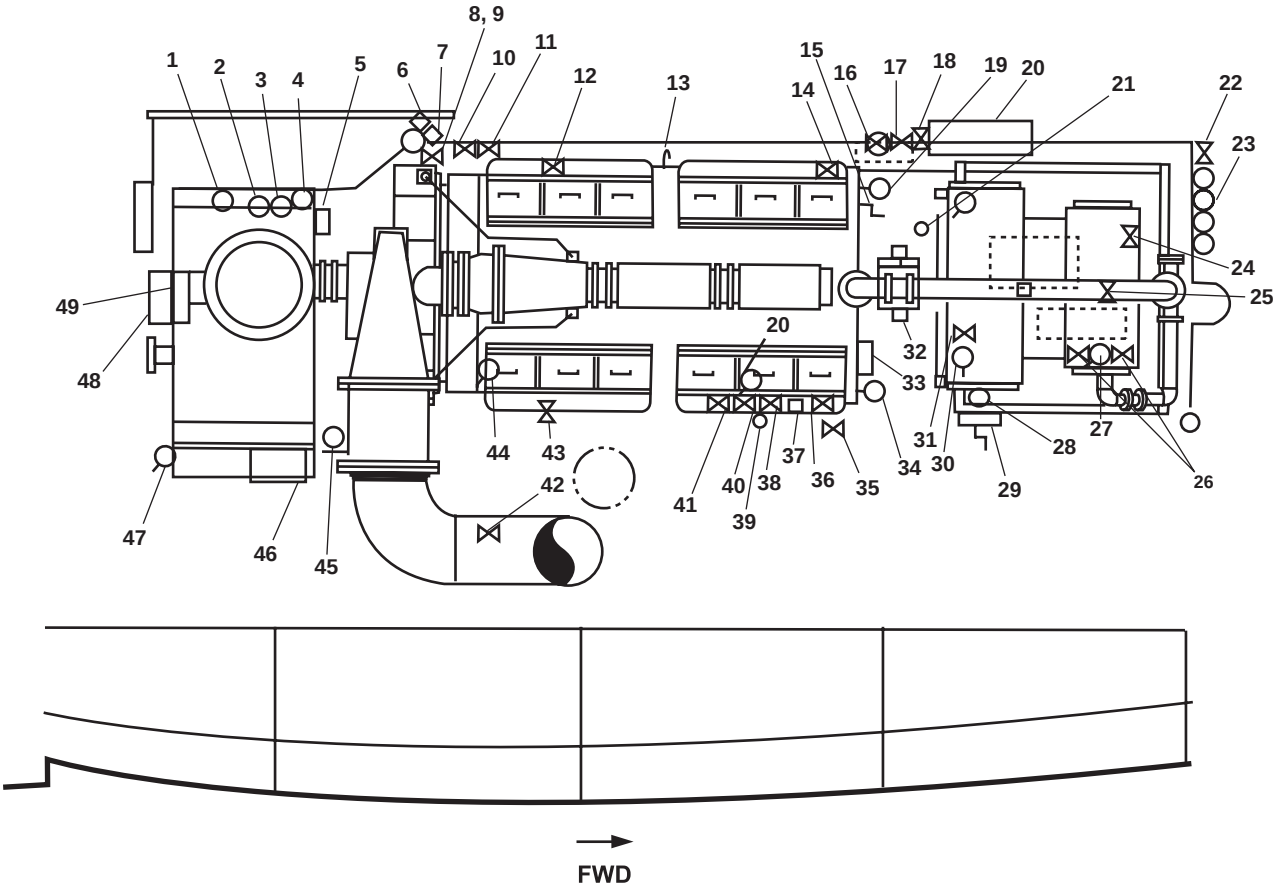


Figure 2. Main Engine 1, General Arrangement

Table 2. Main Engine 1 Operator Controls and Indicators, General Arrangement (refer to figure 2)

Key	Control/Indicator	Function
1	RDCN GR #1 LUBO PRESS Gauge	This gauge displays the reduction gear 1 lube oil pressure.
2	Temperature Gauge, Lube Oil	This gauge indicates the lube oil temperature for reduction gear 1.
3	RDCN GR # 1 LUBO COOLER PRESS Gauge	This gauge indicates the lube oil cooler pressure for reduction gear 1.
4	RDCN GR No. 1 FW COOLING TEMP Gauge	This gauge indicates the temperature of the cooling water for reduction gear 1.
5	Air Filter Restriction Indicator	This indicator shows GREEN when the main engine air filter restriction is acceptable and shows RED when the main engine air filter restriction is unacceptable.
6	RDCN GR #1 FW COOLING PMP DISCH PRESS gauge	This gauge indicates the pressure in the fresh water cooling system for reduction gear 1.

Table 2. Main Engine 1, General Arrangement (refer to figure 2) (continued)

Key	Control/Indicator	Function
7	RDCN GR #2 FW COOLING PMP DISCH PRESS gauge	This gauge indicates the pressure in the fresh water cooling system of reduction gear 2.
8	Cutoff Valve, Jacket Water to Aftercooler	This valve secures the flow of engine coolant to the aftercooler.
9	Cutoff Valve, Aftercooler Drain	This cutoff valve permits draining of engine coolant from the aftercooler.
10	Fwc-15, FR. KEEL CLR TO RED. GEAR No. 1 Valve	This cutoff valve secures the flow of fresh water through the reduction gear's cooling system.
11	Fwc-13, FR. RED. GEAR No. 1 TO KEEL CLR Valve	This cutoff valve secures the flow of fresh water through the reduction gear's cooling system.
12	Air Box Drain Valve (Port and Starboard)	This valve permits the draining of water and oil from the air boxes.
13	Dipstick (Port and Starboard)	The dipstick indicates the lube oil level in the engine.
14	Cutoff Valve, Lube Oil Pressure Remote Sensor	This valve secures the pressure to the main engine 1 remote lube oil pressure sensor.
15	Injector Control Lever	This lever permits manual control of the fuel rack. See figure 7 for details.
16	Lo-31, M.E. No. 1 LUBO PUR DISCH/FILL valve	This valve secures the flow of lube oil to/from main engine 1 from/to the lube oil purifier.
17	Lo-48, C.O.V. PRELUBE PMP. DISCH. valve	This valve secures the flow of lube oil from the prelube discharge pump to main engine 1.
18	Cutoff Valve, Lube Oil Sampling Port	This valve secures the flow of lube oil at the sampling port on the prelube pump.
19	Pressure Gauge, Port Water Jacket	This gauge indicates the jacket water pressure in main engine 1's port water jacket.
20	Main Engine Control Panel	This panel contains the controls and indicators for main engine 1. See figure 3 for details.
21	Temperature Gauge, Engine Coolant Inlet	This gauge indicates the temperature of the engine coolant entering the engine from the keel coolers.
22	FO-20, F.O. SPLY TO STBD ME No. 1 Valve	This cutoff valve secures the fuel oil supply to main engine 1.
23	Fuel Filter/Water Separator	This quadplex fuel filter/water separator removes water from the fuel entering main engine 1. The unit also provides primary fuel filtration for main engine 1. See figure 4 for details.
24	Cutoff Valve	This valve secures the flow of lube oil from the oil filter to the hose connector.
25	Cutoff Valve, Jacket Water Heater Vent	This valve secures the flow of engine coolant from the jacket water heater to the expansion tank.

Table 2. Main Engine 1, General Arrangement (refer to figure 2) (continued)

Key	Control/Indicator	Function
26	Cutoff Valves	These valves secure the pressure to the oil filter differential pressure gauge.
27	Differential Pressure Gauge, Oil Filter	This gauge indicates the differential pressure across the oil filter.
28	Sight Glass	The sight glass indicates the engine coolant level in the expansion tank. See figure 5 for details.
29	Hand Pump, Fuel Priming	The hand pump is used for priming the fuel system.
30	Lube Oil Temperature Gauge	This gauge indicates the temperature of main engine 1's lubricating oil.
31	Cutoff Valve, Jacket Water Heater Vent	This valve secures the flow of engine coolant from the jacket water heater to the expansion tank.
32	Governor	The governor controls main engine 1's speed. See figure 8 for details.
33	Overspeed Trip Lever	In an overspeed condition, the lever moves into the tripped position and secures fuel flow to the combustion chambers, stopping the engine. See figure 7 for details.
34	Pressure Gauge, Starboard Water Jacket	This gauge indicates the jacket water pressure in main engine 1's starboard water jacket.
35	CA-9 STG AIR TO ME #1	This cutoff valve secures the compressed air supply to main engine 1's starting system.
36	Fuel Filter Selector Valve	This valve permits either one or both fuel filters to supply the main engine's fuel system. See figure 6 for details.
37	Starting Air Regulator	This regulates the starting air pressure to the starting motors.
38	De-7, BOW THRUSTER ENG. EXH. DR. valve	This valve drains the condensate from the bow thruster engine's exhaust system when OPEN.
39	Turbocharger Prelube Oil Pressure Gauge	This gauge indicates the lube oil pressure supplied to the turbocharger by the turbocharger prelube oil pump.
40	De-5, S.S.D.G. No. 1 EXH. DR. valve	This valve drains the condensate from SSDG 1's exhaust system when OPEN.
41	Cutoff Valve, Starting Air Remote Sensor	This valve secures the pressure to the starting air remote sensor for main engine 1.
42	De-3, M.E. No. 1. EXH. DR. Valve	This valve drains condensation from main engine 1's exhaust when OPEN.
43	Starting Air Valve	This valve controls the flow of starting air in the engine's starters.
44	Pressure Gauge, Lube Oil Pressure	This gauge indicates lube oil pressure at the cam gear case.
45	Dipstick	The dipstick indicates the oil level for reduction gear 1.

Table 2. Main Engine 1, General Arrangement (refer to figure 2) (continued)

Key	Control/Indicator	Function
46	Shaft Brake Cylinder	This cylinder controls the shaft brake. See figure 9 for details.
47	Reduction Gear Pressure Gauge	This gauge indicates the operating oil pressure in the reduction gear.
48	#1 SHAFT BRAKE PANEL	This panel controls the operation of the shaft brake for shaft 1. See figure 10 for details.
49	Sight Glass, REDN GR COOLING RSVR	This is the sight glass that displays the level of coolant in the reduction gear cooling reservoir.

MAIN ENGINE CONTROL PANEL

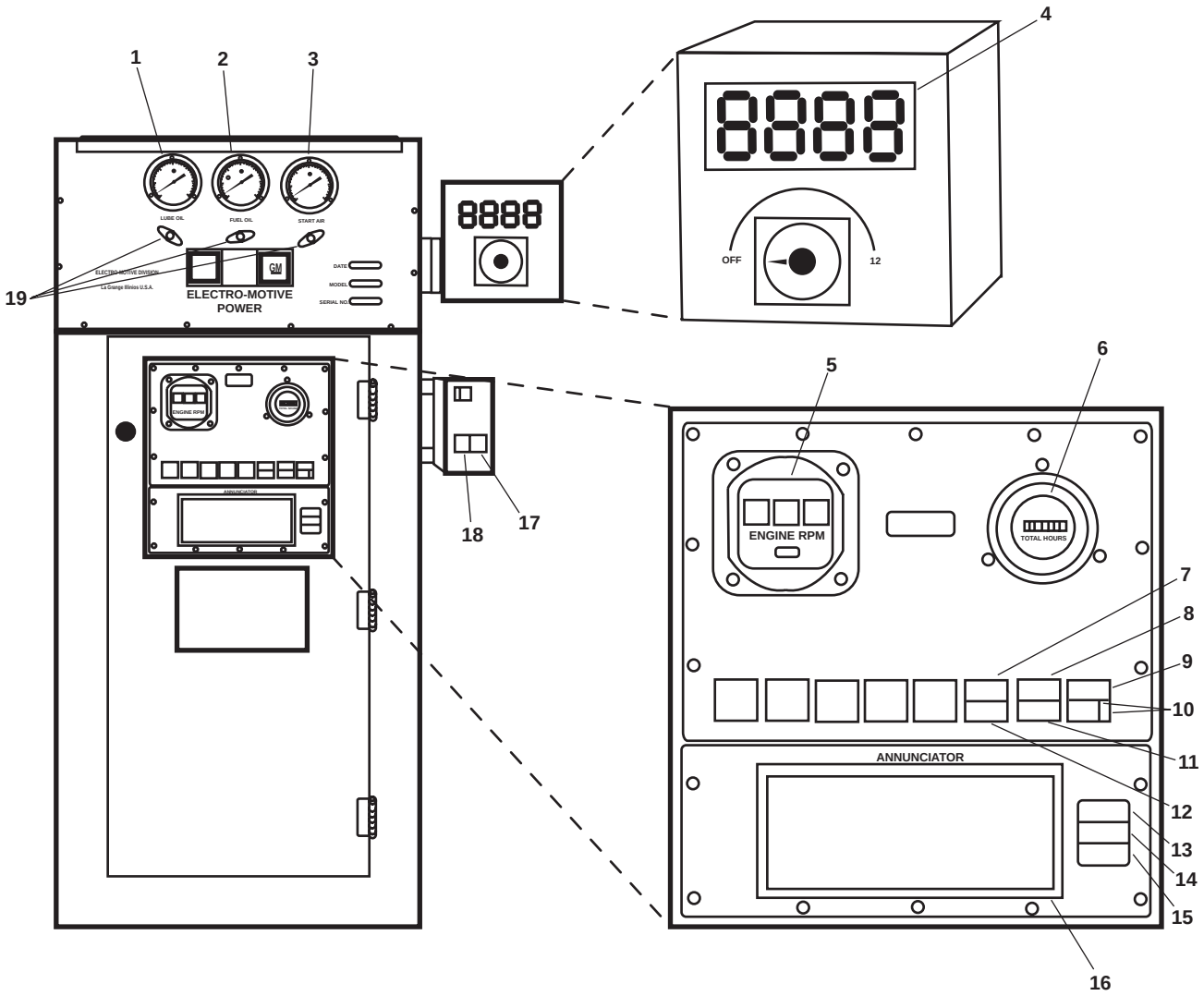


Figure 3. Main Engine Control Panel

Table 3. Main Engine Control Panel (refer to figure 3)

Key	Control/Indicator	Function
1	LUBE OIL Gauge	The lube oil gauge indicates the lube oil pressure of the main engine.
2	FUEL OIL Gauge	The fuel oil gauge indicates the fuel oil pressure of the main engine.
3	START AIR Gauge	The start air gauge indicates the starting air pressure available to the main engine.
4	Digital Readout Pryometer	The digital readout displays the cylinder temperature for the selected cylinder.
5	ENGINE RPM Tachometer	This meter indicates engine speed in revolutions per minute.
6	TOTAL HOURS Meter	This meter records the total hours of engine operation.
7	IMMR HEATER ON Indicator	The indicator illuminates to indicate that the main engine jacket water heater is ON.
8	ENGINE START Indicator	When this indicator is momentarily pressed, the turbocharger lube oil pump is started. When held for more than 2 seconds, the engine starter is engaged.
9	CONTROL POWER Indicator	This indicator illuminates to indicate that the control system is ON.
10	ON and OFF Pushbuttons	These buttons are used to turn the control power ON and OFF.
11	ENGINE STOP Pushbutton	When the engine stop button is pressed, the engine shuts down
12	IMMR HEATER OFF Indicator	This indicator illuminates to indicate that the main engine jacket water heater is OFF.
13	ALARM TEST	The alarm test is used to check all lights to ensure that they are operational.
14	ON Light	This light illuminates to indicate power to the alarm system.
15	ALARM OFF Pushbutton	The alarm off pushbutton turns OFF the alarm.
16	ANNUNCIATOR Display	This display panel indicates various fault conditions.
17	STOP Pushbutton	The stop pushbutton stops the prelube pump.
18	START Pushbutton	This pushbutton starts the prelube pump.
19	VALVES	These are the control valves for the pressure gauges (table 3, items 1, 2, and 3).

FUEL FILTER/WATER SEPARATORS

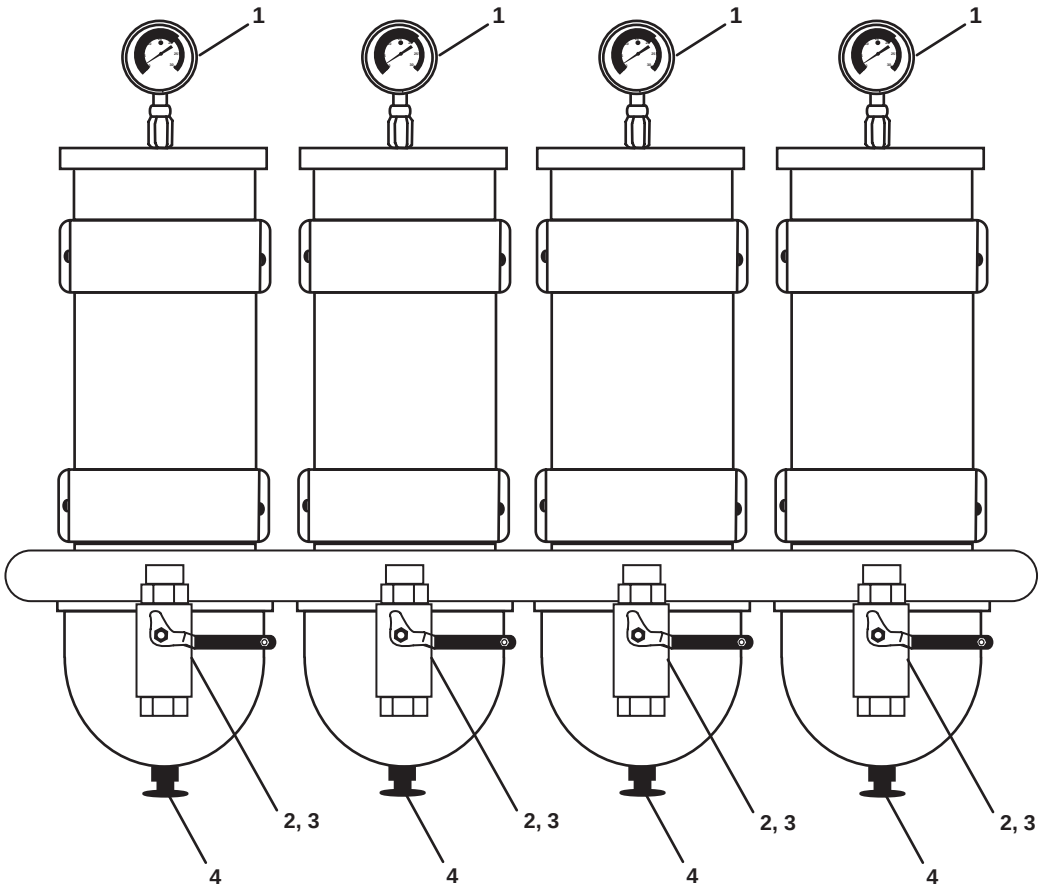


Figure 4. Fuel Filter/Water Separators

Table 4. Fuel Filter/Water Separators (refer to figure 4)

Key	Control/Indicator	Function
1	Filter Restriction Gauge	This gauge indicates the level of filter restriction present at the individual filter unit.
2	Fuel Supply Cutoff Valve	Located on the forward side of the filters, these valves secure the supply of fuel to the individual filter units permitting one filter unit to be serviced while the other filter units remain in service.
3	Fuel Discharge Cutoff Valve	Located on the after side of the filters, these valves secure the discharge of fuel from the individual filter units permitting one filter unit to be serviced while the other filter units remain in service.
4	Draincock	The draincock permits the draining of water and contaminants from the individual filter units' bowls.

MAIN ENGINE COOLANT EXPANSION TANK SIGHT GLASS

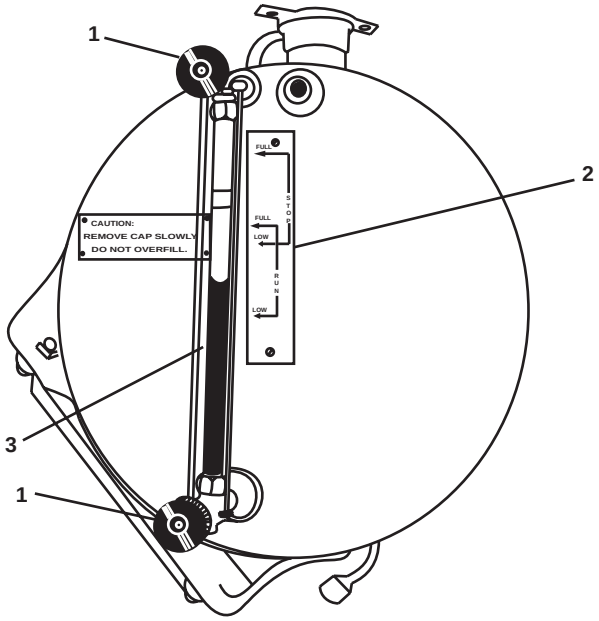


Figure 5. Main Engine Coolant Expansion Tank Sight Glass

Table 5. Main Engine Coolant Expansion Tank Sight Glass (refer to figure 5)

Key	Control/Indicator	Function
1	Cutoff Valves	These valves secure the flow of engine coolant to the sight glass for service or replacement.
2	Service Level Indicator	This indicator provides a visual indication of the proper engine coolant level in the expansion tank.
3	Sight Glass	The sight glass provides a visual indication of the engine coolant level in the expansion tank.

FUEL FILTER SELECTOR VALVE

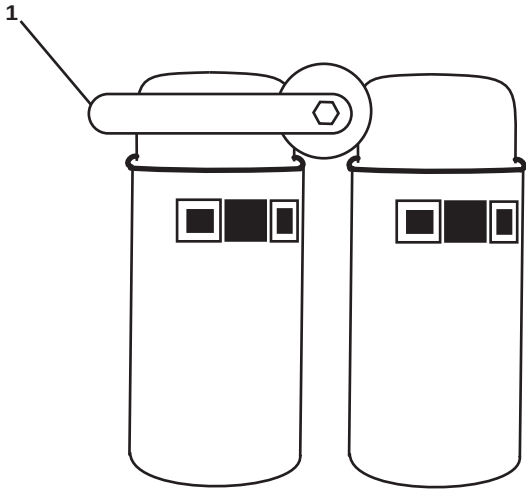


Figure 6. Fuel Filter Selector Valve

Table 6. Fuel Filter Selector Valve (refer to figure 6)

Key	Control/Indicator	Function
1	Selector Valve	This valve permits selection of the online filter(s). When in the center position, both filters are online. When in the R position, only the right filter is online. When in the L position, only the left filter is online.

OVERSPEED TRIP AND INJECTOR CONTROL LEVERS

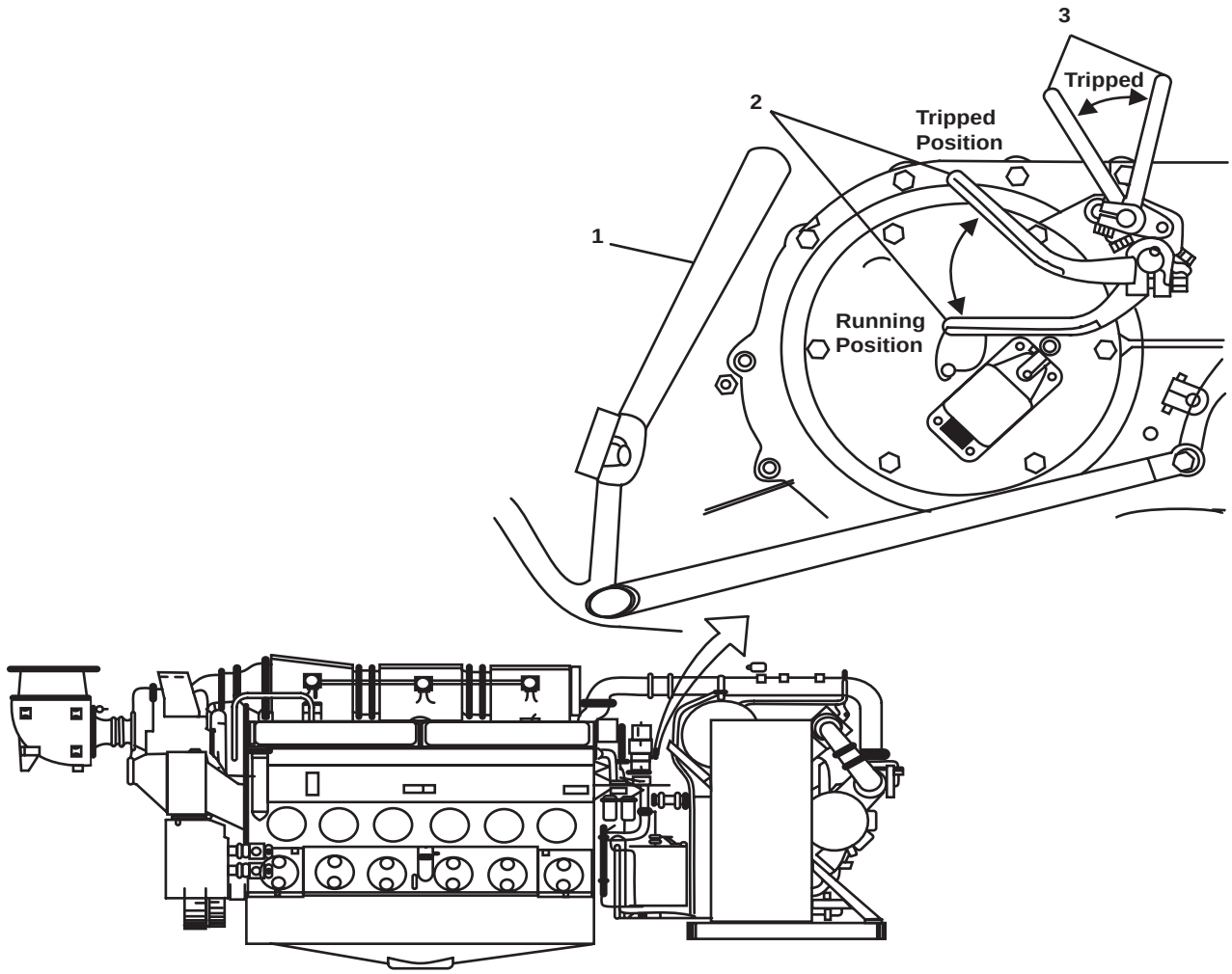


Figure 7. Overspeed Trip and Injector Control Levers

Table 7. Overspeed Trip and Injector Control Levers (refer to figure 7)

Key	Control/Indicator	Function
1	Injector Control Lever	The control lever permits manual control of the fuel injector rack during startup.
2	Overspeed Trip Lever	In an overspeed condition, this lever moves into the TRIPPED position and secures fuel flow to the combustion chambers, stopping the engine.
3	Shutdown Lever	When manually placed in the TRIPPED position, the shutdown lever permits the overspeed trip lever to move into the TRIPPED position, stopping the engine.

GOVERNOR

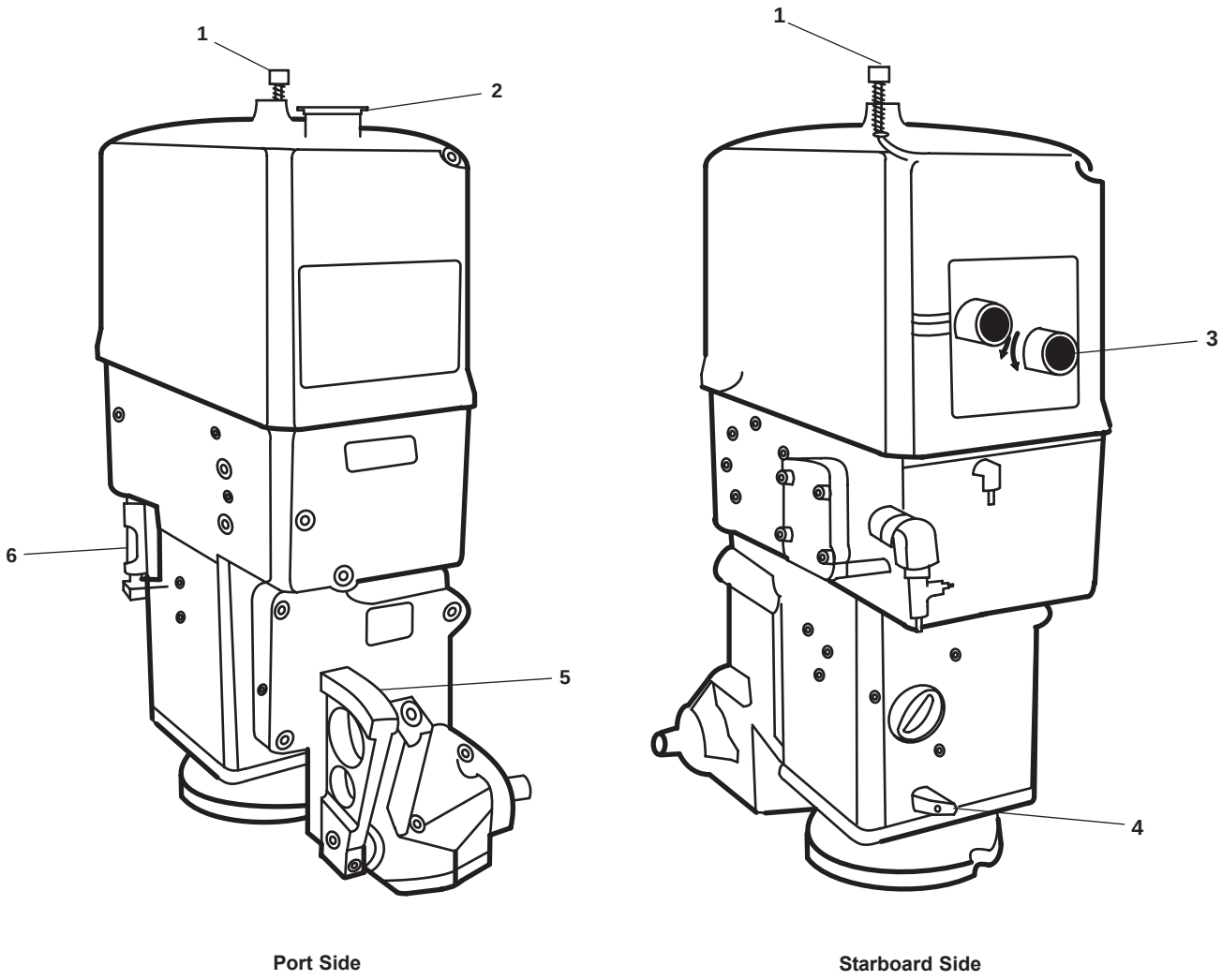


Figure 8. Governor

Table 8. Governor (refer to figure 8)

Key	Control/Indicator	Function
1	Manual Shutdown Button	This button permits manual shutdown of the engine when pressed.
2	Oil Filler Cap	The oil filter cap permits filling of the governor with lube oil.
3	Manual Speed Adjusting Knob	This knob permits manual adjustment of main engine speed.
4	Oil Draincock	The oil draincock permits draining of lube oil from the governor.
5	Terminal Shaft Scale	The shaft scale indicates fuel rack position.
6	Oil Level Sight Gauge	The sight gauge indicates the lube oil level within the governor.

SHAFT BRAKE CYLINDER

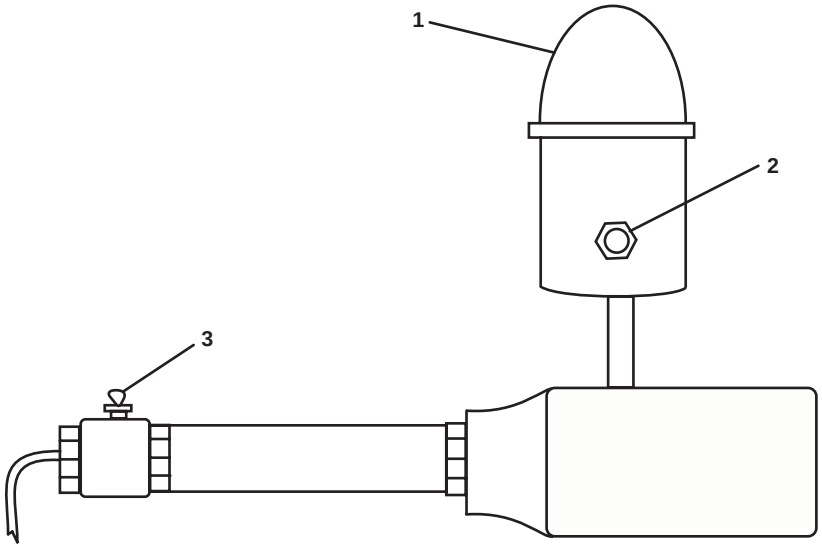


Figure 9. Shaft Brake Cylinder

Table 9. Shaft Brake Cylinder (refer to figure 9)

Key	Control/Indicator	Function
1	Filler Cap	The filler cap permits filling the reservoir with brake fluid.
2	Sight Glass	The sight glass indicates the brake fluid level within the reservoir. When the metal ball is floating, the brake fluid is at the proper level.
3	Bleed Valve	The bleed valve permits the bleeding of air from the shaft brake system.

SHAFT BRAKE PANEL

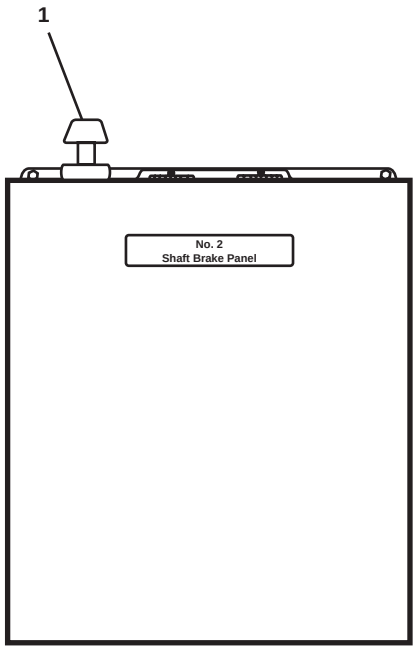


Figure 10. Shaft Brake Panel

Table 10. Shaft Brake Panel (refer to figure 10)

Key	Control/Indicator	Function
1	Control Knob	PULL the control knob to apply the brake. PUSH the knob to release the brake.

MAIN ENGINE 2 OPERATOR CONTROLS AND INDICATORS, GENERAL ARRANGEMENT

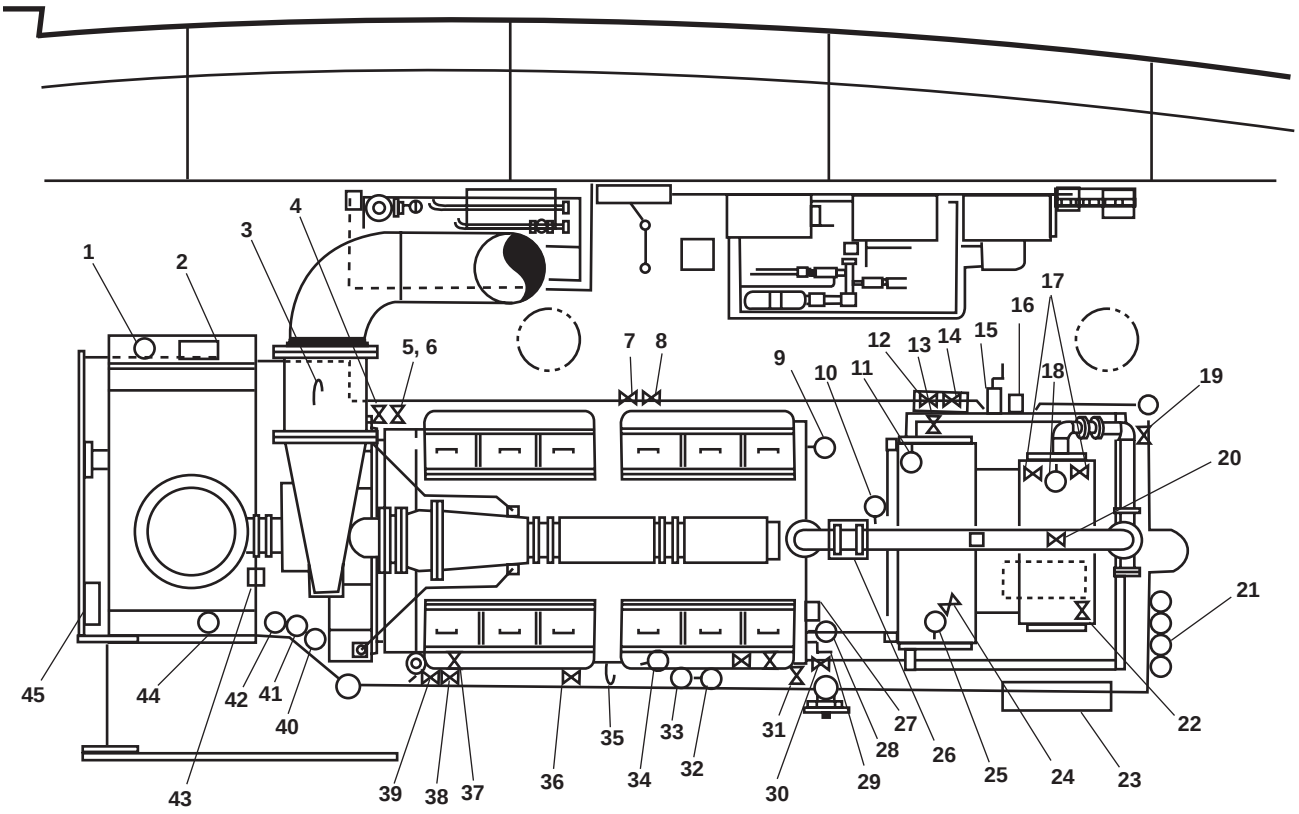


Figure 11. Main Engine 2, General Arrangement

Table 11. Main Engine 2 Operator Controls and Indicators, General Arrangement (refer to figure 11)

Key	Control/Indicator	Function
1	Pressure Gauge, Shaft Brake	This gauge indicates the pressure applied to the shaft brake.
2	Shaft Brake Cylinder	This cylinder controls the shaft brake. See figure 9 for details.
3	Dipstick	This tool indicates the oil level for reduction gear 2.
4	De-4, M.E. No. 2. EXH. DR. Valve	This valve drains condensation from main engine 2's exhaust when OPEN.
5	Cutoff Valve, Jacket Water to Aftercooler	This valve secures the flow of engine coolant to the aftercooler.
6	Cutoff Valve, Aftercooler Drain	This valve permits draining of engine coolant from the aftercooler.
7	De-6, S.S.D.G. No. 2 EXH. DR. Valve	When OPEN, this valve drains condensate from the SSDG 2 exhaust.

Table 11. Main Engine 2, General Arrangement (refer to figure 11) (continued)

Key	Control/Indicator	Function
8	De-8, PUMP DRIVE ENG. EXH. DR. valve	When OPEN, this valve drains condensation from the pump drive engine exhaust.
9	Pressure Gauge, Port Water Jacket	This gauge indicates the pressure of the engine coolant in the engine's port water jacket.
10	Temperature Gauge, Engine Coolant Outlet	This gauge indicates the temperature of the engine coolant being discharged from the engine to the keel cooler.
11	Temperature Gauge, Engine Coolant Inlet	This gauge indicates the temperature of the engine coolant being returned to the engine from the keel cooler.
12	Lo-47, C.O.V. PRELUBE PMP. DISCH valve	This valve secures the flow of oil from the prelube pump to main engine 2.
13	Sight Glass	The sight glass indicates the engine coolant level in the expansion tank. See figure 5 for details.
14	Cutoff Valve, Lube Oil Sampling Port	This valve secures the flow of lube oil at the sampling port on the prelube pump.
15	Hand Pump, Fuel Priming	The hand pump is used for priming the fuel system.
16	Prelube Pump Motor Controller	The controller controls the motor for the main engine 2 prelube oil pump. See figure 12 for details.
17	Cutoff Valves	These valves secure the pressure to the oil filter differential pressure gauge.
18	Differential Pressure Gauge, Oil Filter	This gauge indicates the differential pressure across the oil filter.
19	Cutoff Valve, Fuel Oil Supply	This valve secures the fuel oil supply to main engine 1.
20	Cutoff Valve, Jacket Water Heater Vent	This valve secures the flow of engine coolant from the jacket water heater to the expansion tank.
21	Fuel Filter/Water Separator	This quadplex fuel filter/water separator removes water from the fuel entering main engine 1. The unit also provides primary fuel filtration for main engine 1. See figure 4 for details.
22	Cutoff Valve	This valve secures the flow of lube oil from the oil filter to the hose connector.
23	Engine Control Panel	This panel contains the controls and indicators for main engine 2. See figure 3 for details.
24	Cutoff Valve, Jacket Water Heater Vent	This valve secures the flow of engine coolant from the jacket water heater to the expansion tank.
25	Lube Oil Temperature Gauge	This gauge indicates the temperature of main engine 2's lubricating oil.
26	Governor	The governor controls main engine 2's speed. See figure 8 for details.

Table 11. Main Engine 2, General Arrangement (refer to figure 11) (continued)

Key	Control/Indicator	Function
27	Overspeed Trip Lever	In an overspeed condition, the lever moves into the tripped position and secures fuel flow to the combustion chambers, stopping the engine. See figure 7 for details.
28	Pressure Gauge, Starboard Water Jacket	This gauge indicates the pressure of the engine coolant in the engine's starboard water jacket.
29	Injector Control Lever	This lever permits manual control of the fuel rack. See figure 7 for details.
30	Cutoff Valve, Starting Air Drain	This valve permits draining of the starting air system's pressure.
31	Fuel Filter Selector Valve	This valve permits either one or both fuel filters to supply the main engine's fuel system. See figure 6 for details.
32	Starting Air Regulator	This regulates the starting air pressure to the starting motors.
33	Starting Air Pressure Gauge	This gauge indicates the starting air system pressure.
34	Turbocharger Prelube Oil Pressure Gauge	This gauge indicates the lube oil pressure supplied to the turbocharger by the turbocharger prelube oil pump.
35	Dipstick (Port and Starboard)	This tool indicates the lube oil level in the engine.
36	Cutoff Valve, Starting Air Pressure Remote Sensor	This valve secures the pressure to the starting air pressure remote sensor.
37	Air Box Drain Valve (Port and Starboard)	This valve permits the draining of water and oil from the air boxes.
38	Fwc-14, F.W. FR. RED. GEAR No. 2 TO KEEL CLR Valve	This cutoff valve secures the flow of fresh water through the reduction gear's cooling system.
39	Fwc-16, F.W. FR. KEEL CLR TO RED. GEAR No. 2 Valve	This valve secures the flow of fresh water through the reduction gear's cooling system.
40	Temperature Gauge, Reduction Gear Cooling Water	This gauge indicates the temperature of the cooling water for reduction gear 2.
41	Pressure Gauge, Lube Oil	This gauge indicates the lube oil pressure for reduction gear 2.
42	Temperature Gauge, Lube Oil	This gauge indicates the lube oil temperature for reduction gear 2.
43	Air Filter Restriction Indicator	This indicator shows GREEN when the main engine air filter restriction is acceptable and shows RED when the main engine air filter restriction is unacceptable.
44	RDCN GR #2 LUBO PRESS	This gauge indicates the lube oil pressure for reduction gear 2.
45	#2 SHAFT BRAKE PANEL	This panel controls the operation of the shaft brake for shaft 2. See figure 10 for details.

PRELUBE PUMP MOTOR CONTROLLER, MAIN ENGINE 2

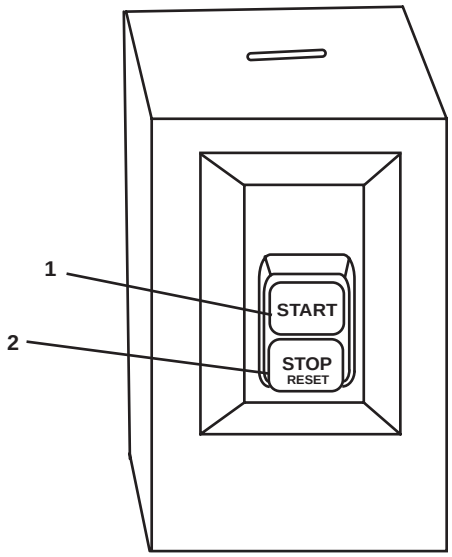


Figure 12. Prelube Pump Motor Controller, Main Engine 2

Table 12. Prelube Pump Motor Controller, Main Engine 2 (refer to figure 12)

Key	Control/Indicator	Function
1	START Pushbutton	This pushbutton starts the prelube pump.
2	STOP Pushbutton	This pushbutton stops the prelube pump.

SHIP'S SERVICE DIESEL GENERATOR 1 (SSDG 1) CONTROLS AND INDICATORS

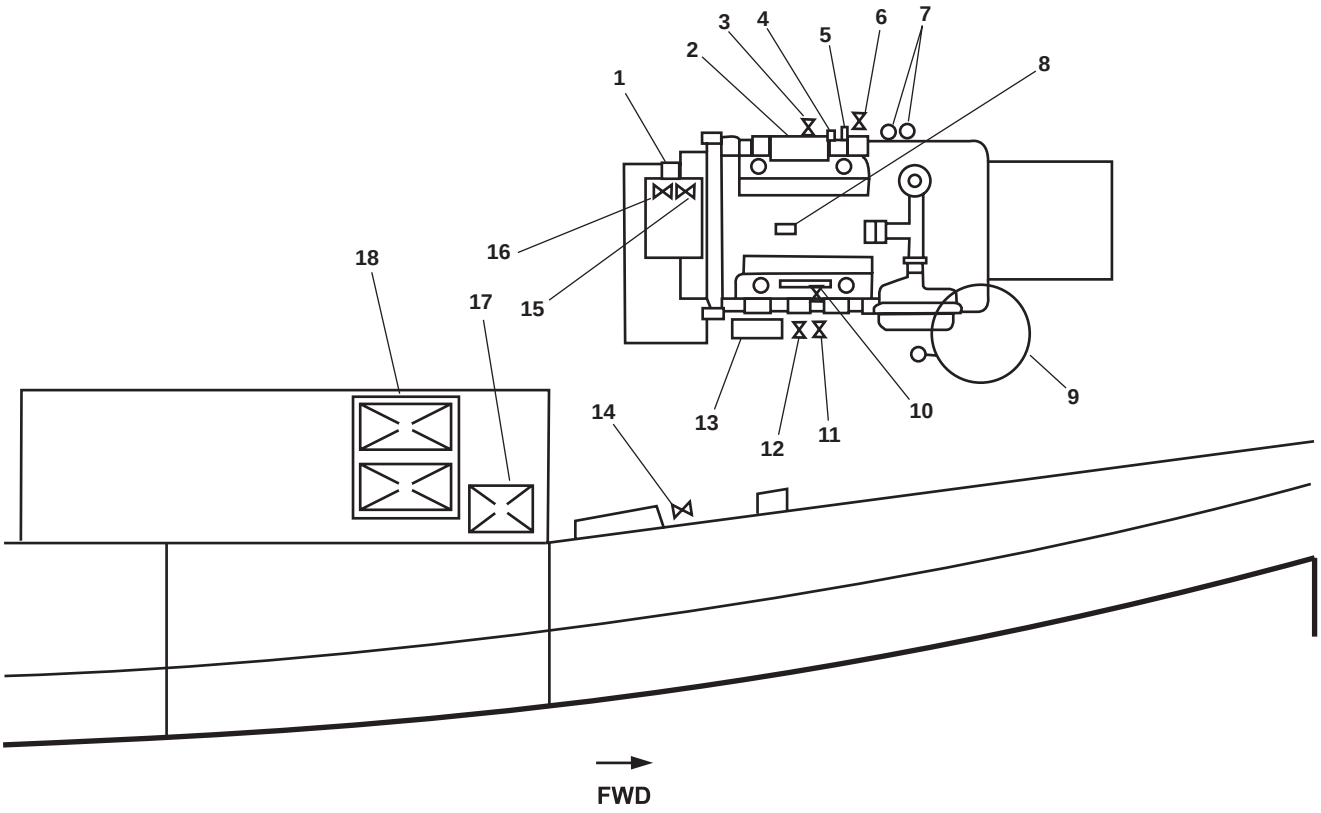


Figure 13. Ship's Service Diesel Generator 1 (SSDG 1)

Table 13. Ship's Service Diesel Generator 1 (SSDG 1) (refer to figure 13)

Key	Control/Indicator	Function
1	Engine Coolant Level Indicator/Alarm Switch	This switch indicates the engine coolant level in the engine's local expansion tank. See figure 14 for details.
2	Engine Gauge Panel	These gauges indicate the engine's vital system readings. See figure 15 for details.
3	Lo-11, LUBO TO S.S.D.G. No. 1	This is the valve for lube oil supply to SSDG 1.
4	Dipstick	The dipstick indicates the lube oil level in the engine's sump.
5	Hand Priming Pump	The pump is used to prime the engine's fuel system.
6	Cutoff Valve, Remote Fuel Pressure Sensor	This valve secures the pressure to the remote fuel pressure sensor.
7	Fuel Filter/Water Separators and Fuel Supply Valves	The fuel filter/water separators separate water from the fuel oil and provide primary fuel filtration. The fuel supply valves control the flow of fuel to the engine's fuel system. See figure 16 for details.

Table 13. Ship's Service Diesel Generator 1 (SSDG 1) (refer to figure 13) (continued)

Key	Control/Indicator	Function
8	Hour Meter	This meter indicates the number of operating hours for the engine.
9	Expansion Tank Sight Gauge	This gauge indicates the level of engine coolant in the remote expansion tank. See figure 17 for details.
10	Cutoff Valve, Remote Lube Oil Pressure Sensor	This valve secures the pressure to the remote lube oil pressure gauge.
11	Cutoff Valve, Jacket Water Heater Supply	This valve secures the flow of engine coolant to the jacket water heater.
12	Cutoff Valve, Jacket Water Heater Discharge	This valve secures the flow of engine coolant from the jacket water heater.
13	Engine Control Panel	This contains the emergency stop pushbutton and circuit breakers. See figure 18 for details.
14	Cutoff Valve, Remote Expansion Tank Fill	This valve controls the flow of potable water to the remote expansion tank fill.
15	Engine Coolant Drain Valve	This valve permits the draining of the engine coolant.
16	Cutoff Valve, Remote Coolant Pressure Gauge	This valve secures the pressure to the remote coolant pressure gauge.
17	Battery Charger, SSDG 1 Batteries	This maintains the charge for the SSDG 1 batteries when the generator is not in use. See figure 19 for details.
18	Battery Bank, SSDG 1	These are the starting batteries for SSDG 1.

ENGINE COOLANT LEVEL INDICATOR/ALARM SWITCH

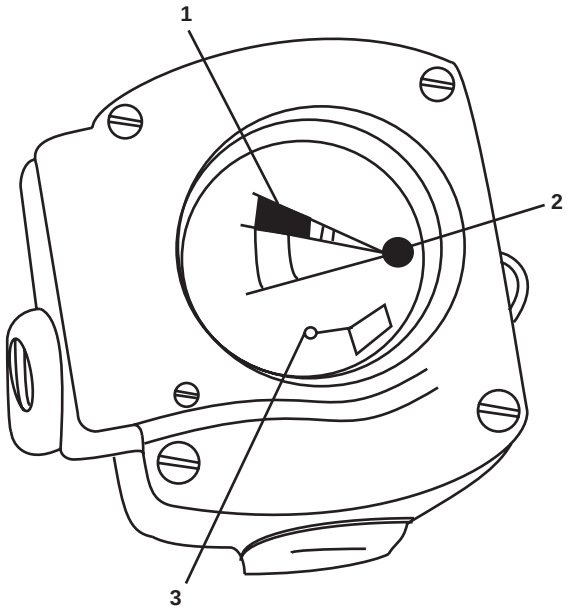


Figure 14. Engine Coolant Level Indicator/Alarm Switch

Table 14. Engine Coolant Indicator/Alarm Switch (refer to figure 14)

Key	Control/Indicator	Function
1	Indicator Needle	The indicator needle indicates the level of engine coolant present in the local expansion tank.
2	Test Knob	The test knob permits the operator to move the indicator needle to test the operation of the alarm switch.
3	Alarm Switch	When CLOSED by low engine coolant level or by manual actuation of the test knob, the alarm switch sends a signal to the engine monitoring system.

ENGINE GAUGE PANEL

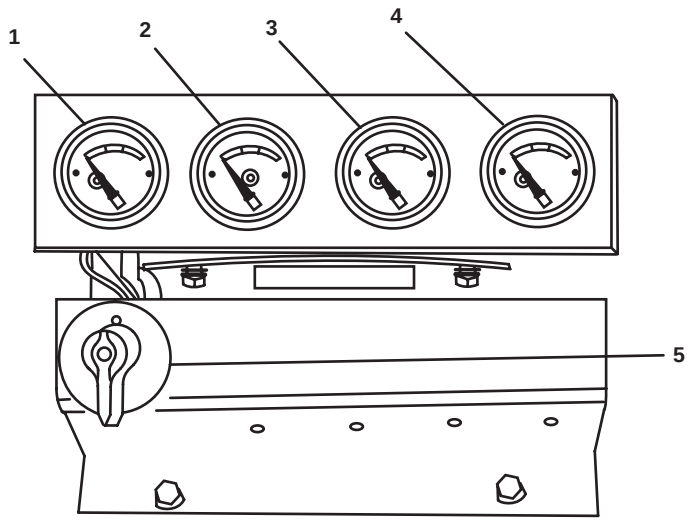


Figure 15. Engine Gauge Panel

Table 15. Engine Gauge Panel (refer to figure 15)

Key	Control/Indicator	Function
1	Fuel Pressure Gauge	The pressure gauge indicates the fuel pressure supplied to the engine.
2	Coolant Temperature Gauge	The temperature gauge indicates the temperature of the engine coolant.
3	Ammeter	The ammeter indicates the charging system's charging rate.
4	Lube Oil Pressure Gauge	The pressure gauge indicates the engine's lube oil pressure.
5	OFF/RUN/START Switch	This switch permits local starting and stopping of the engine.

FUEL FILTER/WATER SEPARATORS AND FUEL SUPPLY VALVES

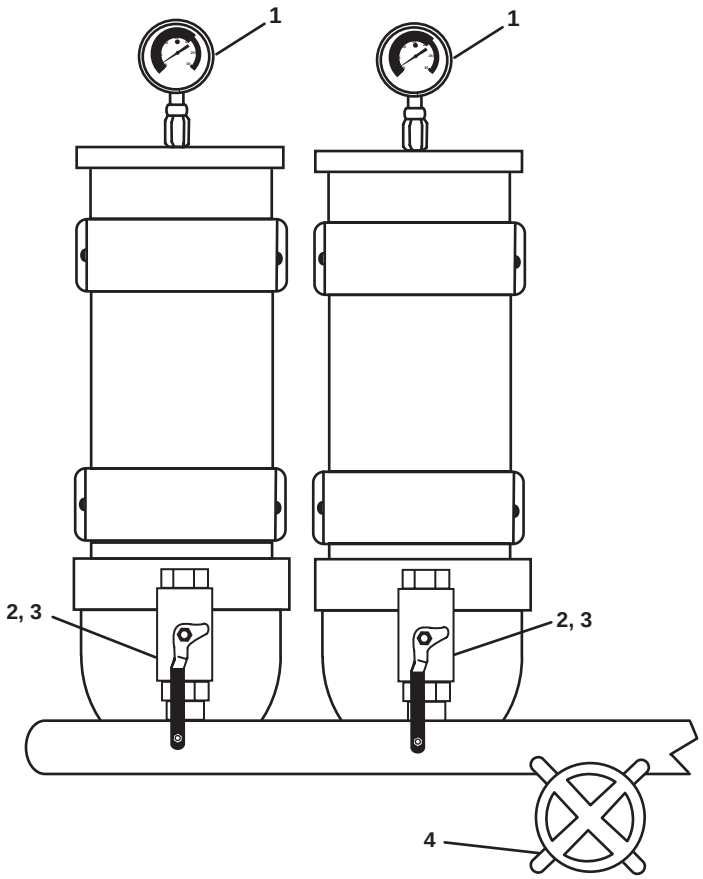


Figure 16. Fuel Filter/Water Separators and Fuel Supply Valves

Table 16. Fuel Filter/Water Separators and Fuel Supply Valves (refer to figure 16)

Key	Control/Indicator	Function
1	Filter Restriction Gauge	This gauge indicates the level of filter restriction for each individual filter unit.
2	Fuel Oil Supply Valve	This valve is located on the front side of the filters. It permits the fuel oil supply into the individual filter unit to be secured.
3	Fuel Oil Discharge Valve	This valve is located on the back side of the filters. It permits the fuel oil discharge from the individual filter unit to be secured.
4	FO-21, F.O. SPLY TO S.S.D.G. No. 1 Valve	This valve secures the fuel oil supply to SSDG 1.

REMOTE EXPANSION TANK SIGHT GAUGE

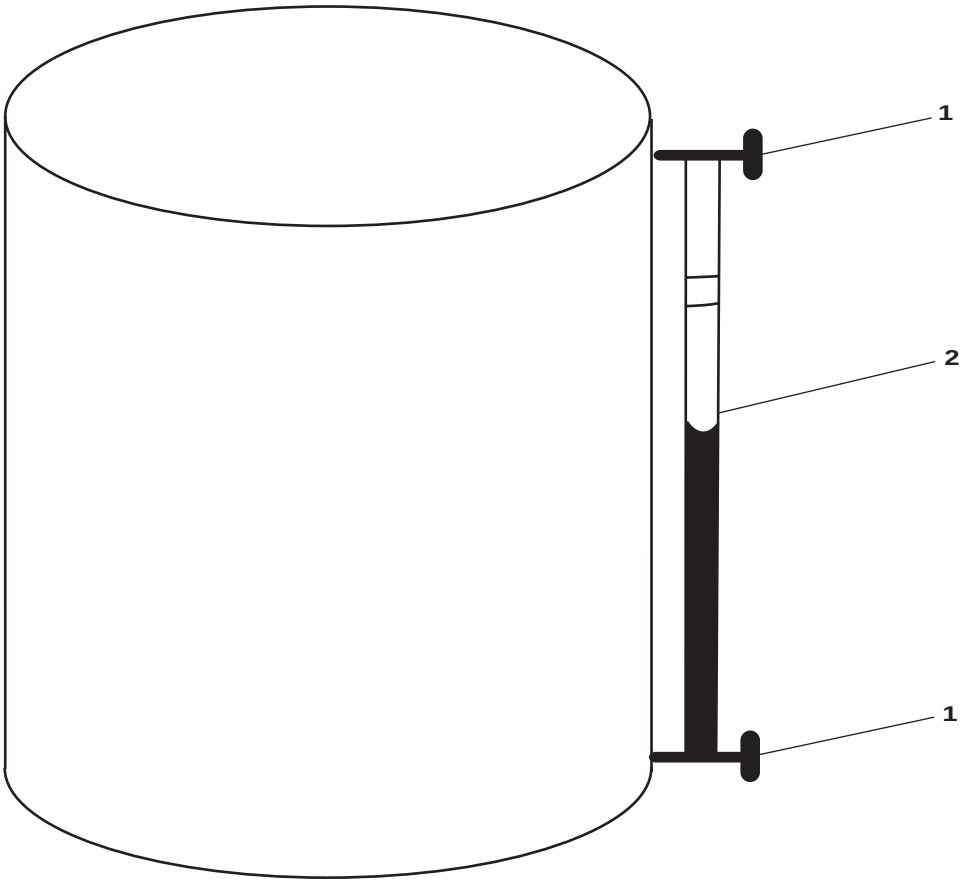


Figure 17. Remote Expansion Tank Sight Gauge

Table 17. Remote Expansion Tank Sight Gauge (refer to figure 17)

Key	Control/Indicator	Function
1	Cutoff Valve	This valve secures the engine coolant to the sight glass.
2	Sight Glass	The sight glass indicates the engine coolant level in the remote expansion. tank.

ENGINE CONTROL PANEL, SSDG 1

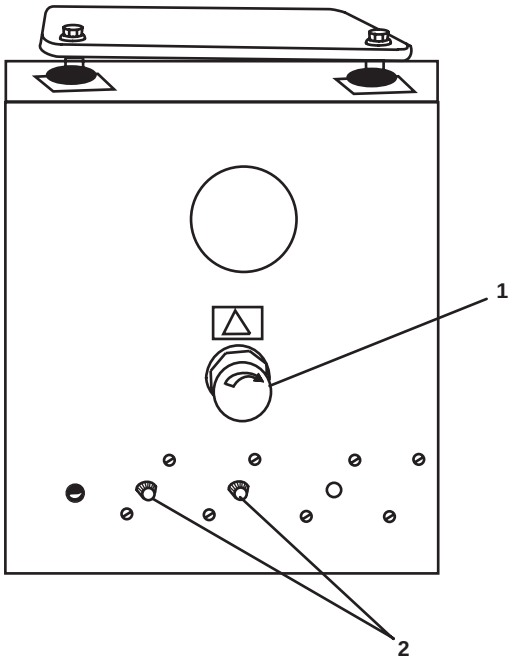


Figure 18. Engine Control Panel, SSDG 1

Table 18. Engine Control Panel, SSDG 1

Key	Control/Indicator	Function
1	Emergency Stop Pushbutton	The emergency stop pushbutton must be positioned OUT to operate the engine. When positioned IN, the engine stops.
2	Circuit Breaker	The circuit breakers provide circuit protection for the engine's operating circuits.

SSDG 1 BATTERY CHARGER

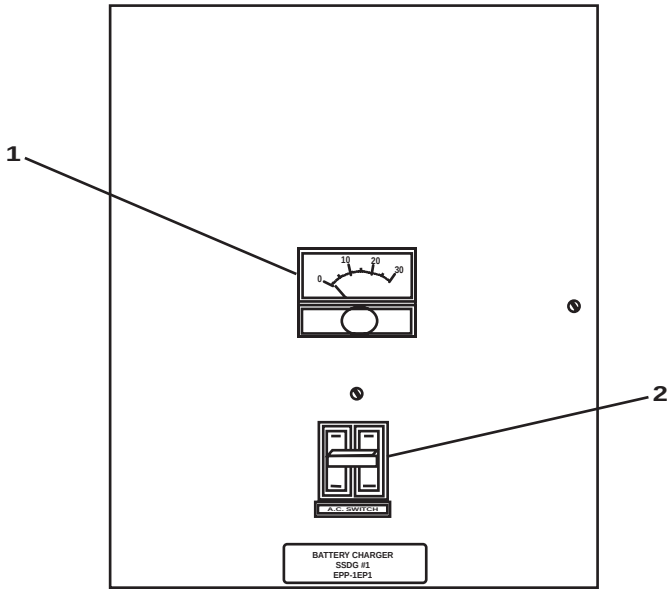


Figure 19. SSDG 1 Battery Charger

Table 19. SSDG 1 Battery Charger (refer to figure 19)

Key	Control/Indicator	Function
1	Ammeter	The ammeter indicates the battery charger's charging rate.
2	A.C. Switch	This switch turns the battery charger ON and OFF.

SSDG 2 CONTROLS AND INDICATORS

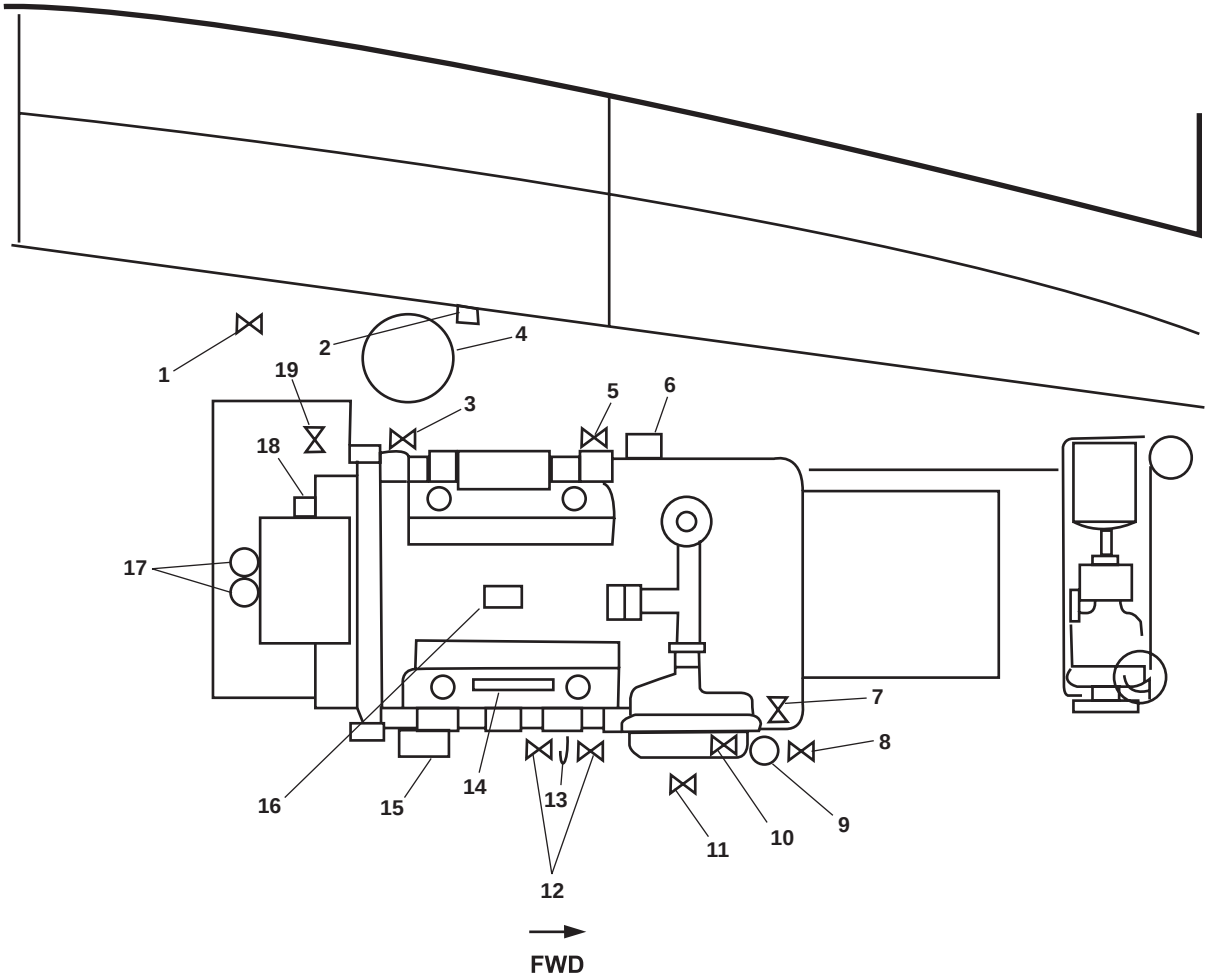


Figure 20. SSDG 2 Controls and Indicators

Table 20. SSDG 2 Controls and Indicators (refer to figure 20)

Key	Control/Indicator	Function
1	Cutoff Valve, Remote Expansion Tank Fill	This valve controls the flow of potable water to the remote expansion tank fill.
2	SSDG 2 STG AIR PRESS Gauge	This gauge indicates the air pressure available to the starting system.
3	Lo-10, LUBO TO S.S.D.G. No. 2 Valve	This is the cutoff valve for the lube oil supply to SSDG 2.
4	Expansion Tank Sight Gauge	This gauge indicates the level of engine coolant in the remote expansion tank. See figure 17 for details.
5	Cutoff Valve, Remote Fuel Pressure Sensor	This valve secures the pressure to the remote fuel pressure sensor.

Table 20. SSDG 2 Controls and Indicators (refer to figure 20)

Key	Control/Indicator	Function
6	Hand Priming Pump	This pump is used to prime the engine's fuel system.
7	Cutoff Valve, SSDG #2 STG AIR PRESS Gauge	This gauge secures pressure to the starting air pressure gauge for this engine.
8	CA-7, STG AIR TO DSL GEN Valve	This valve secures the starting air to SSDG 2.
9	Starting Air Regulator	The starting air regulator regulates the starting air pressure to SSDG 2.
10	Starting Air Valve	The starting air valve controls the flow of starting air to the starter motor.
11	Cutoff Valve, Crankcase Vent	This valve secures the crankcase vent flow from the engine.
12	Cutoff Valves, Jacket Water Heater Supply and Discharge	These valves secure the flow of engine coolant to and from the jacket water heater.
13	Dipstick	The dipstick indicates the lube oil level in the engine's sump.
14	Engine Gauge Panel	The engine gauge panel gauges indicate the engine's vital system readings. See figure 21 for details.
15	Engine Control Panel	This control panel contains the emergency stop pushbutton, ON/OFF/START switch, and circuit breakers. See figure 22 for details.
16	Hour Meter	The hour meter indicates the number of operating hours for the engine.
17	Fuel Filter/Water Separators and Fuel Supply Valves	The fuel filter/water separators separate water from the fuel oil and provide primary fuel filtration. The fuel supply valves control the flow of fuel to the engine's fuel system. See figure 16 for details.
18	Engine Coolant Level Indicator/Alarm Switch	This switch indicates the engine coolant level in the engine's local expansion tank. See figure 14 for details.
19	Lo-4, LUBO DR TO OILY DR. TK.	This is the cutoff valve for engine coolant to SSDG 2.

ENGINE GAUGE PANEL, SSDG 2

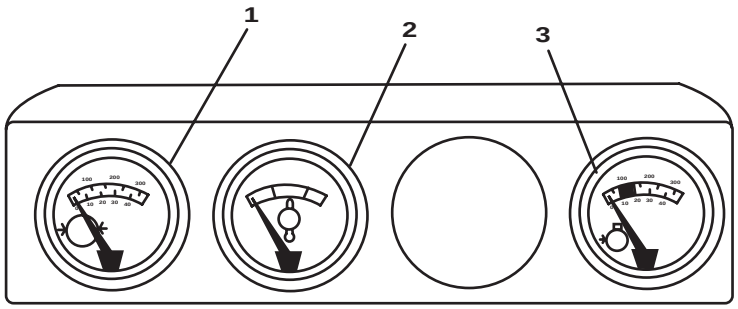


Figure 21. Engine Gauge Panel, SSDG 2

Table 21. Engine Gauge Panel, SSDG 2 (refer to figure 21)

Key	Control/Indicator	Function
1	Fuel Pressure Gauge	This gauge indicates the fuel pressure supplied to the engine.
2	Coolant Temperature Gauge	This temperature gauge indicates the temperature of the engine coolant.
3	Lube Oil Pressure Gauge	This pressure gauge indicates the engine's lube oil pressure.

ENGINE CONTROL PANEL, SSDG 2

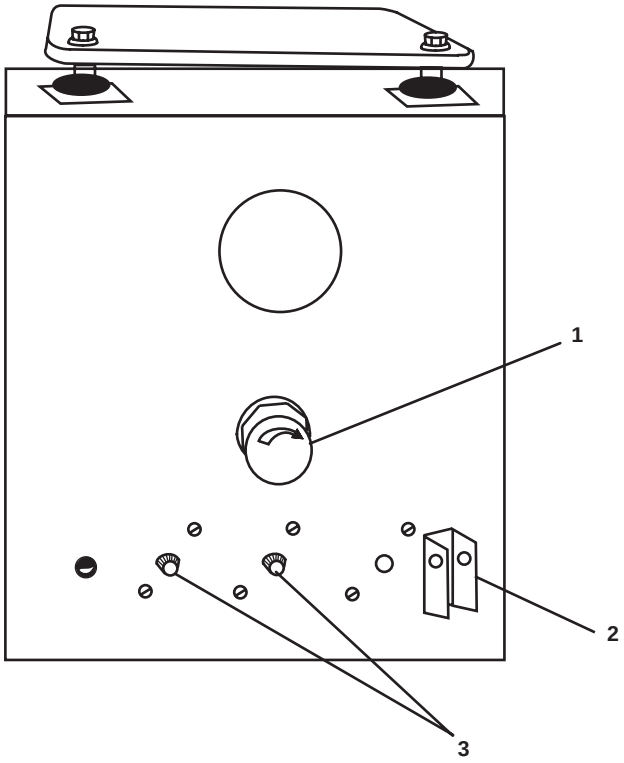


Figure 22. Engine Control Panel, SSDG 2

Table 22. Engine Control Panel, SSDG 2 (refer to figure 22)

Key	Control/Indicator	Function
1	Emergency Stop Pushbutton	This pushbutton must be positioned OUT to operate the engine. When positioned IN, the engine stops.
2	OFF/RUN/START Switch	This switch permits local starting and stopping of the engine.
3	Circuit Breaker	This circuit breakers provide circuit protection for the engine's operating circuits.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
ENGINE ROOM: FUEL OIL, LUBE OIL, AND HYDRAULIC OIL FILL AND TRANSFER SYSTEMS

GENERAL ARRANGEMENT

The general arrangement of the fuel oil, lube oil, and hydraulic oil fill and transfer systems' operator controls and indicators is illustrated in figure 1. Individual figures will accompany each control and indicator as it is discussed later in this work package. Fuel system, lube oil system, and hydraulic oil system controls and indicators particular to a given engine or hydraulic power unit (e.g., fuel filters, oil filters, fuel pressure gauges, and fuel supply valves for individual engines) are detailed in WP 0041 00.

GENERAL ARRANGEMENT; ENGINE ROOM; FUEL OIL, LUBE OIL, AND HYDRAULIC OIL FILL AND TRANSFER SYSTEMS

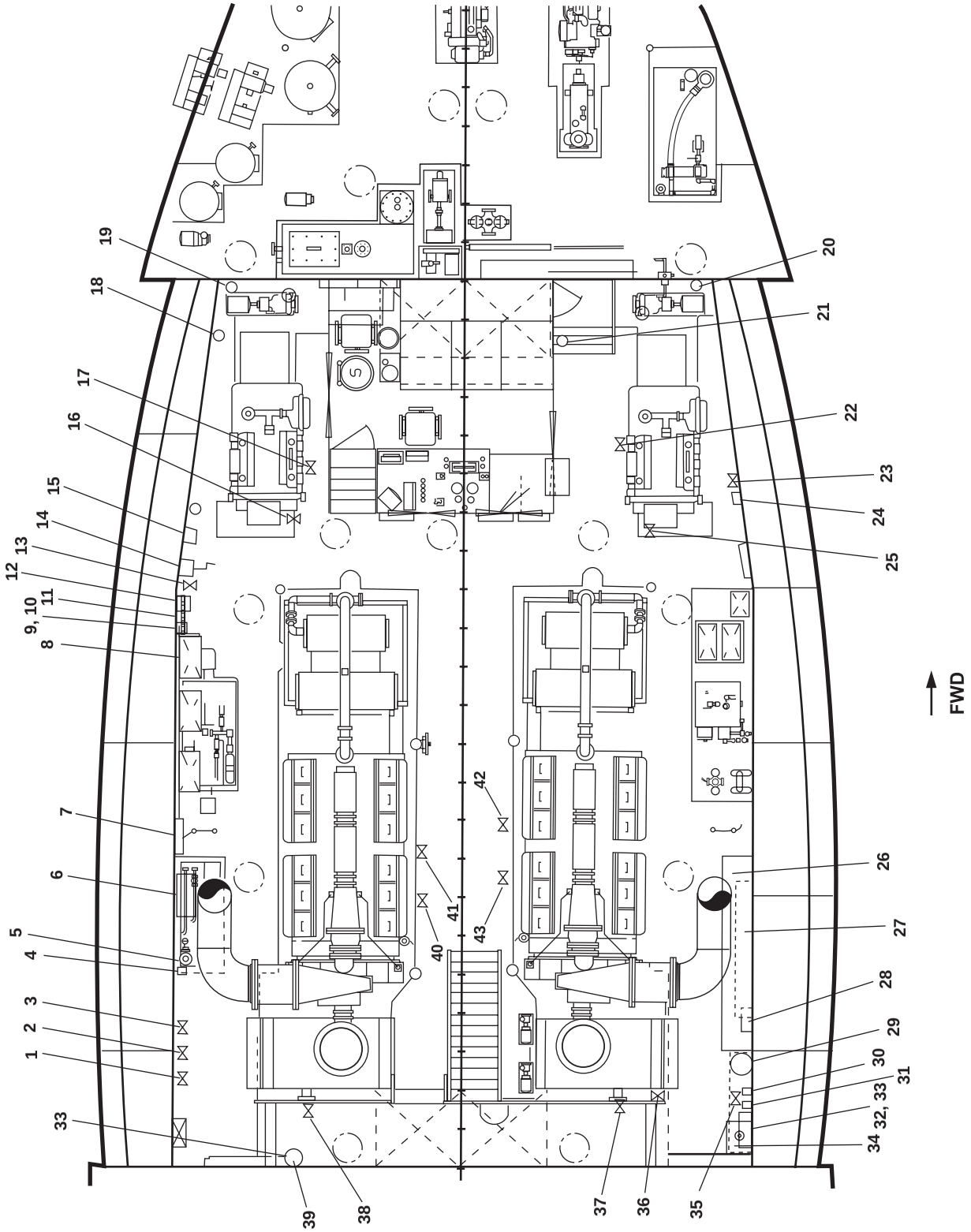


Figure 1. General Arrangement; Engine Room; Fuel Oil, Lube Oil, and Hydraulic Oil Fill and Transfer Systems

Table 1. General Arrangement; Engine Room; Fuel Oil, Lube Oil, and Hydraulic Oil Fill and Transfer Systems'

Key	Control/Indicator	Function
1	FO-33, F.O. RTN TO DAY TK. PORT Valve	This cutoff valve controls the flow of fuel oil into the day tank.
2	FO-36, F.O. RTN RLF - SET AT 10 P.S.I.	This valve permits return fuel to relieve back to the tank if excessive restriction exists in the return piping.
3	FO-2, F.O. DAY TK. FILL Valve	This valve controls the flow of fuel oil into the port fuel oil day tank.
4	Heater Control Panel	This panel controls the lube oil purifier's heating unit. Refer to figure 2 for details.
5	Lube Oil Purifier	The purifier cleans the lube oil. Refer to figure 3 for details.
6	Lube Oil Purifier Control Panel	This panel contains controls for the lube oil purifier. Refer to figure 4 for details.
7	Lube Oil Purification Manifold	The manifold controls the flow of lube oil to and from the lube oil purifier. Refer to figure 5 for details.
8	Lube Oil Transfer Pump and Strainer	This pump transfers lube oil from the lube oil storage tank and through the lube oil oil purification system. Refer to figure 6 for details.
9	LUBO XFR STR DIFF Pressure Gauge	This gauge indicates the differential pressure across the lube oil transfer strainer.
10	LUBO XFR PMP DISCH PRESS Gauge	This gauge indicates the discharge pressure from the lube oil transfer pump.
11	Lube Oil Transfer Manifold	The manifold contains controls for the flow of lube oil from the lube oil transfer pump. Refer to figure 6 for details.
12	LUBE OIL XFER PUMP Motor Controller	This motor controller controls the operation of the lube oil transfer pump. Refer to figure 7 for details.
13	Cutoff Valve, Hydraulic Storage Tank Suction	This valve secures the suction piping from the hydraulic oil storage tank. The valve is located below the deckplate and is operated via a reach rod with controls both in the engine room and in the mess and recreation space.
14	Hydraulic Oil Transfer Pump System	The pump transfers hydraulic oil from the hydraulic tank. Refer to figure 8 for details.
15	LUBE OIL Tank Level Indicator	This indicator displays the lube oil level in the lube oil storage tank. Refer to figure 9 for details.
16	Lo-4, LUBO DR TO OILY DR TK Valve	This cutoff valve drains the lube oil from Ship's Service Diesel Generator (SSDG) 2 to the oily drain tank.
17	Lo-10, LUBO TO S.S.D.G. No. 2 Valve	This cutoff valve controls the transfer of lube oil to SSDG 2.
18	Sight Gauge, Hydraulic Oil Storage Tank	This gauge indicates the hydraulic oil level in the hydraulic oil storage tank. Refer to figure 10 for details.

Table 1. General Arrangement; Engine Room; Fuel Oil, Lube Oil, and Hydraulic Oil Fill and Transfer Systems (refer to figure 1) (continued)

Key	Control/Indicator	Function
19	Overflow Indicator, Fuel Tank 2 Port Vent	This indicator illuminates when fuel tank 2 port has been overfilled. Refer to figure 11 for details.
20	Overflow Indicator, Fuel Tank 2 Starboard Vent	This indicator illuminates when fuel tank 2 starboard has been overfilled. Refer to figure 11 for details.
21	Overflow Indicator, Fuel Tank 2 Center Vent	This indicator illuminates when fuel tank 2 center has been overfilled. Refer to figure 11 for details.
22	Lo-11, LUBO TO S.S.D.G. No. 1 Valve	This cutoff valve controls the transfer of lube oil to SSDG 1.
23	Lo-14, LUBO XFER. TO OILY WST. STOR. TK. Valve	This valve controls the transfer of lube oil from SSDG 1 to the oily waste storage tank.
24	SLUDGE Tank Level Indicator	This indicator displays the liquid level in the oily waste tank. Refer to figure 9 for details.
25	Cutoff Valve, Lube Oil to Oily Drain Tank	This cutoff valve drains the lube oil from SSDG 1 to the oily drain tank.
26	Tank Level Indicator Panel, Fuel Oil Transfer	This panel indicates the tank level for all of the vessel's fuel oil tanks and is located directly above the fuel oil transfer manifold. Refer to figure 12 for details.
27	Fuel Oil Transfer Manifold, Forward	This manifold controls the flow of fuel oil into and out of all of the vessel's fuel oil tanks. See figure 13 for details.
28	RACOR FILTER Control Panel	This panel contains controls for the fuel oil transfer system's fuel filter/ water separator. Refer to figure 14 for details.
29	Fuel Filter/Water Separator	This unit filters the fuel oil and removes water as the fuel oil is transferred.
30	#1 FUEL OIL TRANSFER PUMP Motor Controller	This motor controller controls the operation of fuel oil transfer pump 1. Refer to figure 7 for details.
31	#2 FUEL OIL TRANSFER PUMP Motor Controller	This motor controller controls the operation of fuel oil transfer pump 2. Refer to figure 7 for details.
32	High Level Alarm Panel	This alarm warns of high fuel oil levels in the port and starboard fuel oil day tanks. Refer to figure 15 for details.
33	Fuel Oil Transfer Gauge Panel	These gauges indicate the pressures present in the fuel oil transfer system. Refer to figure 16 for details.
34	Fuel Oil Transfer Manifold, Aft	This manifold contains controls for the fuel oil transfer pumps and the fuel filter/water separator. Refer to figure 17 for details.
35	FO-1, F.O. DAY TK. FILL Valve	This crossover valve controls the flow of fuel oil into the starboard fuel oil day tank.

Table 1. General Arrangement; Engine Room; Fuel Oil, Lube Oil, and Hydraulic Oil Fill and Transfer Systems (refer to figure 1) (continued)

Key	Control/Indicator	Function
36	FO-14, F.O. SERV CRSVR Valve	This crossover valve permits fuel to flow between the day tanks.
37	Lo-27, LUBO DR. FR. RED. GEAR No. 1 Valve	This is the cutoff valve to the reduction gear 1 drain.
38	Lo-28, LUBO DR. FR. RED GEAR No. 2 Valve	This is the cutoff valve to the reduction gear 2 drain.
39	Overflow Indicator, Fuel Tank 3 Center Vent	This indicator illuminates when fuel tank 3 center has been overfilled. Refer to figure 11 for details.
40	Lo-30, M.E. No. 2 - LUBO PUR. SUCT Valve	This is the cutoff valve for main engine 2 lube oil suction.
41	Lo-6, LUBO DR TO OILY DR. TK. Valve	This is the cutoff valve for the lube oil to the oily day tank.
42	Lo-5, LUBO DR TO OILY DR. TK. Valve	This is the cutoff valve for the lube oil to the oily day tank.
43	Lo-29, M.E. No. 1 - LUBO PUR. SUCT Valve	This is the cutoff valve for main engine 1 lube oil suction.

HEATER CONTROL PANEL

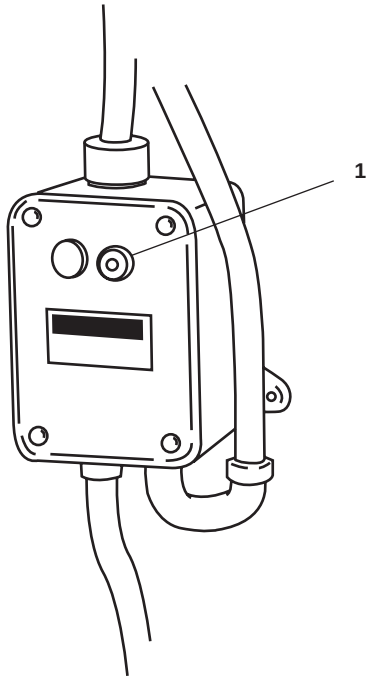


Figure 2. Heater Control Panel

Table 2. Heater Control Panel (refer to figure 2)

Key	Control/Indicator	Function
1	ON/OFF Pushbutton	This pushbutton turns the lube oil purifier heater ON and OFF.

LUBE OIL PURIFIER

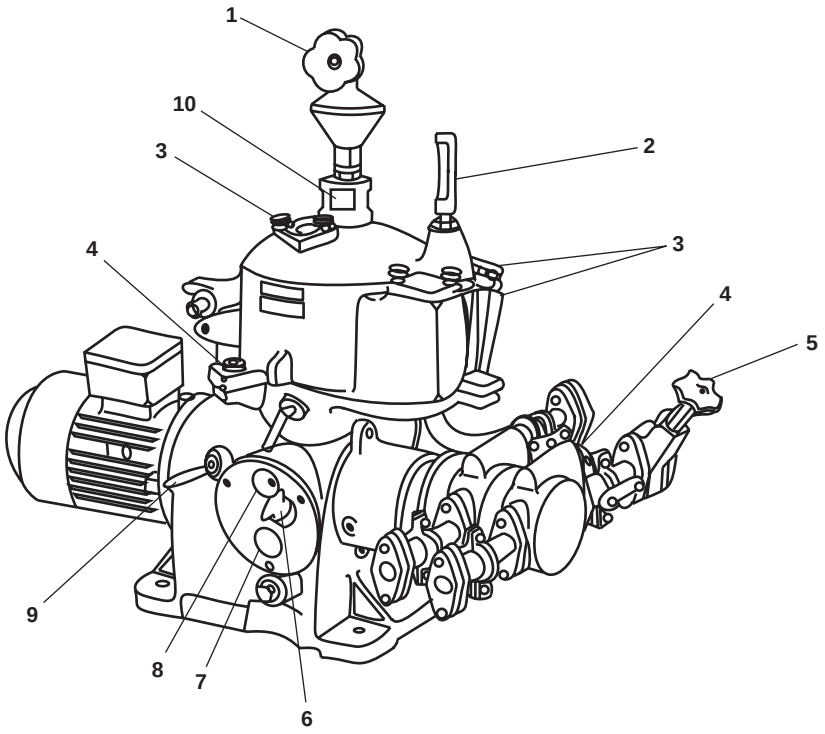


Figure 3. Lube Oil Purifier

Table 3. Lube Oil Purifier (refer to figure 3)

Key	Control/Indicator	Function
1	Needle Valve	This valve provides an opening for filling the bowl and throttle for the amount of makeup water required for the type of oil.
2	Thermometer	This thermometer indicates the temperature of the dirty oil.
3	Inspection Covers (3)	When removed, these covers allow observation of the dirty water and clean oil discharges.
4	Drain Cock	The drain cock drains the oil from the feed channel of the hood.
5	Valve	This valve adjusts the dirty oil feed line capacity.
6	Oil Fill Screw	When OPEN, this screw allows gear oil replenishment.
7	Gear Oil Sight Glass	This sight glass indicates the oil level in the gear chamber. The oil level should be up to the upper third of the sight glass.
8	Revolution Indicator Disk	The disk indicates the direction and speed of bowl rotation. The bowl must rotate in a clockwise direction.
9	Brake Handle	This handle provides braking of the motor driven gear train. The brake is released by turning the handle clockwise.
10	Dirty Oil Sight Glass	The sight glass indicates that dirty oil is going to the preheater.

LUBE OIL PURIFIER CONTROL PANEL

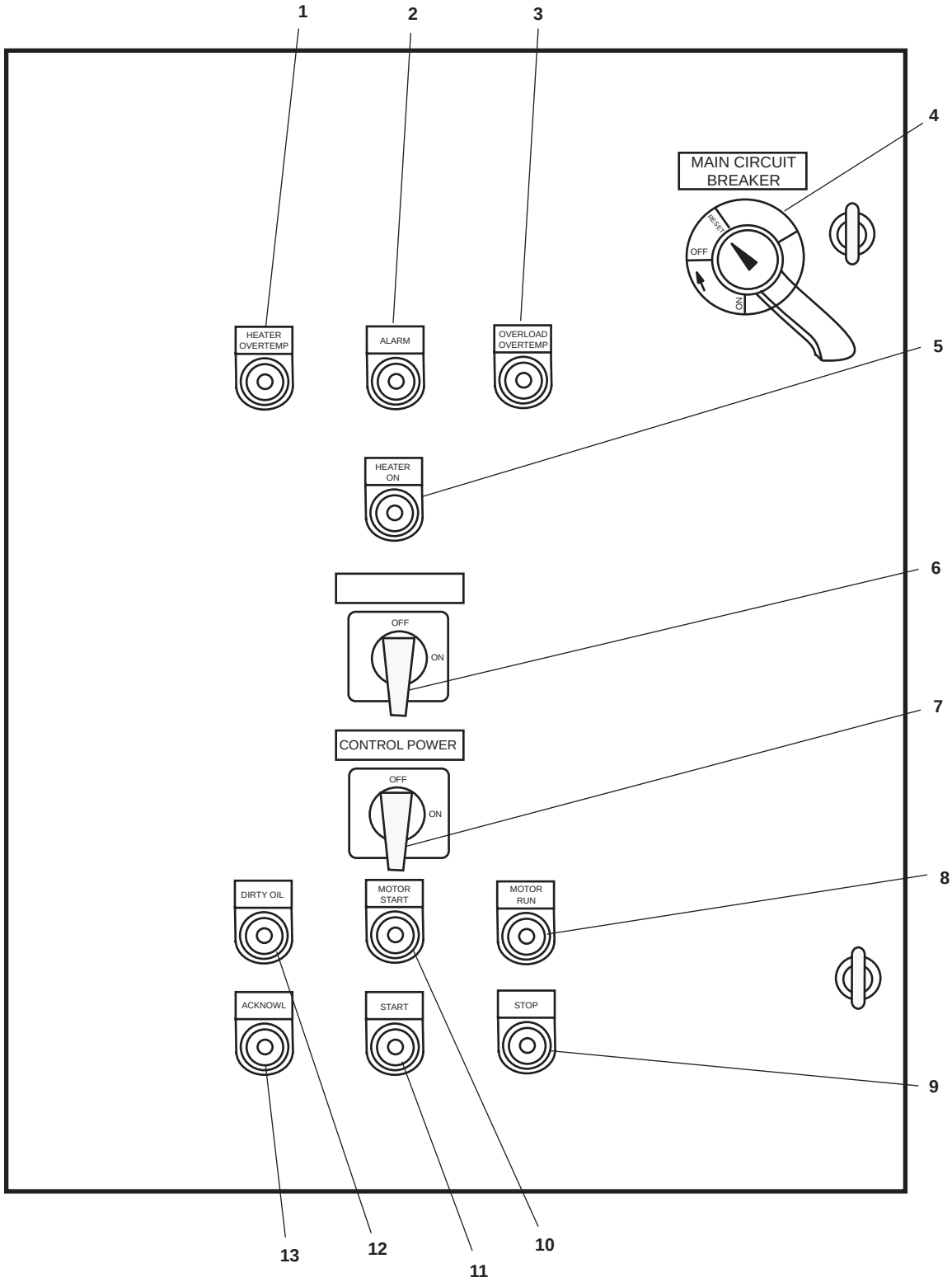


Figure 4. Lube Oil Purifier Control Panel

Table 4. Lube Oil Purifier Control Panel (refer to figure 4)

Key	Control/Indicator	Function
1	HEATER OVERTEMP Light	This light illuminates when the unit exceeds the safe operating temperature.
2	ALARM Light	The light illuminates when an alarm condition is detected.
3	OVERLOAD OVERTEMP Light	The light illuminates when an overload or overtemperature condition is present.
4	MAIN CIRCUIT BREAKER	The breaker is used to turn ON and OFF the main circuit breaker. It also allows the main circuit breaker to be reset.
5	HEATER ON Light	This light illuminates when the heater is ON.
6	Heater Switch	This switch turns the heater ON and OFF.
7	CONTROL POWER Switch	This switch turns the control power ON and OFF.
8	MOTOR RUN Indicator	This indicator illuminates when the lube oil purifier motor is running.
9	STOP Pushbutton	This red pushbutton stops the lube oil purifier motor.
10	MOTOR START Indicator	This indicator illuminates when the motor START pushbutton (table 4, item 11) is pressed.
11	START Pushbutton	This pushbutton starts the lube oil purifier motor.
12	DIRTY OIL Indicator	This indicator illuminates to indicate that dirty oil is in the system.
13	ACKNOWL Pushbutton	This pushbutton is used to acknowledge an alarm condition.

LUBE OIL PURIFICATION MANIFOLD

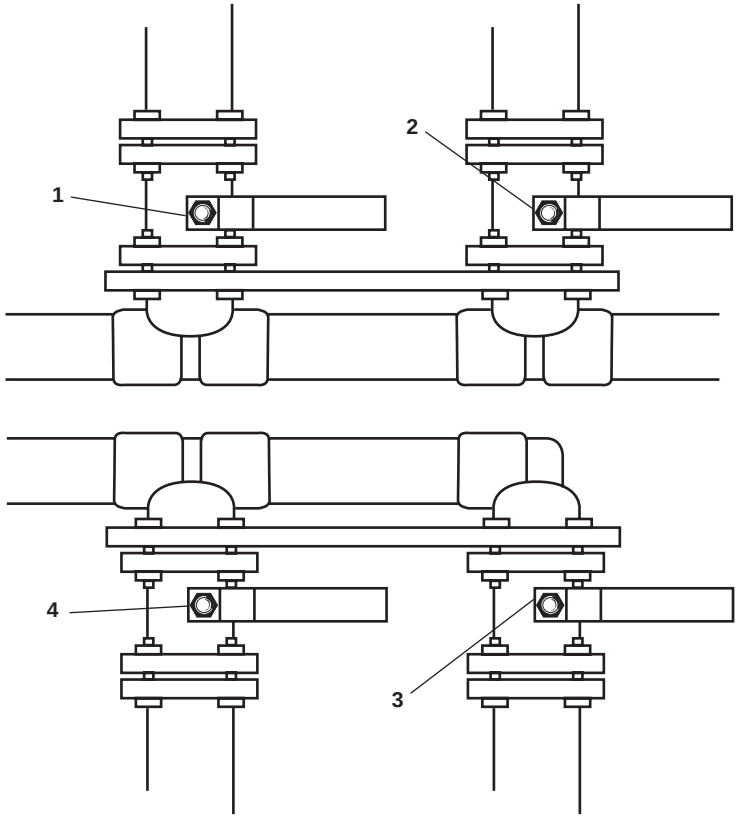


Figure 5. Lube Oil Purification Manifold

Table 5. Lube Oil Purification Manifold (refer to figure 5)

Key	Control/Indicator	Function
1	Lo-24, ME. No. 1-LUBO PUR. DISCH/FILL Valve	The valve permits lube oil to flow to main engine 2 from the lube oil purifier or from the lube oil transfer pump.
2	Lo-26, M.E. No. 2-LUBO PUR. DISCH/FILL Valve	This valve permits the lube oil purifier to draw lube oil from the sump of main engine 2.
3	Lo-25, M.E. No. 2-LUBO PUR. SUCT. Valve	This valve permits the lube oil purifier to draw lube oil from the sump of main engine 1.
4	Lo-23, M.E. No. 1-LUBO PUR. SUCT. Valve	This valve permits lube oil to flow to main engine 1 from the lube oil purifier or from the lube oil transfer pump.

LUBE OIL TRANSFER PUMP, STRAINER, AND MANIFOLD

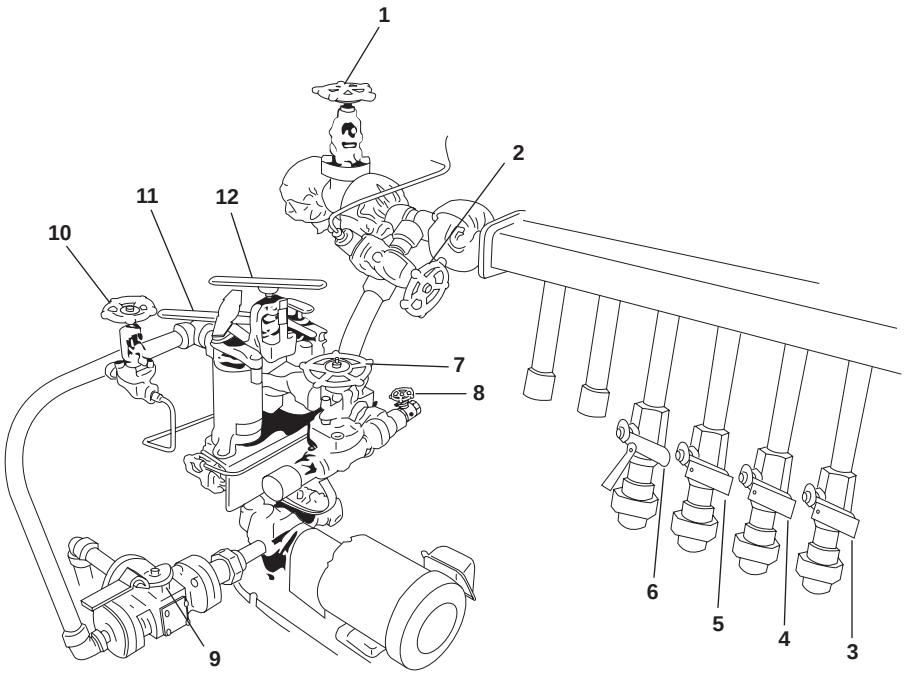


Figure 6. Lube Oil Transfer Pump, Strainer, and Manifold

Table 6. Lube Oil Transfer Pump, Strainer, and Manifold (refer to figure 6)

Key	Control/Indicator	Function
1	Lo-33, LUBO TO MAIN ENGS. Valve	This discharge valve secures the discharge flow from the lube oil transfer pump.
2	LUBO XFR PMP DISCH PRESS Gauge	This valve secures the pressure to the lube oil transfer pump discharge pressure gauge.
3	Lo-40, LUBO TO BOW THRUSTER ENG. Valve	This valve controls the transfer of lube oil to the bow thruster engine.
4	Lo-39, LUBO TO PUMP DRIVE ENG. Valve	This valve controls the transfer of lube oil to the pump drive engine.
5	Lo-38, LUBO TO S.S.D.G. No. 2 Valve	This valve controls the transfer of lube oil to SSDG 2.
6	Lo-37, LUBO TO S.S.D.G. No. 1 Valve	This valve controls the transfer of lube oil to SSDG 1.
7	Lo-17, BKT. FILL CONN. Valve	This fill valve permits filling of buckets with lube oil.
8	LUBO XFR STR DIFF PRESS Gauge COV	This valve secures the pressure to the lube oil strainer differential pressure gauge.
9	Lo-18, LUBO SPLY. Valve	This valve controls the flow of lube oil into the lube oil transfer pump.
10	LUBO XFR STR DIFF PRESS Gauge COV	This valve secures the pressure to the lube oil strainer differential pressure gauge.

Table 6. Lube Oil Transfer Pump Strainer, and Manifold (refer to figure 6) (continued)

Key	Control/Indicator	Function
11	Selector Valve, Lube Oil Strainer	This valve selects the online strainer, leaving the remaining strainer offline for service.
12	Selector Valve Lock	This valve lock locks the lube oil strainer selector valve in the desired position.

MOTOR CONTROLLER, LUBE OIL AND FUEL OIL TRANSFER PUMPS

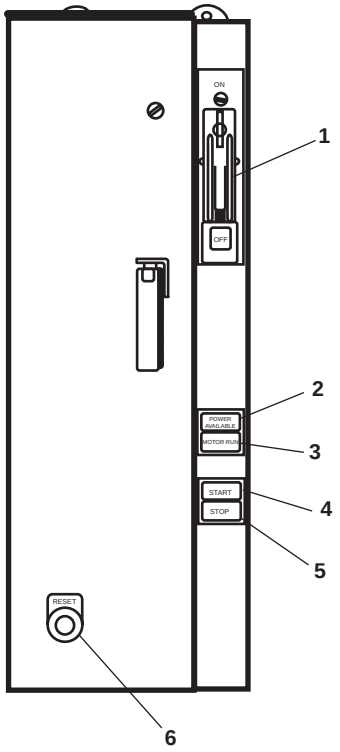


Figure 7. Motor Controller, Lube Oil and Fuel Oil Transfer Pumps

Table 7. Motor Controller, Lube Oil and Fuel Oil Transfer Pumps (refer to figure 7)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit breaker protection.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is supplied to the motor controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the motor is running.
4	START Pushbutton	When pressed, this pushbutton STARTS the pump motor.
5	STOP Pushbutton	When pressed, this pushbutton STOPS the pump motor.
6	RESET Pushbutton	The pushbutton is used to RESET the motor controller.

HYDRAULIC OIL TRANSFER PUMP ASSEMBLY

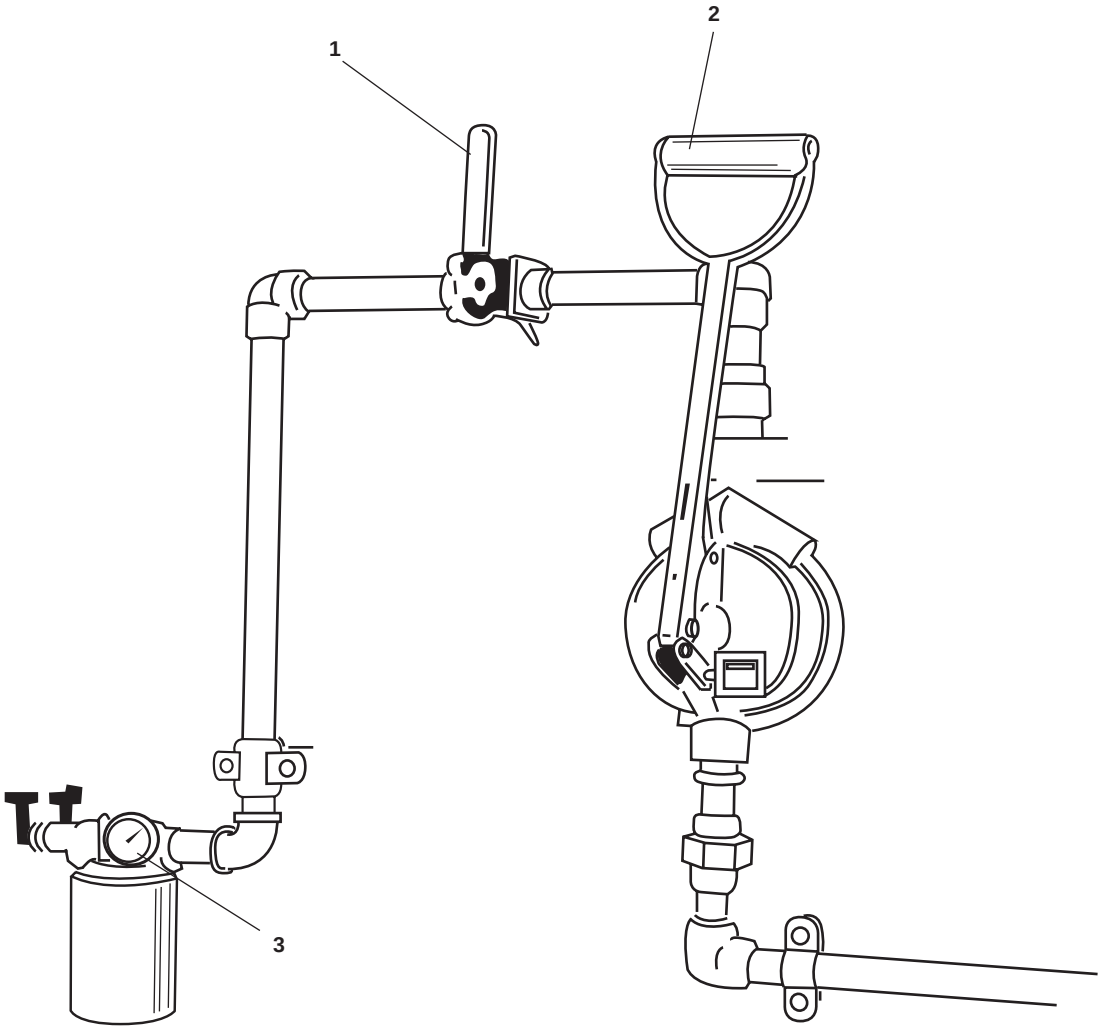


Figure 8. Hydraulic Oil Transfer Pump Assembly

Table 8. Hydraulic Oil Transfer Pump Assembly (refer to figure 8)

Key	Control/Indicator	Function
1	Discharge Valve	This valve secures the discharge flow from the hydraulic oil transfer pump.
2	Operating Handle	Stroke the operating handle to operate the hydraulic oil transfer pump.
3	Filter Restriction Gauge	This gauge indicates the filter restriction for the hydraulic oil transfer filter.

TANK LEVEL INDICATOR, LUBE OIL AND SLUDGE STORAGE TANKS

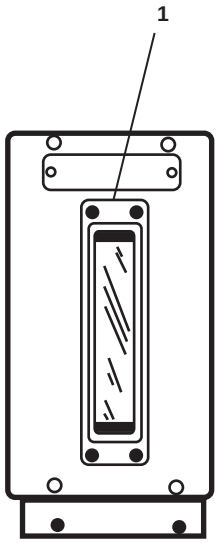


Figure 9. Tank Level Indicator, Lube Oil and Sludge Storage Tanks

Table 9. Tank Level Indicator, Lube Oil and Sludge Storage Tanks (refer to figure 9)

Key	Control/Indicator	Function
1	Tank Level Indicator	This indicator provides the operator with a readout of the applicable tank's liquid level.

HYDRAULIC OIL SIGHT GAUGE

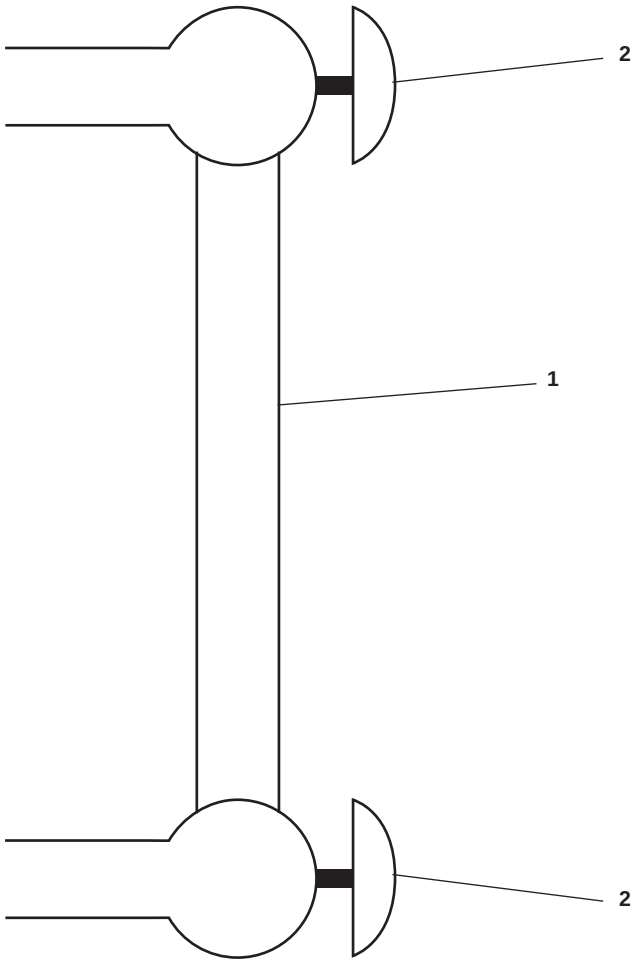


Figure 10. Hydraulic Oil Sight Gauge

Table 10. Hydraulic Oil Sight Gauge (refer to figure 10)

Key	Control/Indicator	Function
1	Sight Glass	The sight glass indicates the hydraulic oil level present in the hydraulic oil storage tank.
2	Cutoff Valve	This valve secures the hydraulic oil to the sight glass.

FUEL TANK VENT OVERFLOW INDICATOR

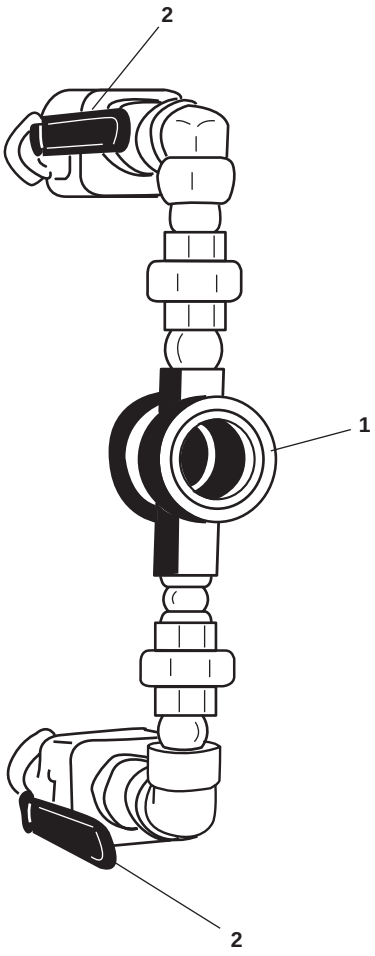


Figure 11. Fuel Tank Vent Overflow Indicator

Table 11. Fuel Tank Vent Overflow Indicator (refer to figure 11)

Key	Control/Indicator	Function
1	Overflow Indicator	When the ball floats in the sight glass, the fuel tank vent is filled with fuel, indicating an overfilled tank.
2	Cutoff Valve	This valve secures flow from the fuel oil tank vent to the overflow indicator.

TANK LEVEL INDICATOR PANEL, FUEL TRANSFER

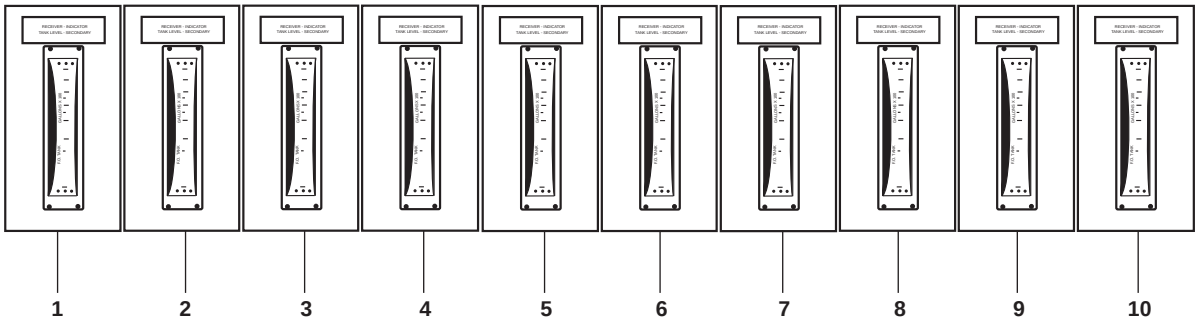


Figure 12. Tank Level Indicator Panel, Fuel Transfer

Table 12. Tank Level Indicator Panel, Fuel Transfer (refer to figure 12)

Key	Control/Indicator	Function
1	PORT 1	This indicates the fuel oil level in the 1 port tank.
2	1 STBD	This indicates the fuel oil level in the 1 starboard tank.
3	2 STBD	This indicates the fuel oil level in the 2 starboard tank.
4	2 PORT	This indicates the fuel oil level in the 2 port tank.
5	2 CENTER	This indicates the fuel oil level in the 2 center tank.
6	3 CENTER	This indicates the fuel oil level in the 3 center tank.
7	4 STBD	This indicates the fuel oil level in the 4 starboard tank.
8	4 PORT	This indicates the fuel oil level in the 4 port tank.
9	STARBOARD DAY TANK	This indicates the fuel oil level in the starboard day tank.
10	PORT DAY TANK	This indicates the fuel oil level in the port day tank.

FUEL OIL TRANSFER MANIFOLD, FORWARD

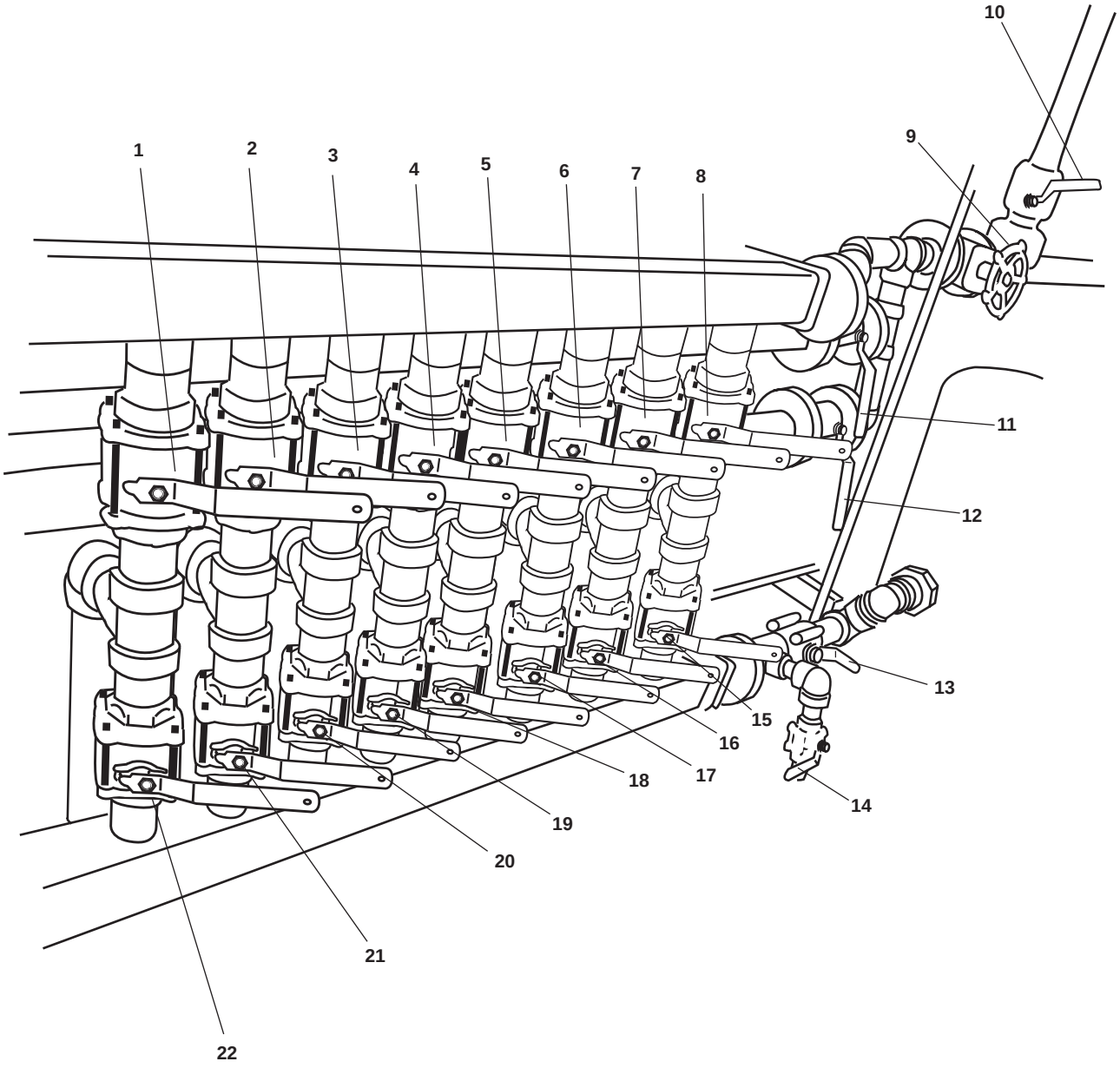


Figure 13. Fuel Oil Transfer Manifold, Forward

Table 13. Fuel Oil Transfer Manifold, Forward (refer to figure 13)

Key	Control/Indicator	Function
1	FO-47, F.O. TK 1S FILL Valve	This valve controls fuel oil flow into fuel oil tank 1 starboard.
2	FO-48, F.O. TK 1P FILL Valve	This valve controls fuel oil flow into fuel oil tank 1 port.
3	FO-49, F.O. TK 2S FILL Valve	This valve controls fuel oil flow into fuel oil tank 2 starboard.
4	FO-50, F.O. TK 2P FILL Valve	This valve controls fuel oil flow into fuel oil tank 2 port.
5	FO-52, F.O. TK 2C FILL Valve	This valve controls fuel oil flow into fuel oil tank 2 center.
6	FO-51, F.O. TK 3C FILL Valve	This valve controls fuel oil flow into fuel oil tank 3 center.
7	FO-54, F.O. TK 4P FILL Valve	This valve controls fuel oil flow into fuel oil tank 4 port.
8	FO-53, F.O. TK 4S FILL Valve	This valve controls fuel oil flow into fuel oil tank 4 starboard.
9	FO-5, F.O. DAY TK EMERG FILL Valve	This valve controls the discharge flow from the fuel oil transfer pumps to the fuel oil transfer manifold.
10	FO-11, F.O. TO E.D.G. DAY TK Valve	This controls the flow of fuel oil to the emergency diesel generator day tank.
11	FO-3, DK. FILL CONN Valve	This valve controls fuel oil flow from the starboard deck fill connector.
12	FO-4, DK. FILL CONN Valve	This valve controls fuel oil flow from the port deck fill connector.
13	FO-16, F.O. FLTR/WATER SEP INLET COV	This valve controls the flow of fuel into the fuel filter/water separator.
14	FO-42, F.O. FLTR/WATER SEP BYPASS COV	This valve permits fuel oil to bypass the fuel filter/water separator when OPEN.
15	FO-61, F.O. TK 4S SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 4 starboard.
16	FO-62, F.O. TK 4P SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 4 port.
17	FO-59, F.O. TK 3C SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 3 center.
18	FO-60, F.O. TK 2C SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 2 center.
19	FO-58, F.O. TK 2P SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 2 port.
20	FO-57, F.O. TK 2S SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 2 starboard.
21	FO-56, F.O. TK 1P SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 1 port.
22	FO-55, F.O. TK 1S SUCT Valve	This valve controls fuel oil flow out of fuel oil tank 1 starboard.

RACOR FILTER CONTROL PANEL

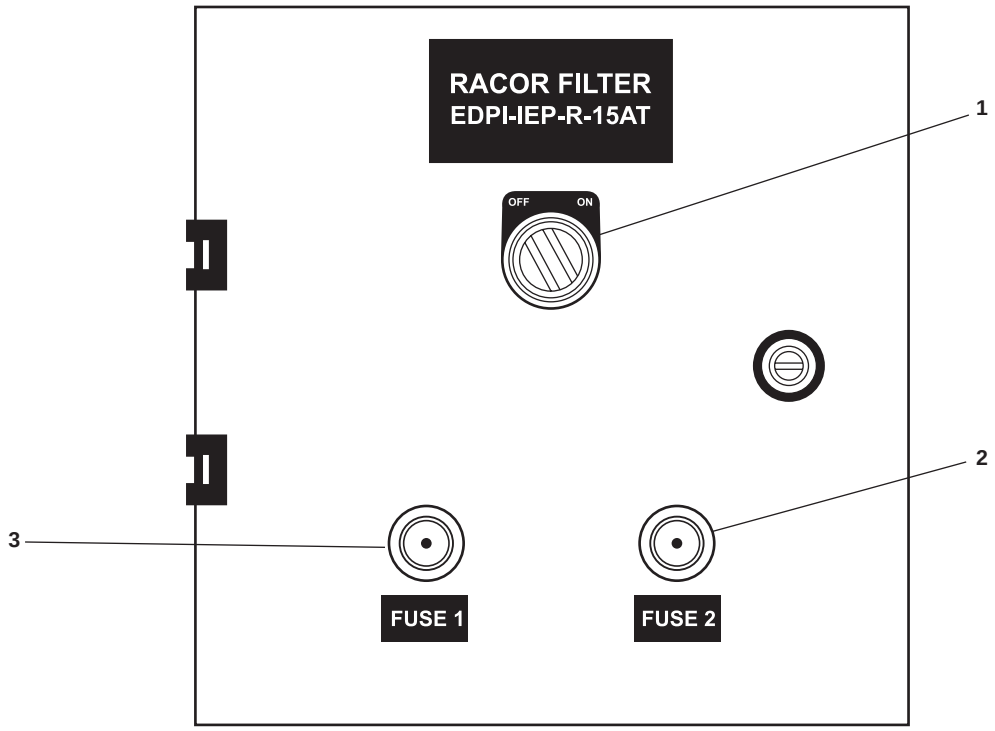


Figure 14. RACOR FILTER Control Panel

Table 14. RACOR FILTER Control Panel (refer to figure 14)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the fuel filter/water separator ON and OFF.
2	FUSE 2	This is the fuse holder assembly for fuse 2.
3	FUSE 1	This is the fuse holder assembly for fuse 1.

HIGH LEVEL ALARM PANEL

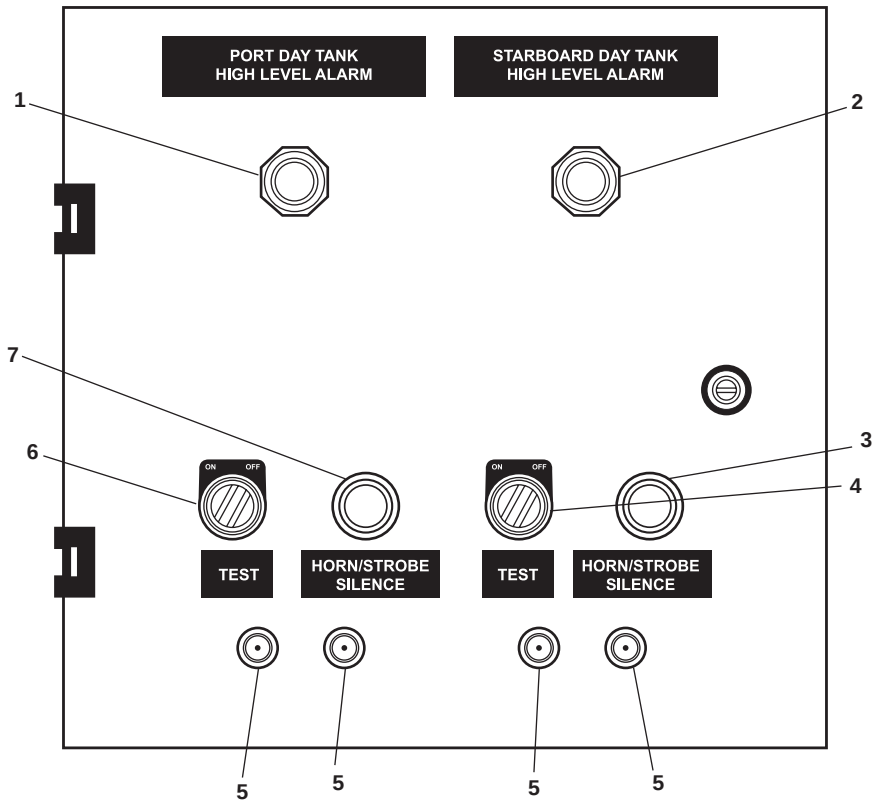


Figure 15. High Level Alarm Panel

Table 15. High Level Alarm Panel (refer to figure 15)

Key	Control/Indicator	Function
1	PORT DAY TANK HIGH LEVEL ALARM Indicator	This indicator illuminates to signal an excessively high fuel oil level in the port day tank.
2	STARBOARD DAY TANK HIGH LEVEL ALARM Indicator	This indicator illuminates to signal an excessively high fuel oil level in the starboard day tank.
3	HORN/STROBE SILENCE Pushbutton	This pushbutton silences the alarm and extinguishes the strobe warning light for the starboard day tank high-level alarm.
4	TEST Switch	This switch is used to test the operation of the starboard day tank high-level alarm.
5	Fuse	This fuse provides circuit protection for the alarm systems.
6	TEST Switch	This switch is used to test the operation of the port day tank high-level alarm.
7	HORN/STROBE SILENCE Pushbutton	This pushbutton silences the alarm and extinguishes the strobe warning light for the port day tank high-level alarm.

FUEL OIL TRANSFER GAUGE PANEL

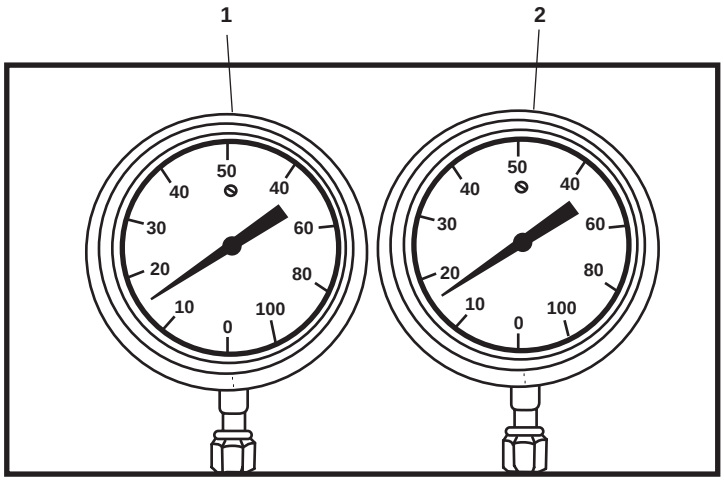


Figure 16. Fuel Oil Transfer Gauge Panel

Table 16. Fuel Oil Transfer Gauge Panel (refer to figure 16)

Key	Control/Indicator	Function
1	FO XFR PMP #1 DISCH PRESS Gauge	This gauge indicates the discharge pressure for fuel oil transfer pump 1.
2	FO XFR PMP #2 DISCH PRESS Gauge	This gauge indicates the discharge pressure for fuel oil transfer pump 2.

FUEL OIL TRANSFER MANIFOLD, AFT

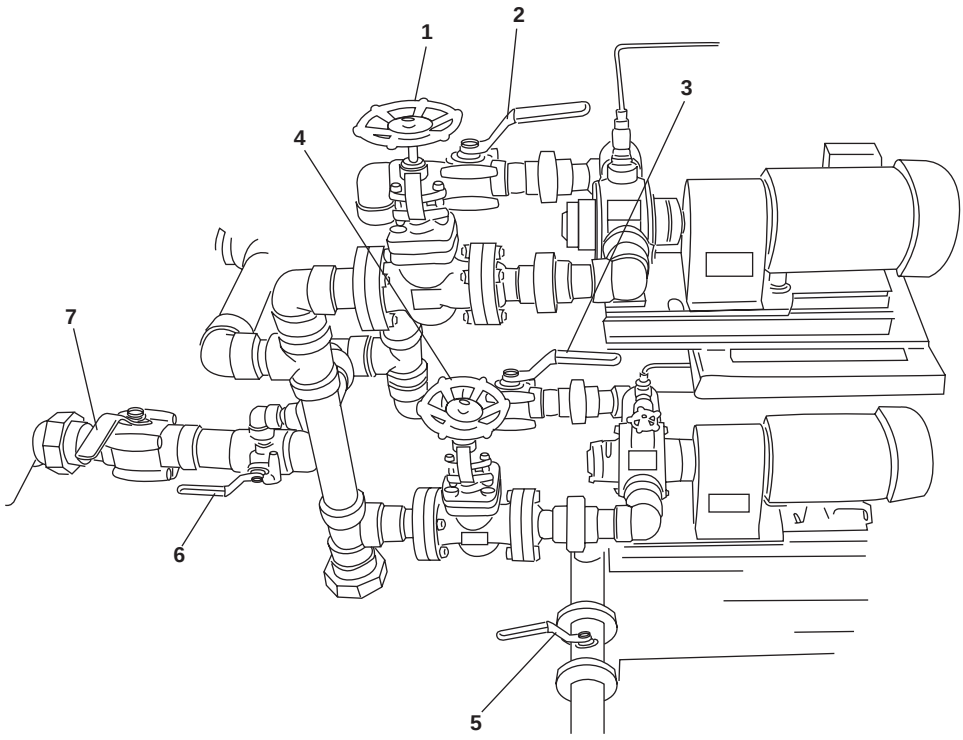


Figure 17. Fuel Oil Transfer Manifold, Aft

Table 17. Fuel Oil Transfer Manifold, Aft (refer to figure 17)

Key	Control/Indicator	Function
1	FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE Valve	This valve controls the flow of fuel from fuel oil transfer pump 1.
2	FO-6, C.O.V.-F.O. XFER PMP No. 1 SUCTION Valve	This valve controls the flow of fuel into fuel oil transfer pump 1.
3	FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION Valve	This valve controls the flow of fuel into fuel oil transfer pump 2.
4	FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE Valve	This valve controls the flow of fuel from fuel oil transfer pump 2.
5	FO-11, F.O. TO E.D.G. DAY TK Valve	This valve controls the flow of fuel from the fuel oil transfer pumps to the day tanks.
6	FO-14, F.O. SERV CRSVR	This valve controls the supply and discharge sides of the manifold.
7	FO-17, F.O. FLTR/WATER SEP OUTLET. COV Valve	This valve controls the flow of fuel from the fuel filter/water separator to the fuel oil transfer pumps.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
ENGINE ROOM: MISCELLANEOUS SYSTEMS

ENGINE ROOM, MISCELLANEOUS SYSTEMS

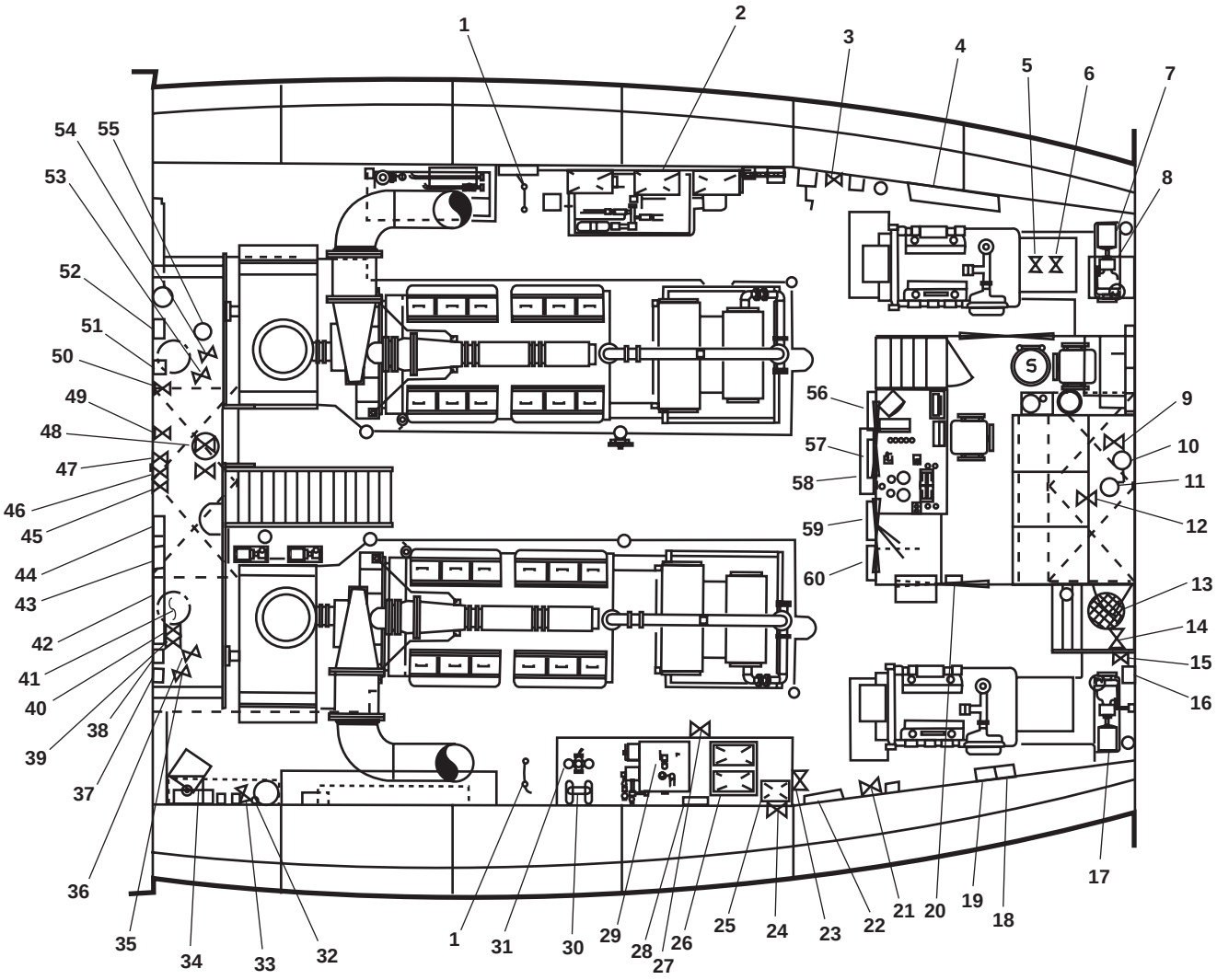


Figure 1. Engine Room, Miscellaneous Systems

Table 1. Engine Room, Miscellaneous Systems (refer to figure 1)

Key	Control/Indicator	Function
1	Emergency Escape Ladder	This ladder permits personnel to exit the engine room through the stacks.
2	Central Hydraulic System	This system provides hydraulic power for many of the vessel's hydraulic systems. Refer to figure 2 for details.
3	PW-40, ENG. FILL CONN. PORT Valve	This provides a connection and a cutoff for a potable water hose.

Table 1. Engine Room, Miscellaneous Systems (refer to figure 1) (continued)

Key	Control/Indicator	Function
4	Control Air Receiver	This receiver stores the control air for the vessel's control air system. Refer to figure 3 for details.
5	PW-20, C.W. TO W.C.	This cutoff valve controls cold water to the water closet.
6	PW-21, C.W. TO W.C.	This cutoff valve controls cold water to the water closet.
7	Control Air Dryer	This air dryer removes moisture from the control air before it is routed to its components. Refer to figure 4 for details.
8	Sewage Discharge Pump 2 and Valves	These valves enable sewage to be discharged from the vessel. Refer to figure 5 for details.
9	Cutoff Valve, Compressed Air	This valve secures the compressed air to the compressed air quick disconnect valve beneath the EOS.
10	Regulator, Compressed Air	This regulates the pressure of the air available at the compressed air quick disconnect valve beneath the EOS.
11	Quick Disconnect Valve	This valve permits attachment of a hose to the compressed air line beneath the EOS.
12	FM-1, SEA SUCT, F.F. PMP. Valve	This valve secures the raw water to the engine-driven fire pump.
13	Asw-17, SEA SUCTION S.W. COOLING	This strainer removes debris from the engine-driven fire pump's suction line.
14	Cutoff Valve for FF PMP SUCT STR DIFF PRESS Gauge	This valve secures pressure to the FF PMP SUCT STR DIFF PRESS gauge.
15	Seachest Cutoff Valve	This valve secures raw water from the sea chest to the pump drive engine and the bow thruster engine.
16	#1 SEWAGE DISCHARGE PUMP Motor Controller	This controls the motor for sewage discharge pump 1. Refer to figure 6 for details.
17	Sewage Discharge Pump 1 and Valves	This pump and its associated valves enable sewage to be discharged from the vessel. Refer to figure 7 for details.
18	SEWAGE PMP NO. 1 DISCH PRESS Gauge	This gauge indicates the discharge pressure for sewage discharge pump 1.
19	FF PMP SUCT STR DIFF PRESS Gauge	This gauge indicates the differential pressure across the firefighting pump suction strainer (figure 1, item 10).
20	Remote Indicator (Alarm) Assembly	Refer to figure 8 for details.
21	PW-39, ENG. FILL CONN. STBD Valve	This provides a connection and a cutoff for a potable water hose.
22	120V Emergency Distribution Panel No. 1	This panel provides circuit protection for the engine room's emergency electrical systems. Refer to figure 9 for details.

Table 1. Engine Room, Miscellaneous Systems (refer to figure 1) (continued)

Key	Control/Indicator	Function
23	OB-17, OILY WASTE STOR. INLET Valve	This valve secures the flow of oily waste into the oily waste storage tank.
24	OB-10, OILY WTR. SEP. OVBD. DISCH Valve	This valve secures the flow of oily water separator effluent overboard.
25	BATTERY CHARGER MACHINERY DC CONTROL	This battery charger charges the battery bank for the machinery dc control panel (figure 1, item 21). Refer to figure 10 for details.
26	Battery Bank, MACHINERY DC CONTROL	This battery bank is used to power the machinery's dc control system.
27	OB-16, OILY WASTE STOR. TK. SUCT. Valve	This valve secures the suction line for the oily waste storage tank.
28	Oil Content Monitor	This unit monitors the oil content of the OWS effluent. Refer to figure 11 for details.
29	Oil Water Separator	This separates oil from the oily waste water prior to discharging the water from the vessel. Refer to figure 10 for details.
30	Oily Waste Discharge Pump	This is used to pump the oily waste to an approved shore facility. Refer to figure 13 for details.
31	Oily Waste System Discharge Pump Inlet Strainer	This duplex strainer removes debris from the oily waste discharge pump's inlet piping. Refer figure 13 for details.
32	FO-35, F.O. RTN TO DAY TK. STBD	This cutoff valve controls the flow of fuel oil into the day tank.
33	FO-37, F.O. RTN RLF - SET AT 10 P.S.I.	This gauge displays the fuel oil return relief pressure.
34	Space Heater	This space heater provides heat for the engine room. Refer to figure 14 for details.
35	OB-3, OILY BILGE SUCT. SHAFT ALLEY	This valve controls oily bilge suction from the starboard shaft alley.
36	OB-7, OILY DR. TK. SUCT Valve	This valve secures the suction line from the oily drain tank.
37	Reduction Gear 1 Cooling Pump Motor Controller	This motor controller controls the motor for the reduction gear 1 cooling pump. Refer to figure 15 for details.
38	Reduction Gear 2 Cooling Pump Motor Controller	This controls the motor for the reduction gear 2 cooling pump. Refer to figure 15 for details.
39	OB-5, OILY BILGE SUCT. ENG. RM. Valve	This valve secures the oily bilge suction for the starboard side of the engine room.
40	OB-21, HOSE CONN. - OILY BILGE SUCT.	This valve provides a connection and cutoff for the engine room aft oily bilge.
41	Raw Water Strainer, Fire and General Service Pump Suction	This strainer removes debris from the fire pump and general service pumps' suction line.
42	Refrigeration Valve Manifold	This manifold permits control of the refrigeration and air conditioning systems. Refer to figure 16 for details.

Table 1. Engine Room, Miscellaneous Systems (refer to figure 1) (continued)

Key	Control/Indicator	Function
43	Engine Room Exhaust Fan 1 Motor Controller (above) Engine Room Supply Fan 1 Motor Controller (below)	These motor controllers turn ON and OFF the engine room's starboard supply and exhaust fans on the starboard side. Refer to figure 17 for details.
44	Engine Room Exhaust Fan 2 Motor Controller (above) Engine Room Supply Fan 2 Motor Controller (below)	These motor controllers turn ON and OFF the engine room's port supply and exhaust fans on the starboard side. Refer to figure 17 for details.
45	OB-21, HOSE CONN-OILY BIILGE SUCT. Valve	This valve secures the hose connection for the oily bilge suction.
46	AE-28, SEACHEST VENT Valve	This valve secures the vent for the sea chest.
47	FM-2, SEA SUCT. FIRE/ G.S. & BLST PMPS. Valve	This valve secures the sea chest feeding the fire, general service, and ballast pumps.
48	FM-4, EMER BILGE SUCT Valve	When OPEN, this valve permits the fire and general service pumps to draw their suction from the bilge.
49	Cutoff Valve, Fire Main	This valve secures the fire main flow beneath the deckplates.
50	Cutoff Valve, Oily Bilge Suction from Reduction Gear	This valve secures oily bilge suction from the reduction gear area bilge.
51	FM-200 Warning Strobe	This amber strobe flashes when the FM-200 system has been actuated, signaling 60 seconds to the release of FM-200 agent.
52	Day Tank High Level Alarm Warning Strobe	This red strobe flashes when the day tank high level alarm is in an alarm condition.
53	OB-6, OILY BILGE SUCT. ENG. RM. Valve	This valve secures the oily bilge suction from the engine room bilge.
54	OB-4, OILY BILGE SUCT. SHAFT ALLEY Valve	This valve secures the oily bilge suction from port shaft alley.
55	FM-200 Rotating Beacon	This amber beacon illuminates and rotates when the FM-200 system has been actuated, signaling 60 seconds to the release of FM-200 agent.
56	120V Distribution Panel No. 4	This panel provides circuit protection and control of 120 Vac for emergency systems in the engine room, AMS 1, and AMS 2. Refer to figure 18 for details.
57	Machinery DC Control Distribution Panel (below)	This panel houses the circuit breakers for 24 Vdc powered equipment. Refer to figure 20 for details.
58	Machinery Monitoring System CPU Multi-Remote (above)	This panel provides control for the machinery monitoring system. Refer to figure 19 for details.
59	Load Center Distribution Panel	This panel distributes 120 Vac power to many of the vessel's power panels. Refer to figure 21 for details.
60	440V Power Panel No. 1	This panel provides 440 Vac for many of the systems in the engine room. Refer to figure 20 for details.

CENTRAL HYDRAULIC SYSTEM

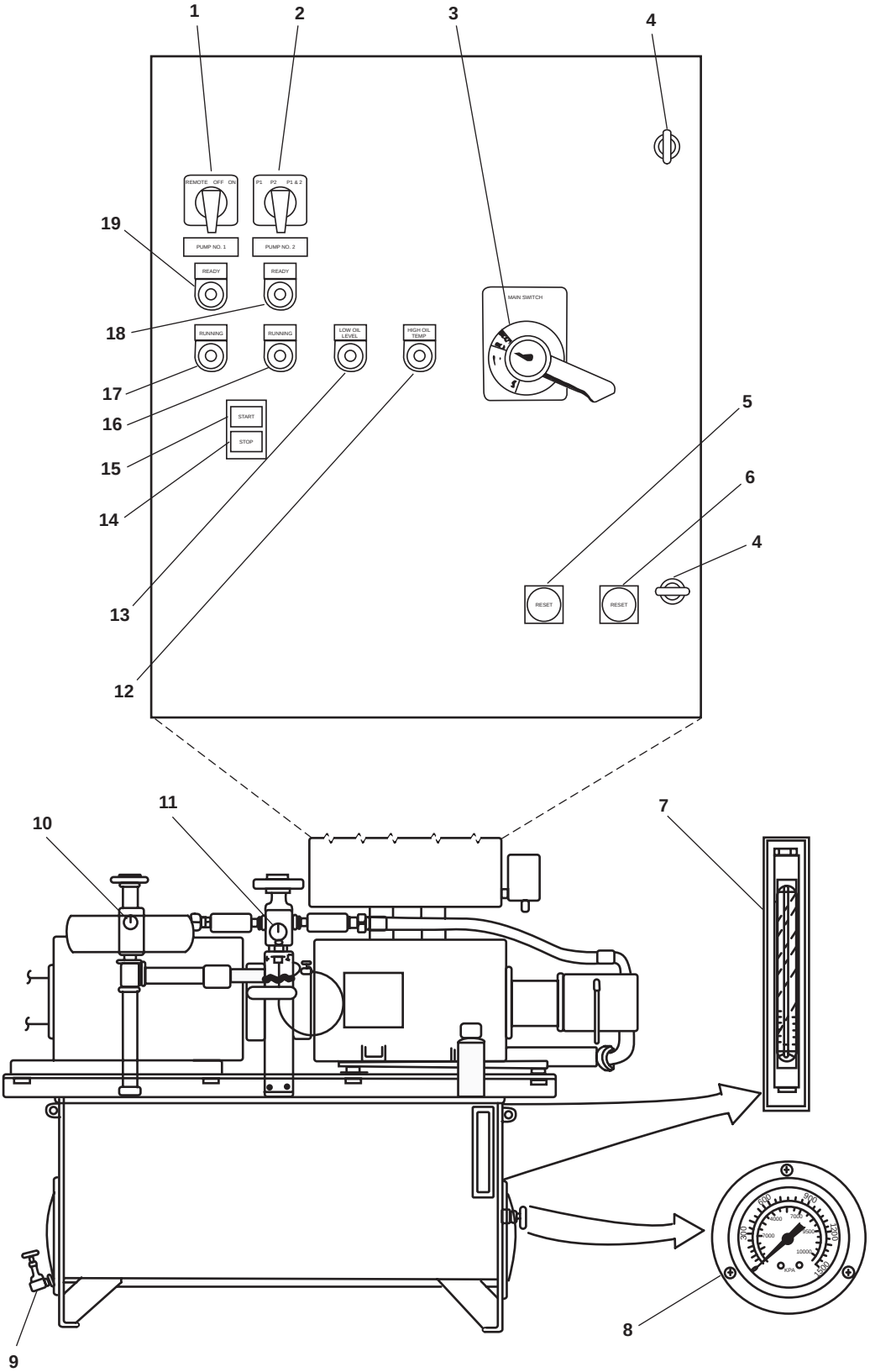


Figure 2. Central Hydraulic System

Table 2. Central Hydraulic System (refer to figure 2)

Key	Control/Indicator	Function
1	REMOTE/OFF/ON Switch	This switch is used to select local or remote operation for the pump(s) selected with the pump select switch.
2	P1/P2/P1&P2 Switch	This switch is used to select pump 1, pump 2, or both pumps.
3	MAIN Switch	This switch is used to turn ON the power to the system.
4	Panel Latches	These latches secure the front panel in the CLOSED position.
5	RESET Pushbutton, Pump 1	This pushbutton resets the thermal overload on pump 1.
6	RESET Pushbutton, Pump 2	This pushbutton resets the thermal overload on pump 2.
7	Sight Glass	This gauge indicates the oil level in the reservoir.
8	Temperature Gauge	This gauge indicates the temperature of the oil in the reservoir.
9	Drain Valve	This valve is used to drain the reservoir.
10	Pressure Gauge, Return	This gauge indicates the pressure in the low pressure return line.
11	Pressure Gauge, Supply	This gauge indicates the pressure in the high pressure supply line.
12	HI OIL TEMP Indicator	This lamp illuminates when the oil in the system exceeds the safe operating range.
13	LOW OIL LEVEL Indicator	This lamp illuminates when the system oil level falls below the safe operating range.
14	STOP Pushbutton	This pushbutton stops the pump(s) selected by the P1/P2/P1&P2 switch.
15	START Pushbutton	This pushbutton starts the pump(s) selected by the P1/P2/P1&P2 switch.
16	RUNNING Indicator, Pump 2	This lamp illuminates to indicate that pump 2 is running.
17	RUNNING Indicator, Pump 1	This lamp illuminates to indicate that pump 1 is running.
18	READY Indicator, Pump 2	This lamp illuminates to indicate that pump 2 is ready to operate.
19	READY Indicator, Pump 1	This lamp illuminates to indicate that pump 1 is ready to operate.

CONTROL AIR RECEIVER

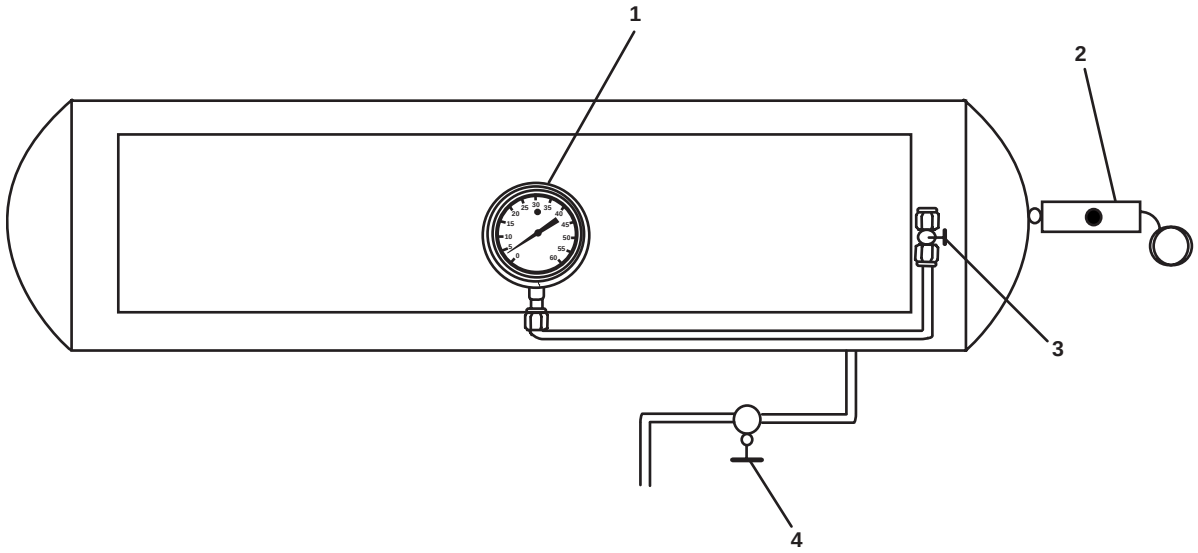


Figure 3. Control Air Receiver

Table 3. Control Air Receiver (refer to figure 3)

Key	Control/Indicator	Function
1	Control Air Pressure Gauge	This gauge indicates the pressure in the control air receiver.
2	Relief Valve	This valve opens to prevent over pressurization of the receiver.
3	Cutoff Valve, Control Air Pressure Gauge	This gauge secures the pressure to the control air pressure gauge.
4	Drain Valve	This valve permits draining of condensate from the receiver.

CONTROL AIR DRYER

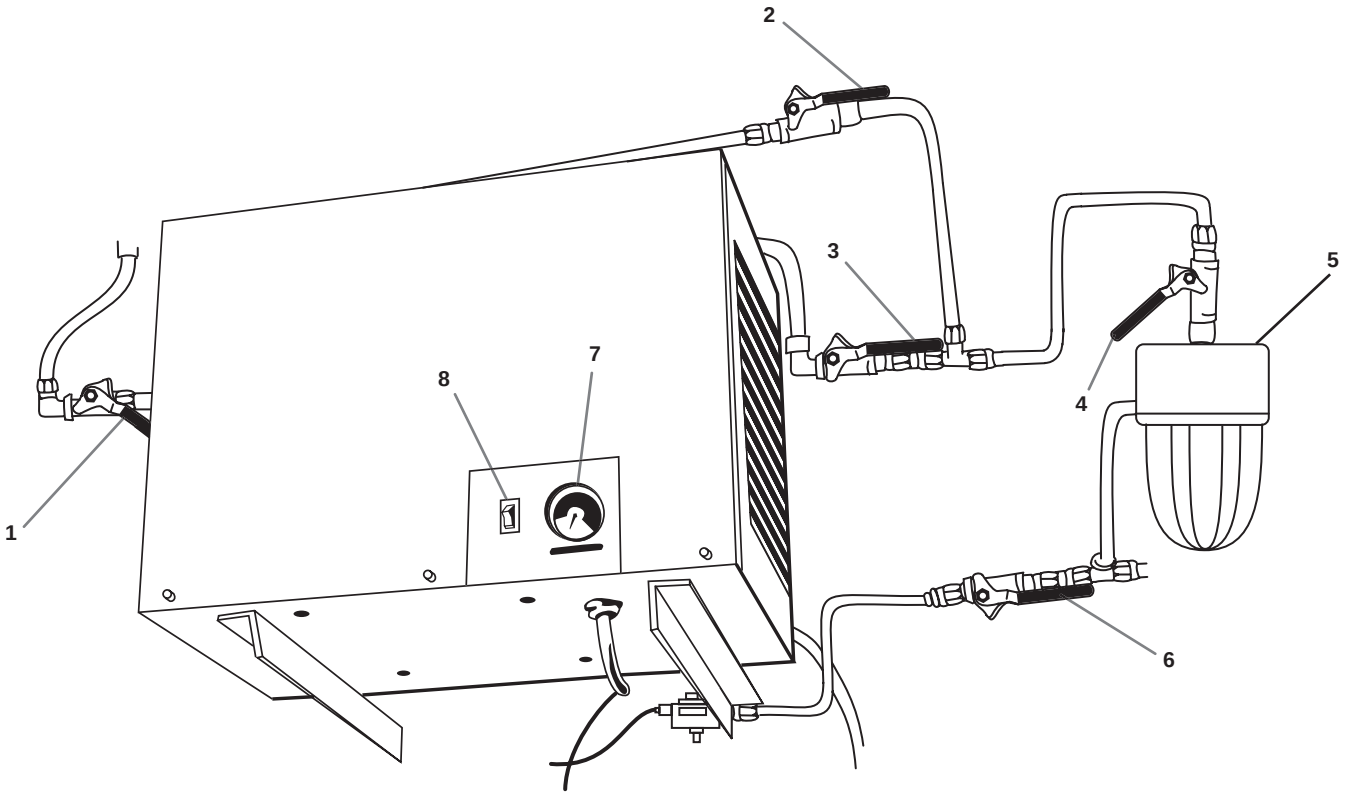


Figure 4. Control Air Dryer

Table 4. Control Air Dryer (refer to figure 4)

Key	Control/Indicator	Function
1	Cutoff Valve, Control Air Dryer Supply	This valve secures the flow of control air into the control air dryer.
2	Bypass Valve	This valve permits the control air dryer to be bypassed in case of a unit malfunction.
3	Cutoff Valve, Control Air Dryer Discharge	This valve secures the flow of control air out of the control air dryer.
4	Cutoff Valve, Control Air Regulator Supply	This valve secures the flow of control air into the control air regulator.
5	Control Air Regulator	This regulator is adjustable and controls the pressure in the control air system.
6	Cutoff Valve, Remote Pressure Sensor	This valve secures the pressure to the remote control air pressure sensor.
7	Operating Gauge	This gauge indicates the operating condition of the control air dryer.
8	ON/OFF Switch and Indicator	These turn the control air dryer ON and OFF and illuminate when the unit is ON.

SEWAGE DISCHARGE PUMP 2

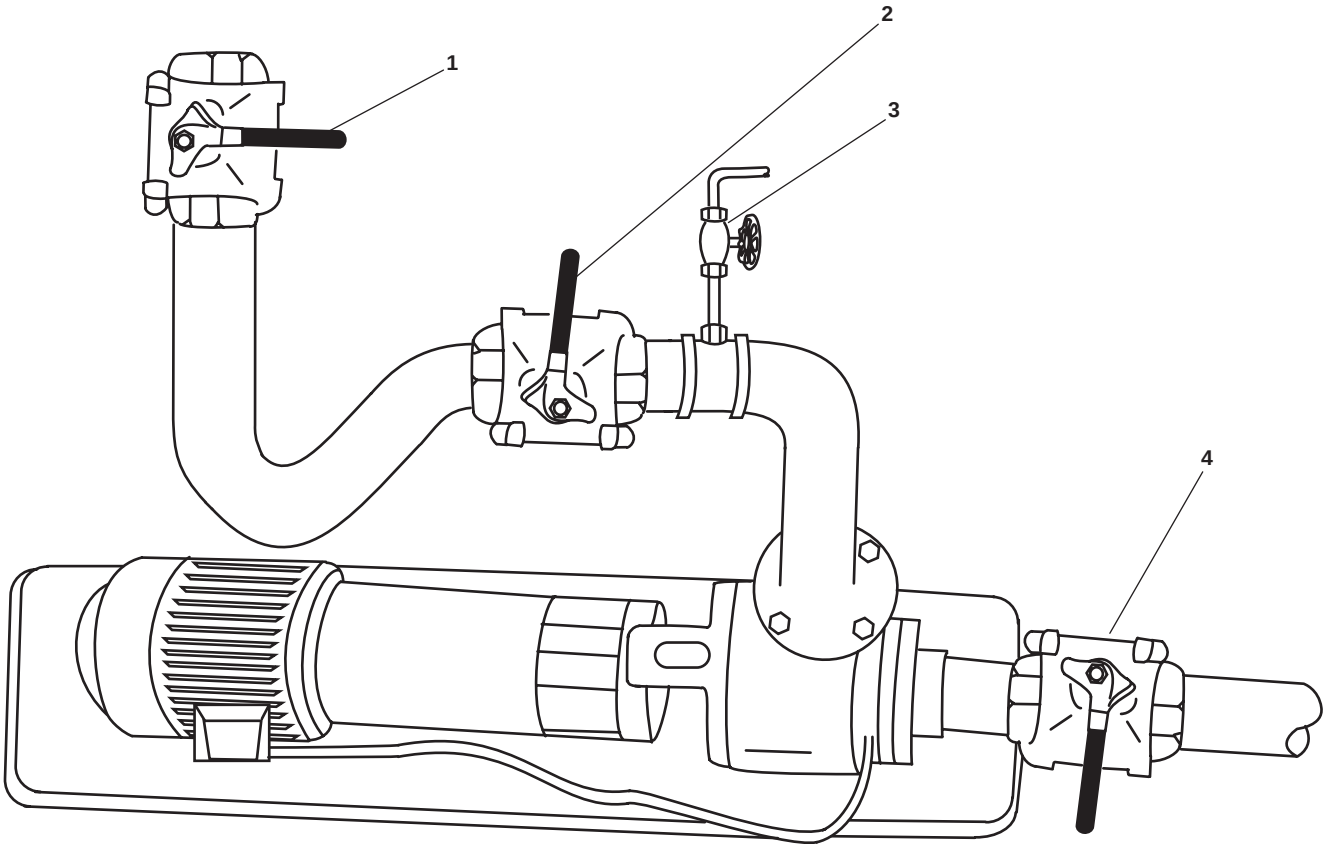


Figure 5. Sewage Discharge Pump 2

Table 5. Sewage Discharge Pump 2 (refer to figure 5)

Key	Control/Indicator	Function
1	SD-8, SEW. OVBD. DISCH Valve	This valve secures the sewage overboard discharge line from sewage dis charge pump 2.
2	SD-6, C.O.V. - SEW. DISCH. PMP. No. 2 DISCH Valve	This valve secures the discharge line from sewage discharge pump 2.
3	SEW. DISCH. PMP. PRESS. GAUGE Valve	This valve secures pressure to the discharge pressure gauge.
4	SD-4, C.O.V. SEW. DISCH. PMP. No. 2 SUCT Valve	This valve secures the suction line into sewage discharge pump 2.

SEWAGE DISCHARGE PUMP MOTOR CONTROLLER

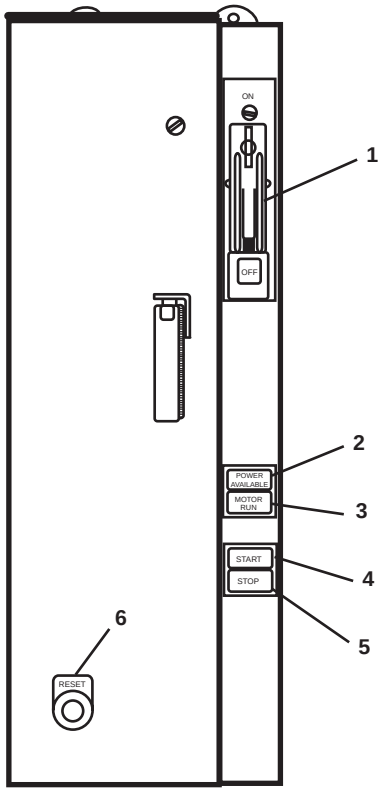


Figure 6. Sewage Discharge Pump Motor Controller

Table 6. Sewage Discharge Pump Motor Controller (refer to figure 6)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit breaker protection.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is supplied to the motor controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the motor is running.
4	START Pushbutton	When pressed, this pushbutton starts the pump motor.
5	STOP Pushbutton	When pressed, this pushbutton stops the pump motor.
6	RESET Pushbutton	This pushbutton is used to reset the motor controller.

SEWAGE DISCHARGE PUMP 1

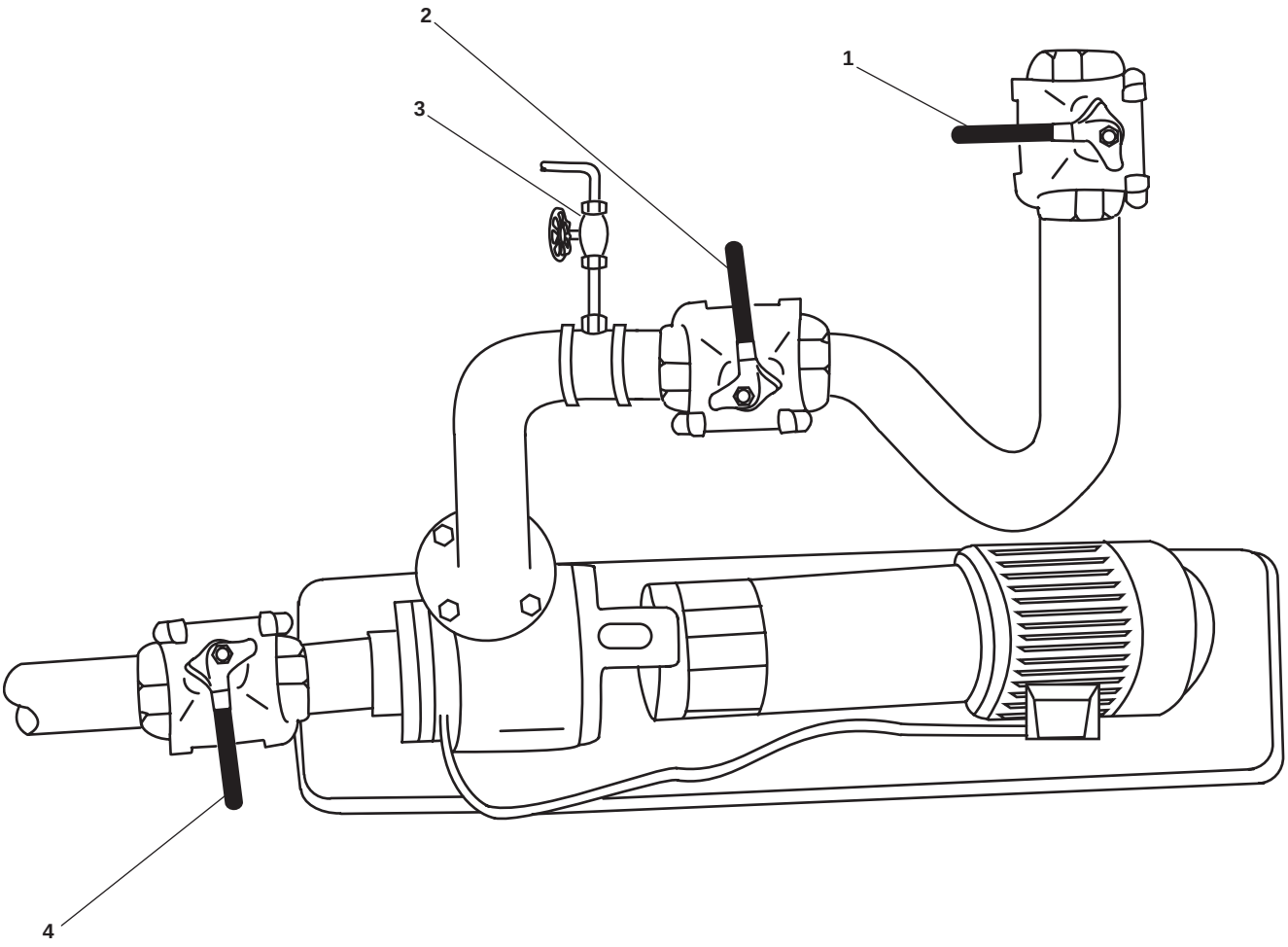


Figure 7. Sewage Discharge Pump 1

Table 7. Sewage Discharge Pump 2 (refer to figure 7)

Key	Control/Indicator	Function
1	SD-9, SEW. OVBD TO SH. CONN. Valve	This valve secures the sewage overboard discharge line from sewage discharge pump 1.
2	SD-7, C.O.V. - SEW. DISCH. PMP. No. 1 DISCH Valve	This valve secures the discharge line from sewage discharge pump 1.
3	SEW PMP PRESS GAUGE Valve	This valve secures pressure to the discharge pressure gauge.
4	SD-5, C.O.V. - SEW. DISCH. PMP. No. 1 SUCT. Valve	This valve secures the suction line into sewage discharge pump 1.

REMOTE INDICATOR (ALARM) ASSEMBLY

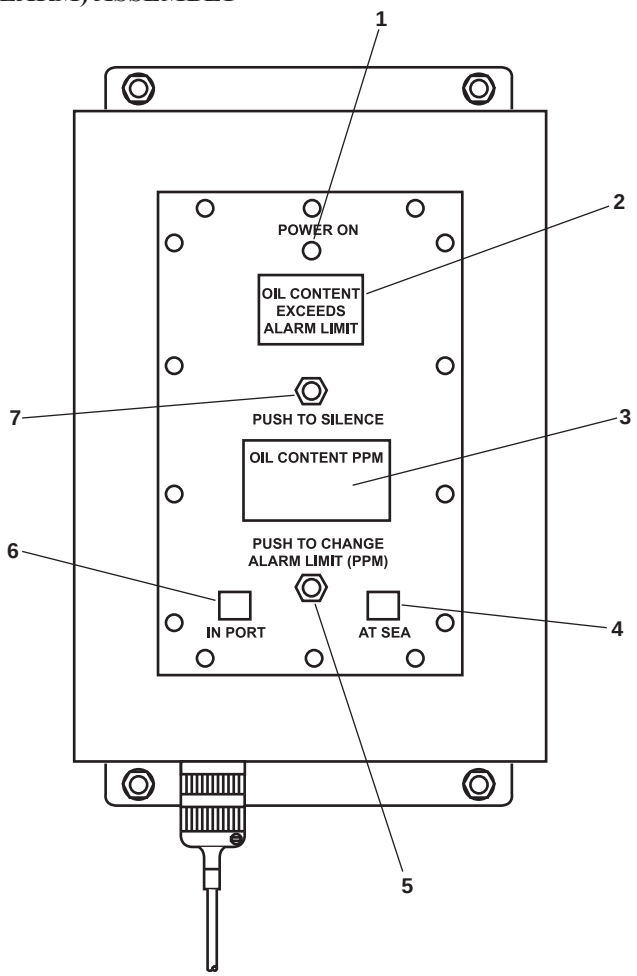


Figure 8. Remote Indicator (Alarm) Assembly

Table 8. Remote Indicator (Alarm) Assembly (refer to figure 8)

Key	Control/Indicator	Function
1	POWER ON Indicator	This illuminates to indicate that the OCM is operating.
2	OIL CONTENT EXCEEDS ALARM LIMIT Indicator	This illuminates to indicate that the effluent oil content exceeds the selected alarm limit.
3	OIL CONTENT PPM Display	This displays the effluent oil content in ppm.
4	70 PPM AT SEA Indicator	This illuminates to indicate that the 70 PPM (at sea) alarm limit is selected.
5	PUSH TO CHANGE ALARM LIMIT PPM Switch	This switch toggles between the 15 and 70 PPM alarm limit settings when the alarm limit selector switch in the sampling/sensor assembly is set to REMOTE.
6	15 PPM IN PORT Indicator	This illuminates to indicate that the 15 PPM (in port) alarm limit is selected.
7	PUSH TO SILENCE Switch	Push this pushbutton switch to toggle the alarm silence function ON and OFF.

120V EMERGENCY DISTRIBUTION PANEL NO. 1

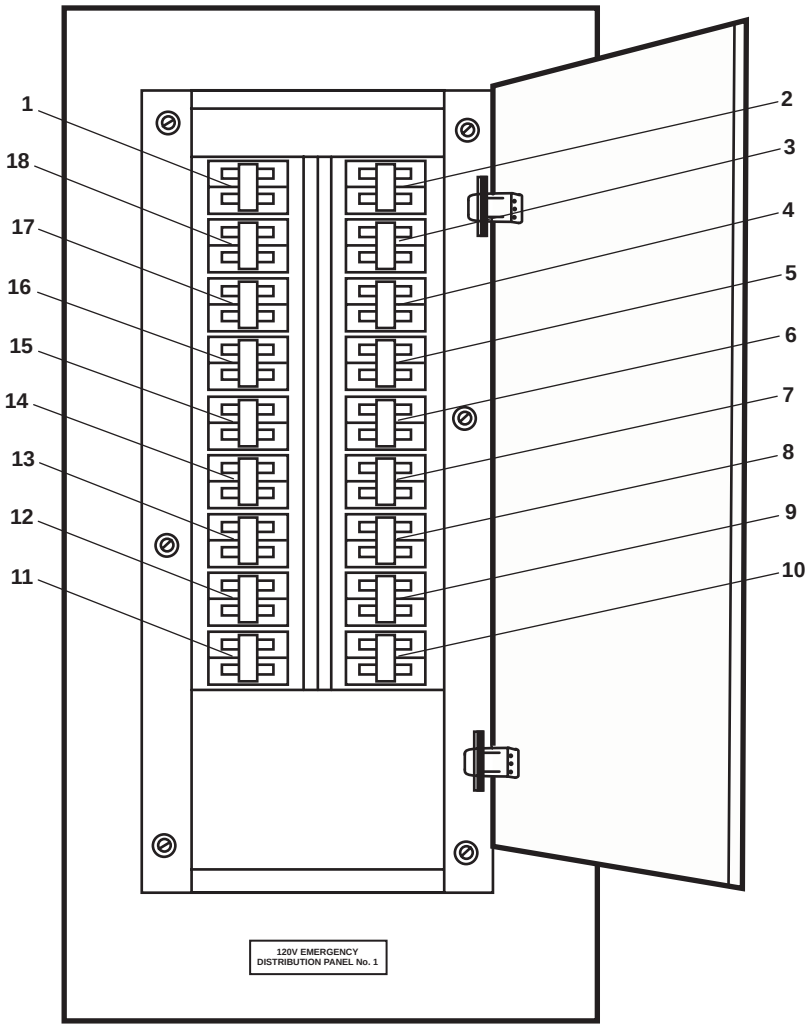


Figure 9. 120V Emergency Distribution Panel No. 1

Table 9. 120V Emergency Distribution Panel No. 1 (refer to figure 9)

Key	Control/Indicator	Function
1	ENGINE ROOM EMERGENCY LIGHTS. (PORT). Circuit Breaker	This circuit breaker provides control of, and protection for, the engine room emergency lights (port).
2	ENGINE ROOM EMERGENCY LIGHTS. (STBD). Circuit Breaker	This circuit breaker provides control of, and protection for, the engine room emergency lights (starboard).
3	AMS No. 2. EMERGENCY LIGHTS. Circuit Breaker	This circuit breaker provides control of, and protection for, the emergency lights in AMS 2.
4	TLI SYSTEM. Circuit Breaker	This circuit breaker provides control of, and protection for, the tank level indicator system.

Table 9. Engine Room Emergency Distribution Panel No. 1 (refer to figure 8) (continued)

Key	Control/Indicator	Function
5	FIRE DETECTION SYSTEM. Circuit Breaker	This circuit breaker provides control of, and protection for, the fire detection system.
6	E.O.T. SYSTEM. Circuit Breaker	This circuit breaker provides control of, and protection for, the engine order telegraph system.
7	MACHINERY DC CONTROL BATTERY CHARGER. Circuit Breaker	This circuit breaker provides control of, and protection for, the battery charger for the machinery plant monitoring system.
8	TOW MACHINE HEATERS Circuit Breaker	This circuit breaker provides control of, and protection for, the towing machine heaters.
9	AFT CONSOLE HEATER. Circuit Breaker	This circuit breaker provides control of, and protection for, the aft towing machine console strip heater.
10	SPARE. Circuit Breaker	This circuit breaker is a spare provided for expansion.
11	BROMINATOR. Circuit Breaker	This circuit breaker provides control of, and circuit protection for, the brominator.
12	RACOR FILTER. Circuit Breaker	This circuit breaker provides control of, and circuit protection for, the Racor fuel filter/water separator.
13	MONITOR SYSTEM CIRCUIT Circuit Breaker	This circuit breaker provides control of, and protection for, the machinery plant monitoring system display.
14	SSDG No. 1. BATTERY CHARGER. Circuit Breaker	This circuit breaker provides control of, and protection for, the SSDG 1 batteries.
15	REMOTE PROPULSION INDICATOR PANEL. Circuit Breaker	This circuit breaker provides control of, and protection for, the remote propulsion indicating panel.
16	TOWING MACHINE. Circuit Breaker	This circuit breaker provides control of, and protection for, the operator control station circuits for the towing machine.
17	STEERING GEAR ROOM & TOWING GEAR LIGHT. Circuit Breaker	This circuit breaker provides control of, and protection for, the lights in the steering gear room and towing gear locker.
18	BOW THRUSTER & AMS No. 1 EMERGENCY LIGHTS. Circuit Breaker	This circuit breaker provides control of, and protection for, the lights in auxiliary machinery space 1 and in the bow thruster compartment.

BATTERY CHARGER, MACHINERY DC CONTROL

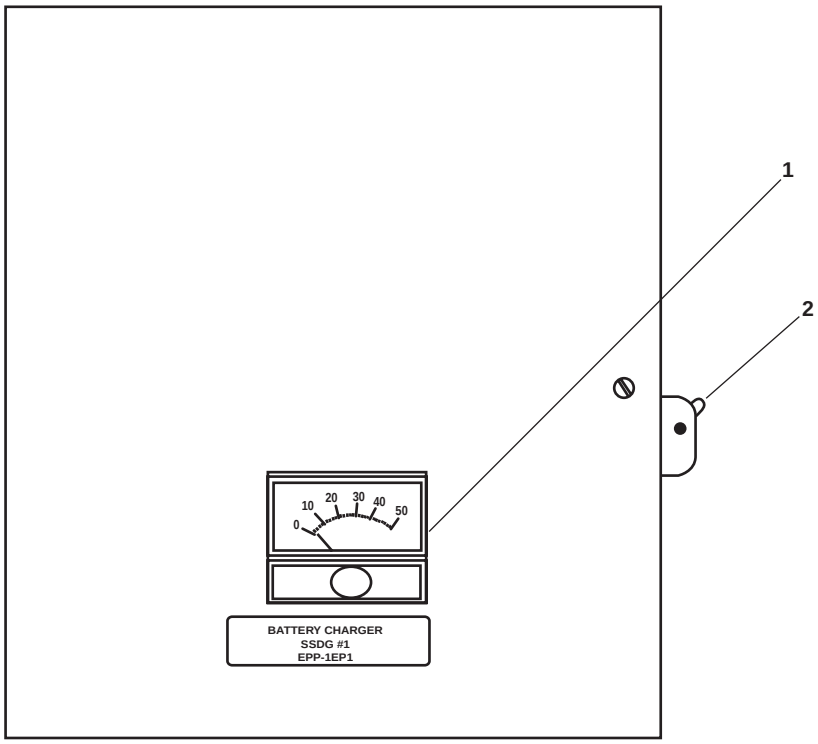
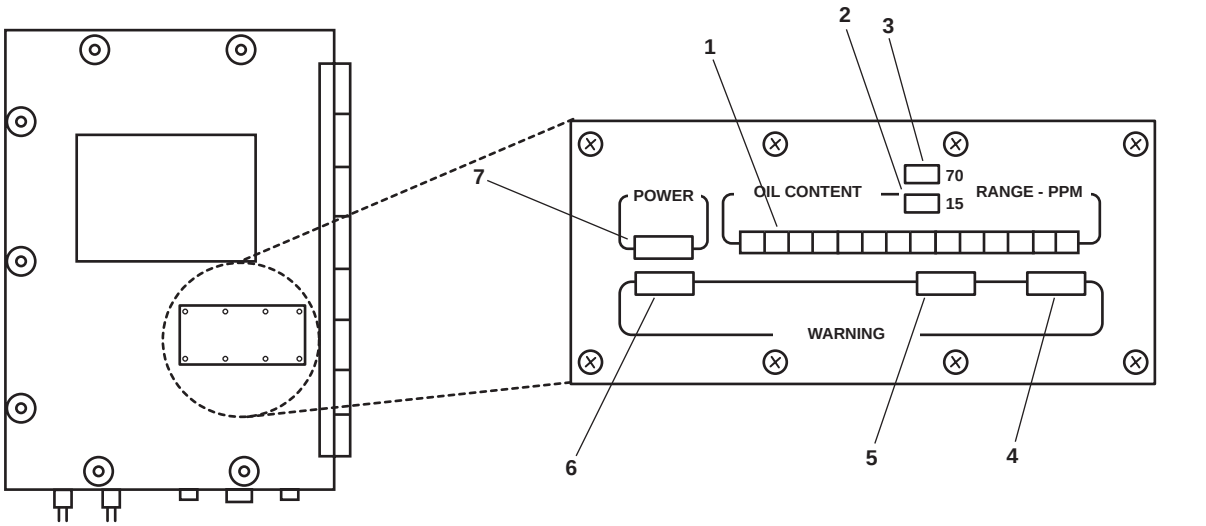


Figure 10. Battery Charger, Machinery DC Control

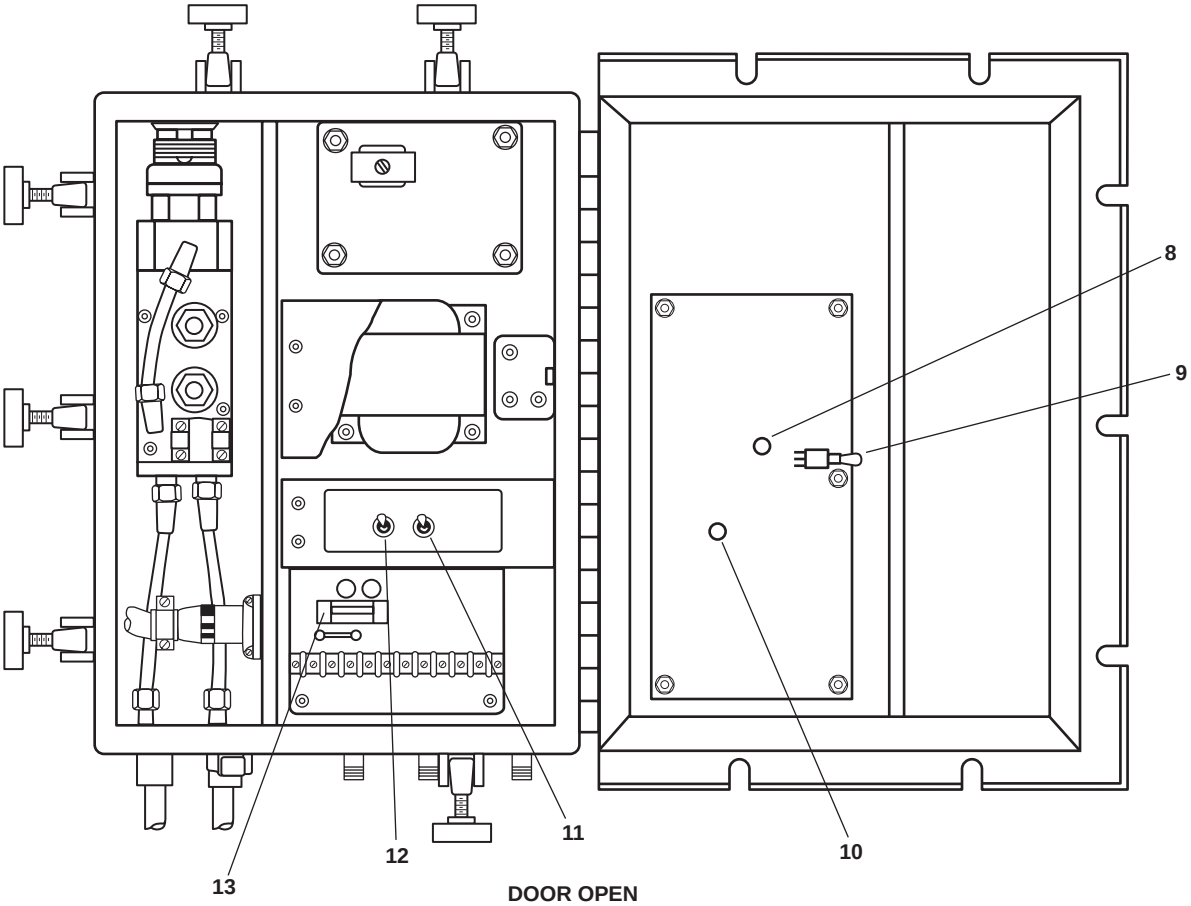
Table 10. Battery Charger, Machinery DC Control (refer to figure 10)

Key	Control/Indicator	Function
1	Ammeter	The ammeter indicates the charging rate of the battery charger.
2	ON/OFF Switch	This switch turns the battery charger ON or OFF.

OIL CONTENT MONITOR SAMPLING/SENSOR ASSEMBLY



DOOR CLOSED



DOOR OPEN

Figure 11. Oil Content Monitor Sampling/Sensor Assembly

Table 11. Oil Content Monitor Sampling/Sensor Assembly (refer to figure 11)

Key	Control/Indicator	Function
1	OIL CONTENT Display	This display indicates the effluent oil content in parts per million (ppm) relative to the selected alarm limit. Green display units are below the alarm limit, and red display units are above the alarm limit.
2	15 PPM Range Indicator	This illuminates to indicate that the 15 PPM alarm limit is selected.
3	70 PPM Range Indicator	This illuminates to indicate that the 70 PPM alarm limit is selected.
4	WARNING 3 Indicator	This illuminates to indicate dirt or foam in the sample, or no flow through the OCM.
5	WARNING 2 Indicator	This illuminates to indicate dirt or bubbles in the sample.
6	WARNING 1 Indicator	This illuminates to indicate that the OCM fuse (2 amp) is blown.
7	POWER Indicator	This illuminates to indicate that the OCM is operating.
8	A1DS8 Indicator Light Emitting Diode (LED)	This illuminates to indicate that the sample detection assembly is ON.
9	CHECK Alarm Switch A1S3	When this switch is in the DOWN position, the Ultrasonic Vibrator Assembly (UVA) operates continuously. To perform OCM electronics tests, the switch is placed in the DOWN position.
10	A1DS9 Indicator (LED)	This indicator flashes when the OCM is in alarm mode (effluent oil content exceeds alarm limit).
11	ALARM LIMIT Selector Switch A1S2	This switch permits the operator to select the 70 or 15 PPM alarm limits, or to enable the remote alarm limit selector switch. In the 70 PPM position, the OCM will activate alarms and energize the diverter valve when the oil content exceeds 70 ppm (+/- 30 ppm). In the 15 PPM position, the OCM will activate alarms and energize the diverter valve when the oil content exceeds 15 ppm (+/- 5 ppm). In the RE MOTE position, the PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch on the remote indicator assembly is engaged, allowing the operator to select the alarm limit from this remote location.
12	OPERATION SELECTOR Switch A1S1	This switch permits the operator to select the mode of operation. With the switch in the OFF position, none of the system indicators or displays will energize, and the diverter solenoid valve will remain in the recirculate (de-energized) position. With the switch in the AUTO position, the OCM will be energized whenever there is 5 to 25 PSI (0.3 to 1.7 bar) at the sample inlet. With the switch in the TEST position, the OCM is energized regardless of the sample pressure or flow. The TEST position is only to be used for troubleshooting and system verification, as operation of the OCM without adequate pressure or flow can damage the unit.
13	Elapsed Time Indicator (ETI)	The ETI keeps track of the hours that the OCM has been in use. Maintenance is performed on the OCM at 500-hour intervals.

OIL WATER SEPARATOR (OWS) AND OIL CONTENT MONITOR (OCM), ENGINE ROOM

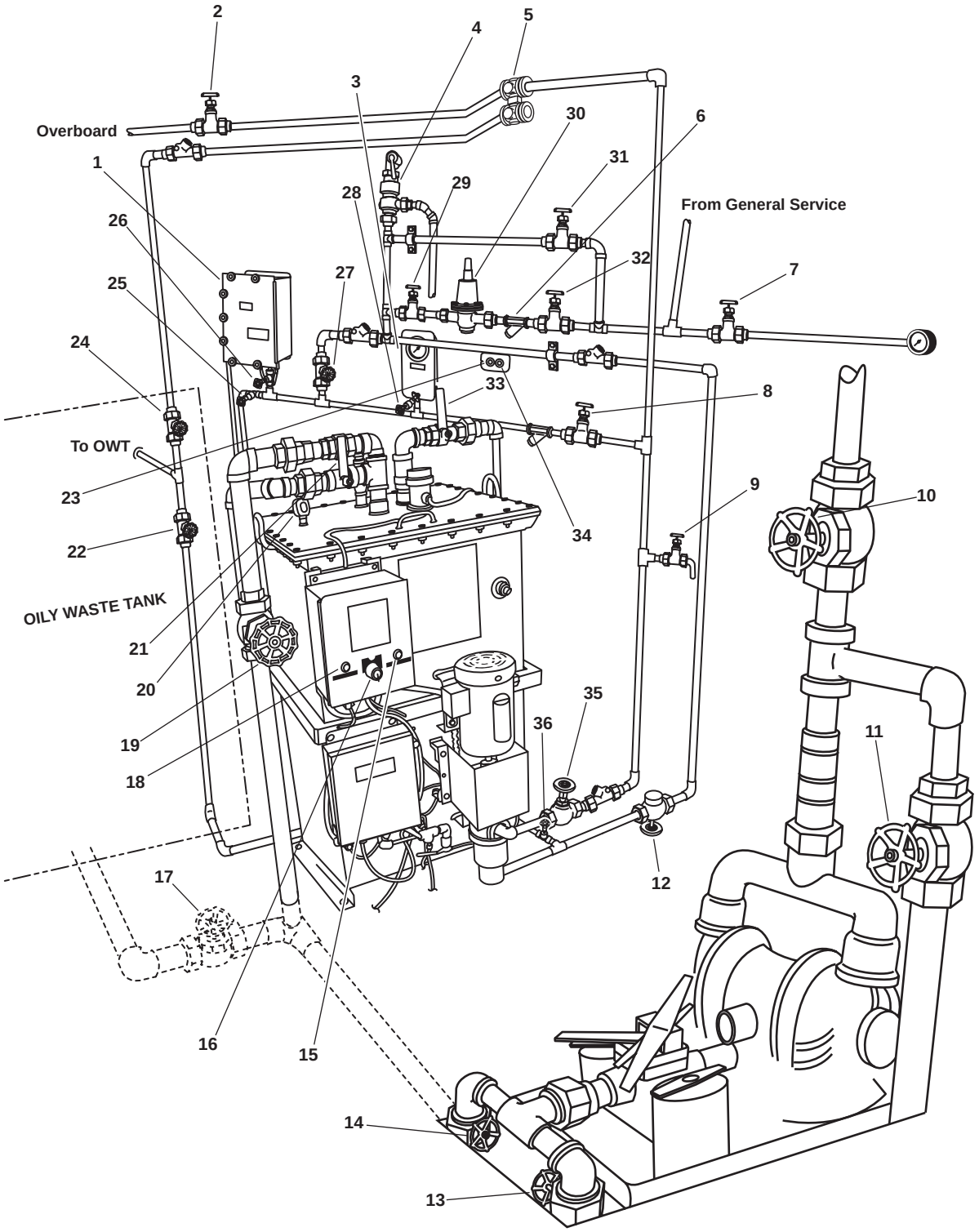


Figure 12. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room

Table 12. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room (refer to figure 12)

Key	Control/Indicator	Function
1	OCM Sampling/Sensor Assembly	This assembly contains the controls for operating the OCM and the readouts that monitor the system operation. See figure 2 for details.
2	OB-10, OWS OVERBOARD DISCHARGE Valve	This valve controls the flow of OWS discharge overboard.
3	OCM-G1, OCM INLET PRESSURE Gauge	This gauge indicates the inlet pressure into the OCM.
4	OCM Pressure Relief	This relief valve is set at 20 PSI (1.37 bar).
5	OWS-4, OCM 3-WAY DIVERTER (Diverter Solenoid Valve)	This diverter solenoid valve directs OWS discharge flow overboard or back to the Oily Waste Tank (OWT) depending upon the oil content in the discharge flow.
6	Strainer	This strainer removes large particles from the general service water.
7	OWS-24, SW TO OWS PRESS GAGE ISOLATION Valve	This valve allows general service water pressure to the OILY WTR SEP Gauge Isolation Valve PRESS gauge.
8	OCM-1, OCM NOZZLE SAMPLER COV Valve	This valve allows effluent from the OWS pump discharge to the OCM SAMPLER COV Valve.
9	OWS-6, OWS PITOT SAMPLE Valve	This valve permits the sampling of the OWS discharge effluent.
10	OB-9, XFR PUMP DISCH TO SHORE Valve	This valve secures oil discharge from the oily bilge pump to the shore.
11	OB-8, XFR PUMP TO OILY WATER TANK Valve	This valve secures oil discharge from the bilge pump to the waste oil storage tank.
12	GS-74, OWS BACKFLUSH INLET SOLENOID Valve	This valve permits back flushing of the OWS.
13	OB-14, COV-XFR PUMP SUCTION Valve	This valve secures the oily water discharge from the bilge.
14	OB-13, OWT TO XFR PUMP SUCTION Valve	This valve controls the flow of oily water from the OWS discharge pump.
15	OIL DISCHARGE Indicator	This lamp illuminates to indicate that oil is being discharged to the OWT.
16	OWS Control Switch	This switch controls operation of the OWS. The switch has three positions: AUTO, OFF, and MAN. The AUTO position is not functional on the Large Tug. In the OFF position, the OWS is off. In the MAN position, the OWS operates continuously.
17	OB-16, OILY WATER FROM OWT COV Valve	This valve secures oily waste suction from the oily waste storage tank.
18	POWER AVAILABLE Indicator	This lamp illuminates to indicate that power is available to the OWS.

Table 12. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room (refer to figure 12) (continued)

Key	Control/Indicator	Function
19	OB-15, OWS INLET Valve	This valve controls flow of oily water from the oily waste tank into the OWS.
20	OWS-G2, OWS VESSEL PRESS Gauge	This gauge indicates the amount of vacuum or pressure present inside the OWS tank.
21	OWS-1, OWS MANUAL BACKFLUSH	This valve allows the user to verify that the OWS tank is full of water.
22	OB-17, OILY WATER TANK INLET Valve	This valve controls the discharge flow into the oily waste holding tank from the OWS during the OWS automatic oil discharge mode.
23	OCM DIVERTER VALVE POSITION INDICATOR-DISCHARGE TO OVERBOARD	This lamp illuminates (green) to indicate that the OCM diverter solenoid valve is set to discharge overboard.
24	OWS-10, OWS RECIRCULATING COV Valve	This valve permits recirculation of oily waste through the oily waste holding tank and back to the OWS for additional purification.
25	OCM-3, OCM SAMPLING VALVE	This valve permits sampling of the OCM input flow.
26	OCM-4, OCM INLET Valve	This valve secures the flow of fluids into the OCM.
27	OCM-2, OCM BACKFLUSH WATER Valve	This valve controls the flow of backflush water to the OCM.
28	OCM-8, OCM GAGE ISOLATION Valve	This valve secures the pressure to OCM-G1 OCM INLET PRESS gauge.
29	OWS-8, BACKFLUSH WTR FROM PRESS RDCR Valve	This valve controls the flow of backflush water from GS-73 GENERAL SERVICE PRESS RDCR.
30	GS 73, GENERAL SERVICE PRESS RDCR	This reduces the general service water pressure to 12 PSI (0.82 bar).
31	OWS-9, BACKFLUSH WTR PRESS RDCR BYPASS Valve	This valve permits general service raw water to bypass GS-73 GENERAL SERVICE PRESS RDCR.
32	OWS-7, BACKFLUSH WTR TO PRESS RDCR Valve	This valve controls the flow of raw water to GS-73 GENERAL SERVICE PRESS RDCR.
33	OWS-2, OWS OIL DISCHARGE	This valve secures the oil discharge from the OWS to the OWT.
34	OCM DIVERTER VALVE POSITION INDICATOR-DISCHARGE TO OILY WASTE TANK	This lamp illuminates (red) to indicate that the OCM diverter solenoid valve is set to discharge to the oily waste tank.

Table 12. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room (refer to figure 12) (continued)

Key	Control/Indicator	Function
35	OWS-3, OWS PUMP DISCHARGE	This valve controls the discharge from the OWS pump.
36	OWS-5, OWS DISCHARGE Valve	This valve controls the discharge flow from the OWS.

OILY WASTE DISCHARGE PUMP

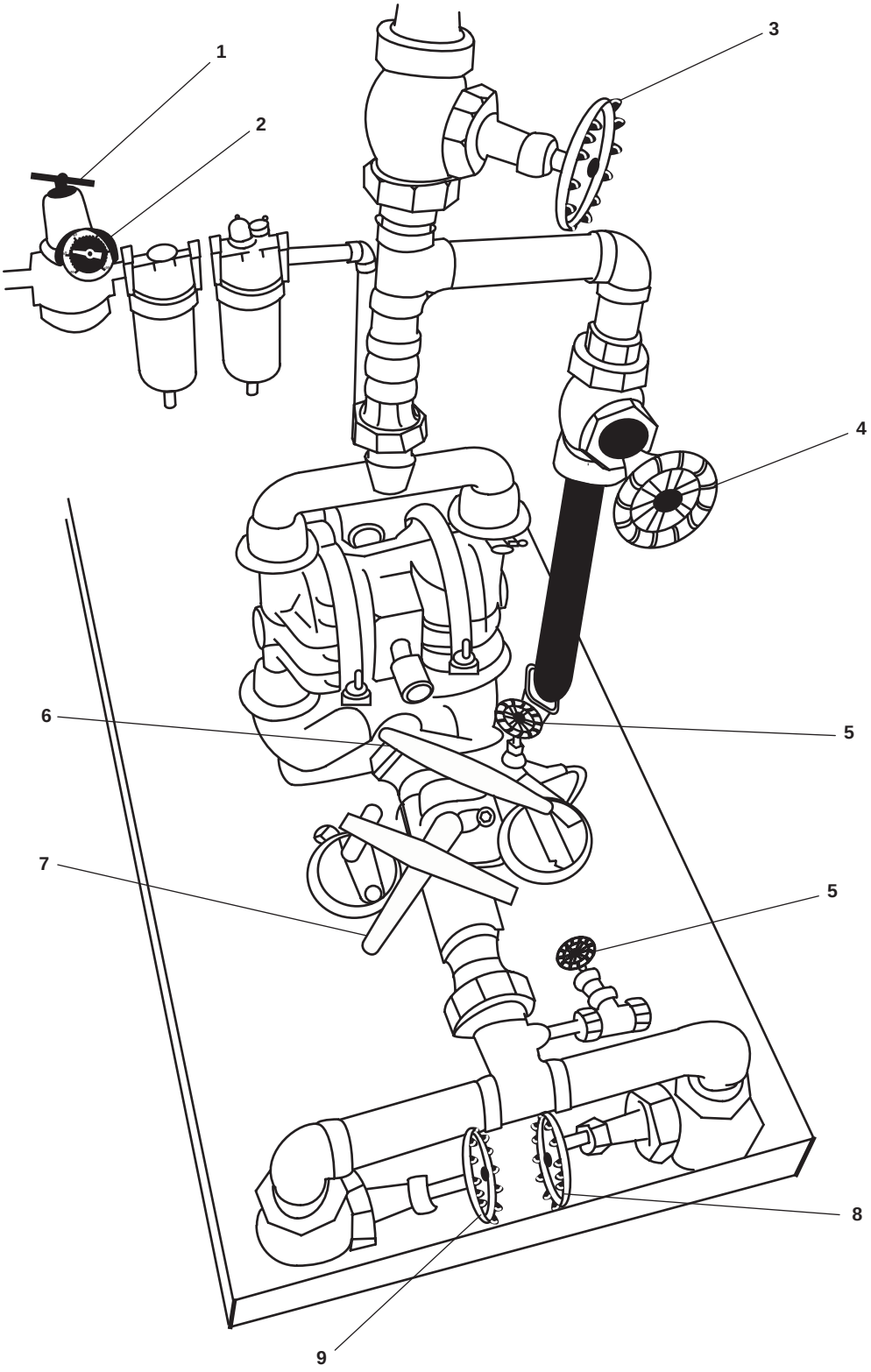


Figure 13. Oily Waste Discharge Pump

Table 13. Oily Waste Discharge Pump (refer to figure 13)

Key	Control/Indicator	Function
1	Adjusting Valve, Air Regulator	This permits adjustment of the air pressure to the oily waste overboard pump.
2	Air Pressure Gauge	This gauge indicates the air pressure available to the oily waste pump.
3	Cutoff Valve, Main Deck Shore Connection	This valve secures oily waste discharge pump flow to the main deck shore connection.
4	Cutoff Valve, OWS	This valve secures oily waste discharge pump flow to the OWS.
5	Cutoff Valve, Differential Pressure Gauge	This secures pressure to the oily waste discharge pump strainer differential pressure gauge.
6	Locking Handle	This handle locks the strainer selector lever in position.
7	Selector Lever	This lever permits the operator to select the online strainer, leaving the remaining strainer offline for service.
8	Cutoff Valve, Bilge Suction	When OPEN, this valve permits the oily waste discharge pump to draw suction from the bilges.
9	Cutoff Valve, OWS Suction	When OPEN, this valve permits the oily waste discharge pump to draw suction from the OWS.

SPACE HEATER

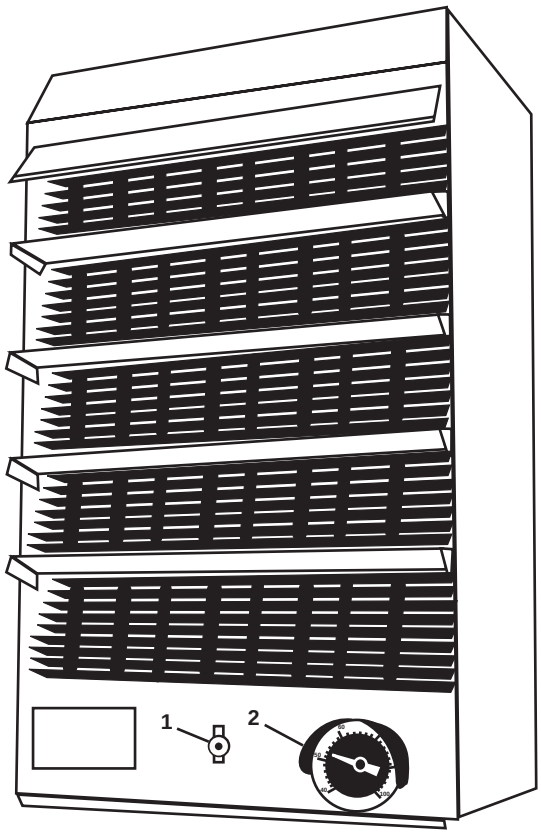


Figure 14. Space Heater

Table 14. Space Heater (refer to figure 14)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the space heater ON and OFF.
2	Thermostat	This permits the operator to adjust the desired temperature in the space.

REDUCTION GEAR COOLING PUMP MOTOR CONTROLLER

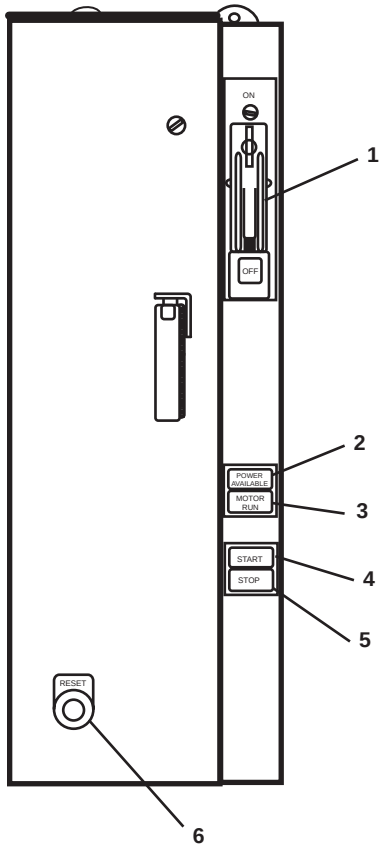


Table 15. Reduction Gear Cooling Pump Motor Controller

Table 15. Reduction Gear Cooling Pump Motor Controller (refer to figure 15)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit protection.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is available to the controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the cooling pump motor is running.
4	START Pushbutton	This pushbutton starts the cooling pump motor.
5	STOP Pushbutton	This pushbutton stops the cooling pump motor.
6	RESET Pushbutton	This pushbutton resets the motor controller.

REFRIGERATION MANIFOLD

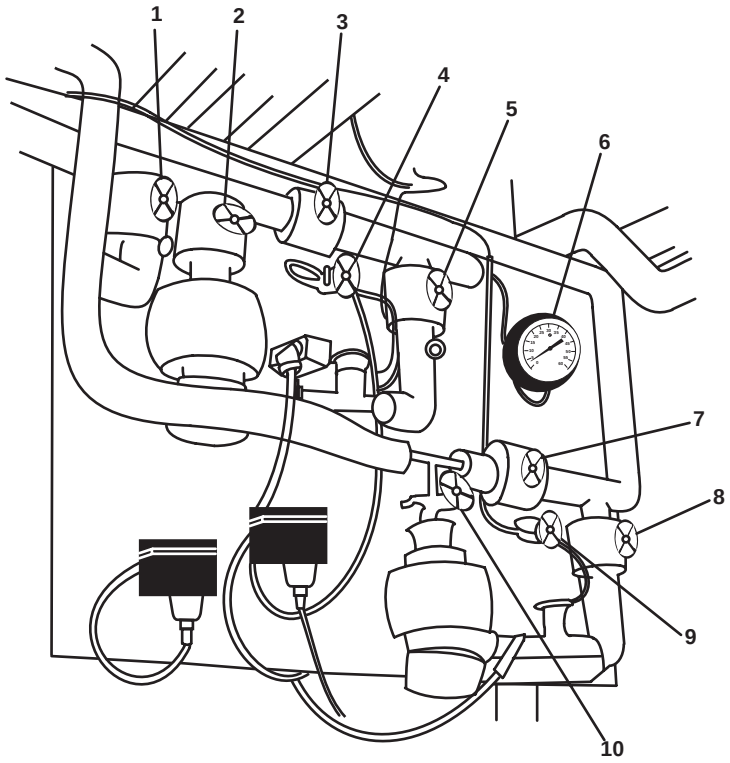


Figure 16. Refrigeration Manifold

Table 16. Refrigeration Manifold (refer to figure 16)

Key	Control/Indicator	Function
1	RFSS-13, LIQUID LINE CRSVR CO Valve	This valve permits the crossover between the liquid lines when in the OPEN position.
2	RFSS-11, TXV/STNR/LLSV COV Valve	This valve secures the flow to the thermal expansion valve, strainer, and liquid line solenoid valve.
3	RFSS-6, HAND EXP V Valve	This valve permits the unit to be operated manually in the event of a thermal expansion valve, strainer, or liquid line solenoid valve failure.
4	RFSS-9, EQL LINE Valve	This valve permits the external equalization line to the thermal expansion valve to be secured for service.
5	RFSS-14, TXV/STRNR/LLSV COV Valve	This valve secures the flow to the thermal expansion valve, strainer, and liquid line solenoid valve.
6	Thermometer	The thermometer indicates the temperature in the chill box, located in the galley.
7	RFSS-7, HAND EXP V Valve	This valve permits the unit to be operated manually in the event of a thermal expansion valve, strainer, or liquid line solenoid valve failure.

Table 16. Refrigeration Manifold (refer to figure 16)

Key	Control/Indicator	Function
8	RFSS-15, TXV/STNR/LLSV COV Valve	This valve secures the flow to the thermal expansion valve, strainer, and liquid line solenoid valve.
9	RFSS-8, EQL LINE Valve	This valve permits the external equalization line to the thermal expansion valve to be secured for service.
10	RFSS-12, TXV/STNR/LLSV COV Valve	This valve secures the flow to the thermal expansion valve, strainer, and liquid line solenoid valve.

ENGINE ROOM SUPPLY AND EXHAUST FAN MOTOR CONTROLLERS

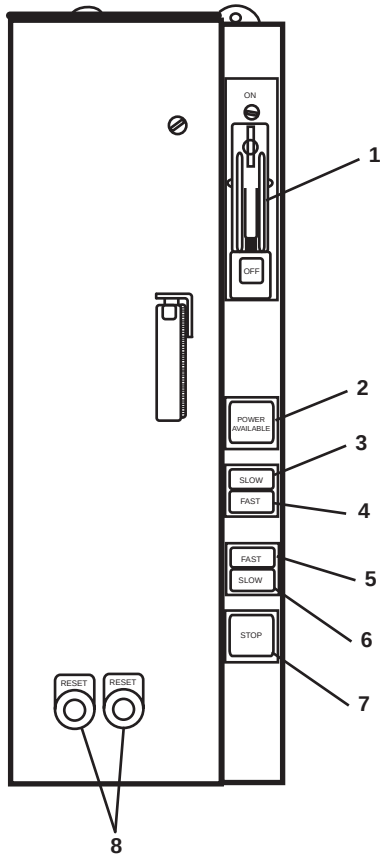


Figure 17. Engine Room Supply and Exhaust Fan Motor Controllers

Table 17. Engine Room Supply and Exhaust Fan Motor Controllers (refer to figure 17)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit protection.
2	POWER AVAILABLE Indicator	This indicator illuminates (green) to indicate that power is available to the controller.
3	SLOW Indicator	This indicator illuminates to indicate that the fan is operating at SLOW speed.
4	FAST Indicator	This indicator illuminates to indicate that the fan is operating at FAST speed.
5	FAST Pushbutton	This pushbutton is used to operate the fan motor at FAST speed.
6	SLOW Pushbutton	This pushbutton is used to operate the fan motor at SLOW speed.
7	STOP Pushbutton	This pushbutton is used to STOP the fan motor.
8	RESET Pushbutton	This pushbutton resets the motor controller.

120V DISTRIBUTION PANEL NO. 4

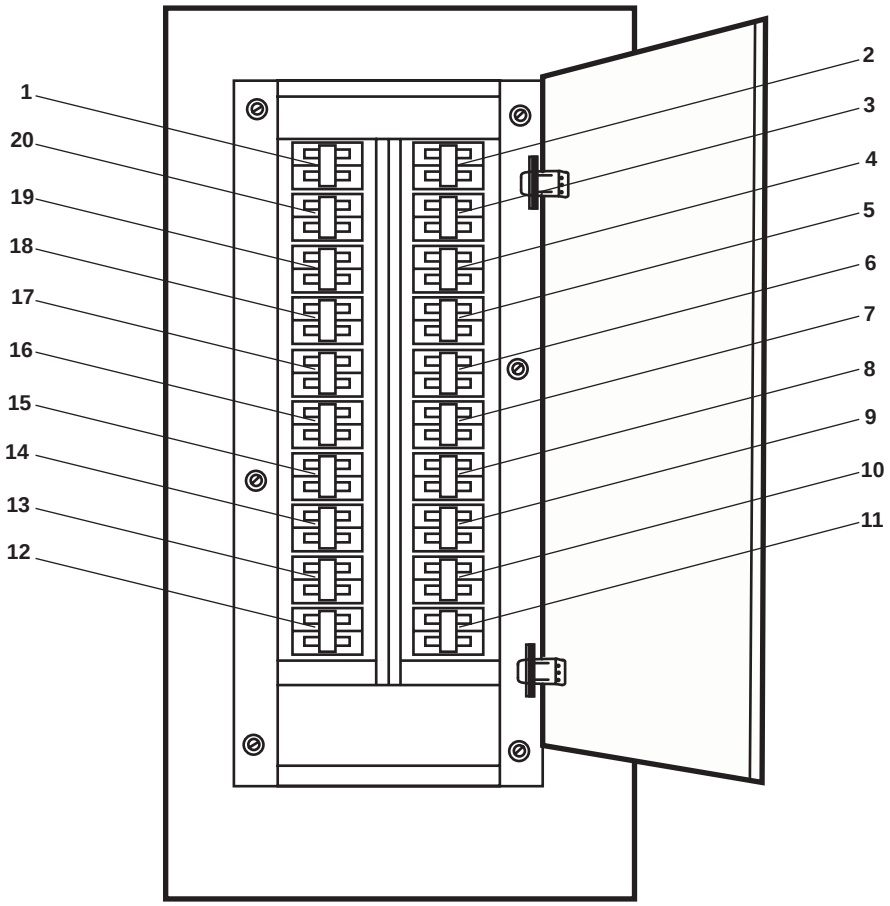


Figure 18. 120V Distribution Panel No. 4

Table 18. 120V Distribution Panel No. 4 (refer to figure 18)

Key	Control/Indicator	Function
1	ENGINE ROOM LIGHTS. Circuit Breaker	This circuit breaker provides control of, and protection for, the engine room lights.
2	BOWTHRUSTER COMPT & AUXILIARY MACHINERY SPACES 1& 2 LIGHTS Circuit Breaker	This circuit breaker provides control of, and protection for, the lights for the bow thruster compartment and auxiliary machinery spaces 1 and 2.
3	ENGINEERS OPERATING STATION R2-40-1. Circuit Breaker	This circuit breaker provides control of, and protection for, the EOS unit air conditioner.
4	J.B. FOR EMERGENCY SWITCHBOARD STRIP HEATER & EMERGENCY GENERATOR SPACE HEATER. Circuit Breaker	This circuit breaker provides control of, and protection for, the emergency switchboard heater and emergency generator room space heater.

Table 18. 120V Distribution Panel No. 4 (refer to figure 18) (continued)

Key	Control/Indicator	Function
5	HOLD LEVEL & FAN TAIL RECEPTICLES. Circuit Breaker	This circuit breaker provides control of, and protection for, the receptacles on the hold level and the fantail.
6	SHIPS SERVICE DIESEL GENERATOR JACKET WATER HEATER No. 2. Circuit Breaker	This circuit breaker provides control of, and protection for, the SSDG 2 jacket water heater.
7	BOW THRUSTER ENGINE JACKET WATER HEATER. Circuit Breaker	This circuit breaker provides control of, and protection for, the bow thruster engine jacket water heater.
8	WORKSHOP EXHAUST FAN EO2-16-1. Circuit Breaker	This circuit breaker provides control of, and protection for, the workshop exhaust fan.
9	J.B. FOR SS REFG Nos. 1 & 2 (INC. FAN COIL AND CONTROLLERS). Circuit Breaker	This provides control of, and protection for, the control power for the freeze box and chill box fan coil units.
10	ROWPU BATTERY CHARGER. Circuit Breaker	This circuit breaker provides control of, and protection for, the Reverse Osmosis Water Purfication Unit (ROWPU) battery charger.
11	OIL CONTENT MONITOR. Circuit Breaker	This circuit breaker provides control of, and protection for, the Oil Content Monitor (OCM).
12	MAIN ENGINE SHUTDOWN, (PILOTHOUSE). Circuit Breaker	This circuit breaker provides control of, and protection for, the pilothouse main engine shutdown system.
13	J.B. FOR AUTO DRAIN ON AIR RECEIVER. (INC. REFER DRYER) Circuit Breaker	This circuit breaker provides control of, and protection for, the air receiver's automatic condensation drains and control of the air dryer.
14	J.B. FOR A/C REEF SYSTEMS Nos. 1 & 2 (INC. LIQUID LINE SOLENOID VALVES). Circuit Breaker	This circuit breaker provides control of, and protection for, the air conditioning control power.
15	ENGINEERS OPERATING STATION DRINKING FOUNTAIN. Circuit Breaker	This circuit breaker provides control of, and protection for, the engine room drinking fountain.
16	PUMP DRIVE ENGINE JACKET WATER HEATER. Circuit Breaker	This circuit breaker provides control of, and protection for, the pump drive engine jacket water heater.
17	SHIPS SERVICE DIESEL GENERATOR SPACE HEATER No. 2. Circuit Breaker	This circuit breaker provides control of, and protection for, the SSDG 2 space heater.
18	SHIPS SERVICE DIESEL GENERATOR JACKET WATER HEATER No. 1. Circuit Breaker	This circuit breaker provides control of, and protection for, the SSDG 1 jacket water heater.

Table 18. 120V Distribution Panel No. 4 (refer to figure 18) (continued)

Key	Control/Indicator	Function
19	OILY WATER SEPARATOR. Circuit Breaker	This circuit breaker provides control of, and protection for, the oil water separator.
20	SHIPS SERVICE DIESEL GENERATOR SPACE HEATER No. 1. Circuit Breaker	This circuit breaker provides control of, and protection for, the SSDG 1 space heater.

MACHINERY MONITORING SYSTEM CPU

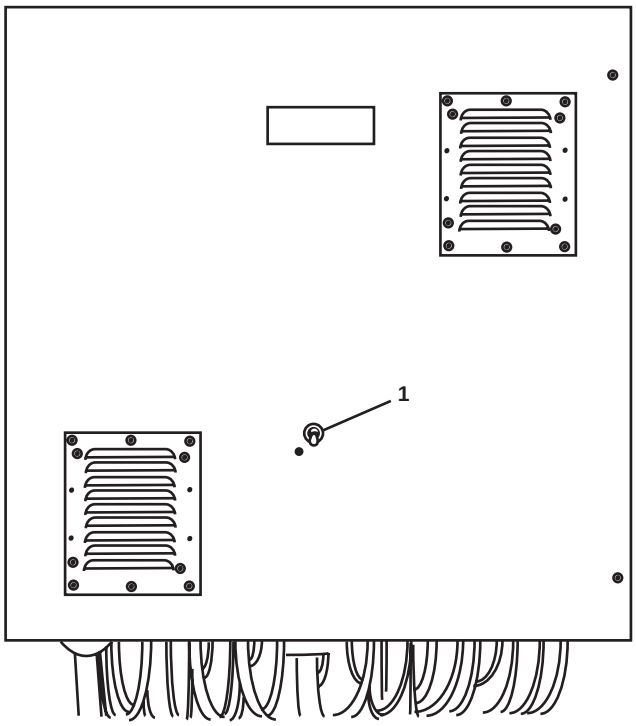


Figure 19. Machinery Monitoring System CPU

Table 19. Machinery Monitoring System CPU (refer to figure 19)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the machinery monitoring system ON and OFF.

MACHINERY DC CONTROL DISTRIBUTION PANEL

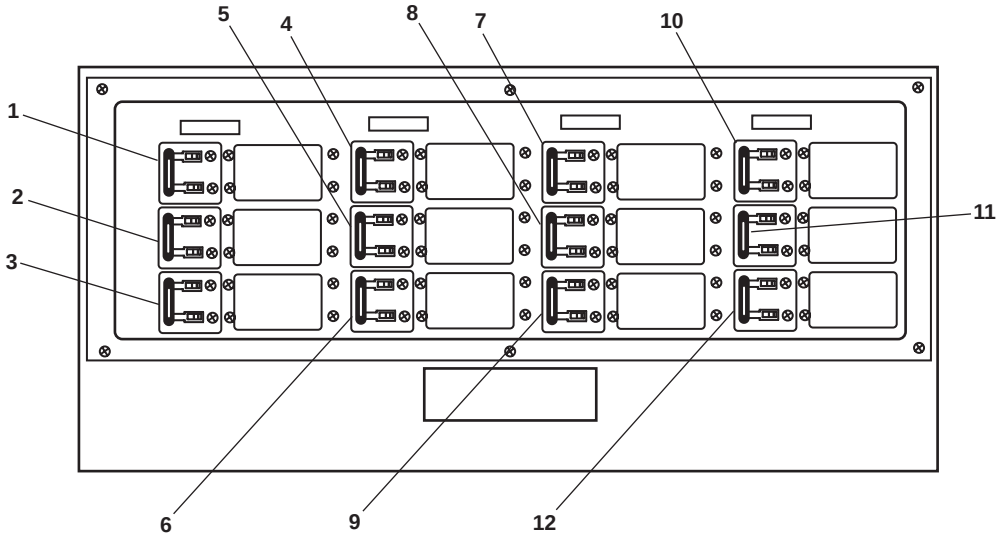


Figure 20. Machinery DC Control Distribution Panel

Table 20. Machinery DC Control Distribution Panel (refer to figure 20)

Key	Control/Indicator	Function
1	FM-200 SHUTDOWN Circuit Breaker	This circuit breaker provides control of, and protection for, the FM-200 system controls.
2	SPARE Circuit Breaker	This circuit breaker provides for future system expansion.
3	FUEL OIL DAY TANK (P&S) HIGH LEVEL ALARM Circuit Breaker	This circuit breaker provides control of, and protection for, the fuel oil day tank high-level alarm system.
4	MACHINERY CONTROL SYS Circuit Breaker	This circuit breaker provides control of, and protection for, the machinery control system.
5	PUMP DRIVE ENG Circuit Breaker	This circuit breaker provides control of, and protection for, the pump drive engine control system.
6	BOW THRUSTER DRIVE ENG Circuit Breaker	This circuit breaker provides control of, and protection for, the bow thruster engine control system.
7	RUDDER ANGLE Circuit Breaker	This circuit breaker provides control of, and protection for, the rudder angle indicator system.
8	STEERING GEAR ALM Circuit Breaker	This circuit breaker provides control of, and protection for, the steering gear alarm system.

Table 20. Machinery DC Control Distribution Panel (refer to figure 20)

Key	Control/Indicator	Function
9	SSDG NO 2 Circuit Breaker	This circuit breaker provides control of, and protection for, the SSDG 2 control system.
10	CRANE LMI Circuit Breaker	This circuit breaker provides control of, and protection for, the crane Load Moment Indicator (LMI).
11	SPARE Circuit Breaker	This is a spare circuit breaker for future system expansion.
12	SPARE Circuit Breaker	This is a spare circuit breaker for future system expansion.

LOAD CENTER DISTRIBUTION PANEL

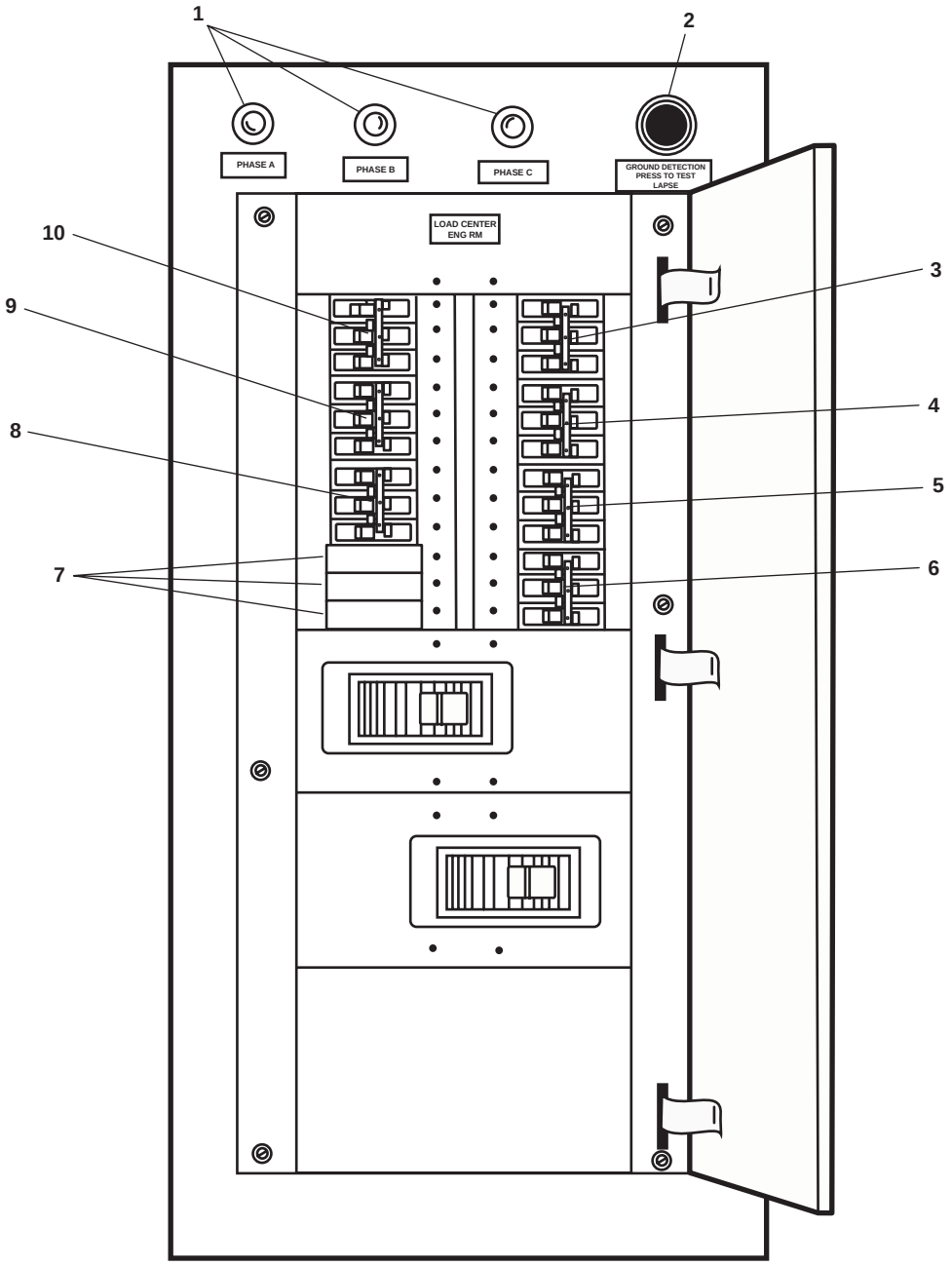


Figure 21. Load Center Distribution Panel

Table 21. Load Center Distribution Panel (refer to figure 21)

Key	Control/Indicator	Function
1	PHASE A, PHASE B, PHASE C Lamps	These lamps are used to indicate ground fault conditions.
2	GROUND DETECTION PUSH TO TEST LAMPS Pushbutton	This pushbutton is used to test the ground fault lamps.
3	120V DISTRIBUTION PANEL No. 3. (MAIN DECK). Circuit Breaker	This circuit breaker provides control of, and protection for, the 120V distribution panel No. 3 on the main deck.
4	120V DISTRIBUTION PANEL No. 4. (ENGINE ROOM). Circuit Breaker	This circuit breaker provides control of, and protection for, the 120V distribution panel No. 4 in the engine room.
5	SPARE Circuit Breaker	The spare circuit breaker allows new circuits to be added.
6	SPARE Circuit Breaker	The spare circuit breaker allows new circuits to be added.
7	Blank	The blank allows the addition of a circuit breaker.
8	MACHINE SHOP EQUIPMENT JUNCTION BOX. (LATHE/ GRINDER/DRILL PRESS). Circuit Breaker	This circuit breaker provides control of, and protection for, the workshop equipment.
9	120V DISTRIBUTION PANEL No. 1. (GALLEY). Circuit Breaker	This circuit breaker provides control of, and protection for, the 120V distribution panel No. 1 in the galley.
10	120V DISTRIBUTION PANEL No. 2. (01 LEVEL). Circuit Breaker	This circuit breaker provides control of, and protection for, the 120V distribution panel No. 2 on the 01 level.

440V POWER PANEL NO. 1

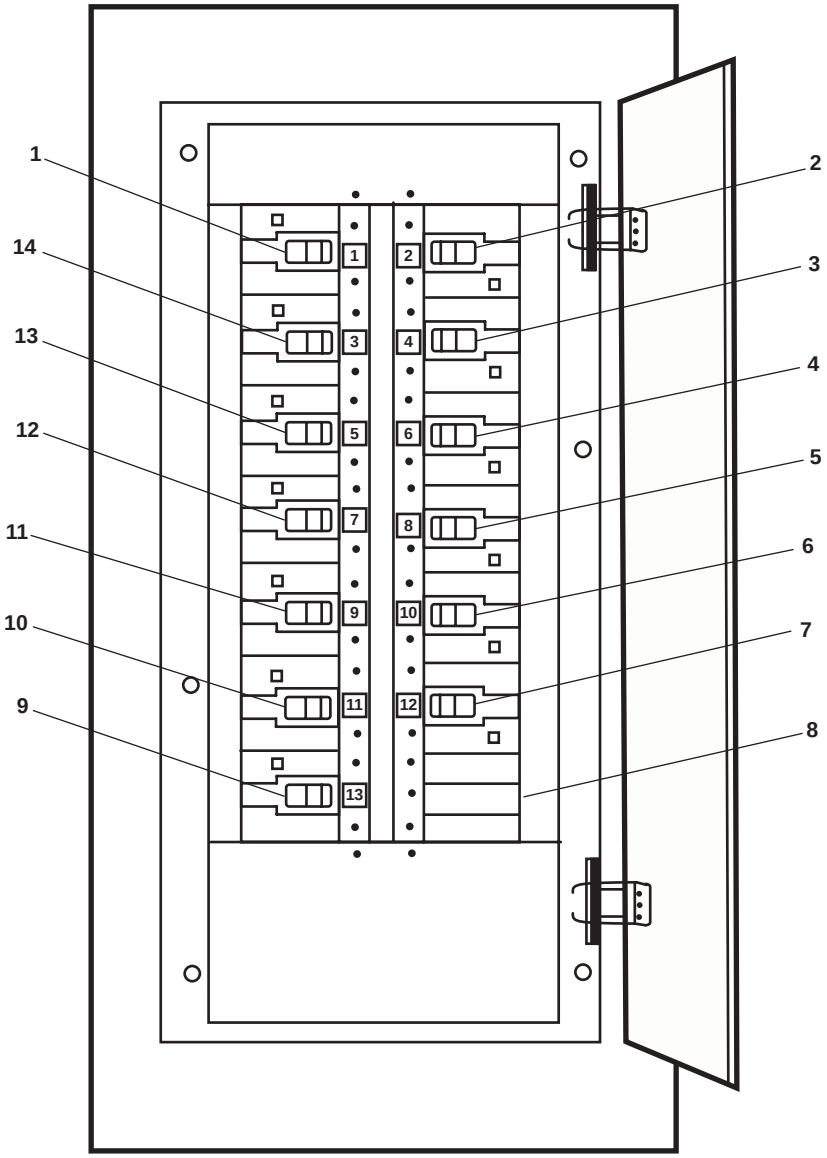


Figure 22. 440V Power Panel No. 1

Table 22. 440V Power Panel No. 1 (refer to figure 22)

Key	Control/Indicator	Function
1	LUBE OIL TRANSFER PUMP. Circuit Breaker	This circuit breaker provides control of, and protection for, the lube oil transfer pump.
2	ENGINE ROOM UNIT HEATER. Circuit Breaker	This circuit breaker provides control of, and protection for, the engine room unit heater.
3	FRESH WATER PUMP No. 2, (REDUCTION GEAR) Circuit Breaker	This circuit breaker provides control of, and protection for, the port reduction gear cooling water pump.
4	MAIN ENGINE LUBE OIL PRIMING PUMP No. 1. Circuit Breaker	This circuit breaker provides control of, and protection for, the starboard main engine lube oil- priming pump.
5	SPARE Circuit Breaker	The spare circuit breaker allows new circuits to be added.
6	SPARE Circuit Breaker	The spare circuit breaker allows new circuits to be added.
7	SEWAGE DISCHARGE PUMP No. 1. Circuit Breaker	This circuit breaker provides control of, and protection for, the starboard sewage discharge pump.
8	Blank	The blank allows the addition of a circuit breaker.
9	SEWAGE DISCHARGE PUMP No. 2. Circuit Breaker	This circuit breaker provides control of, and protection for, the port sewage discharge pump.
10	FUEL OIL TRANSFER PUMP No. 2. Circuit Breaker	This circuit breaker provides control of, and protection for, the fuel oil transfer pump 2.
11	MAIN ENGINE JACKET WATER HEATER No. 2/ TURBO OIL PUMP No. 2./ WATER LAY OVER PUMP No. 2. Circuit Breaker	This circuit breaker provides control of, and protection for, the jacket water layover pump, jacket water heater, and turbo oil pump for main engine 2.
12	MAIN ENGINE LUBE OIL PRIMING PUMP No. 2. Circuit Breaker	This provides control of, and protection for, the port main engine lube oil-priming pump.
13	MAIN ENGINE JACKET WATER HEATER No. 1./ TURBO OIL PUMP No. 1./ WATER LAYOVER PUMP No. 1. Circuit Breaker	This circuit breaker provides control of, and protection for, the jacket water layover pump, jacket water heater, and turbo oil pump for main engine 1.
14	FRESH WATER PUMP No. 1, (REDUCTION GEAR). Circuit Breaker	This circuit breaker provides control of, and protection for, the starboard reduction gear cooling water pump.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
EOS

GENERAL ARRANGEMENT OF EOS

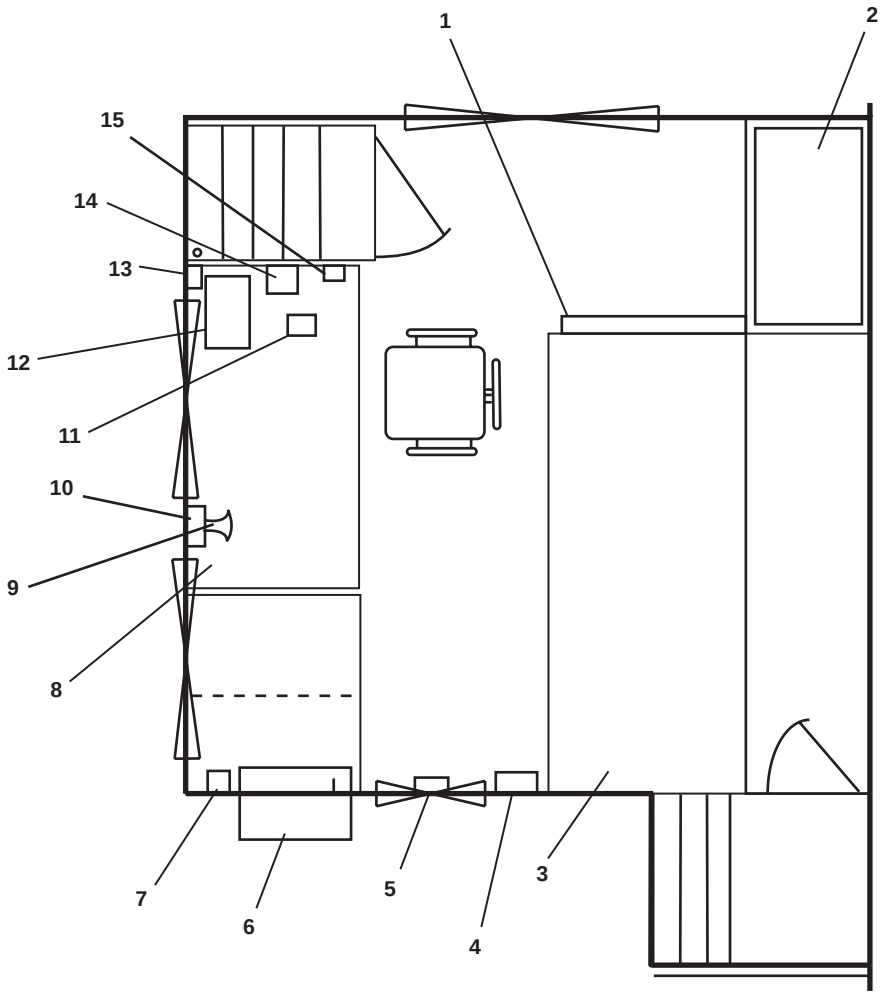


Figure 1. General Arrangement of EOS

Table 1. General Arrangement of EOS

Key	Control/Indicator	Function
1	Fire Alarm and Smoke Detection Panel (over), Fire Alarm Bell (under)	These alarm components indicate the presence of smoke or fire on the vessel. See figure 12 for details.
2	Master Tank Level Indicator Panel 7 Channel	These indicators display the volume of the sewage, sludge, potable water, and ballast tanks. See figure 10 for details.
3	Main Switchboard	The switchboard contains master power controls for various ship systems. See figure 11 for details.

Table 1. General Arrangement of EOS (continued)

Key	Control/Indicator	Function
4	Ship Clinometer (Trim)	The trim clinometer indicates the trim tilt angle of the vessel. See figure 14 for details.
5	OCM Remote Indicator (Alarm) Assembly	This indicator displays the effluent oil content level and over-limit alarm for the Oil Content Monitor (OCM) system. See figure 19 for details.
6	Air Conditioning Unit	The air conditioning unit cools the EOS. See figure 18 for details.
7	EOT Wrong Direction Bell	The bell sounds when EOS personnel have the wrong direction selected. See figure 16 for details.
8	EOS Console	The console contains controls for various vessel systems. See figure 2 for details.
9	PA System Speaker and Volume Control	The PA speaker and volume control provide communications within the ship. See figure 17 for details.
10	Ship Clinometer (Heel)	The heel clinometer indicates the heel angle of the vessel. See figure 13 for details.
11	Intercom	The intercom provides communication within the ship. See Figure 7 for details.
12	Master Tank Level Indicator Panel 11 Channel	These indicators display the volume of the tanks. See figure 9 for details.
13	EOT Constant Ring Bell	This bell sounds when an engine order change has been received. See figure 16 for details.
14	Sound Powered Telephone	The telephone provides communication within the ship. See figure 15 for details.
15	Interior Light Switch	This switch illuminates the EOS.

EOS CONSOLE

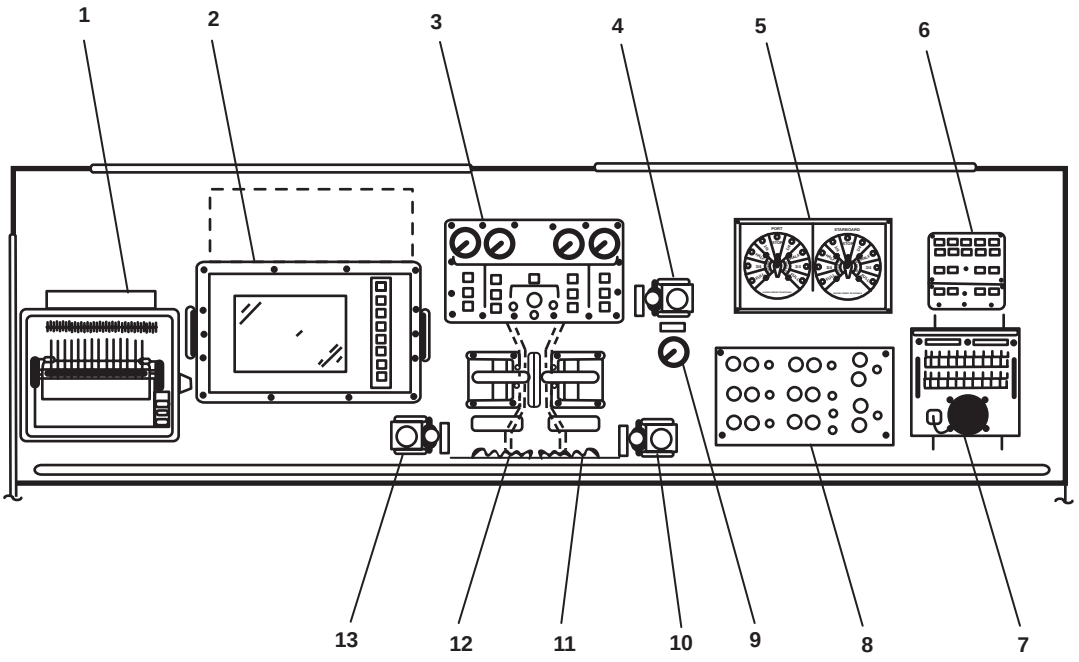


Figure 2. EOS Console

Table 2. EOS Console (refer to figure 2)

Key	Control/Indicator	Function
1	Machinery Plant Monitoring System Printer	This printer provides hard copy of machinery plant monitoring system data.
2	Machinery Plant Monitoring System Display	This system displays the status of machinery as monitored by the machinery plant monitoring system. See figure 3 for details.
3	Remote Propulsion Indicator Panel	This panel provides indicators for propulsion machinery. See figure 4 for details.
4	COMMAND TRANSFER Control	With this control in the REMOTE position, control air is transferred from the EOS console to the remote consoles (pilothouse, aft control station, or either bridge wing control station). In the EOS position, control air is transferred to the EOS console.
5	Engine Order Telegraph (EOT) Panel	This panel indicates the desired speed and directional signals from the pilothouse. See figure 5 for details.
6	Steering Control Alarm Panel	This panel provides remote indicators for the steering gear system. See figure 6 for details.
7	LS-519A/SIC INTER-COMMUNICATIONS STATION	This station provides station-to-station shipboard communications. See figure 7 for details.

Table 2. EOS Console (refer to figure 2) (continued)

Key	Control/Indicator	Function
8	Machinery Remote Control Station	This control station provides controls and indicators for the machinery. See figure 8 for details.
9	CONTROL AIR PRESSURE Gauge	This gauge indicates control air pressure in PSI.
10	PORT AHD SELECTOR	This selector selects the port reduction gear ratio.
11	PORT MN ENG THROTTLE/CLUTCH	This controls the speed of the port main engine and the rotating direction of the port propeller shaft.
12	STBD MN ENG THROTTLE/CLUTCH	This controls the speed of the starboard main engine and the rotating direction of the starboard propeller shaft.
13	STBD AHD SELECTOR	This selector selects the starboard reduction gear ratio.

MACHINERY PLANT MONITORING SYSTEM DISPLAY

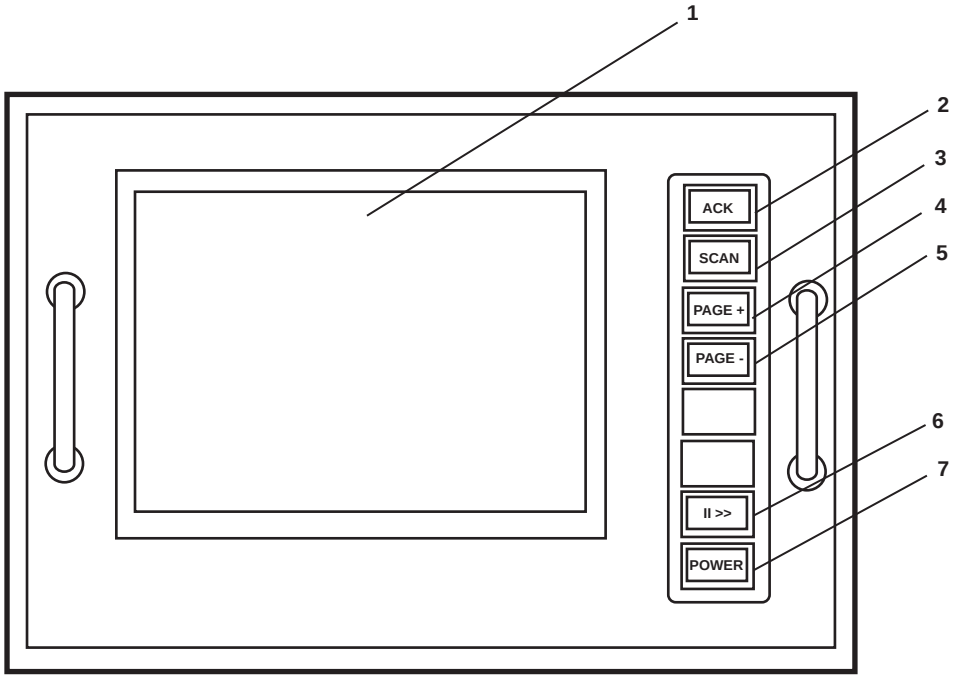


Figure 3. Machinery Plant Monitoring System Display

Table 3. Machinery Plant Monitoring System Display (refer to figure 3)

Key	Control/Indicator	Function
1	Screen	This screen displays the machinery plant operating data.
2	ACK Pushbutton	This pushbutton is pushed to acknowledge an alarm.
3	SCAN Pushbutton	This pushbutton causes the alarm messages to be displayed on the screen in reverse order.
4	PAGE + Pushbutton	This pushbutton moves the screen display forward one page.
5	PAGE - Pushbutton	This pushbutton moves the screen display back one page.
6	Alarm Annunciator	The annunciator provides an audible alarm signal.
7	POWER Pushbutton	This pushbutton turns the screen display ON.

REMOTE PROPULSION INDICATOR PANEL

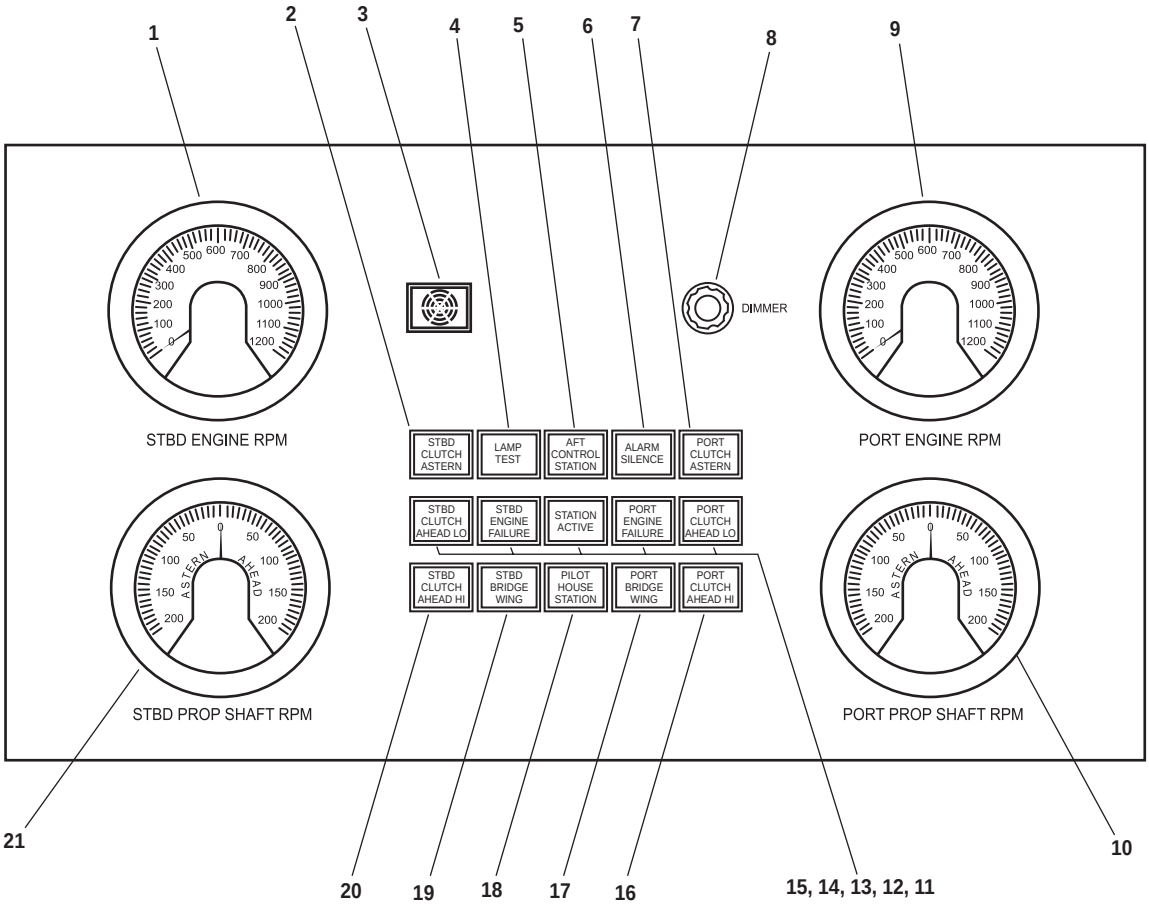


Figure 4. Remote Propulsion Indicator Panel

Table 4. Remote Propulsion Indicator Panel (refer to figure 4)

Key	Control/Indicator	Function
1	STBD ENGINE RPM Tachometer	The tachometer indicates starboard main engine speed in r/min.
2	STBD CLUTCH ASTERN Indicator	This indicator illuminates to indicate that the starboard reduction gear is in the ASTERN position.
3	Annunciator	This annunciator is an audible alarm that alerts the operator that a failure has occurred.
4	LAMP TEST Pushbutton	This pushbutton tests the panel lights when pushed.
5	AFT CONTROL STATION Indicator	This indicator illuminates to indicate that the aft control station is in control of the propulsion systems.
6	ALARM SILENCE Pushbutton	This pushbutton silences the alarm annunciator.

Table 4. Remote Propulsion Indicator Panel (refer to figure 4) (continued)

Key	Control/Indicator	Function
7	PORT CLUTCH ASTERN Indicator	This indicator illuminates to indicate that the port reduction gear is in the ASTERN position.
8	DIMMER Control	This controls the illumination level of the indicators on the panel.
9	PORT ENGINE RPM Tachometer	The tachometer indicates port main engine speed in r/min.
10	PORT PROP SHAFT RPM Tachometer	The tachometer indicates port propeller shaft speed in r/min.
11	PORT CLUTCH AHEAD LO Indicator	This indicator illuminates to indicate that the port reduction gear speed is LO and is in the AHEAD position.
12	PORT ENGINE FAILURE Indicator	This indicator illuminates to indicate that the port main engine is not operating.
13	STATION ACTIVE Indicator	This indicator illuminates to indicate that the EOS is in control of the propulsion systems.
14	STBD ENGINE FAILURE Indicator	This indicator illuminates to indicate that the starboard engine is not operating.
15	STBD CLUTCH AHEAD LO Indicator	This indicator illuminates to indicate that the starboard reduction gear speed is LO, and is in the AHEAD position.
16	PORT CLUTCH AHEAD HI Indicator	This indicator illuminates to indicate that the port reduction gear speed is HI and is in the AHEAD position.
17	PORT BRIDGE WING Indicator	This indicator illuminates to indicate that the port bridge wing station is in control of the propulsion systems.
18	PILOT HOUSE STATION Indicator	This indicator illuminates to indicate that the pilothouse is in control of the propulsion systems.
19	STBD BRIDGE WING Indicator	This indicator illuminates to indicate that the starboard bridge wing station is in control of the propulsion systems.
20	STBD CLUTCH AHEAD HI Indicator	This indicator illuminates to indicate that the starboard reduction gear speed is HI and is in the AHEAD position.
21	STBD PROP SHAFT RPM Tachometer	The tachometer indicates starboard propeller shaft speed in r/min.

ENGINE ORDER TELEGRAPH PANEL

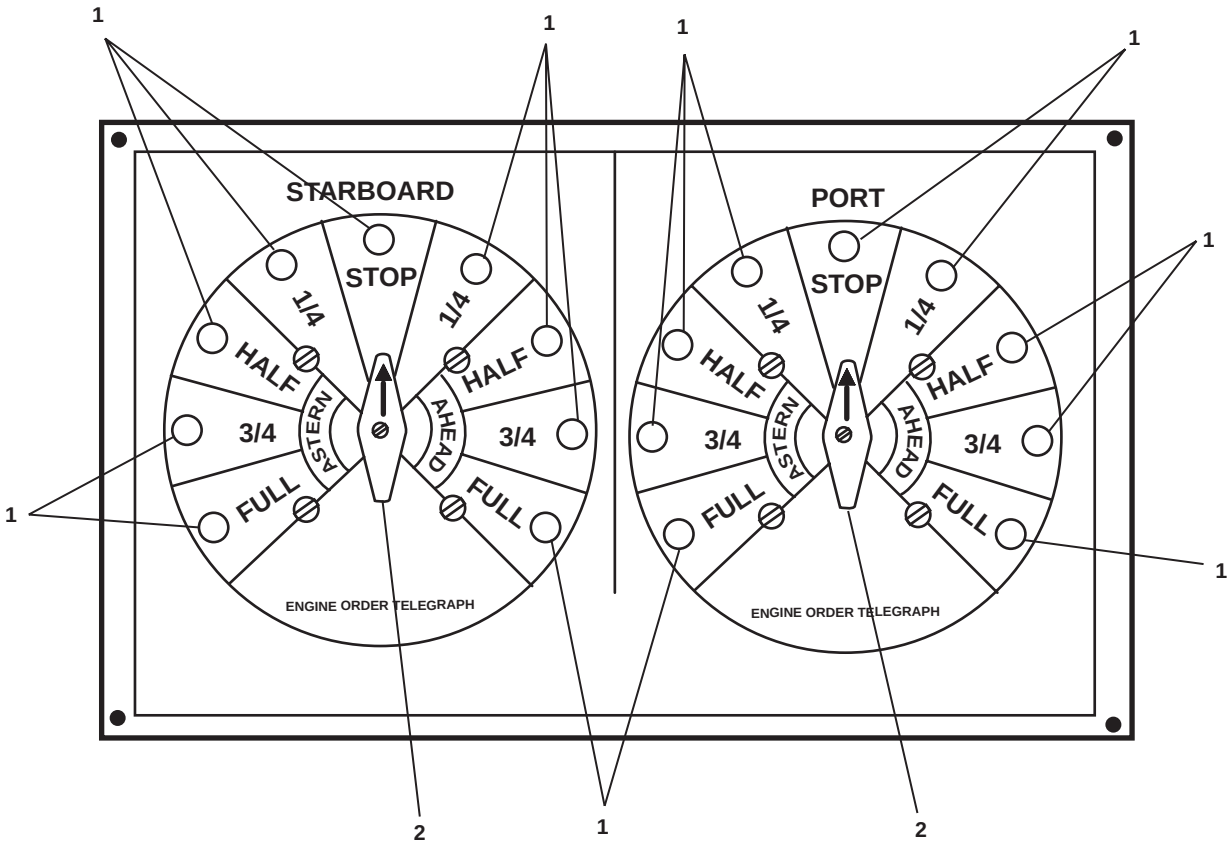


Figure 5. Engine Order Telegraph Panel

Table 5. Engine Order Telegraph Panel (refer to figure 5)

Key	Control/Indicator	Function
1	LEDs	The LEDs illuminate to indicate the selected speed and direction.
2	Selector Knob	This knob selects the desired speed and direction.

STEERING CONTROL ALARM PANEL

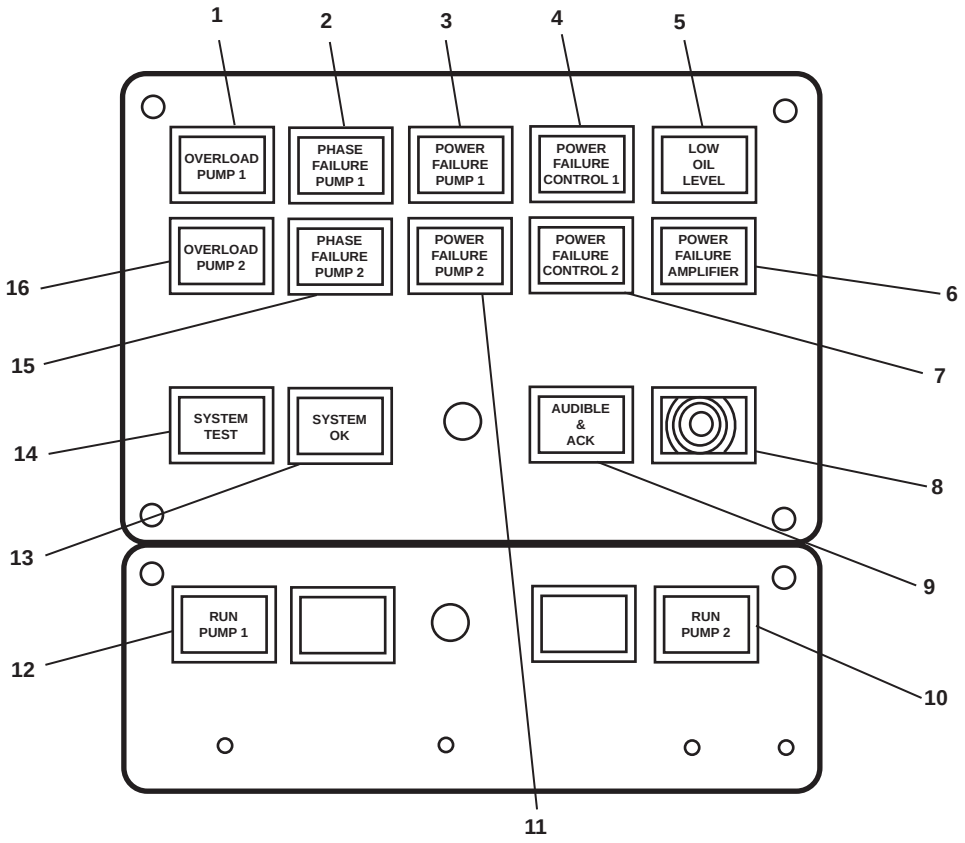


Figure 6. Steering Control Alarm Panel

Table 6. Steering Control Alarm Panel (refer to figure 6)

Key	Control/Indicator	Function
1	OVERLOAD PUMP 1 Indicator	This indicator illuminates to indicate an overload of the electric motor for pump 1.
2	PHASE FAILURE PUMP 1 Indicator	This indicator illuminates to indicate a phase failure in the electrical supply to pump 1.
3	POWER FAILURE PUMP 1 Indicator	This indicator illuminates to indicate a loss of power to pump 1.
4	POWER FAILURE CONTROL 1 Indicator	This indicator illuminates to indicate the loss of power for the control circuit for pump 1.
5	LOW OIL LEVEL Indicator	This indicator illuminates to indicate low oil level in the expansion tank.
6	POWER FAILURE AMPLIFIER Indicator	This indicator illuminates to indicate a loss of power to the amplifier.

Table 6. Steering Control Alarm Panel (refer to figure 6) (continued)

Key	Control/Indicator	Function
7	POWER FAILURE CONTROL 2 Indicator	This indicator illuminates to indicate a loss of power for the control circuit for pump 2.
8	Annunciator	This alarm gives an audible indication that a failure has occurred.
9	AUDIBLE & ACK Indicator (Pushbutton)	This indicator illuminates when an alarm condition is present. It silences the audible alarm when pressed.
10	RUN PUMP 2 Indicator	This indicator illuminates to indicate that pump 2 is operating.
11	POWR FAILURE PUMP 2 Indicator	This indicator illuminates to indicate a loss of power to pump 2.
12	RUN PUMP 1 Indicator	This indicator illuminates to indicate that pump 1 is operating.
13	SYSTEM OK Indicator	This indicator illuminates to indicate that no faults are present in the system.
14	SYSTEM TEST Pushbutton	This pushbutton tests indicators and related circuits when pressed.
15	PHASE FAILURE PUMP 2 Indicator	This indicator illuminates to indicate a phase failure in the electrical supply to pump 2.
16	OVERLOAD PUMP 2 Indicator	This indicator illuminates to indicate an overload of the electric motor for pump 2.

LS-519A/SIC INTERCOMMUNICATIONS STATION

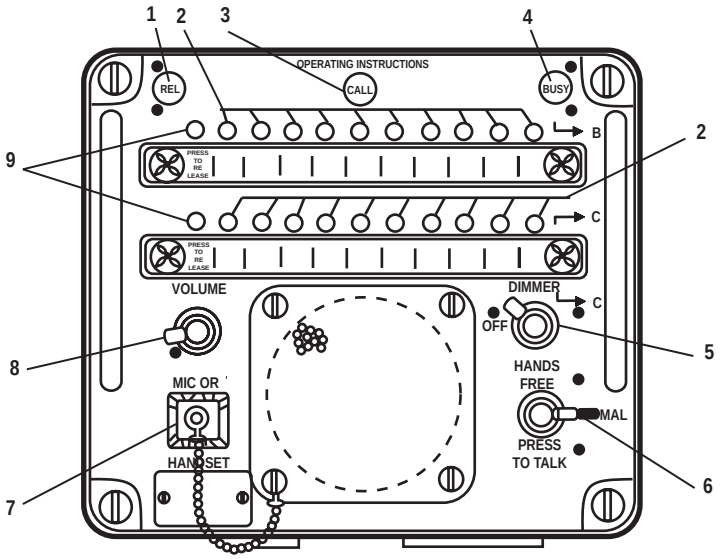


Figure 7. LS-519A/SIC Intercommunications Station

Table 7. LS-519A/SIC Intercommunications Station (refer to figure 7)

Key	Control/Indicator	Function
1	REL Indicator	This indicator illuminates to indicate that release of the system is required.
2	Station Pushbuttons	This pushbutton connects the unit to the selected station.
3	CALL Indicator	This indicator illuminates to indicate an incoming call.
4	BUSY Indicator	This indicator illuminates to indicate that the system is in use.
5	DIMMER Control	This controls the illumination level of the intercom panel.
6	HANDS FREE Control	This control provides hands free or press to talk transmission modes.
7	MIC OR HANDSET Plug	This is a jack plug for an external microphone/handset.
8	VOLUME Control	This controls the sound level of the intercom.
9	PRESS TO RELEASE	When pressed, this releases the station pushbuttons.

MACHINERY REMOTE CONTROL STATION

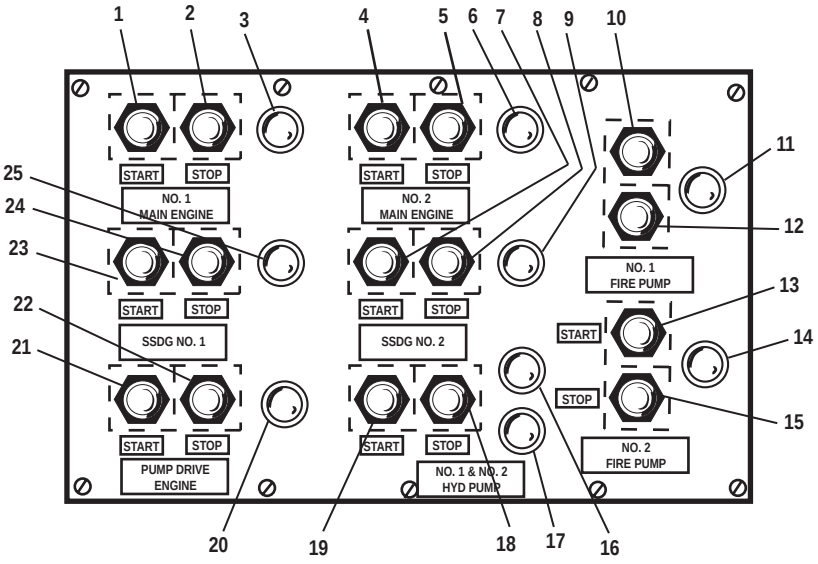


Figure 8. Machinery Remote Control Station

Table 8. Machinery Remote Control Station (refer to figure 8)

Key	Control/Indicator	Function
1	NO. 1 MN ENG START Pushbutton	This pushbutton is used to start the starboard main engine.
2	NO. 1 MN ENG STOP Pushbutton	This pushbutton is used to stop the starboard main engine.
3	Indicator	This indicator illuminates to indicate that the starboard main engine is running.
4	NO. 2 MN ENG START Pushbutton	This pushbutton is used to start the port main engine.
5	NO. 2 MN ENG STOP Pushbutton	This pushbutton is used to stop the port main engine.
6	Indicator	This indicator illuminates to indicate that the port main engine is running.
7	SSDG NO. 2 START Pushbutton	This pushbutton is used to start the SSDG 2 engine.
8	SSDG NO. 2 STOP Pushbutton	This pushbutton is used to stop the SSDG 2 engine.
9	Indicator	This indicator illuminates to indicate that the SSDG 2 engine is running.
10	NO. 1 FIRE PUMP START Pushbutton	This pushbutton is used to start fire and general service pump 1.

Table 8. Machinery Remote Control Station (refer to figure 8) (continued)

Key	Control/Indicator	Function
11	Indicator	This indicator illuminates to indicate that fire and general service pump 1 is operating.
12	NO. 1 FIRE PUMP STOP Pushbutton	This pushbutton is used to stop fire and general service pump 1.
13	NO. 2 FIRE PUMP START Pushbutton	This pushbutton is used to start fire and general service pump 2.
14	Indicator	This indicator illuminates to indicate that fire and general service pump 2 is running.
15	NO. 2 FIRE PUMP STOP Pushbutton	This pushbutton is used to stop fire and general service pump 2.
16	Indicator	This indicator illuminates to indicate that the central hydraulic power unit is operating.
17	Indicator	This indicator illuminates to indicate a power failure of the central hydraulic power unit.
18	NO. 1 & NO. 2 HYD PUMP STOP Pushbutton	This pushbutton is used to stop the central hydraulic power unit.
19	NO. 1 & NO. 2 HYD PUMP START Pushbutton	This pushbutton is used to start the central hydraulic power unit.
20	Indicator	This indicator illuminates to indicate that the pump drive engine is running.
21	PUMP DRIVE ENG START Pushbutton	This pushbutton is used to start the pump drive engine.
22	PUMP DRIVE ENG STOP Pushbutton	This pushbutton is used to stop the pump drive engine.
23	SSDG NO 1 START Pushbutton	This pushbutton is used to start the SSDG 1 engine.
24	SSDG NO 1 STOP Pushbutton	This pushbutton is used to stop the SSDG 1 engine.
25	Indicator	This indicator illuminates to indicate that the SSDG 1 engine is running.

MASTER TANK LEVEL INDICATOR PANEL 11 CHANNEL

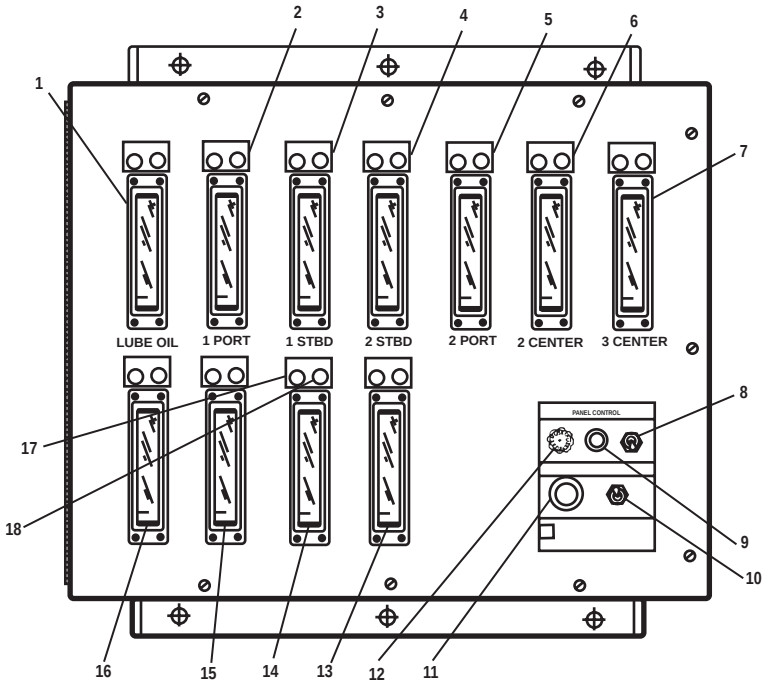


Figure 9. Master Tank Level Indicator Panel 11 Channel

Table 9. Master Tank Level Indicator Panel 11 Channel (refer to figure 9)

Key	Control/Indicator	Function
1	LUBE OIL Meter	This meter indicates lube oil storage tank level.
2	1 PORT Meter	This meter indicates fuel oil tank 1 port level.
3	1 STBD Meter	This meter indicates fuel oil tank 1 starboard level.
4	2 STBD Meter	This meter indicates fuel oil tank 2 starboard level.
5	2 PORT Meter	This meter indicates fuel oil tank 2 port level.
6	2 CENTER Meter	This meter indicates fuel oil tank 2 center level.
7	3 CENTER Meter	This meter indicates fuel oil tank 3 center level.
8	ON/OFF Switch	This switch controls power to the tank level indicator panel.
9	POWER Indicator	This indicator illuminates to indicate that power is supplied to the tank level indicator panel.
10	ALARM SILENCE Switch	This switch silences the alarm signal.
11	ALARM Annunciator	This annunciator is activated by the tank level indicator alarm system.

Table 9. Master Tank Level Indicator Panel 11 Channel (refer to figure 9) (continued)

Key	Control/Indicator	Function
12	FUSE	This fuse provides circuit protection for the indicator lights (table 9, items 17 and 18).
13	PORT DAY TK Meter	This meter indicates the port fuel oil day tank level.
14	STBD DAY TK Meter	This meter indicates the starboard fuel oil day tank level.
15	4 PORT Meter	This meter indicates fuel oil tank 4 port level.
16	4 STBD Meter	This meter indicates fuel oil tank 4 starboard level.
17	High Alarm	This illuminates to indicate a HIGH tank level.
18	Low Alarm	This illuminates to indicate a LOW tank level.

MASTER TANK LEVEL INDICATOR PANEL 7 CHANNEL

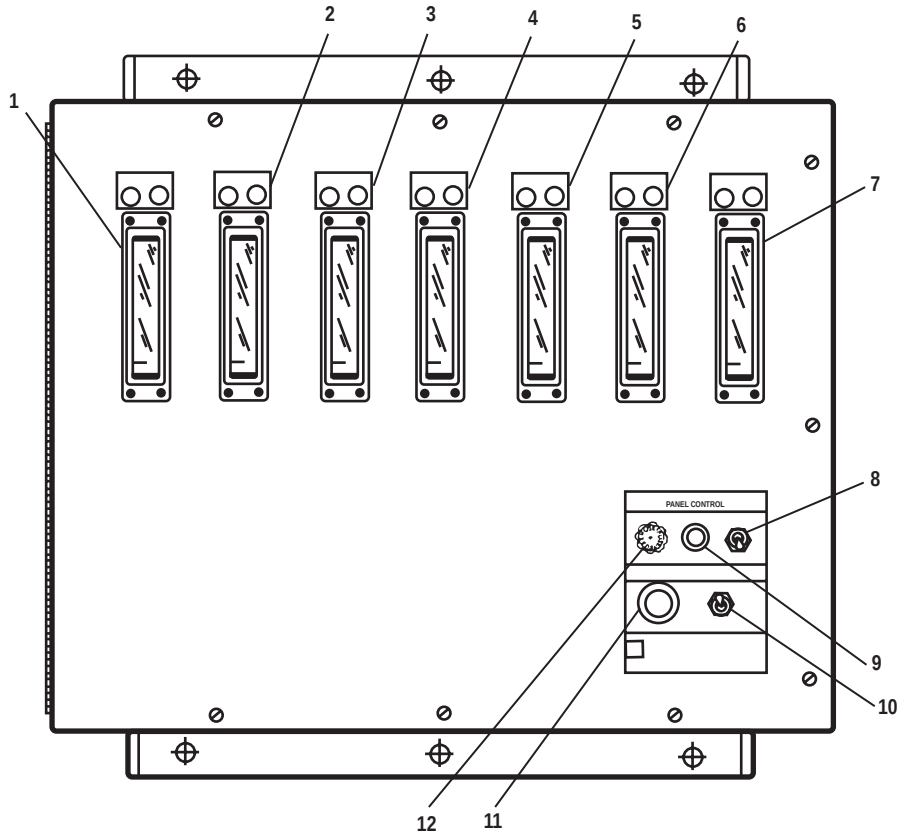


Figure 10. Master Tank Level Indicator Panel 7 Channel

Table 10. Master Tank Level Indicator Panel 7 Channel (refer to figure 10)

Key	Control/Indicator	Function
1	CHT Meter	This meter indicates sewage holding tank level.
2	SLUDGE Meter	This meter indicates oily waste holding tank level.
3	F/W STBD Meter	This meter indicates potable water tank starboard level.
4	F/W PORT Meter	This meter indicates potable water tank port level.
5	BLST PEAK Meter	This meter indicates ballast water tank 1 level.
6	BLST 2 STBD Meter	This meter indicates ballast water tank 2 starboard level.
7	BLST 2 PORT Meter	This meter indicates ballast water tank 2 port level.
8	ON/OFF Switch	This switch controls power to the tank level indicator panel.

Table 10. Master Tank Level Indicator Panel 7 Channel (refer to figure 10) (continued)

Key	Control/Indicator	Function
9	POWER Indicator	This indicator illuminates to indicate that power is supplied to the tank level indicator panel.
10	ALARM SILENCE Switch	This switch silences the alarm signal.
11	ALARM	This alarm is activated by the tank level indicator alarm system.
12	FUSE	This fuse provides circuit protection for the indicator lights (table 9, items 17 and 18).

MAIN SWITCHBOARD (SHEET 1 OF 3)

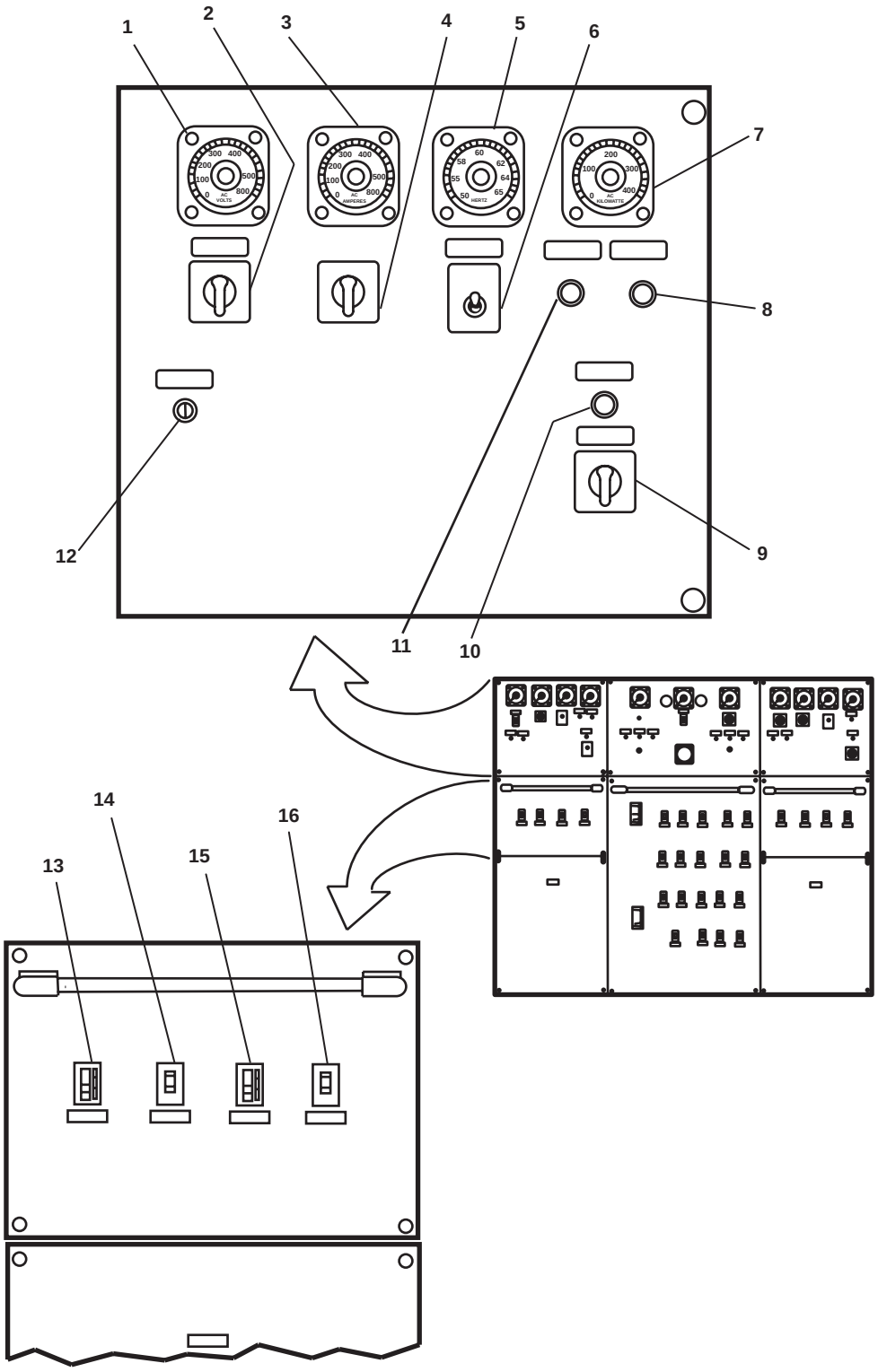


Figure 11. Main Switchboard (Sheet 1 of 3)

MAIN SWITCHBOARD (SHEET 2 OF 3)

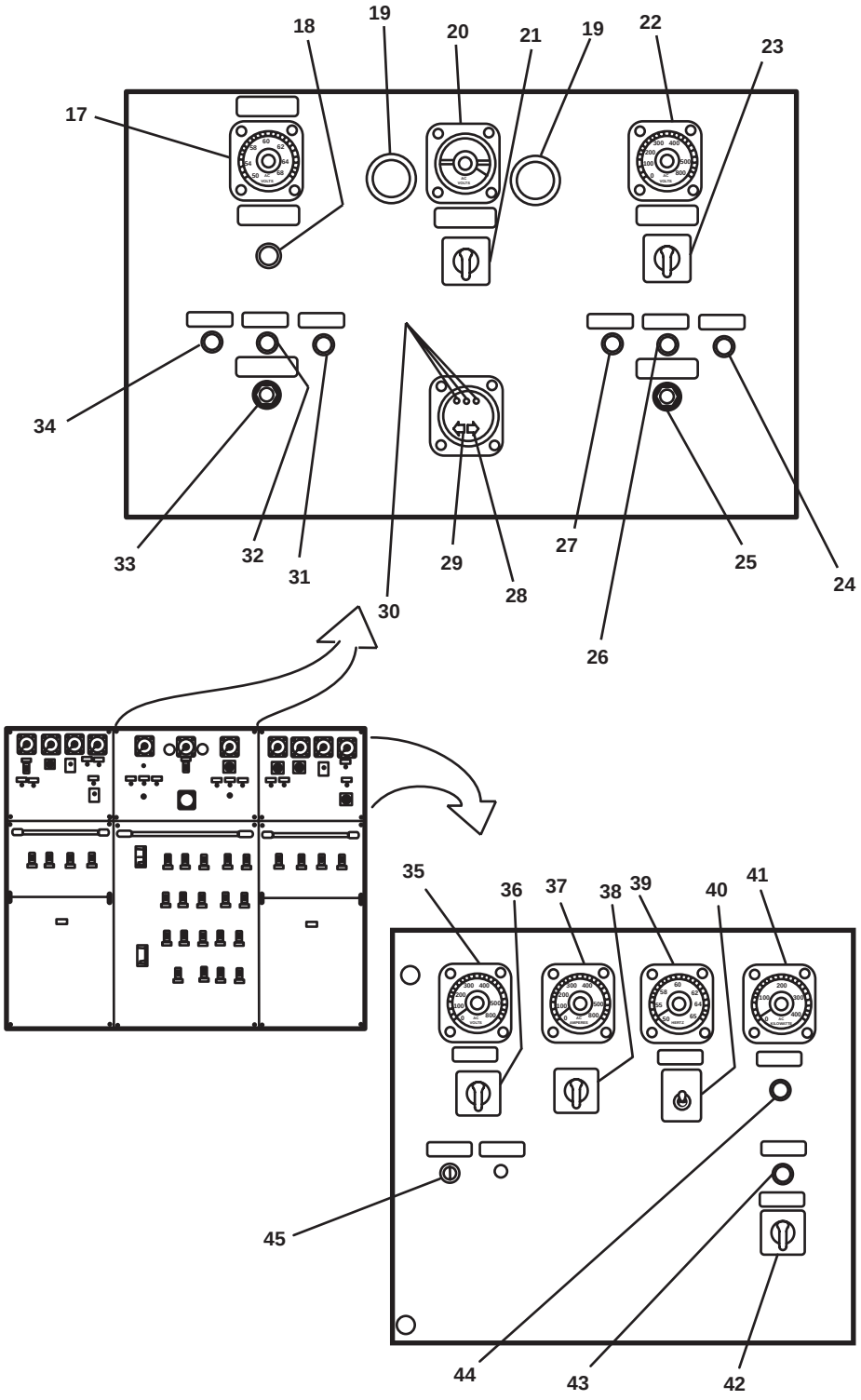


Figure 11. Main Switchboard (Sheet 2 of 3)

MAIN SWITCHBOARD (SHEET 3 OF 3)

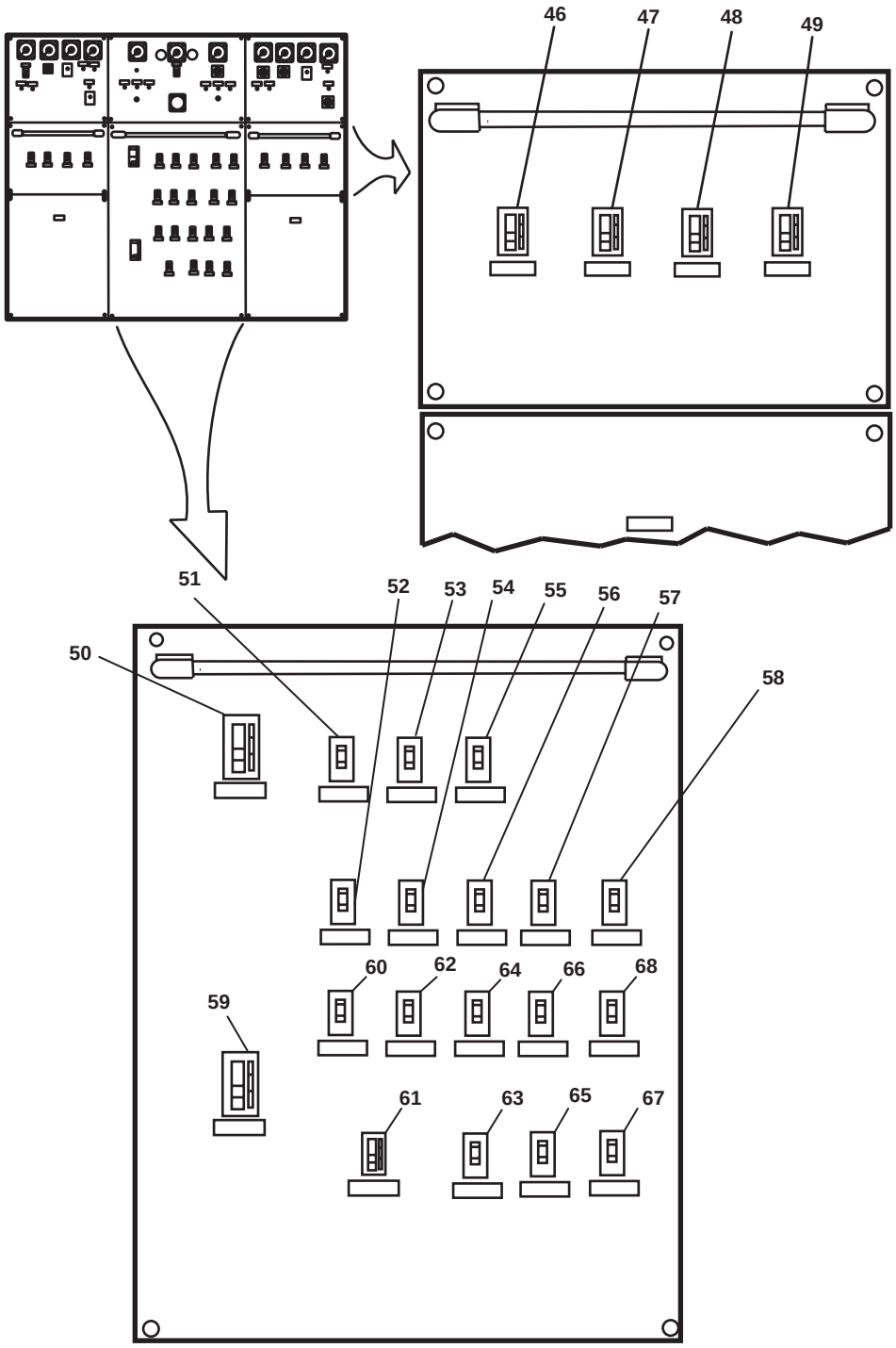


Figure 11. Main Switchboard (Sheet 3 of 3)

Table 11. Main Switchboard (refer to figure 11)

Key	Control/Indicator	Function
1	AC VOLTS Meter	This meter indicates BUS GEN 2 voltage.
2	VOLT OFF Switch	This switch selects phases for reading on the voltmeter.
3	AC AMPERES Meter	This meter indicates SSDG 2 amperage.
4	AMMETER OFF Switch	This switch selects phases for reading on ammeter.
5	HERTZ Meter	This meter indicates SSDG 2 frequency.
6	GENERATOR 2 GOVERNOR RAISE LOWER Switch	This switch controls engine speed for SSDG 2.
7	AC KILOWATTS Meter	This meter indicates SSDG output in kilowatts.
8	SHORE POWER AVAILABLE Indicator	This indicator illuminates to indicate that shore power is supplying the switchboard.
9	GENERATOR 2 CKT BRK OPEN CLOSED	This controls the circuit breaker for SSDG 2.
10	GENERATOR 2 CIRCUIT BREAKER CLOSED Indicator	This indicator illuminates to indicate that circuit breaker 2 is closed.
11	GENERATOR 2 POWER AVAILABLE	This indicator illuminates to indicate that SSDG 2 is generating power.
12	GENERATOR 2 AUTO VOLT RHEO	These are the voltage adjustments for SSDG 2.
13	EMG GEN SWBD BUS TIE #2	This provides circuit protection for bus tie 2 to the emergency switchboard.
14	ENG RM SUPPLY FAN #2	This provides circuit protection for engine room supply fan 2.
15	GALLEY 440V PWR PNL	This provides circuit protection for galley power panel 2.
16	ENG RM EXH FAN #2	This provides circuit protection for engine room exhaust fan 2.
17	SHORE POWER FREQUENCY HERTZ Meter	This meter indicates shore power frequency.
18	BUS TIE CKT BKR CLOSED Indicator	This indicator illuminates to indicate that the main switchboard bus tie to the emergency switchboard is closed.
19	Synchronizing Lights	The lights indicate when the generators are in parallel.
20	SYNCHROSCOPE	This indicates synchronization of generators.
21	SYNCHRONIZING GEN #2 GEN #1 Switch	This switch selects generator to be paralleled.
22	SHORE POWER AC VOLTS Meter	This meter displays shore power voltage.

Table 11. Main Switchboard (refer to figure 11) (continued)

Key	Control/Indicator	Function
23	VOLTMETER OFF Switch	This switch selects the shore power phases to be displayed on the voltmeter.
24	C PHASE Indicator	This indicates a ground fault condition in the C phase.
25	1S BUS GND DETECT PUSH TO TEST LAMPS Pushbutton	This pushbutton is used to test the ground fault indicator lights.
26	B PHASE Indicator	This indicates a ground fault condition in the B phase.
27	A PHASE Indicator	This indicates a ground fault condition in the A phase.
28	CORRECT 123	This illuminates to indicate that the phase sequence is correct.
29	INCORRECT 321	This illuminates to indicate that the phase sequence is incorrect.
30	PHASE SEQUENCE	The flashing LEDs indicate phase sequence.
31	C PHASE Indicator	This indicates a ground fault condition in the C phase.
32	B PHASE Indicator	This indicates a ground fault condition in the B phase.
33	2S BUS GND DETECT PUSH TO TEST LAMPS Pushbutton	This pushbutton is used to test the ground fault indicator lights.
34	A PHASE Indicator	This indicates a ground fault condition in the A phase.
35	AC VOLTS Meter	This meter indicates BUS GEN 1 voltage.
36	VOLT OFF Switch	This switch selects phases for reading on voltmeter.
37	AC AMPERES Meter	This meter indicates SSDG 1 amperage.
38	AMMETER Switch	This switch shases 1, 2, or 3 for reading on the ammeter.
39	HERTZ Meter	This meter indicates SSDG 1 frequency.
40	GENERATOR 1 GOVERNOR RAISE LOWER Switch	This switch controls SSDG 1 engine speed.
41	AC KILOWATTS Meter	This meter indicates SSDG 1 output in kilowatts.
42	GENERATOR 1 CKT BKR OPEN CLOSED Switch	This switch controls the SSDG 1 circuit breaker.
43	GENERATOR 1 CIRCUIT BREAKER CLOSED Indicator	This indicator illuminates to indicate that the SSDG 1 circuit breaker is closed.
44	GENERATOR 1 POWER AVAILABLE Indicator	This indicates that SSDG 1 is generating power.
45	GENERATOR 1 AUTO VOLT RHEO	This is the voltage adjustment for SSDG 1.
46	EMG GEN SWBD BUS TIE 1 Circuit Breaker	This circuit breaker provides circuit protection for emergency switchboard bus tie 1.

Table 11. Main Switchboard (refer to figure 11) (continued)

Key	Control/Indicator	Function
47	STEERING GEAR PUMP #1 Circuit Breaker	This circuit breaker provides circuit protection for steering gear pump 1.
48	3-25 KVA 10 XFMRS Circuit Breaker	This circuit breaker provides circuit protection for power transformers mounted on the engine room port bulkhead.
49	ENG RM SUPPLY FAN 1 Circuit Breaker	This circuit breaker provides circuit protection for engine room supply fan 1.
50	SHORE POWER CKT BRK Circuit Breaker	This circuit breaker provides circuit protection for the shore power circuits.
51	AUX MCHY SPACE #2 PWR PNL 5 Circuit Breaker	This circuit breaker provides circuit protection for auxiliary machinery space 2 power panel 5.
52	BILGE PUMP #2 Circuit Breaker	This circuit breaker provides circuit protection for bilge pump 2.
53	CENT HYD SYS PWR UNIT #1 & #2 Circuit Breaker	This circuit breaker provides circuit protection for the central hydraulic system power pack.
54	LUBE OIL PURIFIER Circuit Breaker	This circuit breaker provides circuit protection for the lube oil purifier.
55	SPARE 3P	This is a spare circuit breaker.
56	SPARE 3P	This is a spare circuit breaker.
57	HOT POTABLE WATER HTR #2 Circuit Breaker	This circuit breaker provides circuit protection for hot water heater 2.
58	MAIN DECK PWR PNL #3 Circuit Breaker	This circuit breaker provides circuit protection for main deck power panel 3.
59	BUS TIE CKT BKR Circuit Breaker	This circuit breaker provides circuit protection for the bus tie.
60	ENG RM PWR PNL #1 Circuit Breaker	This circuit breaker provides circuit protection for power panel 1.
61	SPARE Circuit Breaker	This is a spare circuit breaker.
62	AUX MACH NO.1 PWR PNL #4 Circuit Breaker	This circuit breaker provides circuit protection for power panel 4.
63	1-25 KVA XFMR 440/220/110V Circuit Breaker	This circuit breaker provides circuit protection for the 220/110V distribution panel.
64	SPARE Circuit Breaker	Spare circuit breaker.
65	HOT POTABLE WTR HTR #1 Circuit Breaker	This circuit breaker provides circuit protection for hot water heater 1.
66	ENG RM EXH FAN #1 Circuit Breaker	This circuit breaker provides circuit protection for engine room exhaust fan 1.

Table 11. Main Switchboard (refer to figure 11) (continued)

Key	Control/Indicator	Function
67	AFFF PUMP Circuit Breaker	This circuit breaker provides circuit protection for the AFFF pump.
68	FIRE PUMP #2 Circuit Breaker	This circuit breaker provides circuit protection for fire pump 2.

FIRE AND SMOKE DETECTION PANEL

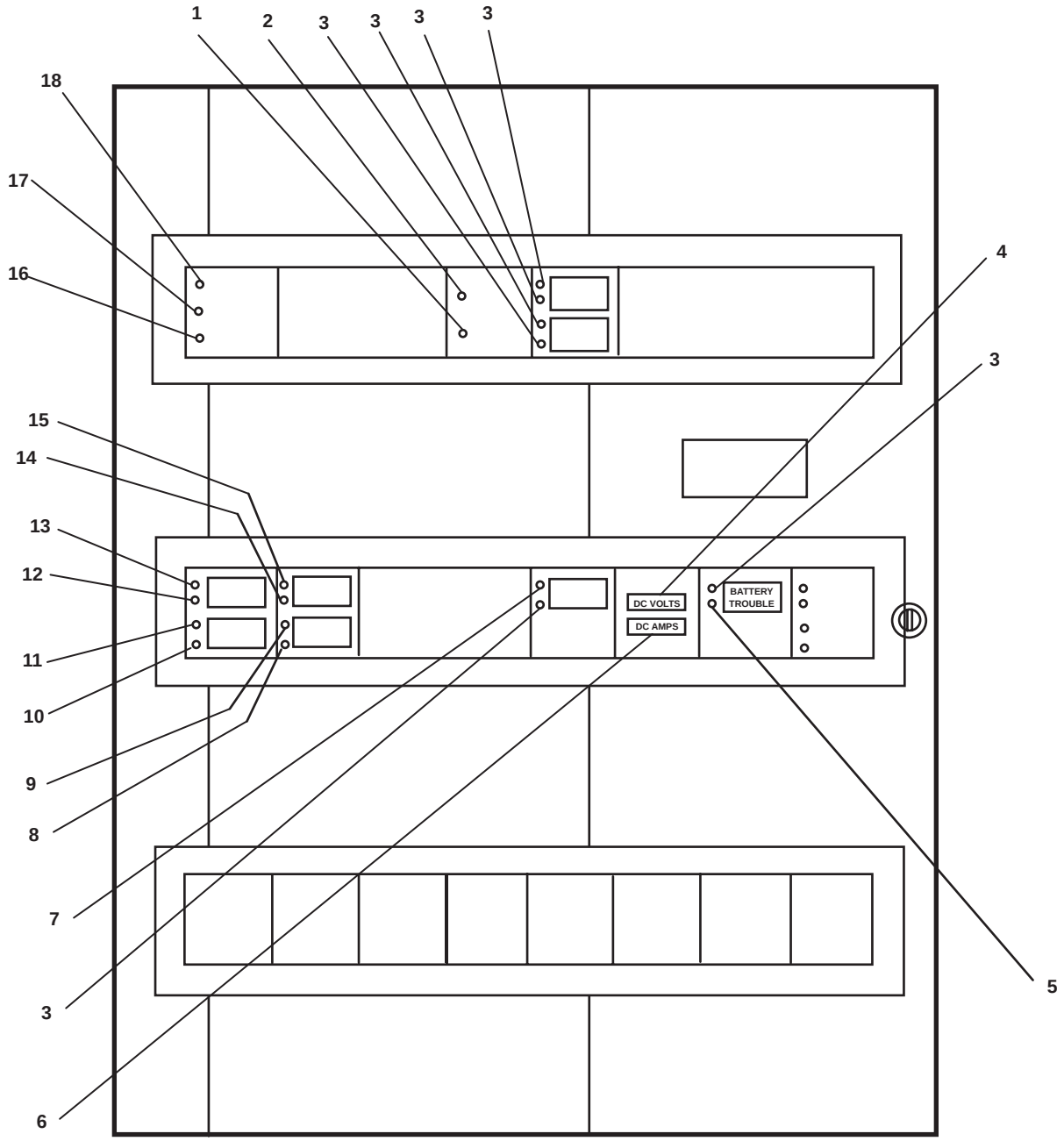


Figure 12. Fire and Smoke Detection Panel

Table 12. Fire and Smoke Detection Panel (refer to figure 12)

Key	Control/Indicator	Function
1	AUDIBLE CIRCUIT Indicator	This indicator illuminates to indicate a fault in the fire detector audible alarm circuit.
2	GROUND FAULT Indicator	This indicator illuminates to indicate a ground fault in the fire detection system.
3	LED Indicators	These indicators are not used.
4	DC VOLTS Meter	This meter indicates fire detection system direct current voltage.
5	BATTERY TROUBLE	This indicates a low charge in the battery system.
6	DC AMPS Meter	This meter indicates fire detection system direct current amperage.
7	TIME CYCLE COMPLETE Indicator	This indicator illuminates to indicate that an alarm condition has been received and the time cycle completed.
8	ZONE 4 HOLD Indicator	This indicator illuminates to indicate that ZONE 4 HOLD is operational.
9	ZONE 4 HOLD Indicator	This indicator illuminates to indicate an alarm from ZONE 4 HOLD.
10	ZONE 2 01 LEVEL Indicator	This indicator illuminates to indicate that ZONE 2 01 LEVEL is operational.
11	ZONE 2 01 LEVEL Indicator	This indicator illuminates to indicate an alarm from ZONE 2 01 LEVEL.
12	ZONE 1 02 LEVEL Indicator	This indicator illuminates to indicate that ZONE 1 02 LEVEL is operational.
13	ZONE 1 02 LEVEL Indicator	This indicator illuminates to indicate an alarm from ZONE 1 02 LEVEL.
14	ZONE 3 MAIN DECK Indicator	This indicator illuminates to indicate that ZONE 3 MAIN DECK is operational.
15	LED Indicator	This indicator illuminates to indicate an alarm from ZONE 3 MAIN DECK.
16	TROUBLE Indicator	This indicator illuminates to indicate a fault in the fire detection system.
17	ALARM FLASHING WHEN SILENCED Indicator	This indicator illuminates to indicate an alarm condition in one or more zones. It flashes after an audible alarm has been silenced.
18	POWER FLASHING WHEN ON BATTERY Indicator	This indicator illuminates to indicate that power is being supplied to the fire detection panel. It flashes when on battery power.

SHIP CLINOMETER-HEEL

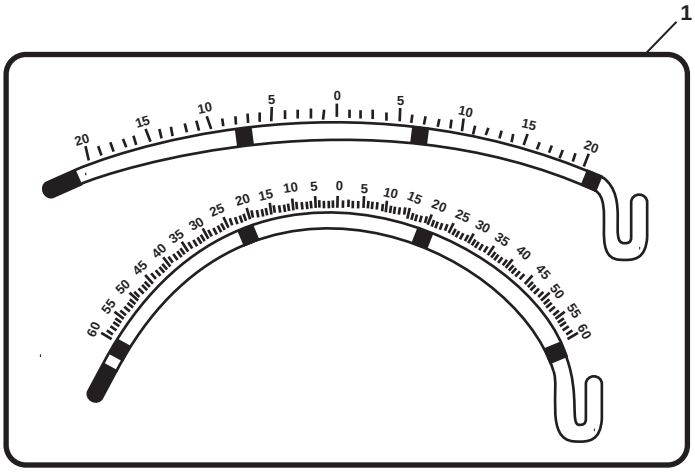


Figure 13. Ship Clinometer-Heel

Table 13. Ship Clinometer--Heel (refer to figure 13)

Key	Control/Indicator	Function
1	Clinometer	This clinometer indicates the angle of the vessel athwartship (heel).

SHIP CLINOMETER-TRIM

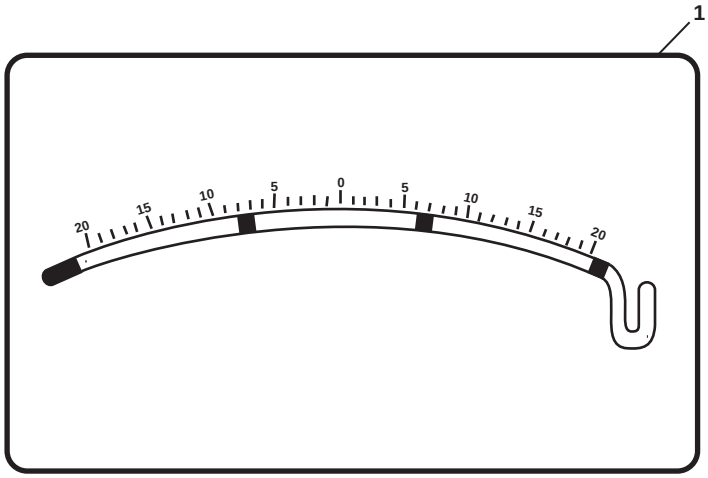


Figure 14. Ship Clinometer-Trim

Table 14. Ship Clinometer--Trim (refer to figure 14)

Key	Control/Indicator	Function
1	Clinometer	This clinometer indicates the angle of the vessel longitudinally (trim).

SOUND POWERED TELEPHONE

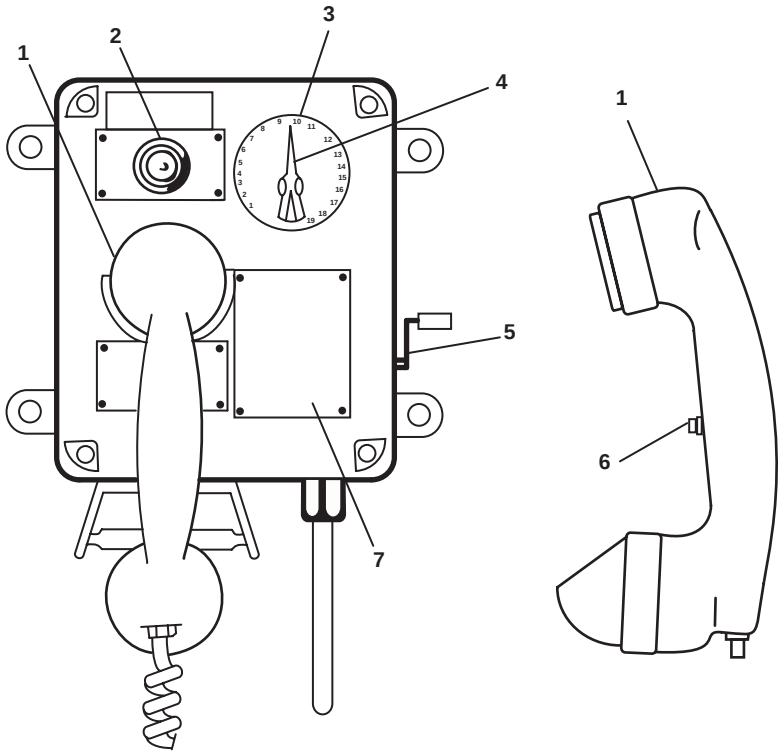


Figure 15. Sound Powered Telephone

Table 15. Sound Powered Telephone (refer to figure 15)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Ring Indicator	This indicator illuminates to indicate an incoming call.
3	Selector Dial	The selector dial outlines available stations.
4	Selector Knob	This knob selects station to be called.
5	Magneto Handle	Crank the magneto handle to call a station.
6	Pushbutton	This pushbutton is used to transmit.
7	DIRECTORY Plate	The directory plate lists telephone stations aboard the vessel.

BELLS: GENERAL ALARM, FIRE ALARM, EOT WRONG DIRECTION, EOT CONSTANT RING

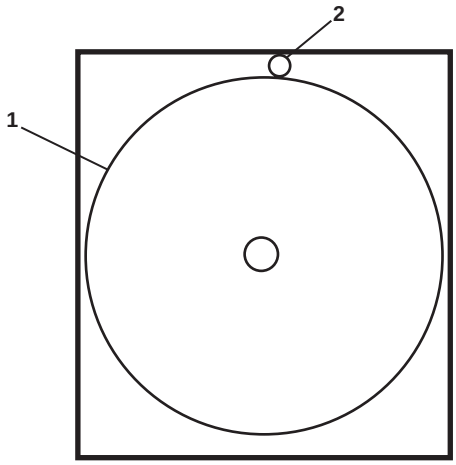


Figure 16. Bells: General Alarm, Fire Alarm, EOT Wrong Direction, EOT Constant Ring

Table 16. Bells: General Alarm, Fire Alarm, EOT Wrong Direction, EOT Constant Ring (refer to figure 16)

Key	Control/Indicator	Function
1	Bell	The general alarm bell sounds when the a general alarm has been signaled. The fire alarm bell sounds when a fire alarm pull box has been pulled. The EOT wrong direction bell sounds when EOS personnel have the wrong direction selected. The EOT constant ring bell sounds when an engine order change has been received.
2	LED Indicator	This indicator is installed on the EOT wrong direction bell only. It indicates that EOS personnel have the wrong direction selected.

PA SYSTEM SPEAKER AND VOLUME CONTROL

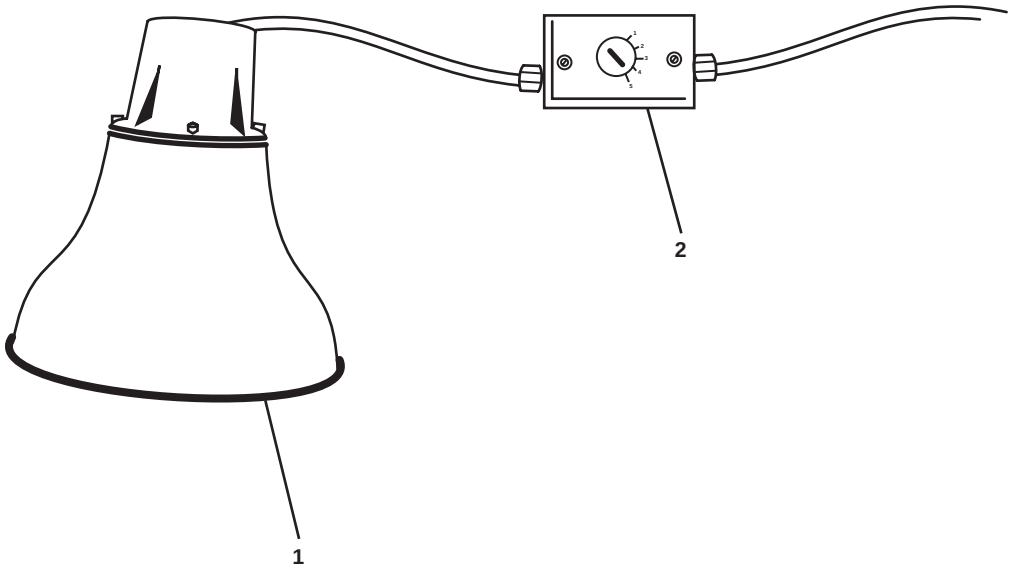


Figure 17. PA System Speaker and Volume Control

Table 17. PA System Speaker and Volume Control (refer to figure 17)

Key	Control/Indicator	Function
1	Loudspeaker	The loudspeaker broadcasts the PA system.
2	Volume Control	This controls the volume of the loudspeaker.

AIR CONDITIONER CONTROLS

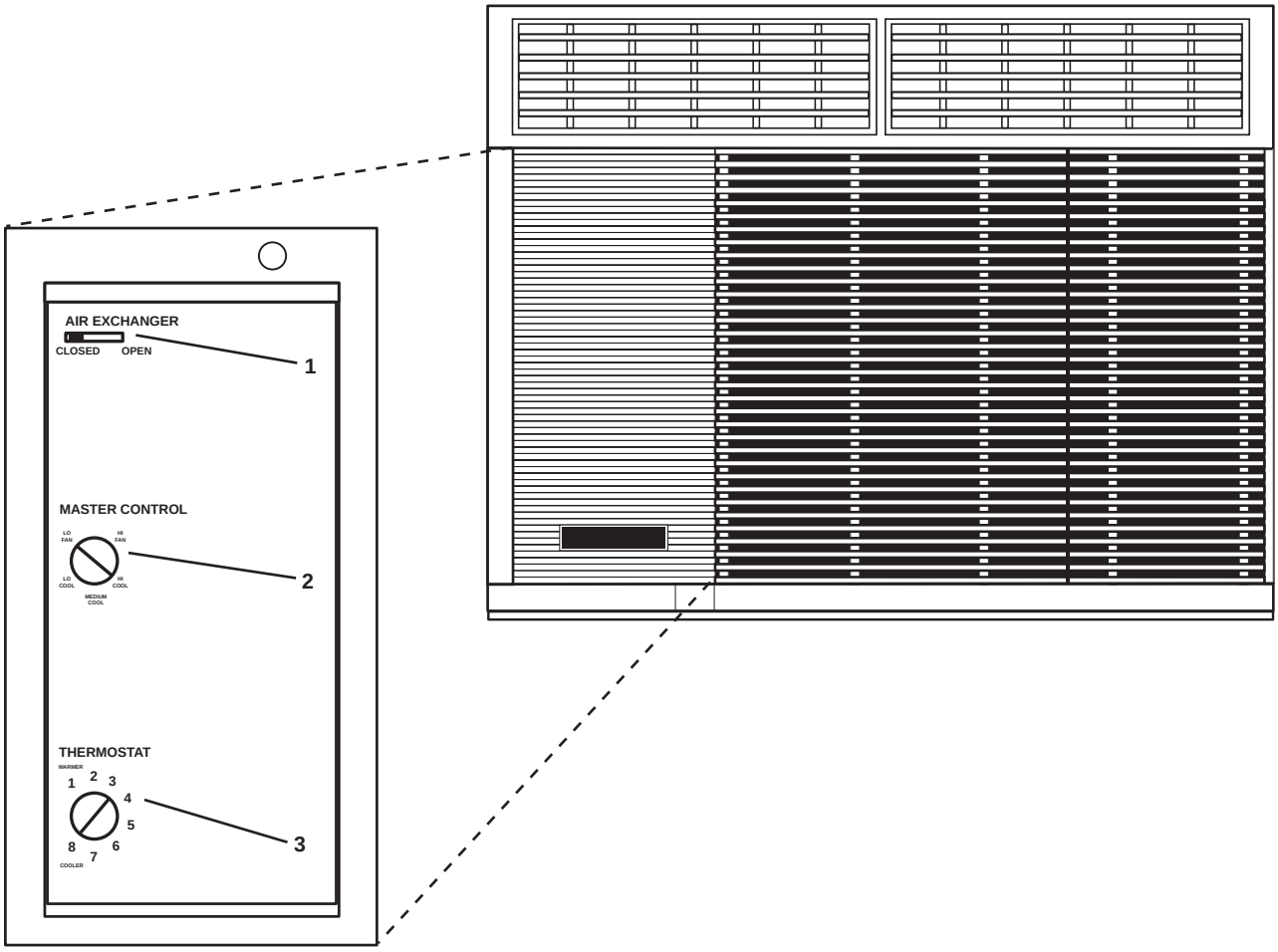


Figure 18. Air Conditioner Controls

Table 18. Air Conditioner Controls (refer to figure 18)

Key	Control/Indicator	Function
1	AIR EXCHANGER Control	In the CLOSED position, the inside air is recirculated. In the OPEN position, outside air is conditioned and admitted to the space.
2	MASTER CONTROL Switch	This switch permits selection between the following modes: OFF, HI FAN, HI COOL, MEDIUM COOL, LO COOL, and LO FAN.
3	THERMOSTAT Control	This control permits adjustment of the air temperature from 1 (warmer) to 8 (cooler).

REMOTE INDICATOR (ALARM) ASSEMBLY

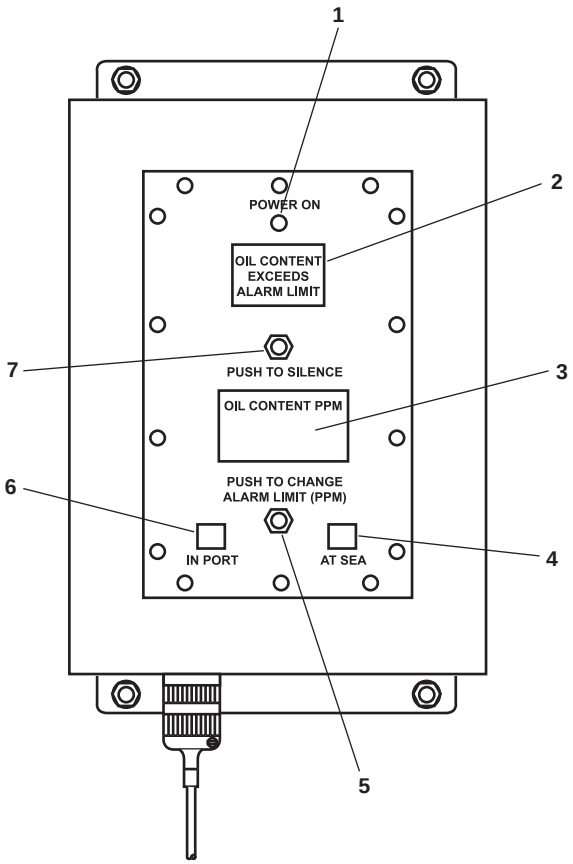


Figure 19. Remote Indicator (Alarm) Assembly

Table 19. Remote Indicator (Alarm) Assembly (refer to figure 19)

Key	Control/Indicator	Function
1	POWER Indicator	This indicator illuminates to indicate that the OCM is operating.
2	OIL CONTENT EXCEEDS ALARM LIMIT Indicator	This indicator illuminates to indicate that the effluent oil content exceeds the selected alarm limit.
3	EFFLUENT OIL CONTENT Display	This displays the effluent oil content in ppm.
4	70 PPM AT SEA Indicator	This indicator illuminates to indicate that the 70 PPM (at sea) alarm limit is selected.
5	PUSH TO CHANGE ALARM LIMIT Switch	This switch toggles between the 15 and 70 PPM alarm limit settings when the alarm limit selector switch in the sampling/sensor assembly is set to REMOTE. The sampling/sensor assembly is located in the engine room.

Table 19. Remote Indicator (Alarm) Assembly (refer to figure 19) (continued)

Key	Control/Indicator	Function
6	15 PPM IN PORT Indicator	This indicator illuminates to indicate that the 15 PPM (in port) alarm limit is selected.
7	PUSH TO SILENCE Switch	Push this pushbutton switch to toggle the alarm silence function ON and OFF.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
AMS 1

AMS 1 GENERAL ARRANGEMENT

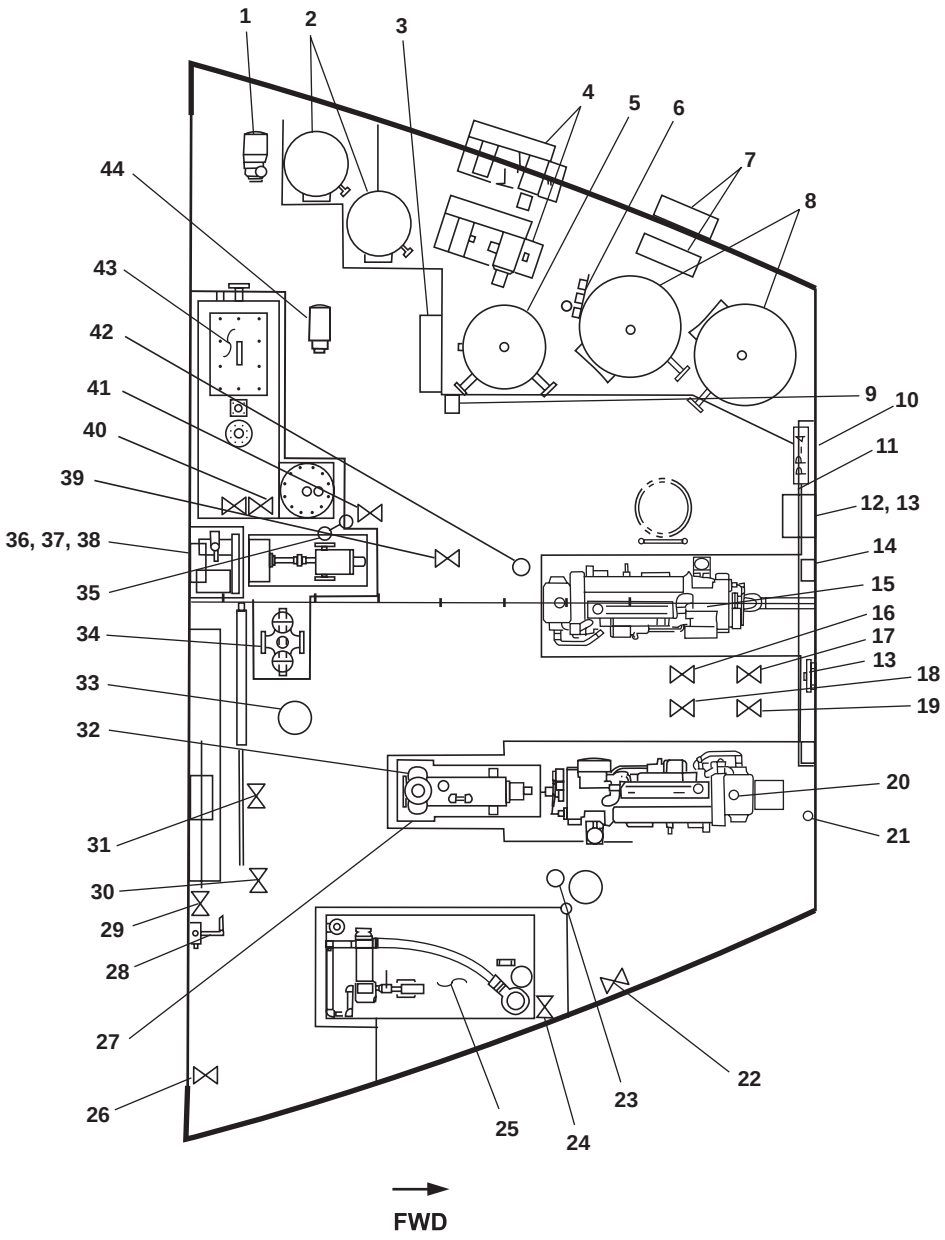


Figure 1. AMS 1 General Arrangement

Table 1. AMS 1 General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Hot Potable Water Recirculation Pump	This pump circulates hot potable water throughout the vessel. See figure 2 for details.
2	Hot Water Heaters	These heaters heat potable water for use throughout the vessel. See figure 2 for details.
3	Air Compressor, MSD, and AFFF Control Panel	This panel contains motor controllers and gauges for the air compressors, Marine Sanitation Device (MSD), and Aqueous Film Forming Foam (AFFF) pump. See figure 3 for details.
4	Air Compressors	The compressors supply compressed air for use throughout the vessel. See figure 8 for details.
5	Ship's Service Air Receiver	The receiver stores compressed air for ship's service use. See figure 9 for details.
6	Compressed Air Gauge Panel	This panel contains gauges for several compressed air systems. See figure 10 for details.
7	Air Compressor Discharge Manifold	This manifold controls the compressed air discharged from the air compressors. See figure 8 for details.
8	Starting Air Receivers	These receivers store compressed air for starting many of the vessel's engines. Refer to figure 9 for details.
9	Sound Powered Telephone	The sound powered telephone provides communication with other areas of the vessel. See figure 11 for details.
10	Compressed Air Piping, Forward Bulkhead	This manifold contains valves and regulators for starting and ship's service air. See figure 17 for details.
11	440V Power Panel No. 4	This panel provides circuit breakers for many of the vessel's electrical systems. See figure 12 for details.
12	Space Heater	The heater provides heat for the space. See figure 13 for details.
13	Flow Indicator	This indicator indicates fuel flow through the 1 Port and 1 Starboard fuel oil tank vents, indicating an overfilled tank. See figure 14 for details.
14	AMS 1 SUPPLY FAN Motor Controller	The controller controls the fan motor for the AMS 1 supply fan. See figure 15 for details.
15	Bow Thruster Drive Engine	The bow thruster engine provides power to drive the bow thruster. See figure 16 for details.
16	Lo-1, LUBO DR TO OILY DR. TK. Valve	This valve drains the lube oil to the oily drain tank.
17	Lo-9, LUBO TO PUMP DRIVE ENG. Valve	This valve controls lube oil flow to the pump drive engine.
18	Lo-2, LUBO DR TO OILY DR .TK. Valve	This valve drains the lube oil to the oily drain tank.
19	Lo-8, LUBO TO BOW THRUSTER ENG. Valve	This valve controls lube oil flow to the bow thruster engine.

Table 1. AMS 1 General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
20	Pump Drive Engine	This engine drives the diesel engine-driven fire pump and the towing machine hydraulic pump. See figure 18 for details.
21	FM- 96 Fire Main Pressure Gauge	The fire main pressure gauge indicates the pressure within the fire main.
22	Asw-22, OVB'D DISCH., S.W. COOLING Valve	This valve controls sea water overboard discharge.
23	General Alarm Bell	This bell gives an audible warning when the general alarm is sounded.
24	Cutoff Valve, Raw Water Overboard Discharge	This cutoff valve controls the overboard discharge flow of raw water used to cool the bow thruster engine and the pump drive engine.
25	Tow Winch Hydraulic System	This system powers the towing machine hydraulic system. See figure 19 for details.
26	PD-3, WASTE WTR TO SEW. HLD. TK Valve	This valve controls the flow of waste water to the sewage holding tank.
27	GS-111, FF PMP PRM EDUCTOR DISCH Valve	This valve controls the eductor discharge.
28	AMS 1 Watertight Door Hand Pump	This pump operates the watertight door between AMS 1 and the engine room.
29	Oily Bilge Pump COV	This is the cutoff valve to the oily bilge pump suction.
30	FM-84, AFFF TK SUCT Valve	This valve controls the AFFF tank suction.
31	Differential Pressure Gauge COV	This valve controls flow to the FF pump suction differential pressure gauge.
32	CA-73, SVCE AIR TO FF PMP PRM EDUCTOR Valve	This valve controls service air to the fire pump primer.
33	FM-200 Strobe and Beacon	The strobe and beacon flash when the FM-200 system has been actuated. They signal that FM-200 release will begin within 60 seconds.
34	Raw Water Duplex Strainer	The duplex strainer removes contaminants from the raw water before it reaches the cooling systems of the bow thruster and pump drive engines. See figure 20 for details.
35	AFFF DISCH PRESS Gauge	This gauge indicates the discharge pressure of the AFFF pump.
36	PA Speaker and Volume Control	The speaker and volume control permit PA announcements to be heard throughout the vessel. See figure 21 for details.
37	AFFF PROPORTIONER DIFF PRESS Gauge	This gauge indicates the differential pressure across the AFFF proportioner.
38	SW STR DIFF PRESS Gauge	This gauge indicates the differential pressure across the raw water strainer for the bow thruster and pump drive engines.
39	FM-13, F.F. TO F.M. CRSVR Valve	This valve controls the flow between the firemain and the diesel engine-driven fire pump discharge piping.
40	FM-97 and FM-99 valves	These valves cut off pressure to the firemain differential pressure gauge.

Table 1. AMS 1 General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
42	General Alarm Beacon	This beacon illuminates when the general alarm bell has been sounded.
43	Marine Sanitation Device (MSD)	The MSD treats sewage generated aboard the vessel prior to discharge. See figure 22 for details.
44	MSD Pump	This pump moves sewage through the MSD unit. See figure 22 for details.

HOT WATER HEATERS AND RECIRCULATION PUMP

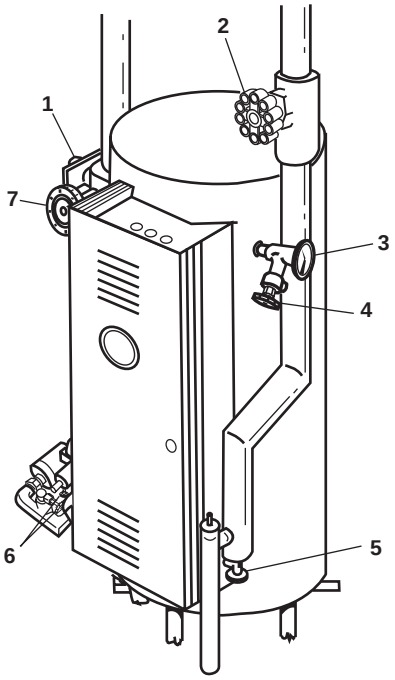


Figure 2. Hot Water Heaters and Recirculation Pump

Table 2. Hot Water Heaters and Recirculation Pump (refer to figure 2)

Key	Control/Indicator	Function
1	Relief Valve	This valve opens to permit excess pressure to vent from the hot water heater tank.
2	PW-80, POT.WTR TO H.W. HTR.	This valve controls the flow of cold potable water into the hot water heater.
3	Thermometer	The thermometer indicates the temperature of the hot water in the hot water heater tank.
4	Hose Bibb, Hot Water	The hose bibb permits a hose to draw hot water directly from the hot water heater tank.
5	Hose Bibb, Cold Water	The hose bibb permits a hose to draw cold water from the vessel's potable water system.
6	Cutoff Valves, Differential Pressure Gauge	These valves secure the pressure to the hot potable water recirculation pump differential pressure gauge.
7	PW-82, H.W. HTR OUT	This valve controls the flow of hot potable water out of the hot water heater.

AIR COMPRESSOR, MSD, AND AFFF MOTOR CONTROL PANEL

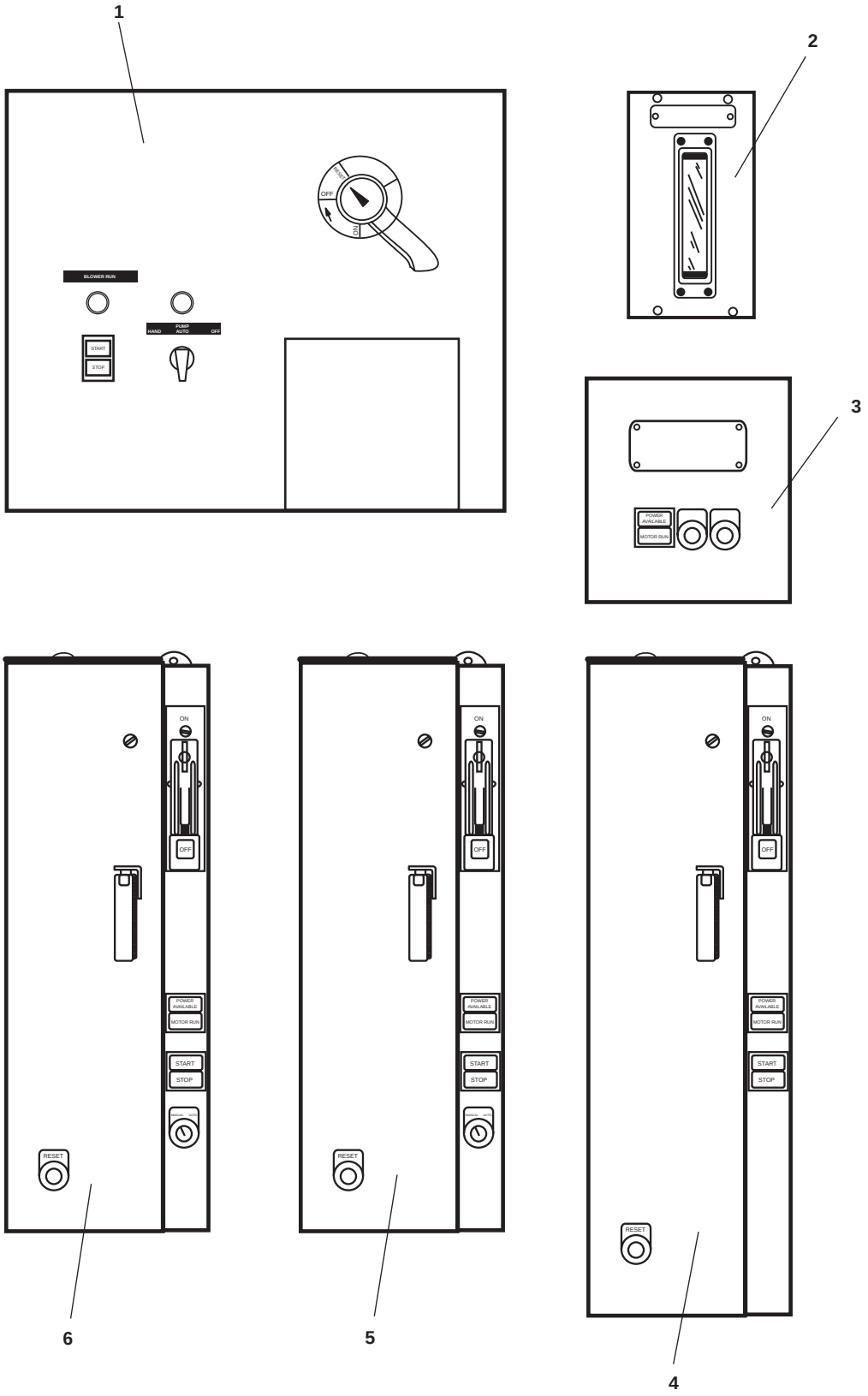


Figure 3. Air Compressor, MSD, and AFFF Pump Motor Control Panel

Table 3. Air Compressor, MSD, and AFFF Pump Motor Control Panel (refer to figure 3)

Key	Control/Indicator	Function
1	MSD Controller	This controller controls the system operation for the MSD unit. Refer to figure 4for details.
2	Tank Level Indicator, Sewage	This indicates the liquid level in the sewage holding tank.
3	HOT POTABLE WATER RECIRCULATION PUMP Motor Controller	This motor controller turns the hot potable water recirculation pump ON and OFF. Refer to figure 5 for details.
5	NO. 1 AIR COMPRESSOR Motor Controller	This motor controller turns air compressor 1 ON and OFF and permits manual and automatic control of the compressor. Refer to figure 6 for details.
4	AFFF PUMP Motor Control	This motor controller turns the AFFF pump motor ON and OFF. Refer to figure 7 for details.
6	NO. 2 AIR COMPRESSOR Motor Controller	This motor controller turns air compressor 2 ON and OFF and permits manual and automatic control of the compressor. Refer to figure 6 for details.

MSD MOTOR CONTROLLER

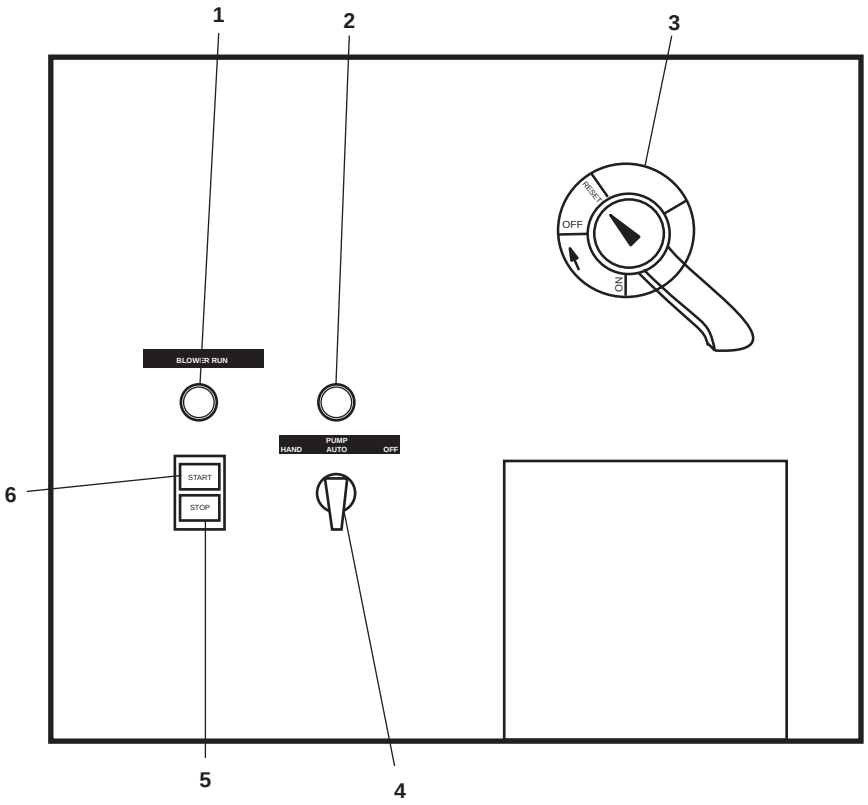


Figure 4. MSD Motor Controller

Table 4. MSD Motor Controller (refer to figure 4)

Key	Control/Indicator	Function
1	BLOWER RUN Indicator	This indicator illuminates to indicate that the blower motor is running.
2	Power Available Indicator	This indicator illuminates to indicate that power is available to the controller.
3	Main Breaker	The main breaker provides ON/OFF control and circuit protection for the motor controller.
4	POWER Switch	This switch permits the operator to select between HAND, OFF, and AUTO operating modes. In the HAND position the MSD pump is controlled manually. In the AUTO position, the blower motor is controlled automatically. In the OFF position the MSD pump is OFF.
5	STOP Pushbutton	This pushbutton is used to STOP the MSD blower motor.
6	START Pushbutton	This pushbutton is used to START the MSD blower motor.

HOT POTABLE WATER RECIRCULATION PUMP MOTOR CONTROLLER

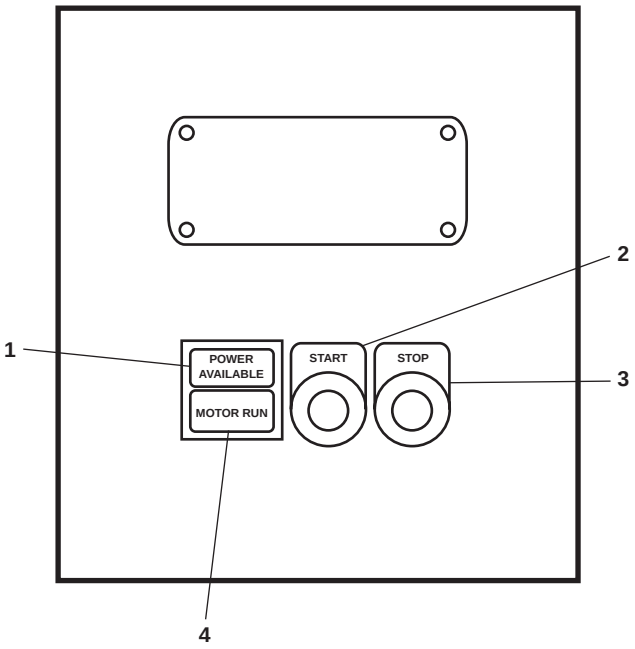


Figure 5. Hot Potable Water Recirculation Pump Motor Controller

Table 5. Hot Potable Water Recirculation Pump Motor Controller (refer to figure 5)

Key	Control/Indicator	Function
1	POWER AVAILABLE Indicator	This indicator iIlluminates to indicate that power is available to the motor controller.
2	START Pushbutton	This pushbutton is used to START the hot potable water recirculation pump motor.
3	STOP Pushbutton	This pushbutton is used to STOP the hot potable water recirculation pump.
4	MOTOR RUN Indicator	This indicator iIlluminates to indicate that the hot potable water recirculation pump motor is running.

AIR COMPRESSOR MOTOR CONTROLLERS

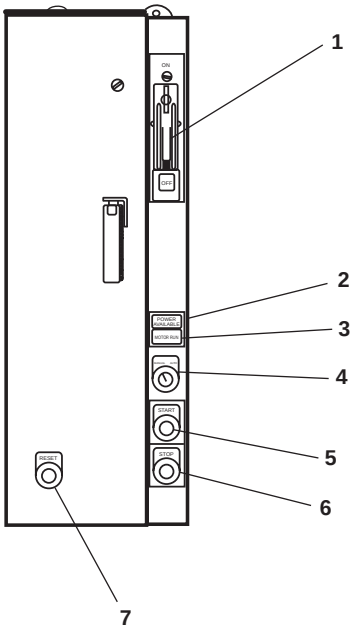


Figure 6. Air Compressor Motor Controllers

Table 6. Air Compressor Motor Controllers (refer to figure 6)

Key	Control/Indicator	Function
1	ON/OFF Breaker	This breaker turns the motor controller ON and OFF and provides circuit protection to the unit.
2	POWER AVAILABLE Indicator	This indicator iIlluminates to indicate that power is available to the motor controller.
3	MOTOR RUN Indicator	This indicator iIlluminates to indicate that the motor is running.
4	MANUAL/AUTO Switch	This switch permits selection of operating mode. When in the AUTO position, the compressor turns ON and OFF automatically depending upon the air pressure in the receivers. When in the MANUAL position, the air compressor runs continuously no matter how much air pressure is available in the receivers.
5	START Pushbutton	This pushbutton is used to START the air compressor.
6	STOP Pushbutton	This pushbutton is used to STOP the air compressor.
7	RESET Pushbutton	This pushbutton is used to RESET the motor controller.

AFFF PUMP MOTOR CONTROLLER

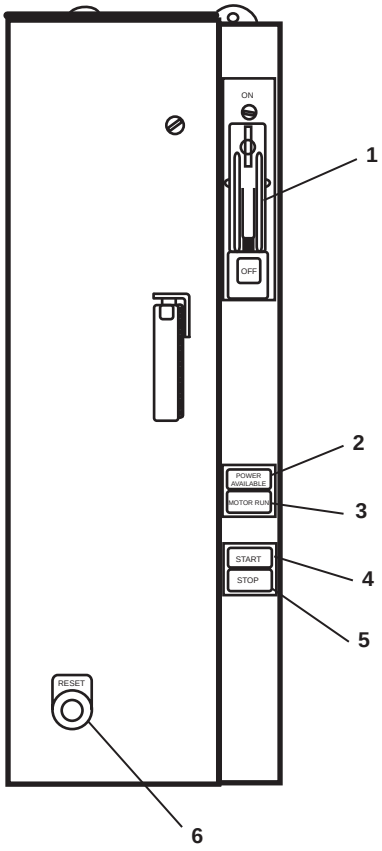


Figure 7. AFFF Pump Motor Controller

Table 7. AFFF Pump Motor Controller (refer to figure 7)

Key	Control/Indicator	Function
1	ON/OFF Breaker	This breaker turns the motor controller ON and OFF and provides circuit protection to the unit.
2	POWER AVAILABLE Indicator	This indicator iIlluminates to indicate that power is available to the motor controller.
3	MOTOR RUN Indicator	This indicator iIlluminates to indicate that the motor is running.
4	START Pushbutton	This pushbutton is used to START the AFFF pump.
5	STOP Pushbutton	This pushbutton is used to STOP the AFFF pump.
6	RESET Pushbutton	This pushbutton is used to RESET the motor controller.

AIR COMPRESSORS AND DISCHARGE MANIFOLDS

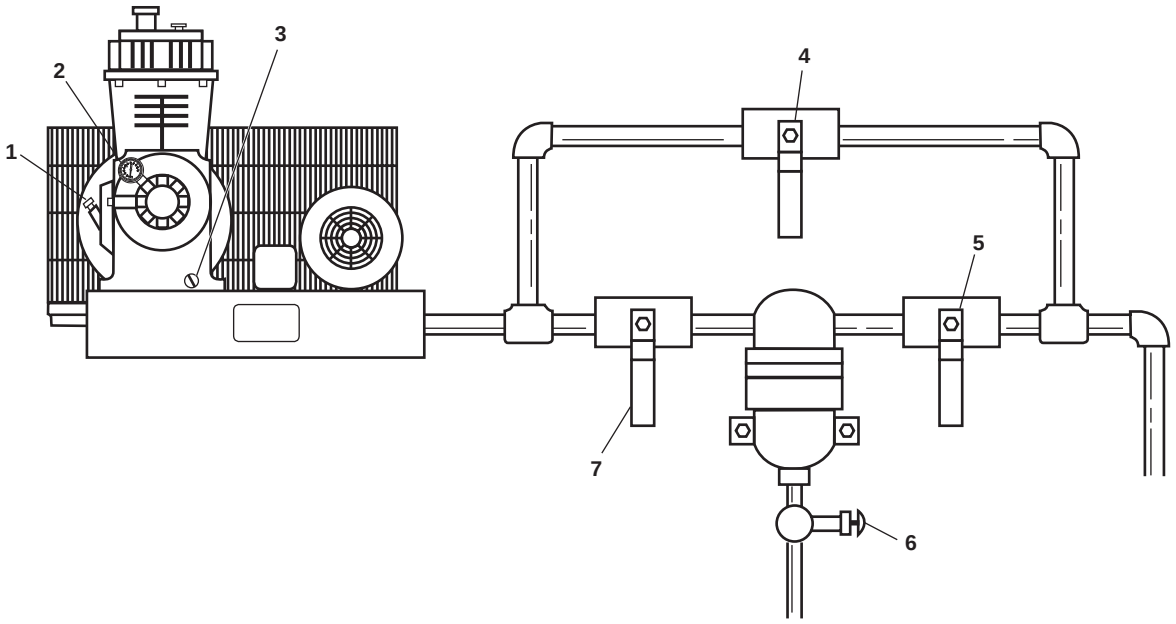


Figure 8. Air Compressors and Discharge Manifolds

Table 8. Air Compressors and Discharge Manifolds (refer to figure 8)

Key	Control/Indicator	Function
1	Dipstick	The dipstick permits the operator to check the lube oil level in the air compressor crankcase.
2	Oil Pressure Gauge	This gauge indicates the lube oil pressure for the air compressor.
3	Drain Fitting	This drain permits draining of the lube oil from the crankcase.
4	CA-89 and CA-90 COV-COMPR DISCH	Open this valve to bypass the air dryer.
5	CA-87 and CA-88 COV-COMPR DISCH	When CLOSED, these valves secure the discharge side of the air dryer.
6	CA-93 and CA-94 MOISTURE SEP DR	OPEN these valves to drain the air dryer. The drain sends all trapped moisture to the bilge when opened.
7	CA-1 and CA-2 COV-COMPR DISCH	CLOSE these valves to cut off the dryer.

AIR RECEIVERS AND VALVES

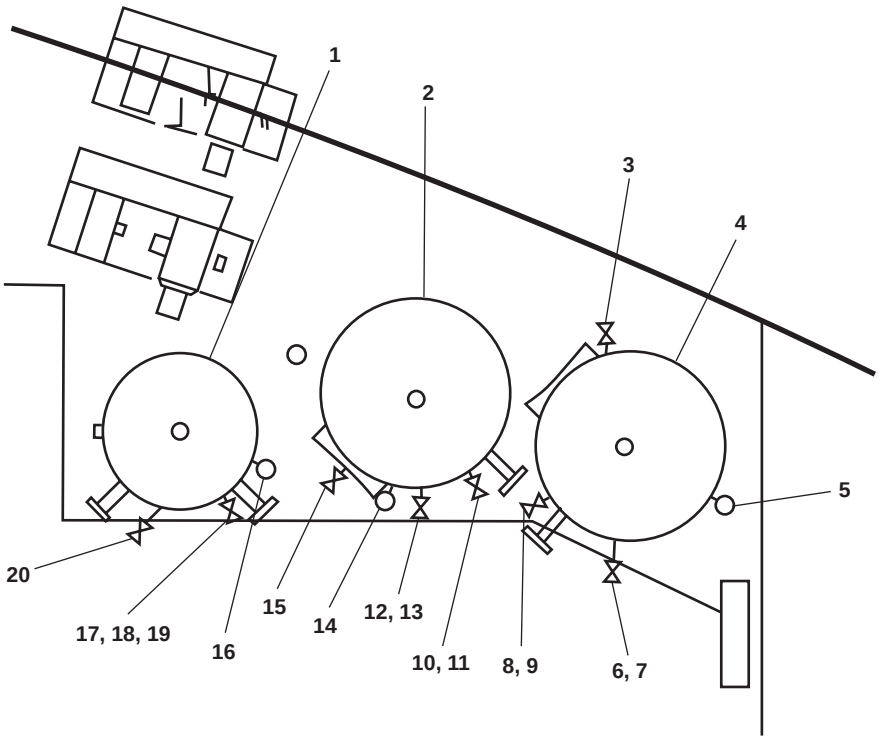


Figure 9. Air Receivers and Valves

Table 9. Air Receivers and Valves (refer to figure 9)

Key	Control/Indicator	Function
1	SHIPS SERVICE AIR RCVR	This receiver stores compressed air for the ship's service compressed air system (Working pressure 125 PSI (8.6bar)).
2	STARTING AIR RCVR NO. 2	This receiver stores compressed air for the starting air system (Working pressure 250 PSI (17.2 bar)).
3	CA-97 Cutoff Valve, Air Compressor Regulator	This valve secures the pressure to the air compressor regulator.
4	STARTING AIR RCVR NO. 1	This receiver stores compressed air for the starting air system (Working pressure 250 PSI (17.2 bar)).
5	Pressure Gauge, STARTING AIR RCVR NO. 1	This gauge indicates the air pressure present in the starting air receiver 1 (Working pressure 250 PSI (17.2 bar)).
6	CA-47, STG AIR TK DR	This valve is located below the deckplate. When OPEN, this valve valve drains condensation and air from starting air receiver 1.
7	CA-50, AUTO DR	This cutoff valve prevents the automatic drain valve from operating.

Table 9. Air Receivers and Valves (refer to figure 9) (continued)

Key	Control/Indicator	Function
8	CA-3, STG AIR TK OUT	This valve is located near the top of the receiver. When OPEN, it discharges air from the receiver to the starting air system.
9	CA-11, STG AIR TK INL	This valve is located just above the deckplate. When OPEN, this valve permits compressed air from the air compressors to enter this receiver.
10	CA-4, STG AIR TK OUT	This valve is located near the top of the receiver. When OPEN, this valve discharges air from the receiver to the starting air system.
11	CA-12, STG AIR TK INL	This valve is located just above the deckplate. When OPEN, this valve permits compressed air from the air compressors to enter this receiver.
12	CA-46, STG AIR TK DR	This valve is located below the deckplate. When OPEN this valve drains condensation and air from the starting air receiver 2.
13	CA-49, AUTO DR	This cutoff valve prevents the automatic drain valve from operating.
14	Pressure Gauge, STARTING AIR RCVR NO. 2	This gauge indicates the air pressure present in starting air receiver 2 (Working pressure 250 PSI (17.2 bar)).
15	CA-97 Cutoff Valve, Air Compressor Regulator	This valve secures the pressure to the air compressor regulator.
16	Pressure Gauge, SHIPS SERVICE AIR RCVR	This gauge indicates the air pressure present in the ship's service air receiver (Working pressure 125 PSI (8.6bar)).
17	CA-48, SVCE AIR TK DR	This valve is located below the deckplate. When OPEN, this valve drains condensation and air from the ship's service air receiver.
18	CA-51, AUTO DR	This valve secures the pressure to the automatic drain valve, preventing the automatic drain valve from operating.
19	CA-14, SVCE AIR TK OUT	This valve secures the pressure to the air compressor regulator.
20	Discharge Valve, Ship's Service Air	When OPEN, this valve permits compressed air from the ship's service air receiver to supply the vessel.

COMPRESSED AIR GAUGE PANEL

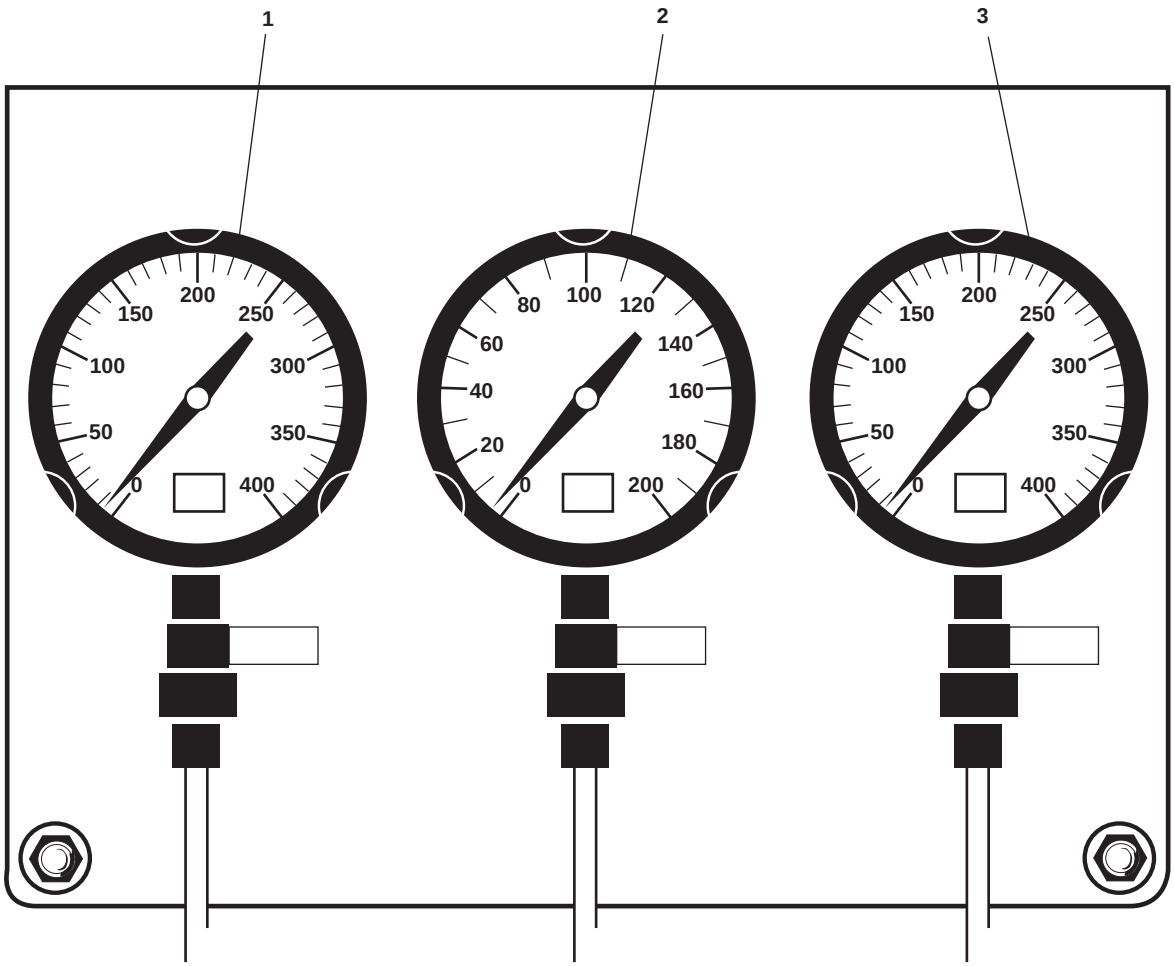


Figure 10. Compressed Air Gauge Panel

Table 10. Compressed Air Gauge Panel (refer to figure 10)

Key	Control/Indicator	Function
1	AIR CPRSR #2 DISCH PRESS Gauge	This gauge indicates the discharge pressure from air compressor 2.
2	SHIP SERVICE AIR PRESS Gauge	This gauge indicates the air pressure available for the ship's service compressed air system.
3	AIR CPRSR #1 DISCH PRESS Gauge	This gauge indicates the discharge pressure from air compressor 1.

SOUND POWERED TELEPHONE

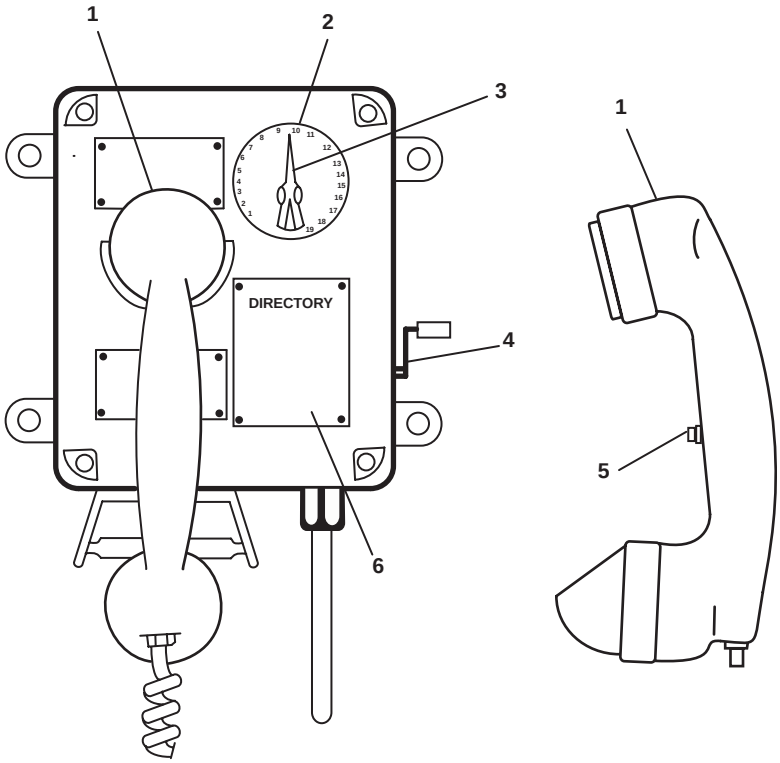


Figure 11. Sound Powered Telephone

Table 11. Sound Powered Telephone (refer to figure 11)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	This knob selects the station to be called.
4	Magneto Handle	Crank this handle to call a station.
5	Pushbutton	This pushbutton is used to transmit.
6	DIRECTORY Plate	This plate lists telephone stations aboard the vessel.

440V POWER PANEL NO. 4

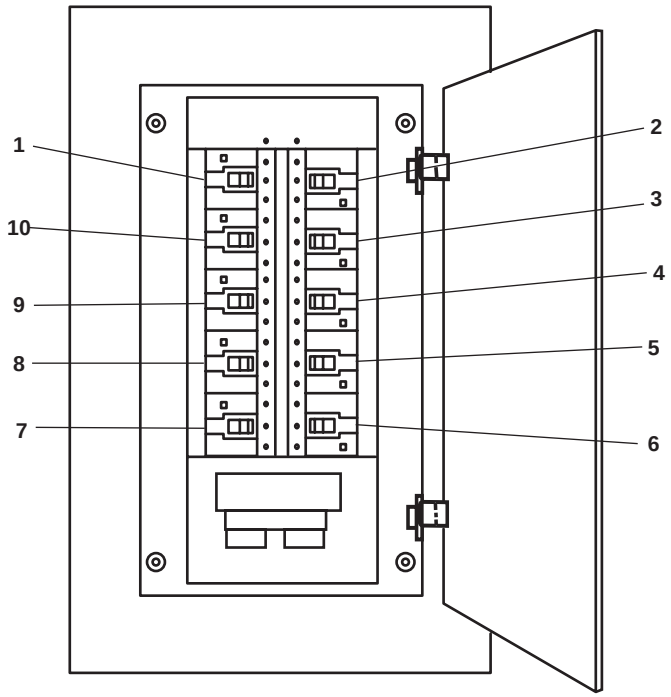


Figure 12. 440V Power Panel No. 4

Table 12. 440V Power Panel No. 4 (refer to figure 12)

Key	Control/Indicator	Function
1	AIR COMPRESSOR No. 1. Circuit Breaker	This circuit breaker provides circuit protection for air compressor 1.
2	AIR COMPRESSOR No. 2. Circuit Breaker	This circuit breaker provides circuit protection for air compressor 2.
3	SPARE. Circuit Breaker	This circuit breaker provides a spare circuit breaker to permit future expansion.
4	UNIT HEATER BOWTHRUSTER. Circuit Breaker	This circuit breaker provides circuit protection for the bow thruster compartment space heater.
5	AUXILIARY MACHINERY SPACE No. 1 UNIT HEATER. Circuit Breaker	This circuit breaker provides circuit protection for the AMS 1 space heater.
6	SPARE. Circuit Breaker	This circuit breaker provides a spare circuit breaker to permit future expansion.

Table 12. 440V Power Panel No. 4 (refer to figure 12) (continued)

Key	Control/Indicator	Function
7	SPARE. Circuit Breaker	This circuit breaker provides a spare circuit breaker to permit future expansion.
8	AUXILIARY MACHINERY SPACE No. 1 SUPPLY FAN. Circuit Breaker	This circuit breaker provides circuit protection for the AMS 1 supply fan.
9	HOT POTABLE WATER RECIRCULATION PUMP. Circuit Breaker	This circuit breaker provides circuit protection for the hot potable water recirculation pump.
10	MSD DISCH PUMP AND BLOWER. Circuit Breaker	This circuit breaker provides circuit protection for the MSD discharge pump and blower.

SPACE HEATER

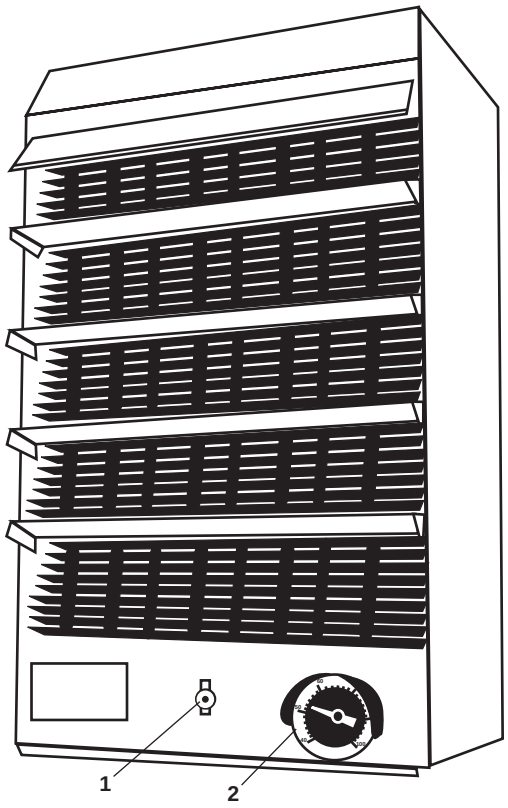


Figure 13. Space Heater

Table 13. Space Heater (refer to figure 13)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the space heater ON and OFF.
2	Thermostat	This thermostat permits the operator to adjust the temperature in the space.

FUEL TANK VENT OVERFLOW INDICATOR

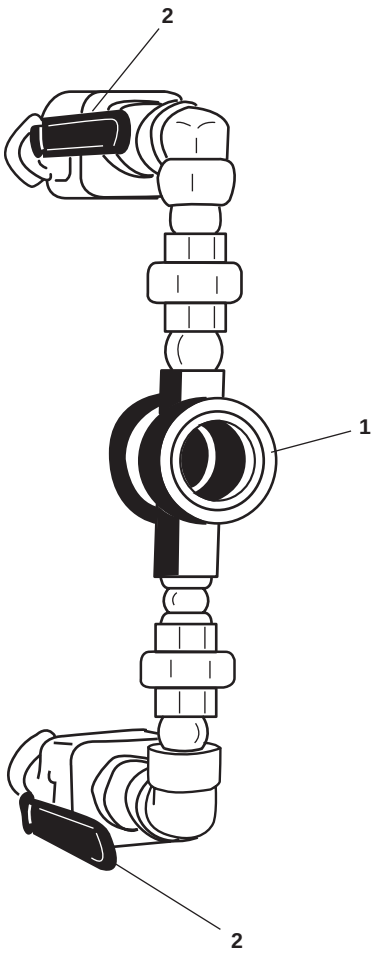


Figure 14. Fuel Tank Vent Overflow Indicator

Table 14. Fuel Tank Vent Overflow Indicator (refer to figure 14)

Key	Control/Indicator	Function
1	Overflow Indicator	When the ball floats in the sight glass the fuel tank vent is filled with fuel. This indicator indicates an overfilled tank.
2	Cutoff Valve	This valve secures flow from the fuel oil tank vent to the overflow indicator.

AMS 1 SUPPLY FAN MOTOR CONTROLLER

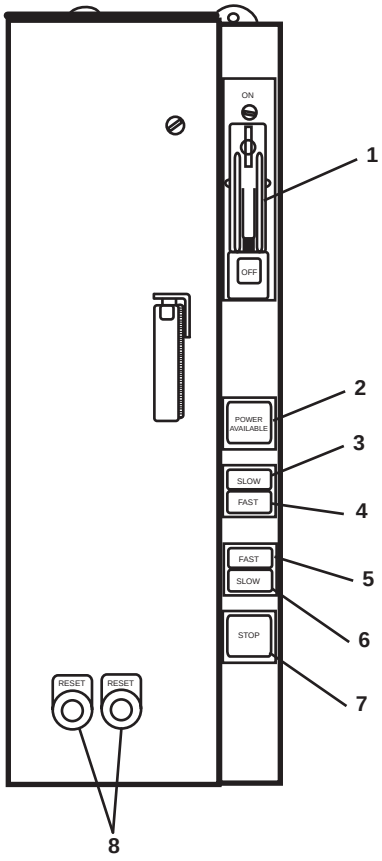
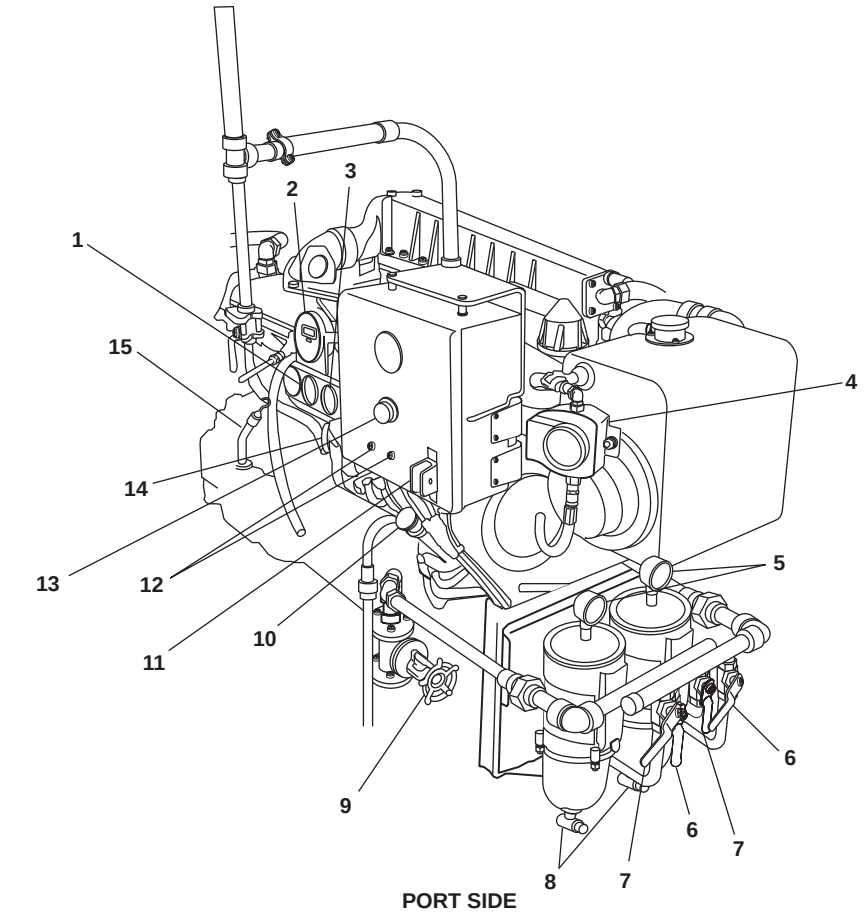


Figure 15. AMS 1 Supply Fan Motor Controller

Table 15. AMS 1 Supply Fan Motor Controller (refer to figure 15)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit protection.
2	POWER AVAILABLE Indicator	This indicator illuminates green to indicate that power is available to the controller.
3	SLOW Indicator	This indicator illuminates to indicate that the fan is operating at SLOW speed.
4	FAST Indicator	This indicator illuminates to indicate that the fan is operating at FAST speed.
5	FAST Pushbutton	This pushbutton is used to operate the fan motor at FAST speed.
6	SLOW Pushbutton	This pushbutton is used to operate the fan motor at SLOW speed.
7	STOP Pushbutton	This pushbutton is used to STOP the fan motor.
8	RESET Pushbuttons	These pushbuttons are used to reset the motor controller.

BOW THRUSTER ENGINE



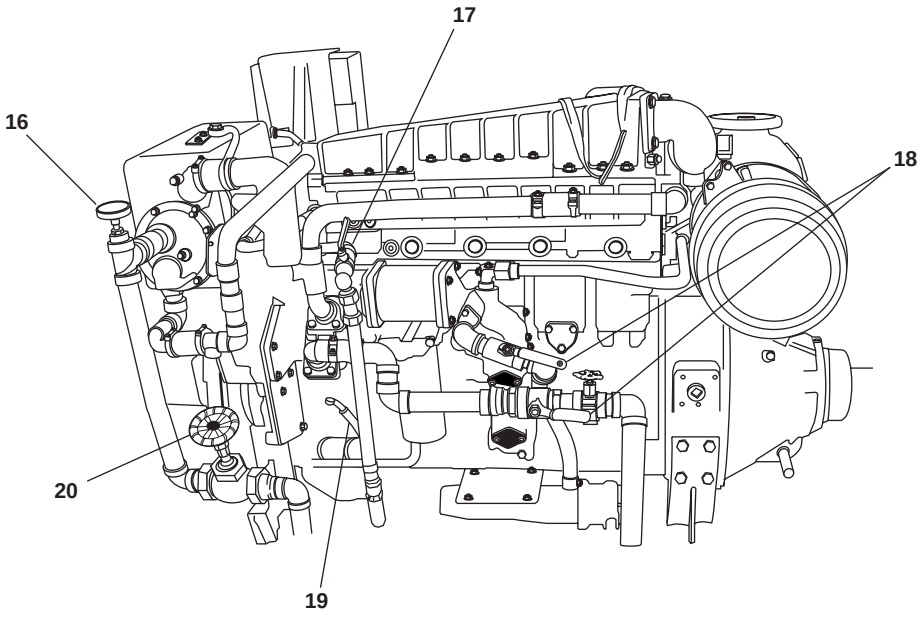


Figure 16. Bow Thruster Engine

Table 16. Bow Thruster Drive Engine (refer to figure 16)

Key	Control/Indicator	Function
1	Oil Pressure Gauge	This gauge indicates the bow thruster engine's lube oil pressure.
2	Tachometer	The tachometer indicates the bow thruster engine's speed.
3	Coolant Temperature Gauge	This gauge indicates the bow thruster engine's coolant temperature.
4	Switch Gauge	This gauge indicates the engine coolant level in the bow thruster engine expansion tank.
5	Filter Restriction Gauge	This gauge indicates the level of restriction in the fuel filter/water separators.
6	Discharge Valve	This valve controls the flow of fuel oil from the fuel filter/water separators to the engine. It permits a single fuel filter/water separator to be taken offline for service while the engine is operating.
7	Supply Valve	This valve controls the flow of fuel oil into the fuel filter/water separators from the day tank. It permits a single fuel filter/water separator to be taken offline for service while the engine is operating.
8	Drain Cock	The drain cock permits water and sediment to be drained from the fuel filter/water separator collection bowl.
9	Fuel Oil Supply Valve	This valve controls the flow of fuel oil from the day tank to the engine's fuel system.
10	Hand Priming Pump	This pump is used to prime the engine's fuel system.
11	ON/OFF/START Switch	This swtch is used to locally start the bow thruster engine.
12	Circuit Breaker	This circuit breaker provides circuit protection for the bow thruster engine junction box.
13	Emergency Stop Pushbutton	Push this button IN to stop the bow thruster engine in an emergency.
14	Fuel Pressure Gauge	This gauge indicates the discharge pressure of the fuel transfer pump.
15	Dipstick, Marine Gear	This dipstick indicates the lube/operating oil level in the marine gear.
16	Temperature Gauge	This gauge indicates the temperature of the raw water discharged from the engine's heat exchanger.
17	Cutoff Valve, Crankcase Vent	This valve secures the crankcase vent flow.
18	Cutoff Valve, Jacket Water Heater	This valve secures the flow of engine coolant through the jacket water heater.
19	Dipstick, Engine	This dipstick indicates the lube oil level in the engine sump.
20	Asw-21 S.W. FR. BOW THRUSTER ENG. TO OVB'D DISCHARGE	This valve secures the flow of raw water from the engine.

COMPRESSED AIR PIPING, FORWARD BULKHEAD

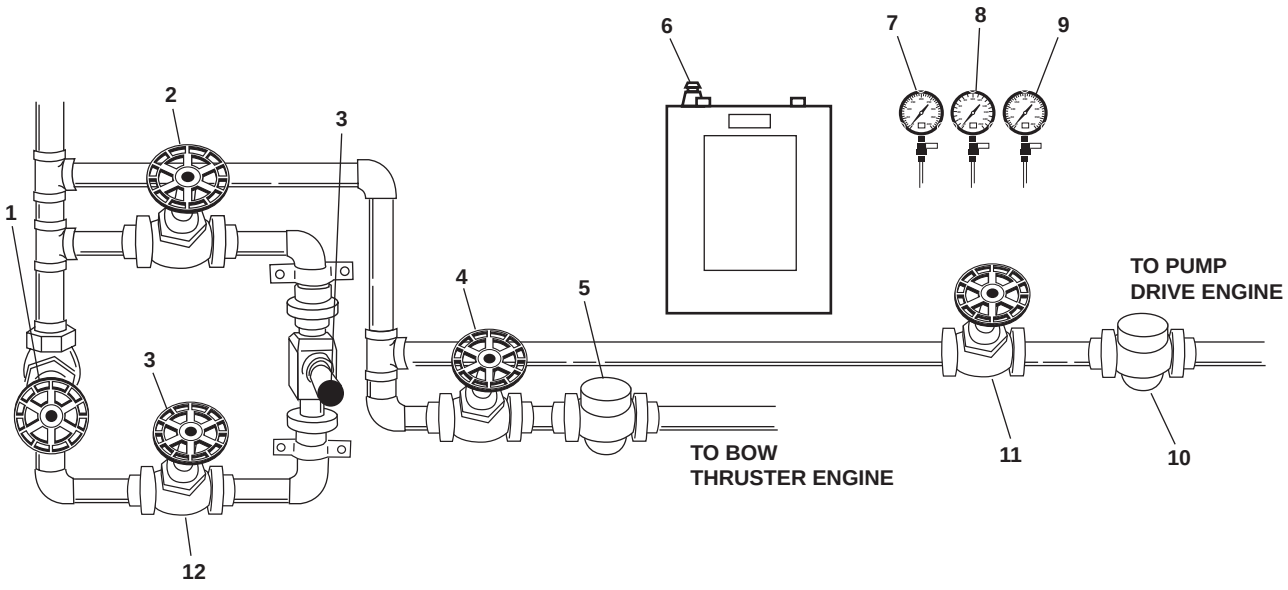


Table 17. Compressed Air Piping, Forward Bulkhead (refer to figure 17)

Key	Control/Indicator	Function
1	CA-41, BYP RDC STA	This valve permits compressed air to bypass the ship's service air regulator.
2	CA-40, SVCE AIR TK INL	This valve isolates the ship's service air regulator.
3	Pressure Regulator	The pressure regulator regulates the pressure of the compressed air entering the ship's service air receiver.
4	CA-5, STG AIR TO BOW THRUSTER ENG Valve	This valve secures the starting air to the bow thruster engine starter.
5	Regulator, Bow Thruster Engine Starting Air	This regulator regulates the pressure of the compressed air supplied to the bow thruster engine starter.
6	Bow Thruster Shaft Brake Control Valve	This valve is pulled UP to apply the bow thruster shaft brake.
7	BOW THRUSTER ENG STG AIR PRESS Gauge	This gauge indicates the starting air pressure available to the bow thruster engine.
9	PUMP DR ENG STG AIR PRESS Gauge	This gauge indicates the starting air pressure available to the pump drive engine.
9	FIRE MAIN PRESS Gauge	This gauge indicates the discharge pressure of the diesel engine-driven fire pump.
10	Regulator, Pump Drive Engine Starting Air	This regulator regulates the pressure of the compressed air supplied to the pump drive engine starter.

Table 17. Compressed Air Piping, Forward Bulkhead (refer to figure 17)

Key	Control/Indicator	Function
11	CA-6, STG AIR TO PMP DR ENG Valve	This valve secures the starting air to the pump drive engine starter.
12	CA-39, SVCE AIR TK INL	This valve isolates the ship's service air regulator.

PUMP DRIVE ENGINE

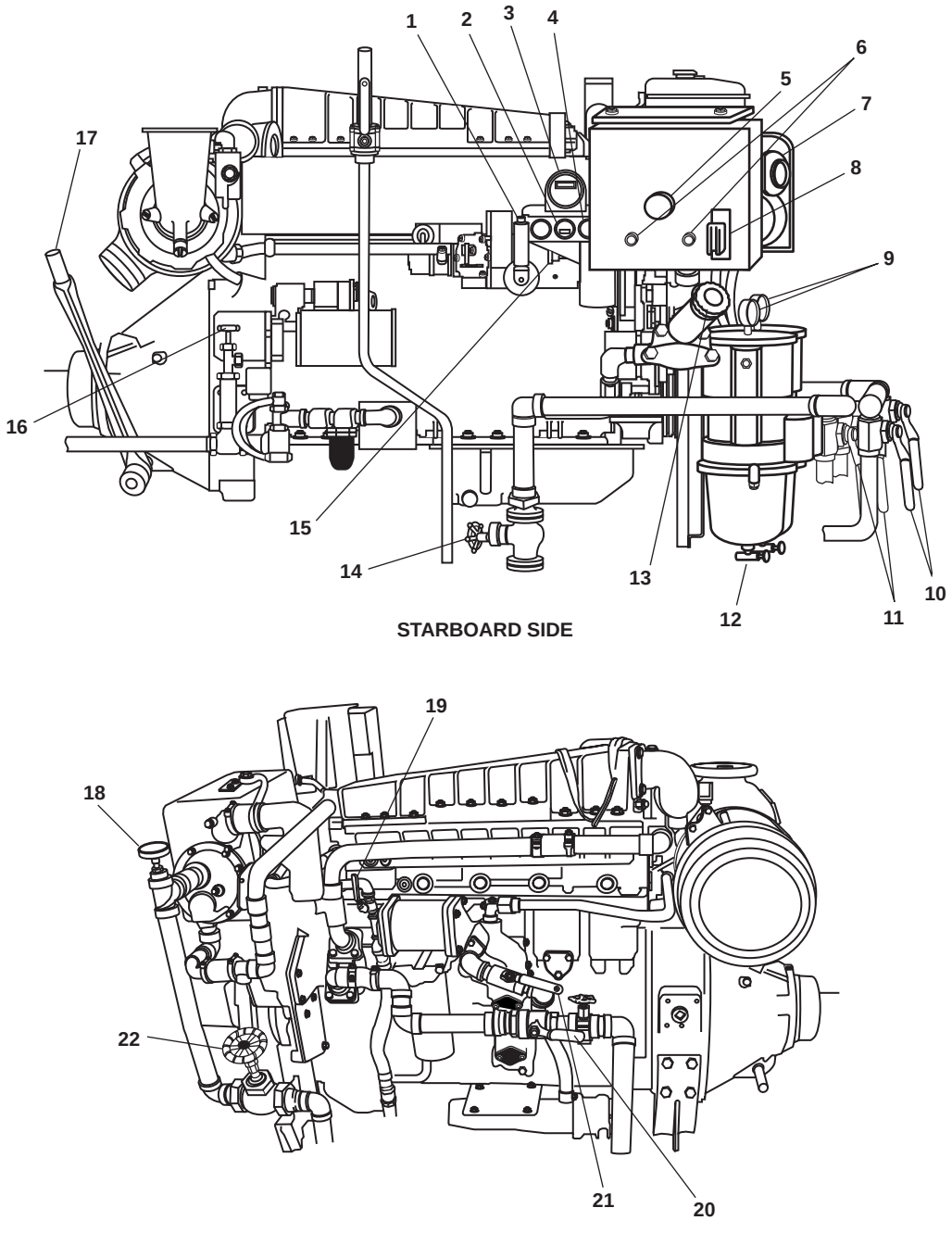
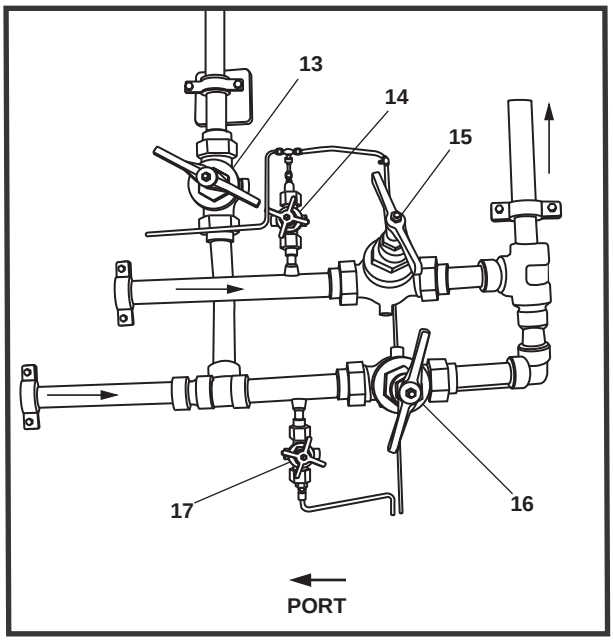


Figure 18. Pump Drive Engine

Table 18. Pump Drive Engine (refer to figure 18)

Key	Control/Indicator	Function
1	Hand Throttle	The hand throttle permits local control of the engine's operating speed.
2	Lube Oil Pressure Gauge	This gauge indicates the engine lube oil pressure.
3	Tachometer	The tachometer indicates the engine speed.
4	Coolant Temperature Gauge	This gauge indicates the engine coolant temperature.
5	Emergency Stop Pushbutton	This pushbutton is used to STOP the engine in an emergency.
6	Circuit Breaker	The circuit breaker provides circuit protection for the engine's control panel.
7	Switch Gauge	This gauge indicates the engine coolant level in the pump drive engine expansion tank.
8	ON/OFF/START Switch	This switch permits local starting and stopping of the engine.
9	Filter Restriction Gauge	This gauge indicates the level of restriction in the fuel filter/water separators.
10	Discharge Valve	This valve is used to control the flow of fuel oil from the fuel filter/water separators to the engine, and it permits a single fuel filter/water separator to be taken offline for service while the engine is operating.
11	Supply Valve	This valve is used to control the flow of fuel oil into the fuel filter/water separators from the day tank, and it permits a single fuel filter/water separator to be taken offline for service while the engine is operating.
12	Drain Cock	The drain cock permits water and sediment to be drained from the fuel filter/water separator collection bowl.
13	Hand Priming Pump	This pump is used to prime the engine's fuel system.
14	Fuel Oil Supply Valve	This valve controls the flow of fuel oil from the day tank to the engine's fuel system.
15	Fuel Pressure Gauge	This gauge indicates the discharge pressure of the fuel transfer pump.
16	Engine Start Valve	This valve starts the pump drive engine when pushed.
17	PTO Lever	This lever is used to engage and disengage the Power Take-Off (PTO) that drives the diesel engine-driven fire pump.
18	Temperature Gauge	This gauge indicates the temperature of the raw water discharged from the engine's heat exchanger.
19	Cutoff Valve, Jacket Water Heater	This valve secures the flow of engine coolant through the jacket water heater.
20	Asw-19, S.W. TO PUMP DRIVE ENG Valve	This valve secures the flow of raw water into the engine.
21	Cutoff Valve, Raw Water Discharge	This valve secures the flow of raw water from the engine.
22	Asw-20, S.W. FR PUMP DRIVE ENG. TO OVB'D DISCHARGE Valve	This valve secures the flow of raw water from the engine.

TOWING MACHINE HYDRAULIC SYSTEM



DETAIL A
ON FORWARD BULKHEAD

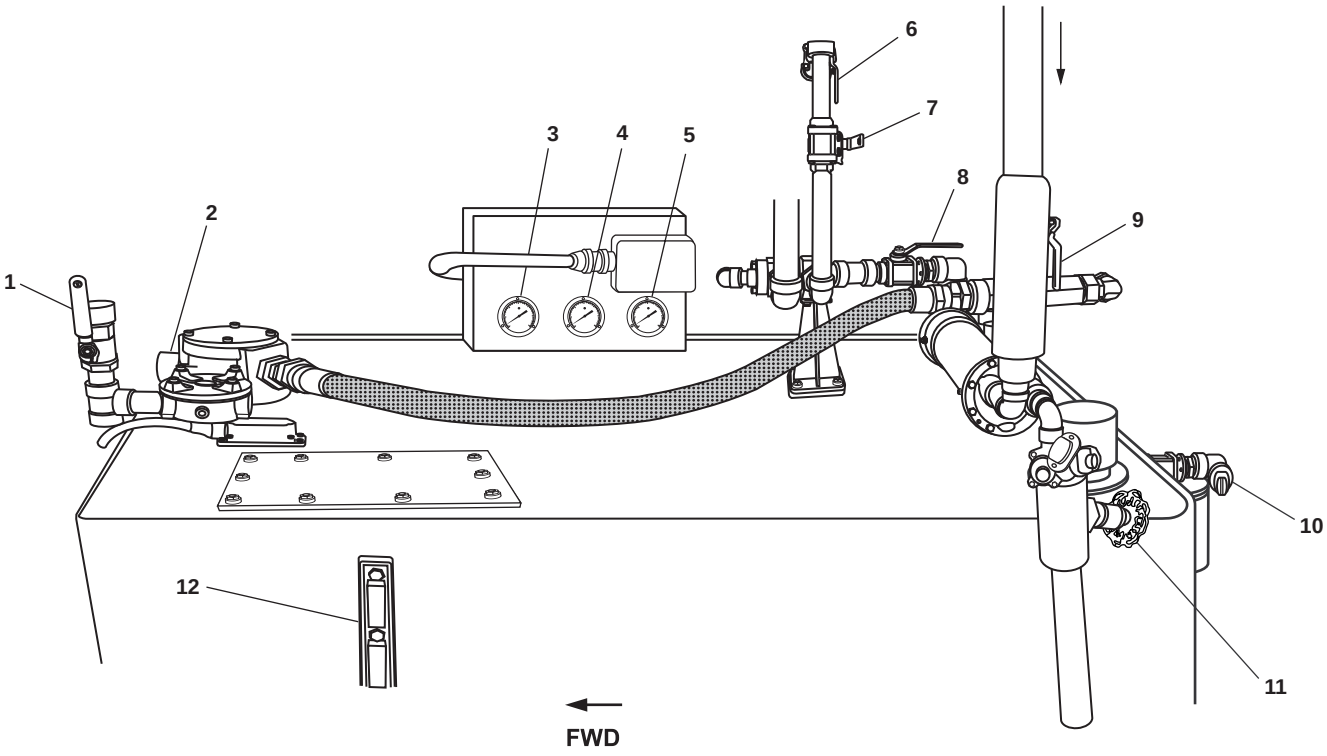


Figure 19. Towing Machine Hydraulic System

Table 19. Towing Machine Hydraulic System (refer to figure 19)

Key	Control/Indicator	Function
1	CH-26, DRN CUT-OUT TOW WN HYDR Valve	This valve cuts out drain flow to the tow winch hydraulic reservoir from the central hydraulic system.
2	Filter Restriction Gauge	This gauge indicates the condition of the return filter. GREEN indicates a good filter and RED indicates a need to change the filter.
3	Pump Output Pressure Gauge	This gauge indicates the hydraulic pump output pressure.
4	Load Sense Pressure Gauge	This gauge indicates the load sense pressure in the system.
5	Unloading Pressure Gauge	This gauge indicates the unloading pressure of the pump.
6	TH-4, DRAIN CRSVR. TO CENT. HYD Valve	This valve secures the drain crossover line between the towing hydraulic and central hydraulic systems.
7	TH-3, RETURN CRSVR. TO CENT. HYD Valve	This valve secures the return crossover line between the towing hydraulic and central hydraulic systems.
8	CH-27, RTN CUT-OUT TOW WN HYDR Valve	The valve cuts out the return line to the tow winch hydraulic reservoir from the central hydraulic system.
9	GS-75, TOW WN HYD OIL CLR SPLY Valve	This valve secures the flow of raw water into the tow winch hydraulic oil cooler.
10	Fill Connector	This permits pressurized filling of the tow winch hydraulic reservoir through a hydraulic oil filter.
11	GS-77, HYD OIL CLR DISCH Valve	This valve secures the flow of raw water out of the tow winch hydraulic oil cooler.
12	Sight Glass	The sight glass indicates the hydraulic oil level in the reservoir.
13	TH-2, PRESS CRSVR CTL HYDR TOW WN HYDR Valve	When OPEN, this valve permits the tow winch hydraulic system to power the central hydraulic system's components.
14	TH-13, FLOW CONTROL Valve	This valve secures the pressure to the hydraulic pressure gauge.
15	TH-14, FLOW CONTROL Valve	When OPEN, this valve permits the tow winch hydraulic pump to draw suction from the tow winch hydraulic reservoir.
16	TH-1, C.O.V.-PMP DISCH. TO TOW WN. HYD Valve	This valve secures the discharge line from the tow winch hydraulic pump to the tow winch hydraulic system.
17	TH-12, FLOW CONTROL Valve	This valve secures the pressure to the pump output pressure gauge (figure 3, item 3).

RAW WATER STRAINER

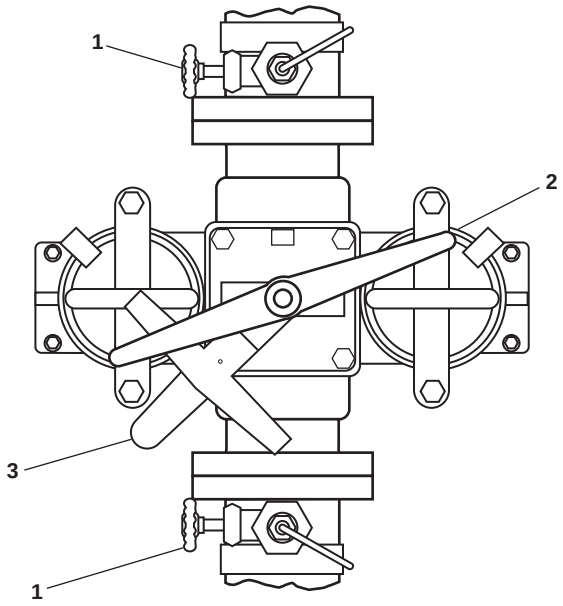


Figure 20. Raw Water Strainer

Table 20. Raw Water Strainer (refer to figure 20)

Key	Control/Indicator	Function
1	Cutoff Valve, Differential Pressure Gauge	This valve secures the flow of pressure to the strainer differential pressure gauge.
2	Locking Handle	This handle locks the selector handle into the desired position.
3	Selector Handle	This handle permits the operator to select the online strainer, leaving the other strainer offline for service.

PA SPEAKER AND VOLUME CONTROL

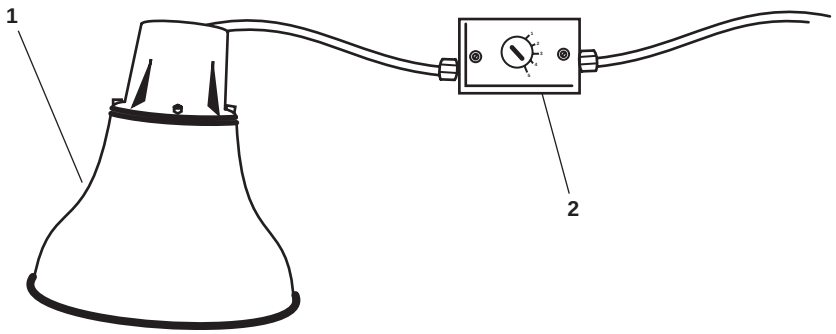


Figure 21. PA Speaker and Volume Control

Table 21. PA Speaker and Volume Control (refer to figure 21)

Key	Control/Indicator	Function
1	Loudspeaker	The loudspeaker broadcasts the PA system.
2	Volume Control	This controls the volume of the loudspeaker (table 21, item 1).

MSD

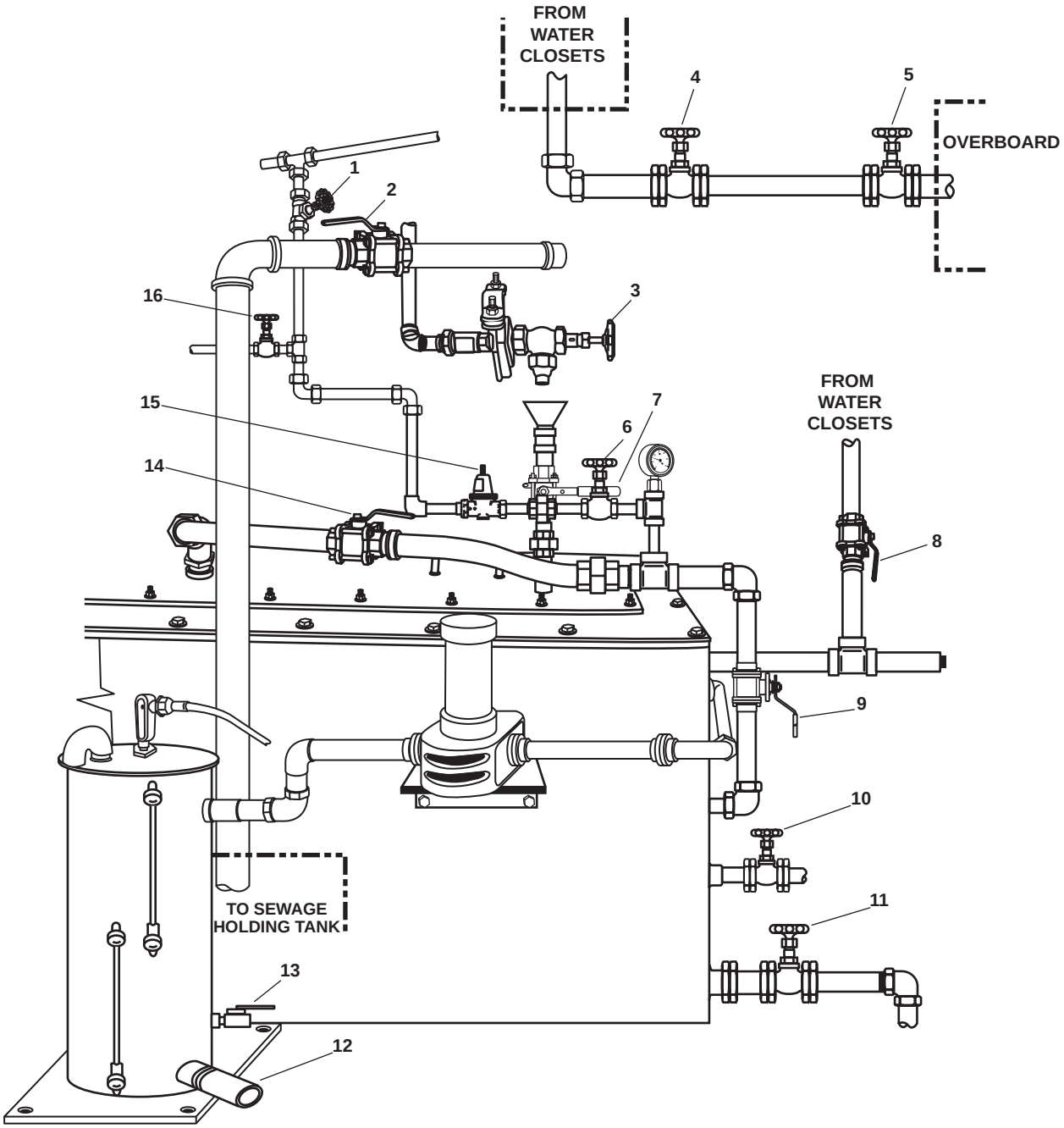


Figure 22. MSD

Table 22. MSD (refer to figure 22)

Key	Control/Indicator	Function
1	CA-80, COV-LP AIR	This valve secures the ship's service low pressure air shutoff.
2	SD-3, SEWAGE DRAIN TO HOLDING TANK	This valve allows sewage to go directly to the sewage holding tank when OPENED.
3	POTW ISOLATION	OPEN this valve to allow potable water to the MSD potable water fill valve.
4	SD-2, SEWAGE OVERBOARD DISCHARGE	OPEN this valve to allow sewage to the overboard discharge.
5	SD-13, SEWAGE OVERBOARD DISCHARGE	This valve, when OPENED, allows sewage to be discharged overboard.
6	CA-81, LP AIR SHUTOFF	This valve, when CLOSED, stops the ship's service compressed air from entering the MSD system.
7	MSD-3, POTW FILL TO MSD ISLN	This valve, when OPENED, permits potable water to fill the media tank.
8	SD-1, SEWAGE INLET TO MSD	This valve, when OPENED, permits sewage to enter the MSD.
9	MSD-6, BLOWER DISCH TO AIR SCOURING SOV	OPEN this valve to air scour the MSD media tank.
10	MSD-8, MEDIA TANK PUMP-OUT DR	OPEN this valve to pump out the MSD media tank.
11	MSD-9, MEDIA TANK DRAIN	OPEN this valve to drain the media tank to the sewage holding tank.
12	MSD-10, WET WELL DISCHARGE	OPEN this valve to allow effluent to the MSD discharge pump.
13	MSD-11, WET WELL SAMPLE	This valve, when OPENED, permits samples to be taken from the wet well.
14	MSD-5, BLOWER DISCHARGE SHUTOFF	This valve, when CLOSED, isolates the blower from the media tank.
15	CA-83, PRV SET AT 2 PSIG	This valve regulates the amount of air pressure entering the media tank from the ship's service low pressure air.
16	CA-82, LP AIR HOSE SHUTOFF	This valve, when CLOSED, isolates the ship's service low pressure air.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
AMS 2

AMS 2 GENERAL ARRANGEMENT

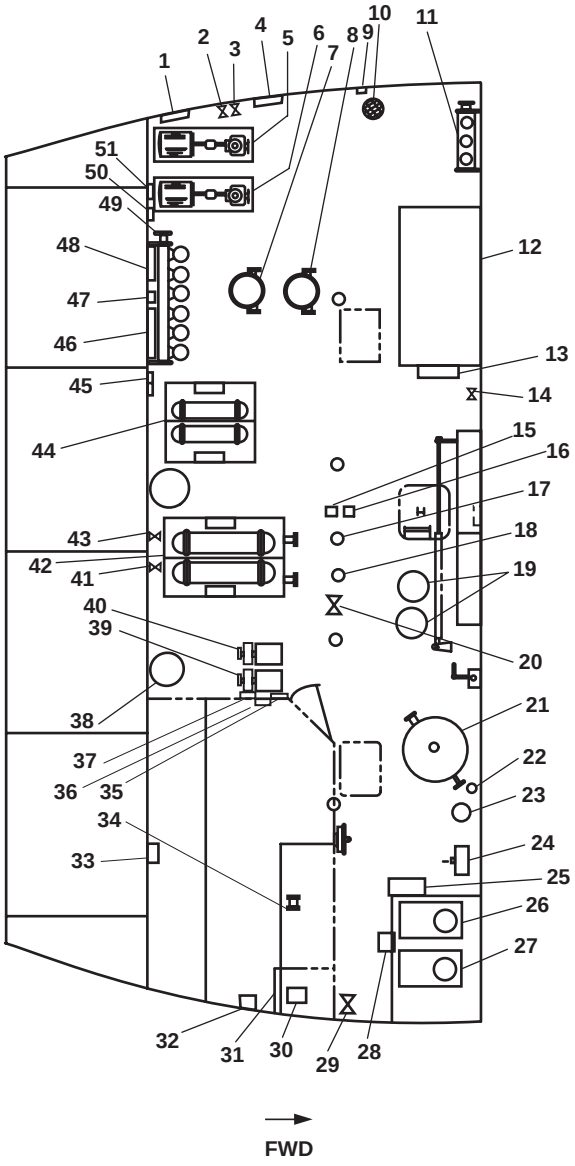


Figure 1. AMS 2 General Arrangement

Table 1. AMS 2 General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Bilge and Ballast Gauge Panel	This gauge panel monitors the system pressures for the bilge and ballast pump system. See figure 2 for details.
2	Cutoff Valve, Bilge Overboard Discharge	This valve controls the overboard discharge of bilge liquid.

Table 1. AMS 2 General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
3	FM-31 OVBD DISCH Valve	This valve controls the overboard discharge from the fire and general service pumps.
4	Tank Level Indicators, Ballast Tanks	These indicate the level of the vessel's three ballast tanks. See figure 3 for details.
5	Bilge and Ballast Pump 2	These pump liquid from the bilges and fill/drain the ballast tanks. See figure 4 for details, including associated valves.
6	Bilge and Ballast Pump 1	These pump liquid from the bilges and fill/drain the ballast tanks. See figure 4 for details, including associated valves.
7	Fire and General Service Pump 2	These pump raw water to the fire mains and to the general service water system. See figure 5 for details, including associated valves.
8	Fire and General Service Pump 1	These pump raw water to the fire mains and to the general service water system. See figure 5 for details, including associated valves.
9	Brominator	The brominator purifies potable water. See figure 8 for details.
10	Duplex Strainer, Ballast Suction	This removes contaminants from the ballast suction stream. See figure 6 for details.
11	Ballast Manifold	This manifold contains valves to control the flow of raw water to and from the ballast tanks. See figure 7 for details.
12	Reverse Osmosis Water Purification Unit (ROWPU)	This unit purifies raw water to potable water for use aboard the vessel. See figure 8 for details.
13	440V Power Panel No. 5	This power panel houses circuit breakers for many of the components in AMS 2. See figure 15 for details.
14	OB-19 HOSE CONN. - OILY BILGE SUCT	This controls the flow from the hose connection to the oily bilge system.
15	PA Loudspeaker and Volume Control	These provide communication into the space from the PA system. See figure 16 for details.
16	General Alarm Bell	This bell sounds when a general alarm condition has been set.
17	FM-200 Beacon	This beacon flashes to indicate that the FM-200 has been actuated.
18	GENERAL ALARM ROTARY BEACON	This red beacon rotates when the general alarm bell sounds.
19	FM-200 Cylinders	These cylinders contain the FM-200 fire suppression agent. See figure 17 for details including associated valves.
20	CA-19 AIR TOOL CONN	This valve provides an air connection for air powered tools.
21	Potable Water Hydro-Pneumatic Tank	This tank maintains stable pressure for the potable water system. See figure 18 for details.

Table 1. AMS 2 General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
22	Discharge Delay Cylinder	This cylinder enables a 60-second delay between actuation of the FM-200 system and release of the suppression agent.
23	CO_2 Cylinder	This cylinder contains the CO_2 gas that actuates the FM-200 System. See figure 17 for details.
24	Emergency Steering Station	The emergency steering station permits steering of the vessel in the event of a main steering system failure. See figure 19 for details.
25	STEERING SYSTEMS STBD STARTER (above) and STEERING SYSTEMS PORT STARTER (below)	This controls the motors for the steering system power packs. See figure 20 for details.
26	Steering System Power Pack 2	This provides hydraulic power to operate the steering system. See figure 20 for details.
27	Steering System Power Pack 1	This provides hydraulic power to operate the steering system. See figure 20 for details.
28	Sound Powered Telephone	The sound powered telephone provides communication with the rest of the vessel. See figure 21 for details.
29	GS-32 GS OVBD DISCH Valve	This valve controls the overboard discharge of general service water.
30	Drill Press	The drill press permits maintenance personnel to drill holes. See figure 22 for details.
31	Welder	The welder permits maintenance personnel to weld metals. See figure 23 for details.
32	Space Heater	The space heater heats the workshop area. See figure 24 for details.
33	HVAC SYSTEM CONTROLLER FOR EXHST FAN	This controller turns ON and OFF the exhaust fan in the workshop. See figure 25 for details.
34	Bench Grinder	The bench grinder permits personnel to grind metals. See figure 26 for details.
35	Potable Water Gauge Panel	This panel provides gauges and indicators for the potable water system. See figure 27 for details.
36	#2 POTABLE WATER PUMP Motor Controller	This motor controller turns ON and OFF potable water pump 1. See figure 28 for details.
37	#2 POTABLE WATER PUMP Motor Controller	This motor controller turns ON and OFF potable water pump 2. See figure 28 for details.
38	FM-200 Cylinder	This cylinder contains FM-200 agent for the bilge system. See figure 17 for details.
39	Potable Water Pump 1	This pump pressurizes and pumps potable water for use aboard the vessel. See figure 29 for details, including associated valves.

Table 1. AMS 2 General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
40	Potable Water Pump 2	This pump pressurizes and pumps potable water for use aboard the vessel. See figure 29 for details, including associated valves.
41	Sight Glass, Starboard Potable Water Tank	The sight glass indicates the level of the starboard potable water tank. See figure 30 for details.
42	Air Conditioner Condensing Units	These units compress and condense refrigerant for use in the air conditioning systems aboard the vessel. See figure 31 for details.
43	Sight Glass, Port Potable Water Tank	The sight glass indicates the level of the port potable water tank. See figure 30 for details.
44	Refrigeration Condensing Units	These units compress and condense refrigerant for use in the refrigeration units aboard the vessel. See figure 31 for details.
45	EPR PSI and Stern Tube Pressure Gauges	These gauges indicate the pressure for the stern tube seals and EPR. See figure 33 for details.
46	#1 FIRE AND GENERAL SERVICE PUMP (EMERGENCY) Motor Controller	This motor controller controls the operation of fire and general service pump 1. See figure 34 for details including related valves.
47	Fire and GS Pump Gauge Panel	This panel indicates the fire and general service systems' operating pressures. See figure 34 for details.
48	#2 FIRE AND GENERAL SERVICE PUMP (EMERGENCY) Motor Controller	This motor controller controls the operation of fire and general service pump 2. See figure 34 for details including related valves.
49	Bilge Manifold	The bilge manifold contains valves to control the flow of liquid from the bilge spaces. See figure 35 for details.
50	#1 BILGE AND BALLAST PUMP (EMERGENCY) Motor Controller	This motor controller controls bilge and ballast pump 1. See figure 28 for details.
51	#1 BILGE AND BALLAST PUMP (EMERGENCY) Motor Controller	This motor controller controls bilge and ballast pump 1. See figure 28 for details.

BILGE AND BALLAST GAUGE PANEL

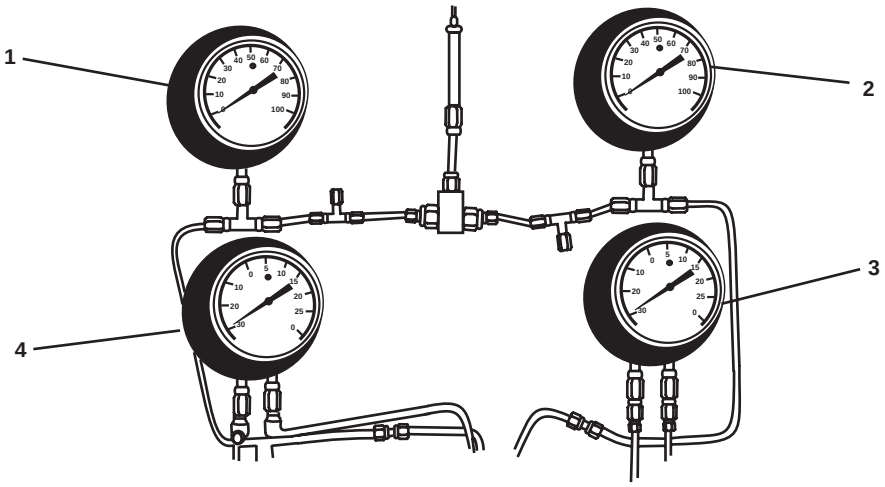


Figure 2. Bilge and Ballast Gauge Panel

Table 2. Bilge and Ballast Gauge Panel (refer to figure 2)

Key	Control/Indicator	Function
1	BILGE/BALLAST PMP #1 DISCH PRESS Gauge	This gauge indicates the discharge pressure of bilge and ballast pump 1.
2	BILGE/BALLAST PMP #2 DISCH PRESS Gauge	This gauge indicates the discharge pressure of bilge and ballast pump 2.
3	BALLAST SUCT STR DIFF PRESS Gauge	This gauge indicates the differential pressure across the ballast suction strainer.
4	BILGE SUCT STR DIFF PRESS Gauge	This gauge indicates the differential pressure across the bilge suction strainer.

TANK LEVEL INDICATORS (TLI), BALLAST TANKS

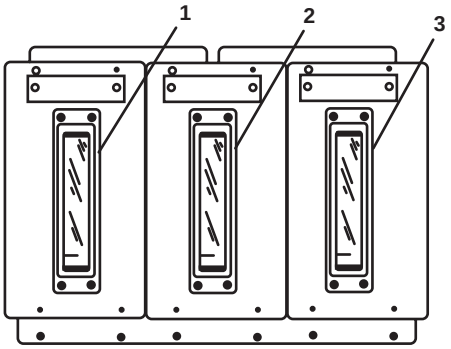


Figure 3. Tank Level Indicators (TLI), Ballast Tanks

Table 3. Tank Level Indicators (TLI), Ballast Tanks (refer to figure 3)

Key	Control/Indicator	Function
1	TLI Ballast Tank 1	This tank indicates the liquid level in ballast tank 1.
2	TLI Ballast Tank 2 Stbd	This tank indicates the liquid level in ballast tank 2 starboard.
3	TLI Ballast Tank 2 Port	This tank indicates the liquid level in ballast tank 2 port.

BILGE AND BALLAST PUMPS AND VALVES

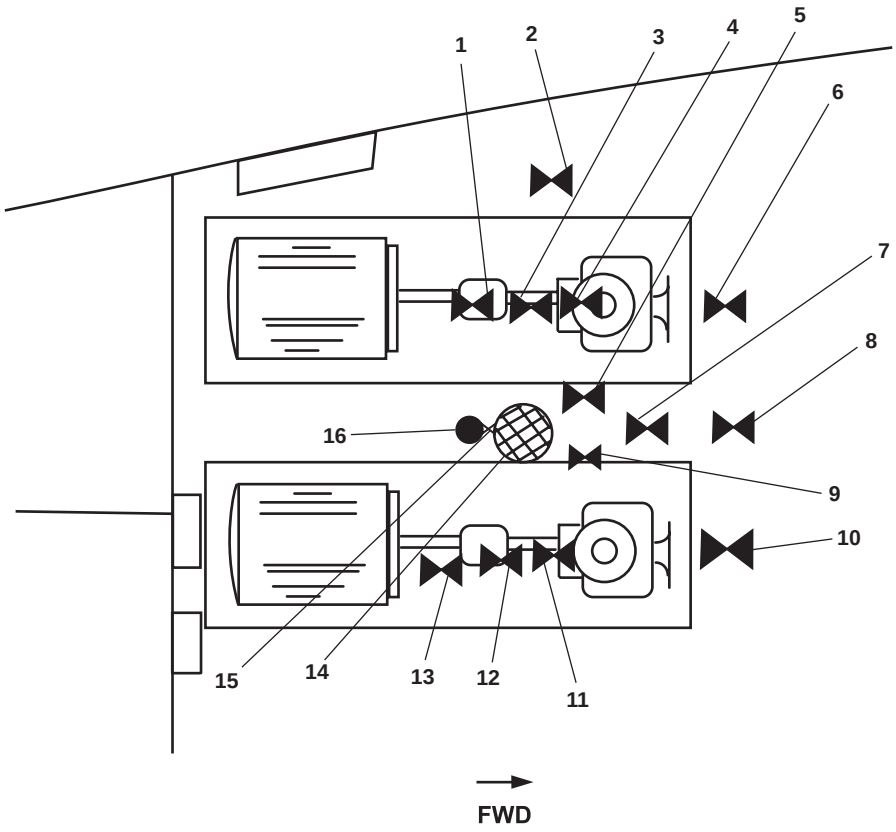


Figure 4. Bilge and Ballast Pumps and Valves

Table 4. Bilge and Ballast Pumps and Valves (refer to figure 4)

Key	Control/Indicator	Function
1	Cutoff Valve for BILGE/BALLAST PMP #2 DISCH PRESS Gauge	This gauge secures pressure to the bilge and ballast pump 2 discharge pressure gauge (figure 2, item 2).
2	BB-29, B/B PMP No. 1 BILGE SUCT. Valve	This valve controls the bilge suction to bilge and ballast pump 1.
3	BB-32, B/B PMP No. 2 OVBD DISCH Valve	This valve controls the overboard discharge from bilge and ballast pump 2.
4	BB-33, B/B PMP. No. 2 BLST TO MANF. Valve	This valve controls the flow from bilge and ballast pump 2 to the ballast manifold.
5	Cutoff Valve for BILGE SUCT STR DIFF PRESS Gauge	This valve secures the pressure to the bilge suction strainer differential pressure gauge (figure 2, item 4).
6	BB-27, B/B PMP. No. 2 BLST. SUCT Valve	This valve controls the ballast suction to bilge and ballast pump 2.

Table 4. Bilge and Ballast Pumps and Valves (continued)

Key	Control/Indicator	Function
7	BB-30, B/B PMP. No. 2 BILGE SUCT Valve	This valve controls the bilge suction to bilge and ballast pump 1.
8	BB-28, BILGE-ENG. RM. EMER SUCT. Valve	This valve controls the suction from the engine room bilge.
9	BB-56, BILGE SYS PRM EDUCTOR DISCH Valve	This valve controls discharge to the bilge system priming eductor.
10	BB-26, B/B PMP No. 1 BLST. SUCT Valve	This valve controls the ballast suction to bilge and ballast pump 1.
11	BB-35, B/B PMP No. 1 BLST. TO MANF Valve	This valve controls the flow from bilge and ballast pump 1 to the ballast manifold.
12	BB-34, B/B PMP No. 1 OVBD DISCH. Valve	This valve controls the overboard discharge from bilge and ballast pump 1.
13	Cutoff Valve for BILGE/BALLAST PMP #1 DISCH PRESS Gauge	This valve secures pressure to the bilge and ballast pump 1 discharge pressure gauge.
14	Bilge Strainer	This strainer removes contaminants from the bilge suction stream.
15	Cutoff Valve, Bilge Strainer Restriction Gauge	This secures the pressure to the bilge strainer restriction gauge.
16	Bilge Strainer Restriction Gauge	This gauge indicates the restriction of the bilge strainer.

FIRE AND GENERAL SERVICE PUMPS AND VALVES

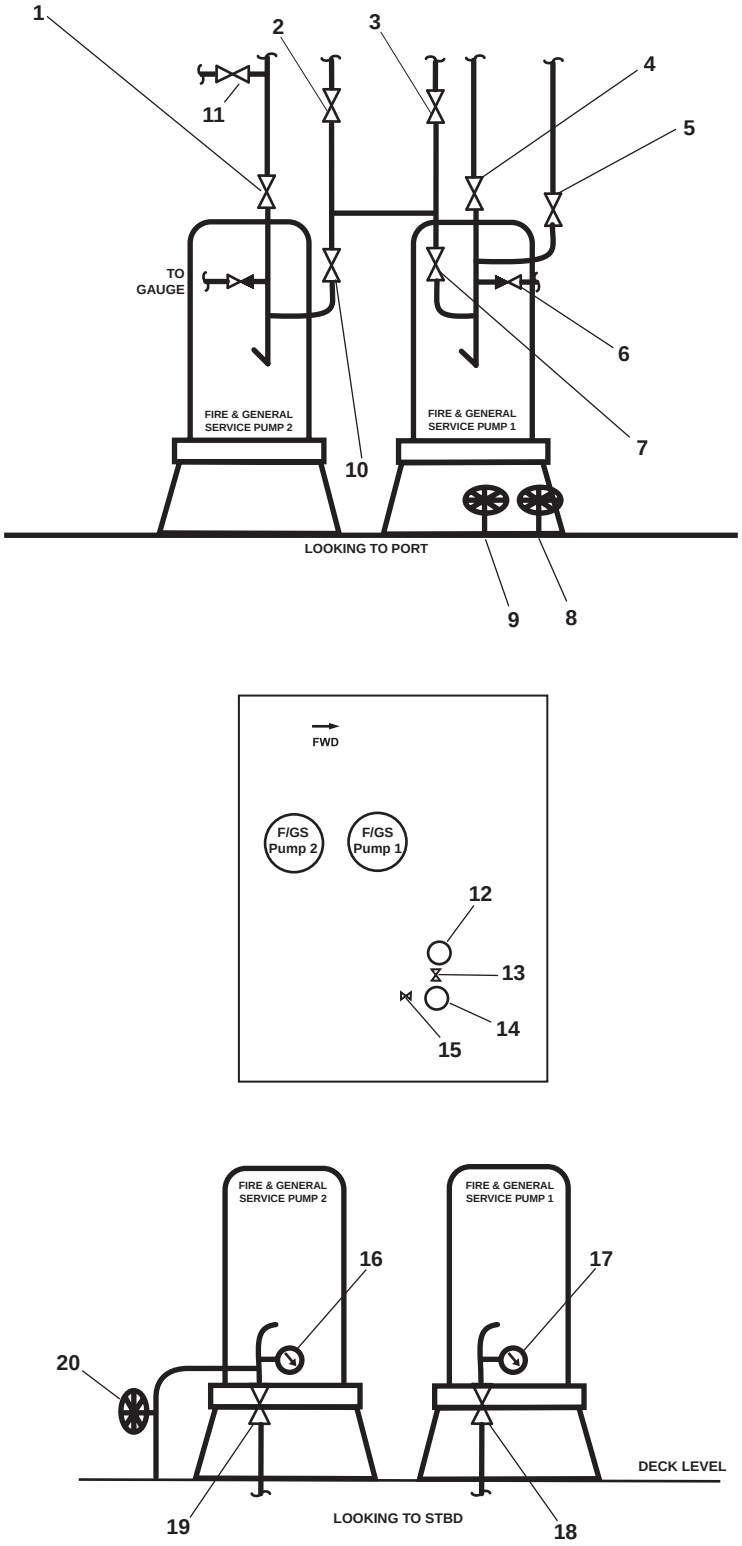


Figure 5. Fire and General Service Pumps and Valves

Table 5. Fire and General Service Pumps and Valves (refer to figure 5)

Key	Control/Indicator	Function
1	FM-14 FIRE/G.S. PMP NO. 2 DISCH TO FM Valve	This valve controls the discharge from fire and general service pump 2 to the fire main.
2	FM-10 GENL SERV PRESS RED VLV MAN BYPASS Valve	When OPEN, this valve permits bypassing of the general service system's pressure reducing valve.
3	FM-9 GENL SERV PRESS RED VLV CO Valve	When OPEN, this valve permits general service water to enter the general service system's pressure reducing valve.
4	FM-16 FIRE/G.S. PMP NO. 1 DISCH TO FM Valve	This valve controls the discharge from fire and general service pump 2 to the fire main.
5	FM-8 EMG BILGE OVBD Valve	When OPEN, this valve permits bilge and ballast pump 1 to discharge overboard.
6	FM-93 Cutoff Valve, Fire/GS Pump 1 Discharge Pressure Gauge	This gauge secures the pressure to the fire and general service pump 1 discharge pressure gauge.
7	FM-17 FIRE/G.S. PMP NO. 1 DISCH TO G.S. Valve	This valve controls the discharge from fire and general service pump 1 to the general service system.
8	High Level Raw Water COV 1	This cutoff valve controls the intake of raw water.
9	High Level Raw Water COV 2	This cutoff valve controls the intake of raw water.
10	FM-15 FIRE/G.S. PMP NO. 2 DISCH TO G.S. Valve	This valve controls the discharge from fire and general service pump 2 to the general service system.
11	FM-92 Cutoff Valve, Fire/GS Pump 2 Discharge Pressure Gauge	This gauge secures the pressure to the fire and general service pump 2 discharge pressure gauge.
12	General Service System Pressure Reducing Valve	This valve reduces fire main pressure to general service pressure.
13	GS-12 GENL SERV PRESS RED VLV CO Valve	When OPEN, this valve permits general service water to be discharged from the general service pressure reducing valve.
14	General Service Temperature Gauge	This gauge indicates the temperature of the water entering the general service system.
15	Cutoff Valve, General Service Pressure Gauge	This gauge secures the pressure to the general service pressure gauge.
16	Discharge Pressure Gauge, Fire/GS Pump 1	This pump indicates the discharge pressure of fire and general service pump 1.
17	Discharge Pressure Gauge, Fire/GS Pump 2	This pump indicates the discharge pressure of fire and general service pump 2.
18	FM-7 FIRE/GS PMP NO. 2 SUCT Valve	This valve secures the suction into fire and general service pump 2.
19	FM-7 FIRE/GS PMP NO. 1 SUCT Valve	This valve secures the suction into fire and general service pump 1.
20	Sea Chest Cross Connect COV	This cutoff valve connects to the sea chest.

BALLAST SUCTION STRAINER

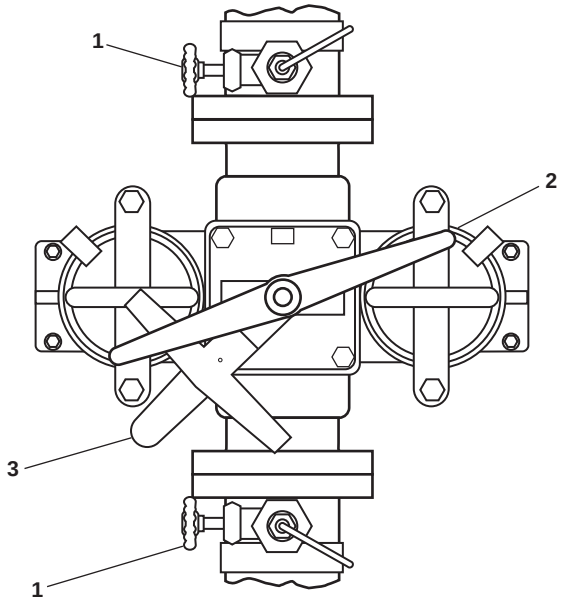


Figure 6. Ballast Suction Strainer

Table 6. Ballast Suction Strainer (refer to figure 6)

Key	Control/Indicator	Function
1	Cutoff Valve, Differential Pressure Gauge	This valve secures the flow of pressure to the strainer differential pressure gauge.
2	Locking Handle	This handle locks the selector handle into the desired position.
3	Selector Handle	This handle permits the operator to select the online strainer, leaving the other strainer offline for service.

BALLAST MANIFOLD

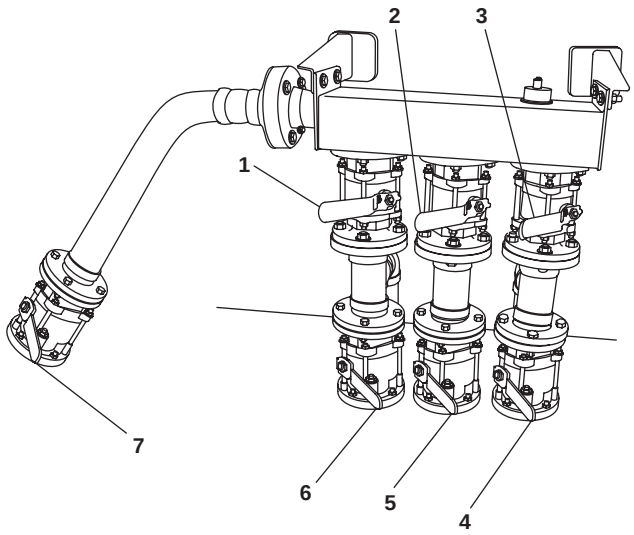


Figure 7. Ballast Manifold

Table 7. Ballast Manifold (refer to figure 7)

Key	Control/Indicator	Function
1	BB-49, BLST TK No. 1 FILL Valve	When OPEN, this valve permits filling of ballast tank 1.
2	BB-47, BLST TK No. 2P FILL Valve	When OPEN, this valve permits filling of ballast tank 2 port.
3	BB-45, BLST TK No. 2S FILL Valve	When OPEN, this valve permits filling of ballast tank 2 starboard.
4	BB-46, BLST TK No. 2S SUCT Valve	When OPEN, this valve permits filling of ballast tank 2 starboard.
5	BB-48, BLST TK No. 2P SUCT Valve	When OPEN, this valve permits filling of ballast tank 2 port.
6	BB-50, BLST TK No. 1 SUCT Valve	When OPEN, this valve permits filling of ballast tank 1.
7	BB-25, BLST MANF TO PMPS OUTLT Valve	When OPEN, this valve permits the ballast pumps to supply water to the ballast manifold for filling of the ballast tank(s).

REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) GENERAL ARRANGEMENT

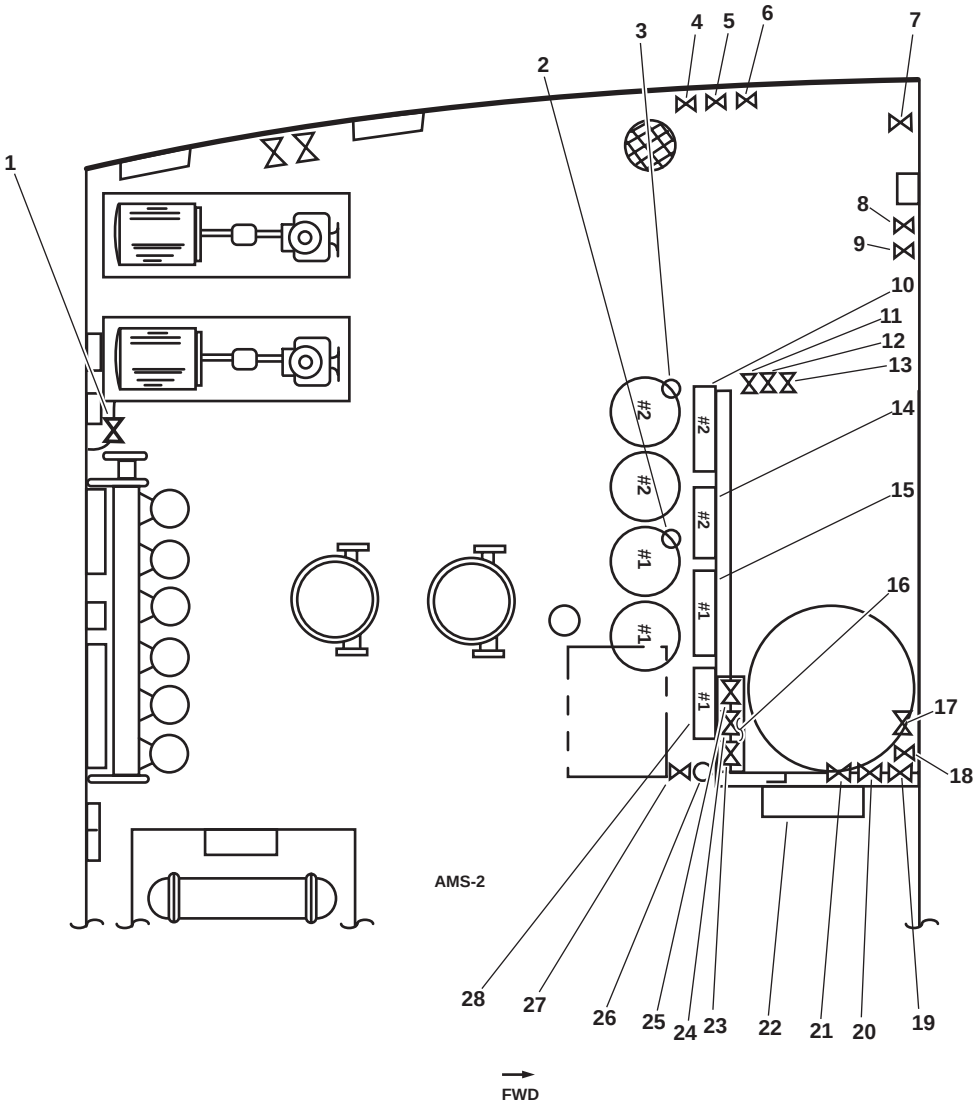


Figure 8. Reverse Osmosis Water Purification Unit (ROWPU) General Arrangement

Table 8. Reverse Osmosis Water Purification Unit (ROWPU) General Arrangement (refer to figure 8)

Key	Control/Indicator	Function
1	RO-V-9, ROWPU Auxiliary Fresh Water Pressure Pump Supply	This valve controls the fresh water supplied for ROWPU flushing during maintenance cycles.
2	RO-PG-1-1, ROWPU 1 20-Micron Filter Outlet/ 5-Micron	This gauge indicates pressure at the 5-micron filter inlet for ROWPU 1. It is used with the high pressure pump inlet pressure gauge to determine differential pressure across the 5-micron filter. Refer to table 2.

Table 8. ROWPU General Arrangement (refer to figure 8) (continued)

Key	Control/Indicator	Function
3	RO-PG-2-1, ROWPU 2 25-Micron Filter Outlet/ 5-Micron Filter Inlet Pressure	This gauge indicates pressure at the 5-micron filter inlet for ROWPU 2. It is used with the high pressure pump inlet pressure gauge to determine differential pressure across the 5-micron filter. Refer to table 9.
4	PW-37, BROMINATOR INLET Valve	This valve controls the flow of potable water into the brominator.
5	PW-36, BYPASS-BROMINATOR Valve	This valve is OPEN to bypass the brominator.
6	PW-38, Inlet Valve	This valve controls the discharge flow from the brominator.
7	PW-84, POT. WTR. TO BROMINATOR Valve	This valve is OPEN to permit the vessel's potable water to recirculate through the brominator.
8	RO-V-7, Backflow Preventer Inlet Valve	This valve controls the flow of water into the fresh water flush circuit's backflow preventer.
9	RO-V-6, Backflow Preventer Discharge Valve	This valve controls the flow of water out of the fresh water flush circuit's backflow preventer.
10	ROWPU 2 Flow Control Panel	This panel contains the gauges needed to monitor the quantity and quality of product water and the means to control overall system pressure for ROWPU 2. Refer to table 10.
11	RO-V-1-2, ROWPU 1 Brine Discharge Valve	This valve controls the flow of brine discharge from ROWPU 1.
12	RO-V-2-2, ROWPU 2 Brine Discharge Valve	This valve controls the flow of brine discharge from ROWPU 2.
13	RO-V-8, Product Water Discharge Valve	This valve controls the flow of product water discharge from the ROWPUs.
14	ROWPU 2 System Controller	The controller monitors the salt content of the product water by means of the salinity probe, and signals the 3-way diversion valve when potable water is being produced. The 3-way diversion valve and pump motors are all directly connected to, and governed by, the system controller. Refer to table 11.
15	ROWPU 1 Flow Control Panel	This panel contains the gauges needed to monitor the quantity and quality of product water and the means to control overall system pressure for ROWPU 1. Refer to table 10.
16	Media Filter Gauges and Valves	The gauges indicate pressure in the media filter, and the valves control the flow of water in and out of the media filter for maintenance purposes. Refer to table 12.
17	RO-V-10, Media Filter Backflush Discharge	This valve permits the operator to purge the filtered contents of the media filter overboard if it becomes clogged. Refer to table 13.

Table 8. ROWPU General Arrangement (refer to figure 8) (continued)

Key	Control/Indicator	Function
18	RO-V-11, Media Filter Drain Valve	OPEN this valve to drain the media filter.
19	RO-V-2, Media Filter Supply	This valve controls the flow of raw water to into the media filter. Refer to table 13.
20	RO-V-3, Media Filter Discharge	This valve controls the flow of filtered raw water out of the media filter. This valve is OPEN during normal ROWPU operation. Refer to table 6.
21	RO-V-4, Media Filter Bypass	This valve permits the operator to bypass the media filter during ROWPU operation. Refer to table 13.
22	440V Power Panel No. 5	This panel provides 440 Vac to the ROWPU system. Refer to table 14.
23	RO-V-1-1, ROWPU 1 Inlet Sea Water Supply	This valve controls the flow of raw water from the media filter into the 25-micron filter basket for ROWPU 1. Refer to table 9.
24	RO-V-5, ROWPU Cleaning Supply	This valve permits the operator to pump cleaning solution and chemicals through the ROWPU during maintenance. Refer to table 9.
25	RO-V-2-,1 ROWPU 2 Inlet Sea Water Supply	This valve controls the flow of raw water from the media filter into the 20-micron filter basket for ROWPU 2. Refer to table 9.
26	RO-PG-1, ROWPU General Service Pressure	This gauge indicates raw water pressure into the ROWPU system.
27	RO-V-1, Main Sea Water Supply	This valve controls the flow of raw water into the ROWPU system.
28	ROWPU 1 System Controller	The controller monitors the salt content of the product water by means of the salinity probe, and signals the 3-way diversion valve when potable water is being produced. The 3-way diversion valve and pump motors are all directly connected to, and governed by, the system controller. Refer to table 4.

FILTRATION SYSTEM VALVES AND GAUGES

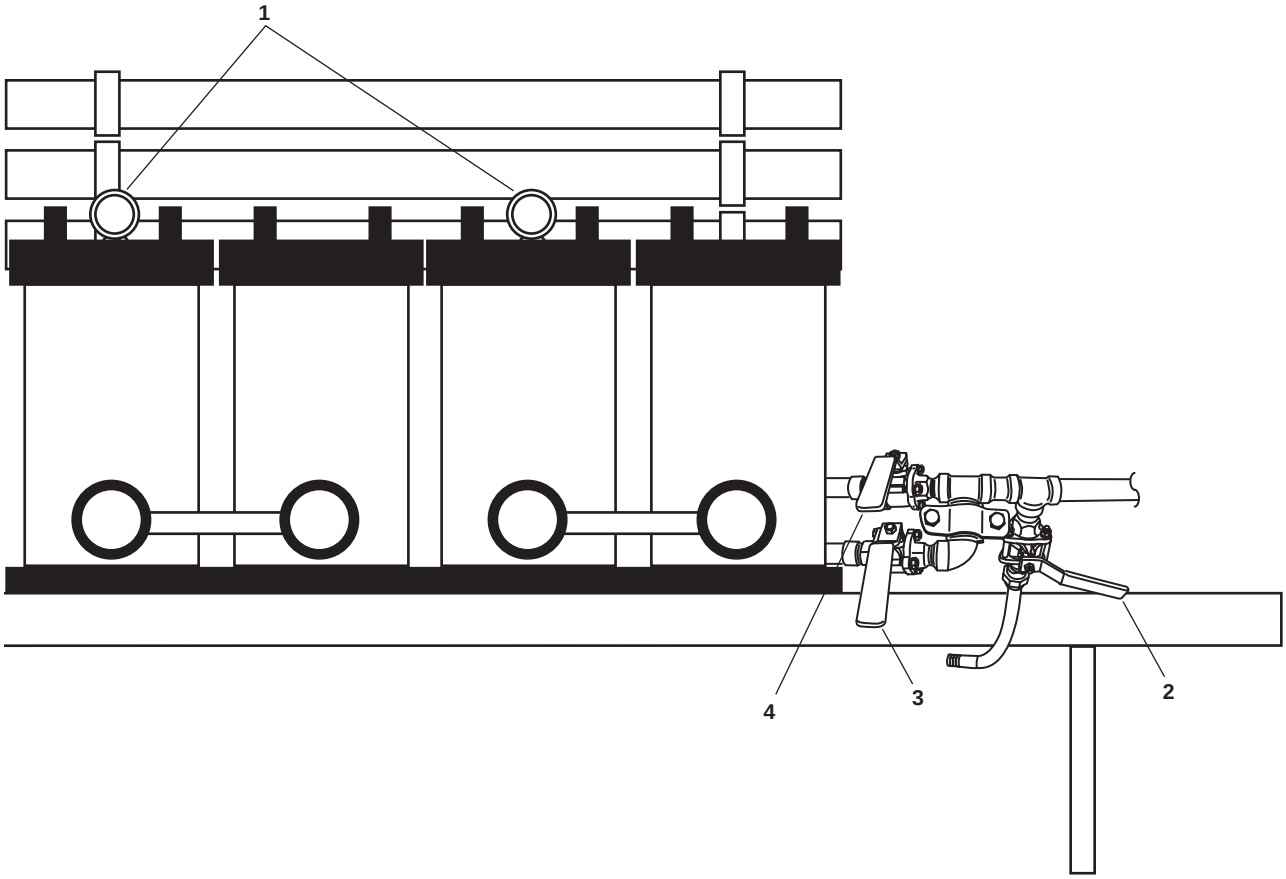


Figure 9. Filtration System Valves and Gauges

Table 9. Filtration System Valves and Gauges (refer to figure 9)

Key	Control/Indicator	Function
1	RO-PG-1-1 (RO-PG-2-1) ROWPU 1 (2) 5-Micron Filter Inlet Pressure Gauge	This gauge indicates pressure at the 5-micron filter inlet. It is used with the high pressure pump inlet pressure gauge to determine differential pressure across the 5-micron filter.
2	RO-V-5 ROWPU Cleaning Supply	The cleaning supply valve controls the introduction of chemical cleaning and flushing solutions into the ROWPU during maintenance periods.
3	RO-V-1-1 ROWPU 1 Inlet Sea Water Supply	This valve controls the flow of raw water into the ROWPU 1 20-micron filter basket.
4	RO-V-2-1 ROWPU 2 Inlet Sea Water Supply	This valve controls the flow of raw water into the ROWPU 2 20-micron filter basket.

FLOW CONTROL PANEL INDICATORS AND CONTROLS

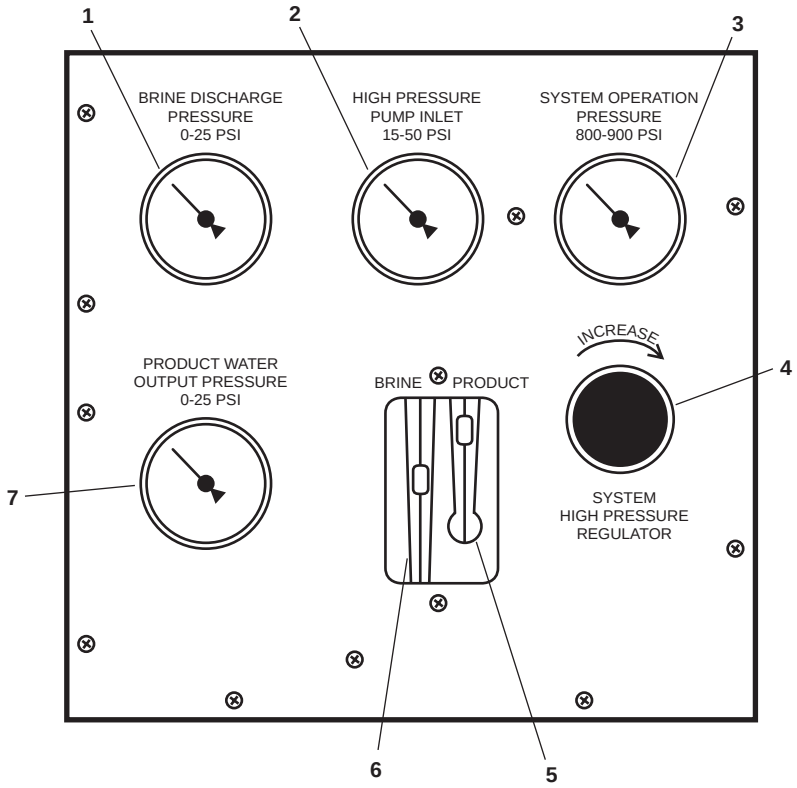


Figure 10. Flow Control Panel Indicators and Controls

Table 10. Flow Control Panel Indicators and Controls (refer to figure 10)

Key	Control/Indicator	Function
1	BRINE DISCHARGE PRESSURE Gauge	This gauge indicates the pressure in the brine discharge header.
2	HIGH PRESSURE PUMP INLET-PRESSURE Gauge	This gauge indicates the pressure at the high pressure pump inlet. It is used in combination with the 5-micron filter inlet pressure gauge to determine differential pressure across the 5-micron filter.
3	SYSTEM OPERATION PRESSURE Gauge	This gauge indicates the output pressure of the high pressure pump.
4	SYSTEM HIGH PRESSURE REGULATOR Valve	This valve controls the operating pressure in the ROWPU. Turn the valve clockwise to increase system pressure, and turn it counterclockwise to decrease the system pressure.
5	PRODUCT Flow Meter	This flow meter indicates product water flow in gallons per hour. It also provides an indication water quality being produced.
6	BRINE Flow Meter	This flow meter indicates the amount of brine that the ROWPU is expelling overboard.
7	PRODUCT WATER OUTPUT PRESSURE Gauge	This gauge indicates the pressure present in the product water line.

SYSTEM CONTROLLER

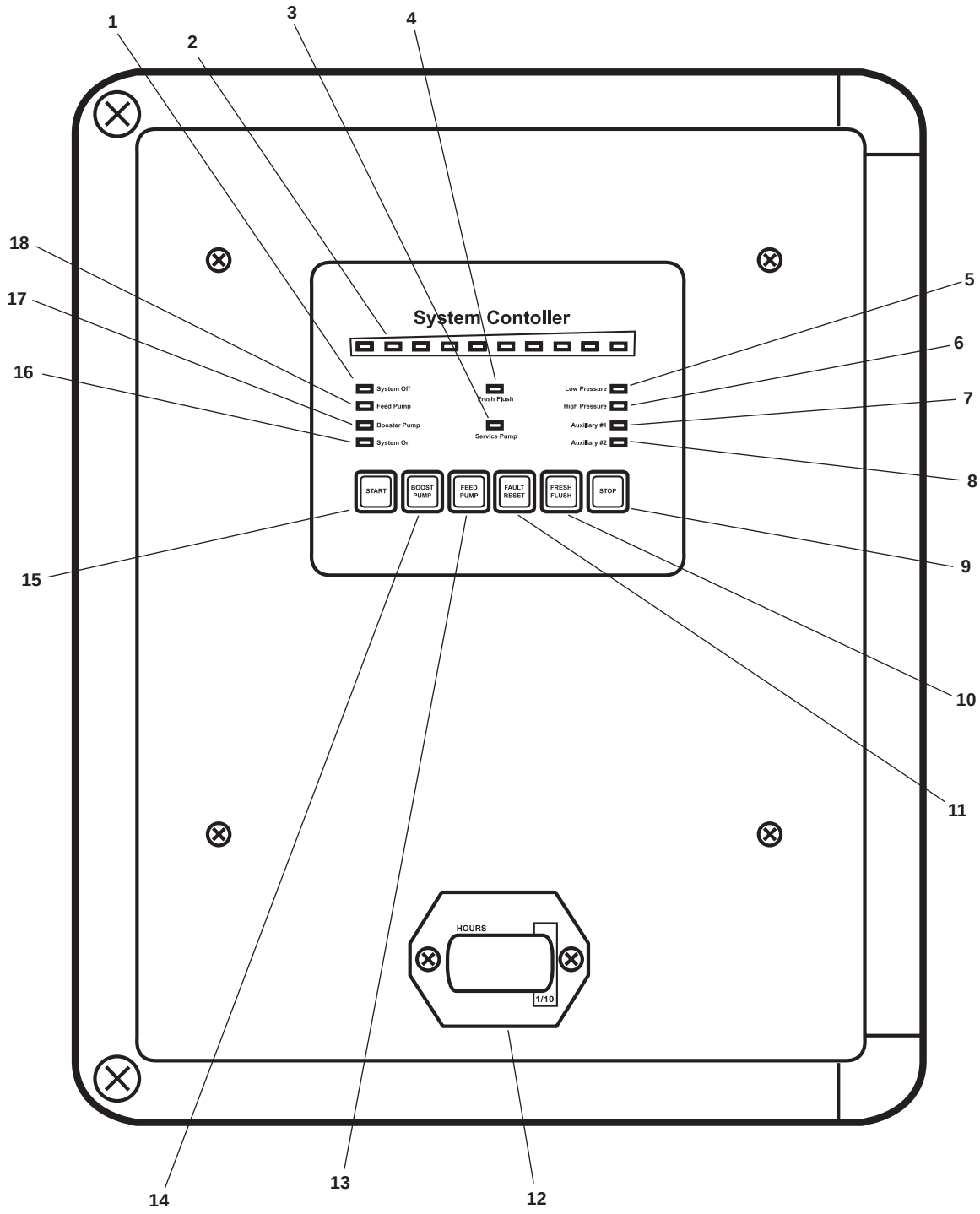


Figure 11. System Controller

Table 11. System Controller (refer to figure 11)

Key	Control/Indicator	Function
1	SYSTEM OFF LED	Indicates no pumps or controlled processes are running, but power is available to the ROWPU.
2	Salinity Meter	The salinity meter indicates product water salinity. The meter displays its increasing values left to right, and each lit LED indicates a value of 100 parts per million (PPM). The first three LEDs are green, followed by six yellow, and a single red.
3	SERVICE PUMP LED	The service pump fault LED illuminates when 500 hours have elapsed, and scheduled pump service is due.
4	FRESH FLUSH LED	This LED illuminates to indicate that the ROWPU fresh water flush cycle is in progress.
5	LOW PRESSURE LED	This LED illuminates to indicate that the ROWPU has shut down due to low raw water pressure at the high pressure pump inlet.
6	HIGH PRESSURE LED	This LED illuminates to indicate that the ROWPU has shut down due to excessive system operation pressure.
7	AUXILIARY #1 LED	This LED illuminates to indicate that the high pressure pump has shut down due to excessive internal temperature.
8	AUXILIARY #2 LED	This LED is not used on the vessel.
9	STOP Switch	This switch is pressed to halt the current operation, and to shut down the ROWPU during normal operation or in an emergency.
10	FRESH FLUSH Switch	This switch is pressed to begin the fresh water flush cycle during maintenance.
11	FAULT RESET Switch	This switch is pressed to reset the system fault that automatically shuts down the ROWPU.
12	Hour Meter	This meter registers the total operating hours of the system, and it assists the operator in following a regular scheduled maintenance program.
13	FEED PUMP Switch	This switch is not used on the vessel.
14	BOOST PUMP Switch	This switch is not used on the vessel.
15	START Switch	This is pressed to provide power to the high pressure pump, and to begin normal operation of the ROWPU.
16	SYSTEM ON LED	This LED illuminates to indicate that the ROWPU is operating normally, or that a controlled process is in progress.
17	BOOSTER PUMP LED	This LED is not used on the vessel.
18	FEED PUMP LED	This LED illuminates to indicate that the high pressure pump is running.

MEDIA FILTER GAUGES AND MAINTENANCE VALVES

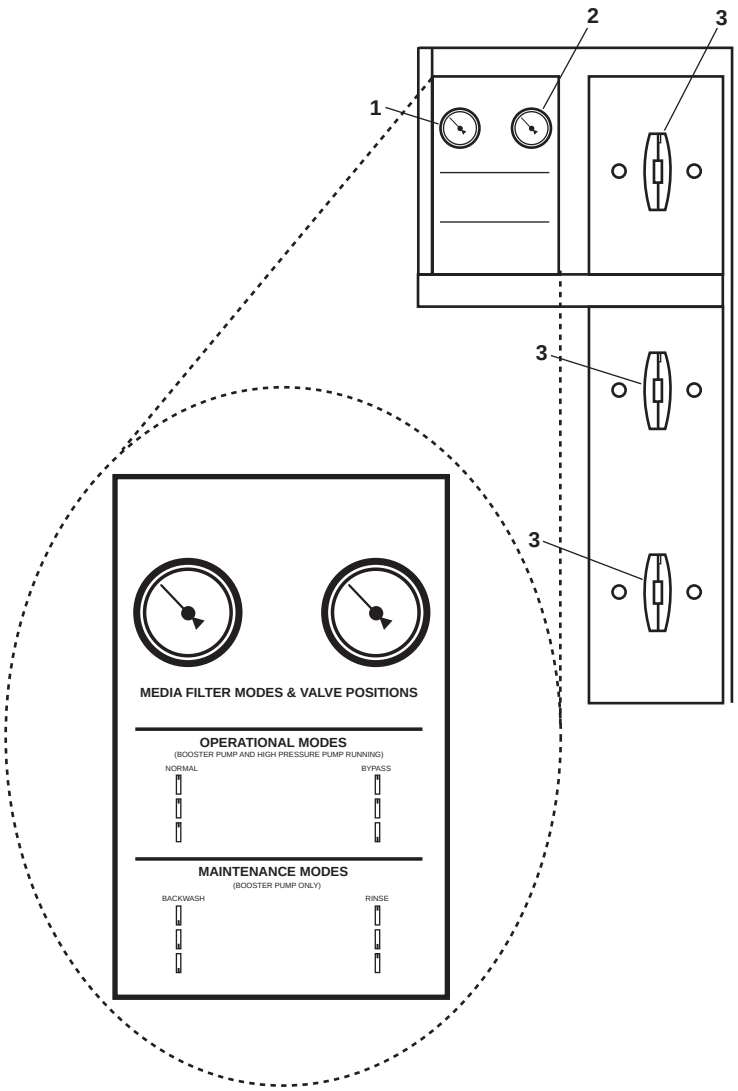


Figure 12. Media Filter Gauges and Maintenance Valves

Table 12. Media Filter Gauges and Maintenance Valves (refer to figure 12)

Key	Control/Indicator	Function
1	Media Filter INLET PRESSURE Gauge	This gauge indicates media filter inlet pressure.
2	Media Filter OUTLET PRESSURE Gauge	This gauge indicates media filter outlet pressure.
3	Media Filter Maintenance Manifold Valves	These valves allow the operator to control the various maintenance cycles associated with the media filter.

MEDIA FILTER VALVE LOCATIONS

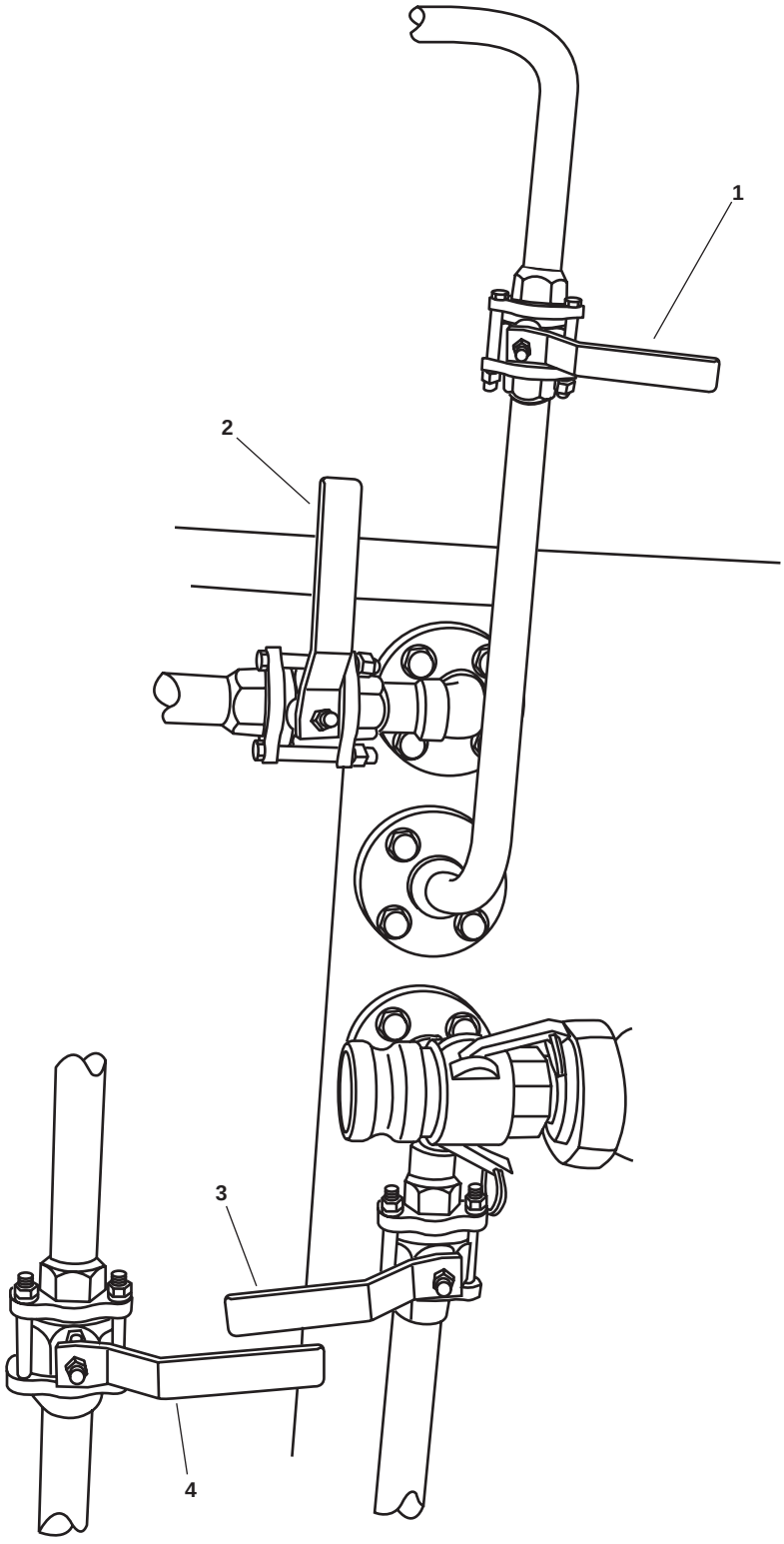


Figure 13. Media Filter Valve Locations

Table 13. Media Filter Valves (refer to figure 13)

Key	Control/Indicator	Function
1	RO-V-10, Media Filter Backflush Discharge	This valve allows the operator to purge the filtered contents of the media filter overboard if it becomes clogged.
2	RO-V-3, Media Filter Discharge	This valve allows filtered raw water to exit the media filter. This valve is OPEN during normal ROWPU operation.
3	RO-V-2, Media Filter Supply	This valve allows raw water to enter the media filter.
4	RO-V-4, Media Filter Bypass	This valve permits the operator to bypass the media filter during ROWPU operation.

24 Vdc CONTROL PANEL

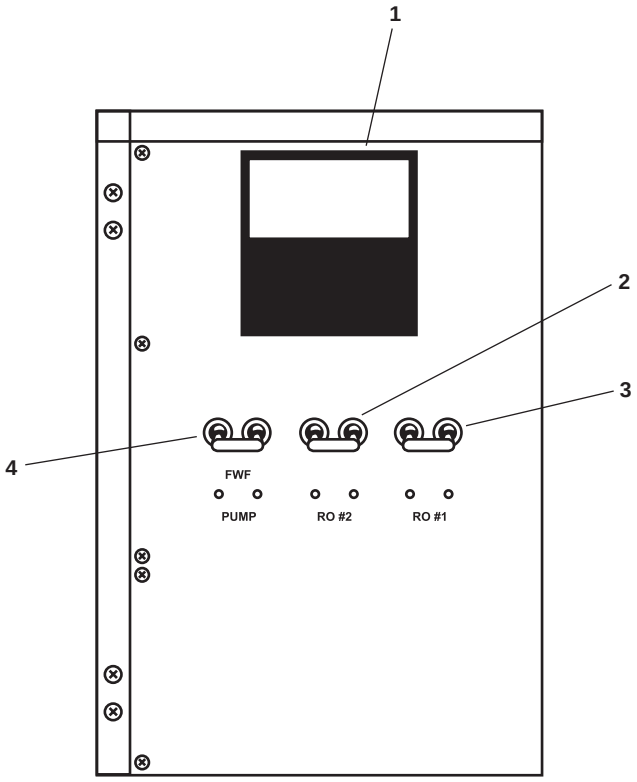


Figure 14. 24 Vdc Control Panel

Table 14. 24 Vdc Control Panel (refer to figure 14)

Key	Control/Indicator	Function
1	Voltmeter	This meter indicates the voltage available to the 24 Vdc control panel
2	RO #2 Circuit Breaker	This circuit breaker provides circuit protection and control for ROWPU 2 24 Vdc circuits.
3	RO #1 Circuit Breaker	This circuit breaker provides circuit protection and control for ROWPU 1 24 Vdc circuits.
4	FWF PUMP Circuit Breaker	This circuit breaker provides circuit protection and control for the fresh water flush pump.

440V POWER PANEL NO. 5

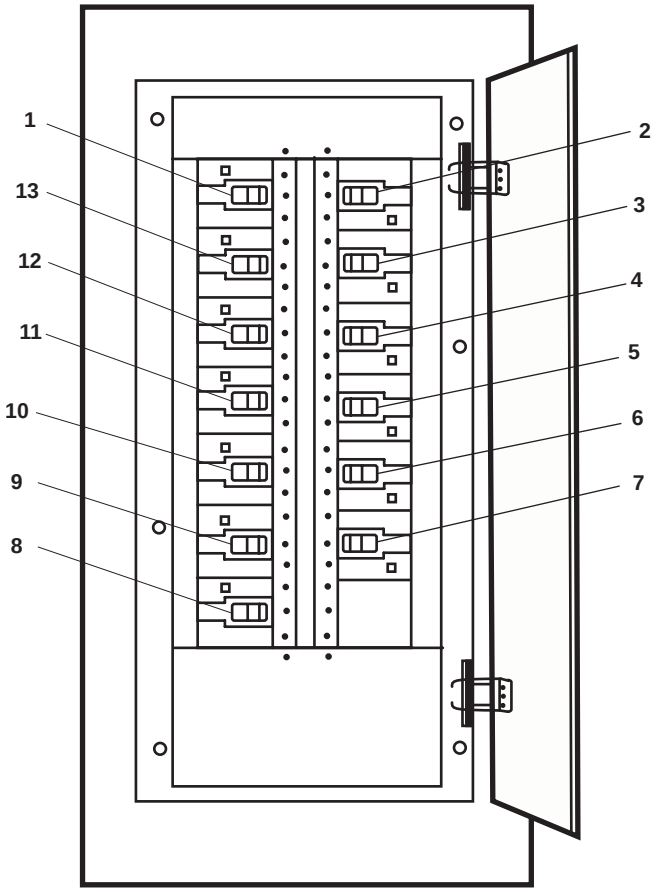


Figure 15. 440V Power Panel No. 5

Table 15. 440V Power Panel No. 5 (refer to figure 15)

Key	Control/Indicator	Function
1	UNIT HEATER. (AUXILIARY MACHINERY SPACE No. 2.). Circuit Breaker	This provides control of, and protection for, the space heater in AMS 2.
2	POTABLE WATER PUMP No. 1. Circuit Breaker	This provides control of, and protection for, potable water pump 1.
3	REVERSE OSMOSIS WATER MAKER No. 1. Circuit Breaker	This provides control of, and protection for, the water purification unit.
4	WELDING MACHINE. Circuit Breaker	This provides control of, and protection for, the welding machine.
5	AIR CONDITIONING REFRIGERATION PLANT No. 2. Circuit Breaker	This provides control of, and protection for, air conditioning refrigeration plant 2.
6	STORE REFRIGERATION PLANT No. 2 Circuit Breaker	This provides control of, and protection for, store refrigeration plant 2.

Table 15. 440V Power Panel No. 5 (refer to figure 15) (continued)

Key	Control/Indicator	Function
7	SPARE. Circuit Breaker	This circuit breaker is a spare provided for expansion.
8	SPARE. Circuit Breaker	This circuit breaker is a spare provided for expansion.
9	TOWING GEAR LOCKER UNIT HEATER. Circuit Breaker	This provides control of, and protection for, the space heater in the towing gear locker.
10	STORE REFRIGERATION PLANT No. 1./FREEZE BOX DEFROST HEATER. Circuit Breaker	This provides control of, and protection for, store refrigeration plant 1 and the freeze box defrost heater.
11	AIR CONDITIONING REFRIGERATION PLANT No. 1. Circuit Breaker	This provides control of, and protection for, air conditioning refrigeration plant 1.
12	REVERSE OSMOSIS WATER MAKER No. 2. Circuit Breaker	This provides control of, and protection for, the water purification unit.
13	POTABLE WATER PUMP No. 2. Circuit Breaker	This provides control of, and protection for, potable water pump 2.

PA SYSTEM SPEAKER AND VOLUME CONTROL

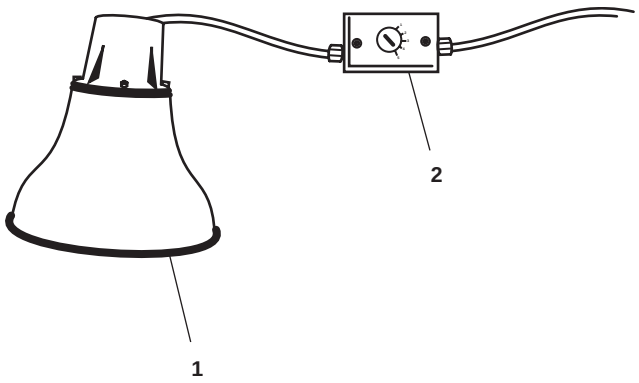


Figure 16. PA System Speaker and Volume Control

Table 16. PA System Speaker and Volume Control (refer to figure 16)

Key	Control/Indicator	Function
1	Loudspeaker	The loudspeaker broadcasts the PA system.
2	Volume Control	This controls the volume of the loudspeaker (table 10, item 1).

FM-200 FIRE SUPPRESSION SYSTEM

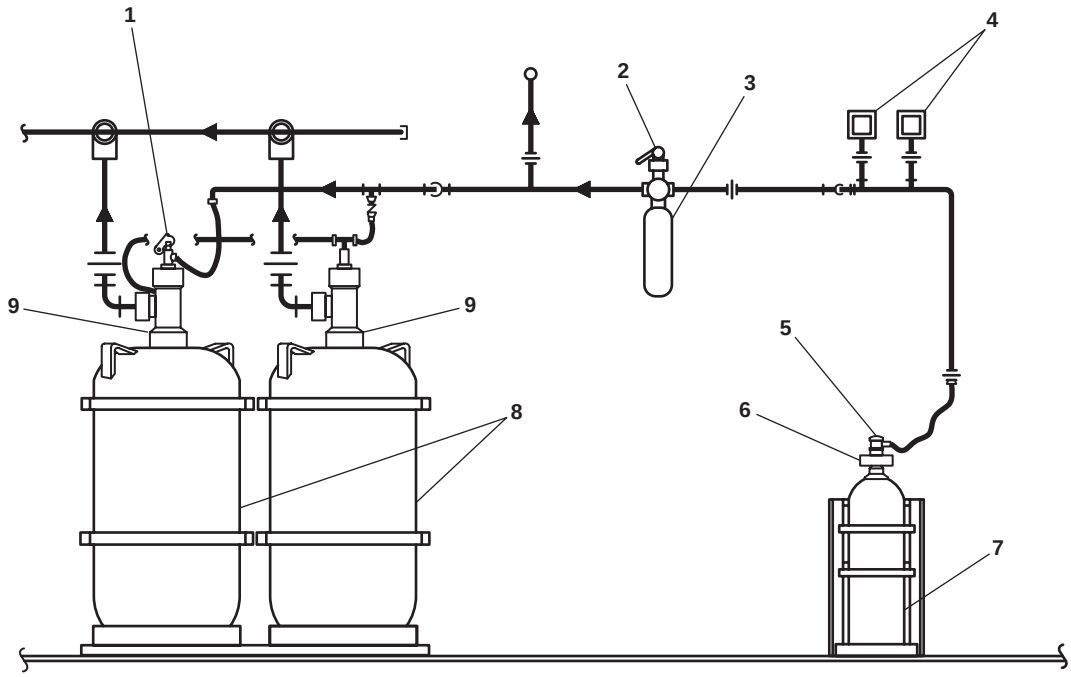


Figure 17. FM-200 Fire Suppression System

Table 17. FM-200 Fire Suppression System (refer to figure 17)

Key	Control/Indicator	Function
1	Manual/Pressure Operated Control Head	This manual permits both manual and pressure actuation of the discharge delay valve.
2	Discharge Delay Valve	When CLOSED, the 60-second delay is active. When OPEN, the 60-second delay is overridden.
3	Discharge Delay Cylinder	This enables the 60-second delay when the discharge delay valve is CLOSED.
4	Pressure Activated Switches	When the FM-200 system is actuated, these switches automatically secure the engine room and AMS 1 ventilation, SSDG 1, SSDG 2, the bow thruster engine, and the pump drive engine.
5	Cable Operated Control Head	When the release T-handle is pulled, this control head releases CO_2 gas that controls the discharge of FM-200 from the cylinders.
6	Discharge Valve	This valve controls the discharge of CO_2 gas from the CO_2 cylinder .
7	CO_2 Cylinder	This stores the CO_2 gas that controls actuation of the FM-200 system.
8	FM-200 Cylinders	These store the FM-200 fire suppression agent. The main cylinders are shown; the bilge cylinder is similar.

Table 17. FM-200 Fire Suppression System (refer to figure 17) (continued)

Key	Control/Indicator	Function
9	Discharge Valve	This valve permits the discharge of FM-200 fire suppression agent when actuated manually with the manual release valve or by the pressure of CO_2 gas when released from the CO_2 cylinder.

POTABLE WATER HYDROPNEUMATIC TANK

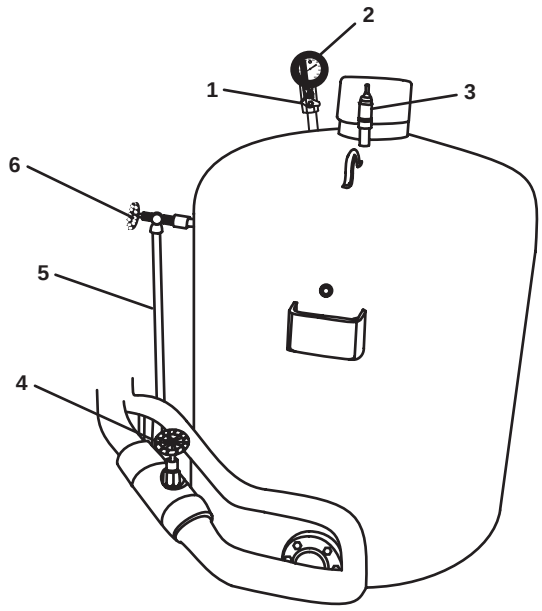


Figure 18. Potable Water Hydropneumatic Tank

Table 18. Potable Water Hydropneumatic Tank (refer to figure 18)

Key	Control/Indicator	Function
1	Cutoff Valve, Pressure Gauge	This secures pressure to the pressure gauge.
2	Pressure Gauge	This indicates the air pressure within the hydropneumatic reservoir.
3	Fill/Vent Valve	This permits air to be added to or bled from the pneumatic side of the tank.
4	PW-78, C.O.V. HYDR. PNEU TK. OUTLET Valve	This controls the discharge from the hydropneumatic tank.
5	Sight Glass	This indicates the level of potable water within the tank.
6	Cutoff Valve	This secures the water to the sight glass.

EMERGENCY STEERING STATION

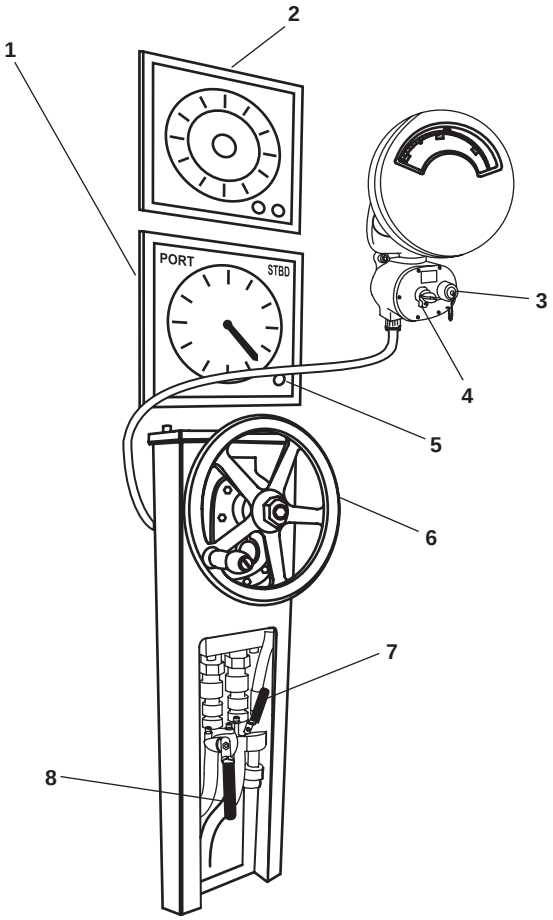


Figure 19. Emergency Steering Station

Table 19. Emergency Steering Station (refer to figure 19)

Key	Control/Indicator	Function
1	Rudder Angle Indicator	This indicates the rudder angle in degrees.
2	Compass Repeater	This provides a display of the reading from the vessel's gyrocompass.
3	Synchronizer Control ON/OFF Switch	Located beneath a screw-off cover, this switch turns the synchronizer control ON and OFF.
4	Dimmer Control	This controls the illumination level of the compass repeater.
5	Dimmer Control	This controls the illumination level of the rudder angle indicator display.
6	Hand Wheel	This provides manual control for the emergency steering pump.
7	SH-7 HAND PMP C.O.V. Valve	This secures the flow of hydraulic oil to and from the emergency steering pump.
8	SH-8 HAND PMP C.O.V. Valve	This secures the flow of hydraulic oil to and from the emergency steering pump.

STEERING SYSTEM HYDRAULIC POWER PACK AND MOTOR CONTROLLER

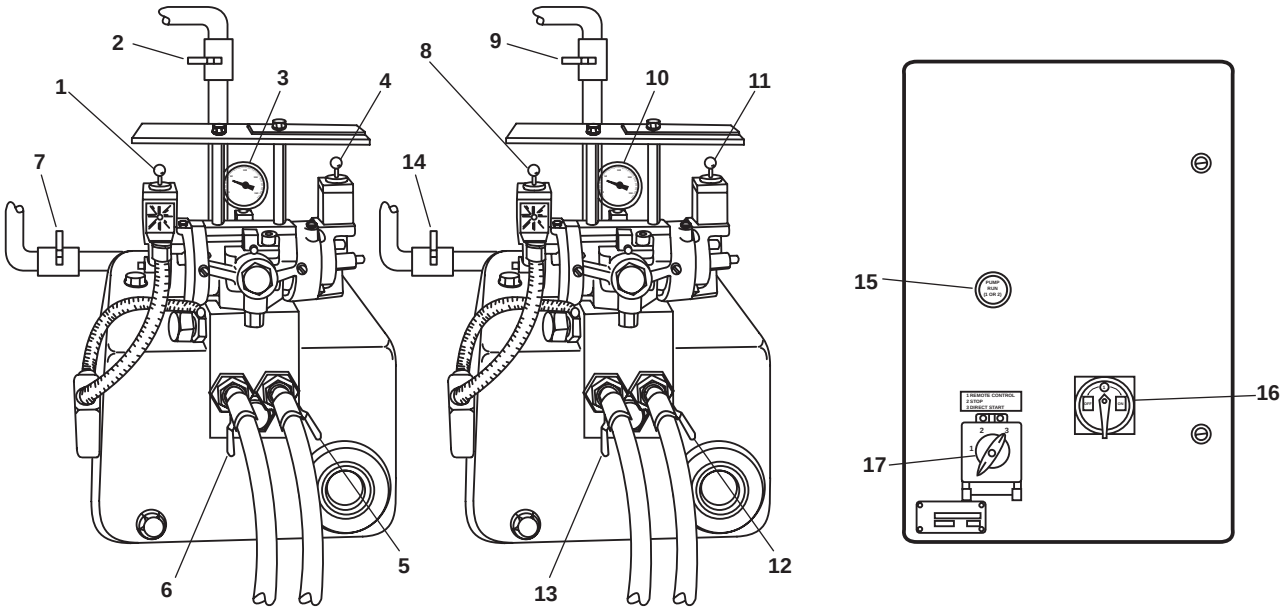


Figure 20. Steering System Hydraulic Power Pack and Motor Controller

Table 20. Steering System Hydraulic Power Pack and Motor Controller (refer to figure 20)

Key	Control/Indicator	Function
1	PORT Hand Lever	Used during manual-powered emergency steering, this lever controls rudder movement to port.
2	SH-5, RUD. MOT NO. 1 SUMP	This valve controls the rudder motor 1 sump.
3	Oil Pressure Gauge	This indicates the operating pressure of the system's hydraulic oil.
4	STBD Hand Lever	Used during manual-powered emergency steering, this lever controls rudder movement to starboard.
5	SH-3, C.O.V.-RUD MOT. No. 1 PRESS/RTN Valve	This is the cutoff valve for rudder motor 1 return.
6	SH-1, C.O.V.-RUD. MOT. No. 1 PRESS/RTN Valve	This is the cutoff valve for rudder motor 1 pressure.
7	Accumulator COV	This valve controls pressure from the accumulator.
8	Port Hand Lever	This lever is used during manual-powered emergency steering, this lever controls rudder movement to port.
9	SH-6, RUD. MOT No. 2 SUMP Valve	This valve controls the rudder motor 2 sump.
10	Oil Pressure Gauge	This gauge indicates the operating pressure of the system's hydraulic oil.
11	STBD Hand Lever	Used during manual-powered emergency steering, this lever controls rudder movement to starboard.

Table 20. Steering System Hydraulic Power Pack and Motor Controller (refer to figure 20) (continued)

Key	Control/Indicator	Function
12	SH-4, C.O.V.- RUD. MOT No. 2 PRESS/RTN Valve	This is the cutoff valve for rudder motor 2 return.
13	SH-2, C.O.V. -RUD MOT. No.2 PRESS/RTN Valve	This is the cutoff valve for rudder motor 2 pressure.
14	Accumulator COV	This valve controls pressure from the accumulator.
15	PUMP RUN (1 or 2) Indicator	This lamp illuminates to indicate that the system is running in REMOTE CONTROL mode.
16	ON-OFF Switch	This switch controls the power into the motor controller.
17	Selector Switch	This switch selects the mode of operation or shuts down the system.

SOUND POWERED TELEPHONE

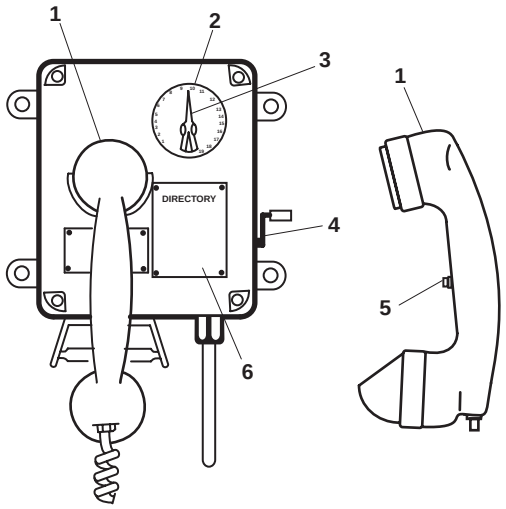


Figure 21. Sound Powered Telephone

Table 21. Sound Powered Telephone (refer to figure 21)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The dial outlines available stations.
3	Selector Knob	Select the station to be called with this knob.
4	Magneto Handle	Crank the handle to call a station.
5	Pushbutton	Press the button to transmit.
6	DIRECTORY Plate	The directory plate lists telephone stations aboard the vessel.

DRILL PRESS

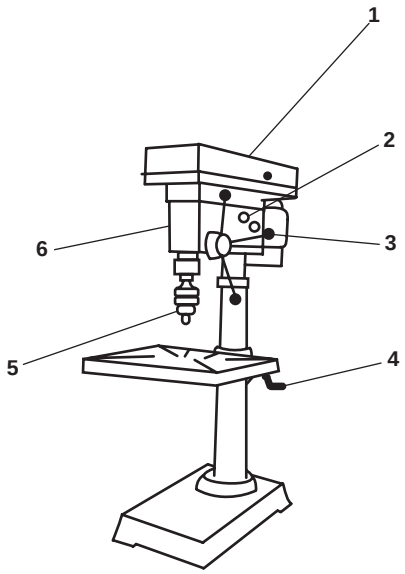


Figure 22. Drill Press

Table 22. Drill Press (refer to figure 22)

Key	Control/Indicator	Function
1	Top Cover	This provides access to the belts and pulleys to change the speed of the drill press.
2	Cam Handle	This engages and disengages the drive train.
3	Handle	The handle controls the height of the spindle.
4	Table Crank	The crank is used to raise or lower the table.
5	Chuck	The chuck is used to secure drill bits.
6	ON/OFF Switch	This switch turns the drill press ON and OFF.

WELDER

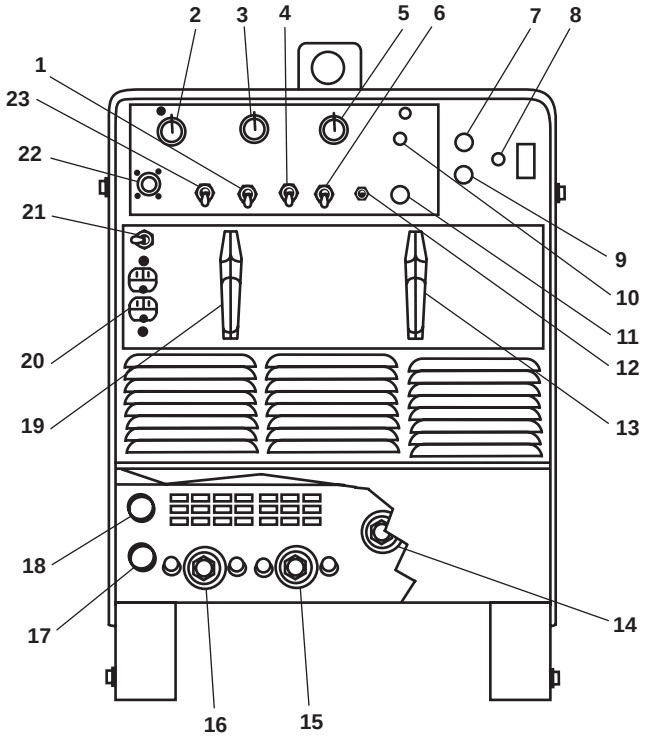


Figure 23. Welder

Table 23. Welder (refer to figure 23)

Key	Control/Indicator	Function
1	START AMPERAGE OFF-ON Control	This provides adjustment of start amperage when the START AMPERAGE ADJUSTMENT control switch is in the ON position.
2	POSTFLOW TIME	Not used.
3	START AMPERAGE ADJUSTMENT Control Switch	This selects whether or not the start amperage will be used for arc initiation.
4	OUTPUT/CONTACTOR ON Switch	This switch must be in the ON position for operation.
5	AMPERAGE ADJUSTMENT Control	This povides fine amperage adjustment within the range selected on the RANGE GTAW switch.
6	AMPERAGE PANEL Switch	This switch must be in the PANEL position for operation.
7	POWER ON Pushbutton	Push this button to turn the welder ON.
8	Indicator Light	This light illuminates to indicate that the engine is ON.

Table 23. Welder (refer to figure 23) (continued)

Key	Control/Indicator	Function
9	POWER OFF Pushbutton	Push this button to turn the welder OFF.
10	SPOT TIME	Not used.
11	Blank	This is a blank switch position for installation of optional equipment.
12	CB1 Circuit Breaker	This provides overload protection for the control circuitry.
13	OUTPUT SELECTOR Switch	This selects mode of operation without changing welding cables.
14	Door	The door protects internal components from dirt.
15	ELECTRODE Weld Output Terminal	This is the connector for attachment of the electrode cable.
16	WORK Weld Output Terminal	This is the connector for attachment of the work cable.
17	Gas In Fitting	Not used.
18	Gas Out Fitting	Not used.
19	RANGE SELECTOR Switch	This switch selects the amperage range.
20	Duplex Receptacle	This provides up to 15A of 120 Vac for accessory or other equipment.
21	Circuit Breaker	This provides overload protection for the duplex receptacle.
22	REMOTE	Not used.
23	HIGH FREQUENCY Switch	This is a three position switch. In the START position, high frequency is present until an arc is established. In the OFF position, high frequency is not present. In the CONTINUOUS position, high frequency is always present.

SPACE HEATER

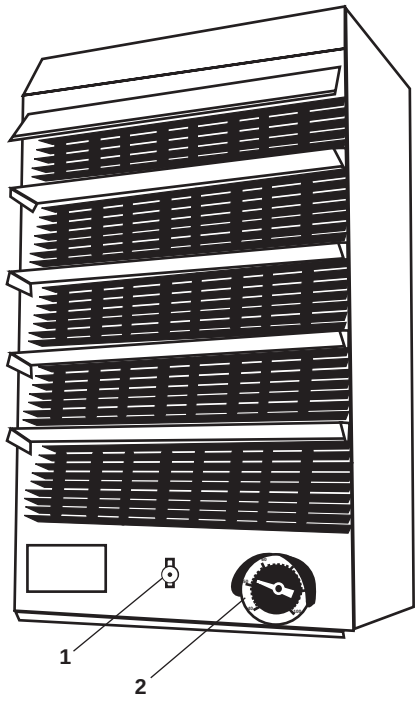


Figure 24. Space Heater

Table 24. Space Heater (refer to figure 24)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the space heater ON and OFF.
2	Thermostat	The thermostat permits adjustment of the temperature in the space.

EXHAUST FAN CONTROLLER

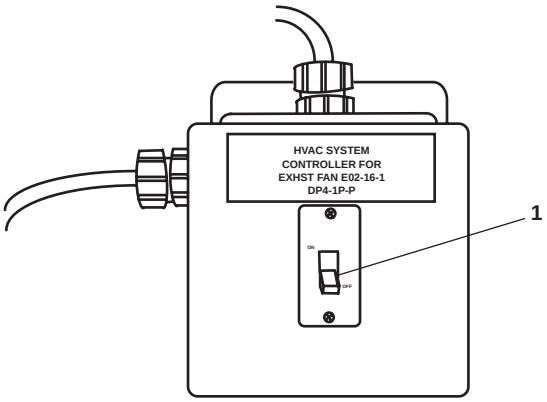


Figure 25. Exhaust Fan Controller

Table 25. Exhaust Fan Controller (refer to figure 25)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the exhaust fan controller ON and OFF.

BENCH GRINDER

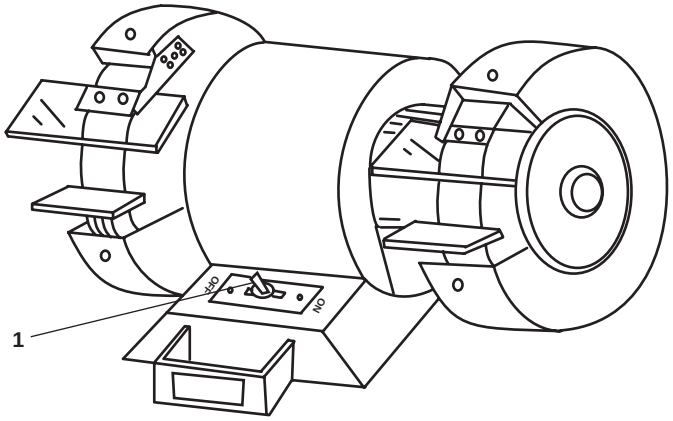


Figure 26. Bench Grinder

Table 26. Bench Grinder (refer to figure 26)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the grinder ON and OFF.

POTABLE WATER GAUGE PANEL

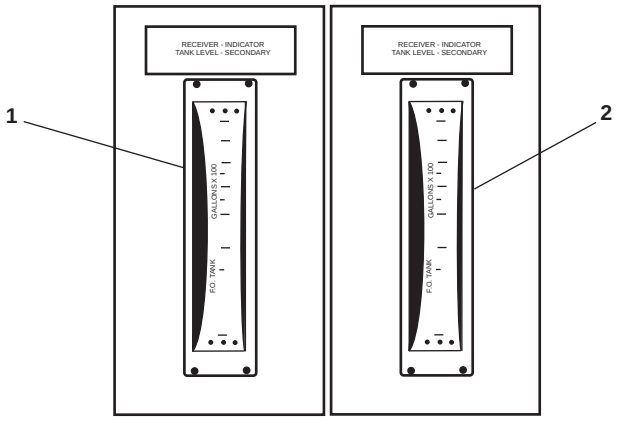


Figure 27. Potable Water Gauge Panel

Table 27. Potable Water Gauge Panel (refer to figure 27)

Key	Control/Indicator	Function
1	TLI, Starboard	This indicates the potable water level in the starboard potable water tank.
2	TLI, Port	This indicates the potable water level in the port potable water tank.

POTABLE WATER PUMP AND BILGE AND BALLAST PUMP MOTOR CONTROLLERS

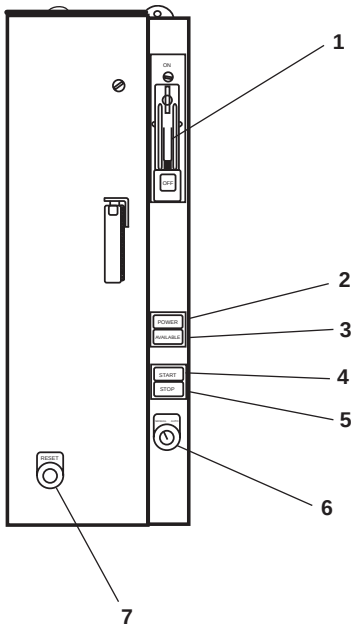


Figure 28. Potable Water Pump and Bilge and Ballast Pump Motor Controllers

Table 28. Potable Water Pump and Bilge and Ballast Pump Motor Controllers (refer to figure 28)

Key	Control/Indicator	Function
1	ON/OFF Breaker	This breaker turns the motor controller ON and OFF and provides circuit protection to the unit.
2	POWER AVAILABLE Indicator	This illuminates to indicate that power is available to the motor controller.
3	MOTOR RUN Indicator	This illuminates to indicate that the motor is running.
4	START Pushbutton	Push this button to START the pump.
5	STOP Pushbutton	Push this button to STOP the pump.
6	AUTO/MAN Switch	This permits selection of operating mode. When in the AUTO position, the unit turns ON and OFF automatically depending upon system requirements. When in the MAN position, the unit runs continuously.
7	RESET Pushbutton	Push this button to RESET the motor controller.

POTABLE WATER PUMPS

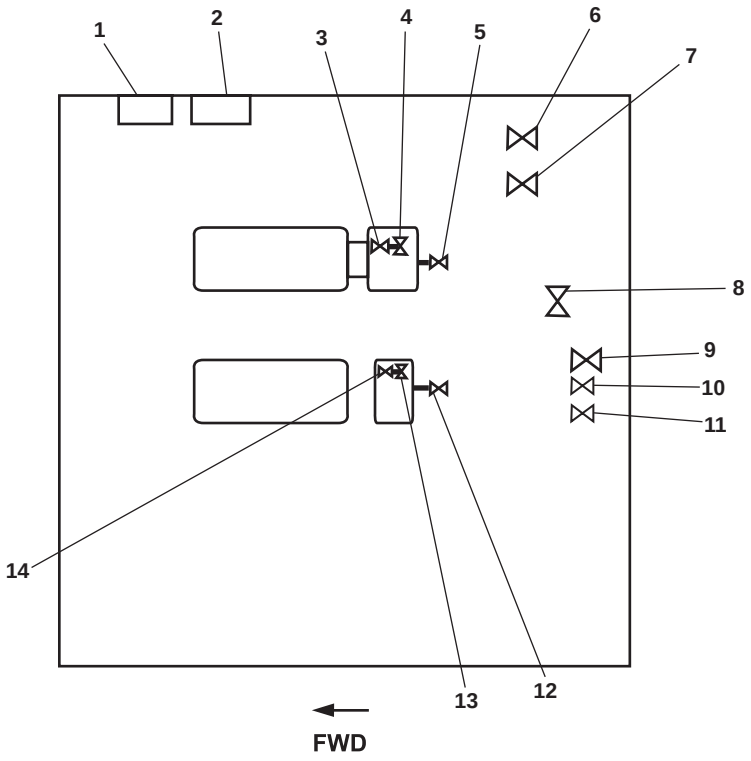


Figure 29. Potable Water Pumps

Table 29. Potable Water Pumps (refer to figure 29)

Key	Control/Indicator	Function
1	POT WTR PMP #2 DISCH PRESS Gauge	This indicates the discharge pressure of potable water pump 2.
2	POT WTR PMP #1 DISCH PRESS Gauge	This indicates the discharge pressure of potable water pump 1.
3	Cutoff Valve, Pressure Gauge	This secures pressure to the potable water pump 1 discharge pressure gauge
4	PW-76, C.O.V. POT. WTR. PMP. No. 1 DISCH. Valve	This valve secures the discharge from potable water pump 1.
5	Drain Valve	When OPEN, this valve drains the volute on potable water pump 1.
6	Potable Water Tank Port Tank Suction Valve	This valve secures the suction from the port potable water pump before the check valve.
7	PW-15, POT. WTR. TK. STBD SUCT Valve	This valve secures the suction from the starboard potable water pump before the check valve.

Table 29. Potable Water Pumps (refer to figure 29) (continued)

Key	Control/Indicator	Function
8	Potable Water Tank Stbd. Tank Suction Valve	This secures the suction from the starboard potable water pump after the check valve.
9	PW-16, C.O.V.-POT. WTR. PMP. No. 1 SUCT Valve	This secures the suction from potable water pump 1.
10	PW-14, POT. WTR. TK. PORT SUCT Valve	This secures the suction from the port potable water pump after the check valve.
11	PW-17, C.O.V.-POT. WTR. PMP. No. 2 SUCT Valve	This secures the suction from potable water pump 2.
12	Drain Valve	When OPEN, this valve drains the volute on potable water pump 1.
13	PW-77, C.O.V. POT. WTR. PMP. No. 2 DISCH. Valve	This secures the discharge from potable water pump 2.
14	Cutoff Valve, Pressure Gauge	This secures pressure to the potable water pump 1 discharge pressure gauge

POTABLE WATER SIGHT GLASS

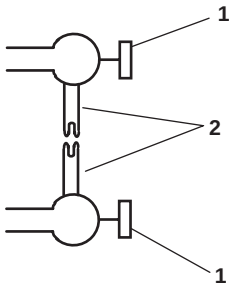


Figure 30. Potable Water Sight Glass

Table 30. Potable Water Sight Glass (refer to figure 30)

Key	Control/Indicator	Function
1	Cutoff Valve	This valve secures the water to the sight glass.
2	Sight glass	This indicates the potable water level in the storage tank.

AIR CONDITIONING AND REFRIGERATION CONDENSING UNITS

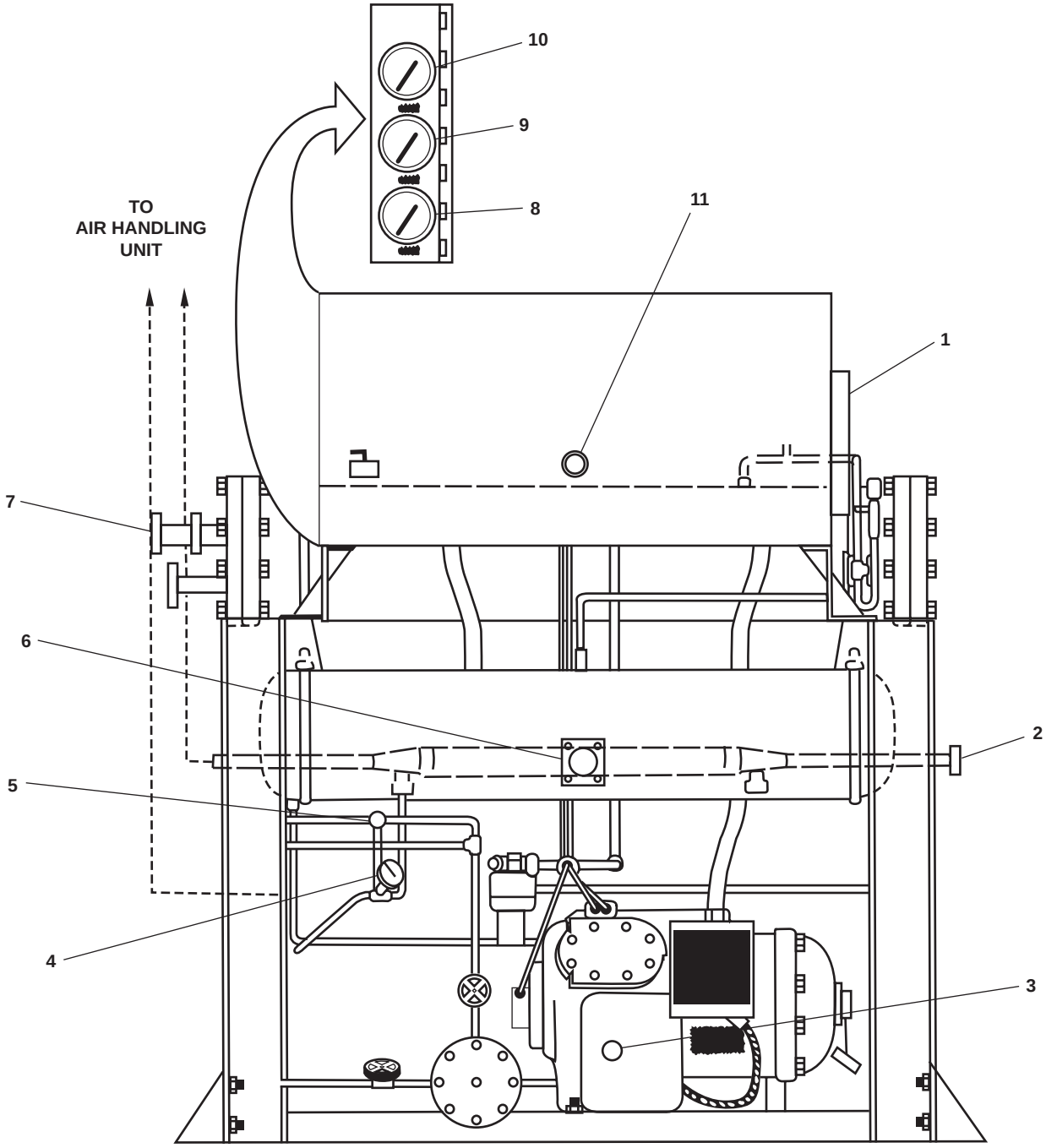


Figure 31. Air Conditioning and Refrigeration Condensing Units

Table 31. Air Conditioning and Refrigeration Condensing Units (refer to figure 31)

Key	Control/Indicator	Function
1	ON-OFF Circuit Breaker	This controls power to the condensing unit.
2	SUCTION Gas Thermometer	This provides temperature of the refrigerant in the suction line.
3	Oil Level Sight Glass	This indicates the oil level in the compressor.
4	Liquid Thermometer	This indicates the temperature of the refrigerant being pumped to the coil.
5	Moisture Indicator	This indicates the moisture level in the pressure line.
6	LIQUID LEVEL Indicator	This indicates the level of liquid refrigerant in the receiver.
7	Water Outlet Connection	This connects the cooling water outlet to the general service system.
8	OIL Pressure Gauge	This indicates compressor oil pressure.
9	SUCTION Pressure Gauge	This indicates the compressor suction pressure.
10	DISCHARGE Pressure Gauge	This indicates the compressor discharge pressure.
11	RESET Button	This resets the compressor electrical circuit.

CONDENSER COOLING WATER VALVES

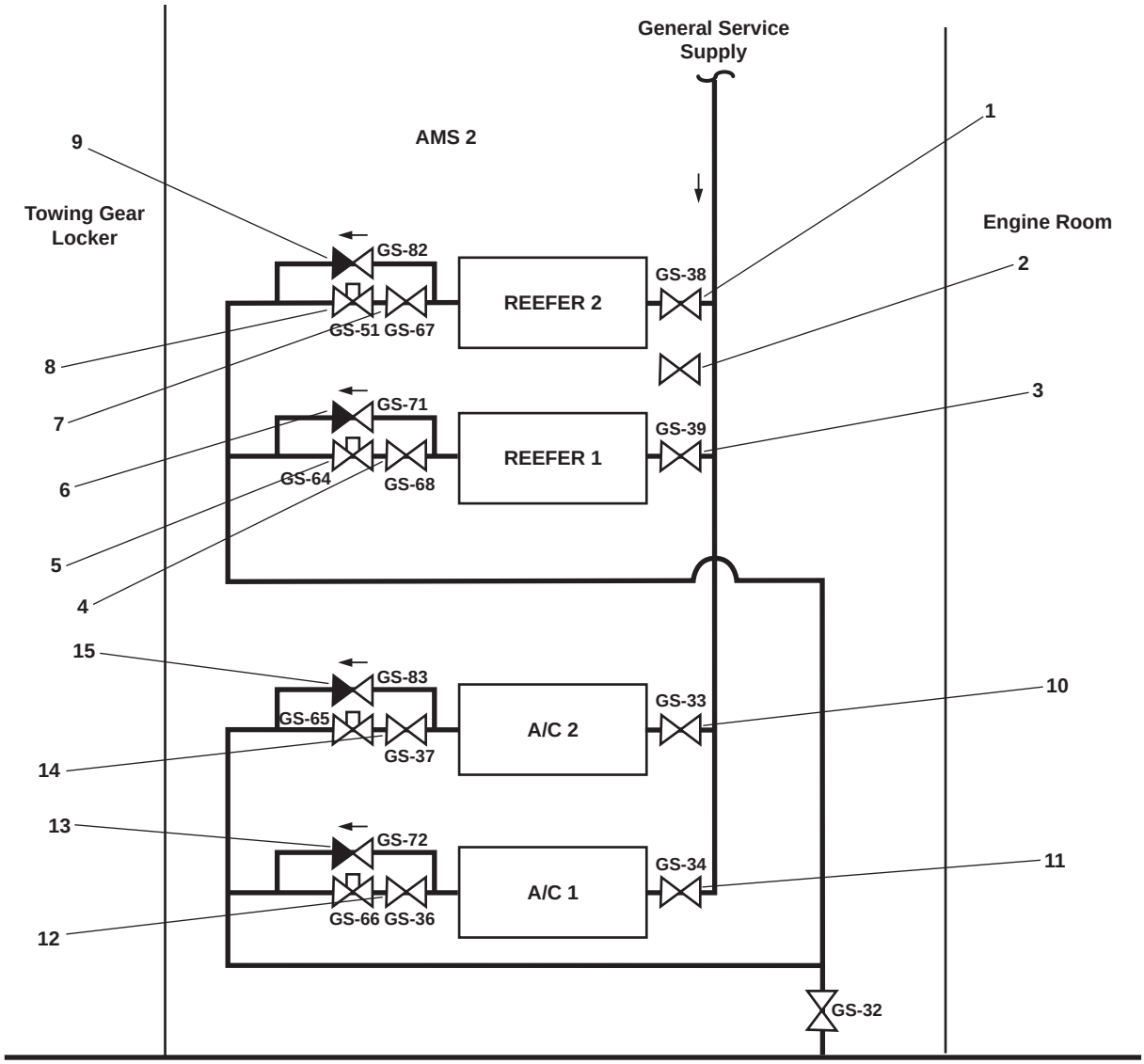


Figure 32. Condenser Cooling Water Valves

Table 32. Condenser Cooling Water Valves (refer to figure 32)

Key	Control/Indicator	Function
1	GS-38, RETR COND No. 1 SPLY Valve	This is the cutoff valve for the reefer 1 condenser supply.
2	Freeze Box Suction COV Valve	This is the cutoff valve for the freeze box air suction.
3	GS-39, RETR COND No. 2 SPLY Valve	This is the cutoff valve for the reefer 2 condenser supply.

Table 32. Condenser Cooling Water Valves (refer to figure 32) (continued)

Key	Control/Indicator	Function
4	GS-68, WTR RLTR COV Valve	This is the cutoff valve for the reefer 1 water regulator.
5	GS-64, Valve	
6	GS-71, BYP WTR RGLTR Valve	This is the cutoff valve for the reefer 1 water regulator bypass.
7	GS-67, WTR RGLTR COV Valve	This is the cutoff valve for the reefer 2 water regulator.
8	GS-51, SW OUT RO No. 2 Valve	
9	GS-82, BYP WTR RGLTR Valve	This is the cutoff valve for the reefer 2 water regulator bypass.
10	GS-33, A/C COND NO. 1 SPLY Valve	This is the cutoff valve for the A/C 1 condenser supply.
11	GS-34, A/C COND NO. 2 SPLY Valve	This is the cutoff valve for the A/C 2 condenser supply.
12	GS-36, WTR RGLTR COV Valve	This is the cutoff valve for the A/C 1 water regulator.
13	GS-72, BYP WTR RGLTR Valve	This is the cutoff valve for the A/C 1 water regulator bypass.
14	GS-37, WTR RGLTR COV Valve	This is the cutoff valve for the A/C 2 water regulator.
15	GS-83, BYP WTR RGLTR Valve	This is the cutoff valve for the A/C 2 water regulator bypass.

EPR AND STERN TUBE GAUGES

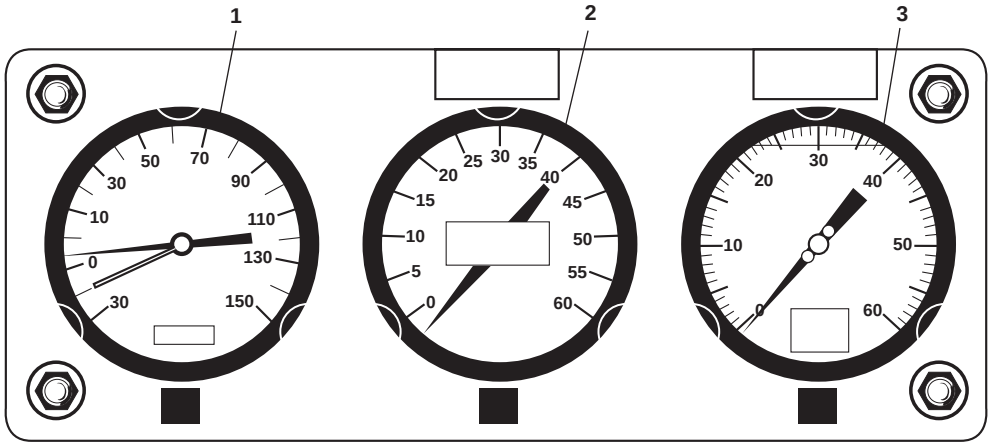


Figure 33. EPR and Stern Tube Gauges

Table 33. EPR and Stern Tube Gauges (refer to figure 33)

Key	Control/Indicator	Function
1	SW PRESS TO EDUCTOR	This indicates the pressure of the seawater to the eductor.
2	SW TO STERNTUBE SEAL PRESS STBD	This indicates the general service pressure supplied to the starboard stern tube seal.
3	SW TO STERNTUBE SEAL PRESS PORT	This indicates the general service pressure supplied to the port stern tube seal.

FIRE AND GENERAL SERVICE PUMP MOTOR CONTROLLERS AND PRESSURE GAUGES

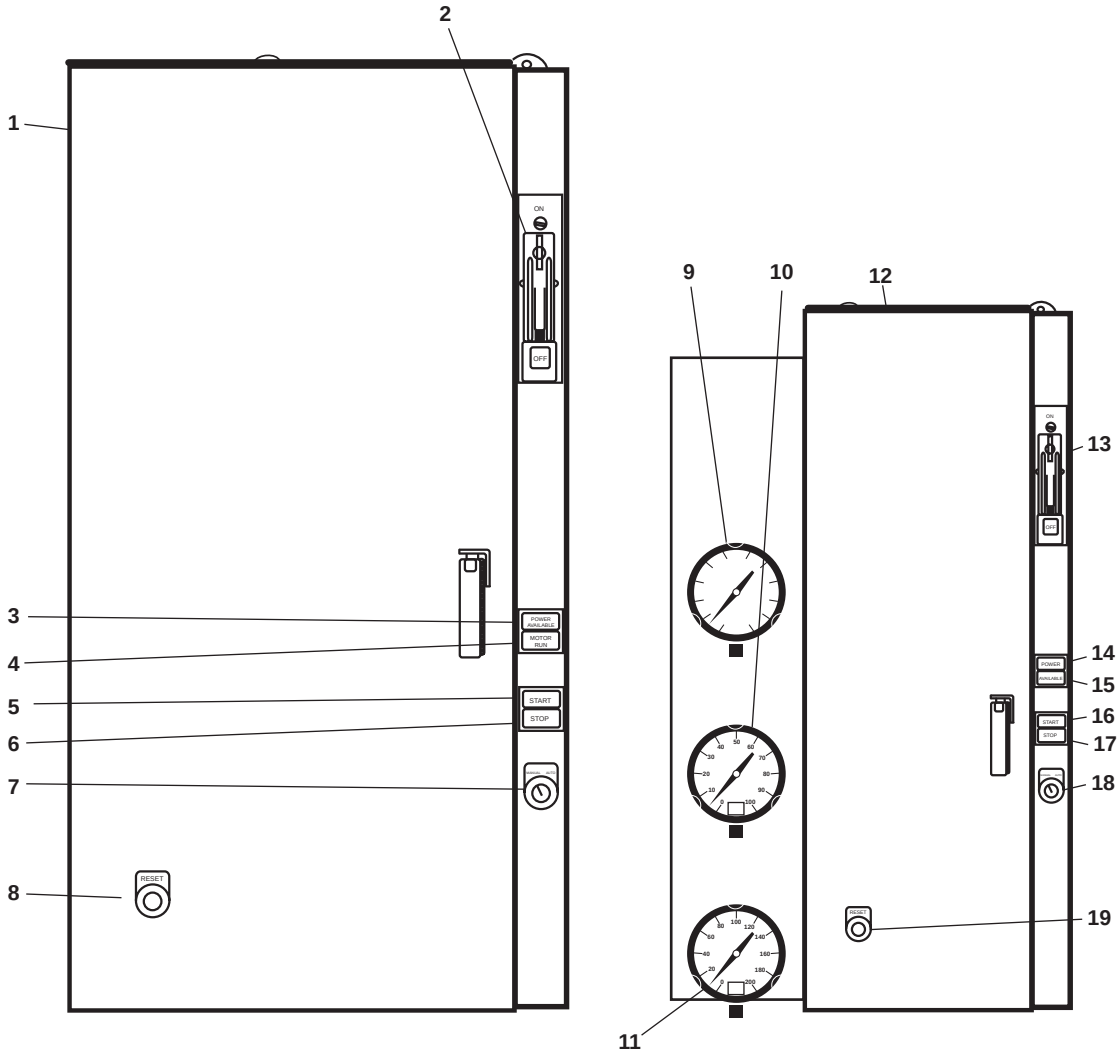


Figure 34. Fire and General Service Pump Motor Controllers and Pressure Gauges

Table 34. Fire and General Service Pump Motor Controllers and Pressure Gauges (refer to figure 34)

Key	Control/Indicator	Function
1	#1 FIRE AND GENERAL SERVICE PUMP (EMERGENCY) Motor Controller	This controls the operation of fire and general service pump 1.
2	ON/OFF Breaker	This turns the motor controller ON and OFF and provides circuit protection to the unit.
3	POWER AVAILABLE Indicator	This illuminates to indicate that power is available to the motor controller.
4	MOTOR RUN Indicator	This illuminates to indicate that the motor is running.

Table 34. Fire and General Service Pump Motor Controllers and Pressure Gauges (refer to figure 34) (continued)

Key	Control/Indicator	Function
5	START Pushbutton	Push this button to START the pump.
6	STOP Pushbutton	Push this button to STOP the pump.
7	AUTO/MAN Switch	This permits selection of operating mode. When in the AUTO position, the pump turns ON and OFF automatically depending upon system require ments. When in the MAN position, the pump runs continuously.
8	RESET Pushbutton	Push this button to RESET the motor controller.
9	FIRE MAIN PRESS Gauge	This indicates the pressure available in the fire main.
10	#2 FIRE/GENL SVCE PMP DISCH PRESS Gauge	This indicates the discharge pressure of fire and general service pump 2.
11	#1 FIRE/GENL SVCE PMP DISCH PRESS Gauge	This indicates the discharge pressure of fire and general service pump 1.
12	#1 FIRE AND GENERAL SERVICE PUMP (EMERGENCY) Motor Controller	This controls the operation of fire and general service pump 1.
13	ON/OFF Breaker	This turns the motor controller ON and OFF and provides circuit protection to the unit.
14	POWER AVAILABLE Indicator	This illuminates to indicate that power is available to the motor controller.
15	MOTOR RUN Indicator	This illuminates to indicate that the motor is running.
16	START Pushbutton	Push this button to START the pump.
17	STOP Pushbutton	Push this button to STOP the pump.
18	AUTO/MAN Switch	This permits selection of operating mode. When in the AUTO position, the pump turns ON and OFF automatically depending upon system require ments. When in the MAN position, the pump runs continuously.
19	RESET Pushbutton	Push this button to RESET the motor controller.

BILGE MANIFOLD

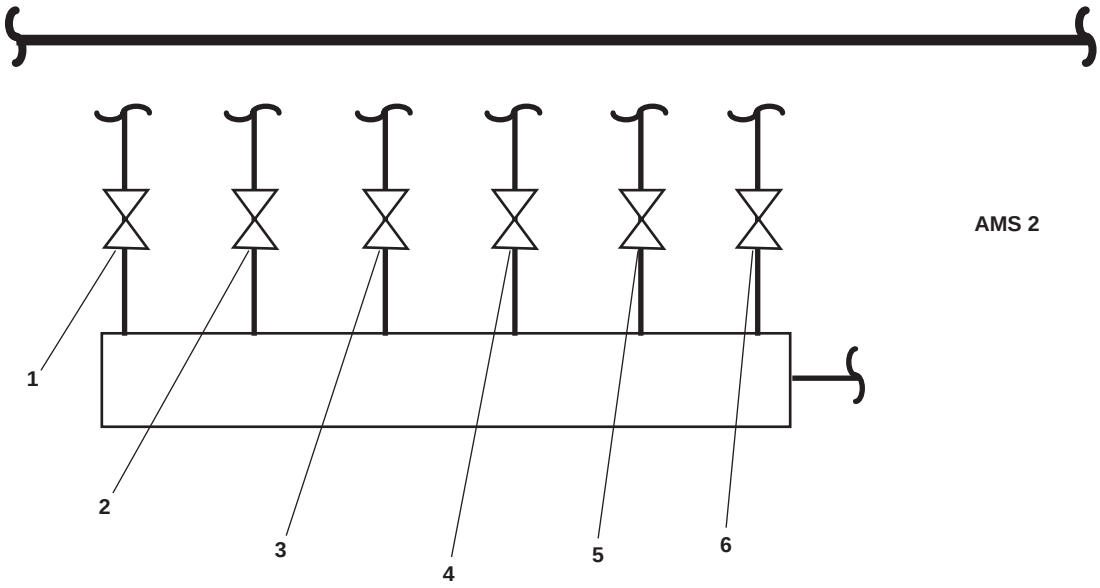


Figure 35. Bilge Manifold

Table 35. Bilge Manifold (refer to figure 35)

Key	Control/Indicator	Function
1	BB-44, BILGE SUCT-STBD SHAFT ALLEY Valve	This valve cuts off bilge flow from AMS 2 starboard.
2	BB-43, BILGE SUCT-PORT SHAFT ALLEY Valve	This valve cuts off bilge flow from AMS 2 port.
3	BB-42, BILGE SUCT- E.R. STBD Valve	This valve cuts off bilge flow from AMS 1 port.
4	BB-41, BILGE SUCT-E.R. PORT Valve	This valve cuts off bilge flow from AMS 1 starboard.
5	BB-40, BILGE SUCT-A.M.S. NO. 1 STBD Valve	This valve cuts off bilge flow from engine room starboard.
6	BB-39, BILGE SUCT-A.M.S. No. 1 PORT Valve	This valve cuts off bilge flow from engine room port.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
SHAFT ALLEYS

STARBOARD SHAFT ALLEY

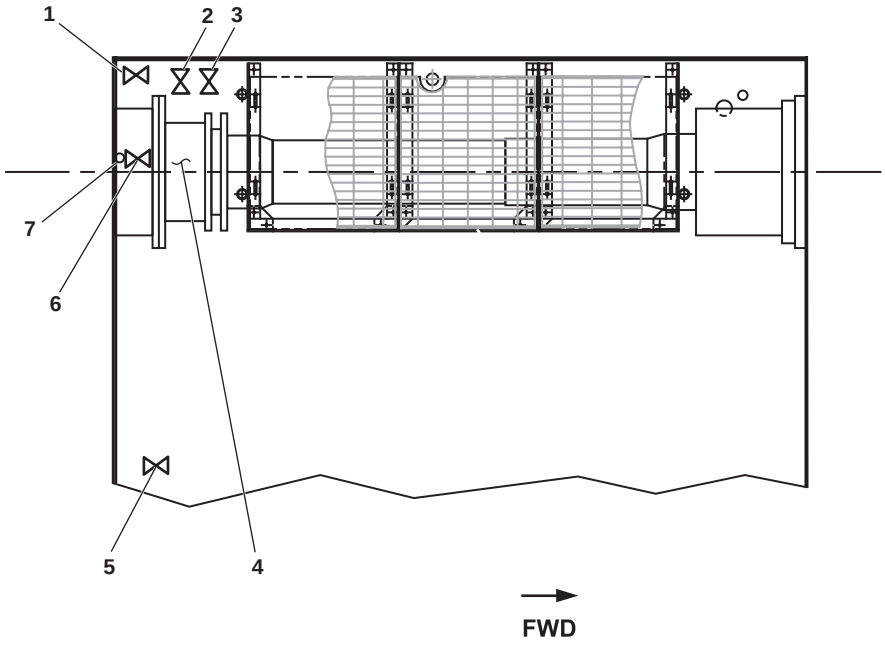


Figure 1. Starboard Shaft Alley

Table 1. Starboard Shaft Alley (refer to figure 1)

Key	Control/Indicator	Function
1	CA-67, SVCE AIR TO STERN TUBE	This valve secures the flow of air pressure for inflation of the shaft seal.
2	GS-43, COV-ST TUBE SEAL S	This valve secures the flow of raw water to the shaft seal.
3	GS-107, DR ST TUBE SEAL	When OPEN, this valve drains the raw water from the shaft seal into the bilge.
4	Shaft Seal	The shaft seal prevents excess raw water leakage around the propeller shaft and into the vessel.
5	Fwc-3, F.W. FR. M.E. No. 1 TO KEEL CLR.	This valve secures the flow through the keel cooler for main engine 1.
6	Shaft Seal Check Valve	The shaft seal check valve provides over inflation protection for the shaft seal.
7	Cutoff Valve, Seal Vent	When OPEN, this valve vents the shaft seal to prevent air pockets from forming in the flush water area of the shaft seal.

PORT SHAFT ALLEY

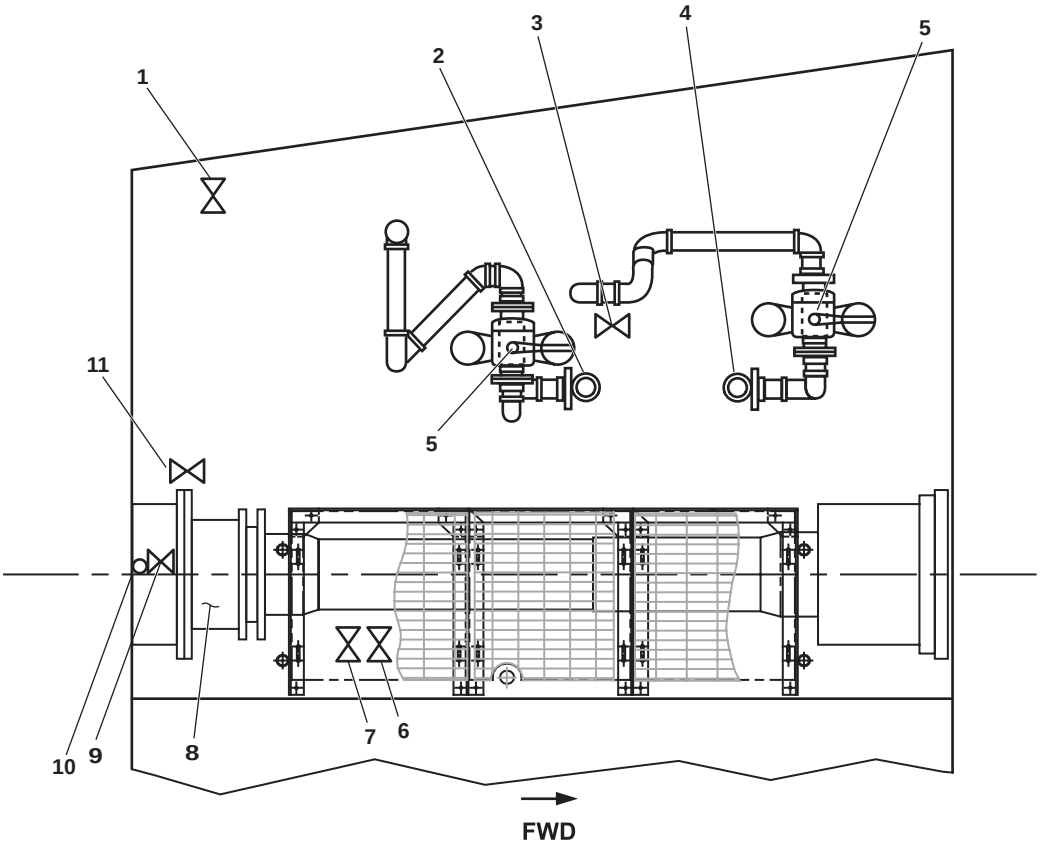


Figure 2. Port Shaft Alley

Table 2. Port Shaft Alley (refer to figure 2)

Key	Control/Indicator	Function
1	Fwc-4, F.W. FR. M.E. No. 2 TO KEEL CLR	This valve secures the flow through the keel cooler for main engine 2.
2	Cutoff Valve, High Level Seachest, Fire/General Service Pump 2	This valve secures the flow of raw water to fire and general service pump 2.
3	Cutoff Valve, High Level Seachest Vent	When OPEN, this valve vents the chest.
4	Cutoff Valve, High Level Seachest, Fire/General Service Pump 1	This valve secures the flow of raw water to fire and general service pump 1.
5	Duplex Strainer Selector	This lever permits the operator to select the in service strainer for the duplex strainer.

Table 2. Port Shaft Alley (refer to figure 2) (continued)

Key	Control/Indicator	Function
6	GS-106, DR ST TUBE SEAL	When OPEN, this valve drains the raw water from the shaft seal to the bilge.
7	GS-42, COV-ST TUBE SEAL P	This valve secures the flow of raw water to the shaft seal.
8	Shaft Seal	The shaft seal prevents excess raw water leakage around the propeller shaft and into the vessel.
9	Cutoff Valve, Shaft Seal Vent	When OPEN, this valve vents the shaft seal to prevent air pockets from forming in the flush water area of the shaft seal.
10	Shaft Seal Check Valve	The shaft seal check valve provides over inflation protection for the shaft seal.
11	CA-66, SVCE AIR TO STERN TUBE	This valve secures the flow of compressed air pressure to the inflatable shaft seal.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
BOW THRUSTER COMPARTMENT

BOW THRUSTER COMPARTMENT

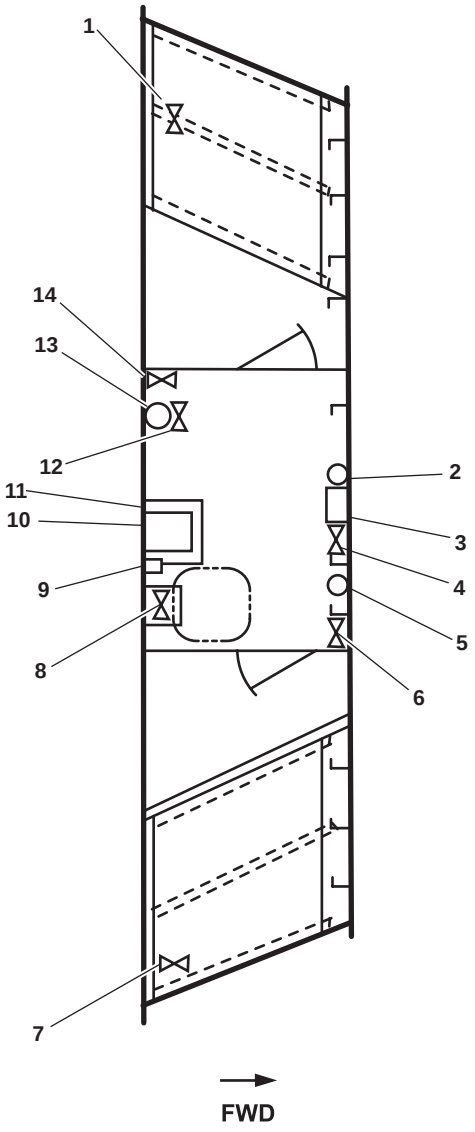


Figure 1. Bow Thruster Compartment

Table 1. Bow Thruster Compartment (refer to figure 1)

Key	Control/Indicator	Function
1	BB-9, OVBD. DISCH. BILGE EDUC Valve	When OPEN, this valve allows bilge contents to be discharged overboard using eductors.
2	General Alarm Bell	This bell sounds to alert the crew of various emergency conditions.

Table 1. Bow Thruster Compartment (refer to figure 1) (continued)

Key	Control/Indicator	Function
3	Space Heater	The space heater provides heat for the compartment. See figure 2 for details.
4	GS-45, BILGE EDUC Valve	This valve secures the raw water flow from the general service system to the eductors.
5	Eductor Pressure Gauge	The eductor pressure gauge indicates the general service system pressure available to the eductor.
6	Shutoff Valve	This valve secures the general service system pressure to the eductor pressure gauge.
7	PW-19, C.W. To W.C. Valve	This valve secures the cold potable water flow to the water closet.
8	ST-47, BOW THRUSTER UPR VOID FR54-57 SNDG Valve	This valve is used to sound the void below the bow thruster compartment.
9	Interior Light Switch	This switch is used to turn ON and OFF the interior lights in the space.
10	Bow Thruster Lube Oil Reservoir	The 10.5 gallon (39.8 liters) lube oil reservoir provides lube oil for the bow thruster system. See figure 3 for details.
11	Bow Thruster	The bow thruster receives power from the bow thruster engine and reversing gear and transmits that power to a propeller that provides athwartships thrust to the vessel's bow during close maneuvering operations.
12	SW PRESS TO EDUCTOR Gauge	This gauge indicates the pressure available to the eductor.
13	Cutoff Valve, Raw Water Pressure to Eductor Gauge	This valve secures the pressure of the raw water to eductor gauge.
14	BB-12, BLST. TK. No. 1 SUCT. COV Valve	This valve secures the flow of raw water from the eductor.

SPACE HEATER

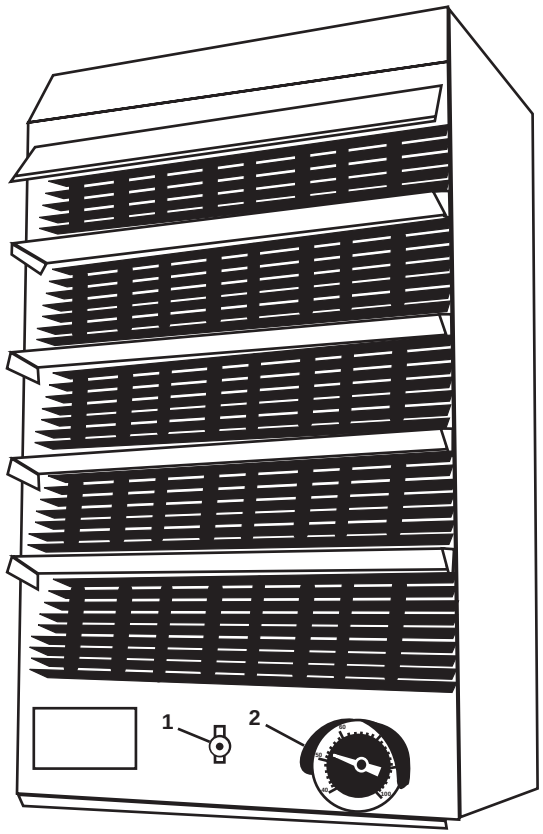


Figure 2. Space Heater

Table 2. Space Heater (refer to figure 2)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the space heater ON and OFF.
2	Thermostat	The thermostat permits the operator to adjust the temperature in the space.

BOW THRUSTER LUBE OIL RESERVOIR

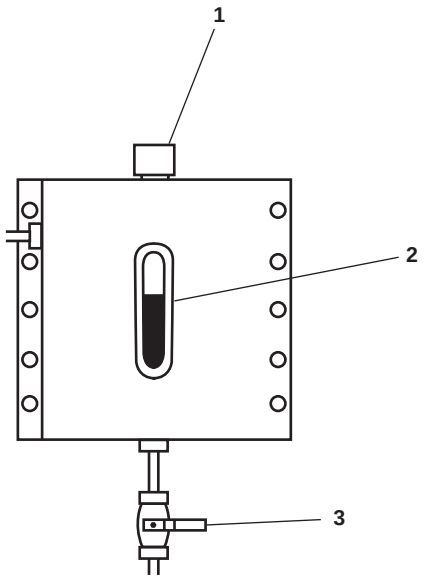


Figure 3. Bow Thruster Lube Oil Reservoir

Table 3. Bow Thruster Lube Oil Reservoir (refer to figure 3)

Key	Control/Indicator	Function
1	Filler Cap	The filler cap permits the addition of lube oil to the reservoir.
2	Sight Glass	The sight glass indicates the lube oil level in the reservoir.
3	Cutoff Valve, Bow Thruster Supply	This valve secures the flow of lube oil from the reservoir to the bow thruster unit.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
TOWING GEAR LOCKER

TOWING GEAR LOCKER

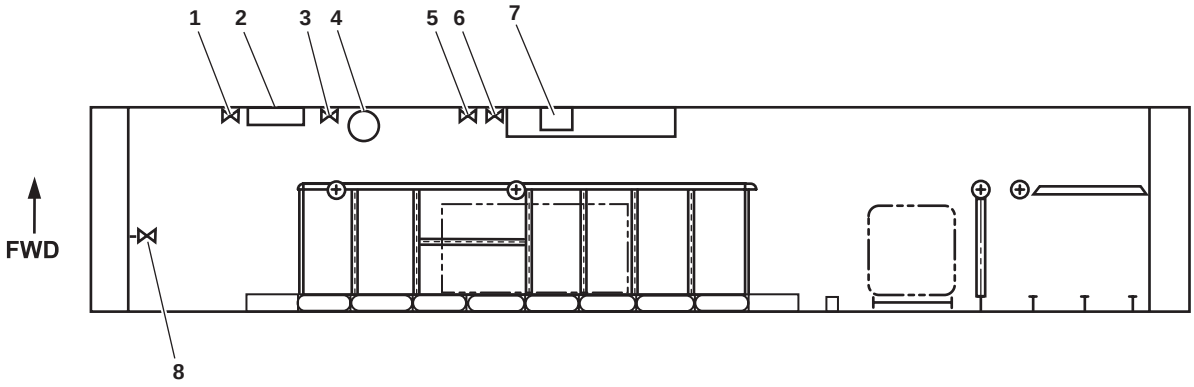


Figure 1. Towing Gear Locker

Table 1. Towing Gear Locker (refer to figure 1)

Key	Control/Indicator	Function
1	PW-10, POT. WTR. TK. PORT DR. Valve	This cutoff valve permits draining of the port potable water tank into the bilge.
2	Service Valves	These are various general service cutoff valves. See figure 2 for details.
3	PW-11, POT. WTR. TK. STBD. DR. Valve	This cutoff valve permits draining of the starboard potable water tank into the bilge.
4	General Alarm Bell	The alarm bell signals various emergency conditions on the vessel.
5	ST-4, BLST. TK. 2P SNDG Valve	This valve permits the sounding of the port ballast tank 2.
6	ST-3, BLST. TK. 2S SNDG Valve	This valve permits the sounding of the starboard ballast tank 2.
7	Space Heater	The heater provides heat for the compartment. See figure 3 for details.
8	BB-11, OVBD. DISCH. BILGE EDUC. Valve	This valve secures the overboard flow from the eductor.

SERVICE VALVES

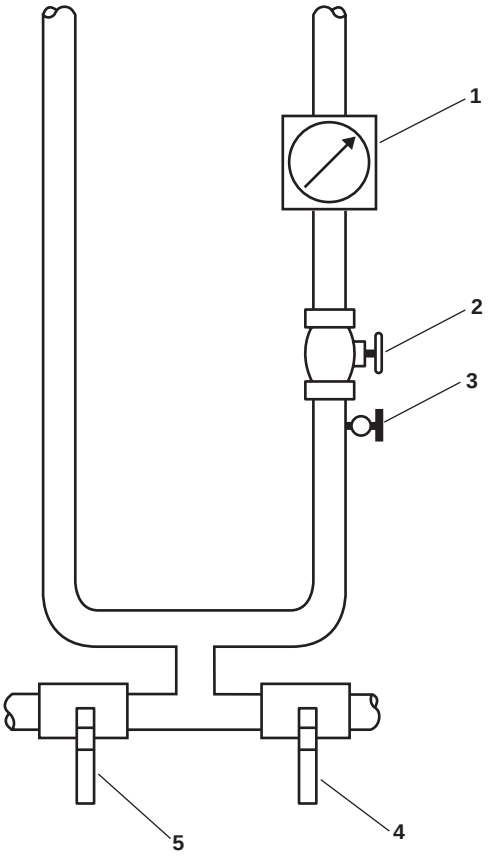


Figure 2. Service Valves

Table 2. Service Valves (refer to figure 2)

Key	Control/Indicator	Function
1	SW PRESS TO EDUCTOR Gauge	This gauge indicates the level of sea water pressure going to the eductor.
2	GS-46, BILGE EDUC Valve	This valve controls the flow of general service water to the bilge eductor in this space.
3	Gauge COV	This valve secures the pressure to the raw water pressure to the eductor gauge.
4	BB-37, BILGE EDUCT SUCT COV	This valve secures the flow to the starboard eductor.
5	GS-36, WTR RGLTR COV	This valve secures the flow to the port eductor.

SPACE HEATER

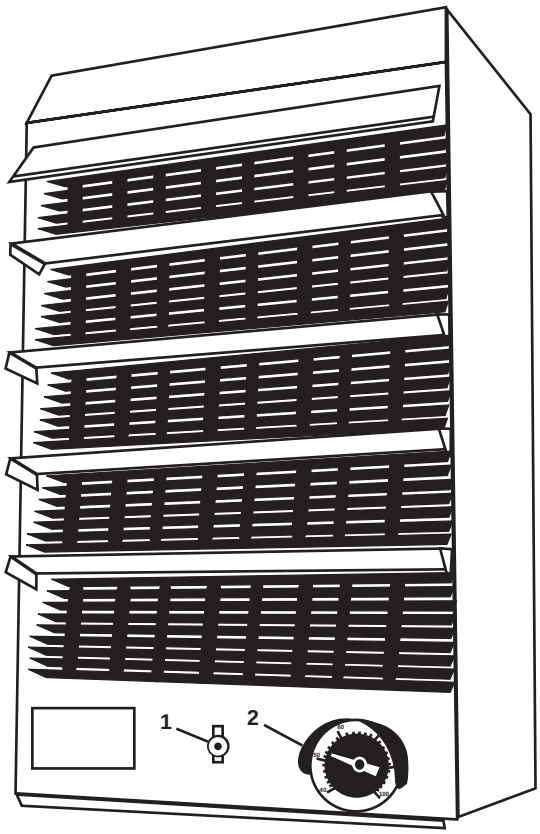


Figure 3. Space Heater

Table 3. Space Heater (refer to figure 2)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the space heater ON and OFF.
2	Thermostat	The thermostat permits a crewmember to adjust the temperature in the space.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
STEERING GEAR COMPARTMENT

STEERING GEAR COMPARTMENT

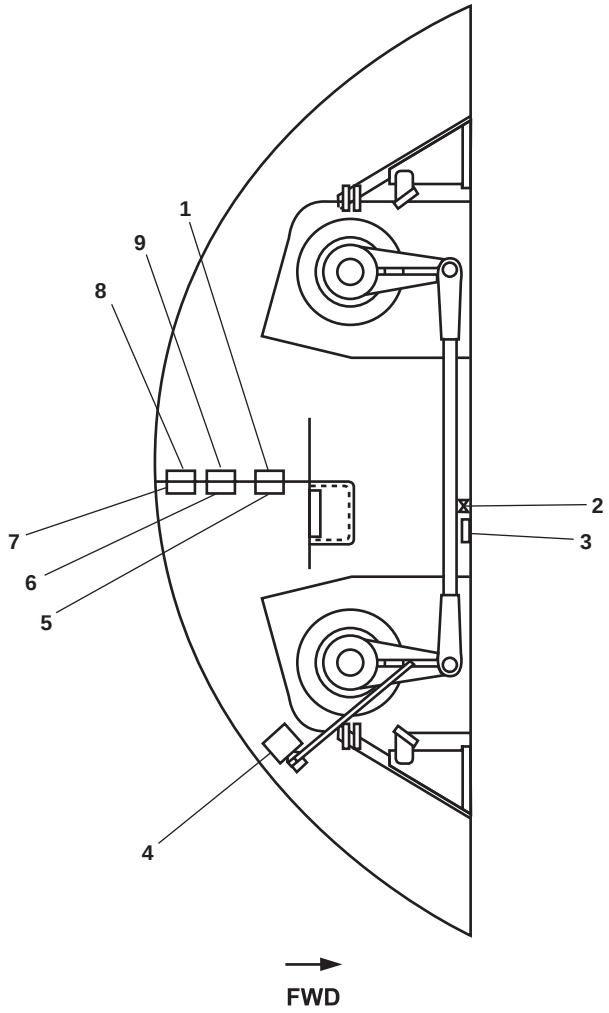


Figure 1. Steering Gear Compartment

Table 1. Steering Gear Compartment (refer to figure 1)

Key	Control/Indicator	Function
1	CH-24, FLW. CONT. - TOW PIN 3 & 4 Valve	The flow control valve controls the hydraulic flow to tow pins 3 and 4.
2	Cutoff Valve, GS Water to Eductor	This valve controls the flow of general service water to the eductor.

Table 1. Steering Gear Compartment (refer to figure 1) (continued)

Key	Control/Indicator	Function
3	Pressure Gauge, GS Water to Eductor	This gauge indicates the pressure of the general service water supplied to the eductor in this space.
4	Rudder Angle Indicator Feedback Unit	This feedback unit sends a signal to the vessel's rudder angle indicators to indicate the rudder's position.
5	CH-23, FLW. CONT. - TOW PIN 1 & 2 Valve	The flow control valve controls the hydraulic flow to tow pins 1 and 2.
6	CH-21, DIR. CONT. TOW PIN No. 3 Valve	The solenoid-operated valve controls the direction of movement (UP or DOWN) of tow pin 3.
7	CH-19, DIR. CONT.-TOW PIN No. 1 Valve	The solenoid-operated valve controls the direction of movement (UP or DOWN) of tow pin 1.
8	CH-22, DIR. CONT. TOW PIN No. 4 Valve	The solenoid-operated valve controls the direction of movement (UP or DOWN) of tow pin 4.
9	CH-20, DIR. CONT. - TOW PIN No. 2 Valve	The solenoid-operated valve controls the direction of movement (UP or DOWN) of tow pin 2.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
MAIN DECK EXTERIOR

FANTAIL

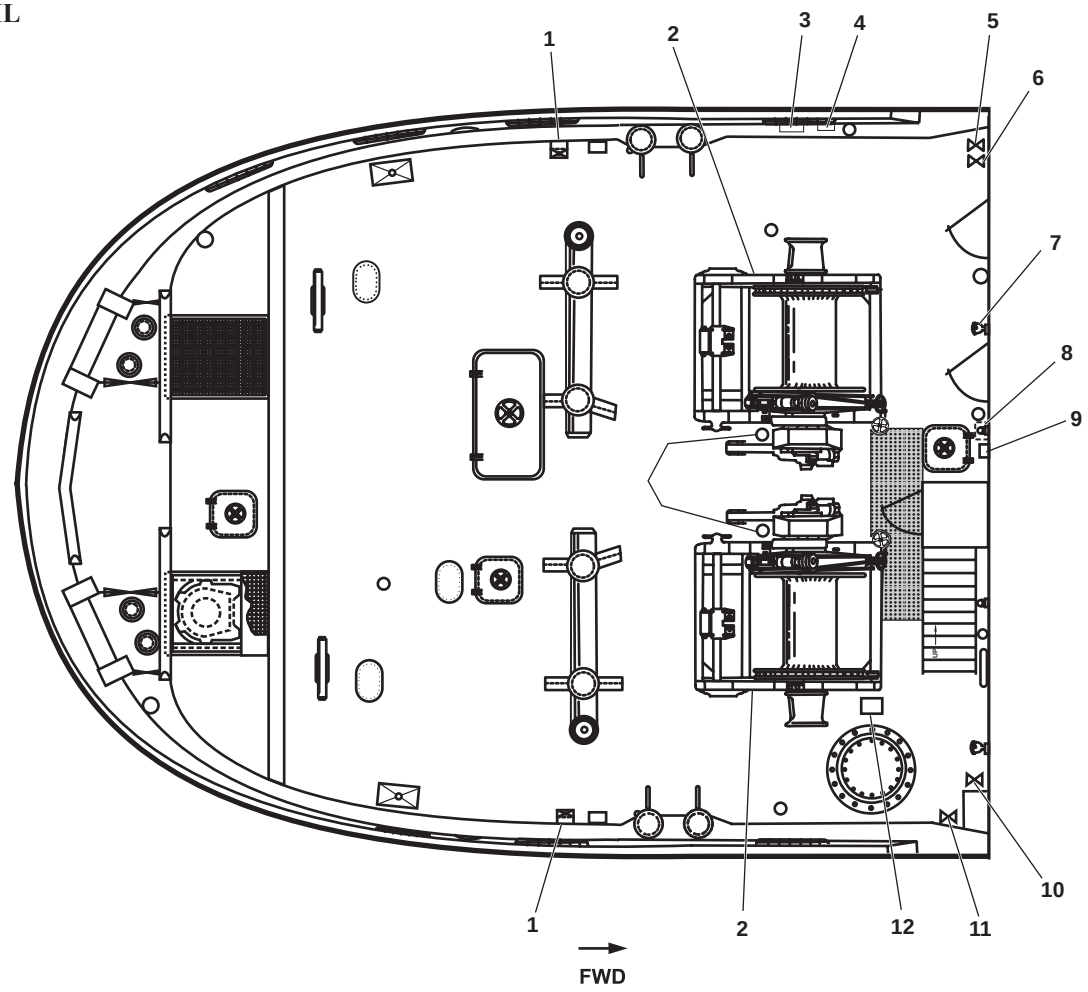


Figure 1. Fantail

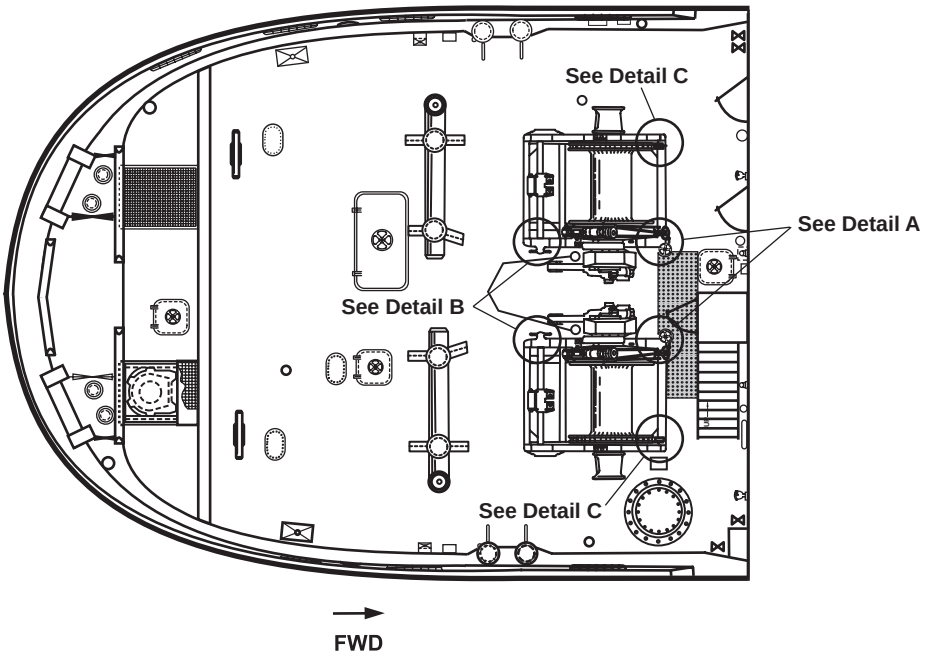
Table 1. Fantail (refer to figure 1)

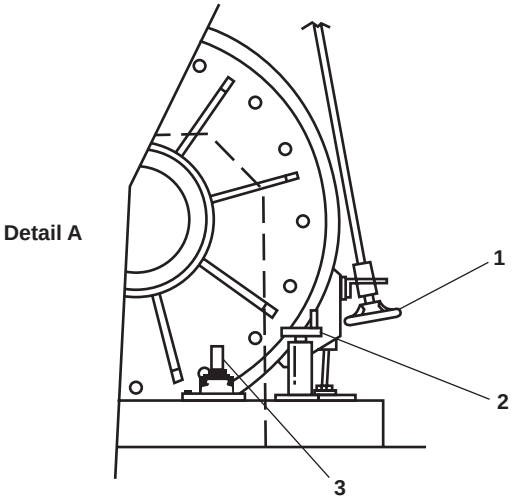
Key	Control/Indicator	Function
1	Tow Pin Control	These switches control the operation of the tow pins. See figure 7 for details.
2	Towing Machine	The towing machine is used for towing astern. See figure 2 for details.
3	Sound Powered Telephone	The sound powered telephone provides communication with the rest of the vessel. See figure 3 for details.
4	Bell, Sound Powered Telephone	The bell rings to alert personnel that a call is coming in to the sound powered telephone.

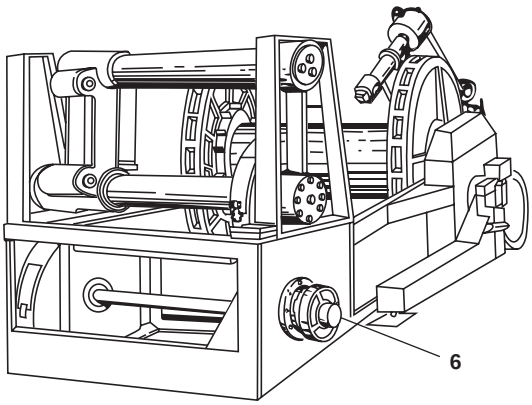
Table 1. Fantail (refer to figure 1) (continued)

Key	Control/Indicator	Function
5	Potable Water Shore Connection Valve	This valve is used to fill the potable water tank from an outside source.
6	Sewage Shore Connection Valve	This valve is used to transfer sewage to a pierside facility.
7	Fire Station	The fire station contains a fire main valve, hose, and nozzle for use in fighting fires. See figure 4 for details.
8	FM-200 Exterior Manual Pull Box	PULL the enclosed T-handle to actuate the FM-200 fire suppression. See figure 5 for details.
9	FM-200 Alarm Bell	The bell sounds to notify personnel that the FM-200 system has been actuated.
10	Oily Waste Discharge Shore Connection	This valve is used to empty the oily waste tank to a pierside facility.
11	Sewage Shore Connection Valve	This valve is used to transfer sewage to a pierside facility.
12	Capstan Control Valve	This valve controls the operation of the capstan. See figure 6 for details.

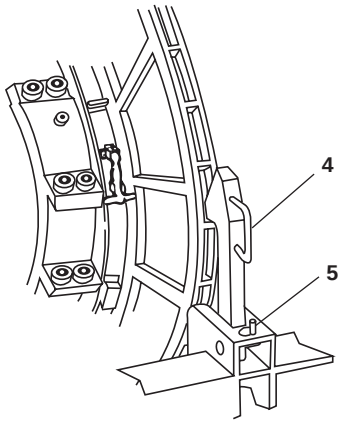
TOWING MACHINE







Detail B



Detail C

Figure 2. Towing Machine

Table 2. Towing Machine (refer to figure 2)

Key	Control/Indicator	Function
1	Clutch Brake Handwheel	The handwheel engages the hydraulic motor drive assembly to the drum assembly.
2	Auxiliary Brake Handwheel	The handwheel controls the auxiliary (mechanical) brake.
3	Local Control	The local control provides local control for use during maintenance or in an emergency.
6	Spooling Device Handwheel	The spooling device handwheel controls the spooling device clutch. It is used in realignment of cable.
4	Mechanical Dog Handle	The mechanical dog handle engages and disengages the mechanical dog.
5	Quick Release Pin	The quick release pin secures the mechanical dog in the disengaged position.

SOUND POWERED TELEPHONE

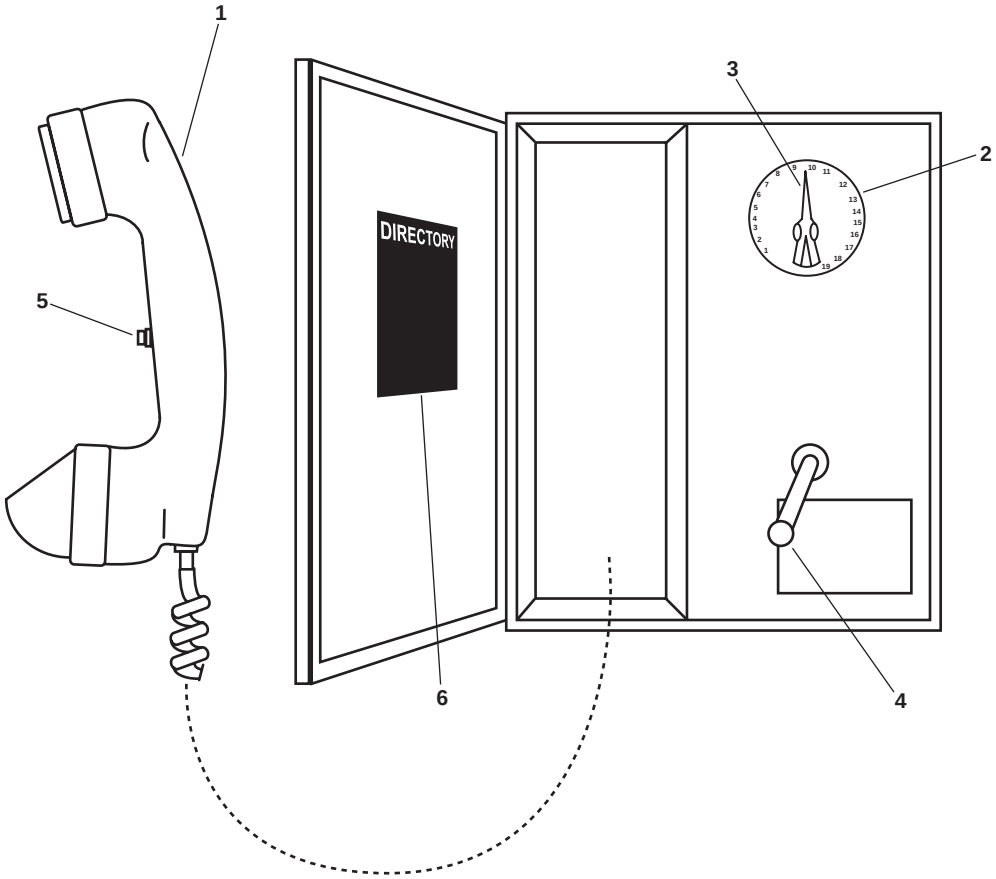


Figure 3. Sound Powered Telephone

Table 3. Sound Powered Telephone (refer to figure 3)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	The selector knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	This pushbutton is used to transmit.
6	DIRECTORY Plate	The directory plate lists telephone stations aboard the vessel.

FIRE STATION

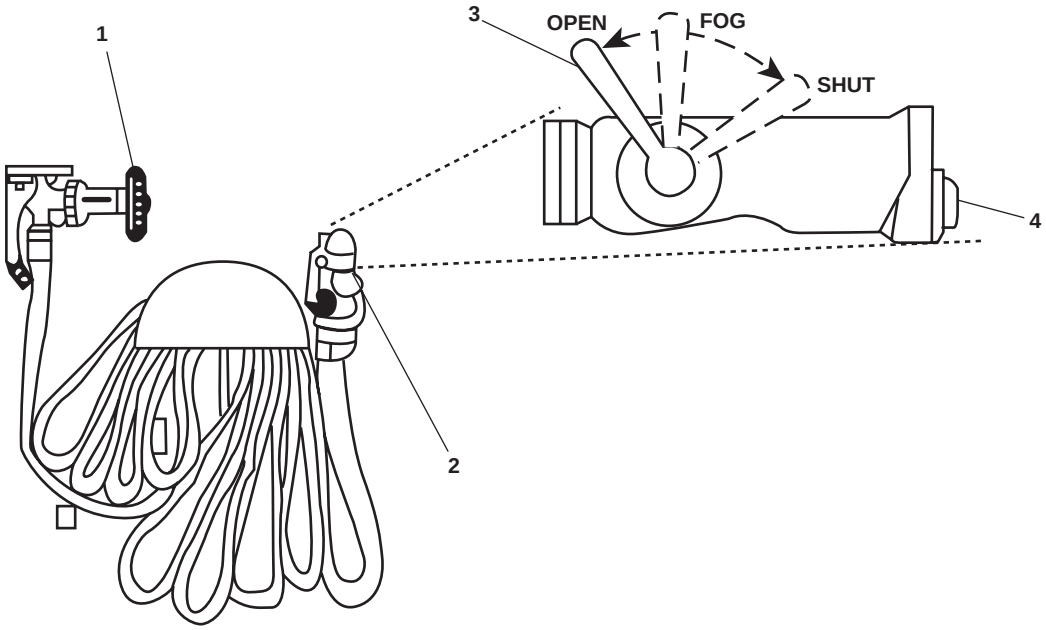


Figure 4. Fire Station

Table 4. Fire Station (refer to figure 4)

Key	Control/Indicator	Function
1	Valve	This valve turns the fire main water ON and OFF.
2	Nozzle	This nozzle directs water by spray or stream to the fire.
3	Nozzle Valve	The nozzle valve controls the flow of water from the nozzle. When in the SHUT position, the flow of water is stopped. When in the FOG position, the water is directed to the fog jet. When in the OPEN position, water is directed to the single stream outlet.
4	Fog Outlet Plug	The fog outlet plug provides an outlet for attaching 4-foot and 12-foot applicators.

FM-200 EXTERIOR PULL BOX

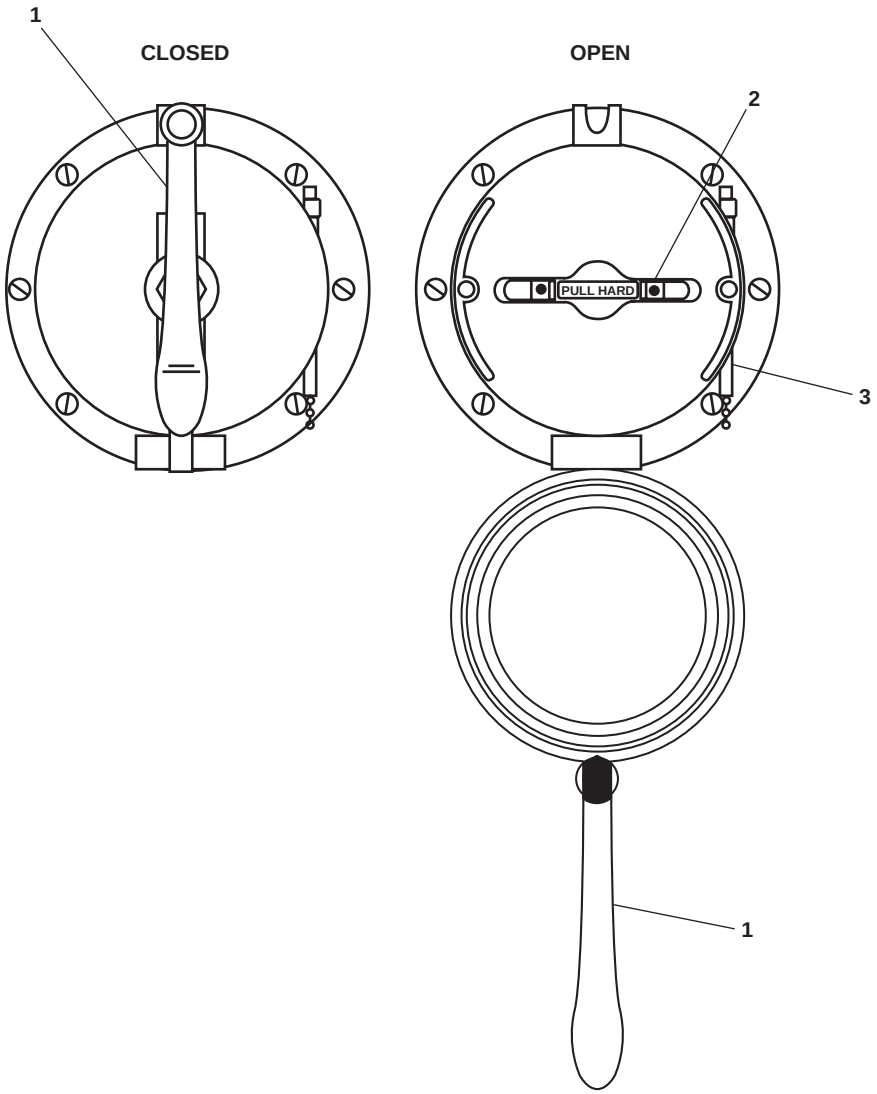


Figure 5. FM-200 Exterior Manual Pull Box

Table 5. FM-200 Exterior Manual Pull Box (refer to figure 5)

Key	Control/Indicator	Function
1	Handle	Twist this handle to OPEN the weathertight door, exposing the operating T-handle (figure 5, item 2).
2	T-Handle	Pull out on this T-handle to discharge the engine room FM-200 fire suppression system.
3	Hammer	Use this hammer to break the glass, exposing the T-handle (figure 5, item 2).

CAPSTAN CONTROL VALVE

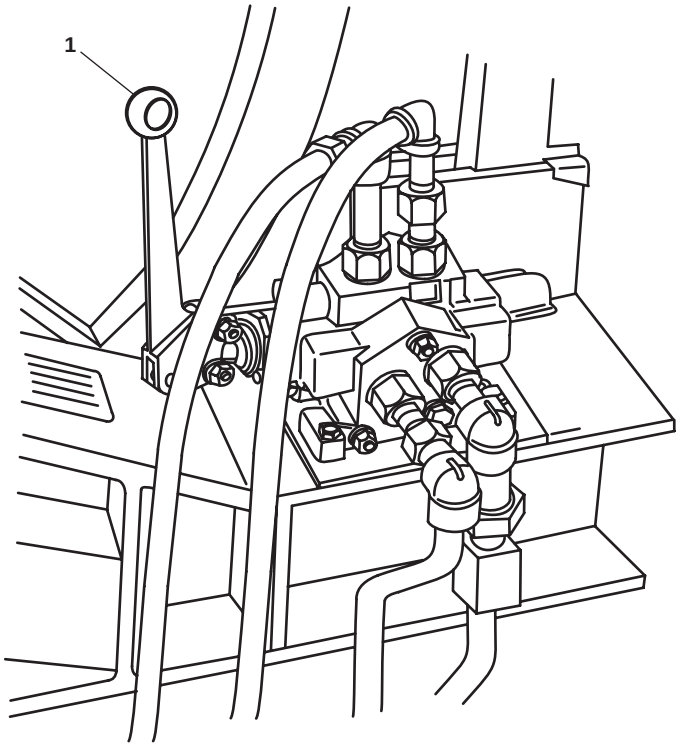


Figure 6. Capstan Control Valve

Table 6. Capstan Control Valve (refer to figure 6)

Key	Control/Indicator	Function
1	Capstan Control Valve	This valve controls the speed and direction of rotation of the capstan.

TOW PIN CONTROL

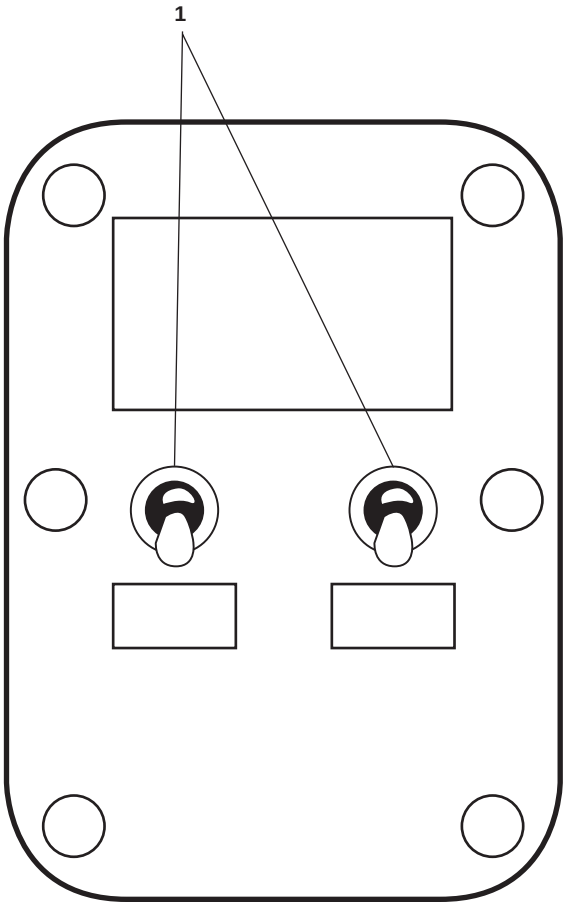


Figure 7. Tow Pin Control

Table 7. Tow Pin Control (refer to figure 7)

Key	Control/Indicator	Function
1	Tow Pin Control Switch	This switch controls the raising and lowering of the stern tow pins.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
FAN ROOM, MAIN DECK

FAN ROOM, MAIN DECK

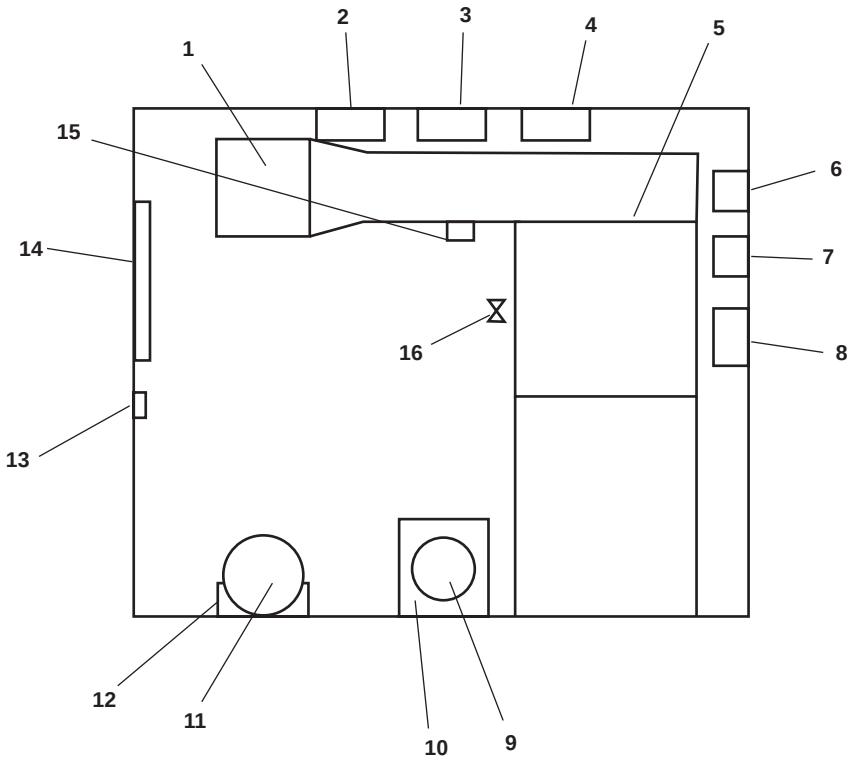


Figure 1. Fan Room, Main Deck

Table 1. Fan Room, Main Deck (refer to figure 1)

Key	Control/Indicator	Function
1	Preheater Unit (1-23-2)	This unit preheats the air entering the fan coil unit (figure 1, item 5).
2	HVAC SYSTEM CONTROLLER FOR PRHTR 1-23-2	This controller turns preheater unit 1-23-2 (figure 1, item 1) ON and OFF. See figure 2 for details.
3	HVAC SYSTEM CONTROLLER FOR RHTR 1-25-2	This controller turns fan coil unit 1-25-2 (figure 1, item 5) ON and OFF. See figure 2 for details.
4	HVAC SYSTEM CONTROLLER FOR PRHTR 1-23-4	This controller turns preheater unit 1-23-4 (figure 1, item 11) ON and OFF. See figure 2 for details.
5	Crew Mess Fan Coil Unit	This fan coil unit heats and cools the air for the crew mess area.
6	CREW MESS FAN COIL UNIT Motor Controller	This controller turns the crew mess fan coil unit ON and OFF. See figure 3 for details.

Table 1. Fan Room, Main Deck (refer to figure 1) (continued)

Key	Control/Indicator	Function
7	GALLEY SUPPLY FAN Motor Controller	This controller turns the galley supply fan ON and OFF. See figure 3 for details.
8	AMS 2 SUPPLY FAN Motor Controller	This controller turns the AMS 2 supply fan ON and OFF and permits selecting between FAST and SLOW modes. See figure 4 for details.
9	Galley Supply Fan	The galley supply fan supplies ventilating air to the galley area.
10	Reheater (1-23-4)	The reheater heats the air drawn in to the galley area.
11	AMS #2 SPLY FAN	This fan supplies ventilating air to AMS 2.
12	Steering Gear Oil Reservoir (above)	This reservoir holds the oil for both steering gears. See figure 5 for details.
13	Interior Light Switch	This switch turns the lights in the space ON and OFF.
14	HVAC Manifold	The manifold contains valves for controlling the HVAC systems. See figure 6 for details.
15	Thermostat	The thermostat provides thermostatic control for preheater unit 1-23-2.
16	Refrigerant Valve	This valve provides cutoff for the refrigerant at the fan coil unit.

PREHEATER/REHEATER CONTROLLER

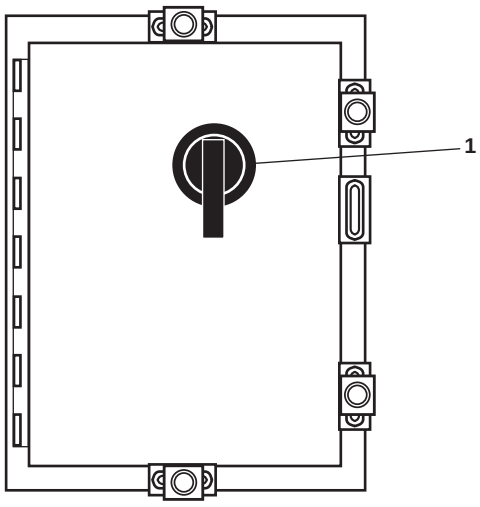


Figure 2. Preheater/Reheater Controller

Table 2. Preheater/Reheater Controller (refer to figure 2)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the affected preheater or reheater ON or OFF.

CREW MESS AND GALLEY SUPPLY FAN MOTOR CONTROLLERS

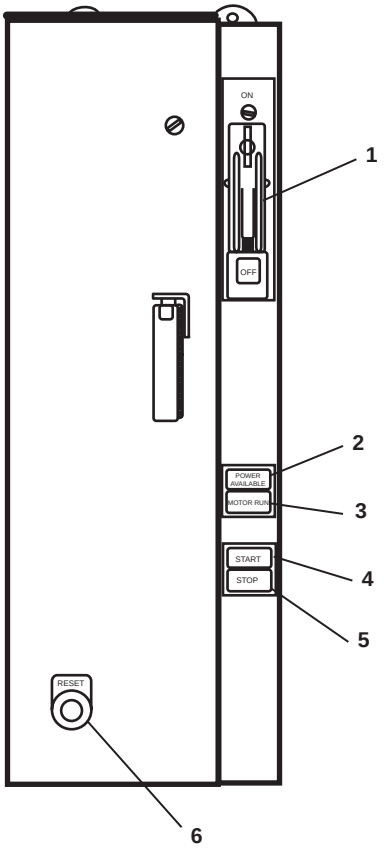


Figure 3. Crew Mess and Galley Supply Fan Motor Controllers

Table 3. Crew Mess and Galley Supply Fan Motor Controllers (refer to figure 3)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit breaker protection.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is supplied to the motor controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the motor is running.
4	START Pushbutton	When pressed, this pushbutton starts the affected fan.
5	STOP Pushbutton	When pressed, this pushbutton stops the affected fan.
6	RESET Pushbutton	This pushbutton is used to reset the motor controller.

AMS 2 SUPPLY FAN MOTOR CONTROLLER

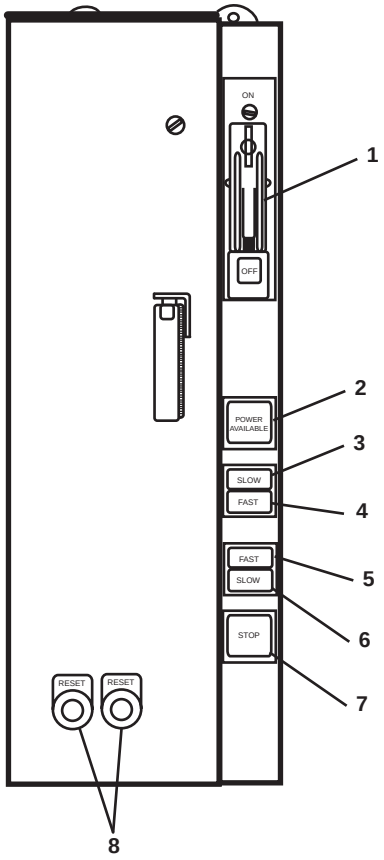


Figure 4. AMS 2 Supply Fan Motor Controller

Table 4. AMS 2 Supply Fan Motor Controller (refer to figure 4)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit protection.
2	POWER AVAILABLE Indicator	This indicator illuminates green to indicate that power is available to the controller.
3	SLOW Indicator	This indicator illuminates to indicate that the fan is operating at SLOW speed.
4	FAST Indicator	This indicator illuminates to indicate that the fan is operating at FAST speed.
5	FAST Pushbutton	This pushbutton is used to operate the fan motor at FAST speed.
6	SLOW Pushbutton	This pushbutton is used to operate the fan motor at SLOW speed.
7	STOP Pushbutton	This pushbutton is used to STOP the fan motor.
8	RESET Pushbutton	This pushbutton is used reset the motor controller.

STEERING GEAR OIL RESERVOIR

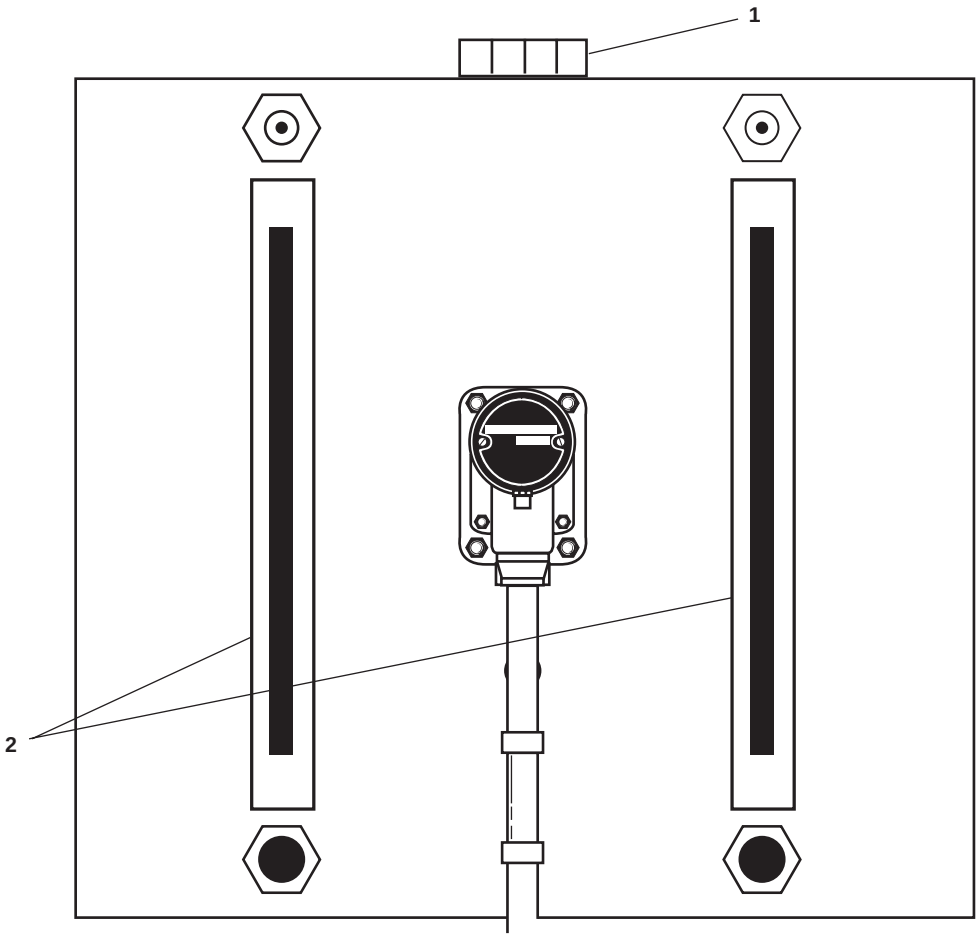


Figure 5. Steering Gear Oil Reservoir

Table 5. Steering Gear Oil Reservoir (refer to figure 5)

Key	Control/Indicator	Function
1	Fill Cap	The fill cap permits the reservoir to be filled with oil.
2	Sight Glass	The sight glass indicates the oil level within the reservoir. There is one sight glass for each steering gear.

HVAC MANIFOLD

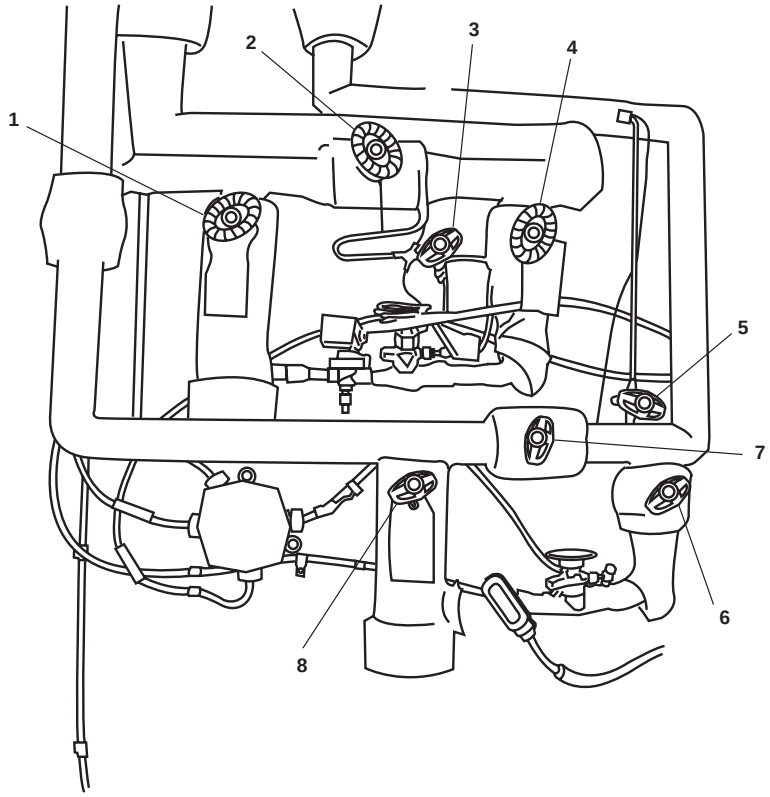


Figure 6. HVAC Manifold

Table 6. HVAC Manifold (refer to figure 6)

Key	Control/Indicator	Function
1	RFAC-33 TXV/STNR/LLSV COV R1-25-2, 4 COIL	This valve secures refrigerant flow to the thermal expansion valve.
2	RFAC-26 HAND EXP Valve	This valve permits hand expansion of the refrigerant in the event of a thermal expansion valve failure.
3	RFAC-29 EQL LINE Cutoff Valve	This valve secures sensing pressure to the thermal expansion valve.
4	RFAC-34 TXV COV, R01-32-2 Valve	This valve secures refrigerant flow from the thermal expansion valve.
5	RFAC-30 EQL LINE Cutoff Valve	This valve secures sensing pressure to the thermal expansion valve.
6	RFAC-36 TXV/STNR/LLSV COV R1-25-2, 8 COIL	This valve secures refrigerant flow from the thermal expansion valve.
7	Hand Expansion Valve	This valve permits hand expansion of the refrigerant in the event of a thermal expansion valve failure.
8	RFAC-37 TXV/STNR/LLSV COV R1-25-2, 8 COIL	This valve secures refrigerant flow to the thermal expansion valve.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
MAIN DECK VESTIBULE

MAIN DECK VESTIBULE, GENERAL ARRANGEMENT

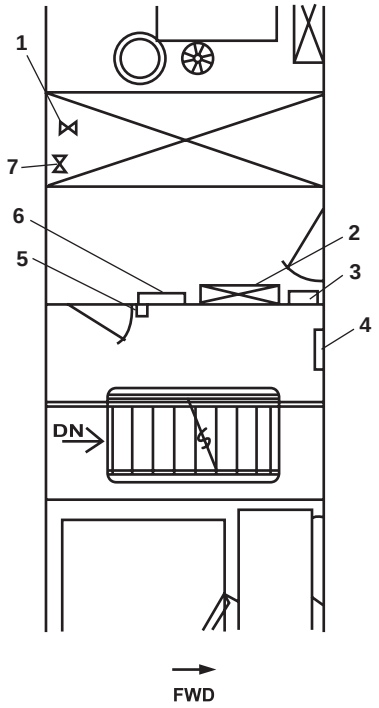


Figure 1. Main Deck Vestibule, General Arrangement

Table 1. Main Deck Vestibule, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Deck Crane Flow Control Valve	This valve controls the flow of hydraulic oil to the deck crane.
2	TOWING MACHINE CONTROL PANEL	This control panel contains the electronic control devices for the towing machines.
3	Water Washdown System Station	This controls the water washdown system operation for the FM-200 fire suppression system. See figure 2 for details.
4	Hydraulic Reservoir, AMS 2 Watertight Door	This reservoir contains the hydraulic oil for the AMS 2 watertight door hydraulic system. See figure 3 for details.
5	Interior Lighting Switch	This switch turns the interior lighting ON and OFF.
6	Fire Emergency Panel	The fire emergency panel contains the pull box for the FM-200 system, the pull box for the fire alarm, and emergency shutdown switches for the engine room ventilation systems and the fuel transfer pumps. See figure 4 for details.
7	FM-55, F STA No. 4 Valve	This valve secures the water supply to firefighting station 4.

WATER WASHDOWN STATION

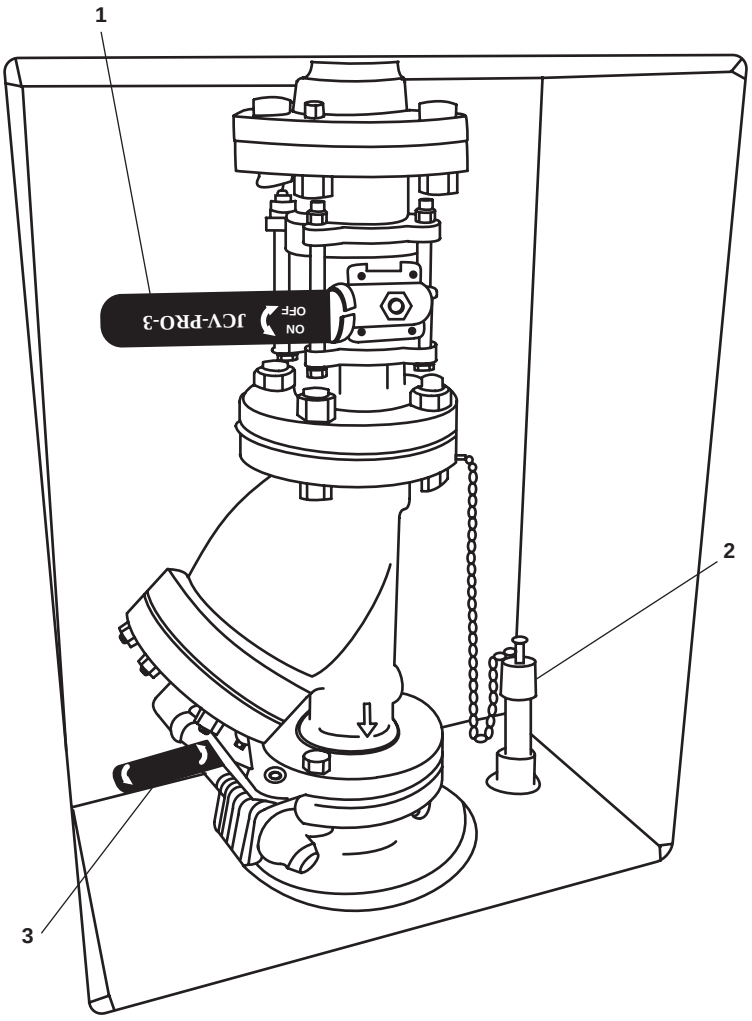


Figure 2. Water Washdown Station

Table 2. Water Washdown Station (refer to figure 2)

Key	Control/Indicator	Function
1	WWS 1	This valve controls the flow of fire main water to the Water Washdown System (WWS).
2	HF Sampling Port	This connection is OPENED to allow Hydrogen Fluoride (HF) gas sampling with the Kwik Draw sampling pump.
3	WWS 2	This valve is OPENED to allow the system strainer to be flushed during operation of the WWS.

HYDRAULIC RESERVOIR, AMS 2 WATERTIGHT DOOR

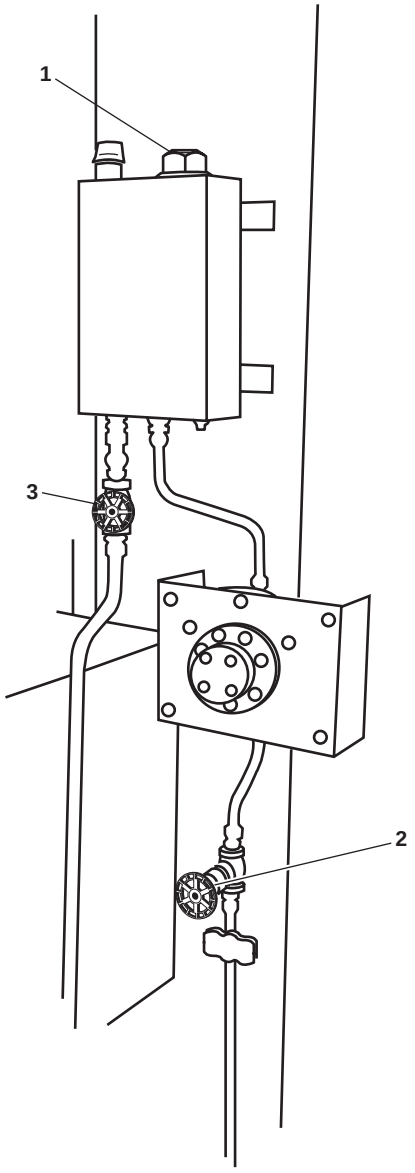


Figure 3. Hydraulic Reservoir, AMS 2 Watertight Door

Table 3. Hydraulic Reservoir, AMS 2 Watertight Door (refer to figure 3)

Key	Control/Indicator	Function
1	Filler Cap	The filler cap permits hydraulic oil to be added to the reservoir.
2	Supply Valve	This valve secures the supply (pressure) line to the hydraulic cylinder.
3	Return Cutoff Valve	This valve secures the return oil line to the reservoir.

FIRE EMERGENCY PANEL

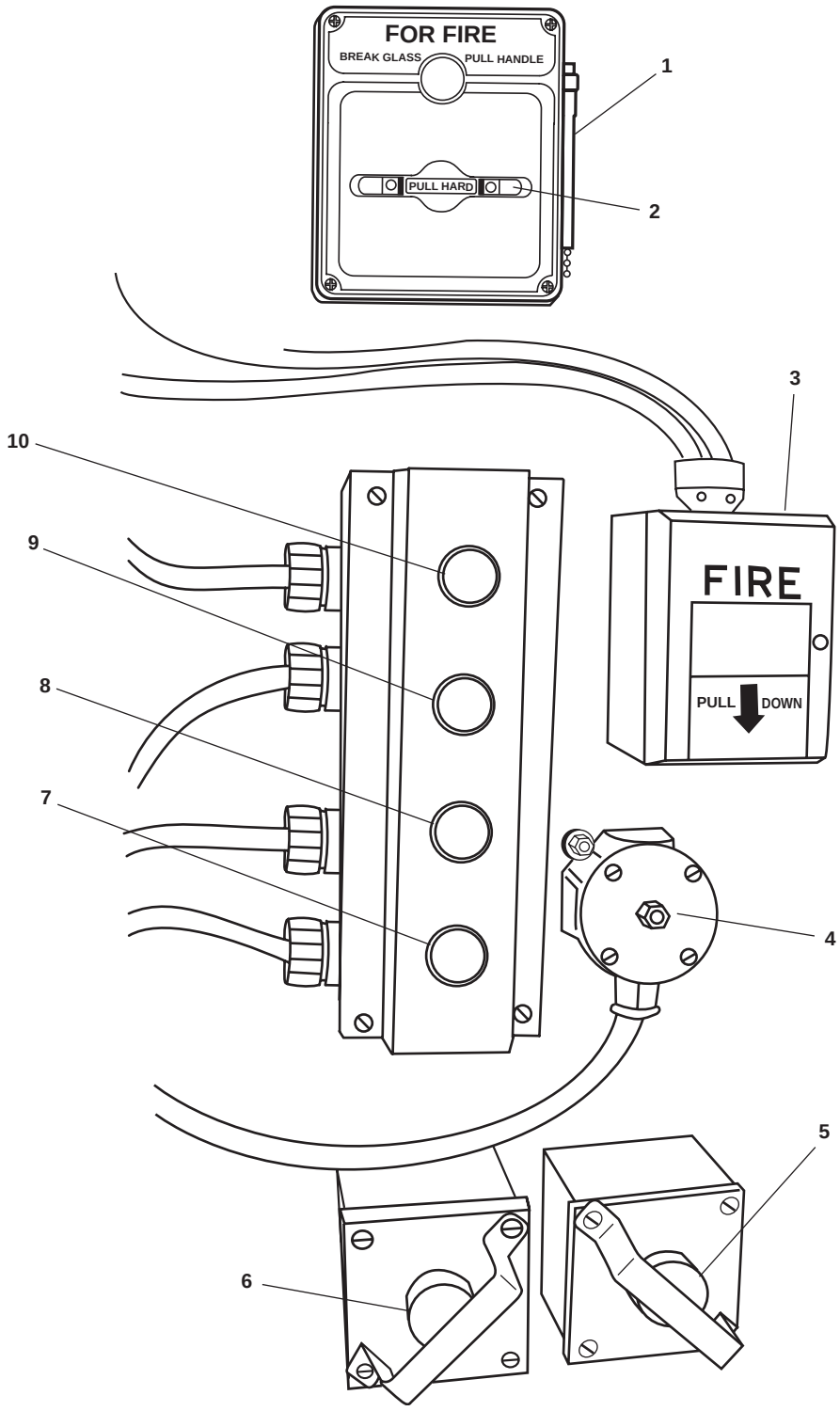


Figure 4. Fire Emergency Panel

Table 4. Fire Emergency Panel (refer to figure 4)

Key	Control/Indicator	Function
1	Hammer	The hammer is used to break the glass in the pull box, exposing the operating T-Handle.
2	T-Handle	Pull this T-handle to actuate the engine room FM-200 system.
3	Fire Alarm Pull Station	Pull DOWN on this box to sound the fire alarm.
4	HVAC EMER STOP AMS 2 SPLY FAN	When pressed, this secures the AMS 2 supply fan.
5	HVAC EMER STOP AMS 1 SPLY FAN	When pressed, this switch secures the AMS 1 supply fan.
6	HVAC SYS EMER STOP ENG RM EXH FAN ENG RM SPLY FAN	When pressed, this switch secures one pair of engine room exhaust and supply fans.
7	HVAC SYS EMER STOP ENG RM EXH FAN ENG RM SPLY FAN	When pressed, this switch secures one pair of engine room exhaust and supply fans.
8	INTERIOR LIGHTING SW Switch	This switch turns the interior lighting in the space ON and OFF.
9	EMER STOP FOR FO XFER PUMP NO 1	This switch secures fuel oil transfer pump 1
10	EMER STOP FOR FO XFER PUMP NO 2	This switch secures fuel oil transfer pump 2.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
MESS/RECREATION ROOM

MESS/RECREATION ROOM, GENERAL ARRANGEMENT

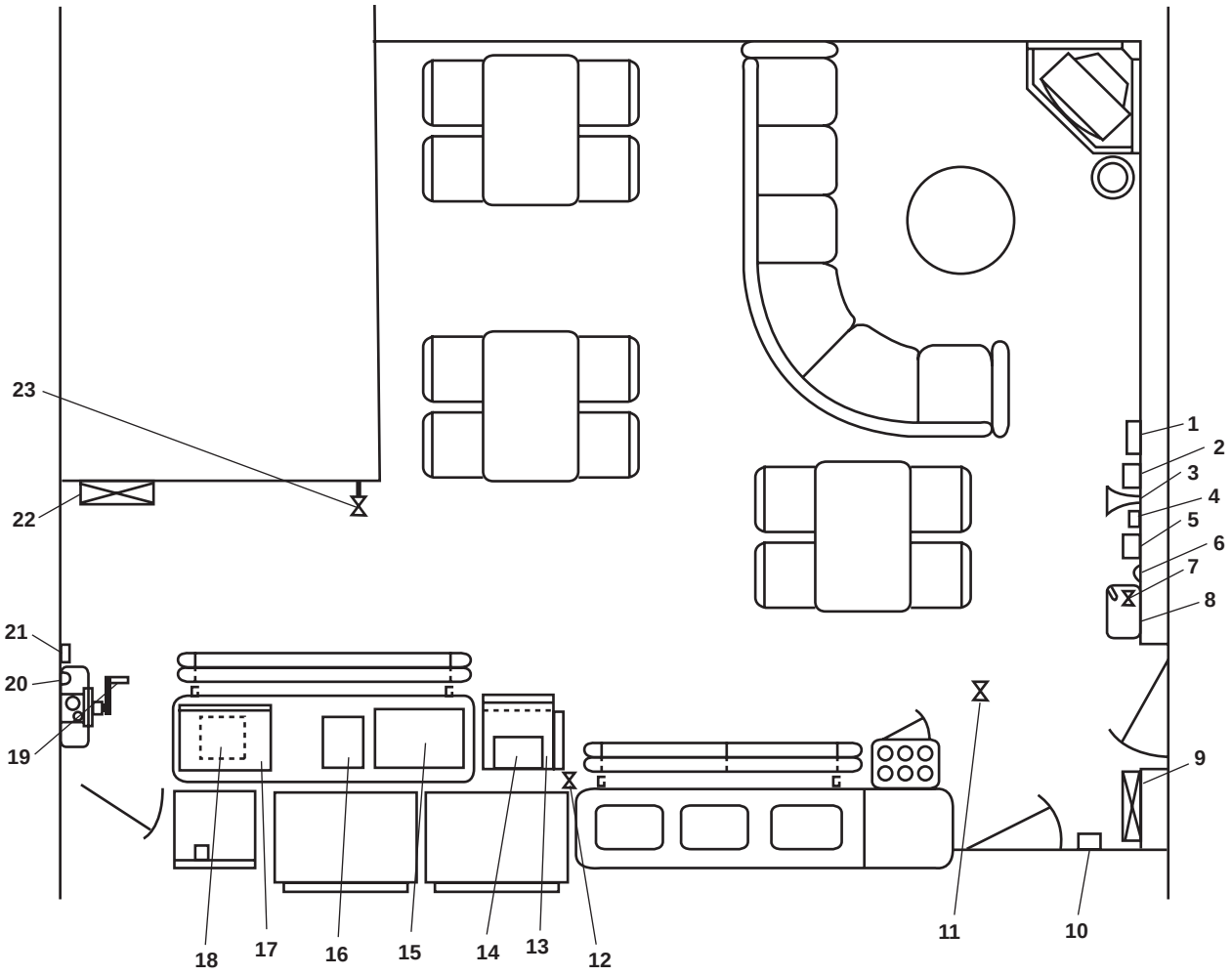


Figure 1. Mess/Recreation Room, General Arrangement

Table 1. Mess/Recreation Room, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Thermostat	The thermostat regulates the temperature within the space.
2	Intercom	The intercom provides communication with other spaces within the vessel. See figure 2 for details.
3	PA Speaker	The PA speaker is used for making announcements throughout the vessel. See figure 3 for details.
4	Volume Control	The volume control controls the volume of the PA speaker.

Table 1. Mess/Recreation Room, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
5	Sound Powered Telephone	The sound powered telephone is used to communicate with other stations onboard the vessel. See figure 4 for details.
6	General Alarm Bell	This bell sounds when the general alarm system has been activated.
7	PW-67, Cutoff Valve, Potable Water to Water Fountain	This valve secures the potable water to the water fountain.
8	Water Fountain	The water fountain provides cold potable water for crew consumption.
9	440V Power Panel No. 3	This panel contains circuit breakers for many main deck electrical components. See figure 5 for details.
10	HVAC SYSTEM EMER STOP GALLEY SUPPLY FAN 1-22-4 CREW MESS FAN COIL 1-25-2 Pushbutton	When pressed, this pushbutton secures the galley supply fan and the crew mess fan coil unit.
11	PW-25, C.W. TO W.C. Valve	This valve secures cold water to the water closet.
12	PW-93, C.W. TO ICE MAKER Valve	This valve secures the potable water supply to the icemaker.
13	Icemaker	The ice maker makes ice for use by the crew. See figure 6 for details.
14	Refrigerator	The refrigerator provides cold storage for food and drink items. See figure 7 for details.
15	Milk Dispenser	The milk dispenser keeps milk cold and dispenses it to the crew. See figure 8 for details.
16	Beverage Dispenser	The beverage dispenser keeps beverages cold and dispenses them to the crew. See figure 9 for details.
17	Microwave Oven	The microwave oven provides quick heating for food items. See figure 10 for details.
18	Toaster	The toaster is used for toasting bread. See figure 17 for details.
19	Operating Handle, AMS 2 Watertight Door	Turn the operating handle to close the AMS 2 watertight door.
20	Indicator, AMS 2 Watertight Door	This pointer indicates the position of the AMS 2 watertight door. See figure 12 for details.
21	Interior Lighting Switch	This switch turns the lighting in the space ON and OFF.
22	120V Main Deck, 01 & 02 Emergency Lighting Panel No. 1	This panel contains the circuit breakers for the emergency lighting circuits on the 01, 02, and main deck levels. See figure 13 for details.
23	Fire Station	The fire station is used for fighting fires. See figure 14 for details.

INTERCOM

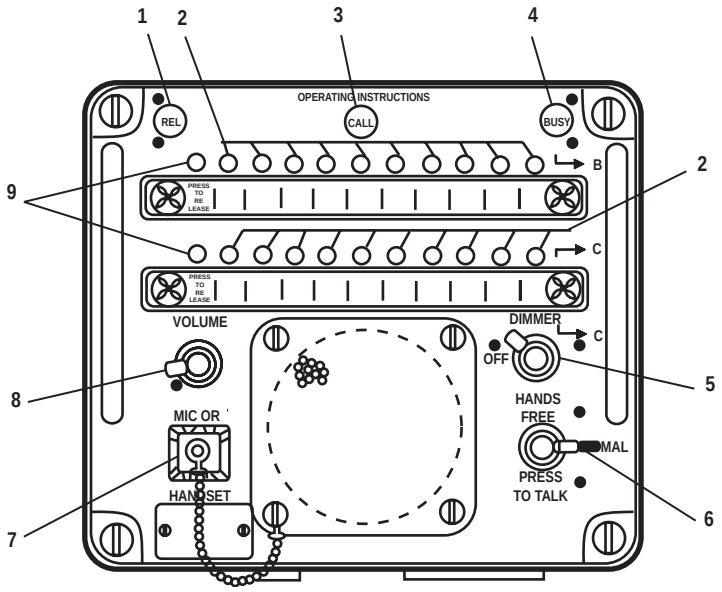


Figure 2. Intercom

Figure 2. Intercom (refer to figure 2)

Key	Control/Indicator	Function
1	REL Indicator	This indicator illuminates to indicate that release of the system is required.
2	Station Pushbuttons	These pushbuttons connect the unit to the selected station.
3	CALL Indicator	This indicator illuminates to indicate an incoming call.
4	BUSY Indicator	This indicator illuminates to indicate that the system is in use.
5	DIMMER Control	This controls the illumination level of the intercom panel.
6	HANDS FREE Control	This control provides hands free or press to talk transmission modes.
7	MIC OR HANDSET Plug	This is the jack plug for an external microphone/handset.
8	VOLUME Control	This knob controls the volume level of the intercom.
9	PRESS TO RELEASE	When pressed, this releases the station pushbuttons.

PA SPEAKER AND VOLUME CONTROL

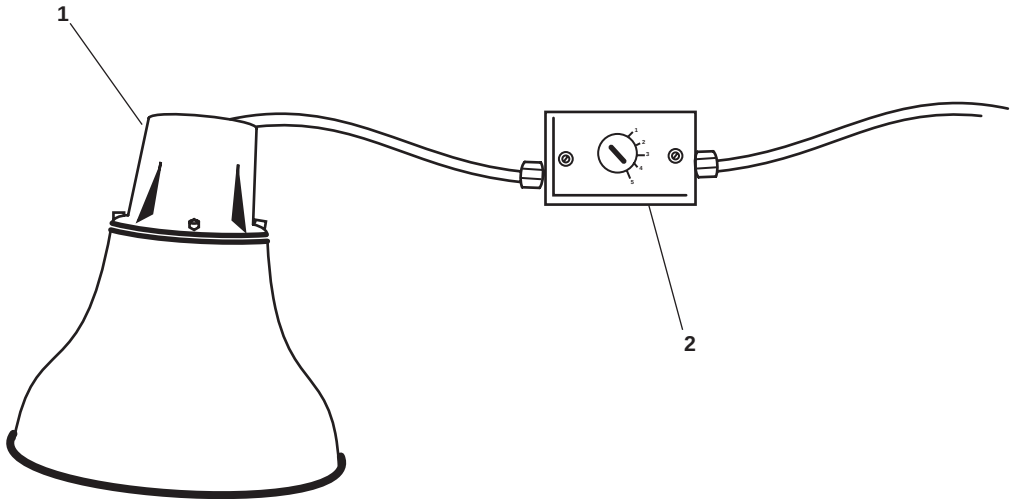


Figure 3. PA Speaker and Volume Control

Table 3. PA Speaker and Volume Control (refer to figure 3)

Key	Control/Indicator	Function
1	Loudspeaker	The loudspeaker broadcasts the PA system.
2	Volume Control	This knob controls the volume of the loudspeaker.

SOUND POWERED TELEPHONE

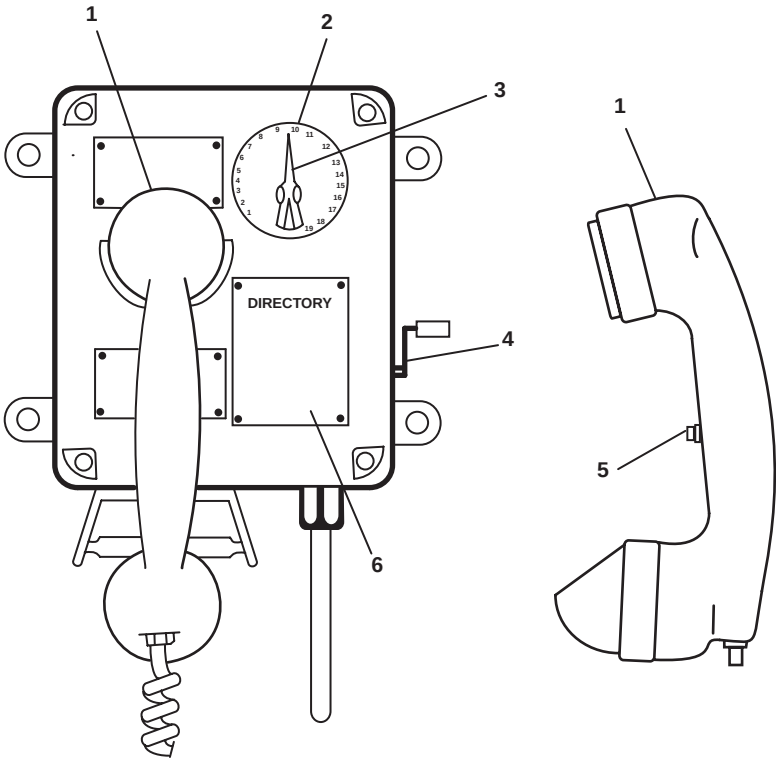


Figure 4. Sound Powered Telephone

Table 4. Sound Powered Telephone (refer to figure 4)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	The selector knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	Use this pushbutton to transmit.
6	DIRECTORY Plate	The directory plate lists telephone stations aboard the vessel.

440V POWER PANEL NO. 3

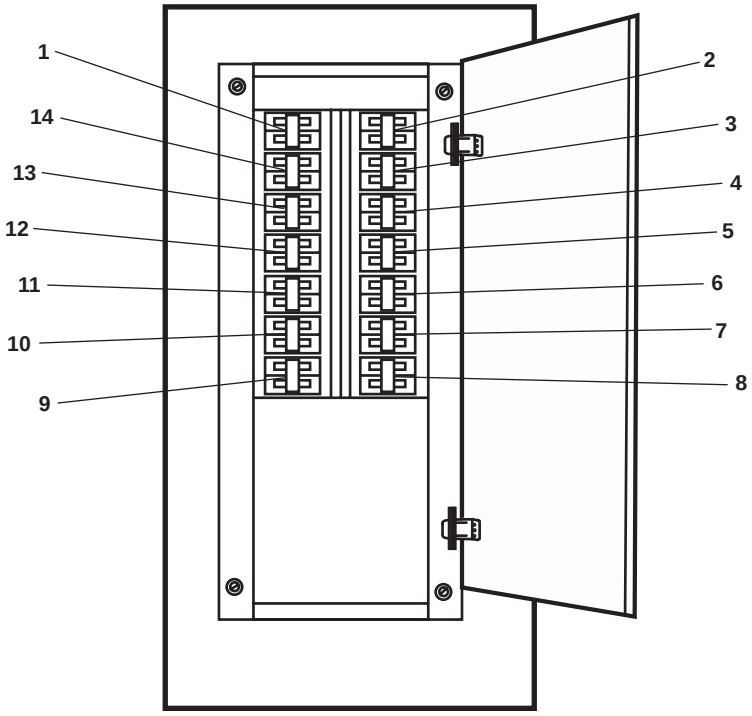


Figure 5. 440V Power Panel No. 3

Table 5. 440V Power Panel No. 3 (refer to figure 5)

Key	Control/Indicator	Function
1	PREHTR 1-23-4. Circuit Breaker	This circuit breaker protects preheater 1-23-4.
2	PREHTR 1-25-2. Circuit Breaker	This circuit breaker protects preheater 1-25-2.
3	BOSUN STORE REHEATER 1-57-1. Circuit Breaker	This circuit breaker protects boatswain's store reheater 1-57-1. reheater 1-57-1.
4	REHEATER 01-32-2. Circuit Breaker	This circuit breaker protects preheater 01-32-2.
5	CREW'S MESS CRSR FAN COIL R1-25-2. Circuit Breaker	This circuit breaker protects the crew's mess fan coil unit.
6	LAUNDRY SPACE EXHAUST FAN E1-62-2/CONTROLLER FOR BOSUN STORE & LAUNDRY SPACE SUPPLY FAN S1-58-1. Circuit Breaker	This circuit breaker protects the arms locker exhaust fan.
7	SANITARY SPACE EXHAUST FAN E01-44-2. Circuit Breaker	This circuit breaker protects the sanitary space exhaust fan.
8	BLANK.	There is no circuit breaker in this position.

Table 5. Main Deck Power Panel 3 (refer to figure 5)

Key	Control/Indicator	Function
9	SPARE. Circuit Breaker	This is a spare circuit breaker.
10	SPARE. Circuit Breaker	This is a spare circuit breaker.
11	01 & PILOTHOUSE LEVEL FAN COIL R01-32-2. Circuit Breaker	This circuit breaker protects the 01 and pilothouse fan coil unit.
12	BOSUN STORE & LAUNDRY SPACE SUPPLY FAN S1-58-1/CONTROLLER FOR LAUNDRY SPACE EXHAUST FAN E1-62-2. Circuit Breaker	This circuit breaker protects the boatswain's store supply fan.
13	PREHEATER 01-31-2. Circuit Breaker	This circuit breaker protects preheater 01-31-2.
14	AUXILIARY MACHINERY SPACE No. 2. SUPPLY FAN 1-22-2. Circuit Breaker	This circuit breaker protects the AMS 2 supply fan.

ICEMAKER

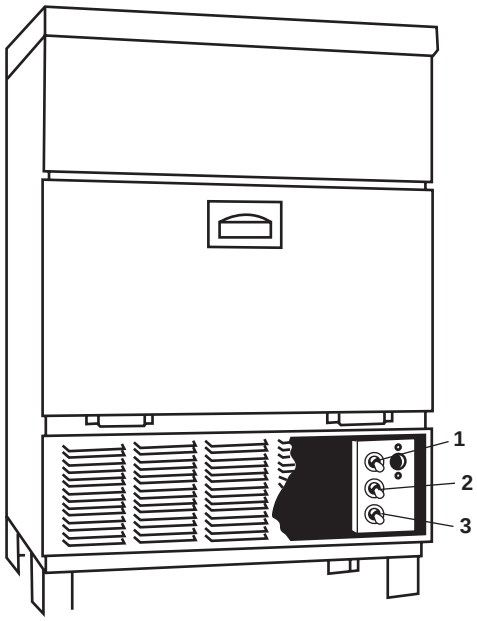


Figure 6. Icemaker

Table 6. Icemaker (refer to figure 6)

Key	Control/Indicator	Function
1	Manual Harvest Switch	This switch permits manual harvesting of ice cubes.
2	Purge Switch	This switch operates the purge valve when the ON/OFF/CLEAN switch is in the CLEAN position. Used when cleaning the machine.
3	ON/OFF/CLEAN Switch	This switch permits selection between ON, OFF, and CLEAN modes.

REFRIGERATOR

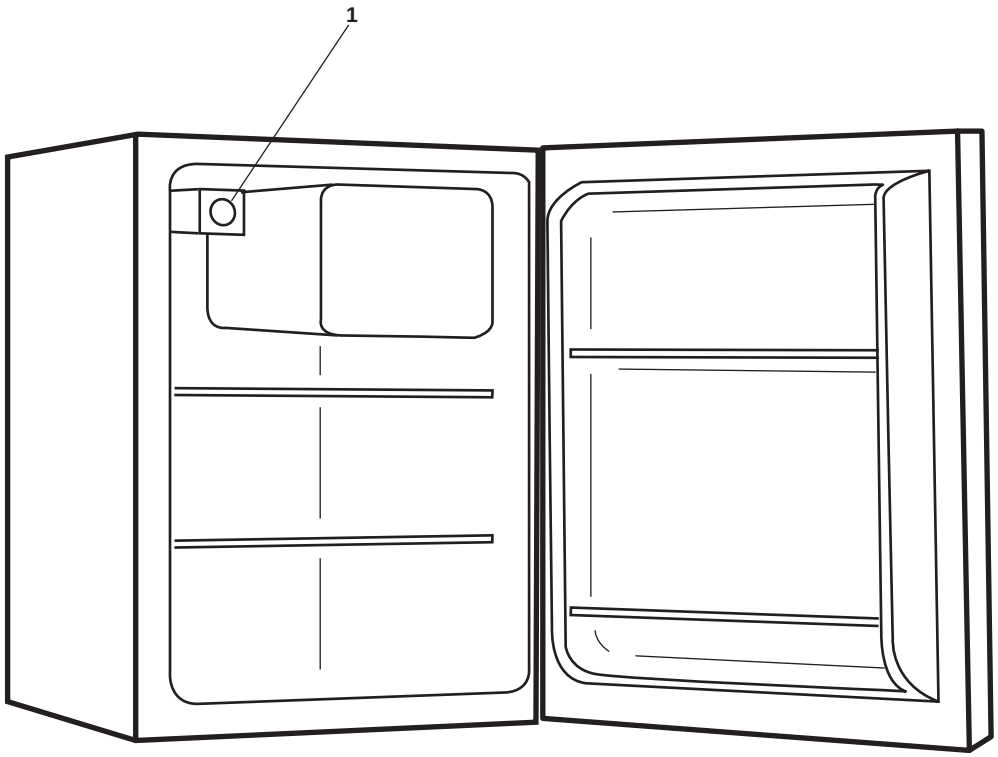


Figure 7. Refrigerator

Table 7. Refrigerator (refer to figure 7)

Key	Control/Indicator	Function
1	Thermostat	The thermostat regulates the temperature inside the refrigerator. It permits adjustment of the temperature.

MILK DISPENSER

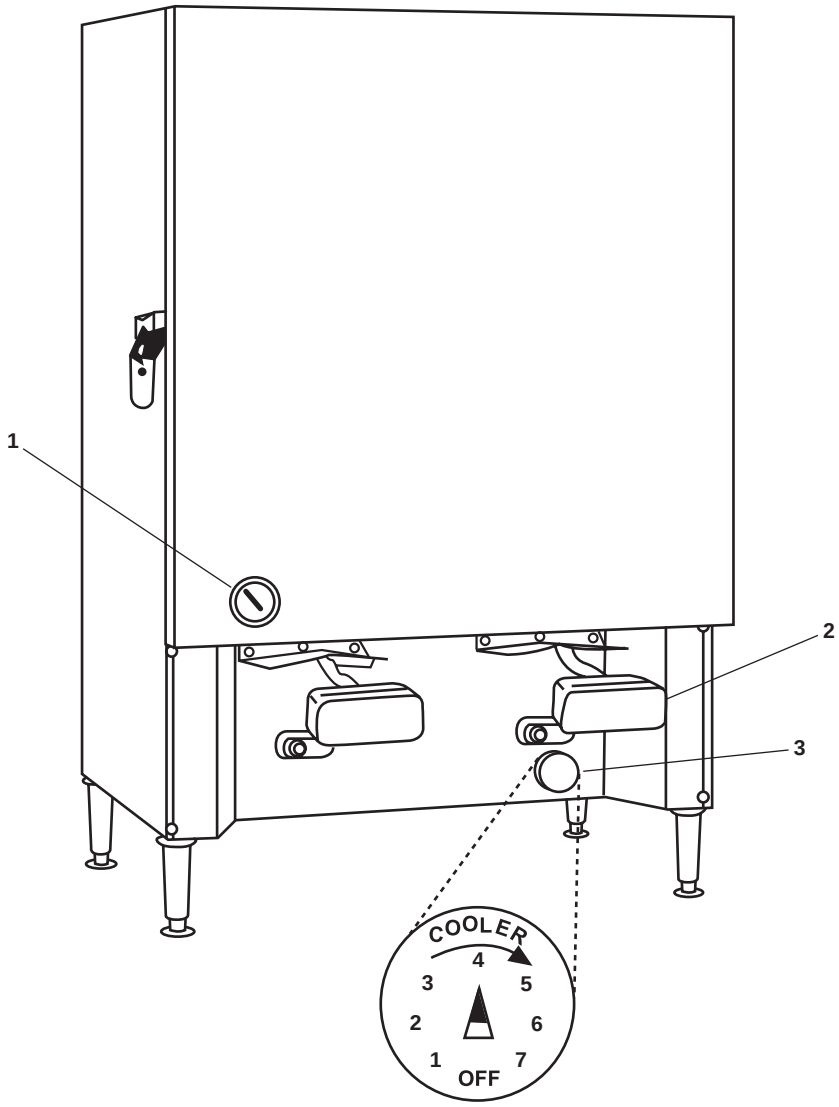


Figure 8. Milk Dispenser

Table 8. Milk Dispenser (refer to figure 8)

Key	Control/Indicator	Function
1	Thermometer	The thermometer gives a continuous reading of the temperature in the dispenser.
2	Dispensing Valve	Movement of the dispensing valve will discharge milk from the holding container.
3	Temperature Control	The temperature control adjusts the temperature inside of the milk dispenser.

BEVERAGE DISPENSER

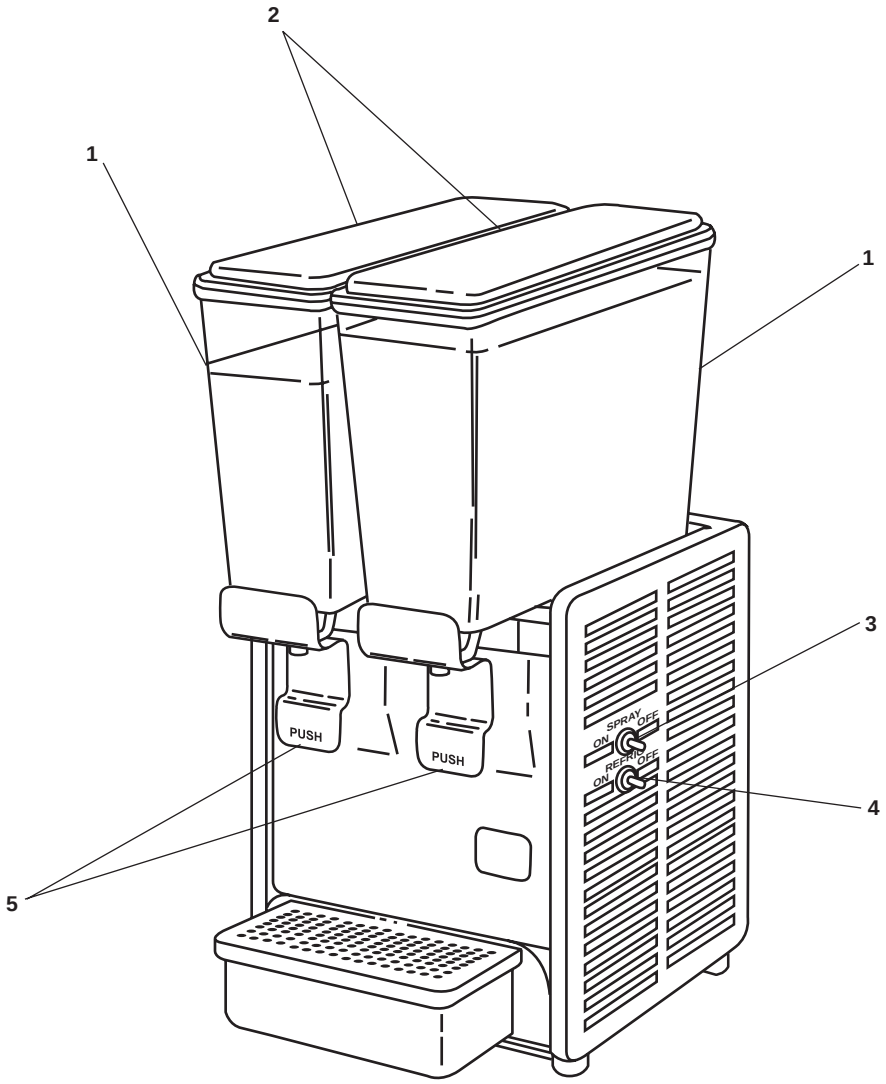


Figure 9. Beverage Dispenser

Table 9. Beverage Dispenser (refer to figure 9)

Key	Control/Indicator	Function
1	Bowl	This is the reservoir for the beverage.
2	Lid	This lid provides access for refilling the bowl.
3	SPRAY ON/OFF Switch	This switch turns the spray ON and OFF.
4	REFRIG ON/OFF Switch	This switch turns the refrigeration ON and OFF.
5	Dispensing Valves	These valves control the dispensing of the drink.

MICROWAVE OVEN

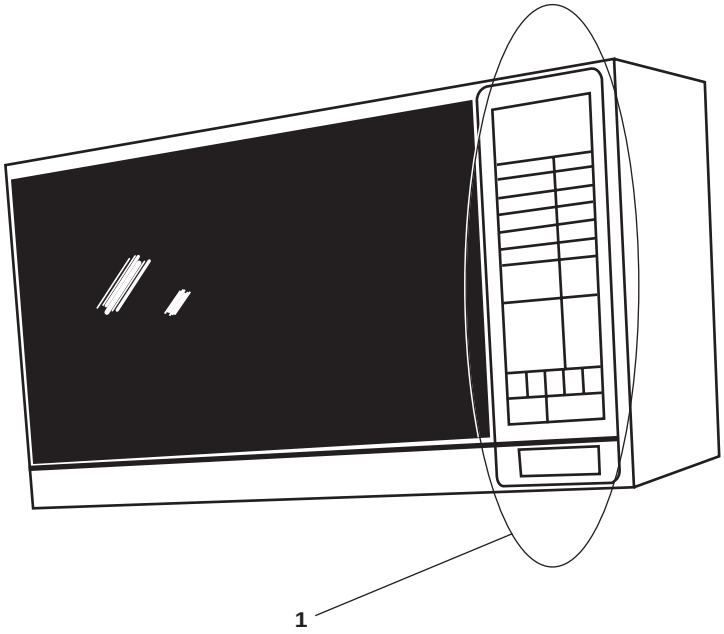


Figure 10. Microwave Oven

Table 10. Microwave Oven (refer to figure 10)

Key	Control/Indicator	Function
1	Control Panel	This control panel contains the pushbuttons that enable operation of the oven.

TOASTER

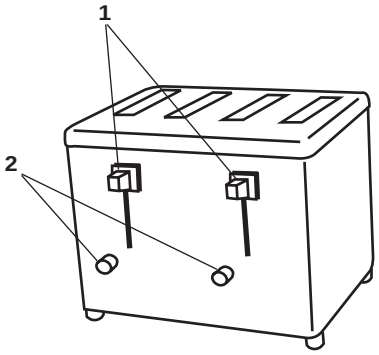


Figure 11. Toaster

Table 11. Toaster (refer to figure 11)

Key	Control/Indicator	Function
1	TOAST Pushbutton	Push DOWN on this pushbutton to toast the selected slices.
2	Level Selector	This knob permits the user to select desired level of darkness for the toast.

AMS 2 WATERTIGHT DOOR INDICATOR

Figure 12. AMS 2 Watertight Door Indicator

Table 12. AMS 2 Watertight Door Indicator (refer to figure 12)

Key	Control/Indicator	Function
1	Indicator Pointer	This pointer indicates the position of the watertight door from CLOSED to OPEN.

120V MAIN DECK, 01 & 02 EMERGENCY LIGHTING PANEL NO. 1

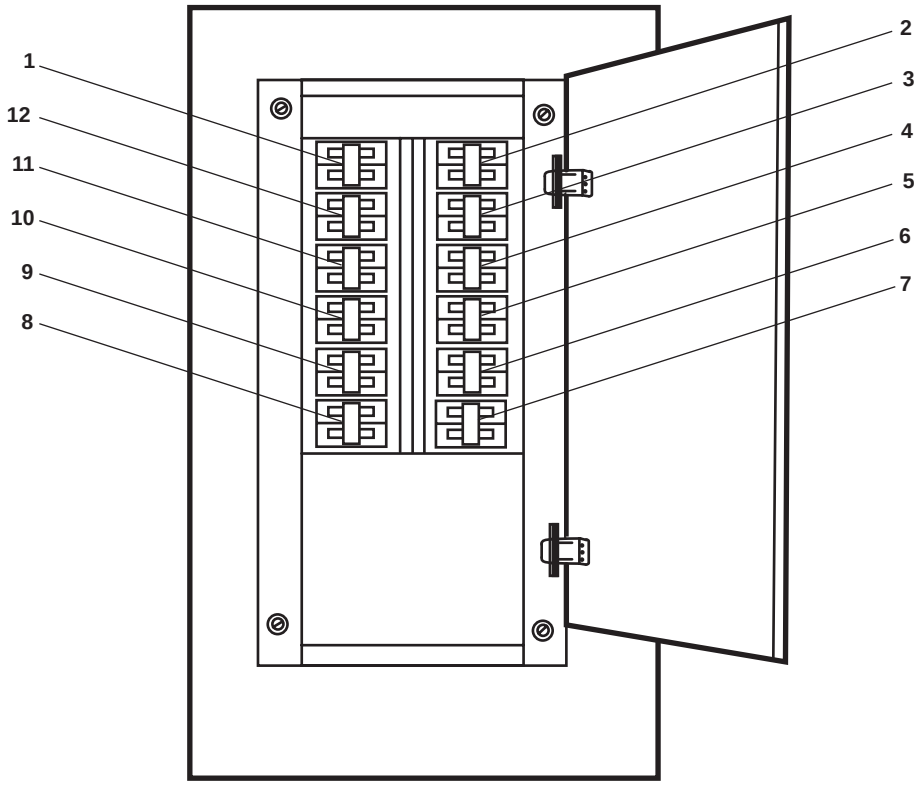


Figure 13. 120V Main Deck, 01 & 02 Emergency Lighting Panel No. 1

Table 13. 120V Main Deck, 01 & 02 Emergency Lighting Panel No. 1 (refer to figure 13)

Key	Control/Indicator	Function
1	MAIN DECK EMERGENCY LIGHTING. Circuit Breaker	This circuit breaker protects the main deck emergency lighting circuits.
2	FM-200 SYSTEM. Circuit Breaker	This circuit breaker protects the FM-200 system amber strobe lights.
3	01 LEVEL EMERGENCY LIGHTS. Circuit Breaker	This circuit breaker protects the 01 level emergency lighting circuits.
4	SPARE. Circuit Breaker	This is a spare circuit breaker.
5	PILOTHOUSE EMERGENCY LIGHTS. Circuit Breaker	This circuit breaker protects the pilothouse emergency lights.
6	ALARM SWITCHBOARD. (HIGH TEMPERATURE & SPRINKLER). Circuit Breaker	This circuit breaker protects the alarm switchboard.
7	SPARE. Circuit Breaker	This is a spare circuit breaker.
8	SPARE. Circuit Breaker	This is a spare circuit breaker.
9	RADIO ROOM EMERGENCY LIGHTS. Circuit Breaker	This circuit breaker protects the emergency lights in the radio room.
10	SPARE. Circuit Breaker	This is a spare circuit breaker.
11	REFRIGERATOR STORE ROOM LIGHTS. Circuit Breaker	This circuit breaker protects the refrigerated storeroom lighting circuits.
12	FREEZER ALARM. Circuit Breaker	This circuit breaker protects the freezer alarms.

FIRE STATION

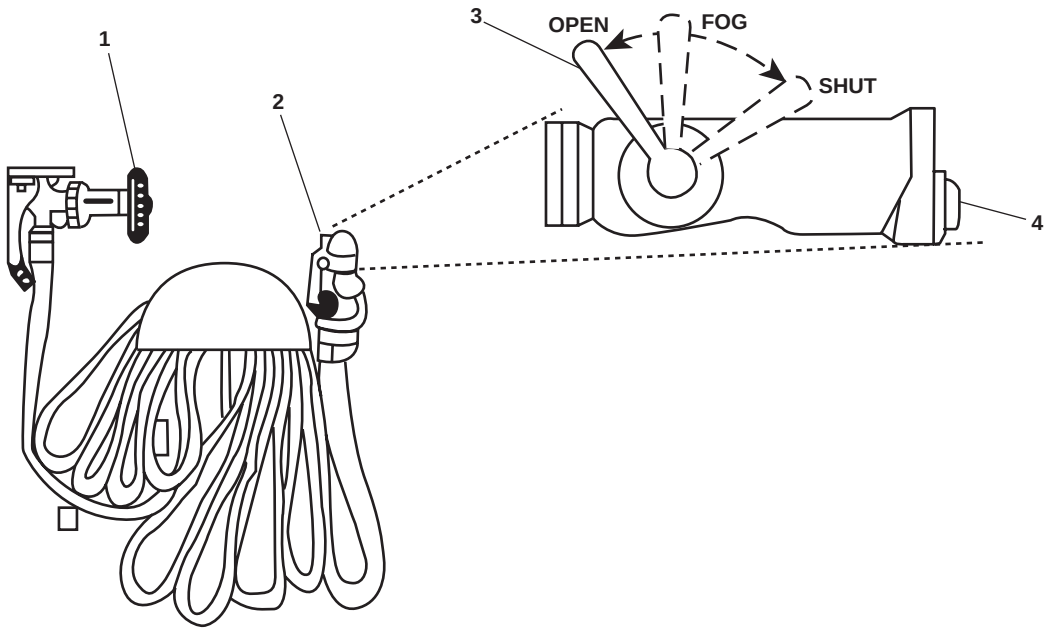


Figure 14. Fire Station

Table 14. Fire Station (refer to figure 14)

Key	Control/Indicator	Function
1	Valve	This valve turns the fire main water ON and OFF.
2	Nozzle	This nozzle directs water by spray or stream to the fire.
3	Nozzle Valve	The nozzle valve controls the flow of water from the nozzle. When in the SHUT position, the flow of water is stopped. When in the FOG position, the water is directed to the fog jet. When in the OPEN position, water is directed to the single stream outlet.
4	Fog Outlet Plug	This plug provides an outlet for attaching 4-foot and 12-foot applicators.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
GALLEY

GALLEY, GENERAL ARRANGEMENT

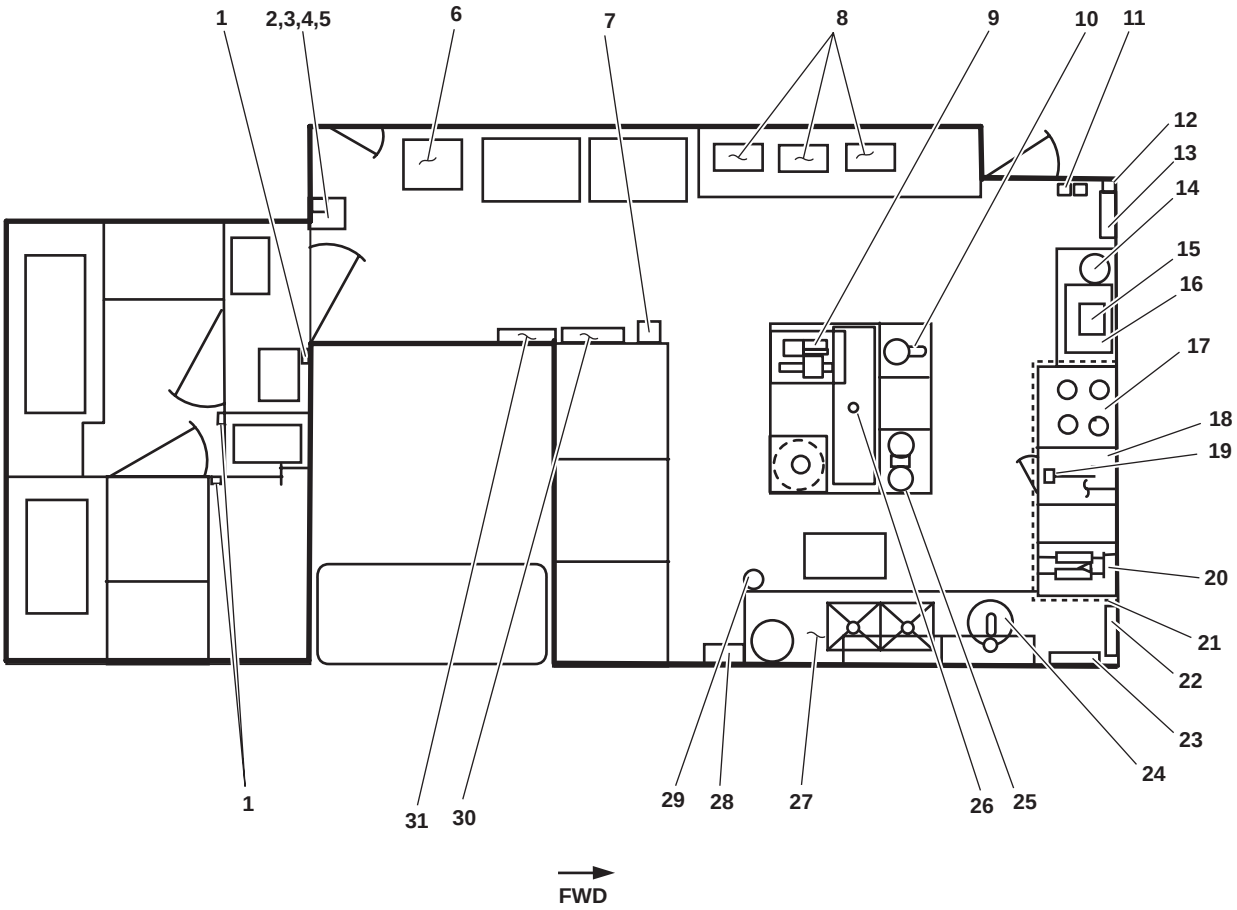


Figure 1. Galley, General Arrangement

Table 1. Galley, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Freezer Alarm Switch	The freezer alarm switch is provided in the event a crewmember becomes trapped inside the chill box, the crewmember can activate the freezer box alarm using the freezer alarm switch.
2	Freeze Alarm Horn	The freezer alarm horn sounds when the freezer alarm is activated.
3	SHIP'S STORE REFER SYS FRZR DEFROST TIMER	This timer controls the freezer's defrost cycle. See figure 2 for details.
4	Ship's Store Refer Sys Disconnect Switch	This switch secures the power to the walk-in box.

Table 1. Galley, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
5	Defrost heater controller	The defrost heater controller controls the power to the walk-in box defrost heaters.
6	Trash Compactor	The trash compactor compacts trash, reducing the volume of trash. See figure 3 for details.
7	Sound Powered Telephone	The sound powered telephone is used for intraship communications. See figure 4 for details.
8	Steam Table	The steam table provides controls for hot wells and dish storage. See figure 5 for details.
9	Meat Slicer	The countertop mounted meat slicer is used to slice meat products. See figure 6 for details.
10	Mixer	The mixer is used to combine ingredients for food preparation. See figure 7 for details.
11	Galley Fire Suppression Pull Box	This pull box allows manual actuation of the gallery fire suppression system.
12	Thermostat	The thermostat provides temperature control in the galley. See figure 9 for details.
13	440V Power Panel No. 2	This power panel contains circuit breakers for the 440V galley equipment. See figure 10 for details.
14	Coffee percolator	This countertop-mounted percolator provides hot coffee. See figure 11 for details.
15	Toaster	This countertop-mounted four-slice toaster provides toasted bread slices. See figure 12 for details.
16	Microwave	This microwave oven is used for quick food preparation. See figure 13 for details.
17	Range	This electric range and oven is used for food preparation. See figure 14.
18	Griddle	The electric griddle used for food preparation. See figure 15 for details.
19	Hood Damper Control Knob	The hood damper control knob contains fail-safe circuitry coupled with a spring drive, which allows closure of the fire damper even if electrical power is interrupted or turned OFF. The hood damper control knob resets to normal operating position when the fan is restarted. See figure 16 for details.
20	Fryer	The double basket, electric fryer is used for deep fat frying. See figure 17 for details.
21	Gaylord Ventilator Hood	The ventilator hood is provided for the cooking area ventilation. The ventilator hood contains the automatic cleaning system and fire protection system. See figure 16 for details.

Table 1. Galley, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
22	Gaylord Ventilation Control Cabinet	This cabinet houses the controls for the ventilator hood cleaning system, the fire cycle spray, and a fire alarm pull box. See figure 18 for details.
23	Galley Fire Suppression System Cabinet	The galley fire suppression cabinet contains the system's reservoir and activating mechanisms. See figure 19 for details.
24	Potato Peeler	The countertop mounted electric peeler is used to peel potatoes. See figure 20 for details.
25	Bakers' Scale	The countertop-mounted bakers' scale is used for weighing food and ingredients. See figure 21 for detail.
26	Thermal Heat Detector	When the area temperature rises to 275 °F (135 °C) or more the thermal heat detector activates the fire alarm system.
27	Dishwasher	The industrial type dishwasher is used for sanitizing dishes and utensils. See figure 22 for details.
28	Galley Exhaust Fan Motor Controller	The galley exhaust fan motor controller turns the fan ON and OFF. See figure 23 for details.
29	FO-15, F.O. SERV. SUCT. STBD. Valve Remote Operator	The remote operator provides control of valve FO-15, F.O. SERV. SUCT. STBD. This valve secures fuel flow from the starboard day tank.
30	220/110V Distribution Panel	This panel contains circuit breakers for the galley and crew's mess equipment. See figure 24 for details.
31	120V Distribution Panel No. 1	This panel contains circuit breakers for various pieces of galley equipment. See figure 25 for details.

SHIP'S STORE REEFER SYSTEM FREEZER DEFROST TIMER

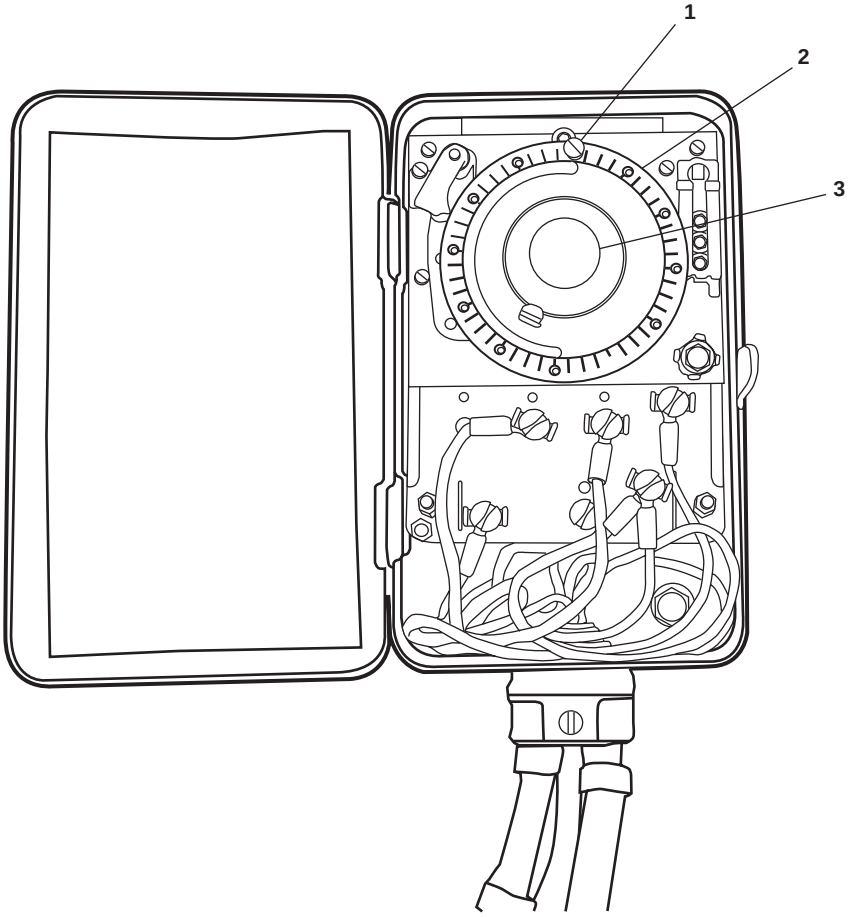


Figure 2. Ship's Store Reefer System Freezer Defrost Timer

Table 2. Ship's Store Reefer System Freezer Defrost Timer (refer to figure 2)

Key	Control/Indicator	Function
1	Tab	This tab can be moved to set the time for defrost.
2	Time Indicator	This dial indicates the time of day.
3	Time Set Knob	This knob is used to set the time of day.

TRASH COMPACTOR

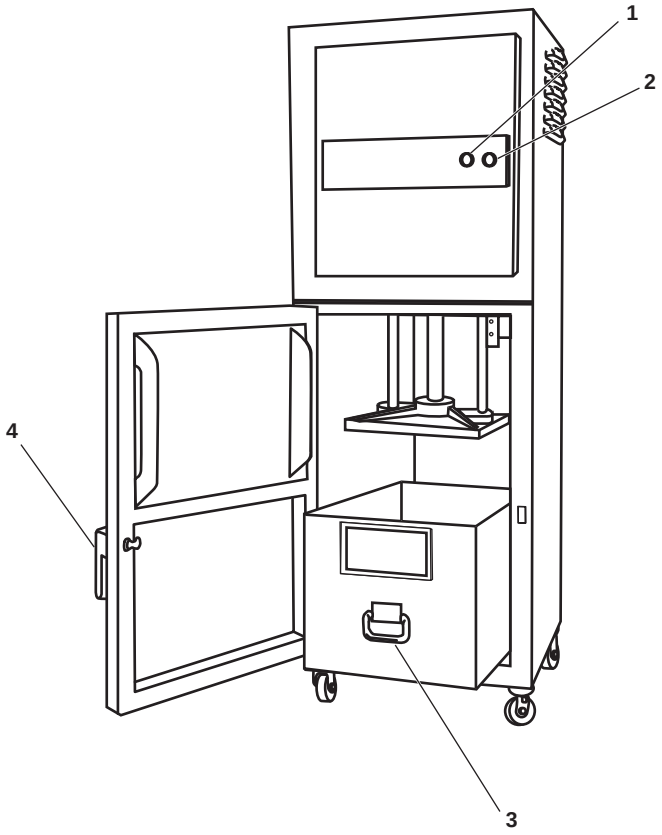


Figure 3. Trash Compactor

Table 3. Trash Compactor (refer to figure 3)

Key	Control/Indicator	Function
1	ON/OFF Key Switch	This switch turns the unit ON and OFF.
2	START/STOP Pushbutton Switch	This switch controls the operation of the compactor.
3	Box Handle	This box handle permits the box to be removed from the compactor.
4	Door Handle	This door handle secures and opens the compactor door.

SOUND POWERED TELEPHONE

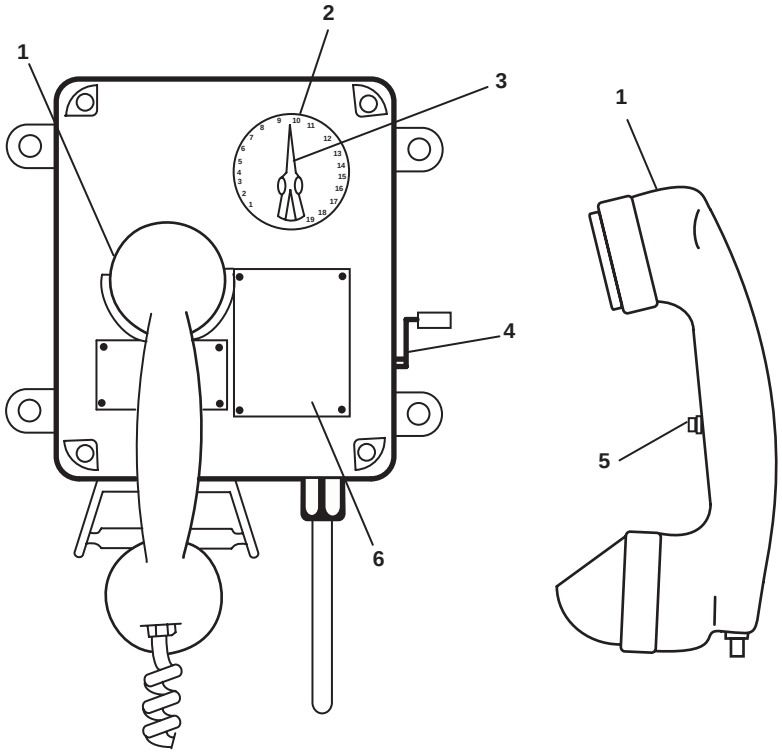


Figure 4. Sound Powered Telephone

Table 4. Sound Powered Telephone (refer to figure 4)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	This dial outlines available stations.
3	Selector Knob	This knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	This pushbutton is used to transmit.
6	DIRECTORY Plate	This directory plate lists telephone stations aboard the vessel.

STEAM TABLE

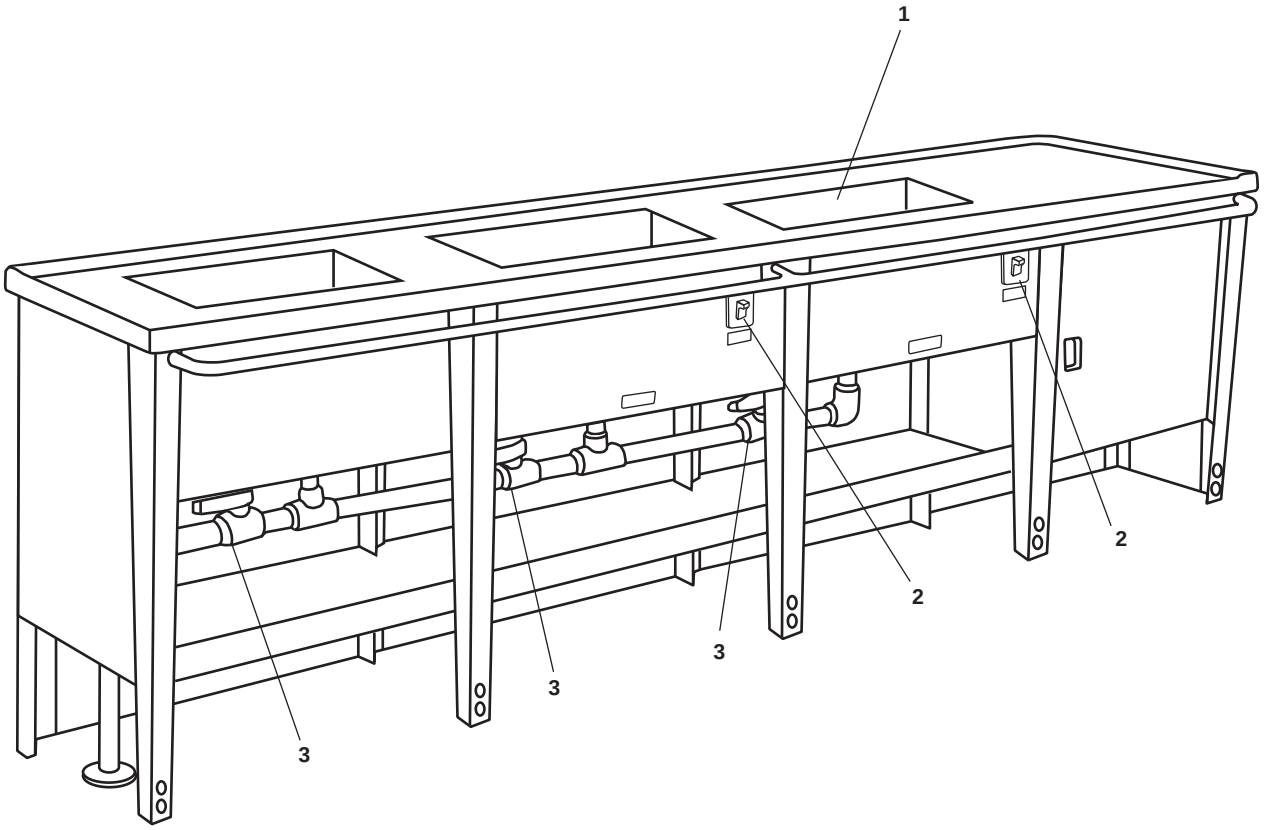


Figure 5. Steam Table

Table 5. Steam Table (refer to figure 5)

Key	Control/Indicator	Function
1	Well	The well holds water for keeping food hot.
2	Power Switch	This switch turns the heating elements that maintain the water temperature in the wells (figure 2, item 1) ON and OFF .
3	Drain Valves	These valves permit draining of the wells for cleaning.

MEAT SLICER

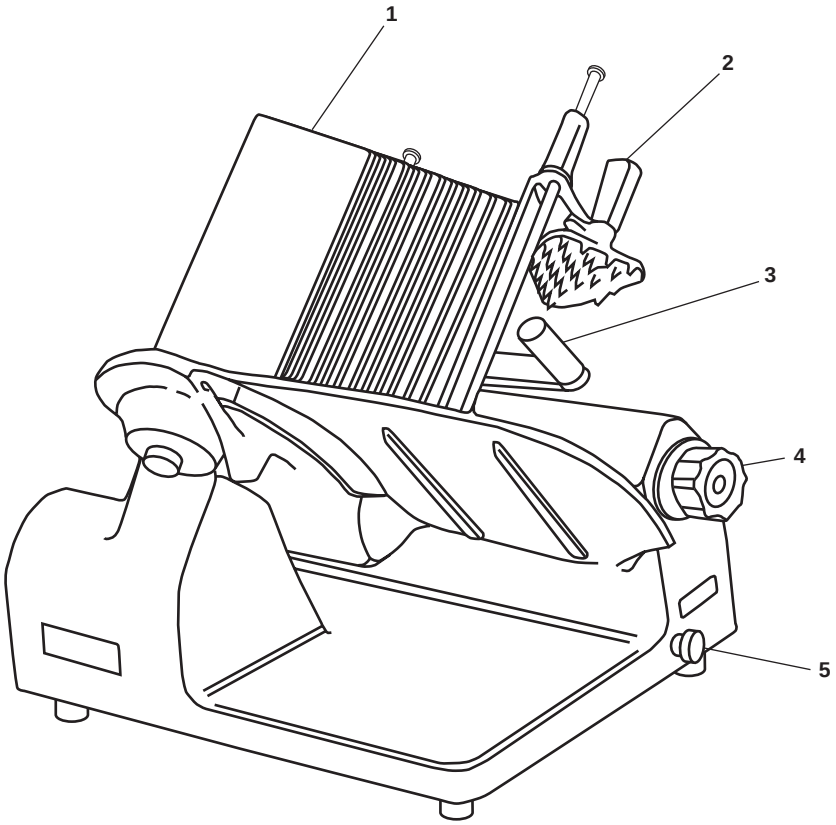


Figure 6. Meat Slicer

Table 6. Meat Slicer (refer to figure 6)

Key	Control/Indicator	Function
1	Carriage	The carriage holds the product during slicing.
2	Meat Grip	The meat grip is used for holding odd shapes or short end pieces.
3	Carriage Handle	The carriage handle is used to move the carriage back and forth.
4	Slice Adjusting Dial	Use this dial to adjust the thickness of the slices cut. Numbers on the dial indicate actual measurements in 0.010 in (0.25 mm) increments.
5	PULL TO START/PUSH Switch	This switch turns the meat slicer ON and OFF.

MIXER

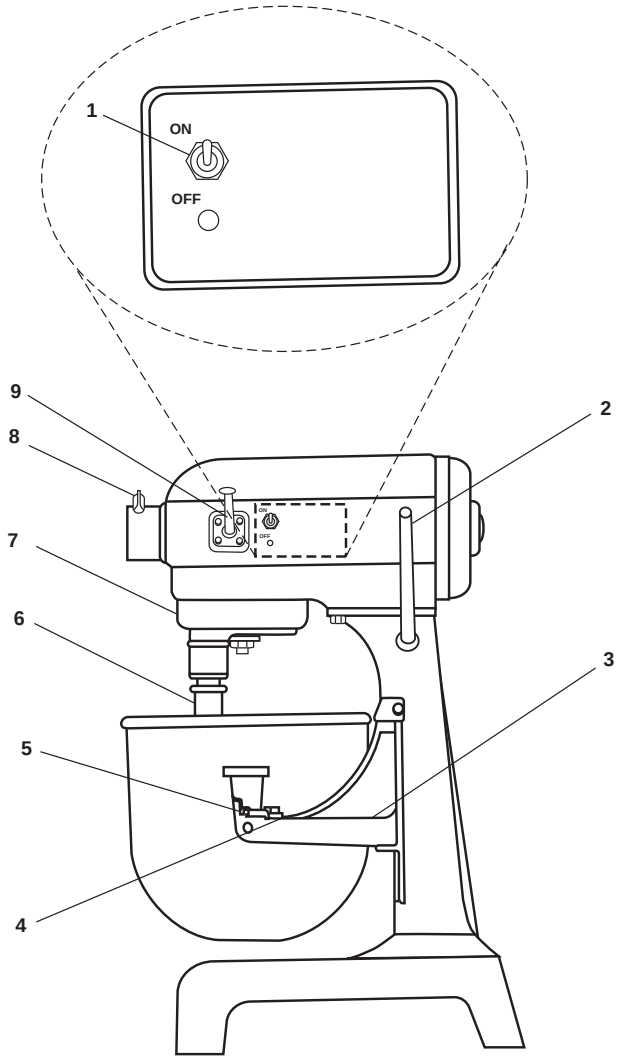


Figure 7. Mixer

Table 7. Mixer (refer to table 7)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the mixer ON and OFF.
2	Bowl Lift Handle	This handle is used to raise or lower the bowl.
3	Bowl Support	This support provides a base for mounting the bowl.
4	Bowl Clamps	These clamps lock the bowl in place when rotated over the ears of the bowl.
5	Alignment Pins	These pins are used to properly set the bowl on the bowl support.
6	Agitator	This agitator mixes the contents in the bowl.
7	Drip Cup	This cup collects any lubricants from the motor.
8	Attachment Hub Thumb Screw	Thus thumb screw secures attachments in the attachment hub.
9	Gear Shift Lever	This lever selects between speed 1 (LOW), speed 2 (MEDIUM), and speed 3 (HIGH).

FIRE ALARM PULL STATION

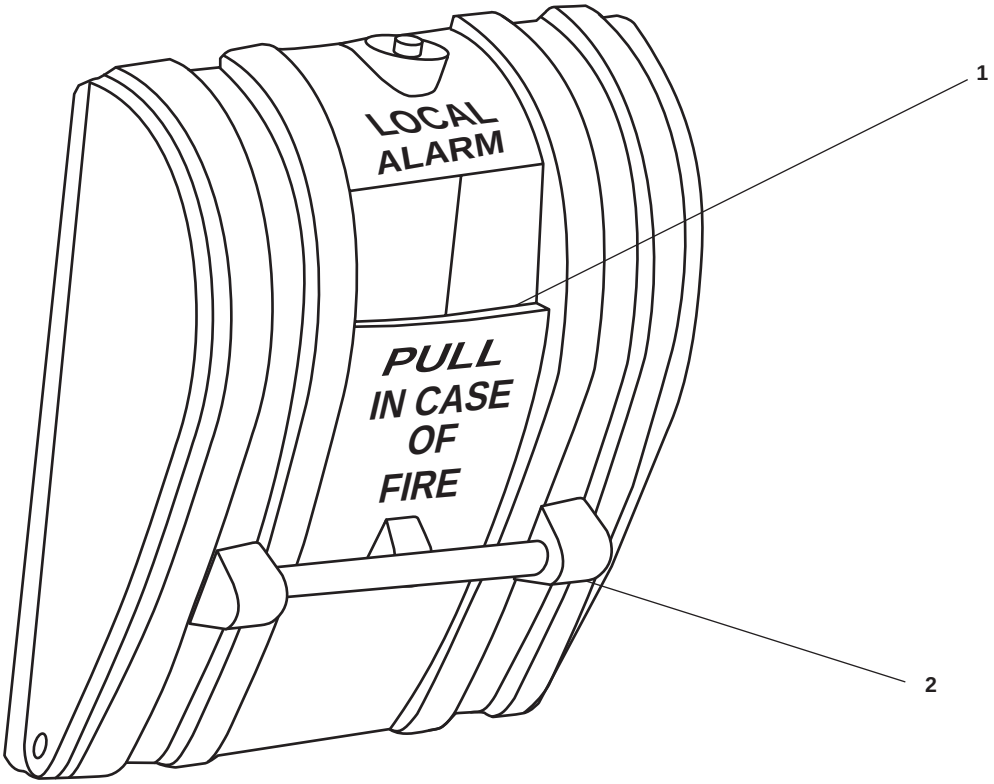


Figure 8. Fire Alarm Pull Station

Table 8. Fire Alarm Pull Station (refer to figure 8)

Key	Control/Indicator	Function
1	Handhold	This is used to pull DOWN to activate the alarm.
2	Glass Rod	The glass rod acts as a seal to indicate if this station has been activated.

THERMOSTAT

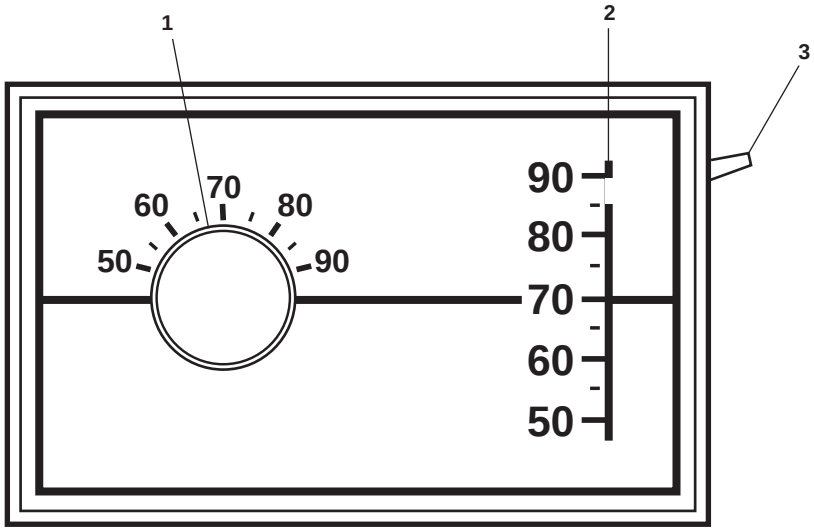


Figure 9. Thermostat

Table 9. Thermostat (refer to figure 9)

Key	Control/Indicator	Function
1	Thermometer	The thermometer indicates the actual temperature in the space.
2	Set Point Dial	This dial indicates the temperature for which the thermostat is set.
3	Set Point Handle	This handle permits changing of the desired temperature for the space.

440V POWER PANEL NO. 2

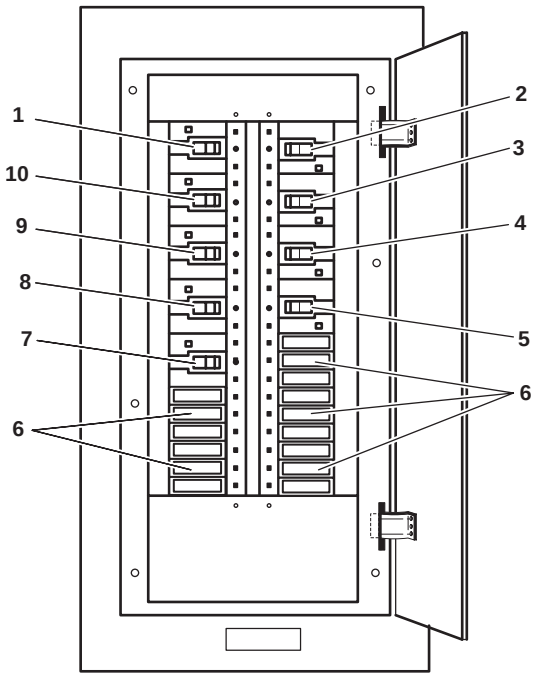


Figure 10. 440V Power Panel No. 2

Table 10. 440V Power Panel No. 2 (refer to figure 10)

Key	Control/Indicator	Function
1	REHEATER 1-23-2. Circuit Breaker	This circuit breaker protects reheater 1-23-2.
2	GALLEY SUPPLY FAN S1-22-4/ CONTROLLER FOR GALLEY EXTRACT FAN E1-37-1. Circuit Breaker	This circuit breaker protects the galley supply ventilation fan.
3	GRIDDLE. Circuit Breaker	This circuit breaker protects the griddle.
4	GALLEY EXHAUST FAN E1-37-1/CONTROLLER FOR GALLEY SUPPLY FAN S1-22-4. Circuit Breaker	This circuit breaker protects the galley exhaust ventilation fan.
5	SPARE. Circuit Breaker	This is a spare circuit breaker.
6	Blank	There is no circuit breaker in this position.
7	SPARE. Circuit Breaker	This is a spare circuit breaker.
8	SPARE. Circuit Breaker	This is a spare circuit breaker.
9	FRY KETTLE. Circuit Breaker	This circuit breaker protects the fryer.
10	RANGE. Circuit Breaker	This circuit breaker protects the range.

COFFEE MAKER

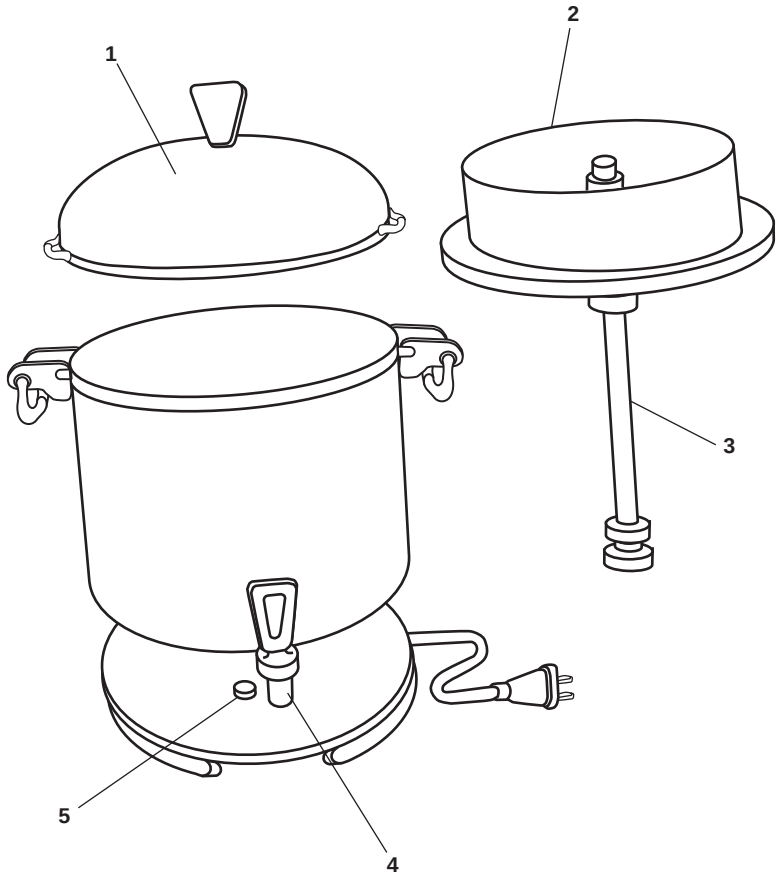


Figure 11. Coffee Maker

Table 11. Coffee Maker (refer to figure 11)

Key	Control/Indicator	Function
1	Cover	The cover keeps percolating coffee inside the coffee maker. It also provides access for filling and cleaning.
2	Basket	The basket holds the coffee grounds.
3	Pump Tube	The tube pumps water to top of coffee maker.
4	Spigot	OPEN the spigot to dispense coffee.
5	Indicator Light	This light illuminates to indicate that the coffee is ready.

TOASTER

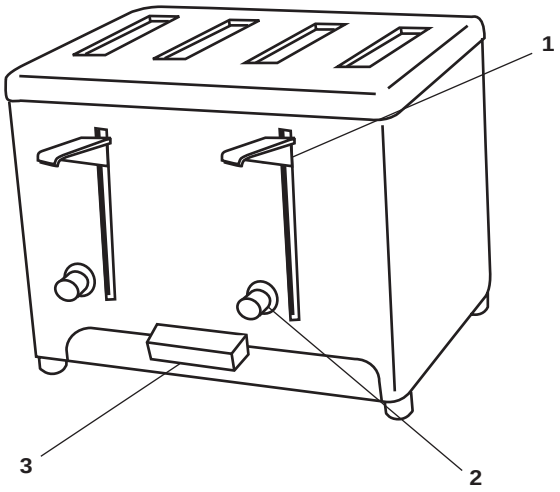


Figure 12. Toaster

Table 12. Toaster (refer to figure 12)

Key	Control/Indicator	Function
1	Operating Lever	When pressed, this lever activates the toaster heating elements while lowering the product for toasting.
2	Color Selection Knob	This knob adjusts from LIGHT to DARK to determine the color of the finished toast.
3	Crumb Tray	The crumb tray is removed for cleaning by pulling it straight out.

MICROWAVE OVEN

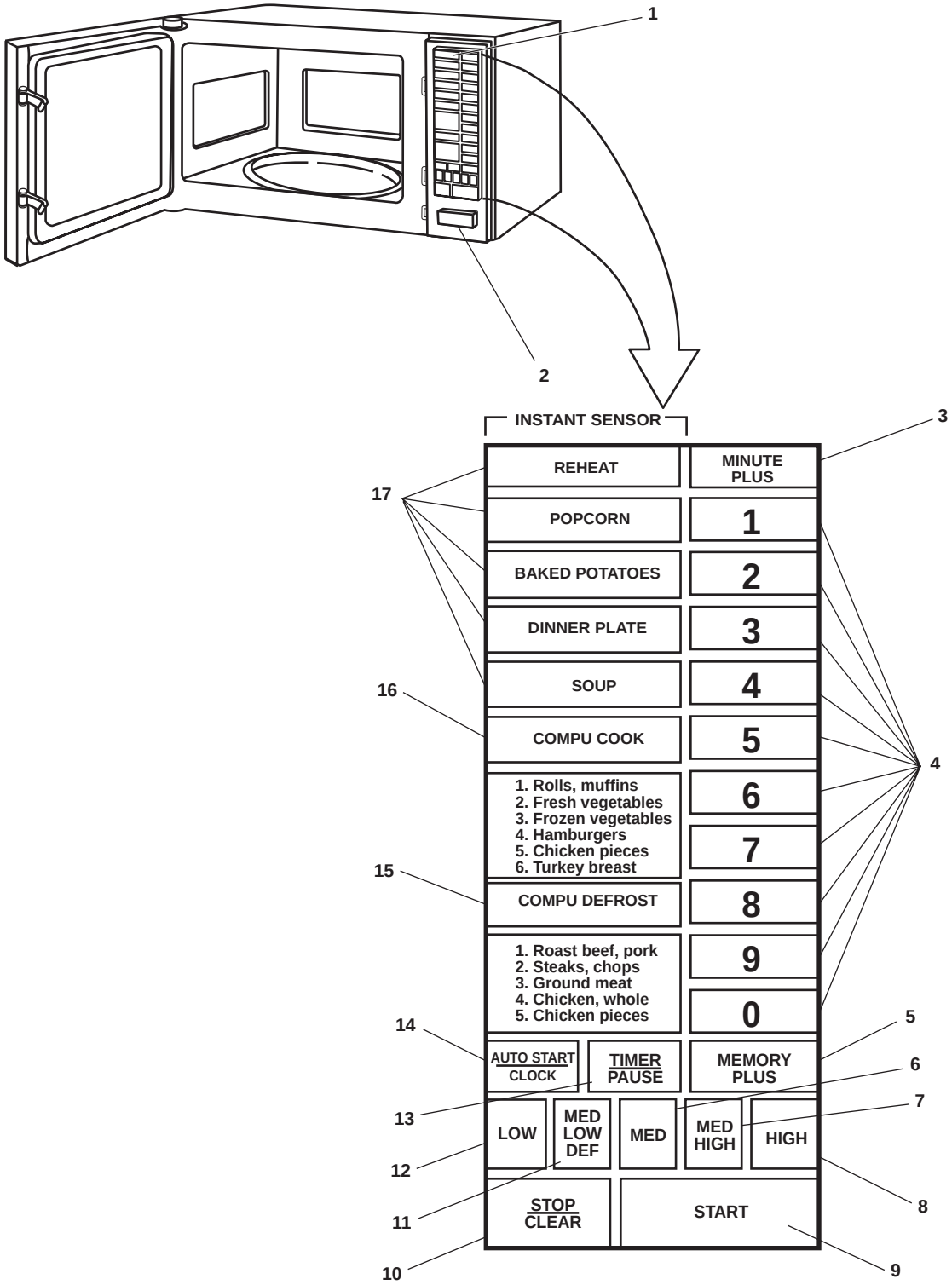


Figure 13. Microwave Oven

Table 13. Microwave Oven (refer to figure 13)

Key	Control/Indicator	Function
1	Time Display	This digital readout displays the time of day or the remaining cooking time.
2	Door Open Button	PUSH this button to OPEN the door.
3	MINUTE PLUS Display	Pressing this button once automatically sets the power level to HIGH and the time to one minute. Pressing MINUTE PLUS during cooking increases time by one minute.
4	Number Buttons	These buttons are used for programming and selecting features.
5	MEMORY PLUS Button	This button is used to enter/recall on cooking sequence into memory.
6	MED Button	This button selects MEDIUM (50%) power level for cooking.
7	MED HIGH Button	This button selects MEDIUM HIGH (70%) power level for cooking.
8	HIGH Button	This button selects HIGH (100%) power for cooking.
9	START Button	This button starts the oven operation.
10	STOP CLEAR Button	This button stops the oven temporarily during cooking. It erases a mistake during programming and cancels the minute timer. Pressing twice during cooking cancels a program.
11	MED LOW DEF Button	This button selects a MEDIUM LOW/DEFROST (30%) power level for cooking.
12	LOW Button	This button selects the LOW (10%) power level for cooking.
13	TIMER/PAUSE Button	This button is used to set the timer without cooking involved.
14	AUTO START CLOCK Button	This button is used to program automatic start functions or to set the time of day.
15	COMPU DEFROST Button	This button selects COMPU DEFROST mode and starts the operating procedure.
16	COMPU COOK Button	This button selects COMPU COOK mode and starts the operating procedure.
17	Instant Sensor Buttons	This button selects preprogrammed cooking controlled by an internal sensor.

RANGE

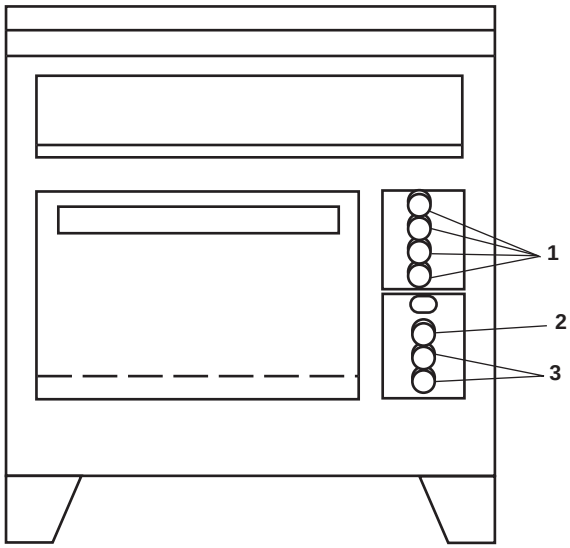


Figure 14. Range

Table 14. Range (refer to figure 14)

Key	Control/Indicator	Function
1	Range Top Controls	These knobs individually control the temperature of the range top elements.
2	Thermostat	The thermostat controls the oven temperature.
3	Temperature-Heating Control	This control provides selection of LOW-MEDIUM-HIGH temperature control for the range oven.

GRIDDLE

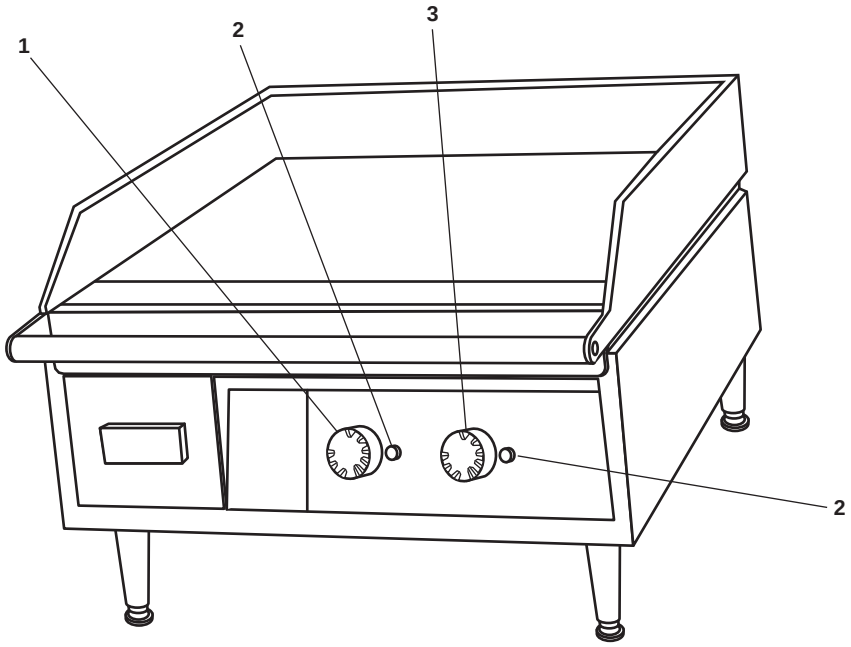


Figure 15. Griddle

Table 15. Griddle (refer to figure 15)

Key	Control/Indicator	Function
1	Left Side Temperature Control	This knob controls the temperature on the left side of the griddle.
2	Power ON Indicator	This indicator illuminates to indicate that the selected heating element is powered.
3	Right Side Temperature Control	This knob controls the temperature on the right side of the griddle.

VENTILATOR HOOD

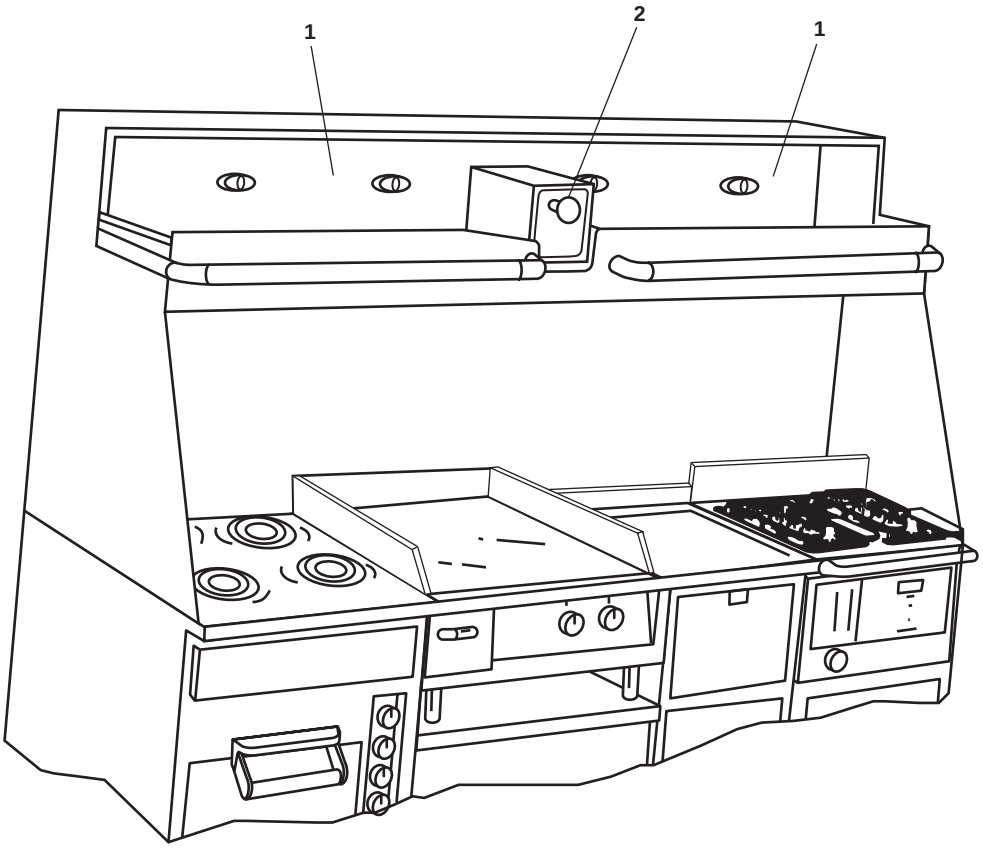


Figure 16. Ventilator Hood

Table 16. Ventilator Hood (refer to figure 16)

Key	Control/Indicator	Function
1	Access Doors	These doors provide the means to visually inspect the internal components of the hood.
2	Damper Control Knob	Pull OUT on the damper control knob to CLOSE the exhaust dampers.

FRYER

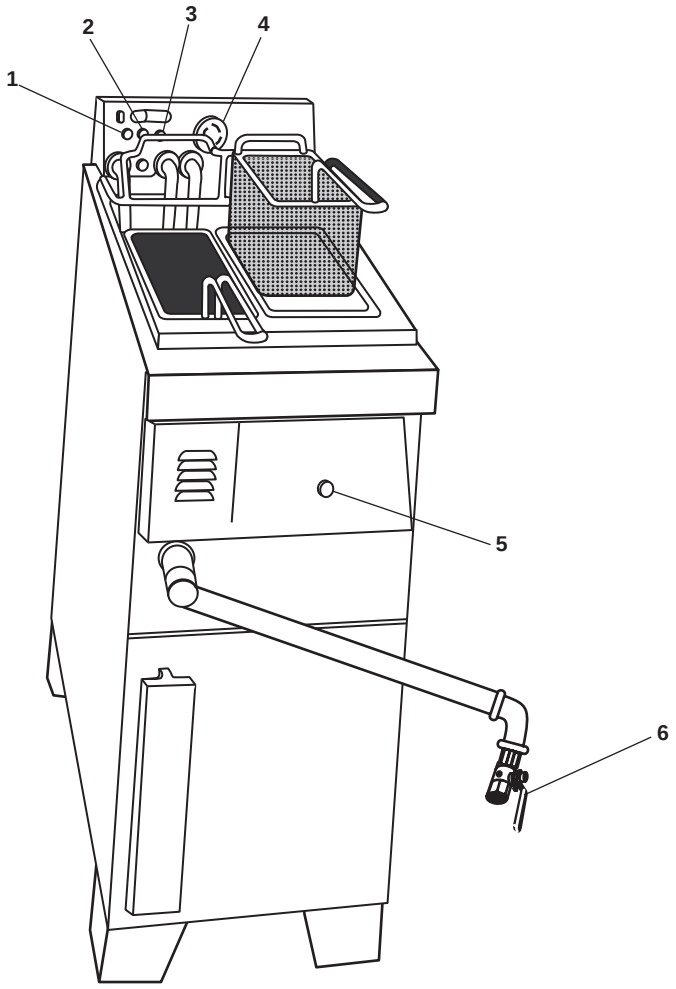


Figure 17. Fryer

Table 17. Fryer (refer to figure 17)

Key	Control/Indicator	Function
1	Power Indicator	This indicator illuminates to indicate that the power is ON.
2	Heat Indicator	This indicator illuminates to indicate that power is applied to the heating elements.
3	Overtemp Indicator	This indicator illuminates to indicate that the oil has reached an over-temperature condition.
4	Thermostat	The thermostat is used to select the desired temperature setting 200 to 400 °F (93 to 204 °C) in 25 °F (14 °C) increments.
5	ON-OFF POWER Switch	This switch turns the fryer ON and OFF.
6	Drain Valve	This valve drains oil from the fryer when OPEN.

VENTILATION CONTROL CABINET

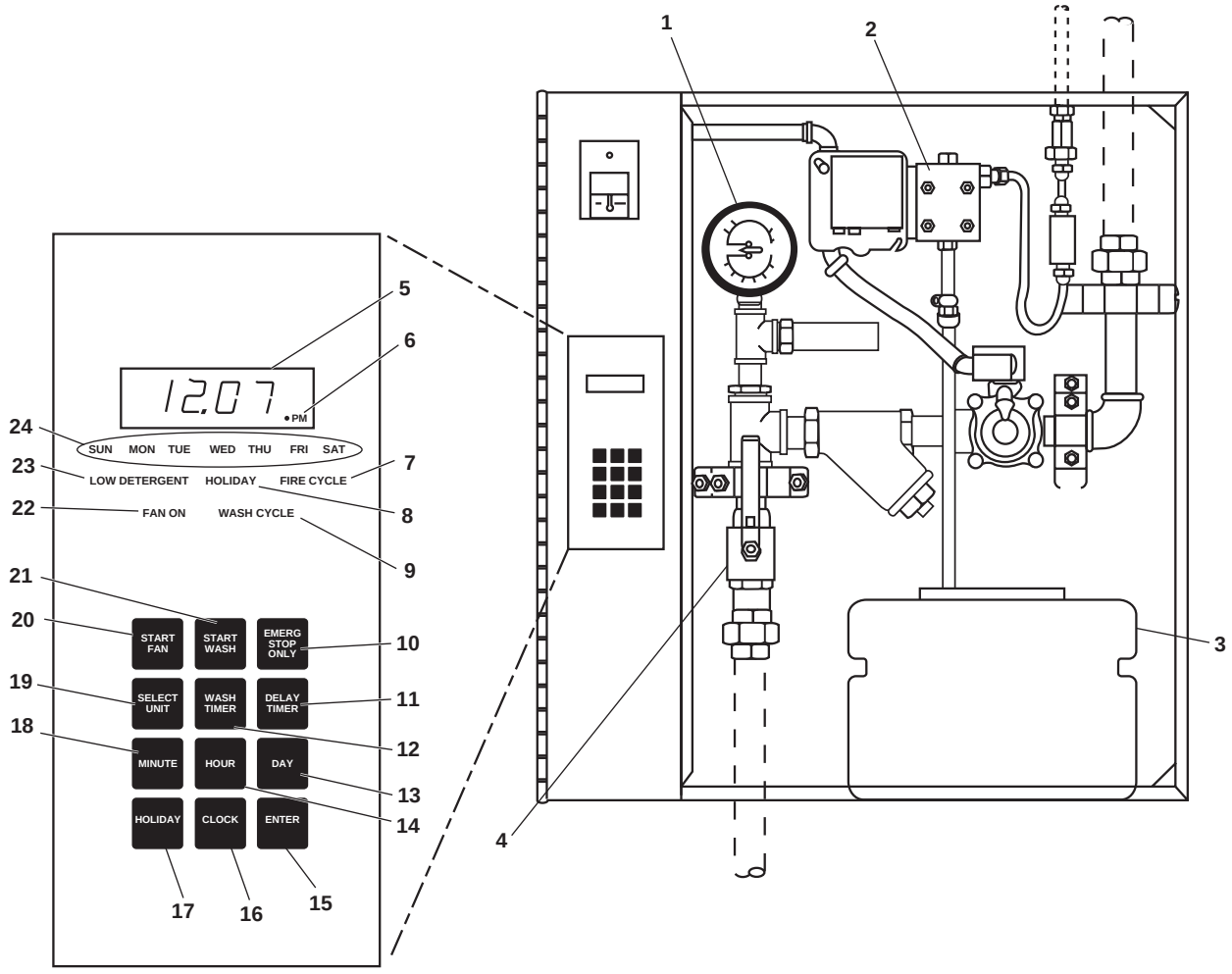


Figure 18. Ventilation Control Cabinet

Table 18. Ventilation Control Cabinet (refer to figure 18)

Key	Control/Indicator	Function
1	Pressure/Temperature Gauge	This gauge provides system pressure and temperature readings.
2	TEST SWITCH	This is a momentary switch used to test the detergent pump.
3	Soap Container	This container contains the soap supply for the hood system. The soap level may be seen through the sides of the container.
4	PW-29, Cutoff Valve	The PW-29 cutoff valve controls the water supply to this system.
5	Clock	The digital clock displays the time of day.
6	PM Indicator	The PM indicator illuminates to indicate the afternoon hours.
7	FIRE CYCLE Indicator	This indicator illuminates to indicate that the fire switch has been pulled or the thermostat has been activated.

Table 18. Ventilation Control Cabinet (refer to figure 18) (continued)

Key	Control/Indicator	Function
8	HOLIDAY Indicator	This indicator illuminates to indicate that no wash is programmed for that day.
9	WASH CYCLE Indicator	This indicator illuminates to indicate that the wash cycle is in progress.
10	EMERG STOP ONLY Button	This pushbutton is used for an emergency shutdown of the exhaust fan or wash cycle.
11	DELAY TIMER Button	This button is used to program the delay timer.
12	WASH TIMER Button	This button is used to program the wash timer.
13	DAY Button	This button is used to program the day of the week.
14	HOUR Button	This button is used to program the hour.
15	ENTER Button	This button is used during various programming functions.
16	CLOCK Button	This button is used to set the clock.
17	HOLIDAY Button	This button is used to program a holiday (non-functioning day).
18	MINUTE Button	This button is used to program the minute.
19	SELECT UNIT Button	This button is used during various programming functions.
20	START FAN Button	This pushbutton manually starts the exhaust fan.
21	START WASH Button	This pushbutton manually starts the wash cycle.
22	FAN ON Indicator	This indicator illuminates to indicate that the fan is ON.
23	LOW DETERGENT Indicator	This indicator illuminates to indicate that the detergent reservoir is empty or that the detergent pump is not pumping.
24	Day of the Week Indicator	This indicator illuminates to display the day of the week.

GALLEY FIRE SUPPRESSION SYSTEM CABINET

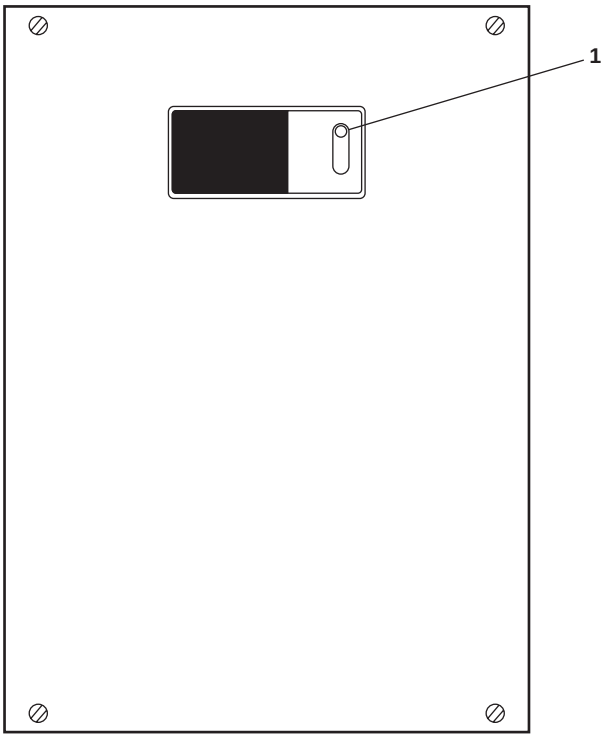


Figure 19. Galley Fire Suppression System Cabinet

Table 19. Galley Fire Suppression System Cabinet (refer to figure 19)

Key	Control/Indicator	Function
1	COCKED/FIRED Indicator	When in the UP position, this indicator shows that the system is COCKED and ready for operation. When in the DOWN position, it shows that the system has been FIRED and is not ready for operation.

PEELER

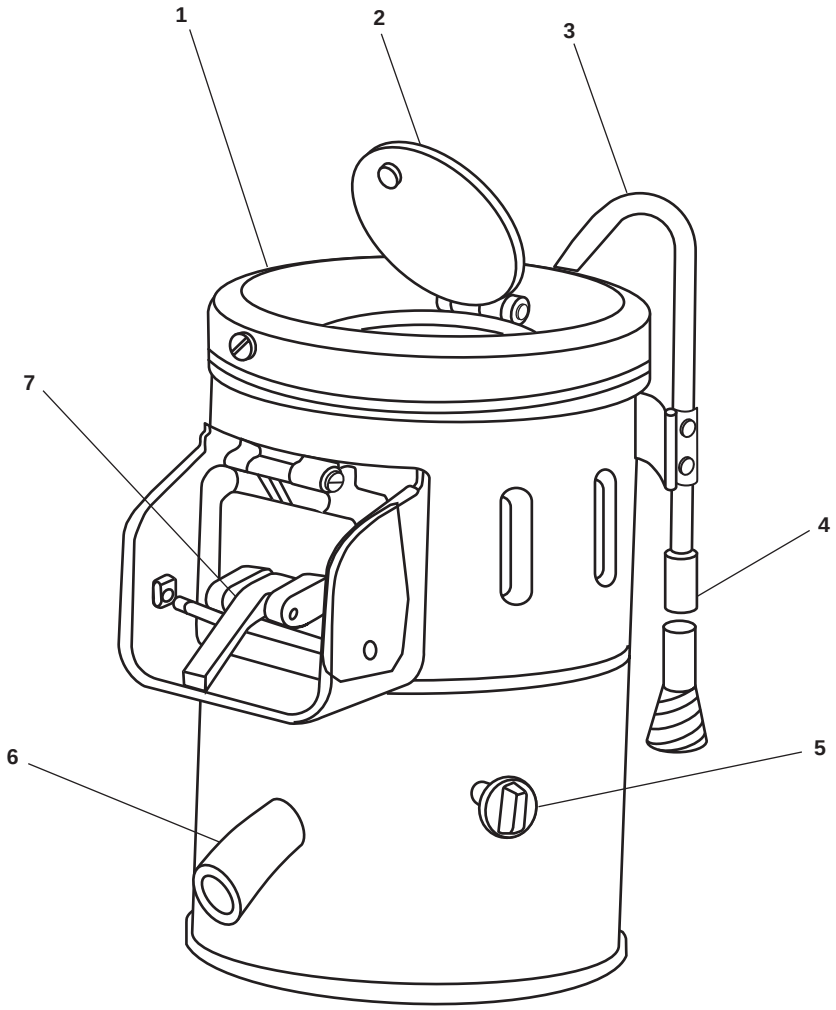


Figure 20. Peeler

Table 20. Peeler (refer to figure 20)

Key	Control/Indicator	Function
1	Cover	This cover prevents splashing during operation.
2	Lid	This lid allows input of unpeeled vegetables.
3	Water Supply Pipe	This pipe provides cold fresh water to flush out peelings.
4	Flexible Hose and Faucet Coupling	This hose and coupling is used to connect the water supply pipe to the faucet.
5	Timer	This timer controls the peeler operation. It also acts as an ON/OFF switch.
6	Water Discharge Hose	This hose is the outlet for water and peelings.
7	Discharge Door	This door provides access for removal of peeled vegetables.

BAKER'S SCALE

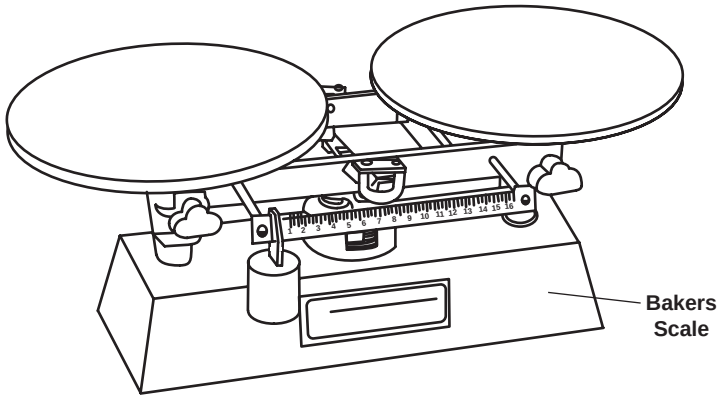


Figure 21. Baker's Scale

Table 21. Baker's Scale (refer to figure 21)

Key	Control/Indicator	Function
1	Tray	This tray holds the material to be weighed.
2	Readout	This readout displays the weight of the item on the tray.

DISHWASHER

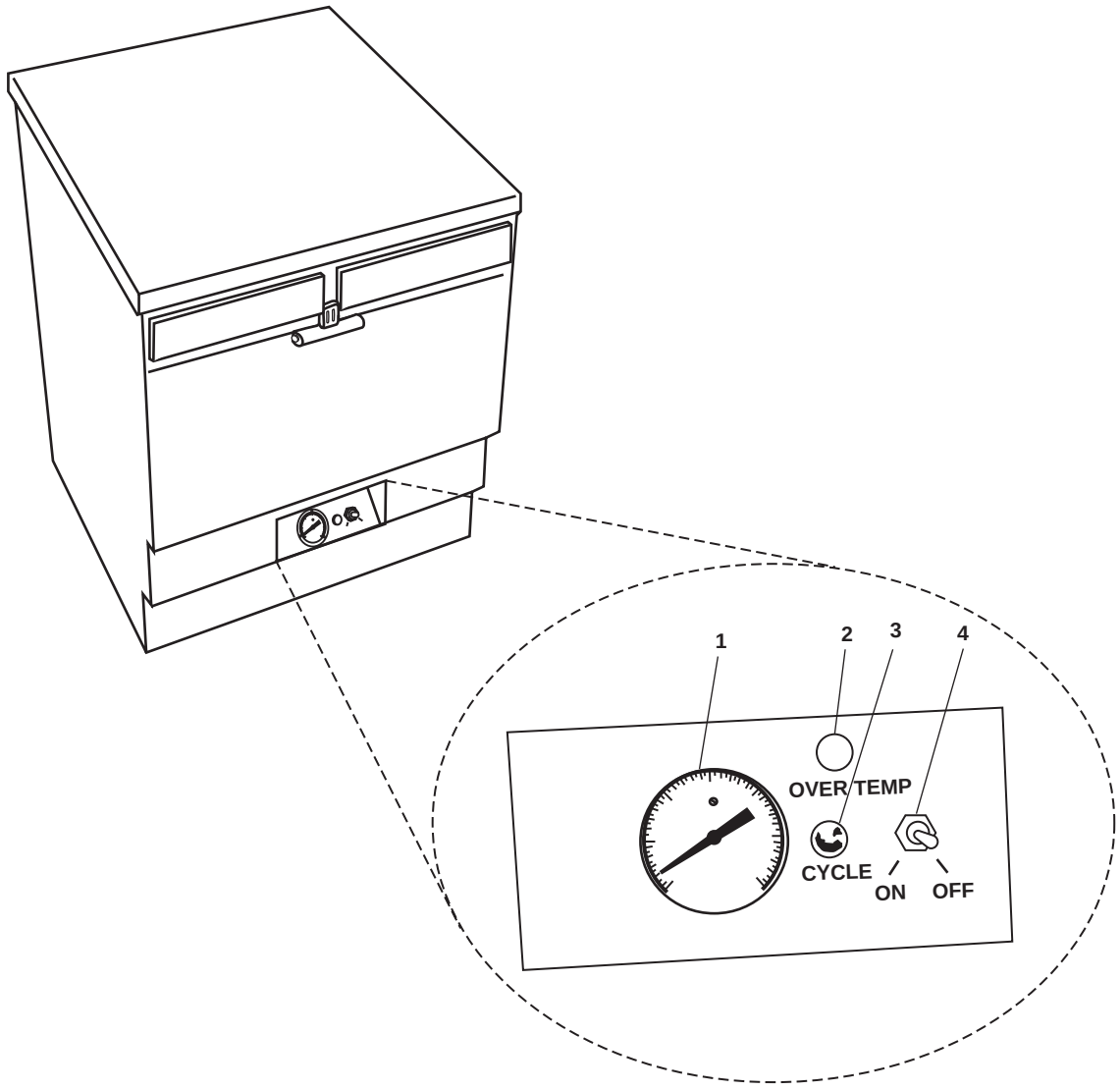


Figure 22. Dishwasher

Table 22. Dishwasher (refer to figure 22)

Key	Control/Indicator	Function
1	Water Temperature Gauge	This gauge indicates the temperature of the wash water.
2	OVER TEMP Indicator	This indicator illuminates to indicate that the wash water is too hot.
3	CYCLE Indicator	This indicator illuminates to indicate that the power is ON.
4	ON/OFF Switch	This switch is used to turn the equipment ON and fill the sump tank at the start of the day and to drain the sump tank and turn the equipment OFF at the end of the day.

GALLEY EXHAUST FAN MOTOR CONTROLLER

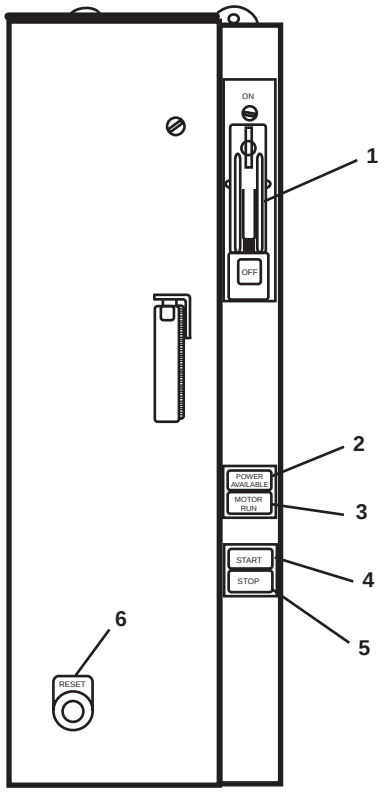


Figure 23. Galley Exhaust Fan Motor Controller

Table 23. Galley Exhaust Fan Motor Controller (refer to figure 23)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit breaker protection.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is supplied to the motor controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the motor is running.
4	START Pushbutton	When pressed, this pushbutton starts the galley exhaust fan.
5	STOP Pushbutton	When pressed, this pushbutton stops the galley exhaust fan.
6	RESET Pushbutton	This pushbutton is used to reset the motor controller.

220/110V DISTRIBUTION PANEL

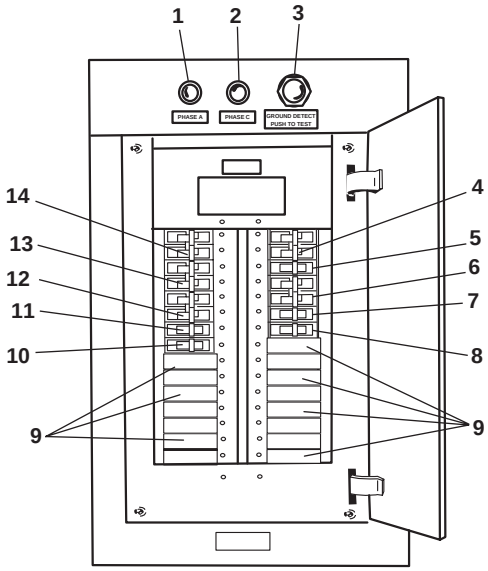


Figure 24. 220/110V Distribution Panel

Table 24. 220/110V Distribution Panel (refer to figure 24)

Key	Control/Indicator	Function
1	PHASE A Light	Illuminates to indicate a ground fault in Phase A.
2	PHASE C Light	Illuminates to indicate a ground fault in Phase C.
3	GROUND DETECT PUSH TO TEST Button	PUSH this button to test the operation of the ground fault indicator lights.
4	GARBAGE DISPOSAL. Circuit Breaker	This circuit breaker protects the garbage disposal unit.
5	WASHER. Circuit Breaker	This circuit breaker protects the washer in the laundry room.
6	CREW'S MESS TOASTER. Circuit Breaker	This circuit breaker protects the crew's mess toaster.
7	BEVERAGE DISPENSER. Circuit Breaker	This circuit breaker protects the beverage dispenser.
8	SPARE. Circuit Breaker	This spare 110V circuit breaker provides for future expansion.
9	BLANK.	These blank spaces provide room for expansion.
10	ICE MAKER. Circuit Breaker	This circuit breaker protects the ice maker.
11	TRASH COMPACTOR. Circuit Breaker	This circuit breaker protects the trash compactor.
12	GALLEY TOASTER. Circuit Breaker	This circuit breaker protects the galley toaster.
13	DRYER. Circuit Breaker	This circuit breaker protects the dryer in the laundry room.
14	DISHWASHER/BOOSTER HEATER. Circuit Breaker	This circuit breaker protects the dishwasher booster heater.

120V DISTRIBUTION PANEL NO. 1

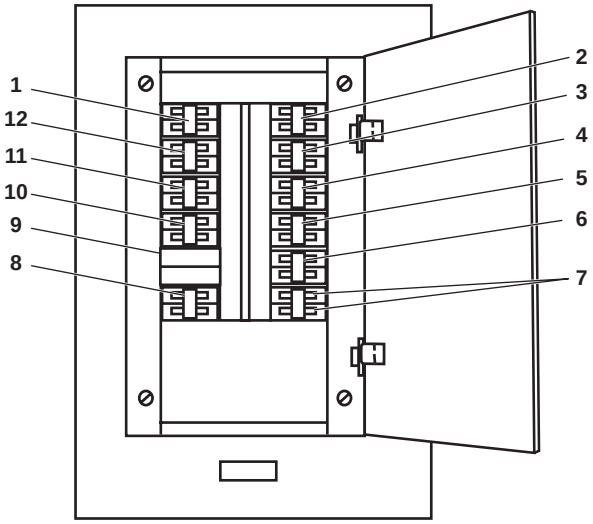


Figure 25. 120V Distribution Panel No. 1

Table 25. 120V Distribution Panel No. 1 (refer to figure 25)

Key	Control/Indicator	Function
1	GALLEY RECEPTACLES. Circuit Breaker	This circuit breaker protects the galley receptacles.
2	REFRIGERATOR. Circuit Breaker	This circuit breaker protects the reach-in refrigerator.
3	GALLEY LIGHTS. Circuit Breaker	This circuit breaker protects the galley lights.
4	STEAM TABLES 1 & 2. Circuit Breaker	This circuit breaker protects steam tables 1 and 2.
5	MICROWAVE RECEPTACLE. Circuit Breaker	This circuit breaker protects the microwave receptacles.
6	SPARE. Circuit Breaker	This is a spare circuit breaker.
7	BLANK.	There is no circuit breaker in this position.
8	GAYLORD CONT CABINET. Circuit Breaker	This circuit breaker protects the ventilation hood control cabinet.
9	BLANK.	There is no circuit breaker in this position.
10	MEAT SLICER & FOOD MIXER. Circuit Breaker	This circuit breaker protects the meat slicer and the mixer.
11	FREEZER. Circuit Breaker	This circuit breaker protects the reach-in freezer.
12	COFFEE POT. Circuit Breaker	This circuit breaker protects the coffee pot.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
MAIN DECK STATEROOMS AND SANITARY SPACES

GENERAL ARRANGEMENT

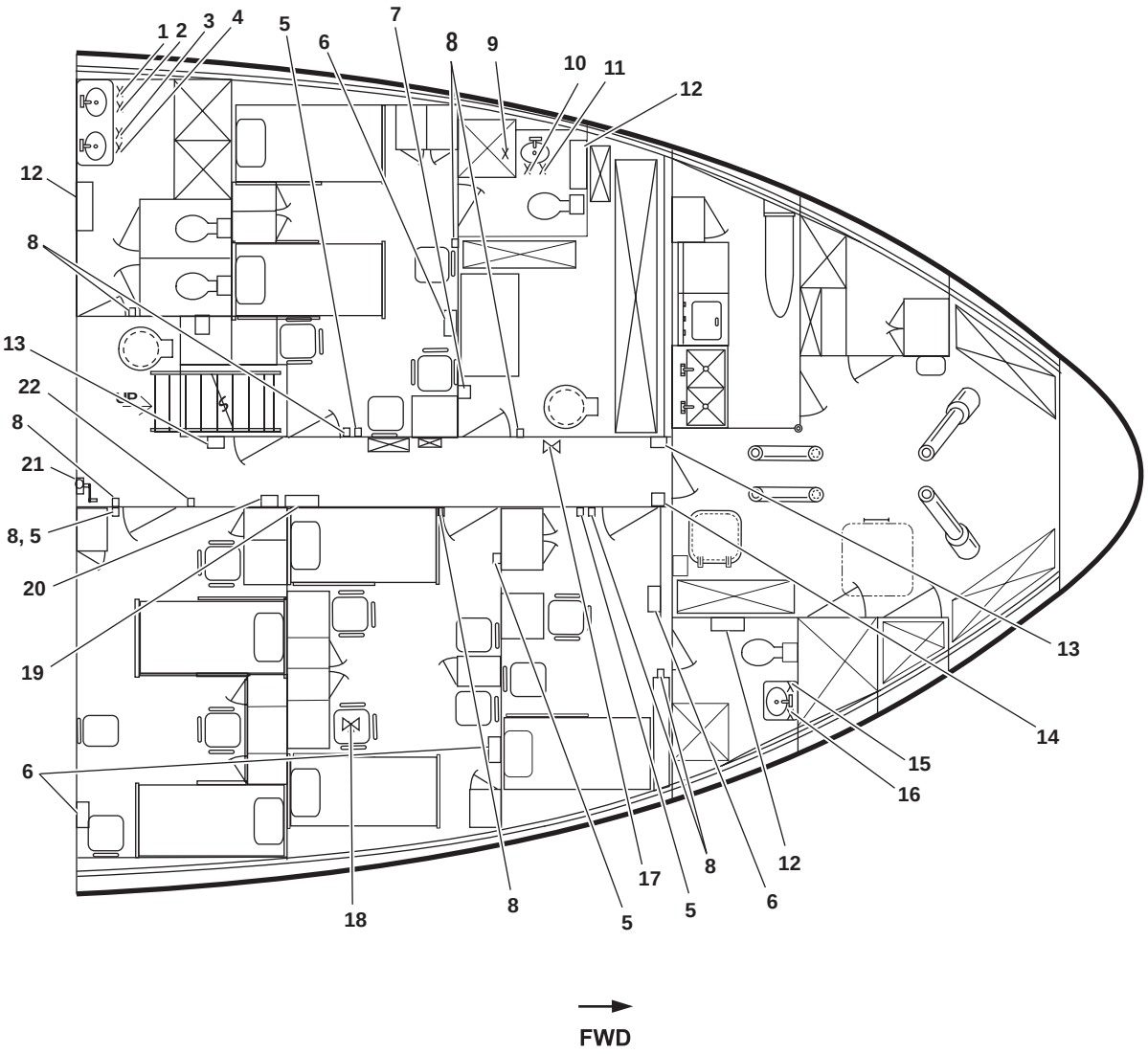


Figure 1. Main Deck Staterooms and Sanitary Spaces, General Arrangement

Table 1. Main Deck Staterooms and Sanitary Spaces, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	PW-53 Valve	This cutoff valve controls cold potable water to the sink.
2	PW-52 Valve	This cutoff valve controls hot potable water to the sink.
3	PW-51 Valve	This cutoff valve controls cold potable water to the sink.

Table 1. Main Deck Staterooms and Sanitary Spaces, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
4	PW-50 Valve	This cutoff valve controls hot potable water to the sink.
5	Thermostat	The thermostat controls the air temperature in the space. See figure 2 for details.
6	Intercom	The intercom provides communication throughout the vessel. See figure 3 for details.
7	Sound Powered Phone	The sound powered telephone is used for intraship communications. See figure 4 for details.
8	Interior Lighting Switch	This switch turns ON and OFF the lighting in the space.
9	PW-24, C.W. TO W.C. (Overhead)	This cutoff valve controls cold water to the water closet.
10	PW-48 Valve	This cutoff valve controls hot potable water to the sink.
11	PW-49 Valve	This cutoff valve controls cold potable water to the sink.
12	Convection Heater	This heater provides additional heat in the sanitary spaces. See figure 5 for details.
13	Fire Alarm Pull Station	When pulled, this station activates the fire alarm.
14	HVAC SYS EMER STOP, Boatswain's Store Arms Locker EXH Fan E1-62-2	This switch turns ON and OFF the boatswain's store exhaust fan E1-62-2.
15	PW-46 Valve	This cutoff valve controls the hot potable water to the sink.
16	PW-47 Valve	This cutoff valve controls the cold potable water to the sink.
17	Fire Station No. 6	The fire station contains a hose and fire axe for firefighting capabilities.
18	PW-23, C.W. TO W.C. (Overhead)	This cutoff valve controls cold water to the water closet.
19	120V Distribution Panel No. 3	This panel contains circuit breakers for many of the main deck electrical circuits. See figure 6 for details.
20	Deck Reheater 120V Fuse Box No. 3	This fuse box contains the fuses for the main deck convection heaters and reheaters. See figure 7 for details.
21	AMS 1 Hydraulic Watertight Door Controls	This remote control controls the opening and closing of the hydraulic watertight door to AMS 1. See figure 8 for details.
22	General Alarm Bell	This bell sounds when the general alarm system is activated.

THERMOSTAT

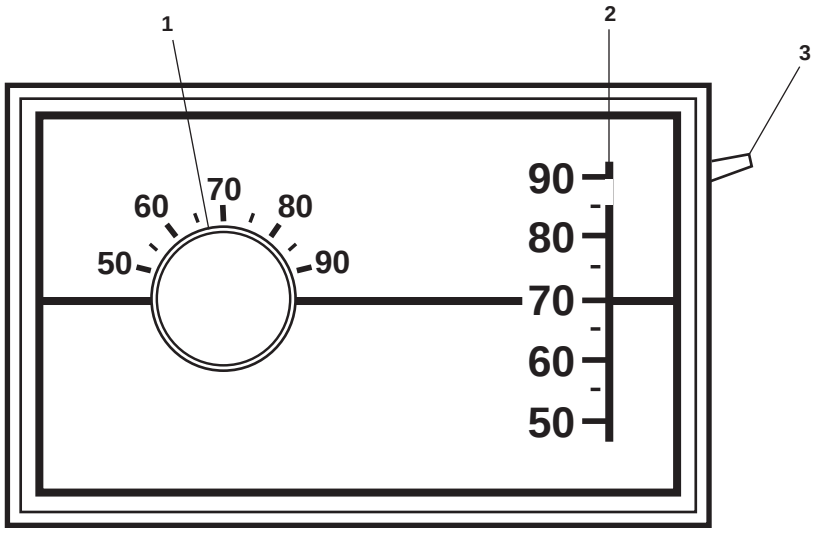


Figure 2. Thermostat

Table 2. Thermostat (refer to figure 2)

Key	Control/Indicator	Function
1	Thermometer	This thermometer indicates the actual temperature in the space.
2	Set Point Dial	This dial indicates the temperature for which the thermostat is set.
3	Set Point Handle	This handle permits changing of the desired temperature for the space.

INTERCOM

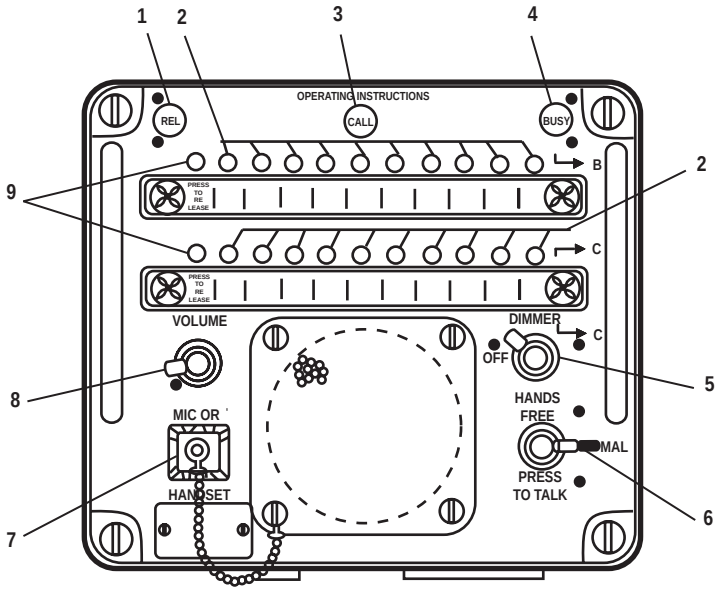


Figure 3. Intercom

Table 3. Intercom (refer to figure 3)

Key	Control/Indicator	Function
1	REL Indicator	This indicator illuminates to indicate that release of the system is required.
2	Station Pushbuttons	These pushbuttons connect the unit to the selected station.
3	CALL Indicator	This indicator illuminates to indicate an incoming call.
4	BUSY Indicator	This indicator illuminates to indicate that the system is in use.
5	DIMMER Control	This controls the illumination level of the intercom panel.
6	HANDS FREE Control	This control provides HANDS FREE or PRESS TO TALK transmission modes.
7	MIC OR HANDSET Plug	This is a jack plug for an external microphone/handset.
8	VOLUME Control	This knob controls the sound level of the intercom.
9	PRESS TO RELEASE	When pressed, this button releases the station pushbuttons.

SOUND POWERED TELEPHONE

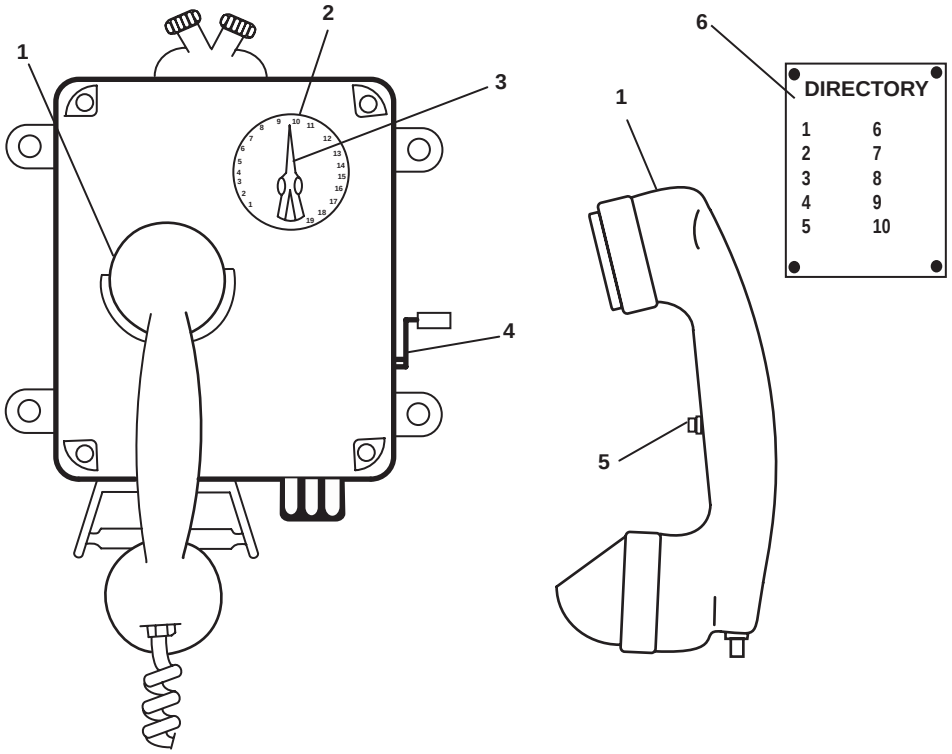


Figure 4. Sound Powered Telephone

Table 4. Sound Powered Telephone (refer to figure 4)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	This knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	This pushbutton is used to transmit.
6	DIRECTORY Plate (On Bulkhead)	The directory plate lists telephone stations aboard the vessel.

CONVECTION HEATER

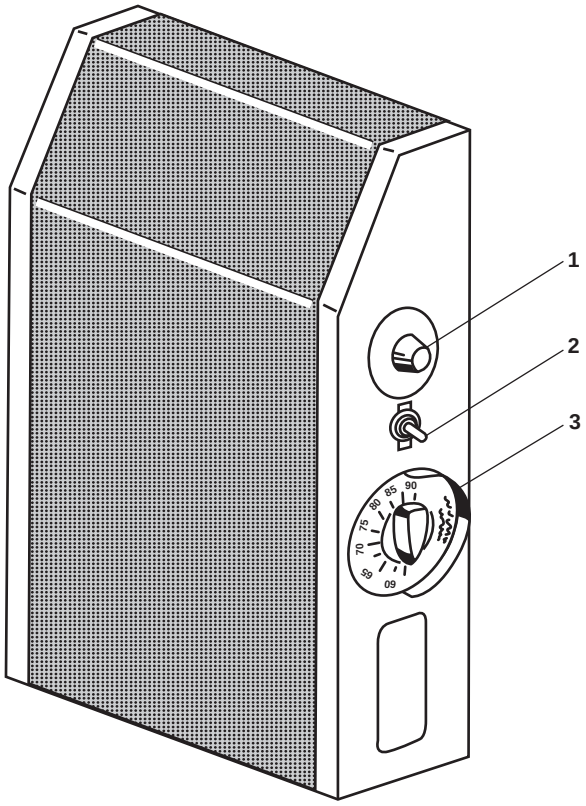


Figure 5. Convection Heater

Table 5. Convection Heater (refer to figure 5)

Key	Control/Indicator	Function
1	Manual Hi-Limit Switch	This switch sets the temperature at which the heater will cut out. It overrides the thermostat setting.
2	ON/OFF Switch	This switch turns the heater ON and OFF.
3	Thermostat	The thermostat controls the temperature setting for the heater.

120V DISTRIBUTION PANEL NO. 3

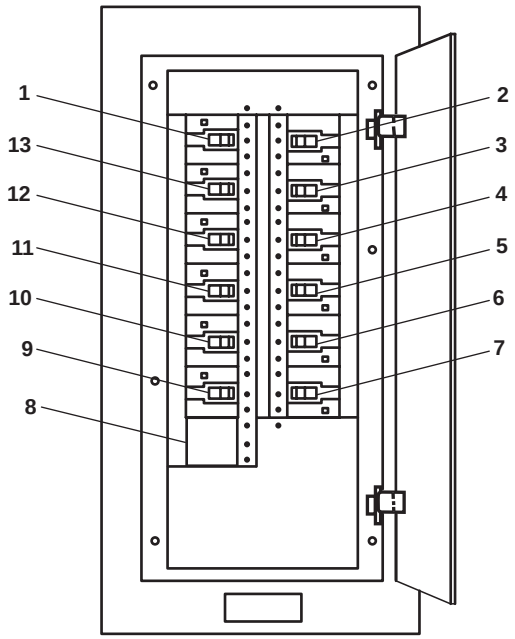


Figure 6. 120V Distribution Panel No. 3

Table 6. 120V Distribution Panel No. 3 (refer to figure 6)

Key	Control/Indicator	Function
1	MAIN DECK DRINKING FOUNTAIN. Circuit Breaker	This circuit breaker protects the main deck drinking fountain.
2	MAIN DECK STARBOARD LIGHTS. Circuit Breaker	This circuit breaker protects the starboard side main deck lights.
3	MAIN DECK PORT RECEPTACLES. Circuit Breaker	This circuit breaker protects the port side main deck receptacles.
4	MESS ROOM LIGHTS. Circuit Breaker	This circuit breaker protects the mess room lights.
5	01 & 02 LEVEL REHEATER FUSE BOX No. 1. Circuit Breaker	This circuit breaker protects 01 and 02 level reheater fuse box 1.
6	SPARE. Circuit Breaker	This is a spare circuit breaker provided for future expansion.
7	SPARE. Circuit Breaker	This is a spare circuit breaker provided for future expansion.
8	BLANK.	This blank space is provided for expansion
9	SPARE. Circuit Breaker	This is a spare circuit breaker provided for future expansion.
10	MAIN DECK STARBOARD RECEPTACLES. Circuit Breaker	This circuit breaker protects the starboard side main deck receptacles.

Table 6. 120V Distribution Panel No. 3 (refer to figure 6) (continued)

Key	Control/Indicator	Function
11	MAIN DECK REHEATER FUSE BOX No. 3. Circuit Breaker	This circuit breaker protects main deck reheater fuse box 3.
12	MAIN DECK PASSAGEWAY LIGHTS. Circuit Breaker	This circuit breaker protects the main deck passageway lights.
13	MAIN DECK PORT LIGHTS. Circuit Breaker	This circuit breaker protects the port side main deck lights.

DECK REHEATER 120V FUSE BOX NO. 3

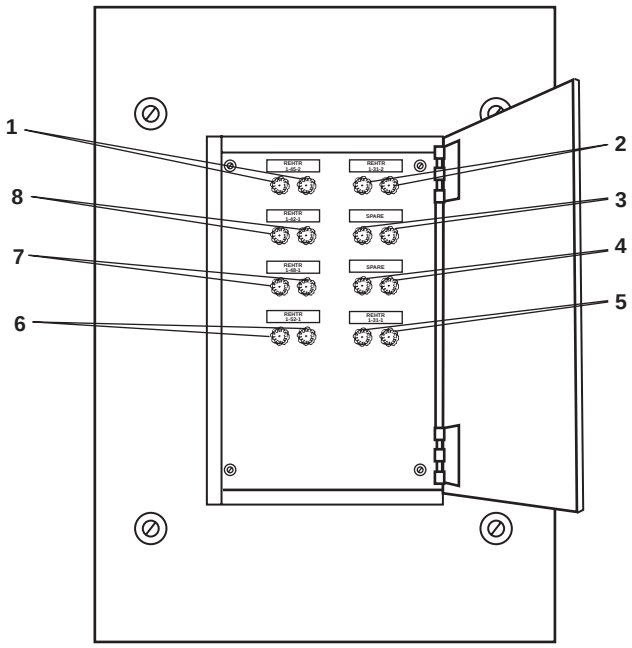


Figure 7. Deck Reheater 120V Fuse Box No. 3

Table 7. Deck Reheater 120V Fuse Box No. 3 (refer to figure 7)

Key	Control/Indicator	Function
1	REHEATER. 1-45-2. (.53 KW). Fuses	These fuses provide circuit protection for the terminal reheater for crew stateroom 3.
2	REHEATER. 1-42-1. (.46 KW). Fuses	These fuses provide circuit protection for the terminal reheater for crew stateroom 4.
3	SPARE. Fuses	This is a spare circuit.
4	SPARE. Fuses	This is a spare circuit.

Table 7. Deck Reheater 120V Fuse Box No. 3 (refer to figure 7) (continued)

Key	Control/Indicator	Function
5	REHEATER. 1-52-1. (.33 KW). Fuses	These fuses provide circuit protection for the terminal reheater for crew stateroom 1.
6	REHEATER. 1-48-1. (.31 KW). Fuses	These fuses provide circuit protection for the terminal reheater for crew stateroom 2.
7	REHEATER. 01-31-2. (.2.66 KW). Fuses	These fuses provide circuit protection for the terminal reheater for the mess/ recreation space.
8	REHEATER. 1-31-1. (.2.43 KW). Fuses	These fuses provide circuit protection for the terminal reheater for the galley.

AMS 1 WATERTIGHT DOOR CONTROLS

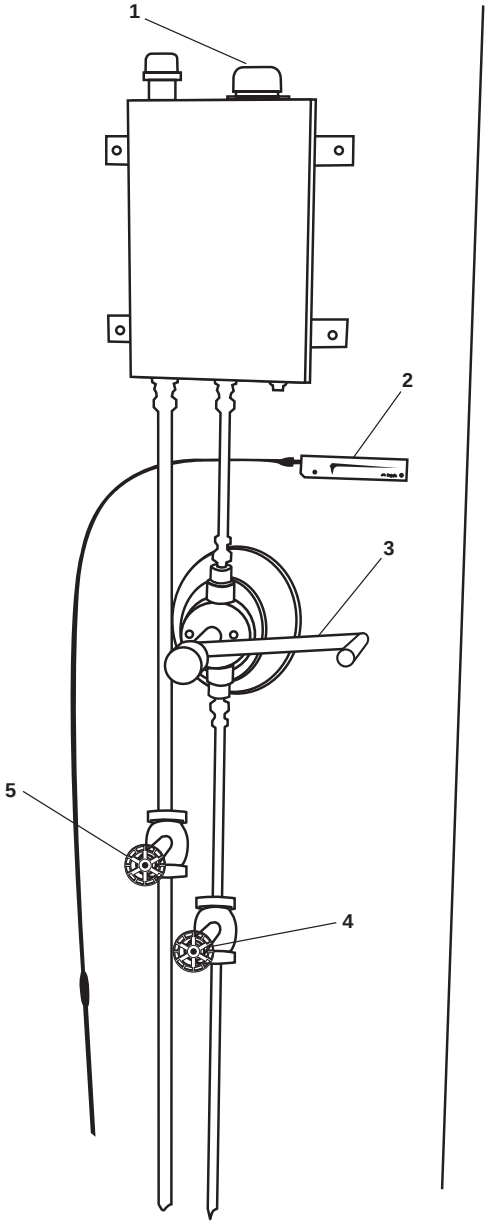


Figure 8. AMS 1 Watertight Door Controls

Table 8. AMS 1 Watertight Door Controls (refer to figure 8)

Key	Control/Indicator	Function
1	Fill Cap	The fill cap is used to fill the hydraulic reservoir.
2	Door Position Indicator	This indicates the position of the AMS 1 watertight door from CLOSED to OPEN.
3	Handle	Turn this handle to OPEN or CLOSE the AMS 1 watertight door.
4	Return Cutoff Valve	This valve secures the return line to the reservoir.
5	Supply Cutoff Valve	This valve secures the supply line from the pump to the cylinder.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
BOATSWAIN'S STORE, ARMS LOCKER, AND LAUNDRY ROOM

BOATSWAIN'S STORE, ARMS LOCKER, AND LAUNDRY ROOM GENERAL ARRANGEMENT

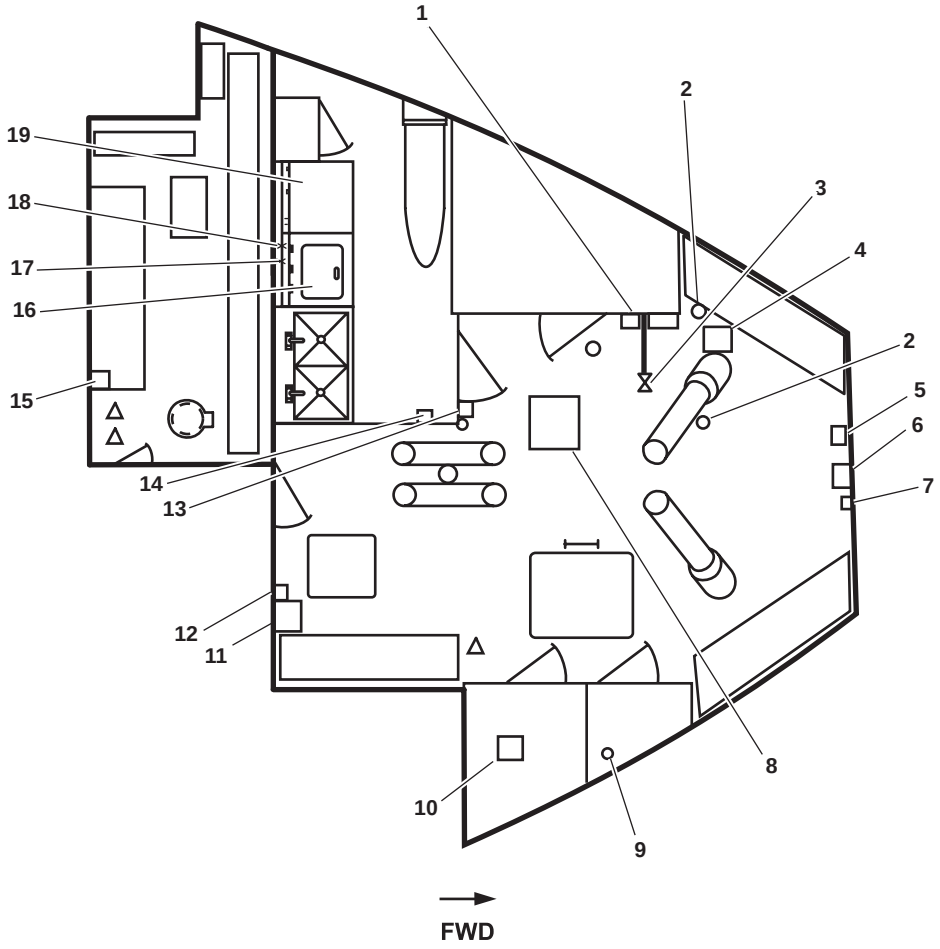


Figure 1. Boatswain's Store, Arms Locker, and Laundry Room General Arrangement

Table 1. Boatswain's Store, Arms Locker, and Laundry Room General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Remote Valve Operator, BB-10, OVBD DISCH BILGE EDUC. Valve	The remote valve operator is a reach rod for the operation of BB-10, OVBD DISCH BILGE EDUC. valve.
2	Fire Extinguisher	The fire extinguisher is used to extinguish small fires on the main deck level.
3	Arms Locker Drenching System Cutoff Valve	This valve turns the arms locker drenching system ON and OFF.
4	Boatswain's Store Exhaust Fan E01-62-2	This exhaust fan ventilates the boatswain store.

Table 1. Boatswain's Store, Arms Locker, and Laundry Room General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
5	Public Address (PA) Speaker Volume Control	The PA speaker volume control adjusts the volume level of the PA speaker. See figure 2 for details.
6	General Alarm Bell	The alarm bell signals various emergency conditions on the vessel.
7	PA Speaker	The PA speaker amplifies messages throughout the vessel. See figure 2 for details
8	Boatswain's Store, Arms Locker, And Laundry Supply Fan (S01-58-1)	This supply fan provides ventilation to the boatswain's store, laundry room and arms locker.
9	Remote Valve Operator BB12, BLST. TK. No. 1 SUCT. COV.	The remote valve operator is a reach rod to OPEN and CLOSE valve BB12, BLST. TK. No. 1 SUCT. COV.
10	Preheater 1-57-1 Thermostat	The thermostat turns the preheater ON and OFF.
11	Boatswain's Storeroom Supply Fan Controller	This controller turns the Boatswain's storeroom supply fan ON and OFF. See figure 3 for details.
12	HVAC System Controller For Preheater And Reheater 1-57-1	This controller provides electrical power to the preheater and reheater. See figure 4 for details.
13	Boatswain Arms Locker Exhaust Fan Controller	This controller controls power to the boatswain arms locker exhaust fan. See figure 3 for details.
14	Interior Lighting Switch	This switch turns the lighting in the space ON and OFF.
15	Sound Powered Phone	Used for intraship communication. See figure 5 for details.
16	Washing Machine	The washing machine is used to wash clothing items. See figure 6 for details.
17	PW-30	This cutoff valve controls the hot potable water to the washing machine.
18	PW-31	This cutoff valve controls the cold potable water to the washing machine.
19	Dryer	The dryer is used to dry clothing items. See figure 7 for details.

PA SPEAKER AND VOLUME CONTROL

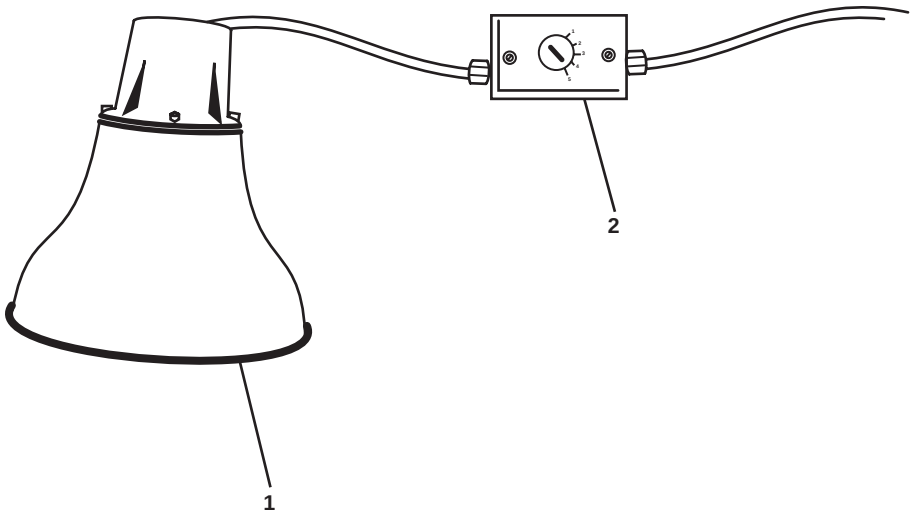


Figure 2. PA Speaker and Volume Control

Table 2. PA Speaker and Volume Control (refer to figure 2)

Key	Control/Indicator	Function
1	Loudspeaker	The loud speaker broadcasts the PA system.
2	Volume Control	This controls the volume of the loudspeaker.

BOATSWAIN'S STORE SUPPLY FAN MOTOR CONTROLLER

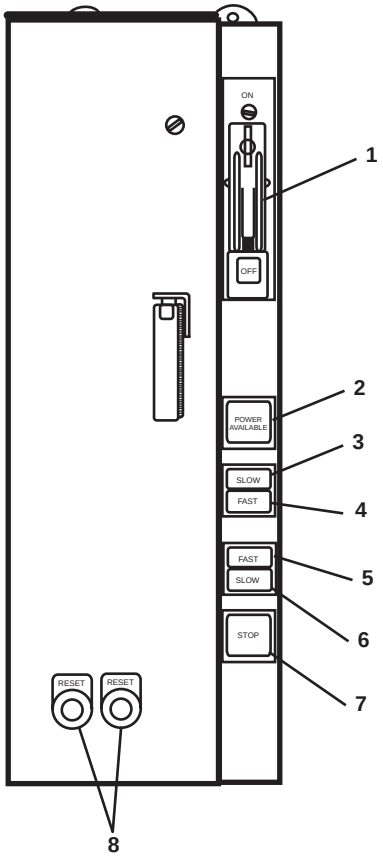


Figure 3. Boatswain's Store Supply Fan Motor Controller

Table 3. Boatswain's Store Supply Fan Motor Controller (refer to figure 3)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit protection.
2	POWER AVAILABLE	This indicator illuminates (green) to indicate that power is available to the controller.
3	SLOW Indicator	This indicator illuminates to indicate that the fan is operating at SLOW speed.
4	FAST Indicator	This indicator illuminates to indicate that the fan is operating at FAST speed.
5	FAST Pushbutton	This pushbutton is used to operate the fan motor at FAST. speed.
6	SLOW Pushbutton	This pushbutton is used to operate the fan motor at SLOW speed.
7	STOP Pushbutton	This pushbutton is used to STOP the fan motor.
8	RESET Pushbuttons	These pushbuttons are used to reset the motor controller.

HVAC SYSTEM CONTROLLER FOR RE/PREHEATER 1-52-1

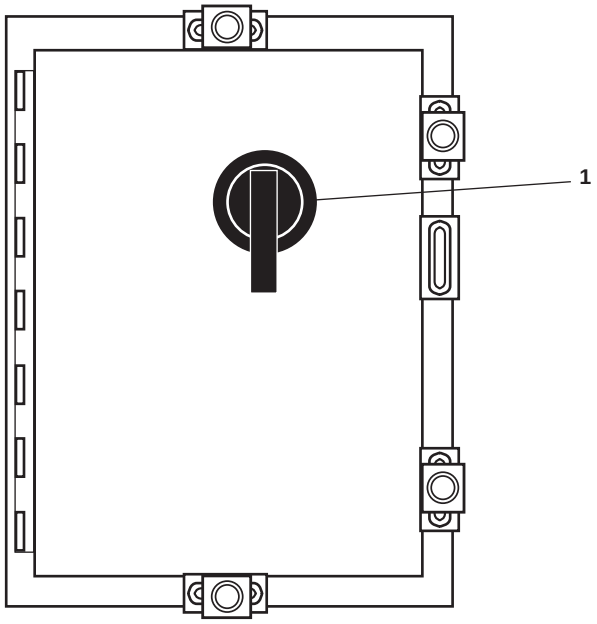


Figure 4. HVAC System Controller for Re/Preheater 1-52-1

Table 4. HVAC System Controller for Re/Preheater 1-52-1 (refer to figure 4)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the affected preheater or reheater ON or OFF.

SOUND POWERED TELEPHONE

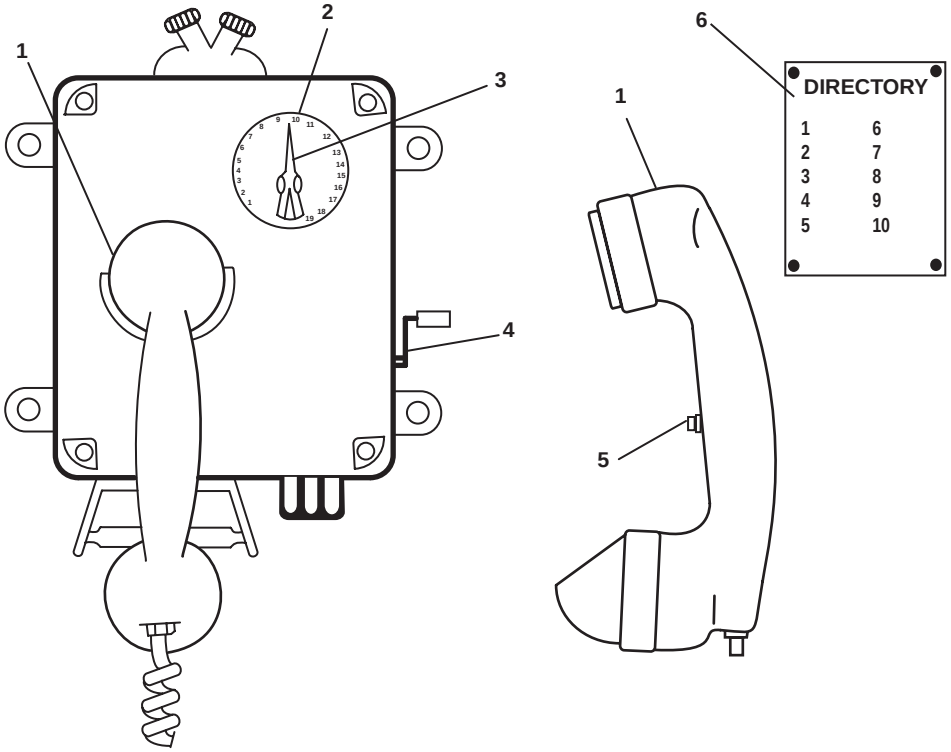


Figure 5. Sound Powered Telephone

Table 5. Sound Powered Telephone (refer to figure 5)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	The selector knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	Thus pushbutton is used to transmit.
6	DIRECTORY Plate (on wall)	The directory plate lists telephone stations aboard the vessel.

WASHER

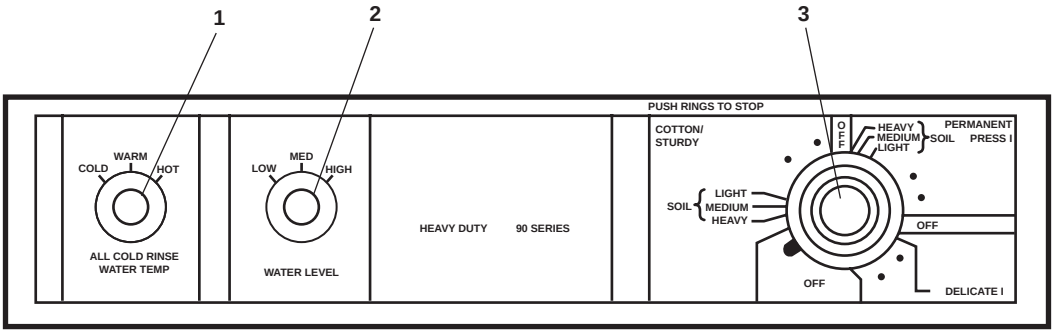


Figure 6. Washer

Table 6. Washer (refer to figure 6)

Key	Control/Indicator	Function
1	WATER TEMP Control	This selects wash water temperature (COLD, WARM HOT).
2	WATER LEVEL Control	This selects water level (LOW, MED, HIGH).
3	OFF and Selector Control	This selects the wash cycle. PULL the knob to START the operation, PUSH the knob to STOP the operation.

DRYER

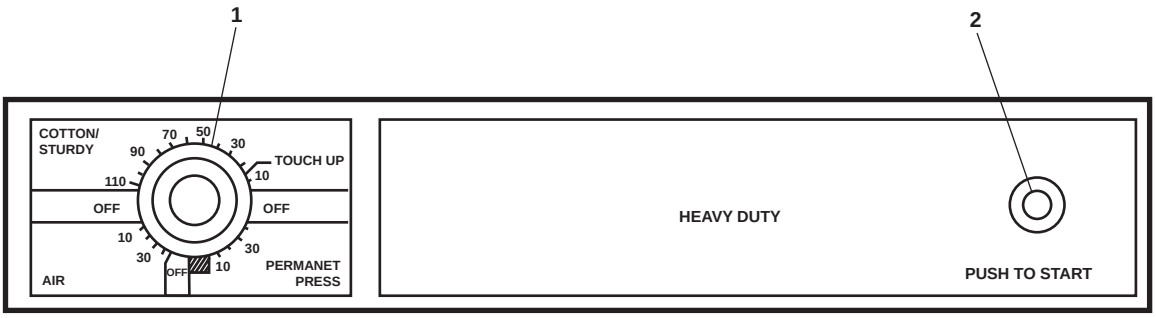


Figure 7. Dryer

Table 7. Dryer (refer to figure 7)

Key	Control/Indicator	Function
1	Selection Knob	This knob selects drying time and load type.
2	PUSH TO START Button	This pushbutton is used to START the dryer.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
01 LEVEL WEATHER DECKS

01 LEVEL WEATHER DECKS, GENERAL ARRANGEMENT

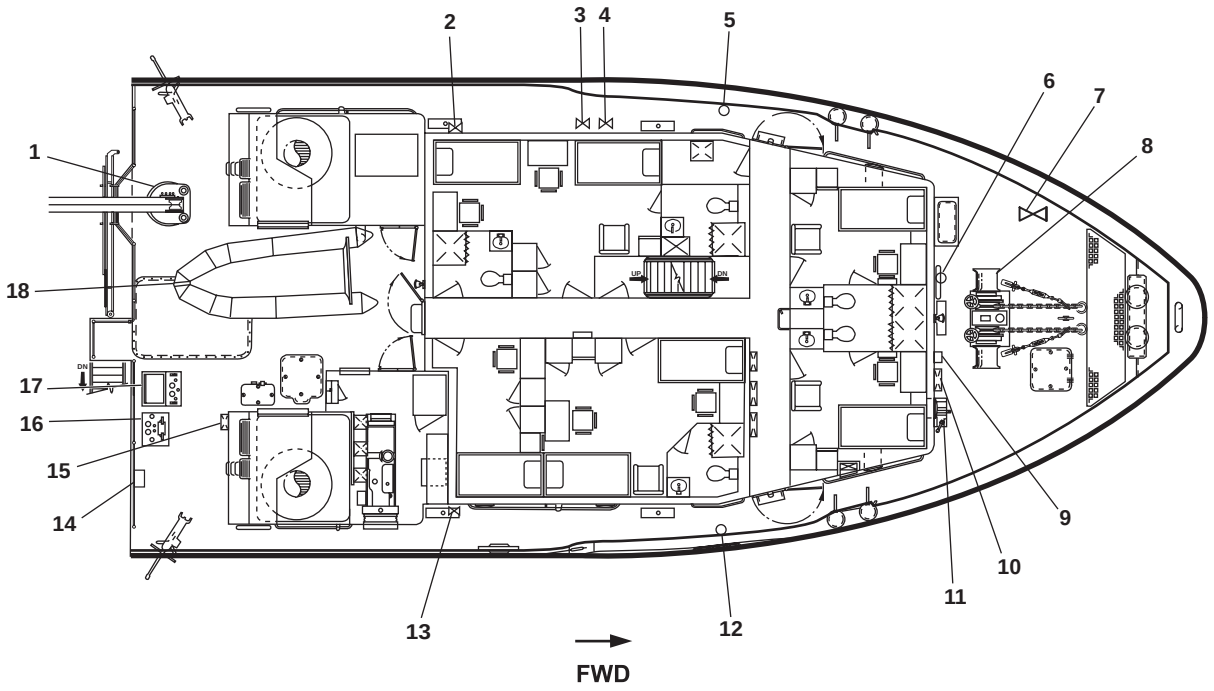


Figure 1. 01 Level Weather Decks, General Arrangement

Table 1. 01 Level Weather Decks, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Crane	The crane is used to launch/retrieve the work boat, to handle towing gear and jewelry, and to lift heavy items on and off the vessel. See figure 9 for details.
2	Fuel Fill Connection, Port	This provides connection and control for filling the vessel's fuel storage and day tanks.
3	Lube Oil Fill Connection	This provides connection and control for filling the lube oil storage tank.
4	Hydraulic Oil Fill Connection	This provides connection and control for filling the hydraulic oil storage tank.
5	Lube Oil Tank Sounding Tube	This tube permits sounding of the lube oil tank.
6	Ship's Bell	This bell provides audible signals in certain situations.
7	Arms Locker Drenching System Remote Cutoff	This valve controls the water supply to the arms locker.

Table 1. 01 Level Weather Decks, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
8	Anchor Windlass	The anchor windlass raises and lowers the vessel's anchors. It is also used to handle lines on the gypsey heads. See figure 2 for details.
9	Sound Powered Telephone	The sound powered telephone provides communication with other stations onboard the vessel. See figure 3 for details.
10	Fire Station 9	The fire station provides firefighting capability. See figure 4 for details.
11	Anchor Windlass Controls	These control the speed and direction of rotation for the anchor windlass. See figure 5 for details.
12	Oily Waste Tank Sounding Tube	This sounding tube permits sounding of the oily waste tank.
13	Fuel Fill Connection, Stbd	This provides connection and control for filling the vessel's fuel storage and day tanks.
14	Sound Powered Telephone	The sound powered telephone provides communication with other stations onboard the vessel. See figure 3 for details.
15	Fire Station 7	The fire station provides firefighting capability. See figure 4 for details.
16	Aft Auxiliary Control Station	This station provides control of the main propulsion engines and bow thruster. See figure 6 for details.
17	Towing Machine Control Station	This station provides operator control of the towing machine and tow pins. See figure 8 for details.
18	Work Boat	The work boat is lowered over the side to work off the vessel. Refer to TM 55-1945-221-14&P and TM 55-1945-224-14&P for the workboat operator controls and indicators.

ANCHOR WINDLASS

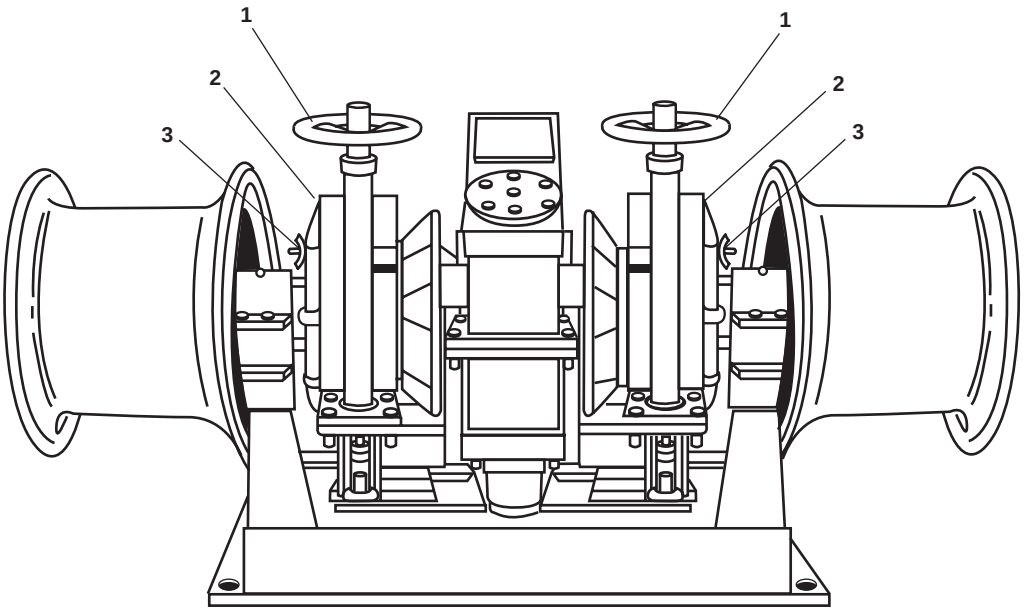


Figure 2. Anchor Windlass

Table 2. Anchor Windlass (refer to figure 2)

Key	Control/Indicator	Function
1	Brake Handwheel	The handwheel controls the mechanical brake.
2	Dog Clutch	The dog clutch engages and disengages the wildcats from the anchor windlass's main shaft.
3	Wing Nut	The wing nut secures the shifter ring to the clutch shifter plate. It keeps the dog clutch engaged/disengaged depending upon the clutch shifter plate position.

SOUND POWERED TELEPHONE

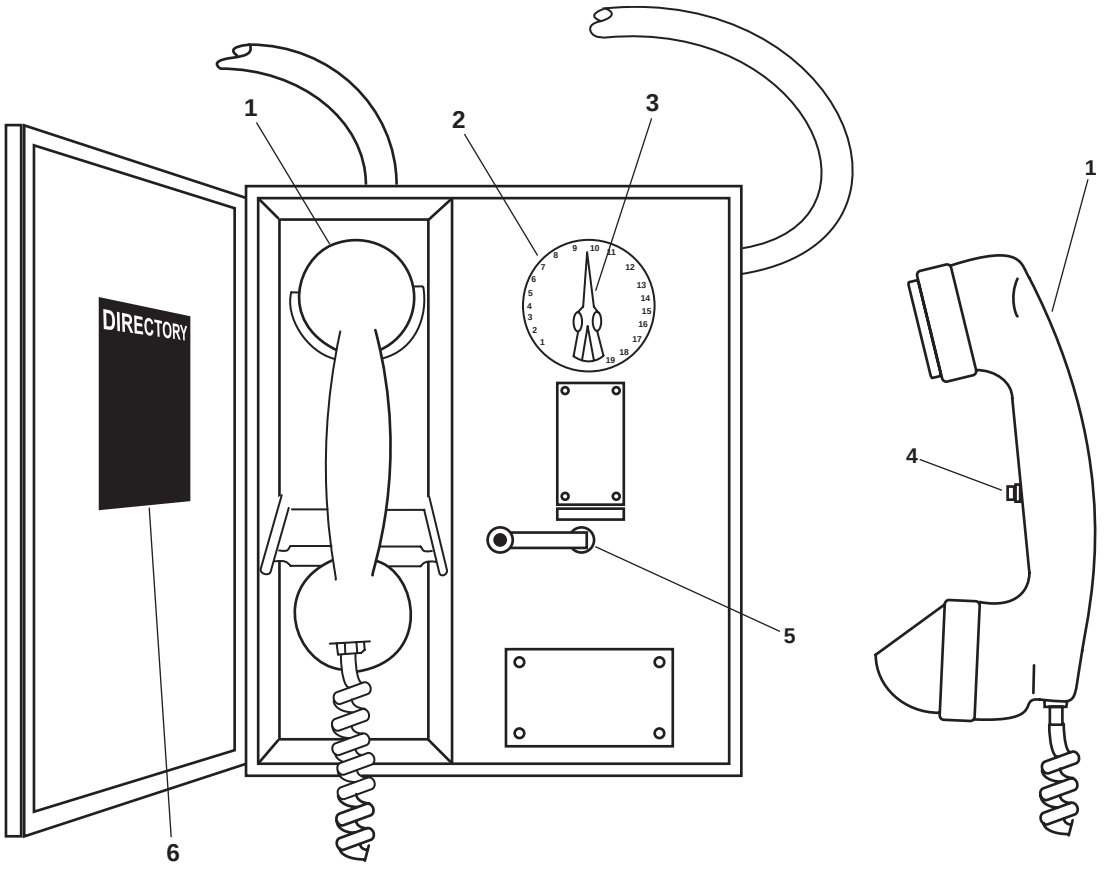


Figure 3. Sound Powered Telephone

Table 3. Sound Powered Telephone (refer to figure 3)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial permits the operator to select from the available stations.
3	Selector Knob	The selector knob selects station to be called.
4	Pushbutton	This pushbutton is used to transmit.
5	Magneto Handle	The magneto handle cranks the handle to call a station.
6	DIRECTORY Plate	The directory plate lists telephone stations aboard the vessel.

FIRE STATION

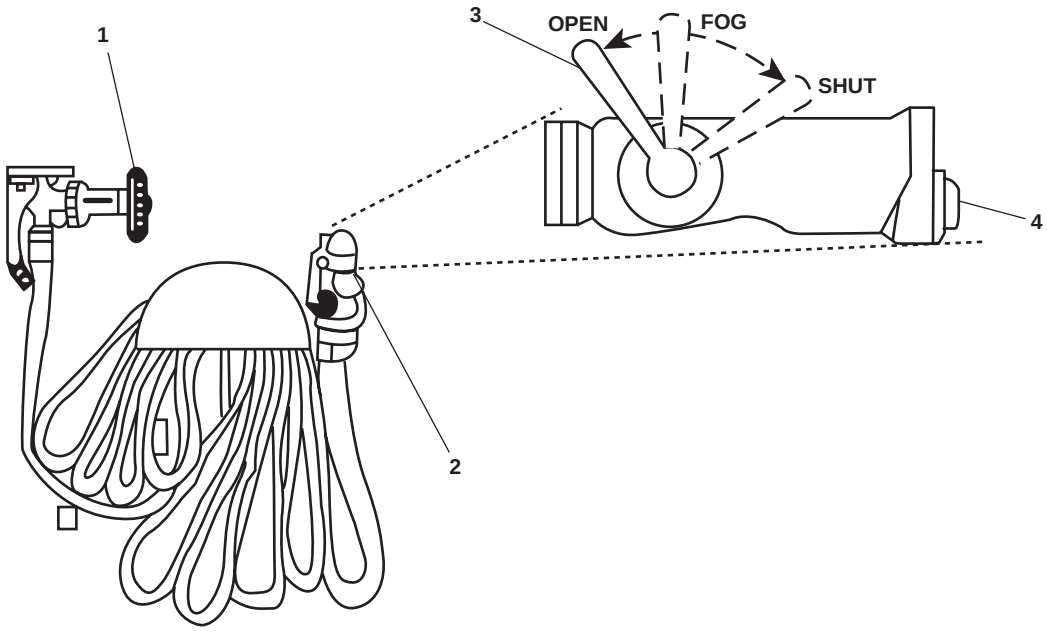


Figure 4. Fire Station

Table 4. Fire Station (refer to figure 4)

Key	Control/Indicator	Function
1	Cutoff Valve	This valve regulates the flow of raw water to the hose.
2	All-Purpose Nozzle	The all-purpose nozzle regulates the flow of raw water exiting the hose. The all-purpose nozzle is capable of producing a solid stream of raw water or a high to low velocity fog using various applicators.
3	Nozzle Valve	This valve controls the flow of raw water from the nozzle. When in the SHUT position, the flow of water is stopped. When in the FOG position, the water is directed to the fog jet. In the OPEN position, water is directed to the single stream outlet.
4	Fog Outlet Plug	This plug provides an outlet connection to attach a 4-foot (1.22 m) or 12-foot (3.7 m) applicator.

ANCHOR WINDLASS CONTROLS

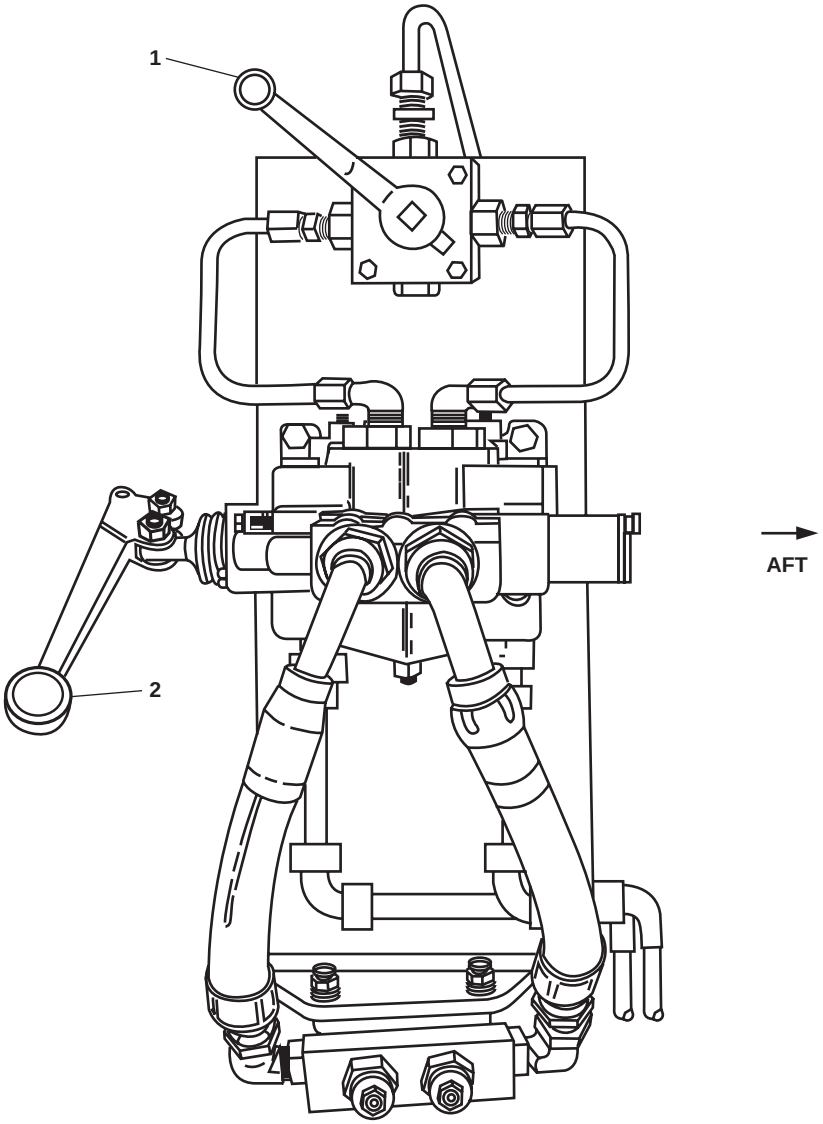


Figure 5. Anchor Windlass Controls

Table 5. Anchor Windlass Controls (refer to figure 5)

Key	Control/Indicator	Function
1	3-Way Ball Valve Handle	This handle provides a HIGH and LOW motor speed range.
2	Directional Control Valve Handle	This handle controls the direction of rotation of the anchor windlass.

AFT AUXILIARY CONTROL STATION

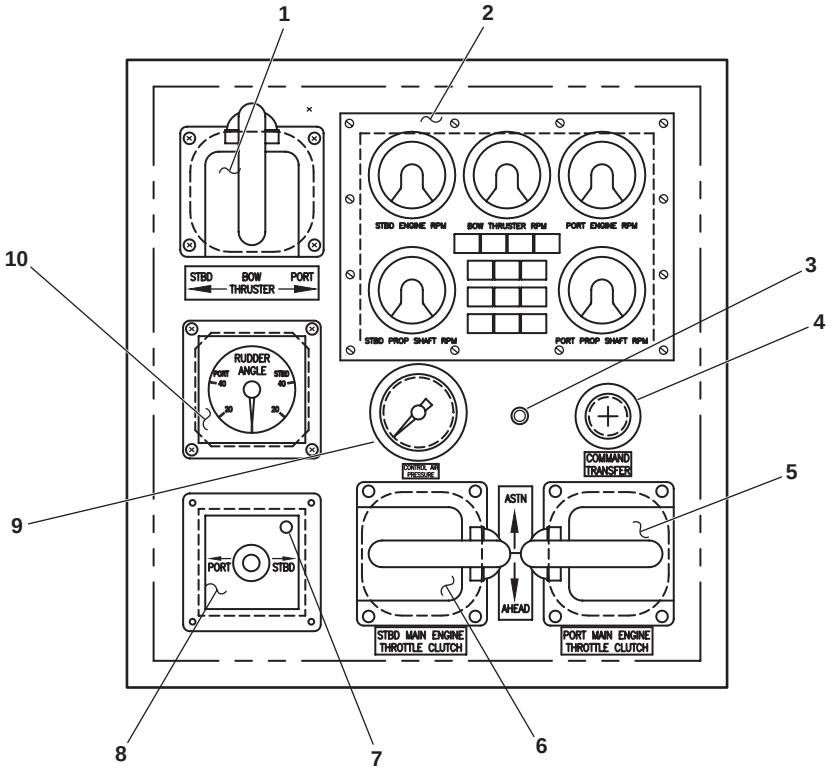


Figure 6. Aft Auxiliary Control Station

Table 6. Aft Auxiliary Control Station (refer to figure 6)

Key	Control/Indicator	Function
1	BOW THRUSTER Engine Throttle	This throttle selects the PORT or STBD direction and RPM of the bow thruster engine's propeller shaft.
2	Remote Propulsion Indicator Panel	This panel contains various controls for propulsion systems onboard. See figure 7 for details.
3	Heater Lamp	This lamp illuminates when the aft auxiliary control station heater is activated.
4	COMMAND TRANSFER	This switch transfers the vessel's control air from a remote location to this station.
5	STBD MAIN ENGINE THROTTLE CLUTCH	This determines the Rotations Per Minute (RPM) of the STBD main engine, propeller shaft and its direction of rotation (ahead or astern).
6	PORT MAIN ENGINE THROTTLE CLUTCH	This determines the RPM of the PORT main engine, propeller shaft and its direction of rotation (ahead or astern).
7	In Command Lamp	This lamp illuminates when the aft auxiliary control station is in command of the vessel's rudders.

Table 6. Aft Auxiliary Control Station (refer to figure 6) (continued)

Key	Control/Indicator	Function
8	Rudder Control Joystick	This controls the movement of the vessel's rudders when the in command lamp is illuminated.
9	CONTROL AIR PRESSURE Gauge	This gauge displays the control air pressure available.
10	RUDDER ANGLE Indicator	This indicator displays the angle of the vessel's rudders.

AFT AUXILIARY CONTROL PANEL

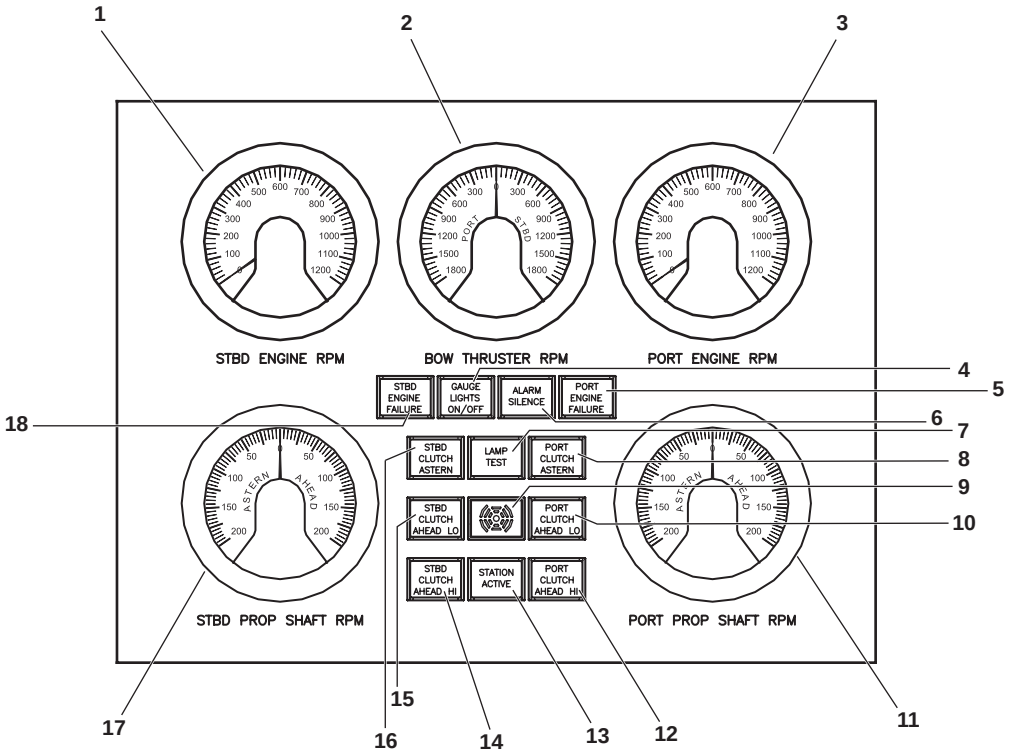


Figure 7. Aft Auxiliary Control Panel

Table 7. Aft Auxiliary Control Panel (refer to figure 7)

Key	Control/Indicator	Function
1	STBD ENGINE RPM Tachometer	This gauge displays the STBD engine RPM.
2	BOW THRUSTER RPM Tachometer	This gauge displays RPM for the bow thruster drive shaft.
3	PORT ENGINE RPM Tachometer	This gauge displays the PORT engine RPM.

Table 7. Aft Auxiliary Control Panel (refer to figure 7) (continued)

Key	Control/Indicator	Function
4	GAUGE LIGHTS ON/OFF	This button turns ON/OFF the gauge lights.
5	PORT ENGINE FAILURE	This indicator illuminates when the PORT main engine has failed.
6	ALARM SILENCE	This pushbutton silences the alarm.
7	LAMP TEST	This pushbutton tests the operation of the gauge lights.
8	PORT CLUTCH ASTERN	This indicator illuminates when the PORT reduction gear is inthe astern position.
9	Alarm	This alarm sounds to alert the operator to an engine failure.
10	PORT CLUTCH AHEAD LO	This indicator illuminates when the PORT reduction gear is inthe ahead slow position.
11	PORT PROP SHAFT RPM Tachometer	This gauge displays the PORT propeller shaft RPM.
12	PORT CLUTCH AHEAD HI	This indicator illuminates when the PORT reduction gear is inthe ahead full position.
13	STATION ACTIVE	This indicator illuminates when the aft auxiliary control station is active.
14	STBD CLUTCH AHEAD HI	This indicator illuminates when the STBD reduction gear is in the ahead full position.
15	STBD CLUTCH AHEAD LO	This indicator illuminates when the STBD reduction gear is in the ahead slow position.
16	STBD CLUTCH ASTERN	This indicator illuminates when the STBD reduction gear is in the astern position.
17	STBD PROP SHAFT RPM Tachometer	This gauge displays the STBD propeller shaft RPM.
18	STBD ENGINE FAILURE	This indicator illuminates when the STBD main engine has failed.

TOWING MACHINE OPERATOR CONTROL PANEL

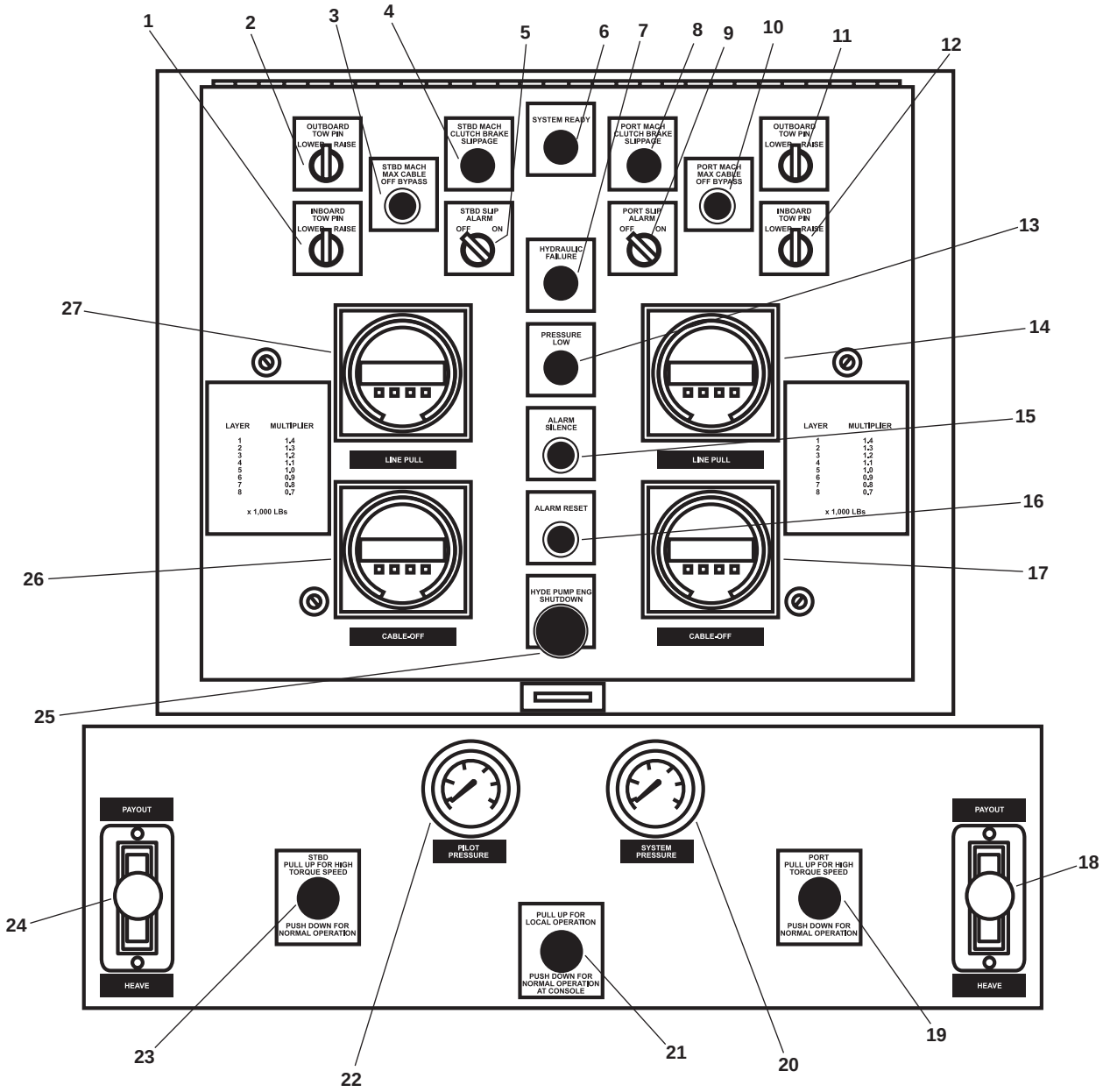


Figure 8. Towing Machine Operator Control Panel

Table 8. Towing Machine Operator Control Panel (refer to figure 8)

Key	Control/Indicator	Function
1	INBOARD TOW PIN LOWER/RAISE Switch	This switch is used to LOWER and RAISE the inboard STBD tow pin.
2	OUTBOARD TOW PIN LOWER/RAISE Switch	This switch is used to LOWER and RAISE the outboard STBD tow pin.
3	STBD MACH MAX CALBE OFF BYPASS Pushbutton Indicator	This indicator illuminates to indicate that less than 300 feet (91m) of cable remains on the STBD towing machine drum. Pressing the button overrides the cable off automatic shutdown.
4	STBD MACH CLUTCH BRAKE SLIPPAGE Indicator	This indicator illuminates when the STBD towing machine clutch brake has excessive slippage.
5	STBD SLIP ALARM Switch	This switch is used to cut off the slip alarm for the STBD towing machine.
6	SYSTEM READY Indicator	This indicator illuminates to indicate that the control station has electrical power.
7	HYDRAULIC SYSTEM FAILURE Indicator	This indicator illuminates to indicate low oil level and/or high oil temperature in the hydraulic system.
8	PORT MACH CLUTCH BRAKE SLIPPAGE Indicator	This indicator illuminates when the PORT towing machine clutch brake has excessive slippage.
9	PORT SLIP ALARM Switch	This switch is used to cut off the slip alarm for the PORT towing machine.
10	PORT MACH MAX CABLE OFF BYPASS Pushbutton Indicator	This indicator illuminates to indicate that less than 300 feet (91 m) of cable remains on the port towing machine drum. Pressing the button overrides the cable off automatic shutdown.
11	OUTBOARD TOW PIN LOWER/RAISE Switch	This switch is used to RAISE and LOWER the outboard PORT tow pin.
12	INBOARD TOW PIN LOWER/RAISE Switch	This switch is used to RAISE and LOWER the inboard PORT tow pin.
13	PRESSURE LOW Indicator	This indicator illuminates to indicate low hydraulic oil pressure.
14	LINE PULL METER	This meter indicates the load applied to the PORT towing machine.
15	ALARM SILENCE Pushbutton	This pushbutton is used to silence the alarm horn.
16	ALARM RESET Pushbutton	This pushbutton is used to reset the fault lights when a malfunction has been corrected.
17	CABLE-OFF-METER	This gauge indicates the amount of cable payed out from the PORT towing machine.
18	PAYOUT/HEAVE Lever	This lever controls the direction of the PORT towing machine.

Table 8. Towing machine Control Station (refer to figure 8) (continued)

Key	Control/Indicator	Function
19	PORT TORQUE Speed Control	When in the DOWN position, selects HIGH speed, and when in the UP position, selects LOW speed for the PORT towing machine hydraulic motor.
20	SYSTEM PRESSURE Gauge	This gauge indicates hydraulic system operating pressure.
21	LOCAL/NORMAL Operation Control	When in the UP position, local control is available at the towing machine. When in the DOWN position, control is available from the aft control station.
22	PILOT PRESSURE Gauge	This gauge indicates the pressure present within the hydraulic control system.
23	STBD TORQUE Speed Control	When in the DOWN position, selects HIGH speed, and when in the UP position, selects LOW speed for the STBD towing machine hydraulic motor.
24	PAYOUT/HEAVE Lever	This lever controls the direction of the STBD towing machine.
25	HYDRAULIC PUMP ENG SHUTDOWN Switch	This switch provides remote shutdown for the pump drive engine and the electric motors for the central hydraulic system.
26	CABLE OFF INDICATOR Gauge	This gauge indicates the amount of cable payed out from the STBD towing machine.
27	LINE PULL METER	This meter indicates the load applied to the STBD towing machine.

CRANE

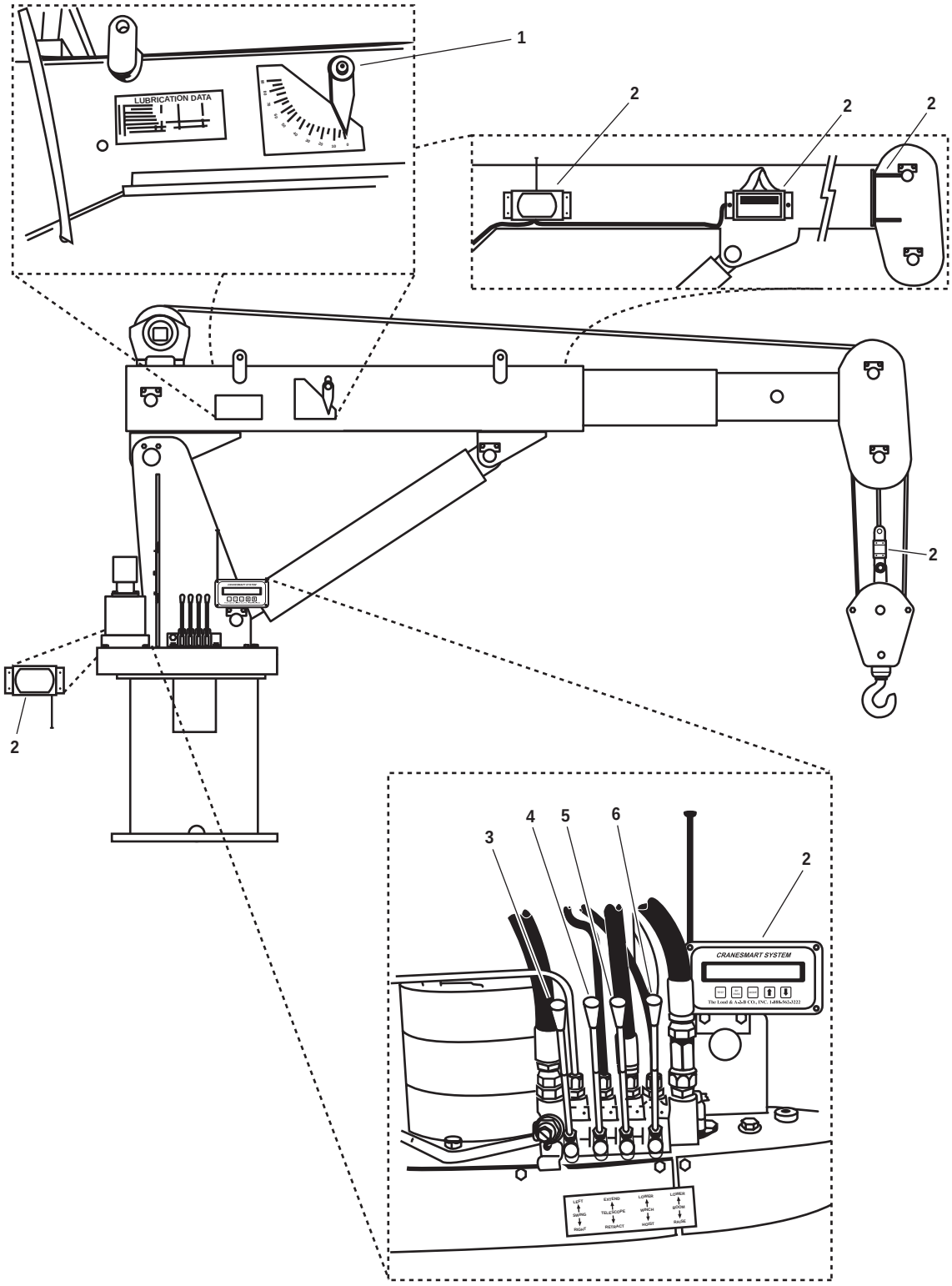


Figure 9. Crane

Table 9. Crane (refer to figure 9)

Key	Control/Indicator	Function
1	Boom Angle Indicator	This gauge indicates the angle of the boom. The boom angle indicator is used in conjunction with the load chart to determine safe lifting capacities.
2	Load Moment Indicator System	This system monitors the boom angle, boom length, and hook load to ensure that the operational limits of the crane are not exceeded. See figure 10 for details.
3	SWING Control	This control rotates the crane right or left.
4	TELESCOPE Control	This control extends or retracts the boom, adjusting its length.
5	WINCH Control	This control LOWERS or RAISES the towing machine block.
6	BOOM Control	This control LOWERS or RAISES the boom.

LOAD MOMENT INDICATOR

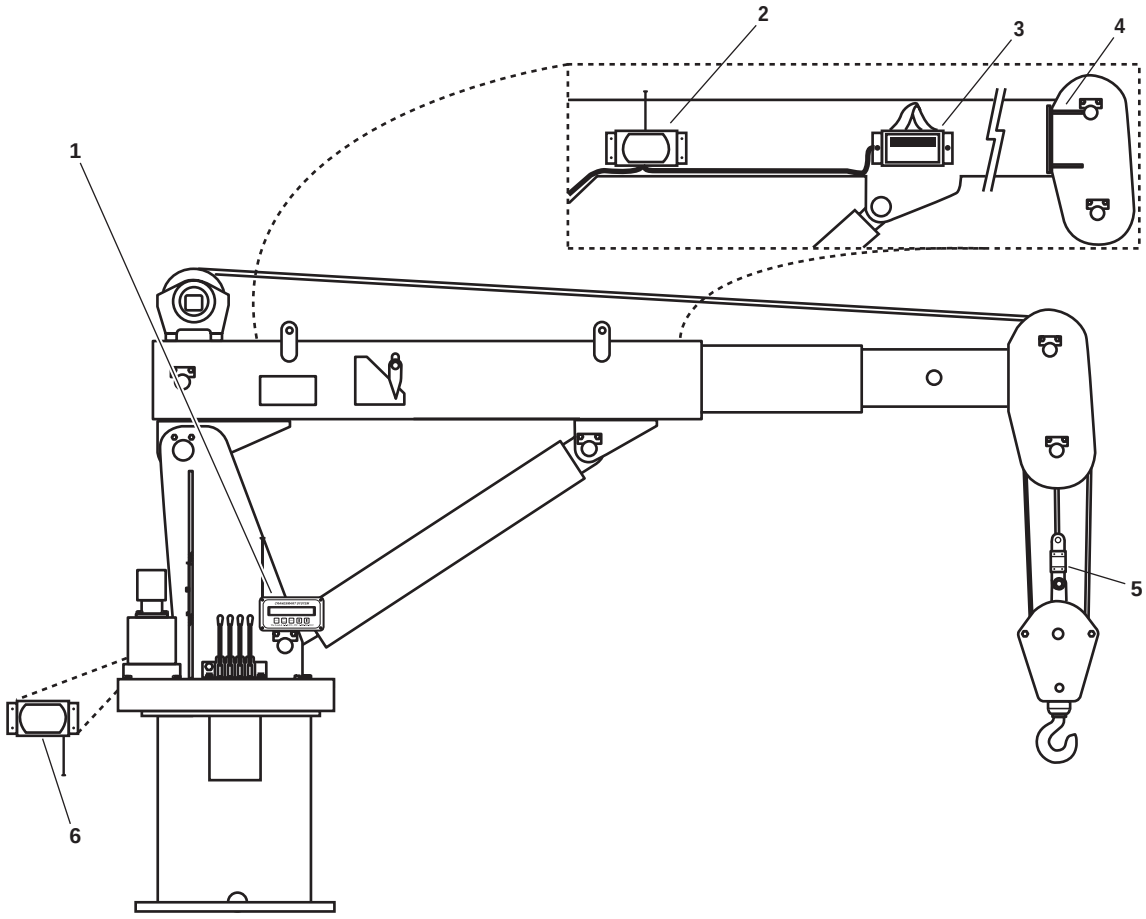


Figure 10. Load Moment Indicator

Table 10. Load Moment Indicator (refer to figure 10)

Key	Control/Indicator	Function
1	Receiver/Display Panel	The receiver/display panel receives signals from the angle sensor, laser emitter, and load cell. If the load exceeds the crane's set limits, the receiver/display panel will activate an audible and visual alarm.
2	Angle Sensor	The boom angle sensor senses the boom's angle and transmits this data to the receiver/display panel.
3	Laser Emitter	The emitter sends a laser beam to the target plate to determine the boom extended length.
4	Target Plate	The target provides a target for the laser emitter.
5	Load Cell	The load cell measures the tension on the crane's wire rope and sends weight calculation information to the receiver/display panel.
6	Power Converter	The power converter provides 12 Vdc to the receiver/display panel.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
EMERGENCY DIESEL GENERATOR ROOM

EMERGENCY DIESEL GENERATOR (EDG) ROOM, GENERAL ARRANGEMENT

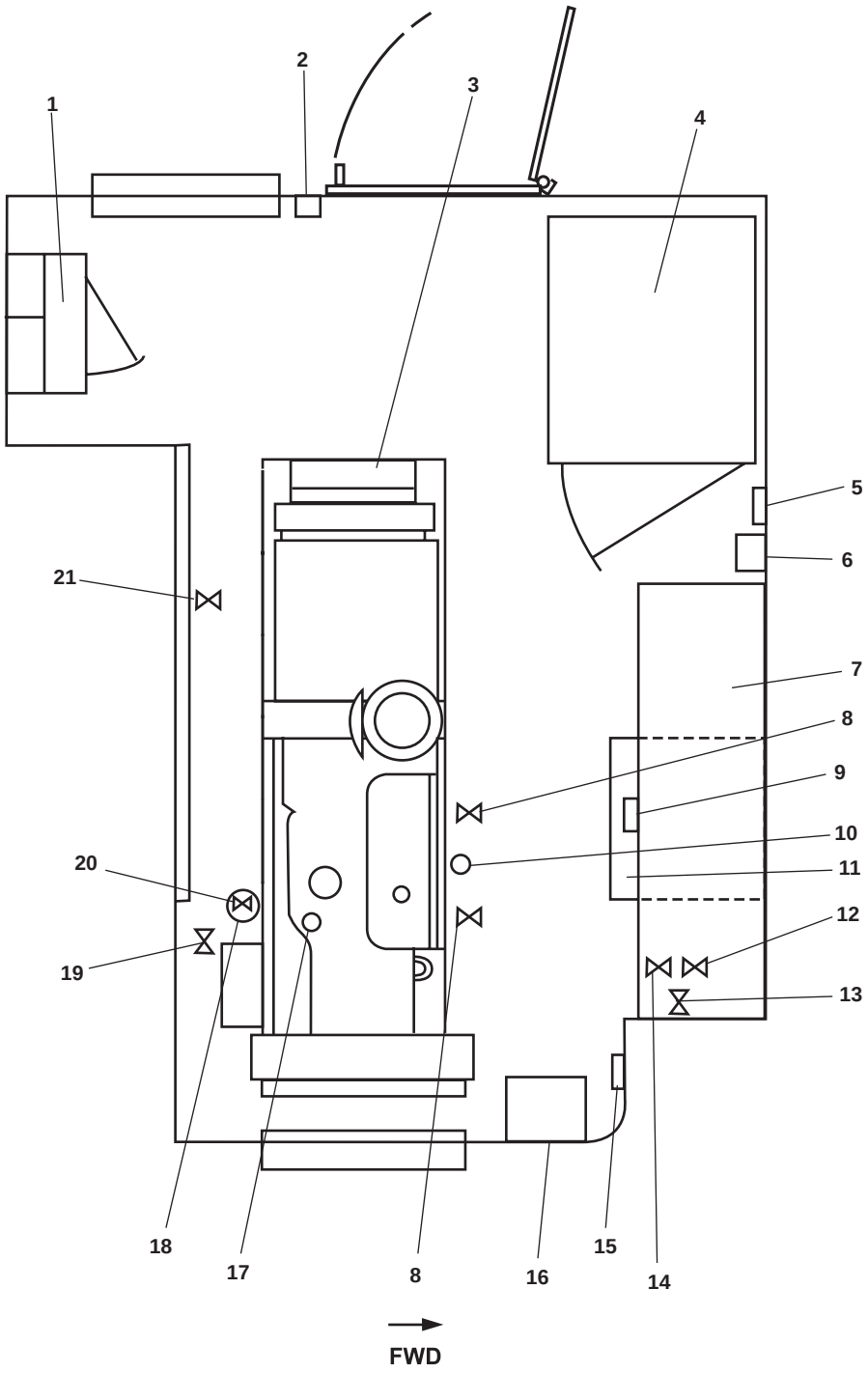


Figure 1. Emergency Diesel Generator (EDG) Room, General Arrangement

Table 1. Emergency Diesel Generator (EDG) Room, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	120V Emergency Load Center Distribution Panel	This panel contains circuit breakers that control and protect the emergency distribution system. See figure 2 for details.
2	Interior Lighting Switch	This switch turns the interior lights in the space ON and OFF.
3	Emergency Diesel Generator Control Panel	This control panel contains indicators and controls for the emergency diesel generator. See figure 3 for details.
4	Emergency Switchboard	This switchboard provides indicators and controls for the emergency generating circuits. See figure 4 for details.
5	#1 FUEL OIL TRANSFER PUMP REMOTE OFF Pushbutton	This pushbutton is used to turn the fuel oil transfer pump 1 from the EDG room OFF.
6	Sound Powered Telephone	The sound powered telephone provides communication with other stations onboard the vessel. See figure 5 for details.
7	EDG Day Tank (Overhead)	The day tank stores fuel oil for use by the EDG.
8	Cutoff Valves, Jacket Water Heater	These valves secure the flow of engine coolant to and from the jacket water heater.
9	Fuel Gauge, EDG Day Tank	This gauge indicates the fuel oil level present in the EDG day tank.
10	Dipstick	The dipstick indicates the lube oil level in the EDG engine.
11	EDG STARTING BATTERY BANK #2 (bottom) and EDG STARTING BATTERY BANK #1 (top)	These are the two banks of starting batteries to start the EDG.
12	Drain Valve, EDG Day Tank	This valve permits condensation and particulates to be drained from the bottom of the EDG day tank.
13	Cutoff Valve, EDG Day Tank Fill	This valve secures the fill line to the EDG day tank.
14	EDG Fuel Oil Supply Valve	This valve secures the supply of fuel oil to the EDG.
15	EMER DIESEL GENERATOR STARTING BATTERY SW Switch	This switch permits selection between the two diesel starting battery banks.
16	BATTERY CHARGER EMER DIESEL GEN	This charges the EDG starting battery banks and maintains their charge when the EDG is not running. See figure 6 for details.
17	Fuel Pressure Gauge	This gauge indicates the fuel oil pressure available to the EDG engine.
18	Fuel Filter/Water Separator	The separator removes water and larger particulates from the fuel oil entering the engine. See figure 7 for details.

Table 1. Emergency Diesel Generator (EDG) Room, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
19	Cutoff Valve, Fuel Supply to Fuel Filter/Water Separator	This valve secures the fuel oil supply upstream of the fuel filter/water separator.
20	Drain Valve, Fuel Filter/ Water Separator	This valve permits water and sediment to be drained from the fuel filter/ water separator.
21	DE-9, E.D.G. EXH. DR. Valve	When OPEN, this valve permits condensate to be drained from the EDG exhaust system.

120V EMERGENCY LOAD CENTER DISTRIBUTION PANEL

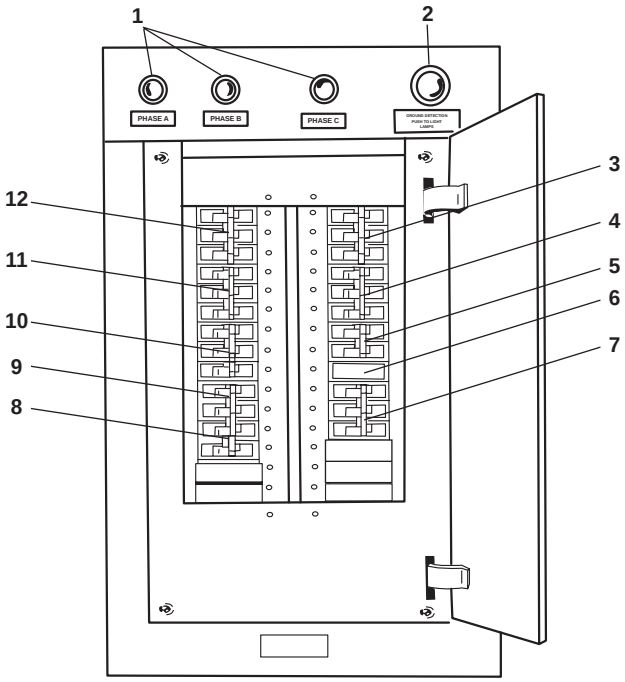


Figure 2. 120V Emergency Load Center Distribution Panel

Table 2. 120V Emergency Load Center Distribution Panel (refer to figure 2)

Key	Control/Indicator	Function
1	PHASE A, PHASE B, PHASE C Indicators	These lamps illuminate to indicate ground fault conditions.
2	GROUND DETECTION PUSH TO TEST LAMPS Pushbutton	This pushbutton is used to test the ground fault indicator lamps.
3	MAIN DECK 01 & 02 LEVEL EMERGENCY LIGHTING PANEL No. 1. Circuit Breaker	This circuit breaker protects 120V main deck, 01 & 02 level emergency lighting panel 1.

Table 2. Emergency Load Center Distribution Panel (refer to figure 2) (continued)

Key	Control/Indicator	Function
4	EXTERIOR EMERGENCY LIGHTING PANEL No. 2. Circuit Breaker	This circuit breaker protects 120V emergency lighting panel 2.
5	RADIO ROOM ELEX DISTRIBUTION PANEL. Circuit Breaker	This circuit breaker protects the 120V ELEX distribution panel.
6	GENERAL ALARM BATTERY CHARGER. Circuit Breaker	This circuit breaker protects the general alarm system battery charger.
7	EMERGENCY DIESEL GENERATOR JACKET WATER HEATER. Circuit Breaker	This circuit breaker protects the EDG jacket water heater.
8	SPARE. Circuit Breaker	This is a spare circuit breaker.
9	NAVIGATION LIGHTING PANEL. Circuit Breaker	This circuit breaker protects the navigation lighting panel.
10	EMERGENCY DIESEL GENERATOR SET BATTERY CHARGER. Circuit Breaker	This circuit breaker protects the emergency diesel generator set's battery charger.
11	PILOTHOUSE EMERGENCY DISTRIBUTION PANEL. Circuit Breaker	This circuit breaker protects the 120V pilothouse emergency distribution panel.
12	ENGINE ROOM EMERGENCY DISTRIBUTION PANEL No. 1. Circuit Breaker	This circuit breaker protects 120V emergency distribution panel 1.

EMERGENCY DIESEL GENERATOR CONTROL PANEL

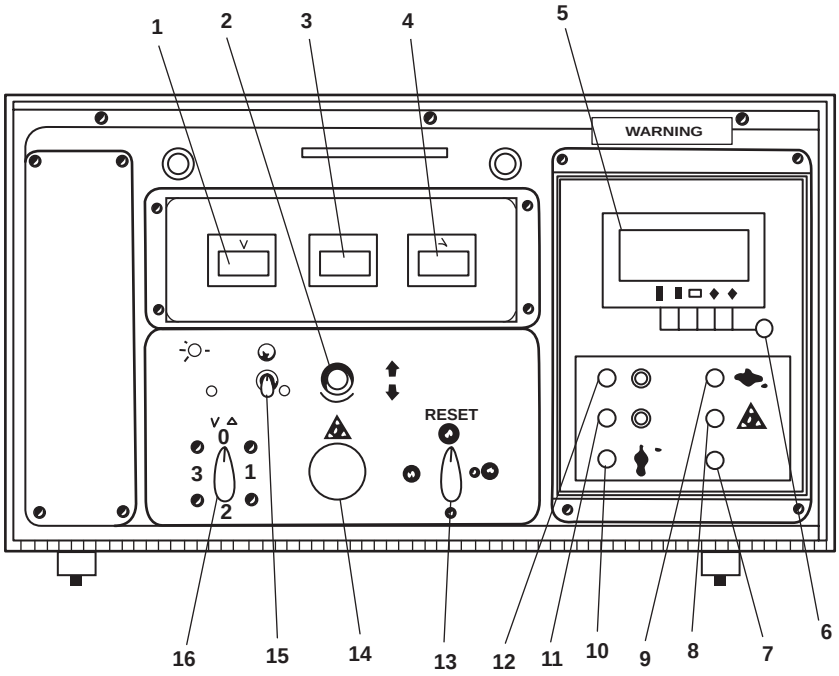


Figure 3. Emergency Diesel Generator Control Panel

Table 3. Emergency Diesel Generator Control Panel (refer to figure 3)

Key	Control/Indicator	Function
1	V Gauge	This gauge provides a digital readout of generator output voltage.
2	Voltage Adjust Rheostat	This rheostat adjusts the generator output voltage.
3	Hz Gauge	This gauge provides digital readout of generator output frequency in Hertz.
4	A Gauge	This gauge provides a digital readout of generator output current.
5	Engine Control Display	This display provides digital readout of various engine operating indicators.
6	Engine Control Display Pushbutton	This pushbutton scrolls through the various engine operating indicators displayed on the screen.
7	REVERSE POWER Indicator	This indicator illuminates to indicate a reversed power connection to the EDG.
8	EMERGENCY STOP Indicator	This indicator illuminates to indicate that an emergency stop has occurred.
9	LOW OIL PRESSURE Indicator	This indicator illuminates to indicate that low lube oil pressure in the EDG engine caused the emergency stop.
10	HIGH COOLANT TEMP Indicator	This indicator illuminates to indicate that high coolant temperature in the EDG engine caused the emergency stop.

Table 3. Emergency Diesel Generator Control Panel (refer to figure 3) (continued)

Key	Control/Indicator	Function
11	OVERSPEED Indicator	This indicator illuminates to indicate that an overspeed condition caused the emergency stop.
12	OVERCRANK Indicator	This indicator illuminates to indicate that an overcrank condition caused the emergency stop.
13	Automatic Control Switch	This switch permits switching between OFF/RESET, AUTO, MAN, and STOP. In the OFF/RESET position, the control panel is reset after an emergency stop condition. In the AUTO position, the EDG will start automatically when normal vessel power is lost. In the MAN position, manual starting of the EDG may be accomplished. In the STOP position, the EDG will shut down despite the lack of normal vessel power.
14	Emergency Shutdown Pushbutton	This pushbutton is used to stop the EDG engine in case of an emergency.
15	Lamp/Display Test Switch	This switch is used to test the indicators and panel lights.
16	Ammeter/Voltmeter Phase Selector Switch	This switch selects the phase to display on the digital voltmeter and digital ammeter.

EMERGENCY SWITCHBOARD

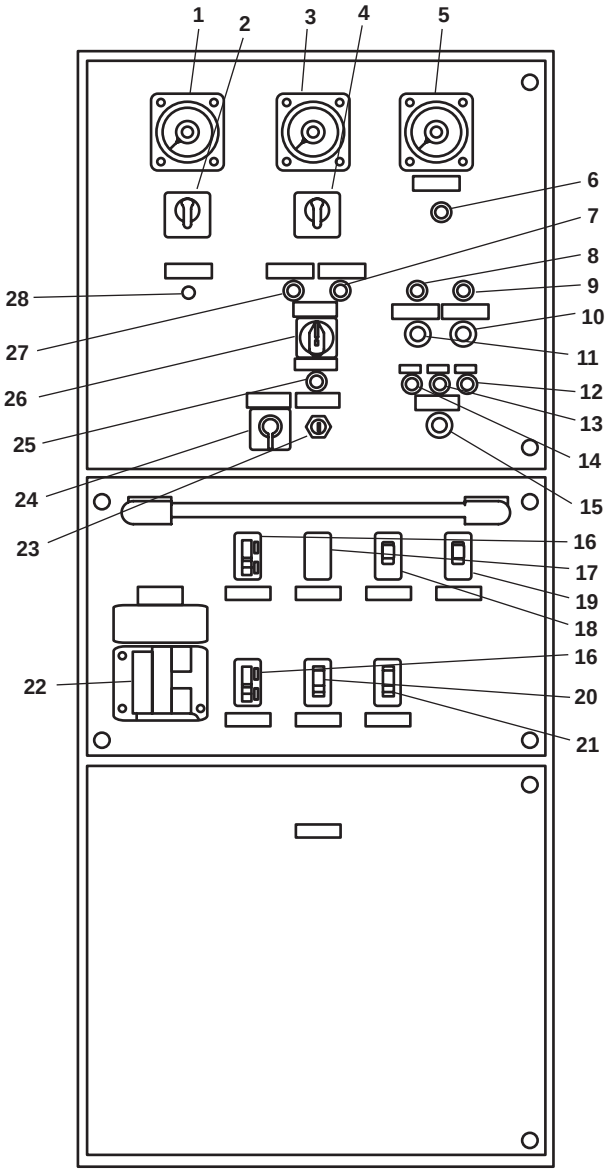


Figure 4. Emergency Switchboard

Table 4. Emergency Switchboard (refer to figure 4)

Key	Control/Indicator	Function
1	AC Voltmeter	The voltmeter indicates EDG output voltage.
2	Voltmeter Selector Switch	This switch selects between OFF, 1-2, 2-3, and 3-1 for the voltmeter.
3	AC Ammeter	The ammeter indicates the EDG output current in amperes.
4	Ammeter Selector Switch	This switch selects between OFF, 1, 2, and 3 for the ammeter.
5	Hertz Meter	This meter indicates the generator output frequency in Hertz.

Table 4. Emergency Switchboard (refer to figure 4) (continued)

Key	Control/Indicator	Function
6	EMG GENERATOR POWER AVAILABLE Indicator	This indicator illuminates to indicate that the EDG is supplying the switchboard.
7	EMER GENERATOR CIRCUIT BREAKER CLOSED Indicator	This indicator illuminates to indicate that the emergency generator circuit breaker is CLOSED.
8	MAIN SWBD BUS TIE CIRCUIT BREAKER OPEN Indicator	This indicator illuminates to indicate that the main switchboard bus tie circuit breaker is OPEN.
9	MAIN SWBD BUS TIE CIRCUIT BREAKER CLOSED Indicator	This indicator illuminates to indicate that the main switchboard bus tie circuit breaker is CLOSED.
10	MAIN SWBD BUS TIE CIRCUIT BREAKER CLOSED Pushbutton	This pushbutton is used to CLOSE the main switchboard bus tie.
11	MAIN SWBD BUS TIE CIRCUIT BREAKER OPEN Pushbutton	This pushbutton is used to OPEN the main switchboard bus tie.
12	"C" PHASE Indicator	This indicator illuminates to indicate a ground fault on the C phase bus.
13	"B" PHASE Indicator	This indicator illuminates to indicate a ground fault on the B phase bus.
14	"A" PHASE Indicator	This indicator illuminates to indicate a ground fault on the A phase bus.
15	EMG GEN BUS GND DET PUSH TO TEST LAMPS Pushbutton	This pushbutton is used to test the ground fault indicator lamps (figure 4, items 12-14).
16	Spare Circuit Breaker	This is a spare circuit breaker.
17	Steering Gear Pump #1	Thuis pump provides control of, and protection for, steering gear pump 1.
18	FIRE PUMP #1 Circuit Breaker	This circuit breaker provides control of and protection for fire pump 1.
19	3 - 10KVA 1Ø XFMRS Circuit Breaker	This circuit breaker provides control of and protection for the transformers mounted above the EDG.
20	BILGE PUMP #1 Circuit Breaker	This circuit breaker provides control of and protection for bilge pump 1.
21	FUEL OIL XFER PUMP Circuit Breaker	This circuit breaker provides control of and protection for the fuel oil transfer pumps.

Table 4. Emergency Switchboard (refer to figure 4) (continued)

Key	Control/Indicator	Function
22	ENG. CONTROL SW MAN OFF STBY	This selects the mode of EDG operation between OFF, MAN, and STBY. In OFF, the EDG is always OFF, regardless of the normal power condition. In MAN, the EDG is enabled to operate manually, regardless of the normal power condition. In STBY, the EDG will start, run, and take the load whenever normal power is lost.
23	BUS TIE BKR SET FOR FEEDBACK Indicator	This indicator illuminates to indicate that the feedback switch (figure 4, item 24) is set to the FEEDBACK position.
24	BUS TIE BKR FEEDBACK SW Normal Feedback	Use this key lock switch to select the FEEDBACK position for the bus tie breaker.
25	MAIN SWBD BUS TIE CIRCUIT BREAKER	This circuit breaker ties the emergency switchboard to the main switchboard.
26	EMG GENERATOR CIRCUIT BREAKER OPEN CLOSE Switch	This switch selects the OPEN or CLOSED position for the emergency generator circuit breaker.
27	EMG GENERATOR CIRCUIT BREAKER OPEN Indicator	This indicator illuminates to indicate that the emergency generator circuit breaker is OPEN.
28	EMG GENERATOR AUTO VOLT RHEO	This rheostat adjusts the output voltage of the EDG.

SOUND POWERED TELEPHONE

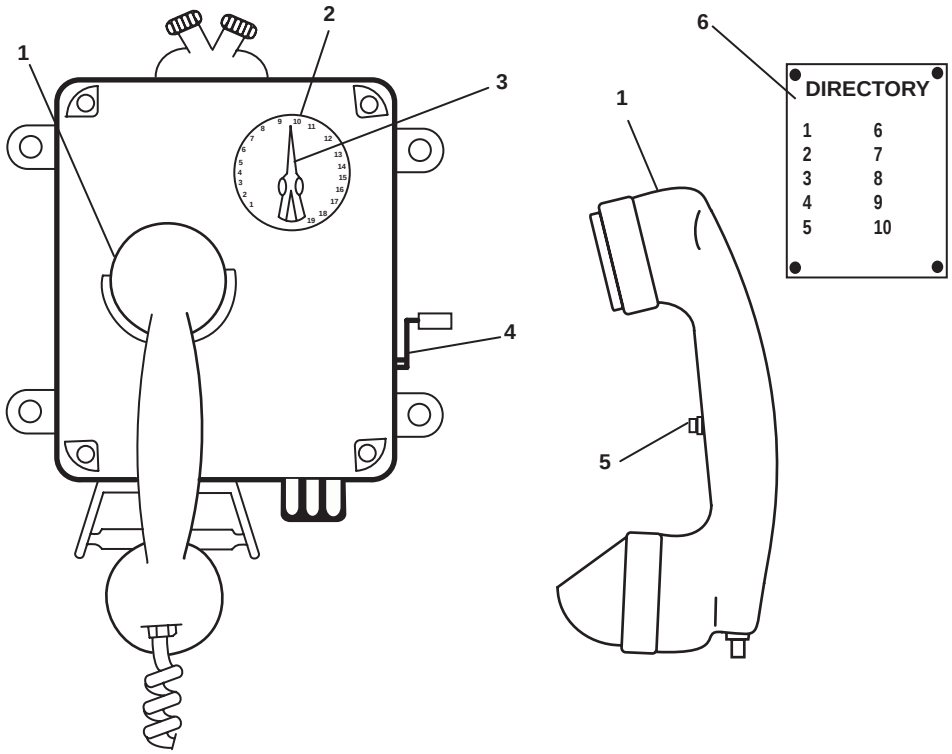


Figure 5. Sound Powered Telephone

Table 5. Sound Powered Telephone (refer to figure 5)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	The selector knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	This pushbutton is used to transmit.
6	DIRECTORY Plate (on bulkhead)	The directory plate lists telephone stations aboard the vessel.

EMERGENCY DIESEL GENERATOR BATTERY CHARGER

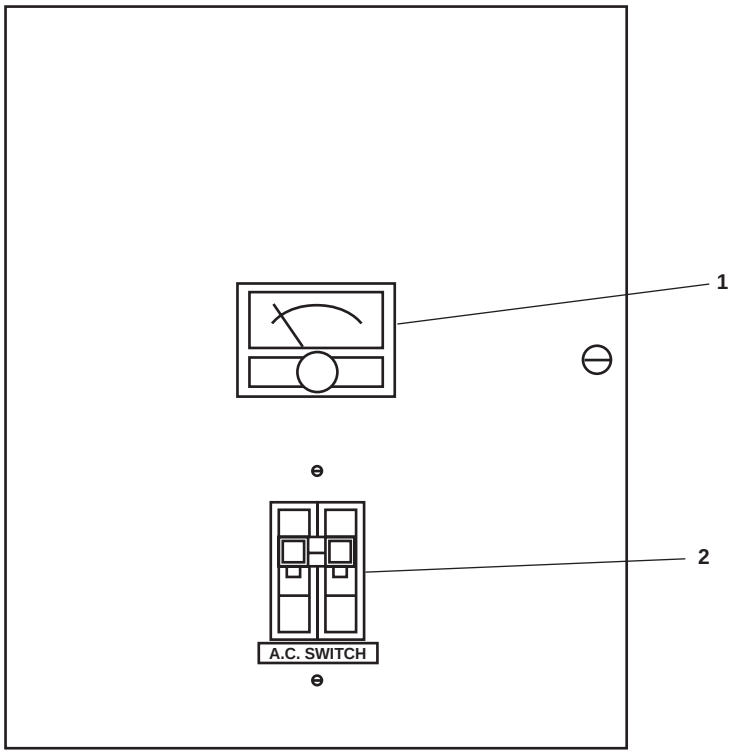


Figure 6. Emergency Diesel Generator Battery Charger

Table 6. Emergency Diesel Generator Battery Charger (refer to figure 6)

Key	Control/Indicator	Function
1	Ammeter	The ammeter indicates the charging current from the battery charger.
2	AC SWITCH	This switch turns the battery charger ON and OFF.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
01 LEVEL STATEROOMS AND SANITARY SPACES

01 LEVEL STATEROOMS AND SANITARY SPACES, GENERAL ARRANGEMENT

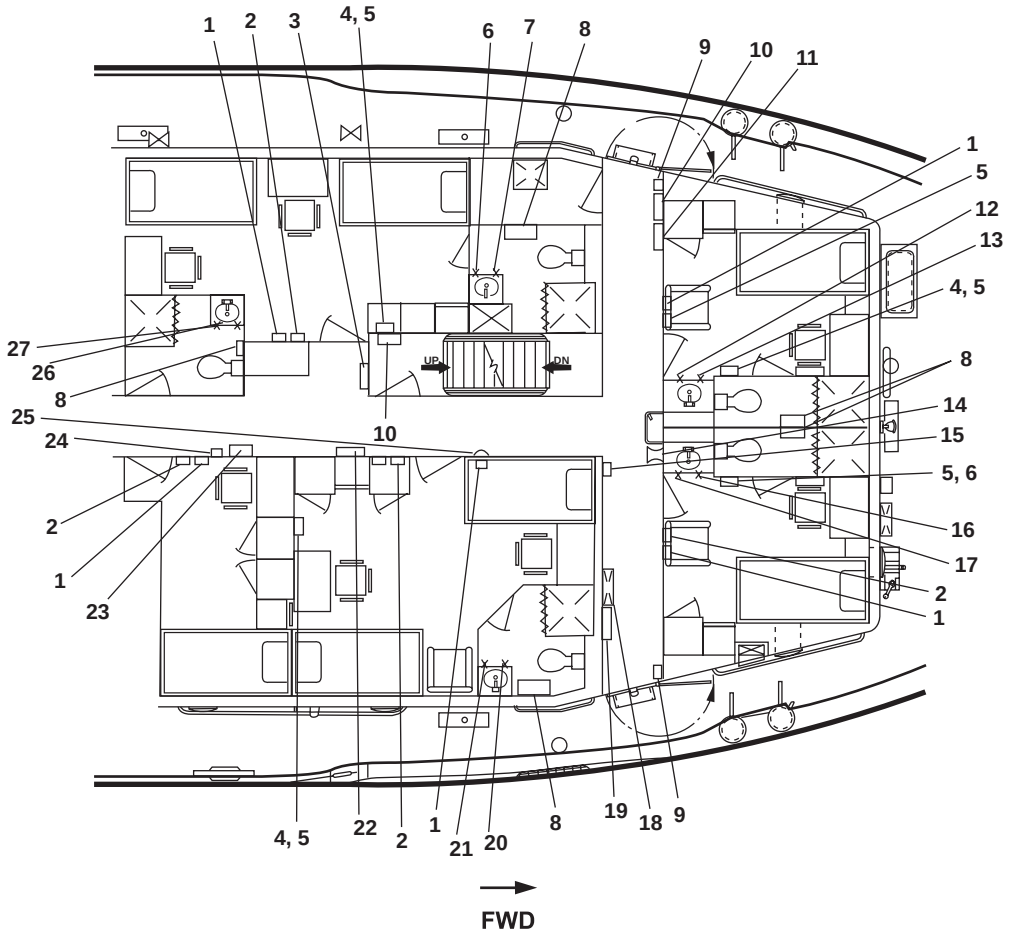


Figure 1. 01 Level Staterooms and Sanitary Spaces, General Arrangement

Table 1. 01 Level Staterooms and Sanitary Spaces, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Thermostat	The thermostat controls the temperature within the space. See figure 2 for details.
2	Interior Lighting Switch	This switch turns the interior lighting within the space ON and OFF.
3	120V Pilothouse Emergency Distribution Panel	This panel contains circuit breakers for the pilothouse electrical gear. See figure 3 for details.
4	Sound Powered Telephone	The sound powered telephone provides communication with other stations onboard the vessel. See figure 4 for details.
5	Intercom	The intercom provides communication with other stations onboard the vessel. See figure 5 for details.

Table 1. 01 Level Staterooms and Sanitary Spaces, General Layout (continued)

Key	Control/Indicator	Function
6	PW-61 Valve	This valve controls cold potable water to the sink.
7	PW-26, C.W. TO W.C.	This valve controls hot potable water to the sink.
8	Convection Heater	This heater supplies supplemental heat to the sanitary spaces. See figure 6 for details.
9	Fire Alarm Pull Station	Pull DOWN on the box to sound the fire alarm.
10	Convector Heater 120V Fuse Box No. 2	This box contains fuses for the 01 and 02 level convection heaters. See figure 7 for details.
11	01 & 02 Level Reheater 120V Fuse Box No. 1	This box contains fuses for the 01 and 02 level reheaters. See figure 8 for details.
12	PW-58 Valve	This valve controls hot potable water to the sink.
13	PW-56 Valve	This valve controls cold potable water to the sink.
14	PA Speaker and Volume Control	This provides communication to the space. See figure 9 for details.
15	Fire Station 8	The fire station provides hose, nozzle, and firemain valve for firefighting. See figure 10 for details.
16	PW-55 Valve	This valve controls cold potable water to the sanitary space.
17	PW-57 Valve	This valve controls hot potable water to the sanitary space.
18	120V Distribution Panel No. 2	This panel contains circuit breakers for many of the electrical systems onboard the vessel. See figure 11 for details.
19	220V Air Conditioning Distribution Panel	This panel contains circuit breakers for the pilothouse and radio room rooftop air conditioning units.
20	PW-60 Valve	This valve controls hot potable water to the sink.
21	PW-59 Valve	This valve controls cold potable water to the sink.
22	120V Exterior Emergency Lighting Panel No. 2	This panel contains circuit breakers for the exterior emergency lighting. See figure 13 for details.
23	General Alarm System Distribution Panel	This panel contains circuit breakers for the general alarm system.
24	Contact Maker General Alarm System	When rotated to the ON position, the general alarm sounds.
25	General Alarm Bell	This bell sounds when the general alarm system is activated.
26	PW-63 Valve	This cutoff valve controls cold potable water to the sink.
27	PW-64 Valve	This cutoff valve controls hot potable water to the sink.

THERMOSTAT

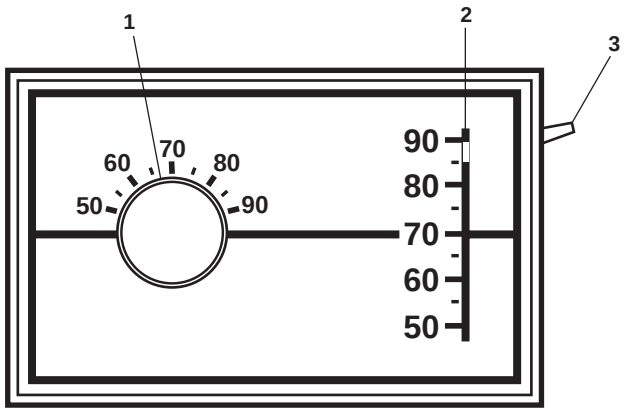


Figure 2. Thermostat

Table 2. Thermostat (refer to figure 2)

Key	Control/Indicator	Function
1	Thermometer	The thermometer indicates the actual temperature in the space.
2	Set Point Dial	This dial indicates the temperature for which the thermostat is set.
3	Set Point Handle	This handle permits changing of the desired temperature for the space.

120V PILOTHOUSE EMERGENCY DISTRIBUTION PANEL

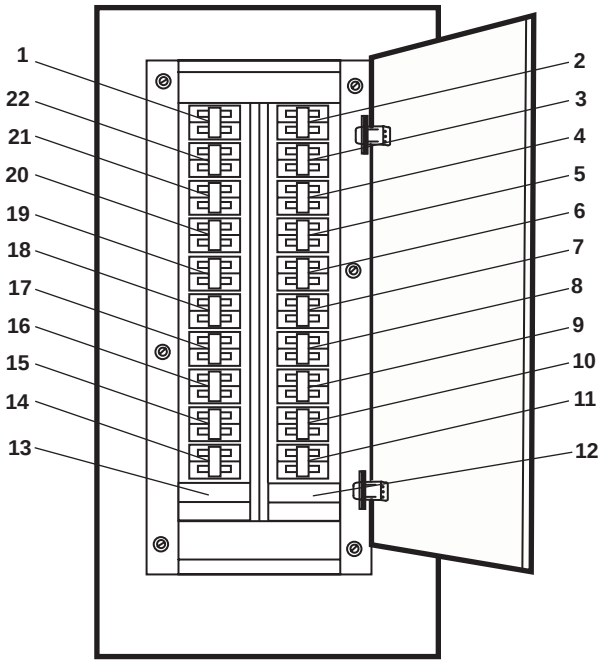


Figure 3. 120V Pilothouse Emergency Distribution Panel

Table 3. 120V Pilothouse Emergency Distribution Panel (refer to figure 3)

Key	Control/Indicator	Function
1	SPARE. Circuit breaker.	This is a spare circuit breaker for future expansion.
2	PORT SEARCH LIGHT POWER SUPPLY. Circuit Breaker	This circuit breaker protects the port searchlight.
3	GMDSS 12VDC BATTERY CHARGER. Circuit Breaker	This circuit breaker protects the GMDSS 12 Vdc Battery Charger.
4	SPEED LOG 85 ELECTRONICS UNIT. Circuit Breaker	This circuit breaker protects the speed log.
5	STARBOARD SEARCH LIGHT POWER SUPPLY. Circuit Breaker	This circuit breaker protects the starboard searchlight.
6	SPARE. Circuit breaker.	This is a spare circuit breaker for future expansion.
7	SPARE. Circuit breaker.	This is a spare circuit breaker for future expansion.
8	WINDSCREEN ELEMENTS. (AFT). Circuit Breaker	This circuit breaker protects the aft pilothouse window heaters.
9	POWER SUPPLY. (GMDSS). Circuit Breaker	This circuit breaker protects the GMDSS power supply.

Table 12. 120V Pilothouse Emergency Distribution Panel (refer to figure 12) (continued)

Key	Control/Indicator	Function
10	DSC 500 POWER. (GMDSS). Circuit Breaker	This circuit breaker protects the GMDSS marine VHF radio.
11	INTERCOM SYSTEM. Circuit Breaker	This circuit breaker protects the intercom system.
12	BLANK.	This blank space is provided for expansion.
13	BLANK.	This blank space is provided for expansion.
14	SPARE. Circuit breaker.	This is a spare circuit breaker for future expansion.
15	RECEPTACLES. (GMDSS). Circuit Breaker	This circuit breaker protects the GMDSS receptacles.
16	SONAR DIGITAL AN/SQN. (ECHO SOUNDER DISPLAY). Circuit Breaker	This circuit breaker protects the digital sonar unit's display.
17	WINDSCREEN ELEMENTS. (FWD). Circuit Breaker	This circuit breaker protects the forward pilothouse window heaters.
18	X BAND RADAR MOTOR. Circuit Breaker	This circuit breaker protects the X band radar motor.
19	RADAR DISTRIBUTION PANEL . Circuit Breaker	This circuit breaker protects the 120V radar power distribution panel.
20	SPARE. Circuit breaker.	This is a spare circuit breaker for future expansion.
21	S BAND RADAR MOTOR. Circuit Breaker	This circuit breaker protects the S band radar motor.
22	POWER SUPPLY. (GMDSS). Circuit Breaker	This circuit breaker protects the Global Maritime Distress and Safety System (GMDSS) power supply.

SOUND POWERED TELEPHONE

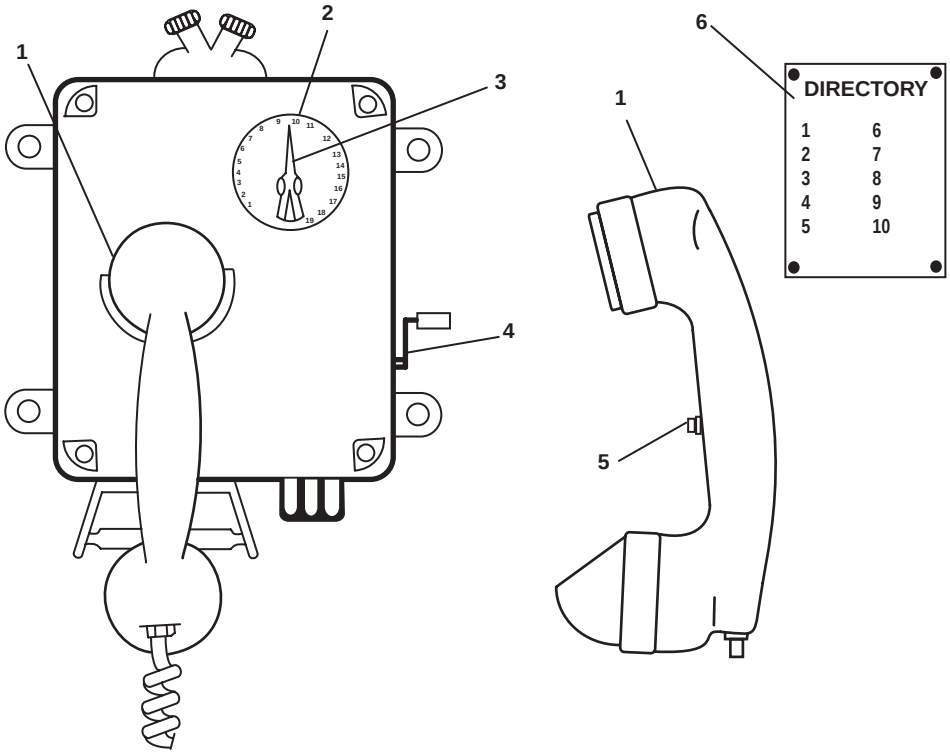


Figure 4. Sound Powered Telephone

Table 4. Sound Powered Telephone (refer to figure 4)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Selector Dial	The selector dial outlines available stations.
3	Selector Knob	The selector knob selects station to be called.
4	Magneto Handle	Crank the magneto handle to call a station.
5	Pushbutton	Thus pushbutton is used to transmit.
6	DIRECTORY Plate (on wall)	The directory plate lists telephone stations aboard the vessel.

INTERCOM

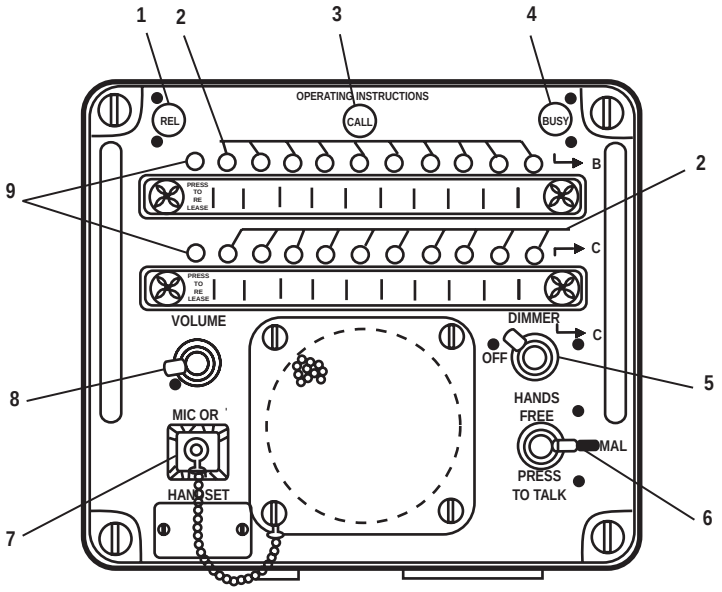


Figure 5. Intercom

Table 5. Intercom (refer to figure 5)

Key	Control/Indicator	Function
1	REL Indicator	This indicator illuminates to indicate that release of the system is required.
2	Station Pushbuttons	This pushbutton connects the unit to the selected station.
3	CALL Indicator	This indicator illuminates to indicate an incoming call.
4	BUSY Indicator	This indicator illuminates to indicate that the system is in use.
5	DIMMER Control	This controls the illumination level of the intercom panel.
6	HANDS FREE Control	This provides hands free or press to talk transmission modes.
7	MIC OR HANDSET Plug	This is the jack plug for an external microphone/handset.
8	VOLUME Control	This controls the sound level of the intercom.
9	PRESS TO RELEASE	When pressed, this releases the station pushbuttons.

CONVECTION HEATER

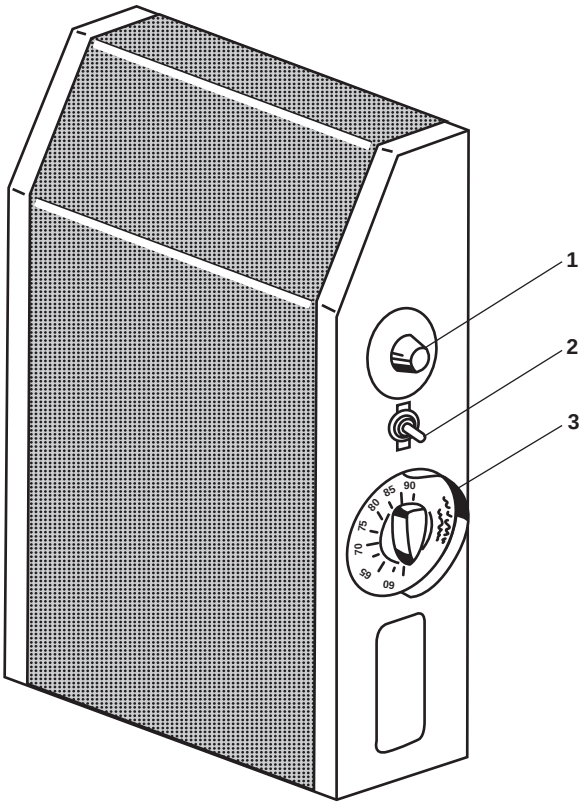


Figure 6. Convection Heater

Table 6. Convection Heater (refer to figure 6)

Key	Control/Indicator	Function
1	Manual Reset Switch	This switch sets the temperature at which the heater will cut out. It overrides the thermostat setting.
2	ON/OFF Switch	This switch turns the heater ON and OFF.
3	Thermostat	The thermostat controls the temperature setting for the heater.

CONVECTOR HEATER 120V FUSE BOX NO. 2

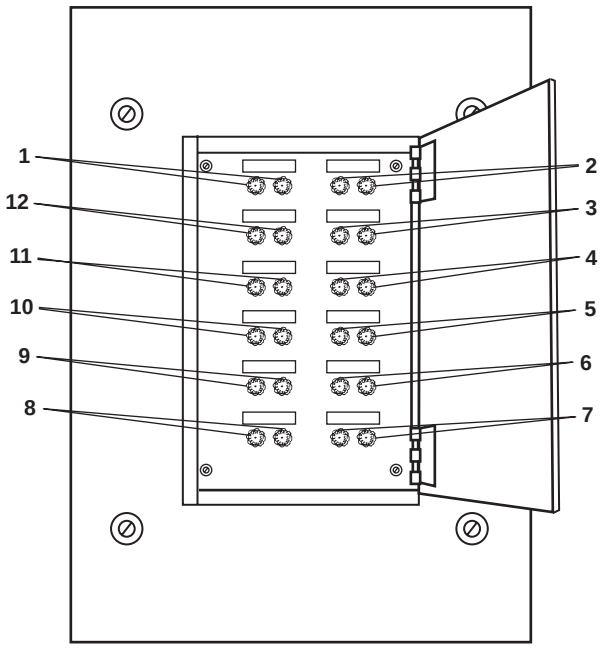


Figure 7. Convector Heater 120V Fuse Box No. 2

Table 7. Convector Heater 120V Fuse Box No. 2 (refer to figure 7)

Key	Control/Indicator	Function
1	CONVECTOR HEATER 01-36-2. (.6 KW). Fuses	These fuses provide protection for the convection heater in the 01 level passageway sanitary space.
2	CONVECTOR HEATER. 01-44-2. (.5 KW). Fuses	These fuses provide protection for the convection heater in the officer's stateroom 2 sanitary space
3	SPARE Fuses	Spare fuses for future expansion.
4	CONVECTOR HEATER. 1-51-2. (.5 KW). Fuses	These fuses provide protection for the convection heater in the chief engineer’s stateroom sanitary space.
5	SPARE. Fuses	Spare fuses for future expansion.
6	CONVECTOR HEATER. 1-56-1. (.75 KW). Fuses	These fuses provide protection for the convection heater in the crew's stateroom 1 sanitary space.
7	SPARE. Fuses	Spare fuses for future expansion.
8	CONVECTOR HEATER. 01-57-2. (.1.2 KW). Fuses	These fuses provide protection for the convection heater in the laundry room.
9	CONVECTOR HEATER. 01-51-1. (.5 KW). Fuses	These fuses provide protection for the convection heater in the captain's stateroom sanitary space.

Table 7. Convector Heater 120V Fuse Box No. 2 (refer to figure 7) (continued)

Key	Control/Indicator	Function
10	CONVECTOR HEATER. 1-40-2. (.1.2 KW). Fuses	These fuses provide protection for the convection heater in the main deck passageway sanitary space.
11	CONVECTOR HEATER. 1-50-2. (.6 KW). Fuses	These fuses provide protection for the convection heater in the crew's stateroom 3 sanitary space.
12	CONVECTOR HEATER. 01-45-1. (.6 KW). Fuses	These fuses provide protection for the convection heater in the officer's stateroom 1 sanitary space.

01 & 02 LEVEL REHEATER 120V FUSE BOX NO. 1

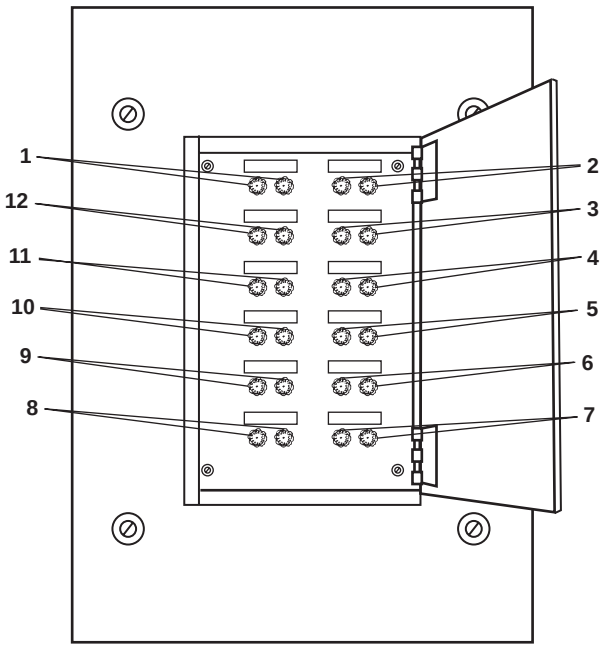


Figure 8. 01 & 02 Level Reheater 120V Fuse Box No. 1

Table 8. 01 & 02 Level Reheater 120V Fuse Box No. 1 (refer to figure 8)

Key	Control/Indicator	Function
1	REHEATER. 01-34-1. (.39 KW). Fuses	These fuses protect the reheater in the NCO stateroom.
2	REHEATER. 01-41-1 (.39 KW). Fuses	These fuses protect the reheater in officer's stateroom 1.
3	REHEATER. 01-50-2. (.35 KW). Fuses	These fuses protect the reheater in the chief engineer's stateroom.
4	PORT BRIDGE WING CONSOLE HEATER. Fuses	These fuses protect the heater in the port pilothouse wing station.

Table 8. 01 & 02 Level Reheater 120V Fuse Box No. 1 (refer to figure 8) (continued)

Key	Control/Indicator	Function
5	REHEATER 01-39-2. (.58 KW). Fuses	These fuses protect the reheater in officer's stateroom 2.
6	SPARE. Fuses	These are spare fuses for future expansion.
7	SPARE. Fuses	These are spare fuses for future expansion.
8	REHEATER. 02-44-1. (2.02 KW). Fuses	These fuses protect the reheater in the pilothouse.
9	REHEATER. 02-46-2. (2.06 KW). Fuses	These fuses protect the reheater in the pilothouse.
10	STARBOARD BRIDGE WING CONSOLE HEATER. Fuses	These fuses protect the heater in the starboard pilothouse wing station.
11	REHEATER. 01-50-1. (.3 KW). Fuses	These fuses protect the reheater in the captain's stateroom.
12	SPARE. Fuses	These are spare fuses for future expansion.

PA SPEAKER AND VOLUME CONTROL

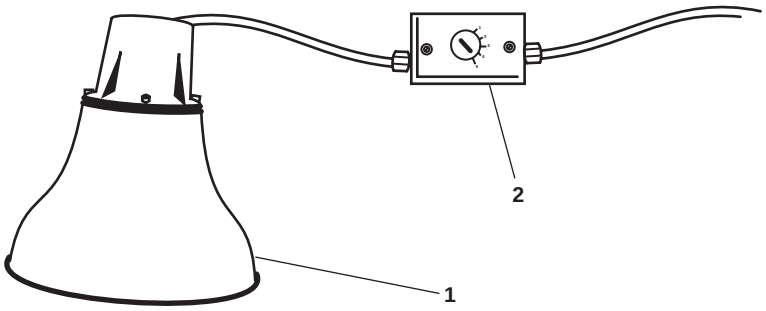


Figure 9. PA Speaker and Volume Control

Table 9. PA Speaker and Volume Control (refer to figure 9)

Key	Control/Indicator	Function
1	Loudspeaker	This loudspeaker broadcasts the PA system.
2	Volume Control	This controls the volume of the loudspeaker.

FIRE STATION

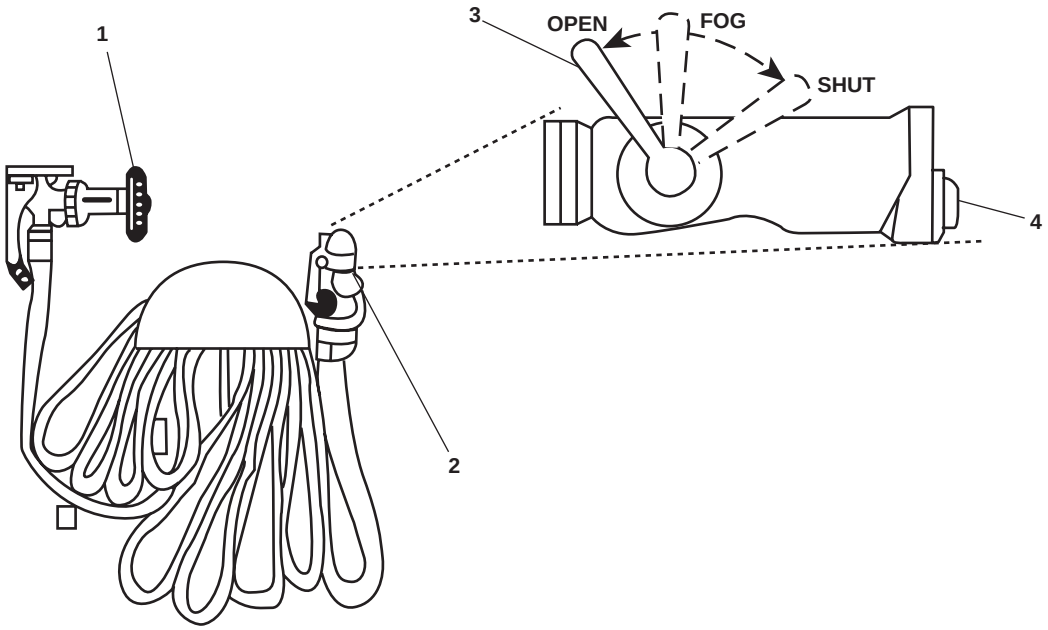


Figure 10. Fire Station

Table 10. Fire Station (refer to figure 10)

Key	Control/Indicator	Function
1	Valve	This valve turns the fire main water ON and OFF.
2	Nozzle	This nozzle directs water by spray or stream to the fire.
3	Nozzle Valve	This valve controls the flow of water from the nozzle. When in the SHUT position, the flow of water is stopped. When in the FOG position, the water is directed to the fog jet. When in the OPEN position, water is directed to the single stream outlet.
4	Fog Outlet Plug	This plug provides an outlet for attaching 4-foot and 10-foot applicators.

120V DISTRIBUTION PANEL NO. 2

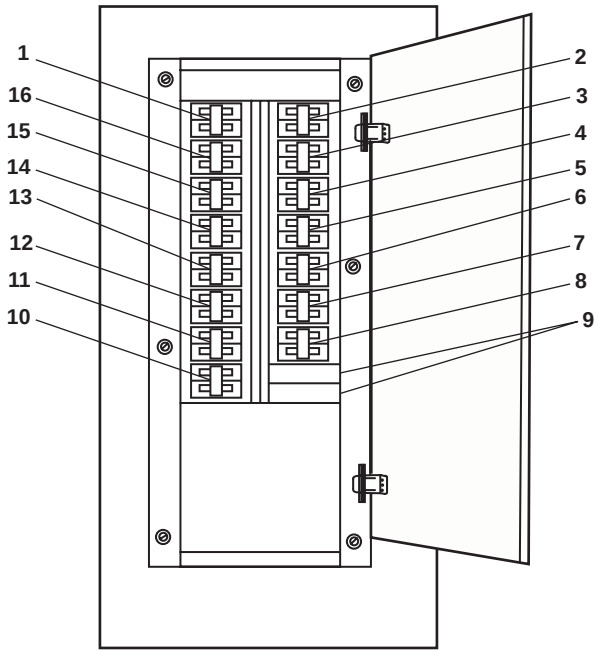


Figure 11. 120V Distribution Panel No. 2

Table 11. 120V Distribution Panel No. 2 (refer to figure 11)

Key	Control/Indicator	Function
1	01 LEVEL PORT LIGHTS. Circuit Breaker	This circuit breaker protects the lights on the port side of the 01 level.
2	PILOTHOUSE FRESH AIR 2-SPEED SUPPLY FANS. Circuit Breaker	This circuit breaker protects the pilothouse supply fans.
3	01 LEVEL STARBOARD RECEPTACLES. Circuit Breaker	This circuit breaker protects the receptacles on the starboard side of the 01 level.
4	PILOTHOUSE FRESH AIR INTAKE DAMPERS. Circuit Breaker	This circuit breaker protects the pilothouse fresh air intake dampers.
5	SPARE. Circuit Breaker	This is a spare circuit breaker provided for system expansion.
6	SPARE. Circuit Breaker	This is a spare circuit breaker provided for system expansion.
7	01 LEVEL PORT RECEPTACLES. Circuit Breaker	This circuit breaker protects the receptacles on the port side of the 01 level.
8	PILOTHOUSE DRINKING FOUNTAIN & COFEE MAKER. Circuit Breaker	This circuit breaker protects the pilothouse drinking fountain and coffee maker.

Table 11. 120V Distribution Panel No. 2 (refer to figure 11) (continued)

Key	Control/Indicator	Function
9	BLANK.	There is no circuit breaker in this position.
10	RADIO ROOM RECEPTACLES. Circuit Breaker	This circuit breaker protects the receptacles in the radio room.
11	PILOTHOUSE RECEPTACLES. Circuit Breaker	This circuit breaker protects the receptacles in the pilothouse.
12	SPARE. Circuit Breaker	This is a spare circuit breaker provided for system expansion.
13	1 & 01 LEVEL CONVECTOR HEATER FUSE BOX No. 2. Circuit Breaker	This circuit breaker protects the 01 & 02 level convection heater fuse box.
14	01 LEVEL STARBOARD LIGHTS. Circuit Breaker	This circuit breaker protects the lights on the starboard side of the 01 level.
15	01 LEVEL DRINKING FOUNTAIN. Circuit Breaker	This circuit breaker protects the drinking fountain on the 01 level.
16	01 LEVEL PASSAGEWAY LIGHTS. Circuit Breaker	This circuit breaker protects the lights in the 01 level passageway.

220V AIR CONDITIONING DISTRIBUTION PANEL

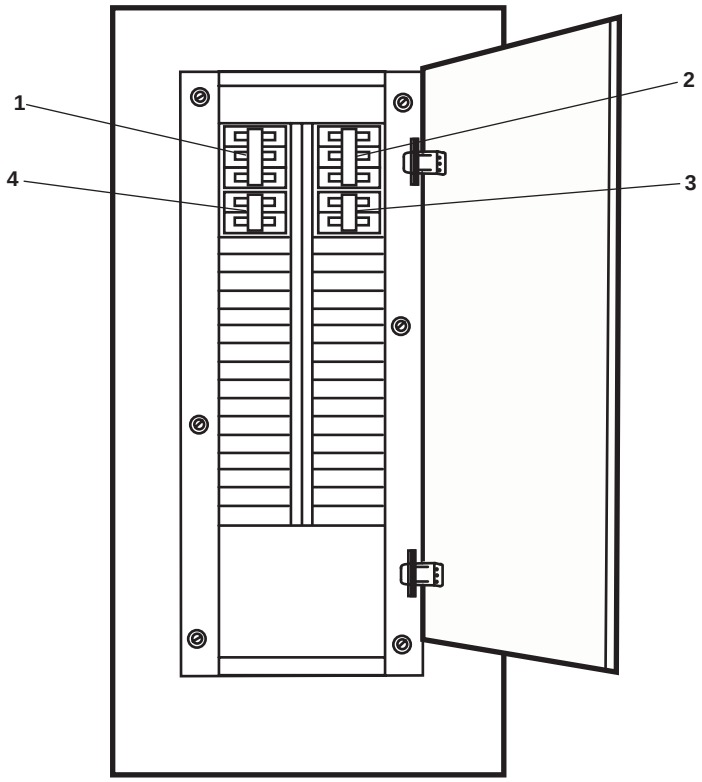


Figure 12. 220V Air Conditioning Distribution Panel

Table 12. 220V Air Conditioning Distribution Panel (refer to figure 12)

Key	Control/Indicator	Function
1	PILOTHOUSE OVERHEAD A/C UNIT PORT. Circuit Breaker	This circuit breaker protects the port side pilothouse rooftop air conditioning unit.
2	PILOTHOUSE OVERHEAD A/C UNIT STARBOARD. Circuit Breaker	This circuit breaker protects the starboard side pilothouse rooftop air conditioning unit.
3	SPARE. Circuit Breaker	This is a spare circuit breaker provided for system expansion.
4	OUTDOOR CONDENSING UNIT FOR RADIO ROOM. Circuit Breaker	This circuit breaker protects the radio room rooftop air conditioning unit (including the fan coil unit in the radio room).

120V EXTERIOR EMERGENCY LIGHTING PANEL NO. 2

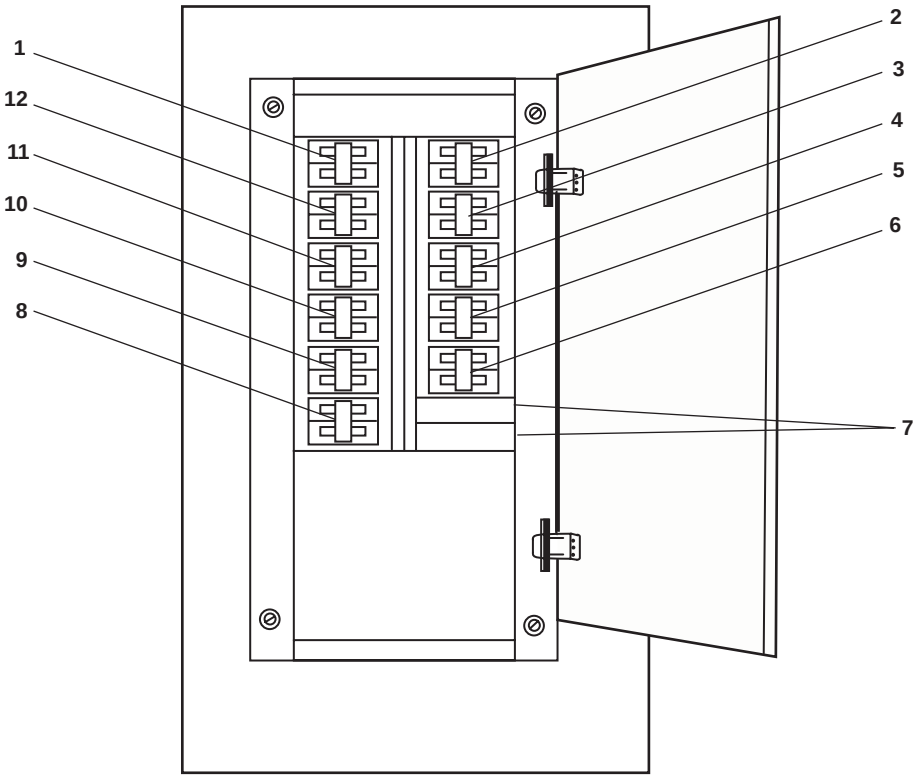


Figure 13. 120V Exterior Emergency Lighting Panel No. 2

Table 13. 120V Exterior Emergency Lighting Panel No. 2 (refer to figure 13)

Key	Control/Indicator	Function
1	INFL BOAT FLOODLIGHT. Circuit Breaker	This circuit breaker protects the inflatable boat floodlight.
2	01 LEVEL WEATHER DECK LIGHTS. Circuit Breaker	This circuit breaker protects the 01 level weather deck lights.
3	ROTARY CLEARVIEW WIPER AND HEATER. Circuit Breaker	This circuit breaker protects the clear view screens.
4	BOW FLOODLIGHTS. Circuit Breaker	This circuit breaker protects the bow floodlights.
5	LIFE RAFT FLOODLIGHT. (PORT). Circuit Breaker	This circuit breaker protects the port life raft floodlight.
6	SPARE. Circuit Breaker	This is a spare circuit breaker for future expansion.
7	BLANK.	There is no circuit breaker in this position.

Table 13. 120V Emergency Lighting Panel No. 2 (refer to figure 13) (continued)

Key	Control/Indicator	Function
8	LIFE RAFT FLOODLIGHT. (STARBOARD). Circuit Breaker	This circuit breaker protects the starboard life raft floodlight.
9	WINDSCREEN WIPERS. (STARBOARD & PORT FWD). Circuit Breaker	This circuit breaker protects the port and starboard forward windscreen wipers.
10	PILOTHOUSE WEATHER DECK LIGHTS. Circuit Breaker	This circuit breaker protects the pilothouse weather deck lights.
11	WINDSCREEN WIPERS. (PORT & STARBOARD FWD). Circuit Breaker	This circuit breaker protects the port and starboard forward windscreen wipers.
12	TOWING FLOODLIGHTS. Circuit Breaker	This circuit breaker protects the towing floodlights.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
01 LEVEL FAN ROOMS

01 LEVEL FAN ROOM, AFT

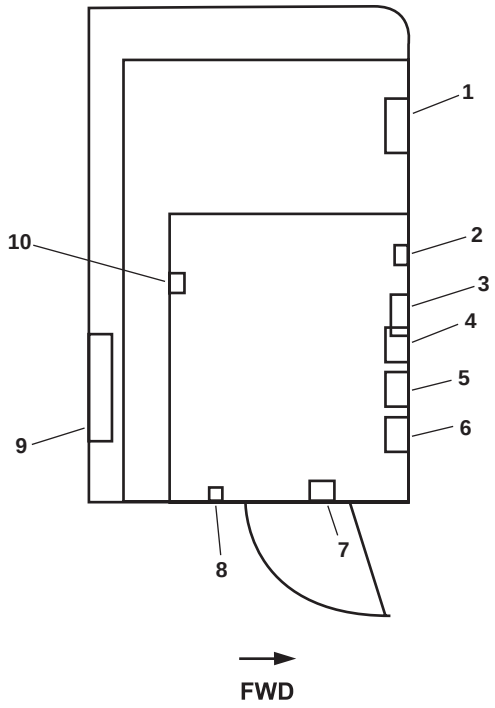


Figure 1. 01 Level Fan Room, Aft

Table 1. 01 Level Fan Room, Aft (refer to figure 1)

Key	Control/Indicator	Function
1	Power Supply	This unit supplies power to the communications gear in the pilothouse and radio room. See figure 3 for details.
2	60 Amp Disconnect	This switch turns the power supply ON and OFF. See figure 4 for details.
3	200 Amp Disconnect	This switch turns ON and OFF power from the batteries to the communication gear. See figure 4 for details.
4	HVAC SYSTEM CONTROLLER FOR RHTR 01-32-2	This controller turns ON and OFF reheater 01-32-2. See figure 5 for details.
5	HVAC SYSTEM CONTROLLER FOR RHTR 01-31-2	This controller turns ON and OFF reheater 01-31-2. See figure 5 for details.

Table 1. 01 Level Fan Room, Aft (refer to figure 1) (continued)

Key	Control/Indicator	Function
6	01 & 02 LEVEL FAN COIL UNIT Motor Controller	This controller turns ON and OFF the 01 and 02 level fan coil unit. See figure 6 for details.
7	Preheater Thermostat	The thermostat controls the output of the reheater.
8	Interior Lighting Switch	This switch turns the lighting in the space ON and OFF.
9	HVAC Manifold	The manifold controls the refrigerant flow for the fan coil unit. See figure 7 for details.
10	Preheater Thermostat	This thermostat controls the output of the reheater.

01 LEVEL FAN ROOM, FORWARD

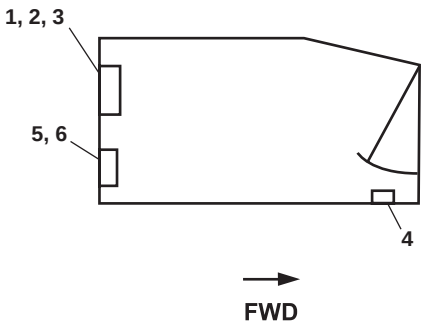


Figure 2. 01 Level Fan Room, Forward

Table 2. 01 Level Fan Room, Forward (refer to figure 2)

Key	Control/Indicator	Function
1	SANITARY SPACE EXHAUST FAN Motor Controller (above)	This controller turns the sanitary space exhaust fan ON and OFF. See figure 6 for details.
2	SHIP'S WHISTLE POWER SUPPLY (middle)	This unit powers the ship's whistle.
3	Power Supply	This power supply converts 120 Vac to 24 Vdc for use by the vessel's dc electrical equipment.
4	Interior Lighting Switch	This switch turns the lighting in the space ON and OFF.
5	PORT SEARCH LIGHT POWER SUPPLY (above)	This unit powers the port searchlight. See figure 8 for details.
6	STBD SEARCH LIGHT POWER SUPPLY (below)	This unit powers the starboard searchlight. See figure 8 for details.

NEWMAR POWER SUPPLY

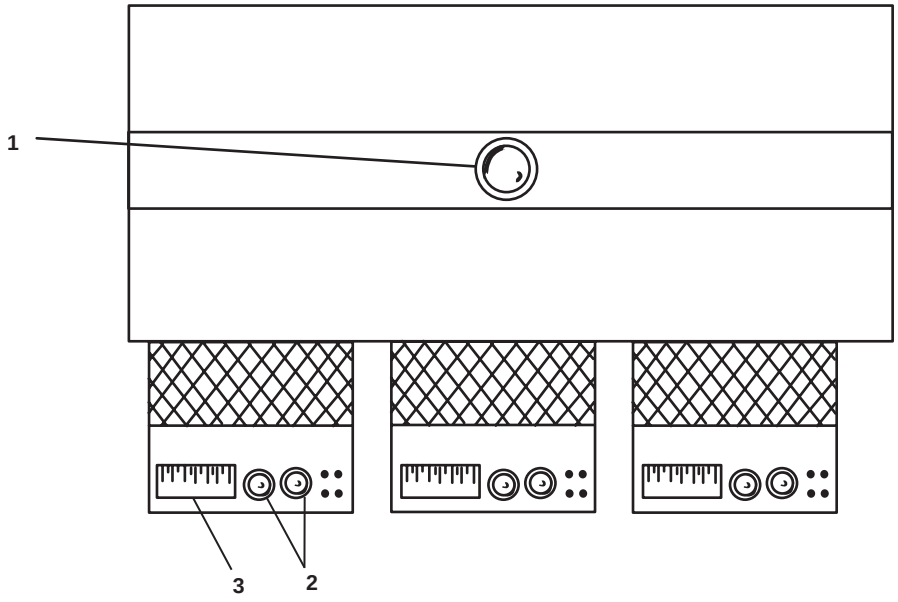


Figure 3. Newmar Power Supply

Table 3. Newmar Power Supply (refer to figure 3)

Key	Control/Indicator	Function
1	Master Voltage Adjuster	This knob turns to adjust the output voltage of the power supply.
2	DC/PWR Indicators	These lamps illuminate to indicate that DC power is being supplied.
3	Current Indicator	The indicator displays the level of current flowing out of the power supply.

60 AND 200 AMP POWER DISCONNECTS

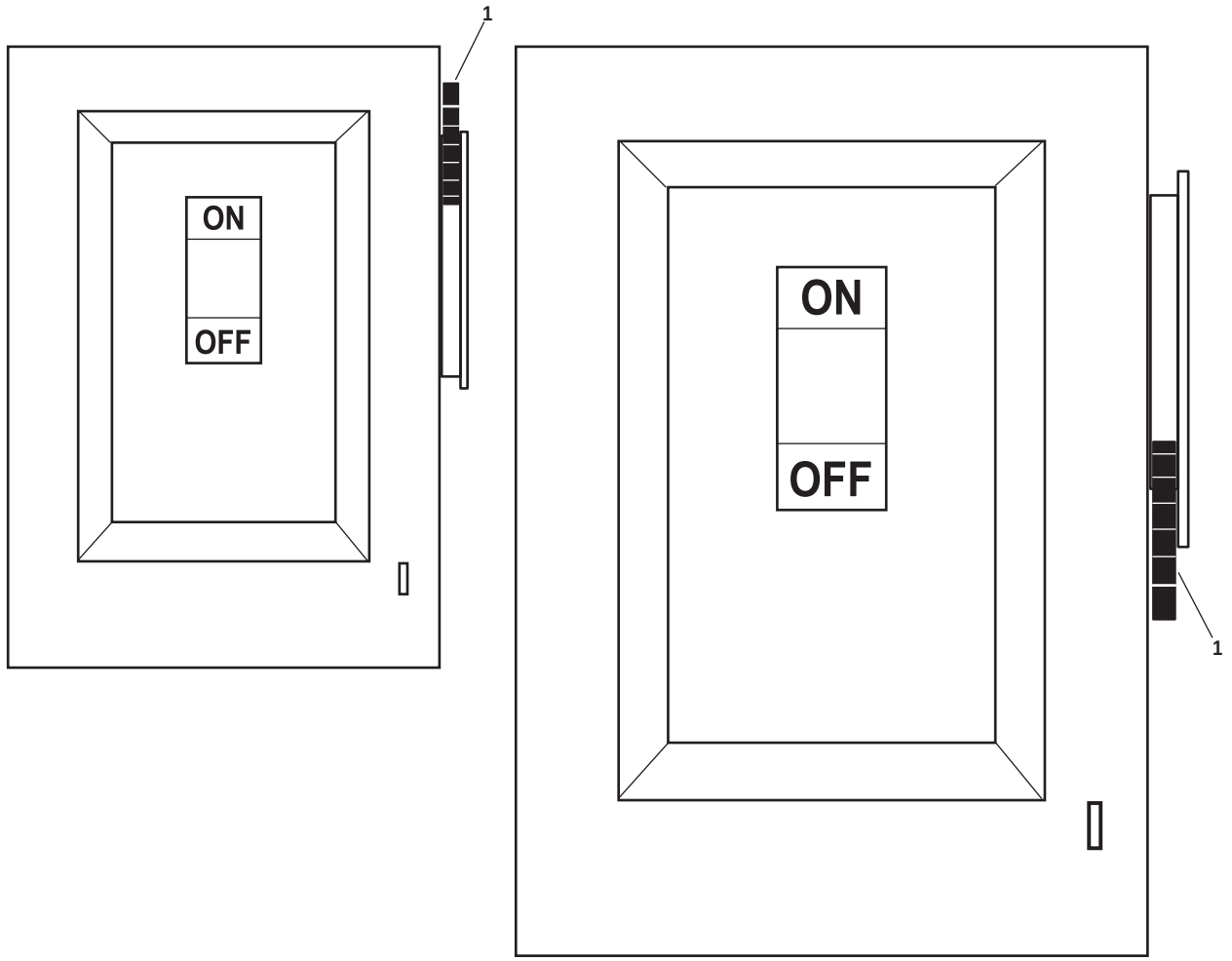


Figure 4. 60 and 200 Amp Power Disconnects

Table 4. 60 and 200 Amp Power Disconnects (refer to figure 4)

Key	Control/Indicator	Function
1	Handle	This handle turns the power disconnect ON and OFF

REHEATER MOTOR CONTROLLER

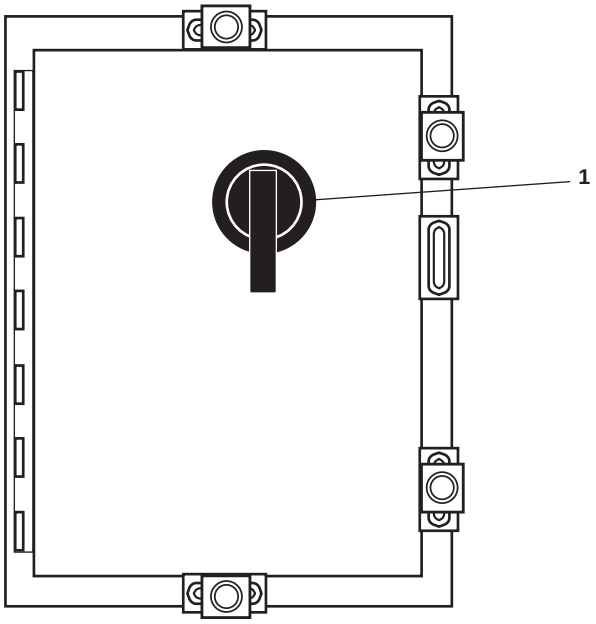


Figure 5. Reheater Motor Controller

Table 5. Reheater Motor Controller (refer to figure 5)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch turns the affected reheater ON or OFF.

FAN COIL UNIT AND SANITARY SPACE EXHAUST FAN MOTOR CONTROLLERS

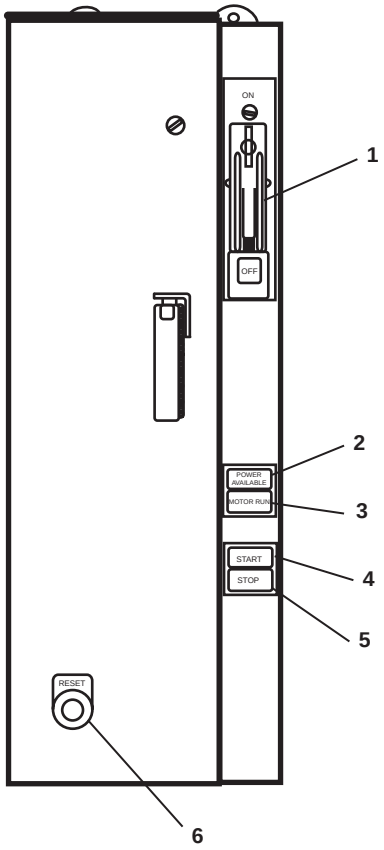


Figure 6. Fan Coil Unit and Sanitary Space Exhaust Fan Motor Controllers

Table 6. Fan Coil Unit and Sanitary Space Exhaust Fan Motor Controllers (refer to figure 6)

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch provides ON/OFF control with circuit breaker protection.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is supplied to the motor controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the motor is running.
4	START Pushbutton	When pressed, this pushbutton starts the affected fan.
5	STOP Pushbutton	When pressed, this pushbutton stops the affected fan.
6	RESET Pushbutton	This pushbutton is used to reset the motor controller.

HVAC MANIFOLD

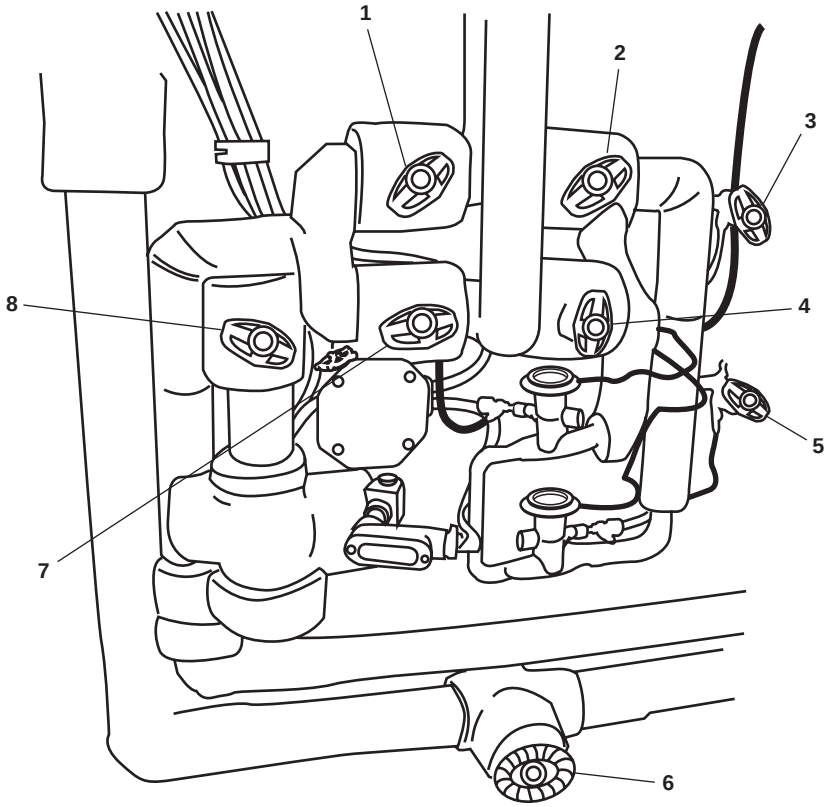


Figure 7. HVAC Manifold

Table 7. HVAC Manifold

Key	Control/Indicator	Function
1	RFAC-HXV Valve	This is the hand expansion valve for the fan coil unit.
2	RFAC-34, TXV, COV, RO1-32-2 Valve	This valve controls refrigerant flow to the condenser bypass.
3	RFAC-57, TXV, R01-32-2 Valve	This is the cutoff valve for the supply to the thermal expansion bulb.
4	RFAC-58, EQL LINE Valve	This valve controls refrigerant flow to the condenser bypass.
5	RFAC-31, EQL LINE Valve	This is the cutoff valve for the supply to the thermal expansion bulb.
6	RFAC-40, COIL SUCT COV, R01-32-2 Valve	This is the cutoff valve for the return line from the condensing unit.
7	RFAC-27 HAND EXP Valve	This is the hand expansion valve for the fan coil unit.
8	RFAC-35, TXV COV, R01-32-2 Valve	This is the cutoff valve for the refrigerant strainer.

SEARCHLIGHT POWER SUPPLY

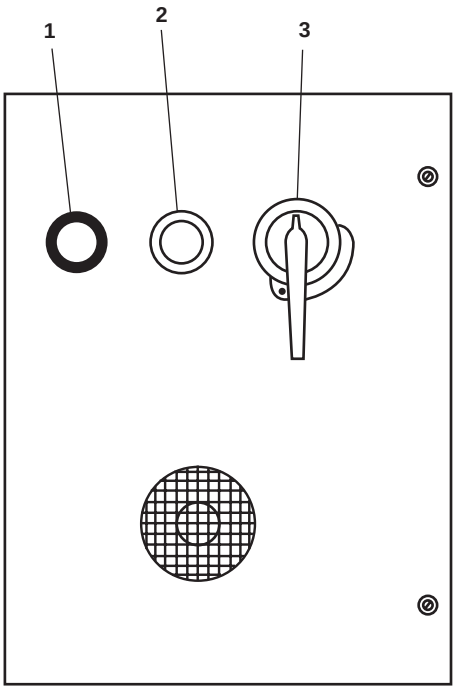


Figure 8. Searchlight Power Supply

Table 8. Searchlight Power Supply (refer to figure 8)

Key	Control/Indicator	Function
1	Voltmeter	This voltmeter indicates the voltage available to the searchlight.
2	Hourmeter	This hourmeter indicates the total hours of searchlight operation.
3	ON/OFF Circuit Breaker	This circuit breaker turns the power supply ON and OFF and provides circuit protection.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
02 LEVEL WEATHER DECKS

02 LEVEL WEATHER DECKS, GENERAL ARRANGEMENT

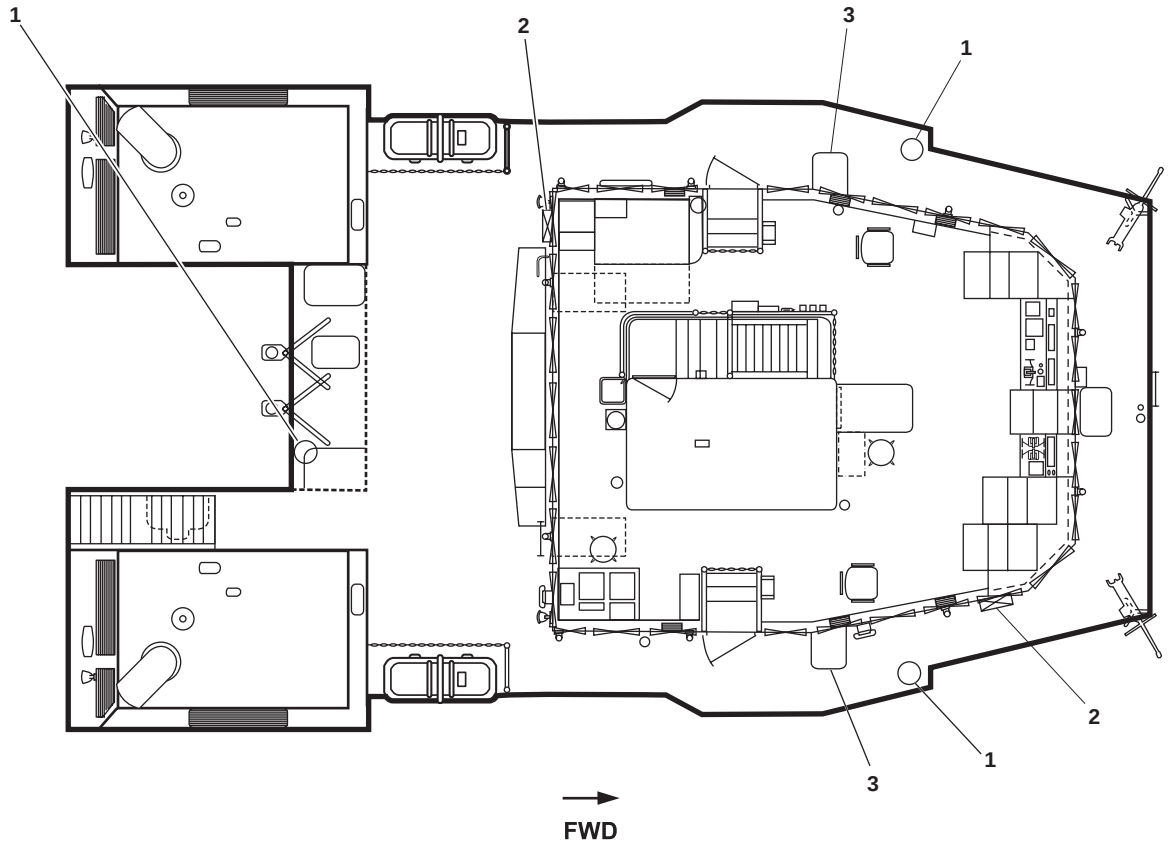


Figure 1. 02 Level Weather Decks, General Arrangement

Table 1. 02 Level Weather Decks, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Bearing Repeater	This repeater provides a remote readout of the vessel's bearing as indicated by the vessel's gyrocompass system. Refer to TM 55-5825-311-10 for details.
2	Fire Station	The fire station provides a hose, nozzle, and fire main valve for firefighting. See figure 4 for details.
3	Bridge Wing Control Station	This station provides control for steering, propulsion engines, and bow-thruster. See figure 2 for details.

BRIDGE WING CONTROL STATION

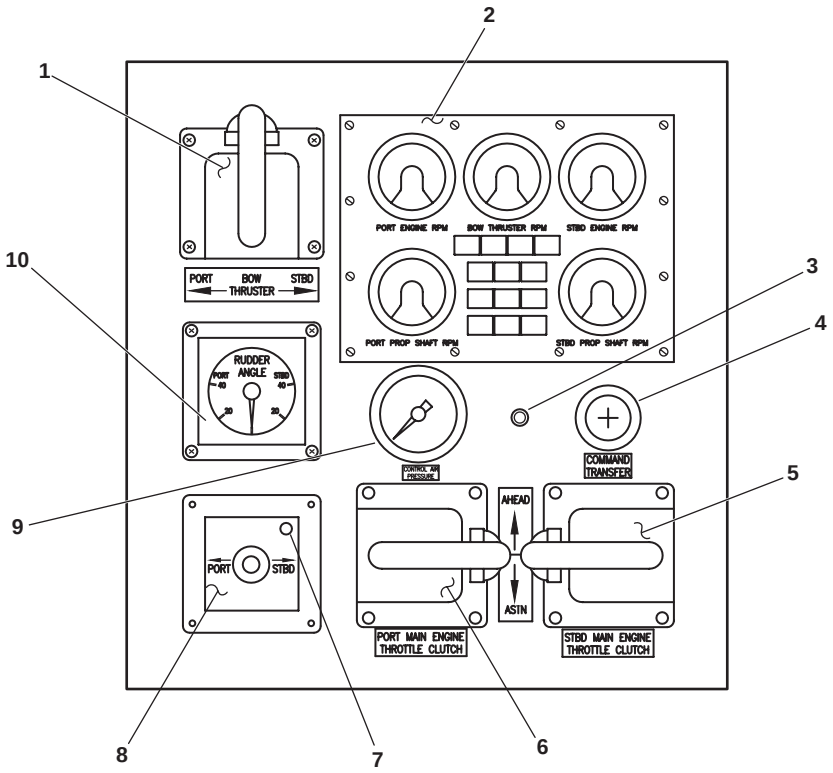


Figure 2. Bridge Wing Control Station

Table 2. Bridge Wing Control Station (refer to figure 2)

Key	Control/Indicator	Function
1	BOW THRUSTER Engine Throttle	This throttle determines the speed and direction of thrust for the bow thruster.
2	Remote Propulsion Indicator Panel	This panel contains various indicators for the vessel's propulsion systems. See figure 3 for details.
3	Heater ON Indicator	This lamp illuminates when the bridge wing internal heater is ON.
4	COMMAND TRANSFER Valve	Pull UP on this valve to transfer throttle command (control air) to this station.
5	STBD MAIN ENGINE THROTTLE CLUTCH	This throttle determines the speed of the starboard main engine and the direction of rotation for the starboard reduction gear.
6	PORT MAIN ENGINE THROTTLE CLUTCH	This throttle determines the speed of the port main engine and the direction of rotation for the port reduction gear.
7	In Command Indicator	This lamp illuminates to indicate that steering control is available at this station.
8	TILLER Control	This control allows the operator to control the vessel's rudders.
9	CONTROL AIR PRESSURE Gauge	This gauge displays the control air pressure available.
10	RUDDER ANGLE Indicator	This indicator displays the angle and direction of the vessel's rudders.

REMOTE PROPULSION INDICATOR PANEL

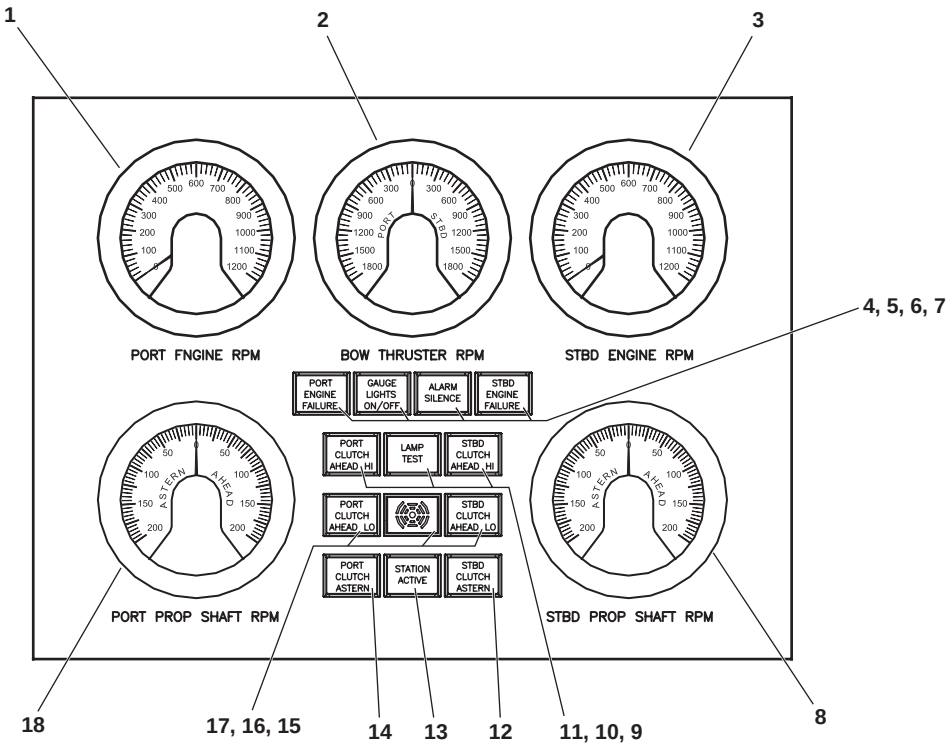


Figure 3. Remote Propulsion Indicator Panel

Table 3. Remote Propulsion Indicator Panel (refer to figure 3)

Key	Control/Indicator	Function
1	PORT ENGINE RPM Tachometer	This gauge displays the PORT main engine speed in r/min.
2	BOW THRUSTER RPM Tachometer	This gauge displays the bow thruster shaft speed in r/min.
3	STBD ENGINE RPM Tachometer	This gauge displays the STARBOARD main engine speed in r/min.
4	PORT ENGINE FAILURE	This red indicator illuminates when the PORT engine has failed.
5	GAUGE LIGHTS ON/OFF	PUSH this button to turn ON/OFF the gauge lights.
6	ALARM SILENCE	PUSH this pushbutton to silence the alarm.
7	STBD ENGINE FAILURE	This red indicator illuminates when the STARBOARD engine has failed.
8	STBD PROP SHAFT RPM Tachometer	This gauge displays the STARBOARD propeller shaft speed.

Table 3. Remote Propulsion Indicator Panel (refer to figure 3) (continued)

Key	Control/Indicator	Function
9	STBD CLUTCH AHEAD HI	This green indicator illuminates when the STARBOARD clutch is in the AHEAD HI position.
10	LAMP TEST	PUSH this pushbutton to test the operation of the indicator lights.
11	PORT CLUTCH AHEAD HI	This green indicator illuminates when the PORT clutch is in the AHEAD HI postion.
12	STBD CLUTCH ASTERN	This green indicator illuminates when the STARBOARD clutch is in the ASTERN position.
13	STATION ACTIVE	This green indicator illuminates when this control station is active.
14	PORT CLUTCH ASTERN	This green indicator illuminates when the PORT clutch is in the ASTERN position.
15	STBD CLUTCH AHEAD LO	This green indicator illuminates when the STARBOARD clutch is in the AHEAD LO position.
16	Alarm Annunciator	This alarm annunciator sounds to alert the operator of an engine failure.
17	PORT CLUTCH AHEAD LO	This green indicator illuminates when the PORT clutch is in the AHEAD LO position.
18	PORT PROP SHAFT RPM	This gauge displays the PORT propeller shaft speed.

FIRE STATION

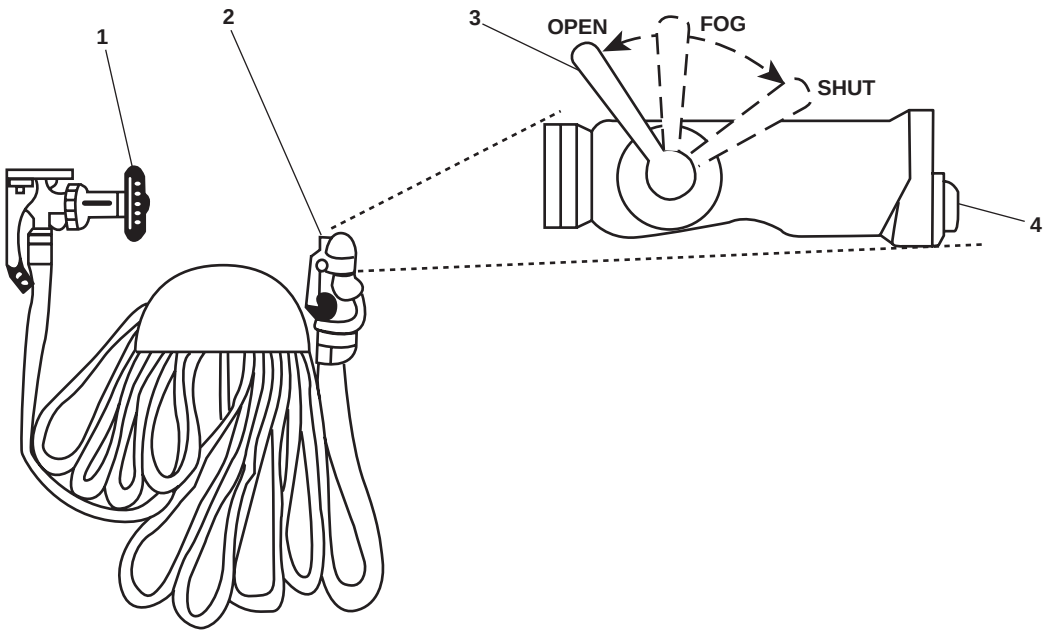


Figure 4. Fire Station

Table 4. Fire Station (refer to figure 4)

Key	Control/Indicator	Function
1	Valve	This valve turns the fire main ON and OFF.
2	Nozzle	This nozzle directs raw water by spray or stream at the fire.
3	Nozzle Valve	This valve controls the flow of raw water from the nozzle. When in the SHUT position, the flow of raw water is stopped. When in the FOG position, the raw water is directed to the fog jet. When in the OPEN position, raw water is directed to the single stream outlet.
4	Fog Outlet Plug	This plug provides an outlet for attaching 4-foot (1.2 m) and 12-foot (3.7 m) applicators.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
RADIO ROOM

RADIO ROOM, LOOKING TO PORT

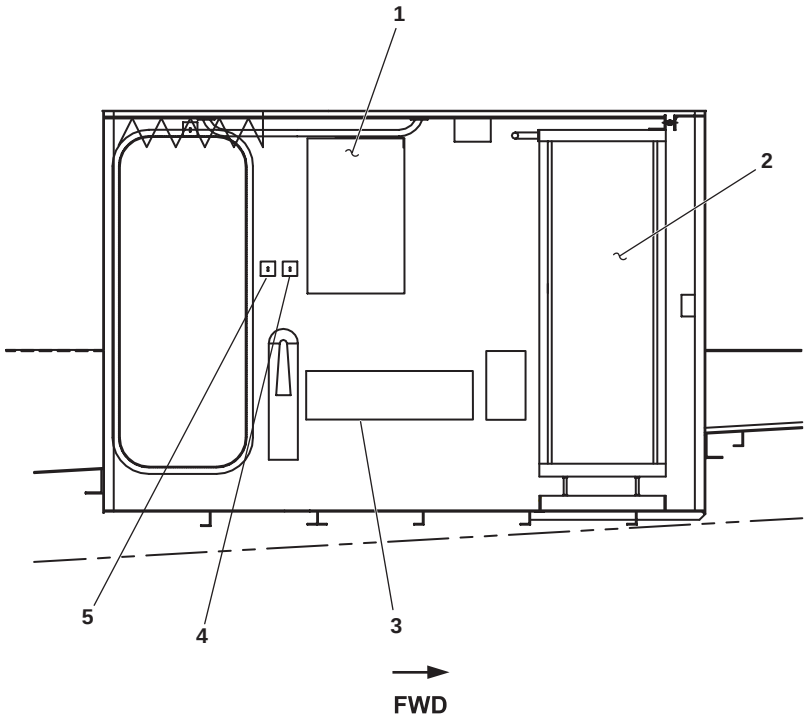


Figure 1. Radio Room, Looking to Port

Table 1. Radio Room, Looking to Port (refer to figure 1)

Key	Control/Indicator	Function
1	120V Elex Distribution Panel	This panel contains circuit breakers to control and protect various pieces of 120V electronic gear. Refer to figure 3 for details.
2	Radio Racks	Radio racks 1 (port), 2 (centerline), and 3 (starboard) contain many components of the vessel's communication suite. Refer to figures 4-6 for details.
3	General Alarm and Emergency Lighting Panel	This distribution panel contains circuit breakers to control and protect many 24 Vdc communication and lighting circuits.
4	Door Alarm Switch	This switch permits the operator to override the radio door alarm.
5	WHITE ON/WHITE OFF Switch	This switch turns the radio room white lights ON and OFF.

RADIO ROOM, LOOKING TO STARBOARD

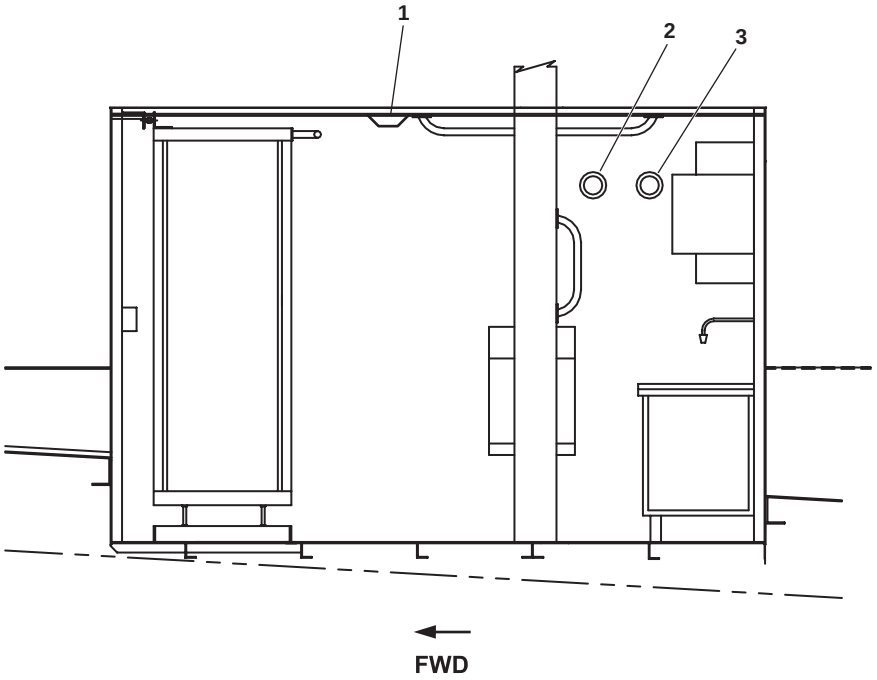


Figure 2. Radio Room, Looking to Starboard

Table 2. Radio Room, Looking to Starboard (refer to figure 2)

Key	Control/Indicator	Function
1	Ionization Smoke Detector	The ionization smoke detector signals the fire and smoke alarm system if smoke is present in the radio room.
2	GENERAL ALARM Strobe	This amber strobe light flashes whenever the general alarm system is actuated.
3	FIRE ALARM ZONE 1 Strobe	This red strobe light flashes whenever a fire condition is reported in zone 1 (02 level).

120V ELEX DISTRIBUTION PANEL

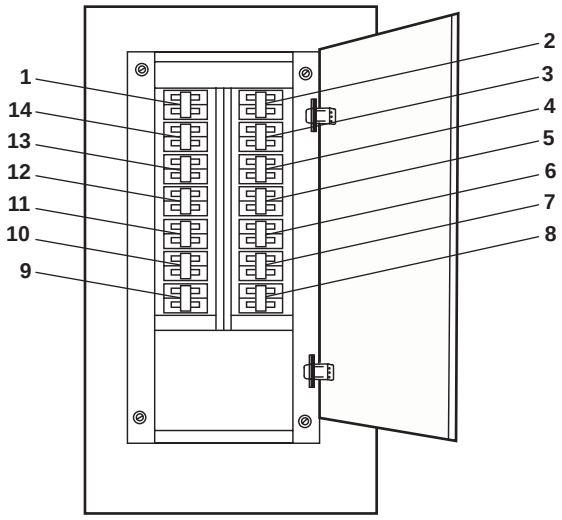


Figure 3. 120V Elex Distribution Panel

Table 3. 120V Elex Distribution Panel (refer to figure 3)

Key	Control/Indicator	Function
1	UPS FOR RADIO RACK. (RECEPTACLE - RACK 3). Circuit Breaker	This circuit breaker provides circuit protection for the radio rack Uninterrupted Power Supply (UPS).
2	UPS FOR BACK-UP ECDIS CONSOLE. Circuit Breaker	This circuit breaker provides circuit protection for the backup Electronic Chart Display and Information System (ECDIS) console.
3	RF5051 POWER SUPPLY. (RECEPTACLE - RACK 2). Circuit Breaker	This circuit breaker provides circuit protection for the radio rack RF5051 power supply.
4	P.A. SYSTEM. Circuit Breaker	This circuit breaker provides circuit protection for the public adress system.
5	GMDSS BATTERY CHARGER. Circuit Breaker	This circuit breaker provides circuit protection for the Global Maritime Distress and Safety System (GMDSS) battery charger.
6	SPARE. Circuit Breaker	The circuit breaker is provided for system expansion.
7	SPARE. Circuit Breaker	The circuit breaker is provided for system expansion.
8	SPARE. Circuit Breaker	The circuit breaker is provided for system expansion.
9	FOG HORN. Circuit Breaker	This circuit breaker provides circuit protection for the automatic fog horn.
10	SPARE. Circuit Breaker	The circuit breaker is provided for system expansion.
11	SPARE. Circuit Breaker	The circuit breaker is provided for system expansion.

Table 3. 120V Elex Distribution Panel (refer to figure 3) (continued)

Key	Control/Indicator	Function
12	15" TFT MONITOR. Circuit Breaker	This circuit breaker provides circuit protection for the 15" Thin Film Transistor (TFT) monitor.
13	RF5051 POWER SUPPLY. (RECEPTACLE - RACK 2). Circuit Breaker	This circuit breaker provides circuit protection for the radio rack RF5051 power supply.
14	UPS FOR MAIN ECDIS CONSOLE. Circuit Breaker	This circuit breaker provides circuit protection for the main ECDIS console.

RADIO RACK 1 (PORT)

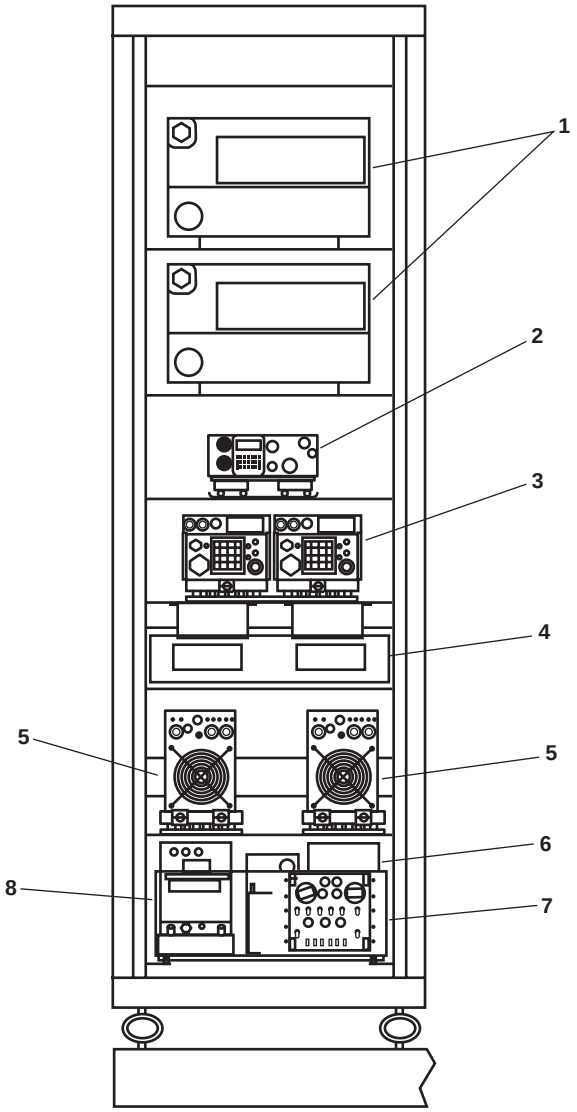


Figure 4. Radio Rack 1 (Port)

Table 4. Radio Rack 1 (Port) (refer to figure 4)

Key	Control/Indicator	Function
1	AN/VRC 103(V)1 Transceiver	This radio provides communication capability in the 30 to 512 MHz range. Refer to TM 55-5825-311-10 for details.
2	AN/PRC-150(C) Manpack Radio	This radio provides communication capability in the 1.6 to 60 MHz range. Refer to TM 55-5825-311-10 for details.
3	LST-5D Transceiver	This radio provides UHF (Ultra High Frequency) DAMA (Demand Assigned Multiple Access) SATCOM (Satellite Communication) communication capability for the vessel. Refer to TM 55-5825-311-10 for details.
4	VDC-300 Airborne Data Control Unit	This unit provides data communication capability for the vessel. Refer to TM 55-5825-311-10 for details.

Table 4. Radio Rack 1 (Port) (refer to figure 4) (continued)

Key	Control/Indicator	Function
5	AM-7175D Power Amplifier	This power amplifier supports the LST-5D transceiver. Refer to TM 55-5825-311-10 for details.
6	IFF KIT-1C Computer	This computer supports the IFF transceiver. Refer to TM 55-5825-311-10 for details.
7	C-6280A(P)/APX IFF Control Responder	This unit works in conjuction with the IFF transceiver. Refer to TM 55-5825-311-10 for details.
8	IFF RT859A/APX-72	This IFF transceiver broadcasts and receives IFF (Identify Friend/Foe) signals. Refer to TM 55-5825-311-10 for details.

RADIO RACK 2 (CENTERLINE)

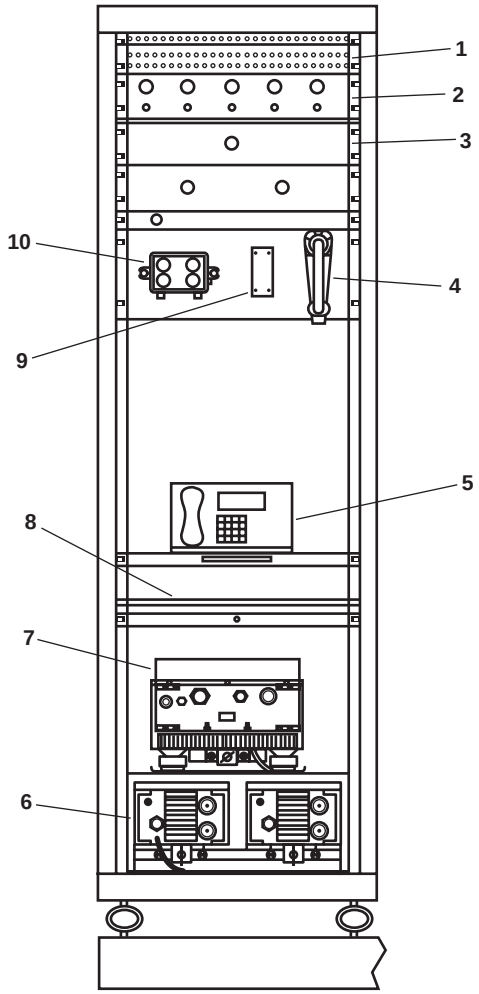


Figure 5. Radio Rack 2 (Centerline)

Table 5. Radio Rack 2 (Centerline) (refer to figure 5)

Key	Control/Indicator	Function
1	DC Distribution Panel	This distribution panel contains circuit breakers for the 24 Vdc communication equipment in the radio racks.
2	Voice Data Switch Unit	This unit enables voice data switching. Refer to TM 55-5825-311-10 for details.
3	Manual Switch Box	This box permits manual switching of communication gear. Refer to TM 55-5825-311-10 for details.
4	Handset	The handset permits semi-private communication. Refer to TM 55-5825-311-10 for details.
5	STU-III Phone	This Secure Telephone Unit (STU) permits secure telephone conversations. Refer to TM 55-5825-311-10 for details.

Table 5. Radio Rack 2 (Centerline) (refer to figure 5) (continued)

Key	Control/Indicator	Function
6	RF-5054-400 Power Supply	This power supply provides power for the AM-7175D Power Amplifier. Refer to TM 55-5825-311-10 for details.
7	AM-7175D Power Amplifier	This amplifier supports the LST-5D transceiver. Refer to TM 55-5825-311-10 for details.
8	Rack Mounted Computer	This computer interfaces with the communication gear. Refer to TM 55-5825-311-10 for details.
9	PTSH-104 Loud Speaker	This loud speaker broadcasts radio output when the handset is not in use. Refer to TM 55-5825-311-10 for details.
10	C12357/VRC Control Intercom Set	This set controls output to the VICS station in the pilothouse. Refer to TM 55-5825-311-10 for details.

RADIO RACK 3 (STARBOARD)

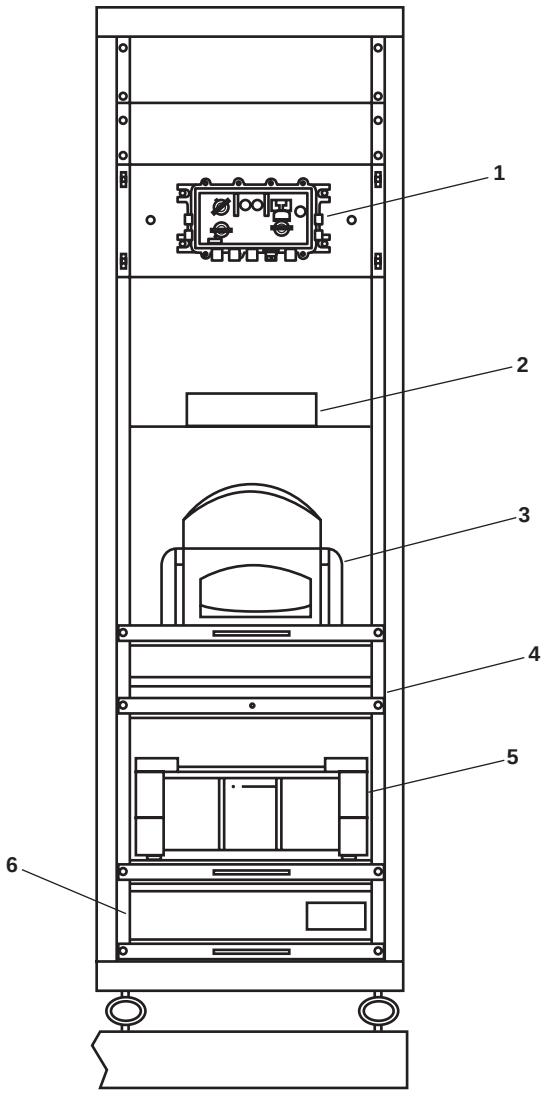


Figure 6. Radio Rack 3 (Starboard)

Table 6. Radio Rack 3 (Starboard) (refer to figure 6)

Key	Control/Indicator	Function
1	CD-82/VRC Master Control Unit	This unit controls tactical communication. Refer to TM 55-5825-311-10 for details.
2	RF Transceiver	This transceiver supports the Fleet 77 communication system.
3	Printer/Fax	The printer/fax permits the vessel to send fax transmissions and to print output from the rack mounted computers. Refer to TM 55-5825-311-10 for details.
4	Rack Mounted Computer	This computer interfaces with the communication gear. Refer to TM 55-5825-311-10 for details.

Table 6. Radio Rack 3 (Starboard) (refer to figure 6) (continued)

Key	Control/Indicator	Function
5	TS-21 Fax	This unit provides secure fax transmission capability. Refer to TM 55-5825-311-10 for details.
6	UPS	The UPS provides an uninterrupted power supply for various radio rack components. Refer to TM 55-5825-311-10 for details.

GENERAL ALARM AND EMERGENCY LIGHTING PANEL

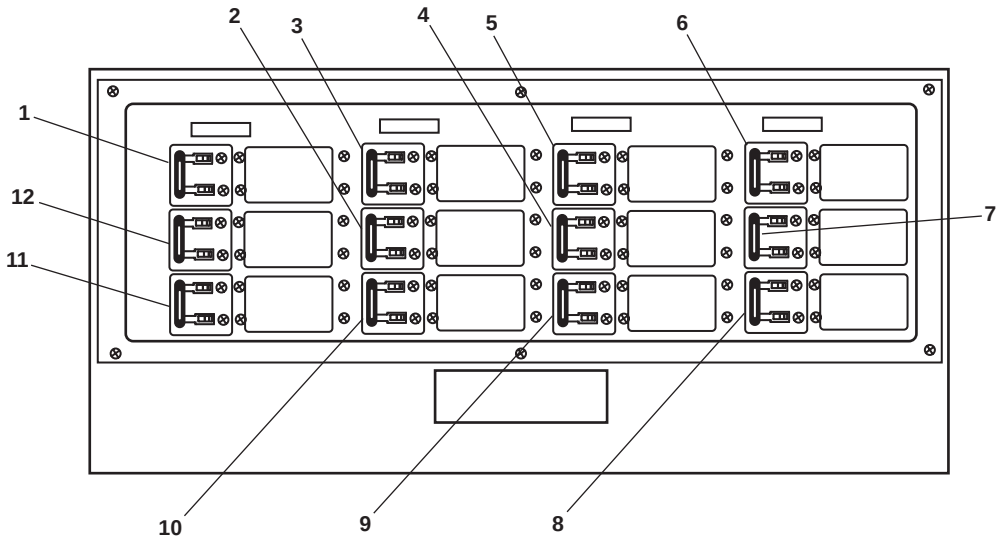


Figure 7. General Alarm and Emergency Lighting Panel

Table 7. General Alarm and Emergency Lighting Panel (refer to figure 7)

Key	Control/Indicator	Function
1	STALK LIGHTS Circuit Breaker	This circuit breaker provides circuit protection for the detachable pilothouse console and radio room work lights.
2	BINNACLE LIGHT Circuit Breaker	This circuit breaker provides circuit protection for the binnacle light.
3	GENERAL ALARM Circuit Breaker	This circuit breaker provides circuit protection for the general alarm.
4	WINDSCREEN WASH VALVE Circuit Breaker	This circuit breaker provides circuit protection for the windshield washer valve.
5	GYRO COMPASS Circuit Breaker	This circuit breaker provides circuit protection for the gyrocompass.
6	BOWTHRUSTER CONTROL Circuit Breaker	This circuit breaker provides circuit protection for the pilothouse console bow thruster control.

Table 7. General Alarm and Emergency Lighting Panel (refer to figure 7) (continued)

Key	Control/Indicator	Function
7	SPEED LOG DISTRIBUTION Circuit Breaker	This circuit breaker provides circuit protection for the speed log distribution center.
8	SPARE Circuit Breaker	This spare circuit breaker provides room for system expansion.
9	PILOTHOUSE CONSOLE ILLUMINATION Circuit Breaker	This circuit breaker provides circuit protection for the pilothouse console illumination (gauge) lights.
10	PILOT HOUSE ALARM PNL Circuit Breaker	This circuit breaker provides circuit protection for the pilothouse alarm panel.
11	RUDDER ANGLE IND Circuit Breaker	This circuit breaker provides circuit protection for the rudder angle indicator.
12	SPEED LOG DISPLAY Circuit Breaker	This circuit breaker provides circuit protection for the speed log display.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
PILOTHOUSE

PILOTHOUSE, GENERAL ARRANGEMENT

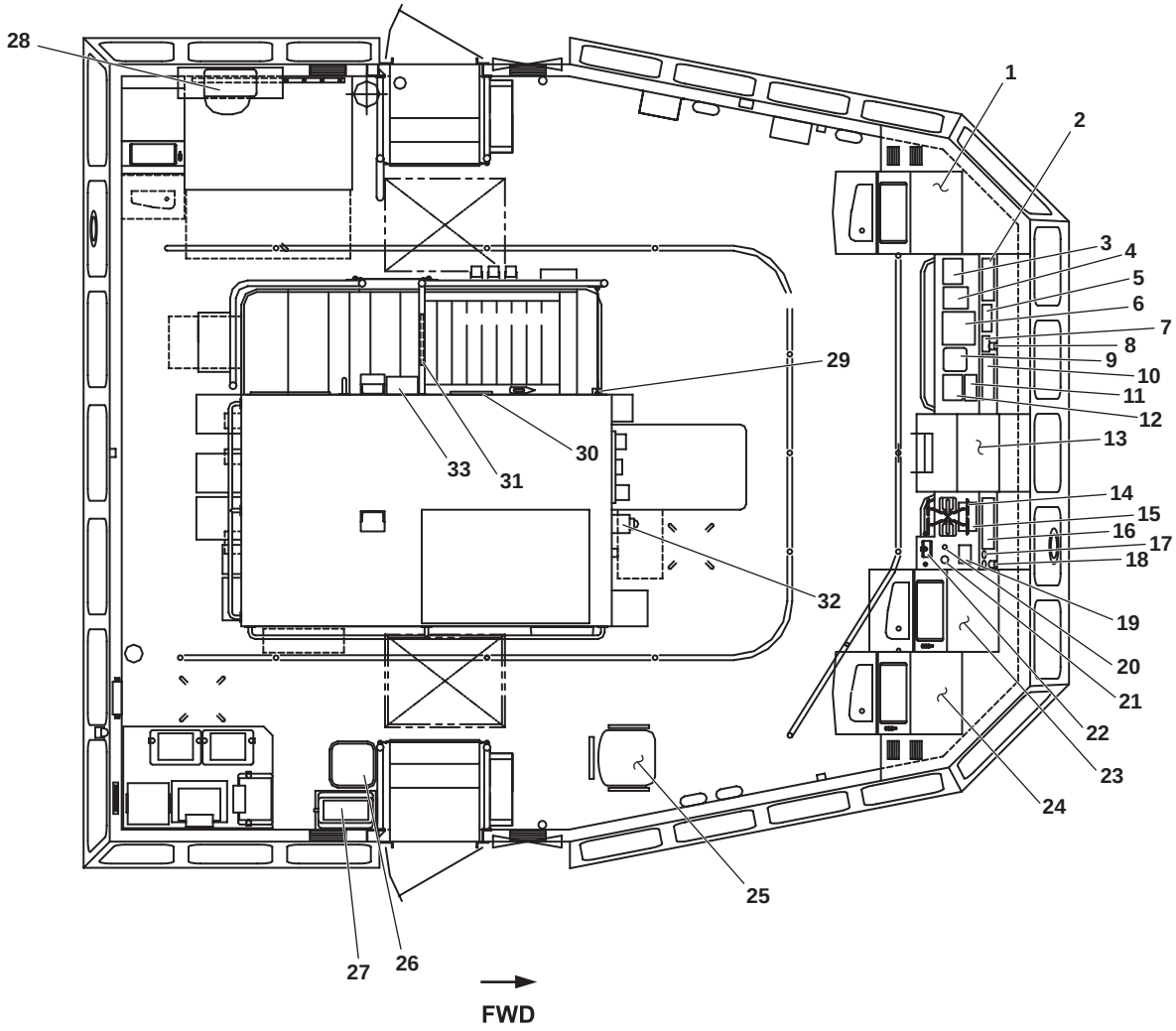


Figure 1. Pilothouse, General Arrangement

Table 1. Pilothouse, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	X Band Raypath Display	This console contains the operator controls and display for the X band radar. Refer to TM 55-5825-311-10 for details.
2	Pilothouse Port Heating, Ventilation, and Air Conditioning (HVAC) Panel	This panel contains controls for the port pilothouse rooftop air conditioning unit and for the pilothouse fresh air fans. See figure 14 for details.
3	Port Searchlight Control Station	This station provides controls for the port searchlight. See figure 8 for details.

Table 1. Pilothouse, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
4	Fire Pump START/STOP Panel	This panel permits pilothouse personnel to START and STOP the fire and general service pumps. See figure 9 for details.
5	Pilothouse Alarm Panel	This panel provides alarms for flooding and critical battery chargers. See figure 10 for details.
6	21 MC Intercom	This system provides communication throughout the vessel. See figure 11 for details.
7	Rudder Angle Indicator	The rudder angle indicator displays rudder angle and direction.
8	Engine Order Telegraph (EOT) Power Failure Panel	This panel warns the operator of an EOT power failure.
9	Panel Mounted Adjustable Lamp	This lamp provides illumination for the port console area. See figure 12 for details.
10	EOT Transceiver	This unit transmits and receives engine order commands between the pilothouse and EOS.
11	Deck/Console Lighting Panel	This panel provides control for various deck and console lights. See figure 13 for details.
12	Starboard Searchlight Control Station	This station provides controls for the starboard searchlight. See figure 8 for details.
13	Compilot 20 Steering Stand	This station provides helm controls for the vessel. Refer to TM 55-5825-311-10 for details.
14	Port and Starboard Main Engine Throttles	These throttles control main engine speed and direction of rotation for the reduction gears.
15	Pilothouse Starboard HVAC Panel	This panel provides thermostatic control for the starboard pilothouse rooftop air conditioning unit. See figure 14 for details.
16	Remote Propulsion Indicator Panel	This panel provides indicators for the vessel's propulsion systems. See figure 15 for details.
17	Main Engine Shutdowns	These controls permit the main engines to be shut down from the pilothouse.
18	Panel Mounted Adjustable Lamp	This lamp provides illumination for the starboard console area. See figure 12 for details.
19	Bow Thruster START/STOP Panel	This panel permits the operator to START and STOP the bow thruster engine from the pilothouse.
20	Station Control Transfer Switch	Pull UP on this valve to transfer throttle command (control air) to this station.
21	Control Air Pressure Gauge	This gauge displays the control air pressure available at the pilothouse helm.

Table 1. Pilothouse, General Arrangement (refer to figure 1) (continued)

Key	Control/Indicator	Function
22	Bow Thruster Control	This electronic control permits the operator to control bow thruster speed and direction of thrust.
23	Electronic Chart Display and Information System (ECDIS) Display	This console permits operator interface with the ECDIS. Refer to TM 55-5825-311-10 for details.
24	S Band Raypath Display	This console contains the operator controls and display for the S band radar. Refer to TM 55-5825-311-10 for details.
25	Navigator's Seat	This seat is provided for the navigator. See figure 16 for details.
26	Water Cooler	The water cooler provides cold potable water for personal consumption. See figure 17 for details.
27	Coffee Maker	This unit brews coffee for pilothouse personnel. See figure 18 for details.
28	Electronic Chart Display and Information System (ECDIS) Display	This console permits operator interface with the ECDIS. Refer to TM 55-5825-311-10 for details.
29	Pilothouse Light Switch	This switch turns the pilothouse lights ON and OFF.
30	Ship Clinometer, Trim	This instrument indicates the trim angle of the vessel. See figure 19 for details.
31	Ship Clinometer, Heel	This instrument indicates the heel angle of the vessel. See figure 20 for details.
32	Sound Powered Telephone	The sound powered telephone provides communication to other sound powered telephone stations throughout the vessel. See figure 21 for details.
33	Navigation Lighting Panel	This panel contains switches and fuses for the vessel's navigation lights. See figure 22 for details.

PILOTHOUSE, LOOKING TO PORT

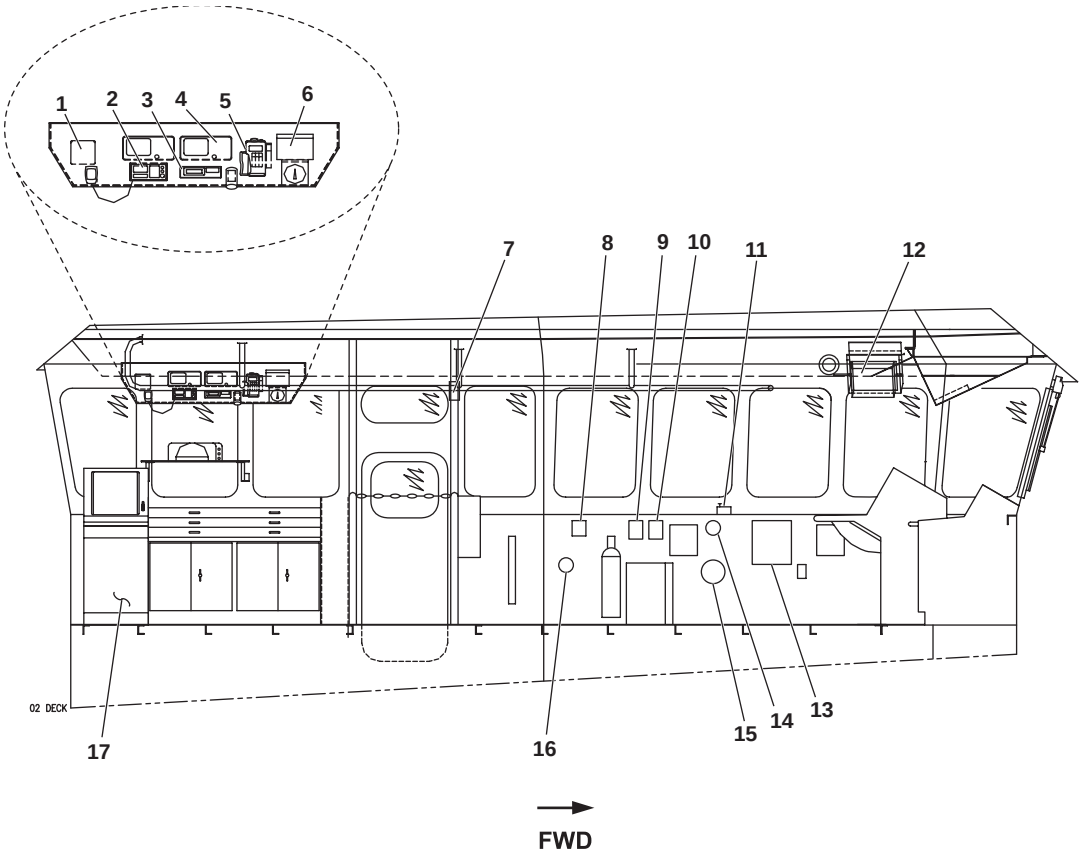


Figure 2. Pilothouse, Looking to Port

Table 2. Pilothouse, Looking to Port (refer to figure 2)

Key	Control/Indicator	Function
1	Speaker	This speaker is connected to the marine Very High Frequency (VHF) radio.
2	Marine VHF (Very High Frequency) Radio	This radio provides ship-to-ship and ship-to-shore Line Of Sight (LOS) communication for the vessel. Refer to TM 55-5825-311-10 for details.
3	Wind Tracker Translator Box	This unit displays information from the wind tracker system. Refer to TM 55-5825-311-10 for details.
4	Leica Global Positioning System (GPS) Units	These units provide GPS input for navigation and trip planning. Refer to TM 55-5825-311-10 for details.
5	Precision Lightweight GPS Receiver (PLGR)	This unit provides GPS input for navigation and trip planning. Refer to TM 55-5825-311-10 for details.
6	AN/PSN-11 Wind Tracker	This unit displays information from the wind tracker system. Refer to TM 55-5825-311-10 for details.
7	Fire Alarm Pull Station	Pull DOWN on this box to actuate the fire alarm.

Table 2. Pilothouse, Looking to Port (refer to figure 2) (continued)

Key	Control/Indicator	Function
8	Fire Detection Remote Indicator Panel	This panel contains indicators that illuminate when a fire condition is detected on the vessel. See figure 23 for details.
9	HVAC SYS EMER. STOP RECIRC SYS Switch	This switch provides emergency shutdown for the HVAC systems.
10	HVAC SYS EMER STOP SAN SPC EXH FAN Switch	This switch provides emergency shutdown for the sanitary space exhaust fan.
11	Blinker Light Key	This key controls the yardarm blinker light. See figure 24 for details.
12	IBS Distribution Panel to Upper Console	This panel contains circuit breakers to protect many Integrated Bridge System (IBS) components. Refer to TM 55-5825-311-10 for details.
13	Door Alarm Switchboard	The door alarm switchboard provides controls and indicators for the door alarm system. See figure 25 for details.
14	General Alarm Contact Maker	This switch controls the general alarm system.
15	General Alarm Bell	When the general alarm system is activated, this bell rings.
16	Fire Detector Alarm Bell	When the fire and smoke alarm system senses a fire condition, this bell rings.
17	Electronic Chart Display and Information System (ECDIS) Display	This console permits operator interface with the ECDIS. Refer to TM 55-5825-311-10 for details.

PILOTHOUSE, LOOKING TO STARBOARD

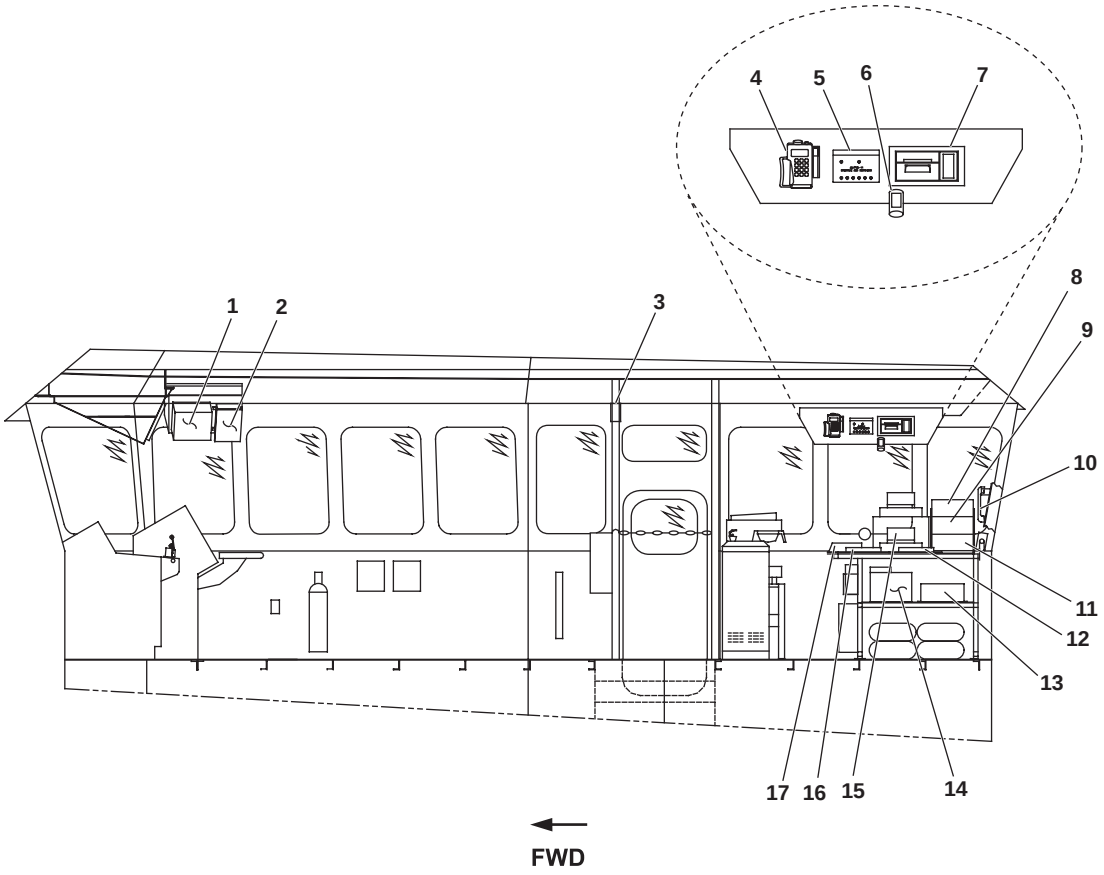


Figure 3. Pilothouse, Looking to Starboard

Table 3. Pilothouse, Looking to Starboard (refer to figure 3)

Key	Control/Indicator	Function
1	Towing Strain Gauge	This panel indicates to strain on the towing machines. See figure 26 for details.
2	Fog Horn Timer	This unit controls the vessel's automatic fog horn. See figure 26 for details.
3	Fire Alarm Manual Pull Box	Pull DOWN on this box to actuate the fire alarm.
4	PLGR	This unit provides GPS input for navigation and trip planning. Refer to TM 55-5825-311-10 for details.
5	AN/PSN-11 Switchbox	This switchbox permits interface between navigation and communication components. Refer to TM 55-5825-311-10 for details.
6	Panel Mounted Adjustable Lamp	This lamp provides illumination for the Global Maritime Distress and Safety System (GMDSS) suite area. See figure 13 for details.
7	Navtex Receiver	This unit receives and prints weather and navigation updates. Refer to TM 55-5830-283-10 for details.

Table 3. Pilothouse, Looking to Starboard (refer to figure 3) (continued)

Key	Control/Indicator	Function
8	SEAWATCH MF/HF (Medium Frequency/High Frequency) DSC (Digital Selective Calling) Watch Receiver	This unit scans for distress signals. Refer to TM 55-5830-283-10 for details.
9	SEASAT 2 INMARSAT-C	This unit provides satellite communication capability. Refer to TM 55-5830-283-10 for details.
10	SEA 330 MF/HF Radio/Telephone	This unit provides long-range communication capability for the vessel. Refer to TM 55-5830-283-10 for details.
11	SEACALL 7000 MF/HF DSC Controller	This unit is coupled with the SEA 330 MF/HF Radio/Telephone. Refer to TM 55-5830-283-10 for details.
12	INMARSAT GMDSS Laptop	This laptop computer interfaces with the INMARSAT satellite communication system. Refer to TM 55-5830-283-10 for details.
13	GMDSS MF/HF 120-24V Power Supply	This unit converts 120 Vac to 24 Vdc for the GMDSS suite. Refer to TM 55-5830-283-10 for details.
14	GMDSS MF/HF TRANSCEIVER	This unit receives and transmits MF/HF radio signals for the GMDSS suite. Refer to TM 55-5830-283-10 for details.
15	GMDSS HF DSC Printer	This printer prints output from the GMDSS suite. Refer to TM 55-5830-283-10 for details.
16	GMDSS SEATOR Data Terminal	This unit receives and transmits fax data for the GMDSS. Refer to TM 55-5830-283-10 for details.
17	GMDSS SEATOR Serial Printer	This printer prints output from the SEATOR data terminal. Refer to TM 55-5830-283-10 for details.

PILOTHOUSE, FRAME 38, LOOKING FORWARD

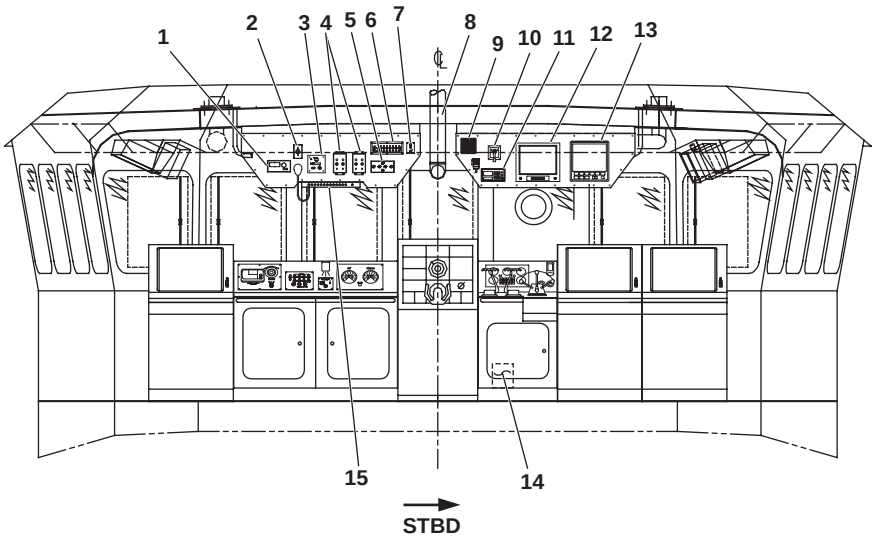


Figure 4. Pilothouse, Frame 38, Looking Forward

Table 4. Pilothouse, Frame 38, Looking Forward (refer to figure 4)

Key	Control/Indicator	Function
1	Digital Repeater Compass	This unit displays output from the gyrocompass. Refer to TM 55-5825-311-10 for details.
2	RED to WHITE Switch for Pilothouse Lights	This switch permits the operator to select between RED and WHITE lighting for the pilothouse.
3	Speed Log	This unit displays output from the speed log. Refer to TM 55-5825-311-10 for details.
4	Clearview Screen Controls	These panels provide control for the pilothouse clearview screens. See figure 27 for details.
5	WINDSCREEN WIPER PNL	This panel contains controls for the pilothouse windshield wipers. See figure 28 for details.
6	SCREEN ELEMENTS PNL	This panel contains controls for the pilothouse heated windows. See figure 29 for details.
7	Binnacle Light Panel	This panel contains controls for the binnacle light. See figure 30 for details.
8	Mirror Projection Binnacle	This display permits the helmsman to view the magnetic compass binnacle.
9	Marine VHF Radio Speaker	This speaker broadcasts output from the marine VHF radio.
10	At Will and Automatic Fog Whistle Controller	This panel permits the operator to control the automatic fog horn. See figure 31 for details.

Table 4. Pilothouse, Frame 38, Looking Forward (refer to figure 4) (continued)

Key	Control/Indicator	Function
11	Marine VHF Radio	This radio provides ship-to-ship and ship-to-shore Line Of Sight (LOS) communication for the vessel. Refer to TM 55-5825-311-10 for details.
12	Nauto Conning Screen	This screen displays output from the nauto conning system. Refer to TM 55-5825-311-10 for details.
13	Echo Sounder Display	This screen displays output from the echo sounder. Refer to TM 55-5825-311-10 for details.
14	Bow Thruster Control Unit	This unit receives input from the bow thruster control on the console and transmits those controls to the bow thruster. An ON/OFF toggle switch is located on the side of the unit to power the unit ON and OFF.
15	Public Address (PA) Console	This console provides controls for the PA system. See figure 32 for details.

PILOTHOUSE, FRAME 39, LOOKING FORWARD

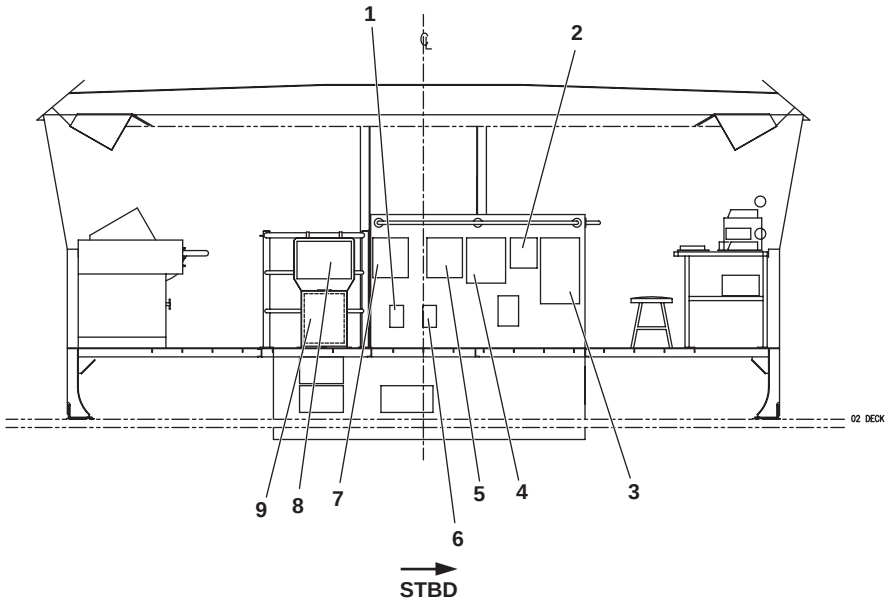


Figure 5. Pilothouse, Frame 39, Looking Forward

Table 5. Pilothouse, Frame 39, Looking Forward (refer to figure 5)

Key	Control/Indicator	Function
1	12V DISCONNECT S/W	This switch disconnects the power supply to the 12 Vdc battery charger.
2	UPS Bypass and Disconnect Switch Box	This panel provides controls for the UPSs. See figure 33 for details.
3	120V Radar Power Distribution Panel	This distribution panel contains circuit breakers to protect the radar units. See figure 34 for details.
4	EMER BATT CHARGER	This battery charger maintains the charge for the general alarm battery bank. See figure 35 for details.

Table 5. Pilothouse, Frame 39, Looking Forward (refer to figure 5) (continued)

Key	Control/Indicator	Function
5	GMDSS BATT CHARGER	This battery charger maintains the charge for the GMDSS battery bank. See figure 36 for details.
6	GMDSS Switch	This switch disconnects the power supply to the GMDSS battery charger.
7	12V BATT CHARGER	This battery charger maintains the charge for the 12 Vdc battery bank. See figure 37 for details.
8	Gyrocompass Control Unit	This unit controls the gyrocompass. Refer to TM 55-5825-311-10 for details.
9	Gyrocompass	This instrument provides precise directional information. Refer to TM 55-5825-311-10 for details.

PILOTHOUSE, FRAME 48, LOOKING AFT

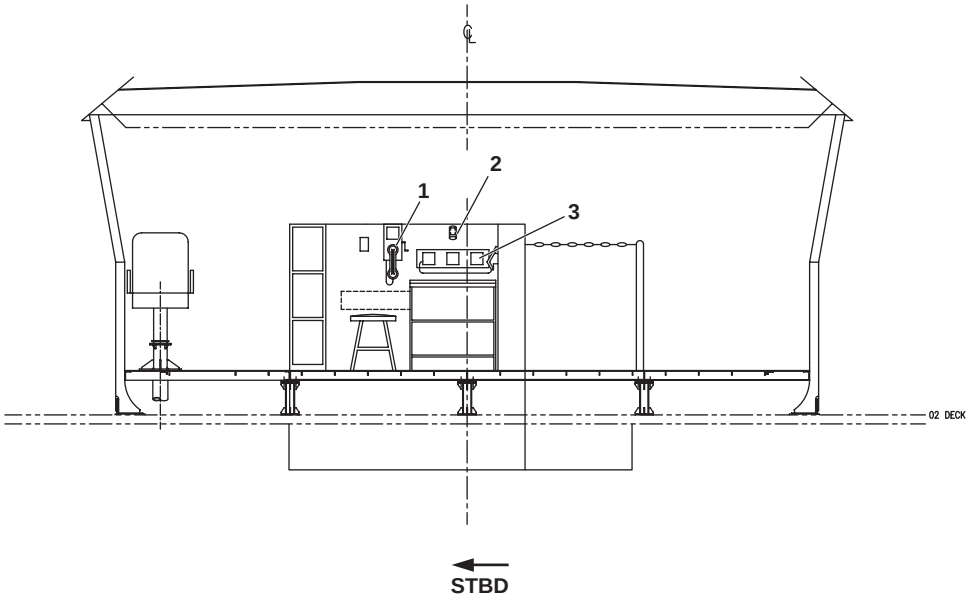


Figure 6. Pilothouse, Frame 48, Looking Aft

Table 6. Pilothouse, Frame 48, Looking Aft (refer to figure 6)

Key	Control/Indicator	Function
1	Sound Powered Telephone	The sound powered telephone provides communication to other sound powered telephone stations throughout the vessel. See figure 21 for details.
2	Bulkhead Mounted Adjustable Lamp	This lamp provides illumination for the log table work area. See figure 13 for details.
3	Vehicular Interface Control Station (VICS)	The VICS station permits pilothouse personnel to utilize the tactical radios. Refer to TM 55-5825-311-10 for details.

PILOTHOUSE, FRAME 42, LOOKING AFT

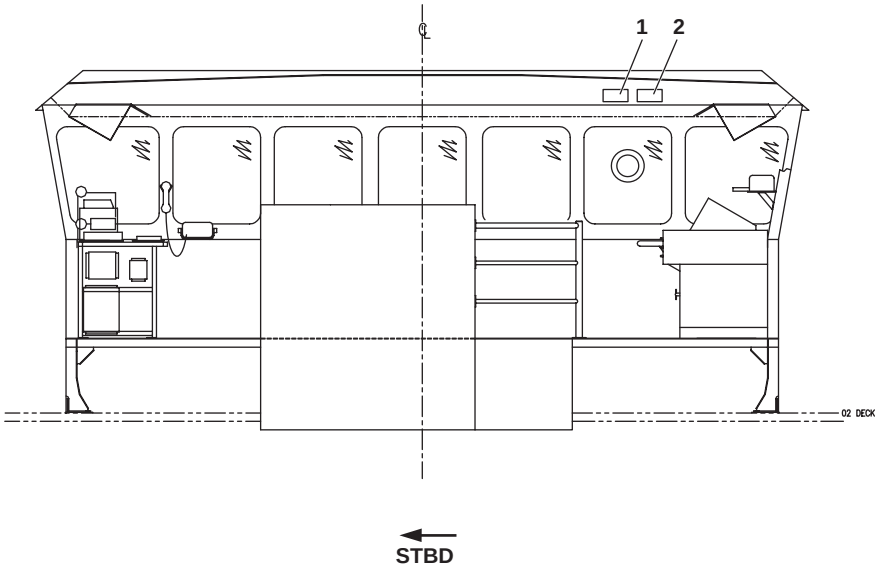


Figure 7. Pilothouse, Frame 42, Looking Aft

Table 7. Pilothouse, Frame 42, Looking Aft (refer to figure 7)

Key	Control/Indicator	Function
1	GMDSS DSC 500 VHF POWER RELAY C/O RELAY BOX	This box contains relays to control the GMDSS marine VHF radio. Refer to TM 55-1900-XXX-XX for details.
2	GMDSS DSC-500 VHF 120-24V POWER SUPPLY	This power supply reduces and rectifies 120 Vac to 24 Vdc for the GMDSS marine VHF radio. Refer to TM 55-1900-XXX-XX for details.

SEARCHLIGHT CONTROLS

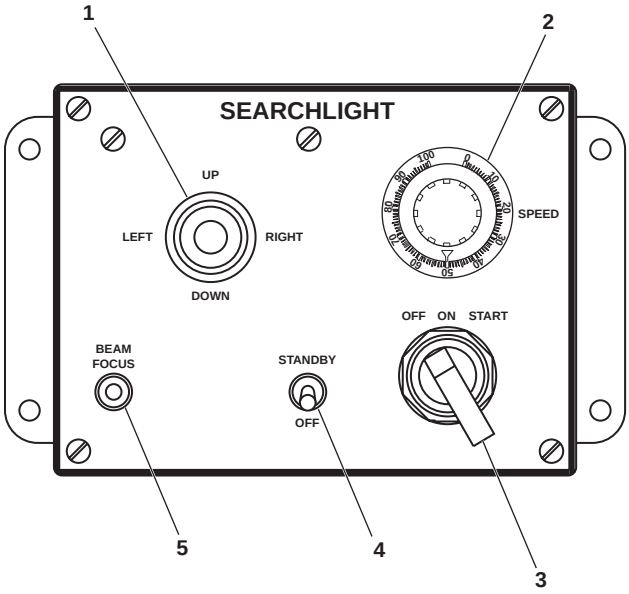


Figure 8. Searchlight Controls

Table 8. Searchlight Controls (refer to figure 8)

Key	Control/Indicator	Function
1	Directional Control	This joystick controls searchlight movement UP, DOWN, LEFT, and RIGHT.
2	Speed Control	The speed control adjusts the searchlight's speed of movement.
3	OFF/ON/START Switch	This switch is used to turn the searchlight ON and OFF and to START the searchlight.
4	OFF/STANDBY Switch	This switch selects between OFF and STANDBY modes.
5	BEAM FOCUS Control	Rotate this knob to adjust the focus of the searchlight beam.

FIRE PUMP START/STOP PANEL

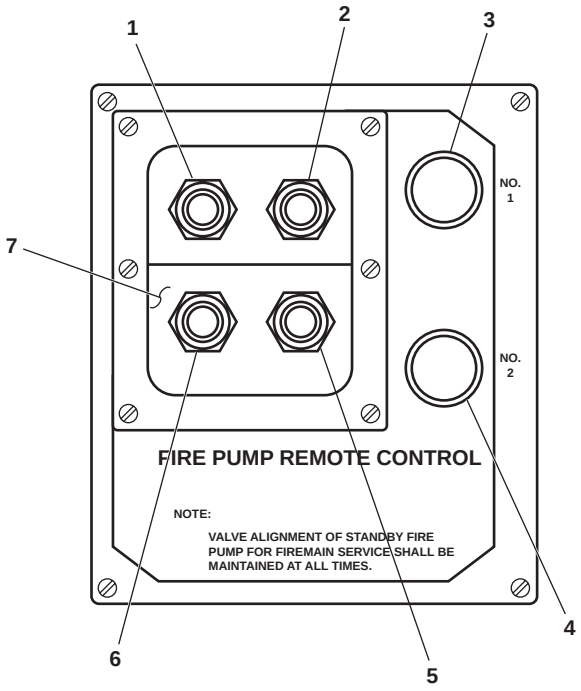


Figure 9. Fire Pump START/STOP Panel

Table 9. Fire Pump START/STOP Panel (refer to figure 9)

Key	Control/Indicator	Function
1	Fire and General Service Pump 1 START Pushbutton	PUSH this button to START fire and general service pump 1 from the pilothouse.
2	Fire and General Service Pump 1 STOP Pushbutton	PUSH this button to STOP fire and general service pump 1 from the pilothouse.
3	Fire and General Service Pump 1 RUN Indicator	This lamp illuminates when fire and general service pump 1 is running.
4	Fire and General Service Pump 2 RUN Indicator	This lamp illuminates when fire and general service pump 2 is running.
5	Fire and General Service Pump 2 STOP Pushbutton	PUSH this button to STOP fire and general service pump 2 from the pilothouse.
6	Fire and General Service Pump 2 START Pushbutton	PUSH this button to START fire and general service pump 2 from the pilothouse.
7	ALIGNED FOR GENERAL SERVICES Blockout Plate	This plate slides over the START and STOP pushbuttons for the fire and general service pump that is aligned for to provide general service water for the vessel. The exposed START and STOP pushbuttons are for the fire and general service pump aligned for firemain service.

PILOTHOUSE ALARM PANEL

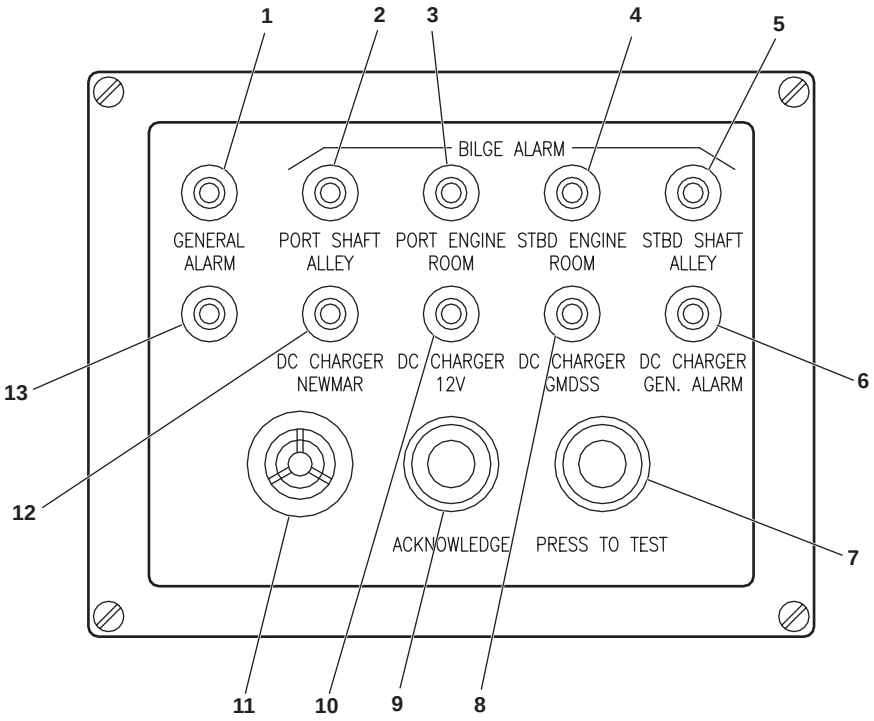


Figure10. Pilothouse Alarm Panel

Table 10. Pilothouse Alarm Panel (refer to figure 10)

Key	Control/Indicator	Function
1	GENERAL ALARM Indicator	This lamp illuminates when the general alarm system has been activated.
2	PORT SHAFT ALLEY Flood Alarm	This lamp illuminates when flooding is detected in the port shaft alley.
3	PORT ENGINE ROOM Flood Alarm	This lamp illuminates when flooding is detected on the port side of the engine room.
4	STBD ENGINE ROOM Flood Alarm	This lamp illuminates when flooding is detected on the starboard side of the engine room.
5	STBD SHAFT ALLEY Flood Alarm	This lamp illuminates when flooding is detected in the starboard shaft alley.
6	DC CHARGER GEN. ALARM	This lamp illuminates when power is lost to the general alarm battery charger.
7	PRESS TO TEST Pushbutton	PRESS this pushbutton to check operation of the lamps and annunciator in this panel.
8	DC CHARGER GMDSS	This lamp illuminates when power is lost to the GMDSS battery charger.
9	ACKNOWLEDGE Pushbutton	PUSH this button to acknowledge and alarm and silence the annunciator.

Table 10. Pilothouse Alarm Panel (refer to figure 10) (continued)

Key	Control/Indicator	Function
10	DC CHARGER 12V	This lamp illuminates when power is lost to the 12V battery charger.
11	Annunciator	The annunciator sounds an audible alarm signal whenever one of the indicator lights on this panel illuminates.
12	DC CHARGER NEWMAR	This lamp illuminates when power is lost to the Newmar power supply.
13	Spare Lamp	The spare lamp is provided for system expansion.

21 MC INTERCOM

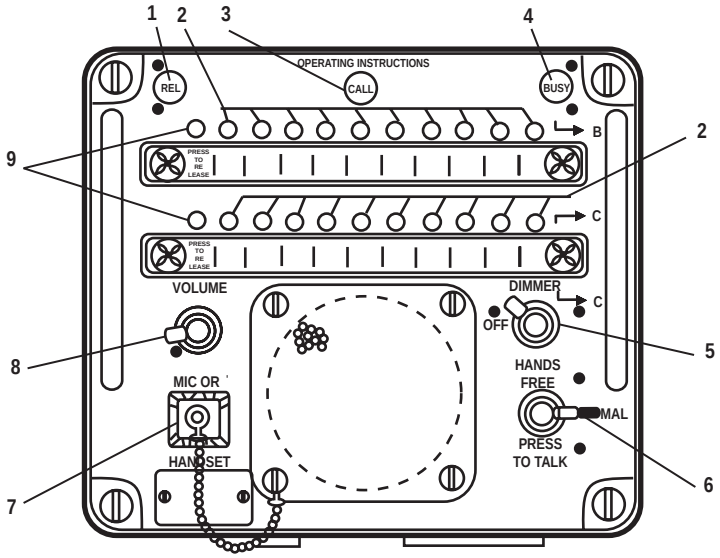


Figure 11. 21 MC Intercom

Table 11. 21 MC Intercom (refer to figure 11)

Key	Control/Indicator	Function
1	REL Indicator	This indicator illuminates to indicate that release of the system is required.
2	Station Pushbuttons	This pushbutton connects the unit to the selected station.
3	CALL Indicator	This indicator illuminates to indicate an incoming call.
4	BUSY Indicator	This indicator illuminates to indicate that the system is in use.
5	DIMMER Control	This controls the illumination level of the intercom panel.
6	HANDS FREE Control	This control provides hands free or press to talk transmission modes.

Table 11. 21 MC Intercom (refer to figure 11) (continued)

Key	Control/Indicator	Function
7	MIC OR HANDSET Plug	This is a jack plug for an external microphone/handset.
8	VOLUME Control	This controls the sound level of the intercom.
9	PRESS TO RELEASE	When pressed, this releases the station pushbuttons.

PANEL MOUNTED ADJUSTABLE LIGHT

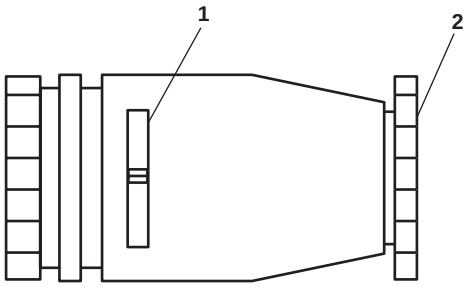


Figure 12. Panel Mounted Adjustable Light

Table 12. Panel Mounted Adjustable Light (refer to figure 12)

Key	Control/Indicator	Function
1	Dimmer Control	Twist this knob to adjust the light's brightness.
2	ON/OFF Switch	Twist this knob to turn the light ON and OFF.

DECK/CONSOLE LIGHTING PANEL

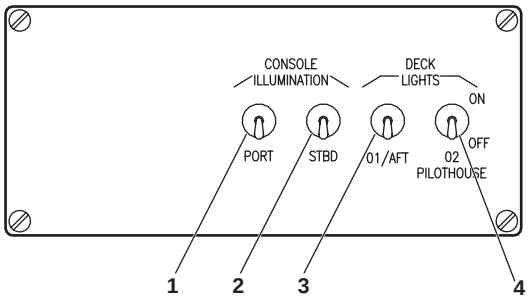


Figure 13. Deck/Console Lighting Panel

Table 13. Deck/Console Lighting Panel (refer to figure 13)

Key	Control/Indicator	Function
1	PORT CONSOLE ILLUMINATION Switch	This switch turns ON and OFF the port console lights.
2	STBD CONSOLE ILLUMINATION Switch	This switch turns ON and OFF the starboard console lights.
3	01/AFT DECK LIGHTS Switch	This switch turns ON and OFF the 01 level and aft deck lights.
4	02 PILOTHOUSE DECK LIGHTS Switch	This switch turns ON and OFF the 02 level and pilothouse deck lights.

PILOTHOUSE STARBOARD HVAC PANEL

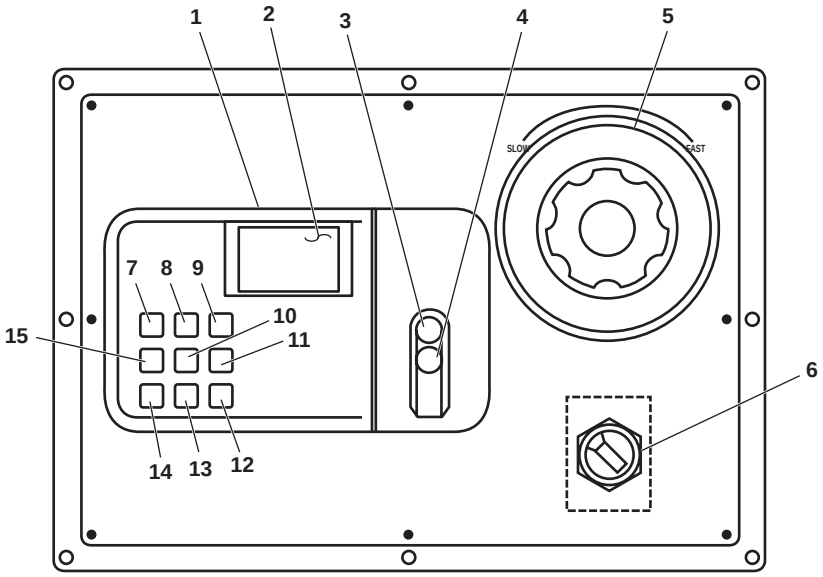


Figure 14. Pilothouse HVAC Panel

Table 14. Pilothouse HVAC Panel (refer to figure 14)

Key	Control/Indicator	Function
1	Port Pilothouse Rooftop Air Conditioning Unit Thermostat	This thermostat controls the port pilothouse rooftop air conditioning unit.
2	LCD (Liquid Crystal Display) Panel	This panel displays thermostat settings.
3	UP Pushbutton	This pushbutton is used to increase values when programming the thermostat.
4	DOWN Pushbutton	This pushbutton is used to decrease values when programming the thermostat.
5	Fresh Air Fans Speed Control (Port Side Only)	This rheostat controls the speed of the pilothouse fresh air fans.
6	Fresh Air Supply Switch (Port Side Only)	This switch turns ON and OFF the pilothouse fresh air supply fans.
7	COPY PREVIOUS DAY Button	This button is used to copy the previous day's settings during thermostat programming.
8	PROGRAM Button	This button is used during thermostat programming.
9	MODE Button	This button selects thermostat mode during thermostat programming.
10	END Button	This button is used to end an operation during thermostat programming.
11	FAN Button	This button permits programming of fan functions.
12	HOLD Button	This button is used during thermostat programming.

Table 14. Pilothouse Starboard HVAC Panel (refer to figure 14) (continued)

Key	Control/Indicator	Function
13	RESET FILTER Button	PRESS this button to reset the filter reminder.
14	SET TIME/TEMP Button	This button is used during time and temperature programming.
15	CHANGE DAY Button	This button is used to scroll through the available days during thermostat programming.

REMOTE PROPULSION INDICATOR PANEL

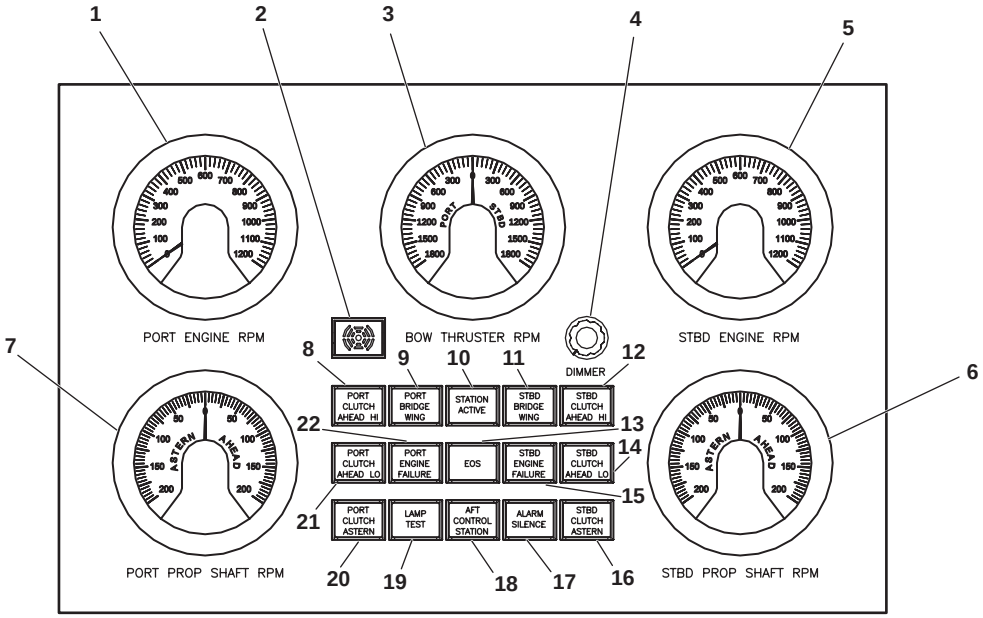


Figure 15. Remote Propulsion Indicator Panel

Table 15. Remote Propulsion Indicator Panel (refer to figure 15)

Key	Control/Indicator	Function
1	PORT ENGINE RPM Tachometer	This tachometer indicates the speed of the port main engine in r/min.
2	Annunciator	The annunciator sounds an audible warning when an engine failure is detected.
3	BOW THRUSTER RPM Tachometer	This tachometer indicates the speed of the bow thruster shaft in r/min.
4	DIMMER Control	This knob controls the brightness of the panel's illumination.
5	STBD ENGINE RPM Tachometer	This tachometer indicates the speed of the starboard main engine in r/min.

Table 15. Remote Propulsion Indicator Panel (refer to figure 15) (continued)

Key	Control/Indicator	Function
6	STBD PROP SHAFT RPM Tachometer	This tachometer indicates the speed of the starboard propeller shaft in r/min.
7	PORT PROP SHAFT RMP Tachometer	This tachometer indicates the speed of the port propeller shaft in r/min.
8	PORT CLUTCH AHEAD HI Indicator	This lamp illuminates to indicate that the port reduction gear is engaged ahead in high range.
9	PORT BRIDGE WING Indicator control.	This lamp illuminates to indicate that the port pilothouse wing station has
10	STATION ACTIVE Indicator	This lamp illuminates to indicate that the pilothouse station has control.
11	STBD BRIDGE WING Indicator	This lamp illuminates to indicate that the starboard pilothouse wing station has control.
12	STBD CLUTCH AHEAD HI Indicator	This lamp illuminates to indicate that the starboard reduction gear is engaged ahead in high range.
13	EOS Indicator	This lamp illuminates to indicate that the EOS station has control.
14	STBD CLUTCH AHEAD LO Indicator	This lamp illuminates to indicate that the starboard reduction gear is engaged ahead in low range.
15	STBD ENGINE FAILURE Indicator	This lamp illuminates to indicate that a starboard engine failure has occurred.
16	STBD CLUTCH ASTERN Indicator	This lamp illuminates to indicate that the starboard reduction gear is engaged astern.
17	ALARM SILENCE Pushbutton	PUSH this pushbutton to silence an active alarm.
18	AFT CONTROL STATION Indicator	This lamp illuminates to indicate that the aft control station has control.
19	LAMP TEST Pushbutton	PUSH this pushbutton to test the indicator lamps on this panel.
20	PORT CLUTCH ASTERN Indicator	This lamp illuminates to indicate that the port reduction gear is engaged astern.
21	PORT CLUTCH AHEAD LO Indicator	This lamp illuminates to indicate that the port reduction gear is engaged ahead in low range.
22	PORT ENGINE FAILURE Indicator	This lamp illuminates to indicate that a port engine failure has occurred.

NAVIGATOR'S SEAT

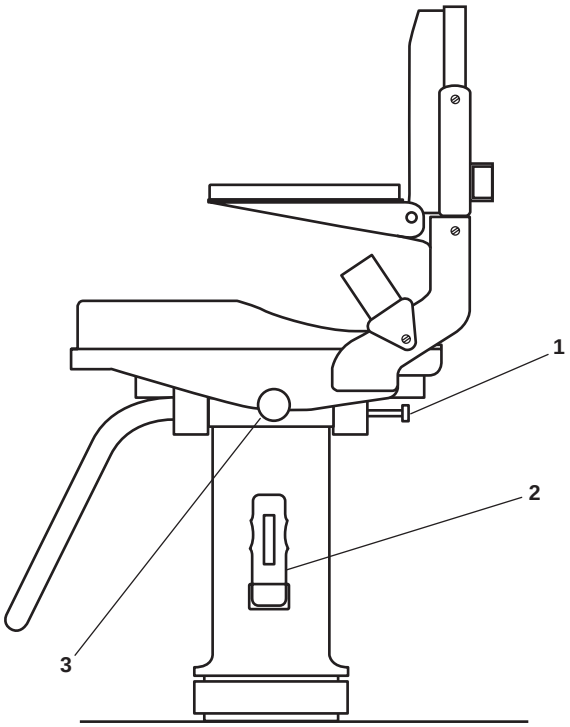


Figure 16. Navigator's Seat

Table 16. Navigator's Seat (refer to figure 16)

Key	Control/Indicator	Function
1	Swivel Lock Assembly	This over-center thumb latch locks the navigator's seat assembly in the FORWARD or AFT position when engaged. When disengaged, free swivel is permitted.
2	Foot Pedal	Step on this foot pedal to permit adjustment of the navigator's seat height. The seat is adjustable to eight stops spaced at 1-inch intervals. The seat is spring-loaded UP.
3	Fore and Aft Adjustment Knob	Pull OUT on this knob to allow fore and aft adjustment of the navigator's seat.

WATER COOLER

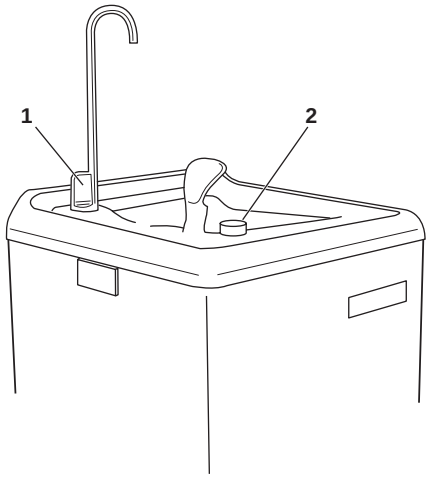


Figure 17. Water Cooler

Table 17. Water Cooler (refer to figure 17)

Key	Control/Indicator	Function
1	Cup Fill Lever	PUSH this lever to release chilled water out the cup spout.
2	Drinking Pushbutton	PUSH this pushbutton to release water out the drinking spout.

COFFEE MAKER

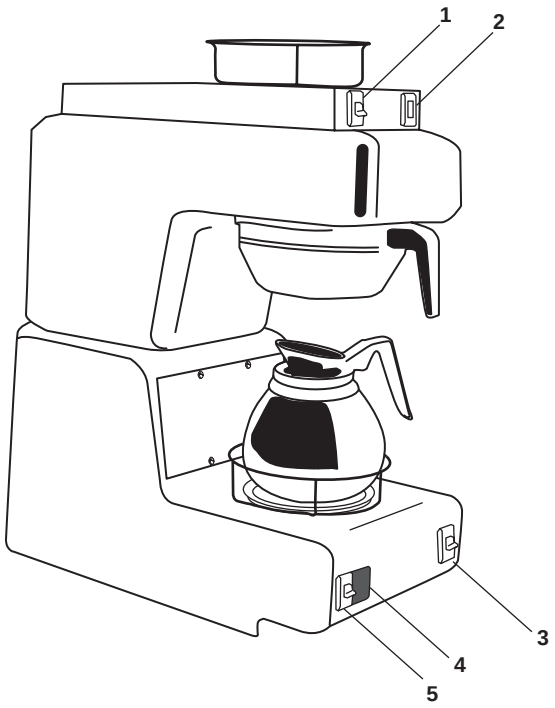


Figure 18. Coffee Maker

Table 18. Coffee Maker (refer to figure 18)

Key	Control/Indicator	Function
1	Upper Burner ON/OFF Switch	This switch turns the upper burner ON and OFF.
2	Upper Burner Power ON Indicator	This lamp illuminates to indicate that the upper burner is ON.
3	Master ON/OFF Switch	This switch turns the entire coffe maker ON and OFF.
4	Lower Burner Power ON Indicator	This lamp illuminates to indicate that the lower burner is ON.
5	Lower Burner ON/OFF Switch	This switch turns the lower burner ON and OFF.

CLINOMETER, TRIM

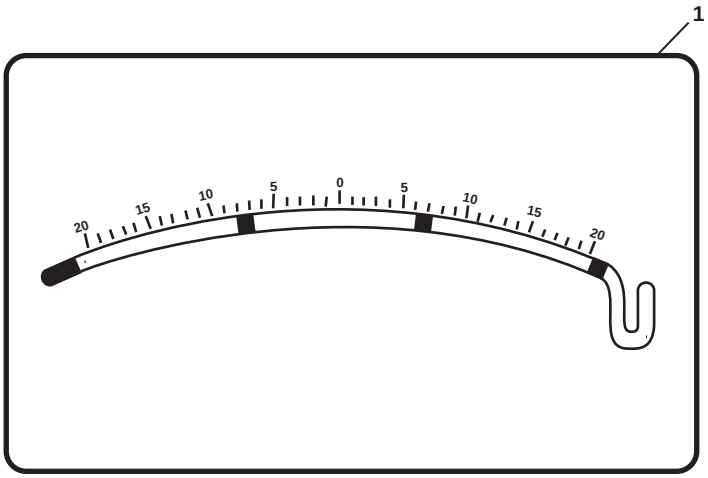


Figure 19. Clinometer, Trim

Table 19. Clinometer, Trim (refer to figure 19)

Key	Control/Indicator	Function
1	Clinometer, Trim	This clinometer indicates the angle of the vessel longitudinally (trim).

CLINOMETER, HEEL

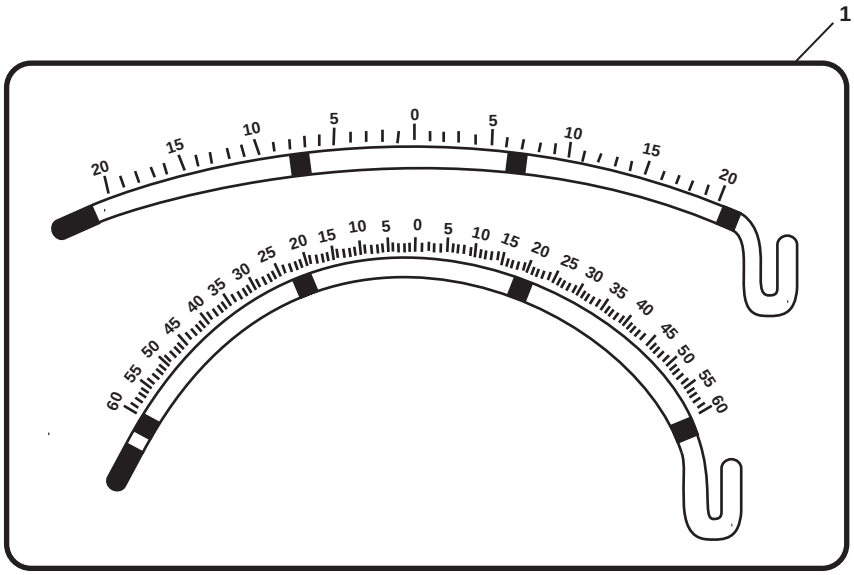


Figure 20. Clinometer, Heel

Table 20. Clinometer, Heel (refer to figure 20)

Key	Control/Indicator	Function
1	Clinometer, Heel	This clinometer indicates the angle of the vessel athwartship (heel).

SOUND POWERED TELEPHONE

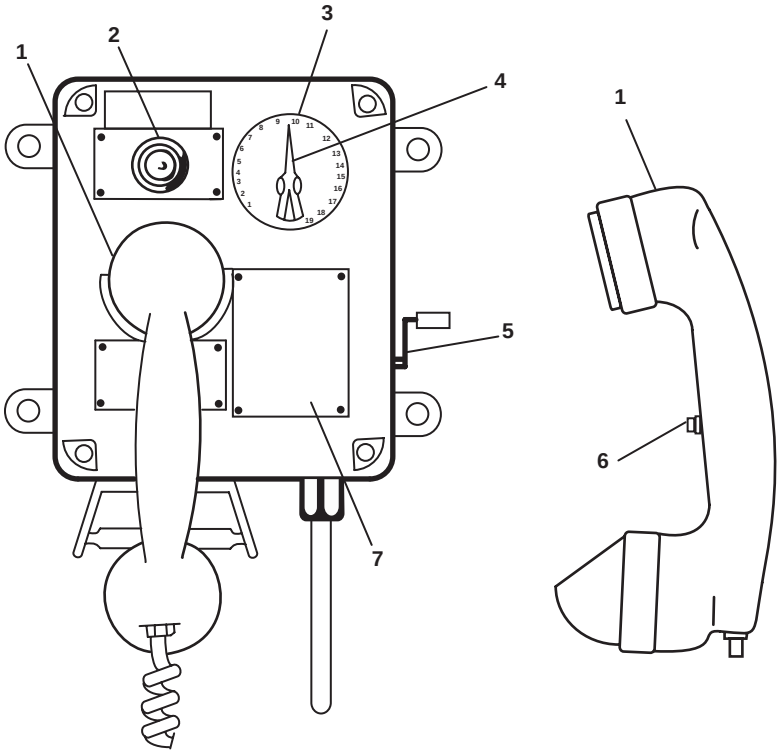


Figure 21. Sound Powered Telephone

Table 21. Sound Powered Telephone (refer to figure 21)

Key	Control/Indicator	Function
1	Handset	The handset is used to speak into and to listen from.
2	Ring Indicator	This indicator illuminates to indicate an incoming call.
3	Selector Dial	The selector dial outlines available stations.
4	Selector Knob	This knob selects station to be called.
5	Magneto Handle	Crank the magneto handle to call a station.
6	Pushbutton	This pushbutton is used to transmit.
7	DIRECTORY Plate	The directory plate lists telephone stations aboard the vessel.

NAVIGATION LIGHTING PANEL

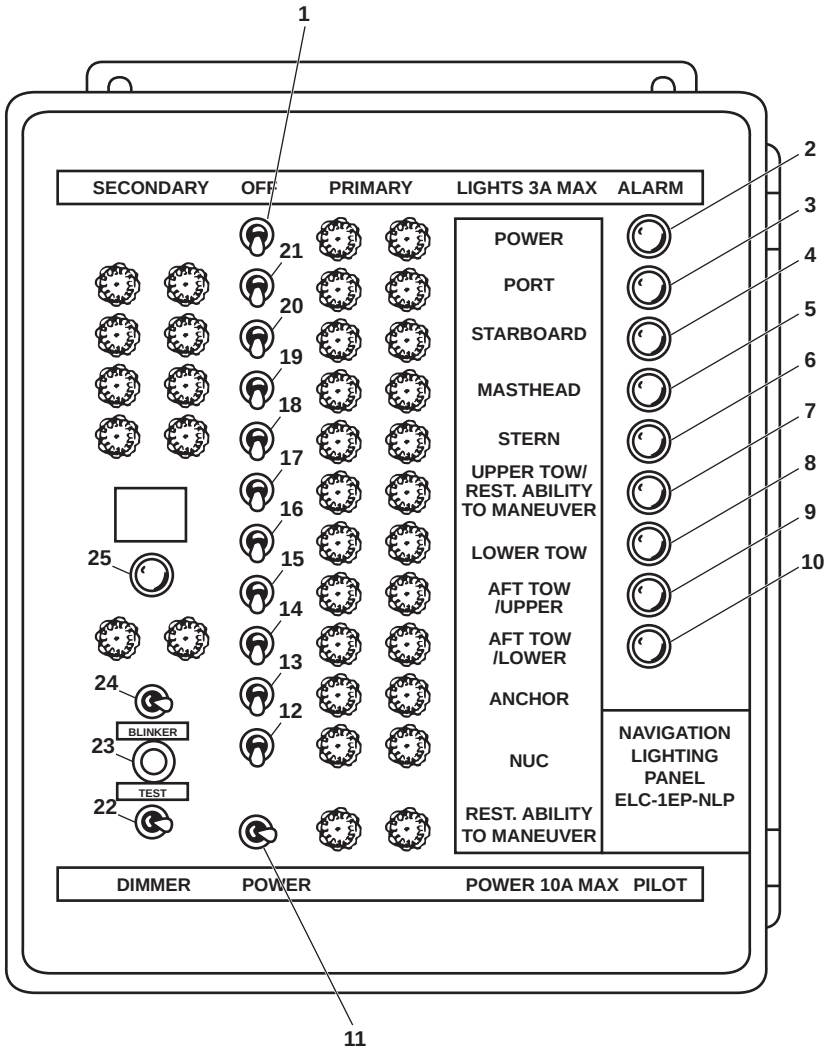


Figure 22. Navigation Lighting Panel

Table 22. Navigation Lighting Panel (refer to figure 22)

Key	Control/Indicator	Function
1	POWER Switch	This switch turns ON and OFF the power for the navigation lighting panel.
2	POWER Alarm Indicator	This lamp illuminates to indicate the the navigation lighting power is ON.
3	PORT Alarm Indicator	This lamp illuminates to indicate that the port side light has failed.
4	STARBOARD Alarm Indicator	This lamp illuminates to indicate that the starboard side light has failed.
5	MASTHEAD Alarm Indicator	This lamp illuminates to indicate that the masthead light has failed.
6	STERN Alarm Indicator	This lamp illuminates to indicate that the stern light has failed.

Table 22. Navigation Lighting Panel (refer to figure 22) (continued)

Key	Control/Indicator	Function
7	UPPER TOW/REST. ABILITY TO MANOEUVRE Alarm Indicator	This lamp illuminates to indicate that the upper tow/restricted ability to maneuver light has failed.
8	LOWER TOW Alarm Indicator	This lamp illuminates to indicate that the lower tow light has failed.
9	AFT TOW/UPPER Alarm Indicator	This lamp illuminates to indicate that the upper aft tow light has failed.
10	AFT TOW/LOWER Alarm Indicator	This lamp illuminates to indicate that the lower aft tow light has failed.
11	REST. ABILITY TO MANOEUVRE Switch	This switch turns ON and OFF the restricted ability to maneuver lights.
12	N.U.C. Switch	This switch turns ON and OFF the NUC (Not Under Command) lights.
13	ANCHOR Switch	This switch turns ON and OFF the anchor lights.
14	AFT TOW/LOWER Switch	This switch selects between PRIMARY, SECONDARY, and OFF for the lower aft tow light.
15	AFT TOW/UPPER Switch	This switch selects between PRIMARY, SECONDARY, and OFF for the upper aft tow light.
16	LOWER TOW Switch	This switch turns ON and OFF the lower tow light.
17	UPPER TOW/REST. ABILITY TO MANOEUVRE Switch	This switch turns ON and OFF the upper tow/restricted ability to maneuver light.
18	STERN Switch	This switch selects between PRIMARY, SECONDARY, and OFF for the stern light.
19	MASTHEAD Switch	This switch selects between PRIMARY, SECONDARY, and OFF for the masthead light.
20	STARBOARD Switch	This switch selects between PRIMARY, SECONDARY, and OFF for the starboard side light.
21	PORT Switch	This switch selects between PRIMARY, SECONDARY, and OFF for the port side light.
22	DIMMER Switch	This switch controls the brightness of the indicator lights. Settings are ON, DIM, and OFF.
23	TEST Switch	PUSH this pushbutton to test the indicator lights.
24	BLINKER Switch	This switch turns ON and OFF the yardarm blinker light.
25	EMERGENCY REPAIR PLUG IN USE Indicator	This lamp illuminates to indicate that an emergency repair plug is in use.

FIRE DETECTION REMOTE INDICATOR PANEL

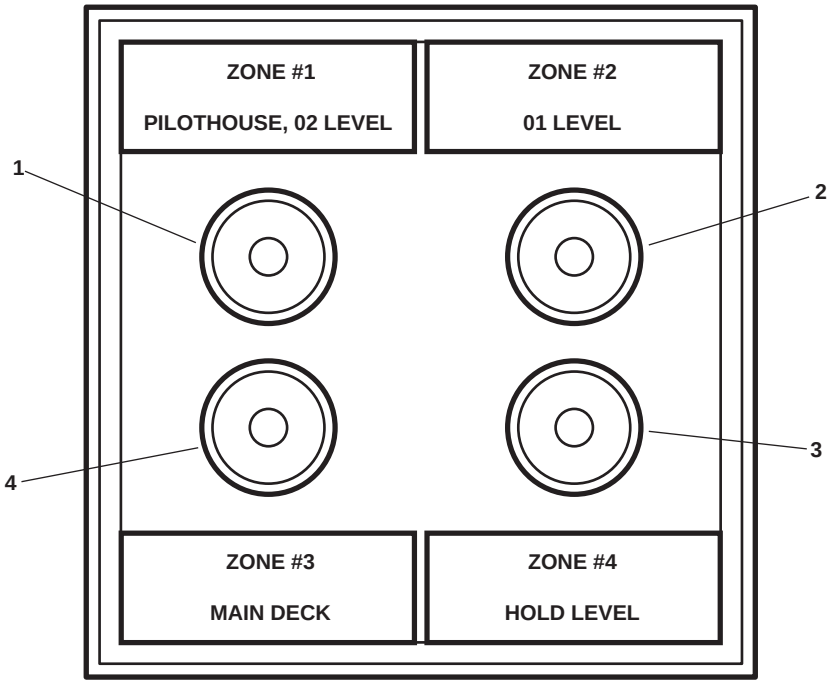


Figure 23. Fire Detection Remote Indicator Panel

Table 23. Fire Detection Remote Indicator Panel (refer to figure 23)

Key	Control/Indicator	Function
1	Zone 1 Alarm Indicator	This lamp illuminates to indicate an alarm condition in the pilothouse or radio room.
2	Zone 2 Alarm Indicator	This lamp illuminates to indicate an alarm condition on the 01 level.
3	Zone 4 Alarm Indicator	This lamp illuminates to indicate an alarm condition on the hold level.
4	Zone 3 Alarm Indicator	This lamp illuminates to indicate an alarm condition on the main deck level.

BLINKER LIGHT KEY

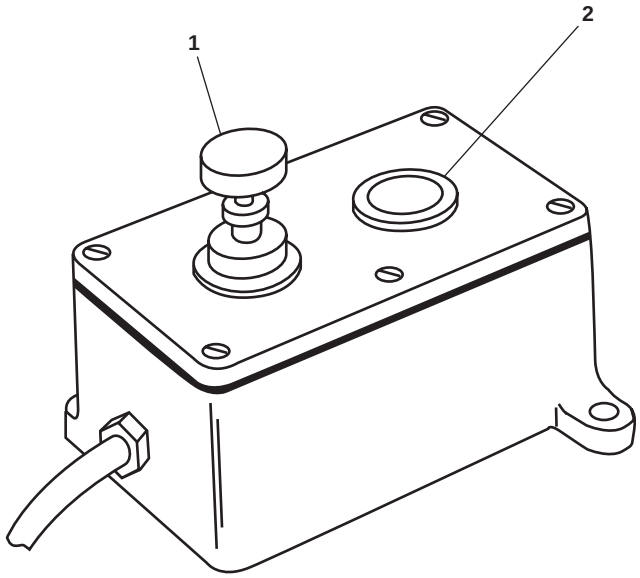


Figure 24. Blinker Light Key

Table 24. Blinker Light Key (refer to figure 24)

Key	Control/Indicator	Function
1	Blinker Key	PUSH this spring-loaded key to blink the yardarm blinker light.
2	Indicator Light	This lamp illuminates when the yardarm blinker light is ON.

DOOR ALARM SWITCHBOARD

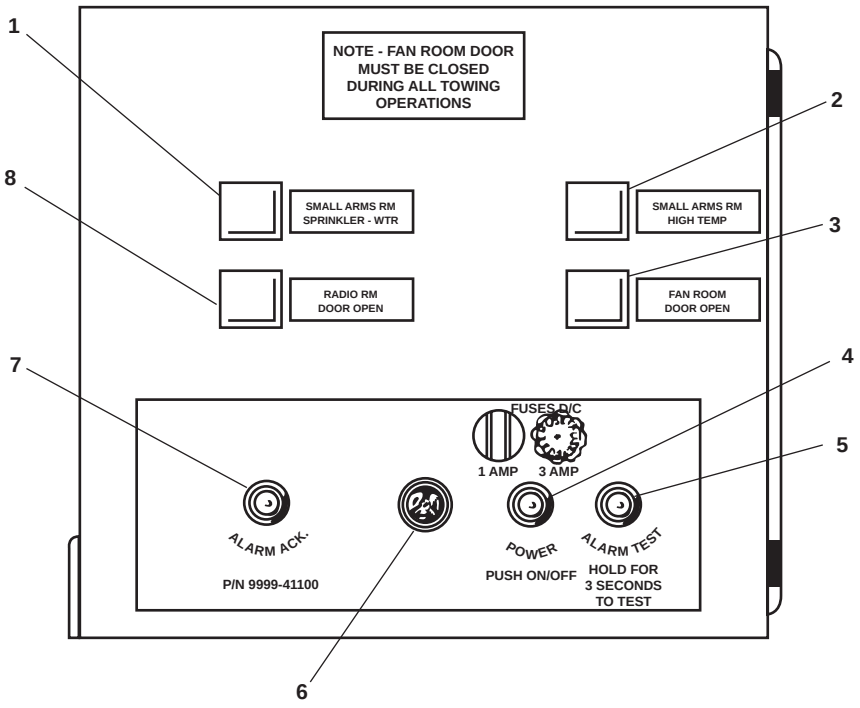


Figure 25. Door Alarm Switchboard

Table 25. Door Alarm Switchboard (refer to figure 25)

Key	Control/Indicator	Function
1	SMALL ARMS RM SPRINKLER-WTR Indicator	This lamp illuminates when the arms locker salt water drenching system is activated.
2	SMALL ARMS RM HIGH TEMP Indicator	This lamp illuminates when high temperatures are sensed in the arms locker.
3	FAN ROOM DOOR OPEN Indicator	This lamp illuminates when the main deck fan room door is OPEN.
4	POWER Switch	PUSH this pushbutton to turn the alarm panel power ON or OFF.
5	ALARM TEST Button	PUSH and hold this button for three seconds to test the alarm system.
6	Speaker	The speaker sounds an audible alarm when any of the indicators is illuminated.
7	ALARM ACK. Pushbutton	PUSH this pushbutton to silence an active alarm.
8	RADIO RM DOOR OPEN Indicator	This lamp illuminates to indicate that the radio room door is OPEN.

TOWING GEAR STRAIN GAUGE AND FOG HORN TIMER

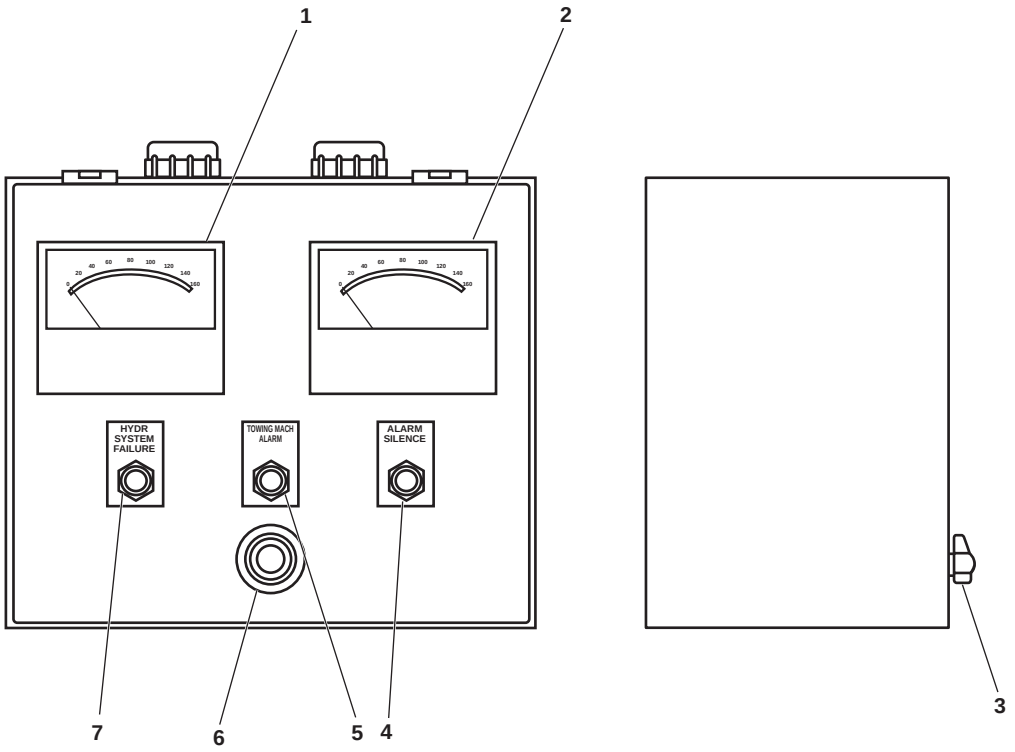


Figure 26. Towing Gear Strain Gauge and Fog Horn Timer

Table 26. Towing Gear Strain Gauge and Fog Horn Timer (refer to figure 26)

Key	Control/Indicator	Function
1	PORT MACHINE LINE PULL Gauge	This gauge indicates the line pull on the port towing machine.
2	STBD MACHINE LINE PULL Gauge	This gauge indicates the line pull on the starboard towing machine.
3	Selector Switch	This switch selects between the preset automatic fog horn signals.
4	ALARM SILENCE Button	PUSH this pushbutton to silence an active alarm.
5	TOWING MACH. ALARM Indicator	This lamp illuminates to indicate an alarm condition in either of the towing machines.
6	Speaker	The speaker sounds when a towing machine alarm condition is detected.
7	HYDR SYSTEM FAILURE Indicator	This lamp illuminates to indicate a towing machine hydraulic system failure.

CLEARVIEW SCREEN CONTROLS

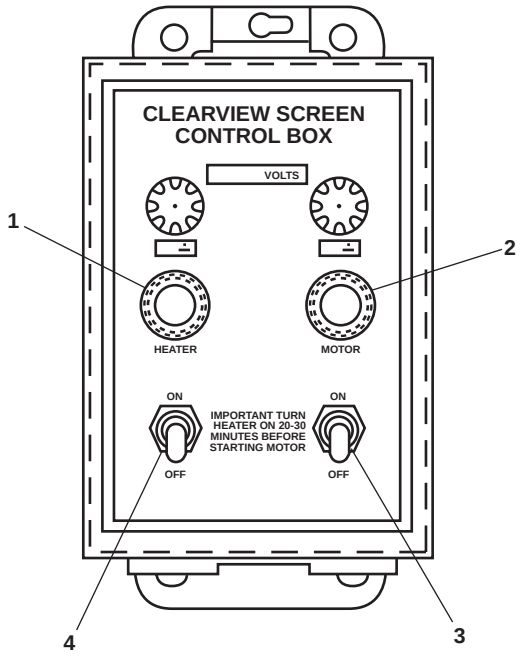


Figure 27. Clearview Screen Controls

Table 27. Clearview Screen Controls (refer to figure 27)

Key	Control/Indicator	Function
1	HEATER Indicator	This lamp illuminates when the heater is ON.
2	MOTOR Indicator	This lamp illuminates when the motor is ON.
3	MOTOR Switch	This switch turns the motor ON and OFF.
4	HEATER Switch	This switch turns the heater ON and OFF.

WINDSCREEN WIPER PNL

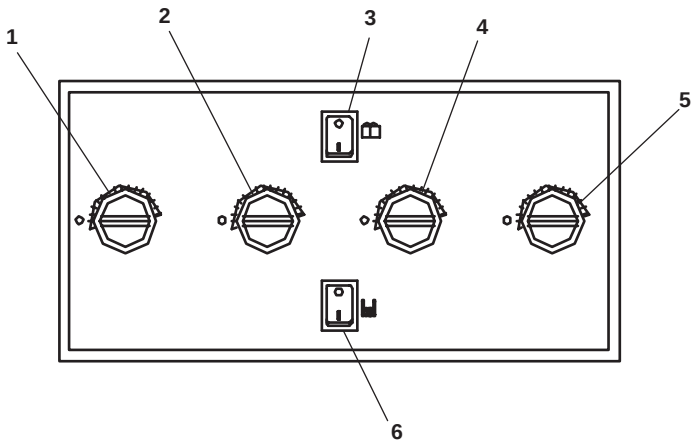


Figure 28. WINDSCREEN WIPER PNL

Table 28. WINDSCREEN WIPER PNL (refer to figure 28)

Key	Control/Indicator	Function
1	Port Outboard Wiper Speed Control	This control varies the speed of the port outboard wiper.
2	Port Inboard Wiper Speed Control	This control varies the speed of the port inboard wiper.
3	Windscreen Washer Switch	This switch turns on the windscreen washers.
4	Centerline Wiper Speed Control	This control varies the speed of the centerline wiper.
5	Starboard Outboard Wiper Speed Control	This control varies the speed of the starboard outboard wiper.
6	Heater Switch	This switch is inactive in this panel.

SCREEN ELEMENT PNL

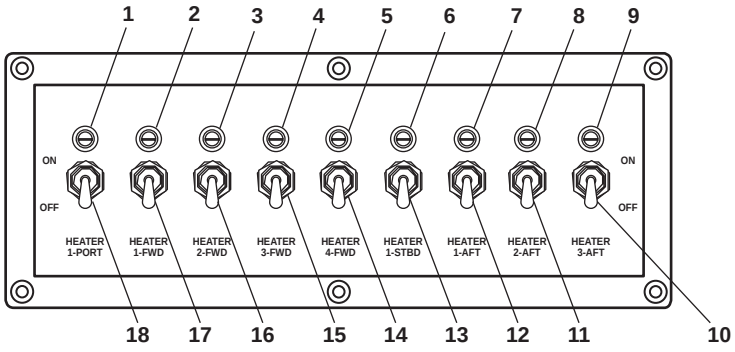


Figure 29. SCREEN ELEMENT PNL

Table 29. SCREEN ELEMENT PNL (refer to figure 29)

Key	Control/Indicator	Function
1	HEATER 1-PORT Indicator	This lamp illuminates when the port corner window heater is ON.
2	HEATER 1-FWD Indicator	This lamp illuminates when the forward outboard port window heater is ON.
3	HEATER 2-FWD Indicator	This lamp illuminates when the forward inboard port window heater is ON.
4	HEATER 3-FWD Indicator	This lamp illuminates when the forward centerline window heater is ON.
5	HEATER 4-FWD Indicator	This lamp illuminates when the forward inboard starboard window heater is ON.
6	HEATER 1-STBD Indicator	This lamp illuminates when the starboard corner window heater is ON.
7	HEATER 1-AFT Indicator	This lamp illuminates when the aft inboard port window heater is ON.
8	HEATER 2-AFT Indicator	This lamp illuminates when the aft centerline window heater is ON.
9	HEATER 3-AFT Indicator	This lamp illuminates when the aft inboard starboard window heater is ON.
10	HEATER 3-AFT Switch	This switch turns ON and OFF the aft inboard starboard window heater.
11	HEATER 2-AFT Switch	This switch turns ON and OFF the aft centerline window heater.
12	HEATER 1-AFT Switch	This switch turns ON and OFF the aft inboard port window heater.
13	HEATER 1-STBD Switch	This switch turns ON and OFF the starboard corner window heater.
14	HEATER 4-FWD Switch	This switch turns ON and OFF the forward inboard starboard window heater.
15	HEATER 3-FWD Switch	This switch turns ON and OFF the forward centerline window heater.
16	HEATER 2-FWD Switch	This switch turns ON and OFF the forward inboard port window heater.
17	HEATER 1-FWD Switch	This switch turns ON and OFF the forward outboard port window heater.
18	HEATER 1-PORT Switch	This switch turns ON and OFF the port corner window heater.

BINNACLE LIGHT PANEL

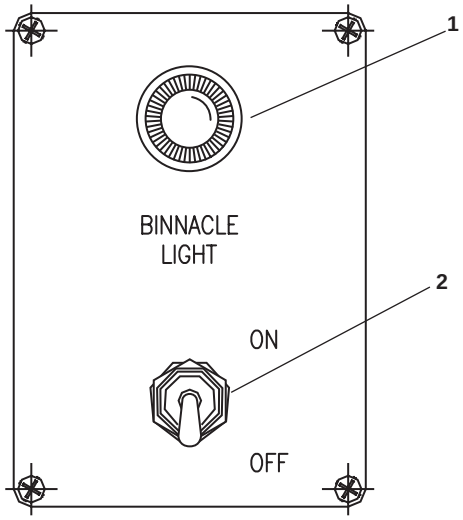


Figure 30. Binnacle Light Panel

Table 30. Binnacle Light Panel (refer to figure 30)

Key	Control/Indicator	Function
1	Indicator Light	This lamp illuminates to indicate that the binnacle light is ON.
2	ON/OFF Switch	This switch turns the binnacle light ON and OFF.

AT WILL AND AUTOMATIC FOG WHISTLE CONTROLLER

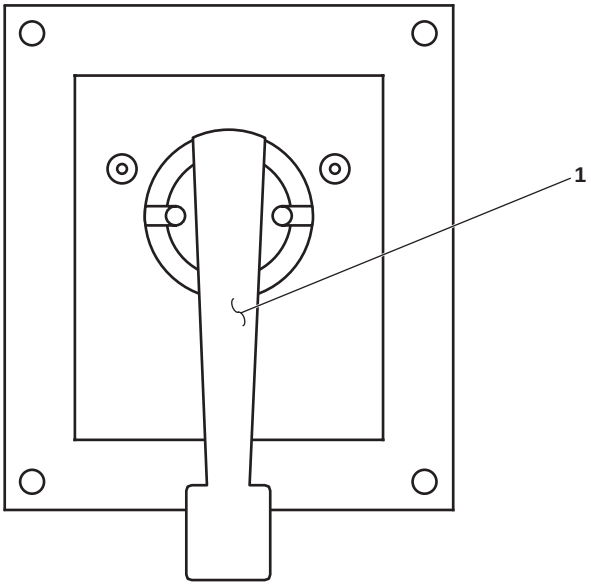


Figure 31. At Will and Automatic Fog Whistle Controller

Table 31. At Will and Automatic Fog Whistle Controller (refer to figure 31)

Key	Control/Indicator	Function
1	Selector Lever	This lever selects between AT WILL and AUTOMATIC modes for the automatic fog horn.

PA CONSOLE

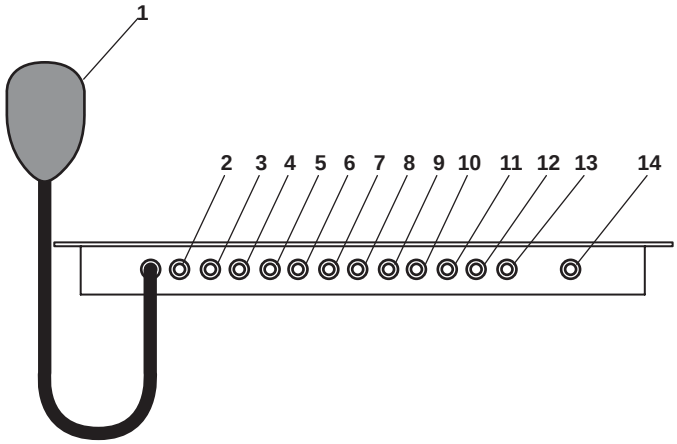


Figure 32. PA Console

Table 32. PA Console (refer to figure 32)

Key	Control/Indicator	Function
1	Microphone	The operator speaks into the microphone to broadcast a message to the selected station(s).
2	FWD 02 LVL Selector Button	Push IN on this button to select the forward 02 level station.
3	AFT 02 LVL Selector Button	Push IN on this button to select the aft 02 level station.
4	PASS 01 LVL Selector Button	Push IN on this button to select the 01 level passageway station.
5	AFT 01 LVL Selector Button	Push IN on this button to select the aft 01 level station.
6	MESS Selector Button	Push IN on this button to select the mess area station.
7	BOSN STORE RM Selector Button	Push IN on this button to select the bosun's store room station.
8	AMS 1 Selector Button	Push IN on this button to select the AMS 1 station.
9	AMS 2 Selector Button	Push IN on this button to select the AMS 2 station.
10	EOS Selector Button	Push IN on this button to select the EOS station.
11	ENG ROOM Selector Button	Push IN on this button to select the engine room station.
12	Blank	This button not used.
13	Blank	This button not used.
14	ALL CALL Selector Button	Push IN on this button to select all stations.

UPS BYPASS AND DISCONNECT SWITCH BOX

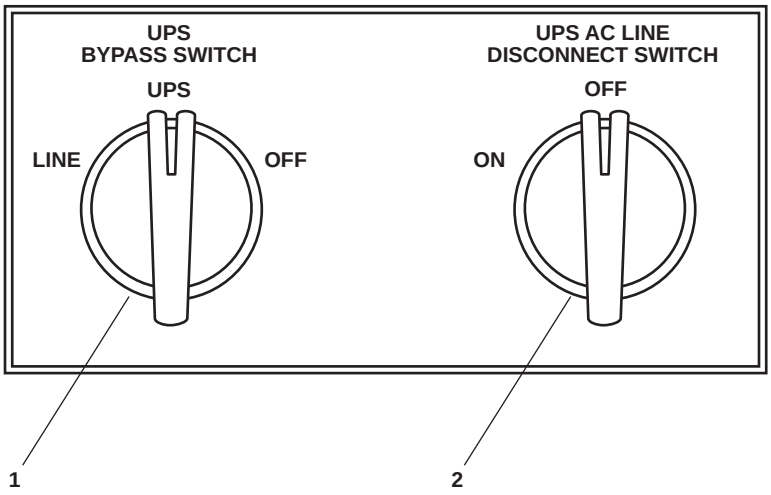


Figure 33. UPS Bypass and Disconnect Switch Box

Table 33. UPS Bypass and Disconnect Switch Box (refer to figure 33)

Key	Control/Indicator	Function
1	LINE/UPS/OFF Switch	This switch selects the power source for the gear. Refer to TM 55-5825-311-10 for details.
2	UPS AC LINE DISCONNECT SWITCH	This switch disconnects AC power to the UPS. Refer to TM 55-5825-311-10 for details.

120V RADAR POWER DISTRIBUTION PANEL

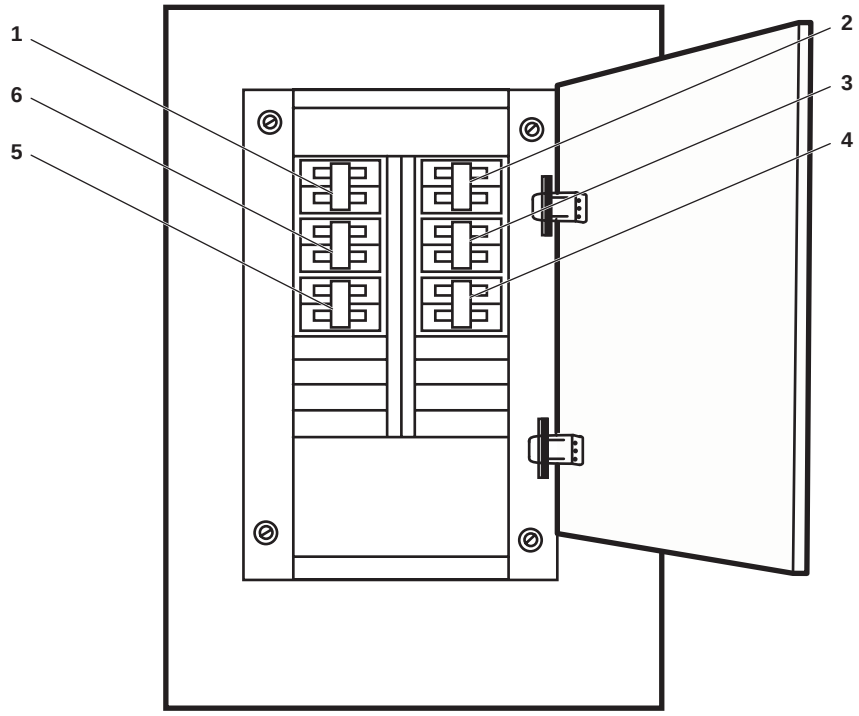


Figure 34. 120V Radar Power Distribution Panel

Table 34. 120V Radar Power Distribution Panel (refer to figure 34)

Key	Control/Indicator	Function
1	S BAND DISPLAY CONSOLE Circuit Breaker	This circuit breaker protects the S band display console.
2	S BAND MODULATOR XMTR - RCVR. Circuit Breaker	This circuit breaker protects the S band transmitter/receiver.
3	X BAND MODULATOR XMTR - RCVR. Circuit Breaker	This circuit breaker protects the X band transmitter/receiver.
4	SPARE Circuit Breaker	This circuit breaker is provided to allow for system expansion.
5	SPARE Circuit Breaker	This circuit breaker is provided to allow for system expansion.
6	X BAND DISPLAY CONSOLE Circuit Breaker	This circuit breaker protects the X band display console.

EMER BATT CHARGER

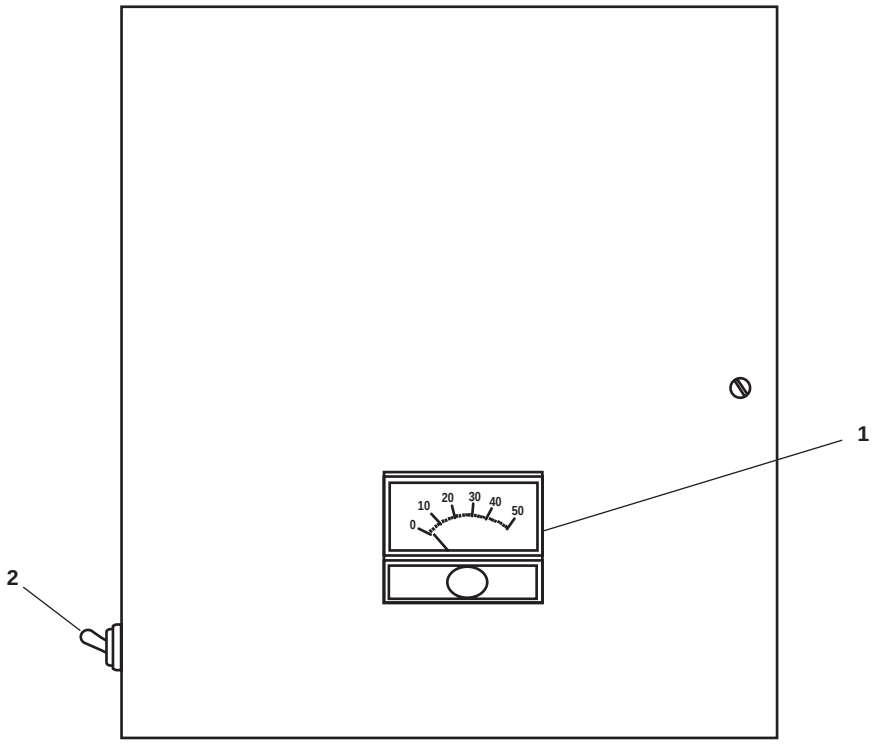


Figure 35. EMER BATT CHARGER

Table 35. EMER BATT CHARGER (refer to figure 35)

Key	Control/Indicator	Function
1	Ammeter	The ammeter displays the battery charger output in amps.
2	ON/OFF Switch	This switch turns the battery charger ON and OFF.

GMDSS BATT CHARGER

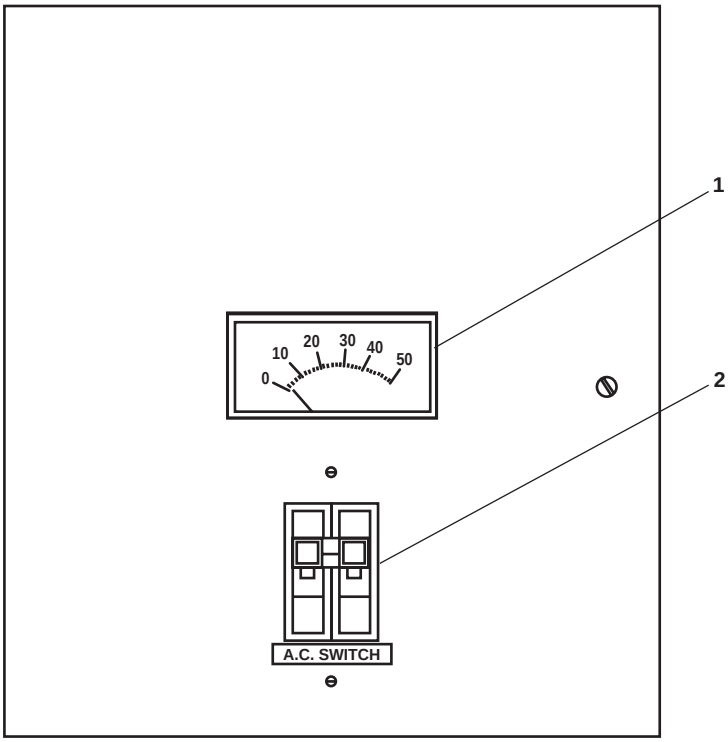


Figure 36. GMDSS BATT CHARGER

Table 36. GMDSS BATT CHARGER (refer to figure 36)

Key	Control/Indicator	Function
1	Ammeter	The ammeter displays the battery charger output in amps.
2	AC SWITCH	This switch turns the battery charger ON and OFF.

12V BATT CHARGER

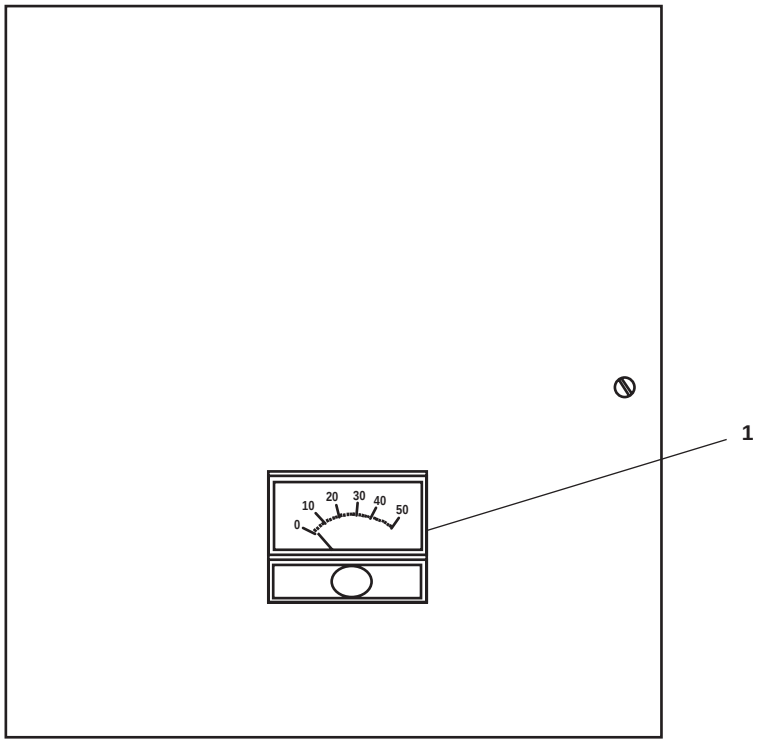


Figure 37. 12V BATT CHARGER

Table 37. 12V BATT CHARGER (refer to figure 37)

Key	Control/Indicator	Function
1	Ammeter	The ammeter displays the battery charger output in amps.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
PILOTHOUSE TOP AND MASTS

PILOTHOUSE TOP, GENERAL ARRANGEMENT

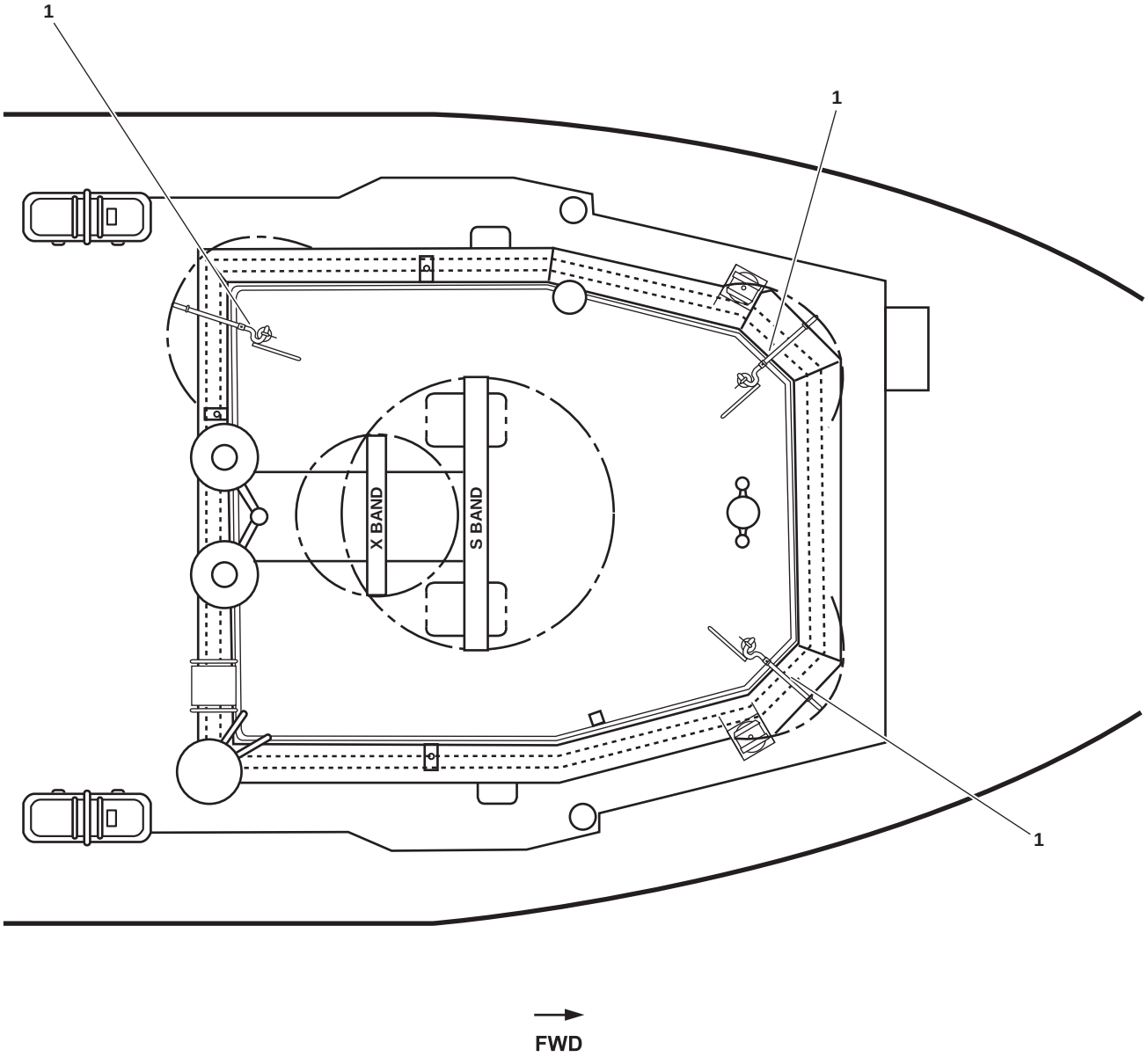


Figure 1. Pilothouse Top, General Arrangement

Table 1. Pilothouse Top, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Fire Monitor	The fire monitor is used to spray raw water and Aqueous Film Forming Foam (AFFF) for firefighting purposes. See figure 2 for details.

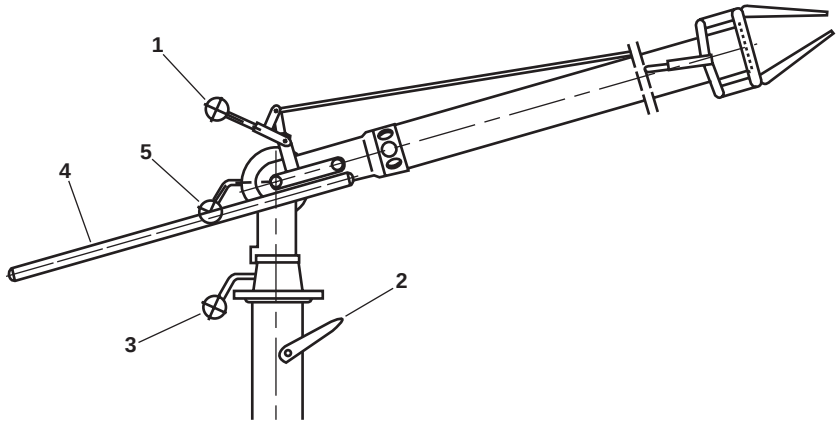


Figure 2. Fire Monitor

Table 2. Fire Monitor (refer to figure 2)

Key	Control/Indicator	Function
1	Stream Control Handle	This handle adjusts the jaws at the tip of the monitor to control the width of the stream output.
2	Monitor Cutoff Valve	This valve controls the flow of raw water and AFFF directed at the fire.
3	Traverse Lock Handle	This handle controls the traverse lock that controls direction of the monitor.
4	Directional Control Handle	This handle allows directional control of the fire monitor by the operator.
5	Elevation Lock Handle	This handle controls the elevation lock.

END OF WORK PACKAGE

Chapter 3

Operator Instructions--
Operation Under Usual Conditions
for
Inland and Coastal Large Tug (LT)

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
SECURITY MEASURES FOR ELECTRONIC DATA

Instructions for handling, loading, purging, overwriting, or unloading classified electronic data under usual conditions are detailed in the applicable technical manual for the system(s) using that data. This type of data is handled only in the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems and Global Maritime Distress and Safety System (GMDSS) components. Refer to TM 55-5825-311-10 for C4ISR equipment and TM 55-5830-283-10 for GMDSS equipment.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
DECALS AND INSTRUCTION PLATES

Figures 1, 2, and 3 show the location of the instruction plates onboard the vessel. Placards 1 through 34 below contain the complete text and figures contained on these instruction plates. Table 1 correlates figures 1 through 3, their individual callouts, and the corresponding placard for the location.

Table 1. 128' Large Tug Instruction Plate Locations

Figure	Item	Instruction Plate Title	Placard Number
1	1	Lube Oil Purifier	1
1	2	Central Hydraulic System	2
1	3	Towing Machine/Central Hydraulic Crossover Operation	3
1	4	Propulsion Control System	4
1	5	No. 2 Diesel Generator Set	5
1	6	Hot Potable Water	6
1	7	Air Compressors	7
1	8	Bow Thruster Engine	8
1	9	Pump Drive Engine	9
1	10	Towing Machine/Central Hydraulic Crossover Operation	3
1	11	Sewage Collection, Holding, and Transfer (CHT) System and Marine Sanitation Device (MSD)	10, 11
1	12	Firefighting/AFFF	12
1	13	Switchboard	13
1	14	No. 1 Diesel Generator Set	14
1	15	Main Propulsion Engines	15
1	16	Oil Water Separator	16
1	17	Oily Bilge System	17
1	18	FM-200 System	18, 19, 20
1	19	Cold Potable Water	21
1	20	Air Conditioning Plant	22, 23
1	21	Refrigeration	24, 25

Table 1. 128' Large Tug Instruction Plate Locations (continued)

Figure	Item	Instruction Plate Title	Placard Number
1	22	Stern Tube Seal	26
1	23	Fire Main/WDCM/General Service System	27
2	1	FM-200	28
2	2	FM-200	29
2	3	Capstan	30
3	1	Cargo Crane	31
3	2	Anchor Capstan	32
3	3	Emergency Diesel Generator	33
3	4	Towing Machine	34

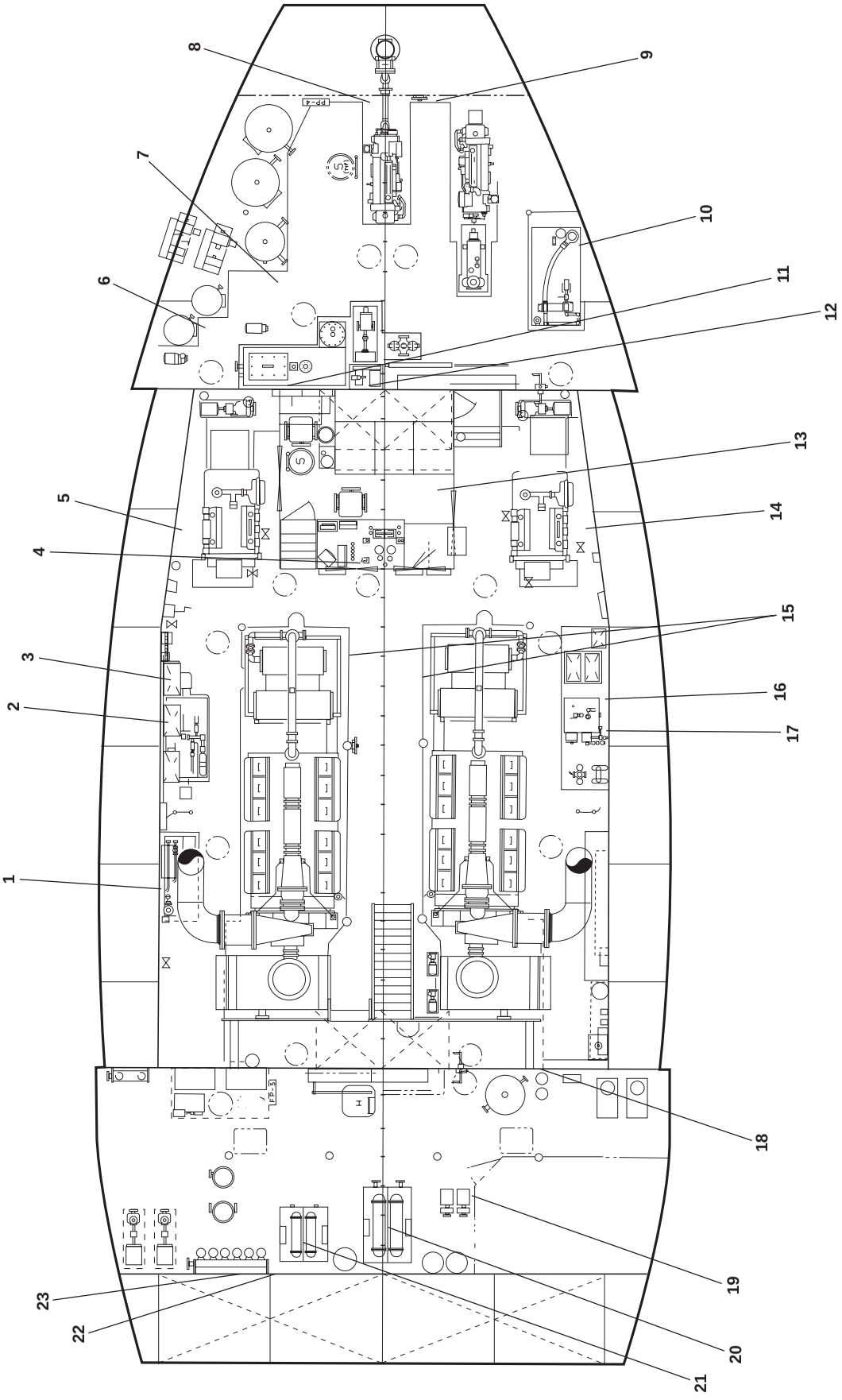


Figure 1. Engine Room, AMS 1, and AMS 2 Instruction Plate Locations

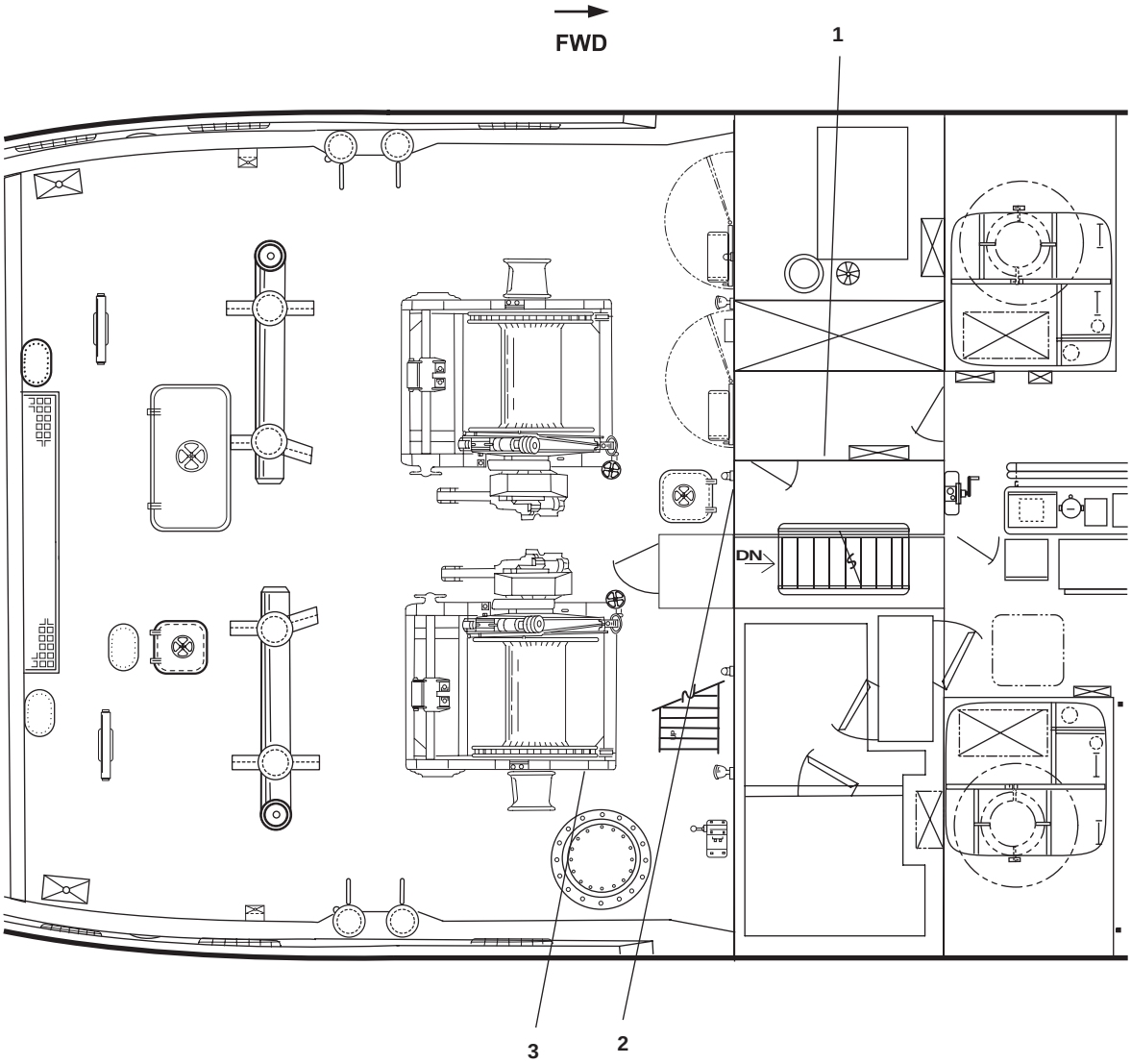


Figure 2. Main Deck Instruction Plate Locations

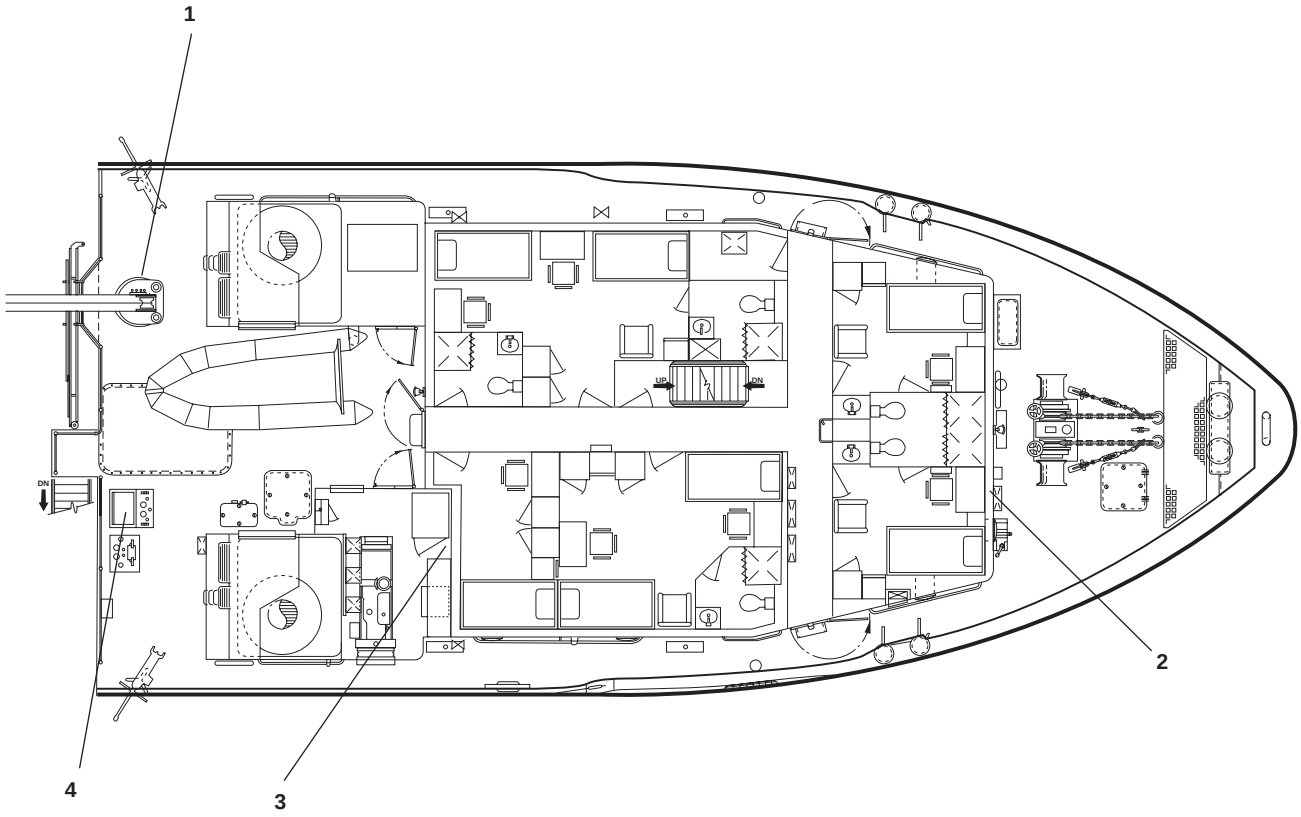


Figure 3. 01 Level Instruction Plate Locations

LUBE OIL PURIFIER

1. Ensure oil level in gear chamber is in the upper third of sight glass.
2. Release break and verify that bowl turns easily by hand.
3. Ensure power is available to purifier control panel and main circuit breaker on control panel is closed.
4. Line up lube oil system to allow purifier to take suction from No.1 or No.2 main engines by opening the following valves:

   No.1 Main Engine L0-23, L0-24, L0-29 and L0-31
   No.2 Main Engine L0-25, L0-26, L0-30 and L0-32

5. Start purifier by depressing start button and allow bowl to reach rated speed, approximately 3-4 minutes. Once bowl has reached rated speed, motor start light will extinguish and motor run light will illuminate.
6. Fill bowl with seal water and adjust needle valve to obtain the proper amount of make-up water, 1 -3 drops/second max.
7. Open shut-off valve in suction line of purifier to feed dirty oil to heater.
8. Once heater is full, as determined by opening petcock on heater outlet, energize heater.
9. After sufficient warm-up time, 70-80 °C, close control power switch and solenoid valve will open feeding dirty oil to purifier. Rate of dirty oil flow to purifier is controlled by throttling suction line valve.
10. To secure purifier, shut off power to oil heater, stop dirty oil supply, stop seal water supply, shut off control power, switch off motor and apply break.
11. Open drain cock and clean bowl if necessary.

Placard 1. Lube Oil Purifier

CENTRAL HYDRAULIC SYSTEM

1. Ensure power is available to hydraulic power unit control panel and main circuit breaker on control panel face is closed.

2. Check reservoir level and ensure it is at the proper operating level.

3. Place mode selector switch in the "ON" position for local control or "REMOTE" for remote control from the EOS.

4. Select pump P1, P2 or both on pump selector switch. Simultaneous operation of both pumps is only required when the central hydraulic system is cross connected to the towing winch hydraulic system. When cross connecting to the towing winch hydraulic system open valves TH-1, TH-2, TH-3 and TH-4 and close valves CH-26 and CH-27.

5. Press local or remote start button to start pump or pumps. When pump selector switch is set for both pumps, there is a preset time delay to stagger pump start up.

NOTE: When operating both pumps simultaneously for extended periods of time, pay close attention to reservoir temperature as this mode of operation may cause excessive oil temperatures.

6. Once pump or pumps have started, observe local instrumentation to verify proper operation and observe return filter pressure gauge, when it exceeds 20 PSIG with one pump running, the elements must be changed.

7. To secure power unit, remove load from system and depress local or remote stop button.

Placard 2. Central Hydraulic System

TOW WINCH/CENTRAL HYDRAULICS CROSSOVER OPERATION

Normal: Pump drive engine supplies towing hydraulic system. Dual hydraulic power unit supplies central system.

Crossover: Dual hydraulic power unit supplies towing hydraulic system.

Valve Line Up:

	Normal	Crossover
TH-1	OPEN	OPEN
TH-2	CLOSED	OPEN
TH-32	OPEN	CLOSED
TH-3	CLOSED	OPEN
TH-4	CLOSED	OPEN
TH-26	OPEN	CLOSED
TH-27	OPEN	CLOSED

Placard 3. Towing Machine/Central Hydraulic Crossover Operation

PROPULSION CONTROL SYSTEM

Start Up & Station Transfer:

1. Ensure Compressed Air System is fully charged and in the automatic mode. See Air Compressor Operating Instructions.

2. Line-up Compressed Air System to feed the control air dryer and control air lines from the dryer to supply the control air reservoir. For normal operation open air dryer inlet and outlet valves, close air dryer by-pass valve. In case of air dryer malfunction close air dryer inlet and outlet valves, open air dryer by-pass valve.

3. Energize control air dryer. (normal operation only)

4. Ensure all control station throttles are in the center neutral position.

5. Place the EOS command transfer valve in the EOS position. Control air pressure will be shown on the local gage mounted on the EOS control console indicating that the local station has control.

6. To transfer control from the local EOS station to any of the remote stations, place the command transfer switch in the remote position and pull up on any of the remote station transfer switches until indication of control air pressure is seen on the applicable remote control air pressure gage. At this time, all other command stations are disabled. Transfer of command from the EOS to remote stations may only be initiated from the EOS and the EOS station may regain control at any time by placing the command transfer switch back in the EOS position.

7. To transfer command from one remote station to another, lift up on the station transfer switch at the desired station until control air is indicated on the control air gage.

Main Engine Throttle Control:

1. Ensure that engine throttles at the active station are in the neutral center position, or the start interlock feature of the control system will prevent engines from starting.

2. Start main engines. (See Main Engines Operating Instructions.)

3. Position throttle levers from the center detent position to either the 20 degrees ahead or astern position for clutch selection. Continued lever movement in the selected, clutch quadrant will increase engine speed.

4. To change reduction gear ratio, main engine throttles at the active station must be in the center neutral position.

Bow Thruster Throttle Control:

1. Ensure that bow thruster throttle lever controls (located at remote operating stations only) are in the neutral center detent position.

2. Start bow thruster engine. (See Bow Thruster Operation Instructions.)

3. Position throttle levers from the center detent position to either the 20 degrees port or starboard position for clutch selection. Continued lever movement in the selected clutch quadrant will increase engine speed.

Placard 4. Propulsion Control System

NO. 2 DIESEL GENERATOR SET

1. Ensure engine sump and jacket water cooling levels are at the proper operating levels.
2. Line-up fuel oil system to allow engine to take suction from and return to port day tank by opening valves FO-13, FO-22 and FO-33 or stbd day tank by opening valves FQ-1S, FO-14, FO-22, FO-34 and FO-35.
3. Line-up cooling system by opening valves FWC-10 and FWC-12.
4. Prime fuel oil system on engine, if necessary, with engine mounted hand pump.
5. Ensure diesel starting air receivers are charged and that starting air system to generator is lined up by opening valves CA-7, CA-4 and CA-3.
6. Ensure oiler on air starting system is at proper level.
7. Start engine by depressing start button on local control panel or remotely in the EOS. Release start button after engine starts.
8. After engine starts, observe local or remote diesel engine instrumentation to verify proper engine operation.
9. Allow engine to warm up until all temperatures and pressures have stabilized.
10. See switchboard operating instructions for placing generator on-line.
11. To secure engine, remove load (see switchboard operating instructions).
12. Allow temperature to cool, approximately 3-5 minutes if engine has been under load.
13. Depress engine stop button on local control panel or remotely in EOS.

Placard 5. No. 2 Diesel Generator Set

HOT POTABLE WATER SYSTEM

1. Align the hot potable water system to allow # 1 and #2 hot water heaters to be fed from the cold potable water system and to feed the hot potable water distribution lines including the hot water recirculating pump by opening valves PW-78, PW-79, PW-80, PW-81, PW-82, PW-43 and PW-44. All other valves serving various components and spaces shall be opened as required.

2. With hot water heaters at the proper operating level, energize heaters by closing circuit breakers on main switchboard in EOS.

3. Ensure power is available to the hot potable water recirc pump motor controller circuit breaker PP4-4P-E(1) and start pump by depressing start button.

4. To secure system, depress stop button on the hot potable water motor controller and open circuit breakers feeding the hot water heaters.

Placard 6. Hot Potable Water System

AIR COMPRESSORS

1. Ensure oil level in compressor crankcase is at the proper operating level.

2. Ensure power is available to automatic moisture separators and air compressor control panels.

3. Manually drain moisture from system by depressing the override button on the moisture separators. During automatic operation the moisture separator will automatically open and close at a pre-determined rate and duration.

4. Line up compressed air system by opening valves CA-1, CA-2, CA-11, CA-12, CA-3, CA-4. CA-39, CA-40, CA-13 and CA-14, verify CA-41 (regulator by-pass) is closed. Other valves in system shall be opened as desired.

5. Place air compressor motor controllers in the automatic mode and start compressors. In the automatic mode compressors will cycle ON at 225 PSI and OFF at 250 PSI.

6. To manually operate compressors, place motor controllers in the manual mode and control compressor operation manually by depressing the start-stop pushbuttons.

CAUTION: Do not leave compressors unattended in manual mode as pressure switches will not function.

7. After compressors are running, verify proper operation by observing compressor oil pressure and system pressure.

Placard 7. Air Compressors

BOW THRUSTER ENGINE

1. Ensure engine sump, marine gear sump, bow thruster lube oil system and jacket water cooling levels are at the proper operating levels (normal level is 1/2 of sightglass).

2. Line up fuel oil system to allow engine to take suction from and return to port day tank by opening valves FO-30, FO-13 and FO-33 or stbd tank by opening valves FO-30, FO-14, FO-15, FO-34 and FO-35. Prime fuel oil system with handpump at bow thruster engine.

3. Line up cooling system by opening valves ASW-18, ASW-17, ASW-21, ASW-22 and AE-28.

4. Ensure that diesel starting air receivers are charged and that starting air system to bow thruster engine is lined-up by opening valves CA-5, CA-4, CA-3, CA-11, CA-12, CA-1 and CA-2.

5. Ensure oiler on air starting system is at proper level (normal level is 3/4 full).

6. Ensure that propulsion control air receiver is charged and propulsion control system is set up for normal operation. Transfer switch at the EOS station shall be in the remote position with pilothouse having control and bow thruster throttle in the neutral position.

7. Ensure that 24V control power is available to engine.

8. Release engine lockout switch.

9. Turn start switch to run position and start engine by lifting the start button on the local control panel or by depressing the remote start button in the pilothouse. Release start button after engine starts, (observe illumination of remote run light in pilothouse when starting remotely).

10. After engine starts, observe local or remote diesel engine instrumentation to verify proper engine operation.

11. Allow engine to warm up until all temperatures and pressure have stabilized.

12. Speed and direction of bow thruster rotation shall be controlled by moving the bow thruster throttle at any of the four bow thruster control stations in the desired thrust direction. (See Propulsion Control System Instructions.)

13. To operate engine in local manual control, lift on hand throttle to change from air control position and engage teeth in manual position. Rotate handle CCW to increase speed. Engine may be stopped by pushing throttle lever CW past idle.

14. To secure engine, remove load and allow temperatures to cool approximately 3 - 5 minutes if engine has been under load.

15. Stop engine by depressing the stop button on the local control panel or by depressing the remote stop button in the pilothouse. Release stop button after engine stops, (observe extinguishing of remote run light in pilothouse when stopping remotely). When stopping remotely, hold stop button down until run light extinguishes.

Placard 8. Bow Thruster Engine

PUMP DRIVE ENGINE

1. Ensure engine sump and jacket water cooling levels are at the proper operating levels.
2. Line up fuel oil system to allow engine to take suction from and return to port ' day tank by opening valves FO-31, FO-13 and FO-33 or stbd day tank by opening valves FO-31, FO-14, FO-15, F0-34 and FO-35.
3. Line-up cooling system by opening valves ASW-17, ASW-19, ASW-20, ASW-22 and AE-28.
4. Ensure that diesel starting air receivers are charged and that starting air system to pump drive engine is lined-up by opening valves CA-6, CA-4, CA-3, CA-12, CA-11, CA-2 and CA-1.
5. Ensure oiler on air starting system is at proper level.
6. Ensure that fire fighting pump is declutched from engine and that tow winch hydraulic system is properly aligned. (See Operating instructions for tow winch/central hydraulics crossover). NOTE: Valve line-up must be in normal condition before running pump drive engine. Ensure tow winch hydraulic reservoir is at proper level.
7. Ensure that 24V control power is available to engine.
8. Release engine lock-out switch.
9. For remote operation: Follow steps 1-7 above. Place local engine control switch in run position. Engine may be started and stopped from EOS.
10. Start engine by lifting start button on local control panel. Release start button after engine starts.
11. After engine starts, observe local or remote diesel engine instrumentation to verify proper engine operation.
12. Allow engine to warm up until all temperatures and pressures have stabilized.
13. Ensure engine is at idle when engaging fire pump clutch.
14. Adjust engine speed as required by moving governor control handle to maintain 170 PSI water pressure or 1850 RPM for tow machine operations.
15. To secure engine slowly return engine to idle, remove load and allow temperatures to cool approximately 3-5 minutes if engine has been under load.
16. Depress engine stop button on local control panel.

Placard 9. Pump Drive Engine

SEWAGE COLLECTION, HOLDING AND TRANSFER (CHT) SYSTEM

The CHT system has the following modes of operation:

a. Directly Overboard

b. Through the Marine Sanitation Device (MSD) to Overboard

c. To the Sewage Holding Tank

Directly Overboard

1. To direct sewage drains directly overboard, close SD-3 (sewage drain to holding tank) and SD-1 (sewage inlet to MSD) and open valves SD-2 and SD-13 (sewage overboard discharging).

Through the Marine Sanitation Device (MSD) to Overboard

1. To direct sewage drains to the MSD, close valves SD-3 (sewage drain to holding tank) and SD-2 and SD-13 (sewage overboard discharge) and open SD-1 (sewage inlet to MSD).

2. See MSD operating instruction for MSD discharge overboard.

To the Sewage Holding Tank

1. To direct sewage drains to the sewage holding tank for eventual discharge overboard or to shore connections close valves SD-1 (sewage inlet to MSD) SD-2 and SD-13 (sewage overboard discharge) and open valve SD-3 (sewage drain to holding tank).

Note: The tank level indicating system will sound an alarm when tank is at the 95% full condition.

2. To discharge sewage from holding tank to overboard, align system by opening valves as follows:

   #1 Sewage Discharge Pump: SD-5, SD-7, SD-8 and SD-13
   #2 Sewage Discharge Pump: SD-4, SD-6, SD-8 and SD-13

Note: When discharging sewage overboard from holding tank, pumping may be enhanced by leading plumbing drains to the holding tank for dilution of sewage.

3. Ensure power is available to #1 and #2 sewage discharge pump motor controllers.

4. Start either pump by depressing start button and observe pump discharge pressure gage and local tank level indicator meter.

5. To secure pump, depress stop button on motor controller.

6. To discharge sewage from holding tank to Port or Stbd shore connection align system by opening valves as follows:

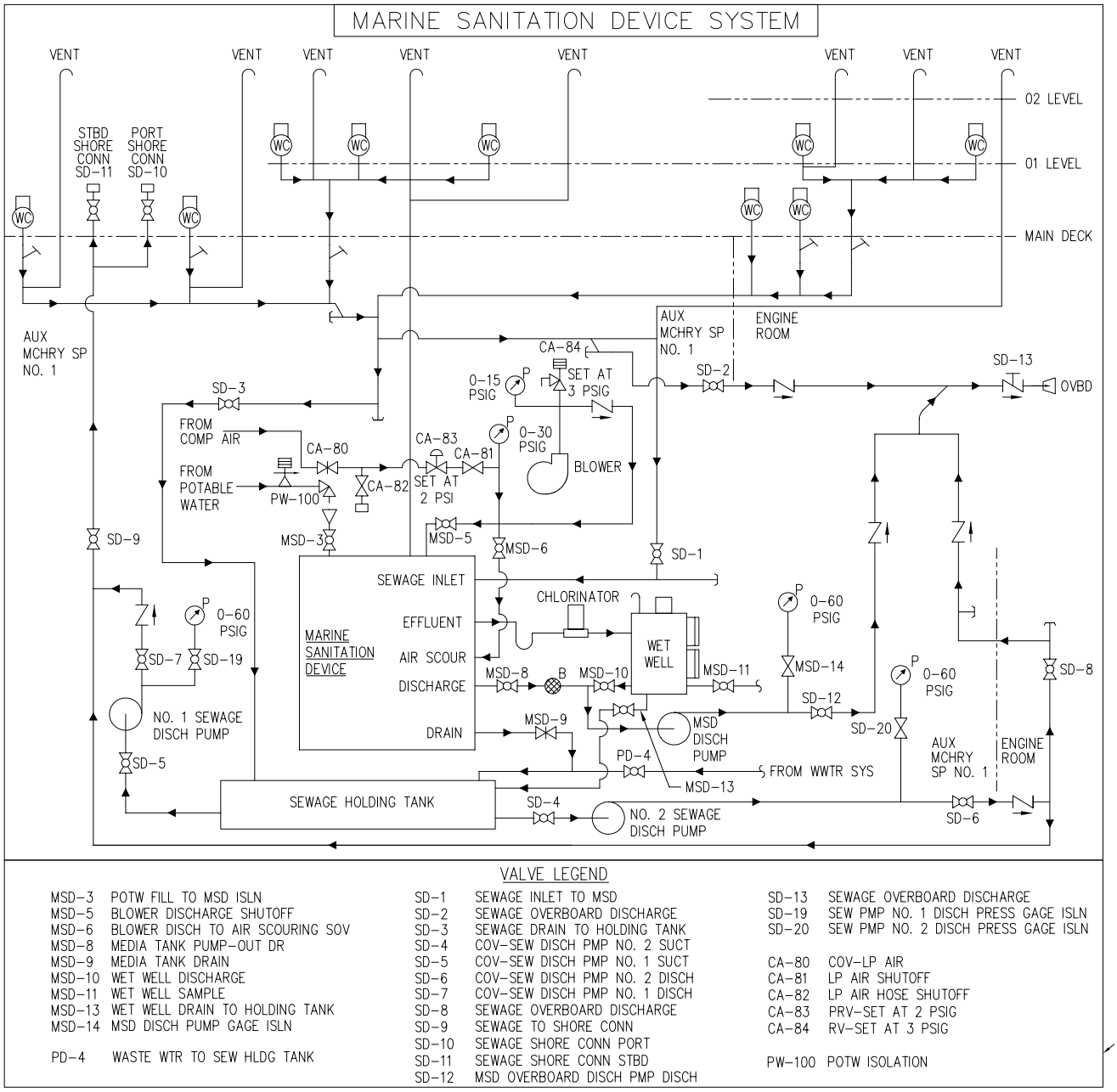
   #1 Sewage Discharge Pump to Port Conn.: SD-5, SD-7 and SD-10
   #1 Sewage Discharge Pump to Stbd Conn.: SD-5, SD-7 and SD-11

   #2 Sewage Discharge Pump to Port Conn.: SD-4, SD-6 and SD-10
   #2 Sewage Discharge Pump to Stbd Conn.: SD-4, SD-6 and SD-11

7. Ensure that shore connection chosen is properly connected to a suitable collection tank.

8. Follow steps 3 -5 above for start/stop of discharge pumps.

Placard 10. Sewage Collection, Holding, and Transfer (CHT) System



Placard 11. Marine Sanitation Device

FIRE FIGHTING/AFFF SYSTEM

Firefighting

1. Align the firefighting system to allow the diesel engine driven fire fighting pump to take suction from the forward sea chest and discharge up to the fire monitors by opening valves AE-28 and FM-1. Individual supply valves to fire monitors, FM-60, FM-61 and FM-62, may be opened as required.

2. Follow steps 1 -14 of pump drive engine operating instructions.

3. Open CA-73 and GS-111.

4. Clutch in fire fighting pump at idle and observe fire fighting pump discharge pressure gauge. Engine RPM shall be set at 2200 when discharging from two monitors.

5. Close CA-73 and GS-111 when pressure rises.

6. To secure system, return engine to idle, declutch fire fighting pump and follow steps 15-16 of pump drive engine operating instructions.

AFFF

1. Ensure AFFF tank is at the proper operating level.

2. Line up system to allow the AFFF pump to take suction from the AFFF storage tank and discharge to the in-line foam proportioner by opening valve FM-84.

3. Ensure power is available to the AFFF pump motor controller.

4. Follow steps 1 - 4 of fire fighting operating instructions.

5. Start AFFF pump by depressing start button on AFFF pump motor controller.

6. Observe system duplex pressure gauge at the foam proportioner. AFFF concentrate supply pressure should be approximately 5 PSI higher than the fire fighting supply pressure.

7. To secure system, depress stop button on the AFFF pump motor controller and allow fire fighting pump to continue discharging out of the monitors to flush system of remaining AFFF concentrate, close FM-84.

8. Upon completion of flushing system, approximately 2-3 minutes, declutch fire fighting pump and follow steps 15 -16 of pump drive engine operating instructions.

Placard 12. Firefighting/AFFF

SWITCHBOARD

SHORE POWER

To Connect Shore Power:

1. Ensure shore power breaker is open.
2. Connect shore power cable to plug. MN DK, FR 21.
3. Check for proper phase rotation.
4. Open all other breakers feeding 1S and 2S buses (i.e. SSDG No.1, No.2, EDG Feedback)
5. Close shore power breaker.

SINGLE GENERATOR OPERATION

1. Star1 55DG No.1 or No.2 (see operating instructions).
2. Adjust voltage to 440V, Frequency to 60 HZ.
3. Open all other breakers feeding 1S and 2S buses (shore power, EDG feedback other SSDG, if running).
4. Close generator breaker.
5. Adjust voltage and frequency as required.

PARALLEL OPERATION

NOTE: SSDG No.1 is set with isochronous governor.
SSDG No.2 is set with 3% droop governor.

1. Apply single SSDG to 1S/2S bus (see above).
2. Start second SSDG, adjust voltage and frequency to match on-line SSDG.
3. Turn synchroscope to incoming SSDG.
4. Adjust speed of incoming SSDG until synchroscope moves slowly clockwise (FAST).
5. When synchroscope is just before 1200 position, and synchronizing lamps are off, close breaker of incoming SSDG.
6. Adjust speed of droop SSDG (No.2) as load changes to maintain equal loads on both SSDGs.

SPLIT BUSS OPERATION

1. In case of emergency 1S and 2S buses may be fed separately. Open bus tie switch and follow steps for single generator operation for each SSDG. Caution: Under no circumstances should the bus tie switch attempted to be closed while both 15 and 25 buses are energized,

Placard 13. Switchboard (Sheet 1 of 3)

EDG OPERATION

Manual Run:

1. Start EDG (see operating instruction)
2. Open Main Bus Tie Breaker (Note: For push-button operation of motorized Main Bus Tie Breaker, mode switch must be in 'Hand' or 'Auto' and door on breaker closed.)
3. Close EDG breaker.

STAND BY (Normal at-sea condition):

1. Place MODE switch to "AUTO".
2. Place EDG engine control switch to auto start (see operating instructions).
3. Ensure that EDG engine is set up for STAND BY operation (see operating instructions).
4. Upon loss of power from main switchboard:

   EDG will start, the main bus tie circuit breaker will open and the EDG breaker will close automatically.

FEEDBACK MODE

With EDG running and breaker closed:

1. Ensure that no power is fed to the main switchboard, (i.e., SSDG No.1, SSDG No. 2 and shore power breakers are open).
2. Insert key and turn to feedback position.
3. Close main bus tie breaker and either 1S/E or 2S/E breaker on main switchboard.

Placard 13. Switchboard (Sheet 2 of 3)

SAFETY INTERLOCKS

SSDG # 1 or #2 Shore Power Feeding Main Switchboard with Main Bus Tie Closed and Feedback switch in 'Normal".

	CLOSED	CANNOT CLOSE
1.	SSDG # 1 Circuit Breaker	Shore Power Circuit Breaker
2.	SSDG #2 Circuit Breaker	Shore Power Circuit Breaker
3.	Shore Power Circuit Breaker	SSDG #1 Circuit Breaker
4.	Shore Power Circuit Breaker	SSDG #2 Circuit Breaker
5.	Main Bus Tie Circuit Breaker (ESWBD)	EDG Circuit Breaker
6.	1S/E Bus Tie Circuit Breaker	2S/E Bus Tie Circuit Breaker
7.	2S/E Bus Tie Circuit Breaker	1 S/E Bus Tie Circuit Breaker

EDG Running With Feedback Switch in Normal Position

8. EDG Circuit Breaker Main Bus Tie Circuit Breaker (ESWBD)

EDG Running with Feedback Switch in Feedback Position

9. EDG & Main Bus Tie Circuit Breaker SSDG # 1 Circuit Breaker (ESWBD)

10. EDG & Main Bus Tie Circuit Breaker SSDG #2 Circuit Breaker (ESWBD)

11. EDG & Main Bus Tie Circuit Breaker Shore Power Circuit Breaker (ESWBD)

POWER CIRCUIT BREAKER CANNOT CLOSE UNLESS SHORE POWER PLUG IS IN RECEPTACLE, BHD 21, MN DK.

Placard 13. Switchboard (Sheet 3 of 3)

NO.1 DIESEL GENERATOR SET

1. Ensure engine sump and jacket water cooling levels are at the proper operating levels.
2. Line-up fuel oil system to allow engine to take suction from and return to stbd day tank by opening valves FO-15, FO-21 and FO-35 or port day tank by opening valves FO-13, FO-14, FO-21, FO-34 and FO-33.
3. Line-up cooling system by opening valves FWC-9 and FWC-11.
4. Prime fuel oil system on engine, if necessary, with engine mounted handpump.
5. Ensure battery charger is energized and batteries are charged.
6. Start engine by depressing start button on local control panel or remotely in the EOS. Release start button after ef1gine starts. For remote start local switch must be in run position.
7. After engine starts, observe local or remote diesel engine instrumentation to verify proper engine operation.
8. Allow engine to warm up until all temperatures and pressures have stabilized.
9. See switchboard operating instructions for placing generator on-line.
10. To secure engine, remove load (see switchboard operating instructions).
11. Allow temperature to cool, approximately 3-5 minutes if engine has been under load.
12. Depress engine stop button on local control panel or remotely in EOS. In EOS, stop button must be held down until run light goes out.

Placard 14. No. 1 Diesel Generator Set

MAIN PROPULSION ENGINES

1. Ensure Port and Starboard main engine and reduction gear lube oil sumps and fresh water cooling systems are at the proper operating levels.

2. Ensure Port and Starboard main engine governor oil levels are at the proper operating level.

3. Open Port and Starboard main engine air box drains to remove any oil that may have accumulated. Close drains.

4. Check intake air filters for dirt and obstructions.

5. Ensure power is available to the reduction gear cooling pumps, main engine pre-lube pumps and main engine control panels.

6. Align main engine pre-lube systems by opening valves LO-47 and LO-48 and pre-lube engines for five minutes if engines have been shut down for twelve hours or longer. Do not exceed five minutes with valves open as oil will enter valve seats.

7. Align cooling water system by opening valves FWC-2, FWC-4, FWC-14, FWC-16, for port main engine and reduction gear and FWC-3, FWC-I, FWC-15 and FWC-13 for stbd main engine and reduction gear. Start reduction gear cooling pumps.

8. Ensure adequate supply of fuel oil is available in day tanks and open valves FO-15, FO-20 and F0-35 for stbd main engine taking suction from and returning to stbd day tank or valves FO-13, FO-14, FO-20, F0-34 and FO-33 for stbd main engine taking suction from and returning to the port day tank. Open valves F0-13, F0-19 and F0-33 for port main engine taking suction from and returning to port day tank or valves F0-15, F0-14, FO-19, FO-34 and FO-35 for port main engine taking suction from and returning to stbd day tank.

9. Ensure that diesel starting air receivers are charged and that starting air system to port and stbd main engines is lined-up by opening valves CA-1, CA-2, CA-3, CA-4, CA-12, CA-8 and CA-9.

10. Ensure that propulsion control air receiver is charged, air dryer is running and propulsion control system is set up for normal operation with propulsion control from EOS station and port and stbd main engine throttles in the neutral position.

11. Ensure that alarms are cleared on local control panels.

12. Ensure that governors emergency stops are pulled out.

13. Momentarily press engine start push-button on engine control cabinet to start turbo oil pump (allow turbo oil pump to run at least 60 seconds before starting engine).

14. Blow down cylinders to remove accumulated moisture by opening indicator cocks and rotate engine slowly (engine may be rotated by manually depressing starting solenoid valve while throttling air with engine mounted ball valve). Close indicator cocks after completion.

15. Push in governor emergency stops and ensure that overspeed trips are in the run position.

16. Start engine by depressing the start button on the local control panel or by pressing the remote start button in the EOS. Release start button after engine starts.

Placard 15. Main Propulsion Engines (Sheet 1 of 2)

17. After engine starts, observe local or remote instrumentation to verify proper engine and reduction gear operation. Check Main Engine oil sump level.

18. Secure pre-lube pumps.

19. See propulsion control instructions for operating main propulsion controls, engaging clutches and cooling shaft seals.

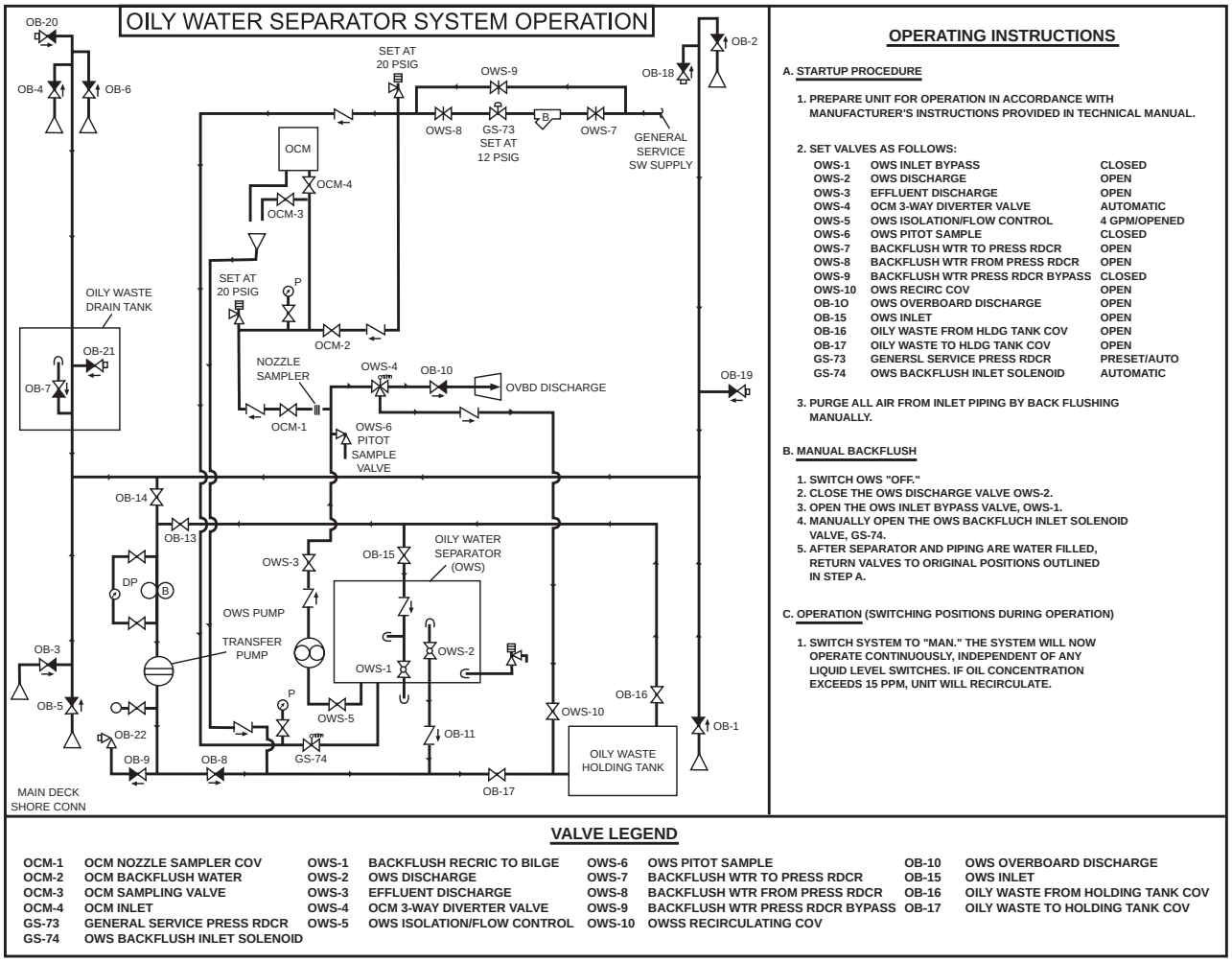
20. To secure engines, remove load and allow temperatures to cool, approximately 3-5 minutes if the engine has been under load.

21. Depress engine stop button on local control panel or remote panel in the EOS (in an emergency situation, engines may be shut down by tripping the overspeed trip lever).

22. After propulsion engine shutdown, ensure that turbo oil pump is operating for at least 15 minutes after shutdown.

23. Secure reduction gear cooling pumps.

Placard 15. Main Propulsion Engines (Sheet 2 of 2)



OPERATING INSTRUCTIONS

A. STARTUP PROCEDURE

1. PREPARE UNIT FOR OPERATION IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PROVIDED IN TECHNICAL MANUAL.

2. SET VALVES AS FOLLOWS:

OWS-1	OWS INLET BYPASS	CLOSED
OWS-2	OWS DISCHARGE	OPEN
OWS-3	EFFLUENT DISCHARGE	OPEN
OWS-4	OCM 3-WAY DIVERTER VALVE	AUTOMATIC
OWS-5	OWS ISOLATION/FLOW CONTROL	4 GPM/OPENED
OWS-6	OWS PITOT SAMPLE	CLOSED
OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
OWS-10	OWS RECIRC COV	OPEN
OB-1O	OWS OVERBOARD DISCHARGE	OPEN
OB-15	OWS INLET	OPEN
OB-16	OILY WASTE FROM HLDG TANK COV	OPEN
OB-17	OILY WASTE TO HLDG TANK COV	OPEN
GS-73	GENERSL SERVICE PRESS RDCR	PRESET/AUTO
GS-74	OWS BACKFLUSH INLET SOLENOID	AUTOMATIC

3. PURGE ALL AIR FROM INLET PIPING BY BACK FLUSHING MANUALLY.

B. MANUAL BACKFLUSH

1. SWITCH OWS "OFF."
2. CLOSE THE OWS DISCHARGE VALVE OWS-2.
3. OPEN THE OWS INLET BYPASS VALVE, OWS-1.
4. MANUALLY OPEN THE OWS BACKFLUCH INLET SOLENOID VALVE, GS-74.
5. AFTER SEPARATOR AND PIPING ARE WATER FILLED, RETURN VALVES TO ORIGINAL POSITIONS OUTLINED IN STEP A.

C. OPERATION (SWITCHING POSITIONS DURING OPERATION)

1. SWITCH SYSTEM TO "MAN." THE SYSTEM WILL NOW OPERATE CONTINUOUSLY, INDEPENDENT OF ANY LIQUID LEVEL SWITCHES. IF OIL CONCENTRATION EXCEEDS 15 PPM, UNIT WILL RECIRCULATE.

VALVE LEGEND

OCM-1	OCM NOZZLE SAMPLER COV	OWS-1	BACKFLUSH RECRIC TO BILGE	OWS-6	OWS PITOT SAMPLE	OB-10	OWS OVERBOARD DISCHARGE
OCM-2	OCM BACKFLUSH WATER	OWS-2	OWS DISCHARGE	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OB-15	OWS INLET
OCM-3	OCM SAMPLING VALVE	OWS-3	EFFLUENT DISCHARGE	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OB-16	OILY WASTE FROM HOLDING TANK COV
OCM-4	OCM INLET	OWS-4	OCM 3-WAY DIVERTER VALVE	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	OB-17	OILY WASTE TO HOLDING TANK COV
GS-73	GENERAL SERVICE PRESS RDCR	OWS-5	OWS ISOLATION/FLOW CONTROL	OWS-10	OWSS RECIRCULATING COV		
GS-74	OWS BACKFLUSH INLET SOLENOID						

Placard 16. Oil Water Separator

OILY BILGE SYSTEM

MODES OF OPERATION:

1. Primary drainage of bilge pockets to oily waste storage tank is through oily bilge transfer pump.

VALVE LINE-UP: Open OB-14, OB-8, OB-17 and approximate bilge pocket valve.

2. Transfer from drain tank to storage tank.

VALVE LINE-UP: Open OB-7, OB-14, OB-8 and OB-17.

3. Oily Water separation is normally from storage tank only.

VALVE LINE-UP: Open OB-16, OB-15, OB-10and OB-17.

OPERATION OF PUMP:

- Ensure built in reservoir is filled with 10 weight motor oil.

-Turn on air supply to pump.

-Monitor pump discharge pressure gauge and duplex suction pressure gauge.

- Turn off air supply to secure pump.

Placard 17. Oily Bilge System

ENGINE ROOM
FM-200 FIRE PROTECTION SYSTEM
FOR LOCAL OPERATION

1. DISCHARGE CYLINDER BY REMOVING LOCKING PIN AND OPERATING LEVER OF CONTROL HEAD MOUNTED ON THE CONTROL CYLINDER.

ALARM WILL SOUND 60 SECONDS PRIOR TO AGENT DISCHARGE, WARNING PERSONNEL TO EVACUATE SPACE. EQUIPMENT AND VENTILATEIOIN SYSTEM WILL SHUTDOWN.

IF NECESSARY, TIME DELAY MAY BE BY-PASSED BY REMOVING LOCKING PIN AND OPERATING TIME DELAY OVERRIDE LEVER.

IF SYSTEM FAILS TO OPERATE, GO TO FM-200 EMERGENCY RELEASE LEVER, AND FOLLOW INSTRUCTIONS POSTED.

Placard 18. FM-200 System Operation

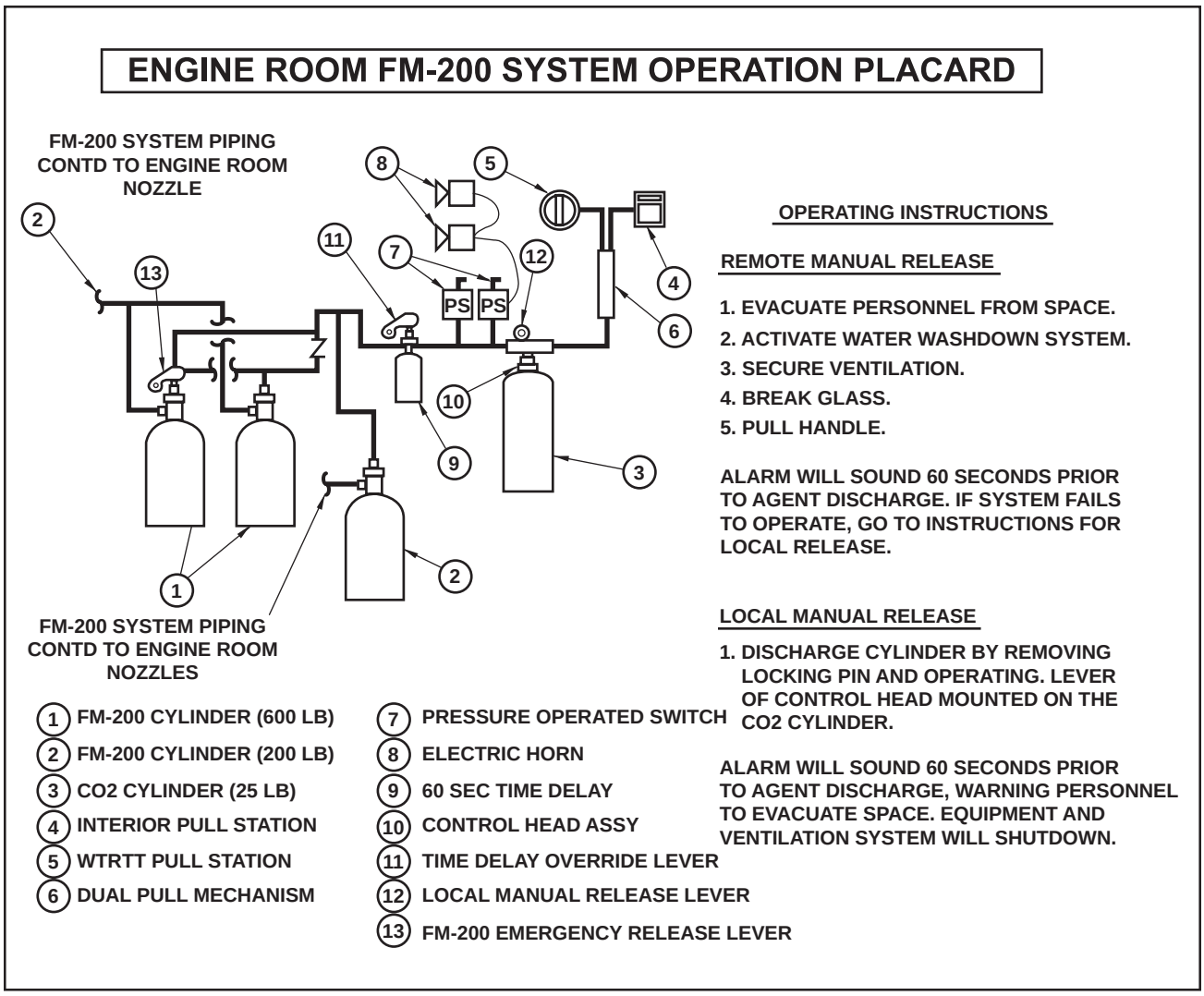
ENGINE ROOM EMERGENCY DISCHARGE OF FM-200
FIRE PROTECTION SYSTEM:

1. BREAK LOCKING PIN SEAL.
2. REMOVE LOCKING PIN.
3. OPERATE FM-200 EMERGENCY RELEASE LEVER.

WARNING

IN THIS MODE 60 SECOND TIME DELAY AUTOMATIC SHUTDOWNS, AUDIBLE ALARMS, AND VISUAL ALARMS WILL NOT OPERATE.

Placard 19. FM-200 System Emergency Discharge Operation



Placard 20. FM-200 System Operation Placard

COLD POTABLE WATER SYSTEM

OPERATION:

Cold Potable Water Service

1. Ensure power is available to #1 and #2 potable water pump motor controllers.
   CIRCUIT BREAKER PUMP
   PP5-4P-B(1) POT WTR PMP NO. 1
   PP5-4P-C(1) POT WTR PMP NO. 2

2. Ensure sufficient water is available in potable water storage tanks and align potable water system to allow pumps to take suction from port or stbd potable water tank and discharge to the hydropneumatic tank by opening valves as follows:

#1 Pump - PW-14 (Port Tank Suction), PW15 (Stbd Tank Suction), PW-16, PW-76, PW-18 and PW-78.
#2 Pump - PW-14 (Port Tank Suction), PW-15 (Stbd Tank Suction), PW-17, PW-77, PW-18 and PW-78.

All other valves in cold potable water system shall be opened as required to serve individual components and spaces.

3. Place either #l or #2 pump motor controller in the auto position. In the automatic mode the starting and stopping of the selected pump is controlled by a pressure switch mounted on the hydropneumatic tank and set to start pump at 40 PSI and stop at 60 PSI. In the manual mode the start stop control is done manually by depressing the start/stop push buttons.

CAUTION: Do not leave pumps unattended in the manual mode as pressure switch will not function. Normal operation is with one pump only in the auto mode.

4. To secure system place motor controllers in the manual mode and depress stop button.

Placard 21. Cold Potable Water

AIR CONDITIONING PLANT

Start Up:

1. Ensure crankcase heater has been energized at least twenty-four (24) hours prior to start-up.
2. Line-up valves for normal or single unit mode as indicated in valve line-up and indicators table. Line-up General Service System and supply SW to the condenser.
3. Apply power to fan coil unit R1-25-2 and R01-32-2.
4. Open compressor suction valve approximately one full turn.
5. Start compressor by placing main disconnect switch in the ON position. Immediately continue to open compressor suction valve, open slowly to prevent rapid pumping down. Observe suction pressure to maintain greater than 5 in Hg.
6. Monitor compressor operation for about five (5) minutes, if there is no sign of liquid refrigerant returning to the compressor, open suction valve wide, if there is evidence of liquid refrigerant returning to the compressor, throttle suction valve until proper suction is obtained.
7. Change over from normal to single unit mode secure one unit in accordance with securing instructions and open interconnecting valves RFAC-39 and RFAC-41.
8. Change over from single unit to normal mode shut interconnecting valves RFAC-39 and RFAC-41 arc' start another unit in accordance with start-up instructions.

Securing:

1. Close dehydrator inlet valve. Let compressor run until it cuts out on suction pressure switch.
2. TURN-OFF main disconnect switch.
3. Close compressor suction valve.

Note: Control power, (110 V), must be left on to keep heater energized.

Placard 22. Air Conditioning Plant

VALVE LINE-UP AND INDICATORS

Condensing Unit #1	Condensing Unit #2	Position or Reading			
		Turn-Off Mode (both)	Normal Mode (both Units)	Single Unit Mode	
				Op.	Non-Op.
GS33	GS34	Shut	Open	Open	Shut
GS69	GS70	Shut	Open	Open	Shut
GS36	GS37	Shut	Open	Open	Shut
GS83	GS72	Shut	Shut	Shut	Shut
Compressor Discharge Valve		Open	Open	Open	Open
Compressor Suction Valve		Shut	Open	Open	Shut
Condensor Outlet Valve		Shut	Open	Open	Shut
RFAC-39		Shut	Shut	Open	N/A
Dehydrator Outlet Valve		Shut	Open	Open	Shut
Dehydrator Bypass Valve		Shut	Shut	Shut	Shut
Dehydrator Inlet Valve		Shut	Open	Open	Shut
Refrigerant Pressure Gauge Valve		Open	Open	Open	Open
Oil Pressure Gauge Valve		Shut	Open	Open	Shut
RFAC-30	RFAC-31	Shut	Open	Open	N/A
RFAC-29	RFAC-58	Shut	Open	Open	N/A
RFAC-37	RFAC-33	Shut	Open	Open	N/A
RFAC-36	RFAC-32	Shut	Open	Open	N/A
RFAC-42	RFAC-35	Shut	Open	Open	N/A
RFAC-38	RFAC-34	Shut	Open	Open	N/A
---	RFAC-56	Shut	Open	Open	N/A
---	RFAC-40	Shut	Open	Open	N/A
Relief Valve By-Pass Valve (Equalizing Line)		Shut	Open	Open	Shut
Purge Valve		Shut	Shut	Shut	Shut
Charge and Drain Valve		Shut	Shut	Shut	Shut
RFAC-41		Shut	Shut	Open	N/A
RFAC-55	RFAC-54	Shut	Open	Open	Shut
Discharge Pressure Gauge (PSIG)		N/A	120-130	120-130	N/A
Suction Pressure Gauge		N/A	1 - 3 in/hg	1 - 3 in/hg	N/A
Oil Pressure Gauge		N/A	Note 1	Note 1	N/A
Inlet Water Temperature		N/A	85 °F Design	85 °F Design	N/A
Outlet Water Temperature		N/A	92.3 °F Design	92.3 °F Design	N/A
Suction Gas Temperature		N/A	25 - 15 °F	25 - 15 °F	N/A
Liquid Line Temperature		N/A	100 - 110 °F	100 - 110 °F	1/8 - 1/2
Liquid Level Indicator		1/8 - 1/2	1/8 or slightly lower	1/8 or slightly lower	1/8 - 1/2
Oil Level Indicator		1/4 - 3/4	1/4 - 3/4	1/4 - 3/4	1/4 - 3/4
Moisture Indicator		Blue	Blue	Blue	Blue

Note: Oil pressure should be 16-22 PSIG above suction pressure.

Placard 23. HVAC Valve Line-up

REFRIGERATION

Start Up:

1. Ensure crankcase heater has been energized at least twenty-four (24) hours prior to start up.

2. Line-up valves for pulldown or holding mode as indicated in valve line-up and indicator table. Line-up General Service System and supply SW to the condenser.

3. Apply power to unit coolers in chill box and freeze room.

4. Open compressor suction valve approximately one full turn.

5. Start compressor by placing main disconnect switch in the ON position. Immediately continue to open compressor suction valve, open slowly to prevent rapid pumping down.

6. Monitor compressor operation for above five (5) minutes, if there is no sign of liquid refrigerant returning to the compressor, open suction valve wide, if there is evidence of liquid refrigerant returning to compressor, throttle suction valve until proper suction is obtained.

7. Change over from pulldown to holding mode, secure one unit in accordance with securing instructions and open interconnecting valves RFSS-13 and RFSS-20.

Securing:

1. Close dehydrator inlet valve. Let compressor run until it cuts out on suction pressure switch.

2. TURN-OFF main disconnect switch.

3 Close compressor suction valve.

NOTE: Control power, (110V), must be left on to keep heater energized.

Placard 24. Refrigeration

VALVE LINE-UP AND INDICATORS

Condensing Unit #1	Condensing Unit #2	Position or Reading			
		Turn-Off Mode (both)	Normal Mode (both Units)	Holding Mode	
				Op.	Non-Op.
GS38	GS39	Shut	Open	Open	Shut
GS67	GS68	Shut	Open	Open	Shut
GS48	GS49	Shut	Open	Open	Shut
GS82	GS71	Shut	Shut	Shut	Shut
Compressor Discharge Valve		Open	Open	Open	Open
Compressor Suction Valve		Shut	Open	Open	Shut
Condensor Outlet Valve		Shut	Open	Open	Shut
RFSS-13		Shut	Shut	Open	N/A
Dehydrator Outlet Valve		Shut	Open	Open	Shut
Dehydrator Bypass Valve		Shut	Shut	Shut	Shut
Dehydrator Inlet Valve		Shut	Open	Open	Shut
Refrigerant Pressure Gauge Valve		Open	Open	Open	Open
Oil Pressure Gauge Valve		Shut	Open	Open	Shut
RFSS-8	RFSS-9	Shut	Open	Open	Shut
RFSS-11	RFSS-12	Shut	Open	Open	Shut
RFSS-14	RFSS-15	Shut	Open	Open	Shut
RFSS-19		Shut	Open	Open	Shut
RFSS-16		Shut	Shut	Open	Shut
RFSS-18		Shut	Shut	Open	Shut
RFSS-17		Shut	Open	Shut	N/A
RFSS-10		Shut	Open	Open	N/A
Relief Valve By-Pass Valve (Equalizing Line)		Shut	Open	Open	Shut
Purge Valve		Shut	Shut	Shut	Shut
Charge and Drain Valve		Shut	Shut	Shut	Shut
RFSS-20		Shut	Shut	Open	N/A
RFSS-53	RFSS-52	Shut	Open	Open	Shut
Discharge Pressure Gauge (PSIG)		N/A	120-130	120-130	N/A
Suction Pressure Gauge		N/A	2.4 PSIG to 2.3 in/hg	2.4 PSIG to 2.3 in/hg	N/A
Oil Pressure Gauge		N/A	Note 1	Note 1	N/A
Evaporator Pressure Regulator		N/A	21 to 28 PSIG	21 to 28 PSIG	N/A
Inlet Water Temperature		N/A	85 °F Design	85 °F Design	N/A
Outlet Water Temperature		N/A	92.3 °F Design	92.3 °F Design	N/A
Suction Gas Temperature		N/A	-15 to -25 °F	-15 to -25 °F	N/A
Liquid Line Temperature		N/A	100 - 110 °F	100 - 110 °F	N/A
Liquid Level Indicator		1/8 - 1/2	1/8 or slightly lower	1/8 or slightly lower	1/8 - 1/2
Oil Level Indicator		1/4 - 3/4	1/4 - 3/4	1/4 - 3/4	1/4 - 3/4
Moisture Indicator		Blue	Blue	Blue	Blue

Note: Oil pressure should be 16-22 PSIG above suction pressure.

Placard 25. Refrigeration Valve Line-up

STERN TUBE SEAL

Normal Operations

1. Stern tube seal operates without operator adjustment. During normal operations. a continuous sea water flush to the seal cavity must be maintained at a pressure of about 10 PSIG.

2. Valves GS-42 and GS-43 should always be open.

Emergency Operations

1. Disable start capability of main propulsion engine.

2. To prevent uncontrolled leakage, the shaft must be stopped and the inflatable seal pressurized. Connect hose from reducing station (CA-31) to quick disconnect for seal and open (CA-23) ships service air isolation valve pressurize to 25 PSI.

3. See John Crane Technical Manual for instructions to convert sealing arrangement to a stuffing box in case of emergency.

Placard 26. Stern Tube Seal

FIREMAIN/WDCM/GENERAL SERVICE SYSTEM

At all times one pump shall be aligned for general service and one for standby firemain.

FIREMAIN

1. Align firemain for #1 and #2 fire and general service pump supply by opening valves as follows:

   #1 Fire & General Service Pump. AE-29, FM-2, FM-3, FM-6 and FM-16
   #2 Fire & General Service Pump. AE-29, FM-2, FM-3, FM-7 and FM-14

Note: Valve alignment of standby fire pump for firemain service shall be maintained at all times when pump is set for remote control. Standby pump shall be determined by pilothouse indicator.

Individual fire station valves shall be opened as required.

2. Ensure power is available to motor controller of pump selected for use on firemain.

3. Place motor controller in either the local or remote position and start pump by depressing start button. Remote start-stop control is from pilothouse and EOS.

4. To secure system depress local or remote stop button as required. Remote start and stop of fire pump may be verified by the indicating light at the remote start/stop station.

5. As a backup to the fire and general service pumps, the diesel driven fire fighting pump may be used to feed the firemain. Open valves AE-28, FM-l and FM-13. Individual fire station valves shall be opened as required.

6. Use fire fighting system operating instructions to start/stop diesel driven fire fighting pump.

WDCM

1. Align the WDCM system for # 1 or #2 fire and general service pump. supply by opening valves as follows:

   #1 Fire & General Service Pump. AE-29, FM-2, FM-3, FM-6, FM-16 & WDCM-11
   #2 Fire & General Service Pump. AE-29, FM-2, FM-3, FM-7, FM-14 & WDCM-11

2. Follow steps 2 -6 of firemain instructions to start/stop fire and general service pumps or diesel driven fire fighting pump.

3. When using the diesel driven fire fighting pump to feed to WDCM system, open valves AE-28, FM-1, FM-13 and WDCM-11.

Placard 27. Fire Main/WDCM/General Service System (Sheet 1 of 2)

GENERAL SERVICE SYSTEM

1. Align general service system to #1 and #2 fire and general service pump supply by opening valves as follows:

   #1 Fire & General Service Pump. AE-29, FM-2, FM.3, FM-6, FM-17, FM-9 and GS-12
   #2 Fire & General Service Pump, AE-29, FM-2, FM-3, FM-7, FM-15, FM-9 and GS-12

Individual component supplies and overboards shall be opened as required.

2. Follow steps 2-4 of firemain instructions to start/stop fire and general service pumps.

3. Ensure that pressure reducing station is set for 60 PSI.

EMERGENCY BILGE SUCTION

1. The engine room bilge area is fitted with an emergency bilge suction which is led directly to the suction side of fire and general service pump No.1 for discharge overboard.

2. Align system for #1 and general service pump suction by opening valves as follows:

   #1 Fire and General Service Pump: FM-4, FM-6, FM-8 and FM-31

3. Follow steps 2-4 of firemain instructions to start/stop fire and general service pumps.

Placard 27. Fire Main/WDCM/General Service System (Sheet 2 of 2)

ENGINE ROOM
FM-200 FIRE PROTECTION SYSTEM
IN CASE OF FIRE

1. EVACUATE PERSONNEL FROM SPACE.
2. ACTIVATE WATER WASHDOWN SYSTEM.
3. SECURE VENTILATION.
4. BREAK GLASS.
5. PULL HANDLE.

ALARM WILL SOUND 60 SECONDS PRIOR TO AGENT DISCHARGE. IF SYSTEM FAILS TO OPERATE, GO TO AMS 2, FOLLOW INSTRUCTIONS POSTED.

Placard 28. FM-200 System Operation (Main deck vestibule and fantail frame 21)

TO SECURE ENGINE ROOM VENTILATION, MANUALLY CLOSE THE FOLLOWING:

1. ENG RM ENTRANCE DOOR
2. AMS II SLIDING STRTT DOOR
3. EOS ESCAPE SCUTTLE
4. AMS I ESCAPE SCUTTLE
5. AMS I EXHAUST COVER (STBD)
6. ENG RM SUPPLY DAMPER (PORT/STBD)
7. ENG RM EXH DAMPER (PORT/STBD)
8. AMS I SUPPLY COVER (PORT)

Placard 29. FM-200 System Ventilation Closure Instruction Plate (Main deck vestibule and fantail frame 21)

CAPSTAN

PRE-USE CHECKS
1. Make sure that unit has been properly lubricated and serviced.
2. Visually inspect capstan and foundation for damage.
3. Visually inspect control station for obvious damage. Ensure control handle is securely mounted.
4. Inspect rubber boot for serviceability.
5. Observe that control operates smoothly, does not bind, and returns to

NEUTRAL (center) position when released.

OPERATION
1. Pressurize central hydraulic system as described on motorized hydraulic power unit operating instructions.
2. Stroke directional control valve by pulling or pushing the handle in the desired heave or payout direction.
3. Observe capstan to ensure capstan responds to controls.
4. Control speed by throttling the directional control valve.

Placard 30. Capstan

CARGO CRANE

Pre-Use Checks

A. Make sure that unit has been properly lubricated and serviced.

B. Make sure Boom is not lashed down.

C. Make sure that all controls are in the neutral center position.

D. Make sure the wire rope is not frayed or damaged.

E. Ensure work area around crane is clear of personnel and equipment.

F. Do not attempt to lift loads which exceed load chart ratings.

Operation

1. Energize central hydraulic system (see Central Hydraulic System Operating Instructions).

a. Swing Operation: To swing crane to the right, pull control/ever backward. To swing the crane to the left, push the control lever forward.

b. Telescope Operation: To extend the Boom, push the control lever forward. To retract the Boom, pull the control lever back.

CAUTION
When extending boom observe block. It may be necessary to lower block to prevent two-blocking block.

c. Winch Operation: To lower the hook, push the control lever forward. To hoist the hook, pull the control lever back.

d. Main Boom Operation: To lower the Main Boom, push the control lever forward. To raise the Main Boom pull the control lever back.

Note: All control levers are attached to the crane spindle. Control levers are spring centered proportional control. When levers are released they will automatically return to the neutral position, Moving the levers progressively farther from the neutral position in either direction will increase the rate at which the controlled function operates. Control levers should be operated smoothly
to prevent surging.

Placard 31. Cargo Crane

ANCHOR WINDLASS

OPERATION:

Powered Wildcats

1. Ensure control lever is in the neutral position.
2. Activate central hydraulic system (see motorized hydraulic power unit operating instructions).
3. Select speed range, LSHT or HSLT.
4. Engage Dog Clutch

a. Loosen both wing nuts on face of shifting ring.

b. Insert special tool in nearest slot in clutch shifting ring.

c. Push forward (50° movement of clutch shifter ring is required to fully engage or disengage Dogs).

5. Remove chain stoppers if set.
6. Release band brake.
7. Operate control lever for desired speed and direction.

Gypsey Heads Only

1. Ensure control lever is in the Neutral position.
2. Activate central hydraulic system.
3. Engage band brake and set chain stoppers.
4. Disengage Dog Clutch.
5. Select speed range.
6. Operate control/ever for desired speed and direction.

Free Wheeling

1. Remove chain stoppers.
2. Disengage Dog Clutch.
3. Release band brake to allow anchor to free fall. Manipulate brake to retard or stop the anchor as desired.

Caution: During free falling, carefully observe speed to prevent chain from "Jumping the Cat" due to centrifugal force. Apply brake slowly or chain may jump a link.

LSHT: Low Speed High Torque (For Heavy Loads)
HSLT: High Speed Low Torque (For Normal Loads and Speeds)

Placard 32. Anchor Windlass

EMERGENCY DIESEL GENERATOR

MANUAL START:

1. Ensure engine and jacket water cooling levels are at the proper operating levels.
2. Line-up fuel system to allow engine, to take suction from and return to EDG day tank by opening valve F0-32.
3. Prime fuel oil system on engine, if necessary, with engine mounted hand pump.
4. Ensure battery charger is energized and batteries are charged. Either battery bank 1 or 2 may be used, both are continuously charged.
5. Set emergency switchboard engine control switch to hand.
6. Release emergency switchboard engine control switch to hand.
7. Start engine by turning panel switch to engine start.
8. After engine starts, observe local instrumentation to verify proper engine operation.
9. Allow engine to warm up until all temperatures and pressures have stabilized.
10. See switchboard operating instructions for placing generators on-line.
11. To secure engine, remove load (see switchboard operating instructions).
12. Allow temperatures to cool approximately 3-5 minutes if engine has been under load.
13. Place engine mode switch in the stop position.

AUTOMATIC START:

1. Ensure steps 1-6 above are performed.
2. Place model switch to the auto position.
3. See switchboard operating instructions for automatic start sequence.

Placard 33. Emergency Diesel Generator (Sheet 1 of 2)

EDG OPERATION

MANUAL RUN

1. Start EDG (see operating instruction)

2. Open Main Bus Tie Breaker (Note: For pushbutton operation of motorized Main Bus Tie Breaker, mode switch must be in “Hand” or “Auto” and door on breaker closed.)

3. Close EDG breaker.

STAND BY

1. Place MOED switch to “AUTO”.

2. Place EDG engine control switch to auto start (see operating instructions.)

3. Ensure that EDG engine is setup for a STAND By operation (see operating instructions.)

4. Open loss of power from main switchboard:
   EDG will start, the main bus tie circuit breaker will open and the EDG breaker will close automatically.

FEEDBACK MODE

With EDG running and breaker closed:

1. Ensure that no power is fed to the main switchboard (i.e. SSDG1, SSDG 2. and shore power breakers are open).

2. Inset key and turn to feedback position.

3. Close main bus tie breaker and either 1s/E or 2s/E breaker on main switcboard.

Placard 33. Emergency Diesel Generator (Sheet 2 of 2)

TOW WINCH

PRE-USE CHECKS

A. Make sure that unit has been properly lubricated and serviced.

B. Visually inspect Remote Control Station for damage or missing parts.

C. Check spools, gears, controls and clutches for foreign objects.

D. Check wire rope for damage or corrosion.

OPERATION

Operation - Start pump drive engine with hydraulic system aligned for normal operation. (See pump Drive Engine Operation Instructions).

Back-up Operation - Align valves in accordance with Central Hydraulic System Operating Instructions. Start both motorized hydraulic system pumps. (See Central Hydraulic System Operating Instructions).

2. Energize tow winch control panel.

MODES OF OPERATION

CAUTION

Do not exceed 80 FPM Payout speed while powering with the hydraulic motor. Overhauling the motor will cause cavitation and severe mechanical damage.

The tug and speed must be carefully controlled while powering out the line because the tug can easily overpower the towing machine motor.

1. Payout or Heave, Normal and Low Speed Ranges - Set the clutch brake and release the auxiliary brake. With the control lever in NEUTRAL position put the speed range selector knob into the desired position, up for low speed, down for normal speed. Select location of operation, put Remote-Local selector up for Local down for Remote. Push the control lever in the PAYOUT or HEAVE direction. The machine will run at normal speed proportional to the lever movement.

CAUTION

Since this procedure produces heat in the clutch-brake band it must be carefully observed so as not to smoke the brake lining. If the band overheats, release the clutch-brake compressor and/or slow down the tug.

In the event of overheat and subsequent tightening of the clutch-brake, the clutch-brake may freeze to the drum surface if left tight for long periods of time. Loosen the clutch-brake at the earliest opportunity to assure that it does not stick.

Check tug speed before tightening the clutch-brake. Severe shock loading can occur if the clutch-brake is tightened while the line is being pulled out at full speed. The speed should be minimal when the clutch-brake is tightened.

2. Free Spooling - With the towline under light tension and the hydraulic motor in its stopped and braked condition, the clutch-brake set and the auxiliary brake released, slowly release the clutch-brake compressor until the line begins to pull out.

The towline may be pulled out at a speed of up to 400 ft./min. (approximately 4 knots). Tension can be maintained on the rope by adjusting the clutch-brake compressor to achieve a slight braking action on the rotating drum.

Placard 34. Towing Machine (Sheet 1 of 2)

WARNING

Never engage the dog while the drum is rotating in the payout direction. This could break the dog and could cause serious injury to personnel in the vicinity.

4. Emergency Release of Towline - Release the clutch-brake and auxiliary brake and allow towline to pull off. When towline stops at 200 ft. push max cable OFF pushbutton to by-pass automatic stop.

5. Gypsy Head Use - Loosen clutch-brake to allow free rotation of the shaft. Tighten auxiliary brake. Put speed range selector knob into the desired position, up for low speed, down for normal speed. Select location at operation. Put Remote-Local selector up for Local, down for Remote. Operate machine as in HEAVE or PAYOUT mode.

Placard 34. Towing Machine (Sheet 2 of 2)

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
PREPARATION FOR USE

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

GENERAL

The procedures contained in this work package are provided for the use of personnel while operating the LT. It is important for the operators/crew to have a basic understanding of the performance of all vessel operations. Performing multiple procedures simultaneously requires the operators to act in a coordinated manner to ensure proper performance of the tasks assigned. The operators may have to vary given procedures to fit the individual tasks as required.

NOTE

This operating procedure assumes that all circuit breakers/switches on the power distribution panels, lighting panels, load center panels, switchboards, and equipment are in the OFF position, and that the vessel is connected to shore power.

1. In the emergency diesel generator room, at the emergency diesel generator switchboard, set the 3-10KVA 1Ø XFMRS circuit breaker (figure 1, item 1) to ON.

2. In the emergency diesel generator room, at the emergency diesel generator control panel, set the RESET control switch (figure 2, item 1) to OFF.

NOTE

Circuit breakers for equipment vital to the LT operation are located on the emergency switchboard bus. They are electrically powered from the main switchboard bus tie. These systems operate on normal ship power and/or emergency power

3. In the enclosed operating space, at the main switchboard, set the BUS TIE CIRCUIT BREAKER (figure 3, item 1) to ON. Place all other main switchboard circuit breakers in the OFF position.

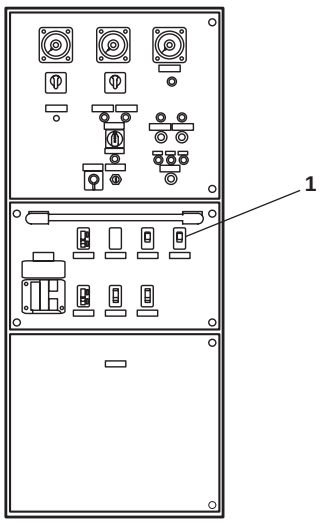


Figure 1. Emergency Switchboard

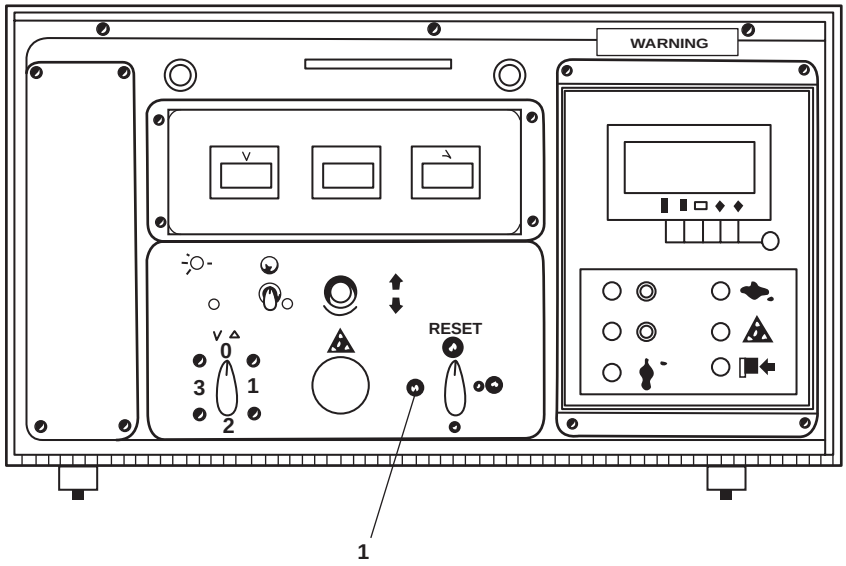


Figure 2. Emergency Diesel Generator Control Panel

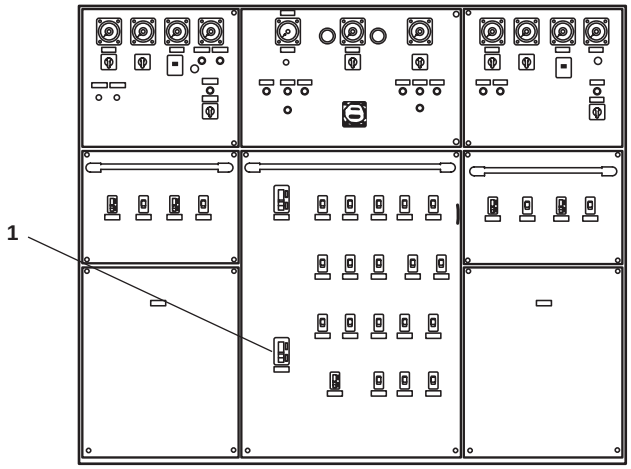


Figure 3. Main Switchboard

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
POWER GENERATION

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

BEFORE OPERATING THIS EQUIPMENT

The following operating procedure may be run partially in sequence or in parallel to allow the crew to bring the Large Tug (LT) from a shore powered condition to a full ship's power operating condition. The provided instructions bring each subsystem/equipment into operation. All subsystem equipment must have the required preventive maintenance services performed before the commencement of normal operations. The intent is to perform the Preventive Maintenance Checks and Services (PMCS) as the vessel is prepared for operation.

POWER GENERATION

1. Set up the following switchboards and lighting panels.

   a. In the crew's mess, at 120V main deck, 01 & 02 emergency lighting panel No. 1, set the following circuit breakers to ON:

      (1) MAIN DECK EMERGENCY LIGHTING. (figure 1, item 1)

      (2) 01 LEVEL EMERGENCY LIGHTS. (figure 1, item 2)

      (3) RADIO ROOM EMERGENCY LIGHTS. (figure 1, item 3)

      (4) ALARM SWITCHBOARD. (HIGH TEMPERATURE & SPRINKLER). (figure 1, item 4)

      (5) REFRIGERATOR STORE ROOM LIGHT. (figure 1, item 5)

      (6) FREEZER ALARM (figure 1, item 6)

      (7) PILOT HOUSE EMERGENCY LIGHTS. (figure 1, item 7)

      (8) FM-200 SYSTEM. (figure 1, item 8)

   b. In the aft 01 level passageway, at 120V exterior emergency lighting panel No. 2, set following circuit breakers to ON:

      (1) INFL BOAT FLOODLIGHT. (figure 2, item 1)

      (2) 01 LEVEL WEATHER DECK LIGHTS. (figure 2, item 2)

      (3) ROTARY CLEARVIEW WIPER AND HEATER. (figure 2, item 3)

      (4) BOW FLOODLIGHTS. (figure 2, item 4)

      (5) LIFE RAFT FLOODLIGHT (PORT). (figure 2, item 5)

      (6) LIFE RAFT FLOODLIGHT (STARBOARD). (figure 2, item 6)

      (7) PILOTHOUSE WEATHER DECK LIGHTS. (figure 2, item 7)

      (8) TOWING FLOODLIGHTS. (figure 2, item 8)

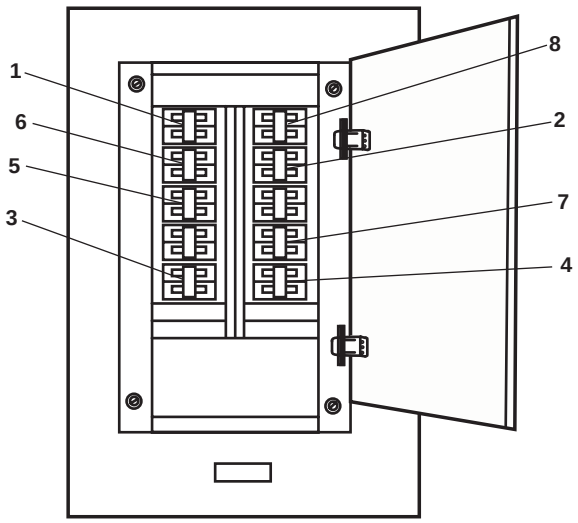


Figure 1. 120V Main Deck, 01 & 02 Emergency Lighting Panel No. 1

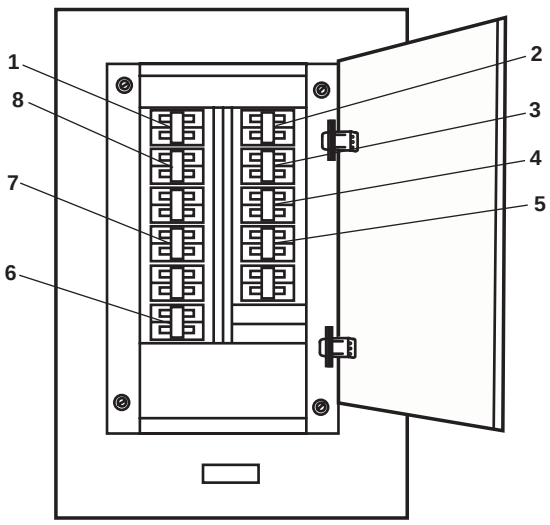


Figure 2. 120V Exterior Emergency Lighting Panel No. 2

NOTE

Ensure that the battery chargers are turned ON.

c. In the engine room, starboard side, at 120V emergency distribution panel No. 1, set the following circuit breakers to ON:

(1) ENGINE ROOM EMERGENCY LIGHTS. (PORT). (figure 3, item 1)

(2) ENGINE ROOM EMERGENCY LIGHTS. (STBD). (figure 3, item 2)

(3) AMS No. 2. EMERGENCY LIGHTS. (figure 3, item 3)

(4) MACHINERY DC CONTROL BATTERY CHARGER. (figure 3, item 4)

(5) MONITOR SYSTEM CIRCUIT. (figure 3, item 5)

(6) SSDG No. 1. BATTERY CHARGER. (figure 3, item 6)

(7) REMOTE PROPULSION INDICATOR PANEL. (figure 3, item 7)

(8) STEERING GEAR ROOM & TOWING GEAR LIGHT. (figure 3, item 8)

(9) BOW THRUSTER & AMS No. 1. EMERGENCY LIGHTS. (figure 3, item 9)

NOTE

If necessary to silence the fire alarm, obtain the key, unlock the fire and smoke detection panel, and press the ALARM SILENCE pushbutton.

(10) FIRE DETECTION SYSTEM. (figure 3, item 10)

d. In the 01 level passageway, at 120V distribution panel No. 2, set the following circuit breakers to ON:

(1) 01 LEVEL PORT LIGHTS. (figure 4, item 1)

(2) 01 LEVEL STARBOARD RECEPTACLES. (figure 4, item 2)

(3) 01 LEVEL PORT RECEPTACLES. (figure 4, item 3)

(4) RADIO ROOM RECEPTACLES. (figure 4, item 4)

(5) PILOTHOUSE RECEPTACLES. (figure 4, item 5)

(6) 01 LEVEL STARBOARD LIGHTS. (figure 4, item 6)

(7) 01 LEVEL PASSWAY LIGHTS. (figure 4, item 7)

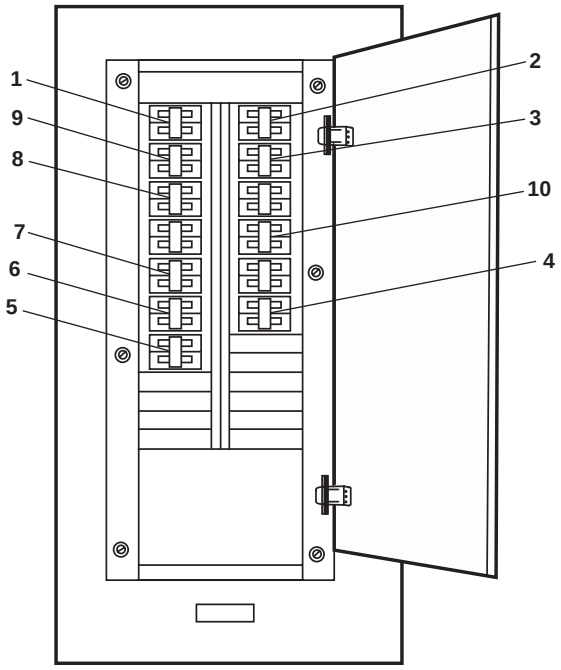


Figure 3. 120 V Emergency Distribution Panel No. 1

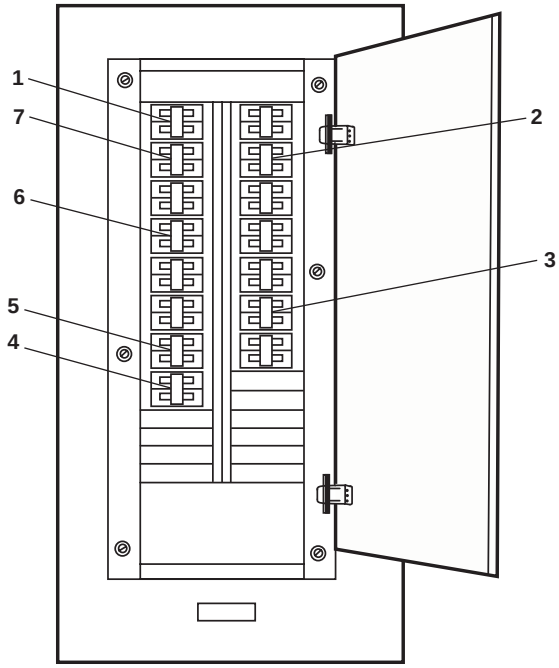


Figure 4. 120V Distribution Panel No. 2

e. In the main deck passageway, at 120V distribution panel No. 3, set the following circuit breakers to ON:

(1) MAIN DECK STARBOARD LIGHTS. (figure 5, item 1)

(2) MAIN DECK PORT RECEPTACLES. (figure 5, item 2)

(3) MESS ROOM LIGHTS. (figure 5, item 3)

(4) MAIN DECK STARBOARD RECEPTACLES. (figure 5, item 4)

(5) MAIN DECK PASSAGEWAY LIGHTS. (figure 5, item 5)

(6) MAIN DECK PORT LIGHTS. (figure 5, item 6)

f. In the galley, at 120V distribution panel No. 1, set the following circuit breakers to ON:

(1) GALLEY RECEPTACLES. (figure 6, item 1)

(2) GALLEY LIGHTS. (figure 6, item 2)

(3) GAYLORD CONT CABINET. (figure 6, item 3)

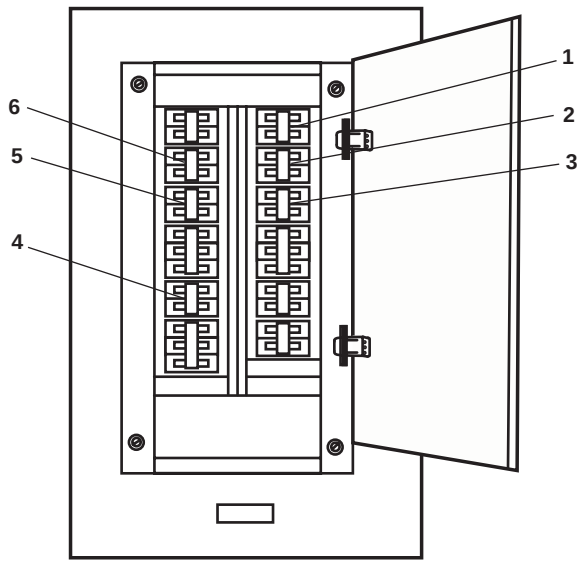


Figure 5. 120V Distribution Panel No. 3

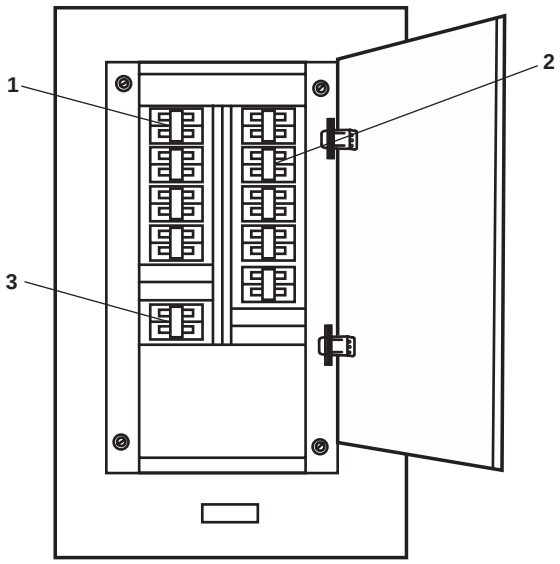


Figure 6. 120V Distribution Panel No. 1

g. In the engine room, at 120V distribution panel No. 4, set the following circuit breakers to ON:

(1) ENGINE ROOM LIGHTS. (figure 7, item 1)

(2) BOWTHRUSTER COMPT & AUXILIARY MACHINERY SPACES 1 & 2 LIGHTS. (figure 7, item 2)

(3) HOLD LEVEL & FAN TAIL RECEPTACLES. (figure 7, item 3).

(4) SHIPS SERVICE DIESEL GENERATOR JACKET WATER HEATER No .2. (figure 7, item 4)

(5) BOW THRUSTER ENGINE JACKET WATER HEATER. (figure 7, item 5)

(6) PUMP DRIVE ENGINE JACKET WATER HEATER. (figure 7, item 6)

(7) SHIPS SERVICE DIESEL GENERATOR JACKET WATER HEATER No. 1. (figure 7, item 7)

h. In the engine room, at 440V power panel No. 1, set the following circuit breakers to ON:

(1) MAIN ENGINE JACKET WATER No. 1./TURBO OIL PUMP No. 1/WATER LAY OVER PUMP No. 1. (figure 8, item 1)

(2) MAIN ENGINE JACKET WATER No. 2./TURBO OIL PUMP No. 2/WATER LAY OVER PUMP No. 2. (figure 8, item 2)

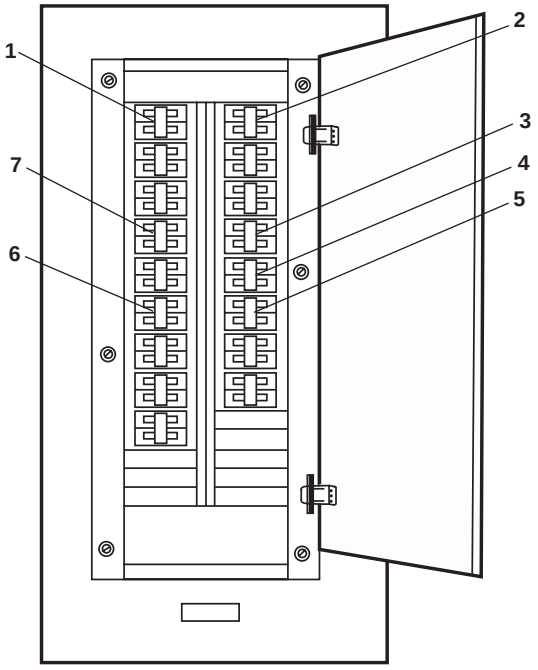


Figure 7. 120V Distribution Panel No. 4

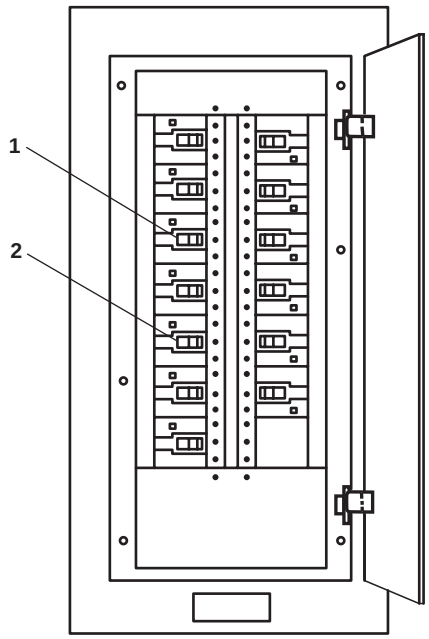


Figure 8. 440V Power Panel No. 1

i. In the engine room, at the machinery dc control distribution panel, set the MACHINERY MONITOR SYS circuit breaker (figure 9, item 1) to ON.

j. In the engine room on the aft bulkhead of the EOS, set to ON the switch (figure 10, item 1) on the machinery monitoring system CPU multi-remote panel.

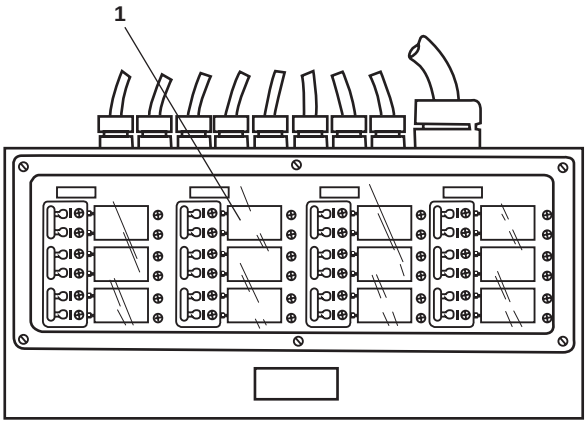


Figure 9. Machinery DC Control Distribution Panel

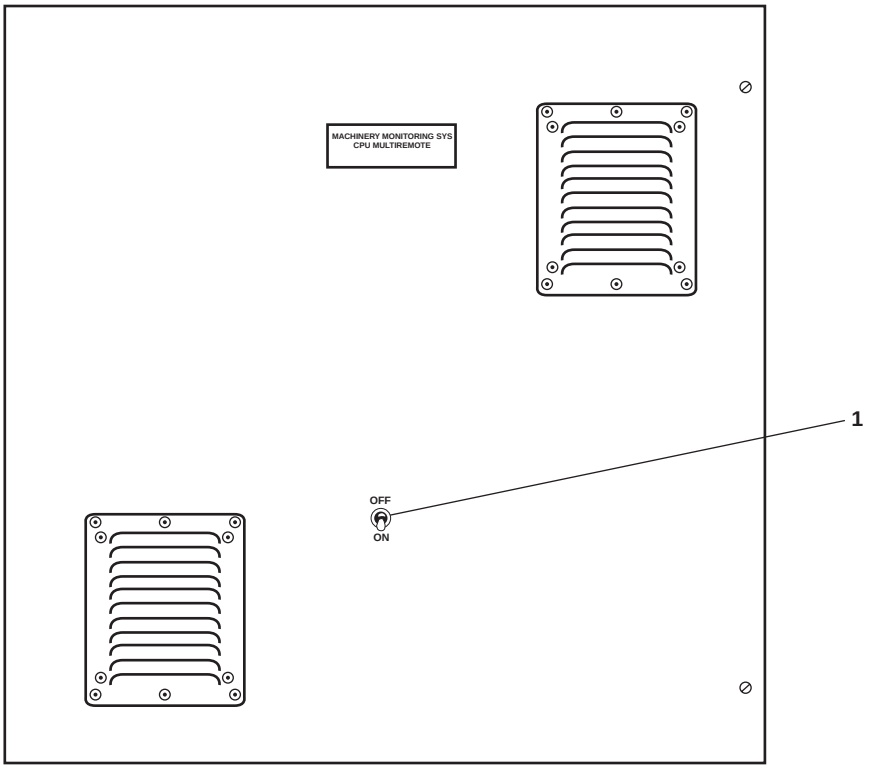


Figure 10. Machinery Monitoring System CPU Multi-Remote Panel

2. At Ship Service Diesel Generator (SSDG) 1, align the fuel oil service system and the fresh water cooling system by opening the following valves:

   a. FO-21, F.O. SPLY TO S.S.D.G. No. 1 (figure 11, item 1)

   b. Fuel oil filter inlet valves (figure 11, item 2)

   c. Fuel oil filter outlet valves (figure 11, item 3)

   d. Fwc-9, F.W. F.R KEEL CLR TO S.S.D.G. No. 1 (figure 11, item 4)

   e. Fwc-11, F.W. FR. S.S.D.G. No. 1 TO KEEL CLR. (figure 11, item 5)

   f. FO-15, F.O. SERV. SUCT. STBD (figure 11, item 6)

   g. FO-35, F.O. RTN TO DAY TK. STBD (figure 11, item 7)

3. Start the generator engine.

NOTE

Perform step a. only if the engine has not been run for several weeks or if all of the fuel was used during a previous operation.

   a. Flood the SSDG 1 engine fuel system by using the hand-operated fuel oil priming pump (figure 12, item 1) until a slight pressure is indicated on the engine fuel pressure gauge (figure 12, item 2).

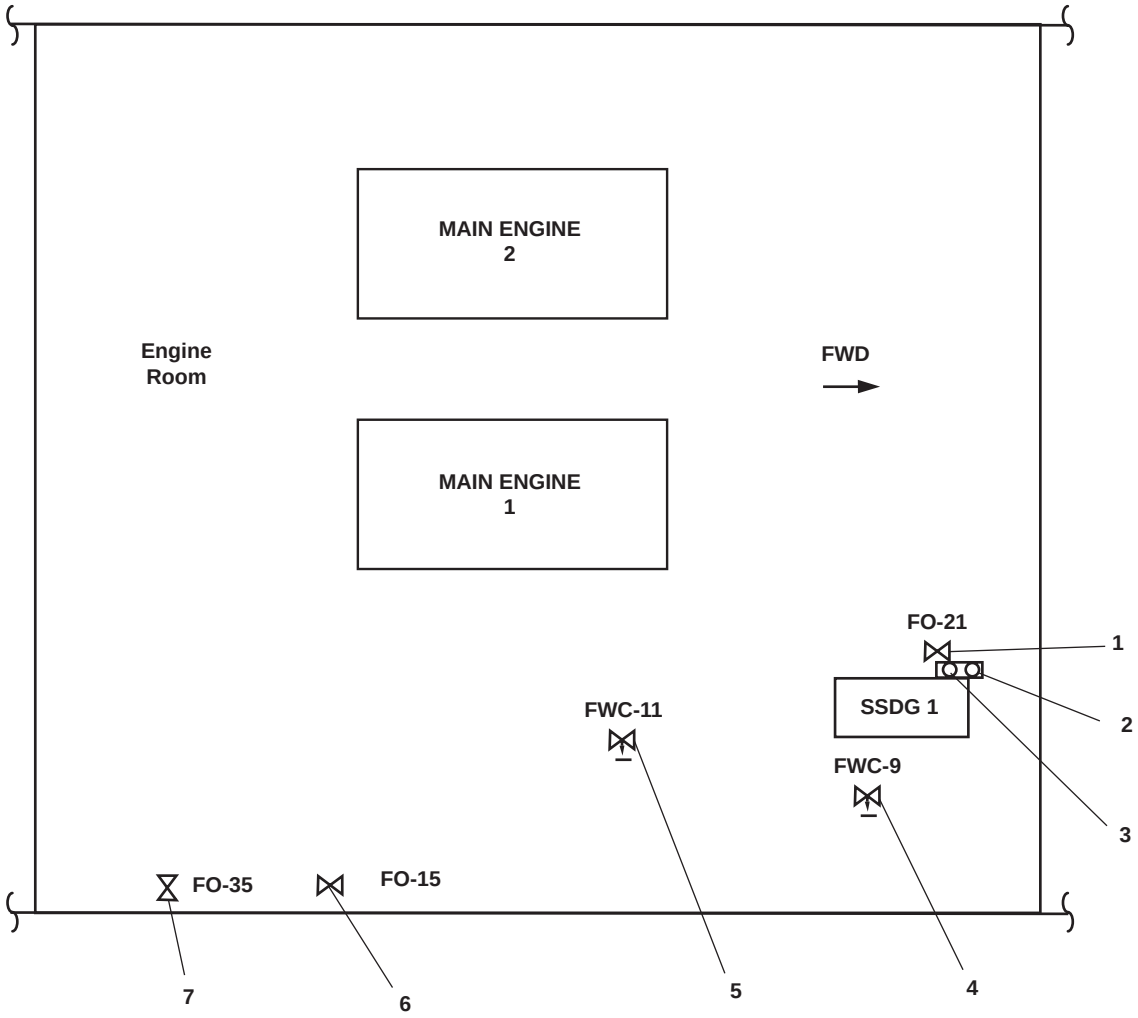


Figure 11. Fuel Oil Service and Fresh Water Cooling System Valve Locations

b. On the SSDG 1 engine control panel, turn the emergency stop pushbutton (figure 12, item 3) clockwise to release it to the OUT position.

⚠ CAUTION

Verify that the engine has oil available by checking the engine lube oil sump level. Check for the presence of cooling water in the sight glass of the head tank. Operating the engine without lube oil or cooling water will result in engine damage.

Do not engage the starter when the flywheel is moving. Failure to comply will result in engine damage.

If oil pressure does not rise within 15 seconds, stop the engine using the emergency stop switch, or damage to the engine could result.

NOTE

When the engine reaches 600 r/min and oil pressure is approximately 22 PSI (1.5 bar), the starter motor will automatically disengage.

c. Turn the START switch to the START position. When the engine starts, release the START switch (figure 12, item 4).

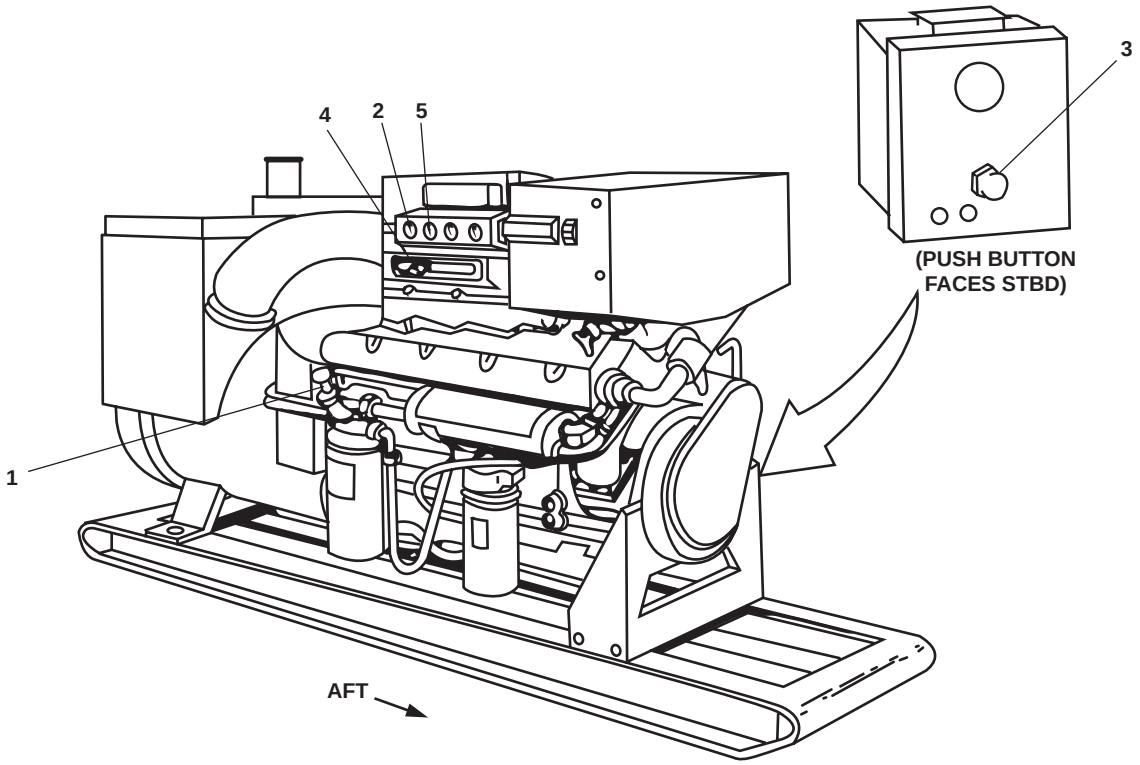


Figure 12. Ship's Service Diesel Generator Controls

⚠ CAUTION

If the engine fails to start within 30 seconds, release the START switch, and wait two minutes to allow the starter motor to cool before attempting to start the engine again.

NOTE

Prolonged cranking at low oil pressure can activate the mechanical safety shut off. If the reset lever is in the shutoff position, reset the mechanical shut off control.

d. Monitor the engine's speed on the CRT display in the EOS.

e. Allow the engine to operate in a no-load condition for 3 to 5 minutes or until the water temperature gauge (figure 12, item 5) begins to rise.

f. During normal operation, ensure the engine gauges read in the NORMAL range.

4. Load the diesel (bringing the generator on-line).

a. Ensure the following prior to loading the diesel:

(1) The engine is at proper operating speed for 3-5 minutes.

(2) All engine gauges are in the normal range.

(3) The engine is warmed up.

b. At the main switchboard in the EOS:

(1) Set the AMMETER switch (figure 13, item 1) to position 1.

(2) Toggle the speed control switch for GEN 1 GOVERNOR (figure 13, item 2) until the HERTZ (frequency) meter (figure 15, item 3) reads 60 hertz.

(3) Turn the BUS GEN. 1 switch (figure 13, item 4) to the 1-2 position.

(4) Rotate the GENERATOR 1 AUTO. VOLT. RHEO (figure 13, item 5) to read 440 on the A-C VOLTS meter (figure 13, item 6).

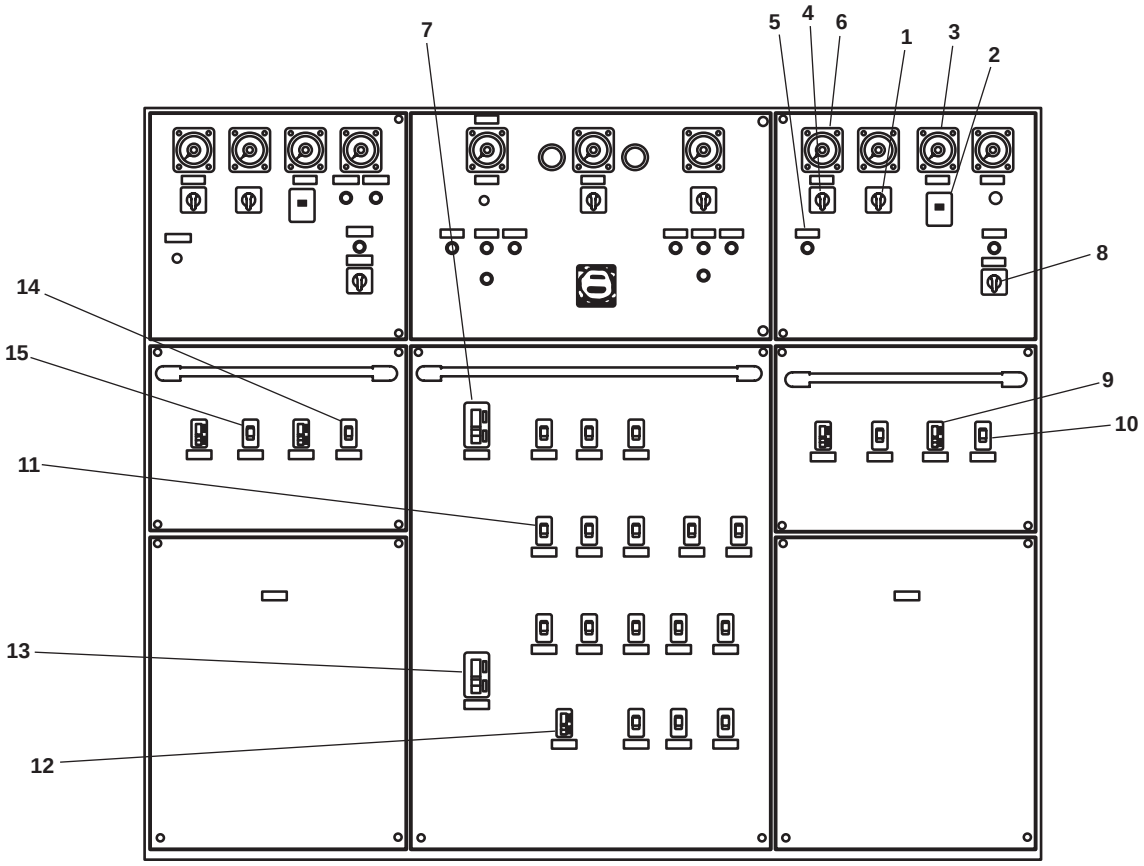


Figure 13. Main Switchboard

c. At the emergency switchboard in the emergency diesel generator room:

(1) Set the ENG. CONTROL SW (figure 14, item 1) to the MANUAL position.

(2) Set the main switchboard bus-tie circuit breaker (figure 14, item 2) to the ON position.

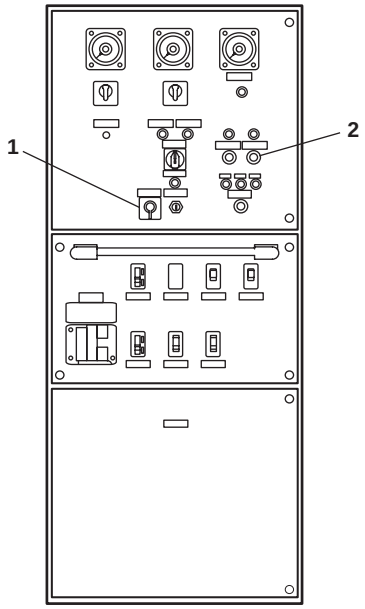


Figure 14. Emergency Switchboard

NOTE

Opening the shore power circuit breaker and closing the generator circuit breaker are done very quickly.

d. At the main switchboard in the EOS:

(1) Set the SHORE POWER CIRCUIT BREAKER (figure 13, item 7) to the OFF position.

(2) Set the following circuit breakers to the ON position:

(a) GEN #1 CKT. BKR. (figure 13, item 8)

(b) 3-25 KVA 1ø XFMRS (figure 13, item 9)

(c) ENG. RM. SUPPLY FAN #1 (figure 13, item 10)

(d) ENGINE ROOM POWER PANEL NO.1 (figure 13, item 11)

(e) ENG. RM. EXH. FAN #1 (figure 13, item 12)

(f) BUS TIE CIRCUIT BREAKER. (figure 13, item 13)

(g) ENG. RM. EXH. FAN #2 (figure 13, item 14)

(h) ENG. ROOM. SUPPLY FAN #2 (figure 13, item 15)

e. On the aft bulkhead of the EOS, at the load center distribution panel, set the following circuit breakers to ON:

(1) 120V DISTRIBUTION PANEL No. 2. (01 LEVEL). (figure 15, item 1)

(2) 120V DISTRIBUTION PANEL No. 3. (MAIN DECK) (figure 15, item 2)

(3) 120V DISTRIBUTION PANEL No. 4. (ENGINE ROOM). (figure 15, item 3)

(4) 120V DISTRIBUTION PANEL No. 1. (GALLEY). (figure 15, item 4)

f. In the emergency diesel generator room, at the 120V emergency load center distribution panel, set following circuit breakers to ON:

(1) MAIN DECK, 01 & 02 LEVEL EMEERGENCY LIGHTING PANEL No. 1. (figure 16, item 1)

(2) ENGINE ROOM EMERGENCY DISTRIBUTION PANEL No. 1. (figure 16, item 2)

(3) PILOTHOUSE EMERGENCY DISTRIBUTION PANEL. (figure 16, item 3)

(4) EMERGENCY DIESEL GENERATOR SET BATTERY CHARGER. (figure 16, item 4)

(5) EMERGENCY DIESEL GENERATOR JACKET WATER HEATER. (figure 16, item 5)

(6) GENERAL ALARM BATTERY CHARGER. (figure 16, item 6)

(7) RADIO ROOM ELEX DISTRIBUTION PANEL. (figure 16, item 7)

(8) EXTERIOR EMERGENCY LIGHTING PANEL No. 2. (figure 16, item 8)

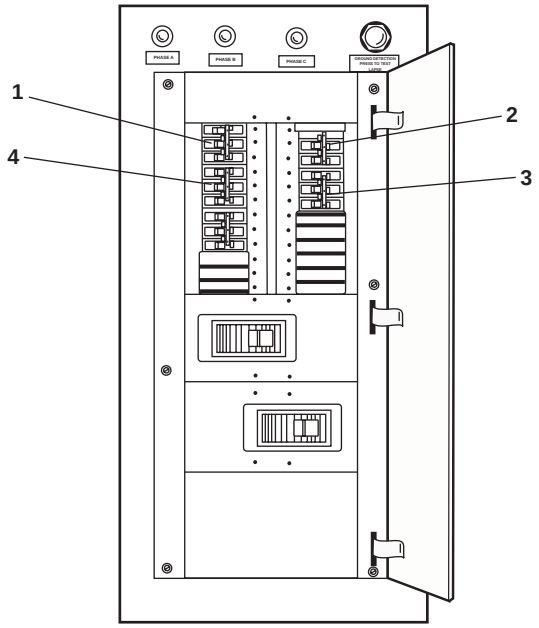


Figure 15. Load Center Distribution Panel

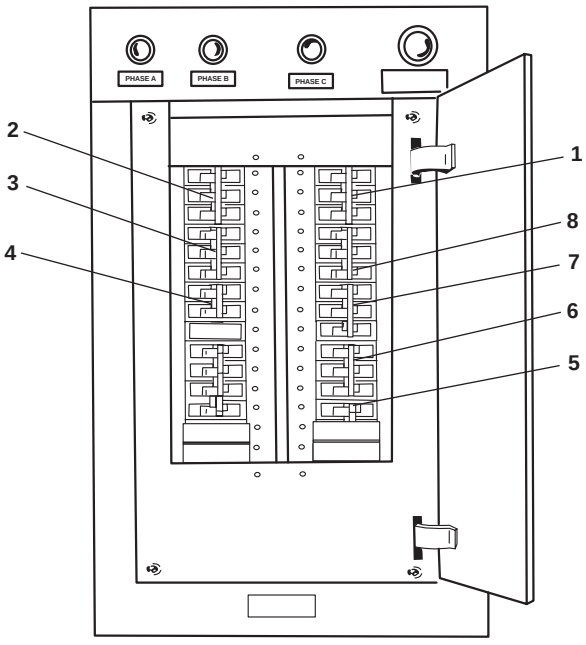


Figure 16. 120V Emergency Load Center Distribution Panel

NOTE

Supply fan motor controllers must be energized before power can be applied to exhaust fan motor controllers.

g. On the aft starboard bulkhead of the engine room, turn on the engine room supply fan motor controllers 1 and 2 as follows:

(1) Set the ON-OFF switch (figure 17, item 1) to the ON position.

(2) The POWER AVAILABLE indicator (figure 17, item 2) will illuminate.

(3) Press the FAST pushbutton (figure 17, item 3).

(4) The FAST indicator (figure 17, item 4) will illuminate.

h. On the aft starboard bulkhead of the engine room, turn on the engine room exhaust fan motor controllers 1 and 2 as follows:

(1) Set the ON-OFF switch (figure 17, item 1) to the ON position.

(2) The POWER AVAILABLE indicator (figure 17, item 2) will light.

(3) Press the FAST pushbutton (figure 17, item 3).

(4) The FAST indicator (figure 17, item 4) will light.

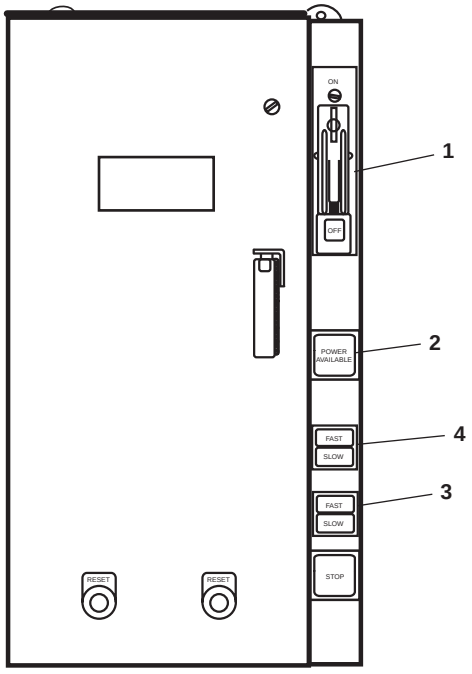


Figure 17. Engine Room Supply and Exhaust Fans Motor Controllers

5. Align the emergency diesel generator for automatic start.

NOTE

Ensure that fuel valves FO-32, F.O. SPLY TO ENG, and FO-12, E.D.G. DAY TK FILL, located in the emergency diesel generator room, are OPEN.

a. In the emergency diesel generator room overhead outboard, open valves FO-32, F.O. SPLY TO ENG, and FO-12, E.D.G. DAY TK FILL.

b. At the emergency switchboard in the emergency diesel generator room, set the ENG. CONTROL SW (figure 14, item 1) to the AUTO position.

c. At the emergency diesel generator control panel in the emergency diesel generator room, complete the following actions:

(1) Turn the red START/STOP pushbutton (figure 18, item 1) clockwise to place it in the OUT position to complete the starting circuit.

(2) Set the RESET control switch (figure 18, item 2) to the AUTO START position.

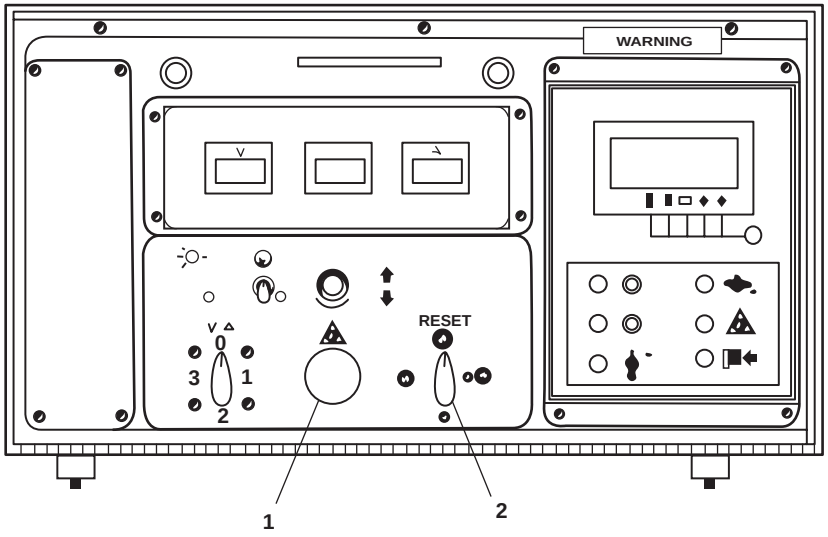


Figure 18. Emergency Diesel Generator Control Panel

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
COMPRESSED AIR SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

OPERATING PROCEDURES

SYSTEM STARTUP

1. OPEN valves CA-4, STG AIR TK OUT (figure 1, item 1) and CA-3, STG AIR TK OUT (figure 1, item 2) at the starting air receivers (figure 1, item 3).

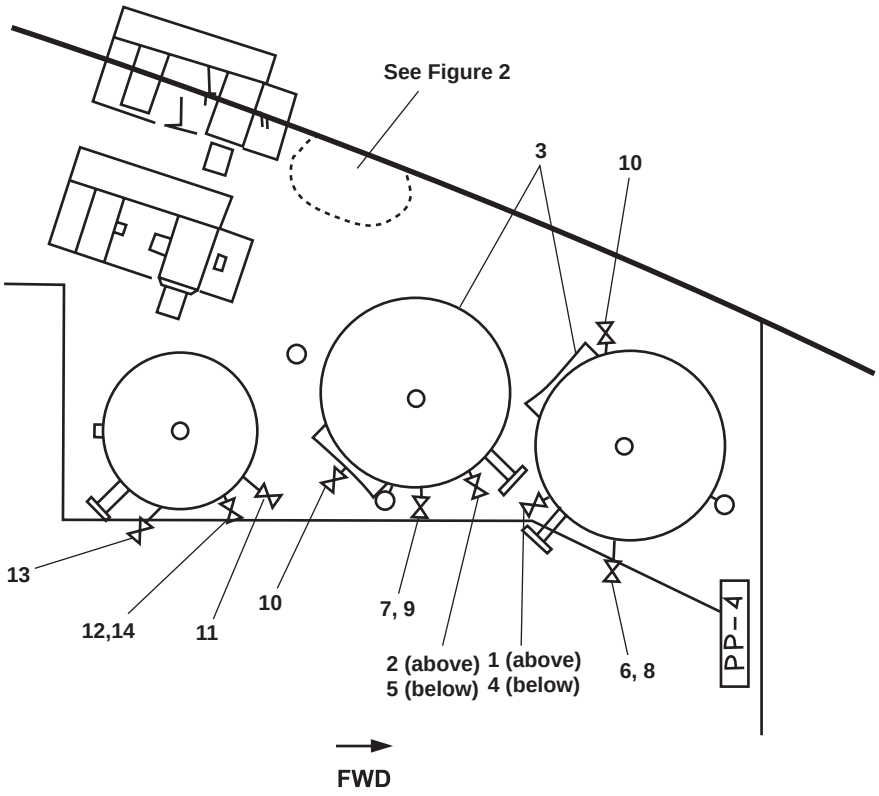


Figure 1. Compressed Air System Component Locations

2. CLOSE valves CA-89 and CA-90, COV-COMPR DISCH (figure 2, item 1) and CA-93 and CA-94, MOISTURE SEP DR (figure 2, item 2).

3. OPEN valves CA-1 and CA-2, COV-COMPR DISCH (figure 2, item 3) and CA-87 and CA-88, COV- COMPR DISCH (figure 2, item 4).

4. OPEN valves CA-11, STG AIR TK INL (figure 1, item 4) and CA-12, STG AIR TK INL (figure 1, item 5).

5. OPEN valves CA-50, AUTO DR (figure 1, item 6) and CA-49, AUTO DR (figure 1, item 7).

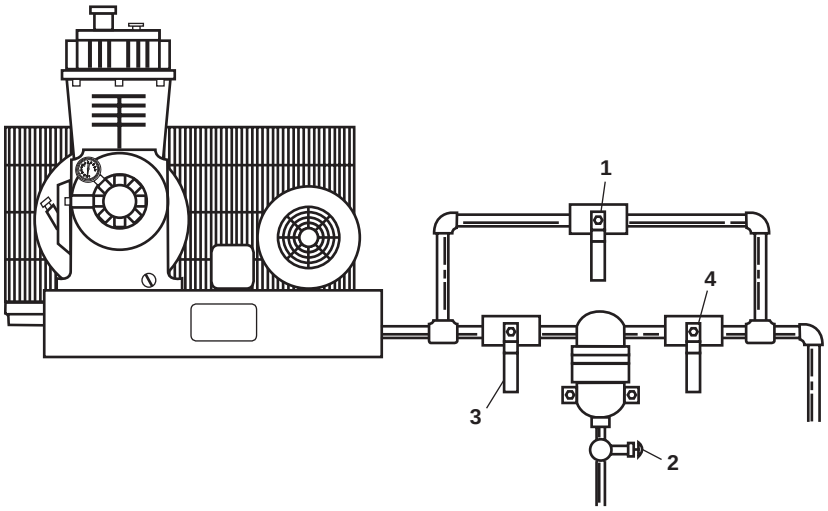


Figure 2. Dryer Valve Locations

6. Ensure that valves CA-46 and CA-47, STG AIR TK DR (figure 1, items 8 and 9) are CLOSED.

7. Ensure that valves CA-98 and CA-99 (figure 1, item 10) are OPEN.

8. At the main switchboard, set the AUX MACH SPACE NO. 1 PWR PANEL NO. 4 circuit breaker (figure 3, item 1) to ON.

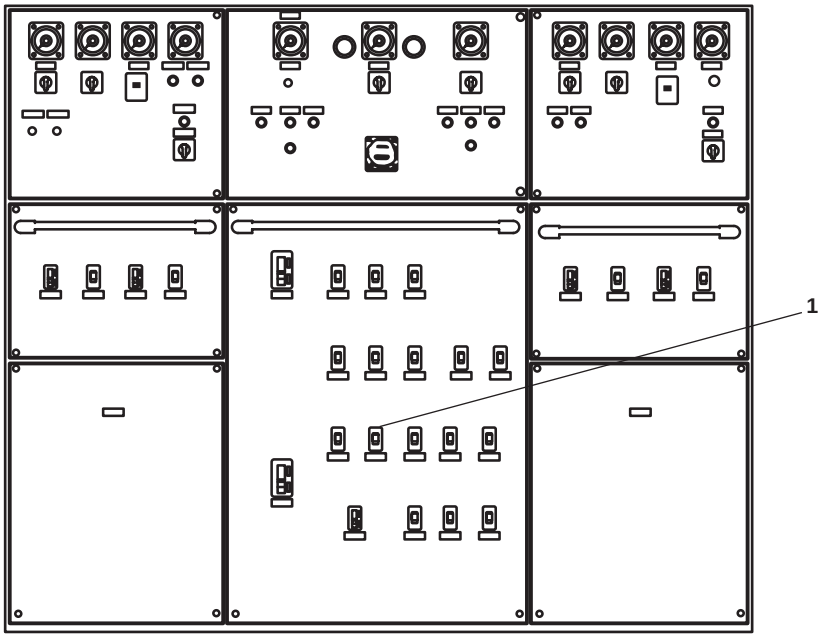


Figure 3. EOS Main Switchboard

9. At 440V power panel No. 4 (figure 4), set the following circuit breakers to ON:

   a. AIR COMPRESSOR No. 1. (figure 4, item 1)

   b. AIR COMPRESSOR No. 2. (figure 4, item 2)

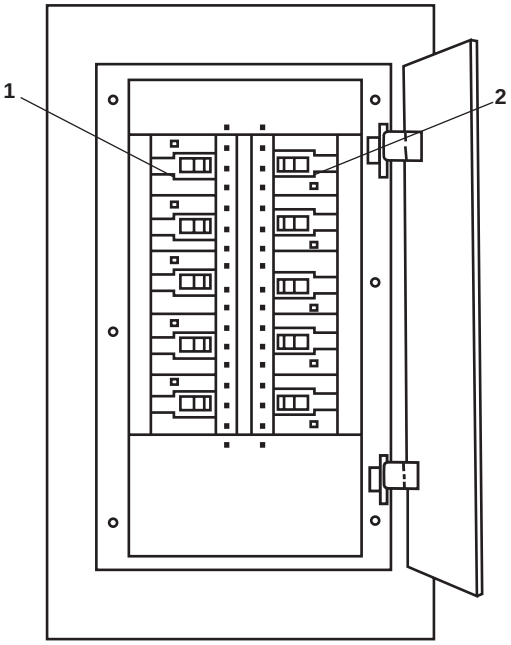


Figure 4. 440V Power Panel No. 4

NOTE

Activation of the air compressor motor controller will cause the power available light to energize, and the compressor will start automatically unless pressure is above 210 PSI (14.5 bar).

10. Set both of the motor controllers' MANUAL-AUTO switches (figure 5, item 1) to AUTO.

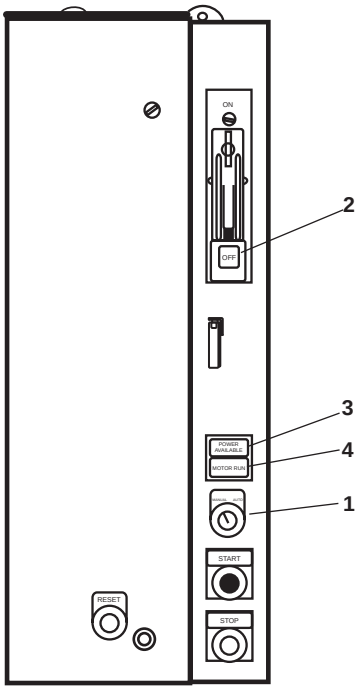


Figure 5. Air Compressor Motor Controller

11. Set both motor controllers' ON-OFF switches (figure 5, item 2) to ON.

12. Ensure that the POWER AVAILABLE light (figure 5, item 3) is illuminated on both motor controllers.

13. Ensure that the MOTOR RUN light (figure 5, item4) is illuminated on both motor controllers.

ACTIVATE SHIP'S SERVICE AIR SYSTEM

1. OPEN valves CA-39, SVCE AIR TK INL (figure 6, item 1), and CA-40, SVCE AIR TK INL (figure 6, item 2).

2. Ensure that valve CA-41, BYP RDC STA (figure 6, item 3) is CLOSED.

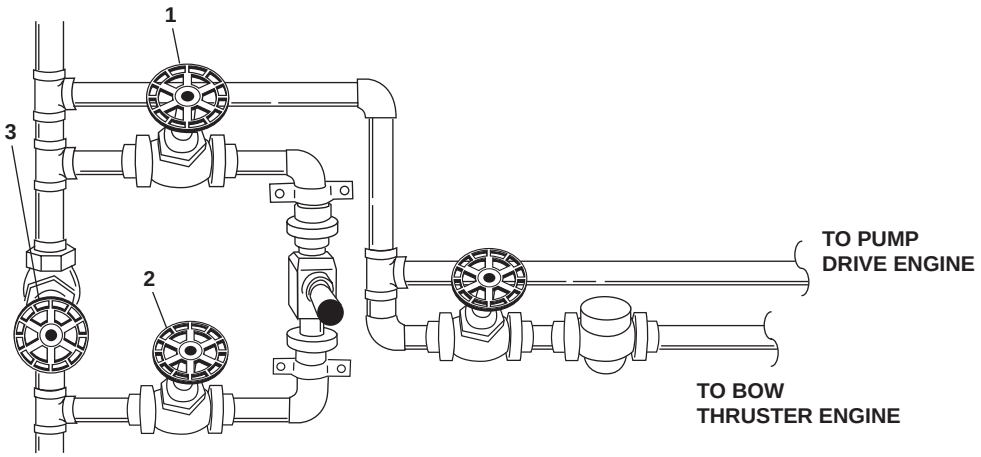


Figure 6. Ship's Service Air System Valve Locations (Forward Bulkhead)

3. OPEN valves CA-13, SVCE AIR TK INL (figure 1, item 11), CA-51, AUTO DR (figure 1, item 12), and CA-14, SVCE AIR TK OUT (figure 1, item 13).

4. Ensure that valve CA-48, SVCE AIR TK DR (figure 1, item 14) is CLOSED.

5. To activate the control air system:

   a. To align the air dryer piping and valves:

      (1) OPEN the air dryer inlet valve (figure 7, item 1).

      (2) OPEN the air dryer outlet valve (figure 7, item 2).

      (3) OPEN the transducer valve (figure 7, item 3).

      (4) OPEN the filter valve (figure 7, item 4).

      (5) CLOSE the bypass valve (figure 7, item 5).

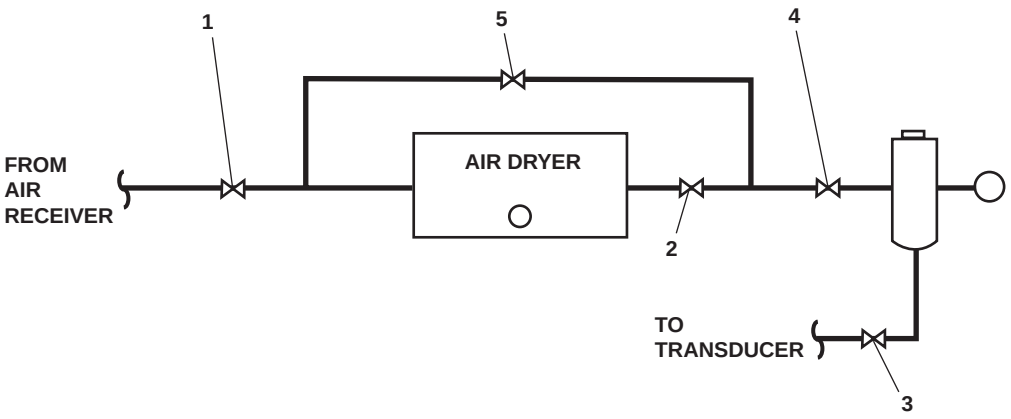


Figure 7. Control Air Dryer Valve Locations

b. Start the control air dryer by completing the following actions:

(1) At 120V distribution panel No. 4, set to ON the J.B. FOR AUTO DRAIN ON AIR RECEIVER. (INC. REFER DRYER) circuit breaker (figure 8, item 1).

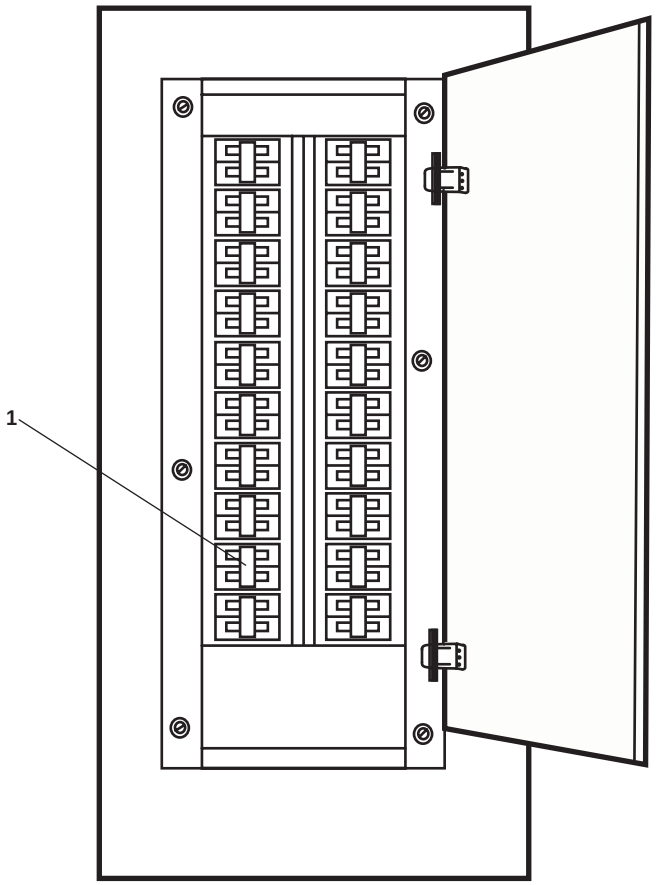


Figure 8. 120V Distribution Panel No. 4

(2) In the forward port corner of the engine room, above SSDG 2:

(a) Set the control air dryer switch (figure 9, item 1) to ON.

(b) Monitor the control air dryer gauge (figure 9, item 2) to ensure normal operation. Normal gauge reading is 125 PSI (8.6 bar).

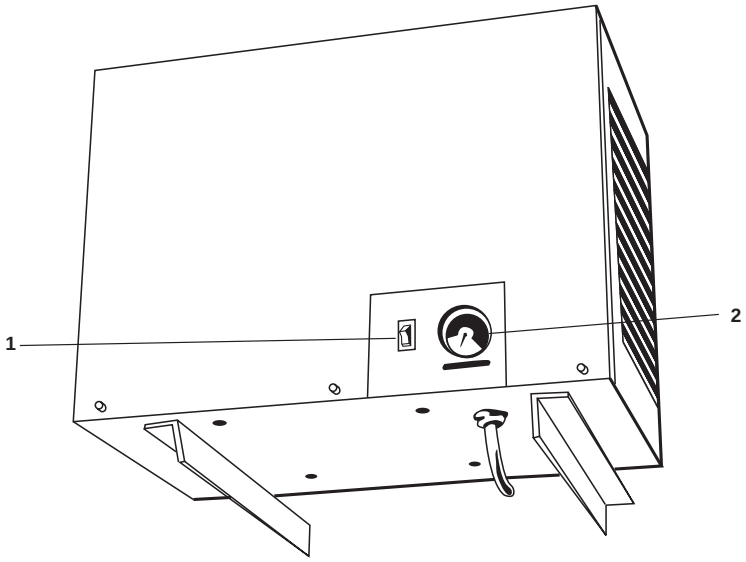


Figure 9. Control Air Dryer

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
FIRE MAIN, GENERAL SERVICE, AQUEOUS FILM FORMING FOAM (AFFF), AND WASHDOWN COUNTERMEASURE SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L
One Watercraft Operator, 88K

GENERAL

The following procedures are included in this work package:

1. Pressurization of the fire main and general service system
2. High level sea chest operations
3. Individual fire station operation
4. Pressurize the fire main with the diesel engine-driven firefighting pump
5. Foam system activation
6. Fire monitor operation
7. Foam system shutdown
8. Fire monitor shutdown
9. Secure the pump drive engine
10. Washdown Countermeasure (WDCM) system operation

NOTE

Only one fire and general service pump is necessary to keep the fire main pressurized, fire and general service pump 2 is normally aligned to the general service system.

PRESSURIZATION OF THE FIRE MAIN AND GENERAL SERVICE SYSTEM

1. Align the electrical system by completing the following actions:
   a. At the emergency switchboard, in the emergency diesel generator room, set the FIRE PUMP NO. 1 circuit breaker (figure 1, item 1) to ON.
   b. At the main switchboard, in the EOS, set the FIRE PUMP NO. 2 circuit breaker (figure 2, item 1) to ON.
   c. Energize the fire pump motor controllers in AMS 2 by completing the following actions:
      (1) Set the LOCAL-REMOTE switch (figure 3, item 1) for each controller to the LOCAL position.
      (2) Set the ON-OFF switch (figure 3, item 2) for each controller to ON.
      (3) Verify that the POWER AVAILABLE light (figure 3, item 3) for each controller illuminates.

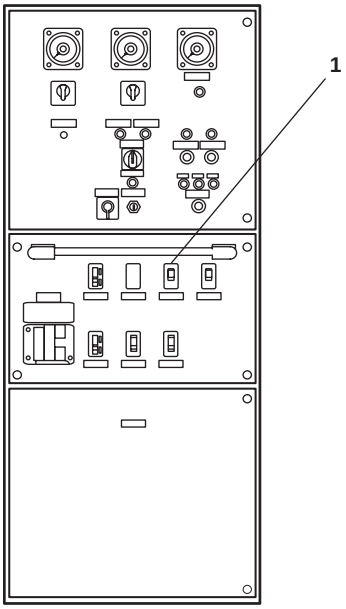


Figure 1. Emergency Switchboard

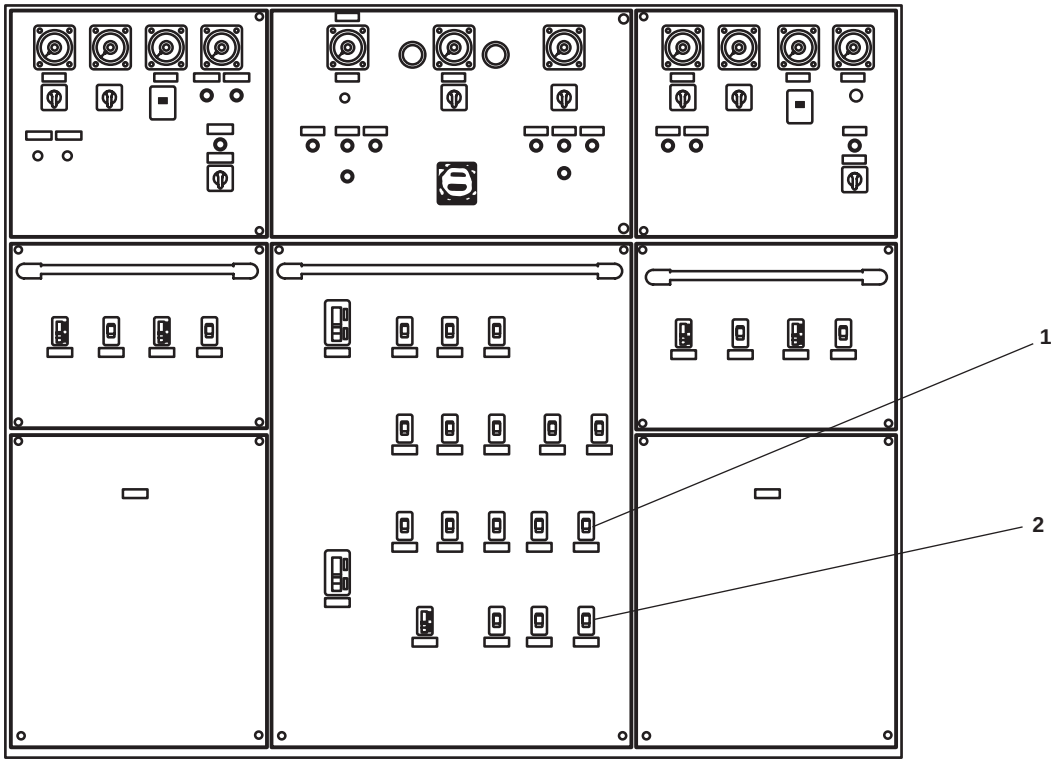


Figure 2. Main Switchboard

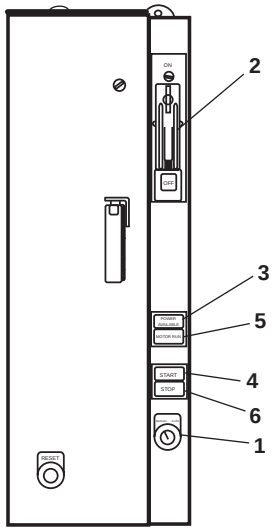


Figure 3. Fire Pump Motor Controllers

2. Perform valve alignment by completing the following actions:

   a. OPEN the following valves:

      (1) FM-9, GENL. SERV. PRESS. RED. VLV. CO. (figure 4, item 1), general service pressure reducer inlet valve.

      (2) FM-16, FIRE/G.S. PMP No. 1 DISCH TO FM (figure 4, item 2), fire and general service pump 1 discharge to fire main.

      (3) FM-93, FM DR (figure 4, item 3), fire and general service pump 1 pressure gauge line.

      (4) FM-15, FIRE/G.S. PMP. No. 2 DISCH TO GS. (figure 4, item 4), fire and general service pump 2 discharges to general service.

      (5) FM-92, FIRE/G.S. PUMP No. 2 SUCT (figure 4, item 5), fire and general service pump 2 pressure gauge line.

      (6) FM-6, FIRE/G.S. PMP No. 1 SUCT (figure 5, item 1), fire and general service pump 1 suction.

      (7) FM-7, FIRE/G.S. PMP No. 2 SUCT (figure 5, item 2), fire and general service pump 2 suction.

      (8) FM-2, SEA SUCT. FIRE /G.S. & BLST PMPS (figure 6, item 1), raw water suction for fire, general service and ballast pumps, located in the engine room, below the entrance to AMS 2.

      (9) FM-3, S.W. TO BILGE/BLST. PMPS. (figure 6, item 2), raw water to fire pumps, located in the engine room, below the entrance to AMS 2.

      (10) AE-29, SEACHEST VENT (figure 6, item 3), sea chest vent, located in the engine room aft, under the deck plate at the entrance to AMS 2.

      (11) FM-89 (figure 7, item 1), fire fighting pump 1 suction strainer differential pressure gauge cutout, located in the engine room, below the entrance to AMS 2 to the starboard side.

      (12) FM-90, FIRE/G.S. PUMP No. 1 SUCT. (figure 7, item 2), fire fighting pump 2 suction strainer differential pressure gauge cut out, located in the engine room, below the entrance to AMS 2 to the starboard side.

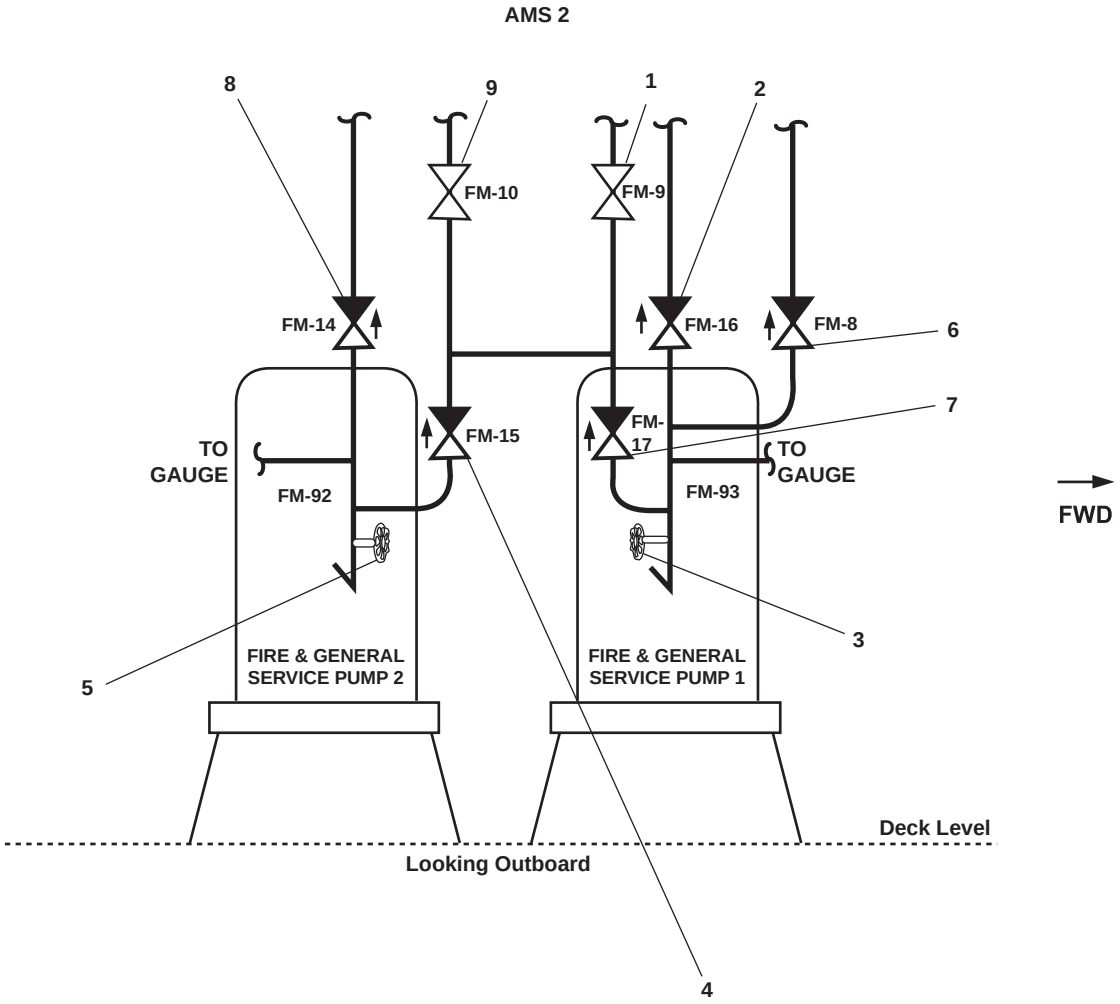


Figure 4. Fire and General Service Pump Discharge Valves

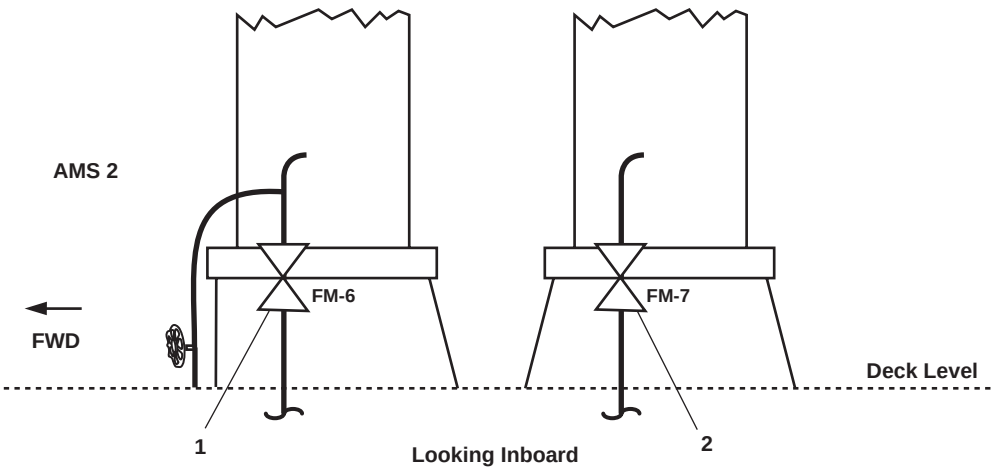


Figure 5. Fire and General Service Pump Suction Valves

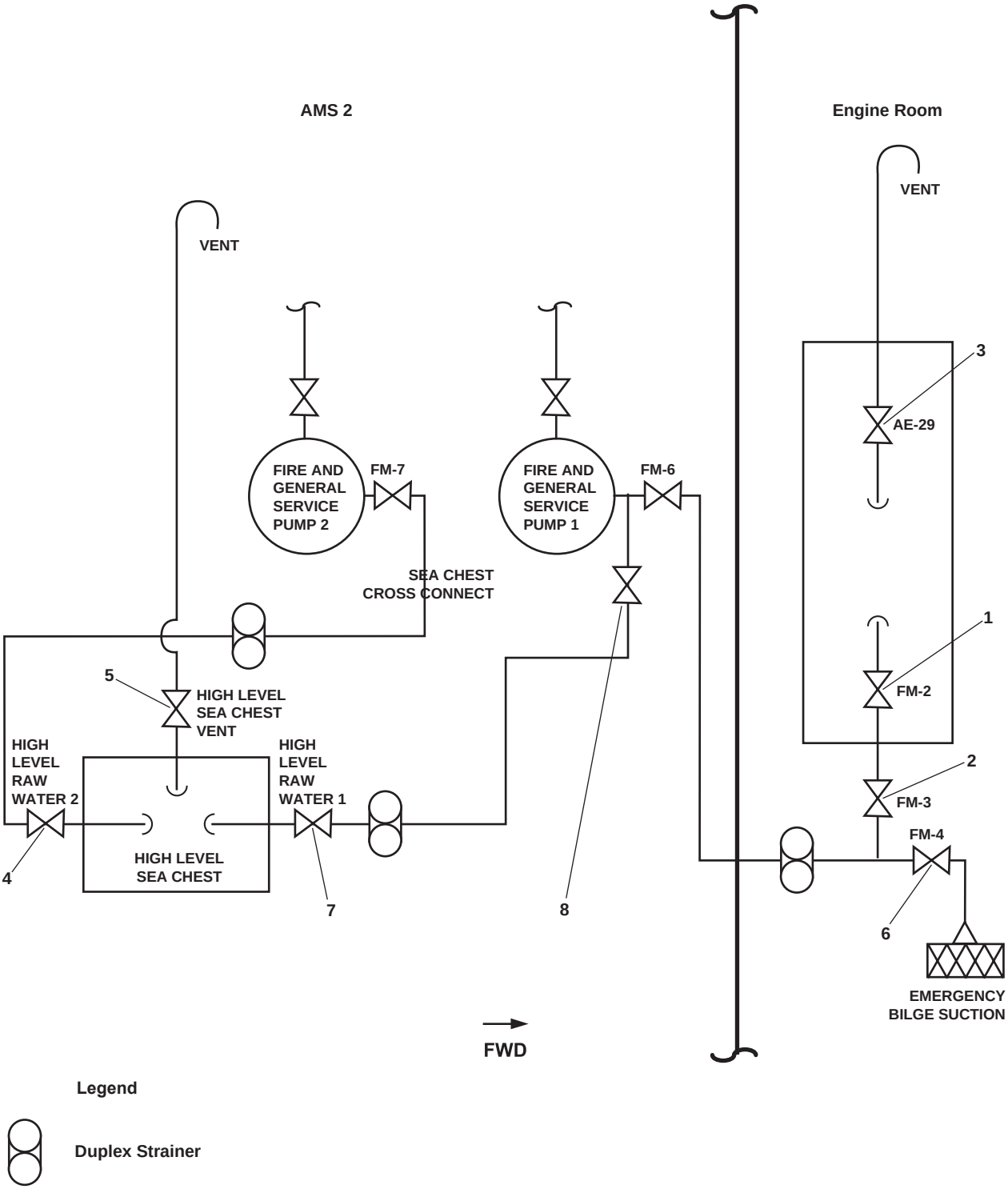


Figure 6. Sea Chest Valves

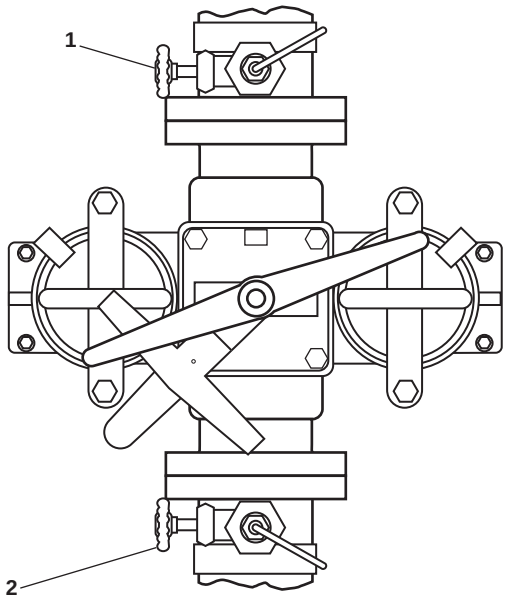


Figure 7. Gauge Valves

(13) GS-32, GS OVBD DISCH (figure 8, item 1), located in AMS 2 on the starboard side by the steering hydraulic pumps.

(14) GS-12, GENL SERV PRESS RED VLV CO (figure 8, item 2), general service pressure reducer outlet valve.

(15) FM-91, FIRE/G.S. PUMP No. 1 SUCT. located near GS-12 (figure 8, item 3) in the overhead.

(16) GS-104 (figure 9, item 1) ,raw water to port stern tube shaft seal gauge valve, located behind the refrigeration plant in AMS 2.

(17) GS-105 (figure 10, item 1), raw water to starboard stern tube shaft seal gauge valve, located behind the refrigeration plant in AMS 2.

(18) GS-42, COV-ST TUBE SEAL P (figure 9, item 2), port stern tube seal, located on the bottom of the shaft in port shaft alley.

(19) GS-43, COV-ST TUBE SEAL S (figure 10, item 2), starboard stern tube seal, located on the bottom of the shaft in starboard shaft alley.

(20) HIGH LEVEL RAW WATER 2 (figure 6, item 4)

(21) HIGH LEVEL SEACHEST VENT (figure 6, item 5)

b. Verify that the following valves are CLOSED:

(1) FM-8, EMG. BILDE OVBD (figure 4, item 6), emergency bilge overboard

(2) FM-17, FIRE/G.S. PMP No. 1 DISCH TO GS (figure 4, item 7), fire and general service pump 1 discharge to general service

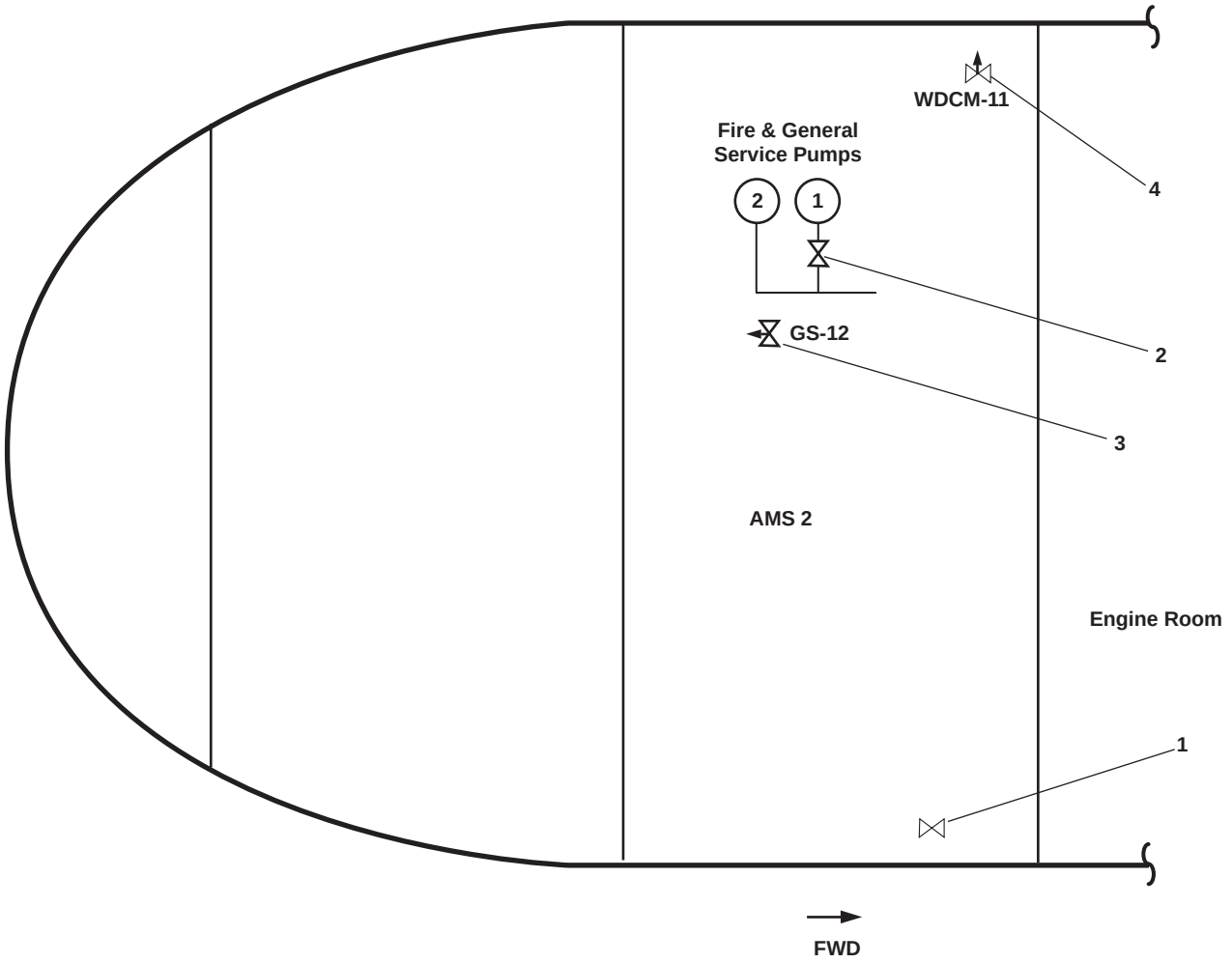


Figure 8. General Service Valves

(3) FM-14, FIRE/G.S. PMP. No. 2 DISCH. TO FM. (figure 4, item 8), fire and general service pump 2 discharges to fire main

(4) FM-10, GENL. SERV. PRESS. RED. VLV. MAN. BYPASS (figure 4, item 9), general service pressure reducer manual bypass valve

(5) FM-4, EMER BILGE SUCT (figure 6, item 6), emergency bilge suction valve

(6) HIGH LEVEL RAW WATER 1 (figure 6, item 7)

(7) SEACHEST CROSS CONNECT (figure 6, item 8)

3. Verify that WWS-1, located in the main deck vestibule, is pinned CLOSED.

4. Verify that all 11 fire station cut off valves are CLOSED.

5. To pressurize the system:

a. Press the START pushbutton (figure 3, item 4) on each fire pump motor controller.

b. Verify that the MOTOR RUN indicator lamp (figure 3, item 5) on each controller is illuminated.

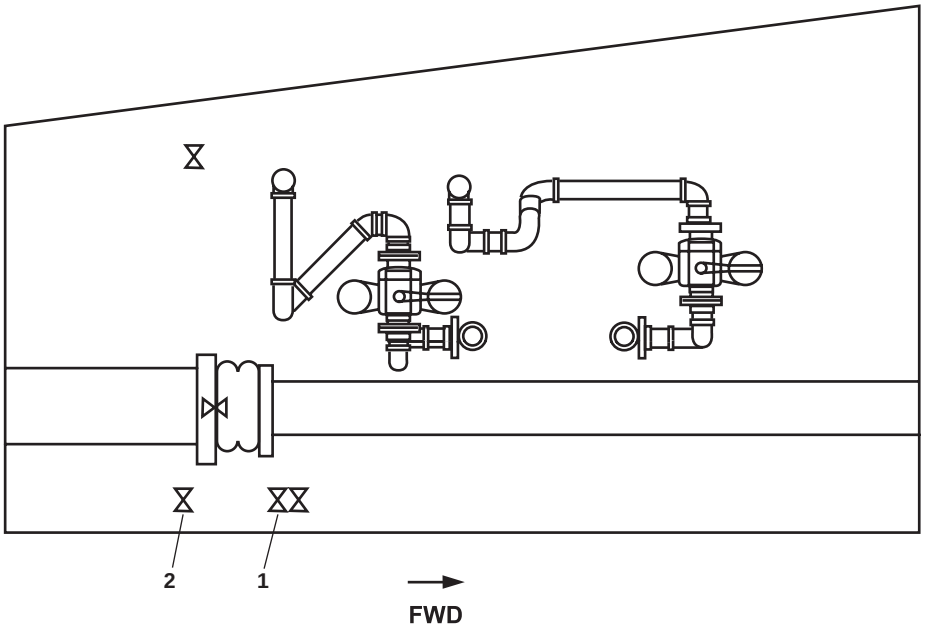


Figure 9. Port Shaft Alley

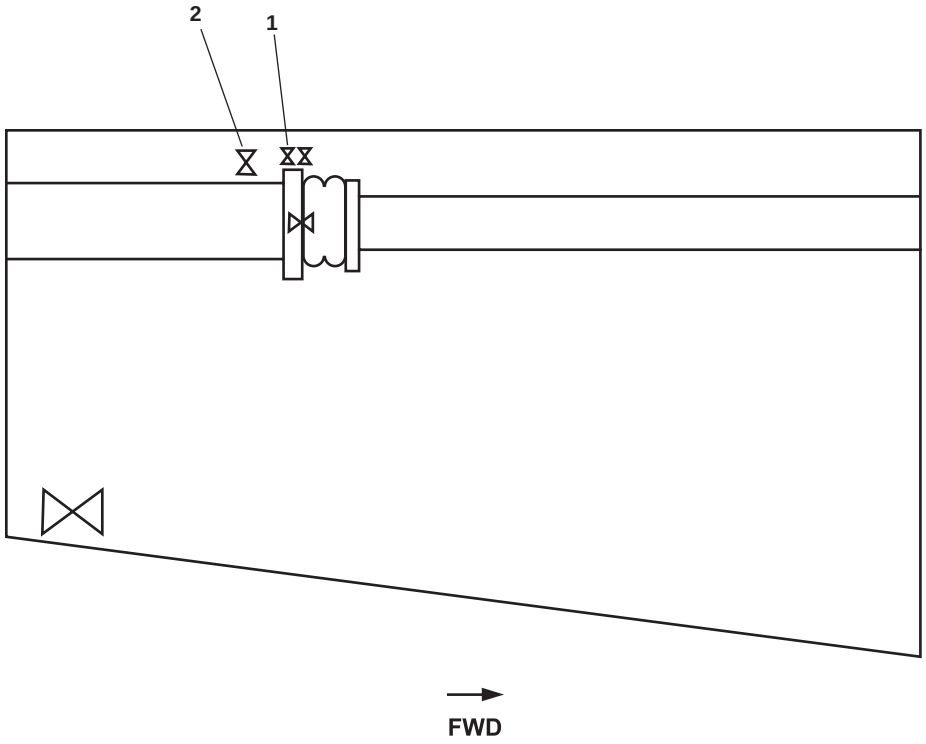


Figure 10. Starboard Shaft Alley

HIGH LEVEL SEACHEST (SHALLOW WATER) OPERATION

NOTE

Only fire and general service pump 1 is capable of drawing suction from both the aft sea chest and the high level sea chest. Normal lineup is for fire and general service pump 1 to draw suction from the aft sea chest while fire and general service pump 2 draws from the high level sea chest.

1. At fire and general service pump 1 motor controller:
    a. Press the STOP pushbutton (figure 3, item 6)
    b. Verify that the MOTOR RUN indicator lamp (figure 3, item 5) goes out.
2. Perform valve lineup as shown in table 1.
3. At fire and general service pump 1 motor controller:
    a. Press the START pushbutton (figure 3, item 4).
    b. Verify that the MOTOR RUN indicator lamp (figure 3, item 5) is illuminated.

Table 1. Aft Sea Chest and High Level Sea Chest Valve Lineup (refer to figure 6)

Key	Valve	Normal Operation	Shallow Water Operation
1	FM-2 SEA SUCT. FIRE /G.S. & BLST PMPS	OPEN	CLOSED
2	FM-3 S.W. TO BILGE/BLST. PMPS.	OPEN	CLOSED
3	AE-29 SEACHEST VENT	OPEN	OPEN
4	High Level Raw Water 2	OPEN	OPEN
5	High Level Sea Chest Vent	OPEN	OPEN
6	FM-4 EMER BILGE SUCT	CLOSED	CLOSED
7	High Level Raw Water 1	CLOSED	OPEN
8	Sea Chest Cross Connect	CLOSED	OPEN

INDIVIDUAL FIRE STATION OPERATION

1. Verify that the fire main is pressurized.
2. At the selected fire station, perform the following actions:
    a. Ensure that the hose is connected to a fire station cutoff valve.
    b. Remove the fire hose from its storage rack.
    c. Lay the hose out and extend it to its full length.

d. Ensure that the nozzle valve is CLOSED.

e. Slowly OPEN the fire station cutoff valve to pressurize the hose.

f. Firmly grasp the fire hose nozzle and direct it at the base of the fire.

WARNING

When operating a pressurized fire hose, hold the nozzle with a firm grip. If not held firmly, the nozzle will thrash about and may cause serious injury or death to personnel.

g. Slowly OPEN the nozzle valve, and direct the water stream at the base of the fire.

3. Shut down and secure the selected fire station by performing the following actions:

a. CLOSE the nozzle valve on the fire hose.

b. CLOSE the fire station cutoff valve.

c. Slowly OPEN the nozzle valve to relieve pressure in the fire hose.

d. Disconnect the fire hose from the fire station cutoff valve, and place the fire station end of the fire hose in a lower area than the nozzle end.

e. Drain the water from the hose by raising the nozzle end of the fire hose above head level and walking it back to the fire station end. The water in the fire hose should gravity drain.

f. Inspect the fire hose for damage.

g. Properly re-stow the hose on the hose storage rack.

h. Reconnect the fire hose to the fire station cutoff valve.

i. Close the nozzle valve.

PRESSURIZE THE FIRE MAIN WITH THE DIESEL ENGINE-DRIVEN FIREFIGHTING PUMP

1. Line up the diesel engine-driven firefighting pump by OPENING the following valves:

a. FO-31, F.O. SPLY TO PMP DRV ENG (figure 11, item 1), fuel oil supply to the pump drive engine

b. Fuel oil filter/water separator outlet valve (figure 11, item 2)

c. Fuel oil filter/water separator inlet valve. (figure 11, item 3)

d. Asw-19, S.W. TO PUMP DRIVE ENG (figure 11, item 4), raw water to pump drive engine

e. Asw-20, S.W. FR. PUMP DRIVE ENG. TO OVB'D DISCHARGE (figure 11, item 5), raw water from pump drive engine to overboard discharge

f. Asw-22, OVB'D DISCH., S.W. COOLING (figure 11, item 6)

g. Asw-17, SEA SUCTION S.W. COOLING (figure 11, item 7), raw water cooling suction valve, located in the engine room below stairs to AMS 1.

h. FM-1, SEA SUCT, F.F. PMP. (figure 11, item 8), fire pump raw water suction valve, located in the engine room below the EOS.

i. FO-13, F.O. SERV. SUCT. PORT, port fuel oil service suction valve, located aft outboard main engine 2 (remote operator in the in the fan room on the main deck).

j. FO-33, F.O. RTN TO DAY TK. PORT, located aft outboard main engine 2.

k. FM-96, fire main pressure gauge (figure 11, item 9), located on the forward bulkhead of AMS 1 near the pump drive engine.

l. FM-97 and FM-99, AFFF proportioner differential pressure gauge valves (figure 11, items 10 and 11), located in the overhead on the AFFF proportioner line in AMS 1.

2. Verify that FM-13, F.F. TO F.M. CRSVR (figure 11, item 12), firefighting pump to fire main cross connect, is CLOSED.

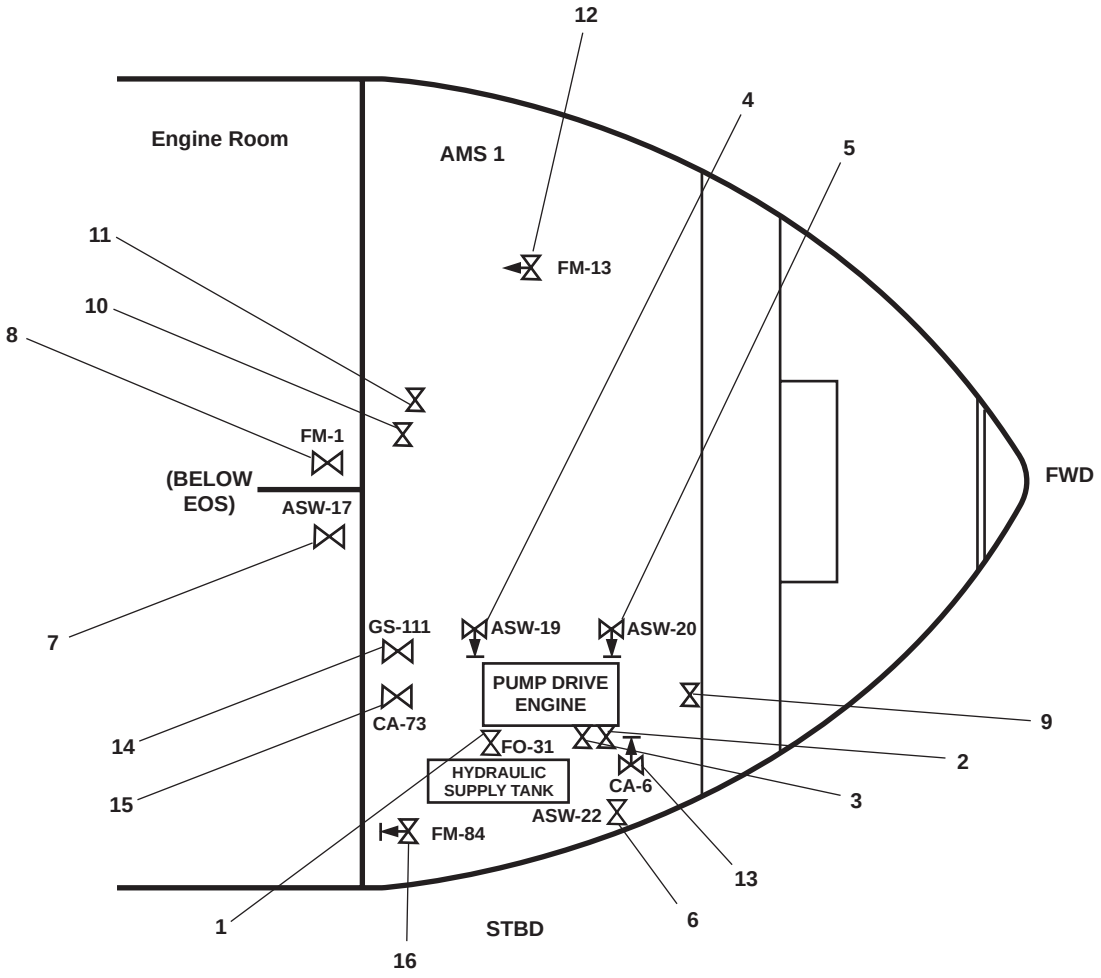


Figure 11. Diesel Engine Driven Firefighting Pump Valve Locations

⚠ CAUTION

The towing hydraulic system must always be in a normal operating lineup when the pump drive engine is running or damage to the system could occur.

NOTE

The towing hydraulic system hydraulic pump is driven from the front of the pump drive engine.

3. Verify that the towing hydraulic system is lined up as follows:

   a. OPEN the following valves:

      (1) GS-77, HYD OIL CLR DISCH (figure 12, item 1), hydraulic oil circulation discharge

      (2) GS-75, TOW WN HYD OIL CLR SPLY (figure 12, item 2), towing machine hydraulic oil circulation supply

      (3) CH-26, DRN CUT-OUT TOW WN HYDR (figure 12, item 3), towing machine hydraulic drain

      (4) CH-27, RTN CUT-OUT TOW WN HYDR (figure 12, item 4), towing machine hydraulic return

      (5) TH-1, C.O.V. – PMP DISCH. TO TOW WN. HYD (figure 12, item 5), pump discharge to towing machine hydraulics

      (6) TH-14, FLOW CONTROL (figure 12, item 6), pump supply cutoff valve

      (7) TH-13, FLOW CONTROL (figure 12 item 7)

      (8) TH-12, FLOW CONTROL (figure 12, item 8)

   b. In AMS 1, on the starboard side, at the towing hydraulic reservoir, verify that the following valves are CLOSED:

      (1) TH-4, DRAIN CRSVR. TO CENT. HYD. (figure 12, item 9), cross connect drain valve

      (2) TH-3, RETURN CRSVR. TO CENT. HYD (figure 12, item 10), cross connect from towing hydraulics to central hydraulics

      (3) TH-2, PRESS CRSVR CTL HYDR TOW WN HYDR (figure 12, item 11), crossover valve to the central hydraulic reservoir

4. In the engine room on the aft bulkhead of the EOS, at the machinery DC control distribution panel, set the PMP DR ENG circuit breaker to ON (figure 13, item 1).

5. Verify that all towing machine operating levers are in the NEUTRAL position at the towing machine operator's control panel on the 01 level.

6. Start the pump drive engine by completing the following actions:

   a. OPEN valve CA-6, STG AIR TO PMP DR ENG (figure 11, item 13), starting air to the pump drive engine.

   b. Place the power take-off control lever in the disengaged (aft) position (figure 14, item 1).

   c. Move the mechanical governor control lever (figure 14, item 2) to the half engine speed position (approximately straight up).

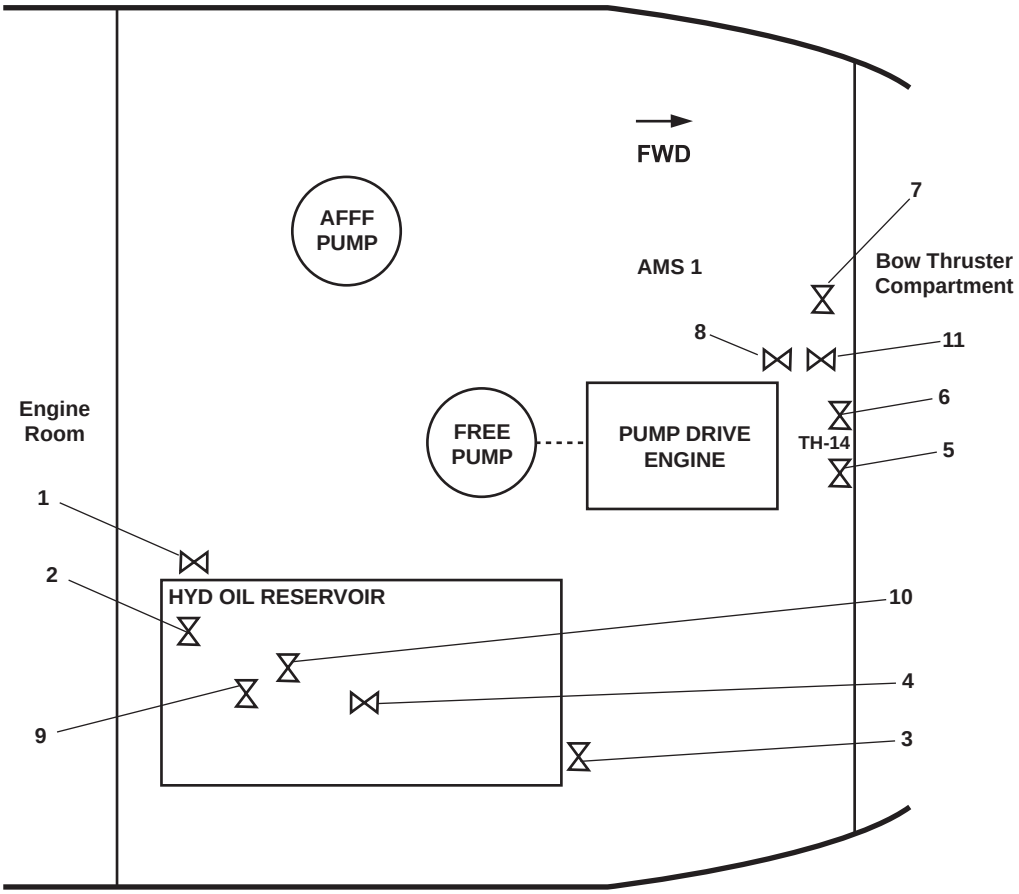


Figure 12. Hydraulic Valve Locations

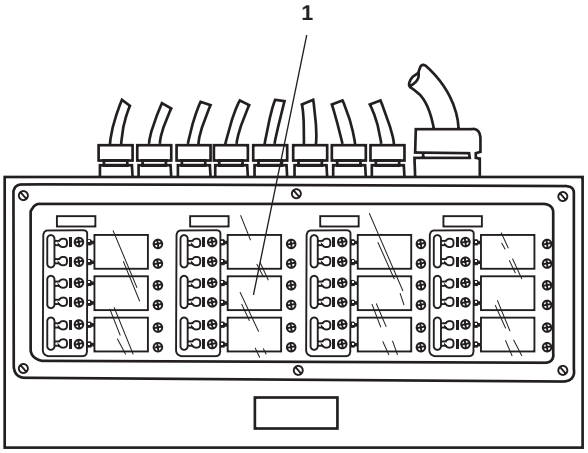


Figure 13. Machinery DC Control Distribution Panel

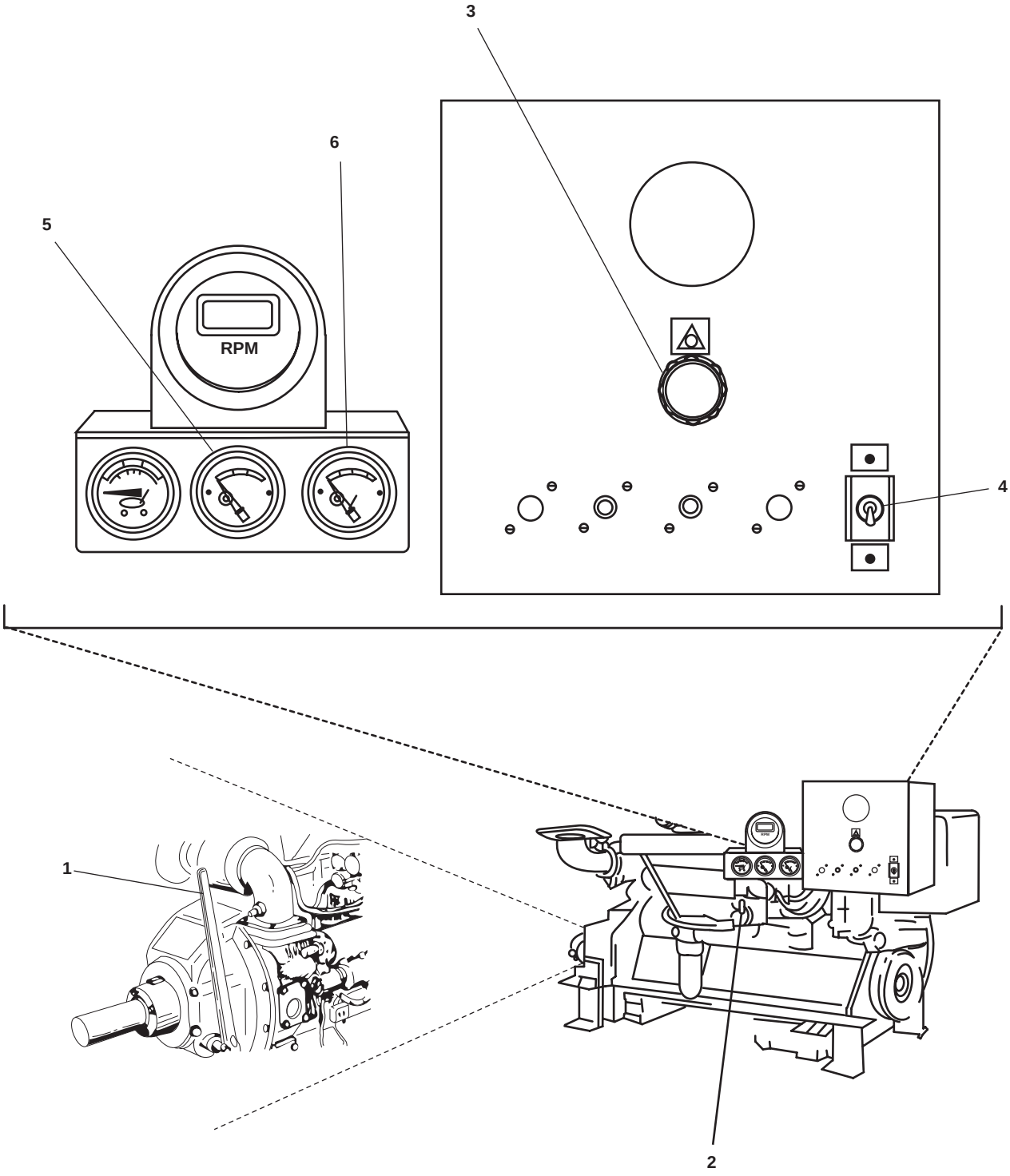


Figure 14. Pump Drive Engine

NOTE

Starting air start pressure must be at least 100 PSI (6.9 bar) to ensure that the engine starts properly.

d. Verify that the starting air pressure gauge reads at least 100 PSI (6.9 bar).

e. On the pump drive engine control panel, turn the start/stop pushbutton (figure 14, item 3) clockwise to release the pushbutton to the OUT position.

⚠ CAUTION

If oil pressure does not rise within 15 seconds, stop the engine or damage to equipment could result.

f. Push the OFF-RUN-START toggle switch (figure 14, item 4) up to the START position to crank the engine. As soon as the engine starts, release the toggle switch. Verify that the toggle switch returns to the RUN position.

g. Allow the engine to idle 3 to 5 minutes, or until the coolant temperature gauge (figure 14, item 5) begins to rise.

h. Check for hydraulic oil leaks in the area of the towing machines on the main deck, and the towing machine operator's control station on the 01 level.

7. Prime the diesel engine-driven firefighting pump by completing the following actions:

a. OPEN the following valves:

(1) GS-111, FF PMP PRM EDUCTOR DISCH (figure 11, item 14), the fire pump priming eductor discharge valve, located in AMS 1 on the port side, near the fire pump.

(2) CA-73, SVCE AIR TO FF PMP PRM EDUCTOR (figure 11, item 15), service air to the fire pump prime, to start the eductor.

b. Continue priming the diesel engine-driven firefighting pump until water discharges from the overflow lines.

c. CLOSE the following valves:

(1) CA-73, SVCE AIR TO FF PMP PRM EDUCTOR (figure 11, item 15) to stop the eductor.

(2) GS-111, FF PMP PRM EDUCTOR DISCH (figure 11, item 14)

8. Load the pump drive engine by completing the following actions:

⚠ CAUTION

Ensure that the engine is at idle before engaging the power take-off lever or damage could occur.

a. Place the power take-off control lever (figure 14, item 1) in the engaged (forward) position.

b. Check the engine gauges (figure 14, items 5 and 6) to ensure that the readings are in the green range.

c. Move the mechanical governor control lever (figure 14, item 2) to the high idle (full load) position (aft). Verify that the pump drive engine is operating at approximately 1800 rpm.

d. Observe the fire main pressure gauge to verify that the firefighting pump is delivering water at approximately 120 PSI (8.3 bar).

FOAM SYSTEM ACTIVATION

1. Perform the Pressurize the Fire Main with the Diesel Engine-Driven Firefighting Pump procedure in this work package.

2. OPEN FM-84, AFFF TK SUCT (figure 11, item 16), AFFF tank suction, to align the AFFF supply system piping with the pump drive engine.

3. To start the AFFF pump:

   a. At the main switchboard in the EOS, set the AFFF PUMP circuit breaker (figure 2, item 2) to ON.

   b. At the AFFF pump motor controller complete the following actions:

      (1) Set the ON-OFF switch (figure 15, item 1) to the ON Position.

      (2) Verify the POWER AVAILABLE indicator (figure 15, item 2) is energized.

      (3) Press the START pushbutton (figure 15, item 3).

      (4) Verify that the MOTOR RUN indicator (figure 15, item 4) is energized.

      (5) Verify that the AFFF system pressure on the duplex gauge is approximately 5 PSI (0.3 bar) higher than fire main pressure.

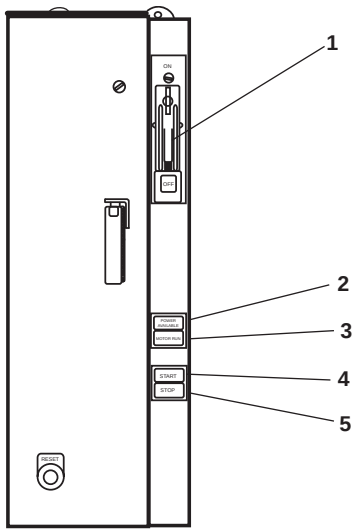


Figure 15. AFFF Pump Motor Controller

FIRE MONITOR OPERATION

WARNING

Radar and radio equipment transmit harmful radiation. Ensure that all transmitting devices are properly secured, locked out, and tagged out (FM 55-502) prior to allowing personnel to work on the pilothouse top and masts. Failure to comply may result in serious injury or death.

NOTE

The monitors are capable of shooting foam or water. If shooting foam, ensure that firefighting stations shooting water do not wash away the foam.

1. Verify that the fire main is pressurized.
2. Direct (aim) the monitor to place foam/water at the base of the fire.
3. OPEN the cutoff valve for the desired monitor.

FOAM SYSTEM SHUTDOWN

1. To shut down the AFFF pump:
   a. At the AFFF pump motor controller complete the following actions:
      (1) Press the STOP pushbutton (figure 15, item 5).
      (2) Observe that the MOTOR RUN indicator (figure 15, item 4) goes out.
      (3) Set the ON-OFF switch (figure 15, item 1) to the OFF position.
      (4) Observe that the POWER AVAILABLE indicator (figure 15, item 2) goes out.
   b. On the main switchboard in the EOS, set the AFFF PUMP circuit breaker (figure 2, item 2) to OFF.
2. To secure the AFFF system, CLOSE the following valves:
      (1) FM-84, AFFF TK SUCT (figure 11, item 16), AFFF tank suction.
      (2) FM-97 and FM-99, the AFFF proportioner differential pressure gauge, located in the overhead on the AFFF/PROPORTIONER line in AMS 1.

FIRE MONITOR SHUTDOWN

1. Keep the cutout valve OPEN, and maintain output flow until clear raw water is discharging from the monitor.
2. CLOSE the cutout valve for the desired monitor.

SECURE THE PUMP DRIVE ENGINE

1. To unload and cool down the pump drive engine:
   a. Move the governor control lever (figure 14, item 2) to the half engine speed position.
   b. Place the power take-off control lever (figure 14, item 1) in the disengaged (aft) position.

⚠ CAUTION

Stopping the engine without a cool down period may cause accelerated wear of engine components. Follow the stopping procedure to avoid damage to the engine.

c. Allow engine to idle with no load for at least 5 minutes.

d. Pull upward on the governor control lever (figure 14, item 2) and move the lever to the OFF position.

e. Place the OFF-RUN-START toggle switch (figure 14, item 4) down in the OFF position.

f. Push in START/STOP pushbutton (figure 14, item 3).

2. To secure the pump drive engine system piping:

a. OPEN FM-13, F.F. TO F.M. CRSVR (figure 11, item 12), fire pump to fire main cross connect.

b. To secure the pump drive engine, CLOSE the following valves:

(1) FO-31, F.O. SPLY TO PMP DRV ENG (figure 11, item 1), fuel oil supply to the pump drive engine

(2) Asw-19, S.W. TO PUMP DRIVE ENG (figure 11, item 4), raw water to the pump drive engine

(3) Asw-20, S.W. FR. PUMP DRIVE ENG. TO OVB'D DISCHARGE (figure 11, item 5), raw water from the pump drive engine to the overboard discharge

(4) FM-1, SEA SUCT, F.F. PMP. (figure 11, item 8), fire pump raw water suction valve, accessed from under the EOS.

(5) Asw-17, SEA SUCTION S.W. COOLING (figure 11, item 7), raw water cooling suction valve, located in the engine room below the EOS.

WASHDOWN COUNTERMEASURE (WDCM) SYSTEM OPERATION

1. Verify that the fire main is pressurized.

2. Activate the WDCM system by OPENING valve WDCM-11 (figure 8, item 4).

3. Secure the WDCM system by CLOSING valve WDCM-11 (figure 8, item 4).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
MAIN PROPULSION SYSTEM

INITIAL SETUP:

Materials/Parts:
Aural Protector, Sound (Item 12, Table 3, WP 0163 00, Volume 2)
Goggles, Industrial (Item 272, Table 3, WP 0163 00, Volume 2)

References:
TM 55-1925-208-24
TM 55-1925-223-24&P
TM 55-1925-286-13&P
TM 55-1925-292-14&P
WP 0163 00 (volume 2)

Personnel Required:
Two Watercraft Engineers, 88L

START THE STARBOARD PROPULSION PLANT

1. Ensure that the air compressors are online and that the starting air receivers are pressurized to 250 PSI (17.2 bar). If the compressors are not online or the starting air receivers are not charged, START the air compressors (TM 55-1925-286-13&P).

2. Check that the coolant level in the starboard main engine coolant expansion tank sight glass (figure 1, item 1) is between LOW and FULL in the STOP range (figure 1, item 2). If the coolant is not between LOW and FULL, add coolant through the fill cap (figure 1, item 3) until the proper level is achieved. Proper engine coolant is a 50/50 mix of ethylene glycol antifreeze and water.

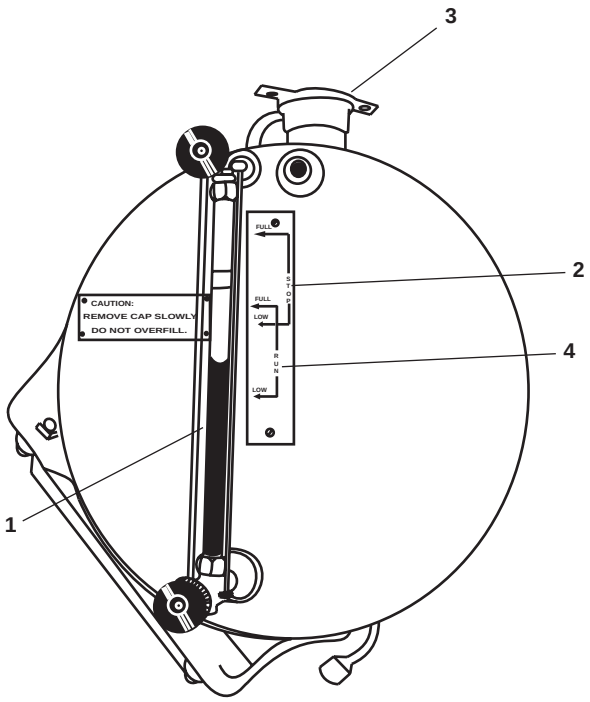


Figure 1. Main Engine Coolant Expansion Tank

3. Check that the starboard main engine oil is at the normal level on the dipstick (figure 2, item 1). If the engine oil level is low, add oil until the proper level is achieved. Refer to TM 55-1925-208-24 or the maintenance supervisor for oil specification.

4. Check that the starboard reduction gear oil is at the normal level on the dipstick (figure 2, item 2). If the reduction gear oil is level low, add oil until the proper level is achieved. Refer to TM 55-1925-223-24&P or the maintenance supervisor for oil specification.

5. At 440V power panel No. 1, set the following circuit breakers to ON:

   a. FRESH WATER PUMP No. 1, (REDUCTION GEAR). (figure 3, item 1)

   b. MAIN ENGINE LUBE OIL PRIMING PUMP No. 1. (figure 3, item 2)

   c. MAIN ENGINE JACKET WATER HEATER No. 1./TURBO OIL PUMP No. 1./WATER LAY OVER PUMP No. 1. (figure 3, item 3)

6. OPEN valve LO-48, C.O.V. PRELUBE PMP. DISCH. (figure 2, item 3).

7. PUSH the START pushbutton (figure 4, item 1) for the prelube pump.

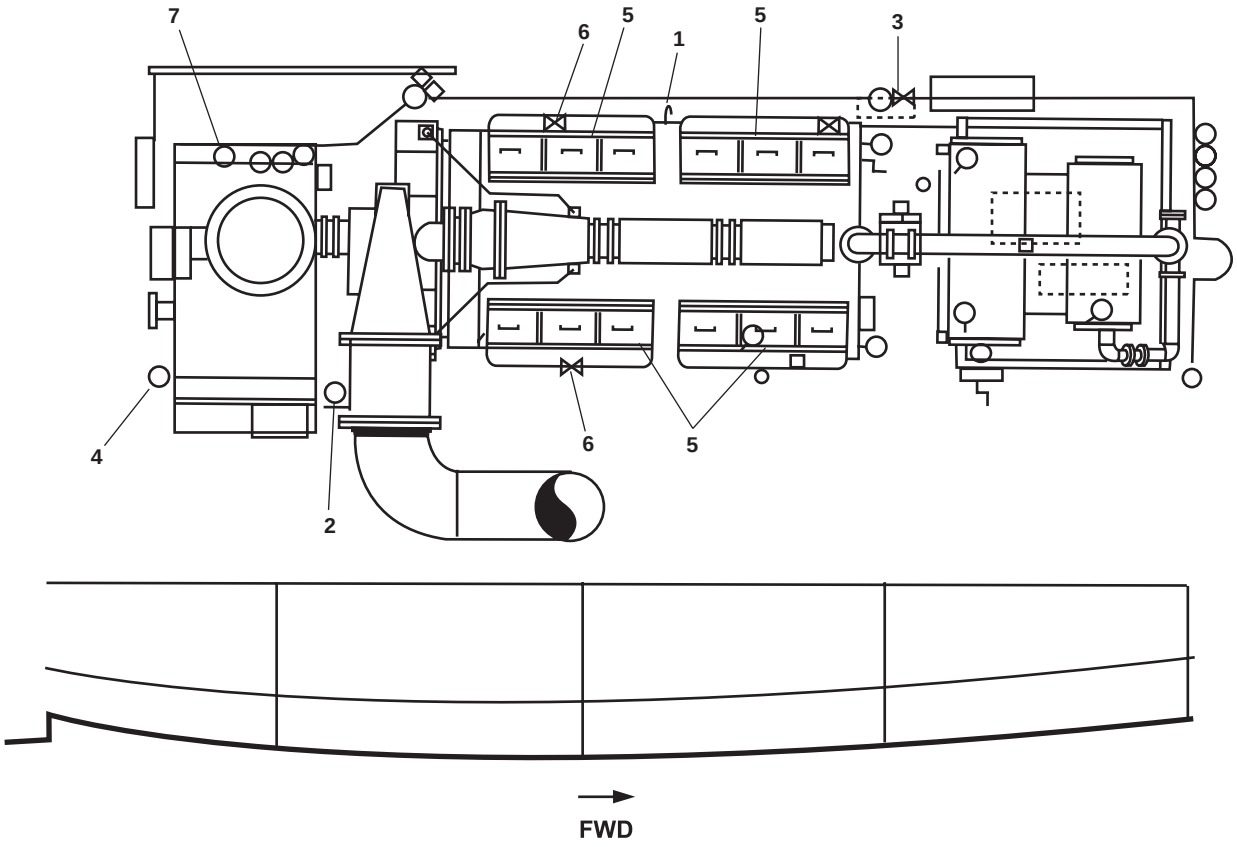


Figure 2. Starboard Main Engine and Reduction Gear

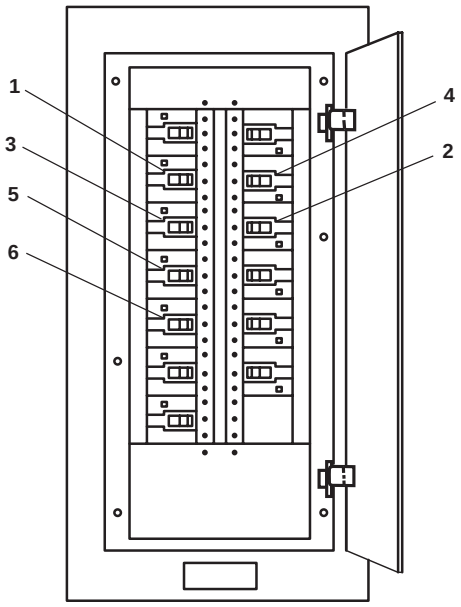


Figure 3. 440V Power Panel No. 1

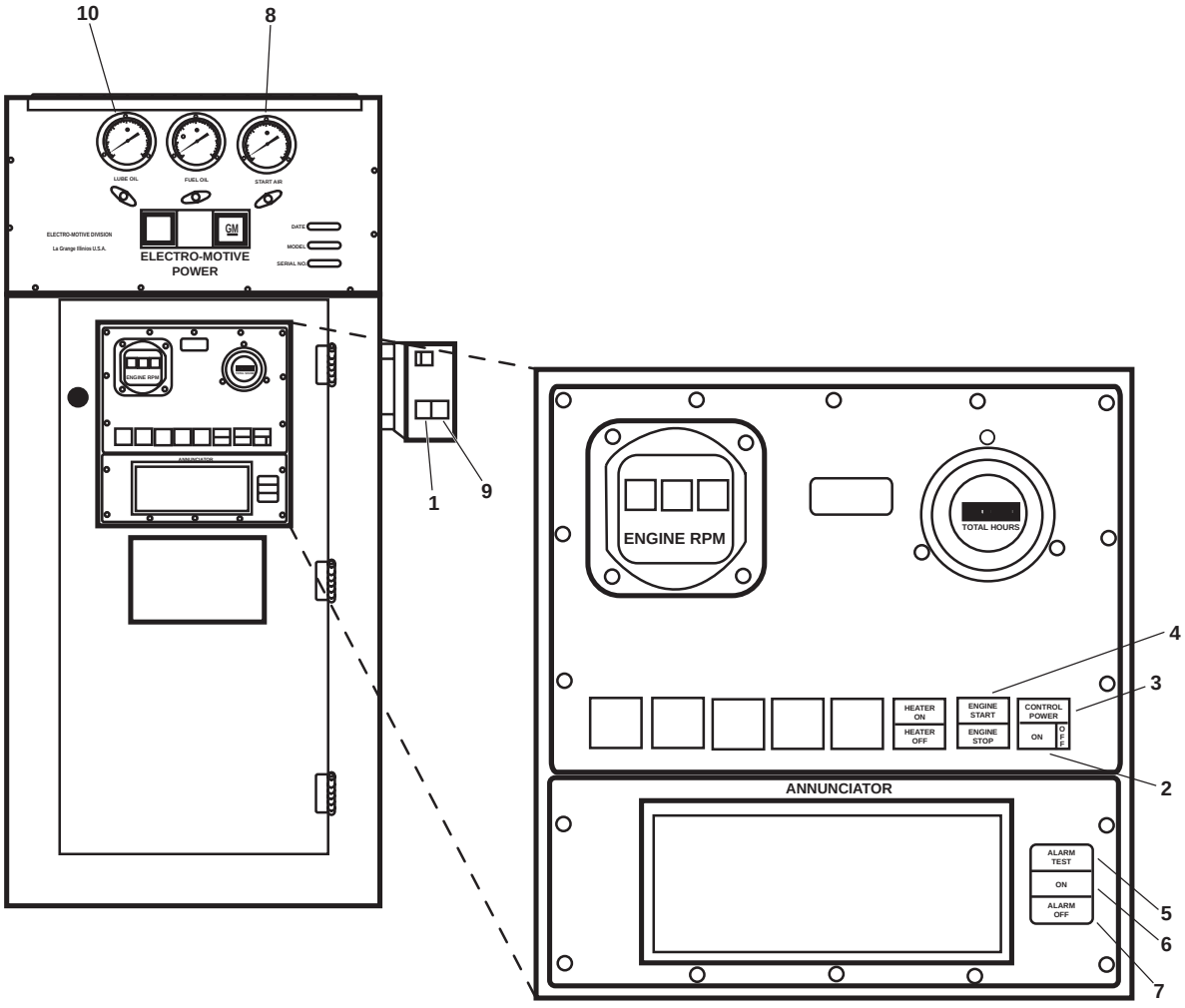


Figure 4. Starboard Main Engine Control Panel

8. At 120V emergency distribution panel No. 1, ensure that the following circuit breakers are set to ON:

NOTE

If necessary to silence the fire alarm, obtain the key, unlock the fire and smoke alarm panel and press the ALARM SILENCE pushbutton (TM 55-1925-292-14&P).

a. FIRE DETECTION SYSTEM. (figure 5, item 1)

b. E.O.T. SYSTEM. (figure 5, item 2)

c. MONITOR SYSTEM CIRCUIT. (figure 5, item 3)

d. REMOTE PROPULSION INDICATOR PANEL. (figure 5, item 4)

9. OPEN the following fuel system valves:

a. FO-20, F.O. SPLY TO STBD ME No. 1 (figure 6, item 1)

b. FO-14, F.O. SERV CRSVR (figure 6, item 2)

c. FO-15, F.O. SERV. SUCT. STBD (remote operator in the galley) (figure 6, item 3)

d. FO-35, F.O. RTN TO DAY TK. STBD (figure 6, item 4)

e. FO-34, F.O. RTN CRSVR (figure 6, item 5)

f. Four Racor fuel supply cutoff valves (figure 7, item 1) and four Racor fuel discharge cutoff valves (figure 7, item 2) located at the forward inboard corner of the engine.

10. OPEN the following coolant valves:

a. Fwc-15, F.W. FR. KEEL CLR TO RED. GEAR No. 1 (figure 6, item 6)

b. Fwc-13, F.W. FR. RED. GEAR No. 1 TO KEEL CLR (figure 6, item 7)

c. Fwc-1, F.W. FR. KEEL CLR TO M.E. N0. 1 (figure 6, item 8)

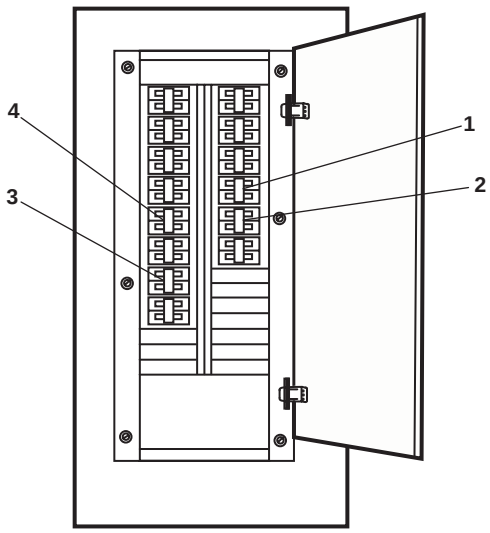


Figure 5. 120V Emergency Distribution Panel No. 1

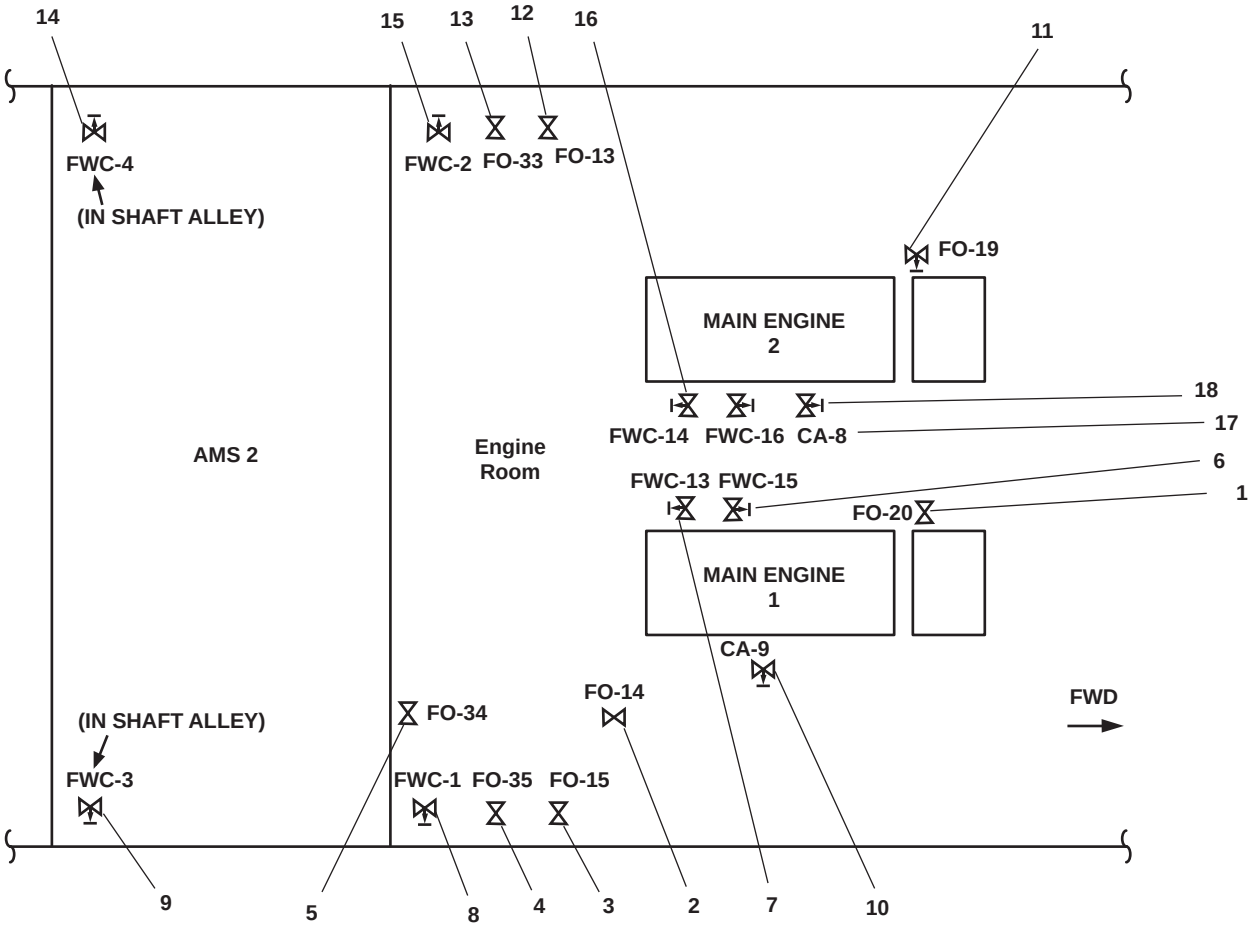


Figure 6. Main Propulsion System Valve Locations

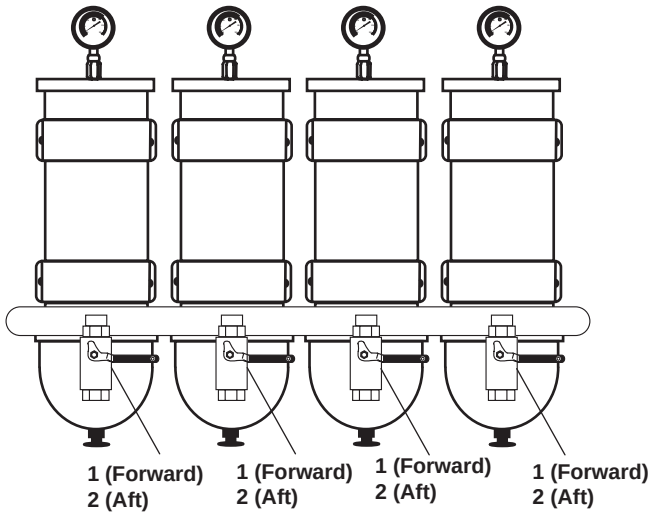


Figure 7. Racor Valves

d. FWC-3, F.W. FR. M.E. No. 1 TO KEEL CLR. (figure 6, item 9)

11. Start the reduction gear 1 fresh water cooling pump by performing the following actions at its motor controller (located on the engine room aft bulkhead):

    a. Set the ON-OFF switch (figure 8, item 1) to the ON position.

    b. Verify that the POWER AVAILABLE indicator (figure 8, item 2) is energized.

    c. Press the START pushbutton (figure 8, item 3).

    d. Verify that the MOTOR RUN indicator (figure 8, item 4) is energized.

12. Verify that the reduction gear 1 fresh water cooling pump discharge pressure gauge reads approximately 20 PSI (1.4 bar).

13. Verify that coolant is visible in the reduction gear 1 expansion tank sight glass. The sight glass is located on the forward end of the expansion tank, near the overhead, above reduction gear 1. If coolant is not visible, add coolant through the fill port. Refer to TM 55-1925-223-24&P or the maintenance supervisor for the reduction gear coolant specification.

14. OPEN valve CA-9, STG AIR TO ME #1 (figure 6, item 10).

WARNING

Starting the main engine with the reduction gear engaged can result in injury or death to personnel.

15. On the EOS console, place the COMMAND TRANSFER control (figure 9, item 1) in the EOS position.

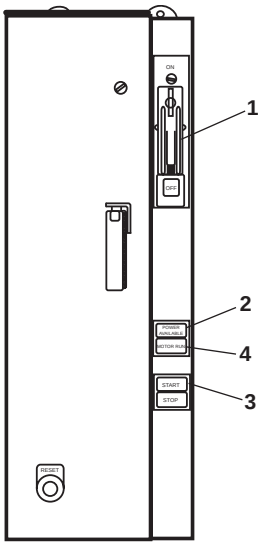


Figure 8. Reduction Gear Fresh Water Cooling Pump Motor Controller

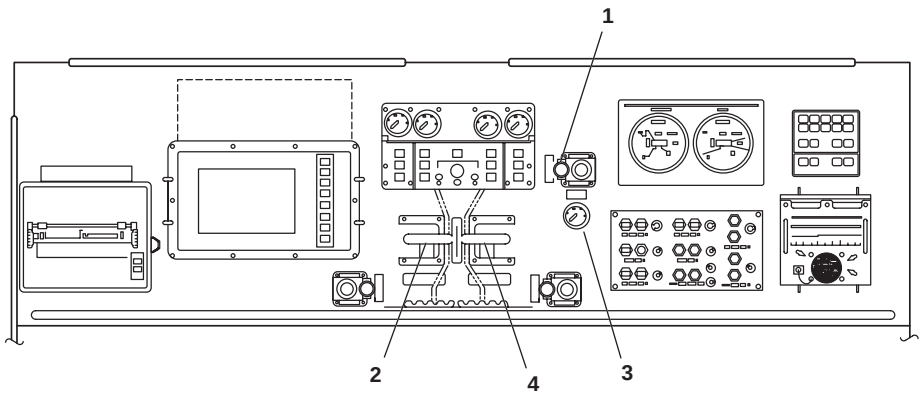


Figure 9. EOS Console

16. On the EOS console, place the STBD MN ENG THROTTLE/CLUTCH lever (figure 9, item 2) in the NEUTRAL (straight UP) position.

17. At the starboard main engine control panel:

    a. Press the CONTROL POWER pushbutton (figure 4, item 2), and verify that the CONTROL POWER indicator (figure 4, item 3) is illuminated.

NOTE

Main engine start normally includes a 60-second operation of the turbo lube oil pump prior to starting the engine. However, in an emergency, the engine may be started without delay.

    b. Momentarily press and release the ENGINE START pushbutton (figure 4, item 4) to start the turbocharger lube oil pump.

    c. Verify that the ALARM TEST indicator (figure 4, item 5) is illuminated.

    d. Verify that the power ON indicator (figure 4, item 6) is illuminated.

    e. Verify that the ALARM OFF indicator (figure 4, item 7) is illuminated.

    f. Verify that the START AIR pressure gauge (figure 4, item 8) indicates approximately 200 PSI (13.8 bar).

18. On the EOS console, verify that the CONTROL AIR PRESSURE gauge (figure 9, item 3) indicates approximately 125 PSI (8.6 bar).

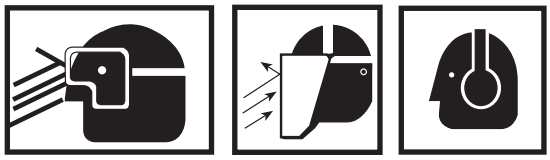
19. Ensure that the shaft brake pressure gauge (figure 2, item 4) indicates 1200 to 1500 PSI (82.7-103.4 bar).

20. Open the engine top deck covers (figure 2, item 5) and check that the valve train is receiving adequate flow from the prelube pump. If the flow is adequate, close the engine top deck covers. If the flow is inadequate, notify unit maintenance.

21. Blow down the starboard main engine by performing the following steps:

    a. OPEN the test valves (figure 10, item 1) on both sides of the starboard main engine, approximately ½ inch.

WARNING



Use eye protection when checking test valves. Failure to comply could result in severe eye damage, blindness, or death.

Do not permit personnel to stand between or outboard of the engines during blowdown. Failure to comply can result in injury or death.

High noise levels are present in the engine room and AMS 1 when the engines are operating. Hearing protection must be worn at all times when the engines are operating. Failure to comply can result in permanent loss of hearing.

b. Pull OUT on the governor's alarm switch plunger (figure 11, item 1) to prevent the engine from starting unexpectedly.

c. Press and hold the ENGINE START pushbutton (figure 4, item 4) to crank the engine for 1-2 complete revolutions. Release the ENGINE START pushbutton when finished cranking.

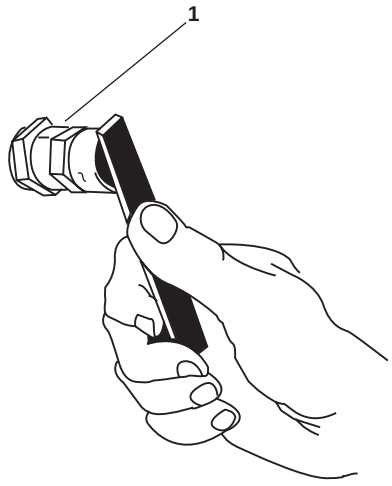


Figure 10. Main Engine Test Valve

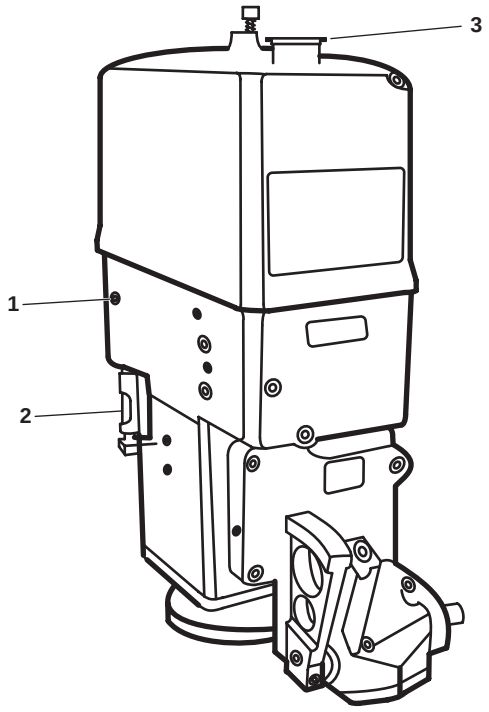


Figure 11. Governor

⚠ CAUTION

If there is any sign of water or oil being ejected at the cylinder test valves, or any indication of obstruction while rotating the engine, refer to unit maintenance. Do not attempt to start the engine until the problem has been corrected, or serious damage to the main engine could result.

d. Check the starboard main engine test valves (figure 10, item 1) and air box blow down valves (figure 2, item 6) for the presence of oil and/or water. If no oil or water are detected, continue with this procedure. If oil or water are detected, notify the maintenance supervisor.

e. CLOSE all the test valves (figure 10, item 1).

22. Ensure that the starboard main engine overspeed trip lever (figure 12) is in the RUNNING (latched) position.

23. Push IN the governor's alarm switch plunger (figure 11, item 1).

24. Check that the governor oil level is at the mid-point in the sight glass (figure 11, item 2). If the oil level is low, add oil through the fill cap (figure 11, item 3). Refer to TM 55-1925-208-24 or the maintenance supervisor for the oil specification.

NOTE

Removing the rear oil pan handhold cover is only necessary after an engine rebuild or a prolonged layup period.

25. Notify unit maintenance to remove the rear oil pan handhold cover, and confirm that lube oil is flowing from the gear train.

26. Replace/verify that all handhold and engine top deck covers are secure on the starboard main engine.

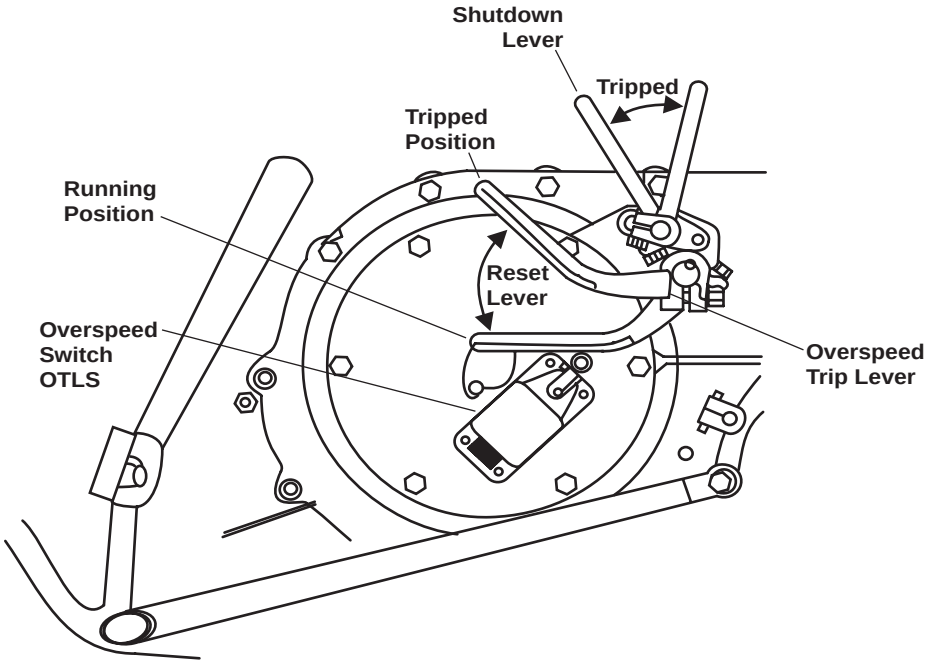


Figure 12. Main Engine Overspeed Trip Lever

27. Press the STOP pushbutton (figure 4, item 9) on the prelube pump motor controller.

WARNING

High noise levels are present in the engine room and AMS 1 when the engines are operating. Hearing protection must be worn at all times when the engines are operating. Failure to comply can result in permanent loss of hearing.

NOTE

The starboard main engine can also be started by pressing the MN ENG NO. 1 green pushbutton on EOS console.

28. Start the starboard main engine by pressing and holding the ENGINE START (figure 4, item 3) pushbutton until the engine starts.

NOTE

The engine should start within 10 seconds.

29. When the engine starts, release the ENGINE START pushbutton (figure 4, item 4).

⚠ CAUTION

If pressure is not indicated on the lube oil pressure gauge within 30 seconds after the main engine starts, stop the engine and determine the cause. Failure to comply could result in serious engine damage.

Do not increase engine speed above idle until the fresh water temperature gauge above the governor indicates at least 120 °F (49 °C). Failure to comply could result in serious engine damage.

Engine operation at less than 50% load increases turbocharger gear train wear and adds to maintenance requirements.

30. At the starboard main engine control panel, check the LUBE OIL pressure gauge (figure 3, item 10).

31. Check/verify the following conditions:

    a. Starboard reduction gear bearing oil pressure (figure 2, item 7) rises to approximately 32 PSI (2.2 bar) as soon as the engine starts.

    b. Starboard engine gauges and flow switch indicators are operating in the normal range.

    c. Engine coolant level in the starboard main engine coolant expansion tank sight glass (figure 1, item 1) is between LOW and FULL in the RUN range (figure 1, item 4). If the coolant is not between LOW and FULL, add coolant through the fill cap (figure 1, item 3) until the proper level is achieved. Proper engine coolant is a 50/50 mix of ethylene glycol antifreeze and water.

    d. Proper engine operating conditions are displayed on the machinery monitoring system.

START THE PORT PROPULSION PLANT

1. Ensure that the air compressors are online and that the starting air receivers are pressurized to 250 PSI (17.2 bar). If the compressors are not online or the starting air receivers are not charged, START the air compressors (TM 55-1925-286-13&P).

2. Check that the coolant level in the port main engine coolant expansion tank sight glass (figure 1, item 1) is between LOW and FULL in the STOP range (figure 1, item 2). If the coolant is not between LOW and FULL, add coolant through the fill cap (figure 1, item 3) until the proper level is achieved. Proper engine coolant is a 50/50 mix of ethylene glycol antifreeze and water.

3. Check that the port main engine oil is at the normal level on the dipstick (figure 13, item 1). If the engine oil level is low, add oil until the proper level is achieved. Refer to TM 55-1925-208-24 or the maintenance supervisor for the oil specification.

4. Check that the port reduction gear oil is at the normal level on the dipstick (figure 13, item 2). If the reduction gear oil is level low, add oil until the proper level is achieved. Refer to TM 55-1925-223-24&P or the maintenance supervisor for the oil specification.

5. At 440V power panel No. 1, set the following circuit breakers to ON:

   a. FRESH WATER PUMP No. 2, (REDUCTION GEAR) (figure 3, item 4)

   b. MAIN ENGINE LUBE OIL PRIMING PUMP No. 2. (figure 3, item 5)

   c. MAIN ENGINE JACKET WATER HEATER No. 2/TURBO OIL PUMP No. 2./WATER LAY OVER PUMP No. 2. (figure 3, item 6)

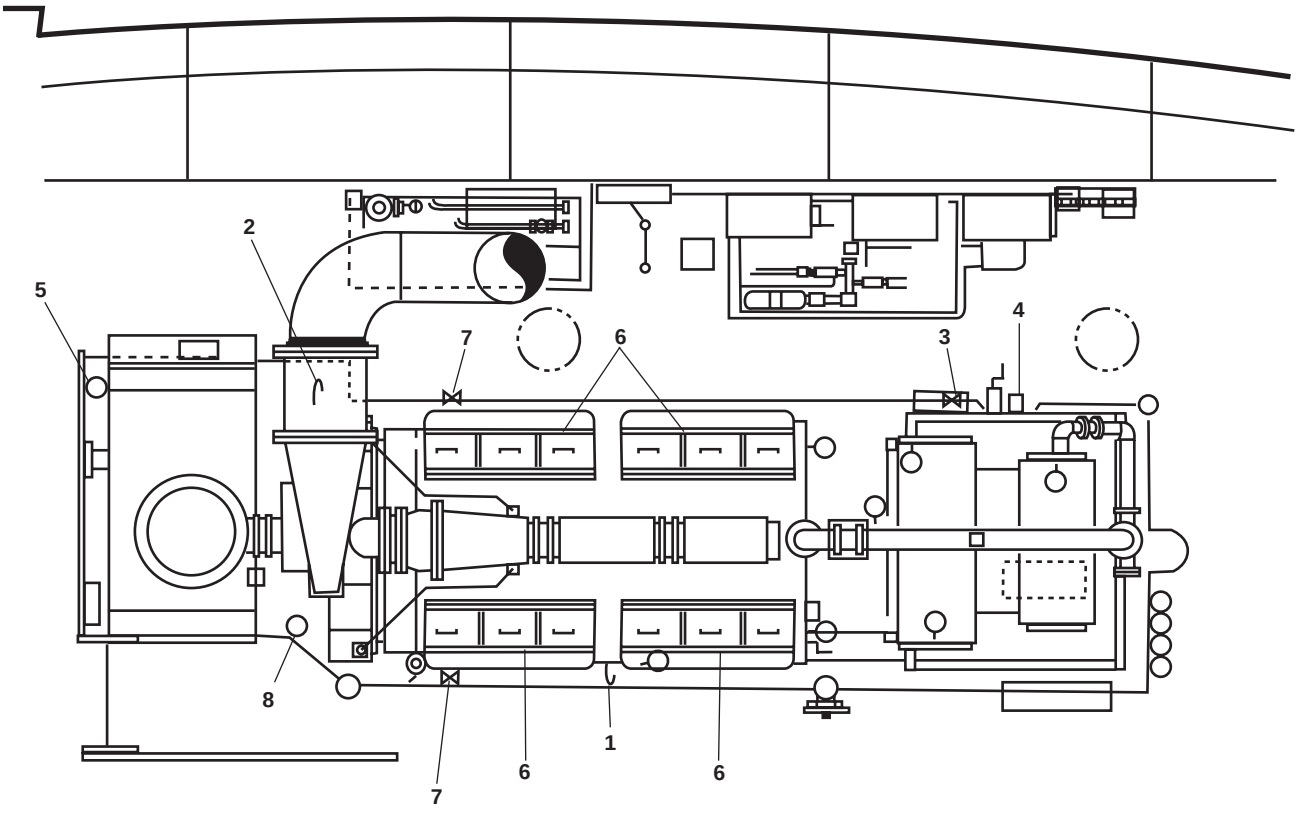


Figure 13. Port Main Engine and Reduction Gear

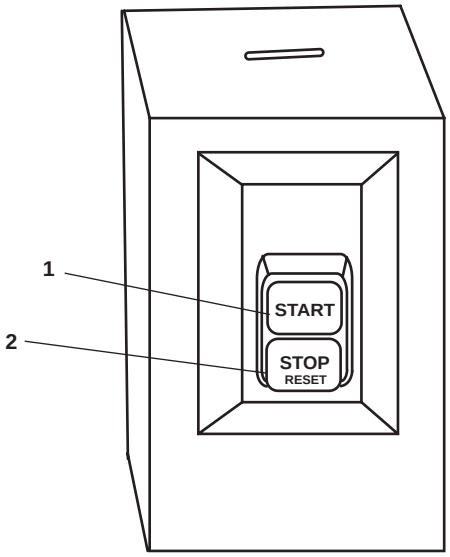


Figure 14. Port Main Engine Prelube Pump Motor Controller

6. OPEN valve LO-47, C.O.V. PRELUBE PMP. DISCH. (figure 13, item 3).

7. At the prelube pump motor controller (figure 13, item 4), PUSH the START pushbutton (figure 14, item 1).

8. At 120V emergency distribution panel No. 1, ensure that the following circuit breakers are set to ON:

NOTE

If necessary to silence the fire alarm, obtain the key, unlock the fire and smoke alarm panel and press the ALARM SILENCE pushbutton (TM 55-1925-292-14&P).

   a. FIRE DETECTION SYSTEM. (figure 5, item 1).

   b. E.O.T. SYSTEM. (figure 5, item 2).

   c. MONITOR SYSTEM CIRCUIT. (figure 5, item 3).

   d. REMOTE PROPULSION INDICATOR PANEL. (figure 5, item 4).

9. OPEN the following fuel system valves:

   a. FO-19, F.O. SPLY TO PORT ME No. 2 (figure 6, item 11).

   b. FO-14, F.O. SERV CRSVR (figure 6, item 2).

   c. FO-13, F.O. SERV. SUCT. PORT (remote operator in the main deck fan room) (figure 6, item 12).

   d. FO-33, F.O. RTN TO DAY TK. PORT (figure 6, item 13).

   e. FO-34, F.O. RTN CRSVR (figure 6, item 5).

   f. Four Racor fuel supply cutoff valves (figure 7, item 1) and four Racor fuel discharge cutoff valves (figure 7, item 2) located at the forward inboard corner of the engine.

10. OPEN the following coolant valves:

    a. FWC-4, F.W. FR. M.E. No. 2 TO KEEL CLR. (figure 6, item 14).

    b. FWC-2, F.W. FR. KEEL CLR TO M.E. No 2 (figure 6, item 15).

    c. FWC-14, F.W. FR. RED. GEAR No. 2 TO KEEL CLR (figure 6, item 16).

    d. FWC-16, F.W. FR. KEEL CLR TO RED. GEAR No. 2 (figure 6, item 17).

11. Start the reduction gear 2 fresh water cooling pump by performing the following actions at its motor controller (located on the engine room aft bulkhead):

    a. Set the ON-OFF switch (figure 8, item 1) to the ON position.

    b. Verify that the POWER AVAILABLE indicator (figure 8, item 2) is energized.

    c. Press the START pushbutton (figure 8, item 3).

    d. Verify that the MOTOR RUN indicator (figure 8, item 4) is energized.

12. Verify that the reduction gear 2 fresh water cooling pump discharge pressure gauge reads approximately 20 PSI (1.4 bar).

13. Verify that coolant is visible in the reduction gear 2 expansion tank sight glass. The sight glass is located on the aft end of the expansion tank, near the overhead, above reduction gear 1. If coolant is not visible, add coolant through the fill port. Refer to TM 55-1925-223-24&P or the maintenance supervisor for the reduction gear coolant specification.

14. OPEN valve CA-8, STG AIR TO ME #2 (figure 6, item 18).

WARNING

Starting the main engine with the reduction gear engaged can result in injury or death to personnel.

15. On the EOS console, place the COMMAND TRANSFER control (figure 9, item 1) in the EOS position.

16. On the EOS console, place the PORT MN ENG THROTTLE/CLUTCH lever (figure 9, item 4) in the NEUTRAL (straight UP) position.

17. At the port main engine control panel:

    a. Press the CONTROL POWER pushbutton (figure 15, item 1) and verify that the CONTROL POWER indicator (figure 15, item 2) is illuminated.

NOTE

Main engine start normally includes a 60-second operation of the turbo lube oil pump prior to starting the engine. However, in an emergency, the engine may be started without delay.

    b. Momentarily press and release the ENGINE START pushbutton (figure 15, item 3) to start the turbocharger lube oil pump.

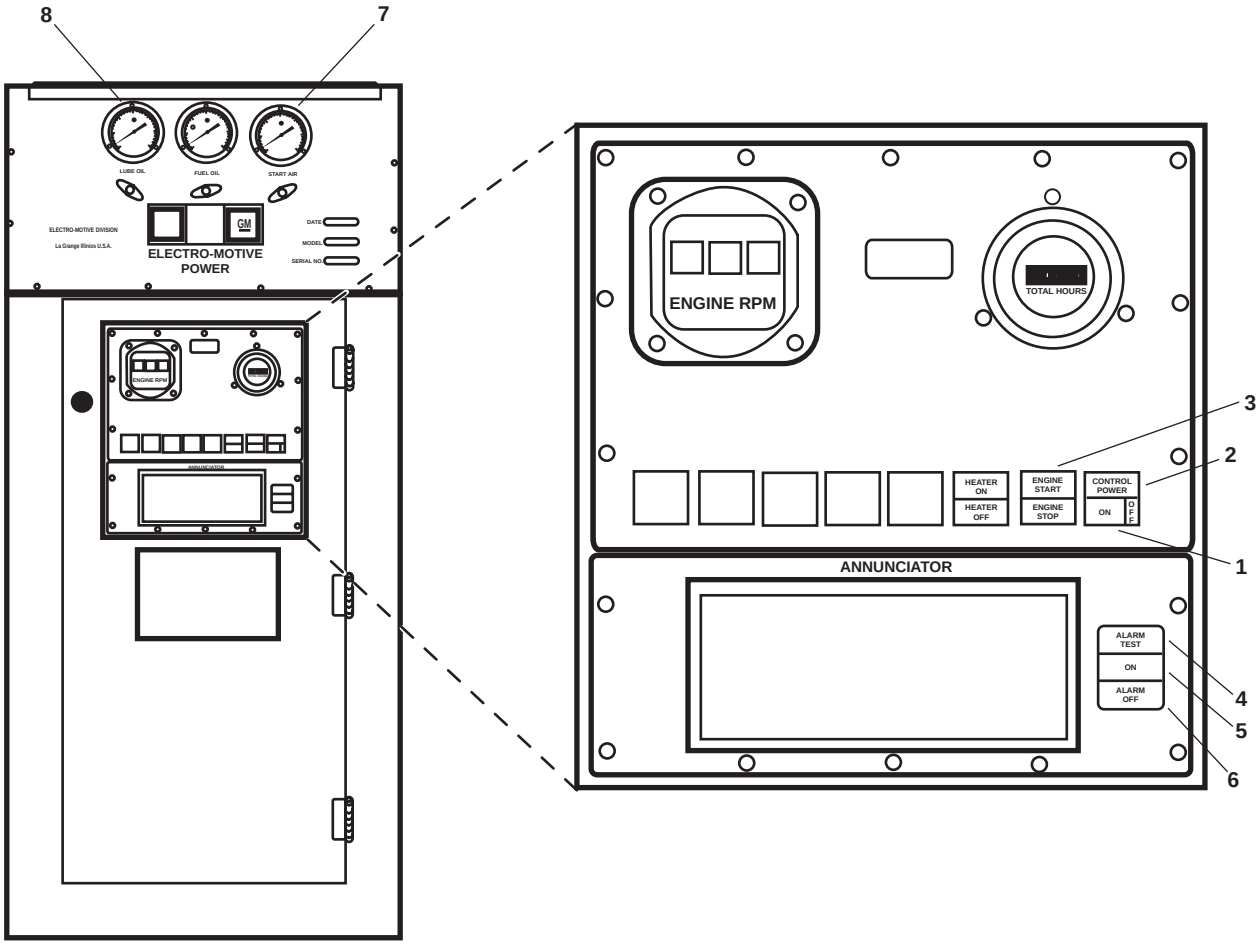


Figure 15. Port Main Engine Control Panel

c. Verify that the ALARM TEST indicator (figure 15, item 4) is illuminated.

d. Verify that the power ON indicator (figure 15, item 5) is illuminated.

e. Verify that the ALARM OFF indicator (figure 15, item 6) is illuminated.

f. Verify that the START AIR pressure gauge (figure 15, item 7) indicates approximately 200 PSI (13.8 bar).

18. On the EOS console, verify that the CONTROL AIR PRESSURE gauge (figure 9, item 3) indicates approximately 125 PSI (8.6 bar).

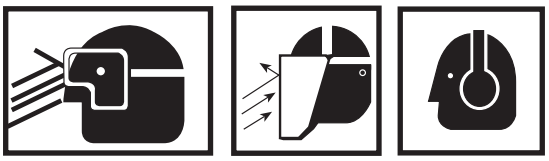
19. Ensure that the shaft brake pressure gauge (figure 13, item 5) indicates 1200 to 1500 PSI (82.7-103.4 bar).

20. Open the engine top deck covers (figure 13, item 6) and check that the valve train is receiving adequate flow from the prelube pump. If the flow is adequate, close the engine top deck covers. If the flow is inadequate, notify unit maintenance.

21. Blow down the port main engine by performing the following steps:

a. Open the test valves (figure 10, item 1) on both sides of the port main engine, approximately ½ inch.

WARNING



Use eye protection when checking test valves. Failure to comply could result in severe eye damage, blindness, or death.

Do not permit personnel to stand between or outboard of the engines during blowdown. Failure to comply can result in injury or death.

High noise levels are present in the engine room and AMS 1 when the engines are operating. Hearing protection must be worn at all times when the engines are operating. Failure to comply can result in permanent loss of hearing.

b. Pull OUT on the governor's alarm switch plunger (figure 11, item 1) to prevent the engine from starting unexpectedly.

c. Press and hold the ENGINE START pushbutton (figure 15, item 3) to crank the engine for 1-2 complete revolutions. Release the ENGINE START pushbutton when finished cranking.

⚠ CAUTION

If there is any sign of water or oil being ejected at the cylinder test valves, or any indication of obstruction while rotating the engine, refer to unit maintenance. Do not attempt to start the engine until the problem has been corrected, or serious damage to the main engine could result.

d. Check the port main engine test valves (figure 10, item 1) and air box blow down valves (figure 13, item 7) for the presence of oil and/or water. If no oil or water are detected, continue with this procedure. If oil or water are detected, notify the maintenance supervisor.

e. Shut all the test valves (figure 10, item 1).

22. Ensure that the port main engine overspeed trip lever (figure 12) is in the RUNNING (latched) position.

23. Push IN the governor's alarm switch plunger (figure 11, item 1).

24. Check that the governor oil level is at the mid-point in the sight glass (figure 11, item 2). If the oil level is low, add oil through the fill cap (figure 11, item 3). Refer to TM 55-1925-208-24 or the maintenance supervisor for the oil specification.

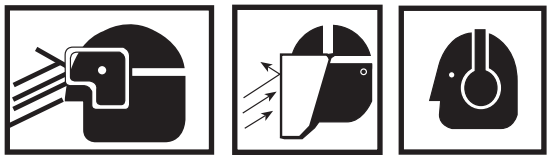
NOTE

Removing the rear oil pan handhold cover is only necessary after an engine rebuild or a prolonged layup period.

25. Notify unit maintenance to remove the rear oil pan handhold cover, and confirm that lube oil is flowing from the gear train.

26. Replace/verify that all handhold and engine top deck covers are secure on the port main engine.

WARNING



High noise levels are present in the engine room and AMS 1 when the engines are operating. Hearing protection must be worn at all times when the engines are operating. Failure to comply can result in permanent loss of hearing.

NOTE

The port main engine can also be started by pressing the MN ENG NO. 2 green pushbutton on EOS console.

27. Press the STOP pushbutton (figure 4, item 9) on the prelube pump motor controller.

28. Start the port main engine by pressing and holding the ENGINE START (figure 15, item 3) pushbutton until the engine starts.

NOTE

The engine should start within 10 seconds.

29. When the engine starts, release the ENGINE START pushbutton (figure 15, item 3).

⚠ CAUTION

If pressure is not indicated on the lube oil pressure gauge within 30 seconds after the main engine starts, stop the engine and determine the cause. Failure to comply could result in serious engine damage.

Do not increase engine speed above idle until the fresh water temperature gauge above the governor indicates at least 120 °F (49 °C). Failure to comply could result in serious engine damage.

Engine operation at less than 50% load increases turbocharger gear train wear and adds to maintenance requirements.

30. At the port main engine control panel, check the LUBE OIL pressure gauge (figure 15, item 8).

31. Check/verify the following conditions:

    a. Port reduction gear bearing oil pressure (figure 13, item 8) rises to approximately 32 PSI (2.2 bar) as soon as the engine starts.

    b. Port engine gauges and flow switch indicators are operating in the normal range.

    c. Engine coolant level in the port main engine coolant expansion tank sight glass (figure 1, item 1) is between LOW and FULL in the RUN range (figure 1, item 4). If the coolant is not between LOW and FULL, add coolant through the fill cap (figure 1, item 3) until the proper level is achieved. Proper engine coolant is a 50/50 mix of ethylene glycol antifreeze and water.

    d. Proper engine operating conditions are displayed on the machinery monitoring system.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
LUBE OIL PURIFICATION AND TRANSFER PIPING SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

GENERAL

The following procedures are included in this work package:

1. Drain the lube oil sump.
2. Fill the lube oil sump.
3. Purify the main engine lubricating oil.
4. Filling the lube oil tank
5. Pumping the contents of the lube oil tank to the oily water storage tank.

DRAIN THE LUBE OIL SUMP

⚠ CAUTION

It is important that the engine/machinery being drained of lubricating oil is properly secured until the filling procedure is complete. Rotating the engines or machinery without proper lubrication will cause major damage to the equipment.

NOTE

Drain only one sump at a time to avoid overfilling the oily waste drain tank.

1. Align the system piping as described in table 1. Refer to figure 1 for valve locations.
2. Allow enough time for the selected lube oil sump to thoroughly drain.
3. If draining a reduction gear sump, use the hand pump (figure 1, item 1).
4. After draining the sump, CLOSE any valves that were OPENED in step 2.

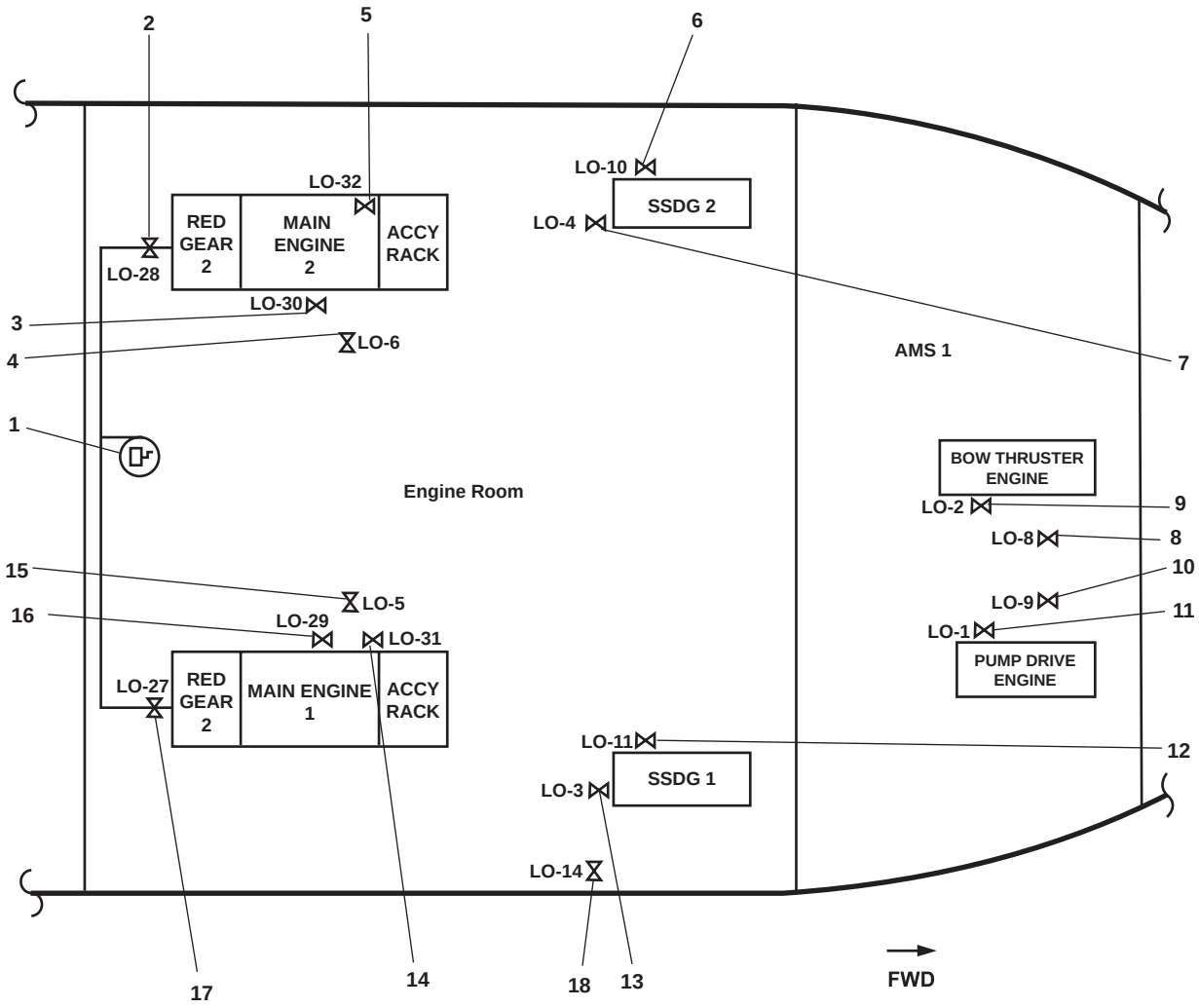


Figure 1. Lube Oil System Valve Locations

Table 1. Sump Drain Valve Alignment (Refer to Figure 1 for Valve Locations)

Sump	CLOSE	OPEN
Reduction Gear 2		Lo-28, LUBO DR. FR. RED. GEAR No. 2 (figure 1, item 2)
Main Engine 2	Lo-30, M.E. No. 2 - LUBO PUR. SUCT (figure 1, item 3) Lo-32, M.E. No. 2 - LUBO PUR DISCH. / FILL (figure 1, item 5)	Lo-6, LUBO DR TO OILY DR. TK (figure 1, item 4)
SSDG 2	Lo-10, LUBO TO S.S.D.G. No. 2 (figure 1, item 6)	Lo-4, LUBO DR TO OILY DR. TK. (figure 1, item 7)
Bow Thruster Engine	Lo-8, LUBO TO BOW THRUSTER ENG. (figure 1, item 8)	Lo-2, LUBO DR TO OILY DR. TK. (figure 1, item 9)
Pump Drive Engine	Lo-9, LUBO TO PUMP DRIVE ENG. (figure 1, item 10)	Lo-1, LUBO DR TO OILY DR. TK. (figure 1, item 11)
SSDG 1	Lo-11, LUBO TO S.S.D.G. No. 1 (figure 1, item 12)	Lo-3, LUBO DR TO OILY DR. TK. (figure 1, item 13)
Main Engine 1	Lo-31, M.E. No. 2 - LUBO PUR DISCH. / FILL (figure 1, item 14) Lo-29, M.E. No. 1 - LUBO PUR. SUCT (figure 1, item 16)	Lo-5, LUBO DR TO OILY DR. TK. (figure 1, item 15)
Reduction Gear 1		Lo-27, LUBO DR. FR. RED. GEAR No. 2 (figure 1, item 17)

FILL THE LUBE OIL SUMP

1. Align the piping for filling the selected sump with lube oil as follows:

    a. Verify that the starter of the engine of the selected engine sump to be filled is disabled, locked out, and tagged out (FM 55-502).

    b. In the engine room, on the port side, below deck level, OPEN Lo-15, LUBO STOR. TK. OUT (figure 2, item 1).

    c. In the engine room, on the port side, below deck level, OPEN Lo-7, C.O.V. - LUBO XFER PMP. SUCT. (figure 2, item 2).

    d. Line up Lo-18. LUBO SPLY. (figure 2, item 3) to send lube oil to the lube oil manifold (figure 2, item 4).

    e. Verify that Lo-17, BKT. FILL CONN is CLOSED (figure 2, item 5).

2. Align the system piping as described in table 2. Refer to figure 1 for valve locations.

Table 2. Sump Fill Alignment (Refer to Figure 1 for Valve Locations) (continued)

Sump	OPEN	CLOSE
Reduction Gear 2		Lo-28, LUBO DR. FR. RED. GEAR No. 2 (figure 1, item 2)
Main Engine 2	Lo-32, M.E. No. 2 - LUBO PUR DISCH. / FILL (figure 1, item 5) Lo-6, LUBO DR TO OILY DR. TK (figure 1, item 4)	Lo-30, M.E. No. 2 - LUBO PUR. SUCT (figure 1, item 3)
SSDG 2	Lo-10, LUBO TO S.S.D.G. No. 2 (figure 1, item 6)	Lo-4, LUBO DR TO OILY DR. TK. (figure 1, item 7)
Bow Thruster Engine	Lo-8, LUBO TO BOW THRUSTER ENG. (figure 1, item 8)	Lo-2, LUBO DR TO OILY DR. TK. (figure 1, item 9)
Pump Drive Engine	Lo-9, LUBO TO PUMP DRIVE ENG. (figure 1, item 10)	Lo-1, LUBO DR TO OILY DR. TK. (figure 1, item 11)
SSDG 1	Lo-11, LUBO TO S.S.D.G. No. 1 (figure 1, item 12)	Lo-3, LUBO DR TO OILY DR. TK. (figure 1, item 13)
Main Engine 1	Lo-31, M.E. No. 2 - LUBO PUR DISCH. / FILL (figure 1, item 14) Lo-5, LUBO DR TO OILY DR. TK. (figure 1, item 15)	Lo-29, M.E. No. 1 - LUBO PUR. SUCT (figure 1, item 16)
Reduction Gear 1		Lo-27, LUBO DR. FR. RED. GEAR No. 2 (figure 1, item 17)

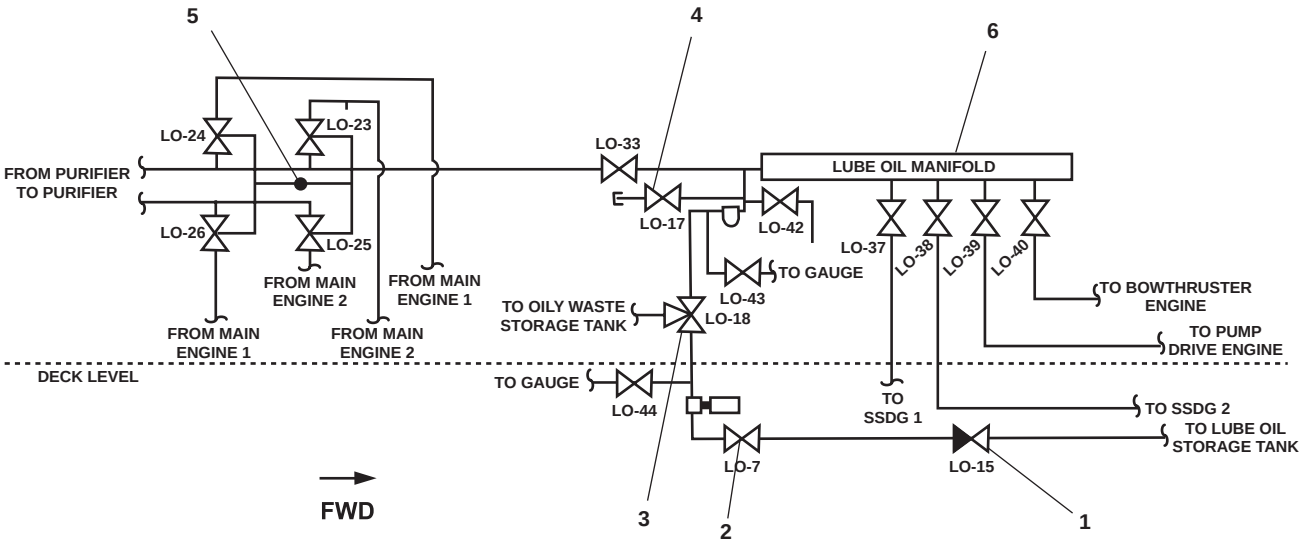


Figure 2. Lube Oil Manifold and Circuit Valve Location

⚠ CAUTION

Do not overfill the engine lube oil sump. Overfilling the sump can cause damage to the engine oil seals.

3. Align the electrical system, and start the transfer pump to fill the sump with lube oil by completing the following actions:

   a. At the main switchboard in the EOS, verify that the ENGINE ROOM PWR PNL NO.1 circuit breaker (figure 3, item 1) is set to ON.

   b. In the engine room on the aft bulkhead of the EOS, at 440V power panel No. 1, set the LUBE OIL TRANSFER PUMP circuit breaker (figure 4 item 1) to ON.

   c. In the engine room, at the lube oil transfer pump motor controller:

      (1) Set the ON-OFF switch (figure 5 item 1) to ON.

      (2) Verify that the POWER AVAILABLE indicator (figure 5, item 2) energizes.

      (3) Press the motor controller START pushbutton (figure 5, item 3).

      (4) Verify that the MOTOR RUN indicator (figure 5, item 4) energizes.

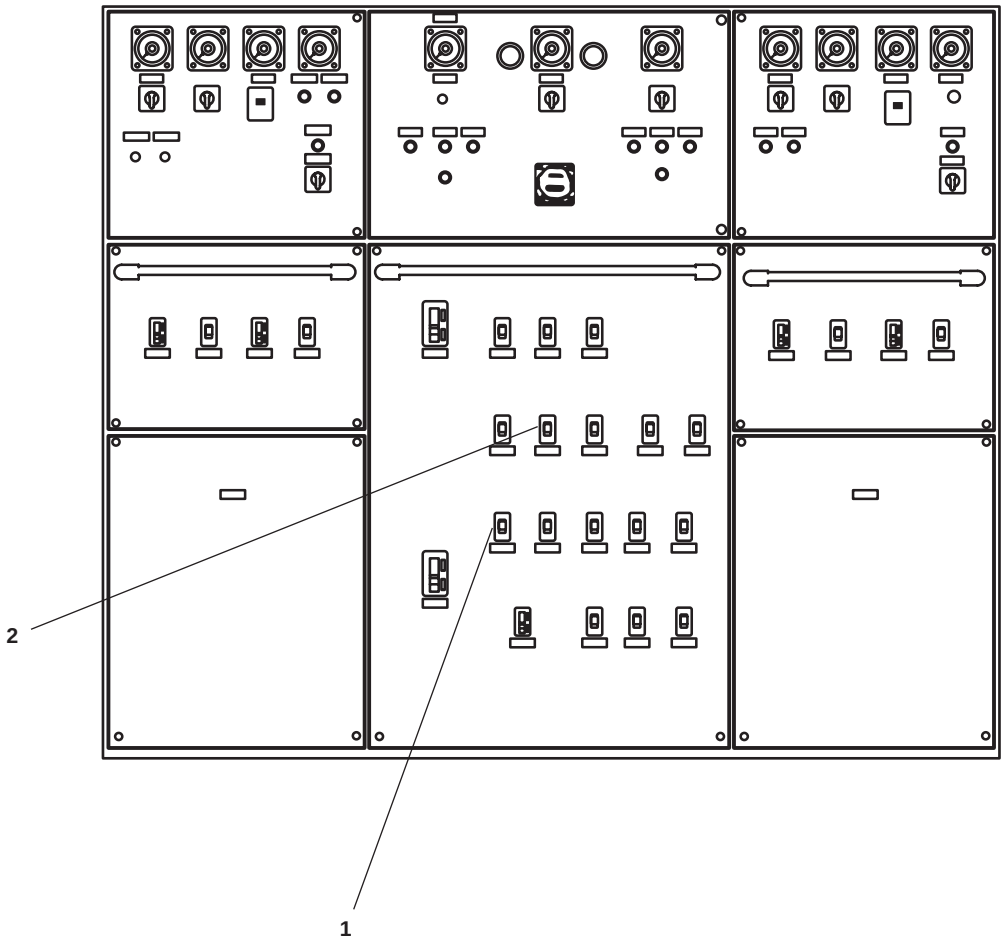


Figure 3. Main Switchboard

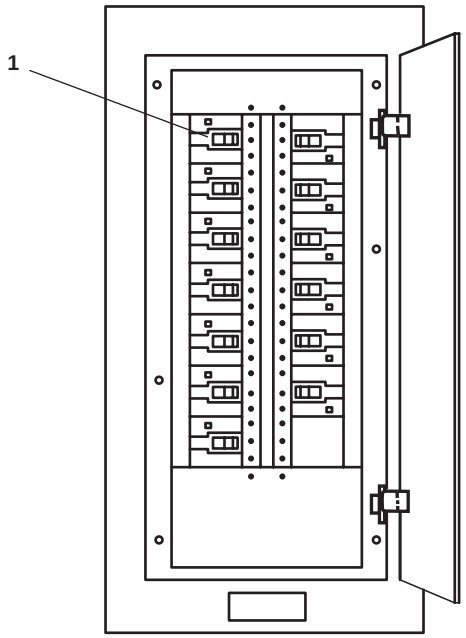


Figure 4. 440V Power Panel No. 1

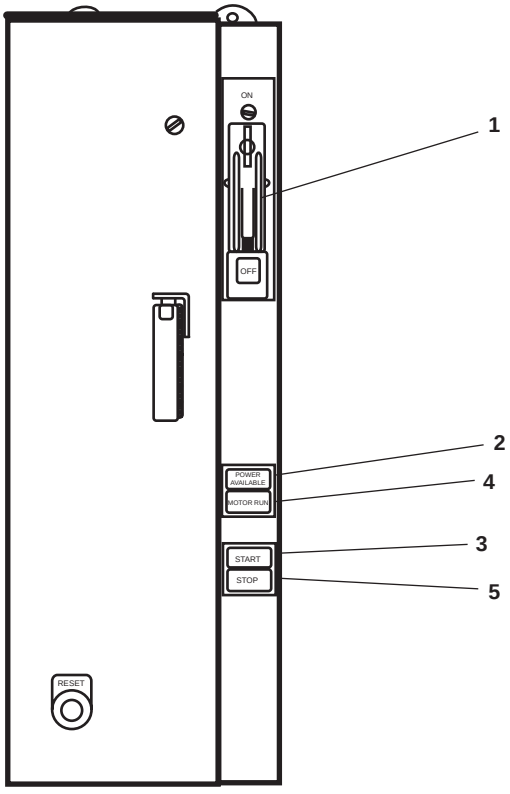


Figure 5. Lube Oil Transfer Pump Motor Controller

NOTE

When filling the sump with lube oil, frequently check the sump oil level by using the engine's dipstick. Be sure to use the ENGINE STOPPED side of the dipstick when performing this procedure.

4. When the oil level is above the ADD mark but below the FULL mark on the ENGINE STOPPED side of the dipstick, stop the lube oil transfer pump at the lube oil motor controller by completing the following actions:

   a. Press the STOP pushbutton (figure 5, item 5).

   b. Verify that the MOTOR RUN indicator lamp (figure 5, item 4) goes out.

   c. Set the ON/OFF switch (figure 5, item 1) to the OFF position.

   d. Verify that the POWER AVAILABLE indicator (figure 5, item 2) goes out.

5. Secure the electrical system at 440V power panel No. 1, by setting the LUBE OIL TRANSFER PUMP circuit breaker (figure 4, item 1) to OFF.

6. Secure the piping system by placing the following valves in the CLOSED position:

   a. In the engine room, on the port side, below deck level, Lo-15, LUBO STOR. TK. OUT (figure 2, item 1).

   b. In the engine room, on the port side, below deck level, Lo-7, C.O.V. - LUBO XFER PMP. SUCT. (figure 2, item 2).

   c. All valves on the lube oil manifold, located in the engine room on the port side (figure 2, item 4).

   d. All of the valves that were OPENED in step 2.

PURIFY THE MAIN ENGINE LUBRICATING OIL

1. In the engine room, on the port bulkhead, at the lube oil purifier heater, ensure that the heater drain valve is CLOSED.

NOTE

The circuit valve is mechanically interlocked to prevent purifying the oil of one engine while sending oil to another engine at the same time.

2. Align the piping for the selected main engine as detailed in table 3. The figure and item numbers are contained in parentheses next to each valve number.

3. Align the electrical system at the main switchboard in the EOS by setting the LUBE OIL PURIFIER circuit breaker (figure 3, item 2) to ON.

4. Start the lube oil purifier by completing the following actions:

   a. At the lube oil purifier control panel set the following controls to ON:

      (1) MAIN CIRCUIT BREAKER (figure 6, item 1).

      (2) CONTROL POWER switch (figure 6, item 2).

   b. In the engine room, on the port side, at the lube oil purifier, perform the following actions:

      (1) Release the bowl brake by turning the handle (figure 7, item 1) clockwise.

Table 3. Main Engine Valve Line Up

Main Engine	OPEN	OPEN
1	Lo-31, M.E. No. 1 - LUBO PUR DISCH. / FILL (figure 1, item 15) Lo-29, M.E. No. 1 - LUBO PUR. SUCT (figure 1, item 16) Lo-23, M.E. No. 1 - LUBO PUR. SUCT. (figure 2, item 6) Lo-24, M.E. No. 1 - LUBO PUR. DISCH / FILL (figure 2, item 6)	Lo-5, LUBO DR TO OILY DR. TK. (figure 1, item 14)
2	Lo-30, M.E. No. 2 - LUBO PUR. SUCT (figure 1, item 3) Lo-32, M.E. No. 2 - LUBO PUR DISCH. / FILL (figure 1, item 4) Lo-25, M.E. No. 2 - LUBO PUR. SUCT. (figure 2, item 6) Lo-26, M.E. No. 2 - LUBO PUR. DISCH / FILL (figure 2, item 6)	Lo-6, LUBO DR TO OILY DR. TK. (figure 1, item 5)

(2) Loosen the bowl lock screws (figure 7, item 2).

(3) Unfasten the three hood securing bolts (figure 7, item 3).

(4) Open the hood (figure 7, item 4).

(5) Ensure that the bowl can be turned by hand.

(6) Close the hood (figure 7, item 4).

(7) Fasten the three hood securing bolts (figure 7, item 3).

⚠ CAUTION

The lube oil purifier gear oil sight glass must be at least two-thirds full. Operating the lube oil purifier with a low gear oil level could damage the purifier.

(8) Observe the gear oil level in the sight glass (figure 7, item 5).

c. At the lube oil purifier control panel:

(1) Press the START pushbutton (figure 6, item 3)

(2) Verify that the MOTOR START indicator (figure 6, item 4) energizes.

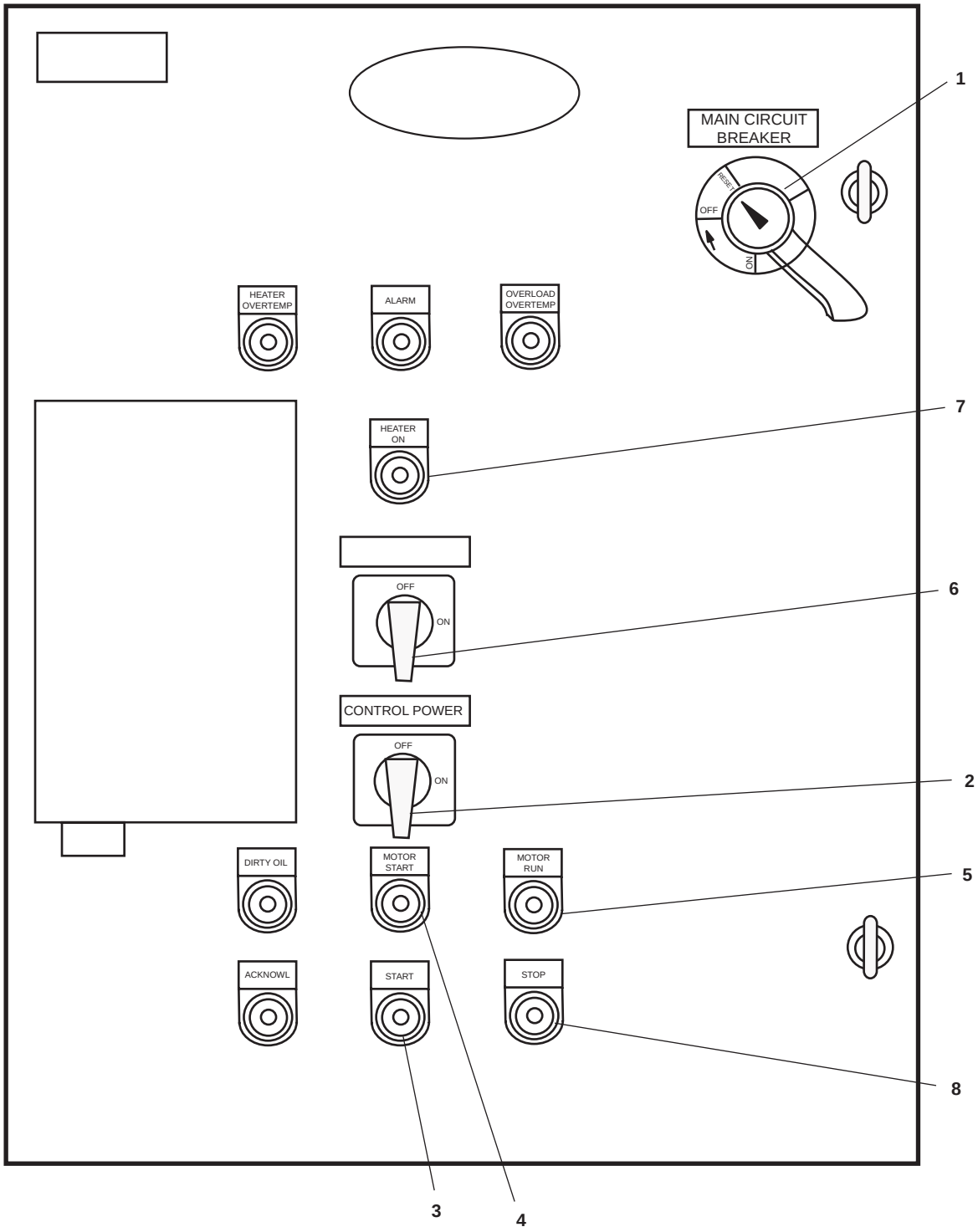


Figure 6. Lube Oil Purifier Control Panel

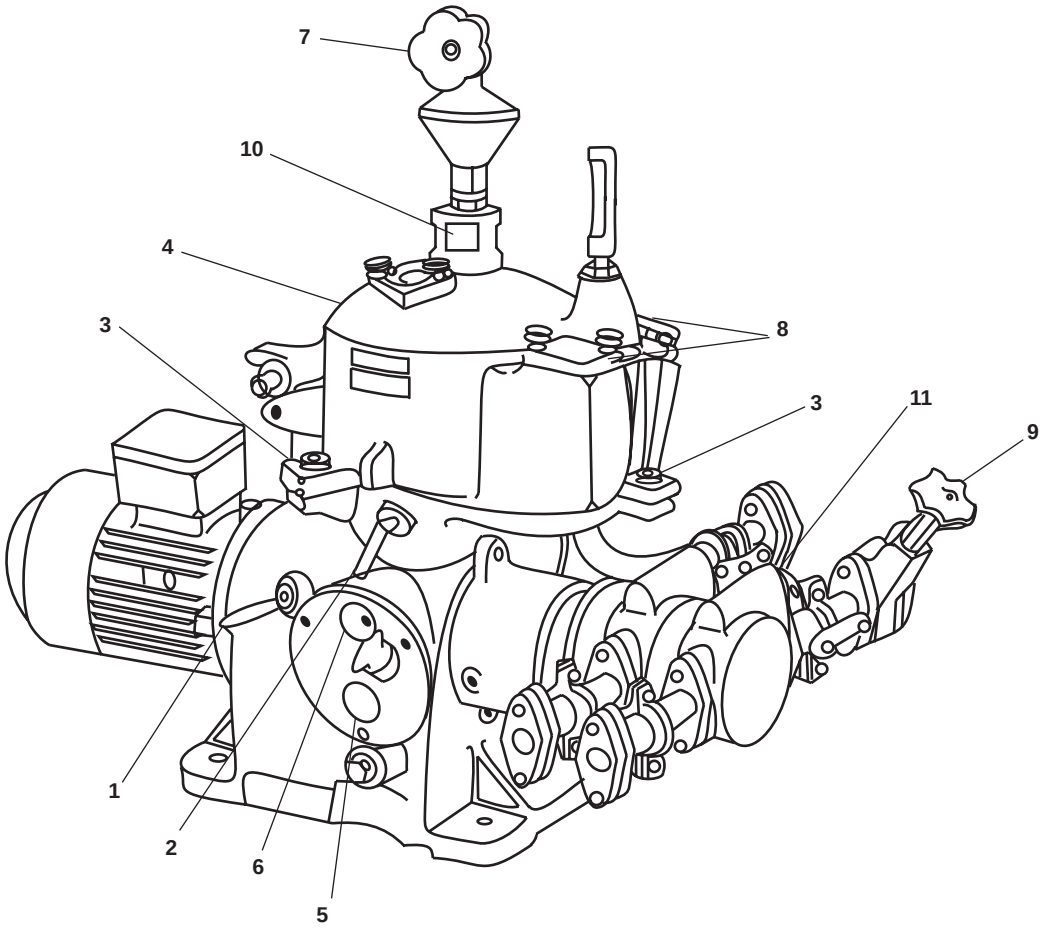


Figure 7. Lube Oil Purifier

NOTE

It takes 3 to 4 minutes for the bowl to reach its rated speed. When the bowl has reached its rated speed, the motor run indicator will energize and the motor start indicator will go out.

d. At the lube oil purifier, perform the following actions:

(1) Check the revolution indicator disc (figure 7, item 6) and verify that the purifier is maintaining 65 to 78 r/min.

(2) Open the needle valve (figure 7, item 7) to the fill bowl with water.

NOTE

The bowl is full when water enters and drains from the discharge chamber, as observed through the opened inspection cover.

(3) Open the inspection cover (figure 7, item 8) to verify that the bowl is filling with water.

(4) When bowl is full, adjust the needle valve (figure 7, item 7) so that 1-3 drops per second of make-up water enter the bowl for proper oil purification.

NOTE

The seal formed by the fresh water will prevent oil from escaping through the water outlet.

(5) OPEN the shutoff valve (figure 7, item 9) to feed the dirty oil to the oil pre-heater.

(6) Verify that dirty oil enters the sight glass (figure 7, item 10).

(7) CLOSE the shutoff valve (figure 7, item 9).

e. At the lube oil purifier control panel:

(1) After the bowl reaches its rated speed, verify that the motor run indicator (figure 6, item 5) is energized.

(2) Verify that the motor start indicator (figure 6, item 4) goes out.

(3) Set the HEATER switch (figure 6, item 6) to the ON position.

(4) Verify that the HEATER ON indicator (figure 6, item 7) energizes.

NOTE

Heat oil to separating temperature of 70° to 80 °C (150° to 176 °F).

f. At the lube oil purifier perform the following actions:

NOTE

The purifier hourly capacity is variable depending on temperature, grade, and the amount of impurities in the oil.

(1) Slowly OPEN the shutoff valve (figure 7, item 9) in the oil supply line to the separator, and adjust the oil flow rate to the match hourly capacity.

(2) Observe through the opened inspection covers (figure 7, item 8), that the purifier has both dirty water and clean oil discharges.

5. Stopping and securing the lube oil purifier.

⚠ CAUTION

Allow the oil to continue flowing for several minutes to ensure proper cool down of the heater elements. Securing oil flow before the heater elements are sufficiently cooled can cause damage to the heater.

a. In the engine room, on the port bulkhead, at the lube oil purifier control panel:

(1) Set the HEATER switch (figure 6, item 6) to OFF.

(2) Verify that the HEATER ON indicator (figure 6, item 7) goes out.

(3) Press the STOP pushbutton (figure 6, item 8).

(4) Verify that the MOTOR RUN indicator (figure 6, item 5) goes out.

(5) Set the CONTROL POWER switch (figure 6, item 2) to OFF.

(6) Set the MAIN CIRCUIT BREAKER (figure 6, item 1) to OFF.

b. At the main switchboard in the EOS, set the LUBE OIL PURIFIER circuit breaker (figure 3, item 2) to OFF.

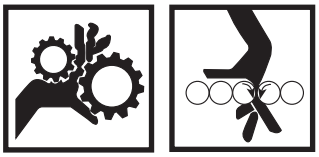
c. At the lube oil purifier perform the following actions:

(1) CLOSE the shutoff valve (figure 7, item 9) to shut off the dirty oil supply.

(2) CLOSE the needle valve (figure 7, item 7) to shut off any makeup water.

(3) Observe revolution indicator disc (figure 7, item 6) to ensure that the bowl stops.

WARNING



Do not loosen or remove any parts or apply the brake before the bowl comes to a complete stop, or serious personal injury and/or damage to the equipment could result.

(4) When the bowl comes to a complete stop, apply the brake by turning the handle (figure 7, item 1) counterclockwise.

(5) OPEN the dirty oil drain (figure 7, item 11) to drain the feed channel of the hood.

(6) CLOSE the dirty oil drain (figure 7, item 11).

(7) Remove the three hood securing bolts (figure 7, item 3).

(8) OPEN the hood (figure 7, item 4).

(9) Clean the bowl.

(10) Secure the bowl lock screws (figure 7, item 2) by turning them counterclockwise.

(11) CLOSE the hood (figure 7, item 4).

(12) Fasten the three hood securing bolts (figure 7, item 3).

FILLING THE LUBE OIL TANK

NOTE

Filling the lube oil tank requires the use of communications at various stations to prevent spillage of lube oil and/or the overfilling of the lube oil tank.

1. In the engine room, on the port bulkhead, verify that the remote Tank Level Indicator (TLI) (figure 8, item 1) for the lube oil tank is operational.

2. Connect a lube oil supply hose (from an external source) to the lube oil deck fill valve, Lo-20, LUBO MN. DK. FILL CONN., located on the 01 level port side weather deck, slightly aft of frame 40.

3. Slowly OPEN Lo-20, LUBO MN. DK. FILL CONN.

4. Fill the lube oil tank by directing the external source to begin pumping lube oil.

5. On the TLI receiver module (figure 8, item 1), observe the fluid level meter. When the tank is near full, direct the supplier to stop pumping.

6. Allow all hoses to drain before disconnecting.

7. Disconnect the supply hose, and recap the hose fill connection fitting.

8. CLOSE and cap Lo-20, LUBO MN. DK. FILL CONN.

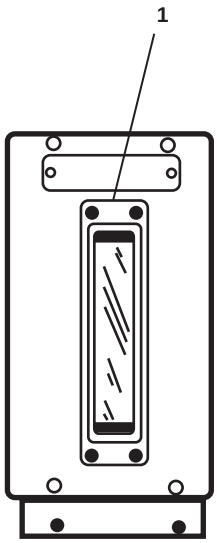


Figure 8. Lube Oil Tank Level Indicator

PUMPING THE CONTENTS OF THE LUBE OIL TANK TO THE OILY WATER STORAGE TANK

1. Align the piping system.

   a. OPEN Lo-15, LUBO STOR. TK. OUT. (figure 2, item 1), located in the engine room, on the port side, below deck level.

   b. OPEN Lo-7, C.O.V. - LUBO XFER PMP. SUCT. (figure 2, item 2), located in the engine room, on the port side, below deck level.

   c. Line up Lo-18, LUBO SPLY. (figure 2, item 3), to send lube oil to the oily waste storage tank.

   d. OPEN Lo-14, LUBO XFER. TO OILY WST. STOR. TK. (figure 1, item 18), located on the starboard engine room bulkhead, aft of SSDG 1.

2. Align the electrical system, and start the lube oil transfer pump.

   a. Verify that the remote TLI (figure 8, item 1), is operational.

   b. At the 440V power panel No. 1, set the LUBE OIL TRANSFER PUMP circuit breaker (figure 4, item 1) to ON.

c. In the engine room, on the port bulkhead, at the lube oil transfer pump motor controller, perform the following actions:

(1) Set the ON-OFF switch (figure 5, item 1) to the ON position

(2) Verify that the POWER AVAILABLE indicator (figure 5, item 2) energizes.

(3) Press the START pushbutton (figure 5, item 3).

(4) Verify that the MOTOR RUN indicator (figure 5, item 4) energizes.

3. Monitor the lube oil tank remote TLI (figure 8, item 1), and observe that the tank level decreases.

4. When the lube oil tank is near empty, stop the lube oil transfer pump at the motor controller, by performing the following actions:

a. Press the STOP pushbutton (figure 5, item 5).

b. Verify that the MOTOR RUN indicator (figure 5, item 4) goes out.

c. Set the ON-OFF switch (figure 5, item 1) to OFF

d. Verify that the POWER AVAILABLE indicator (figure 5, item 2) goes out.

5. Secure the piping system by closing the following valves:

a. Lo-15, LUBO STOR. TK. OUT. (figure 2, item 1)

b. Lo-7, C.O.V. - LUBO XFER PMP. SUCT. (figure 2, item 2)

c. Lo-14, LUBO XFER. TO OILY WST. STOR. TK. (figure 1, item 18)

6. Line up Lo-18, LUBO SPLY. to the lube oil manifold position (figure 2, item 3)

7. At the 440V power panel No. 1, set the LUBE OIL TRANSFER PUMP circuit breaker (figure 4, item 1) to OFF.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
FUEL OIL FILL, TRANSFER, AND SUPPLY SYSTEM

INITIAL SETUP:

Personnel Required:
Six Watercraft Engineers, 88L

References:
FM 55-502
TM 55-1925-283-12&P

PURPOSE

This work package provides the user with instructions for transferring fuel within the vessel and fueling the vessel from an off hull source under normal conditions. The following procedures are contained within this work package:

1. Aligning the electrical system for fuel transfer operations.

2. Filling the day tanks.

3. Transferring fuel between storage tanks.

4. Fueling.

ALIGNING THE ELECTRICAL SYSTEM FOR FUEL TRANSFER OPERATIONS

1. In the engine room, on the starboard side, at 120V emergency distribution panel No. 1, set the following circuit breakers to ON:

   a. RACOR FILTER. (figure 1, item 1).

   b. TLI SYSTEM. (figure 1, item 2).

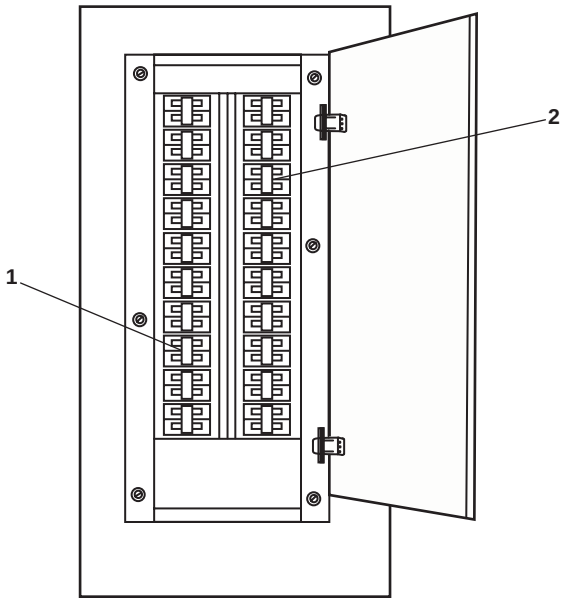


Figure 1. 120V Emergency Distribution Panel No. 1

2. At the emergency switchboard, in the emergency diesel generator room, set the FUEL OIL XFER PUMP circuit breaker (figure 2, item 1) to ON.

3. At 440V power panel No. 1, set FUEL OIL TRANSFER PUMP No. 2. circuit breaker (figure 3, item 1) to ON.

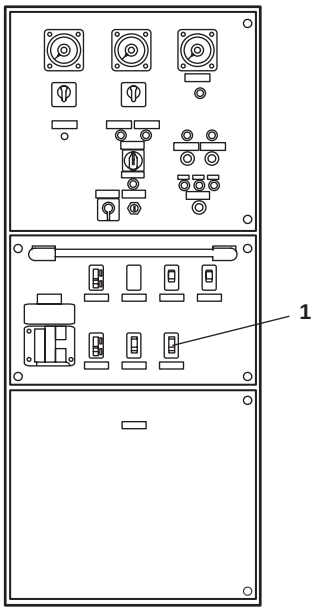


Figure 2. EDG Emergency Switchboard

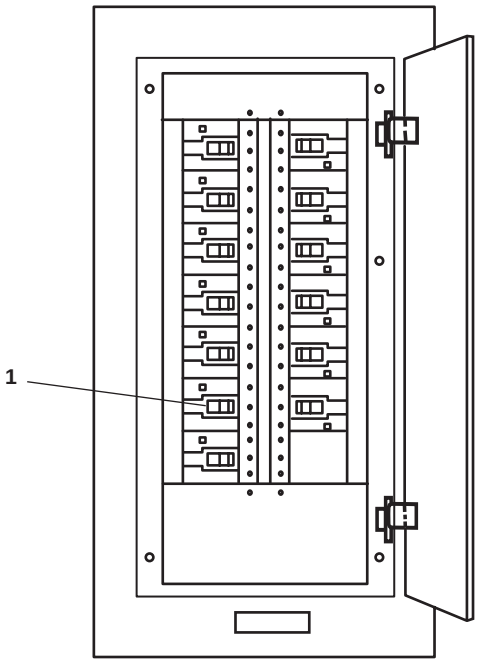


Figure 3. 440V Power Panel No. 1

4. Energize and test the high level alarm panel:

   a. In the engine room on the aft bulkhead of the EOS, at the machinery DC control distribution panel, set/verify that the FUEL OIL DAY TANKS (P&S) HIGH LEVEL ALARM circuit breaker (figure 4, item 1) is set to ON.

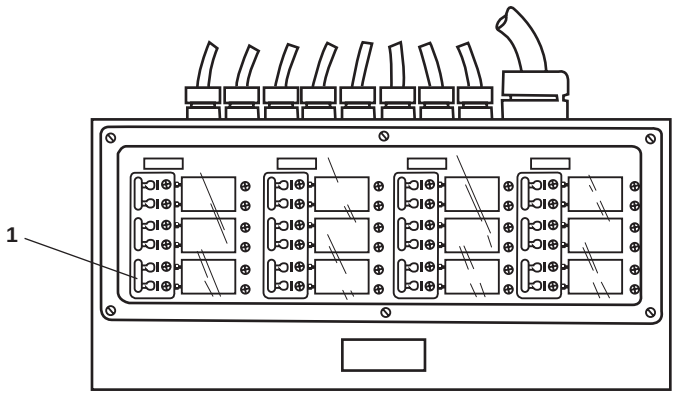


Figure 4. Machinery DC Control Distribution Panel

   b. In the engine room, at the fuel oil transfer station, test the port and starboard day tank high level alarm panel by momentarily placing each TEST switch (figure 5, item 1) in the ON position.

   c. If necessary, secure the tested alarm by momentarily pressing the HORN/STROBE SILENCE pushbutton (figure 5, item 2) on the port and starboard day tank high level alarm panel.

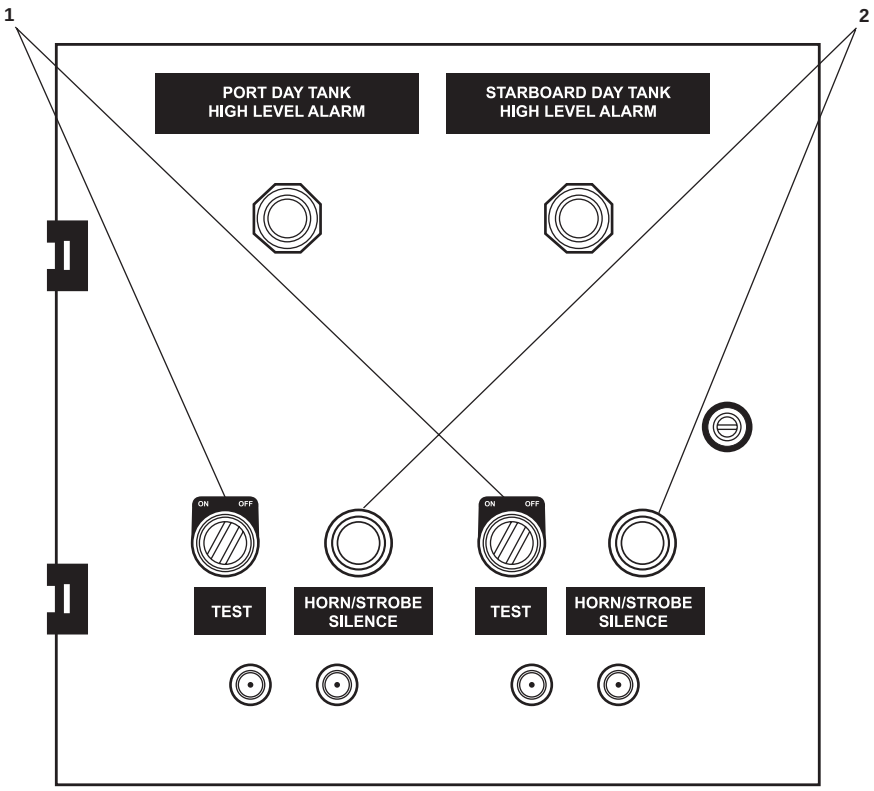


Figure 5. High Level Alarm Panel

5. Set to ON the ON-OFF switch (figure 6, item 1) on the master tank level indicator panel (figure 6, item 2) in the EOS.

6. Compare the STBD DAY TK Tank Level Indicator (TLI) gauge (figure 6, item 3) and the PORT DAY TK TLI gauge (figure 6, item 4) in the EOS with the STARBOARD DAY TANK TLI gauge (figure 7, item 1) and the PORT DAY TANK TLI gauge (figure 7, item 2) above the fuel oil transfer manifold (figure 7, item 3).

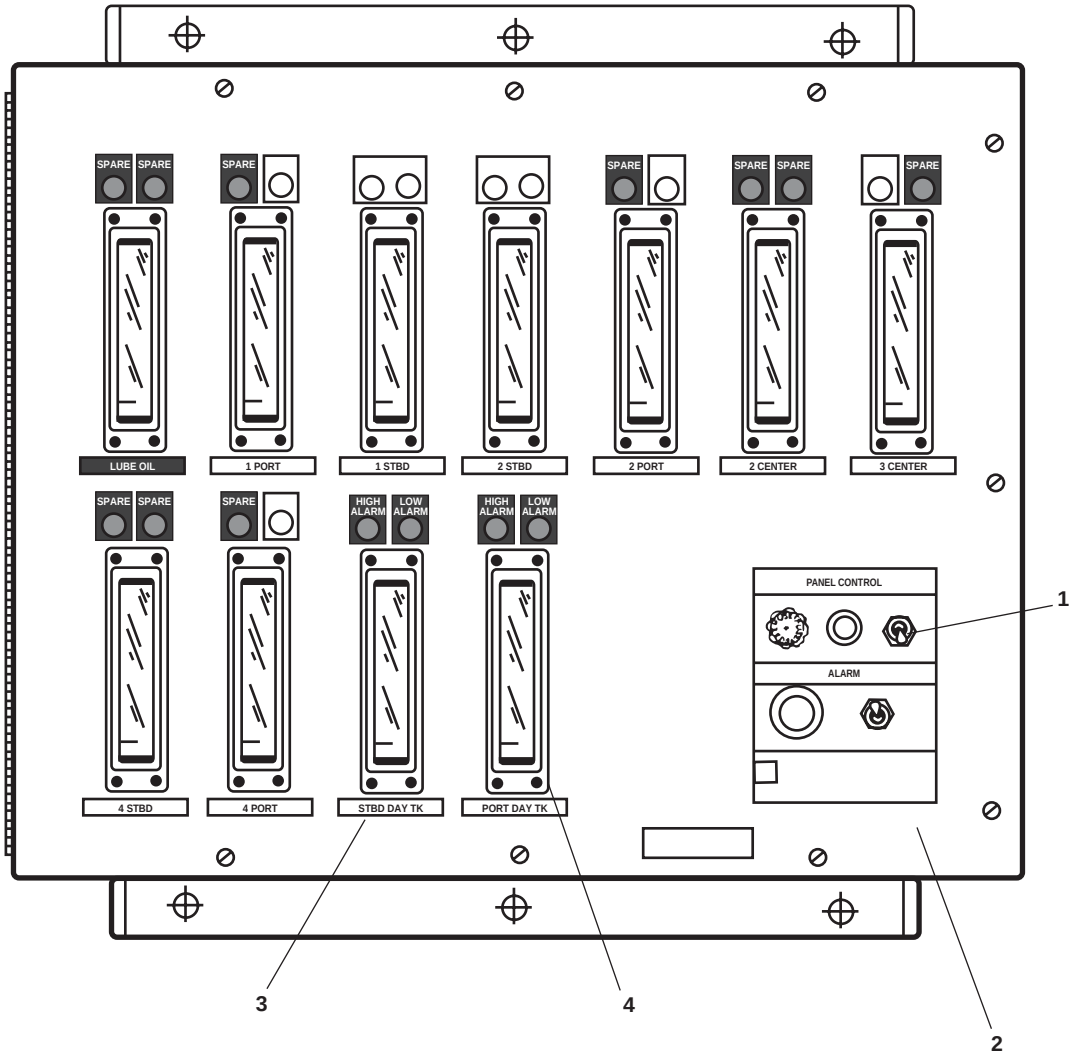


Figure 6. Master Tank Level Indicator Panel

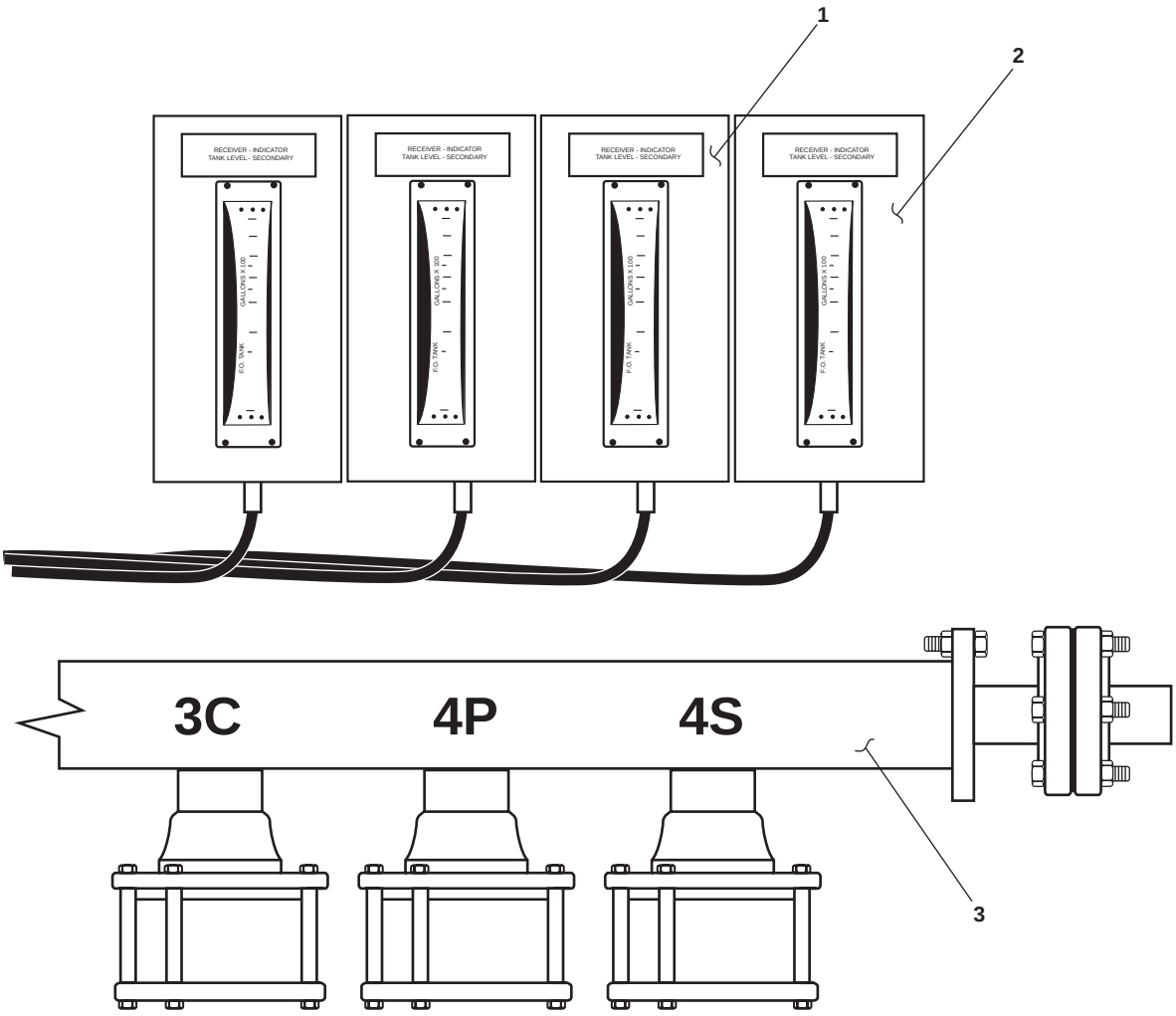


Figure 7. Fuel Filter/Water Separator Filter Control Panel

FILL THE DAY TANKS

1. Align the fuel oil transfer piping system as follows:

   a. Verify and place the following valves in the CLOSED position:

      (1) FO-3, DK. FILL CONN (figure 8, item 1)

      (2) FO-4, DK. FILL CONN (figure 8, item 2)

      (3) FO-5, F.O. DAY TK EMERG FILL (figure 8, item 3)

   b. If operating the fuel filter/water separator, complete the following actions:

      (1) At the fuel filter/water separator control panel, set the OFF/ON (figure 9, item 1) switch to ON.

      (2) OPEN FO-17, F.O. FLTR/WATER SEP OUTLET. COV (figure 8, item 8).

      (3) CLOSE FO-42, F.O. FLTR/WATER SEP BYPASS COV (figure 8, item 9).

      (4) OPEN FO-16, F.O. FLTR/WATER SEP INLET. COV (figure 8, item 10).

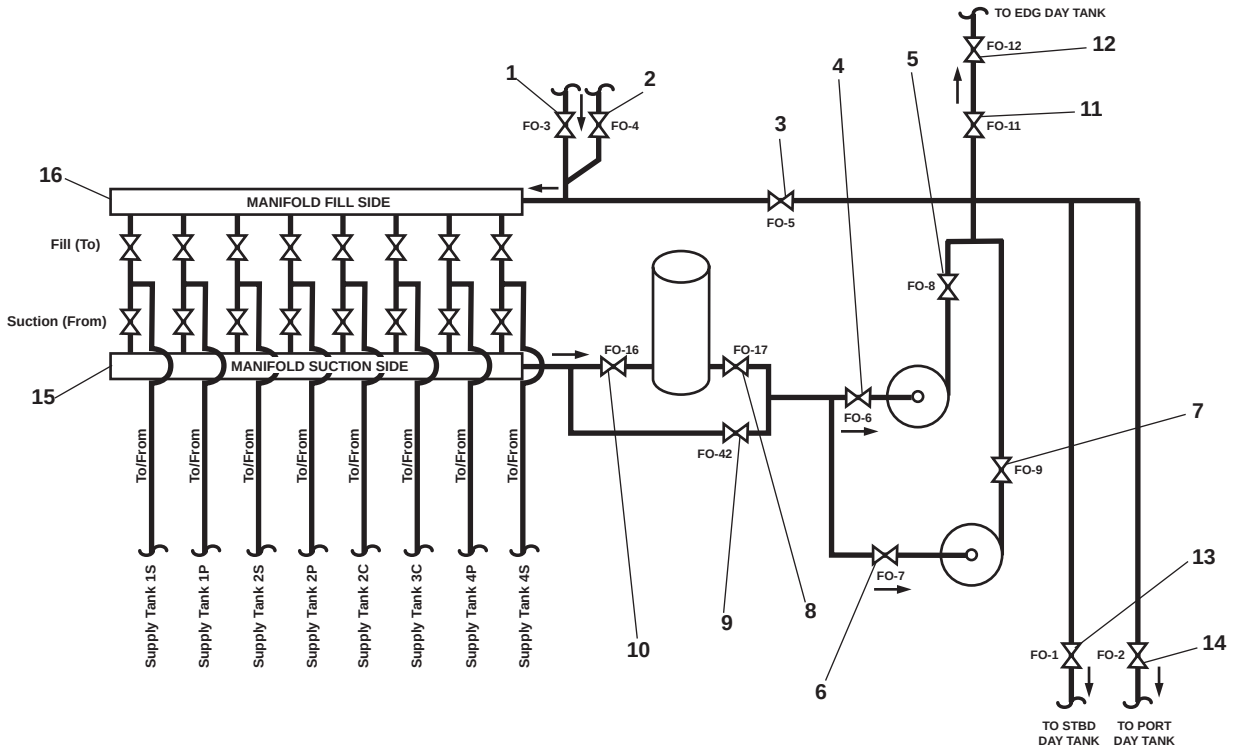


Figure 8. Fuel Oil Valve Locations

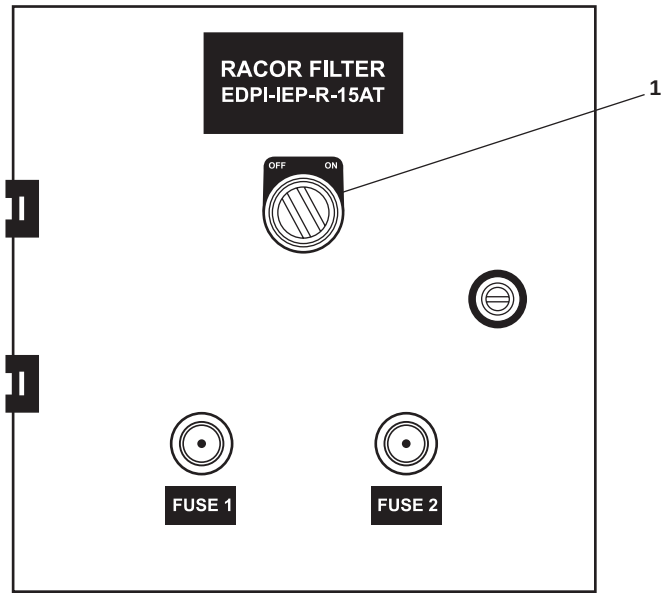


Figure 9. Fuel Filter/Water Separator Filter Control Panel

⚠ CAUTION

While operating the fuel filter/water separator, use only one pump to accomplish the fuel transfer. The use of both fuel oil transfer pumps will exceed the rated capacity of the fuel filter/water separator.

(5) Place one fuel oil transfer pump online:

(a) To place fuel oil transfer pump 1 online, OPEN FO-6, C.O.V.-F.O. XFER PMP No. 1 SUCTION (figure 8, item 4) and FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE (figure 8, item 5).

(b) To place fuel oil transfer pump 2 online, OPEN FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION (figure 8, item 6) and FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE (figure 8, item 7).

c. If the fuel filter/water separator is not to be used while transferring fuel to the day tanks, complete the following actions:

(1) CLOSE FO-16, F.O. FLTR/WATER SEP INLET. COV (figure 8, item 10).

(2) CLOSE FO-17, F.O. FLTR/WATER SEP OUTLET. COV (figure 8, item 8).

(3) OPEN FO-42, F.O. FLTR/WATER SEP BYPASS COV (figure 8, item 9).

(4) OPEN FO-6, C.O.V.-F.O. XFER PMP NO. 1 SUCTION (figure 8, item 4).

(5) OPEN FO-8, C.O.V.-F.O. XFER PMP NO. 1 DISCHARGE (figure 8, item 5).

(6) OPEN FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION (figure 8, item 6).

(7) OPEN FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE (figure 8, item 7).

2. Select the day tank to be filled.

a. To fill the emergency diesel generator day tank, place the following valves in the OPEN position:

(1) FO-11, F.O. TO E.D.G. DAY TK (figure 8, item 11)

(2) FO-12, E.D.G. DAY TK FILL (figure 8, item 12), located in the emergency diesel generator room

b. To fill the starboard fuel oil day tank, place FO-1, starboard F.O. DAY TK. FILL (figure 8, item 13) in the OPEN position.

c. To fill the port fuel oil day tank, place FO-2, port F.O. DAY TK. FILL (figure 8, item 14), in the OPEN position.

WARNING

Avoid overfilling any tank. Overfilling may result in a fuel spill and fire hazard. Ensure that vent caps are OPEN on oil fuel vents. Failure to comply may result in damaged equipment and serious injury or death to personnel.

d. On the fuel oil manifold, OPEN the suction (from) valve (figure 8, item 15) for the selected fuel oil supply tank.

3. Commence transferring fuel (filling the day tank):

⚠ CAUTION

Do not operate the fuel oil transfer pumps against a closed fill valve as damage to the pump and/or piping could occur.

Prior to transferring fuel to the starboard or port day tank, verify that the fuel transfer pump alarm panel is energized and tested.

NOTE

If filling the day tanks while operating the fuel filter/water separator, use only the selected fuel oil transfer pump that was lined up in step 1. b. 5 of this procedure. The rated capacity of both pumps exceeds the rated capacity of the fuel filter/water separator unit.

a. At the fuel oil transfer pump motor controller(s) 1 and/or 2 (figure 10):

(1) Set the ON-OFF switch(es) (figure 10, item 1) to ON.

(2) Verify that the POWER AVAILABLE indicator(s) (figure 10, item 2) energize(s).

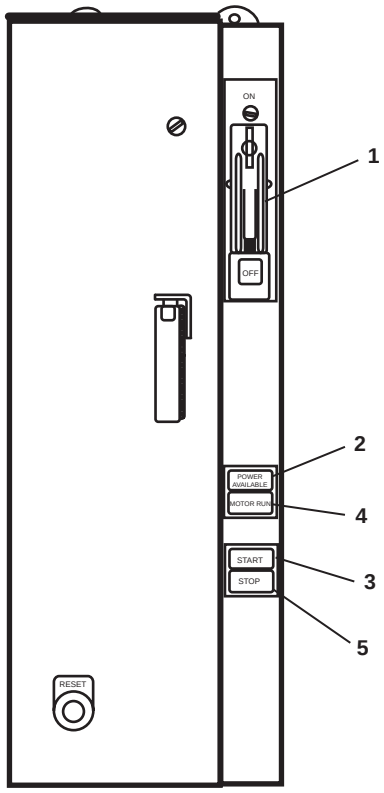


Figure 10. Fuel Oil Transfer Pump Motor Controller

(3) Start the pump(s) by pressing the START pushbutton(s) (figure 10, item 3).

(4) Verify that the MOTOR RUN indicator(s) (figure 10, item 4) energize(s).

b. At the fuel oil station, observe that the TLIs (figure 7, items 1 and 2) indicate that the selected day tank level is increasing, and the selected supply tank is decreasing.

c. Observe the readings on the inlet pressure gauge (figure 11, item 1) and the discharge pressure gauge (figure 11, item 2) on the fuel filter/water separator (figure 11, item 3). If the differential pressure between these gauges exceeds 10 PSI (0.7 bar) or 10 in. Hg (254 mm Hg), secure from fuel transfer and change the filters (TM 55-1925-283-12&P).

d. To drain water from the fuel filter/water separator (figure 11, item 3), secure from fuel transfer, CLOSE valve FO-16, F.O. FLTR/WATER SEP INLET. COV (figure 11, item 4), and OPEN the drain valve (figure 11, item 5) (located under the deck plate). After draining the water, CLOSE the drain valve, OPEN FO-16, F.O. FLTR/WATER SEP INLET. COV, and resume fuel transfer.

e. When the TLIs (figure 7, items 1 and 2) for the selected day tank indicate the desired level, STOP the fuel oil transfer pump(s), and secure the fuel oil transfer piping system.

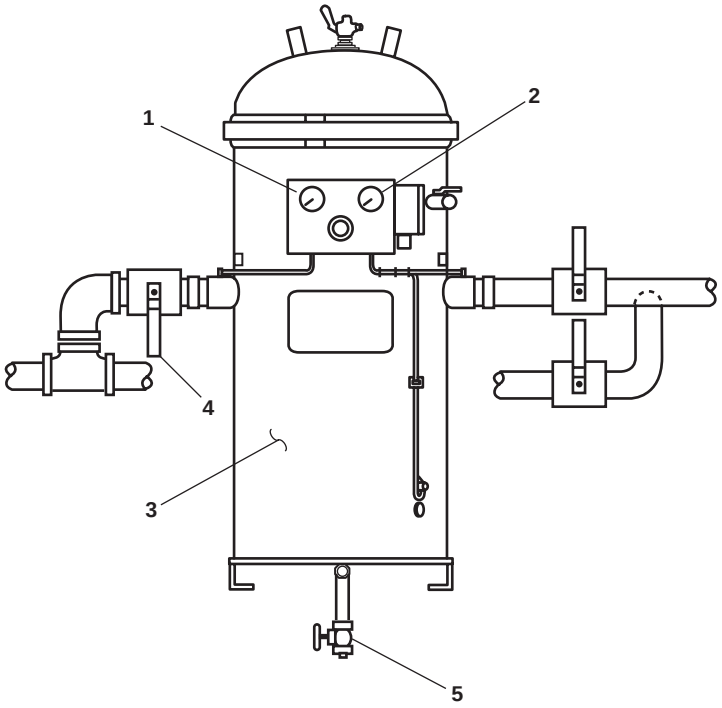


Figure 11. Fuel Filter/Water Separator

4. Secure the fuel oil transfer piping system:

a. At the fuel oil transfer pump motor controller(s) 1 and/or 2 (figure 10):

(1) Press the STOP pushbutton(s) (figure 10, item 5).

(2) Verify that the MOTOR RUN indicator(s) (figure 10, item 4) go(es) out.

(3) Set the ON-OFF switch(es) (figure 10, item 1) to OFF.

(4) Verify that the POWER AVAILABLE indicator(s) (figure 10, item 2) go(es) out.

b. At the fuel filter/water separator control panel, place the OFF/ON (figure 9, item 1) switch to OFF.

c. Secure the fuel oil transfer piping by verifying that the following valves are CLOSED:

(1) All of the valves on the suction side of the fuel oil manifold (figure 8, item 15)

(2) All of the valves on the fill side of the fuel oil manifold (figure 8, item 16)

(3) FO-1, F.O. DAY TK. FILL (figure 8, item 13)

(4) FO-2, F.O. DAY TK. FILL (figure 8, item 14)

(5) FO-12, E.D.G. DAY TK FILL (figure 8, item 12)

(6) FO-11, F.O. TO E.D.G. DAY TK (figure 8, item 11)

(7) FO-42, F.O. FLTR/WATER SEP BYPASS COV (figure 8, item 9)

(8) FO-16, F.O. FLTR/WATER SEP INLET. COV (figure 8, item 10)

(9) FO-17, F.O. FLTR/WATER SEP OUTLET. COV (figure 8, item 8)

(10) FO-6, C.O.V.-F.O. XFER PMP NO. 1 SUCTION (figure 8, item 4)

(11) FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE (figure 8, item 5)

(12) FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION (figure 8, item 6)

(13) FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE (figure 8, item 7)

TRANSFERRING FUEL BETWEEN STORAGE TANKS

NOTE

The fuel filter/water separator is not needed when transferring fuel between storage tanks.

1. Align the fuel oil transfer piping system:

a. Verify that the following valves are CLOSED:

(1) FO-3, DK. FILL CONN (figure 8, item 1)

(2) FO-4, DK. FILL CONN (figure 8, item 2)

(3) FO-1, F.O. DAY TK. FILL (figure 8, item 13)

(4) FO-2, F.O. DAY TK. FILL (figure 8, item 14)

(5) FO-11, F.O. TO E.D.G. DAY TK (figure 8, item 11)

(6) FO-12, E.D.G. DAY TK FILL (figure 8, item 12)

b. OPEN the following valves:

(1) FO-5, F.O. DAY TK EMERG FILL (figure 8, item 3)

(2) FO-6, C.O.V.-F.O. XFER PMP NO. 1 SUCTION (figure 8, item 4)

(3) FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE (figure 8, item 5)

(4) FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION (figure 8, item 6)

(5) FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE (figure 8, item 7)

c. Bypass the fuel filter/water separator:

(1) CLOSE FO-17, F.O. FLTR/WATER SEP OUTLET. COV (figure 8, item 8).

(2) CLOSE FO-16, F.O. FLTR/WATER SEP INLET. COV (figure 8, item 10).

(3) OPEN FO-42, F.O. FLTR/WATER SEP BYPASS COV (figure 8, item 9).

WARNING

Avoid overfilling any tank. Overfilling may result in a fuel spill and fire hazard. Ensure that vent caps are OPEN on oil fuel vents. Failure to comply may result in damaged equipment and serious injury or death to personnel.

d. On the fuel oil manifold, OPEN the suction valve (figure 8, item 15) for the selected fuel oil supply tank the fuel oil is being pumped from.

e. On fuel oil manifold, OPEN the fill valve (figure 8, item 16) for the selected fuel oil supply tank the fuel oil is being pumped to.

2. Commence transferring fuel:

⚠ CAUTION

Do not operate the fuel oil transfer pumps against a CLOSED discharge valve as damage to the pump and/or piping could occur.

a. At the fuel oil transfer pump motor controllers 1 and 2 (figure 10):

(1) Set the ON-OFF switches (figure 10, item 1) to ON.

(2) Verify that the POWER AVAILABLE indicators (figure 10, item 2) energize.

(3) Start the pumps by pressing the START pushbuttons (figure 10, item 3).

(4) Verify that the MOTOR RUN indicators (figure 10, item 4) energize.

b. At the fuel oil station TLIs (figure 7), observe/verify that the level for the tank being pumped to increases, and the level for the tank being pumped from decreases.

c. When the TLI (figure 7) for the tank being pumped to indicates the desired level, STOP the fuel oil transfer pumps, and secure the fuel oil transfer system as described in steps 3 and 4 below.

3. Secure the fuel oil transfer pumps at the fuel oil pump motor controllers:

a. Press on the STOP pushbuttons (figure 10, item 5).

b. Verify that the MOTOR RUN indicators (figure 10, item 4) go out.

c. Set the ON-OFF switches (figure 10, item 1) to the OFF position.

d. Verify that the POWER AVAILABLE indicators (figure 10, item 2) go out.

4. Secure the fuel oil transfer piping by placing the following valves in the CLOSED position:

a. All valves on the fuel oil manifold

b. FO-6, C.O.V.-F.O. XFER PMP NO. 1 SUCTION (figure 8, item 4)

c. FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE (figure 8, item 5)

d. FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION (figure 8, item 6)

e. FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE (figure 8, item 7)

FUELING

WARNING

During fueling operations, close coordination is required between the crew and the fuel oil supplier to prevent spills or overfilling tanks. Failure to comply can result in damaged equipment and serious injury or death to personnel.

Fueling operations present a serious fire hazard. Ensure NO SMOKING signs are placed at designated locations. Make routine announcements that fueling operations are in progress. Take all necessary precautions as required by FM 55-502. Failure to comply can result in damaged equipment and serious injury or death to personnel.

Static electricity can cause a spark when connecting the hose from a fuel source to the LT. Ensure that all grounding connections are made prior to connecting any fuel hose. Failure to comply can result in damaged equipment and serious injury or death to personnel.

The wake of passing watercraft can cause the LT to move sufficiently enough to separate the fuel hose. Ensure that the BRAVO flag is hoisted by day and that the RED LIGHT is lit by night in order to alert passing watercraft to pass with minimum wake action. Failure to comply can result in damaged equipment and serious injury or death to personnel.

⚠ CAUTION

Do not refuel at a fill rate greater than 250 gal/min.

Prior to commencing a refueling operation, ensure that drip pans are in place at each connection, and ensure that the scuppers are plugged to prevent accidental fuel spillage overboard.

1. Align the fuel oil fill piping to receive fuel from an off hull source.
   a. If fueling from the port side OPEN FO-4, DK. FILL CONN (figure 8, item 2).
   b. If fueling from the starboard side OPEN FO-3, DK. FILL CONN (figure 8, item 1).
   c. CLOSE FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE (figure 8, item 5).
   d. CLOSE FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE (figure 8, item 7).
2. Align the tank to be fueled:
   a. To fill a day tank directly from the shore connection proceed as follows:
      (1) CLOSE all of the valves on the fill side of the fuel oil manifold (figure 8, item 16).
      (2) OPEN FO-5, F.O. DAY TK EMERG FILL (figure 8, item 3).
      (3) To fill the emergency generator day tank, place the following valves in the OPEN position:
         (a) FO-11, F.O. TO E.D.G. DAY TK (figure 8, item 11)
         (b) FO-12, E.D.G. DAY TK FILL (figure 8, item 12), located in the emergency diesel generator room
      (4) To fill the starboard fuel oil day tank, OPEN FO-1, F.O. DAY TK. FILL (figure 8, item 13).
      (5) To fill the port fuel oil day tank, OPEN FO-2, F.O. DAY TK. FILL (figure 8, item 14).
   b. To fill the fuel oil storage tanks from the shore connection:
      (1) CLOSE FO-5, F.O. DAY TK EMERG FILL (figure 8, item 3).
      (2) At the fuel oil manifold, OPEN the manifold fuel oil fill valve(s) (figure 1 item 16) for the tank(s) selected to be filled.
3. Select the fuel supply line:

NOTE

The maximum fueling rate is 250 gal/min. The port and starboard fill connections join before reaching the fuel oil header. If both external fuel oil connections are used to fuel the ship, ensure that the total fueling rate does not exceed 250 gal/min.

   a. If the fuel supply line is connected to the port fuel oil deck connection, OPEN FO-18, F.O. FILL CONN PORT (figure 12, item 1).
   b. If fuel supply line is connected to the starboard fuel oil deck connection, OPEN FO-39, F.O. FILL CONN. STBD (figure 12, item 2).

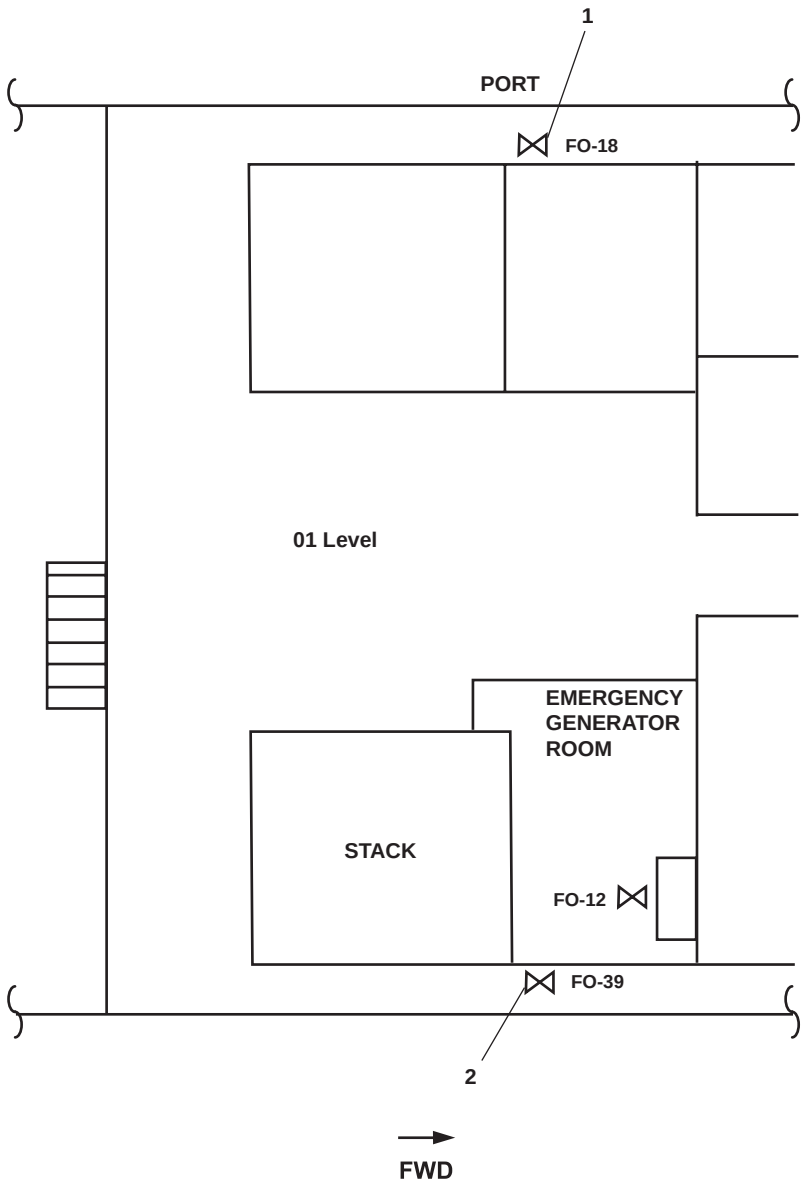


Figure 12. Fuel Oil Supply Line Connection Locations

4. Commence fueling:

   a. Direct the supplier to begin sending fuel oil to the vessel.

   b. At the TLIs (figure 7) carefully monitor the tank levels.

   c. As a tank reaches approximately 3/4 full, OPEN the supply valve for next tank to be filled, and "throttle down" the supply valve of tank that is almost full.

   d. When a tank is full, CLOSE the fill valve, (figure 8, item 16) on the fuel oil manifold, for the selected supply tank.

   e. Repeat steps b-d until all of the selected storage tanks are full.

   f. When the final tank to be filled is near full, direct the supplier on the pier to cease pumping.

5. Stop the fueling operation:

    a. Verify that pumping has ceased.

    b. Allow all hoses to drain before closing the last fill valve on the fuel oil manifold (figure 8, item 16).

6. Secure the fuel oil supply piping system:

    a. Disconnect the shore connection, and cap the hose connection fitting.

    b. CLOSE and cap the deck fill connection valve:

        (1) FO-18, F.O. FILL CONN PORT (figure 12, item 1) for port

        (2) FO-39, F.O. FILL CONN. STBD (figure 12, item 2) for starboard

    c. CLOSE the last fill valve (figure 8, item 16) on the fuel oil manifold.

    d. Place/verify that the following valves are in the CLOSED position:

        (1) All of the valves on the fill side of the fuel oil manifold (figure 8, item 16)

        (2) All of the valves on the suction side of the fuel oil manifold (figure 8, item 15)

        (3) FO-3, DK. FILL CONN (figure 8, item 1)

        (4) FO-4, DK. FILL CONN (figure 8, item 2)

        (5) FO-5, F.O. DAY TK EMERG FILL (figure 8, item 3)

        (6) FO-11, F.O. TO E.D.G. DAY TK (figure 8, item 11)

        (7) FO-12, E.D.G. DAY TK FILL (figure 8, item 12)

        (8) FO-1, F.O. DAY TK. FILL (figure 8, item 13)

        (9) FO-2, F.O. DAY TK. FILL (figure 8, item 14)

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
BOW THRUSTER

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

PURPOSE

The purpose of this procedure is to provide instructions for the normal startup and operation of the bow thruster.

1. Align the fuel oil system by placing the following valves in the OPEN position:

   a. FO-33, F.O. RTN TO DAY TK. PORT (figure 1, item 1), located in the engine room aft on the port bulkhead

   b. FO-13, F.O. SERV. SUCT. PORT (figure 1, item 2), (remote operator in the main deck fan room)

   c. Fuel filter/water separator inlet and outlet valves (figure 1, item 3), located on the bow thruster engine

   d. FO-30, F.O. SPLY TO BOW THRUSTER ENG (figure 1, item 4)

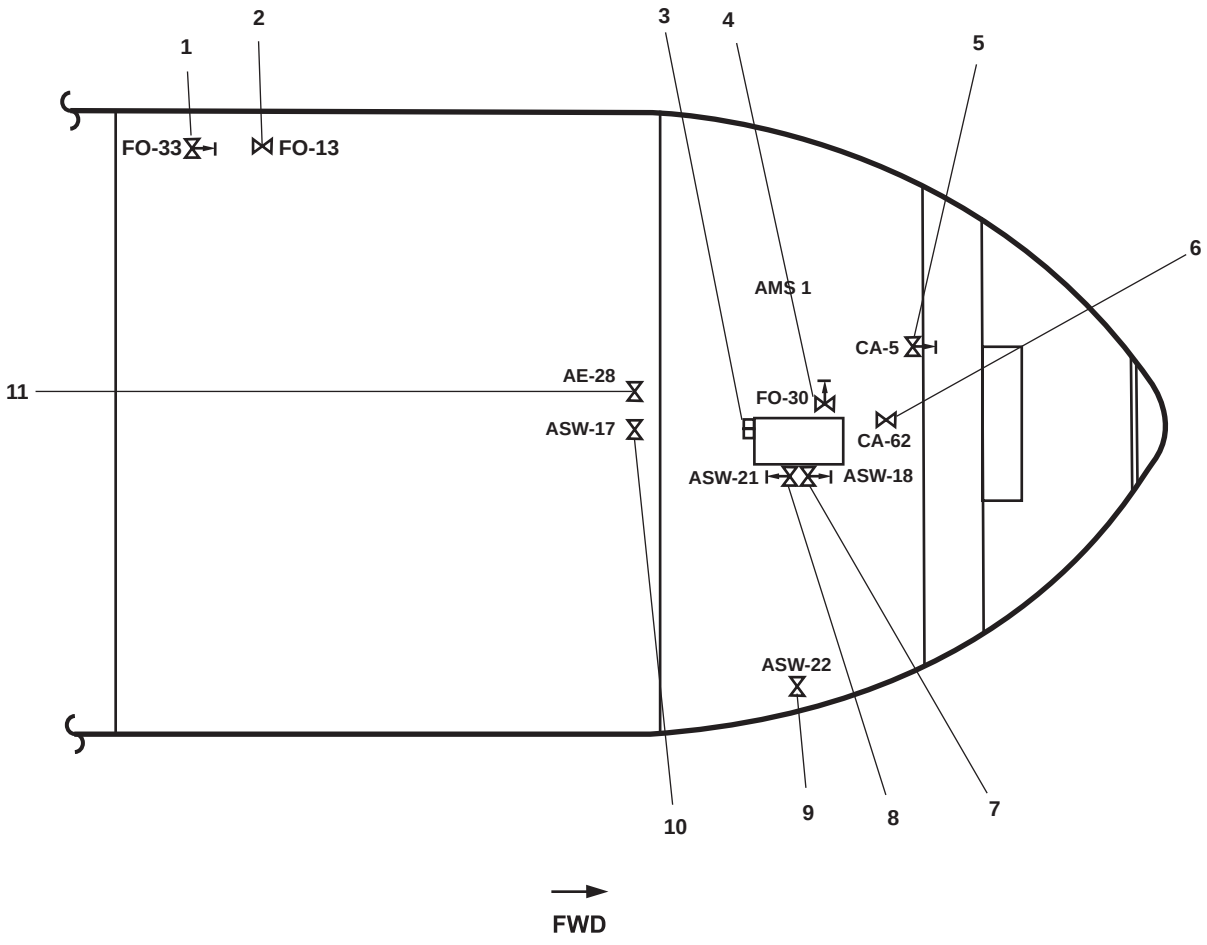


Figure 1. Bow Thruster Valve Locations

2. Align the compressed air system by opening the following valves:

   a. CA-5, STG AIR TO BOW THRUSTER ENG (figure 1, item 5), located on the AMS 1 forward bulkhead

   b. CA-62, STARTING AIR GAUGE - COV (figure 1, item 6)

3. Align the cooling water to the bow thruster engine by OPENING the following valves:

   a. Asw-18, S.W. TO BOW THRUSTER ENG. (figure 1, item 7).

   b. Asw-21, S.W. FR. BOW THRUSTER ENG TO OVB'D DISCHARGE. (figure 1, item 8).

   c. Asw-22, OVB'D DISCH., S.W. COOLING (figure 1, item 9), located in AMS 1 outboard of the pump drive engine on the starboard bulkhead.

   d. Asw-17, SEA SUCTION S.W. COOLING (figure 1, item 10), located in the engine room below the EOS.

   e. AE-28, SEACHEST VENT (figure 1, item 11), located in the engine room below the EOS.

4. Set the controls for starting the bow thruster engine as follows:

   a. At the pilothouse console:

      (1) Ensure that the bow thruster engine throttle control lever (figure 2, item 1) is straight up in the NEUTRAL (center) position.

      (2) Ensure that the COMMAND TRANSFER plunger (figure 2, item 2) is down, in the disengaged position.

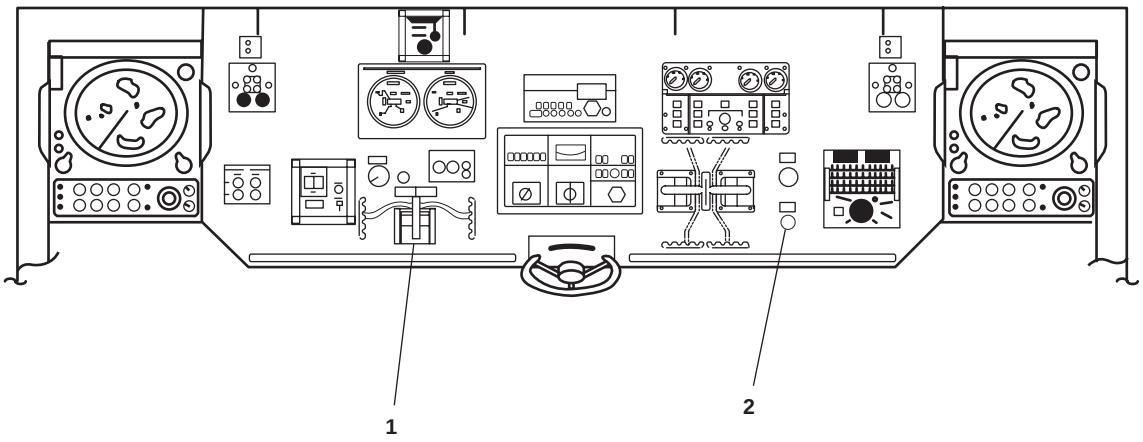


Figure 2. Pilothouse Console

   b. At the auxiliary control stations:

      (1) Ensure that the bow thruster engine throttle control lever (figure 3, item 1) is straight up in the NEUTRAL (center) position.

      (2) Ensure that the COMMAND TRANSFER plunger (figure 3, item 2) is down in the disengaged position.

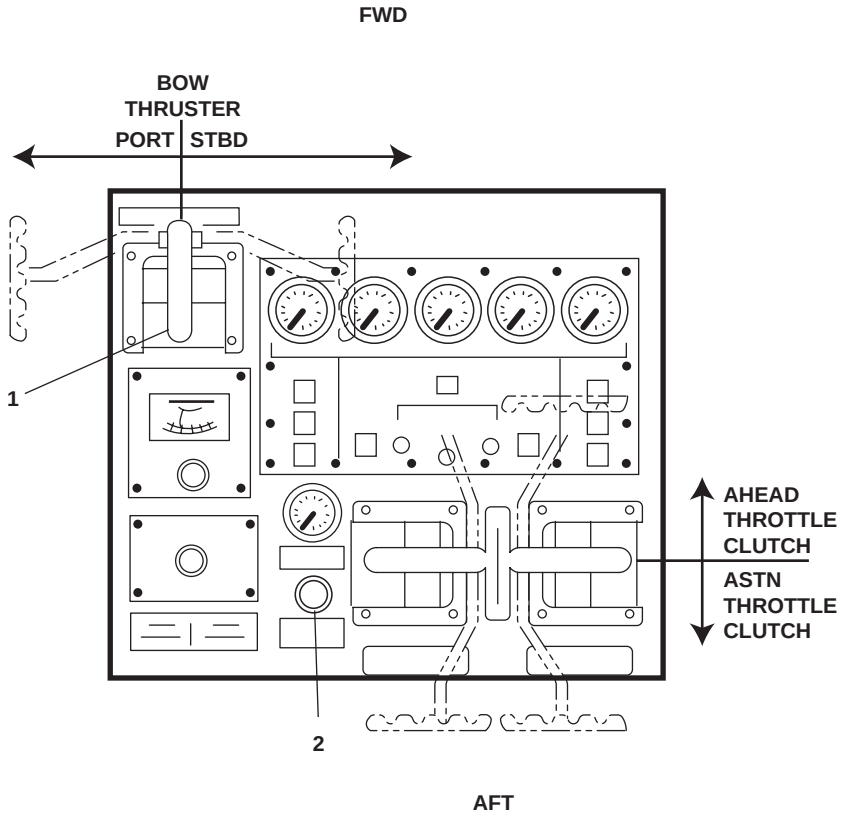


Figure 3. Auxiliary Control Station

c. At the EOS console, ensure that the COMMAND TRANSFER valve (figure 4, item 1) is UP in the REMOTE position.

d. In the engine room on the aft bulkhead outside of the EOS, at the machinery dc control distribution panel, set the BOW THRUSTER DRIVE ENG circuit breaker (figure 5, item 1) to the ON position.

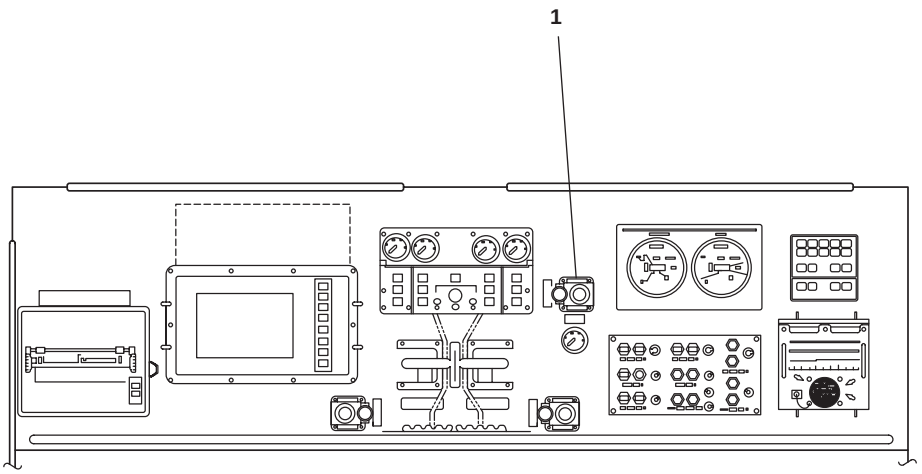


Figure 4. EOS Console

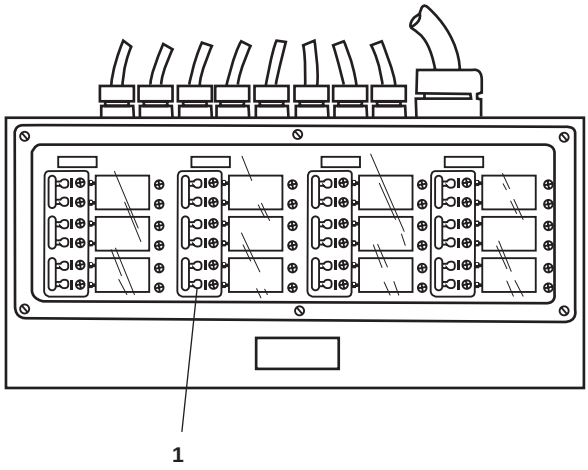


Figure 5. Machinery DC Control Distribution Panel

5. Start the bow thruster engine by performing the following actions:

⚠ CAUTION

Operating the bow thruster with the brake engaged can damage the bow thruster.

a. Pull UP on the shaft brake plunger (figure 6, item 1), located just forward of the bow thruster engine, so that the bow thruster can rotate freely.

b. Check the engine oil level using the dipstick.

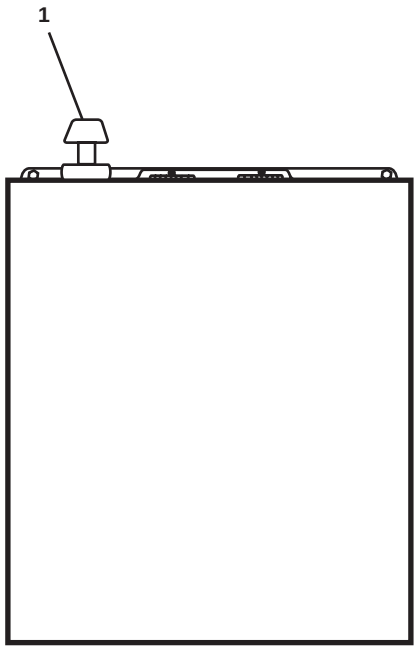


Figure 6. Bow Thruster Shaft Brake Plunger

c. Verify the proper heat exchanger coolant level using coolant level gauge (figure 7, item 1).

d. Move the governor control lever (figure 7, item 2) to the half engine speed position (approximately straight up).

e. On the bow thruster engine control panel, turn the start/stop pushbutton (figure 7, item 3) clockwise to release the pushbutton to the OUT position.

NOTE

Starting air start pressure must be at least 100 PSI (6.9 bar) to ensure that the engine starts properly.

f. Verify that the starting air pressure gauge reads at least 100 PSI (6.9 bar).

⚠ CAUTION

Oil pressure should rise within 15 seconds after the engine starts. If oil pressure does not rise, stop the engine immediately to prevent damage, and refer the problem to unit maintenance.

g. Position the START-STOP toggle switch (figure 7, item 4) up to the START position to crank the engine. As soon as the engine starts, release the toggle switch, and verify the toggle switch returns to the RUN position.

h. Allow the engine to idle 3 to 5 minutes, or until the coolant temperature gauge (figure 7, item 5), begins to rise.

i. Check the engine gauges (figure 7, items 5 and 6), and ensure the readings are in the green range.

6. Operate the bow thruster from the pilothouse console by completing the following actions:

a. Place the COMMAND TRANSFER plunger (figure 2, item 2), UP in the engaged position.

b. Move the bow thruster engine throttle control lever (figure 2, item 1), to the left for port thrust and to the right for starboard thrust.

7. Secure the bow thruster by completing the following actions.

a. Place the bow thruster engine throttle control lever (figure 2, item 1) in the neutral (center) position.

b. Place the governor control lever (figure 7, item 2) in idle position (local control and locked).

c. Operate the engine at idle for at least 5 minutes.

d. Set the START-STOP switch (figure 7, item 4) to the OFF position, or push the governor control lever (1) in the aft direction until the engine stops.

e. Push in the EMERGENCY STOP pushbutton (figure 7, item 3).

f. Wait until the bow thruster engine stops completely, then push the shaft brake plunger (figure 6, item 1) down to lock the bow thruster shaft.

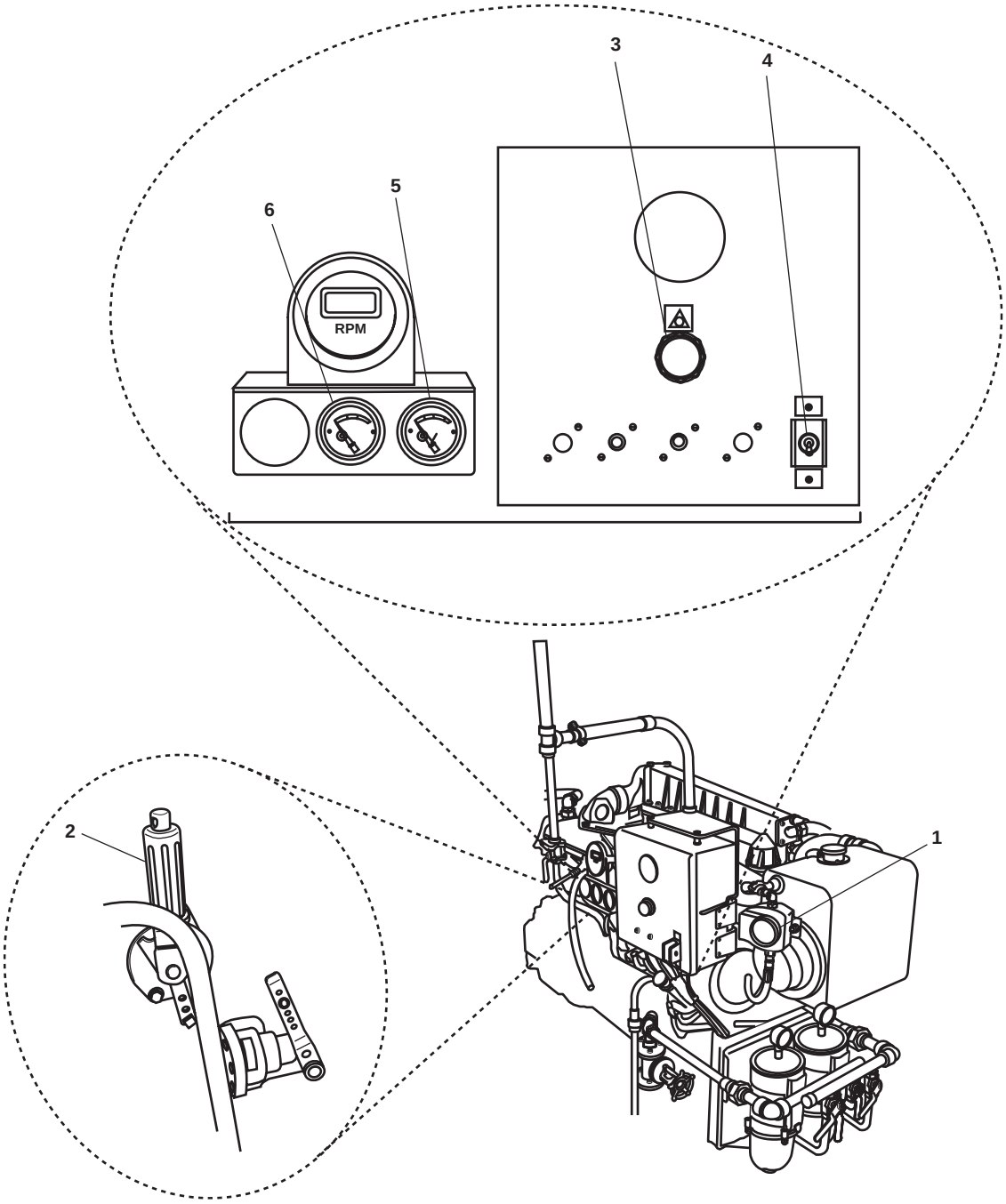


Figure 7. Bow Thruster Engine Controls

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
HYDRAULIC SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

CENTRAL HYDRAULIC SYSTEM HYDRAULIC POWER UNIT (HPU) STARTUP

1. CLOSE the following valves, located in AMS 1:

   a. TH-3, RETURN CRSVR. TO CENT. HYD (figure 1, item 1)

   b. TH-2, PRESS CRSVR CTL HYDR TOW WN HYDR (figure 1, item 2)

   c. TH-4, DRAIN CRSVR. TO CENT. HYD. (figure 1, item 3)

2. In the engine room, on the port side, at the central hydraulic system reservoir (figure 2, item 1), verify that the hydraulic fluid level is at ¾ full in the hydraulic reservoir sight glass (figure 2, item 2). If the hydraulic fluid level is low, add hydraulic fluid at the breather (figure 2, item 3) until the fluid level on the sight glass is ¾ full.

3. Set to ON the CENT HYD SYS POWER UNIT NO. 1 & 2 circuit breaker (figure 3, item 1) on the main switchboard.

4. Set to ON the MAIN switch (figure 2, item 4) on the central HPU motor controller (figure 2, item 5).

5. To enable local operation of the central hydraulic system, set to ON the REMOTE/OFF/ON switch (figure 2, item 6) at the central HPU motor controller (figure 2, item 5). To enable remote operation from the EOS, set to REMOTE the REMOTE/OFF/ON switch.

⚠ CAUTION

Only one pump is required to operate the power pack. Both pumps may be used, but the reservoir temperature must be checked frequently. If oil temperature exceeds 180 °F (82 °C), or a low oil level is indicated, shut down the system immediately. Operating the pumps with hot and/or low oil could damage the equipment.

6. Set the P1/P2/P1 & 2 switch (figure 2, item 7) to the P1, P2, or P1 & P2 position. In the P1 position, pump 1 is enabled; in the P2 position, pump 2 is enabled; and in the P1 & P2 position, both pumps are enabled.

7. Verify that the READY light (figure 2, item 8 and/or 9) is illuminated for the selected pump(s).

8. If local operation was selected in step 5, press the START pushbutton (figure 2, item 10) to start the selected pump(s). If remote operation was selected, press the NO.1 & 2 HYD PMP pushbutton (figure 4, item 1) to start the selected pump(s).

9. Verify that the RUNNING indicator(s) (figure 2, items 11 and/or 12) are illuminated for the selected pump(s).

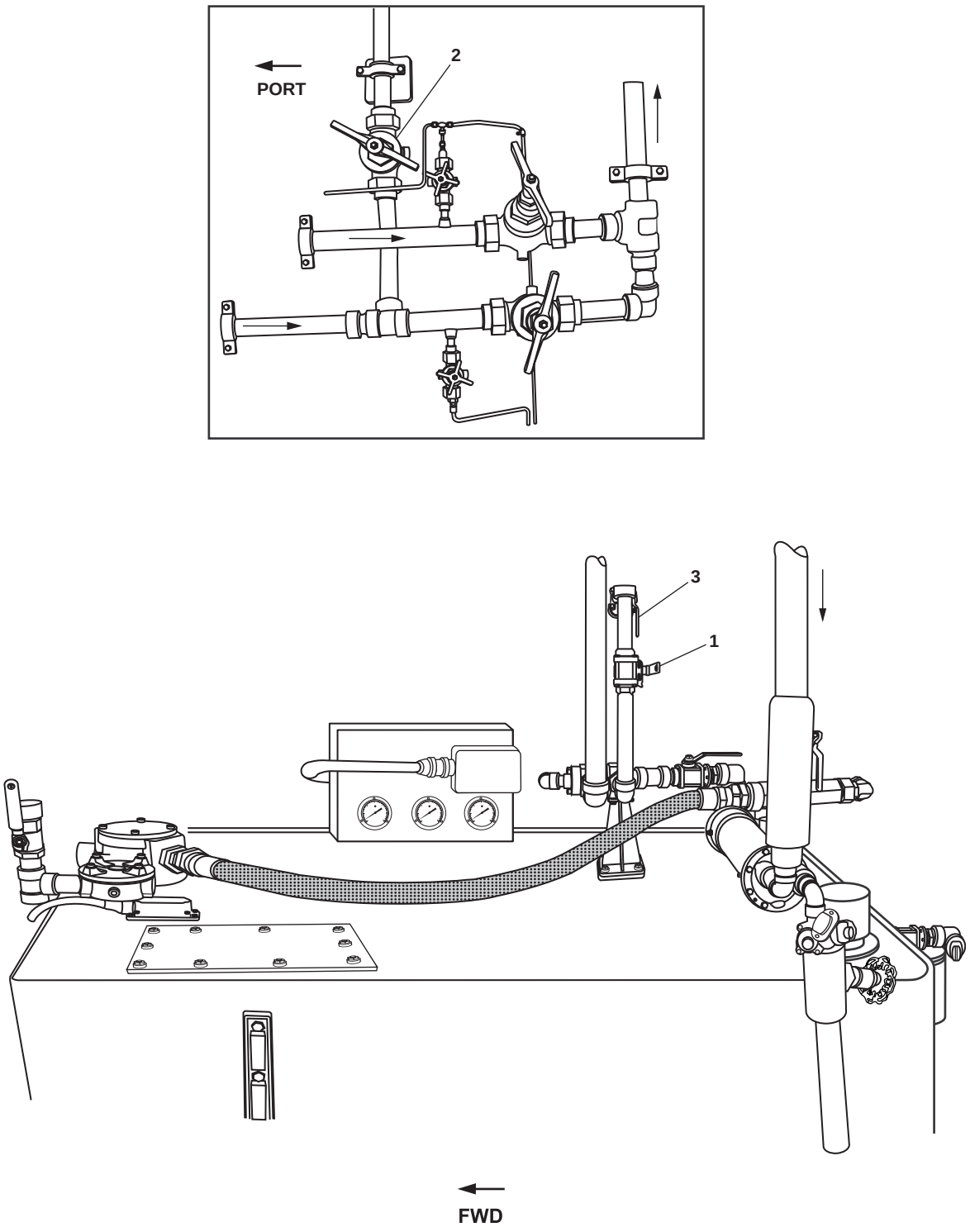


Figure 1. Towing Machine Hydraulic Power Unit

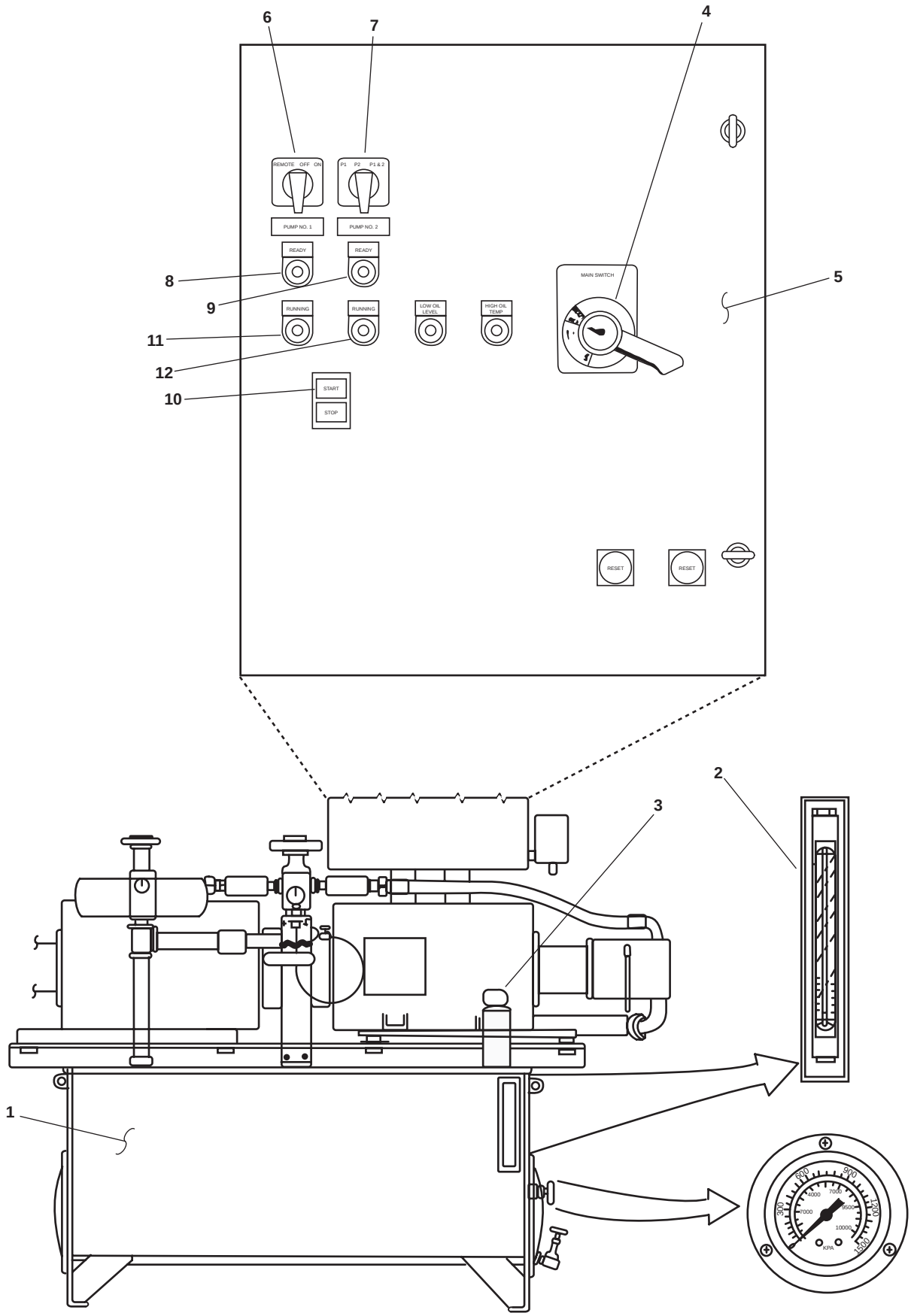


Figure 2. Central Hydraulic System, Hydraulic Power Unit

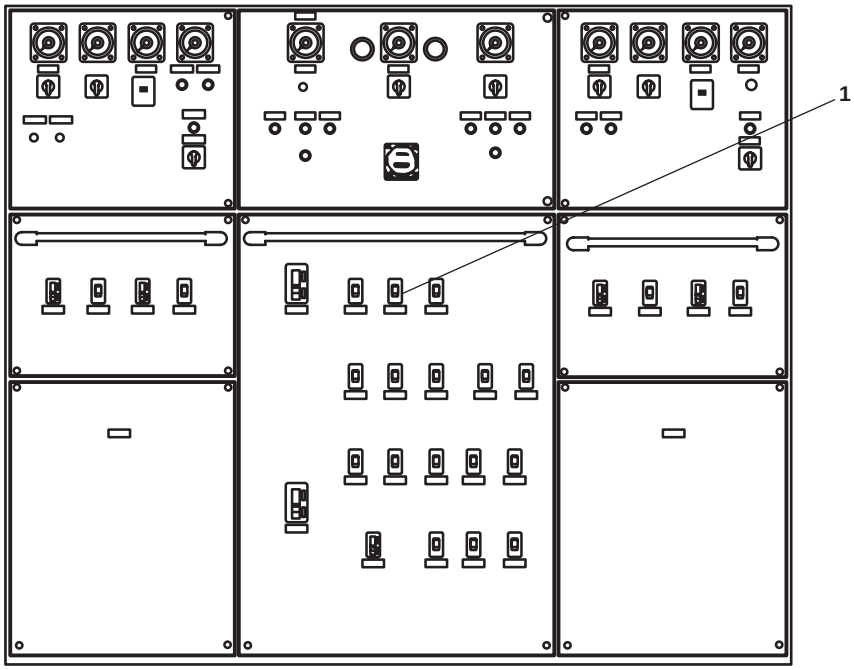


Figure 3. Main Switchboard

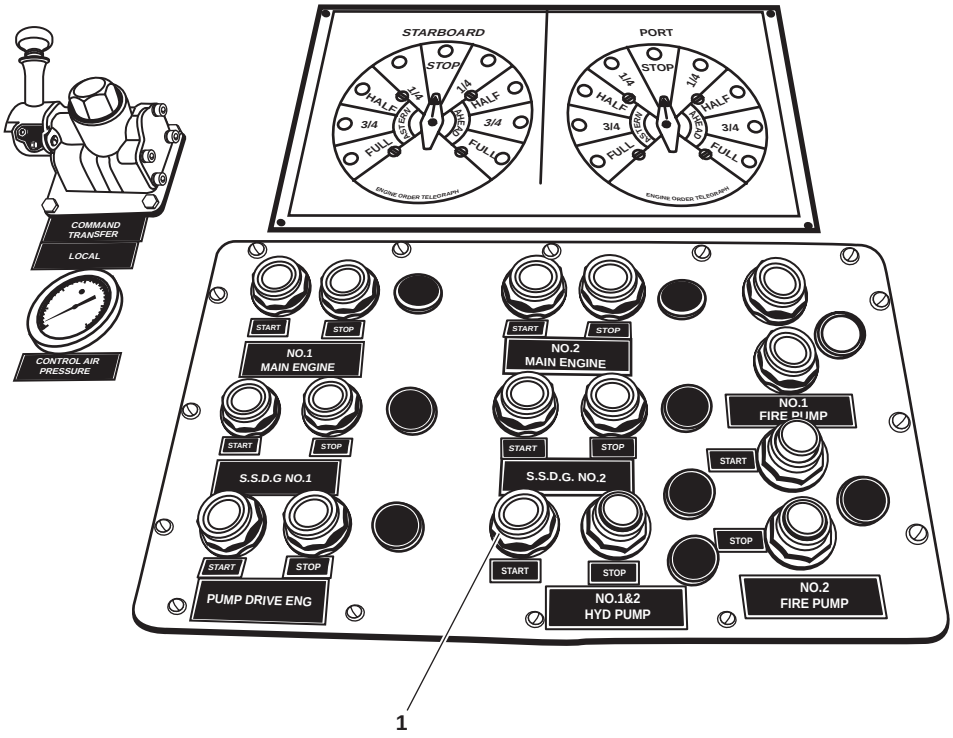


Figure 4. Remote Control Station (EOS)

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
STEERING SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

ALIGN THE STEERING HYDRAULIC SYSTEM

1. At the steering hydraulic oil reservoir, located in the main deck fan room, check the oil level in the sight glasses (figure 1, item 1) by pushing in and holding the knobs (figure 1, item 2) at the bottom of the sight glasses until fluid levels out.

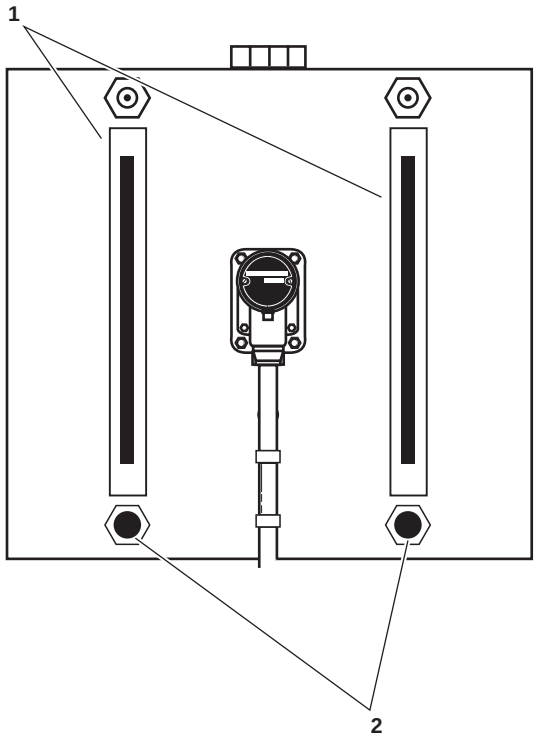


Figure 1. Hydraulic Reservoir

2. In AMS 2, at the emergency steering hand pump, verify that the following valves are CLOSED:

   a. SH-7, HAND PMP C.O.V. (figure 2, item 1)

   b. SH-8, HAND PMP C.O.V. (figure 2, item 2)

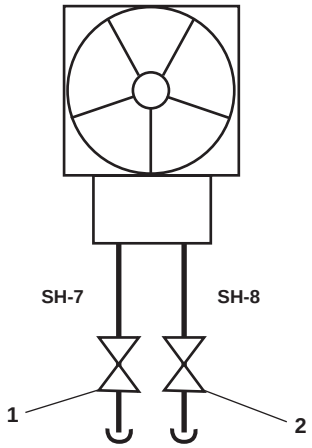


Figure 2. Emergency Steering Hand Pump

3. In AMS 2, at the steering hydraulic pump station, verify that the following valves are OPEN:

   a. SH-5, RUD. MOT NO. 1 SUMP (figure 3, item 1)

   b. SH-6, RUD. MOT No. 1 SUMP (figure 3, item 2)

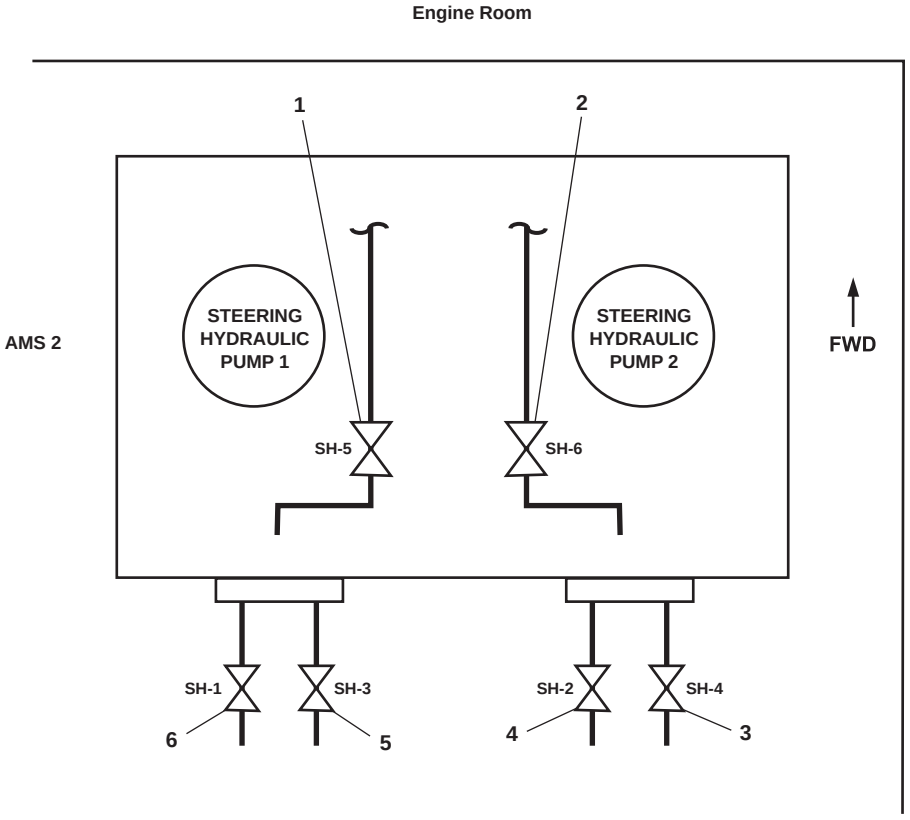


Figure 3. Steering Hydraulic Pump Station

c. SH-4, C.O.V. -RUD. MOT. No.2 PRESS / RTN (figure 3, item 3)

d. SH-2, C.O.V.-RUD MOT. No.2 PRESS / RTN (figure 3, item 4)

e. SH-3, C.O.V. -RUD. MOT. No. 1 PRESS / RTN (figure 3, item 5)

f. SH-1, C.O.V. -RUD. MOT. No. 1 PRESS / RTN (figure 3, item 6)

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
TANK LEVEL INDICATOR SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

OPERATION

1. Align the electrical system:

   a. In the engine room, on the STARBOARD side, at the 120V emergency distribution panel No. 1, set the TLI SYSTEM circuit breaker (figure 1, item 1) to ON.

   b. On the 11 channel master TLI panel in the EOS, set the ON-OFF switch (figure 2, item 1) to ON.

   c. On the 7 channel master TLI panel in the EOS, set the ON-OFF switch (figure 3, item 1) to ON.

   d. Verify that the POWER indicator for each TLI panel (figures 2 and 3, item 2) illuminates.

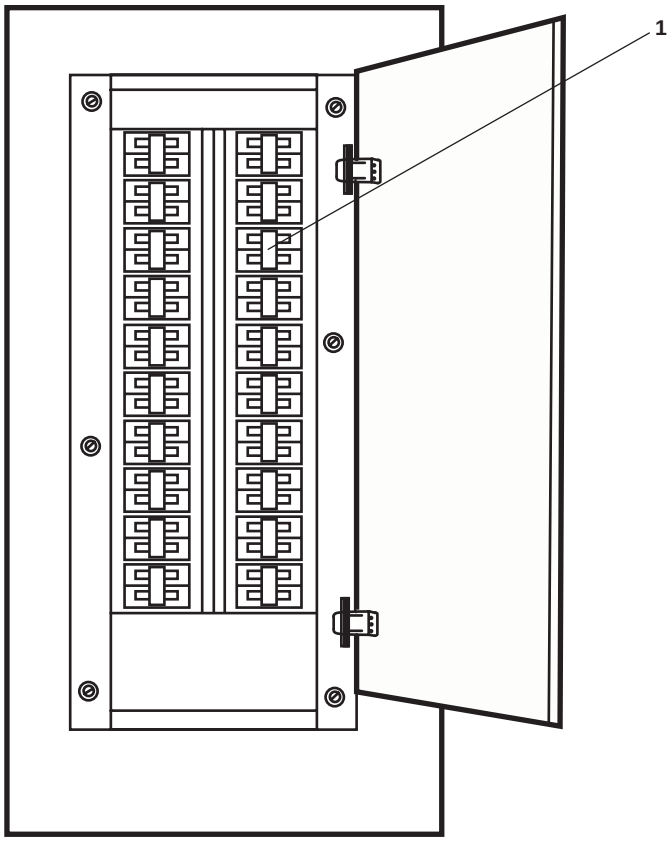


Figure 1. 120V Emergency Distribution Panel No. 1

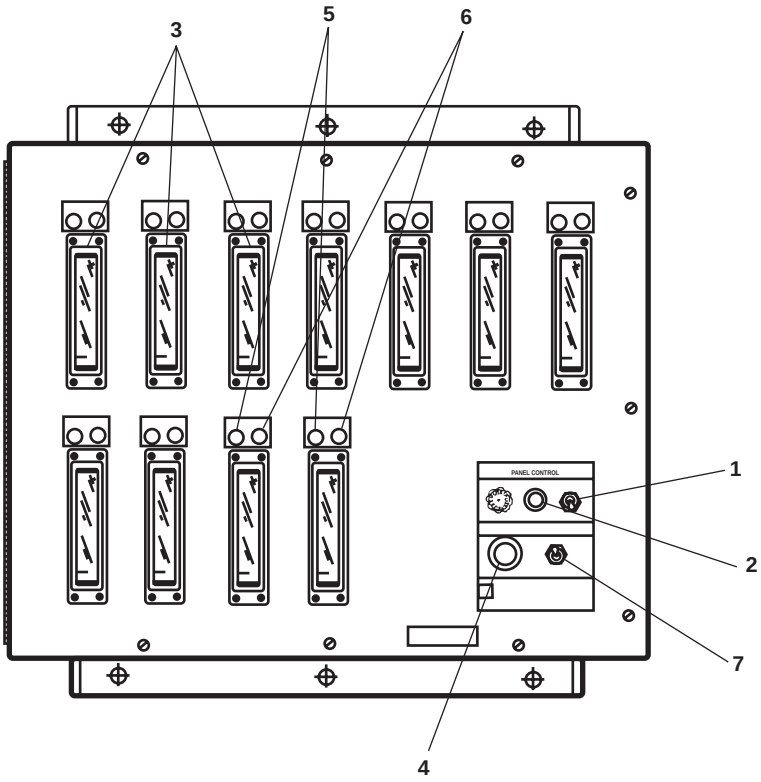


Figure 2. 11 Channel Master TLI Panel

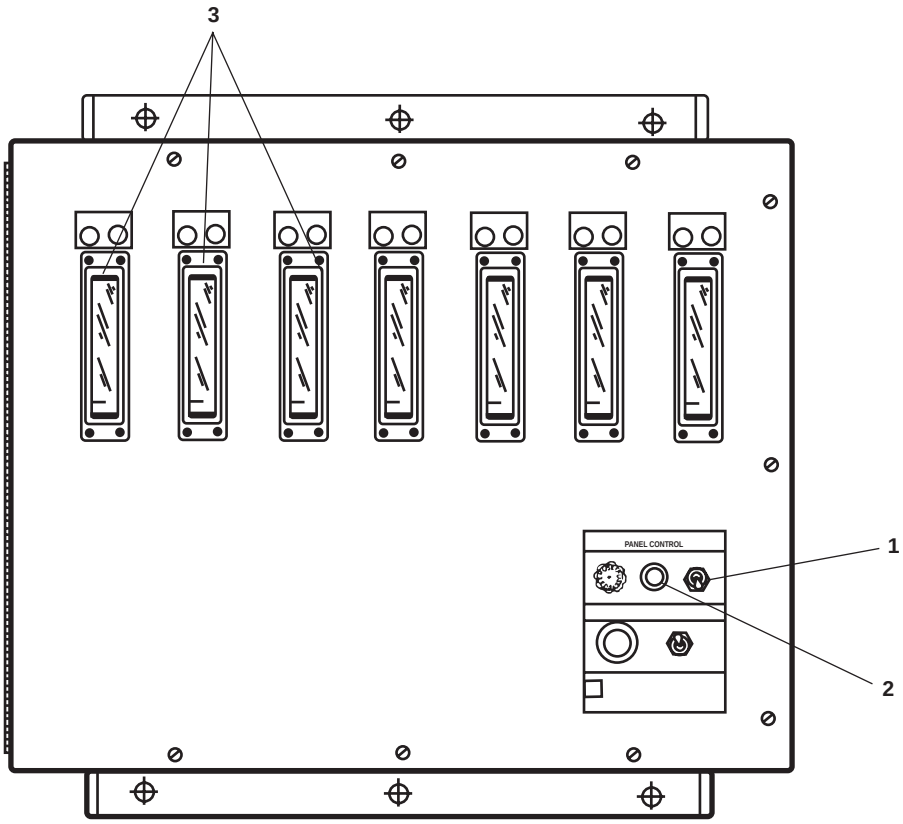


Figure 3. 7 Channel Master TLI Panel

2. Fluid level monitoring procedures:

NOTE

The TLI panels in the EOS are the master transmitter modules. The repeaters are located in the various spaces and are slaved to the transmitter modules. If there are disparities between the transmitter and receiver, the transmitter is considered correct until proven otherwise.

a. To monitor at a transmitter module, observe the fluid level meter (figure 2 & 3, item 3) to determine the correct fluid level.

b. To monitor at a receiver panel, locate the TLI of the tank to be monitored and observe fluid level meter (figure 4, item 1) to determine the fluid level.

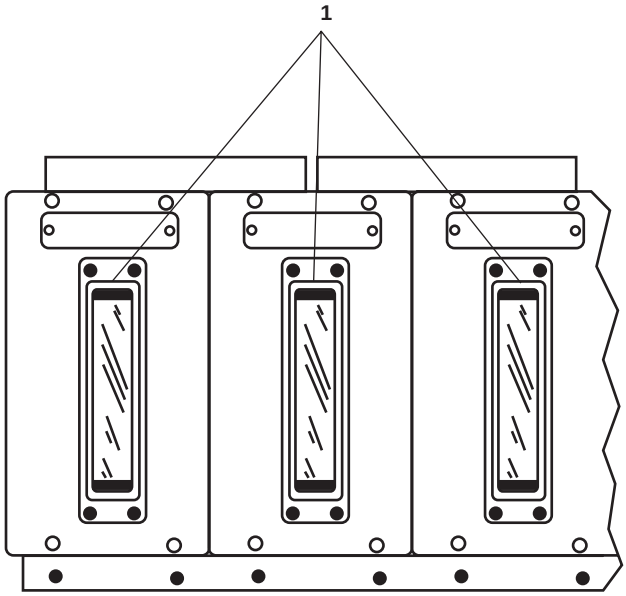


Figure 4. TLI Remote Indicator

3. Alarm monitoring procedure:

NOTE

Only the port and starboard day tanks have alarms on the TLI system. The associated alarm will sound only at the master TLI panel in the EOS. A LOW LEVEL alarm indicates that the tank is at 25% or less capacity, and a HIGH LEVEL alarm indicates the tank is at 95% or greater capacity.

a. When the alarm speaker (figure 2, item 4) sounds on the 11 channel master TLI panel, observe the indicator lights (figure 2, item 5 or 6) to determine the cause.

b. Take appropriate action to correct the alarm condition.

NOTE

The alarm indicators will remain lit until the alarmed condition is corrected.

NOTE

The port and starboard day tank high-level alarm system is a separate and independent system from the TLI system. The port and starboard day tank high level alarm system can only be deactivated at the panel at the fuel oil transfer station.

c. To silence the TLI alarm, perform the following at the 11 channel master TLI panel:

(1) Pull out, press down and release the ALARM SILENCE switch (figure 2, item 7).

(2) Verify that the alarm speaker (figure 2, item 4) is silent.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
BILGE/BALLAST SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
TM 55-1925-285-13&P

PURPOSE

This work package contains for following procedures:

1. Align the electrical system.
2. Align the piping system.
3. Fill the ballast tanks with raw water.
4. Deballasting the ballast tanks.
5. From ballast tank to ballast tank.
6. Bilge system operations with the eductors.
7. Machinery spaces bilge system.
8. Oily bilge water pumping.
9. Transfer oily water from drain tank to storage tank.
10. Pump contents of tanks to shore.
11. Oil Water Separator (OWS) and Oil Content Monitor (OCM) operations.

ALIGN THE ELECTRICAL SYSTEM

1. At the main switchboard in the EOS, set the BILGE PUMP NO. 2 circuit breaker (figure 1, item 1) to ON.
2. At the emergency switchboard in the Emergency Diesel Generator (EDG) room, set the BILGE PUMP #1 circuit breaker (figure 2, item 1) to ON.
3. At the bilge pump 1 and 2 motor controllers, in AMS 2, perform the following:
   a. Set the LOCAL-REMOTE switch(es) (figure 3, item 1) to LOCAL.
   b. Set the ON-OFF switch(es) (figure 3, item 2) to ON.
   c. Verify that the POWER AVAILABLE indicator(s) (figure 3, item 3) is/are illuminated.
4. In the engine room, at 120V emergency distribution panel No. 1, set the TLI SYSTEM. circuit breaker (figure 4, item 1) to ON.
5. On the 7 channel master Tank Level Indicator (TLI) panel in the EOS:
   a. Set the ON-OFF switch (figure 5, item 1) to ON.
   b. Verify that the POWER indicator (figure 5, item 2) is illuminated.

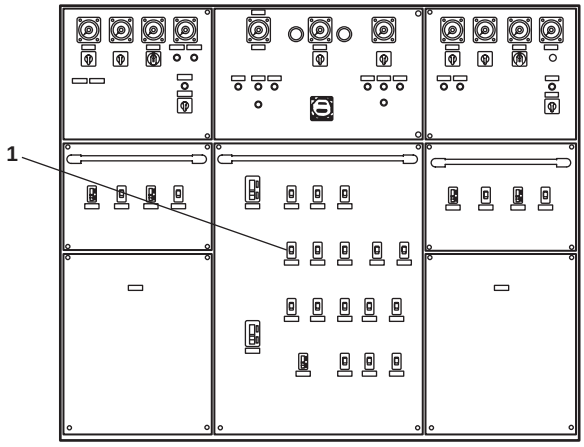


Figure 1. Main Switchboard

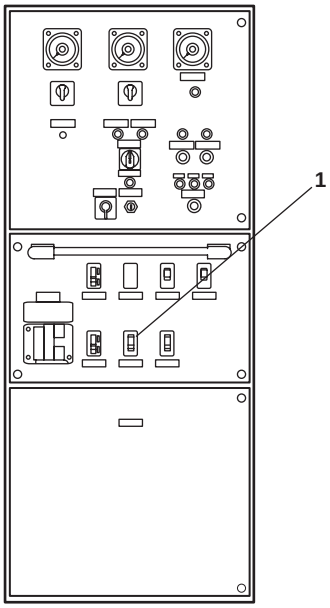


Figure 2. EDG Emergency Switchboard

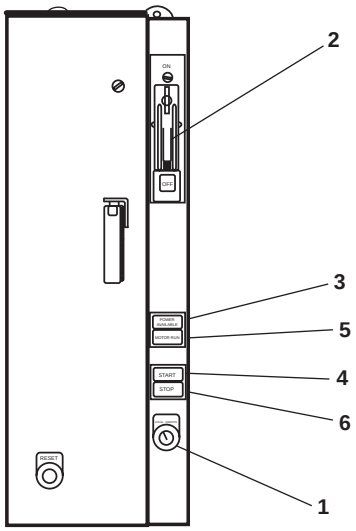


Figure 3. Bilge Pump Motor Controller

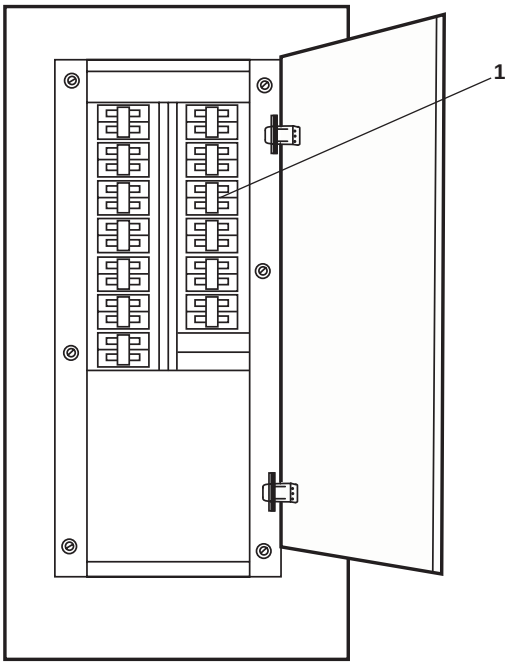


Figure 4. Engine Room Emergency Distribution Panel No. 1

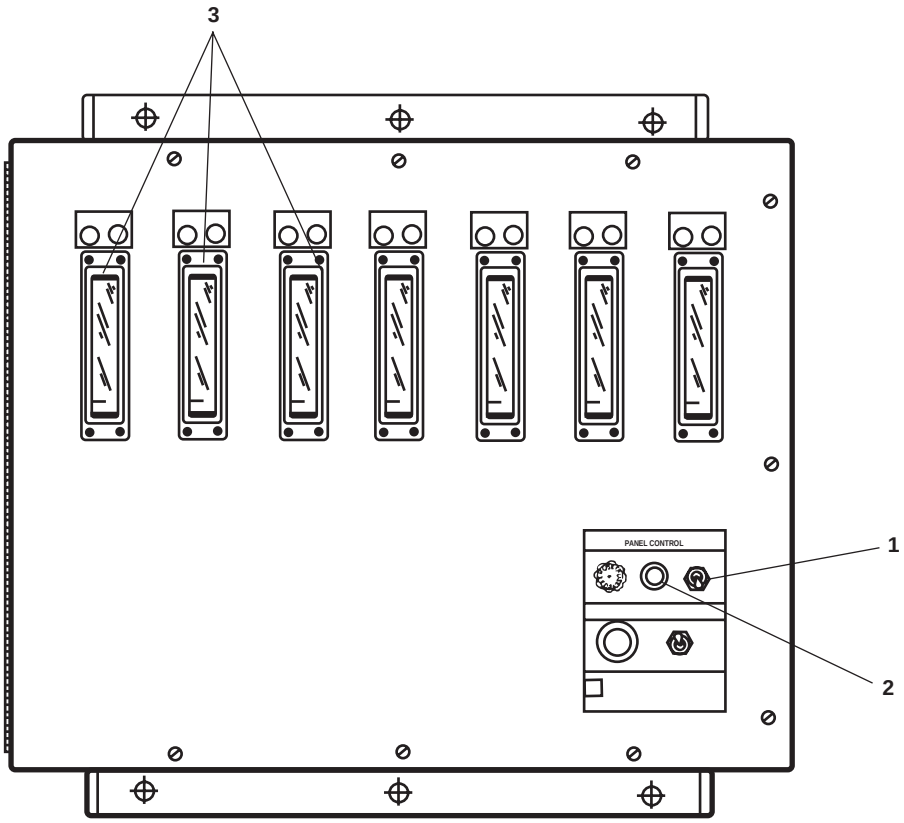


Figure 5. 7 Channel Master TLI Panel

ALIGN THE PIPING SYSTEM

1. Verify that the following valves are in the OPEN position:

    a. FM-2, SEA SUCT. FIRE/G.S. & BLST PMPS. (figure 6, item 1), the sea suction to the fire/general service and bilge/ballast pumps located in the engine room aft, under the deck plate at the entrance to AMS 2.

    b. FM-3, S.W. TO BILGE/BLST. PMPS. (figure 6, item 2), raw water to the fire/general service pumps, located in the engine room aft, under the deck plate at the entrance to AMS 2.

    c. AE-29, SEACHEST VENT (figure 6, item 3), the sea chest vent, located in the engine room aft, under the deck plate at the entrance to AMS 2.

    d. BB-12, BLST. TK. No. 1 SUCT. COV (figure 6 item 4), ballast tank 1 isolation in the bow thruster compartment.

2. Verify that the following valves are CLOSED:

    a. BB-25, BLST MANF TO PMPS OUTLT (figure 6, item 5)

    b. BB-34, B/B PMP No. 1 OVBD DISCH. (figure 6, item 7), bilge/ballast pump 1 discharge

    c. BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 8), bilge/ballast pump 2 discharge

    d. BB-29, B/B PMP No. 1 BILGE SUCT. (figure 6, item 9), bilge/ballast pump 1 suction

    e. BB-30, B/B PMP. No. 2 BILGE SUCT (figure 6, item 10), bilge/ballast pump 2 suction

    f. BB-58 (figure 6, item 12), bilge/ballast overboard discharge

    g. BB-13, S.W. TO BLST. PMPS (figure 6, item 13), raw water supply from fire main

    h. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold

    i. BB-27, B/B PMP. No.1 BLST. TO MANF. (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold

    j. BB-35, BILGE EDUCT SUCT COV (figure 6, item 16), bilge/ballast pump 1 discharge to ballast manifold

    k. BB-33, B/B PMP. No.2 BLST TO MANF. (figure 6, item 17), bilge/ballast pump 2 discharge to ballast manifold

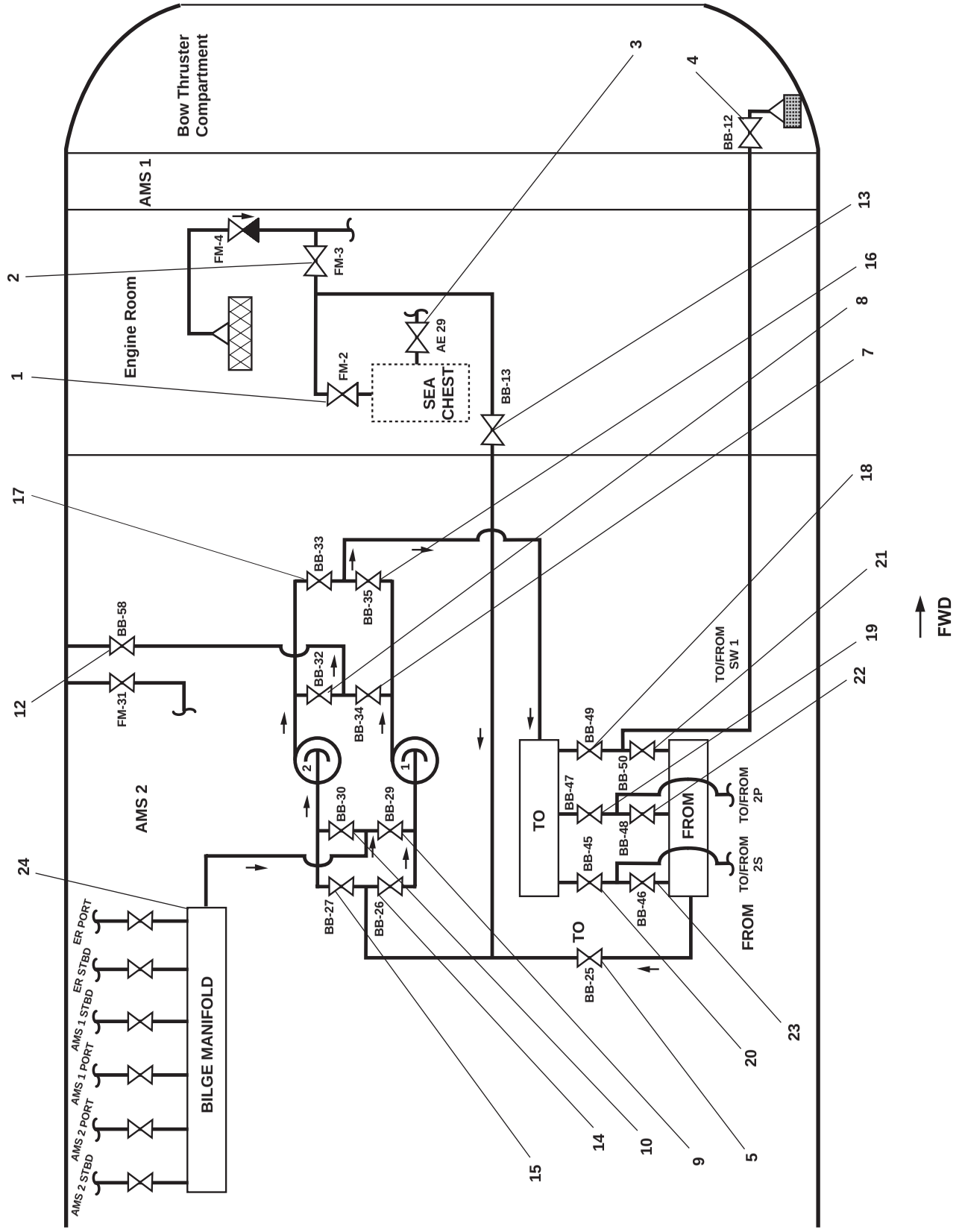


Figure 6. Bilge/Ballast System Valve Locations

FILL THE BALLAST TANKS WITH RAW WATER

1. Align the piping by placing the following valves in the OPEN position:
   a. BB-13, S.W. TO BLST. PMPS (figure 6, item 13), raw water supply from fire main
   b. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold
   c. BB-27, B/B PMP. No.2 BLST. SUCT (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold
   d. BB-35, B/B PMP No.1 BLST. TO MANF. (figure 6, item 16), bilge/ballast pump 1 discharge to ballast manifold
   e. BB-33, B/B PMP. No.2 BLST TO MANF (figure 6, item 17), bilge/ballast pump 2 discharge to ballast manifold
2. Select a ballast tank to fill and OPEN the valve as follows:
   a. To fill SALT WATER BALLAST TANK No. 1, OPEN BB-49, BLST TK No.1 FILL (figure 6, item 18), ballast tank 1 fill valve.
   b. To fill SW BALLAST TANK No. 2P, OPEN BB-47, BLST TK No.2P FILL (figure 6, item 19), ballast tank 2P fill valve.
   c. To fill SW BALLAST TANK No.2S, OPEN BB-45, BLST TK No.2S FILL (figure 6, item 20), ballast tank 2S fill valve.
3. Start the pump(s) by completing the following actions at the bilge/ballast pump motor controllers 1 and/or 2:
   a. Press and release the START pushbutton(s) (figure 3, item 4).
   b. Verify that the MOTOR RUN indicator(s) (figure 3, item 5) illuminate(s).
4. Verify that the pump discharge pressure gauge(s) read about 10 to 20 PSI (.67 to 1.38 bar).
5. Observe the tank level on the remote TLI receiver module (figure 7, item 1) of the tank being filled.

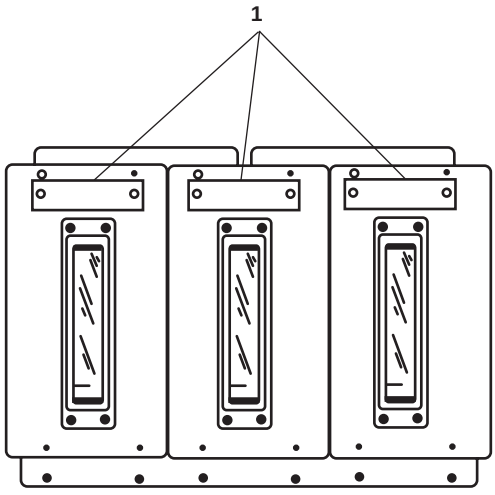


Figure 7. Remote TLI Receiver Module

6. When the tank reaches the desired level, stop the pumps by completing the following actions at the bilge pump motor controller(s):

    a. Press and release the STOP pushbutton(s) (figure 3, item 6).

    b. Verify that the MOTOR RUN indicator(s) (figure 3, item 5) go(es) out.

7. Secure the piping system by placing the following valves in the CLOSED position:

    a. All valves on the ballast manifold

    b. BB-13, S.W. TO BLST. PMPS (figure 6, item 13), raw water supply from fire main

    c. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold

    d. BB-27, B/B PMP. No.2 BLST. SUCT (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold

    e. BB-35, B/B PMP No. 1 BLST. TO MANF. (figure 6, item 16), bilge/ballast pump 1 discharge to ballast manifold

    f. BB-33, B/B PMP. No.2 BLST TO MANF. (figure 6, item 17), bilge/ballast pump 2 discharge to ballast manifold

DEBALLASTING BALLAST TANKS

1. Align the piping system by placing the following valves in the OPEN position:

    a. BB-25, BLST MANF TO PMPS OUTLT (figure 6, item 5)

    b. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold

    c. BB-27, B/B PMP. No.2 BLST. SUCT (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold

    d. BB-34, B/B PMP No. 1 OVBD DISCH. (figure 6, item 7), bilge/ballast pump 1 discharge

    e. BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 8), bilge/ballast pump 2 discharge

    f. BB-58 (figure 6, item 12), bilge/ballast overboard discharge

2. At the ballast manifold, select the tank to be deballasted by placing the valve in the OPEN position:

    a. SALT WATER BALLAST TANK No. 1, BB-50, BLST TK No.1 SUCT (figure 6, item 21), ballast tank 1 suction.

    b. SW BALLAST TANK No. 2P, OPEN BB-48, BLST TK No.2P SUCT (figure 6, item 22), ballast tank 2P suction.

    c. SW BALLAST TANK No.2S, OPEN BB-46, BLST TK No.2S SUCT (figure 6, item 23), ballast tank 2S suction.

3. Start the pump(s) by completing the following actions at the bilge/ballast pump motor controllers 1 and/or 2:

    a. Press and release the START pushbutton(s) (figure 3, item 4).

    b. Verify that the MOTOR RUN indicator(s) (figure 3, item 5) illuminate(s).

4. Verify that the pump discharge pressure gauge(s) reads about 10 to 20 PSI (.67 to 1.38 bar).

5. Observe the tank level on the remote TLI receiver module (figure 7, item 1) of the tank being filled.

6. When the tank reaches desired level, stop the pumps by completing the following actions at the bilge pump motor controller(s):

a. Press and release the STOP pushbutton(s) (figure 3, item 6).

b. Verify that the MOTOR RUN indicator(s) (figure 3, item 5) go(es) out.

7. Secure the piping system by placing the following valves in the CLOSED position:

a. All valves on the ballast manifold.

b. BB-25, BLST MANF TO PMPS OUTLT (figure 6, item 5)

c. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold

d. BB-27, B/B PMP. No.2 BLST. SUCT (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold

e. BB-33, B/B PMP. No.2 BLST TO MANF. (figure 6, item 7), bilge/ballast pump 1 discharge

f. BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 8), bilge/ballast pump 2 discharge

g. BB-58 (figure 6, item 12), bilge/ballast overboard discharge

FROM BALLAST TANK TO BALLAST TANK

1. Align the piping system by placing the following valves in the OPEN position:

a. BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 5), ballast manifold suction (from) isolation valve.

b. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold.

c. BB-27, B/B PMP. No.2 BLST. SUCT (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold.

d. BB-35, B/B PMP No. 1 BLST. TO MANF. (figure 6, item 16), bilge/ballast pump 1 discharge to ballast manifold.

e. BB-33, B/B PMP. No.2 BLST TO MANF (figure 6, item 17), bilge/ballast pump 2 discharge to ballast manifold.

2. At the ballast manifold perform the following actions:

a. OPEN the suction valve for the tank to remove ballast from.

b. OPEN the discharge valve for the tank to send ballast to.

3. Start the pump(s) by completing the following actions at the bilge/ballast pump motor controllers 1 and/or 2:

a. Press and release the START pushbutton(s) (figure 3, item 4).

b. Verify that the MOTOR RUN indicator(s) (figure 3, item 5) illuminate(s).

4. Verify that the pump discharge pressure gauge(s) read(s) about 10 to 20 PSI (.67 to 1.38 bar).

5. Observe the tank level on the remote TLI receiver module (figure 7, item 1) of the tank being filled.

6. When the tank reaches desired level, stop the pumps by completing the following actions at the bilge pump motor controller(s):

a. Press and release the STOP pushbutton(s) (figure 3, item 6).

b. Verify that the MOTOR RUN indicator(s) (figure 3, item 5) go(es) out.

7. Secure the piping system by placing the following valves in the CLOSED position:

   a. All valves on the ballast manifold.

   b. BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 5), ballast manifold suction (from) isolation valve

   c. BB-26, B/B PMP No. 1 BLST. SUCT (figure 6, item 14), bilge/ballast pump 1 suction from ballast manifold

   d. BB-27, B/B PMP. No.2 BLST. SUCT (figure 6, item 15), bilge/ballast pump 2 suction from ballast manifold

   e. BB-35, B/B PMP No. 1 BLST. TO MANF. (figure 6, item 16), bilge/ballast pump 1 discharge to ballast manifold

   f. BB-33, B/B PMP. No.2 BLST TO MANF. (figure 6, item 17), bilge/ballast pump 2 discharge to ballast manifold

BILGE SYSTEM OPERATIONS WITH THE EDUCTORS

1. Verify that the general service system is pressurized and operational.

NOTE

Operate only one bilge eductor at a time.

2. To pump bilges using the eductors, complete the following actions:

   a. To pump the chain locker bilge, OPEN the following valves:

      (1) BB-10 (figure 8, item 1), chain locker bilge eductor overboard discharge

      (2) GS-44, BILGE EDUC. (figure 8, item 2), general service to the chain locker bilge eductor

      (3) When chain locker bilge pumping is complete, place the valves opened in the CLOSED position

   b. To pump the bow thruster compartment bilge, OPEN the following valves:

      (1) BB-9, OVBD. DISCH. BILGE EDUC (figure 8, item 3), bow thruster compartment bilge eductor overboard discharge

      (2) GS-45, BILGE EDUC (figure 8, item 4), general service to bow thruster compartment bilge eductor

      (3) When bow thruster bilge pumping is complete, place the valves opened in the CLOSED position.

   c. To pump the aft steering compartment bilge, OPEN the following valves:

      (1) BB-11, OVBD. DISCH. BILGE EDUC. (figure 8, item 5), aft bilge eductor overboard discharge

      (2) GS-47, BILGE EDUC (figure 8, item 6), general service to the aft steering compartment bilge eductor

      (3) When aft steering compartment bilge pumping is complete, place the valves opened in the CLOSED position.

   d. To pump the STARBOARD towing gear locker bilge, OPEN the following valves:

      (1) BB-11, OVBD. DISCH. BILGE EDUC. (figure 8, item 5), aft bilge eductor overboard discharge

      (2) BB-37, BILGE EDUCT SUCT COV (figure 8, item 7), STARBOARD towing gear locker eductor suction isolation

      (3) GS-46, BILGE EDUC (figure 8, item 8), general service to the towing gear locker bilge eductor

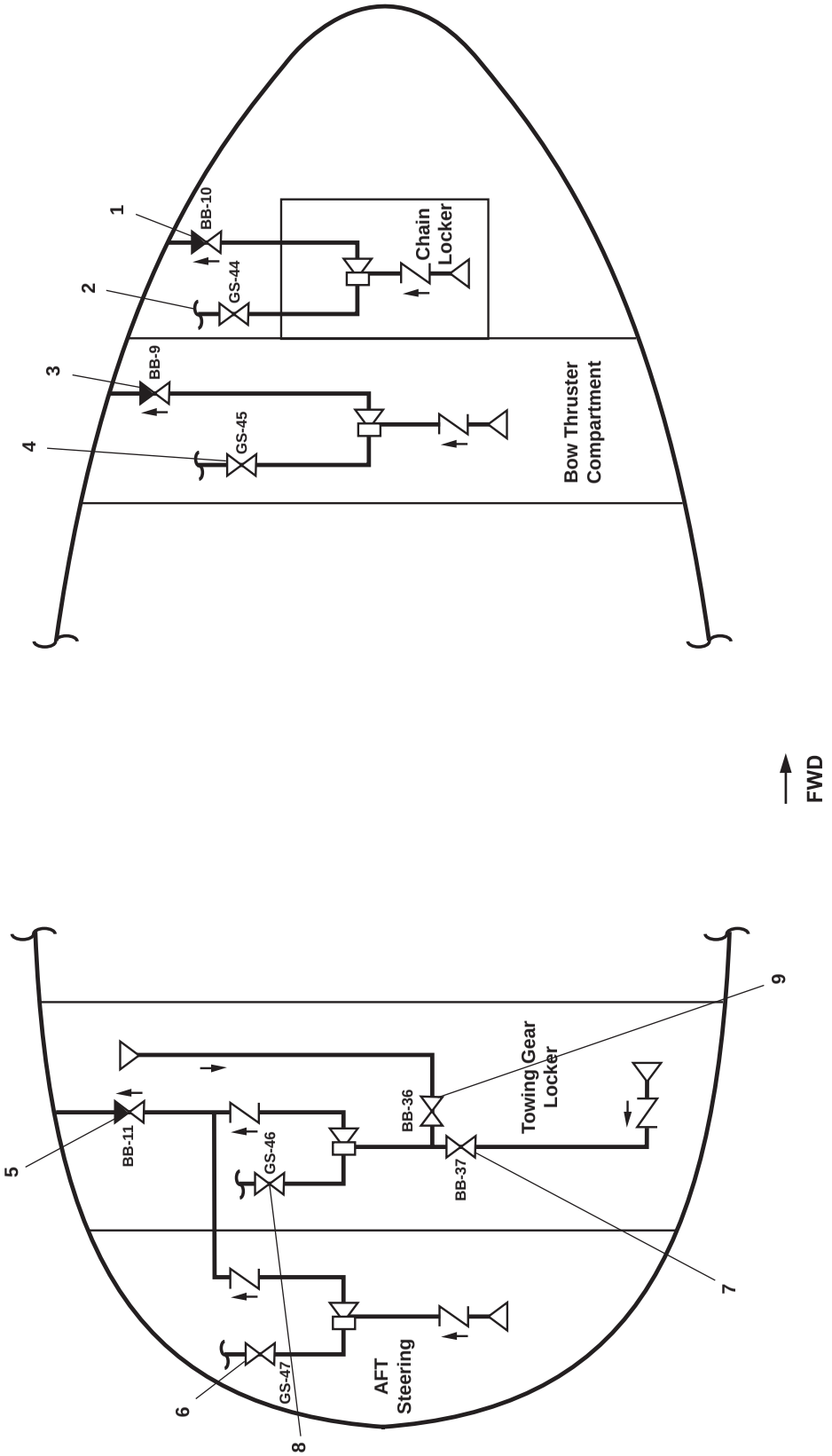


Figure 8. Bilge Eductor System

(4) When the STARBOARD towing gear locker bilge pumping is complete, place the valves opened in the CLOSED position.

e. To pump the PORT towing gear locker bilge, OPEN the following valves:

(1) BB-11, OVBD DISCH BILGE EDUC (figure 8, item 5), aft bilge eductor overboard discharge

(2) BB-36, BILGE EDUCT SUCT C.O.V. (figure 8, item 9), PORT towing gear locker eductor suction isolation

(3) GS-46, BILGE EDUC (figure 8, item 8), general service to the towing gear locker bilge eductor

(4) When the PORT towing gear locker bilge pumping is complete, place the valves opened in the CLOSED position.

MACHINERY SPACES BILGE SYSTEM

To pump clear water that does not contain oil from the bilges of the engine room, AMS 1 and AMS 2, using the machinery spaces bilge system, proceed as follows:

NOTE

Pumping oily water overboard could result in fines and/or legal action. When in doubt, follow the procedures for pumping oily bilge water.

1. Align the machinery spaces bilge piping system by placing the following valves in the OPEN position:

a. BB-33, B/B PMP. No.2 BLST TO MANF. (figure 6, item 7), bilge/ballast pump 1 discharge

b. BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 8), bilge/ballast pump 2 discharge

c. BB-29, B/B PMP No. 1 BILGE SUCT. (figure 6, item 9), bilge/ballast pump 1 suction

d. BB-30, B/B PMP. No. 2 BILGE SUCT (figure 6, item 10), bilge/ballast pump 2 suction

e. BB-58 (figure 6, item 12), bilge/ballast overboard discharge.

2. On bilge manifold (figure 6, item 24), open the valve(s) for the bilge(s) selected to be pumped.

NOTE

It is necessary to prime BILGE/BALLAST pumps before using the pumps to dewater the bilges.

3. Prime the bilge/ballast pumps by completing the following actions:

NOTE

Observe the vacuum bilge suction strainer differential pressure. When the gauge reads approximately 5-10 inches, stop the priming eductor.

a. OPEN priming eductor discharge valve.

b. OPEN air supply valve to eductor.

4. Start the pumps and pump the bilges by completing the following actions:

a. At the bilge pump 1 and/or 2 motor controllers:

(1) Press and release the START pushbutton(s) (figure 3, item 4).

(2) Verify that the MOTOR RUN indicator(s) (figure 3, item 5) illuminate(s).

b. Verify that the strainer differential pressure gauge(s) read(s) between 0 and 10 PSI (0 to .67 bar).

⚠ CAUTION

Monitor the discharge pressure gauge to verify that the pump is moving liquid. Running the pump dry can cause severe damage.

c. Verify that the pump discharge pressure gauge(s) read(s) between 10 and 40 PSI (.67 to 2.76 bar).

d. When bilges are empty, stop the pumps by performing the following actions at the bilge pump 1 and 2 motor controllers:

(1) Press and release the STOP pushbutton(s) (figure 3, item 6).

(2) Verify that the MOTOR RUN indicator(s) (figure 3, item 5) go(es) out.

e. Secure piping system by placing the following valves in the CLOSED position:

(1) All valves on the bilge manifold (figure 6, item 24).

(2) BB-58 (figure 6, item 12), bilge/ballast overboard discharge

(3) BB-33, B/B PMP. No.2 BLST TO MANF. (figure 6, item 7), bilge/ballast pump 1 discharge

(4) BB-32, B/B PMP No.2 OVBD DISCH (figure 6, item 8), bilge/ballast pump 2 discharge

(5) BB-29, B/B PMP No. 1 BILGE SUCT. (figure 6, item 9), bilge/ballast pump 1 suction

(6) BB-30, B/B PMP. No. 2 BILGE SUCT (figure 6, item 10), bilge/ballast pump 2 suction

OILY BILGE WATER PUMPING

1. Verify that the compressed air system is operational and available.

2. Align the oily bilge water pumping system piping as follows:

a. Place the following valves in the CLOSED position:

(1) OB-18, HOSE CONN. - OILY BILGE SUCT. (figure 9, item 1), engine room forward 1½" flush connection

(2) OB-2, OILY BILGE SUCT (figure 9, item 2), AMS 1 PORT oily bilge suction

(3) AMS 1 1½" flush connection (figure 9, item 3)

(4) OB-1, OILY BILGE SUCT (figure 9, item 4), AMS 1 STARBOARD oily bilge suction

(5) OB-16, OILY WASTE STOR. TK. SUCT. (figure 9, item 5), oily waste storage tank suction

(6) OB-10, OILY WTR. SEP. OVBD. DISCH (figure 9, item 6), oil water separator overboard discharge

(7) OB-15, OILY WTR. SEP. INLET (figure 9, item 7), oil water separator inlet

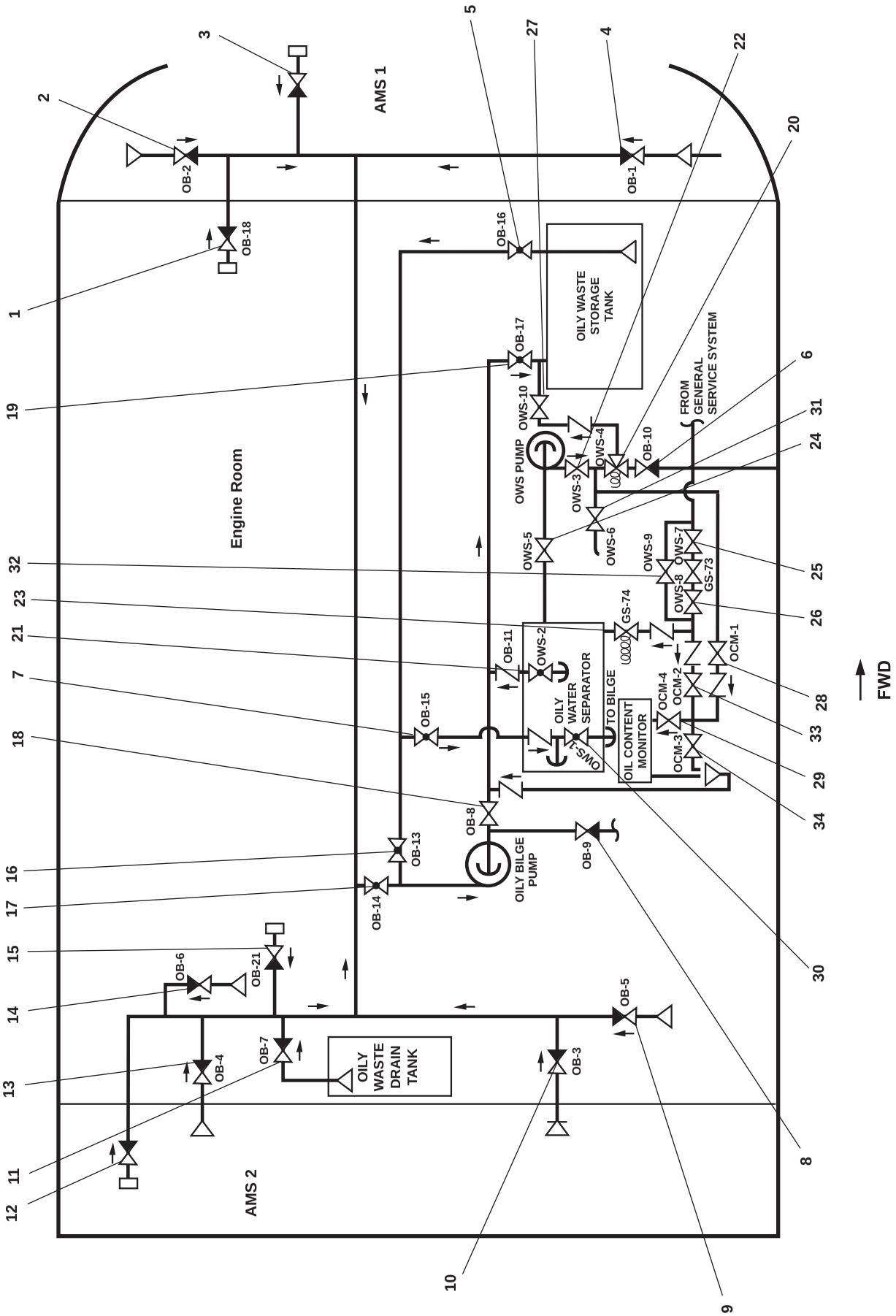


Figure 9. Oily Bilge Piping System

(8) OB-9, OILY BILGE PMP. DISCH TO SHORE (figure 9, item 8), oily bilge pump discharge to shore connection

(9) OB-5, OILY BILGE SUCT. ENG. RM. (figure 9, item 9), engine room STARBOARD oily bilge suction

(10) OB-3, OILY BILGE SUCT. SHAFT ALLEY (figure 9, item 10), STARBOARD shaft alley oily bilge suction

(11) OB-7, OILY DR. TK. SUCT (figure 9, item 11), oily waste drain tank suction

(12) PORT shaft alley 1½" flush connection (figure 9, item 12)

(13) OB-4, OILY BILGE SUCT. SHAFT ALLEY (figure 9, item 13), PORT shaft alley oily bilge suction

(14) OB-6, OILY BILGE SUCT. ENG. RM. (figure 9, item 14), engine room PORT oily bilge suction

(15) OB-21, HOSE CONN. – OILY BILGE SUCT. (figure 9, item 15), engine room aft 1½" flush connection

(16) OB-13, OILY WST. STOR. TK. TO OILY BILGE PMP. SUCT. (figure 9, item 16), oily waste storage tank to oily bilge pump suction

b. Place the following valves in the OPEN position:

(1) OB-14, C.O.V. – OILY BILGE PMP. SUCT. (figure 9, item 17), pump suction from oily bilge header.

(2) OB-8, OILY BILGE PMP. DISCH. TO OILY WST.STOR. TK. (figure 9, item 18), oily bilge pump discharge to the oily waste storage tank.

(3) OB-17, OILY WASTE STOR. INLET (figure 9, item 19), oily waste storage tank inlet.

NOTE

The suction bell mouth must be below liquid level in bilge that is being pumped. Only open the bilge valve that suction is to be taken from.

3. Select the bilge to be pumped as follows:

a. To pump AMS 1 STARBOARD bilge, OPEN OB-1, OILY BILGE SUCT (figure 9, item 4).

b. To pump AMS 1 PORT bilge, OPEN OB-2 OILY BILGE SUCT (figure 9, item 2).

c. To pump engine room STARBOARD bilge, OPEN OB-5, OILY BILGE SUCT. ENG. RM. (figure 9, item 9).

d. To pump engine room PORT bilge, OPEN OB-6, OILY BILGE SUCT. ENG. RM. (figure 9, item 14).

e To pump STARBOARD shaft alley bilge, OPEN OB-3, OILY BILGE SUCT. SHAFT ALLEY (figure 9, item 10).

f. To pump sort shaft alley bilge, OPEN OB-4, OILY BILGE. SUCT SHAFT ALLEY (figure 9, item 13).

4. Start the pump by placing CA-56, COV – OILY BILGE PMP SUCT in the OPEN position.

⚠ CAUTION

Air supply regulator pressure gauge should not read above 90 PSI (6.21 bar) or damage could occur to the pump.

5. Verify the readings at the following gauges:

a. Oily bilge transfer pump strainer differential pressure gauge reads between 0 and 15 PSI (0 to 1.03 bar).

b. Oily bilge transfer pump discharge press gauge reads between 0 and 20 PSI (0 to 1.39 bar).

6. When the bilge is empty, stop the pump by placing CA-56, COV – OILY BILGE PMP SUCT in the CLOSED position.

7. CLOSE the suction valve for the bilge that was pumped.

TRANSFER OILY WATER FROM DRAIN TANK TO STORAGE TANK

1. OPEN OB-7, OILY DR. TK. SUCT (figure 9, item 11), oily waste drain tank suction.

⚠ CAUTION

The air supply regulator pressure gauge should not read above 90 PSI (6.21 bar) or damage could occur to the pump.

2. Start the pump by placing CA-56, COV – OILY BILGE PMP SUCT in the OPEN position.

3. Verify the readings at the following gauges:

a. Oily bilge transfer pump strainer differential pressure gauge reads between 0 and 15 PSI (0 to 1.03 bar).

b. Oily bilge transfer pump discharge press gauge reads between 0 and 20 PSI (0 to 1.39 bar).

4. When the bilge is empty, stop the pump by placing CA-56, COV – OILY BILGE PMP SUCT in the CLOSED position.

5. CLOSE OB-7, OILY DR. TK. SUCT (figure 9, item 11), oily waste drain tank suction.

PUMP CONTENTS OF TANKS TO SHORE

1. Make a connection to the shore facility with the oily waste shore connection.

2. Align the piping system as follows:

a. OPEN the following valves:

(1) OB-22, C.O.V. SHORE CONN oily waste shore connection cutoff, located on the main deck

(2) OB-9, OILY BILGE PMP. DISCH TO SHORE (figure 9, item 8), oily bilge pump discharge to shore connection

b. CLOSE OB-8, OILY BILGE PMP DISCH. TO OILY WST.STOR. TK. (figure 9, item 18), oily bilge pump discharge to the oily waste storage tank.

3. Align the selected tank to pump to shore as follows:

NOTE

Pump the contents of one tank at a time.

a. To pump the oily waste drain tank, position the valves as follows:

(1) OPEN OB-7, OILY DR. TK. SUCT (figure 9, item 11), oily waste drain tank suction.

(2) CLOSE OB-13, OILY WST. STOR. TK. TO OILY BILGE PMP. SUCT. (figure 9, item 16), oily waste storage tank to oily bilge pump suction.

b. To pump the oily waste storage tank, position the valves as follows:

(1) CLOSE OB-14, C.O.V. – OILY BILGE PMP. SUCT. (figure 9, item 17), pump suction from oily bilge header.

(2) OPEN OB-13, OILY WST. STOR. TK. TO OILY BILGE PMP. SUCT. (figure 9, item 16), oily waste storage tank to oily bilge pump suction.

(3) OPEN OB-16, OILY WASTE STOR. TK. SUCT. (figure 9, item 5), oily waste storage tank suction.

4. Start the oily bilge pump by placing CA-56, COV – OILY BILGE PMP SUCT in the OPEN position.

⚠ CAUTION

The air supply regulator pressure gauge should not read above 90 PSI (6.21 bar) or damage could occur to the pump.

5 Verify the readings at the following gauges:

a. Oily bilge transfer pump strainer differential pressure gauge reads between 0 and 15 PSI (0 to 1.03 bar).

b. Oily bilge transfer pump discharge press gauge reads between 0 and 20 PSI (0 to 1.39 bar).

6. When the bilge is empty, stop the oily bilge pump by placing CA-56, COV – OILY BILGE PMP SUCT in the CLOSED position.

7. Secure the piping system and realign the valves as follows:

a. CLOSE the following valves:

(1) OB-22, C.O.V. SHORE CONN. oily waste shore connection, located on the main deck

(2) OB-16, OILY WASTE STOR. TK. SUCT. (figure 9, item 5), oily waste storage tank suction

(3) OB-13, OILY WST. STOR. TK. TO OILY BILGE PMP. SUCT. (figure 9, item 16), oily waste storage tank to oily bilge pump suction

(4) OB-7, OILY DR. TK. SUCT (figure 9, item 12), oily waste drain tank suction

(5) OB-9, OILY BILGE PMP. DISCH TO SHORE (figure 9, item 8), oily bilge pump discharge to shore connection

b. Place the following valves in the OPEN position:

(1) OB-14, C.O.V. – OILY BILGE PMP. SUCT. (figure 9, item 17), pump suction from oily bilge header

(2) OB-8, OILY BILGE PMP DISCH. TO OILY WST.STOR. TK. (figure 9, item 18), oily bilge pump discharge to the oily waste storage tank

8. Disconnect the hose at oily waste shore connection.

OWS AND OCM OPERATING PROCEDURES

OWS STARTUP AND NORMAL OPERATION

1. Set to OFF the OWS switch (figure 10, item 1) on the OWS control panel (figure 10, item 2).

2. Set to ON the OILY WATER SEPARATOR. circuit breaker (figure 11, item 1) in the 120V distribution panel No. 4. The green POWER AVAILABLE indicator (figure 10, item 3) will illuminate to indicate that the OWS control panel has power available.

3. Align the OWS, the Oily Bilge (OB), and OCM valves as indicated in table 1 and figure 12.

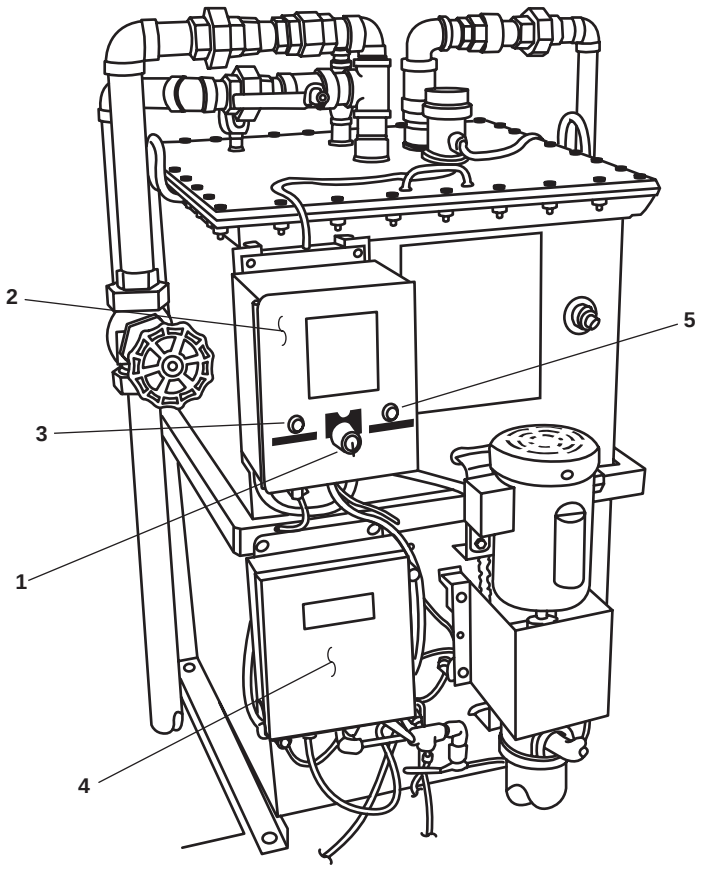


Figure 10. OWS Control Panel

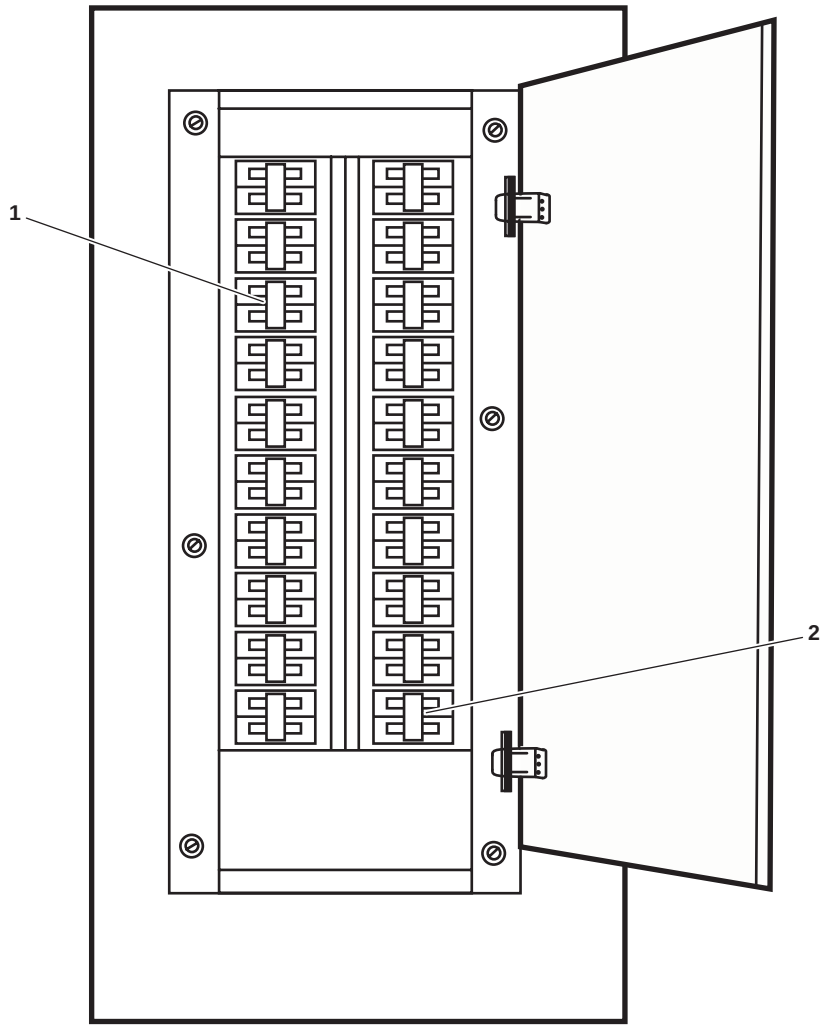


Figure 11. 120V Distribution Panel No. 4

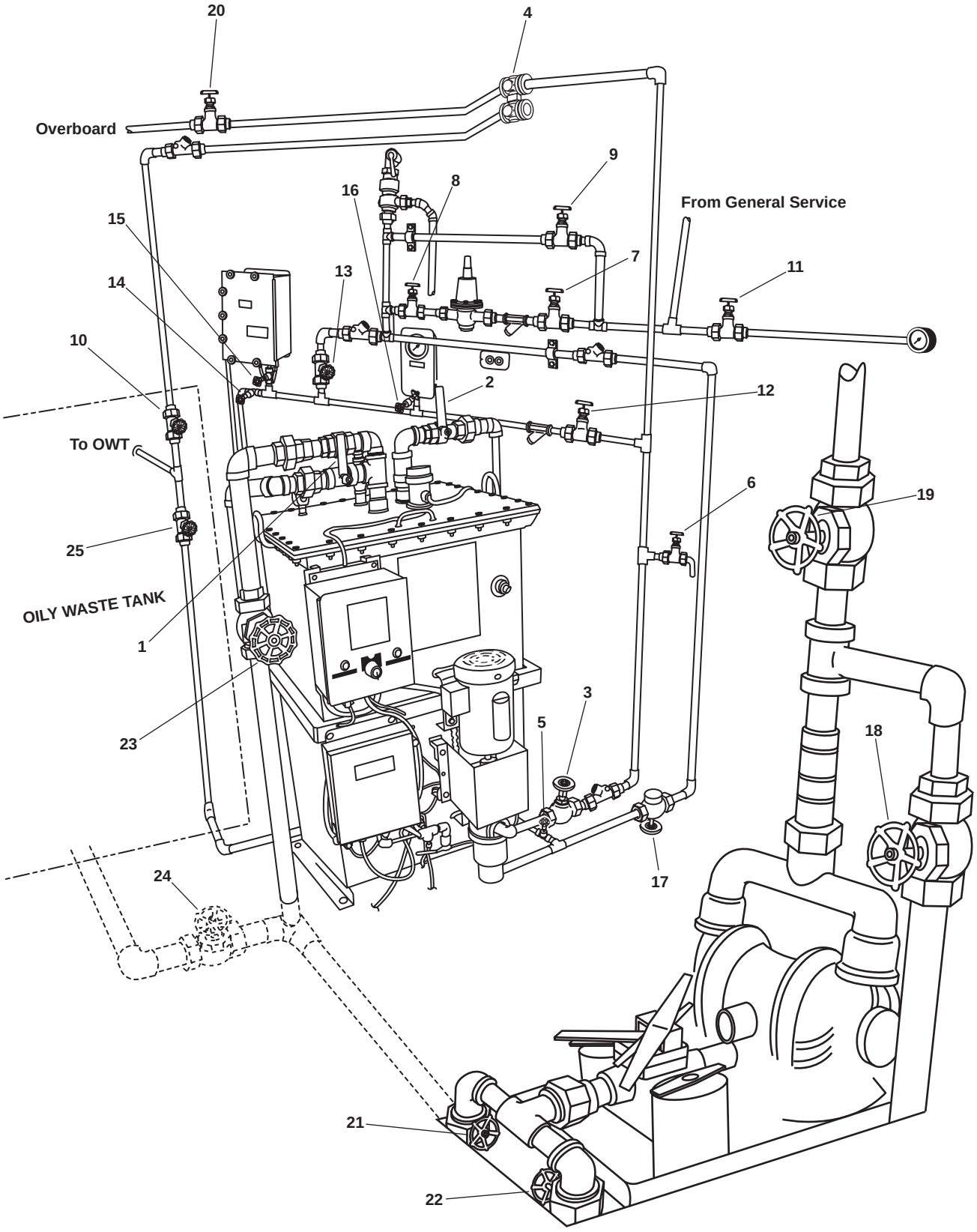


Figure 12. OWS, OB, and OCM Piping

Table 1. Valve Positions During Operation Under Usual Conditions

Item Number (Figure 12)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
2	OWS-2	OWS DISCHARGE	OPEN
3	OWS-3	OWS PUMP DISCHARGE	OPEN
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	OPEN
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	OPEN
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	OPEN
12	OCM-1	OCM NOZZLE SAMPLER COV	OPEN
13	OCM-2	OCM BACKFLUSH WATER	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	OPEN
16	OCM-8	OCM GAGE ISOLATION	OPEN
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	OPEN
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	OPEN
24	OB-16	WATER FROM OWT COV	OPEN
25	OB-17	OILY WATER TANK INLET	OPEN

4. If the OWS and the system inlet piping are not completely filled with water, purge all air from the system by performing a manual backflush, as described in TM 55-1925-285-13&P.

⚠ CAUTION

The OCM will operate regardless of fluid flow through the monitor when the OCM OPERATION SELECTOR Switch A1S1 is in the TEST position. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Failure to comply with this caution will result in damage to the equipment.

5. Set the OCM OPERATION SELECTOR Switch A1S1 (figure 13, item 1) to the OFF position.

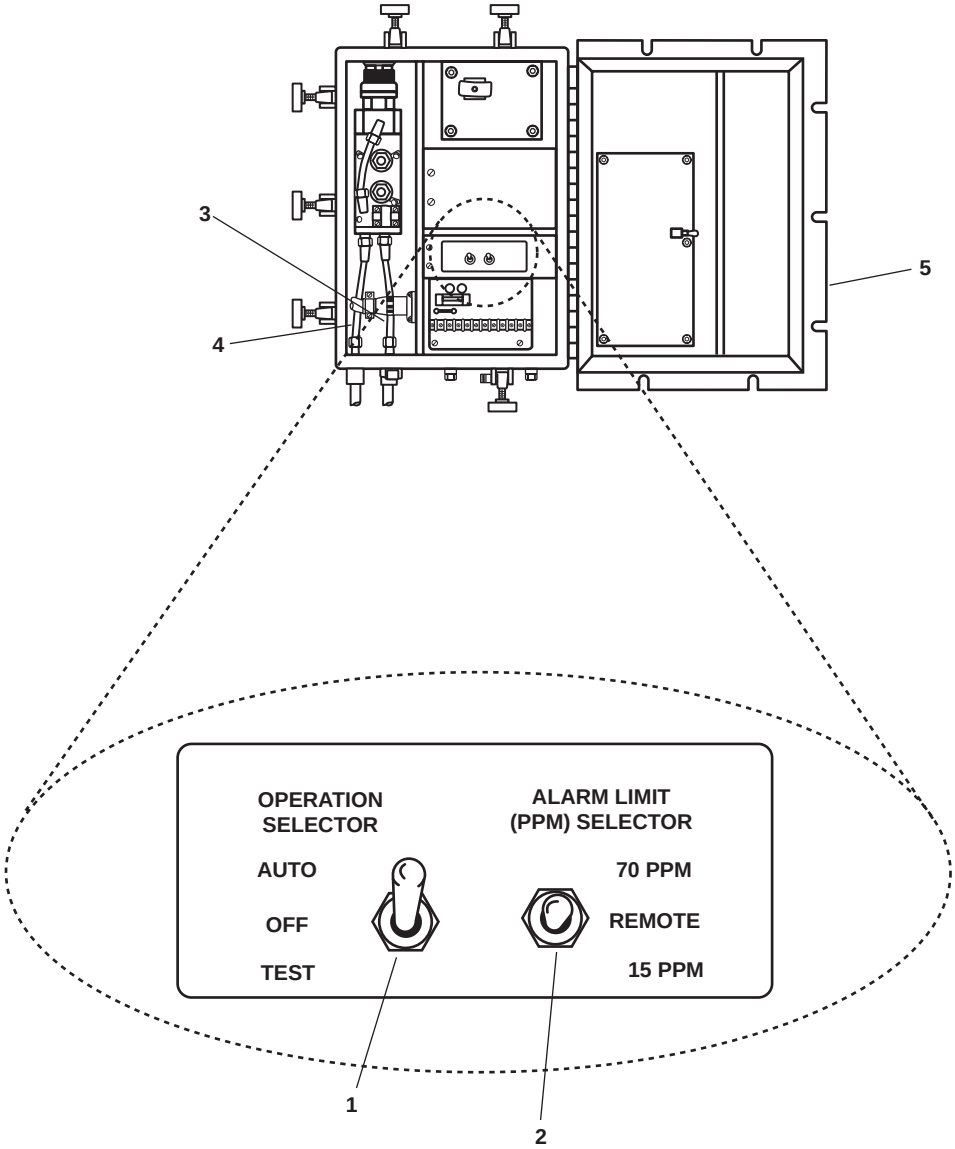


Figure 13. Sampling/Sensor Assembly Interior

6. Set the OIL CONTENT MONITOR. circuit breaker (figure 11, item 2) in 120V distribution panel No. 4 to ON. The red indicator (figure 14, item 1) on the OCM diverter valve position indicator (figure 14, item 2) will illuminate to signal that the OCM has power available.

NOTE

With the OPERATION SELECTOR Switch A1S1 (figure 13, item 1) in the AUTO position, the OCM will not operate until the pressure switch senses a pressure between 5 to 25 PSI (0.3 to 1.7 bar) at the OCM sample inlet. The OCM will automatically shut down if the pressure at the OCM sample inlet falls below 5 PSI (0.3 bar).

7. Position the OPERATION SELECTOR Switch A1S1 (figure 13, item 1) to AUTO.

NOTE

Placing the ALARM LIMIT (PPM) SELECTOR Switch A1S2 in the 15 PPM or 70 PPM position disables the Remote Indicator Assembly.

8. If the Remote Indicator Assembly (figure 15) is not used, set the ALARM LIMIT (PPM) SELECTOR Switch A1S2 (figure 13, item 2) to the 15 PPM position for OWS operation within 12 nautical miles of land or the 70 PPM position for OWS operation outside 12 nautical miles of land. To utilize the Remote Indicator Assembly, set the ALARM LIMIT (PPM) SELECTOR switch A1S2 to the REMOTE position.

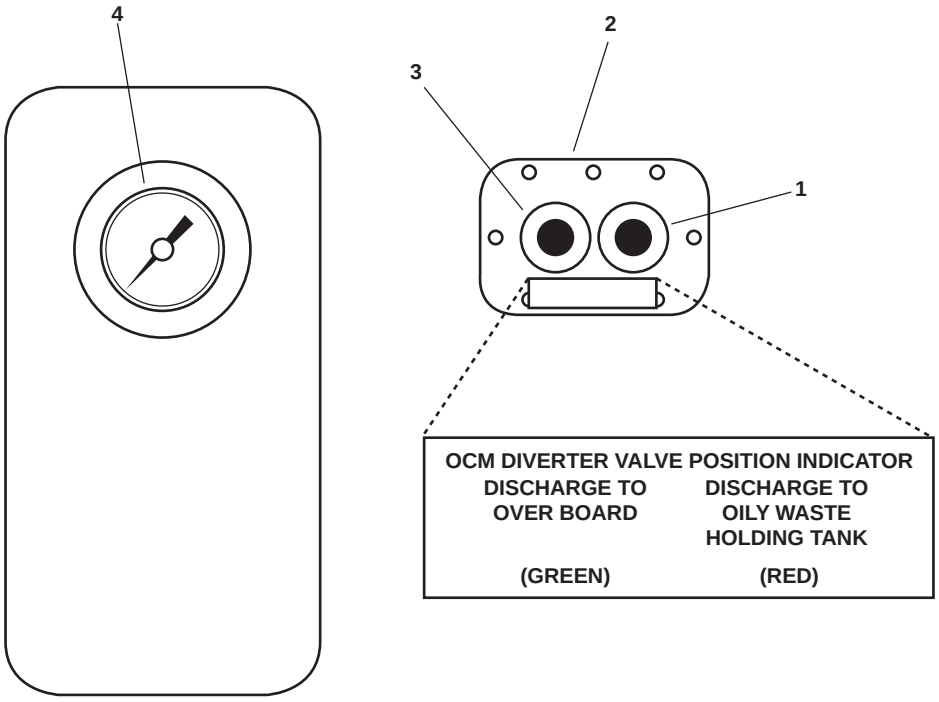


Figure 14. OCM Diverter Valve Position Indicator

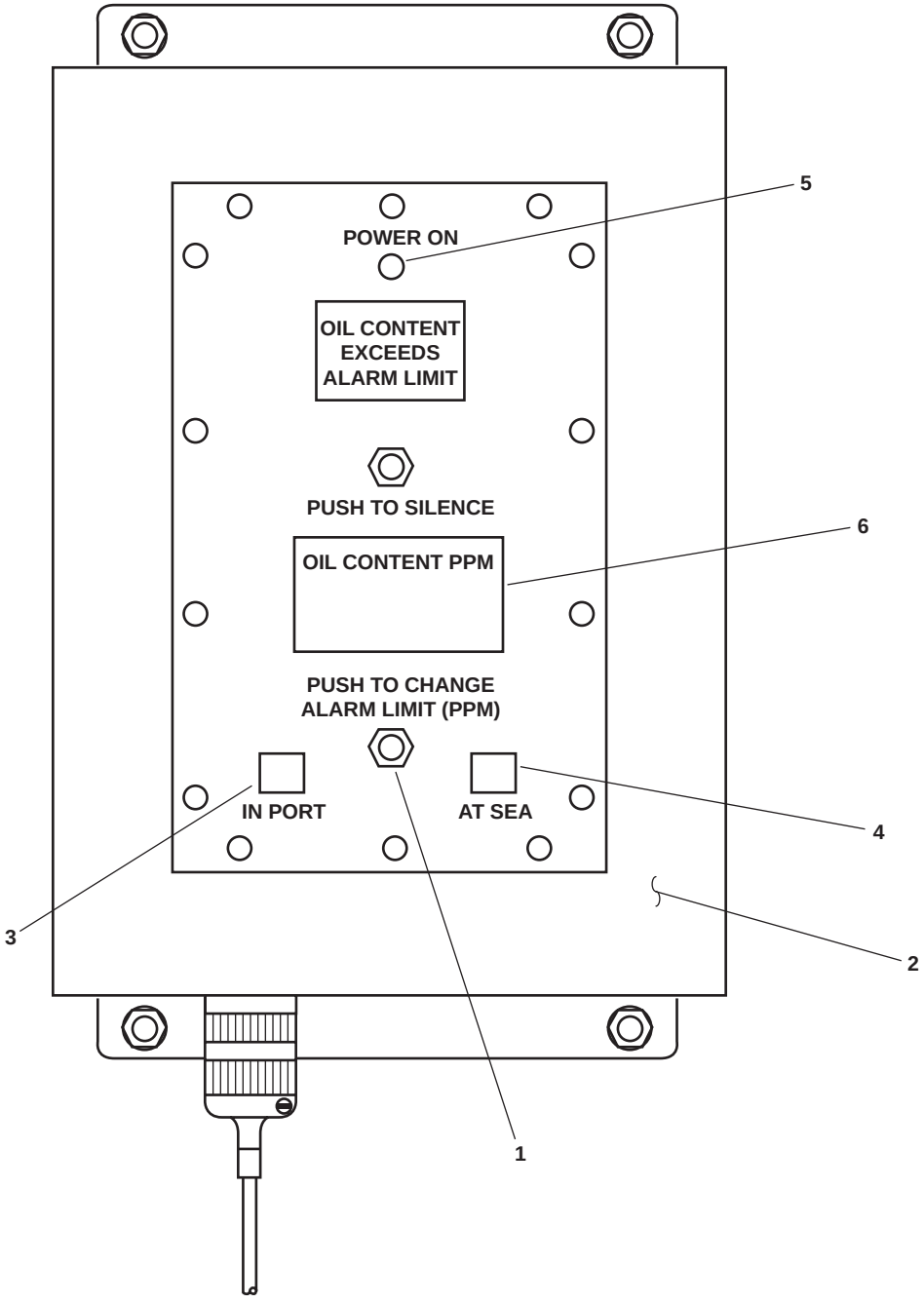


Figure 15. Remote Indicator (Alarm) Assembly

⚠ CAUTION

The OCM must have flow through it while in operation. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Failure to comply with this caution will result in damage to the equipment.

9. Set the OWS control panel switch (figure 10, item 1) to MAN. The OWS pump will start, drawing oily water through the unit. The pump will continue to run as long as the switch is in the MAN position.

10. Verify that the OCM has fluid flowing through the OCM sample inlet tubing (figure 13, item 3) and is discharging fluid through the OCM sample discharge tubing (figure 13, item 4). If the OCM does not have fluid flow within 2 minutes, turn the OWS control panel switch (figure 10, item 2) to OFF and notify the maintenance supervisor. If the OCM does have fluid flow within 2 minutes continue with the procedure.

11. Close and secure the sampling/sensor assembly door (figure 13, item 5).

12. If the Remote Indicator was selected, the PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch A2S1 (figure 15, item 1) on the remote indicator (alarm) assembly (figure 15, item 2) must be set to the proper PPM. Select the IN PORT (15 PPM) or AT SEA (70 PPM) alarm limit by pushing the PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch A2S1 until the IN PORT indicator (figure 15, item 3) or the AT SEA indicator (figure 15, item 4) illuminates.

13. Verify that the OCM is operating properly by checking the following OCM system indicators:

    a. The POWER indicator A1DS1 (figure 16, item 1) on the OCM display (figure 16, item 2) is illuminated.

    b. The RANGE-PPM indicator (figure 16, item 3) on the OCM display (figure 16, item 2) indicates the PPM Selected.

    c. The sampling/sensor assembly Light Emitting Diodes (LEDs) (figure 16, item 4) on the OCM display (figure 16, item 2) are illuminated.

    d. OCM WARNING 1 (figure 16, item 5) on the OCM display (figure 16, item 2) is not illuminated.

⚠ CAUTION

OCM WARNING 2 and 3 may cycle on and off depending on the amount of dirt, bubbles, foam, or air in the sample. If OCM WARNING 2 or 3 illuminate for more than 60 seconds continuously, check the OCM to ensure flow is present. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Failure to comply with this caution will result in damage to the equipment.

    e. OCM WARNING 2 (figure 16, item 6) on the OCM display (figure 16, item 2) is not illuminated.

    f. OCM WARNING 3 (figure 16, item 7) on the OCM display (figure 16, item 2) is not illuminated.

    g. The POWER ON indicator A2DS1 (figure 15, item 5) is illuminated on the Remote Indicator Assembly (figure 15, item 2) if the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 13, item 2) is in the REMOTE position.

    h. The appropriate alarm limit indicator (figure 15, items 3 and 4) is illuminated on the Remote Indicator Assembly figure 15, item 2) to correspond with the alarm limit selected if the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 13, item 2) is in the REMOTE position.

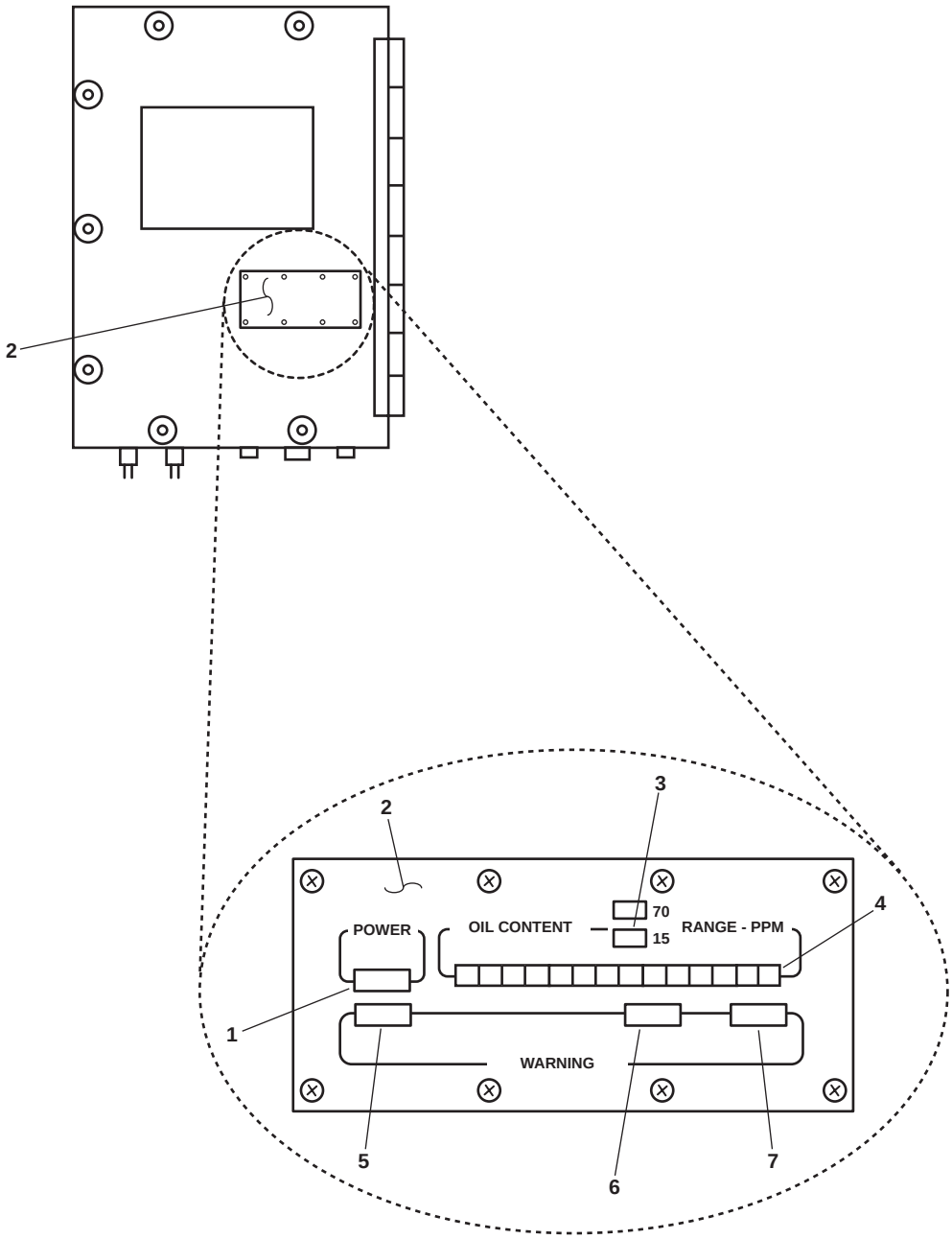


Figure 16. Sampling/Sensor Assembly Indicators

NOTE

There may be up to a one-minute delay between the time when the OCM turns on and when a numeric PPM value is displayed.

i. The OIL CONTENT PPM (figure 15, item 6) is displayed on the Remote Indicator Assembly (figure 15, item 2) if the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 13, item 2) is in the REMOTE position.

j. The Diverter Valve Position Indicator (figure 14, item 2) illuminates green (figure 14, item 3) for overboard discharge and illuminates red (figure 14, item 1) for discharge to the Oily Waste Holding Tank.

NOTE

When the OCM is turned OFF, or is inactive because sample pressure is outside the operating pressure range, the effluent diverter solenoid valve will be in its default position, recirculating effluent to the Oily Waste Tank (OWT). When the OCM is activated by its pressure switch, it must detect four consecutive "good" samples (at 15-second intervals) before the remote relay assembly will send a signal to the diverter solenoid valve, diverting effluent flow overboard. If the effluent oil concentration rises above the set alarm level for one sample, the Remote Relay Assembly will remove the signal, causing the diverter solenoid valve to return to its default (recirculating) position. Loss of control signal or power to the diverter solenoid valve also causes it to return to its default position.

k. The OCM Sample Inlet Pressure Gauge (figure 14, item 4) indicates a pressure between 5 and 25 PSI (0.3 to 1.7 bar).

l. Monitor the effluent diverter solenoid valve (figure 12, item 4) to ensure that it is being automatically controlled by a signal from the OCM remote relay assembly (figure 10, item 4).

NOTE

Oil Discharge from the OWS to the OWT is automatic during manual operation. When enough oil has collected in the top of the OWS tank to cover the tip of the lower sensor probe, the OWS will enter the oil discharge mode. The yellow OIL DISCHARGE indicator on the OWS control panel will light and the OWS pump will stop. The OWS backflush inlet solenoid valve will open, admitting raw water at about 12 PSI (0.8 bar) to force the oil out of the OWS tank and into the OWT. When enough oil has been discharged that the upper sensor probe is again covered with water, the OWS will automatically return to processing mode. The yellow OIL DISCHARGE light will turn off, the OWS backflush inlet solenoid valve will close, and the OWS pump will start.

14. Monitor the operation of the OWS. A temporary automatic shutdown of the OWS is normal. Do not drain the OWT below 10 percent during normal OWS operation. Fouling of the OWS will occur.

OWS SHUTDOWN

1. Turn the OWS control panel switch (figure 10, item 1) to the OFF position.

2. Position OPERATION SELECTOR switch A1S1 (figure 13, item 1) to OFF.

3. Perform OCM backflush by OPENING OCM 2 (figure 12, item 13) and CLOSING OCM 1. Continue OCM backflush until all liquid from the OCM discharge tube (figure 13, item 4) is clear.

4. Perform OWS manual backflush (WP 0006 00).

5. Return all valves from table 1 to the CLOSED position.

6. At 120V distribution panel No. 4, set the following circuit breakers to OFF:

   a. OILY WATER SEPARATOR (figure 11, item 1).

   b. OIL CONTENT MONITOR (figure 11, item 2).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
POTABLE WATER SYSTEM

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0071 00

PURPOSE

This work package contains the following procedures:

1. Main potable water system setup.
2. Place hot water heaters online.
3. Place the shipwide potable water system online.
4. Reverse osmosis units operating procedure.
5. Brominator operating procedure.

NOTE

Verify that the marine sanitation device is operational before using the potable water system.

MAIN POTABLE WATER SYSTEM SETUP

1. Align the electrical system as follows:

   a. At the main switchboard in the EOS, set the AUX MACH SPACE NO.2 PWR PNL NO.5 circuit breaker (figure 1, item 1) to the ON position.

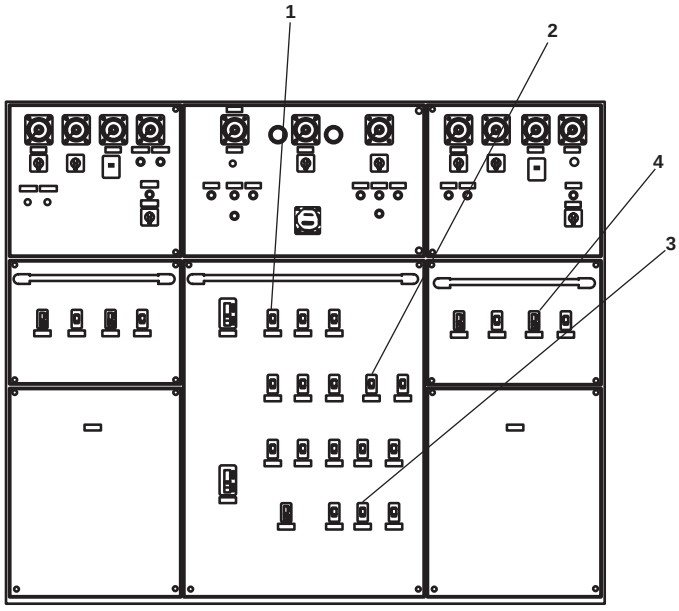


Figure 1. EOS Main Switchboard

b. At the 440V power panel No. 5, set the following circuit breakers to ON:

(1) POTABLE WATER PUMP No. 1 (figure 2, item 1)

(2) POTABLE WATER PUMP No. 2 (figure 2, item 2)

c. At the 120V emergency distribution panel No. 1, set the TLI SYSTEM. circuit breaker (figure 3, item 1) to ON.

d. At the 120V distribution panel No. 4, set the ENGINEERING OPERATING STATION DRINKING FOUNTAIN. circuit breaker (figure 4, item 1) to ON.

e. At the 120V distribution panel No. 3, set the MAIN DECK DRINKING FOUNTAIN. circuit breaker (figure 5, item 1) to ON.

f. At the 120V distribution panel No. 2, set the following circuit breakers to ON:

(1) 01 LEVEL DRINKING FOUNTAIN. (figure 6, item 1)

(2) PILOT HOUSE DRINKING FOUNTAIN & COFEE MAKER. (figure 6, item 2)

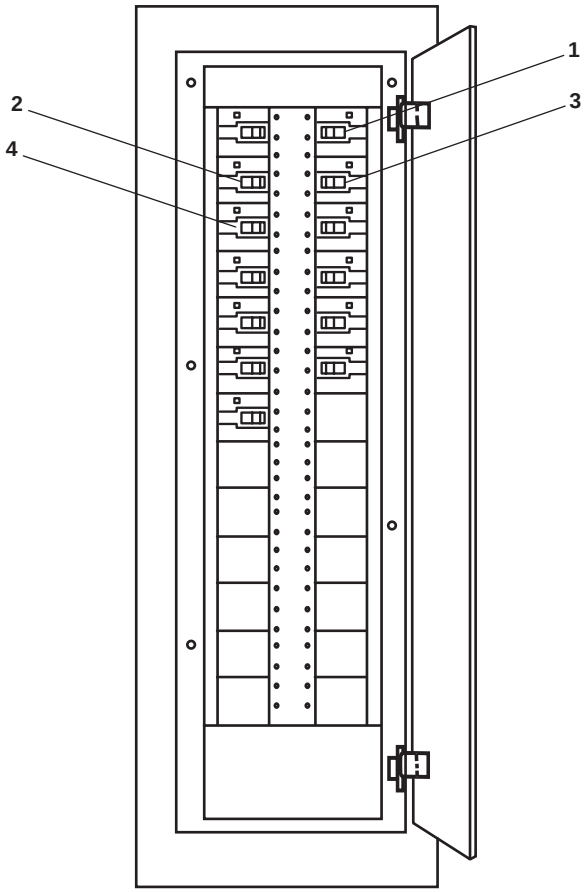


Figure 2. 440V Power Panel No. 5

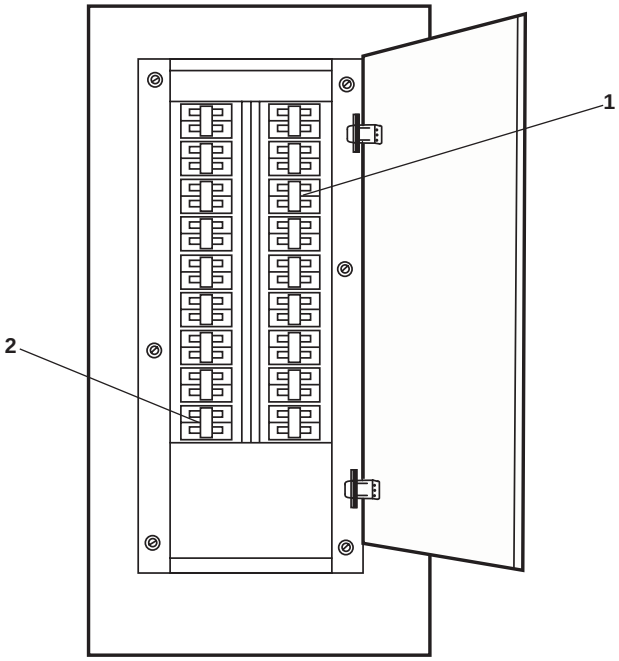


Figure 3. 120V Emergency Distribution Panel No. 1

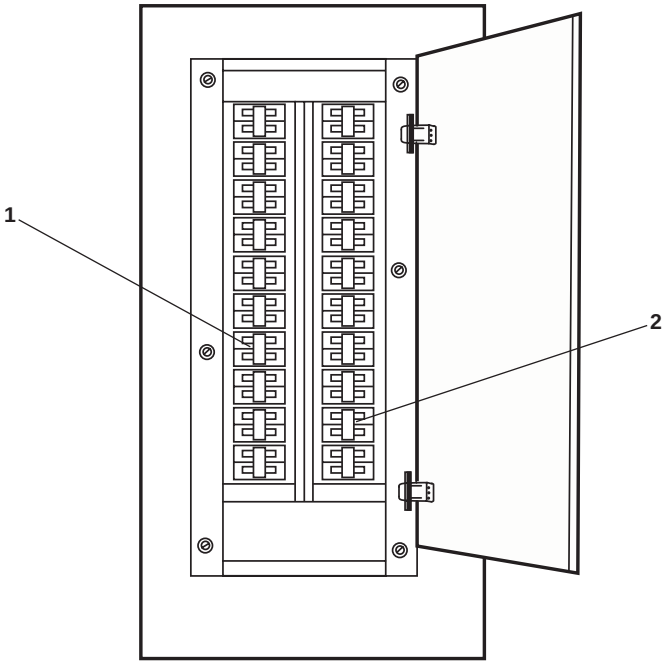


Figure 4. 120V Distribution Panel No. 4

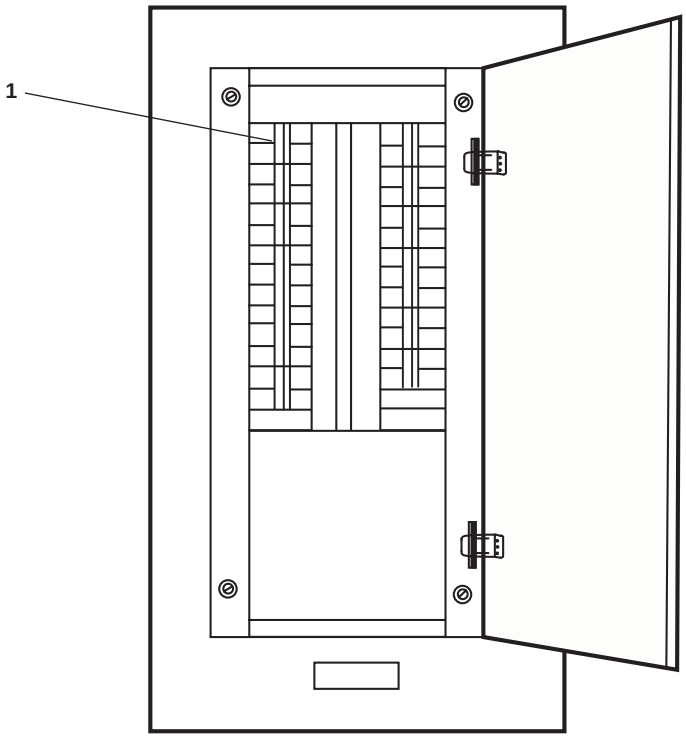


Figure 5. 120V Distribution Panel No. 3

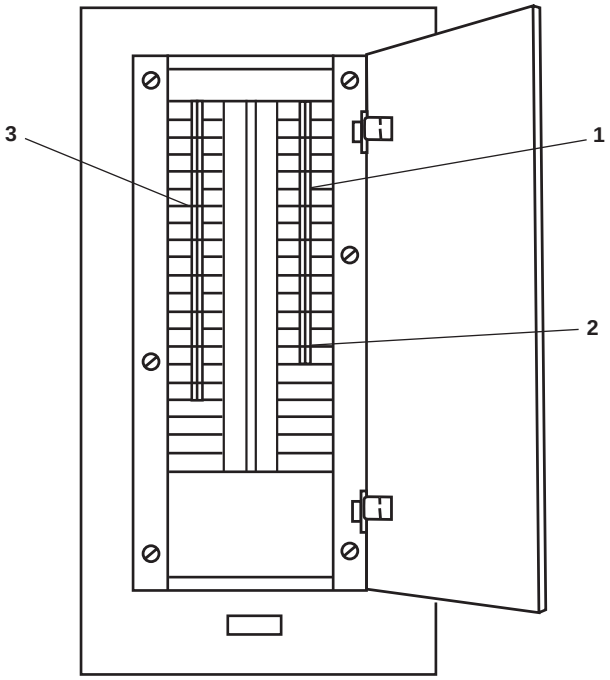


Figure 6. 120V Level Distribution Panel No. 2

2. Align the main potable water system piping and valves as follows:

   a. Place the following valves in the OPEN position:

      (1) In AMS 2:

         (a) PW-14, POT. WTR. TK. PORT SUCT (figure 7, item 1)

         (b) PW-15, POT. WTR. TK. STBD SUCT (figure 7, item 2)

         (c) PW-16, C.O.V.-POT. WTR. PMP. No. 1 SUCT (figure 7, item 3)

         (d) PW-17, C.O.V.-POT. WTR. PMP. No. 2 SUCT (figure 7, item 4)

         (e) PW-78, C.O.V. HYDR.PNEU TK. OUTLET (figure 7, item 5)

         (f) PW-18, HYDRO. PNEU TK INLET (figure 7, item 6)

         (g) PW-76, C.O.V. POT.WTR.PMP. No. 1 DISCH. (figure 7, item 7)

         (h) PW-77, C.O.V. POT. WTR. PMP. No. 2 DISCH. (figure 7, item 8)

      (2) In AMS 1:

         (a) PW-42, HW RECIRC. PMP. SUCT. (figure 7, item 9)

         (b) PW-43, RECIRC TO H.W. HEATER (figure 7, item 10)

         (c) PW-44, RECIRC TO H.W. HEATER (figure 7, item 11)

         (d) PW-79, POT. WTR.TO H.W. HTR. (figure 7, item 12)

         (e) PW-80, POT.WTR. TO H.W. HTR. (figure 7, item 13)

         (f) PW-81, H.W. HTR OUT (figure 7, item 14)

         (g) PW-82, H.W. HTR OUT (figure 7, item 15)

         (h) PW-22, C.W. TO W.C. (figure 7, item 16)

   b. Place the following valves in the CLOSED position:

      (1) In towing gear locker:

         (a) PW-10, POT. WTR. TK. PORT DR. (figure 7, item 17)

         (b) PW-11, POT. WTR. TK. STBD. DR. (figure 7, item 18)

      (2) In AMS 2:

         (a) PW-12, POT. WTR. TK. PORT FILL (figure 7, item 19)

         (b) PW-13, POT. WTR. TK. STBD FILL (figure 7, item 20)

         (c) PW-36, BYPASS-BROMINATOR (figure 7, item 21)

         (d) PW-37, BROMINATOR INLET (figure 7, item 22)

(e) PW-38, BROMINATOR OUTLET (figure 7, item 23)

(f) PW-83, POT.WTR.TO MN. DK. WSH. DN (figure 7, item 24)

(g) PW-35, M.E. KEEL CLR WTR FILL CONN. (figure 7, item 25)

(h) PW-84, POT. WTR.TO BROMINATOR (figure 7, item 26)

(3) In the engine room:

(a) PW-40, ENG. FILL CONN. PORT (figure 7, item 27)

(b) PW-39, ENG.FILL CONN. STBD (figure 7, item 28)

3. Charge the potable water hydropneumatic tank by completing the following actions:

a. Fill the tank with water:

(1) OPEN the hydropneumatic tank vent valve (figure 8, item 1).

(2) Verify that PW-18, HYDRO. PNEU TK INLET (figure 7, item 6) is OPEN.

(3) CLOSE valve PW-78, C.O.V. HYDR.PNEU TK. OUTLET (figure 7, item 5).

(4) At the potable water pump 1 or 2 motor controller perform the following:

(a) Set MAN-AUTO switch (figure 9, item 1) to the MAN position.

(b) Set the ON-OFF switch (figure 9, item 2) to the ON position.

(c) Verify that the POWER AVAILABLE light (figure 9, item 3) illuminates.

(d) Press the START (figure 9, item 4) pushbutton.

(e) Verify that the MOTOR RUN indicator (figure 9, item 5) illuminates.

(5) At the hydropneumatic tank, observe and verify that the tank water level is increasing in the sight glass (figure 8, item 2).

(6) When water level is approximately one-half in sight glass, perform the following actions at the running potable water pump motor controller:

(a) Press the STOP pushbutton (figure 9, item 6).

(b) Verify that the MOTOR RUN indicator (figure 9, item 5) goes out.

b. Verify that the ship's service air system is online and pressurized, and connect a charging air hose to the nearest air tool connection.

c. Pressurize the hydropneumatic tank by performing the following actions:

(1) CLOSE the hydropneumatic tank vent valve (figure 8, item 1).

(2) Connect the other end of the charging air hose to the air charging connection (figure 8, item 3) on the hydropneumatic tank.

(3) Slowly OPEN the air tool connection valve to pressurize the hose

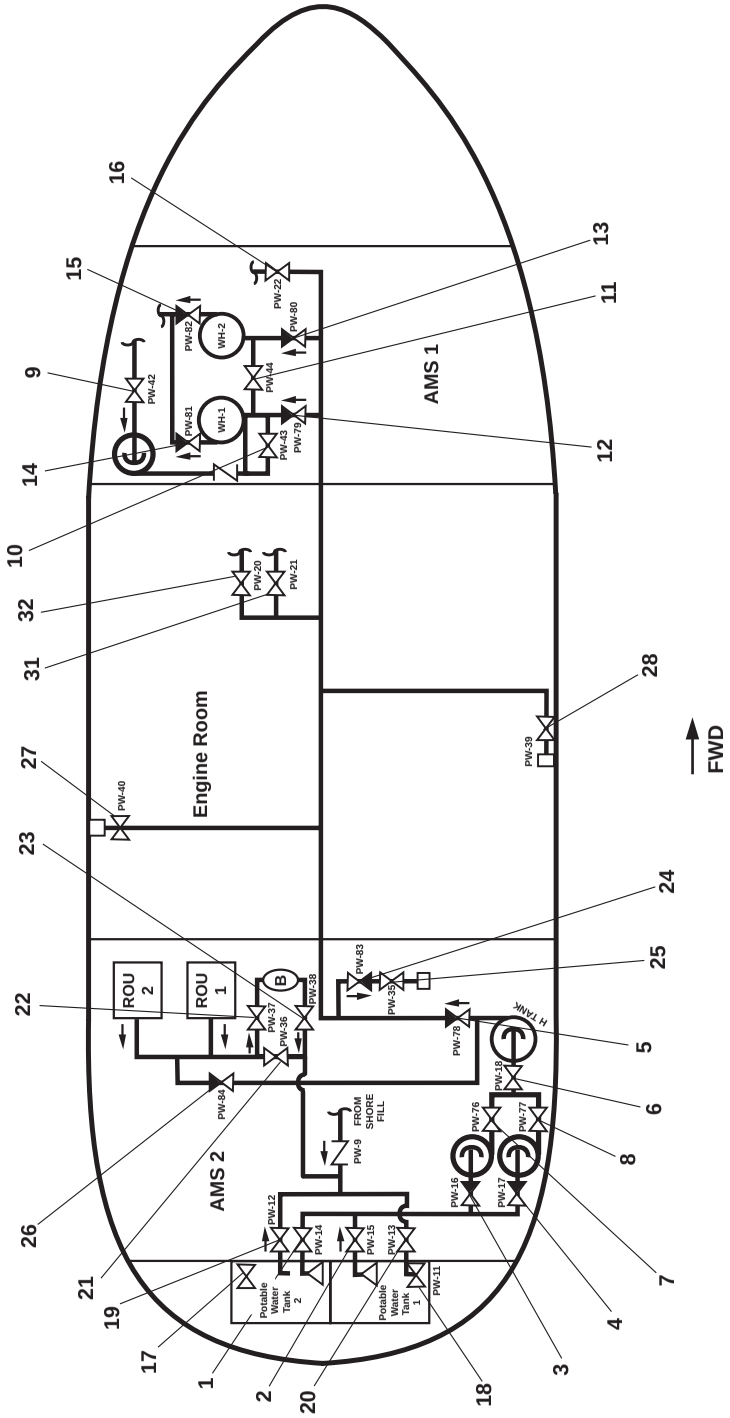


Figure 7. Main Potable Water System Valves

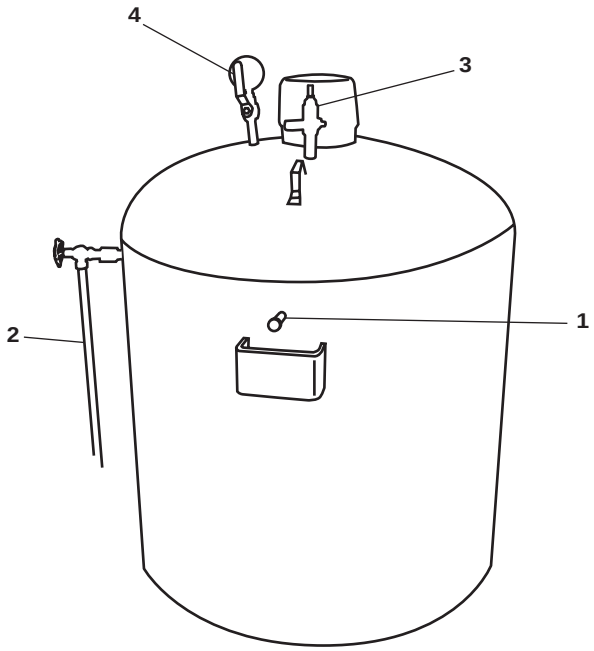


Figure 8. Hydropneumatic Tank

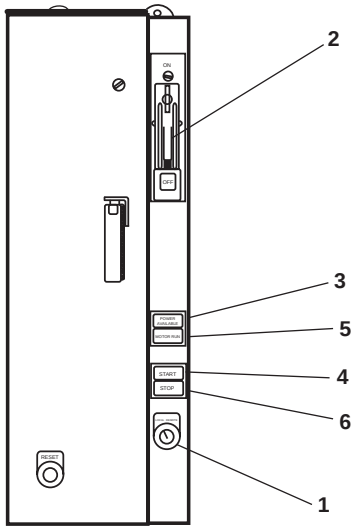


Figure 9. Potable Water Pump No. 1 & No. 2 Motor Controller

(4) Slowly OPEN the charging air connection isolation valve (figure 8, item 3), and pressurize the hydropneumatic tank.

(5) When the hydropneumatic pressure gauge (figure 8, item 4) indicates approximately 60 PSI (4.14 bar), CLOSE the charging air connection isolation valve.

(6) CLOSE the air tool connection valve and disconnect the air hose from the hydropneumatic tank.

NOTE

Both potable water pumps may be operated at the same time; however, normal operation is one pump online at a time.

4. Place the potable water system online by completing the following actions:

a. OPEN PW-78, C.O.V. HDR.PNEU TK. OUTLET (figure 7, item 5).

b. At the potable water pump motor controller 1 or 2, place the MAN-AUTO switch (figure 9, item 1), to AUTO.

PLACE HOT WATER HEATERS ONLINE

1. Fill the hot water heaters by completing the following actions:

a. Verify that the following valves are OPEN:

(1) PW-79, POT. WTR.TO H.W. HTR. (figure 7, item 12)

(2) PW-80, POT.WTR. TO H.W. HTR. (figure 7, item 13)

(3) PW-81, H.W. HTR OUT (figure 7, item 14)

(4) PW-82, H.W. HTR OUT (figure 7, item 15)

⚠ CAUTION

Failure to fill the water heaters with water prior to applying power could damage the heating elements.

2. In the galley, slowly OPEN the hot water faucet at the sink. Allow the water to run until air has been purged from the piping, and a solid stream of water flows from the faucet.

3. On the main switchboard in the EOS, set the following circuit breakers to ON:

a. HOT POTABLE WTR HTR NO.2 (figure 1, item 2)

b. HOT POTABLE WTR HTR NO.1 (figure 1, item 3)

4. Place the hot water recirculating system online by:

a. Verifying that the following valves are OPEN:

(1) PW-42, HW RECIRC. TO PMP. SUCT. (figure 7, item 9)

(2) PW-43, RECIRC TO H.W. HEATER (figure 7, item 10)

(3) PW-44, RECIRC TO H.W. HEATER (figure 7, item 11)

b. Start the hot water recirculating pump by performing the following actions:

(1) At the 440V power panel No. 4, set the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker (figure 10, item 1) to ON.

(2) Complete the following at the hot potable water recirculating pump motor, located in AMS 1:

(a) Verify that the POWER AVAILABLE indicator (figure 11, item 1) illuminates.

(b) Press and release the START pushbutton (figure 11, item 2).

(c) Verify that the MOTOR RUN indicator (figure 11, item 3) illuminates.

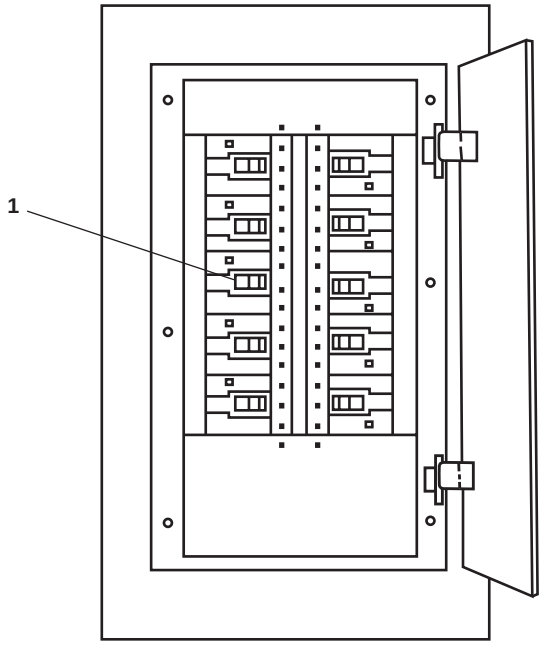


Figure 10. AMS 1 Power Panel No. 4

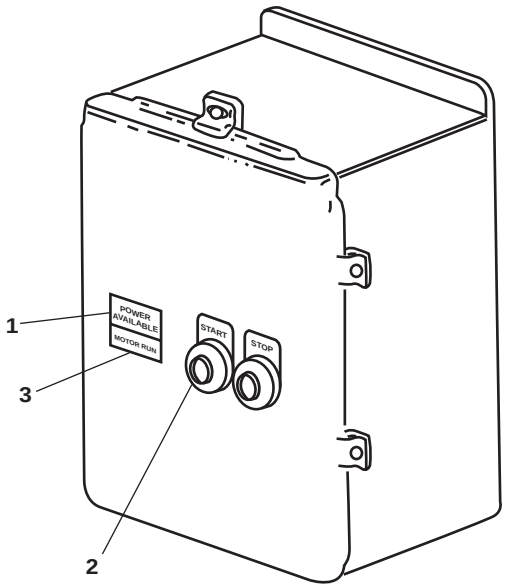


Figure 11. Hot Water Recirculating Pump Motor Controller

PLACE THE SHIPWIDE POTABLE WATER SYSTEM ON LINE

1. OPEN the following valves:
   a. In the bow thruster compartment: PW19, C.W. TO W.C.
   b. In AMS 1 (figure 7, item 16): PW-22, C.W. TO W.C.
   c. In the engine room:
      (1) PW-21, C.W. TO W.C. (figure 7, item 31)
      (2) PW-20, C.W. TO W.C. (figure 7, item 32)
   d. In AMS 2, PW-83, POT. WTR. TO MN. DK. WSH. DN (figure 7, item 24).
   e. In the galley:
      (1) PW-29 (figure 12, item 1), sprinkler supply to the gaylord hood
      (2) PW-33 (figure 12, item 2), galley hot water supply
      (3) PW-34 (figure 12, item 3), galley supply
      (4) PW-32 (figure 12, item 4), hot water to the dishwasher
   f. In the crew's mess:
      (1) PW-25, C.W. TO W.C. (figure 13, item 1)
      (2) PW-67 (figure 13, item 2), supply to drinking fountain
      (3) PW-93, C.W. TO ICE MAKER (figure 13, item 3)

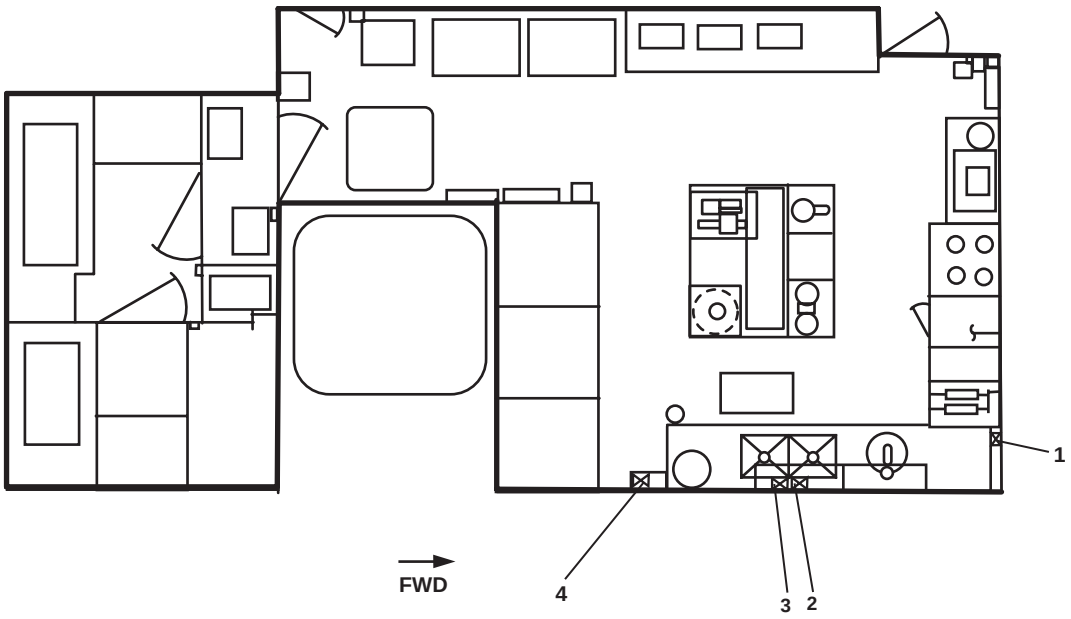


Figure 12. Galley Valve Locations

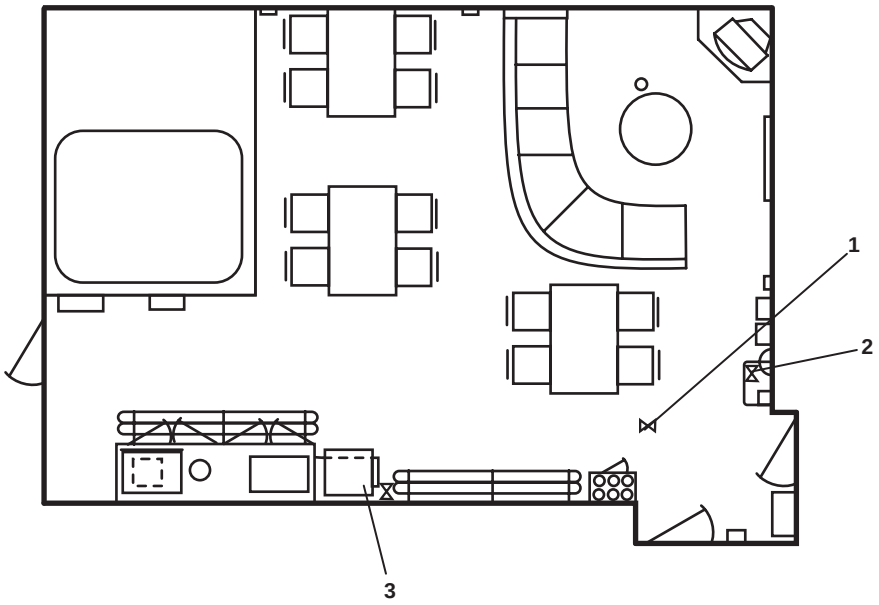


Figure 13. Crew's Mess Valve Locations

g. In the crew's sanitary space:

(1) PW-53 (figure 14, item 1), cold potable water to the sanitary space

(2) PW-52 (figure 14, item 2), hot potable water to the sanitary space

(3) PW-51 (figure 14, item 3), cold potable water to the sanitary space

(4) PW-50 (figure 14, item 4), hot potable water to the sanitary space

h. In the crew's stateroom #3 and sanitary space:

(1) PW-24, C.W. TO W.C. (figure 14, item 5) (overhead)

(2) PW-48 (figure 14, item 6), hot potable water to the sanitary space

(3) PW-49 (figure 14, item 7), cold potable water to the sanitary space

i. In the laundry room:

(1) PW-30 (figure 14, item 8), hot potable water to the sanitary space

(2) PW-31 (figure 14, item 9), cold potable water to the sanitary space

j. In crew's stateroom #1 sanitary space:

(1) PW-46 (figure 14, item 10), hot potable water to the sanitary space

(2) PW-47 (figure 14, item 11), cold potable water to the sanitary space

k. In crew's stateroom #2: PW-23, C.W. TO W.C. (figure 14, item 12)

l. In officer's stateroom #2 and sanitary space:

(1) PW-61 (figure 15, item 1), cold potable water to the sanitary space

(2) PW-26, C.W. TO W.C. (figure 15, item 2)

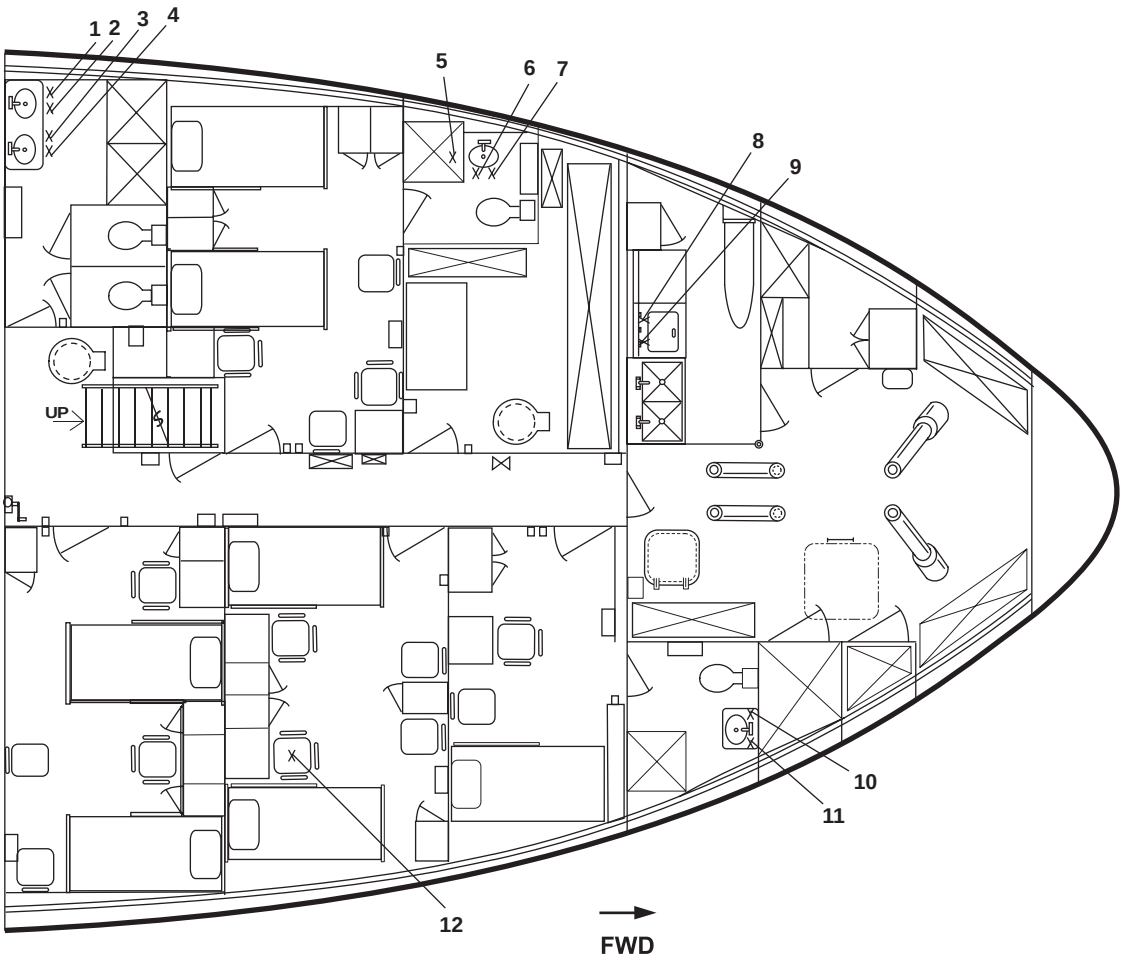


Figure 14. Main Deck Potable Water Valves

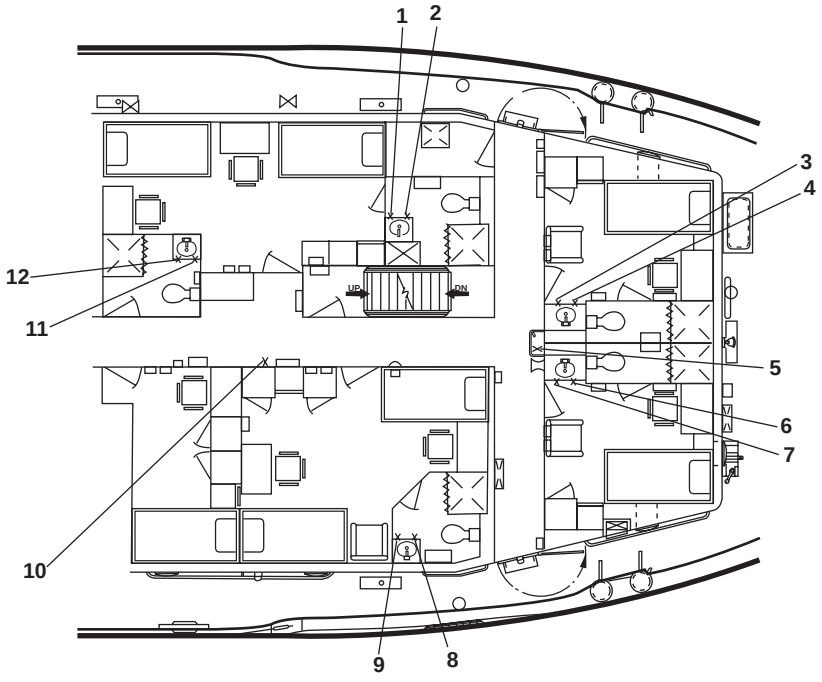


Figure 15. 01 Level Potable Water Valves

m. In the chief engineer's stateroom and sanitary space:

(1) PW-56 (figure 15, item 3), cold potable water to the sanitary space

(2) PW-58 (figure 15, item 4), hot potable water to the sanitary space

n. In the 01 level passageway:

(1) PW-68 (figure 15, item 5), supply to drinking fountain

(2) PW-62, C.W. TO W.C. (figure 15, item 10)

o. In the captain's stateroom and sanitary space:

(1) PW-55 (figure 15, item 6), cold potable water to the sanitary space

(2) PW-57 (figure 15, item 7), hot potable water to the sanitary space

p. In the officer's stateroom #1 sanitary space:

(1) PW-60 (figure 15, item 8), hot potable water to the sanitary space

(2) PW-59 (figure 15, item 9), cold potable water to the sanitary space

q. In the NCO's sanitary space:

(1) PW-63 (figure 15, item 11), cold potable water to the sanitary space

(2) PW-64 (figure 15, item 12), hot potable water to the sanitary space

REVERSE OSMOSIS UNITS OPERATING PROCEDURE

ELECTRICAL/PIPING LINEUP

1. At the main switchboard in the EOS, set the following circuit breakers to ON:

   a. AUX MACH SPACE NO.2 PWR PNL NO.5 (figure 1, item 1)

   b. 3-25 KVA 1Ø XFMRS (figure 1, item 4)

2. At the load center distribution panel, set the 120V DISTRIBUTION PANEL No. 4. circuit breaker (figure 2, item 1) to ON.

3. At 120V distribution panel No. 4, set the ROWPU BATTERY CHARGER. circuit breaker (figure 4, item 2) to ON.

4. At the ROWPU battery charger, turn ON the A.C. SWITCH (figure 17, item 1).

5. At the ROWPU 24 Vdc control panel, set the following circuit breakers to ON:

   a. RO #1 (figure 18, item 1)

   b. RO #2 (figure 18, item 2)

   c. FWF PUMP (figure 18, item 3)

6. At 440V power panel No. 5, set the following circuit breakers to ON:

   a. REVERSE OSMOSIS WATER MAKER No. 1. (figure 2, item 3)

   b. REVERSE OSMOSIS WATER MAKER No. 2. (figure 2, item 4)

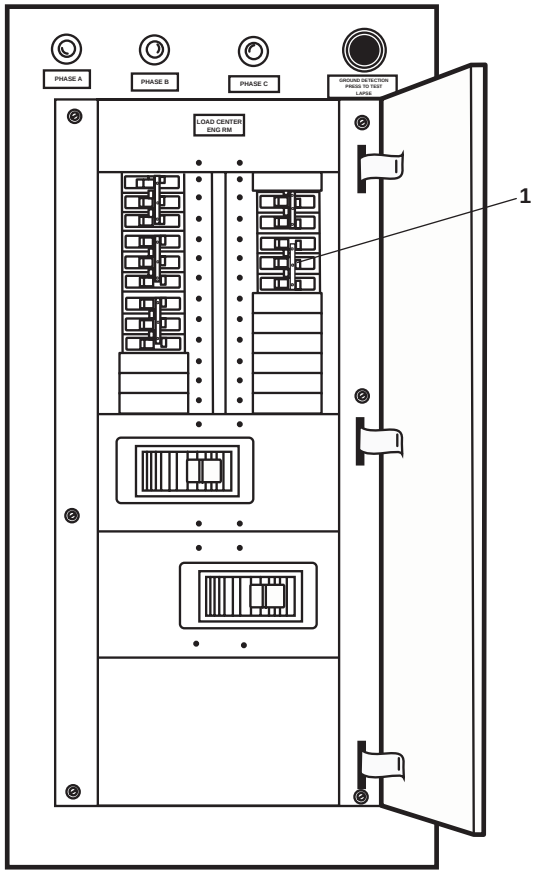


Figure 16. Load Center Distribution Panel

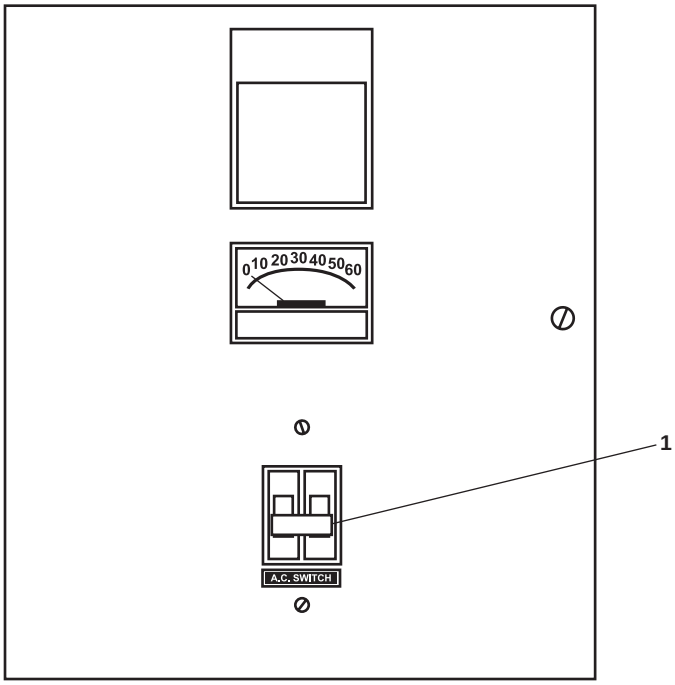


Figure 17. ROWPU Battery Charger

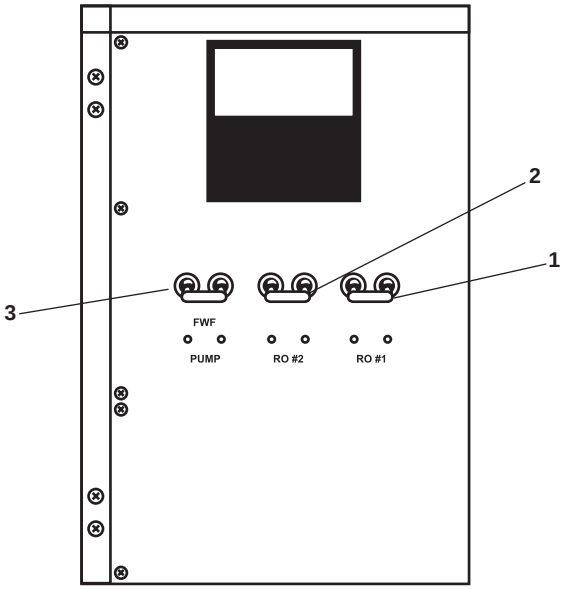


Figure 18. ROWPU 24 Vdc Control Panel

7. Verify that the general service system is online (WP 0071 00) and operating at a minimum pressure of 60 PSI (4.1 bar).

8. Verify that the brominator is online and operating normally, or that PW-36, BYPASS-BROMINATOR (figure 19, item 1) is OPEN.

9. CLOSE RO-V-1 (figure 20, item 1), main sea water supply.

10. OPEN the following valves:

    a. RO-V-7 (figure 21, item 1), backflow preventer supply valve

    b. RO-V-6, (figure 21, item 2), backflow preventer discharge valve

    c. RO-V-9, (figure 22, item 1), fresh water flush pump supply valve

    d. RO-V-1-2 (figure 23, item 1), ROWPU 1 brine discharge valve

    e. RO-V-2-2 (figure 23, item 2), ROWPU 2 brine discharge valve

    f. RO-V-8 (figure 23, item 3), product water discharge valve

    g. PW-13 (figure 22, item 2), starboard potable water tank fill valve

    h. PW-12, POT. WTR. TK. PORT FILL (figure 22, item 3)

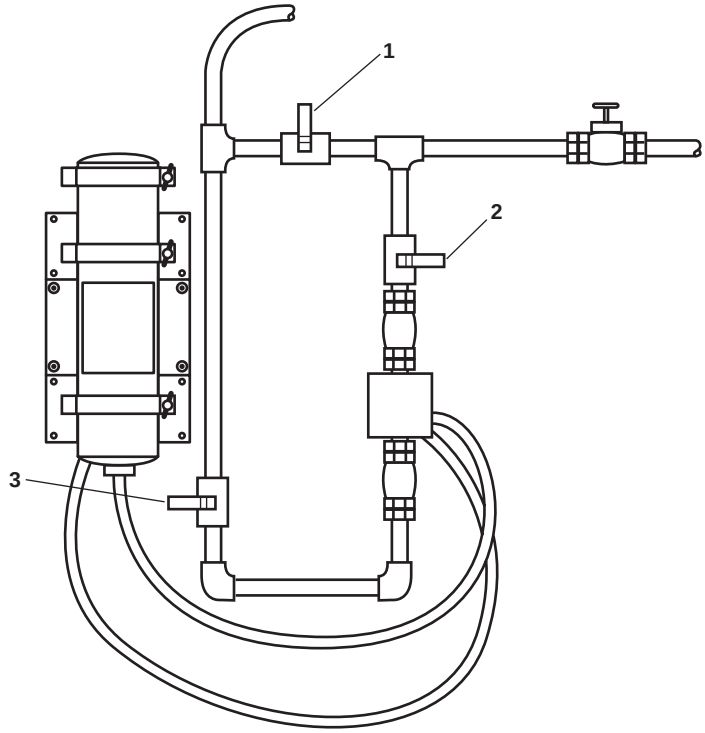
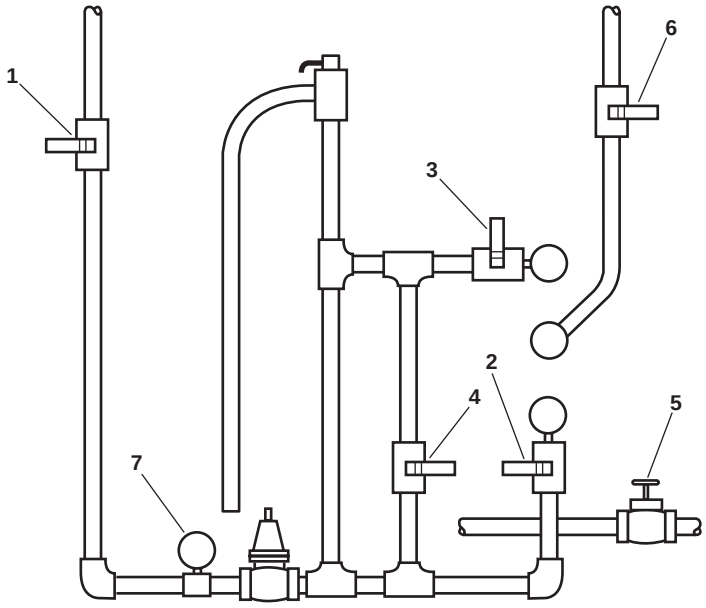


Figure 19. Brominator



Items Not Shown Omitted for Clarity

Figure 20. ROWPU System as Viewed from Starboard Side

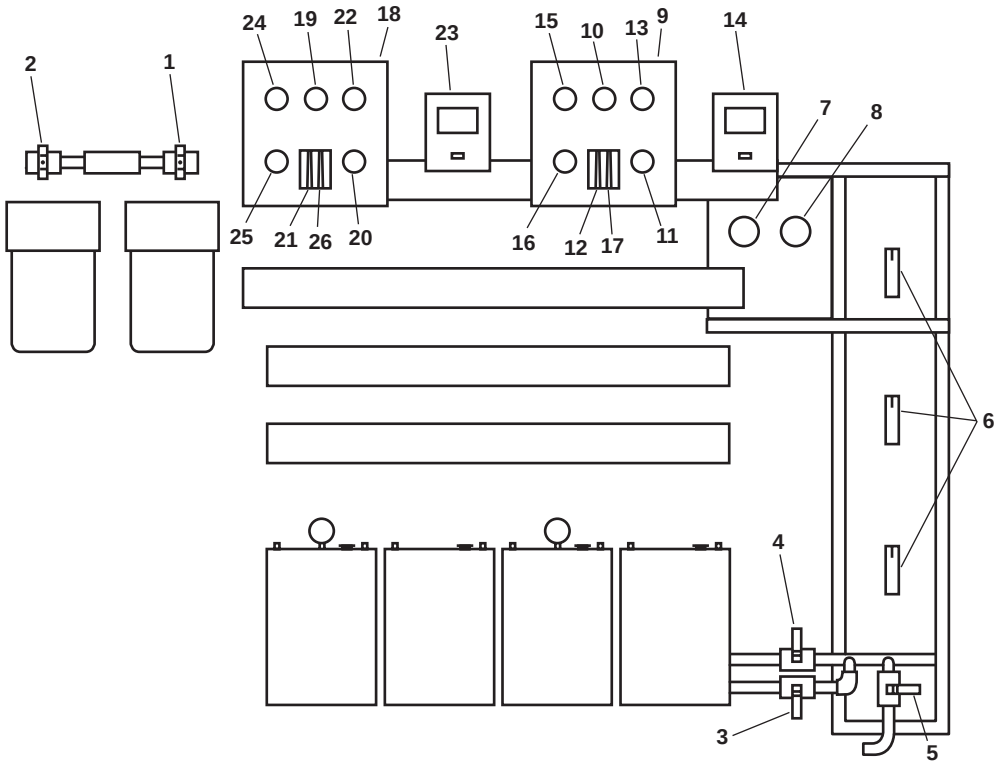


Figure 21. ROWPU System, Front View

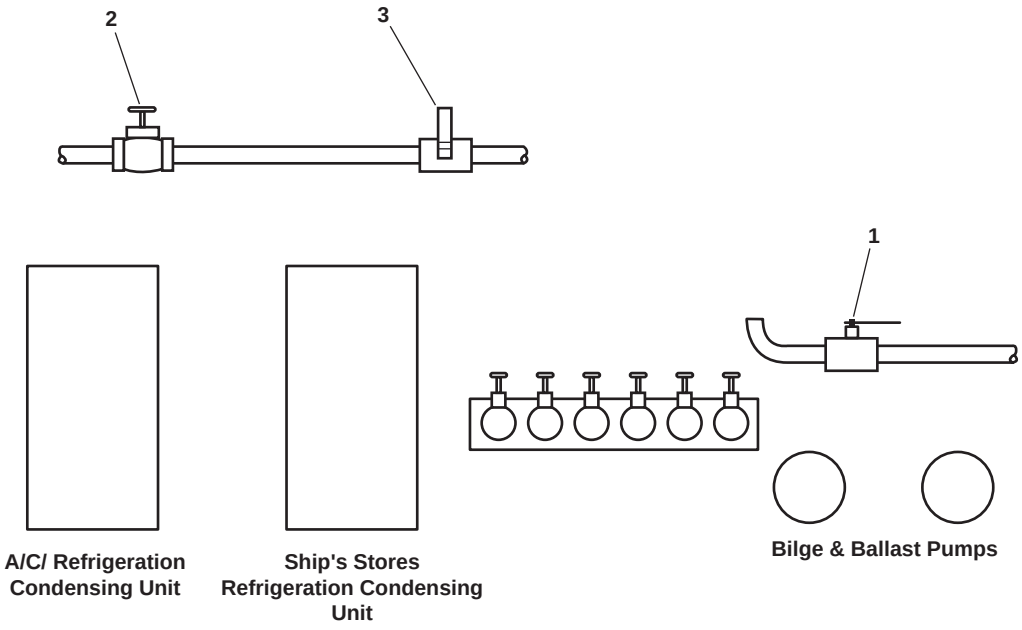


Figure 22. Potable Water Valves on AMS 2 Aft Bulkhead

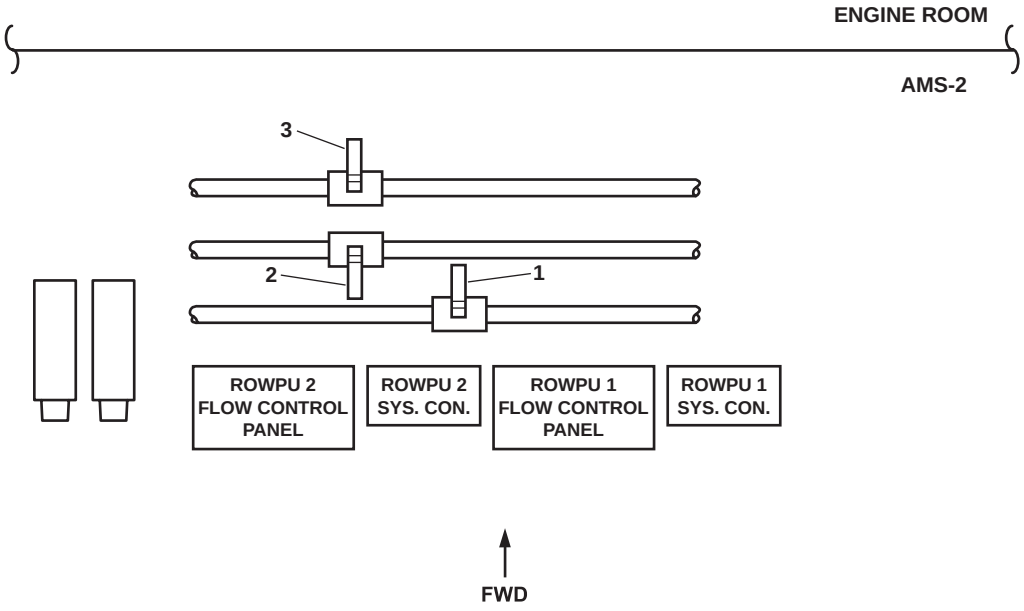


Figure 23. ROWPU System Valves as Viewed from Above

MEDIA FILTER BACKFLUSH

NOTE

Always perform the media filter backflush procedure before and after all ROWPU operations. If differential pressure exceeds 20 PSI (1.4 bar) as indicated by the difference between the media filter INLET PRESSURE and OUTLET PRESSURE gauges, secure ROWPU operation, and perform media filter backflush.

1. CLOSE the following valves:
   a. RO-V-2 (figure 20, item 2), media filter supply
   b. RO-V-3 (figure 20, item 3), media filter discharge
   c. RO-V-1-1 (figure 21, item 3), ROWPU 1 inlet sea water supply
   d. RO-V-2-1 (figure 21, item 4), ROWPU 2 inlet sea water supply
   e. RO-V-4 (figure 20, item 4), media filter bypass
   f. RO-V-5 (figure 21, item 5), cleaning supply
   g. RO-V-11 (figure 20, item 5), media filter drain
2. OPEN the following valves:
   a. RO-V-10 (figure 20, item 6), media filter backflush valve
   b. RO-V-1 (figure 20, item 1), main sea water supply
3. Verify that RO-PG-1 (figure 8, item 7), general service pressure, indicates a minimum of 30 PSI (2.4 bar).

⚠ CAUTION

Media tank inlet pressure must not exceed 45 PSI (3.1 bar) and differential pressure must not exceed 35 PSI (2.4 bar), or damage could occur to the media filter tank.

4. Align the media filter maintenance mode valves (figure 21, item 6) to the "BACKWASH" position as shown in figure 24.

5. Slowly OPEN RO-V-2 (figure 21, item 2), media filter supply, to backwash the media filter.

6. Verify that the media filter INLET PRESSURE gauge (figure 21, item 7) does not exceed 45 PSI (3.1 bar).

7. Verify that the pressure differential between the media filter INLET PRESSURE gauge (figure 21, item 7) and the media filter OUTLET PRESSURE gauge (figure 21, item 8) does not exceed 20 PSI (2.4 bar).

8. BACKWASH the media filter for a minimum of 10 minutes, or until differential pressure between the media filter INLET PRESSURE gauge (figure 21, item 7) and the media filter OUTLET PRESSURE gauge (figure 21, item 8) is less than 5 PSI (0.3 bar).

9. CLOSE RO-V-2 (figure 21, item 2), media filter supply.

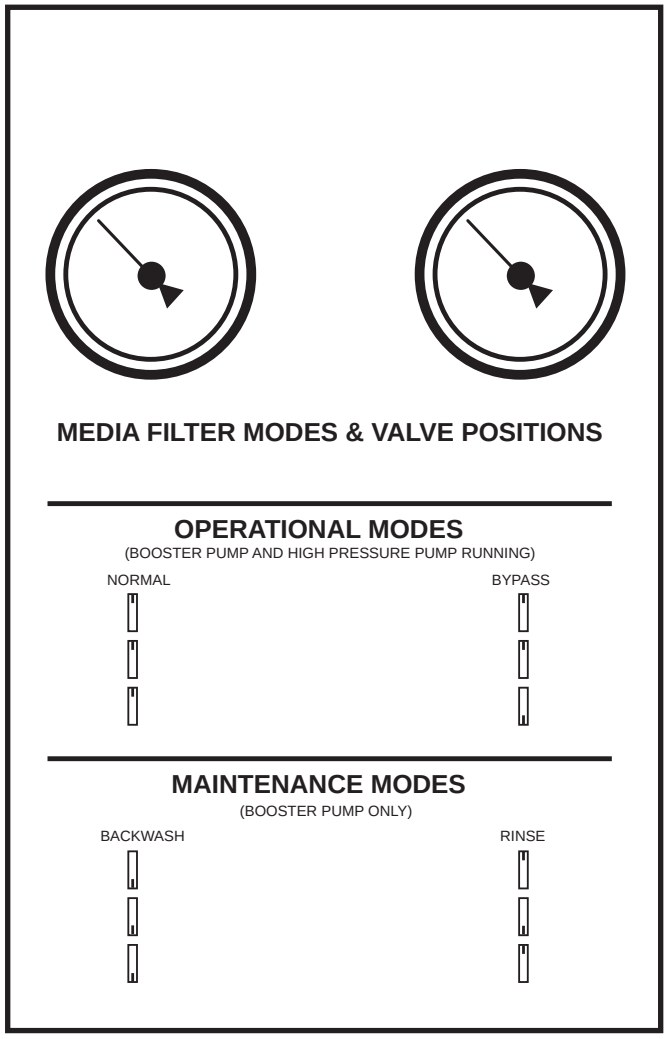


Figure 24. Media Filter Maintenance Mode Valve Positions

10. Align the media filter maintenance mode valves (figure 21, item 6) to the “RINSE” position as shown in figure 24.

11. Slowly OPEN RO-V-2 (figure 20, item 2), media filter supply.

12. RINSE the media filter for a minimum of 5 minutes.

13. CLOSE RO-V-2 (figure 21, item 2), media filter supply.

14. To align the media filter for normal operation, CLOSE the following valves:

    a. RO-V-2 (figure 20, item 2), media filter supply

    b. RO-V-4 (figure 20, item 4), media filter bypass

    c. RO-V-10 (figure 20, item 6), media filter backflush valve

    d. RO-V-5 (figure 21, item 5), cleaning supply

15. OPEN RO-V-3 (figure 20, item 3), media filter discharge.

16. Align the media filter maintenance mode valves (figure 21, item 6) to the “NORMAL” position as shown in figure 24.

ROWPU 1 STARTUP

⚠ CAUTION

If bypassing the media filter, RO-PG-1-1, 20-micron filter outlet/5-micron filter inlet pressure should not exceed 45 PSI (3.1 bar), or damage could occur.

1. OPEN the following valves:

    a. RO-V-1-1 (figure 21, item 3), ROWPU 1 inlet sea water supply

    b. RO-V-1 (figure 20, item 1), main sea water supply

2. Slowly OPEN RO-V-2 (figure 20, item 2), media filter supply

3. At ROWPU 1 flow control panel (figure 21, item 9), perform the following:

    a. Verify that the HIGH PRESSURE PUMP INLET pressure gauge (figure 21, item 10) indicates a minimum of 10 PSI (0.7 bar).

⚠ CAUTION

Failure to completely OPEN the SYSTEM HIGH PRESSURE REGULATOR valve prior to starting the high pressure pump will result in damage to the reverse osmosis membranes.

    b. Fully OPEN the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-1-3 (figure 21, item 11).

    c. Observe the BRINE flow meter (figure 21, item 12) until it displays a minimum reading of 1 gal/min (3.8 l/min) with few or no bubbles present.

    d. Verify that the SYSTEM OPERATION PRESSURE gauge (figure 21, item 13) does not rise above 50 PSI (3.4 bar).

4. At the ROWPU 1 system controller (figure 9, item 14), perform the following:

   a. Press the STOP pushbutton (figure 25, item 1) and verify that the SYSTEM OFF indicator (figure 25, item 2) is illuminated.

   b. Press the START pushbutton (figure 25, item 3) and verify the following:

      (1) BOOSTER PUMP indicator (figure 25, item 4) illuminates.

      (2) SYSTEM ON indicator (figure 25, item 5) is illuminated.

5. Verify the following conditions at the ROWPU 1 flow control panel (figure 21, item 9):

   a. The BRINE flow meter (figure 21, item 12) displays a minimum flow reading of 4 gallons (15.1 liters) per minute with no bubbles present.

   b. The BRINE DISCHARGE PRESSURE gauge (figure 21, item 15) indicates less than 15 PSI (1 bar).

   c. The PRODUCT WATER OUTPUT PRESSURE gauge (figure 21, item 16) indicates approximately 0 PSI (0.0 bar).

   d. The SYSTEM OPERATION PRESSURE gauge (figure 21, item 13) indicates less than 50 PSI (3.4 bar).

   e. The PRODUCT WATER flow meter (figure 21, item 17) indicates less than 1 gallon (3.8 liters) per hour.

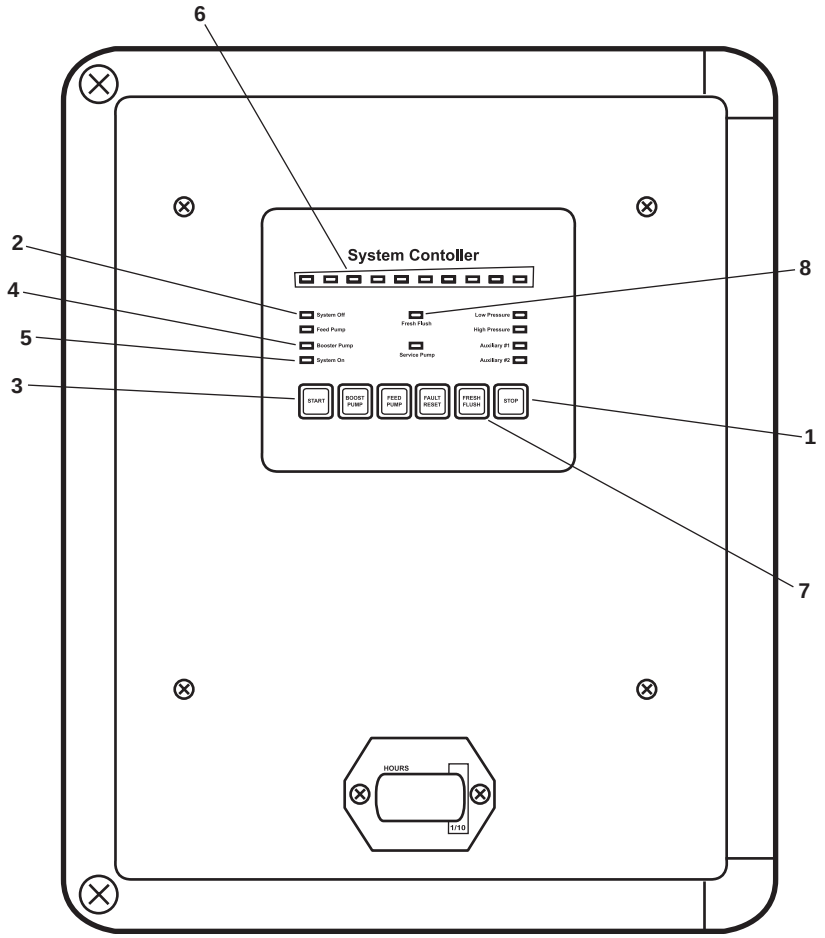


Figure 25. System Controller

6. Allow the system to operate in this configuration for approximately two minutes. Ensure that all gauges stabilize, and most of the air is purged from the system as indicated by a fluid stream with few or no bubbles flowing through the BRINE flow meter (figure 21, item 12).

⚠ CAUTION

Increase system pressure slowly. Failure to comply with this caution will cause damage to the reverse osmosis membranes.

7. At ROWPU 1 flow control panel (figure 21, item 9), slowly increase system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-1-3 (figure 21, item 11) in the INCREASE direction until the SYSTEM OPERATION PRESSURE gauge (figure 21, item 13) indicates 400 PSI (27.6 bar).

8. Allow the system to operate in this configuration for approximately two minutes. Ensure that all gauges stabilize and that most of the air is purged from the system as indicated by fluid streams with few or no bubbles flowing through the BRINE flow meter (figure 21, item 12) and the PRODUCT WATER flow meter (figure 21, item 17).

⚠ CAUTION

Increase system pressure slowly. Failure to comply with this caution will cause damage to the reverse osmosis membranes.

9. At ROWPU 1 flow control panel (figure 21, item 9), slowly increase system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-1-3 (figure 21, item 11) in the INCREASE direction until the SYSTEM OPERATION PRESSURE gauge (figure 21, item 13) indicates 650 PSI (44.8 bar).

10. Allow the system to operate in this configuration for approximately two minutes. Ensure that all gauges stabilize, and that all air bubbles are purged from the system as indicated by solid fluid streams flowing through the BRINE flow meter (figure 21, item 12) and the PRODUCT WATER flow meter (figure 21, item 17).

⚠ CAUTION

ROWPU maximum safe operating pressure is 950 PSI (65.5 bar). The system high pressure cutout is set at 950 PSI (65.5 bar) ± 25 PSI (1.7 bar). Do not exceed 900 PSI (62.1 bar) as indicated by the SYSTEM OPERATION PRESSURE gauge, or damage to the ROWPU system could occur.

11. At ROWPU 1 flow control panel (figure 21, item 9), slowly adjust system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-1-3 (figure 21, item 11) as necessary until the PRODUCT WATER flow meter (figure 21, item 17) indicates 66 gallons (249.8 liters) per hour, to a maximum 900 PSI (62.1 bar) as indicated by the SYSTEM OPERATION PRESSURE gauge (figure 21, item 13).

12. Verify that the ROWPU 1 gauges and indicators stabilize as follows:

    a. At ROWPU 1 flow control panel (figure 21, item 9), verify the following:

⚠ CAUTION

If bypassing the media filter, RO-PG-1-1, 20-micron filter outlet/5-micron filter inlet pressure gauge, should not exceed 45 PSI (3.1 bar), or damage could occur.

    (1) HIGH PRESSURE PUMP INLET pressure gauge (figure 21, item 10) indicates a minimum of 10 PSI (0.7 bar) and a maximum of 45 PSI (3.1 bar).

(2) The SYSTEM OPERATION PRESSURE gauge (figure 21, item 13) indicates less than 900 PSI (62.1 bar).

(3) The PRODUCT WATER OUTPUT PRESSURE gauge (figure 21, item 16) indicates less than 20 PSI(1.4 bar).

(4) The BRINE DISCHARGE PRESSURE gauge (figure 21, item 15) indicates approximately 10 PSI (0.7 bar).

(5) The BRINE flow meter (figure 21, item 12) indicates approximately 3.2 gallons (12.1 liters) per minute.

(6) The PRODUCT WATER flow meter (figure 21, item 17) indicates approximately 66 gallons (248.8 liters) per hour.

b. At the ROWPU 1 system controller (figure 21, item 14), verify that the SALINITY METER (figure 25, item 6) indicates that product water salinity is less than 500 parts per million (ppm), as indicated by five or fewer LEDs lit.

ROWPU 2 STARTUP

⚠ CAUTION

If bypassing the media filter, RO-PG-2-1, 20-micron filter outlet/5-micron filter inlet pressure, should not exceed 45 PSI (3.1 bar) or damage could occur.

1. OPEN the following valves:

   a. RO-V-2-1 (figure 21, item 4), ROWPU 2 inlet sea water supply

   b. RO-V-1 (figure 20, item 1), main sea water supply

2. Slowly OPEN RO-V-2 (figure 20, item 2), media filter supply

3. Complete the following actions at ROWPU 2 flow control panel (figure 21, item 18):

   a. Verify that the HIGH PRESSURE PUMP INLET pressure gauge (figure 21, item 19) indicates a minimum of 10 PSI (0.7 bar).

⚠ CAUTION

Failure to completely OPEN the SYSTEM HIGH PRESSURE REGULATOR valve prior to starting the high pressure pump will result in damage to the reverse osmosis membranes.

   b. Fully OPEN the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-2-3 (figure 21, item 20).

   c. Observe the BRINE flow meter (figure 21, item 21) until it displays a minimum reading of 1 gal/min (3.8 l/min) with few or no bubbles present.

   d. Verify that the SYSTEM OPERATION PRESSURE gauge (figure 21, item 22) does not rise above 50 PSI (3.4 bar).

4. At the ROWPU 2 system controller (figure 21, item 23), perform the following:

   a. Press the STOP pushbutton (figure 25, item 1) and verify that the SYSTEM OFF indicator (figure 13, item 2) is illuminated.

b. Press the START pushbutton (figure 25, item 3) and verify the following:

(1) BOOSTER PUMP indicator (figure 25, item 4) illuminates.

(2) SYSTEM ON indicator (figure 25, item 5) is illuminated.

5. At the ROWPU 2 flow control panel (figure 21, item 18), verify the following:

a. The BRINE flow meter (figure 21, item 21) displays a flow reading of 4 gallons (15.1 liters) per minute with no bubbles present.

b. The BRINE DISCHARGE PRESSURE gauge (figure 21, item 24) indicates less than 15 PSI (1 bar).

c. The PRODUCT WATER OUTPUT PRESSURE gauge (figure 21, item 25) indicates approximately 0 PSI (0.0 bar).

d. The SYSTEM OPERATION PRESSURE gauge (figure 21, item 22) indicates less than 50 PSI (3.4 bar).

e. The PRODUCT WATER flow meter (figure 21, item 26), indicates less than 1 gallon (3.8 liters) per hour.

6. Allow the system to operate in this configuration for approximately two minutes. Ensure that all gauges stabilize, and that most of the air is purged from the system as indicated by a fluid stream with few or no bubbles flowing through the BRINE flow meter (figure 21, item 21).

⚠ CAUTION

Increase system pressure slowly. Failure to comply with this caution will cause damage to the reverse osmosis membranes.

7. At ROWPU 2 flow control panel (figure 21, item 18), slowly increase system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-2-3 (figure 21, item 20) in the INCREASE direction until the SYSTEM OPERATION PRESSURE gauge (figure 21, item 22) indicates 400 PSI (27.6 bar).

8. Allow the system to operate in this configuration for approximately two minutes. Ensure that all gauges stabilize, and that most of the air is purged from the system as indicated by fluid streams with few or no bubbles flowing through the BRINE flow meter (figure 21, item 21) and the PRODUCT WATER flow meter (figure 21, item 26).

9. At ROWPU 2 flow control panel (figure 21, item 18), slowly increase system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-2-3 (figure 21, item 20) in the INCREASE direction until the SYSTEM OPERATION PRESSURE gauge (figure 21, item 22) indicates 650 PSI (44.8 bar).

10. Allow the system to operate in this configuration for approximately two minutes. Ensure that all gauges stabilize, and that all air bubbles are purged from the system as indicated by solid fluid streams flowing through the BRINE flow meter (figure 21, item 21) and the PRODUCT WATER flow meter (figure 21, item 26).

⚠ CAUTION

ROWPU maximum safe operating pressure is 950 PSI (65.5 bar). The system high pressure cutout is set at 950 PSI (65.5 bar) ± 25 PSI (1.7 bar). Do not exceed 900 PSI (62.1 bar) as indicated by the SYSTEM OPERATION PRESSURE gauge, or damage to the ROWPU system could occur.

11. At ROWPU 2 flow control panel (figure 21, item 18), slowly adjust system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve, RO-V-2-3 (figure 21, item 20) as necessary until the PRODUCT WATER flow meter (figure 21, item 26), indicates 33 gallons (125 liters) per hour, to a maximum 900 PSI (62.1 bar) as indicated by the SYSTEM OPERATION PRESSURE gauge (figure 21, item 22).

12. Verify that the ROWPU 2 gauges and indicators stabilize as follows:

    a. At ROWPU 2 flow control panel (figure 21, item 18), verify the following:

⚠ CAUTION

If bypassing the media filter, RO-PG-2-1, 20-micron filter outlet/5-micron filter inlet pressure gauge should not exceed 45 PSI (3.1 bar), or damage could occur.

    (1) HIGH PRESSURE PUMP INLET pressure gauge (figure 21, item 19) indicates a minimum of 10 PSI (0.7 bar) and a maximum of 45 PSI (3.1 bar).

    (2) The SYSTEM OPERATION PRESSURE gauge (figure 21, item 22) indicates 900 PSI (62.1 bar) or less.

    (3) The PRODUCT WATER OUTPUT PRESSURE gauge (figure 21, item 25) indicates less than 20 PSI (1.4 bar).

    (4) The BRINE DISCHARGE PRESSURE gauge (figure 21, item 24) indicates approximately 10 PSI (0.7 bar).

    (5) The BRINE flow meter (figure 21, item 21) indicates approximately 3.5 gallons (12.1 liters) per minute.

    (6) The PRODUCT WATER flow meter (figure 21, item 26) indicates approximately 33 gallons (124.9 liters) per hour.

    b. At the ROWPU 2 system controller (figure 21, item 23), verify that the SALINITY METER (figure 25, item 6) indicates that product water salinity is less than 500 parts per million (ppm), as indicated by five or fewer LEDs lit.

BROMINATOR OPERATING PROCEDURE

1. Place the potable water system online by performing the Place the Shipwide Potable Water System Online procedure in this work package.

2. Place the brominator online by completing the following actions:

    a. At 120V emergency distribution panel No. 1, set the BROMINATOR circuit breaker (figure 3, item 2) to ON.

    b. Place the following valves in the OPEN position:

    (1) PW-38, BROMINATOR OUTLET (figure 19, item 2)

    (2) PW-37, BROMINATOR INLET (figure 19, item 3)

    c. Verify that PW-36, BYPASS-BROMINATOR (figure 19, item 1) is CLOSED.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
MARINE SANITATION DEVICE

INITIAL SETUP:

Materials/Parts:
Gloves, Chemical and Oil Protective (Item 264, Table 3, WP 0163 00, Volume 2)
Goggles, Industrial (Item 270, Table 3, WP 0163 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0165 00, Volume 2)

Personnel Required:
One Watercraft Engineer, 88L

References:
FM 55-502
TM 55-1925-284-14&P
WP 0082 00
WP 0163 00 (volume 2)
WP 0165 00 (volume 2)

Equipment Conditions:
All ventilation fans operating normally (WP 0082 00).

OPERATION UNDER USUAL CONDITIONS

SYSTEM STARTUP

NOTE

The System Startup procedure is performed after the following: New System Installation, System Lay Up, System Overhaul, Air Scour and Pump Out of the Media Tank, and Cleaning of the Media Tank.

1. Set to ON the AUX MACH SPACE NO. 1 PWR PNL NO. 4 circuit breaker (figure 1, item 1) at the main switchboard (figure 1, item 2) in the EOS.

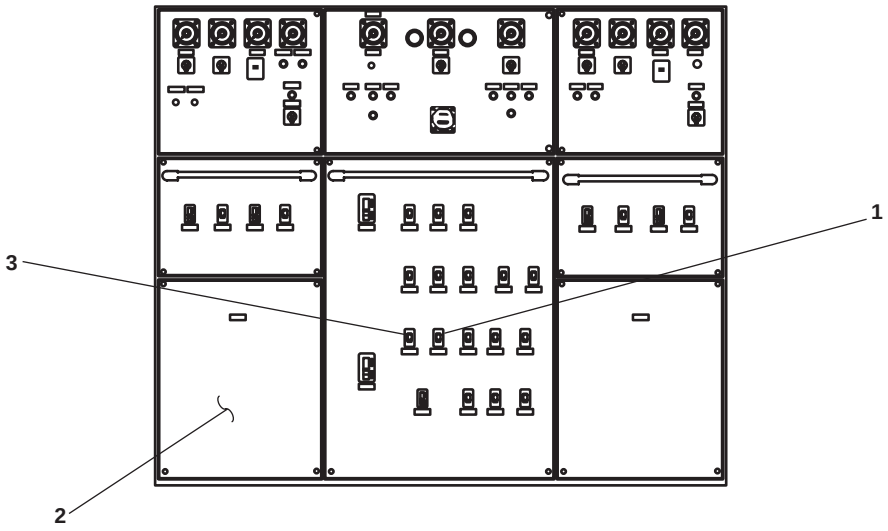


Figure 1. Main Switchboard

2. Set to ON the MSD DISCHARGE PUMP AND BLOWER. circuit breaker (figure 2, item 1) in 440V power panel No. 4.

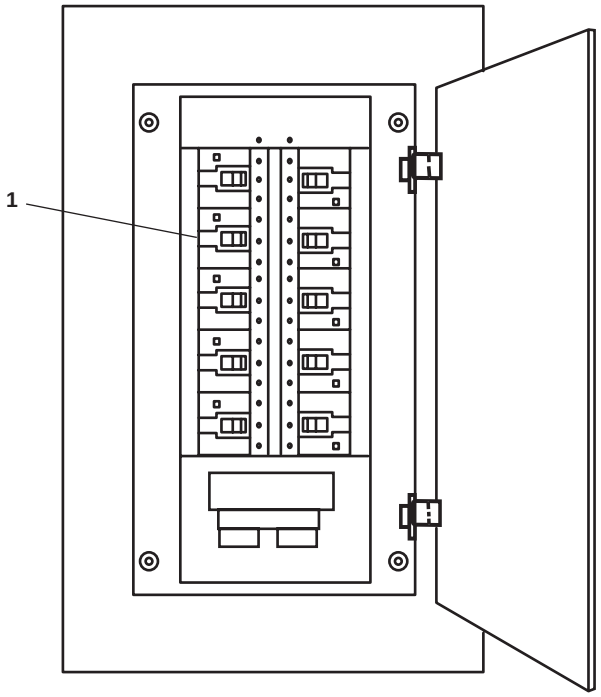


Figure 2. 440V Power Panel No. 4

NOTE

Pay particular attention to valve lineup. Sewage can back up in the system if valves SD-2 SEWAGE OVERBOARD DISCHARGE, SD-3 SEWAGE DRAIN TO HOLDING TANK, and SD-1 SEWAGE INLET TO MSD VALVES are CLOSED.

3. Align the valves for the MSD to operate under usual conditions as specified in figure 3 and table 1.

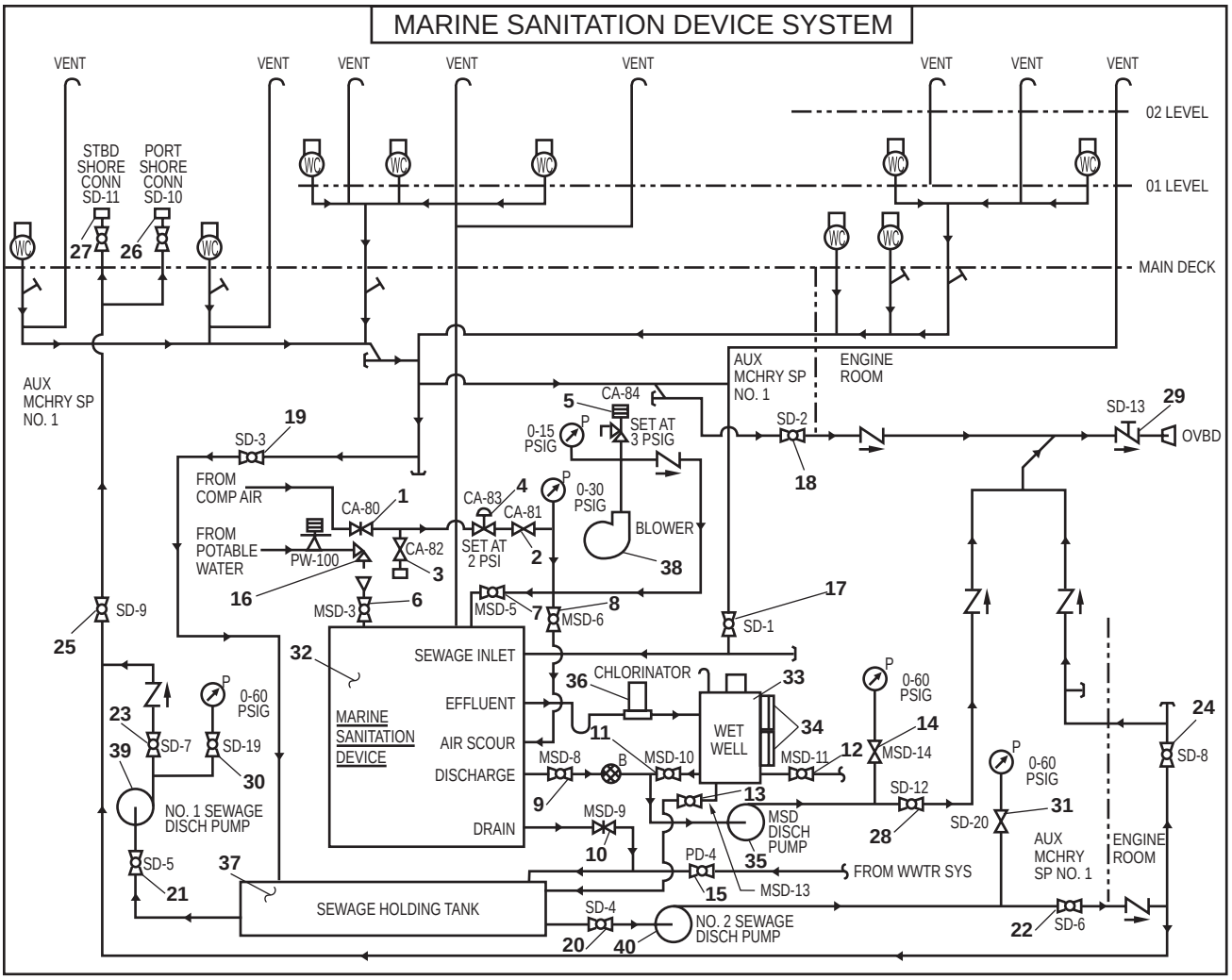


Figure 3. MSD System Schematic

Table 1. Valve Alignment Under Usual Conditions

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
1	CA-80	COV-LP AIR	CLOSED
2	CA-81	COV-LP AIR	CLOSED
3	CA-82	LP AIR HOSE SHUTOFF	CLOSED
4	CA-83	PRV-SET AT 2 PSIG	Factory Set
5	CA-84	RV-SET AT 3 PSIG	Factory Set
6	MSD-3	POTW FILL TO MSD ISLN	CLOSED
7	MSD-5	BLOWER DISCHARGE SHUTOFF	OPEN

Table 1. Valve Alignment Under Usual Conditions (continued)

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
8	MSD-6	BLOWER DISCH TO AIR SCOURING SOV	CLOSED
9	MSD-8	MEDIA TANK PUMP-OUT DR	CLOSED
10	MSD-9	MEDIA TANK DRAIN	CLOSED
11	MSD-10	WET WELL DISCHARGE	OPEN
12	MSD-11	WET WELL SAMPLE	CLOSED
13	MSD-13	WET WELL DRAIN TO HOLDING TANK	CLOSED
14	MSD-14	MSD DISCH PUMP GAGE ISLN	OPEN
15	PD-4	WASTE WTR TO SEW HLDG TANK	OPEN
16	PW-100	POTW ISOLATION	CLOSED
17	SD-1	SEWAGE INLET TO MSD	OPEN
18	SD-2	SEWAGE OVERBOARD DISCHARGE	CLOSED
19	SD-3	SEWAGE DRAIN TO HOLDING TANK	CLOSED
20	SD-4	COV-SEW DISCH PMP NO. 2 SUCT	CLOSED
21	SD-5	COV-SEW DISCH PMP NO. 1 SUCT	CLOSED
22	SD-6	COV-SEW DISCH PMP NO. 2 DISCH	CLOSED
23	SD-7	COV-SEW DISCH PMP NO. 1 DISCH	CLOSED
24	SD-8	SEWAGE OVERBOARD DISCHARGE	CLOSED
25	SD-9	SEWAGE TO SHORE CONN	CLOSED
26	SD-10	SEWAGE SHORE CONN PORT	CLOSED
27	SD-11	SEWAGE SHORE CONN STBD	CLOSED
28	SD-12	MSD OVERBOARD DISCH PMP DISCH	OPEN
29	SD-13	SEWAGE OVERBOARD DISCHARGE	OPEN
30	SD-19	SEW PMP NO. 1 DISCH PRESS GAGE ISLN	CLOSED
31	SD-20	SEW PMP NO. 2 DISCH PRESS GAGE ISLN	CLOSED

4. OPEN MSD-3 POTW FILL TO MSD ISLN (figure 3, item 6) and PW-100 POTW ISOLATION (figure 3, item 16) valves and fill the media tank (figure 3, item 32) with potable water. Fill the media tank until the water in the wet well (figure 3, item 33) reaches a level halfway up the wet well sight glass (figure 3, item 34).

5. CLOSE MSD-3 POTW FILL TO MSD ISLN (figure 3, item 6) and PW-100 POTW ISOLATION (figure 3, item 16) valves.

6. Ensure that chlorine tablets have been installed in the chlorinator (figure 3, item 36) (TM 55-1925-284-14&P).

7. Set to ON the MSD control panel master switch (figure 4, item 1).

8. Press the START button (figure 4, item 2) on the MSD control panel (figure 4, item 3) to start the blower (figure 3, item 38).

9. Set the PUMP HAND/OFF/AUTO switch (figure 4, item 4) on the MSD control panel (figure 4, item 3) to AUTO.

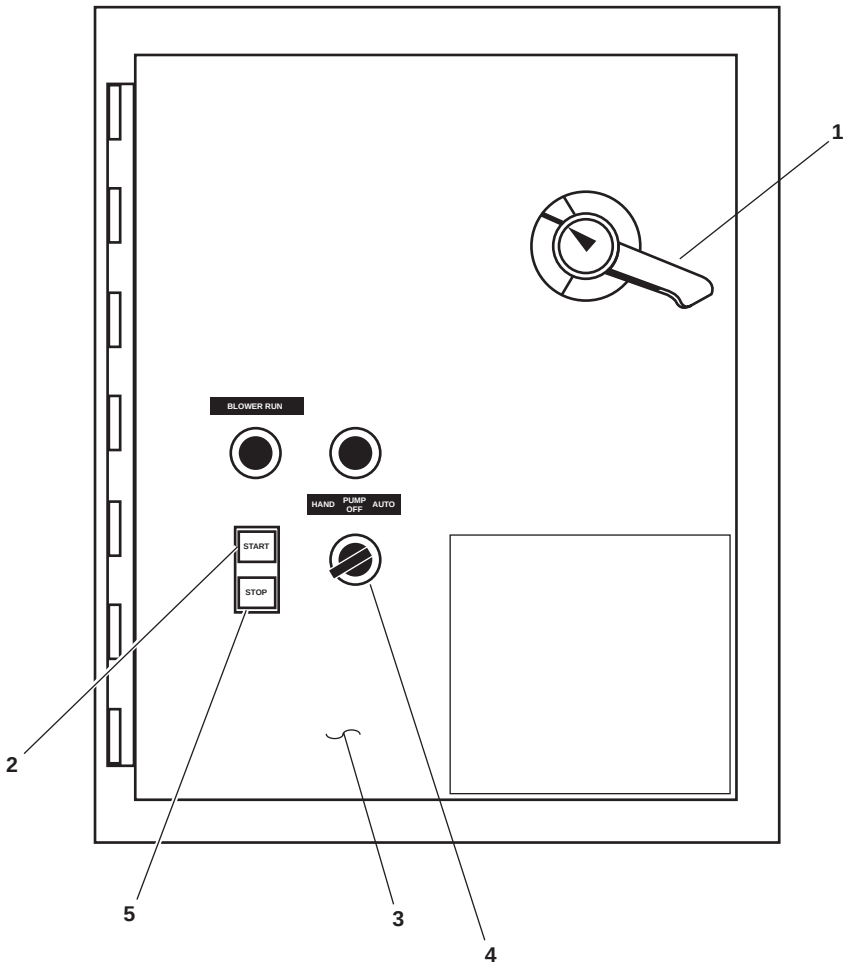


Figure 4. MSD Control Panel

NOTE

It will take approximately two weeks for bacterial culture to grow to normal operating strength. During this period, system effluent may change from clear to cloudy. If the bacterial culture has started properly, it will revert to clear.

10. Verify that SD-1 SEWAGE INLET TO MSD (figure 3, item 17) valve is OPEN to allow sewage to flow into the media tank (figure 3, item 32).

SEWAGE HOLDING TANK TO SHORE CONNECTION

NOTE

Either one or both of the sewage discharge pumps can be used to pump sewage to the shore discharge connections.

1. Ensure that the shore connection hoses are in good working order and connected to the vessel and the shore facility.

2. Perform the Air Scour and Pump Out Media Tank procedure (TM 55-1925-284-14&P).

3. Align the valves for the sewage holding tank to shore connection as specified in figure 3 and table 2.

Table 2. Valve Alignment for Sewage Holding Tank To Shore Connection

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
1	CA-80	COV-LP AIR	CLOSED
2	CA-81	COV-LP AIR	CLOSED
3	CA-82	LP AIR HOSE SHUTOFF	CLOSED
4	CA-83	PRV-SET AT 2PSIG	Factory Set
5	CA-84	RV-SET AT 3 PSIG	Factory Set
6	MSD-3	POTW FILL TO MSD ISLN	CLOSED
7	MSD-5	BLOWER DISCHARGE SHUTOFF	CLOSED
8	MSD-6	BLOWER DISCH TO AIR SCOURING SOV	CLOSED
9	MSD-8	MEDIA TANK PUMP-OUT DR	CLOSED
10	MSD-9	MEDIA TANK DRAIN	CLOSED
11	MSD-10	WET WELL DISCHARGE	CLOSED
12	MSD-11	WET WELL SAMPLE	CLOSED
13	MSD-13	WET WELL DRAIN TO HOLDING TANK	CLOSED

Table 2. Valve Alignment for Sewage Holding Tank To Shore Connection (continued)

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
14	MSD-14	MSD DISCH PUMP GAGE ISLN	CLOSED
15	PD-4	WASTE WTR TO SEW HLDG TANK	OPEN
16	PW-100	POTW ISOLATION	CLOSED
17	SD-1	SEWAGE INLET TO MSD	CLOSED
18	SD-2	SEWAGE OVERBOARD DISCHARGE	CLOSED
19	SD-3	SEWAGE DRAIN TO HOLDING TANK	CLOSED
20	SD-4	COV-SEW DISCH PMP NO. 2 SUCT	CLOSED
21	SD-5	COV-SEW DISCH PMP NO. 1 SUCT	CLOSED
22	SD-6	COV-SEW DISCH PMP NO. 2 DISCH	CLOSED
23	SD-7	COV-SEW DISCH PMP NO. 1 DISCH	CLOSED
24	SD-8	SEWAGE OVERBOARD DISCHARGE	CLOSED
25	SD-9	SEWAGE TO SHORE CONN	CLOSED
26	SD-10	SEWAGE SHORE CONN PORT	CLOSED
27	SD-11	SEWAGE SHORE CONN STBD	CLOSED
28	SD-12	MSD OVERBOARD DISCH PMP DISCH	CLOSED
29	SD-13	SEWAGE OVERBOARD DISCHARGE	CLOSED
30	SD-19	SEW PMP NO. 1 DISCH PRESS GAGE ISLN	CLOSED
31	SD-20	SEW PMP NO. 2 DISCH PRESS GAGE ISLN	CLOSED

4. Set to ON the ENGINE ROOM POWER PANEL NO. 1 circuit breaker (figure 1, item 3) at the main switchboard (figure 1, item 2) in the EOS.

5. To operate sewage discharge pump No.1 (figure 3, item 39), set to ON the SEWAGE DISCHARGE PUMP No. 1. circuit breaker (figure 5, item 1) in the 440V power panel No. 1 (figure 5, item 2).

6. OPEN SD-5 (figure 3, item 21), SD-7 (figure 3, item 23), SD-9 (figure 3, item 25), SD-19 (figure 3, item 30). To pump to the port shore connection, OPEN SD-10 (figure 3, item 26). To pump to the starboard shore connection, OPEN SD-11 (figure 3, item 27).

7. To operate sewage discharge pump No. 2 (figure 3, item 40), set to ON the SEWAGE DISCHARGE PUMP No. 2. circuit breaker (Figure 5 item 3) in the 440V power panel No. 1 (Figure 5, item 2).

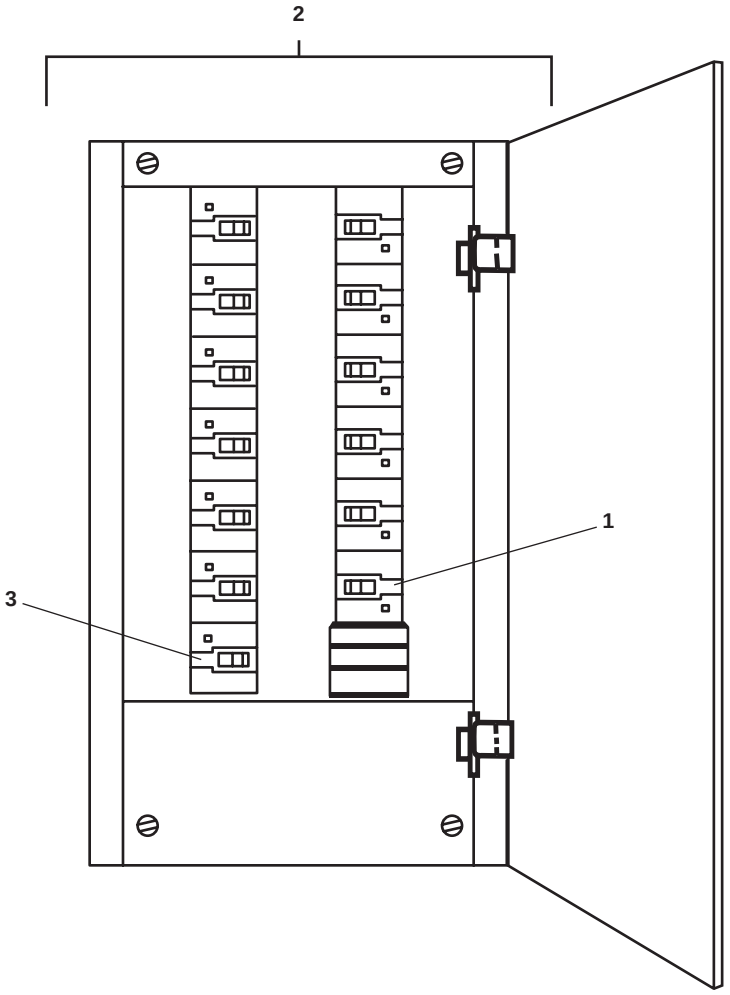


Figure 5. 440V Power Panel No. 1

8. OPEN SD-4 (figure 3, item 20), SD-6 (figure 3, item 22), SD-9 (figure 3, item 25), and SD-20 (figure 3, item 31). Ensure that SD-8 (figure 3, item 24) is CLOSED. To discharge to the port shore connection, OPEN SD-10 (figure 3, item 26). To pump to the starboard shore connection, OPEN SD-11 (figure 3, item 27).

9. Set the ON/OFF switch (figure 6, item 1) to the applicable SEWAGE DISCHARGE PUMP CONTROLLER (figure 6, item 2) to ON.

10. Press the START button (figure 6, item 3). Verify that the motor run light (figure 6, item 4) is illuminated.

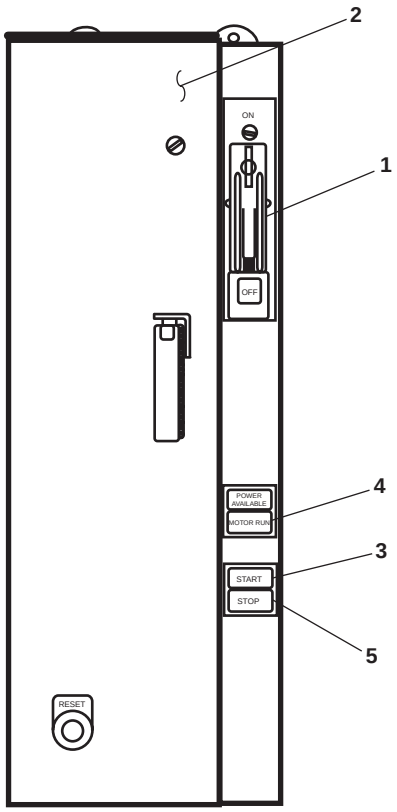


Figure 6. Sewage Discharge Pump Controller

11. Monitor the sewage level in the sewage holding tank by checking the tank level indicator (figure 7, item 1) in AMS 1 to prevent the sewage discharge pump from running dry.

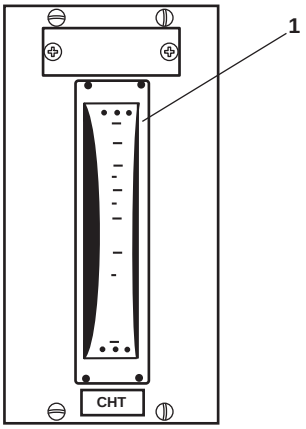


Figure 7. CHT Tank Level Indicator

12. Press the STOP button (figure 6, item 5) on the applicable SEWAGE DISCHARGE PUMP CONTROLLER (figure 6, item 2).

13. Set the applicable ON/OFF switch (figure 6, item 1) to the SEWAGE DISCHARGE PUMP CONTROLLER (figure 6, item 2) to OFF.

14 Set to OFF the SEWAGE DISCHARGE PUMP No. 1. circuit breaker (figure 5, item 1) and SEWAGE DISCHARGE PUMP No. 2. circuit breaker (figure 5, item 3) in 440V power panel No. 1 (figure 5, item 2).

15. Align the valves for the MSD as specified in figure 3 and table 2.

16. Perform the System Start Up procedure in this work package.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
HEATING, VENTILATION, AIR CONDITIONING, AND REFRIGERATION (HVACR) SYSTEMS

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

GENERAL

This work package provides the following procedures:

1. Align the electrical system
2. Heating and ventilation
3. EOS marine air conditioning unit
3. Air conditioning condenser unit operation
5. Air conditioning split-plant operation
6. Split-plant to normal operation
7. Refrigeration
8. Ship stores refrigeration split-plant operation
9. Shifting refrigeration plants
10. Refrigeration pull down mode operation
11. Pilothouse rooftop air conditioning unit operation
12. Radio room rooftop air conditioning unit operation
13. Pilothouse fresh air fan operation

ALIGN THE ELECTRICAL SYSTEM

1. At the main switchboard in the EOS, set the following circuit breakers to ON:
    a. ENG. RM. SUPPLY FAN #1 (figure 1, item 1).
    b. MAIN DECK PWR NO.3 (figure 1, item 2).
    c. ENGINE ROOM EXHAUST FAN NO.1 (figure 1, item 3).
    d. AUX MACH SPACE NO.1 PWR PNL NO.4 (figure 1, item 4).
    e. ENGINE ROOM PWR PNL NO.1 (figure 1, item 5).
    f. ENG. RM SUPPLY FAN #2 (figure 1, item 6).
    g. AUX MACH SPACE NO.2 PWR PNL NO.5 (figure 1, item 7).

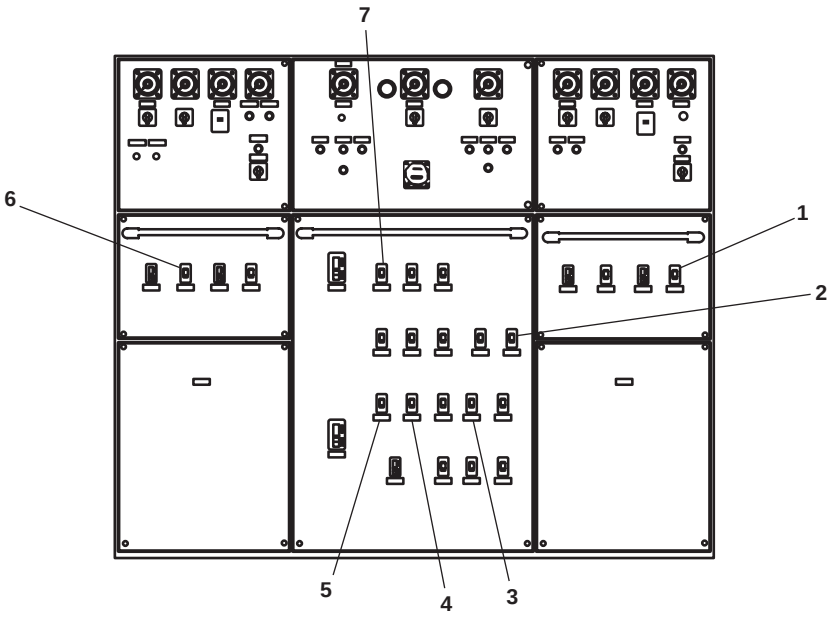


Figure 1. Main Switchboard

2. At 120V distribution panel No. 4, set the following circuit breakers to ON:
   a. ENGINEERS OPERATING STATION R2-40-1. (figure 2, item 1)
   b. WORKSHOP EXHAUST FAN E02-16-1. (figure 2, item 2)
   c. J.B. FOR SS REFG Nos. 1 & 2 (INC. FAN COIL AND CONTROLERS). (figure 2, item 3)
   d. J.B. FOR A/C REEF SYSTEMS Nos. 1 & 2 (INC. LIQUID LINE SOLENOID VALVES). (figure 2, item 4)
   e. SHIPS SERVICE DIESEL GENERATOR SPACE HEATER No. 2. (figure 2, item 5)
   f. SHIPS SERVICE DIESEL GENERATOR SPACE HEATER No. 1. (figure 2, item 6)
3. At 440v power panel 1, set the ENGINE. ROOM UNIT HEATER. (figure 3, item 1) circuit breaker to ON.
4. At 440V power panel No. 5, set the following circuit breakers to ON:
   a. AIR CONDITIONING REFRIGERATION PLANT No. 2. (figure 4, item 1)
   b. STORE REFRIGIRATION PLANT No. 2. (figure 4, item 2)
   c. TOWING GEAR LOCKER UNIT HEATER. (figure 4, item 3)
   d. STORE REFRIGIRATION PLANT No. 1./FREEZE BOX DEFROST HEATER. (figure 4, item 4)
   e. AIR CONDITIONING REFRIGERATION PLANT No. 1. (figure 4, item 5)
   f. UNIT HEATER. (AUXILIARY MACHINERY SPACE No. 2.). (figure 4, item 6)

5. At 440V power panel No. 4, set the following circuit breakers to ON:

   a. UNIT HEATER BOWTHRUSTER. (figure 5, item 1)

   b. AUXILIARY MACHINERY SPACE No. 1. UNIT HEATER. (figure 5, item 2)

   c. AUXILIARY MACHINERY SPACE No. 1. SUPPLY FAN. (figure 5, item 3)

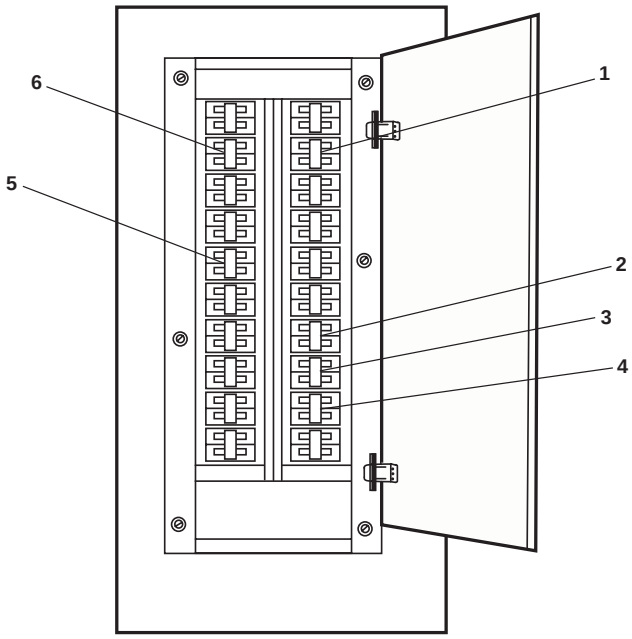


Figure 2. 120V Distribution Panel No. 4

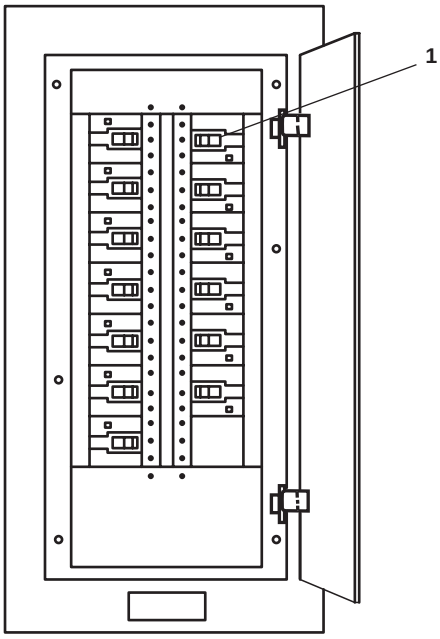


Figure 3. 440V Power Panel No. 1

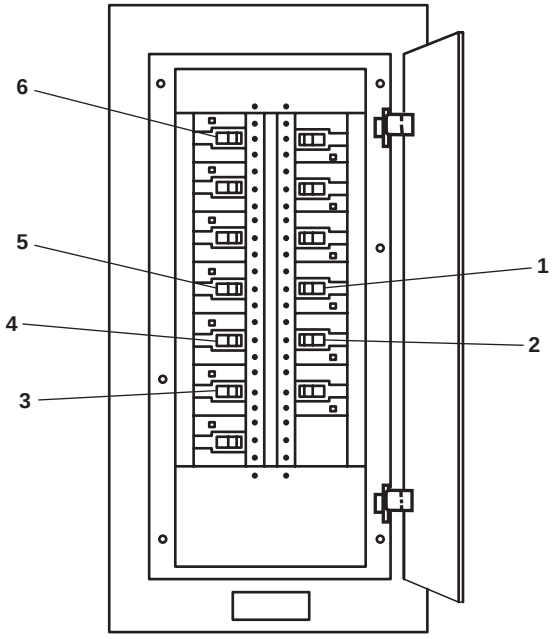


Figure 4. 440V Power Panel 5

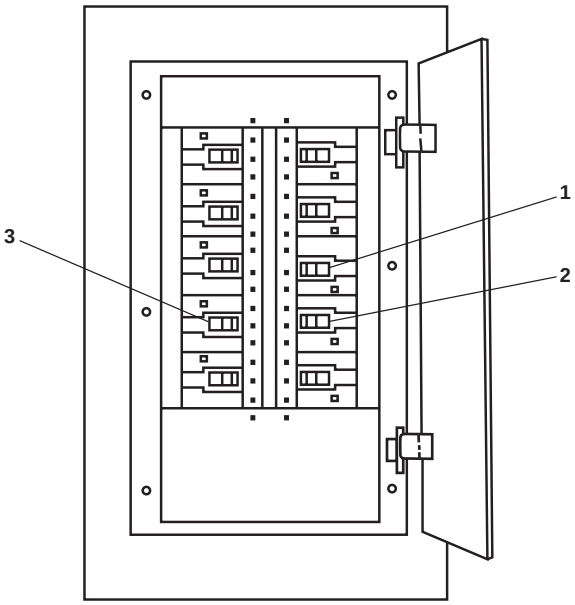


Figure 5. 440V Power Panel No. 4

6. At 120V distribution panel No. 3, set the following circuit breakers to ON:

   a. 01 & 02 LEVEL REHEATER FUSE BOX No. 1. (figure 6, item 1).

   b. MAIN DECK REHEATER FUSE BOX No. 3. (figure 6, item 2).

7. At 440V power panel No. 3, set the following circuit breakers to ON:

   a. PREHEATER 1-25-2. (figure 7, item 1)

   b. BOSUN STORE REHEATER 1-57-1. (figure 7, item 2)

   c. REHEATER 01-32-2. (figure 7, item 3)

   d. CREW'S MESS CRSR FAN COIL R1-25-2. (figure 7, item 4)

   e. LAUNDRY SPACE EXHAUST FAN E1-62-2/CONTROLLER FOR BOSUN STORE & LAUNDRY SPACE SUPPLY FAN S1-58-1. (figure 7, item 5)

   f. SANITARY EXHAUST FAN SPACE E01-44-2. (figure 7, item 6)

   g. 01 & PILOTHOUSE LEVEL FAN COIL R01-32-2. (figure 7, item 7)

   h. BOSUN STORE & LAUNDRY SPACE SUPPLY FAN S1-58-1/CONTROLLER FOR LAUNDRY SPACE EXHAUST FAN E1-62-2. (figure 7, item 8)

   i. PREHEATER 01-31-2. (figure 7, item 9)

   j. AUXILARY MACHINERY SPACE No. 2 SUPPLY FAN 1-22-2. (figure 7, item 10)

   k. PREHEATER 1-23-4. (figure 7, item 11)

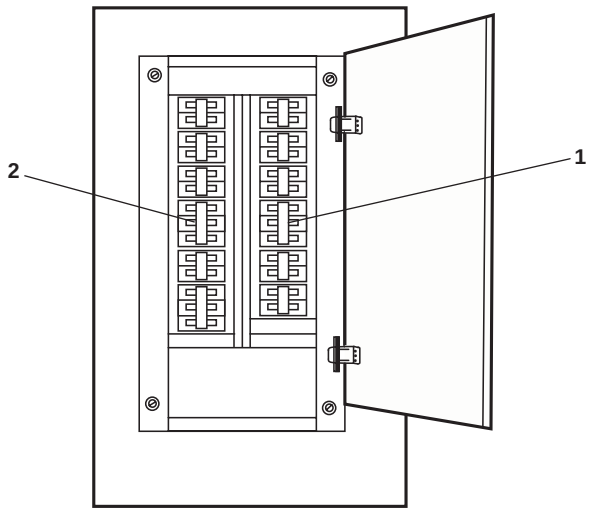


Figure 6. 120V Distribution Panel No. 3

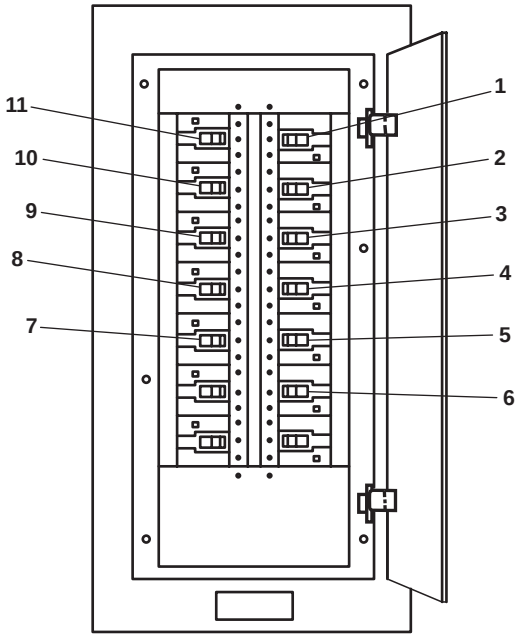


Figure 7. 440V Power Panel No. 3

8. At the 120V distribution panel No.1, set the following circuit breakers to ON:

    a. REFRIGERATOR. (figure 8, item 1)

    b. GAYLORD CONT CABINET. (figure 8, item 2)

    c. FREEZER. (figure 8, item 3)

9. At the 120V distribution panel No. 2, set the 1 & 01 LEVEL CONVECTOR HEATER FUSE BOX No. 2. circuit breaker (figure 9, item 1) to ON.

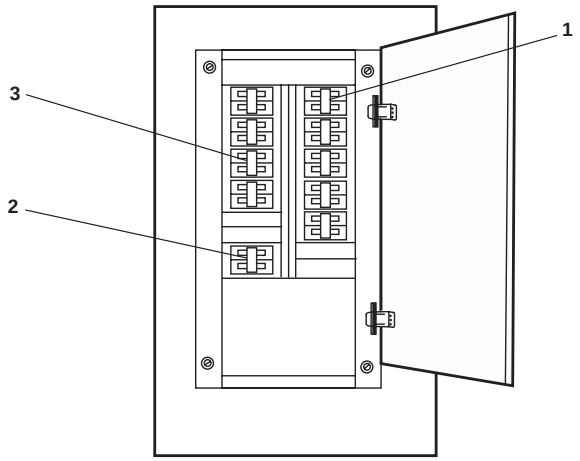


Figure 8. 120V Distribution Panel No. 1

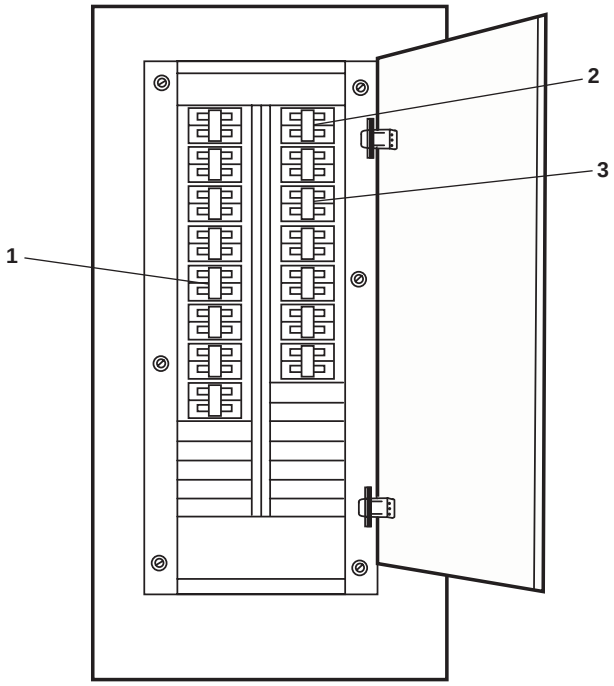


Figure 9. 120V Distribution Panel No. 2

HEATING AND VENTILATION

1. Position all preheater ON/OFF switches (figure 10, item 1) to ON.

2. Position all reheater ON/OFF switches (figure 11, item 1) to ON.

3. Set all thermostats in each compartment to the desired setting.

4. Start all convection heaters by completing the following actions:

    a. Set the power switch (figure 12, item 1) to ON.

    b. Set the thermostat (figure 12, item 2) to the desired temperature.

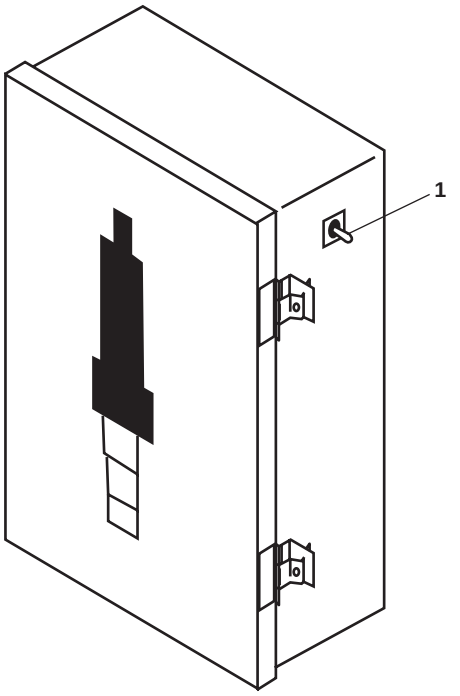


Figure 10. Preheater ON/OFF Switch

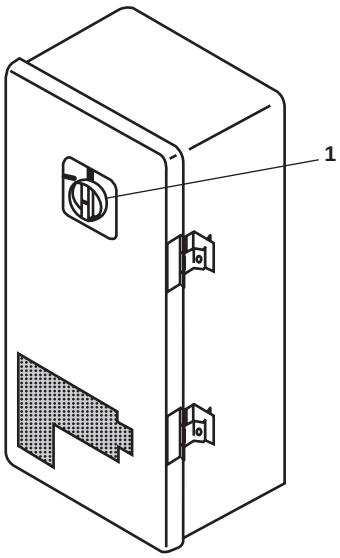


Figure 11. Reheater ON/OFF Switch

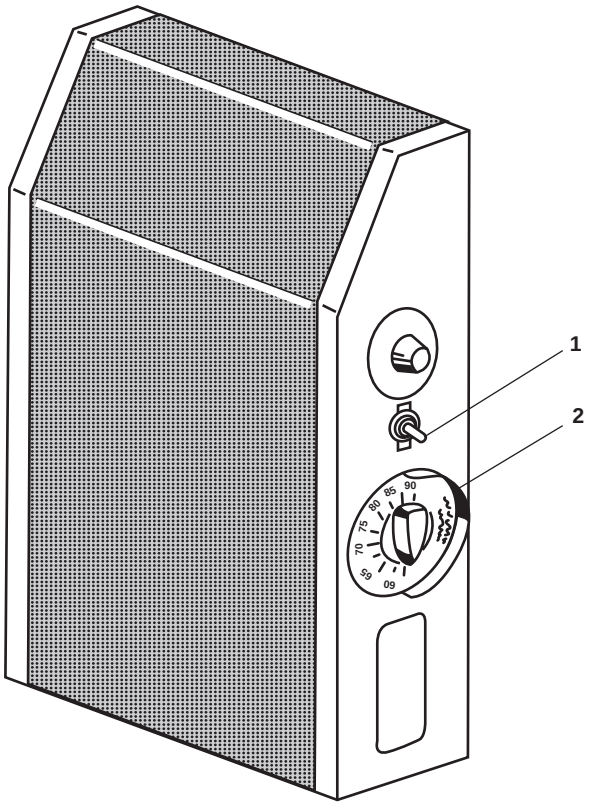


Figure 12. Convection Heater

NOTE

Heaters will cycle automatically to maintain the temperature set on the thermostats.

5. Start all space heaters by completing the following actions:
   a. Set the ON-OFF switch (figure 13, item 1) to ON.
   b. Set the thermostat (figure 13, item 2) to the desired temperature.
6. In the crew's mess, at the crew's mess fan coil motor controller R1-25-2, perform the following actions:
   a. Set ON-OFF switch (figure 14, item 1) to ON.
   b. Verify that the POWER AVAILABLE indicator (figure 14, item 2) illuminates.
   c. Press and release the START pushbutton (figure 14, item 3).
   d. Verify that the MOTOR RUN indicator (figure 14, item 4) illuminates.
7. At the 01, 02, and pilothouse fan coil, R01-32-2 motor controller, perform the following actions:
   a. Set ON-OFF switch (figure 14, item 1) to ON.
   b. Verify that the POWER AVAILABLE indicator (figure 14, item 2) illuminates.
   c. Press and release the START pushbutton (figure 14, item 3).
   d. Verify that the MOTOR RUN indicator (figure 14, item 4) illuminates.

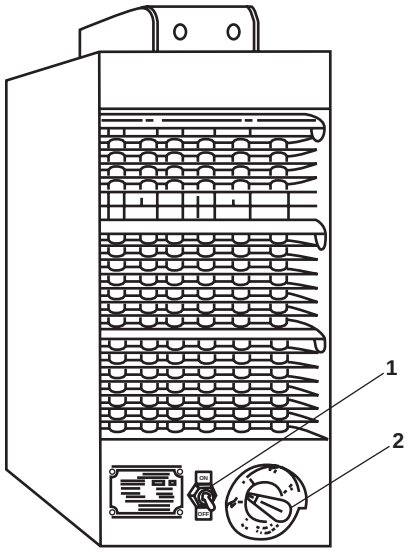


Figure 13. Space Heater

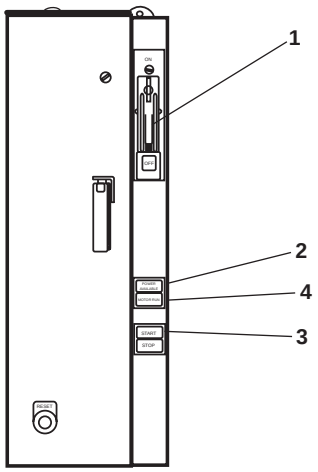


Figure 14. Single Speed Fan Motor Controller

8. In the boatswain's store, at the boatswain's store room supply fan motor controller, perform the following actions:
   a. Set the ON-OFF switch (figure 15, item 1) to ON.
   b. Verify that the POWER AVAILABLE indicator (figure 15, item 2) illuminates.
   c. Select a fan speed by pressing and releasing either the FAST or SLOW pushbutton (figure 15, item 3 or 4).
   d. Verify that the fan speed selected is displayed on the appropriate indicator (figure 15, item 5 or 6).
9. In the boatswain's locker, at the paint locker and storeroom exhaust fan motor controller, perform the following actions:
   a. Set the ON-OFF switch (figure 15, item 1) to ON.
   b. Verify that the POWER AVAILABLE indicator (figure 15, item 2) illuminates.
   c. Select a fan speed by pressing and releasing either the FAST or SLOW pushbutton (figure 15, item 3 or 4).
   d. Verify that the fan speed selected is displayed on the appropriate indicator (figure 15, item 5 or 6).
10. In AMS 1, at the AMS 1 supply fan motor controller.
   a. Set the ON-OFF switch (figure 15, item 1) to ON.
   b. Verify that the POWER AVAILABLE indicator (figure 15, item 2) illuminates.
   c. Select a fan speed by pressing and releasing either the FAST or SLOW pushbutton (figure 15, item 3 or 4).
   d. Verify that the fan speed selected is displayed on the appropriate indicator (figure 15, item 5 or 6).
11. In AMS 2, at the workshop exhaust fan motor controller the ON-OFF switch (figure 16, item 1) to ON.

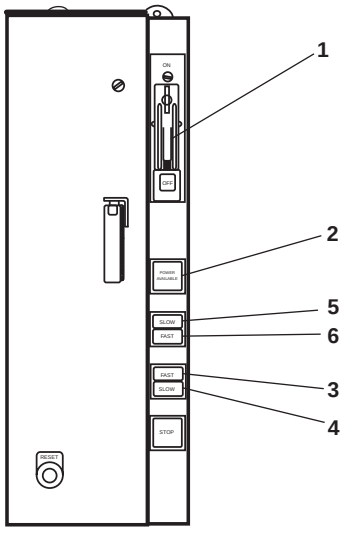


Figure 15. Dual Speed Fan Motor Controller

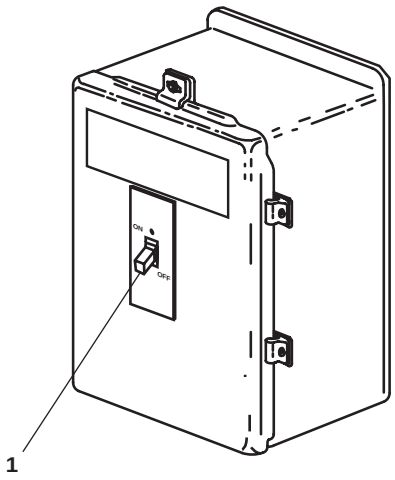


Figure 16. Workshop Exhaust Fan Motor Controller

12. At the sanitary spaces exhaust fan motor controller, perform the following:

    a. Set ON-OFF switch (figure 14, item 1) to ON.

    b. Verify that the POWER AVAILABLE indicator (figure 14, item 2) illuminates.

    c. Press and release the START pushbutton (figure 14, item 3).

    d. Verify that the MOTOR RUN indicator (figure 14, item 4) illuminates.

EOS MARINE AIR CONDITIONING UNIT

1. Place the EOS marine air conditioning unit online by completing the following actions at the EOS marine air conditioning unit control panel:

    a. MASTER CONTROL switch (figure 17, item 1) to the desired position.

    b. THERMOSTAT (figure 17, item 2) to the desired temperature setting.

    c. AIR EXCHANGER control (figure 17, item 3) to the desired setting.

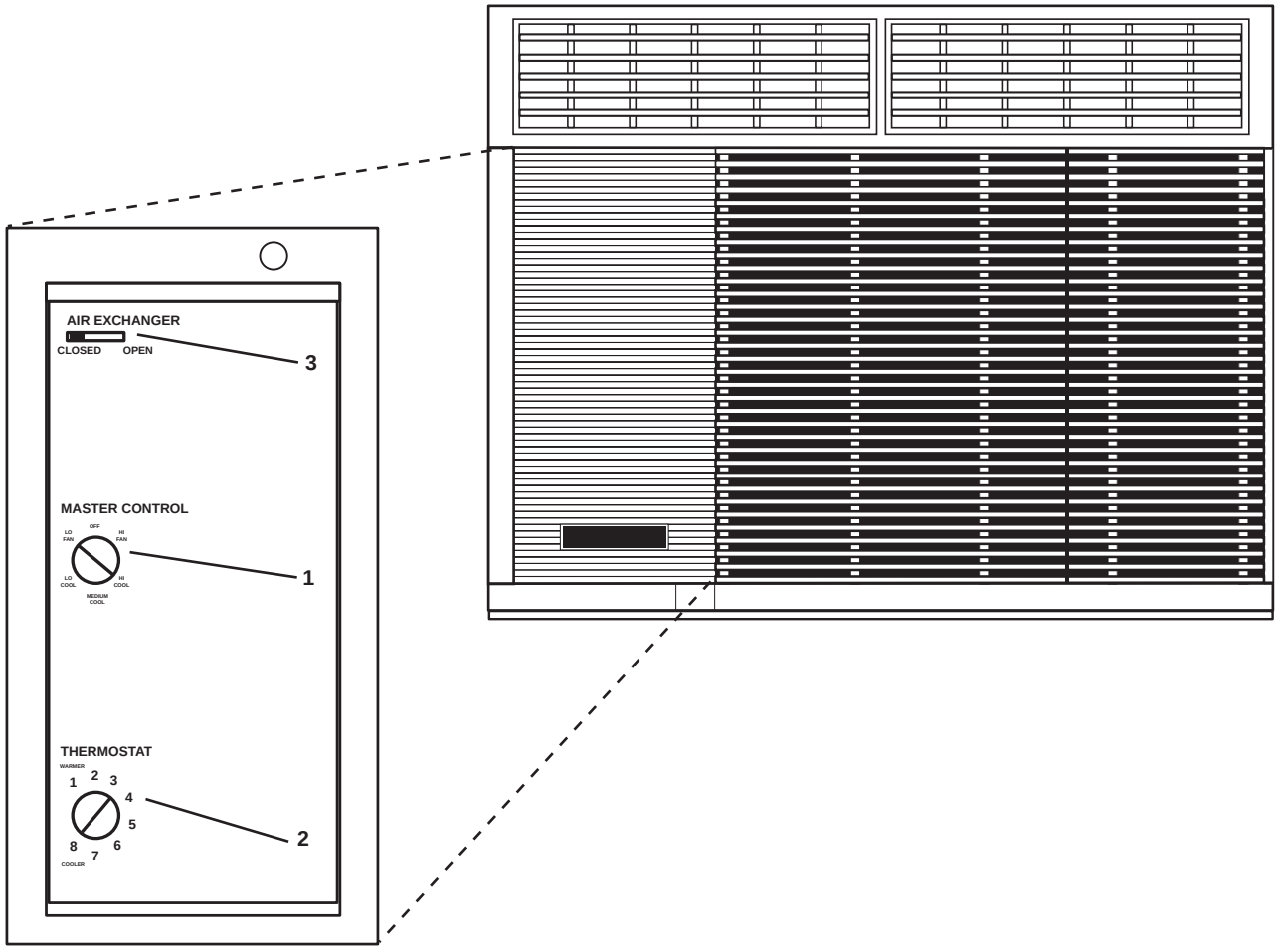


Figure 17. EOS Marine Air Conditioning Unit

AIR CONDITIONING CONDENSER UNIT OPERATION

⚠ CAUTION

Align the condenser cooling water piping system before starting the refrigeration plant or the plant can be damaged.

1. Verify that the general service system is pressurized and available for use, and align the cooling system by positioning valves as follows:

⚠ CAUTION

The condenser water cooling system must be purged of all air. Air in the cooling system will reduce heat exchange efficiency and can result in damage to the condenser.

a. For air conditioning condenser 1:

(1) OPEN GS-33, A/C COND No. 1 SPLY (figure 18, item 1), air conditioning condenser 1 supply.

(2) OPEN GS-36, WTR RGLTR COV (figure 18, item 2), water regulator inlet.

(3) Verify that GS-65 (figure 18, item 3), water regulator, is OPEN.

(4) Verify that GS-83, BYP WTR RGLTR (figure 18, item 4), water regulator bypass, is CLOSED.

b. For air conditioning condenser 2:

(1) OPEN GS- 34, A/C COND No. 2 SPLY (figure 18, item 5), air conditioning condenser 2 supply.

(2) OPEN GS-37, WTR RGLTR COV(figure 18, item 6), water regulator inlet.

(3) Verify that GS-66 (figure 18, item 7), water regulator, is OPEN.

(4) Verify that GS-72, BYP WTR RGLTR (figure 18, item 8), water regulator bypass, is CLOSED.

c. Verify that GS-32, GS OVBD DISCH (figure 18, item 9), general service overboard discharge, is OPEN.

⚠ CAUTION

When starting the condenser, avoid rapid pump-down to ensure oil is not carried off with refrigerant. If oil is pulled from sump, ensure that oil pressure is a minimum of 16 PSI (1.10 bar) above suction pressure. If the pressure difference becomes greater than 16 PSI (1.10 bar), stop the condenser and add oil temporarily. Added oil must be later removed when the sight glass oil level becomes too high.

NOTE

Before starting a condenser, the crankcase heater must be energized for at least 24 hours. Energizing the heater for this period of time ensures that the refrigerant is driven from the oil.

2. Align the air conditioning condenser piping system by completing the following:

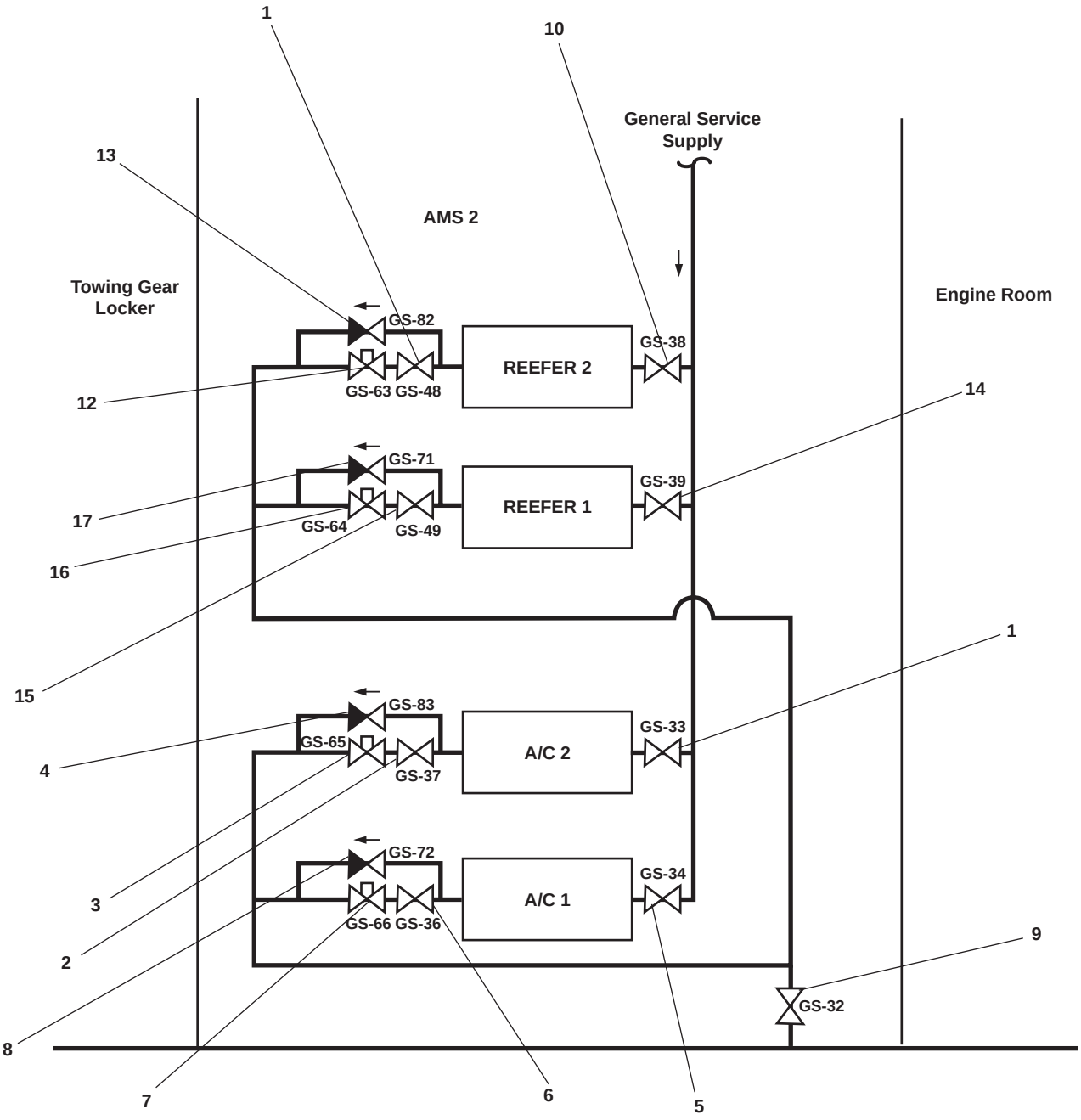


Figure 18. Condenser Cooling Water Valves

NOTE

Use a refrigeration ratchet wrench to OPEN or CLOSE the valves on the air conditioning and reefer condensers.

a. OPEN the following valves:

(1) Compressor discharge valve (figure 19, item 1)

(2) Condenser outlet valve (figure 19, item 2)

(3) Dehydrator outlet valve (figure 19, item 3)

(4) Dehydrator inlet valve (figure 19, item 4)

(5) Equalizing line valve (figure 19, item 5)

(6) Water regulator valve actuating line valve (figure 19, item 6)

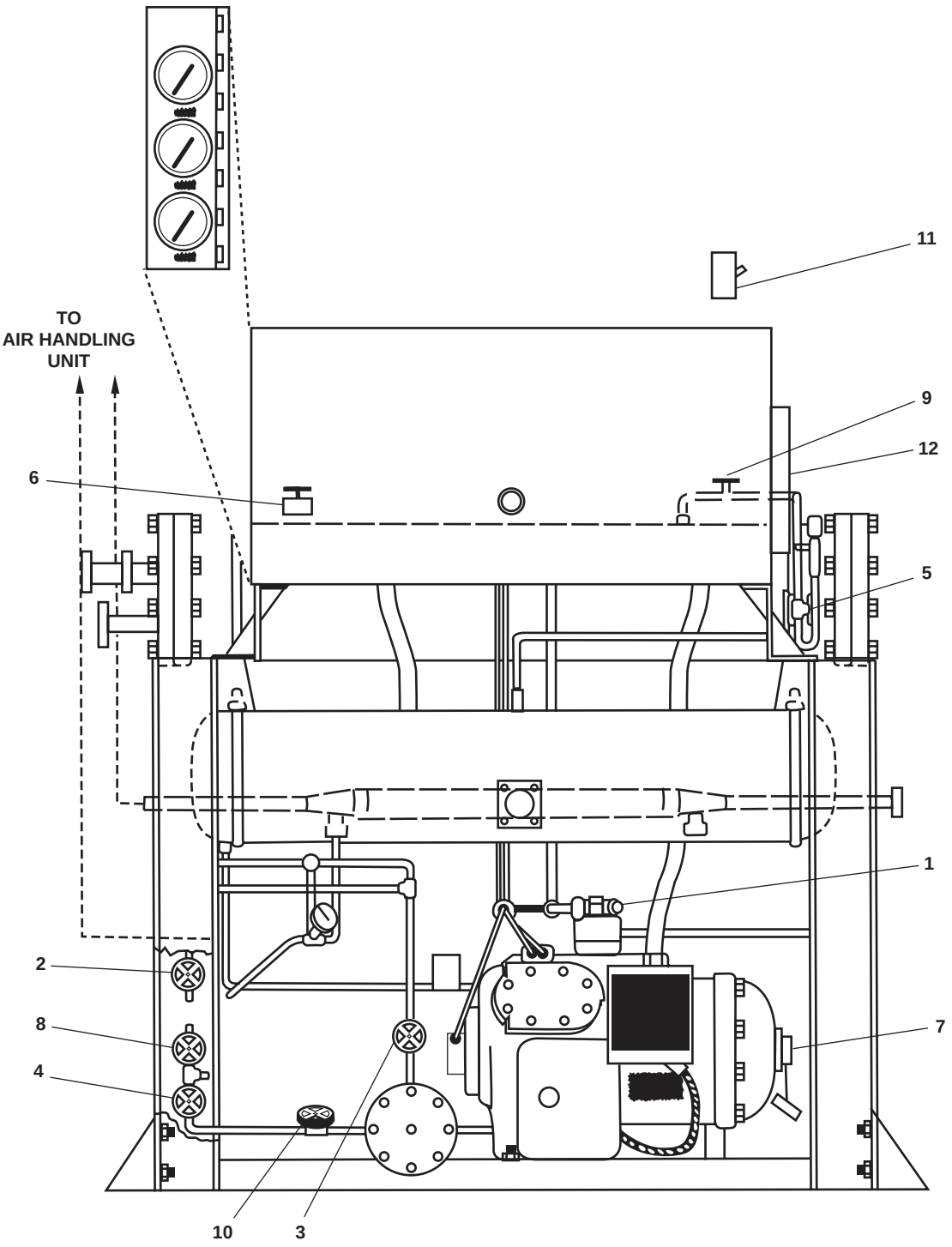


Figure 19. Condensing Unit Valves and Switches

b. CLOSE the following valves:

(1) Compressor suction valve (figure 19, item 7)

(2) Dehydrator bypass valve (figure 19, item 8)

(3) Purge valve (figure 19, item 9)

(4) Charge and drain valve (figure 19, item 10)

3. Align the air conditioning refrigerant piping by completing the following:

⚠ CAUTION

To prevent oil return problems and damage to the condenser, do not operate both condensing units at the same time with RFAC-39, LIQUID LINE CRVR CO. and RFAC-41, SUCT LINE CRSVR COV. valves open.

a. In AMS 2, verify that the following valves are CLOSED:

(1) RFAC-39. LIQUID LINE CRVR CO. air conditioning liquid line crossover cut out, located in the overhead

(2) RFAC-41. SUCT LINE CRSVR COV. air conditioning suction line crossover cut out, located in the overhead

b. Run the fan coil units to place a heat load on the system by completing the following actions:

(1) In the main deck fan room, OPEN the following valves:

(a) RFAC-29, EQL LINE (figure 20, item 1), air conditioning 2 equalizing line

(b) RFAC-30, EQL LINE (figure 20, item 2), air conditioning 1 equalizing line

(c) RFAC-33, TXV/STNR/LLSV COV, R1-25-2, 4 COIL (figure 20, item 3), TXV strainer and low level cut out from air conditioning 2

(d) RFAC-34, TXV COV, R01-32-2 (figure 20, item 4), TXV strainer and low level cut out from air conditioning 2

(e) RFAC-36, TXV/STNR/LLSV COV, R1-25-2, 8 COIL (figure 20, item 5), strainer and low level cut out from air conditioning 1

(f) RFAC-37, TXV/STNR/LLSV COV, R1-25-2, 8 COIL (figure 20, item 6), strainer and low level cut out from air conditioning 1

(g) RFAC-38, 4 COIL SUCT, COV, R1-25-2 (figure 20, item 7), coil suction

(h) RFAC-42, 8 COIL SUCT COV, R1-25-2 (figure 20, item 8), coil suction

(2) In the 01 level fan room OPEN the following valves:

(a) RFAC-31, 8 EQL LINE (figure 21, item 1), equalizing line

(b) RFAC-34, TXV COV, R01-32-2 (figure 21, item 2), TXV outlet

(c) RFAC-40, COIL SUCT COV, R01-32-2 (figure 21, item 3), coil suction

(d) RFAC-35, TXV COV, R01-32-2 (figure 21, item 4), TXV inlet

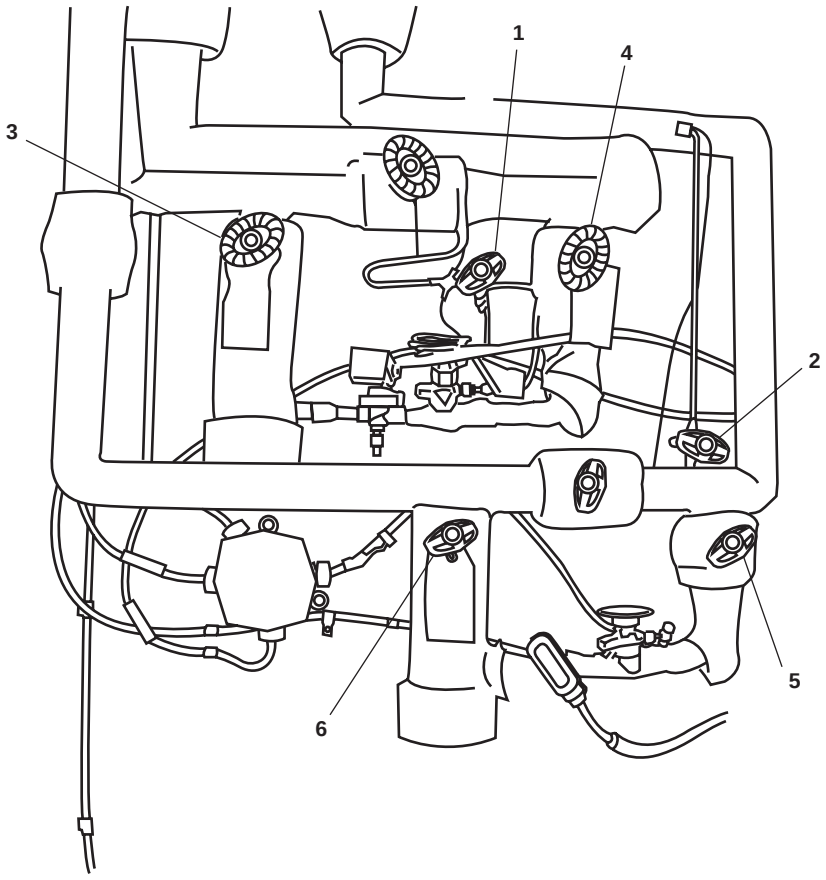


Figure 20. Main Deck Fan Room Air Conditioning Refrigerant Valves

4. Start the air conditioning condensers by completing the following actions:

   a. OPEN the both air conditioning compressor suction valves (figure 19, item 7) one full turn.

   b. Set the following switches to ON at both air conditioning condenser units:

      (1) Main power disconnect switch (figure 19, item 11)

      (2) Power ON/OFF switch (figure 19, item 12)

⚠ CAUTION

Open the compressor suction valves slowly to prevent rapid pumping down of the suction side, which could cause oil foaming, and result in pumping of oil from condenser crankcase. Damage to condenser could result from lack of lubrication.

   c. Slowly, OPEN the compressor suction valves (figure 19, item 7) as suction pressure decreases.

   d. Verify that the condenser water temperature gauges remain in the NORMAL range.

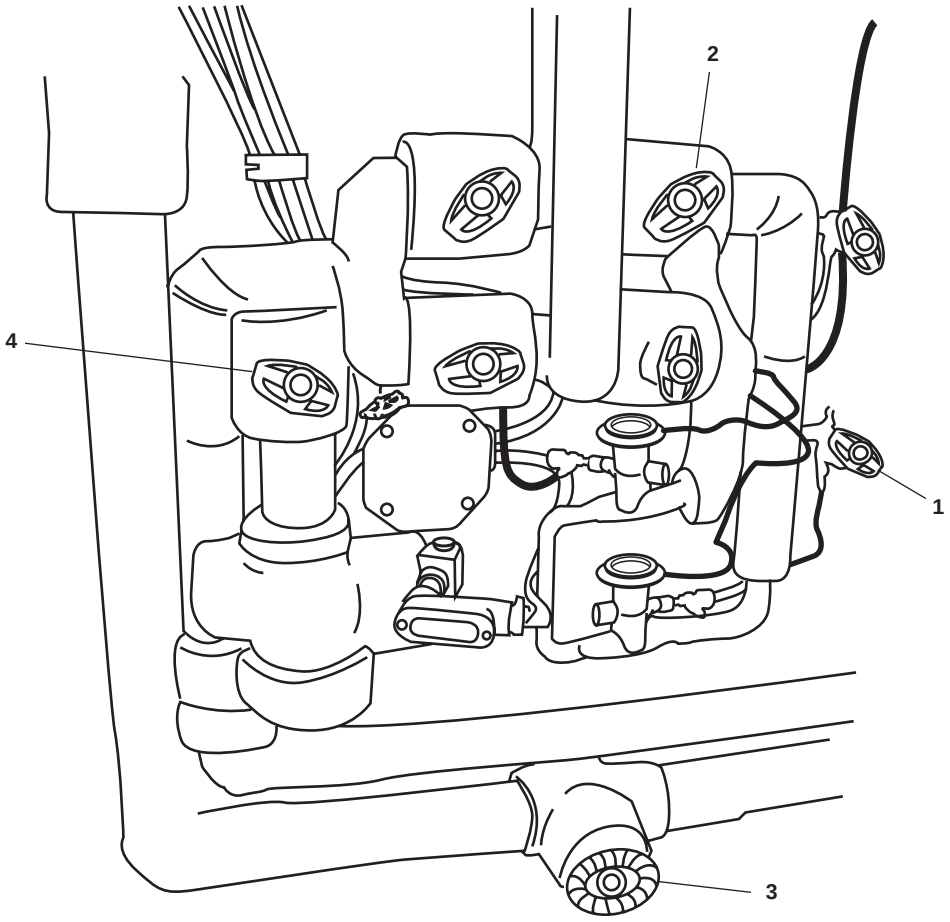


Figure 21. 01 Level Fan Room Air Conditioning Refrigerant Valves

e. Verify that the following gauges read in the NORMAL operating range:

(1) Liquid line temperature gauges.

(2) Suction pressure gauges.

(3) Suction temperature gauges.

(4) Discharge pressure gauges.

(5) Oil pressure gauges.

⚠ CAUTION

Oil pressure must be a minimum of 16 PSI (1.10 bar) above suction pressure, or damage to the condenser could result from lack of lubrication.

f. Observe the condensers operating for 5 minutes.

⚠ CAUTION

Liquid refrigerant returning to the condenser is indicated by a sudden drop in suction temperature and a rapid fluctuation in suction pressure. If the suction temperature and oil pressure do not stabilize, or if the condenser develops a knock, immediately stop condenser by placing power disconnect ON/OFF switch in the OFF position.

g. Slowly adjust the compressor suction valves (figure 19, item 7) as needed until proper suction pressure of 2.3 to 2.4 PSI (0.16-0.17 bar) has stabilized as indicated on the SUCTION gauge.

AIR CONDITIONING SPLIT-PLANT OPERATION

NOTE

The air conditioning system normally has both plants in operation. This procedure aligns the system for use with only one air conditioning condenser unit.

1. Secure one condensing unit by completing the following:

   a. Place the DEHYDRATOR INLET valve (figure 19, item 4) on the condenser unit being secured in the CLOSED position.

   b. Allow the condenser to operate until it is shut down automatically by the suction pressure switch.

   c. CLOSE the following valves on the condenser being secured:

      (1) Compressor discharge valve (figure 19, item 1)

      (2) Condenser outlet valve (figure 19, item 2)

      (3) Dehydrator outlet valve (figure 19, item 3)

      (4) Dehydrator inlet valve (figure 19, item 4)

      (5) Relief valve bypass valve (figure 19, item 5)

      (6) Water regulator valve actuating line valve (figure 19, item 6)

      (7) Compressor suction valve (figure 19, item 7)

2. Align air conditioning piping as follows:

   a. In AMS 2, slowly OPEN the following valves:

      (1) RFAC-39, LIQUID LINE CRVR CO. liquid line crossover cut out (figure 20, item 1)

      (2) RFAC-41, SUCT LINE CRSVR COV. suction line crossover cut out (figure 20, item 2)

3. Secure general service piping by placing the following valves for the condensing unit being shut down in the CLOSED position:

   a. Air conditioning condensing unit 1:

      (1) GS-33, A/C COND No. 1 SPLY (figure 18, item 1), air conditioning condenser 1 supply

      (2) GS-36, WTR RGLTR COV (figure 18, item 2), water regulator inlet

b. Air conditioning condensing unit 2:

(1) GS- 34, A/C COND No. 2 SPLY (figure 18, item 5), air conditioning condenser 2 supply

(2) GS-37, WTR RGLTR COV (figure 18, item 6), water regulator inlet

SPLIT-PLANT TO NORMAL OPERATION

1. Start up and place a second condenser on line by verifying that the general service system is pressurized and available for use, and by positioning the valves as follows:

⚠ CAUTION

The condenser water cooling system must be purged of all air. Air in the cooling system will reduce heat exchange efficiency and can result in damage to the condenser.

a. To start air conditioning condenser 1:

(1) OPEN GS-33, A/C COND No. 1 SPLY (figure 18, item 1), air conditioning condenser 1 supply.

(2) OPEN GS-36, WTR COV (figure 18, item 2), water regulator inlet.

(3) Verify that GS-65 (figure 18, item 3), water regulator, is OPEN.

(4) Verify that GS-83, BYP WTR RGLTR (figure 18, item 4), water regulator bypass, is CLOSED.

b. To start air conditioning condenser 2:

(1) OPEN GS- 34 A/C COND No. 2 SPLY (figure 18, item 5), air conditioning condenser 2 supply.

(2) OPEN GS-37 WTR RGLTR COV (figure 18, item 6), water regulator inlet.

(3) Verify that GS-66 (figure 18, item 7), water regulator, is OPEN.

(4) Verify that GS-72, BYP WTR RGLTR (figure 18, item 8), water regulator bypass, is CLOSED.

2. Align condenser unit piping for the condenser be started as follows:

a. OPEN the following valves on the condenser being started:

(1) Compressor discharge valve (figure 19, item 1)

(2) Condenser outlet valve (figure 19, item 2)

(3) Dehydrator outlet valve (figure 19, item 3)

(4) Dehydrator inlet valve (figure 19, item 4)

(5) Relief valve bypass valve (figure 19, item 5)

(6) Water regulator valve actuating line valve (figure 19, item 6)

b. Verify the following valves are CLOSED on the condenser being started:

(1) Compressor suction valve (figure 19, item 7)

(2) Dehydrator bypass valve (figure 19, item 8).

(3) Purge valve (figure 19, item 9).

(4) Charge and drain valve (figure 19, item 10).

3. Align the air conditioning refrigerant piping for the condensing unit to be started by CLOSING the following valves in AMS 2:

⚠ CAUTION

Do not operate both condensing units at the same time with RFAC-39, LIQUID LINE CRVR CO .and RFAC-41, SUCT LINE CRSVR COV. OPEN or return problems and damage to the condenser could occur.

a. RFAC-39, LIQUID LINE CRVR CO, liquid line crossover cut out, located in overhead

b. RFAC-41, SUCT LINE CRSVR COV, suction line crossover cut out, located in overhead

4. Start the standby air conditioning condenser by completing the following actions:

a. OPEN the compressor suction valve (figure 19, item 7) one full turn.

b. Set the following switches to ON for the air conditioning condenser unit:

(1) Main power disconnect switch (figure 19, item 11)

(2) Power ON/OFF switch (figure 19, item 12)

⚠ CAUTION

Open the compressor suction valve slowly to prevent rapid pumping down of suction pressure side which could cause oil foaming and result in pumping of oil from condenser crankcase. Damage to condenser could result from lack of lubrication.

c. Slowly, OPEN the compressor suction valve (figure 19, item 7) as suction pressure decreases.

d. Verify that the condenser water temperature gauge remains in the NORMAL range.

e. Verify that the following gauges read in the normal operating range:

(1) Liquid line temperature gauge

(2) Suction pressure gauge

(3) Suction temperature gauge

(4) Oil pressure gauge

⚠ CAUTION

Oil pressure must be a minimum of 16 PSI (1.10 bar) above suction pressure, or damage to the condenser could result from lack of lubrication.

f. Observe condenser operation for 5 minutes.

⚠ CAUTION

Liquid refrigerant returning to the condenser is indicated by a sudden drop in suction temperature and a rapid fluctuation in suction pressure. If the suction temperature and oil pressure do not stabilize, or if the condenser develops a knock, immediately stop condenser by placing power disconnect ON/OFF switch in the OFF position.

g. Slowly adjust the compressor suction valve (figure 19, item 7) until proper suction pressure of 2.3 to 2.4 PSI (0.16-0.17 bar) is indicated on the suction gauge.

REFRIGERATION

NOTE

During initial loading of the walk-in freezer and chill box, it may be necessary to operate both condensers to ensure timely cool down of perishable items, however normal operation is for one condenser to operate at a time.

If the refrigerator thermometer reads below 37 °F (2.78 °C) or above 43 °F (6.11 °C) and/or the freezer thermometer reads below 5 °F (-15 °C) or above 0 °F (-17.78 °C), refer to unit maintenance. It is important that the units not be loaded with perishables until the inside temperature of the walk-in units stabilize at the correct temperature.

1. Verify that the thermostats are set as follows:

   a. Chill room between 33 °F (0.56 °C) and 37 °F (2.78 °C).

   b. Freeze room between –4 °F (-20 °C) and 0 °F (-17.78 °C).

⚠ CAUTION

Align the condenser cooling water piping system before starting the refrigeration plant, or damage to the plant can occur.

2. Align the ship stores refrigeration (walk-in freezer and refrigerator) room condenser cooling water piping system as follows:

⚠ CAUTION

The condenser water cooling system must be purged of all air. Air in the cooling system will reduce heat exchange efficiency and can result in damage to the condenser.

   a. For reefer condenser 1:

      (1) OPEN GS-38, RETR COND No. 1 SPLY (figure 18, item 10), reefer condenser 1 supply.

(2) OPEN GS-48, WTR. RGLTR COV (figure 18, item 11), water regulator inlet.

(3) Verify that GS-63 (figure 18, item 12), water regulator, is OPEN.

(4) Verify that GS-82, BYP WTR RGLTR (figure 18, item 13), water regulator bypass, is CLOSED.

b. For reefer condenser 2:

(1) OPEN GS-39, RETR COND No. 2 SPLY (figure 18, item 14), reefer condenser 2 supply.

(2) OPEN GS-49, WTR RGLTR COV (figure 18, item 15), water regulator inlet.

(3) Verify that GS-64 (figure 18, item 16), water regulator, is OPEN.

(4) Verify CLOSED GS-71, BYP WTR RGLTR (figure 18, item 17), water regulator bypass, is CLOSED.

c. Verify that GS-32, GS OVBD DISCH (figure 18, item 9), general service overboard discharge, is OPEN.

3. Align the reefer refrigerant piping system as follows:

⚠ CAUTION

Use a refrigeration ratchet wrench to open and close refrigeration system valves, or damage may occur to the piping system.

a. At both reefer condenser units OPEN the following valves:

(1) Compressor discharge valve (figure 19, item 1)

(2) Condenser outlet valve (figure 19, item 2)

(3) Dehydrator outlet valve (figure 19, item 3)

(4) Dehydrator inlet valve (figure 19, item 4)

(5) Relief valve bypass valve (figure 19, item 5)

(6) Water regulator valve actuating line valve (figure 19, item 6)

b. Verify that the following valves are CLOSED on the reefer condenser being started:

(1) Compressor suction valve (figure 19, item 7)

(2) Dehydrator bypass valve (figure 19, item 8)

(3) Purge valve (figure 19, item 9)

(4) Charge and drain valve (figure 19, item 10)

⚠ CAUTION

To prevent oil return problems and possible damage to condenser, do not operate both condensing units at the same time with RFSS-13, LIQUID LINE CRSVR CO and RFSS-20, SUCT LINE CRSVR COV valves OPEN.

4. Isolate the reefer condensers from each other by placing the RFSS-13, LIQUID LINE CRSVR COV (figure 22, item 1) in the CLOSED position.

5. Line up reefer condenser 1 to the walk-in chill box by placing the following valves in the OPEN position:
   a. RFSS-14, TXV/STRNR/LLSV COV (figure 22, item 2), TXV strainer low-level suction
   b. RFSS-11, TXV/STRNR/LLSV COV (figure 22, item 3), TXV strainer low-level suction
   c. RFSS-8, EQL LINE (figure 22, item 4), equalizing line
6. Line up reefer condenser 2 to the walk in freezer by OPENING the following valves:
   a. RFSS-12, TXV/STRNR/LLSV COV (figure 22, item 5), TXV strainer low-level suction
   b. RFSS-15, TXV/STRNR/LLSV COV (figure 22, item 6), TXV strainer low-level suction
   c. RFSS-9, EQL LINE (figure 22, item 7), equalizing line
7. Verify that the following valves are CLOSED:
   a. RFSS-6 HAND EXP V, (figure 22, item 8)
   b. RFSS-7 HAND EXP V, (figure 22, item 9)

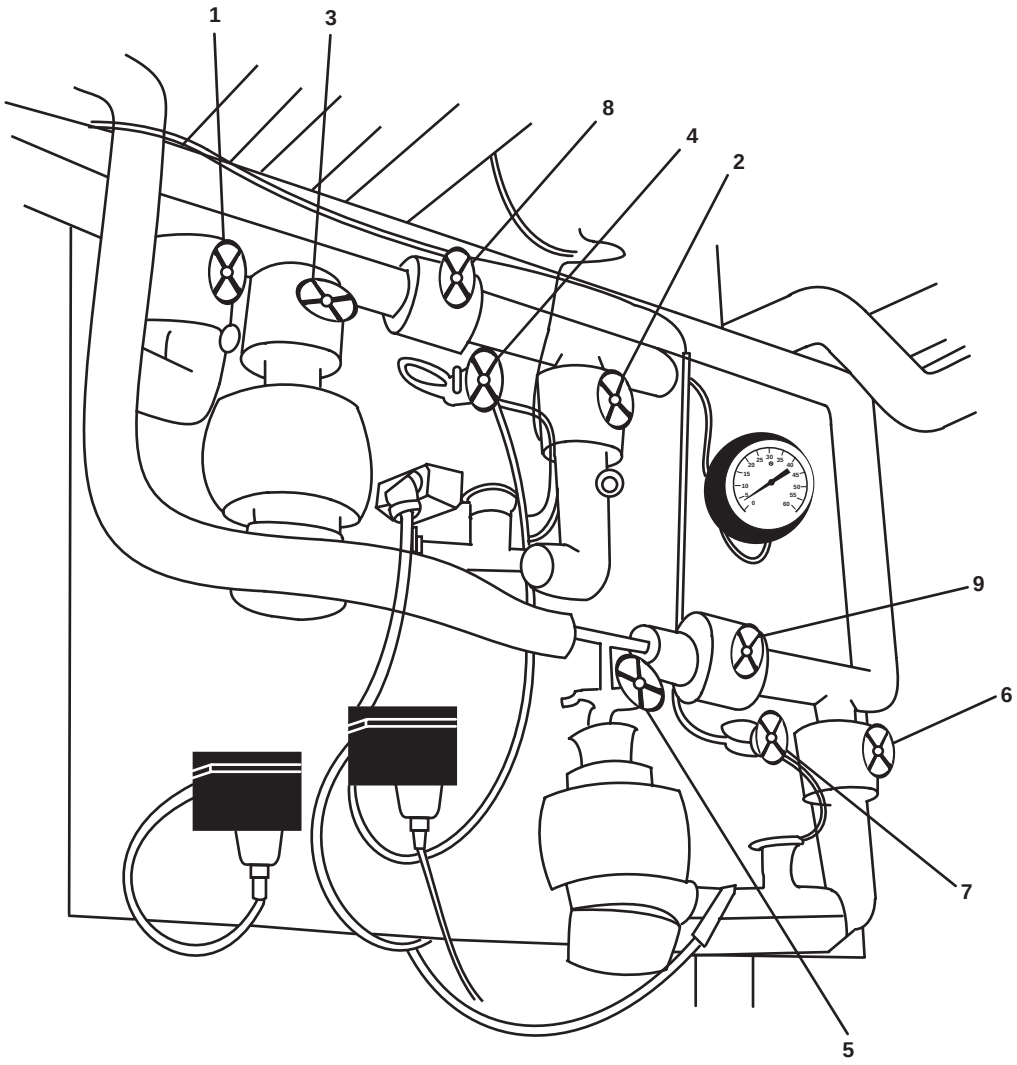


Figure 22. Reefer Refrigerant Piping Valves

8. Start the reefer condensers as follows:

NOTE

Before starting a condenser, the crankcase heater must be energized for at least 24 hours. Energizing the heater for this period of time ensures that the refrigerant is driven from the oil.

⚠ CAUTION

When starting the condenser, avoid rapid pump-down to ensure that oil is not carried off with refrigerant. If oil is pulled from sump, ensure that oil pressure is a minimum of 16 PSI (1.10 bar) above suction pressure. If the pressure difference becomes greater than 16 PSI (1.10 bar), stop the condenser and add oil temporarily. Added oil must be later removed when the sight glass oil level becomes too high.

a. OPEN the compressor suction valves (figure 19, item 7) one full turn.

b. Set the following switches to ON for the reefer condenser units:

(1) Main power disconnect switches (figure 19, item 11)

(2) Power ON/OFF switches (figure 19, item 12)

⚠ CAUTION

Open the COMPRESSOR SUCTION Valves slowly to prevent rapid pumping down of suction pressure side, which could cause oil foaming and result in pumping of oil from condenser crankcase. Damage to the condensers could result from lack of lubrication.

c. Slowly, continue to OPEN the compressor suction valves (figure 19, item 7) as suction pressure decreases.

d. Verify that the condenser water temperature gauges remain in the normal range.

e. Verify that the following gauges read in the normal operating range:

(1) Liquid line temperature gauge

(2) Suction pressure gauge

(3) Suction temperature gauge

(4) Discharge pressure gauge

(5) Oil pressure gauge

⚠ CAUTION

Oil pressure must be a minimum of 16 PSI (1.10 bar) above suction pressure, or damage to the condensers could result from lack of lubrication.

f. Observe the condenser operating for 5 minutes.

⚠ CAUTION

Liquid refrigerant returning to the condenser is indicated by a sudden drop in suction temperature and a rapid fluctuation in suction pressure. If the suction temperature and oil pressure do not stabilize, or if the condenser develops a knock, immediately stop condenser by placing power disconnect ON/OFF switch to OFF. Failure to comply could result in damage to equipment.

g. Slowly adjust the compressor suction valves (figure 19, item 7) until proper suction pressure of 2.3 to 2.4 PSI (0.16-0.17 bar) is indicated on the SUCTION gauges.

SHIP STORES REFRIGERATION SPLIT-PLANT OPERATION

NOTE

The following procedure provides instructions for shifting from two condensers online to one.

1. CLOSE the dehydrator inlet valve (figure 19, item 4) at reefer condensing unit being secured.
2. Allow the condenser being secured to operate until it is shut down automatically by the suction pressure switch.

WARNING

Injury to personnel could result if the discharge service valve is not opened before condenser is started.

3. CLOSE the compressor suction valve (figure 19, item 7) for the condensing unit being secured.
4. CLOSE the compressor discharge (figure 19, item 1) valve for the condensing unit being secured.
5. Set the following switches to OFF on the reefer condenser unit being secured:
   a. Main power disconnect switches (figure 19, item 11)
   b. Power ON/OFF switches (figure 19, item 12)
6. Secure the condenser cooling water piping system for the reefer condenser being secured as follows:
   a. For reefer condenser 1, CLOSE the following valves:
   (1) GS-38, RETR COND No.1 SPLY (figure 18, item 10), reefer condenser 1 supply
   (2) GS-48, WTR. RGLTR COV (figure 18, item 11), water regulator inlet
   b. For reefer condenser 2, CLOSE the following valves:
   (1) GS-39, RETR COND No.2 SPLY (figure 18, item 14), reefer condenser 2 supply
   (2) GS-49, WTR RGLTR COV (figure 18, item 15), water regulator inlet
7. Align the operating reefer condenser to the walk in freezer and chill box by completing the following actions.
   a. OPEN RFSS-13, LIQUID LINE CRSVR CO (figure 22, item 1), liquid line crossover cut out

b. Verify that the operating reefer condenser unit water temperature gauge remains in the NORMAL range.

c. Verify that the following gauges read in the NORMAL operating range for the operating reefer condenser unit:

(1) Liquid line temperature gauge

(2) Suction pressure gauge

(3) Suction temperature gauge

(4) Discharge pressure gauge

(5) Oil pressure gauge

⚠ CAUTION

Oil pressure must be a minimum of 16 PSI (1.10 bar) above suction pressure, or damage to the condensers could result from lack of lubrication.

d. Observe the condenser operating for 5 minutes.

⚠ CAUTION

Liquid refrigerant returning to the condenser is indicated by a sudden drop in suction temperature and a rapid fluctuation in suction pressure. If the suction temperature and oil pressure do not stabilize, or if the condenser develops a knock, immediately stop condenser by placing power disconnect ON/OFF switch in the OFF position.

e. Slowly adjust the compressor suction valve (figure 19, item 7) until proper suction pressure of 2.3 to 2.4 PSI (0.16-0.17 bar) is indicated on the suction gauge.

SHIFTING REFRIGERATION PLANTS

NOTE

The following procedure provides instructions for securing one reefer condenser and shifting to another.

1. CLOSE the dehydrator inlet valve (figure 19, item 4) at the reefer condensing unit being secured.

2. Allow the reefer condenser being secured to operate until it is shut down automatically by the suction pressure switch.

WARNING

Injury to personnel could will result if the discharge service valve is not opened before condenser is started.

3. CLOSE the compressor suction valve (figure 19, item 7) for the reefer condensing unit being secured.

4. CLOSE the compressor discharge valve (figure 19, item 1) for the reefer condensing unit being secured.

5. Set the following switches to OFF on the reefer condenser unit being secured:

a. Main power disconnect switches (figure 19, item 11)

b. Power ON/OFF switches (figure 19, item 12)

6. Start the standby reefer condenser unit by completing the following actions:

a. OPEN the compressor suction valve (figure 19, item 7) one full turn.

b. Set the following switches to the ON position:

(1) Main power disconnect switches (figure 19, item 11)

(2) Power ON/OFF switches (figure 19, item 12)

⚠ CAUTION

Open the compressor suction valves slowly to prevent rapid pumping down of suction pressure side which could cause oil foaming and result in pumping of oil from condenser crankcase. Damage to the condensers could result from lack of lubrication.

c. Slowly, continue to OPEN the compressor suction valves (figure 19, item 7) as suction pressure decreases.

d. Verify that the condenser water temperature gauge remain in the normal range.

e. Verify that the following gauges read in the normal operating range:

(1) Liquid line temperature gauge

(2) Suction pressure gauge

(3) Suction temperature gauge

(4) Discharge pressure gauge

(5) Oil pressure gauge

⚠ CAUTION

Oil pressure must be a minimum of 16 PSI (1.10 bar) above suction pressure, or damage to the condenser could result from lack of lubrication.

f. Observe condenser operation for 5 minutes.

⚠ CAUTION

Liquid refrigerant returning to the condenser is indicated by a sudden drop in suction temperature and a rapid fluctuation in suction pressure. If the suction temperature and oil pressure do not stabilize, or if the condenser develops a knock, immediately stop condenser by placing power disconnect ON/OFF switch in the OFF position.

g. Slowly adjust the compressor suction valve (figure 19, item 7) until proper suction pressure of 2.3 to 2.4 PSI (0.16-0.17 bar) is indicated on the suction gauge.

REFRIGERATION PULL DOWN MODE OPERATION

⚠ CAUTION

Align condenser cooling water piping system before starting the refrigeration plant, or damage to the plant can occur.

1. Align the condenser cooling water system by completing the following:

⚠ CAUTION

The condenser water cooling system must be purged of all air. Air in the cooling system will reduce heat exchange efficiency and can result in damage to the condenser.

a. For refrigeration condenser 1:

(1) OPEN GS-38, RETR COND No.1 SPLY (figure 18, item 10), reefer condenser 2 supply.

(2) OPEN GS-48, WTR. RGLTR COV (figure 18, item 11), water regulator inlet.

(3) Verify that GS-63 (figure 18, item 12), water regulator, is OPEN.

(4) Verify that GS-82, BYP WTR RGLTR (figure 18, item 13), water regulator bypass, is CLOSED.

b. For refrigeration condenser 2:

(1) OPEN GS-39, RETR COND No.2 SPLY (figure 18, item 14), reefer condenser 1 supply.

(2) OPEN GS-49, WTR RGLTR COV (figure 18, item 15), water regulator inlet.

(3) Verify that GS-64 (figure 18, item 16), water regulator, is OPEN.

(4) Verify that GS-71, BYP WTR RGLTR (figure 18, item 17), water regulator bypass is CLOSED.

c. Verify that GS-32, GS OVBD DISCH (figure 18, item 9), general service overboard discharge, is OPEN.

NOTE

Before starting a condenser, the crankcase heater must be energized for at least 24 hours. Energizing the heater for this period of time ensures that the refrigerant is driven from the oil.

⚠ CAUTION

When starting the condenser, avoid rapid pump-down to ensure oil is not carried off with refrigerant. If oil is pulled from sump, ensure that oil pressure is a minimum of 16 PSI (1.10 bar) above suction pressure. If the pressure difference becomes greater than 16 PSI (1.10 bar), stop the condenser and add oil temporarily. Added oil must be later removed when the sight glass oil level becomes too high.

2. Align condenser unit piping as follows by:

a. OPEN the following valves:

(1) Compressor discharge valve (figure 19, item 1)

(2) Condenser outlet valve (figure 19, item 2)

(3) Dehydrator outlet valve (figure 19, item 3)

(4) Dehydrator inlet valve (figure 19, item 4)

(5) Relief valve bypass valve (figure 19, item 5)

(6) Water regulator valve actuating line valve (figure 19, item 6)

b. CLOSE the following valves:

(1) Compressor suction valve (figure 19, item 7)

(2) Dehydrator bypass valve (figure 19, item 8)

(3) Purge valve (figure 19, item 9)

(4) Charge and drain valve (figure 19, item 10)

3. Align refrigerant piping system by placing the following valves in the CLOSED position:

⚠ CAUTION

To prevent oil return problems and possible damage to condenser, do not operate both condensing units at the same time with RFSS-13, LIQUID LINE CRSVR CO and RFSS-20, SUCT LINE CRSVR COV valves open.

a. RFSS-13, LIQUID LINE CRSVR CO (figure 22, item 1), liquid line crossover cut out

b. RFSS-20, SUCT LINE CRSVR COV (figure 22, item 2), suction line crossover cut out

4. Start the standby reefer condenser unit by completing the following actions:

a. OPEN the compressor suction valve (figure 19, item 7) one full turn.

b. Set the following switches to the ON position:

(1) Main power disconnect switch (figure 19, item 11)

(2) Power ON/OFF switch (figure 19, item 12)

⚠ CAUTION

Open the compressor suction valves slowly to prevent rapid pumping down of suction pressure side which could cause oil foaming and result in pumping of oil from condenser crankcase. Damage to the condensers could result from lack of lubrication.

c. Slowly OPEN the compressor suction valve (figure 19, item 7) as suction pressure decreases.

d. Verify that the condenser water temperature gauge remain in the NORMAL range.

e. Verify that the following gauges read in the normal operating range:

(1) Liquid line temperature gauge

(2) Suction pressure gauge

(3) Suction temperature gauge

(4) Discharge pressure gauge

(5) Oil pressure gauge

⚠ CAUTION

Oil pressure must be a minimum of 16 PSI (1.10 bar) above suction pressure, or damage to the condenser could result from lack of lubrication.

f. Observe the condenser operating for 5 minutes.

⚠ CAUTION

Liquid refrigerant returning to the condenser is indicated by a sudden drop in suction temperature and a rapid fluctuation in suction pressure. If the suction temperature and oil pressure do not stabilize, or if the condenser develops a knock, immediately stop condenser by placing power disconnect ON/OFF switch in the OFF position.

g. Slowly adjust the compressor suction valves for both condensers (figure 19, item 7) until proper suction pressure of 2.3 to 2.4 PSI (0.16-0.17 bar) is indicated on the SUCTION gauges.

PILOTHOUSE ROOFTOP AIR CONDITIONING UNIT OPERATION

INITIAL STARTUP

1. Set to ON the PILOTHOUSE OVERHEAD A/C UNIT PORT circuit breaker (figure 23, item 1) and the PILOTHOUSE OVERHEAD A/C UNIT STARBOARD circuit breaker (figure 23, item 2) in the 220V air conditioning distribution panel (figure 23, item 3).

2. OPEN the cover (figure 24, item 1) of the thermostat (figure 24, item 2).

NOTE

The thermostat does not require batteries. If there is a power interruption, the internal memory stores the programs for an unlimited time and the clock continues to run for at least 72 hours.

3. Verify/set the current day by pressing the CHANGE DAY BUTTON (figure 24, item 3) on the thermostat (figure 24, item 2) until the desired day (figure 24, item 4) is displayed on the Liquid Crystal Display (LCD) (figure 24, item 5).

4. Verify/set the current time by pressing the SET TIME/TEMP button (figure 24, item 6). The word TIME (figure 24, item 7) will flash on the LCD (figure 24, item 5).

5. Press the UP button (figure 24, item 8) or the DOWN button (figure 24, item 9) on the thermostat (figure 24, item 2) until the desired time (figure 24, item 10) and AM or PM (figure 24, item 11) is displayed on the LCD (figure 24, item 5).

NOTE

The word TIME will stop flashing after 15 seconds if the END button is not pushed once the desired time has been set.

6. Once the desired time has been set/verified, press the END button (figure 24, item 12) on the thermostat (figure 24, item 2).

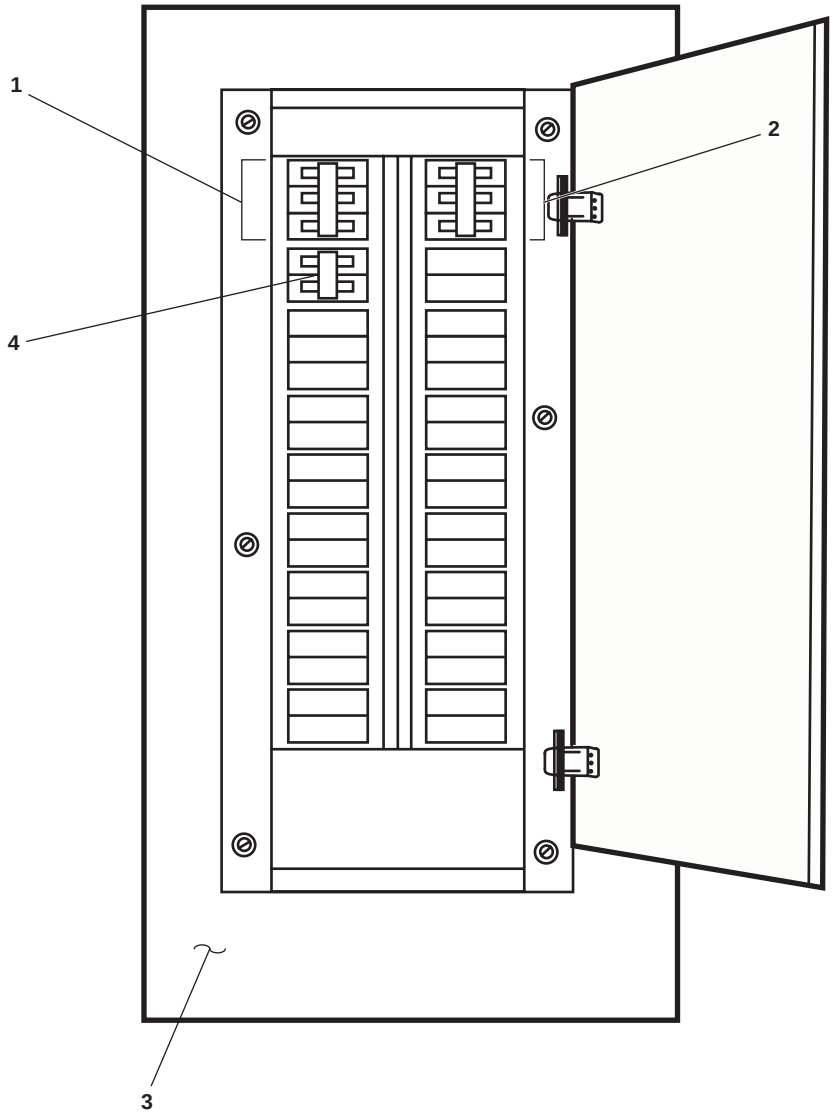


Figure 23. 220V Air Conditioning Distribution Panel

NOTE

After pressing the MODE button on the thermostat, OFF, HEAT, COOL, and EHEAT will rotate and be displayed on the LCD. The EHEAT option is not available for use with the pilothouse rooftop air conditioning units.

7. Verify/set the mode of operation by pressing the MODE button (figure 24, item 13) on the thermostat (figure 24, item 2). The words OFF, HEAT, COOL, and AUTO (figure 24, item 17) will rotate in the MODE display (figure 24, item 14).

8. Press the MODE button (figure 24, item 13) until the desired mode is displayed in the MODE display (figure 24, item 14).

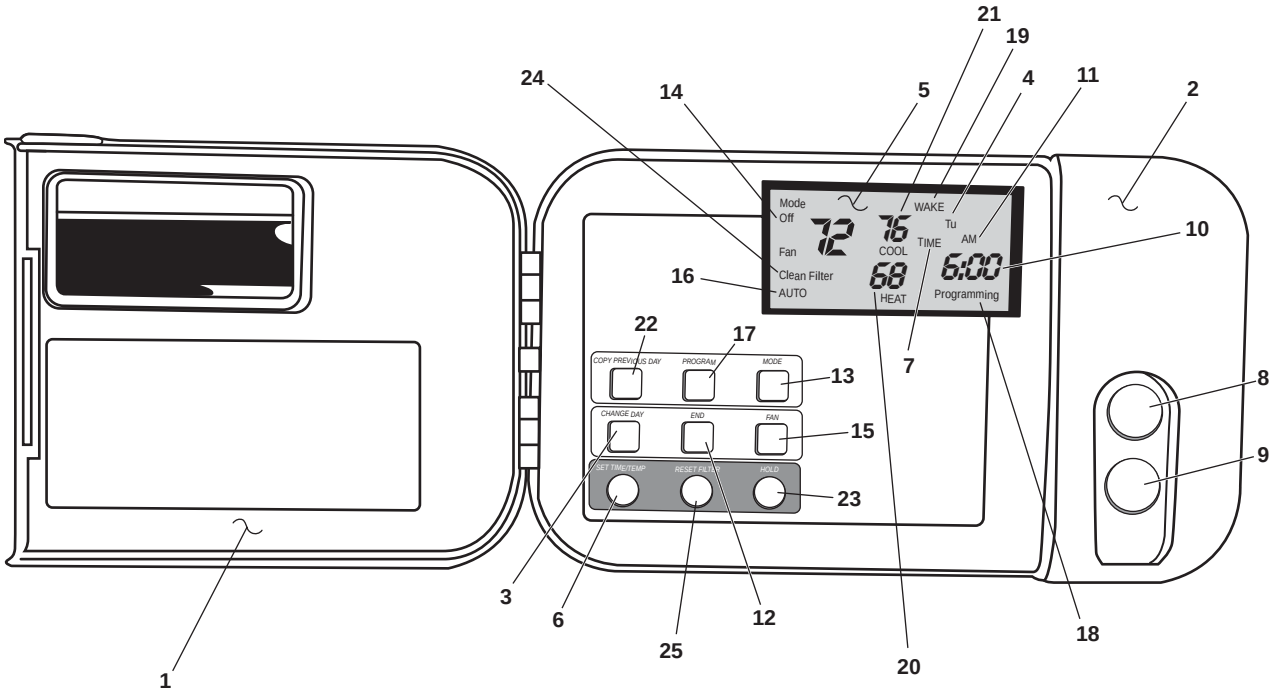


Figure 24. Pilothouse Rooftop Air Conditioning Thermostat

NOTE

When the fan is in the AUTO mode, the fan only operates as required to maintain the set temperature. When the fan is in the ON mode, the fan will operate continuously regardless of the temperature setting.

9. Press the FAN button (figure 24, item 15) on the thermostat (figure 24, item 2) to move the fan setting between ON (figure 24, item 19) and AUTO (figure 24, item 17) on the FAN display (figure 24, item 16).

10. CLOSE the cover (figure 24, item 1) of the thermostat (figure 24, item 2).

THERMOSTAT OPTIONS

SETTING THE COMFORT SCHEDULE

1. OPEN the cover (figure 24, item 1) of the thermostat (figure 24, item 2).

NOTE

The programming process always starts at the current time and day. If it is desired to start the program at a different day or time period, press the program button until the desired time period (WAKE, DAY, EVE, or SLEEP) is displayed on the Liquid Crystal Display (LCD). Each day of the week is divided into four time periods (WAKE, DAY, EVE, and SLEEP). Programming should be set for each time period. During the programming process if the buttons are not touched or no entries are made within a three minute window, the program mode will automatically shut off. All programmed information will be saved.

2. Press the program button (figure 24, item 17) on the thermostat (figure 24, item 2). The word PROGRAMMING will be displayed in the PROGRAMMING display (figure 24, item 18). The word TIME (figure 24, item 7) will flash. The word WAKE, DAY, EVE, or SLEEP will be displayed in the STATUS display (figure 24, item 19). The current day will be displayed (figure 24, item 4) with a two letter abbreviation.

3. Press the UP button (figure 24, item 8) or DOWN button (figure 24, item 9) on the thermostat (figure 24, item 2) until the desired time (figure 24, item 10) is displayed on the LCD (figure 24, item 5) for the time period displayed in the STATUS display (figure 24, item 19).

NOTE

Pressing the SET TIME/TEMP button allows the operator to select heat, cool, and time settings.

4. Press the SET TIME/TEMP button (figure 24, item 6) on the thermostat (figure 24, item 2). The word HEAT will flash on the HEAT display (figure 24, item 20).

5. Press the UP button (figure 24, item 8) or the DOWN button (figure 24, item 9) on the thermostat (figure 24, item 2) until the desired temperature (figure 35, item 7) is displayed on the HEAT display (figure 24, item 20).

NOTE

The thermostat requires that there be a two degree temperature difference between the cooling and heating temperatures when programming the thermostat.

6. Press the SET TIME/TEMP button (figure 24, item 6) on the thermostat (figure 24, item 2). The word COOL will flash on the COOL display (figure 24, item 21).

7. Press the UP button (figure 24, item 8) or the DOWN button (figure 24, item 9) on the thermostat (figure 24, item 2) until the desired temperature is displayed on the COOL display (figure 24, item 21).

8. Press the PROGRAM button (figure 24, item 17) on the thermostat (figure 24, item 2) to advance to the next desired time period (WAKE, DAY, EVE, or SLEEP).

9. Perform steps 2-7 of this procedure to program each time period (WAKE, DAY, EVE, or SLEEP) or perform the Copying A Daily Schedule procedure in this work package.

10. Press the END button (figure 24, item 12) on the thermostat (figure 24, item 2) once all time periods (WAKE, DAY, EVE, and SLEEP) have been programmed.

11. CLOSE the cover (figure 24, item 1) of the thermostat (figure 24, item 2).

COPYING A DAILY SCHEDULE

1. Perform the Initial Startup procedure in this work package.

2. Perform steps 1-7 of Setting The Comfort Schedule procedure in this work package.

3. Press the CHANGE DAY button (figure 24, item 3) in the thermostat (figure 24, item 2).

4. Press the COPY THE PREVIOUS DAY button (figure 24, item 22) on the thermostat (figure 24, item 2).

5. Perform steps 3 and 4 for each day to be copied.

6. CLOSE the cover (figure 24, item 1) on the thermostat (figure 24, item 2).

OVERRIDING THE COMFORT SCHEDULE

1. Perform the Initial Startup procedure in this work package.

2. Press the HOLD button (figure 24, item 23) on the thermostat (figure 24, item 2). The word HOLD will be displayed above the COOL display (figure 24, item 21). The comfort schedule is disabled until the HOLD button is pressed again.

3. To return to the comfort schedule press the HOLD Button (figure 24, item 23) on the thermostat (figure 24, item 2).

CLEAN FILTER

1. Perform the Initial Startup procedure in this work package.

2. The words CLEAN FILTER (figure 24, item 24) are displayed on the LCD (figure 24, item 5) after 800 hours of operation to remind the crewmembers to service the filter. Refer to TM 55-1925-224-24&P for filter servicing instructions.

3. OPEN the cover (figure 24, item 1) of the thermostat (figure 24, item 2).

3. After the filter has been serviced, press the RESET FILTER button (figure 24, item 25) on the thermostat (figure 24, item 2).

4. CLOSE the cover (figure 24, item 1) of the thermostat (figure 38, item 2).

INITIAL STARTUP

1. Set to ON the OUTDOOR CONDENSING UNIT FOR RADIO ROOM circuit breaker (figure 23, item 4) in the 220V air conditioning distribution panel (figure 23, item 3).

2. OPEN the cover (figure 25, item 1) on the radio room rooftop air conditioning fan unit (figure 25, item 2).

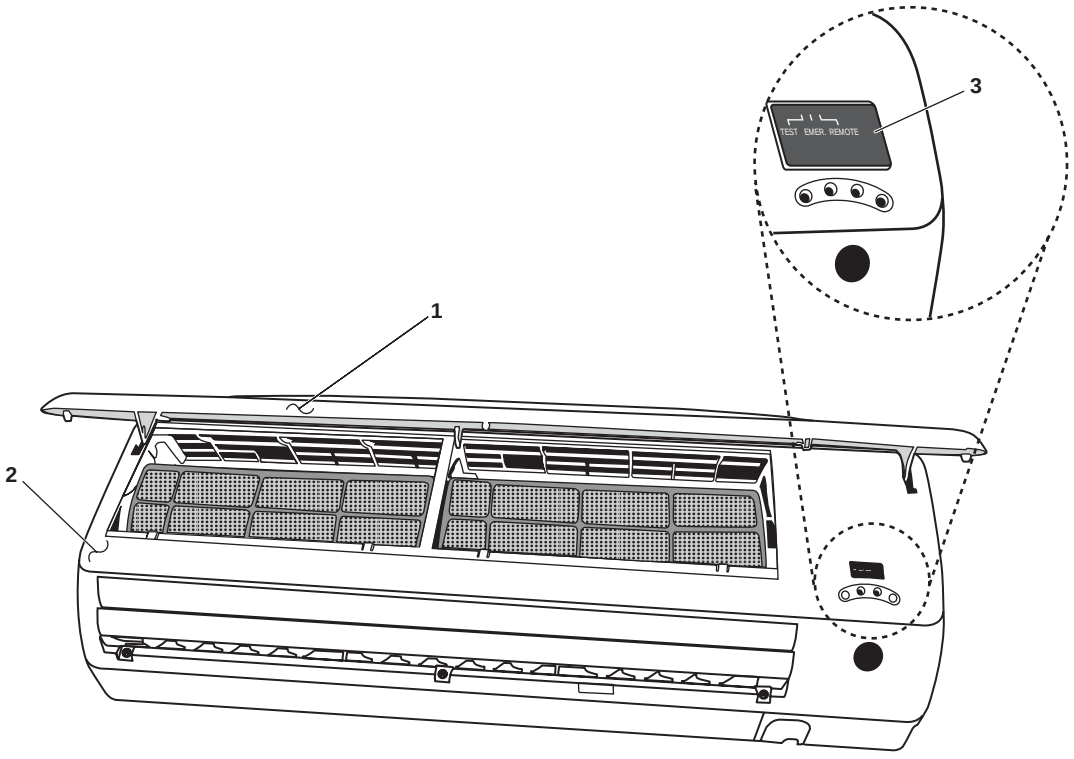


Figure 25. Radio Room Rooftop Air Conditioning Fan Unit (Open)

NOTE

Do not place the fan unit in the test position. The test position is only used after initial installation.

3. Set the TEST EMER. REMOTE switch (figure 25, item 3) on the fan unit (figure 25, item 2) to the REMOTE position.

4. CLOSE the cover (figure 25, item 1) on the radio room rooftop air conditioning fan unit (figure 25, item 2).

5. Remove the battery cover (figure 26, item 1) from the rear of the radio room rooftop air conditioning unit remote (figure 26, item 2).

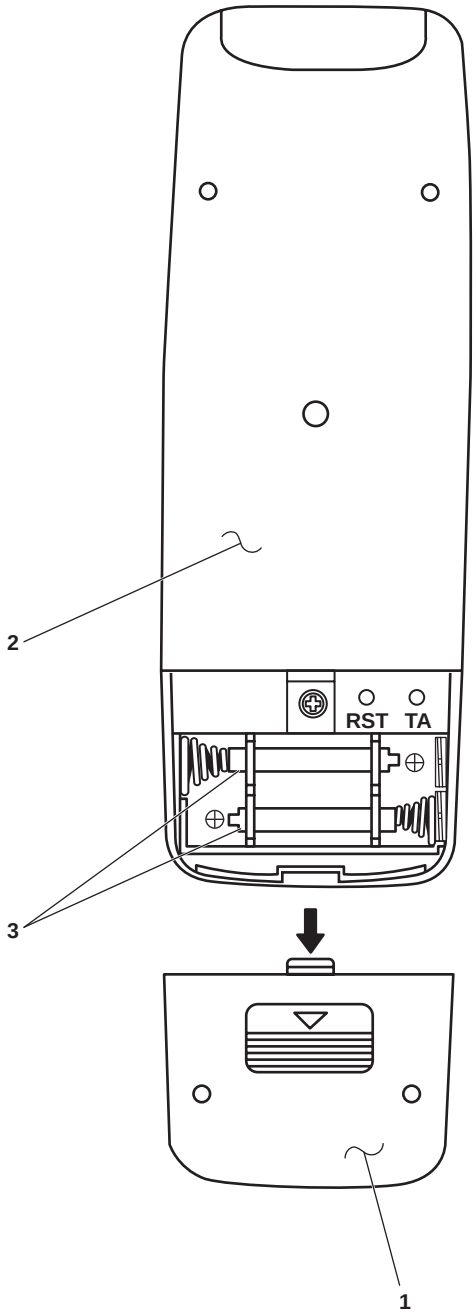


Figure 26. Radio Room Rooftop Air Conditioning Unit Remote Battery Installation

6. Install/verify that two 1.5 volt dc AAA alkaline batteries (figure 26, item 3) are in the radio room rooftop air conditioning unit remote (figure 26, item 2).

7. Install the battery cover (figure 26, item 1) on the rear of the radio room rooftop air conditioning unit remote (figure 26, item 2).

8. OPEN the cover (figure 27, item 1) on the front of the radio room rooftop air conditioning unit remote (figure 27, item 2).

9. Press the RST button (figure 27, item 3) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

10. Press the TA button (figure 27, item 4) on the radio room rooftop air conditioning unit remote (figure 27, item 2). 6:00 AM (figure 27, item 5) will be displayed on the Liquid Crystal Display (LCD) (figure 27, item 6).

11. Press the HOUR button (figure 27, item 7) on the radio room rooftop air conditioning unit remote (figure 27, item 2) to set the current hour.

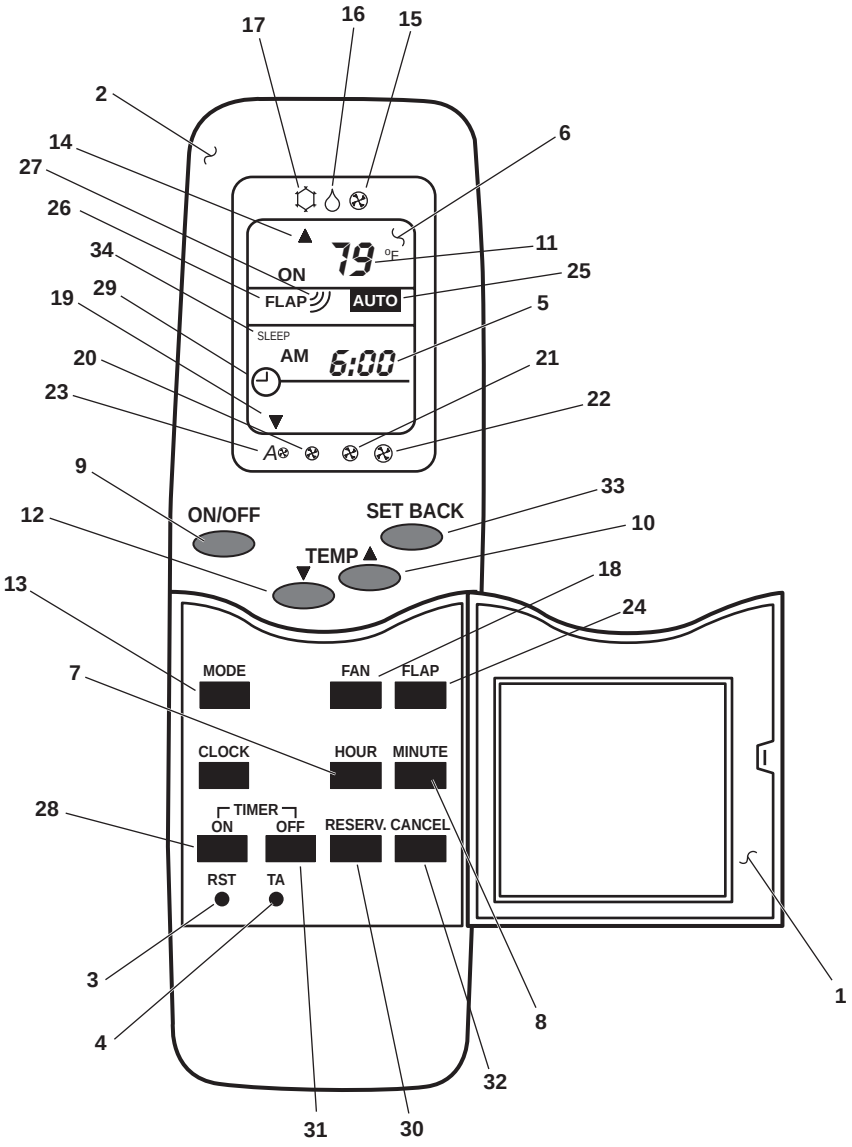


Figure 27. Radio Room Rooftop Air Conditioning Unit Remote Operation

12. Press the MINUTE button (figure 27, item 8) on the radio room rooftop air conditioning unit remote (figure 27, item 2) to set the current minutes.

13. Press the TA button (figure 27, item 4) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

14. Press the ON/OFF button (figure 27, item 9) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

15. Verify that the green UNIT ON INDICATOR (figure 28, item 1) is illuminated on the radio room rooftop air conditioning unit (figure 28, item 2) and that it is operating.

16. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

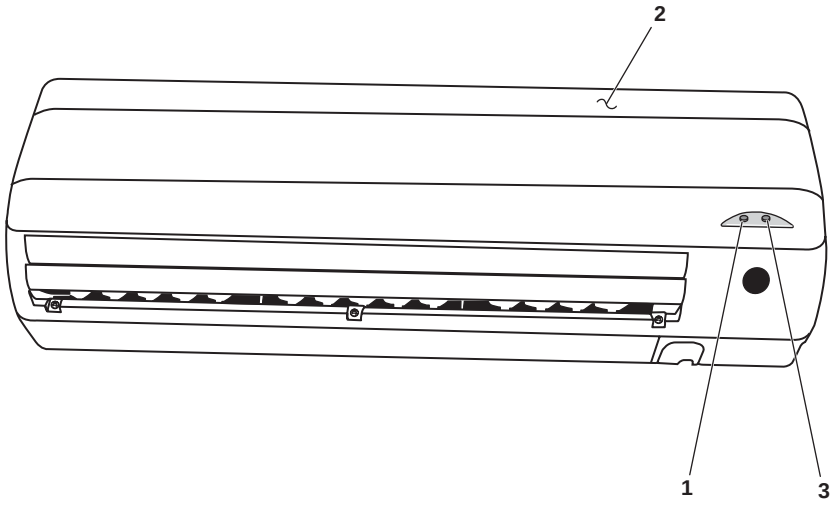


Figure 28. Radio Room Rooftop Air Conditioning Unit (Closed)

RADIO ROOM ROOFTOP AIR CONDITIONING UNIT REMOTE OPTIONS

TEMPERATURE SETTING

1. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

NOTE

The radio room rooftop air conditioning unit is a cool only unit. Increasing the temperature setting only indicates what temperature the unit will cool to.

2. Press the UP arrow button (figure 27, item 10) on the radio room rooftop air conditioning unit remote (figure 27, item 2) to increase the temperature setting (figure 27, item 11) on the LCD (figure 27, item 6).

3. Press the DOWN arrow button (figure 27, item 12) on the radio room rooftop air conditioning unit remote (figure 27, item 2) to decrease the temperature setting (figure 27, item 11) on the LCD (figure 27, item 6).

4. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

OPERATION MODE

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

NOTE

In the fan mode, only the fan operates. Cooling is not available.

3. To select the fan mode, press the MODE button (figure 27, item 13) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the arrow (figure 27, item 14) on the LCD (figure 27, item 6) is aligned with the fan symbol (figure 27, item 15) on the radio room rooftop air conditioning unit remote.

NOTE

The dry mode is the preferred operation mode. The radio room rooftop air conditioning unit is controlled automatically by a microcomputer according to room temperature.

4. To select the dry mode, press the MODE button (figure 27, item 13) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the arrow (figure 27, item 14) on the LCD (figure 27, item 6) is aligned with the water droplet symbol (figure 27, item 16) on the radio room rooftop air conditioning unit remote.

5. To select the cool mode, press the MODE button (figure 27, item 13) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the arrow (figure 27, item 14) on the LCD (figure 27, item 6) is aligned with the snow flake symbol (figure 27, item 17) on the radio room rooftop air conditioning unit remote.

6. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

FAN SPEED

NOTE

The fan can only be adjusted in the fan or cool mode of operation.

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. To select the LOW fan speed setting, press the FAN button (figure 27, item 18) until the arrow (figure 27, item 19) on the LCD (figure 27, item 6) is aligned with the small sized fan symbol (figure 27, item 19) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

4. To select the MEDIUM fan speed setting, press the FAN button (figure 27, item 18) until the arrow (figure 27, item 19) on the LCD (figure 27, item 6) is aligned with the medium sized fan symbol (figure 27, item 21) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

5. To select the HIGH fan speed setting, press the FAN button (figure 27, item 18) until the arrow (figure 27, item 19) on the LCD (figure 27, item 6) is aligned with the large sized fan symbol (figure 27, item 22) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

NOTE

If the AUTO fan speed mode is selected, the fan speed will be controlled automatically by the microcomputer of the radio room rooftop air conditioning unit.

6. To select the AUTO fan speed setting, press the FAN button (figure 27, item 18) until the arrow (figure 27, item 19) on the LCD (figure 27, item 6) is aligned with the A and smallest sized fan symbol (figure 27, item 23) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

7. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

FLAP SETTING

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. To select the AUTO flap setting, press the FLAP button (figure 27, item 24) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the word AUTO (figure 27, item 25) is displayed on the LCD (figure 27, item 6) next to the word FLAP (figure 27, item 26) and the FLAP symbol (figure 27, item 27).

4. To select the SWING flap setting, press the FLAP button (figure 27, item 24) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the word SWING replaces the word AUTO (figure 27, item 25) on the LCD (figure 27, item 6) next to the word FLAP (figure 27, item 26) and the FLAP symbol (figure 27, item 27).

5. To select a desired flap setting other than AUTO or SWING, press the FLAP button (figure 27, item 24) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the FLAP symbol (figure 27, item 27) on the LCD (figure 27, item 6) displays the desired setting.

6. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

ON TIMER OPERATION

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. To set the fan unit (figure 28, item 2) to start at a specific time setting, press the ON TIMER button (figure 27, item 28) on the radio room rooftop air conditioning unit remote (figure 27, item 2). The current on timer setting (figure 27, item 5) and temperature setting (figure 27, item 11) will be displayed on the LCD (figure 27, item 6). The ON TIMER symbol (figure 27, item 29) will start flashing.

NOTE

The ON TIMER symbol must be flashing to set the hour and minute start time. If the ON TIMER symbol stops flashing, press the ON TIMER button.

4. Press the HOUR button (figure 27, item 7) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the desired start hour (figure 27, item 5) is displayed on the LCD (figure 27, item 6).

5. Press the MINUTE button (figure 27, item 8) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the desired start minute (figure 27, item 4) is displayed on the LCD (figure 27, item 6).

6. Point the radio room rooftop air conditioning unit remote (figure 27, item 2) at the fan unit (figure 28, item 2) and press the RESERV. button (figure 27, item 30) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until a beep is heard.

7. Verify that the yellow TIMER LAMP (figure 28, item 3) is illuminated on the fan unit (figure 28, item 2).

8. Perform the Mode Operation procedure in this work package.

9. Perform the Fan Speed procedure in this work package.

10. Perform the Flap Setting procedure in this work package.

11. Perform the Temperature Setting procedure in this work package.

12. Press the ON/OFF button (figure 27, item 9) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

13. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

OFF TIMER OPERATION

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. To set the fan unit (figure 28, item 2) to turn off at a specific time setting, press the OFF TIMER button (figure 27, item 31) on the radio room rooftop air conditioning unit remote (figure 27, item 2). The current OFF timer setting (figure 27, item 5) and temperature setting (figure 27, item 11) will be displayed on the LCD (figure 27, item 6). The OFF TIMER symbol (figure 27, item 29) will start flashing.

NOTE

The OFF TIMER symbol must be flashing to set the hour and minute stop time. If the OFF TIMER symbol stops flashing, press the OFF TIMER button.

4. Press the HOUR button (figure 27, item 8) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the desired start hour (figure 27, item 5) is displayed on the LCD (figure 27, item 6).

5. Press the MINUTE button (figure 27, item 8) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until the desired start minute (figure 27, item 5) is displayed on the LCD (figure 27, item 6).

6. Point the radio room rooftop air conditioning unit remote (figure 27, item 2) at the fan unit (figure 28, item 2) and press the RESERV. button (figure 27, item 30) on the radio room rooftop air conditioning unit remote (figure 27, item 2) until a beep is heard.

7. Verify that the yellow TIMER LAMP (figure 28, item 3) is illuminated on the fan unit (figure 28, item 2).

8. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

COMBINATION OF ON AND OFF TIMER

1. Perform the ON Timer procedure in this work package.

2. Perform the OFF Timer procedure in this work package.

COMBINATION OF OFF AND ON TIMER

1. Perform the OFF Timer procedure in this work package.

2. Perform the ON Timer procedure in this work package.

CANCELLATION OF THE ON TIMER

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. Press the ON TIMER button (figure 27, item 28) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

4. Point the radio room rooftop air conditioning unit remote (figure 27, item 2) at the fan unit (figure 28, item 2) and press the CANCEL button (figure 27, item 32) on the radio room rooftop air conditioning unit remote.

5. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

CANCELLATION OF THE OFF TIMER

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. Press the OFF TIMER button (figure 27, item 31) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

4. Point the radio room rooftop air conditioning unit remote (figure 27, item 2) at the fan unit (figure 28, item 2) and press the CANCEL button (figure 27, item 32) on the radio room rooftop air conditioning unit remote.

5. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

SET BACK (SLEEP) TIMER

1. Perform the Initial Startup procedure in this work package.

2. OPEN the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

3. Press the SET BACK button (figure 27, item 33) on the radio room rooftop air conditioning unit remote (figure 27, item 2). The word SLEEP (figure 27, item 34) will be flashing on the LCD (figure 27, item 6). Continue to press the SET Back button until the desired sleep time (1hr, 2hr, 3hr, 7hr, 9hr or CANCEL) (figure 27, item 5) is displayed on the LCD.

4. CLOSE the cover (figure 27, item 1) on the radio room rooftop air conditioning unit remote (figure 27, item 2).

PILOTHOUSE FRESH AIR FAN OPERATION

1. Set to ON the PILOTHOUSE FRESH AIR 2 SPEED SUPPLY FANS (figure 9, item 2) and PILOTHOUSE FRESH AIR INTAKE DAMPERS (figure 9, item 3) circuit breakers in 120V distribution panel No. 2.

2. Turn ON the FRESH AIR SUPPLY switch (figure 29, item 1).

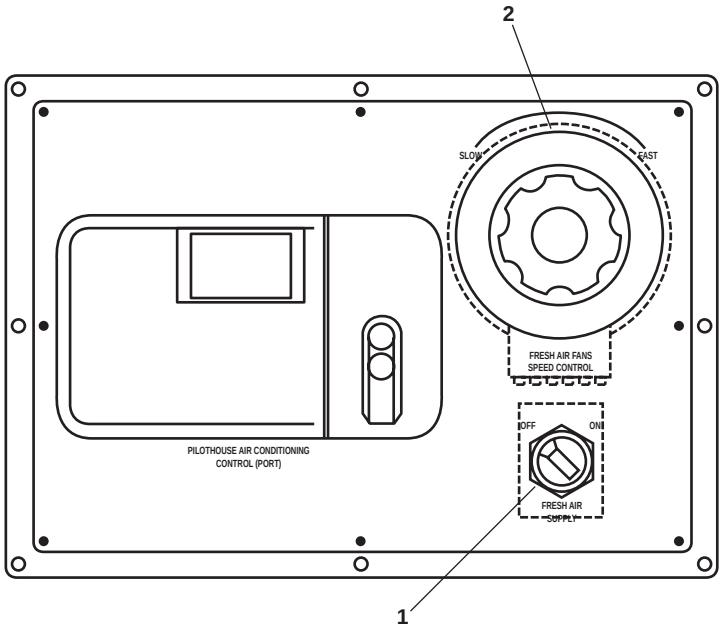


Figure 29. Pilothouse Fresh Air Fan Control Panel

3. To adjust the fan speed, turn the FRESH AIR FANS SPEED CONTROL knob (figure 29, item 2). Clockwise rotation will INCREASE fan speed, counterclockwise rotation will DECREASE fan speed.

4. To secure the pilothouse fresh air fans, set the FRESH AIR SUPPLY switch (figure 29, item 1) to OFF.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
INTERCOMMUNICATION AND SOUND POWERED TELEPHONE SYSTEMS

INITIAL SETUP:

Personnel Required:
One Crewmember

SOUND POWERED TELEPHONE SYSTEM

NOTE

There are four models of sound powered telephones used on the Large Tug (LT), and all operate with the same overall method of operation as described in this work package.

1. To answer a call, pick up the handset (figure 1, item 1), press and hold the pushbutton (figure 1, item 2), and talk like it is a regular telephone.

2. To place a call:

   a. Turn the selector knob (figure 1, item 3) to the desired station number.

   b. Turn the magneto handle (figure 1, item 4) clockwise three to four times to signal the station being called.

NOTE

The handset pushbutton (figure 1, item 2) must be pressed to talk or listen.

   c. Press the handset pushbutton (figure 1, item 2) to communicate with the station you called.

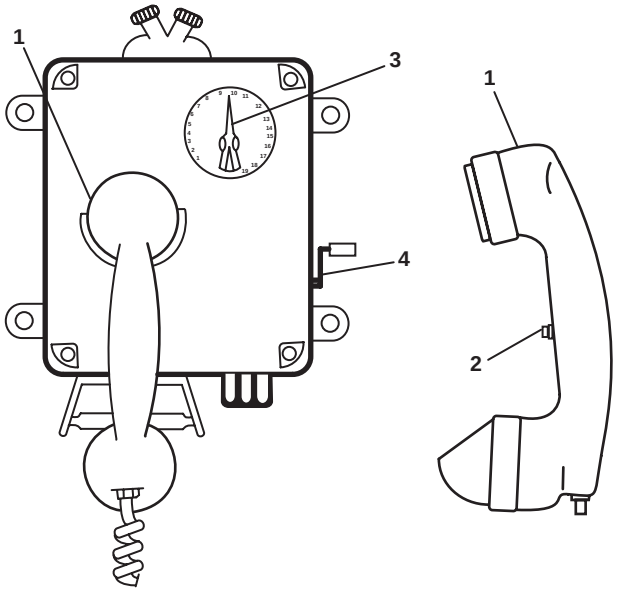


Figure 1. Typical Sound Powered Handset

3. To communicate with a headset:

   a. Remove the headset from the storage box.

   b. Unhook one end of the strap (figure 2, item 1) from the chest plate and unroll the cord (figure 2, item 2).

   c. Remove the jack cover from the phone jack box.

   d. Insert the jack plug (Figure 2, item 3) into the socket.

   e. Place the strap around neck and connect the hook to the chest plate (figure 2, item 4).

   f. Place the headset (figure 2, item 5) on the head with the ear cups covering the ears.

   g. Adjust the strap so that the mouthpiece (figure 2, item 6) is approximately 3 inches in front of the mouth and 2 inches below the lips.

NOTE

The headset will receive the other party even when the button is pressed.

4. Press and hold the button (figure 2, item 7) on top of the mouthpiece to speak to another station.

5. When authorized to discontinue operation, remove the headset (figure 2, item 5) from around the neck and loop it over the mouthpiece and around the support bracket (figure 2, item 8).

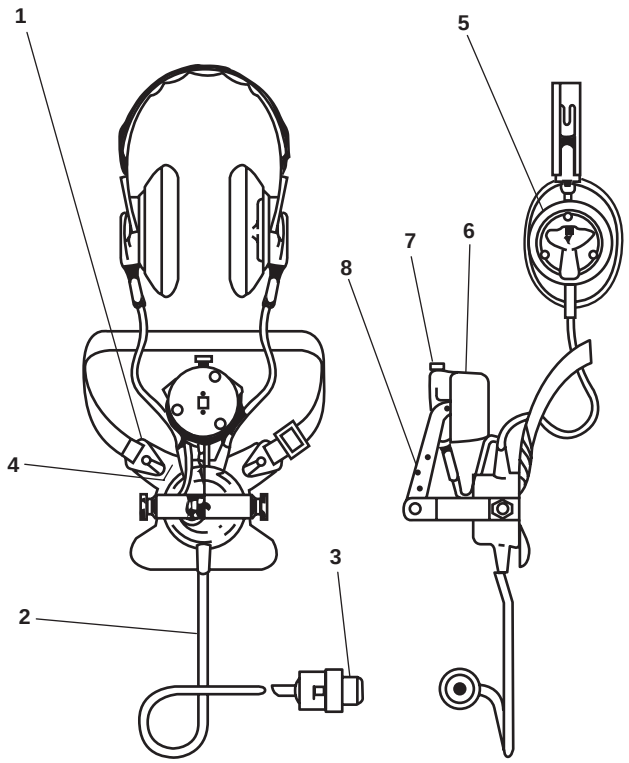


Figure 2. Typical Sound Powered Headset

6. Disconnect the plug (figure 2, item 3) from the telephone jack.

7. Replace the jack cover on the telephone box.

8. Roll up the phone cord (figure 2, item 2), loop it over the mouthpiece, and place it on the support bracket.

9. Disconnect one end of the strap from the chest plate, remove it from around the neck, wrap it around the support bracket, and reconnect it to the chest plate to secure the headset and cord.

10. Replace the headset in its storage box and secure the storage box cover.

INTERCOM SYSTEM

1. In the Emergency Diesel Generator (EDG) room, at the 120V emergency load center distribution panel, verify that the PILOTHOUSE EMERGENCY DISTRIBUTION PANEL. circuit breaker (figure 3, item 1) is set to ON.

2. At the 120V pilothouse emergency distribution panel, set the INTERCOM SYSTEM. circuit breaker (figure 4, item 1) to ON.

3. To answer a call:

   a. Turn DOWN and hold the intercom control lever (figure 5, item 1) in the PRESS TO TALK position.

   b. Speak directly into the wire mesh speaker (figure 5, item 2).

   c. Acknowledge the incoming call by giving your station name, then release the intercom control lever (figure 5, item 1).

   d. Each time you answer a call or pass information, you must turn down and hold the intercom control lever (figure 5, item 1) in the PRESS TO TALK position.

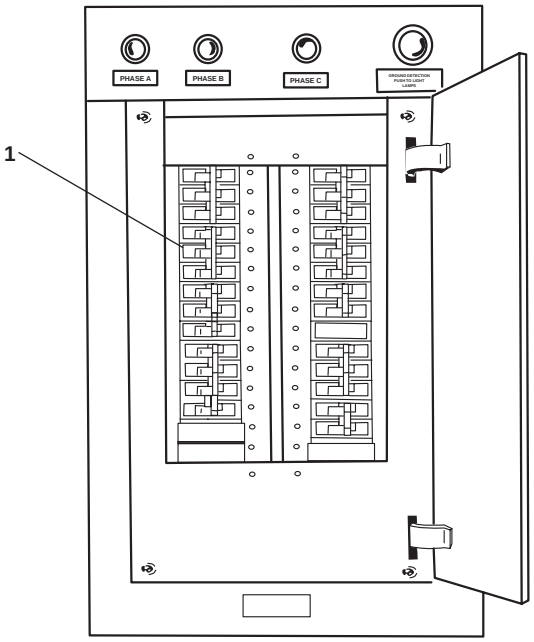


Figure 3. 120V Emergency Load Center Distribution Panel

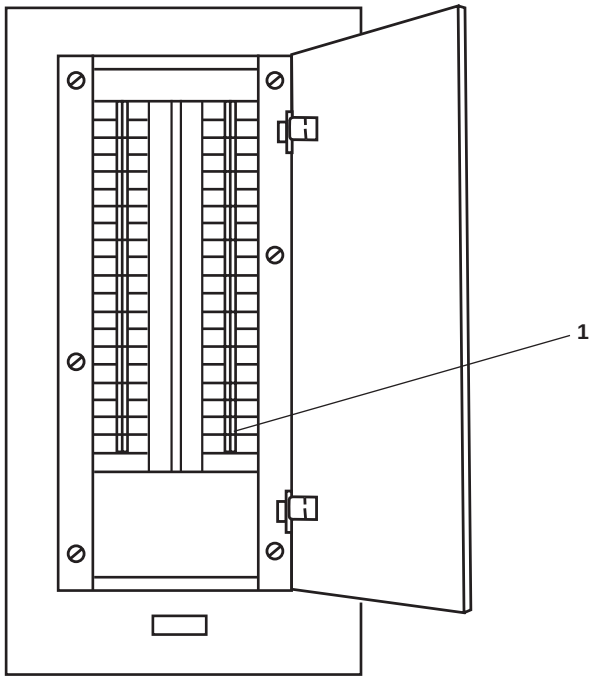


Figure 4. 120V Pilothouse Emergency Distribution Panel

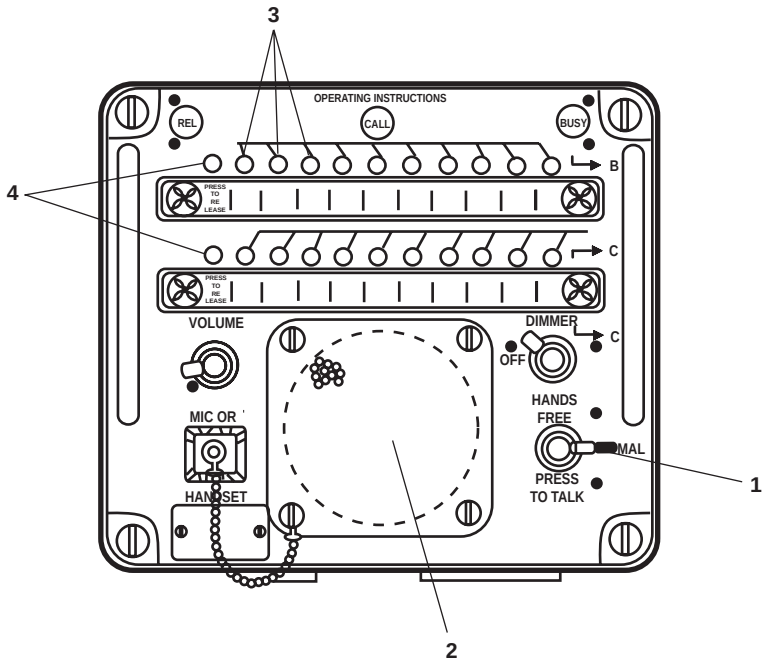


Figure 5. Intercom Panel

4. To place a call:

    a. Press a STATION pushbutton (figure 5, item 3).

    b. Turn DOWN and hold the intercom control lever (figure 5, item 1) in the PRESS TO TALK position.

    c. Speak the station name you are calling directly into the wire mesh speaker (figure 5, item 2).

    d. Release the intercom control lever to hear the answer from the station you called.

    e. When the call is complete, press the PRESS TO RELEASE pushbutton (figure 5, item 4).

5. To make a general announcement:

    a. Press all the station pushbuttons (figure 5, item 3).

    b. Turn UP the intercom control lever (figure 5, item 1) and lock it into the HANDS FREE position.

    c. Speak directly into the wire mesh speaker (figure 5, item 2) to make the announcement.

    d. When the announcement is completed, turn down intercom control lever (figure 5, item 1) and allow it to return to the NORMAL position.

    e. Press the PRESS TO RELEASE pushbutton (figure 5, item 4).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
ENGINE ORDER TELEGRAPH, GENERAL ALARM, DOOR ALARM, AND FREEZER ALARM SYSTEMS

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

GENERAL

This work package contains the following procedures:

1. Engine order telegraph operation
2. General alarm system operation
3. Door alarm and freezer alarm system operation

ENGINE ORDER TELEGRAPH OPERATION

1. At 120V emergency distribution panel No. 1, set the E.O.T. SYSTEM circuit breaker (figure 1, item 1) to ON.
2. In the pilothouse, order the desired speed and direction for each engine by rotating EOT selector (figure 2, item 1) to the desired position.

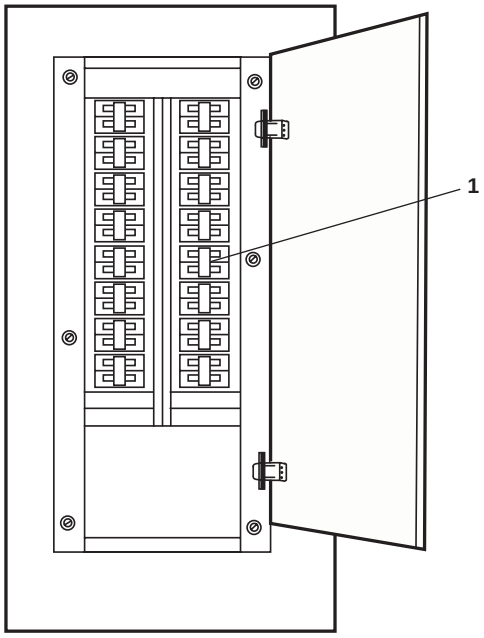


Figure 1. 120V Emergency Distribution Panel No. 1

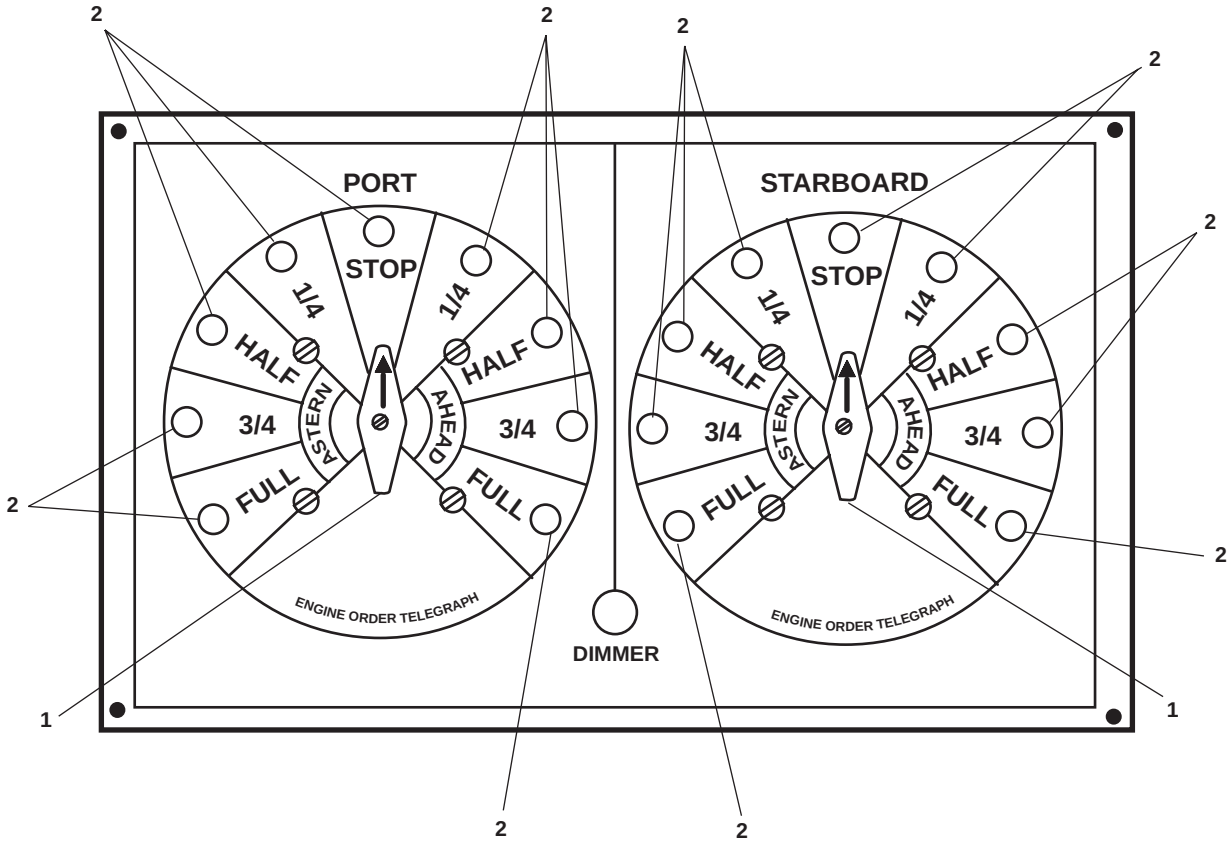


Figure 2. EOT Panel

NOTE

The engine order telegraph bell will sound until the Encoded Operation Station (EOS) answers with the correct speed and direction on the EOS engine order telegraph panel. When the EOS completes the appropriate throttle adjustments, the Light Emitting Diode (LED) will stop flashing and stay on.

3. In the EOS, complete the following actions when the engine order telegraph bell sounds, and the LED flashes, signifying that a change in speed and/or direction is ordered.

   a. Acknowledge order by rotating the selector(s) (figure 2, item 1) to the ordered position.

   b. Verify that the bell goes silent.

NOTE

If incorrect throttle adjustments are made the engine order telegraph bells will continue to sound, and the LEDs in the pilothouse and EOS will flash until the throttles match ordered direction and speed.

   c. In the EOS, make throttle adjustment(s) as ordered, and verify that the LED(s) (figure 2, item 2) stop(s) flashing and remain(s) lit.

GENERAL ALARM SYSTEM OPERATION

1. In the Emergency Diesel Generator (EDG) room, at the 120V emergency load center distribution panel, set to ON the GENERAL ALARM BATTERY CHARGER. circuit breaker (figure 3, item 1).

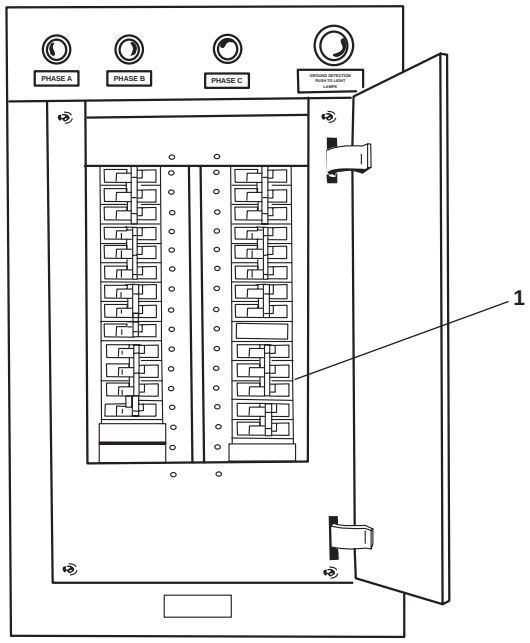


Figure 3. 120V Emergency Load Center Distribution Panel

NOTE

The general alarm system is a 24 VDC system, and it is always powered by the general alarm battery charger or battery bank.

2. Test the general alarm system by activating the contact makers in the pilothouse and the 01 Level passageway.

3. Verify operation of the general alarm system by ensuring that the bells provide an audible alarm throughout the Large Tug (LT) and the rotating lights operate when each actuator is pressed.

DOOR ALARM AND FREEZER ALARM SYSTEMS OPERATION

1. At 120V main deck, 01 & 02 emergency lighting panel No. 1, set the following circuit breakers to ON:

   a. FREEZER ALARM. (figure 4, item 1)

   b. ALARM SWITCHBOARD (HIGH TEMPERATURE & SPRINKLER). (figure 4, item 2)

2. Verify operation of the radio room door alarm system by opening the radio room door and verifying that the alarm buzzer and indicator on the alarm switchboard in the pilothouse activates.

3. Verify operation of the arms stowage alarm system by opening the arms stowage room door and verifying that the alarm buzzer and indicator on the alarm switchboard in the pilothouse activates.

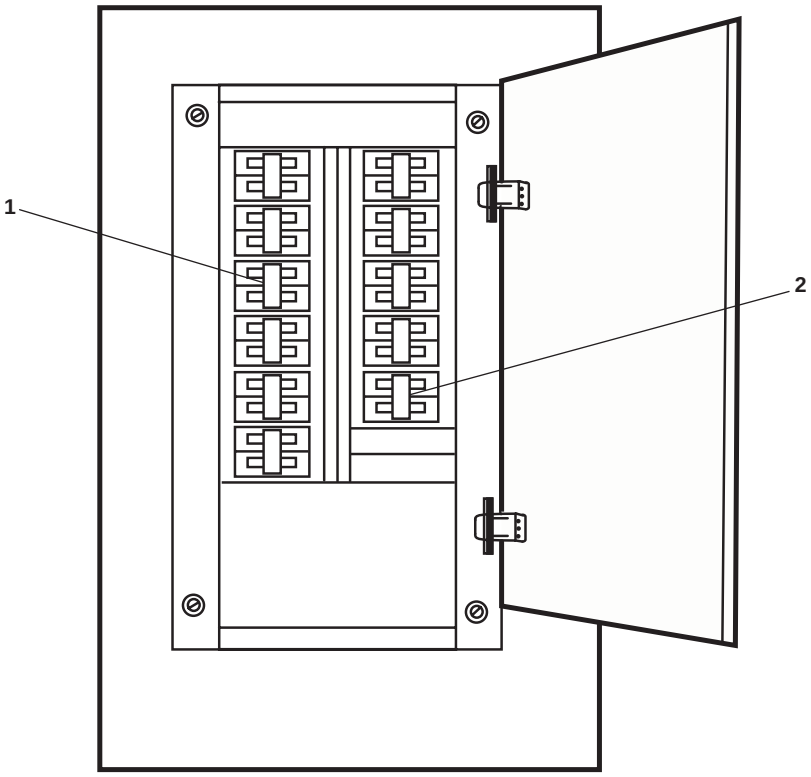


Figure 4. Main Deck, 01 & 02 Emergency Lighting Panel No. 1

4. Verify operation of the main deck fan room door alarm system by opening the main deck fan room door and verifying that the alarm buzzer and indicator on the alarm switchboard in the pilothouse activates.

5. Verify operation of the freezer alarm system by operating the switches located in the thaw room, vegetable storage room, and freezer room and verifying that the alarm buzzer and lamp in the galley activates.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
FM-200 SYSTEM

INITIAL SETUP:

Tools and Special Tools:
Sampling Pump (Item 514, Table 3, WP 0163 00, Volume 2)

Personnel Required:
Six Crewmembers, Any MOS

References:
TM 55-1925-273-SDC
WP 0007 00
WP 0071 00
WP 0163 00 (volume 2)

FM-200 FIRE SUPPRESSION SYSTEM ACTUATION

The following steps must be accomplished prior to system actuation:

1. Evacuate all personnel from the engine room and AMS 1.
2. Close the watertight doors between the engine room, AMS 1, and AMS 2.
3. Align fire and general service pump 1 as the online fire pump (WP 0071 00).

⚠ CAUTION

FM-17 and/or FM-15 supplies raw water to various shipboard systems including the refrigeration plant, the air conditioning plant, and the water maker. Failure to secure power to these systems prior to closing the valves will cause damage to the equipment.

4. CLOSE the following valves:
   a. FM-17, FIRE/G.S. PMP No. 1 DISCH TO GS (figure 1, item 1)
   b. FM-15, FIRE/G.S. PMP No. 2 DISCH. TO GS. (figure 1, item 2)
5. OPEN WWS-1 (figure 2, item 1), located in the main deck vestibule, starboard side, to activate the Engine Room Water Washdown System (ERWWS).
6. CLOSE the following:
   a. PORT engine room supply fan intake damper (figure 3, item 1)
   b. PORT engine room exhaust fan outlet damper (figure 3, item 2)
   c. STBD engine room supply fan intake damper (figure 4, item 1)
   d. STBD engine room exhaust fan outlet damper (figure 4, item 2)
   e. AMS 1 supply fan intake hinged cover (figure 5, item 1)
   f. AMS 1 exhaust hinged cover (figure 6, item 1)
   g. Engine room entrance door engine room vestibule (figure 7, item 1)
   h. EOS emergency escape scuttle (figure 8, item 1)
   i. AMS 1 emergency escape scuttle (figure 9, item 1)

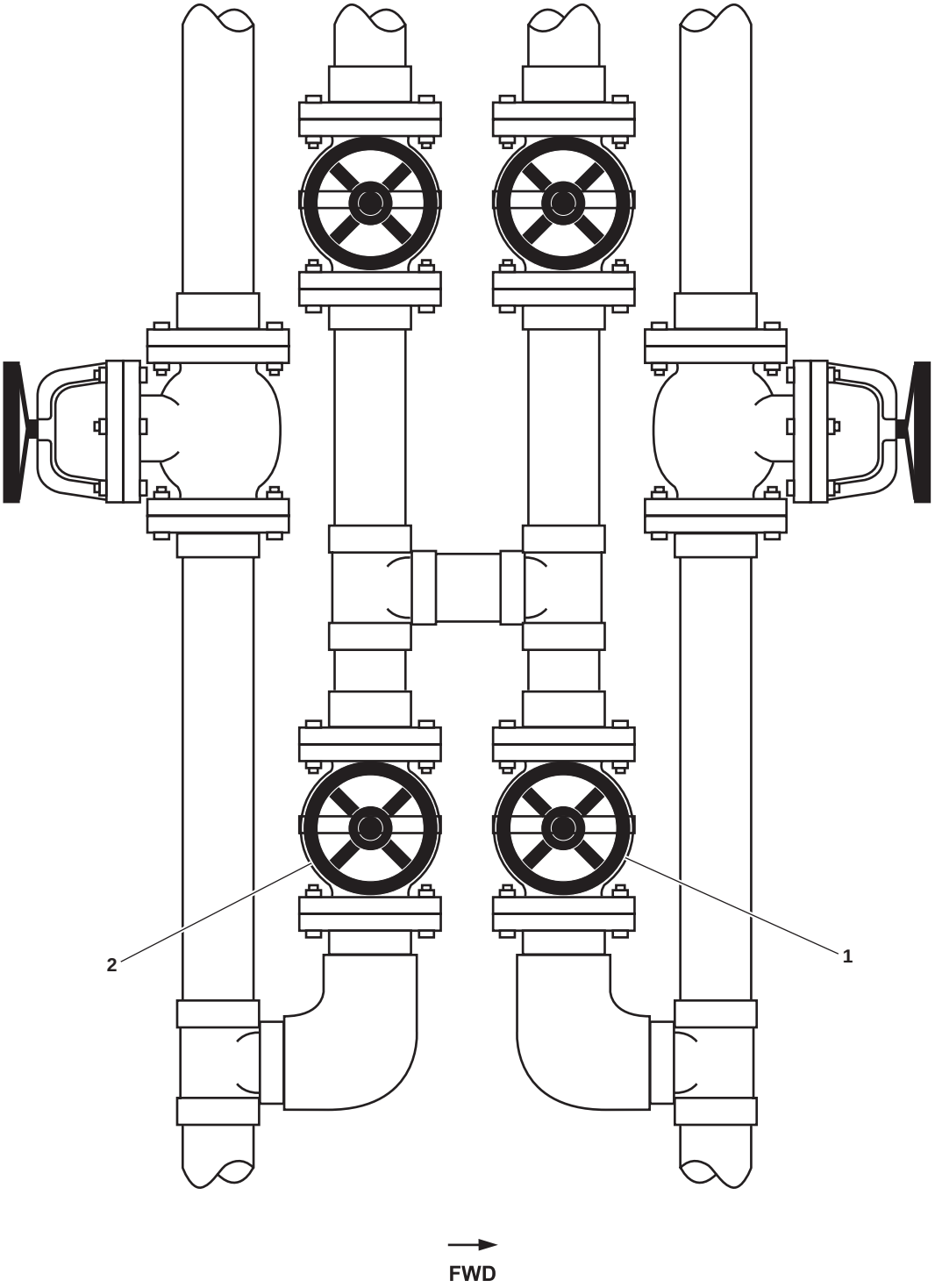


Figure 1. Fire and General Service Pump Valves

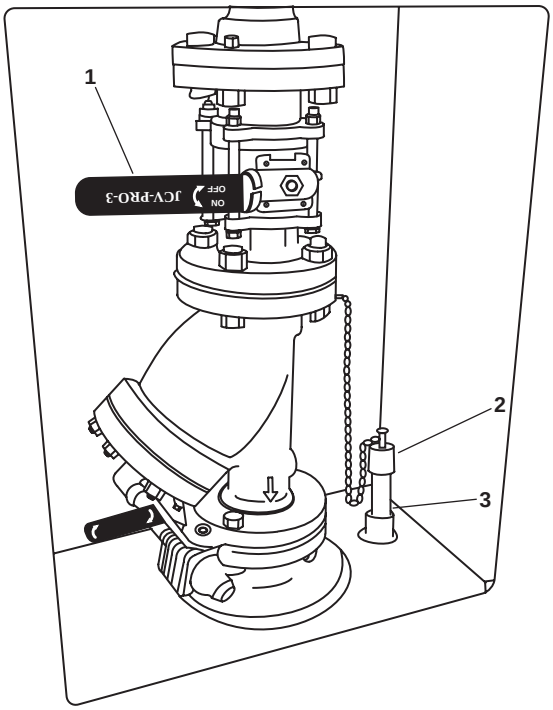


Figure 2. Engine Room Water Washdown Station

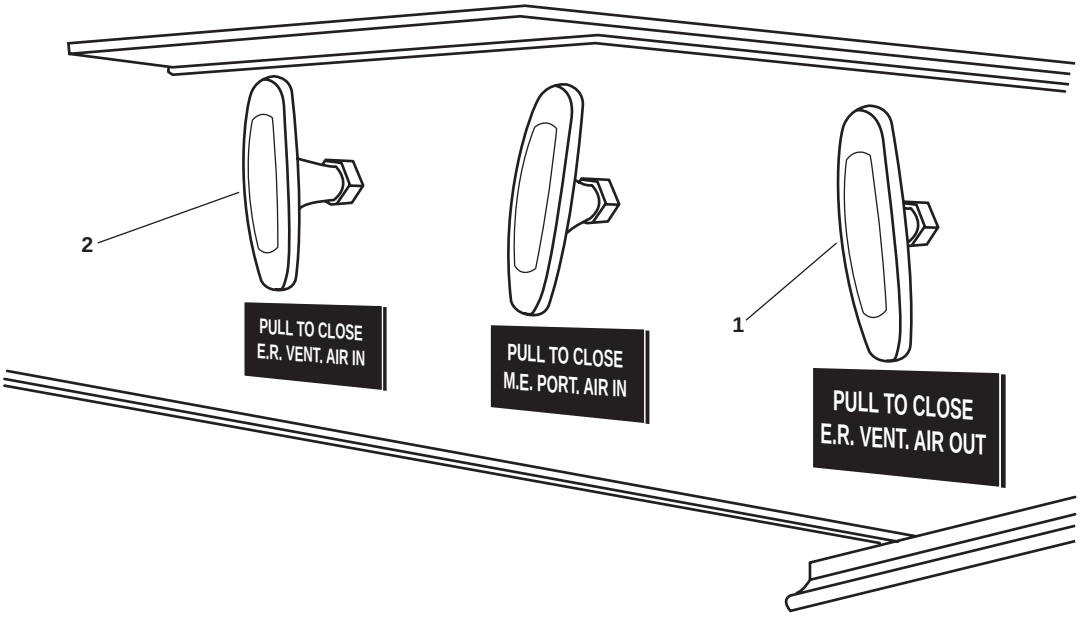


Figure 3. PORT Engine Room Fire Flap Quick Release T Handles

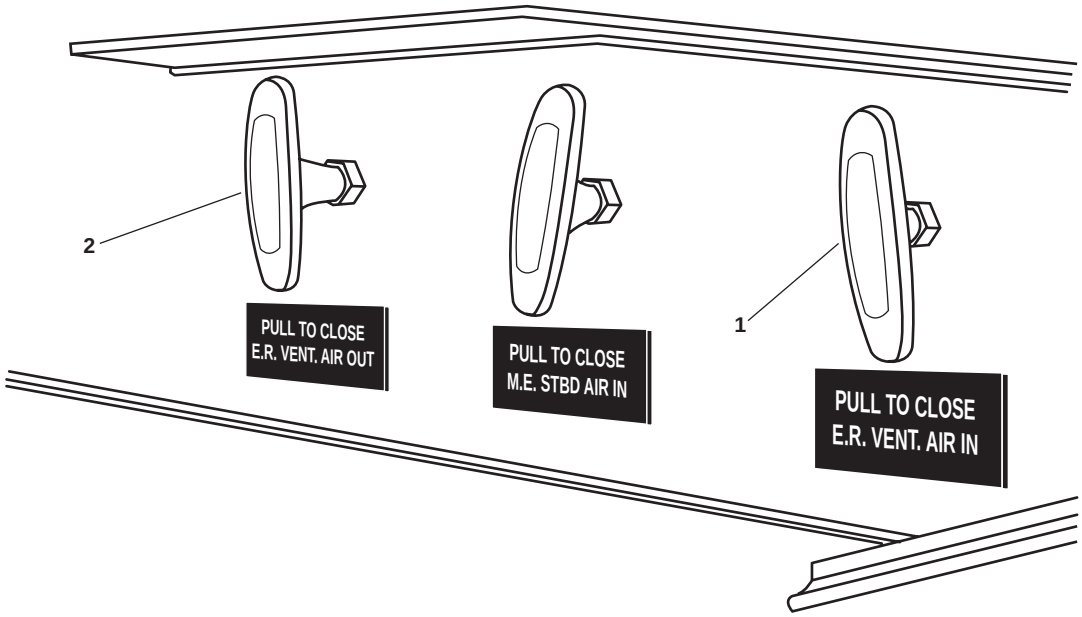


Figure 4. STBD Engine Room Fire Flap Quick Release T Handles

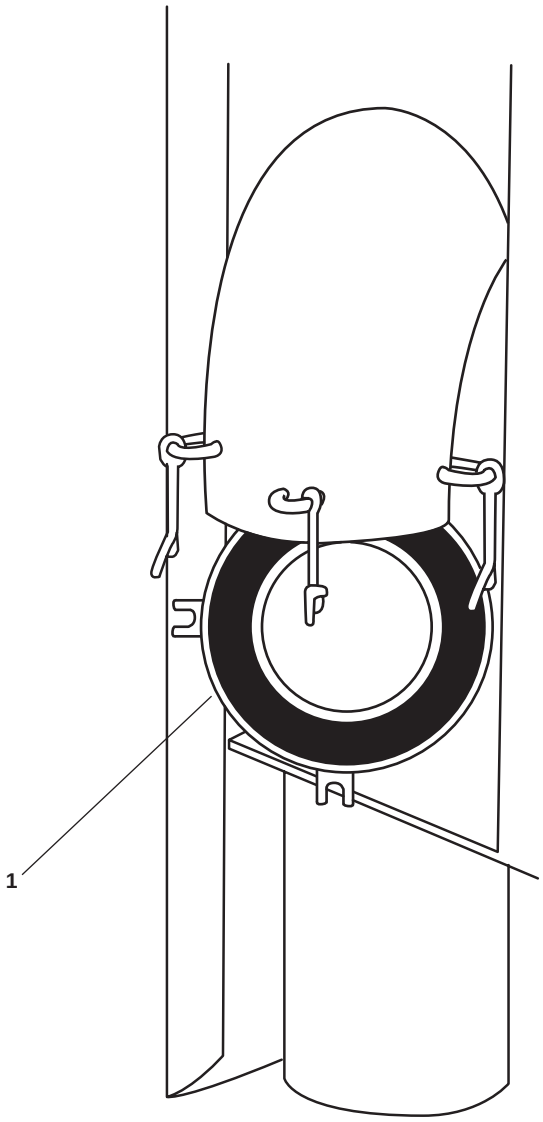


Figure 5. AMS 1 Supply Fan Intake Hinged Cover

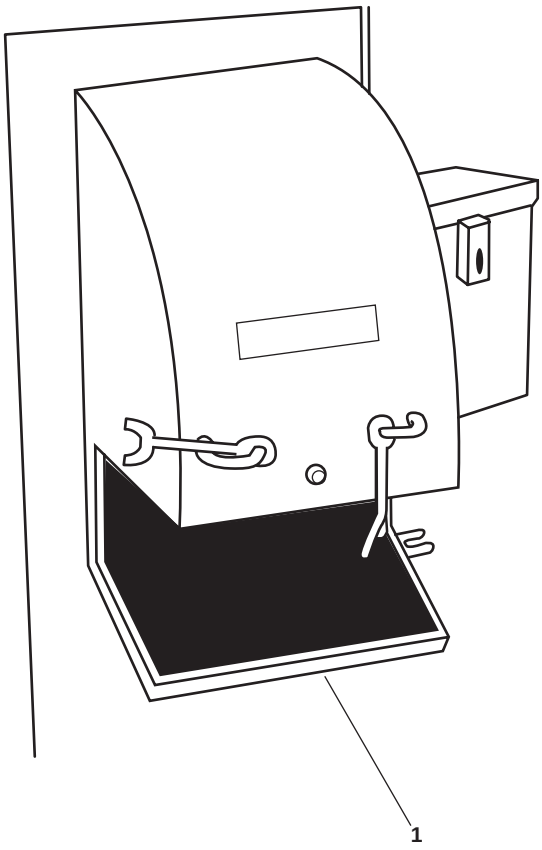


Figure 6. AMS 1 Exhaust Hinged Cover

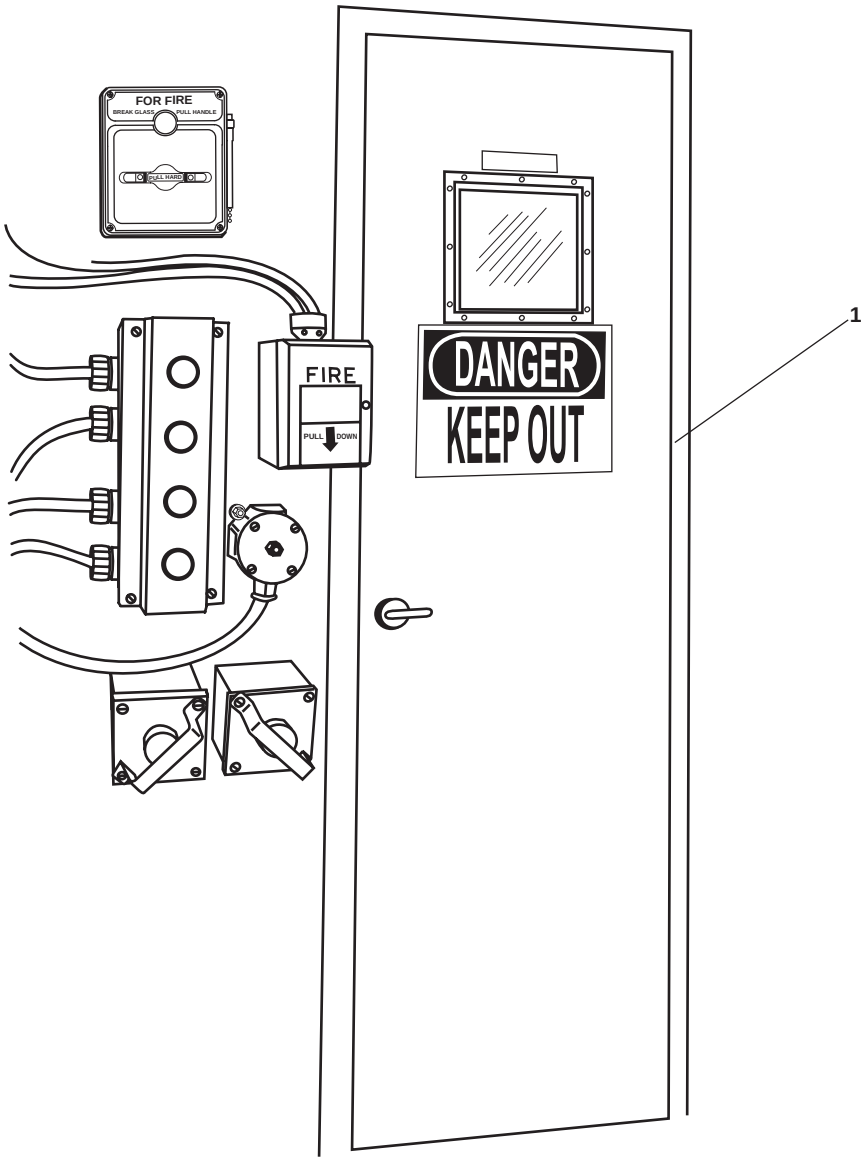


Figure 7. Engine Room Entrance Door

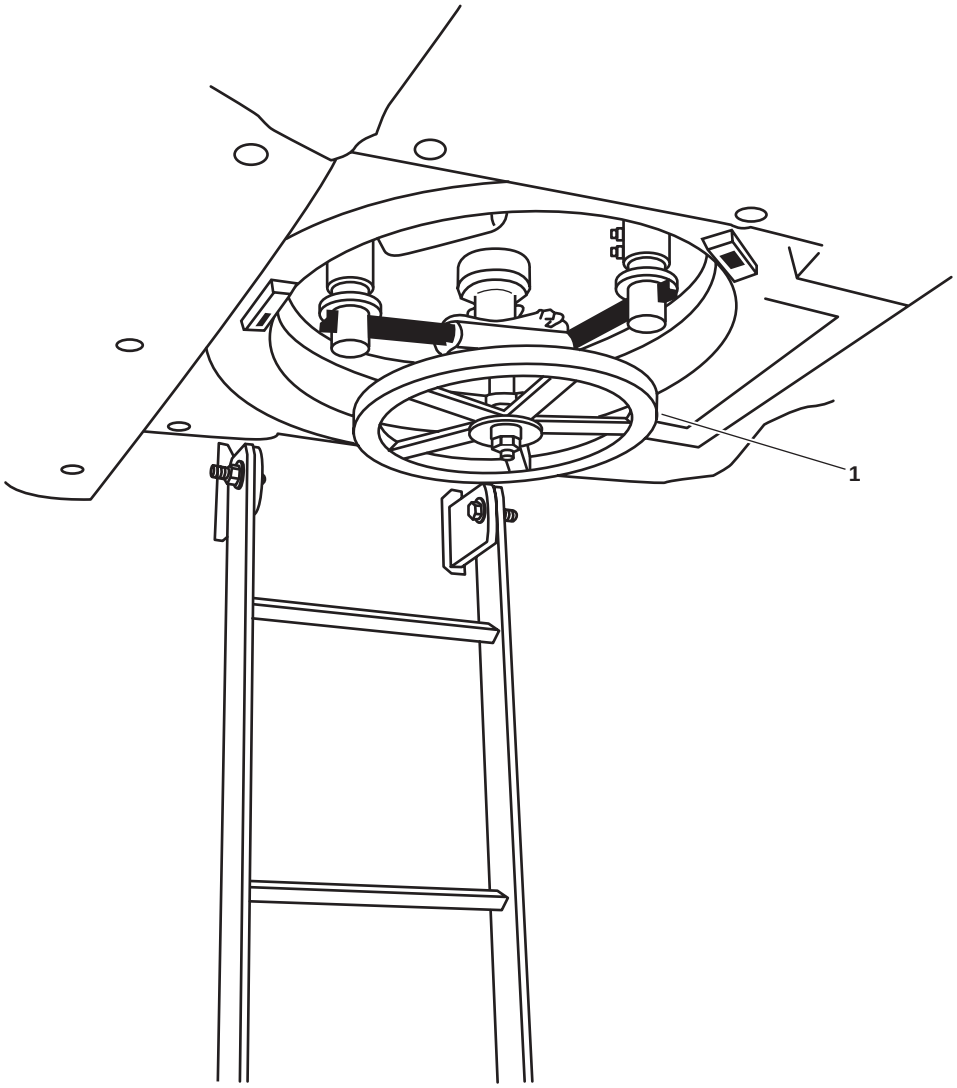


Figure 8. EOS Emergency Escape Scuttle

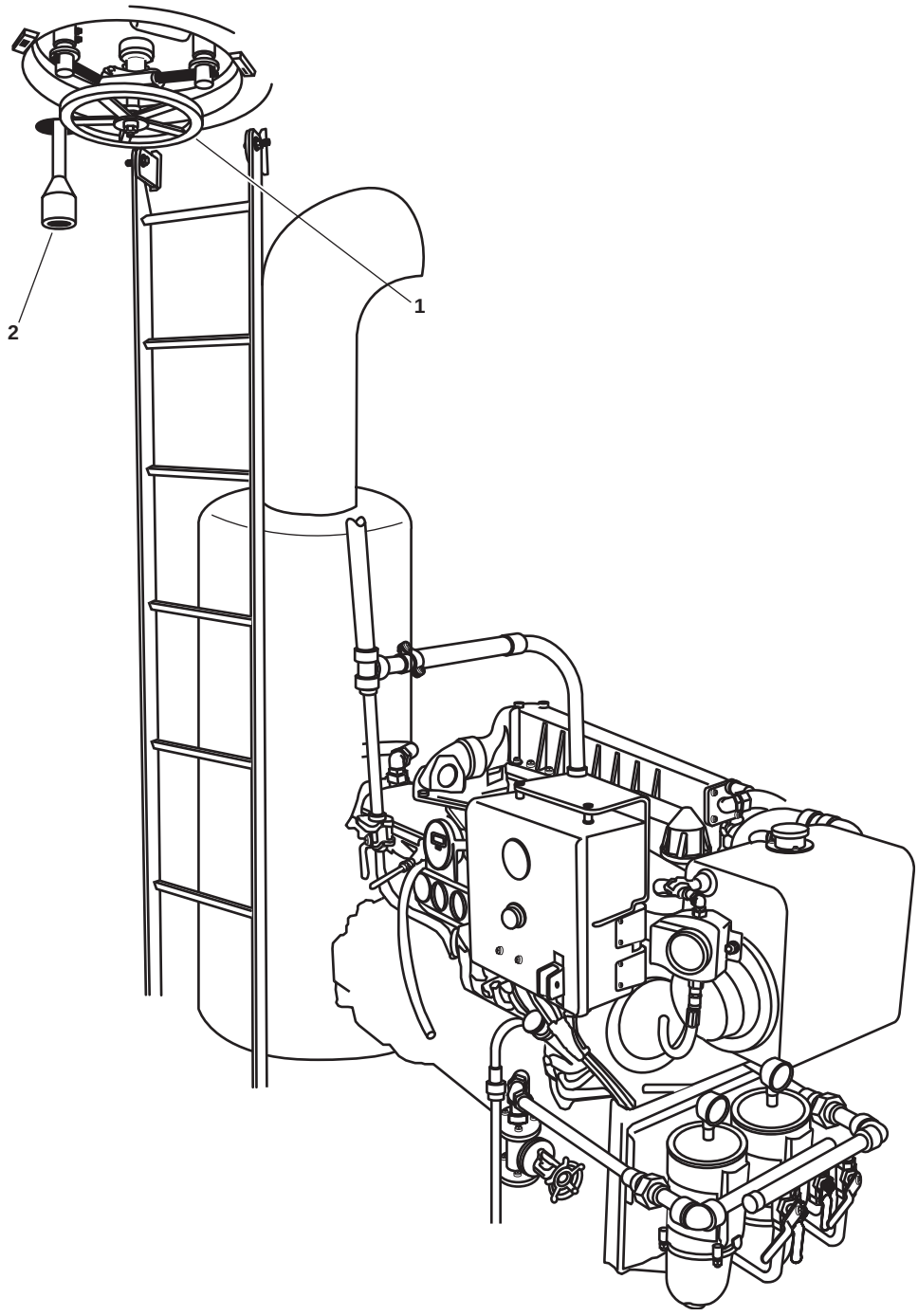


Figure 9. AMS 1 Emergency Escape Scuttle

NOTE

The ERWWS will shut down once the FM-200 system has been activated. Restart fire and general service pump 1 remotely (pilothouse) once the emergency generator has come online.

7. Break the glass on one of the FM-200 pull boxes (figure 10 or 11, item 1). Pull boxes are found in the following locations:

   a. Engine room vestibule, main deck, 01 level, frame 23

   b. Main deck, on the weather deck, starboard of the engine room vestibule entrance door, frame 21. This exterior watertight pull box requires opening the watertight cover to expose the glass.

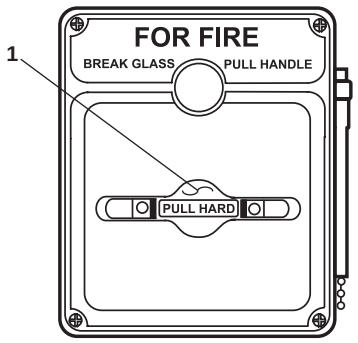


Figure 10. Interior FM-200 Pull Box

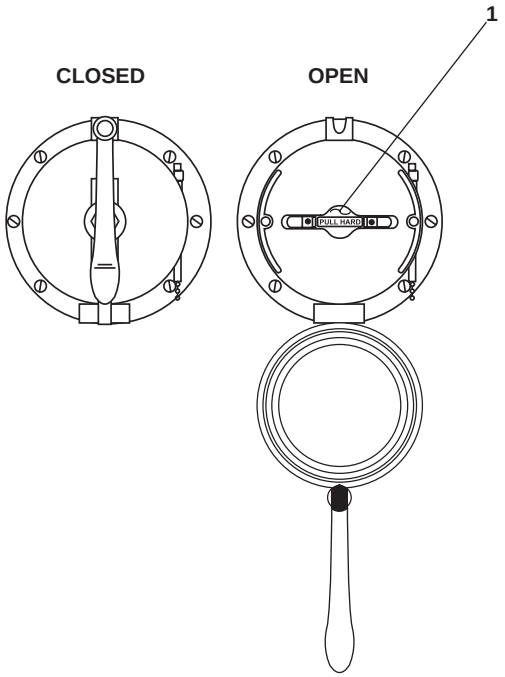


Figure 11. Exterior FM-200 Pull Box

8. Pull the handle (figure 10 or 11, item 1) to actuate the FM-200 system. The handle is designed to require less than 40 pounds (18.14 kg) force and 14 inches (35.6 cm) of pull to operate. If the FM-200 system fails to actuate, proceed to the FM-200 cylinder location, AMS 2, frame 22, and follow the emergency discharge instructions posted at the FM-200 cylinder location and in WP 0007 00. Enter and evacuate AMS 2 using the emergency escape scuttle.

9. Verify that the emergency generator has come online and start fire and general service pump 1 at the remote start located in the pilothouse.

10. Wait a minimum of 15 minutes after FM-200 system actuation before initiating reentry procedures. The water washdown system should be allowed to operate continuously during this time. Allow no one to enter the protected spaces until reentry procedures are complete and permission is granted to do so.

11. Actuation of the FM-200 fire suppression system will result in the automatic shutdown of the auxiliary engines and ventilation fan motors affecting the protected spaces. Verify that the following fans, engines, and pumps are shut down:

    a. Fan Motors:

        (1) PORT engine room supply fan

        (2) PORT engine room exhaust fan

        (3) STBD engine room supply fan

        (4) STBD engine room exhaust fan

        (5) AMS 1 supply fan

    b. Engines:

        (1) SSDG 1

        (2) SSDG 2

        (3) Pump drive engine

        (4) Bow thruster engine

    c. Pumps:

        (1) Fuel oil transfer pump 1

        (2) Fuel oil transfer pump 2

REENTRY PROCEDURES

WARNING

Following a fire and actuation of the engine room fire suppression system, the engine room may contain a dangerous level of Hydrogen Fluoride (HF) gas, which is dangerous to humans. Do not reenter the engine room until the post-fire re-entry procedure has been performed. Death or serious injury can result from unprotected entry into this space prior to completion of the post-fire reentry procedure.

1. Wait at least 15 minutes after extinguishing the fire before performing this procedure. The natural decay rate for Hydrogen Fluoride (HF) gas is approximately 15 minutes after a fire is extinguished.

2. Perform HF gas sampling as follows:

   a. Remove the cap (figure 2, item 2) from the aft HF sampling port (figure 2, item 3) located in the main deck vestibule or the forward HF sampling port (figure 9, item 2) located in the damage control locker.

   b. Zero the stroke counter (figure 12, item 1).

   c. Install the rubber hose (figure 12, item 2) on the pump by sliding one end of the rubber hose over the tube holder (figure 12, item 3).

   d. Break off both tips (figure 12, item 4) of the detector tube (figure 12, item 5) using the breaker (figure 12, item 6) on the sampling pump (figure 12, item 7).

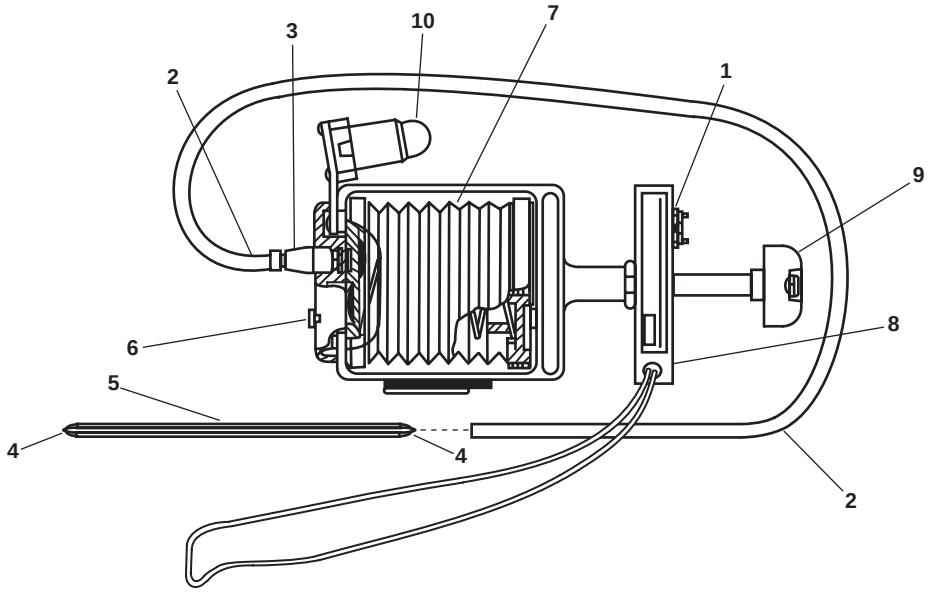


Figure 12. Sampling Pump

e. Install the detector tube (figure 12, item 5) into the rubber hose (figure 12, item 2) with the arrow on the detector tube pointing toward the sampling pump (figure 12, item 7).

f. Insert the detector tube (figure 12, item 5) into the HF sampling port (figure 2, item 3). Ensure that all of the rubber hose (figure 12, item 2) is inserted into the HF sampling port.

NOTE

Determine the number of strokes required for a proper sample by checking the detector tube instructions that are in the box of detector tubes or the detector tube itself. The tube will be labeled as n=number of strokes.

g. With all four fingers on the handle (figure 12, item 8), fully press the knob (figure 12, item 9) with the palm of the hand until the stroke counter (figure 12, item 1) changes number.

h. Release the knob (figure 12, item 9).

i. Verify that the end of stroke indicator (figure 12, item 10) has turned a high visibility yellow. Once the pump has consumed 100 cc of the sample, the end of stroke indicator will return to its black color.

j. Repeat steps f-i until the proper number of strokes has been performed.

k. Remove the detector tube (figure 12, item 5) from the HF sampling port (figure 2, item 3).

l. Install the cap (figure 2, item 2) on the HF sampling port (figure 2, item 3).

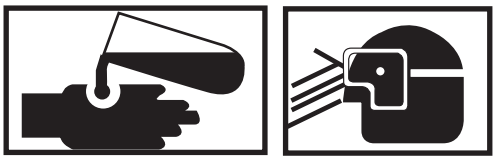
m. Observe the color of the detector tube and read the scale printed on the detector tube. Record the reading.

n. Remove the detector tube (figure 12, item 5) from the hose (figure 12, item 2).

o. Wait two minutes and repeat steps a-m above using a new detector tube.

p. When three consecutive readings of 3 parts per million (ppm) are obtained, the engine room is safe for reentry.

WARNING



Residue from FM-200 fire suppression is a minor irritant to the skin, the eyes, and the respiratory tract. All personnel who may come in contact with this residue must wear Personal Protective Equipment (PPE), which prevents the FM-200 residue from contacting the skin, eyes, and/or respiratory tract.

3. After ensuring that no reflash risks exist, the engine room must be ventilated in accordance with TM 55-1925-273-SDC and the following procedure:

a. If explosive or flammable gases are present, desmoke using the water-driven blower. Desmoke using the water-driven blower until no flammable gases are detected.

b. If no explosive or flammable gases are present, desmoke using the ventilation exhaust fans in high speed.

c. When the smoke has cleared, restart the ventilation supply fans in high speed.

d. When all smoke is cleared and air quality is at normal levels, return all ventilation fans to their normal operating speed.

e. Ventilate the engine room for at least 15 minutes before proceeding to the cleanup phase.

4. After the engine room has been ventilated and has cooled down, wash down the engine room interior and all equipment with fresh water.

NOTE

Bilge water which has been exposed to FM-200 fire extinguishing agent while extinguishing a fire shall be classified and treated as hazardous waste.

5. Use the oily water collection system to remove all contaminated bilge water from the engine room. Discharge this contaminated water only to a suitable treatment facility.

6. Return the equipment to the desired readiness condition.

PRESSURIZE FIRE MAIN

1. Align fire and general service pump no. 1 as the online fire and general service pump (WP 0071 00).

2. CLOSE valve FM-17, FIRE/G.S. PMP No. 1 DISCH TO GS (figure 13, item 1).

3. OPEN valve FM-16, FIRE/G.S. PMP No. 1 DISCH TO FM (figure 13, item 2).

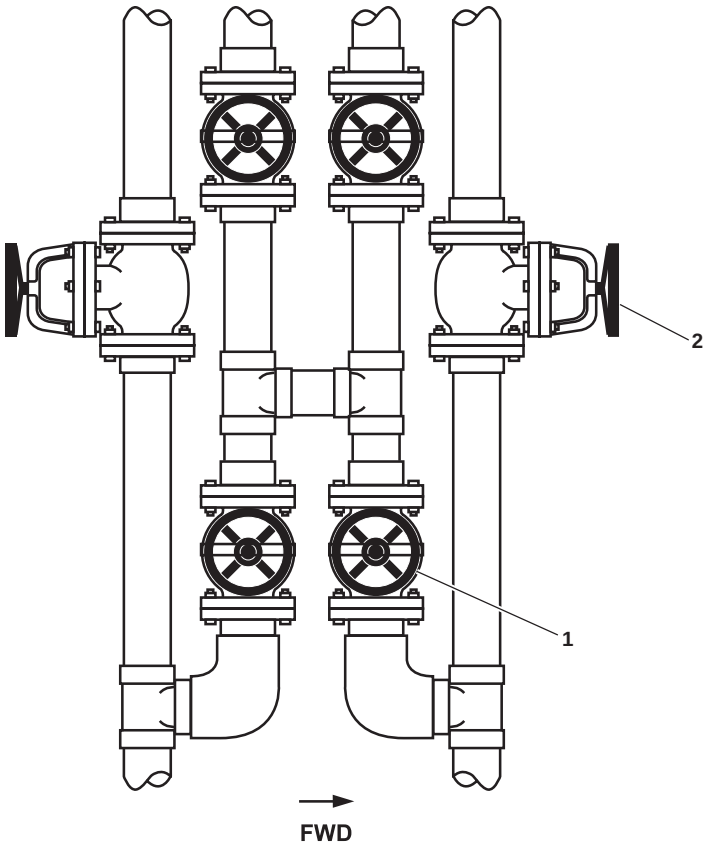


Figure 13. Pressurize Fire Main

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
WORKBOAT/CRANE

INITIAL SETUP:

Personnel Required:
Two Watercraft Operators, 88K
One Watercraft Engineer, 88L

References:
TM 55-1945-221-14&P
TM 55-1945-224-14&P
WP 0076 00
WP 0102 00

LOAD MOMENT INDICATOR (LMI) STARTUP

1. Set to ON the CRANE LOAD circuit breaker (figure 1, item 1) on the machinery DC control distribution panel (figure 1, item 2) in the engine room.

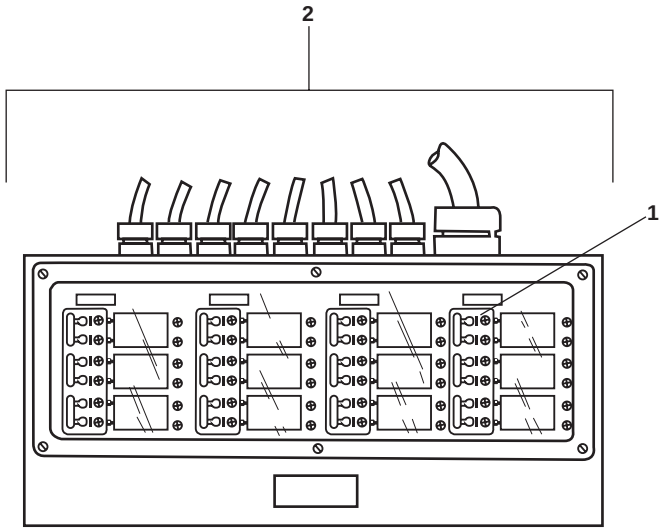


Figure 1. Machinery DC Control Distribution Panel

2. The Liquid Crystal Display (LCD) panel (figure 2, item 1) on the Load Moment Indicator (LMI) receiver panel (figure 2, item 2) will display the screens shown in figures 3-6 before operator input is required.

3. When the main winch selected screen (figure 6) appears on the LCD panel (figure 2, item 1), select the programmed setting by pressing and holding the MODE button (figure 2, item 3) while pressing the down arrow button (figure 2, item 4) once. At this point there are no available options.

4. The correct load chart in use screen (figure 7) will appear on the LCD display (figure 2, item 1). At this point there are no available options.

5. Accept the correct programmed load chart by pressing and holding the MODE button (figure 2, item 3) while pressing the down arrow button (figure 2, item 4) once.

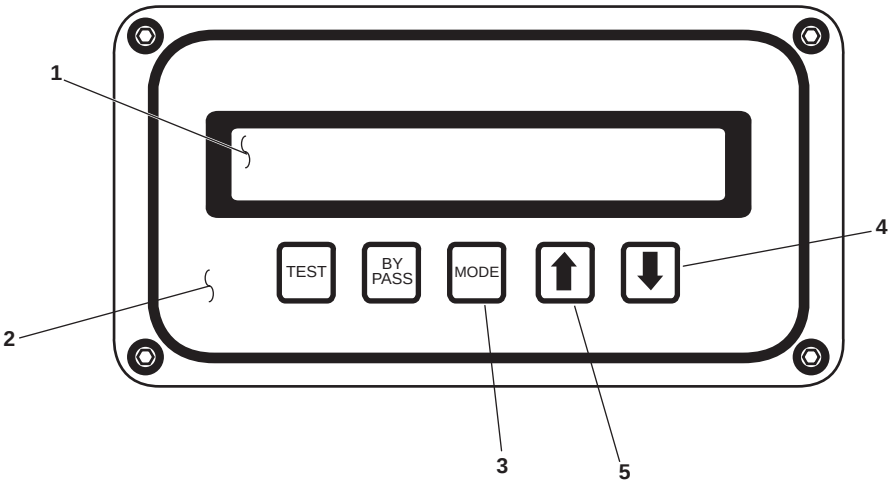


Figure 2. LCD Panel on the LMI Receiver

Figure 3. Startup Screen 1

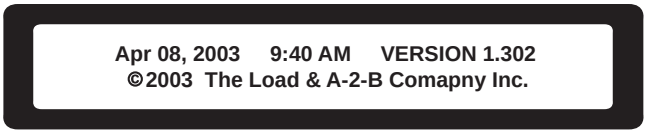


Figure 4. Startup Screen 2

Figure 5. Startup Screen 3

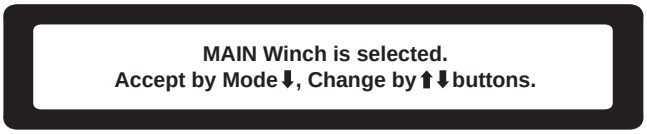


Figure 6. Main Winch is Selected Screen

6. After accepting the correct load chart, the PARTS OF LINE screen (figure 8) will appear. At this point there are no available options.

7. Accept the programmed parts of line by pressing and holding the MODE button (figure 2, item 3) while pressing the down arrow button (figure 2, item 4) once.

8. The saving screen (figure 9) will appear briefly. Once the save is complete, the primary operating display screen (figure 10) will appear. The LMI is now ready for normal operation.

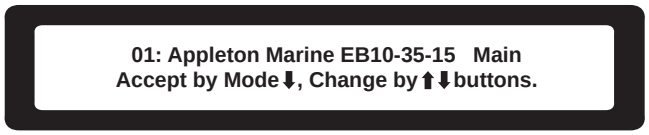


Figure 7. Correct Load Chart in Use Screen

Figure 8. Parts of Line Screen

Figure 9. Saving Screen

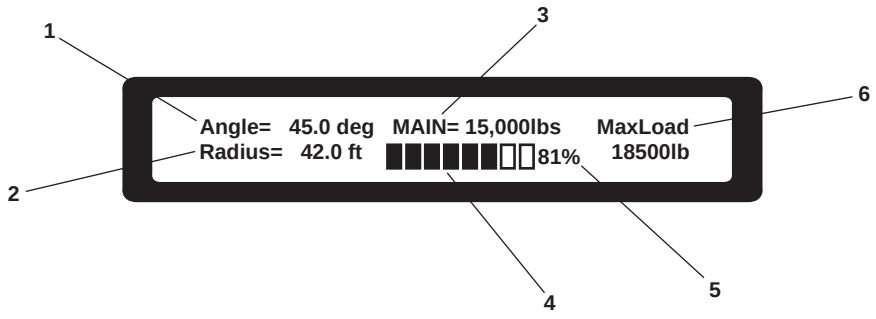


Figure 10. Primary Operating Screen

LOAD MOMENT INDICATOR (LMI) OPERATION

1. Perform the Load Moment Indicator (LMI) Startup procedure in this work package.

2. During normal operation, the LMI has five display screens, defaulting to the primary operating display shown in figure 10. You may move from screen to screen with a simple push of either the up arrow button (figure 2, item 5) or the down arrow button (figure 2, item 4). After approximately ten seconds the Liquid Crystal Display (LCD) (figure 2, item 1) will always default to the primary operating display. This function cannot be changed.

3. The primary operating display provides the operator with the information outlined in table 1 and figure 10.

Table 1. Primary Operating Display Screen Data (refer to figure 10)

Item No.	Display	Information Displayed
1	Angle	Actual boom angle in degrees in 0.5° increments.
2	Radius	Actual radius in feet in 0.1 feet increments as measured from the crane center of rotation to the center of the load.
3	MAIN Load	Displays the actual load on the hook in 100 lb increments
4	Bar Graph	Displays a bar graph of the percentage of permissible load, increasing from left to right as the load increases. Blank display indicates no load. All bars filled at 100% of load.
5	Percentage	Displays a numerical value of the percentage of allowed load.
6	MaxLoad	Displays the actual maximum load allowed as determined by the load chart.

4. During operation, the values on the primary operating display will change in response to the changing operating conditions of the crane.

WARNING

Never operate the crane in an overloaded state. Operating the crane in an overloaded state can lead to structural failure of the crane. Failure to comply will result in death or serious injury.

5. The LMI will alert the operator to overload conditions via audible and visual alarms. The audible alarm is in the form of a beeper signal; the visual alarm is in the form of a flashing display panel accompanied by various text messages.

   a. If the crane reaches 90% of its rated capacity for a given condition, the 90% alarm will activate. In this mode, the following indications are given:

      1) The 90% overload screen (figure 11) will appear and the alarm beeper will beep slowly.

      2) After approximately 10 seconds, the 90% overload screen (figure 11) will be replaced by the primary operating display screen (figure 10). At this time, the primary operating display screen's bar graph display (figure 10, item 4) will flash and the alarm beeper will continue to beep slowly.

      3) The bar graph display (figure 10, item 4) will continue to flash and the alarm beeper will continue to beep slowly until the load moment is reduced or until a 100% overload condition is achieved.

b. If the crane exceeds 100% of its rated capacity for a given condition, the overload alarm will activate. In this mode, the following indications are given:

1) The overload screen (figure 12) will appear, and the alarm beeper will beep rapidly.

2) After approximately 10 seconds, the overload screen (figure 12) will be replaced by the primary operating screen (figure 10). As long as the overload condition is present, the bar graph (figure 10, item 4) will be replaced by a flashing OVERLOAD text message and the alarm beeper will beep rapidly.

c. When the crane's boom angle falls below the minimum value for the load chart (0.0°), the minimum boom angle alarm will activate. In this mode, the following indications are given:

1) The minimum boom angle alarm screen (figure 13) will appear on the LCD display (figure 2, item 1).

2) The alarm beeper will beep rapidly.

3) After approximately 10 seconds, the LCD display (figure 2, item 1) will alternate between the minimum boom angle alarm screen (figure 13) and the primary operating display screen (figure 10).

d. When the crane's boom angle exceeds the maximum value for the load chart (80.0°), the maximum boom angle alarm will activate. In this mode, the following indications are given:

1) The maximum boom angle alarm screen (figure 14) will appear on the LCD display (figure 2, item 1).

Figure 11. 90% Overload Screen

Figure 12. Overload Screen

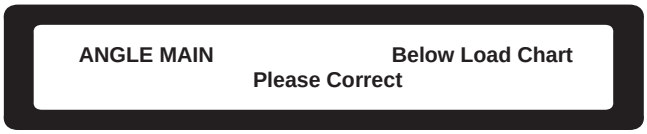


Figure 13. Minimum Boom Angle Alarm Screen

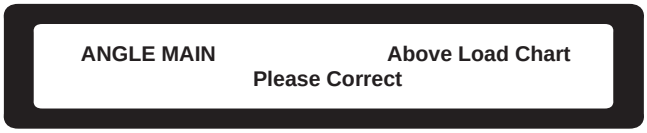


Figure 14. Maximum Boom Angle Screen

2) The alarm beeper will beep rapidly.

3) After approximately 10 seconds, the LCD display (figure 2, item 1) will alternate between the maximum boom angle alarm screen (figure 14) and the primary operating display screen (figure 10).

LOAD MOMENT INDICATOR (LMI) ACCESSING ADDITIONAL DISPLAY SCREENS

LOAD CHART IN USE DISPLAY SCREEN

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.
2. Access the load chart in use display screen (figure 15) by pressing the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once while in the primary operating screen (figure 10).
3. The load chart in use display screen (figure 15) will display the information contained in table 2.
4. The display will automatically default to the primary operating screen (figure 10) after approximately 10 seconds.

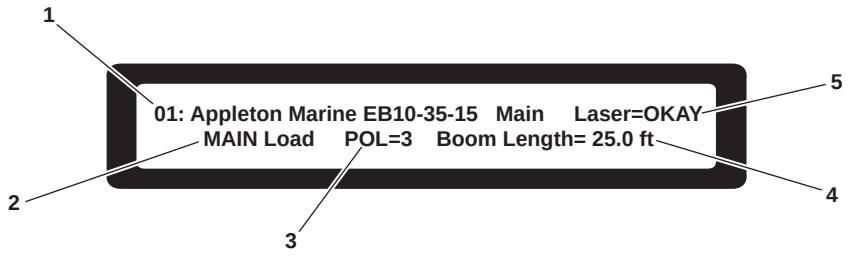


Figure 15. Load Chart in Use Screen

Table 2. Load Chart In Use (refer to figure 15)

Item No.	Display	Information Displayed
1	01	Details the current programmed load chart
2	MAIN	Is the selected winch
3	POL	The parts of line in use on the winch
4	Boom Length	Indicated total length of boom in use
5	Laser Condition	Indicates operating condition of the laser. Normal condition is OKAY.

TRANSMITTER SIGNAL STRENGTH DISPLAY SCREEN

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.
2. Access the transmitter(s) signal strength display screen (figure 16) by pressing the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) twice while in the primary operating display screen (figure 10).

3. The transmitter signal strength display will indicate load cell signal strength (figure 16, item 1) and boom angle indicator signal strength (figure 16, item 2) as a percentage and as a bar graph display.

4. The display will automatically default to the primary operating display screen (figure 10) after approximately 10 seconds.

Figure 16. Signal Strength Display Screen

VOLTMETER, LASER TEMPERATURE, AND OPERATION TIME

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. Check the voltmeter, laser temperature, and operation time (figure 17) by pressing the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice while in the primary operating display screen (figure 10).

3. The voltmeter, laser temperature, and operation time display (figure 17) will indicate operating voltage (figure 17, item 1) numerically and by bar graph. The display will also give numeric readout of laser operating temperature (figure 17, item 2) and operation time (figure 17, item 3).

4. The display will automatically default to the primary operating display screen (figure 10) after approximately 10 seconds.

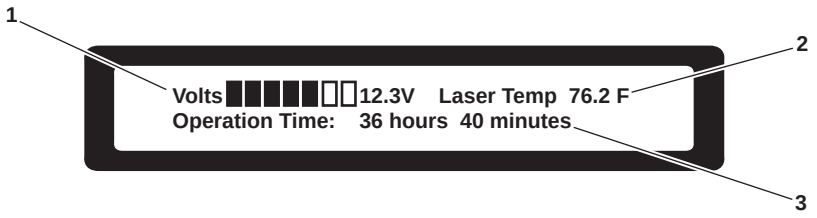


Figure 17. Voltmeter, Laser Temperature and Operation Time Screen

RADIUS, LIVE BOOM ANGLE, AND TIP HEIGHT DISPLAY SCREEN

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. Access the radius, live boom angle, and tip height display screen (figure 18) by pressing the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) once while in the primary operating screen (figure 10).

3. The radius, live boom angle, and tip height display screen (figure 18) will display load radius (figure 18, item 1), boom angle (figure 18, item 2), and tip height (figure 18, item 3).

4. The display will automatically default to the primary operating display screen (figure 10) after approximately 10 seconds.

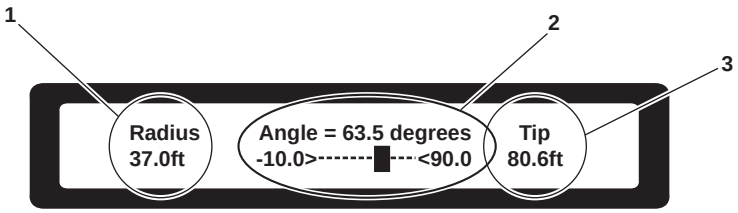


Figure 18. Radius, Live Boom Angle and Tip Height Display Screen

SETTING ALARMS

NOTE

The LMI allows the operator to specify minimum and maximum operating limits for various crane functions. If any maximum preset limit is exceeded or the minimum limits are broken, the LMI will alarm.

SET MAXIMUM LOAD ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen, (figure 10) press the MODE button (figure 2, item 3) and down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19). LOAD is highlighted by default in this screen.

3. Press the MODE button (figure 2, item 3) and down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to select the load preset selection screen (figure 20).

4. SET MAX appears as the default setting in the load preset selection screen (figure 20). Press the MODE button (figure 2, item 3) and down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to select the load main max display screen (figure 21).

5. Press the down arrow button (figure 2, item 4) or up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 21, item 1) displays the maximum load value desired.

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

6. Save the setting by pressing the MODE button (figure 2, item 3) and down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. When the save is complete, the saving screen will be replaced by the load preset selection screen (figure 20).

7. Press and hold the MODE button (figure 2, item 3) and push the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

Figure 19. Change Min/Max Presets & Select Sensor Screen

Figure 20. Load Preset SelectionScreen

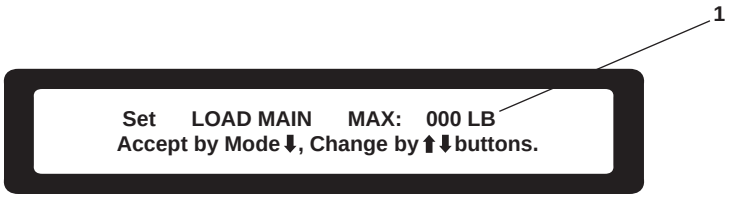


Figure 21. Load Main Max Display Screen

SET MAXIMUM BOOM ANGLE ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen, (figure 10) press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19).

3. Press the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) and scroll through the selections until ANGLE is highlighted.

4. Press the MODE button (figure 2, item 3) and down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once to reach the angle alarm menu screen (figure 22). If SET MAX is not already highlighted, press the up arrow button (figure 2, item 5) or the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) until SET MAX is highlighted.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to reach the maximum angle alarm setting screen (figure 23).

6. Press the down arrow button (figure 2, item 4) or the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 23, item 1) displays the angle value desired.

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

7. Save the setting by pressing the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. Once the save is complete, the saving screen will be replaced by the angle alarm menu screen (figure 22).

8. Press and hold the MODE button (figure 2, item 3) and push the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

Figure 22. Angle Alarm Menu Screen

Figure 23. Maximum Angle Alarm Setting Screen

SET MINIMUM BOOM ANGLE ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen, (figure 10) press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19).

3. Press the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) and scroll through the selections until ANGLE is highlighted.

4. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once to reach the angle alarm menu screen (figure 22). If SET MIN is not already highlighted, press the up arrow button (figure 2, item 5) or the down arrow button on the LMI receiver panel until SET MIN is highlighted.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to reach the minimum angle alarm setting screen (figure 24).

6. Press the down arrow button (figure 2, item 4) or the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 24, item 1) displays the angle value desired.

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

7. Save the setting by pressing the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. Once the save is complete, the saving screen will be replaced by the angle alarm menu screen (figure 22).

8. Press and hold the MODE button (figure 2, item 3) and the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

Figure 24. Minimum Angle Alarm Setting Screen

SET MAXIMUM RADIUS ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen, (figure 10) press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19).

3. Press the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) and scroll through the selections until RADIUS is highlighted.

4. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once to reach the radius alarm menu screen (figure 25). If SET MAX is not already highlighted, press the up arrow button (figure 2, item 5) or the down arrow button on the LMI receiver panel until SET MAX is highlighted.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to reach the maximum radius alarm setting screen (figure 26).

6. Press the down arrow button (figure 2, item 4) or the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 26, item 1) displays the radius value desired.

Figure 25. Radius Alarm Menu Screen

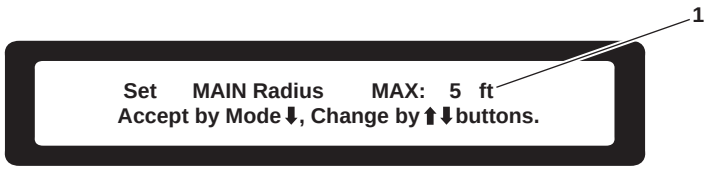


Figure 26. Maximum Radius Alarm Setting Screen

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

7. Save the setting by pressing the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. Once the save is complete, the saving screen will be replaced by the radius alarm menu screen (figure 25).

8. Press and hold the MODE button (figure 2, item 3) and push the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

SET MINIMUM RADIUS ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen (figure 10), press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19).

3. Press the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) and scroll through the selections until RADIUS is highlighted.

4. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once to reach the radius alarm menu screen (figure 25). If SET MAX is not already highlighted, press the up arrow button (figure 2, item 5) or the down arrow button on the LMI receiver panel until SET MAX is highlighted.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to reach the minimum radius alarm setting screen (figure 27).

6. Press the down arrow button (figure 2, item 4) or the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 27, item 1) displays the radius value desired.

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

7. Save the setting by pressing the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. Once the save is complete, the saving screen will be replaced by the radius alarm menu screen (figure 25).

8. Press and hold the MODE button (figure 2, item 3) and push the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

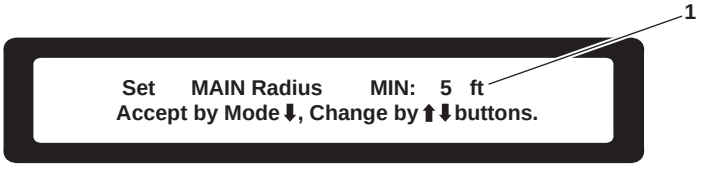


Figure 27. Minimum Radius Alarm Setting Screen

SET MAXIMUM TIP HEIGHT ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen (figure 10), press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19).

3. Press the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) and scroll through the selections until TIP is highlighted.

4. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once to reach the tip height alarm menu screen (figure 28). If SET MAX is not already highlighted, press the up arrow button (figure 2, item 5) or the down arrow button on the LMI receiver panel until SET MAX is highlighted.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to reach the maximum tip height alarm setting screen (figure 29).

6. Press the down arrow button (figure 2, item 4) or the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 29, item 1) displays the tip height value desired.

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

7. Save the setting by pressing the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. Once the save is complete, the saving screen will be replaced by the tip height alarm menu screen (figure 28).

8. Press and hold the MODE button (figure 2, item 3) and push the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

Figure 28. Tip Height Alarm Menu Screen

Figure 29. Maximum Tip Height Alarm Setting Screen

SET MINIMUM TIP HEIGHT ALARM

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. From the primary operating display screen (figure 10), press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19).

3. Press the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) and scroll through the selections until TIP is highlighted.

4. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once to reach the tip height alarm menu screen (figure 28). If SET MIN is not already highlighted, press the up arrow button (figure 2, item 5) or the down arrow button on the LMI receiver panel until SET MIN is highlighted.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to reach the minimum tip height alarm setting screen (figure 30).

6. Press the down arrow button (figure 2, item 4) or the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) until the readout (figure 30, item 1) displays the tip height value desired.

NOTE

Once saved, the settings will remain in effect even after the unit is powered off. If the settings are not saved, they will not remain in effect the next time the unit is powered up.

7. Save the setting by pressing the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) once. The saving screen (figure 9) will appear briefly. Once the save is complete, the saving screen will be replaced by the tip height alarm menu screen (figure 28).

8. Press and hold the MODE button (figure 2, item 3) and push the up arrow button (figure 2, item 5) on the LMI receiver panel (figure 2, item 2) twice to return to the primary operating display screen (figure 10).

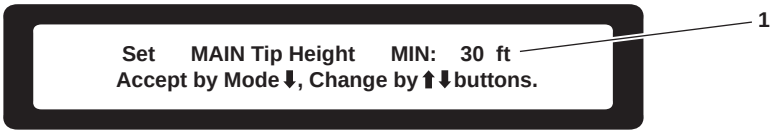


Figure 30. Minimum Height Alarm Setting Screen

ENABLE LOAD TARE OUT FUNCTION

1. Perform the Load Moment Indicator (LMI) Operation procedure in this work package.

2. If the primary operating display screen (figure 10) is not already displayed, return to the primary operating display screen.

3. Lift the desired weight that you wish to tare out. This weight might be the hook block, rigging, or another item.

4. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to display the change min/max presets & select sensor display screen (figure 19). LOAD is highlighted by default in this screen.

5. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to select the load preset selection screen (figure 20).

6. Press the up arrow button (figure 2, item 5) or the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) until TARE is highlighted.

7. Press the MODE button (figure 2, item 3) and the down arrow button (figure 2, item 4) on the LMI receiver panel (figure 2, item 2) to return to the primary operating display (figure 10). The primary operating display will show the letter T (figure 31, item 1).

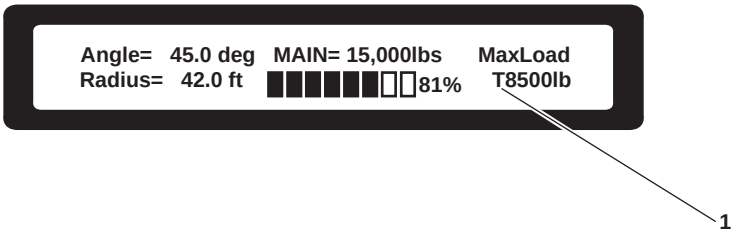


Figure 31. Primary Operating Display Screen with Tare Enabled

DISABLE LOAD TARE OUT FUNCTION

NOTE

Increasing or decreasing crane the boom angle by 3 degrees will disable the TARE OUT function.

1. Increase or decrease the crane boom angle by three degrees.

2. Disabling of the TARE OUT function is complete.

LOAD MOMENT INDICATOR (LMI) SHUTDOWN

1. Ensure that any minimum and/or maximum alarm settings have been returned to their desired readiness condition.

2. Set to OFF the CRANE LOAD circuit breaker (figure 1, item 1) on the 24V machinery DC control distribution panel (figure 1, item 2) in the engine room.

CRANE OPERATION

1. Perform the Central Hydraulic System Hydraulic Power Unit (HPU) Startup procedure (WP 0076 00).

2. Perform the Load Moment Indicator (LMI) Startup procedure in this work package.

WARNING

Maintain at least five dead wraps of wire rope on the drum at all times. Failure to comply will result in serious injury or death.

⚠ CAUTION

The control handles should be moved smoothly and deliberately, NOT with a jerking motion. Damage to the crane could result.

NOTE

Moving control handles progressively away from the neutral position in either direction will increase the rate of movement. When the handle is released, the control will automatically return to the neutral position.

3. Movement of the crane controls (figure 32, items 1 through 4) produces a corresponding movement in the crane's block (figure 32, item 5) or boom (figure 32, item 6).

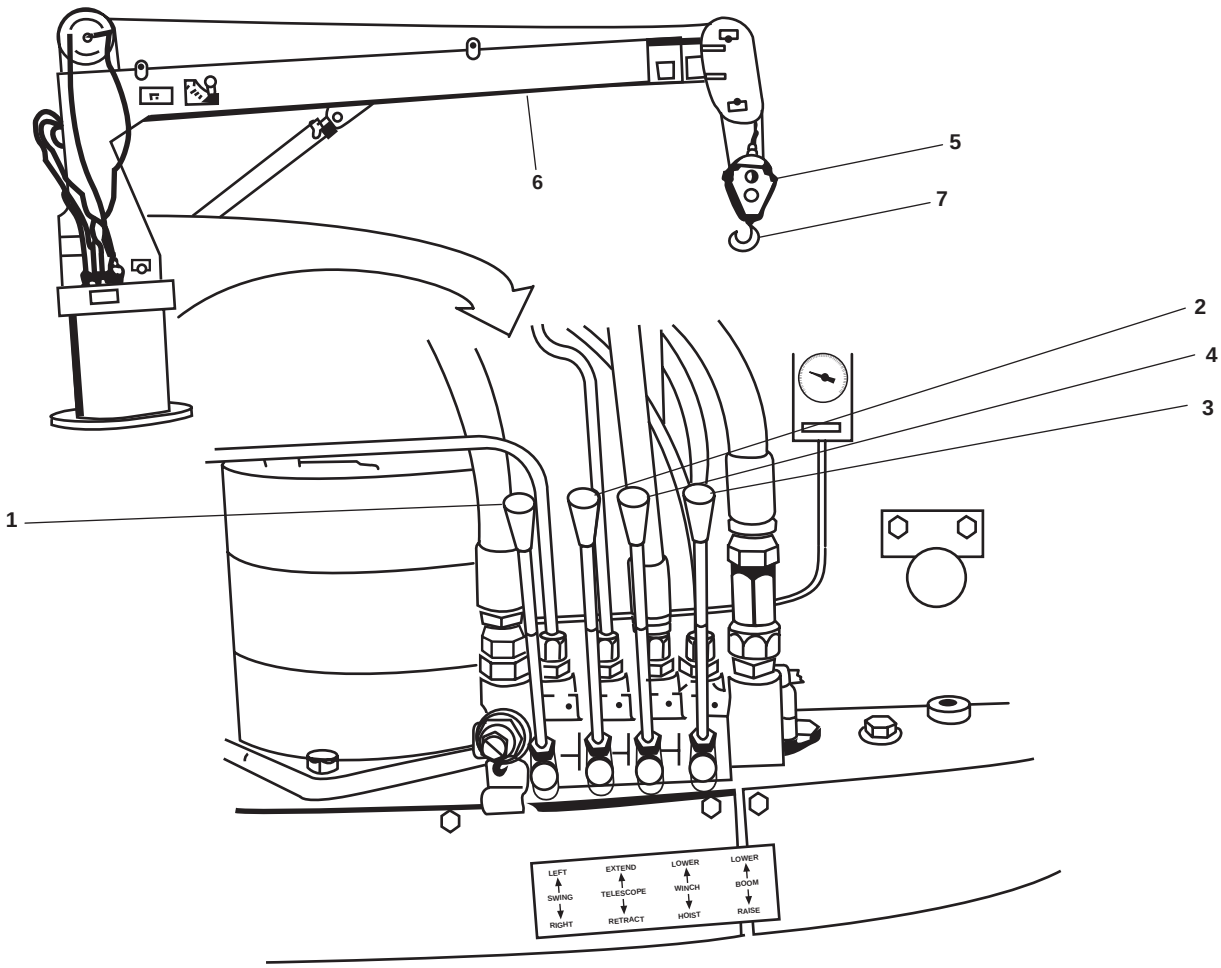


Figure 32. Crane Controls

a. To swing the crane to the right, pull the SWING control handle (figure 32, item 1) toward the operator. To swing the crane to the left, push the SWING control handle away from the operator.

b. To extend the boom (figure 32, item 6), push the TELESCOPE control handle (figure 32, item 2) away from the operator. To retract the boom, pull the TELESCOPE control handle toward the operator.

c. To move the boom (figure 32, item 6) down, push the BOOM control handle (figure 32, item 3) away from the operator. To move the boom up, pull the BOOM control handle toward the operator.

d. To raise the block (figure 32, item 5), pull the WINCH control handle (figure 32, item 4) toward the operator. To lower the block, push the WINCH control handle away from the operator.

CRANE SHUTDOWN

1. Verify that crane operations have ended.

2. Perform the Load Moment Indicator (LMI) Shutdown procedure in this work package.

3. Perform the Central Hydraulic System Hydraulic Power Unit (HPU) Shutdown procedure (WP 0102 00).

WORKBOAT

Operating procedures for the workboat are contained in TM 55-1945-221-14&P and TM 55-1945-224-14&P. Consult these publications for all workboat operation, PMCS, and maintenance procedures.

LAUNCH THE WORKBOAT

1. Operate the crane as necessary to position the hook (figure 32, item 7) over the workboat (figure 33, item 1).

2. Attach the lifting sling (figure 33, item 2) securely to the lift points.

3. Attach the hook (figure 32, item 7) to the lifting sling ring (figure 33, item 3).

4. Remove the tie down straps securing the workboat (figure 33, item 1) to the deck cradle.

5. Operate the crane as necessary to raise the workboat from the deck and move it to the water.

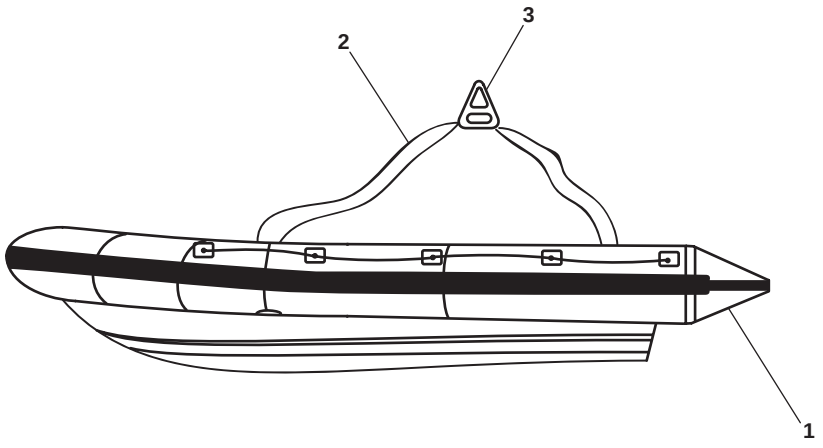


Figure 33. Workboat

6. Once the workboat (figure 33, item 1) is in the water, have personnel man the workboat and disconnect the hook (figure 32, item 7) from the lifting sling ring (figure 33, item 3).

7. Disconnect the lifting sling (figure 33, item 2) from the workboat (figure 33, item 1)

RECOVER THE WORKBOAT

1. Attach the lifting sling (figure 33, item 2) securely to the lift points in the workboat (figure 33, item 1).

2. Operate the crane as necessary to position the hook (figure 32, item 7) over the workboat (figure 33, item 1).

3. Attach the hook (figure 32, item 7) to the lifting sling ring (figure 33, item 3).

4. Instruct personnel to disembark from the workboat (figure 33, item 1).

5. Operate the crane as necessary to raise the workboat (figure 33, item 1) from the water and move it to the deck cradle.

6. Secure the workboat (figure 33, item 1) in place with the tie down straps.

7. Disconnect the hook (figure 32, item 7) from the sling lifting ring (figure 33, item 2).

8. Perform the Crane Shutdown procedure in this work package.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
ANCHOR WINDLASS

INITIAL SETUP:

Personnel Required:
One Watercraft Operator, 88K
One Watercraft Engineer, 88L

References:
WP 0076 00
WP 0102 00

ANCHOR WINDLASS OPERATION

GENERAL

Three modes of operation are provided for the anchor windlass: powered wildcat, free wheeling, and gypsey only. Operating procedures for each mode follow the pre-operation procedure.

ANCHOR WINDLASS PRE-OPERATION

1. Verify that the pelican hooks (figure 1, item 1) are secured to the anchor chain (figure 1, item 2) and that the pelican hook turnbuckles (figure 1, item 3) are tight.

2. Set both anchor windlass brakes (figure 1, item 4) by turning the anchor windlass brake handwheels (figure 1, item 5).

3. Perform the Central Hydraulic System Hydraulic Power Unit (HPU) Startup procedure (WP 0076 00).

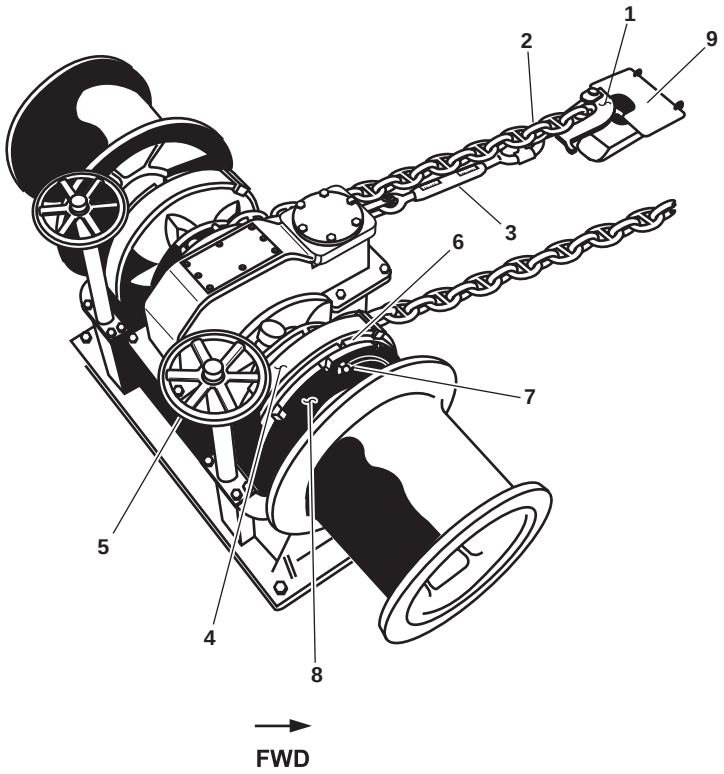


Figure 1. Anchor Windlass

ANCHOR WINDLASS POWERED WILDCAT OPERATION

GENERAL

1. Wildcats can be operated together or separately as dictated by the torque limitations and the load. Each wildcat is equipped with a dog clutch and a hand brake. Engaging the dog clutch and releasing the brake allows the wildcat to be driven in a direction and at a speed set by the appropriate controls.

2. For normal speeds and loads, the two-speed lever will be in the HIGH SPEED position. The chain can be lowered or raised at a variable speed from creep to approximately 25 ft/min (7.9 m/min). For heavy loads, the two-speed lever should be in the LOW SPEED position. The LOW SPEED mode doubles the torque and allows the chain to be lowered or raised at variable speeds, from creep to approximately 12 ft/min (3.8 m/min).

OPERATION

1. Perform the Anchor Windlass Pre-Operation procedure in this work package.

2. Engage the dog clutch (figure 1, item 6) by performing the following steps:

   a. Remove the dog clutch tool from the frame-mounted bracket.

   b. Loosen both wing nuts (figure 1, item 7) on the face of the shifter ring (figure 1, item 8).

⚠ CAUTION

Maneuvering the main shaft may be necessary (with the brake set) to engage the dogs with the clutch jaws on the wildcat. Attempting to engage dogs and clutch jaws when not properly aligned could damage the windlass.

   c. Verify that the anchor windlass brake (figure 1, item 4) is set by rotating the anchor windlass brake handwheel (figure 1, item 5) fully clockwise.

   d. Verify that the pelican hooks (figure 1, item 1) are secured to the anchor chain (figure 1, item 2) and that the pelican hook turnbuckles (figure 1, item 3) are tight.

   e. Set the two-speed control lever (figure 2, item 1) to LOW SPEED.

   f. Operate the RAISE-LOWER control (figure 2, item 2) until the slots in the dog clutch (figure 1, item 6) are aligned with the slots in the shifter ring (figure 1, item 8).

   g. Insert the dog clutch tool in the nearest slot that is aligned with the dog clutch (figure 1, item 6) and the shifter ring (figure 1, item 8).

NOTE

A 50-degree movement of the clutch shifter ring is required to fully engage or disengage the dog clutch.

   h. Push the dog clutch tool forward to engage the dog clutch (figure 1, item 6).

   i. Tighten both wing nuts (figure 1, item 7) on the face of the shifter ring (figure 1, item 8).

3. Select the desired speed by setting the two-speed control lever (figure 2, item 1) to the desired speed.

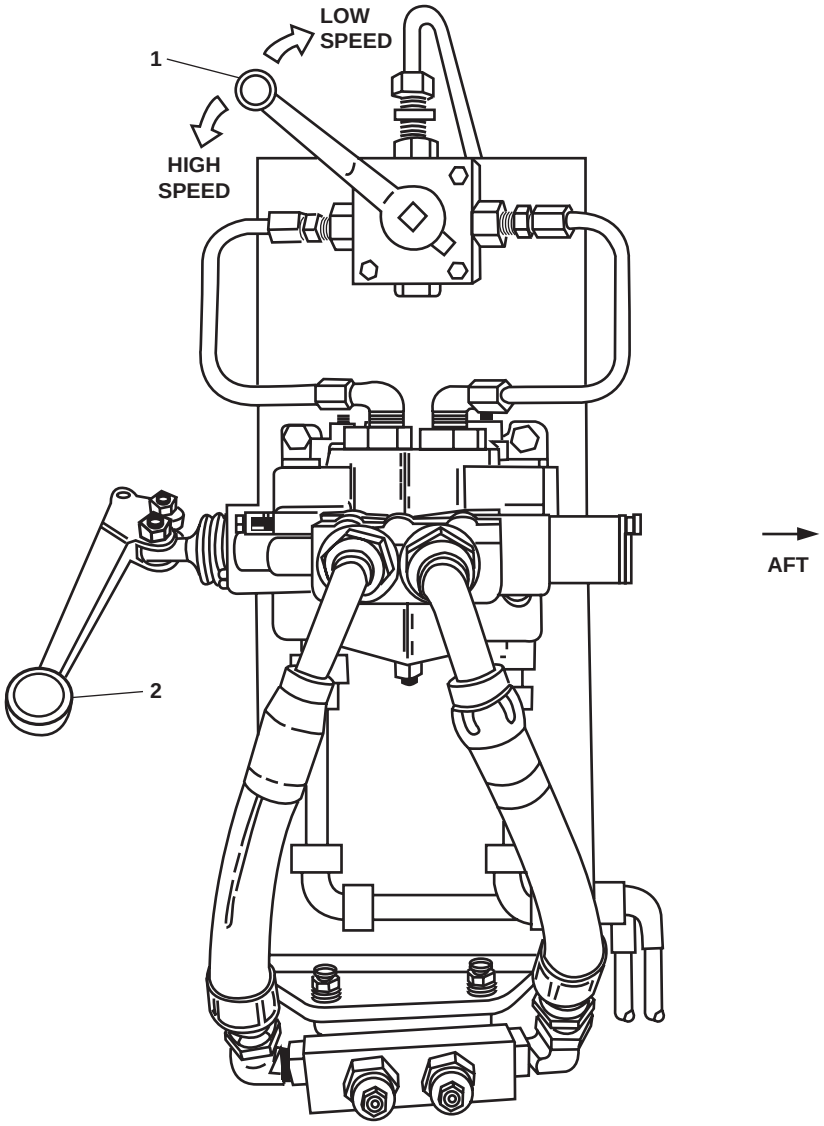


Figure 2. Anchor Windlass Control Station

NOTE

Raise the anchor chain until there is slack in the pelican hook/turnbuckle chain.

4. Swing the hawsepipe cover plate (figure 1, item 9) clear of the hawsepipe opening and remove the pelican hook (figure 1, item 1) from the anchor chain (figure 1, item 2) by loosening the pelican hook turnbuckles (figure 1, item 3).

NOTE

It may be necessary to lightly tap on the anchor windlass brake handwheel to free the anchor windlass brake. Proper lubrication will prevent the anchor windlass brake from becoming stuck.

5. Release the anchor windlass brake(s) (figure 1, item 4) by turning the anchor windlass brake handwheels (figure 1, item 5).

6. To raise or lower the anchor chain (figure 1, item 2), move the RAISE-LOWER control (figure 2, item 2) to the desired position.

ANCHOR WINDLASS FREE WHEELING OPERATION

1. Perform the Anchor Windlass Pre-Operation procedure in this work package.

⚠ CAUTION

When operating the anchor windlass in the free wheeling mode, the windlass must be carefully observed and controlled to ensure that the windlass speed does not cause the chain to "jump the cat" causing damage to the anchor windlass.

NOTE

With the dog clutch disengaged and the brake released, the wildcat will free wheel, allowing the anchor to free-fall. Manipulating the brake slows or stops the anchor as desired.

2. Set both anchor windlass brakes (figure 1, item 4) by turning the anchor windlass brake handwheels (figure 1, item 5) fully clockwise.

3. Disengage the dog clutch (figure 1, item 6) by performing the following steps:

   a. Remove the dog clutch tool from the frame-mounted bracket.

   b. Loosen both wing nuts (figure 1, item 7) on the face of shifter ring (figure 1, item 8).

⚠ CAUTION

Maneuvering the main shaft may be necessary (with the brake set) to engage the dogs with the clutch jaws on the wildcat. Attempting to engage dogs and clutch jaws when not properly aligned could damage the windlass.

   c. Verify that the anchor windlass brake (figure 1, item 4) is set by rotating the anchor windlass brake handwheel (figure 1, item 5) fully clockwise.

   d. Verify that the pelican hooks (figure 1, item 1) are secured to the anchor chain (figure 1, item 2) and that the pelican hook turnbuckles (figure 1, item 3) are tight.

   e. Set the two-speed control lever (figure 2, item 1) to LOW SPEED.

   f. Operate the RAISE-LOWER control (figure 2, item 2) until the slots in the dog clutch (figure 1, item 6) are aligned with the slots in the shifter ring (figure 1, item 8).

   g. Insert the dog clutch tool in the nearest slot that is aligned with the dog clutch (figure 1, item 6) and the shifter ring (figure 1, item 8).

NOTE

A 50-degree movement of the clutch shifter ring is required to fully engage or disengage the dog clutch.

   h. Pull the dog clutch tool aft to disengage the dog clutch (figure 1, item 6).

   i. Tighten both wing nuts (figure 1, item 7) on the face of the shifter ring (figure 1, item 8).

4. Remove the pelican hook (figure 1, item 1) from the anchor chain (figure 1, item 2) by loosening the pelican hook turnbuckles (figure 1, item 3).

⚠ CAUTION

Observe the anchor windlass and control its speed using the brake to ensure that the windlass speed does not cause the chain to "jump the cat," causing damage to the windlass.

5. Slowly release the anchor windlass brake(s) (figure 1, item 4) by turning the anchor windlass brake handwheels (figure 1, item 5) counterclockwise.

6. When the desired amount of anchor chain (figure 1, item 2) has been paid out, set the anchor windlass brake(s) (figure 1, item 4) by turning the anchor windlass brake handwheel(s) (figure 1, item 5) fully clockwise.

ANCHOR WINDLASS GYPSEY ONLY OPERATION

1. Perform the Anchor Windlass Pre-Operation procedure in this work package.

NOTE

The gypsies turn whenever the anchor windlass is being operated. For gypsey-only operation, the dog clutch is disengaged, and the brake is set. The main shaft can be driven with the wildcats held stationary.

2. Set both anchor windlass brakes (figure 1, item 4) by turning the anchor windlass brake handwheels (figure 1, item 5) fully clockwise.

3. Disengage the dog clutch (figure 1, item 6) by performing the following steps:

   a. Remove the dog clutch tool from the frame-mounted bracket.

   b. Loosen both wing nuts (figure 1, item 7) on the face of shifter ring (figure 1, item 8).

⚠ CAUTION

Maneuvering the main shaft may be necessary (with the brake set) to engage the dogs with the clutch jaws on the wildcat. Attempting to engage dogs and clutch jaws when not properly aligned could damage the windlass.

   c. Verify that the anchor windlass brake (figure 1, item 4) is set by rotating the anchor windlass brake handwheel (figure 1, item 5) fully clockwise.

   d. Verify that the pelican hooks (figure 1, item 1) are secured to the anchor chain (figure 1, item 2) and that the pelican hook turnbuckles (figure 1, item 3) are tight.

   e. Set the two-speed control lever (figure 2, item 1) to LOW SPEED.

   f. Operate the RAISE-LOWER control (figure 2, item 2) until the slots in the dog clutch (figure 1, item 6) are aligned with the slots in the shifter ring (figure 1, item 8).

   g. Insert the dog clutch tool in the nearest slot that is aligned with the dog clutch (figure 1, item 6) and the shifter ring (figure 1, item 8).

NOTE

A 50-degree movement of the clutch shifter ring is required to fully engage or disengage the dog clutch.

h. Pull the dog clutch tool aft to disengage the dog clutch (figure 1, item 6).

i. Tighten both wing nuts (figure 1, item 7) on the face of the shifter ring (figure 1, item 8).

4. Select the desired speed by setting the two-speed control lever (figure 2, item 1) to the desired speed.

5. Haul in (raise) or pay out (lower) by moving the RAISE-LOWER control (figure 2, item 2) to the desired position.

ANCHOR WINDLASS SHUTDOWN

1. Verify that anchor windlass operations have ended and the anchors are properly stowed in their hawse pipes.

2. Set both anchor windlass brakes (figure 1, item 4) by turning the anchor windlass brake handwheels (figure 1, item 5) fully clockwise.

3. Install the pelican hooks (figure 1, item 1) on the anchor chain (figure 1, item 2) and tighten the pelican hook turnbuckles (figure 1, item 3).

4. Perform a thorough fresh water washdown of the anchor windlass.

5. Notify unit maintenance to perform lubrication of the anchor windlass following each use.

6. Perform the Central Hydraulic System Hydraulic Power Unit (HPU) Shutdown procedure (WP 0102 00).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
CAPSTAN

INITIAL SETUP:

Personnel Required:
One Watercraft Operator, 88K
One Watercraft Engineer, 88L

References:
WP 0076 00
WP 0102 00

CAPSTAN OPERATION

1. Perform the Central Hydraulic System Power Unit (HPU) Startup procedure (WP 0076 00).

NOTE

The directional control valve is equipped with a spring, that will return the handle to the NEUTRAL position when the handle is released.

2. To operate the capstan, move the directional control valve handle (figure 1, item 1) by pushing or pulling in the desired direction (HEAVE or PAYOUT).

3. The rotational direction and speed of the capstan is controlled by throttling the directional control valve (figure 1, item 1).

CAPSTAN SHUTDOWN

1. Verify that capstan operations have ended.

2. Perform the Central Hydraulic System Hydraulic Power Unit (HPU) Shutdown procedure (WP 0102 00).

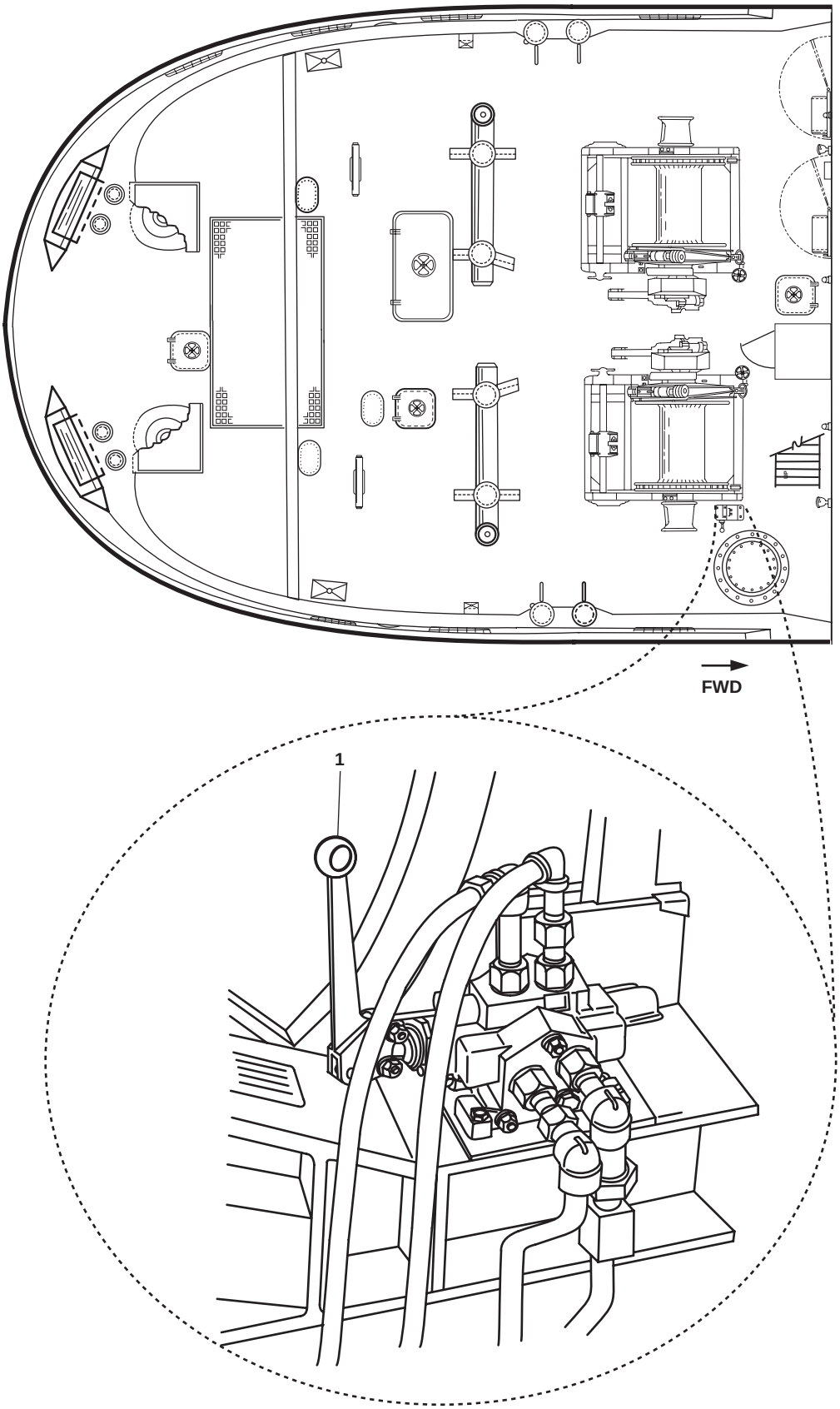


Figure 1. Capstan Control Valve

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
TOWING MACHINE

INITIAL SETUP:

Personnel Required:
Two Watercraft Operators, 88K
One Watercraft Engineer, 88L

References:
WP 0071 00

TOWING MACHINE HYDRAULIC SYSTEM STARTUP

1. OPEN the following valves in AMS 1:
   a. TH-13, FLOW CONTROL (figure 1, item 4)
   b. TH-1, C.O.V. PMP DISCH.TO TOW WN. HYD (figure 1, item 5)
   c. TH-14, FLOW CONTROL (figure 1, item 6)
   d. GS-75, TOW WN HYD OIL CLR SPLY (figure 1, item 7)
   e. GS-77, HYD OIL CLR DISCH (figure 1, item 8)
   f. TH-12, FLOW CONTROL (figure 1, item 9)
   g. CH-27, RTN CUT-OUT TOW WN HYDR (figure 1, item 10)
   h. CH-26, DRN CUT-OUT TOW WN HYDR (figure 1, item 11)
   i. FO-31, F.O. SPLY TO PMP DRV ENG (figure 2, item 1)
   j. CA-6, STG AIR TO PMP DR ENG (figure 2, item 2)
   k. Asw-19, S.W. TO PUMP DRIVE ENG (figure 2, item 3)
   l. Asw-20, S.W. FR. PUMP DRIVE ENG. TO OVB'D DISCHARGE (figure 2, item 4)
   m. Asw-22, OVB'D DISCH., S.W. COOLING (figure 2, item 5)
2. CLOSE the following valves in AMS 1:
   a. TH-2, PRESS CRSVR CTL HYDR TOW WN HYDR (figure 1, item 2)
   b. TH-3, RETURN CRSVR. TO CENT. HYD (figure 1, item 1)
   c. TH-4, DRAIN CRSVR. TO CENT. HYD. (figure 1, item 3)
3. In the engine room, OPEN the following valves:
   a. FO-33, F.O. RTN TO DAY TK. PORT (figure 2, item 6)
   b. FO-13, F.O. SERV. SUCT. PORT (figure 2, item 7)
   c. AE-28, SEACHEST VENT (figure 2, item 8)
   d. Asw-17, SEA SUCTION S.W. COOLING (figure 2, item 9)

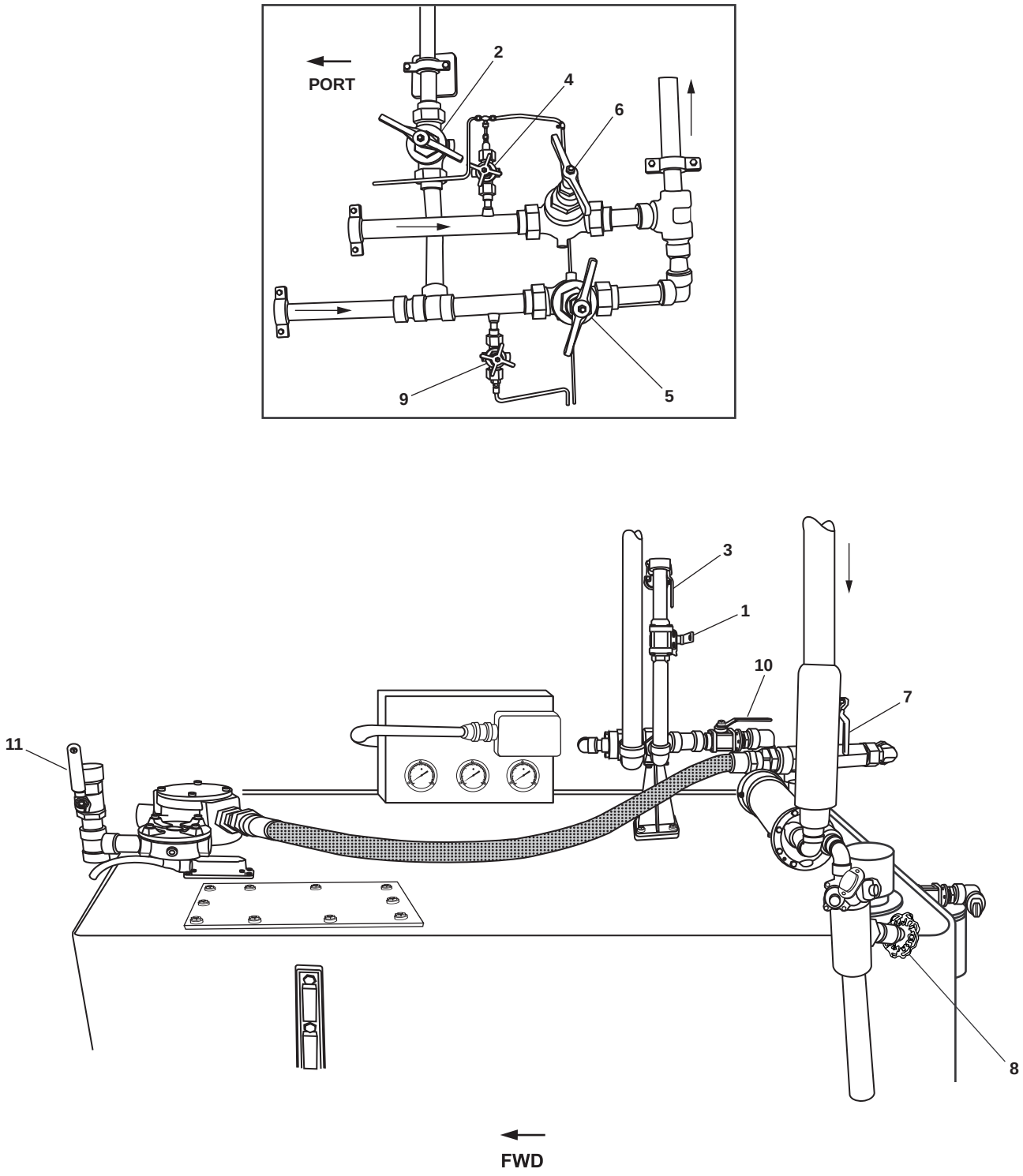


Figure 1. Towing Machine Hydraulic Power Unit

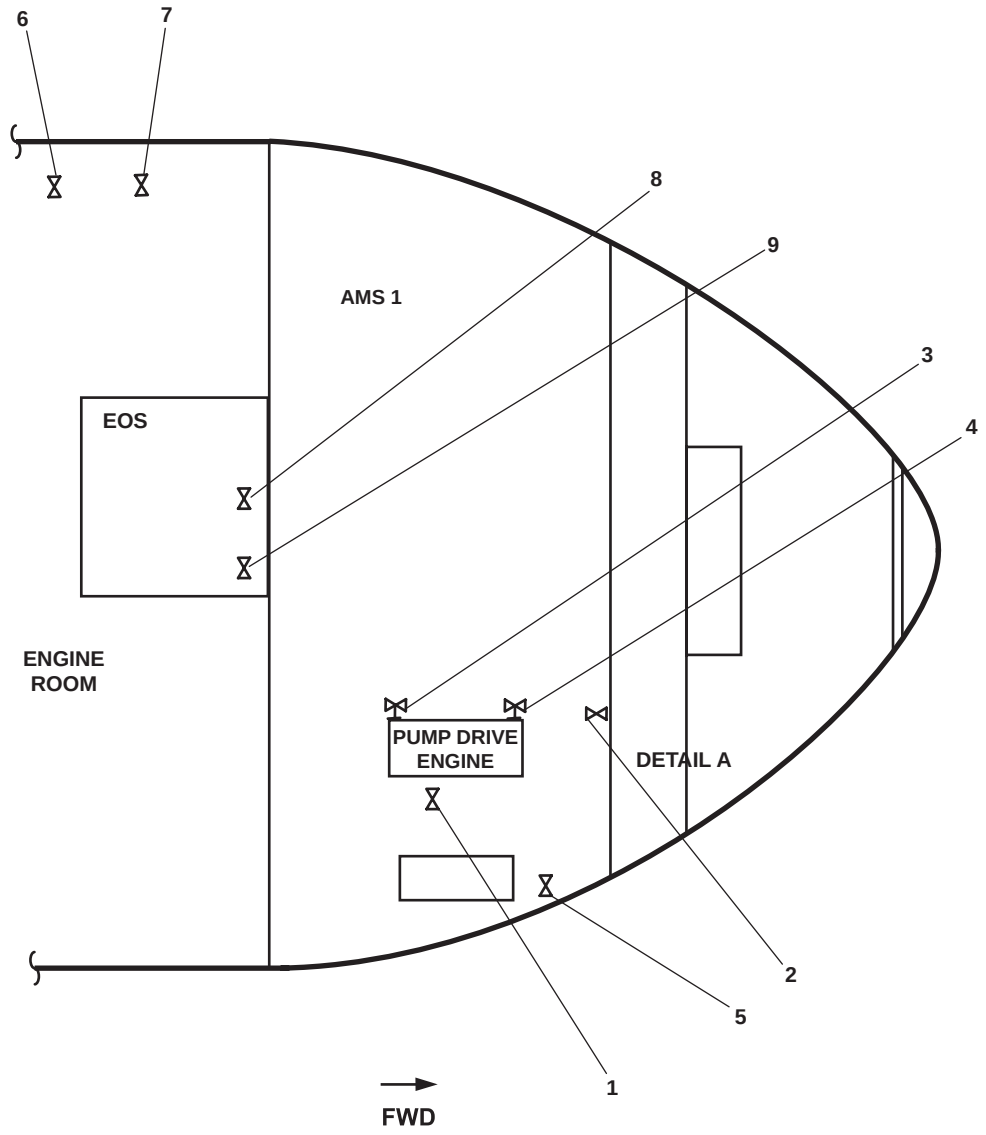


Figure 2. Towing Machine Hydraulic System Valve Locations

4. At 120V distribution panel No. 4, set the PUMP DRIVE ENGINE JACKET WATER. circuit breaker (figure 3, item 1) to ON.

5. Start the pump drive engine by performing the following steps:

   a. Place the firefighting pump power take-off control lever (figure 4, item 1) in the disengaged (aft) position.

   b. Move the governor control lever (figure 5, item 1) to the half engine speed position (approximately straight up).

   c. In AMS 1, check that the PMP DR ENG STG AIR PRESS air supply pressure gauge indicates an air start reading between 100 to 120 PSI (6.9 to 8.3 bar) in order to operate properly.

   d. On the pump drive engine control panel, turn the START/STOP pushbutton (figure 5, item 2) clockwise to release the pushbutton to the OUT position.

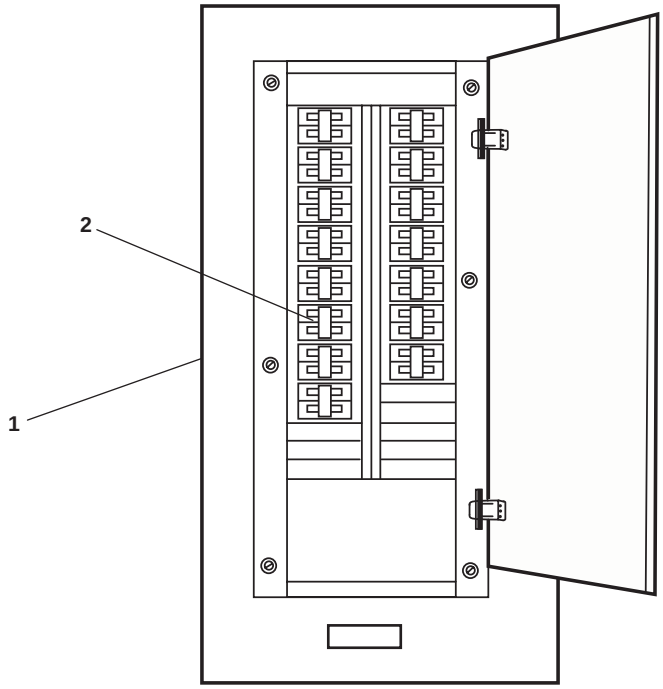


Figure 3. 120V Distribution Panel No. 4

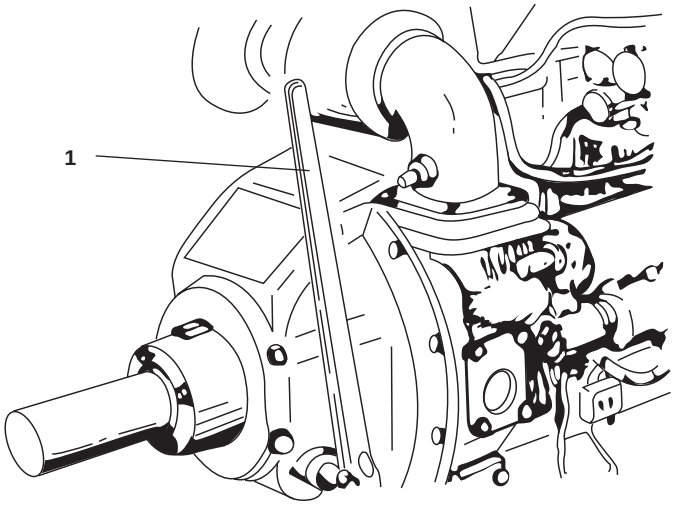


Figure 4. Pump Drive Engine Power Take-Off

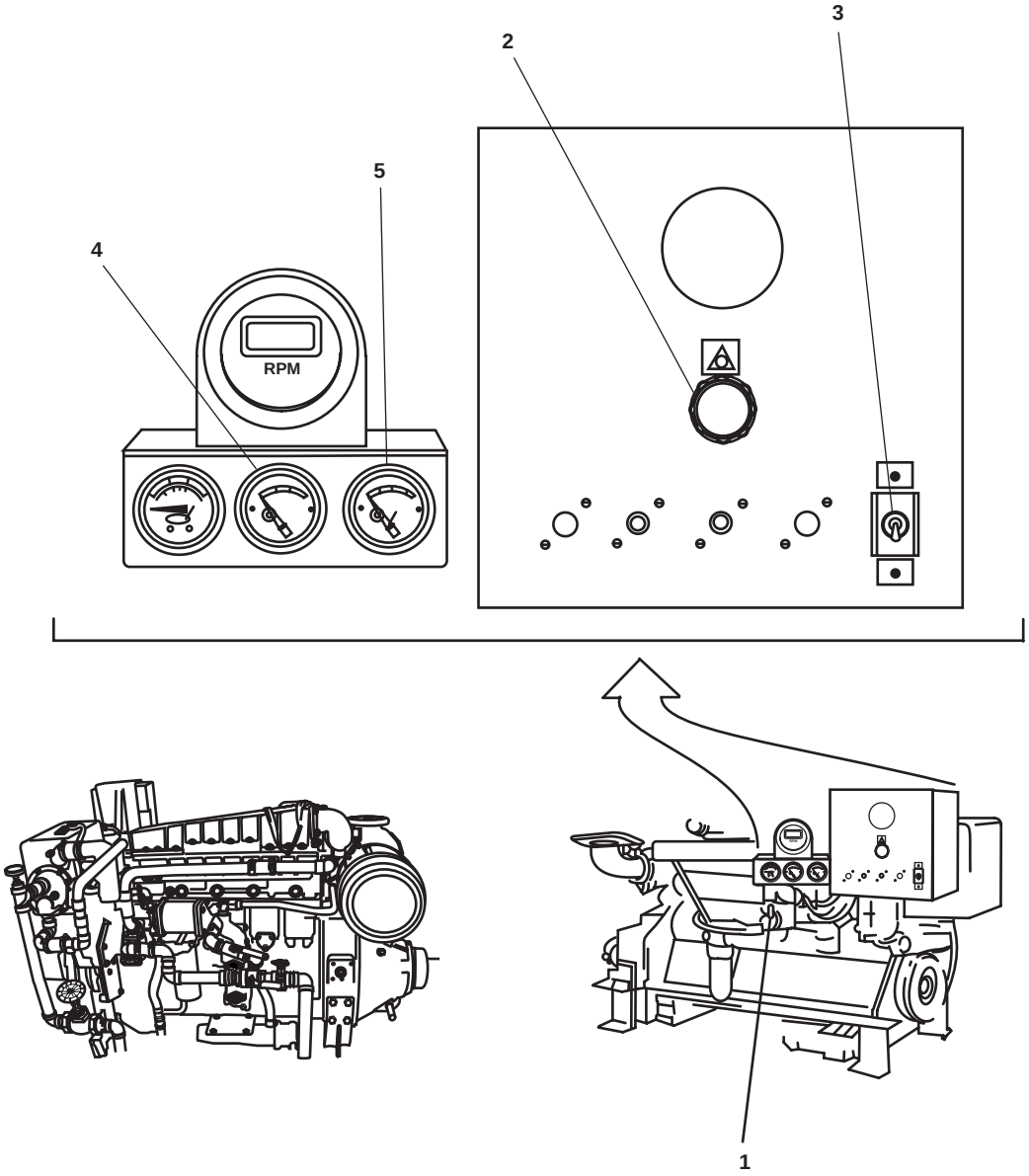


Figure 5. Pump Drive Engine Controls

WARNING

High noise levels are present in the engine room and AMS 1 when the engines are operating. Hearing protection must be worn at all times when the engines are operating. Failure to comply can result in permanent loss of hearing.

e. Push the START/STOP toggle switch (figure 5, item 3) UP to the START position to crank the engine. As soon as the engine starts, release the toggle switch (switch is spring loaded and will return to the center RUN position).

⚠ CAUTION

Oil pressure should rise after the engine starts. If the oil pressure does not rise, stop the engine immediately by pushing the toggle switch DOWN. Failure to comply will result in engine damage.

f. Allow the engine to idle 3 to 5 minutes, or until the oil pressure gauge (figure 5, item 4) indicates between 35 and 70 PSI (2.4 to 4.8 bar).

g. Operate the engine at low load until all systems have reached their operating temperatures.

h. Check the engine gauges (figure 5, items 4 and 5) for normal operation during the warmup period.

i. Move the governor control lever (figure 5, item 1) to the high idle position.

6. Verify that the general service system is providing cooling water to the vessel (WP 0071 00).

7. Perform the desired towing machine operation procedure in this work package.

TOWING MACHINE HYDRAULIC SYSTEM SHUTDOWN

1. Verify that all towing machine operations have ended.

⚠ CAUTION

Stopping the pump drive engine immediately after it has been under a load can result in overheating and accelerating wear of the engine components. Follow the stopping procedure below to avoid damage to the engine.

2. Operate the pump drive engine at low idle, with no load for 5 minutes.

3. Secure the pump drive engine by completing the following steps:

a. Move the governor control lever (figure 5, item 1) to the half engine speed position.

b. Pull upward on the governor control lever (figure 5, item 1) and then move the governor control lever to the OFF position.

c. Push IN the START/STOP pushbutton (figure 5, item 2).

4. CLOSE the following valves in AMS 1:
   a. TH-13, FLOW CONTROL (figure 1, item 4)
   b. TH-1, C.O.V. PMP DISCH.TO TOW WN. HYD (figure 1, item 5)
   c. TH-14, FLOW CONTROL (figure 1, item 6)
   d. GS-75, TOW WN HYD OIL CLR SPLY (figure 1, item 7)
   e. GS-77, HYD OIL CLR DISCH (figure 1, item 8)
   f. TH-12, FLOW CONTROL (figure 1, item 9)
   g. CH-27, RTN CUT-OUT TOW WN HYDR (figure 1, item 10)
   h. CH-26, DRN CUT-OUT TOW WN HYDR (figure 1, item 11)
   i. FO-31, F.O. SPLY TO PMP DRV ENG (figure 2, item 1)
   j. CA-6, STG AIR TO PMP DR ENG (figure 2, item 2)
   k. Asw-19, S.W. TO PUMP DRIVE ENG (figure 2, item 3)
   l. Asw-20, S.W. FR. PUMP DRIVE ENG. TO OVB'D DISCHARGE (figure 2, item 4)
   m. Asw-22, OVB'D DISCH., S.W. COOLING (figure 2, item 5)
5. In the engine room, CLOSE the following valves:
   a. AE-28, SEACHEST VENT (figure 2, item 8)
   b. Asw-17, SEA SUCTION S.W. COOLING (figure 2, item 9)

TOWING MACHINE OPERATION SYSTEM SETUP

1. Perform the Towing Machine Hydraulic System Startup procedure in this work package.
2. Set to ON the TOWING MACHINE. circuit breaker (figure 6, item 1) in 120V emergency distribution panel No. 1.

⚠ CAUTION

Never use a lever or wrench to tighten the clutch brake. Overtightening the clutch brake will damage the mechanism.

NOTE

A force of about 25 pounds on the handwheel is usually sufficient to provide enough friction in the clutch brake to drive the towing machine under normal loads.

3. Tighten the clutch brake (figure 7, item 1) by tightening the clutch brake handwheel (figure 7, item 2).
4. Loosen the auxiliary brake (figure 7, item 3) by loosening the auxiliary brake handwheel (figure 7, item 4) to allow free rotation of the drum.

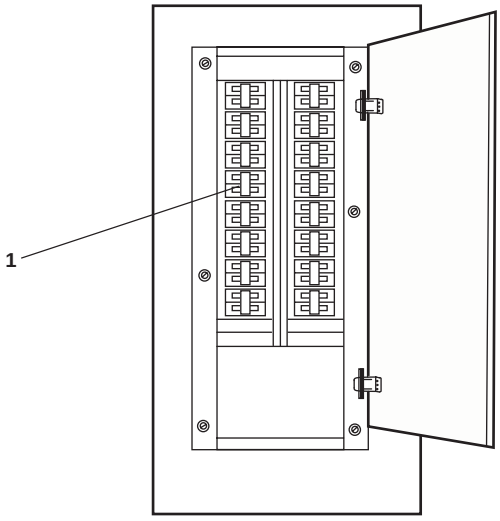


Figure 6. 120V Emergency Distribution Panel No. 1

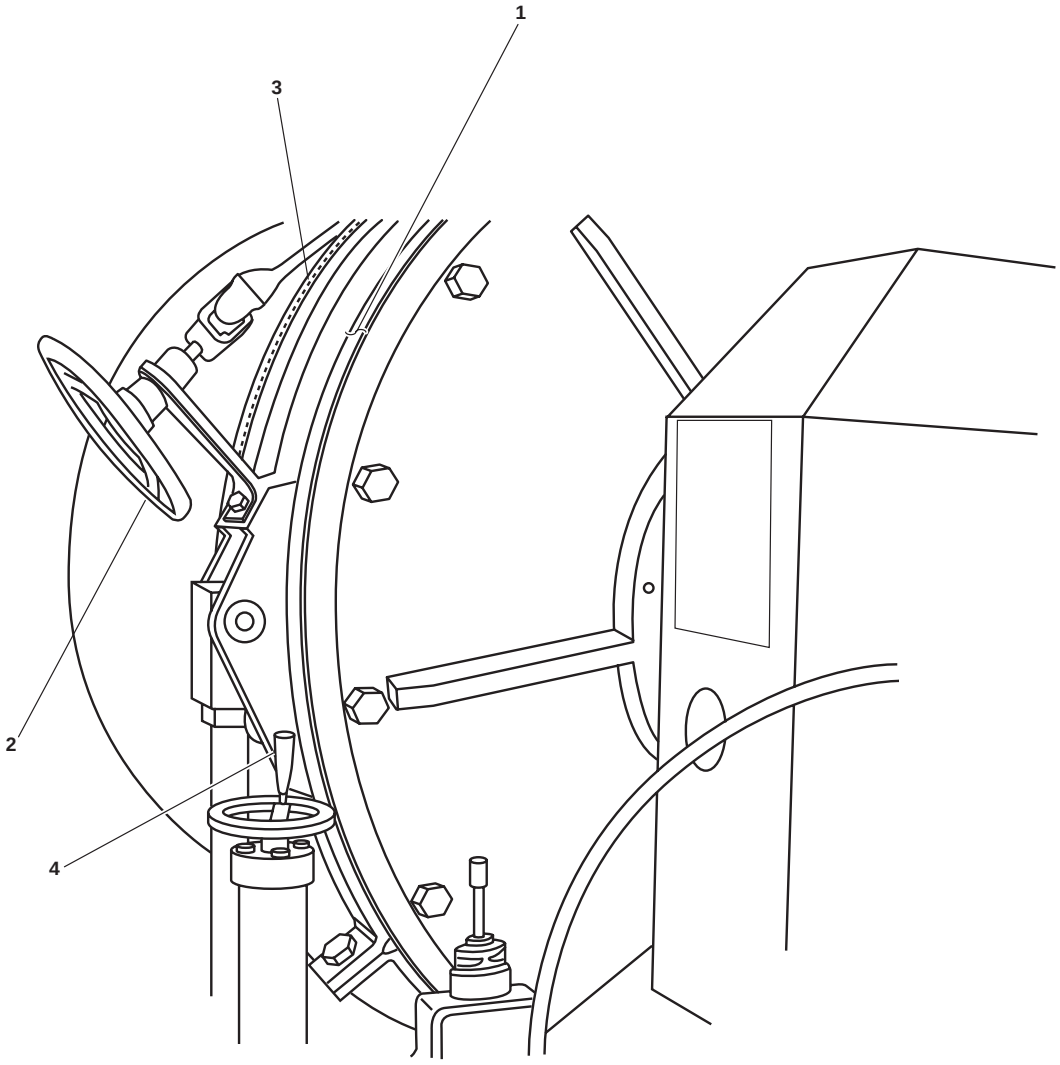


Figure 7. Towing Machine Clutch Brake and Auxiliary Brake

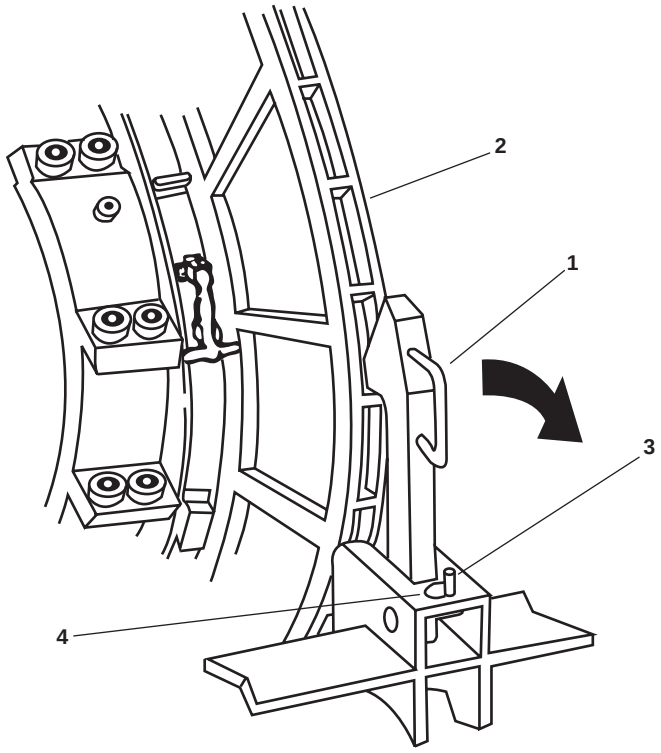


Figure 8. Towing Machine Mechanical Dog

5. Disengage the mechanical dog (figure 8, item 1) from towing machine drum (figure 8, item 2) and insert the keeper pin (figure 8, item 3) in the retaining hole (figure 8, item 4).

6. For port towing machine operation, OPEN the following valves at the port towing machine:

   a. TH-30, PORT TOW WINCH RETURN TO RSVR (figure 9, item 1)

   b. TH-32, PORT TOW WINCH PRESS TO DRUM (figure 9, item 2)

   c. TH-34, PORT TOW WINCH DR TO RSVR (figure 9, item 3)

   d. TH-36, PORT TOW WINCH DR TO RSVR (figure 9, item 4)

   e. TH-38, PORT TOW WINCH BRAKE DR RSVR (figure 9, item 5)

7. For starboard towing machine operation, OPEN the following valves at the starboard towing machine:

   a. TH-31, STBD TOW WINCH RETURN TO RSVR (figure 10, item 1)

   b. TH-33, STBD TOW WINCH PRESS TO DRUM (figure 10, item 2)

   c. TH-35, STBD TOW WINCH DR TO RSVR (figure 10, item 3)

   d. TH-37, STBD TOW WINCH DR TO RSVR (figure 10, item 4)

   e. TH-39, STBD TOW WINCH BRAKE DR TO RSVR (figure 10, item 5)

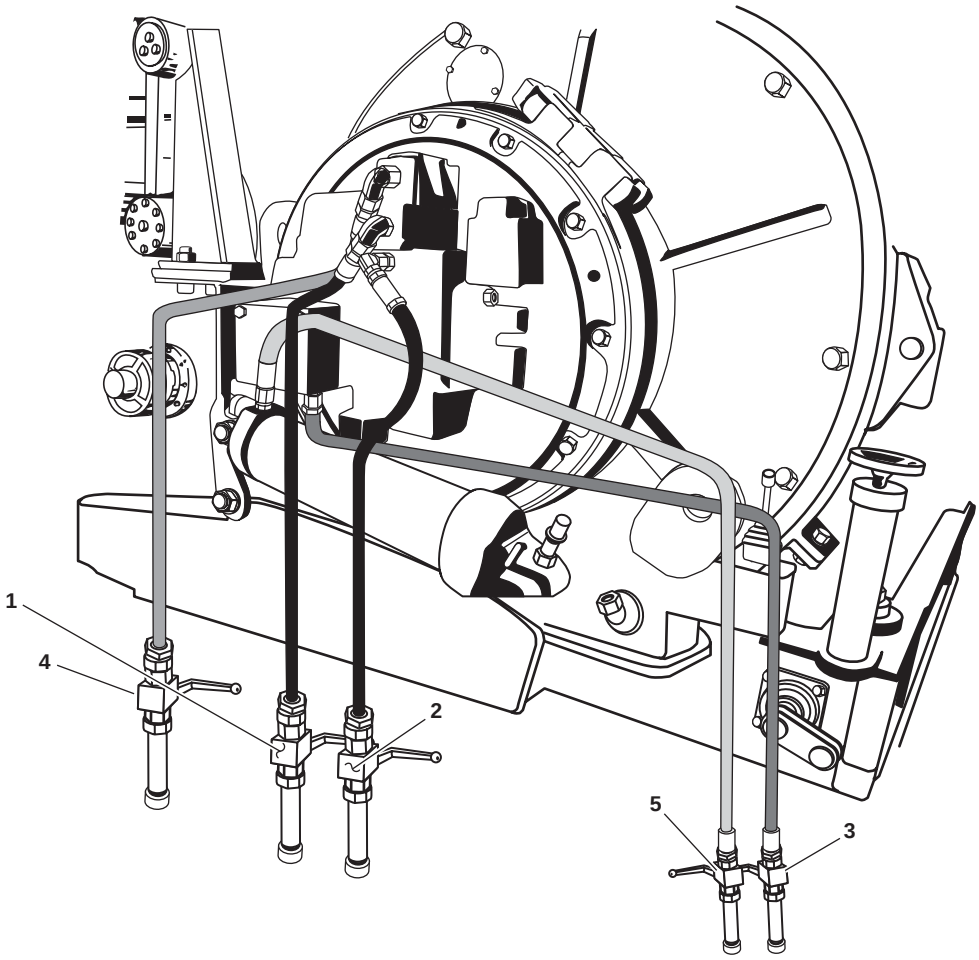


Figure 9. Port Towing Machine Isolation Valves

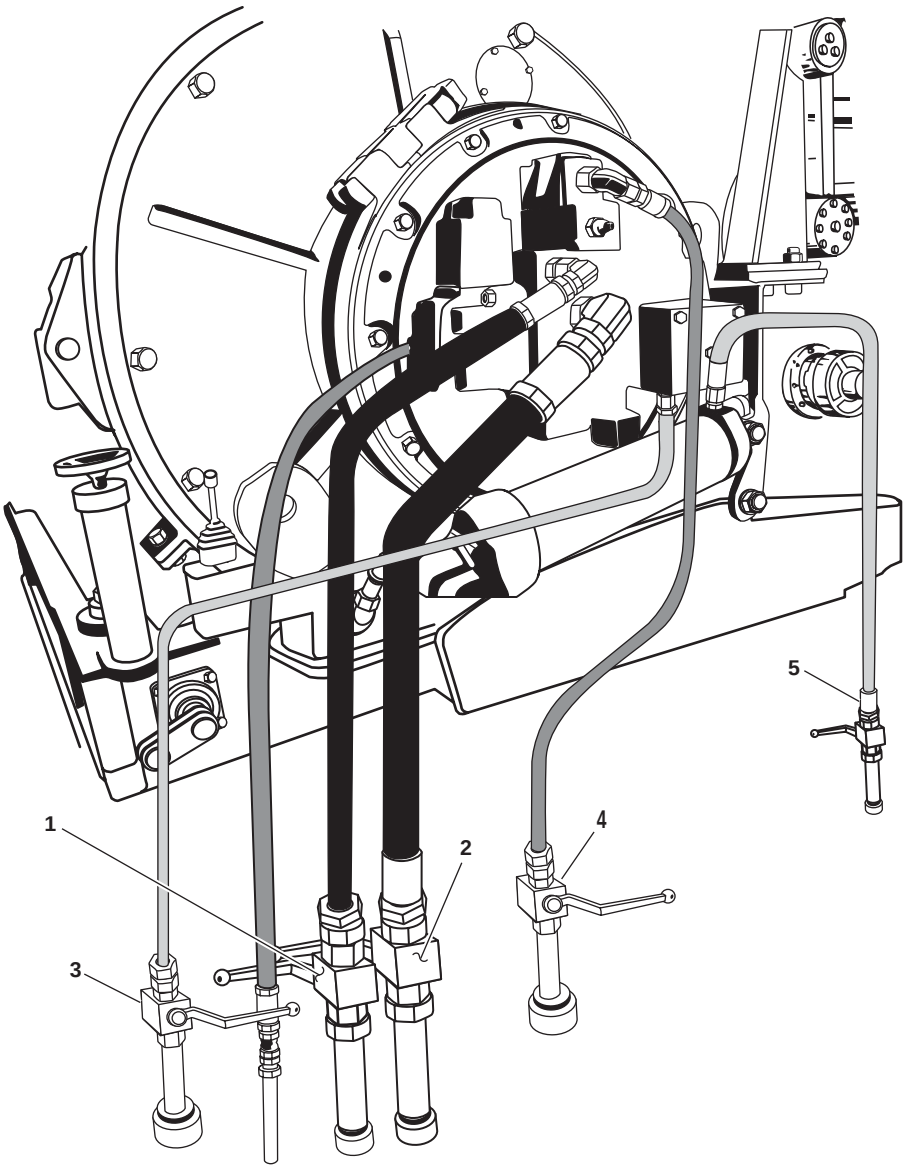


Figure 10. Starboard Towing Machine Isolation Valves

TOWING MACHINE OPERATION PAYOUT MODE NORMAL SPEED

1. Perform the Towing Machine Operation System Setup procedure in this work package.

2. Verify that the SYSTEM READY indicator (figure 11, item 1) on the towing machine operator control panel (figure 11, item 2) is illuminated.

3. Verify that the SYSTEM PRESSURE gauge (figure 11, item 3) indicates that the towing machine hydraulic system is supplying hydraulic fluid to the system.

4. Place the local or remote switch (figure 11, item 4) in the local position by pushing it down fully to the NORMAL OPERATION AT CONSOLE mode.

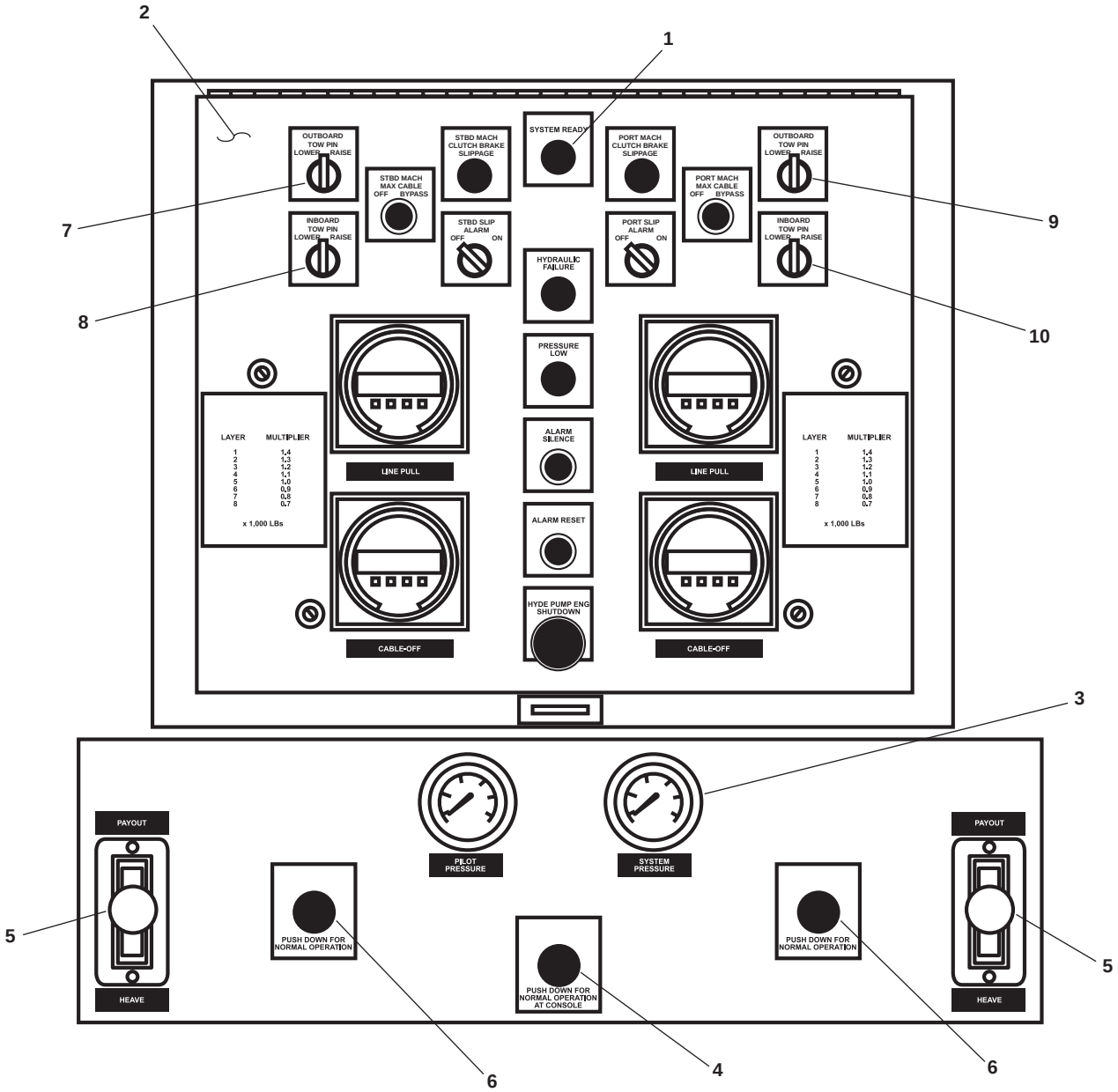


Figure 11. Towing Machine Operator Control Panel

NOTE

Shifting the two-speed valve must always be done with the control lever in the NEUTRAL position. The knob may be shifted at any time, but the control circuit will prevent a speed range shift while the towing machine is moving. Once the towing machine stops, the speed range shift will automatically take place, corresponding with the current position of the speed range selector knob valve.

5. Ensure that the directional control lever (figure 11, item 5) is in the NEUTRAL position. The NEUTRAL position is centered between the PAYOUT and HEAVE positions.

6. Place the speed range selector (figure 11, item 6) in the NORMAL OPERATION mode by pushing it down fully.

⚠ CAUTION

It is advisable to free-spool after making up the tow and establishing the desired scope. The speed of the LT must be carefully controlled while powering out the line. The LT could overpower the towing machine motor, causing severe damage to the motor.

7. Place the directional control lever (figure 11, item 5) in the PAYOUT position. The towing machine will operate at a speed proportional to the lever movement.

TOWING MACHINE OPERATION PAYOUT MODE LOW SPEED

NOTE

Operation in the low speed range mode will seldom be required or desired, but if it is necessary to pay out a small amount of line to “freshen the nip” under heavy load, use this mode.

1. Perform the Towing Machine Operation System Setup procedure in this work package.

2. Verify that the SYSTEM READY indicator (figure 11, item 1) on the towing machine operator control panel (figure 11, item 2) is illuminated.

3. Verify that the SYSTEM PRESSURE gauge (figure 11, item 3) indicates that the towing machine hydraulic system is supplying hydraulic fluid to the system.

4. Place the local or remote switch (figure 11, item 4) in the local position by pushing it down fully to the NORMAL OPERATION AT CONSOLE mode.

5. Ensure that the directional control lever (figure 11, item 5) is in the NEUTRAL position. The NEUTRAL position is centered between the PAYOUT and HEAVE positions.

NOTE

The towing machine will pay out the line at half the normal speed and at a rate proportional to the lever movement. This mode develops twice the normal torque at half the normal speed.

6. Place the speed range selector (figure 11, item 6) in the LOW SPEED mode by fully pulling it up to its fully extended position.

7. Place the directional control lever (figure 11, item 5) in the PAYOUT position. The towing machine will operate at a speed proportional to the lever movement.

TOWING MACHINE OPERATION HEAVE MODE NORMAL SPEED

1. Perform the Towing Machine Operation System Setup procedure in this work package.

2. Verify that the SYSTEM READY indicator (figure 11, item 1) on the towing machine operator control panel (figure 11, item 2) is illuminated.

3. Verify that the SYSTEM PRESSURE gauge (figure 11, item 3) indicates that the towing machine hydraulic system is supplying hydraulic fluid to the system.

4. Place the local or remote switch (figure 11, item 4) in the local position by pushing it down fully to the NORMAL OPERATION AT CONSOLE mode.

5. Ensure that the directional control lever (figure 11, item 5) is in the NEUTRAL position. The NEUTRAL position is centered between the PAYOUT and HEAVE positions.

NOTE

Shifting the two-speed valve must always be done with the control lever in the NEUTRAL position. The knob may be shifted at any time, but the control circuit will prevent a speed range shift while the towing machine is moving. Once the towing machine stops, the speed range shift will automatically take place, corresponding with the current position of the speed range knob.

6. Place the speed range selector (figure 11, item 6) in the NORMAL OPERATION mode by pushing it down fully.

⚠ CAUTION

The speed of the LT must be carefully controlled while heaving in the line. The LT could overpower the towing machine motor, causing severe damage to the motor.

NOTE

The towing machine will operate at a speed proportional to the lever movement.

7. Place the directional control lever (figure 11, item 5) in the HEAVE position. The towing machine will operate at a speed proportional to the lever movement.

TOWING MACHINE OPERATION HEAVE MODE LOW SPEED

1. Perform the Towing Machine Operation System Setup procedure in this work package.

2. Verify that the SYSTEM READY indicator (figure 11, item 1) on the towing machine operator control panel (figure 11, item 2) is illuminated.

3. Verify that the SYSTEM PRESSURE gauge (figure 11, item 3) indicates that the towing machine hydraulic system is supplying hydraulic fluid to the system.

4. Place the local or remote switch (figure 11, item 4) in the local position by pushing it down fully to the NORMAL OPERATION AT CONSOLE mode.

5. Ensure that the directional control lever (figure 11, item 5) is in the NEUTRAL position. The NEUTRAL position is centered between the PAYOUT and HEAVE positions.

NOTE

Shifting the two-speed valve must always be done with the control lever in the NEUTRAL position. The knob may be shifted at any time, but the control circuit will prevent a speed range shift while the towing machine is moving. Once the towing machine stops, the speed range shift will automatically take place, corresponding with the current position of the speed range knob.

6. Place the speed range selector (figure 11, item 6) in the LOW SPEED mode by fully pulling it up to its fully extended position.

NOTE

The towing machine will heave at half the normal speed and at a rate proportional to the lever movement. This mode develops twice the normal torque at half the normal speed.

7. Place the directional control lever (figure 11, item 5) in the HEAVE position. The towing machine will operate at a speed proportional to the lever movement.

TOWING MACHINE OPERATION FREE SPOOLING MODE

1. Perform the Towing Machine Operation System Setup procedure in this work package.

2. Verify that the SYSTEM READY indicator (figure 11, item 1) on the towing machine operator control panel (figure 11, item 2) is illuminated.

3. Verify that the SYSTEM PRESSURE gauge (figure 11, item 3) indicates that the towing machine hydraulic system is supplying hydraulic fluid to the system.

4. Place the local or remote switch (figure 11, item 4) in the local position by pushing it down fully to the NORMAL OPERATION AT CONSOLE mode.

5. Ensure that the directional control lever (figure 11, item 5) is in the NEUTRAL position. The NEUTRAL position is centered between the PAYOUT and HEAVE positions.

NOTE

The free spooling mode is used to rapidly deploy the towline after the tow has been made up and the line has sufficiently been payed out (usually 200 to 2000 feet) to safely free spool to the desired scope. The hydraulic power unit should be in operation for this mode to permit alternative modes of operation (heave or payout) to compensate for any sudden changes in the operating condition.

6. With the towline under light tension, slowly release the clutch brake (figure 7, item 1) by loosening the clutch brake handwheel (figure 7, item 2) until the line begins to pull out.

⚠ CAUTION

This procedure produces heat in the clutch brake band. Carefully observe the brake for overheating. If the brake overheats, release the clutch brake by using the handwheel or by slowing down the LT. Failure to do so will result in damage to the brake lining. In the event of overheating and subsequent tightening of the clutch brake, there may be a tendency for the clutch brake to freeze or cement to the drum surface if left tight for long periods of time. It is good practice to loosen the clutch brake at the earliest opportunity to prevent any damage to the brake.

7. Accelerate the LT to approximately 4 knots and allow the towline to be pulled out at a speed of up to 400 ft/min (122 m/min). Tension can be maintained on the towline by tightening and loosening the clutch brake (figure 7, item 1) with the clutch brake handwheel (figure 7, item 2).

8. When the desired scope is achieved, check down the speed of the LT.

⚠ CAUTION

Severe shock loading can occur if the clutch brake is tightened while the line is being pulled out at full speed. Depending on the size of the tow, speed should be no higher than creep speed when the clutch brake is tightened. Tightening of the clutch brake with the speed of the LT too fast can cause severe damage to the towing machine.

Do not over tighten the clutch brake. The clutch brake provides shock protection for the towing machine and should be loose enough to slip under a sudden shock load due to heavy seas or other reason(s).

9. Slowly tighten the clutch brake (figure 7, item 1) by turning the clutch brake handwheel (figure 7, item 2) until the clutch brake is properly adjusted for tow size, sea conditions, and the LT speed.

WARNING

The clutch brake should not slip excessively. If this occurs however, the slip alarm will activate. Continuous slipping can eventually cause an increase in scope to the point where the towline could be lost. Severe personal injury or death could result from towline whip if the towline is lost.

NOTE

Occasional slippage during heavy seas indicates that the clutch brake is doing its job, and it is necessary to heave in occasionally to maintain desired scope. Towing on smooth or moderate seas should not cause slippage of the clutch brake.

10. Towing operations can commence when the clutch brake is properly tightened.

TOWING MACHINE OPERATION GYPSEY HEAD MODE

1. Perform the Towing Machine Operation System Setup procedure in this work package.

2. Verify that the SYSTEM READY indicator (figure 11, item 1) on the towing machine operator control panel (figure 11, item 2) is illuminated.

3. Verify that the SYSTEM PRESSURE gauge (figure 11, item 3) indicates that the towing machine hydraulic system is supplying hydraulic fluid to the system.

4. Place the local or remote switch (figure 11, item 4) in the local position by pushing it down fully to the NORMAL OPERATION AT CONSOLE mode.

5. Ensure that the directional control lever (figure 11, item 5) is in the NEUTRAL position. The NEUTRAL position is centered between the PAYOUT and HEAVE positions.

6. Loosen the clutch brake (figure 7, item 1) by turning the handwheel (figure 7, item 2) to allow free rotation of the ring gear.

⚠ CAUTION

Never use a lever or a wrench to tighten the auxiliary brake. Damage to the mechanism will occur.

NOTE

A force of about 25 lbs on the handwheel is usually sufficient to provide enough friction on the band to hold the drum.

7. Tighten the auxiliary brake (figure 7, item 3) by turning the auxiliary brake handwheel (figure 7, item 4).

8. Perform the desired Towing Machine Operation HEAVE or PAYOUT MODE procedure in this work package.

TOWING MACHINE OPERATION SPOOLING DEVICE ALIGNMENT

NOTE

For tight spooling, the rollers should have a slight lead on the previous wrap. This is more important during respooling than paying out.

1. During all heave and payout operations, observe the spooling device alignment to make sure the wire rope is passing through the rollers more or less perpendicular to the drum and in line with the previous wrap.

WARNING

Do not disengage the clutch if there is heavy quartering load on the towline as the towline may drive the handwheel at rapid speed until spooling rollers align themselves with wire rope. Always make sure there is a light line pull or small misalignment before disengaging the clutch. Rapidly turning the handwheel could cause personal injury.

2. If the spooling device is not properly aligned to the towline, realign the spooling device by pulling OUT on the spooling device handwheel (figure 12, item 1) and turning it in the desired direction.

3. After realigning the spooling device, push IN on the spooling device handwheel (figure 12, item 1) to engage it in the drive.

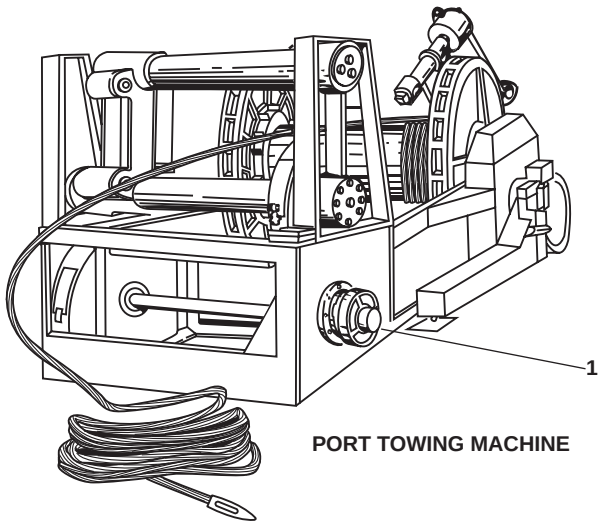


Figure 12. Towing Machine Spooling Device

SECURE TOWING MACHINE

1. Ensure that all towing machine operations have ended.

⚠ CAUTION

Never use a lever or wrench to tighten the clutch brake. Overtightening the clutch brake will damage the mechanism.

2. Tighten the clutch brake (figure 7, item 1) by turning the clutch brake handwheel (figure 7, item 2).
3. Tighten the auxiliary brake (figure 7, item 3) by turning the auxiliary brake handwheel (figure 7, item 4).
4. Remove the quick release pin (figure 8, item 3) from the retaining hole (figure 8, item 4) and engage the mechanical dog (figure 8, item 1) in the drum (figure 8, item 2).
5. If the port towing machine was operated, CLOSE the following valves at the port towing machine:
   a. TH-30, PORT TOW WINCH RETURN TO RSVR (figure 9, item 1)
   b. TH-32, PORT TOW WINCH PRESS TO DRUM (figure 9, item 2)
   c. TH-34, PORT TOW WINCH DR TO RSVR (figure 9, item 3)
   d. TH-36, PORT TOW WINCH DR TO RSVR (figure 9, item 4)
   e. TH-38, PORT TOW WINCH BRAKE DR RSVR (figure 9, item 5)
6. If the starboard towing machine was operated, CLOSE the following valves at the starboard towing machine:
   a. TH-31, STBD TOW WINCH RETURN TO RSVR (figure 10, item 1)
   b. TH-33, STBD TOW WINCH PRESS TO DRUM (figure 10, item 2)
   c. TH-35, STBD TOW WINCH DR TO RSVR (figure 10, item 3)
   d. TH-37, STBD TOW WINCH DR TO RSVR (figure 10, item 4)
   e. TH-39, STBD TOW WINCH BRAKE DR TO RSVR (figure 10, item 5)
7. Set to OFF the TOWING MACHINE circuit breaker (figure 6, item 1) in engine room emergency distribution panel 1 (figure 6, item 2).
8. Perform the Towing Machine Hydraulic System Shutdown procedure in this work package.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
PORTABLE DEWATERING PUMP

INITIAL SETUP:

Materials/Parts:
Lubricant, Silicone (Item 94, Table 1, WP 0165 00, Volume 2)

References:
WP 0165 00 (volume 2)

Personnel Required:
One Watercraft Operator, 88K
One Watercraft Engineer, 88L

GENERAL

This work package contains the following procedures:

1. Preoperational Check
2. Starting the Pump
3. Priming the Pump and Commencing Pumping
4. Securing the Pump.

PREOPERATIONAL CHECK

Perform the following steps to prepare the P-100 dewatering pump for operation.

⚠ CAUTION

The suction hose may require support to prevent excessive weight from stressing the pump casing, inboard head, or engine. Where practical, the suction hose should be tied to a nearby structure or blocks should be placed beneath the suction hose adjacent to the pump unit to relieve stress on the pump.

NOTE

Care should be taken to ensure that the suction hose (or pipe) is airtight. Neither the pump nor the primer will lift water if the suction side of the pump has any air leaks.

1. Connect the suction hose fitting to the suction coupling and place the suction hose into the water supply.
2. Submerge the suction intake sufficiently into the water to prevent sucking in air.
3. CLOSE the drain valve and all other openings into the pump casing.
4. Connect the discharge hose fitting to the discharge valve. Ensure that the discharge hose is manned.

WARNING

Do not operate the pump unit in confined spaces unless the exhaust hose is connected to carry the toxic engine exhaust gases to weather. Failure to comply can result in serious injury or death.

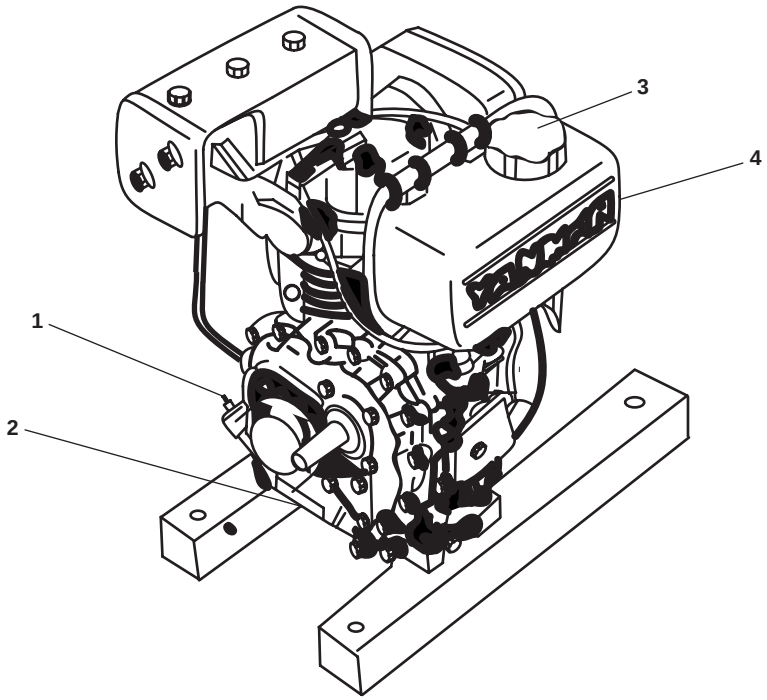
5. Check the engine lube oil for proper level prior to starting the pump:

⚠ CAUTION

When checking the oil level, ensure that the pump unit is sitting level. If it is tilted, too much or too little oil may be installed. Overfilling the recommended oil level may cause the engine to consume too much oil and the oil temperature may become dangerously high. Operation of the pump unit with the oil level below the recommended level may cause severe damage to the engine. Never check the engine lube oil level with the engine running.

a. Unscrew the oil dipstick (figure 1, item 1).

b. Wipe the dipstick (figure 1, item 1) clean and then dip into the oil sump (figure 1, item 2).



Pump end and cage removed for clarity.

Figure 1. P-100 Portable Dewatering Pump

NOTE

Do not screw in the dipstick when checking the oil level. Screwing the dipstick in will give a false reading indicating that the level is higher than actually present.

c. Remove the dipstick (figure 1, item 1) and check that the oil is within the acceptable range.

d. If the oil level is reading low, add additional oil (MIL-PRF-2104).

e. Install the dipstick (figure 1, item 1).

6. Check the fuel level by removing the fuel cap (figure 1, item 3) on the fuel tank (figure 1, item 4). Add fuel as required.

STARTING THE PUMP

1. Set the fuel tank isolation valve (figure 2, item 1) located under the fuel tank (figure 2, item 2) to the "O" (OPEN) position.

2. Set the engine throttle control (figure 3, item 1) to the START position.

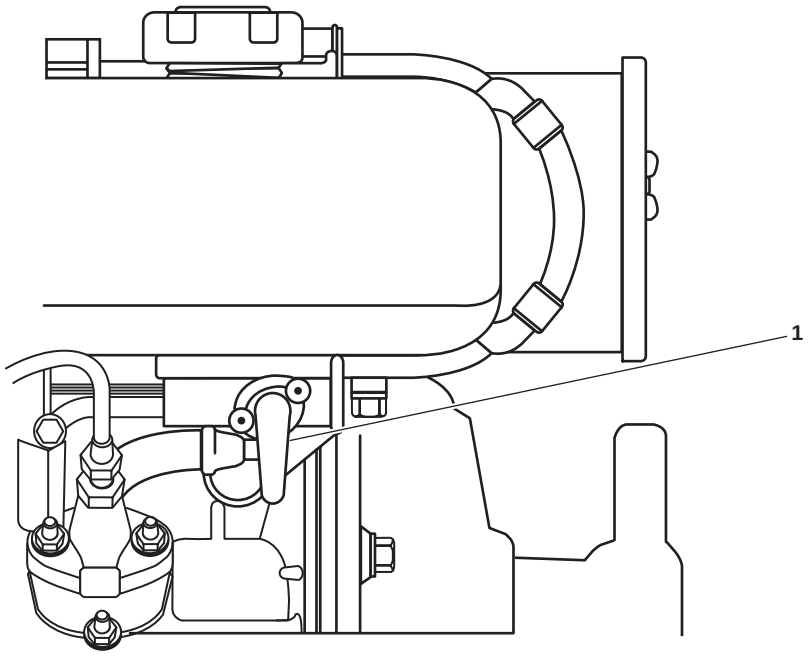


Figure 2. Fuel Tank Isolation Valve

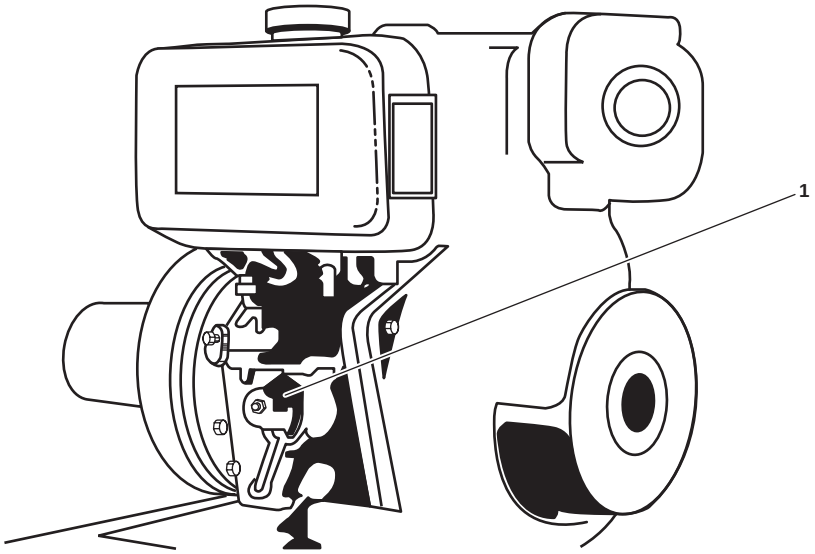


Figure 3. Engine Throttle Control

NOTE

The valve is OPENED when the knob is aligned with the air passage.

3. OPEN the primer line shutoff valve between the primer jet and the pump suction.

4. Prime the exhaust butterfly valve.

5. Press down on the compression release lever (figure 4, item 1), ensuring that it remains pressed downward.

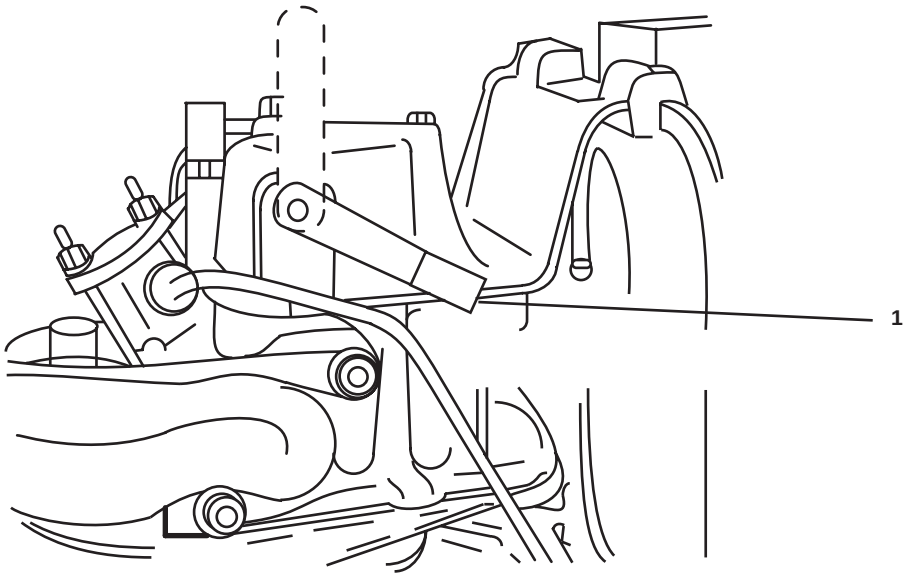


Figure 4. P-100 Portable Dewatering Pump Compression Release Lever

NOTE

The first pull of the recoil starter rope is to verify that the motor will operate smoothly.

6. Slowly pull on the recoil starter rope (figure 5, item 1) while checking the engine and pump for freedom of movement.

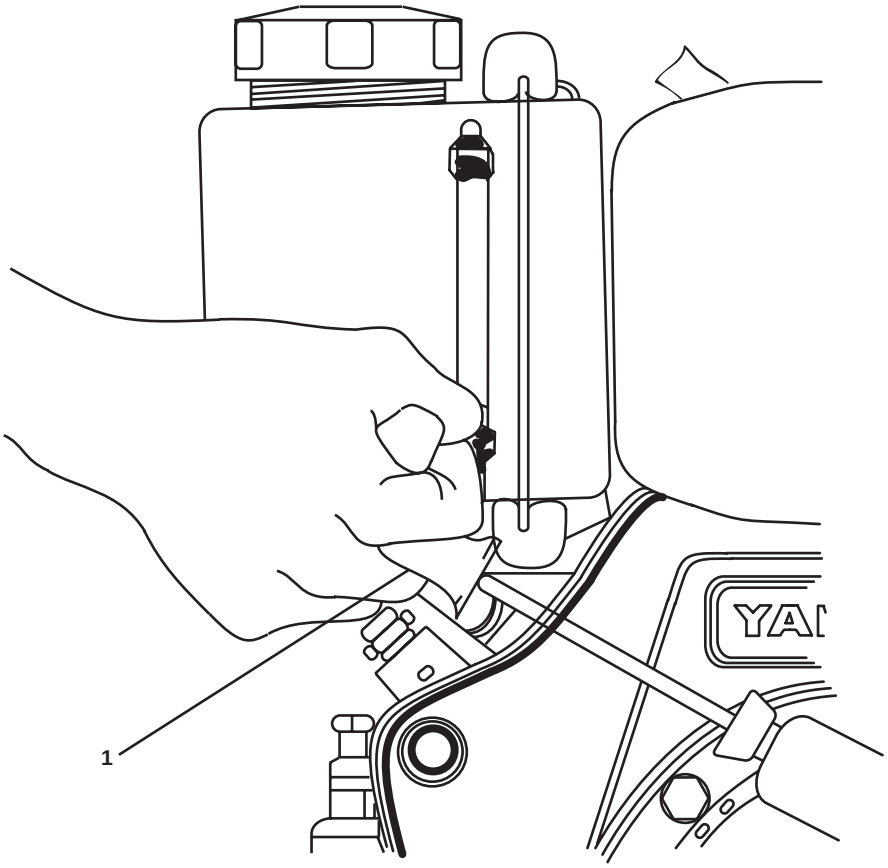


Figure 5. P-100 Portable Dewatering Pump Recoil Starter Rope

7. Press down on the compression release lever (figure 4, item 1), ensuring that it remains pressed downward.

NOTE

The compression release lever will spring shut when the engine rotates during starting attempts.

⚠ CAUTION

A strong deliberate pull is required to prevent engine kickback and possible starting in the reverse rotational direction. If this occurs, immediately shut down the engine. Operation in the reverse direction is characterized by the evidence of exhaust gases coming out of the intake filter. Reverse operation does not allow full power operation or positive priming, and will cause damage to the pump unit.

8. Start the engine by pulling the recoil starter rope (figure 5, item 1).

⚠ CAUTION

Never run the pump at high speeds unless it is discharging water. Never run the pump without water any longer than the short time required for priming. Extended operation without prime may cause serious damage to the packing gland, the pump shaft, and other pump internals.

9. After the engine is running, set the engine throttle control to the RUN position.

PRIMING THE PUMP AND COMMENCING PUMPING

To prime the dewatering pump prior to operation of the pump:

NOTE

Start the engine and run at a fast idle to prime with lifts less than 10 feet. Start the engine and run at full throttle to prime with 10 to 22 foot lifts. When priming on high lifts, or when pumping dirty water, it may be necessary to seat the discharge stop-check valve by tightening down gently with the handwheel. Unscrew the handwheel when water is discharged through the exhaust jet.

1. Shift the engine exhaust valve to the PRIME position, blocking the main exhaust opening.

NOTE

The exhaust valve is in the PRIME position when the handle is horizontal.

2. When a steady stream of water appears at the discharge of the priming pipe, CLOSE the primer line shutoff valve and return the engine exhaust valve to the NORMAL position (vertical).

3. OPEN the pump discharge valve.

⚠ CAUTION

Do not overload the engine. If black smoke appears from the exhaust, reduce the throttle.

4. Adjust the throttle to get the desired pressure.

5. If the pump fails to hold its prime, repeat the priming operation.

6. If the pump still does not deliver water within 2 minutes, stop the engine and check for air leaks at the suction connections and the pump packing gland.

SECURING THE PUMP

To shut down the dewatering pump:

1. To STOP the pump unit, reduce the engine speed to idle and allow the engine to cool down for 2 minutes.

2. Set the engine throttle control (figure 3, item 1) to the STOP position.

3. If the engine continues to run, CLOSE the fuel tank isolation valve (figure 2, item 1).

4. To flush the pump with fresh water:

   a. Place the suction hose with foot valve and strainer into fresh water supply.

   b. Run the pump, permitting it to pump the fresh water for at least 1 minute.

c. STOP the pump as described in steps 1-3.

5. Drain the pump by removing the pump drain plug.

6. Disconnect the suction and discharge hoses.

7. Replace the hose connection caps and drain cocks after draining all the water.

8. Apply silicone lubricant through the pump's inlet fitting while slowly pulling the recoil starter rope (figure 2, item 1) to lubricate the pump's internal components.

9. Stow the portable pump, hoses, and accessories.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
COMMISSARY EQUIPMENT

INITIAL SETUP:

Personnel Required:
One Crewmember, Any MOS

Tools and Special Tools:
Suitable Drain Pan

GALLEY VENTILATOR HOOD

PREPARATION FOR USE

1. At the main switchboard in the EOS (figure 1, item 1), set the GALLEY 440 V PWR. PNL. #2 circuit breaker (figure 1, item 2) to ON.

2. At 440V power panel No. 2 (figure 2, item 1), set the following circuit breakers to the ON position:

   a. REHEATER 1-23-2. (figure 2, item 2)

   b. GALLEY SUPPLY FAN S1-22-4/CONTROLLER FOR GALLEY EXTRACT FAN E1-37-1. (figure 2, item 3)

   c. GALLEY EXHAUST FAN E1-37-1/CONTROLLER FOR GALLEY SUPPLY FAN S1-22-4. (figure 2, item 4)

3. At the galley supply fan controller located in the main deck fan room and the galley exhaust fan located in the galley, perform or observe the following:

   a. Set the ON-OFF switch (figure 3, item 1) to the ON position.

   b. The POWER AVAILABLE indicator (figure 3, item 2) will illuminate.

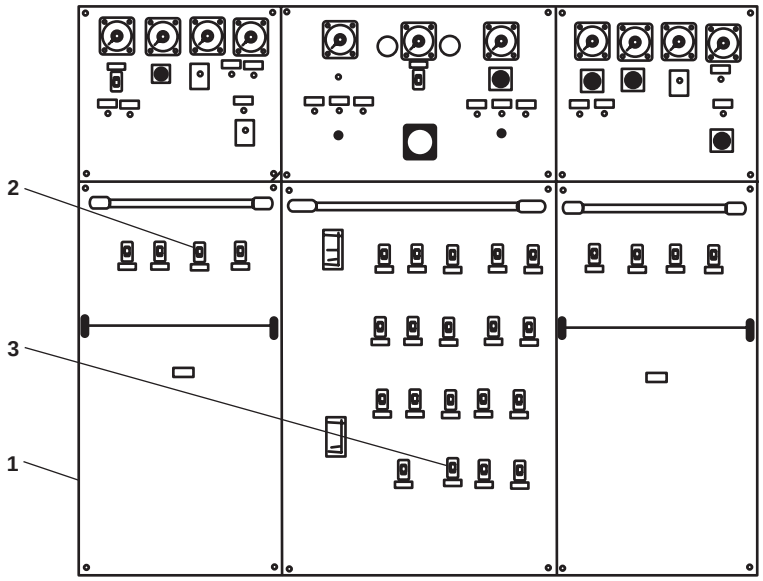


Figure 1. Main Switchboard

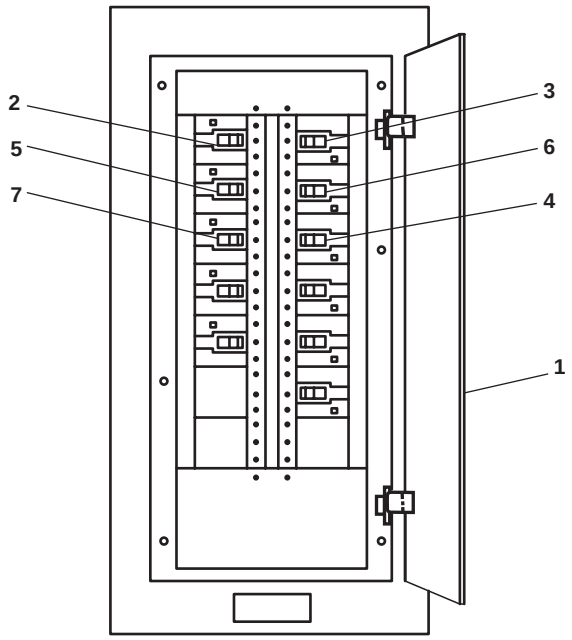


Figure 2. Galley 460V Power Panel #2

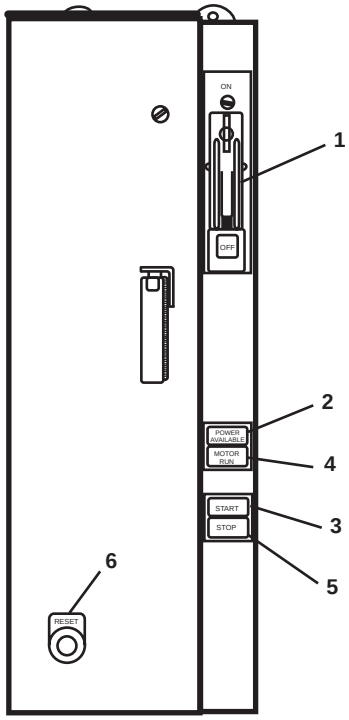


Figure 3. Motor Controllers

c. Press the START pushbutton (figure 3, item 3).

d. The MOTOR RUN indicator (figure 3, item 4) will illuminate.

4. At 120V distribution panel No. 1, set the GAYLORD CONT CABINET. circuit breaker (figure 4, item 1) to ON.

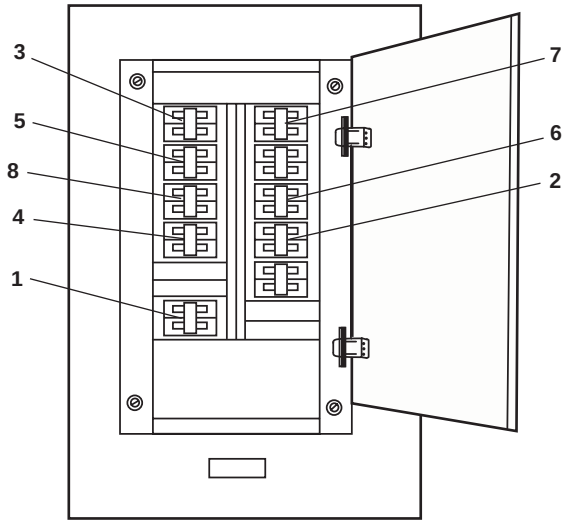


Figure 4. Galley 120V Distribution Panel #1

NOTE

PW-29 is located in the ventilator control cabinet.

5. At the galley ventilator and control cabinet, perform the following:

   a. OPEN valve PW-29 (figure 5, item 1).

   b. Observe the pressure-temperature gauge (figure 5, item 2). Pressure should be between 40 and 80 PSI (2.75 and 5.52 bar). Temperature should be between 140 °F and 180 °F (60 °C and 82 °C). If the readings are out of range, notify unit maintenance.

6. Program the automatic exhaust fan and wash cycle functions using the steps below:

NOTE

Panel must be opened to operate keypad pushbuttons.

   a. On the control center (figure 5, item 3), press the ENTER pushbutton (figure 5, item 4) and hold for 5 seconds until the "1" appears.

⚠ CAUTION

The wash cycle should be programmed to come on during a time when the cooking equipment is either off or turned to low to avoid high heat buildup that could set off the surface fire protection system.

   b. Press the START FAN pushbutton (figure 5, item 5) to program the exhaust fan or press the START WASH pushbutton (figure 5, item 6) to program the wash cycle.

   c. Press the HOUR pushbutton (figure 5, item 7) and hold down until the desired hour appears.

   d. Press the MINUTE pushbutton (figure 5, item 8) and hold down until the desired minute appears.

   e. Press the ENTER pushbutton (figure 5, item 4).

   f. Press the CLOCK pushbutton (figure 5, item 9).

EXHAUST FAN OPERATION

1. Ensure that the damper control switch (figure 5, item 10) is in the OPEN position (pushed in).

2. On the control center (figure 5, item 3), press the START FAN pushbutton (figure 5, item 5). Observe that the FAN ON indicator (figure 5, item 11) lights and the exhaust fan operates.

WASH MODE OPERATION

1. With the exhaust fan operating, press the START WASH pushbutton (figure 5, item 6).

NOTE

The exhaust fan will stop. The FAN ON indicator will go out. The WASH CYCLE indicator will light and water will begin spraying inside the hood.

2. At the control cabinet, check the pressure-temperature gauge (figure 5, item 5). Pressure should be between 40 and 80 PSI (2.75 and 5.52 bar). Temperature should be between 140 °F and 180 °F (60 °C and 82 °C). If the readings are out of range, notify unit maintenance. The liquid detergent pump (figure 5, item 12) should be operating.

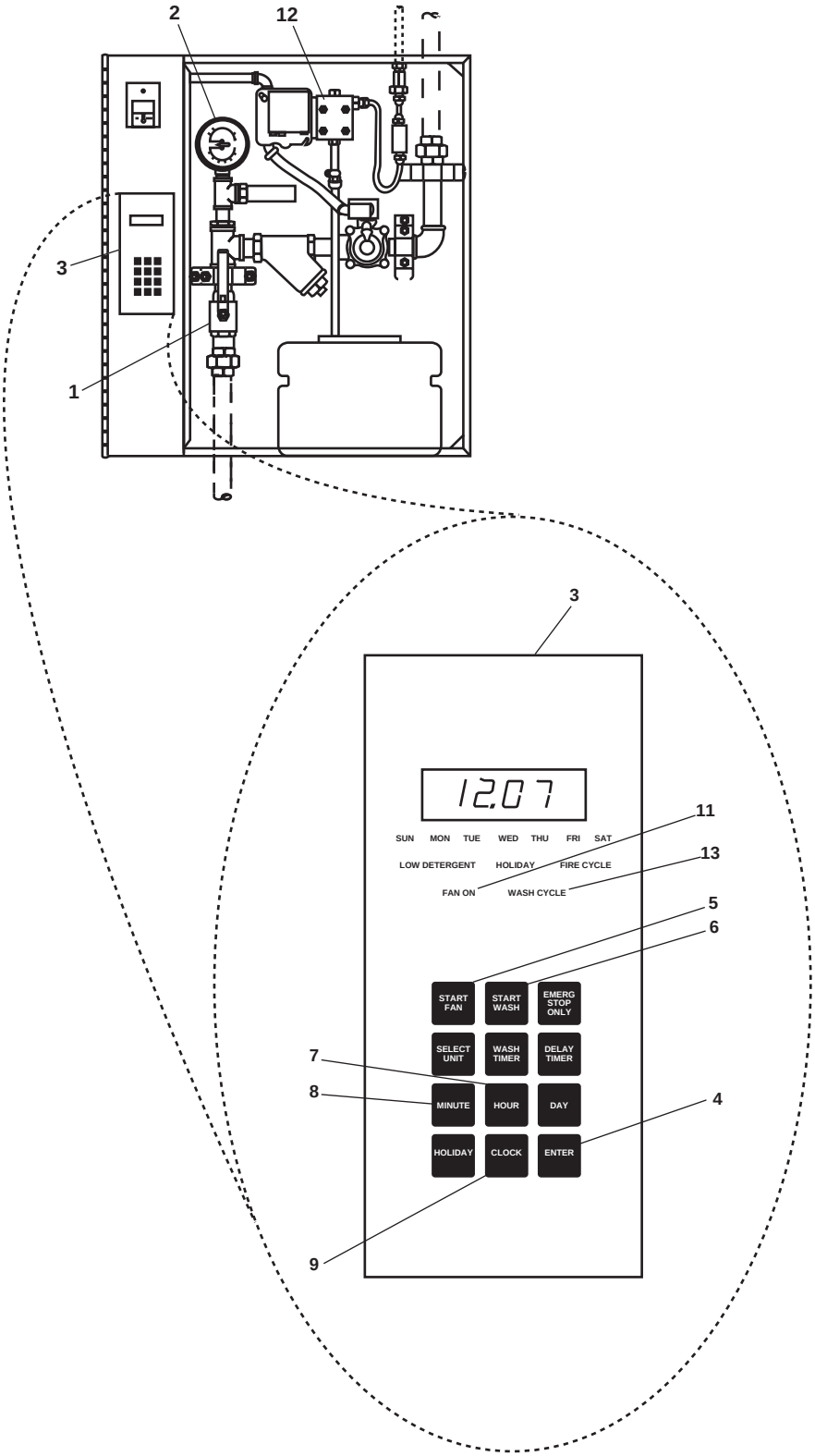


Figure 5. Galley Ventilator and Control Cabinet (Sheet 1 of 2)

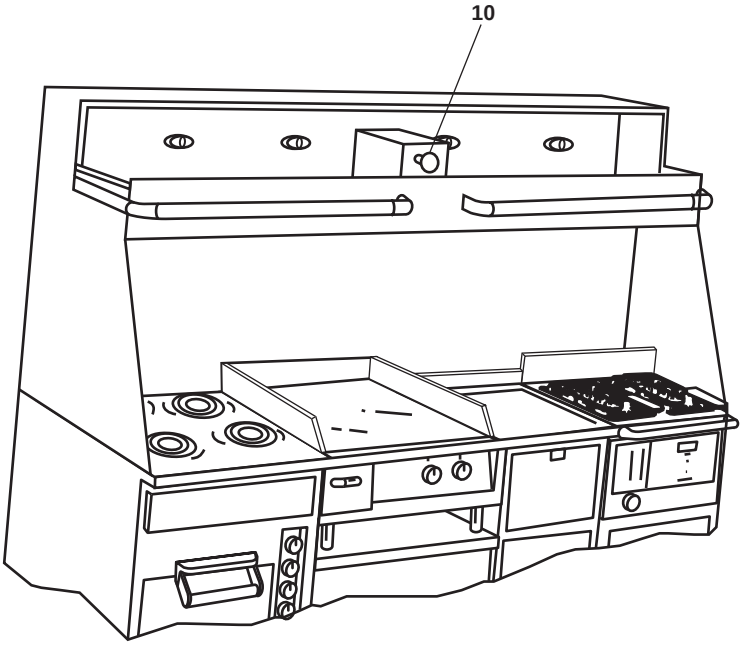


Figure 5. Galley Ventilator and Control Cabinet (Sheet 2 of 2)

3. When the wash cycle is complete:

   a. The detergent pump (figure 5, item 12) will stop.

   b. Water will stop spraying inside the hood.

   c. The WASH CYCLE indicator (figure 5, item 13) will go out.

   d. If cooking operations are to continue, or the ventilator is to be operational, restart the exhaust fan by pressing the START FAN pushbutton (figure 5, item 5).

GALLEY FIRE SUPPRESSION SYSTEM OPERATION

The galley fire suppression system operates automatically when the fusible links detect fire at the range, griddle and/or the fryer. To manually actuate this system, PULL the manual pull box (figure 6, item 1) located just inside the galley's forward door.

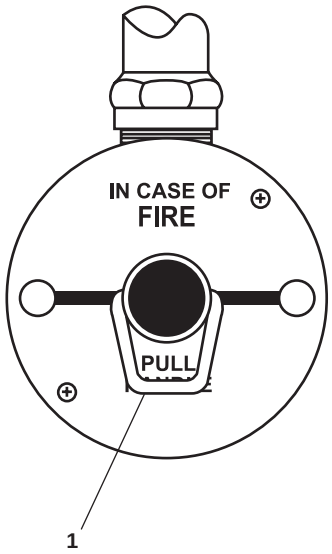


Figure 6. Manual Pull Box for the Galley Fire Suppression System

RANGE

1. At 440 power panel No. 2 (figure 2, item 1), set the RANGE. circuit breaker (figure 2, item 5) to the ON position.
2. Follow the steps below for range top operation:
    a. Set the appropriate LEFT-CENTER-RIGHT control (figure 7, item 1) to the desired temperature and preheat for 10 minutes.
    b. When the desired heat setting has been reached, place the pot on the range and cook.
3. To shut down the range top, set the selected LEFT-CENTER-RIGHT control (figure 7, item 1) to the OFF position.
4. Follow the steps below for operating the oven:
    a. Set the oven TEMPERATURE-HEATING control (figure 7, item 2) to 50 degrees above desired temperature.
    b. Set the oven LOW-MED-HIGH element control (figure 7, item 3) to the ON position.
    c. Allow the oven to preheat until the signal light goes out.
    d. Place the pans containing food in the oven.
    e. Set the oven TEMPERATURE-HEATING control (figure 7, item 2) to the desired temperature.

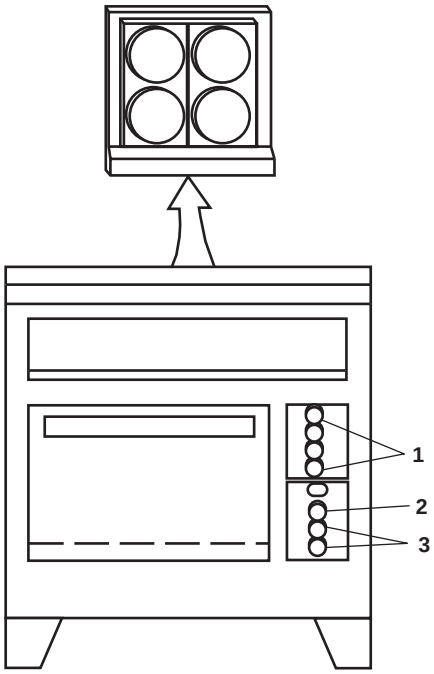


Figure 7. Range

WARNING

Use the potholders or the heatproof glove when removing the pans to prevent burns.

f. When cooking is complete, remove the food pans.

5. To shut down the oven, perform the following steps:

   a. Set the oven TEMPERATURE-HEATING control (figure 7, item 2) to the OFF position.

   b. Set the oven LOW-MED-HIGH element control (figure 7, item 3) to the OFF position.

GRIDDLE

1. At the 440V power panel No. 2 (figure 2, item 1), set the GRIDDLE. circuit breaker (figure 2, item 6) to the ON position.

2. Follow the steps below to season the griddle.

NOTE

Unless the product to be cooked contains sufficient fat, the griddle surface must be seasoned before each cooking operation.

a. Set the LEFT SIDE temperature control (figure 8, item 1) and the RIGHT SIDE temperature control (figure 8, item 2) to 400 °F (204 °C).

WARNING

Hot surface may cause serious burns and injury.

b. When the HEATING indicator lights (figure 8, item 3) go out, use a clean cloth to spread a light film of unsalted cooking oil or fat over the cooking surface.

c. Wait 3 to 5 minutes and wipe the excess oil off the cooking surface with a clean cloth.

d. Apply a second coat of oil or fat.

e. Wait 3 to 5 minutes and wipe the excess oil off the cooking surface with a clean cloth.

3. Follow the steps below to operate the griddle.

a. Set the LEFT SIDE temperature control (figure 8, item 1) and the RIGHT SIDE temperature control (figure 8, item 2) to the desired temperature. When the HEATING indicator lights (figure 8, item 3) go out, the griddle is ready.

b. Use a metal spatula to turn food being cooked and use it to push excess oil or grease into the grease drawer (figure 8, item 4). This will reduce smoking.

c. Set the LEFT SIDE temperature control (figure 8, item 1) and the RIGHT SIDE temperature control (figure 8, item 2) to 200 °F (93.33 °C) during idle periods.

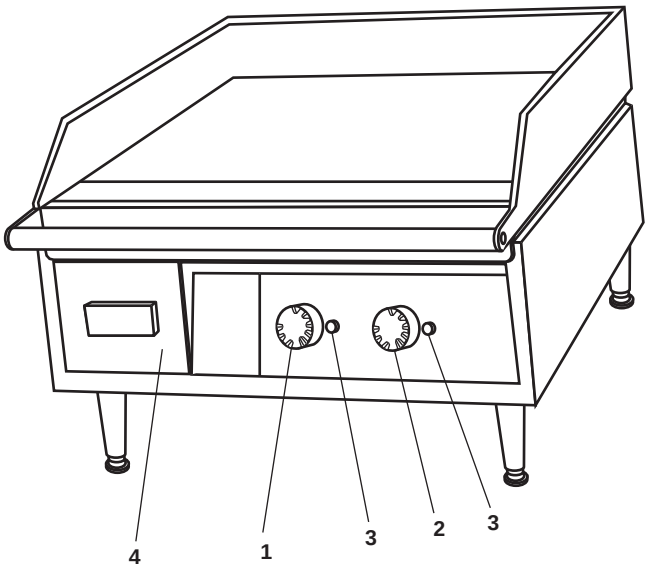


Figure 8. Griddle

4. To shut down the griddle, perform the following steps:

   a. Set the LEFT SIDE temperature control (figure 8, item 1) and the RIGHT SIDE temperature control (figure 8, item 2) to the OFF position.

   b. The HEATING indicator lights (figure 8, item 3) will go out.

   c. Slide the grease drawer (figure 8, item 4) out and empty into an approved container after each shift and wash it with washing detergent. Rinse and dry with a soft cloth. Replace the drawer.

   d. At 440V power panel No. 2 (figure 2, item 1), set the GRIDDLE. circuit breaker (figure 2, item 6) to OFF.

FRYER

1. At 440V power panel No. 2 (figure 2, item 1), set the FRY KETTLE. circuit breaker (figure 2, item 7) to ON.

WARNING

Overfilling the fryer oil container with cooking oil may result in oil spilling onto the deck causing slippery conditions. Overfilling may also present a fire hazard.

NOTE

There are two fill marks on the oil container. The oil level should be maintained between the upper and lower fill marks.

2. To operate the fryer, perform the following steps:

   a. Fill the fryer oil container with cooking oil until the level is between the fill marks.

   b. Set the ON-OFF POWER switch (figure 9, item 1) to the ON position. The POWER indicator (figure 9, item 2) will light.

WARNING

Failure to keep oil level above the top of the heating element will result in overheating of elements, and a possible flash fire if oil is splashed on them.

   c. Set the THERMOSTAT (figure 9, item 3) to the desired temperature. Observe that the heating indicator (figure 9, item 4) is lit.

WARNING

When the fryer is in operation, an attendant must always be present.

NOTE

When cooking oil reaches the desired temperature, the heating indicator will go out.

d. Place food in the wire-mesh type cooking basket and place the basket in the hot cooking oil.

e. When the food is cooked, remove the basket and hang it on the support to allow the excess oil to drain off.

3. To shut down the fryer, perform the following steps:

a. Set the THERMOSTAT (figure 9, item 3) to the OFF position.

b. Set the ON-OFF POWER switch (figure 9, item 1) to the OFF position. The POWER indicator (figure 9, item 2) will go out.

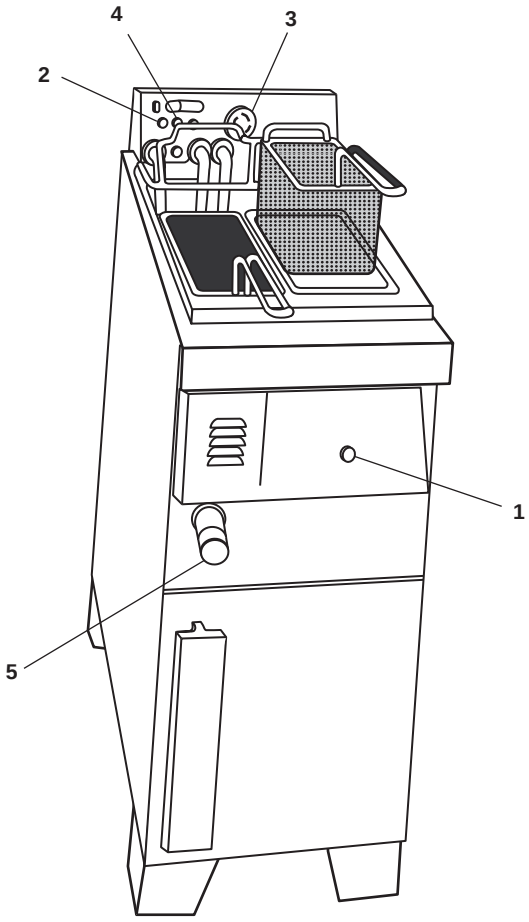


Figure 9. Fryer

WARNING

Allow the heating elements to cool down before raising the heating elements from the cooking oil. The hot elements and the hot cooking oil may cause severe burns.

c. When the cooking oil has cooled down, open the drain (figure 9, item 5) and allow the oil to drain into the bucket.

d. At 440V power panel No. 2 (figure 3, item 1), set the FRY KETTLE. circuit breaker (figure 3, item 7) to OFF.

TOASTER

NOTE

There are two toasters, one in the galley and the other in the mess/recreation space. Both toasters operate exactly the same except for the supplying circuit breaker.

1. At the main switchboard (figure 1, item 1), set the 1-25 KVA XFMR 440V/220V/110V circuit breaker (figure 1, item 3) to the ON position.

2. At the 220/110V distribution panel, set the following circuit breakers to ON:

   a. CREW'S MESS TOASTER. (figure 10, item 1)

   b. GALLEY TOASTER. (figure 10, item 2)

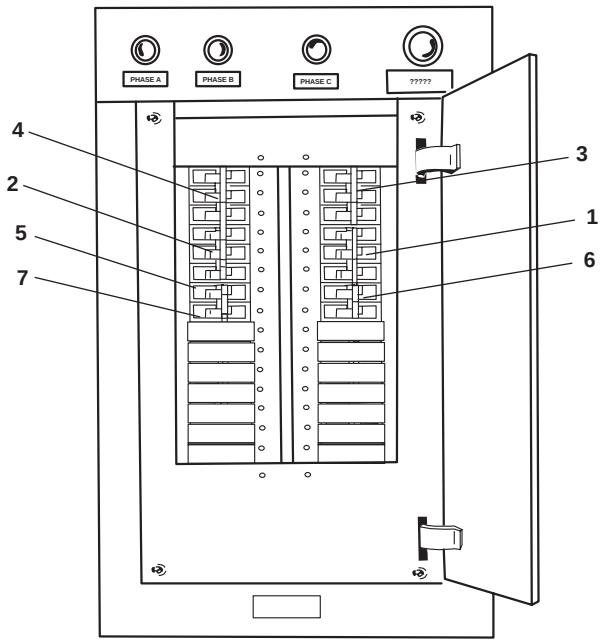


Figure 10. 220/120V Distribution Panel

3. Follow the steps below for operating the toaster:

   a. Set the adjustment knob (figure 11, item 1) about halfway between LIGHTER and DARKER.

   b. Load the bread. Drop the bread slices into the toaster wells.

   c. Start operation of the toaster by pressing down the front handle (figure 11, item 2) as far as it will go.

NOTE

The front handle lowers the bread and starts the toasting cycle. When the cycle is complete, the bread will automatically pop up and the toasting elements will be turned off.

   d. Adjust the toasting level by moving the adjustment knob (figure 11, item 1) towards LIGHTER or DARKER as desired.

   e. Repeat the operation by inserting bread slices and toast again. Once the desired toasting level is reached, no further adjustment is required.

4. To shut down the toaster, go to the 220/110V distribution panel and set the following circuit breakers to OFF:

   a. CREW'S MESS TOASTER (figure 10, item 1)

   b. GALLEY TOASTER (figure 10, item 2)

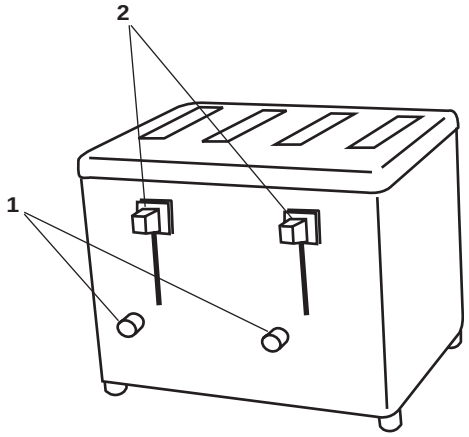


Figure 11. Toaster

MICROWAVE OVEN

1. At 120V distribution panel No. 1, set the MICROWAVE RECEPTACLE. circuit breaker (figure 4, item 2) to ON.

2. Perform the following steps for operating the microwave oven:

⚠ CAUTION

DO NOT place non-microwave items in the microwave (e.g. aluminum foil).

   a. Press the DOOR OPEN button (figure 12, item 1) until the door (figure 12, item 2) opens.

   b. Place the food in the microwave oven and close the door (figure 12, item 2).

   c. Select the desired setting on the control panel (figure 12, item 3).

d. Press the START button (figure 12, item 4).

e. When cooking is complete, press the DOOR OPEN button (figure 12, item 1) until the door (figure 12, item 2) opens.

f. Remove the food and close the door (figure 12, item 2).

3. To shut down the microwave oven, set the MICROWAVE RECEPTACLE. circuit breaker (figure 4, item 2) to the OFF position.

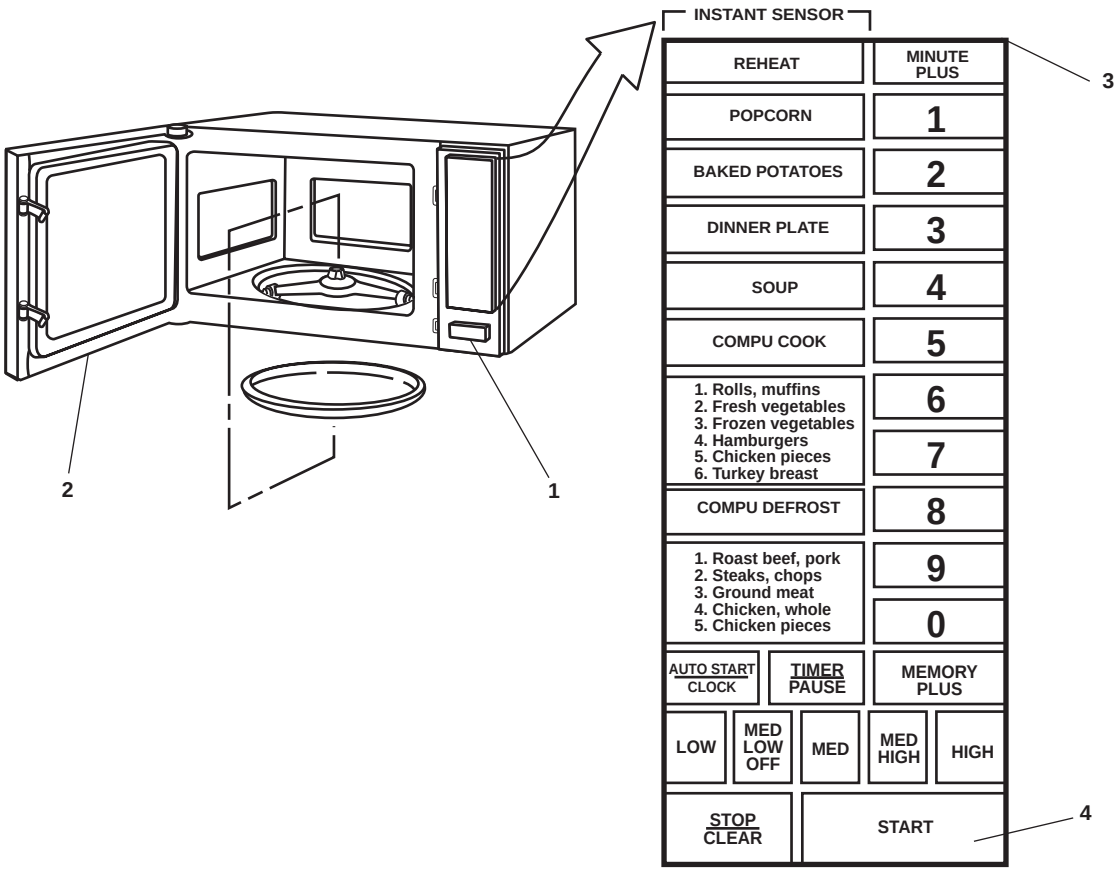


Figure 12. Microwave Oven

PEELER

The following procedures describe how to prepare the peeler for use, and how to operate and shut down the peeler.

1. To prepare the peeler for use, perform the following steps:

a. At 120V distribution panel No. 1, set the GALLEY RECEPTACLES circuit breaker (figure 4, item 3) to ON.

b. Place the peeler on the sink well cover next to the sink with the garbage disposal.

c. Turn the peeler so that the water and the peelings will discharge through the drain outlet (figure 13, item 1) into the sink.

d. Place the water inlet tube (figure 13, item 2) into position. Water must flow into the top of the peeler without obstructing the cover (figure 13, item 3).

e. Place the small end of the flexible hose (figure 13, item 4) over the intake end of the water inlet tube (figure 13, item 2).

f. Place the large end of the flexible hose (figure 13, item 4) over the cold water faucet.

g. Close and latch the discharge door (figure 13, item 5).

h. Plug the power cord into the outlet.

2. Perform the following steps for operating the peeler:

a. Adjust the cold water faucet for a small flow of water to flush away the peelings.

b. Turn on the garbage disposal.

⚠ CAUTION

Start the peeler before loading.

c. Turn the timer knob (figure 13, item 6) beyond the desired time; then turn back to the 1-minute mark.

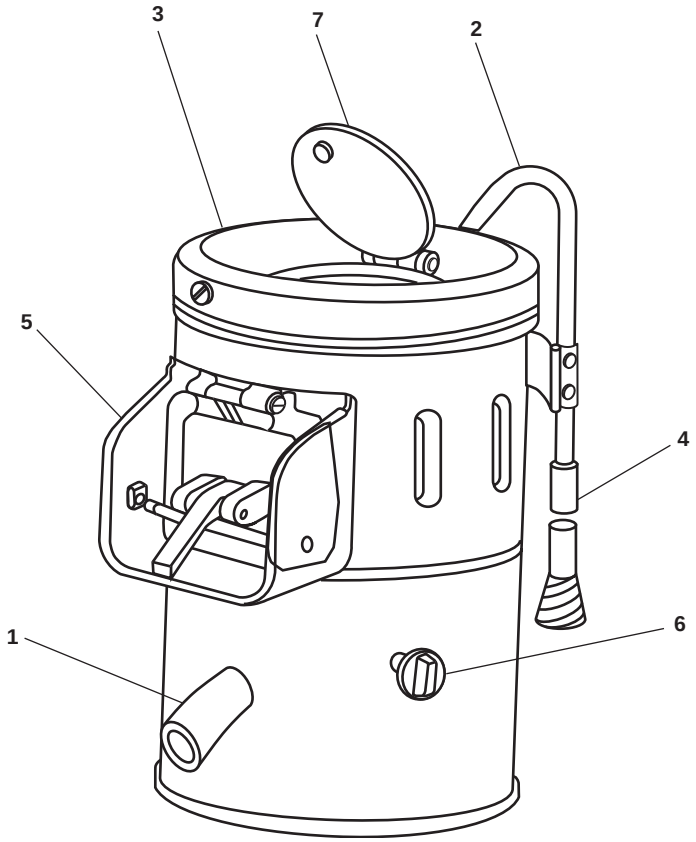


Figure 13. Peeler

NOTE

The average time to peel a 20-pound (9.1 kg) load is 1 minute.

d. Open the lid (figure 13, item 7) and insert the vegetables.

e. Close the lid (figure 13, item 7) to prevent splashing.

NOTE

The timer will automatically stop the unit.

f. Open the lid (figure 13, item 7) and inspect the vegetables.

g. If satisfied with the peeling, place the container under the discharge door (figure 13, item 5).

h. Unlatch the discharge door (figure 13, item 5).

i. To eject the vegetables, do the following steps:

(1) Release the door latch and hold the discharge door (figure 13, item 5) partially open with the container below.

NOTE

Timer may be turned OFF and ON without causing any damage.

(2) Set the timer knob (figure 13, item 6) ON and OFF for short intervals.

NOTE

Rotation of the peeling disc will eject the load.

(3) When the peeler is empty, turn the timer knob (figure 13, item 6) to the OFF position.

3. Perform the following steps to shut down the peeler:

a. Allow water to flow for 2 to 3 minutes to clear the disposal.

b. Turn OFF the garbage disposal.

c. Turn OFF the faucet.

d. Remove the flexible hose (figure 13, item 4) from the faucet and the water inlet tube (figure 13, item 2) and stow.

e. Place the water inlet tube (figure 13, item 2) in the stowed (down) position.

f. Latch the discharge door (figure 13, item 5).

g. Close the lid (figure 13, item 7).

h. Unplug the power cord.

MEAT SLICER

1. At 120V distribution panel No. 1, set the MEAT SLICER & FOOD MIXER. circuit breaker (figure 4, item 4) to ON.

WARNING

The rotating knife blade is extremely sharp and may cause serious personal injury. Keep fingers and hands clear of rotating the knife blade when in use. Use caution when cleaning the knife blade.

2. Perform the following steps for operating the meat slicer:

   a. Plug the power cord into the outlet.

   b. Pull the carriage handle (figure 14, item 1) towards you until the carriage reaches its stop.

   c. With the meat grip (figure 14, item 2) out of the way, place the product to be sliced on the carriage tray (figure 14, item 3).

   d. Set the meat grip (figure 14, item 2) against the product.

   e. Adjust the slice-adjusting dial (figure 14, item 4) for the desired thickness.

   f. Place the tray on the tray shelf (figure 14, item 5) to receive meat slices.

   g. Pull the PULL TO START PUSH STOP switch (figure 14, item 6) to the OUT position.

   h. Move the carriage handle (figure 14, item 1) back and forth with the right hand to slice the product.

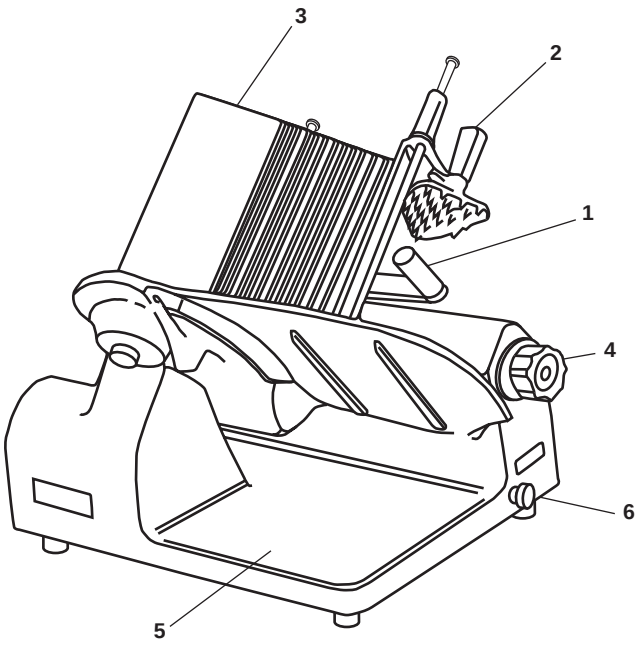


Figure 14. Meat Slicer

3. To shut down the meat slicer, perform the following steps:

   a. Push the PULL TO START PUSH STOP switch (figure 14, item 6) to the IN position.

WARNING

To prevent accidentally cutting yourself, set the slice-adjusting dial to the minimum setting and place the gauge plate over the slice knife. Unplug the power cord before cleaning, servicing, or removing the guards.

   b. Set the slice-adjusting dial (figure 14, item 4) to the minimum setting.

   c. Unplug the power cord.

   d. Clean the meat slicer after each use.

   e. At 120V distribution panel No. 1, set the MEAT SLICER & FOOD MIXER. circuit breaker (figure 4, item 4) to OFF.

ELECTRIC MIXER

1. At 120V distribution panel No. 1, set the MEAT SLICER & FOOD MIXER. circuit breaker (figure 4, item 4) to ON.

2. Perform the following steps for operating the electric mixer:

   a. Lower the bowl lift hand lever (figure 15, item 1) to the DOWN position.

   b. Select the desired attachment; line up the slots in the attachment spindle (figure 15, item 2) with the pins on the beater shaft (figure 15, item 3).

   c. Raise the attachment on the beater shaft (figure 15, item 3) and twist clockwise. When released, the attachment will drop slightly into the full locked position.

NOTE

Ensure that the bowl retainer latches are clear of the bowl support guide pins.

   d. Place the bowl (figure 15, item 4) on the bowl support (figure 15, item 5). Lock the bowl in place with the bowl retainer latches.

   e. Place the ingredients in the bowl (figure 15, item 4).

   f. Raise the bowl lift hand lever (figure 15, item 1) to the UP position.

   g. Select the desired speed on the gearshift lever (figure 15, item 6).

   h. Set the ON-OFF power switch (figure 15, item 7) to the ON position.

   i. When the mixing is complete, set the ON-OFF power switch (figure 15, item 7) to the OFF position.

   j. Lower the bowl lift hand lever (figure 15, item 1) to the down position.

NOTE

Unlock the bowl retainer latches.

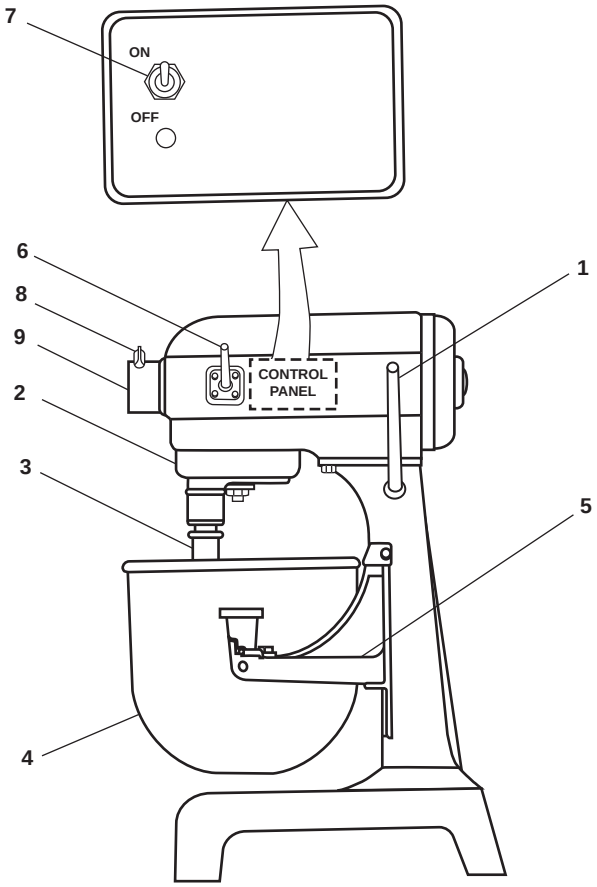


Figure 15. Electric Mixer

k. Remove the bowl (figure 15, item 4) from the bowl support (figure 15, item 5).

l. Remove the attachment from the beater shaft (figure 15, item 3) by holding it near the top, raising slightly while twisting counterclockwise, and sliding it downward.

3. Follow the steps below for mounting the electric mixer accessories:

a. Turn the thumbscrew (figure 15, item 8) counterclockwise so that it does not extend into the auxiliary drive socket.

b. Remove the cover plate (figure 15, item 9) from the auxiliary drive socket.

c. Insert the hub of the attachment into the auxiliary drive socket, rotating slightly until it slides into place against the mixer housing.

d. Turn the thumbscrew (figure 15, item 8) clockwise to lock the attachment in place.

4. To shut down the electric mixer, perform the following steps:

a. Set the ON-OFF power switch (figure 15, item 7) to the OFF position.

b. At 120V distribution panel No. 1, set the MEAT SLICER & FOOD MIXER. circuit breaker (figure 5, item 4) to OFF.

COFFEE PERCOLATOR

1. At 120V distribution panel No. 1, set the COFFEE POT. circuit breaker (figure 4, item 5) to ON.

Do not touch hot surfaces. Use the handles or knobs. Contact with hot surfaces will cause personal injury. Do not immerse the cord, plugs, or base in water or other liquid. Damage to the percolator and possible electrical hazard could cause personal injury. Personal injury (scalding) may occur if the lid is removed during the brewing cycle.

2. Perform the following steps to operate the coffee percolator:

   a. Remove the cover (figure 16, item 1) by turning the cover counterclockwise until the cover lock tabs (figure 16, item 2) clear the handle slots (figure 16, item 3).

   b. Lift out the coffee basket (figure 16, item 4) and the pump tube (figure 16, item 5).

   c. Fill the percolator body (figure 16, item 6) with cold potable water.

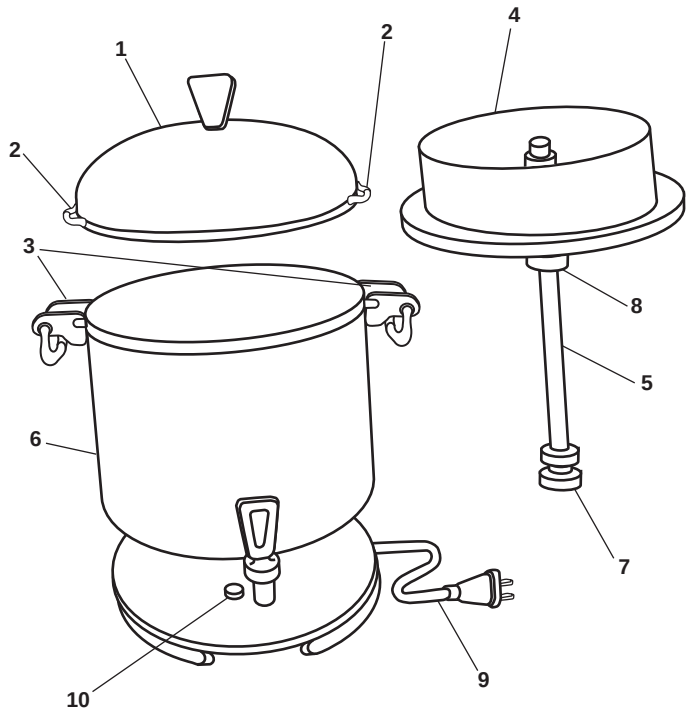


Figure 16. Coffee Percolator

NOTE

The automatic brewing cycle is timed to begin with a cold water start.

NOTE

Wetting the coffee basket keeps small particles of coffee from sifting through the basket.

d. Wet the coffee basket (figure 16, item 4) with cold potable water.

e. Add the desired amount of coffee grinds to the coffee basket (figure 16, item 4) (see table 1).

f. Insert the pump tube (figure 16, item 5) with the washer (figure 16, item 7) installed into the well in the coffee urn.

g. Place the spring (figure 16, item 8) and the basket (figure 16, item 4) on the pump tube (figure 16, item 5) inside the percolator body (figure 16, item 6).

h. Replace the cover (figure 16, item 1) and secure by turning the cover clockwise until the cover lock tabs (figure 16, item 2) are in the handle slots (figure 16, item 3).

i. Plug the power cord (figure 16, item 9) into the receptacle.

NOTE

The percolator will automatically switch to the warm mode to maintain coffee at a serving temperature. For best flavor, remove the coffee basket and the tube when the brewing is complete.

j. When the coffee brewing is complete, percolating will stop and the red indicator light (figure 16, item 10) will light.

WARNING

Remove the parts carefully. The coffee percolator and the parts will be hot and could cause burns.

⚠ CAUTION

Unplug the coffee percolator when only 1 or 2 cups (237 to 473 mL) of coffee remain. Excessive heat may damage the coffee percolator.

3. Unplug the coffee percolator.

4. To shut down the coffee percolator, set the COFFEE POT circuit breaker (figure 5, item 5) in 120V distribution panel 1 to OFF.

Table 1. Amount of Coffee Grinds to Use

Cups to be Brewed	Amount of Coffee Grinds
12	1 1/2 cups (355 mL)
18	1 3/4 cups (414 mL)
24	2 1/2 cups (592 mL)
30	3 cups (710 mL)
36	3 1/2 cups (828 mL)
42	4 cups (946 mL)
48	4 1/2 cups (1065 mL)
55	1 pound can (0.9 kg)

STEAM TABLE

1. At 120V distribution panel No. 1, set the STEAM TABLES 1 & 2. circuit breaker (figure 4, item 6) to ON.
2. At the steam table, close the drain valves (figure 17, item 1).
3. Fill the wells (figure 17, item 2) with water to 1 inch above the heating elements.
4. Set the POWER switches (figure 17, item 3) to the ON position.
5. To shut down the steam table, perform the following steps:
   a. At the steam table, set the POWER switches (figure 17, item 3) to the OFF position.
   b. At 120V distribution panel No. 1, set the STEAM TABLES 1 & 2. circuit breaker (figure 4, item 6) to the OFF position.

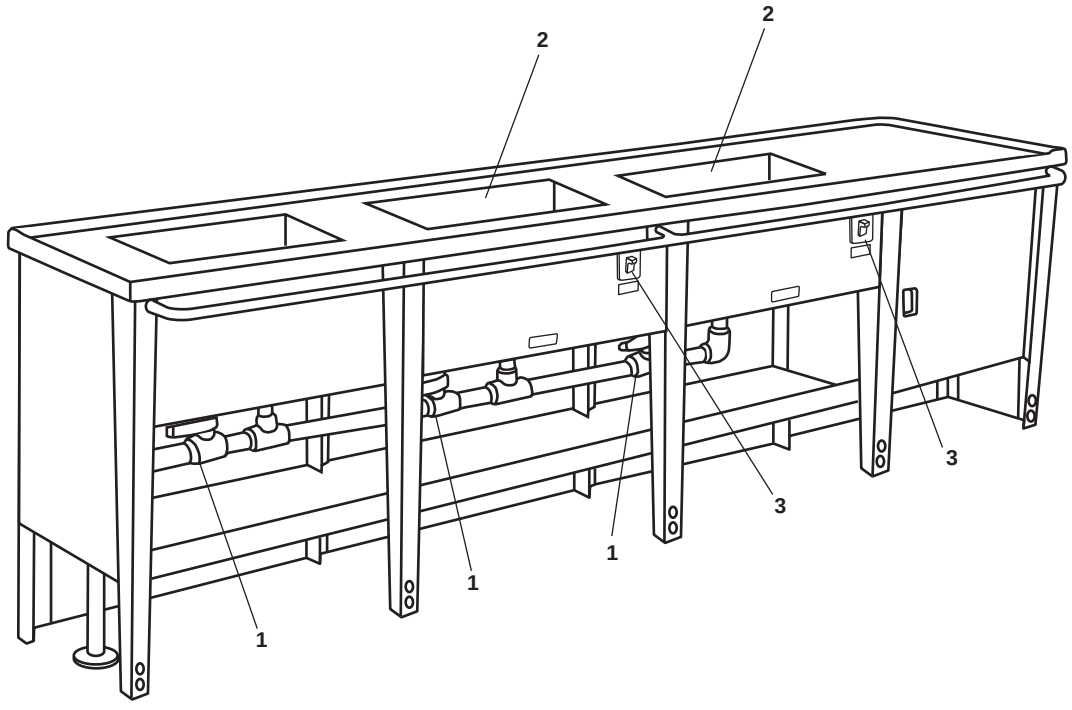


Figure 17. Steam Table

WARNING

The heating elements are very hot. Use extreme care to avoid contact with the elements. Allow water to cool before draining and cleaning the wells. Serious burns or scalding could result.

c. To empty the wells (figure 17, item 2), place suitably sized drain pans under the valves (figure 17, item 1). Open the valves until all water has drained from the wells. After the water has drained, use a sponge or a clean rag to clear the wells. Wipe dry with a clean soft cloth. Close the drain valves.

GARBAGE DISPOSAL

1. At the 220/110V distribution panel, set the GARBAGE DISPOSAL. circuit breaker (figure 10, item 3) to ON.

WARNING

Never use your hand to check rotation of the flywheel or to remove foreign matter from the garbage disposal. Use a stick or a similar object to turn the flywheel. Foreign matter should only be removed using tongs or pliers. Use of hands could result in serious personal injury. Never reach inside the garbage disposal while it is operating. Serious personal injury will result.

2. Perform the following steps for operating the garbage disposal:

   a. Turn on the cold water.

   b. Set the GARBAGE DISPOSAL SW to the ON position.

⚠ CAUTION

Do NOT feed china, metal, rags, clamshells, etc. into the garbage disposal. Damage to the blades will result.

⚠ CAUTION

Do NOT put grease or oil in the garbage disposal. The drain may become clogged.

   c. Feed the food waste into the garbage disposal.

   d. Allow the garbage disposal to run two minutes after the grinding is complete to allow proper flushing of the garbage disposal and the drain line.

3. To shut down the garbage disposal, perform the following steps:

   a. Set the GARBAGE DISPOSAL SW to the OFF position.

   b. Turn off the cold water.

   c. At the 220/110V distribution panel, set the GARBAGE DISPOSAL. circuit breaker (figure 10, item 3) to OFF.

DISHWASHER

1. Perform the following steps to prepare the dishwasher for use.

   a. At the 220/110V distribution panel, set the DISHWASHER/BOOSTER HEATER. circuit breaker (figure 10, item 4) to the ON position.

   b. CLOSE and latch the door.

   c. Set the selector switch (figure 18, item 1) to ON.

   d. Allow the dishwasher to cycle through three wash cycles to fill the booster heater.

NOTE

It will be necessary to OPEN the door between each cycle. OPEN the door and observe the cycle indicator. When the cycle indicator goes out, CLOSE the door to start the next cycle.

2. Perform the following steps for operating the dishwasher:

   a. Dishes must be scraped and rinsed to remove food particles/debris.

   b. Place the dishes in the rack.

   c. OPEN the door.

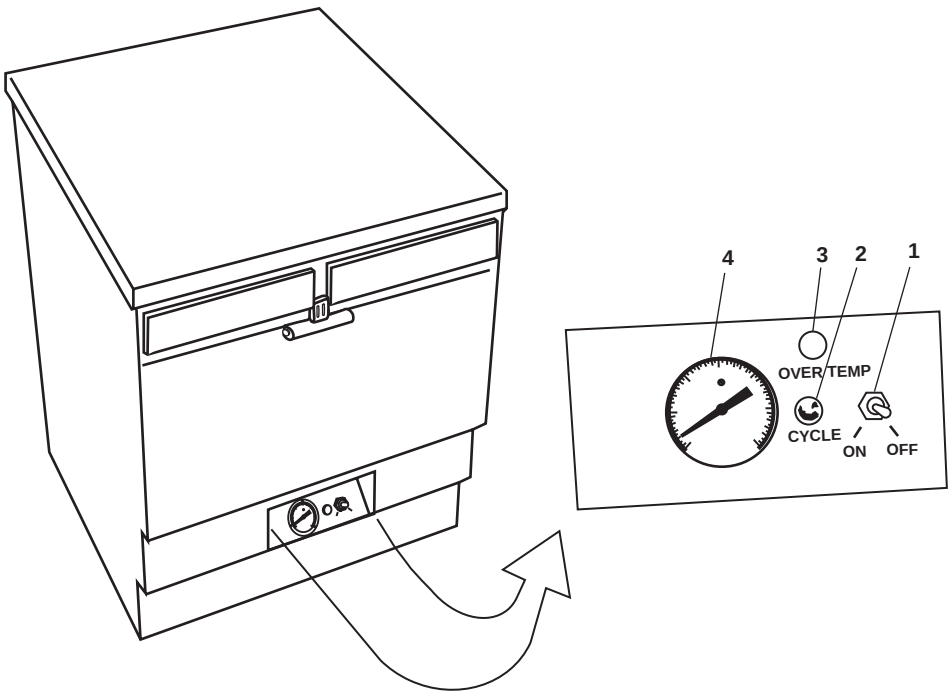


Figure 18. Dishwasher

NOTE

When the door is opened, the cycle indicator will light during the reset period (approximately 8 seconds).

d. Slide the rack of dishes into the dishwasher.

e. Add detergent.

f. Ensure that the cycle indicator (figure 18, item 2) is OFF.

g. Close and latch the door.

⚠ CAUTION

If the OVER TEMP indicator lights during any operation cycle, turn off the unit to prevent damage and refer to unit maintenance.

NOTE

The wash cycle will begin automatically. The cycle indicator will be ON.

h. Observe the water temperature gauge (figure 18, item 4) during the rinse cycle. The temperature should be 180 °F (82 °C) as a minimum.

NOTE

When the cycle indicator (figure 18, item 2) goes OFF, the cycle is complete.

3. To shut down the dishwasher, perform the following steps:

a. Set the selector switch (figure 18, item 1) to the OFF position.

b. At the 220/110V distribution panel, set the DISHWASHER/BOOSTER HEATER. circuit breaker (figure 10, item 4) to OFF.

TRASH COMPACTOR

1. At the 220/110V distribution panel, set the TRASH COMPACTOR. circuit breaker (figure 10, item 5) to ON.

2. Perform the following steps to operate the trash compactor:

a. Load the compactor. Pull the PULL handle (figure 19, item 1) and open the load door (figure 19, item 2). Load the compactor with trash.

b. Insert the key and turn the key switch (figure 19, item 3) to the ON position.

c. Start the compactor. Press the START pushbutton (figure 19, item 4) and then release.

NOTE

The trash compactor will operate automatically, compacting the trash and returning the compactor mechanism to the ready (UP) position.

d. Empty the trash compactor. Pull up and turn the handle (figure 19, item 5). Open the door (figure 19, item 6) and empty the compactor.

3. Perform the following procedures to shut down the trash compactor:

a. Turn the key switch (figure 19, item 3) to the OFF position. Remove the key.

b. At the 220/110 V distribution panel, set the TRASH COMPACTOR. circuit breaker (figure 10, item 5) to OFF.

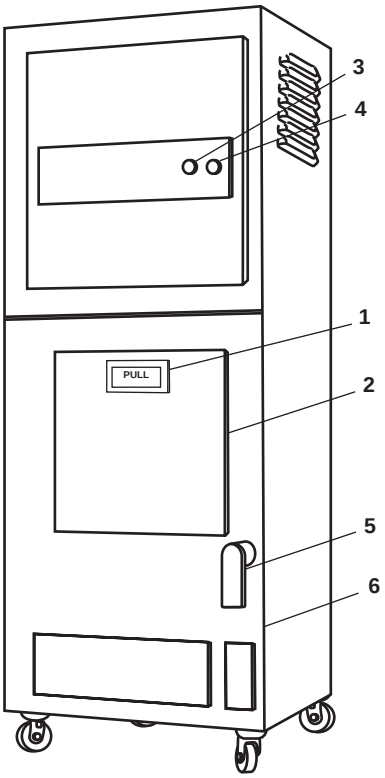


Figure 19. Trash Compactor

BEVERAGE DISPENSER

1. At the 220/110V distribution panel, set the BEVERAGE DISPENSER. circuit breaker (figure 10, item 6) to ON.
2. To set up the beverage dispenser, perform the following steps:
   a. Install the drip pan as follows:
      (1) Place the drip pan cover on top of each drip pan.
      (2) Place the top edge of the drip pan under the lip on the front panel.
      (3) Lower each drip pan enough that the alignment tab goes into the tab slot and locks the pan into place.
   b. Assemble the bowl as follows:
      (1) Place the bowl (figure 20, item 1) upside down on the counter.

NOTE

Both the bowl and the gasket must be dry. If wet, beverage could leak out.

      (2) Place the bowl gasket over the neck of the large opening on the bottom of the bowl (figure 20, item 1).
      (3) Place the bowl (figure 20, item 1) right side up, with the bowl gasket centered on the cooling plate and the guide pin.
      (4) Grasp the bowl (figure 20, item 1) by opposite corners and with downward pressure and twisting motion, set the bowl (figure 20, item 1) into position.

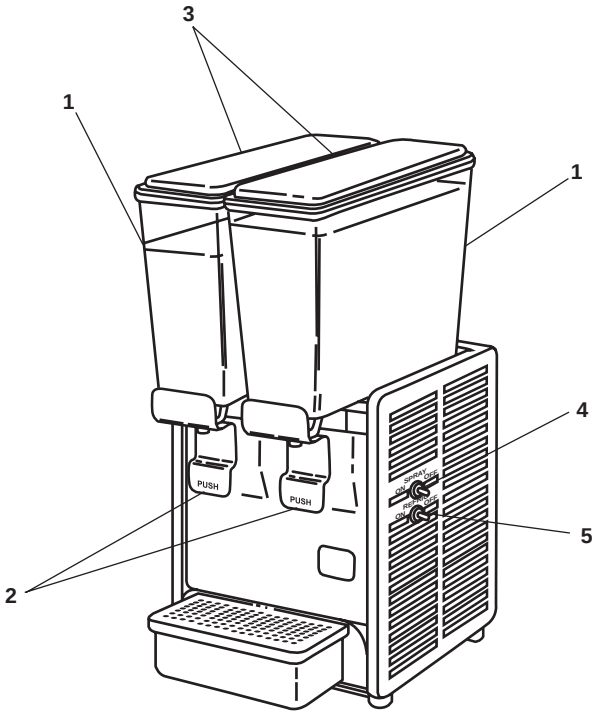


Figure 20. Beverage Dispenser

NOTE

Ensure that the bowl is square to front of the unit, with the handle bracket in front over the drip pan. If necessary, use a touch of cornstarch to lubricate the gasket for easier assembly.

There are flat surfaces on the guide pin. Turn the bearing sleeve until the sleeve aligns with the guide pin and drops into place. The flange on the bearing sleeve must rest flush on the cooling plate.

(5) Place the bearing sleeve over the guide pin in the middle of the cooling plate.

(6) Place the impeller on the bearing sleeve (fin side up).

NOTE

The top of the spray tube is "pinched" and bent. The "pinched" and bent top end of tube is to be pointed toward the front of the bowl. A 3/8-inch tab on the front of the pump cover, near the spray tube sleeve, goes between the two locator notches on the bowl.

(7) Press the spray tube into the sleeve on top of the pump cover.

(8) Place the pump cover over the guide pin, keeping the spray tube toward the front of the unit and centered in the bowl.

(9) Install the lock washer on the guide pinhead until the guide pin neck is completely in the keyway.

c. Assemble the valve and handle by performing the following steps:

(1) Place the handle (figure 20, item 2) in the two "V" notches in front of the handle bracket.

(2) While holding the handle in place and pushed back, lower the valve down through the valve hole and through the hole in the handle (figure 20, item 2).

(3) When the valve is seated on the O-ring, release the handle.

(4) Push the handle (figure 20, item 2) in and release it several times to make sure that the valve moves up and down freely.

(5) To seat the O-ring, press down on the valve and twist.

d. To start the dispenser, perform the following:

(1) Fill the bowl (figure 20, item 1) with the desired beverage.

(2) Install the cover (figure 20, item 3).

NOTE

Ensure that the cover is well down over the bowl edge, not resting on the lip. Improperly installed cover will leak.

(3) Set the SPRAY switch (figure 20, item 4) to the 1/ON position.

(4) Set the REFRIG. switch (figure 20, item 5) to the 1/ON position.

3. Dispense the beverage by doing the following:

a. Place a glass against the handle (figure 20, item 2).

b. Press the handle (figure 20, item 2) rearward to dispense the beverage. Release the handle (figure 20, item 2) when the glass has been filled to the desired level.

4. Shutdown the beverage dispenser by performing the following steps:

a. Set the SPRAY switch (figure 20, item 4) to the O/OFF position.

b. Set the REFRIG. switch (figure 20, item 5) to the OFF position.

c. At the 220/110V distribution panel, set the BEVERAGE DISPENSER. circuit breaker (figure 10, item 6) to OFF.

MILK DISPENSER

1. To prepare the milk dispenser for use, perform the following steps:

a. At 120V distribution panel No. 1, set the GALLEY RECEPTACLES. circuit breaker (figure 5, item 3) to ON.

NOTE

During an initial start-up (after the unit has been inoperative for some time), the unit should operate for at least 1 hour to obtain operating temperature.

b. Ensure that the unit is at operating temperature by observing the thermometer (figure 21, item 1) reading; it should be in the GREEN (safe) zone.

c. Set the temperature control switch (figure 21, item 2) to maintain the temperature in the GREEN (safe) zone.

d. Open the door by disengaging the latch (figure 21, item 3) and pulling on the door edge.

e. Place the milk container over the dispensing valve (figure 21, item 4).

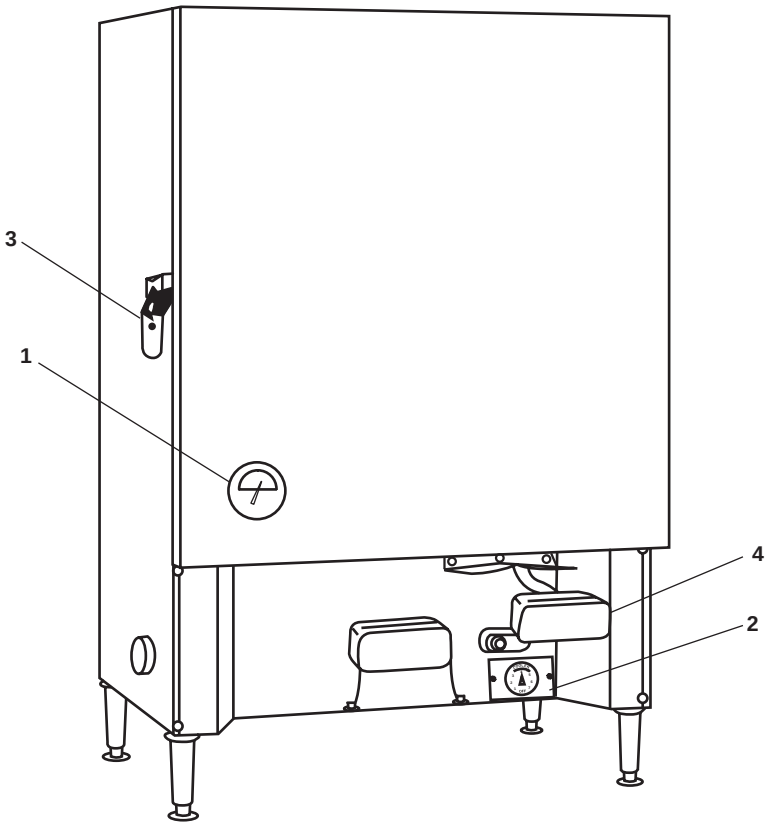


Figure 21. Milk Dispenser

⚠ CAUTION

Do not stretch the tube. Pulling on the tube may cause the tube to pull loose from the milk container, causing the milk container to drain.

f. Lift the dispensing valve (figure 21, item 4) and feed tube from the milk container through the tube passage in the dispensing valve (figure 21, item 4).

g. Remove the polyethylene film covering the tube.

h. Lower the dispensing valve (figure 21, item 4).

i. Remove the plug from the feed tube.

NOTE

If the feed tube is too long, cut off 1/2 inch (13 mm) below the valve.

j. Close the door and secure the latch (figure 21, item 3).

2. Follow the procedures listed below for milk dispenser operation.

a. Hold the container under the feed tube of the selected dispensing valve (figure 21, item 4).

b. Raise the dispensing valve (figure 21, item 4) so that milk will flow into the container.

c. When the container is filled to the desired level, lower the dispensing valve (figure 21, item 4).

3. To shut down the milk dispenser, do the following:

   a. At 120V distribution panel No. 1, set the GALLEY RECEPTACLES. circuit breaker (figure 5, item 3) to OFF.

   b. If the milk dispenser is not to be used for an extended period, block the door OPEN.

ICEMAKER

1. At the 220/110V distribution panel, set the ICE MAKER circuit breaker (figure 10, item 7) to ON.

2. OPEN valve PW-93, C.W. TO ICEMAKER (figure 22, item 1).

NOTE

The ice maker operates automatically. Refer any problems to unit maintenance.

3. To shut down the icemaker, do the following:

   a. CLOSE valve PW-93, C.W. TO ICEMAKER (figure 22, item 1).

   b. At the 220/110V distribution panel, set the ICE MAKER. circuit breaker (figure 10, item 7) to OFF.

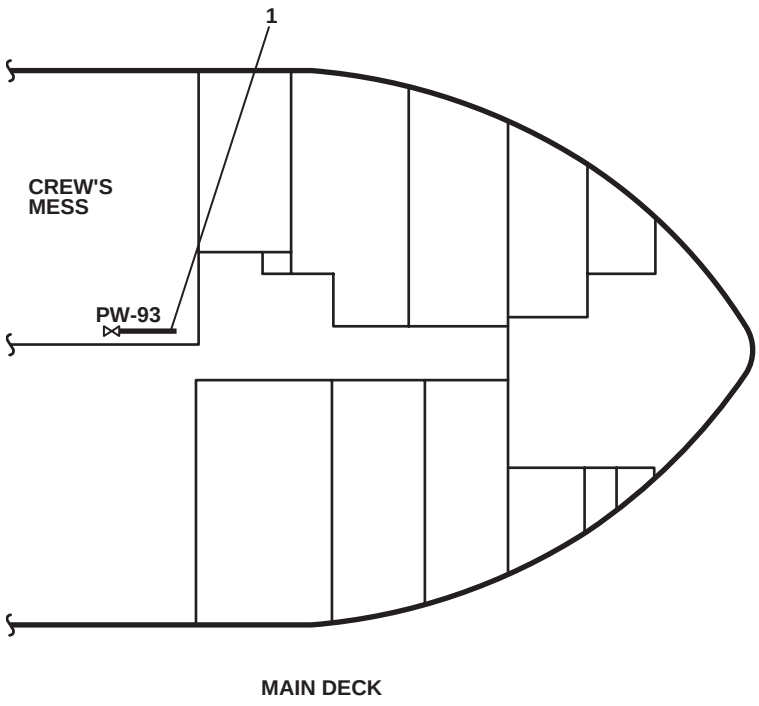


Figure 22. Ice Maker Valve Location

REFRIGERATOR

The following procedures describe how to operate and shut down the refrigerator.

1. At 120V distribution panel No. 1, set the REFRIGERATOR. circuit breaker (figure 4, item 7) to ON.

NOTE

All controls are factory set for proper operation. If the thermometer reads below 37 °F (3 °C) or above 43 °F (6 °C) refer to unit maintenance. It is important that the refrigerator not be loaded with perishables until the inside temperature has reached operating level. This will take approximately 3 hours.

2. Allow space for the air to circulate within the refrigerator for maximum efficiency.

3. To shut down the refrigerator, set the REFRIGERATOR. circuit breaker (figure 4, item 7) in 120V distribution panel No. 1 to OFF.

4. If the freezer is not to be used for an extended period, block the door OPEN.

FREEZER

The following procedures describe how to operate and shut down the freezer.

1. At 120V distribution panel No. 1, set the FREEZER. circuit breaker (figure 4, item 8) to ON.

NOTE

All controls are factory set for proper operation. If the thermometer reads below -5 °F (-21 °C) or above 0 °F (-18 °C) refer to unit maintenance. It is important that the freezer not be loaded with perishables until the inside temperature has reached operating level. This will take approximately 3 hours.

2. Allow space for the air to circulate within the freezer for maximum efficiency.

3. To shut down the freezer, set the FREEZER. circuit breaker (figure 4, item 8) in 120V distribution panel No. 1 to OFF.

4. If the freezer is not to be used for an extended period, block the door OPEN.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
WORKSHOP EQUIPMENT

INITIAL SETUP:

Materials/Parts:
Gloves, Leather (Item 267, Table 3, WP 0163 00, Volume 2)
Helmet, Welder's (Item 293, Table 3, WP 0163 00, Volume 2)

Personnel Required:
One Watercraft Engineer, 88L

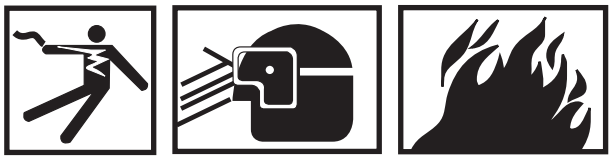
References:
WP 0163 00 (volume 2)

GENERAL

This work package describes the operation of the arc welder, the drill press, and the bench grinder. The operating procedures describe how to power up, operate, and shut down these items.

ARC WELDER

WARNING



Electric shock can kill. Electrodes and work area (or ground) are "hot" when the welder is on. Never touch electrodes to body or clothing. Wear dry gloves. Never weld in wet or damp areas. Ensure that all the connections are tight and clean. Fumes and gases can be dangerous. Keep away from fumes. Work in well ventilated area. Welding on galvanized steel, lead or cadmium produces toxic fumes. Ensure adequate ventilation. DO NOT weld in areas where chlorinated hydrocarbon vapors from degreasing, cleaning or spraying chemicals are present. These are highly toxic gases. Death could result. Arc rays can injure eyes and burn skin. Wear proper protection for eyes and skin to prevent injury. Wearing of contact lenses during welding can fuse the eye and lens when welding. DO NOT wear contact lenses when welding. Serious eye injury could result. Welding produces heat and sparks; keep a fire extinguisher at hand in the event of a fire during welding. Welder and electrodes are "live" when the power switch is ON. Observe safety precautions or injury could result.

1. At 440V power panel No. 5, set the WELDING MACHINE. circuit breaker (figure 1, item 1) to ON.

2. To prepare to weld at the arc welder:

   a. Set the RANGE SELECTOR switch (figure 2, item 1) to the desired amperage.

   b. Set the OUTPUT SELECTOR switch (figure 2, item 2) to the DC position.

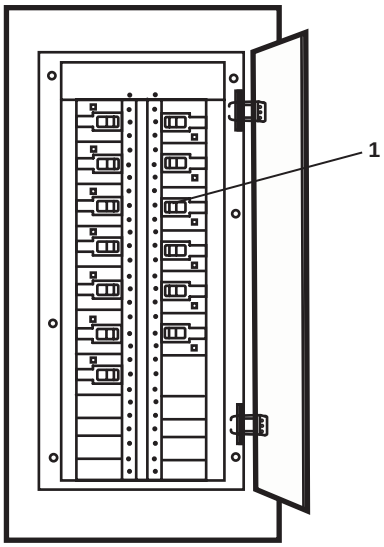


Figure 1. 440V Power Panel No. 5

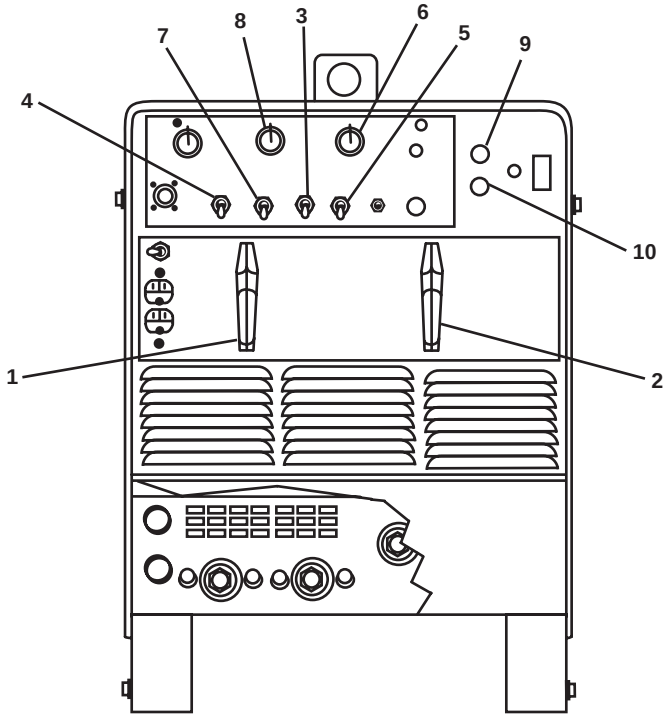


Figure 2. ARC Welder

WARNING

Use of Vac output requires the use of remote controls not provided. Serious personal injury or death could result.

c. Set the OUTPUT/CONTACTOR ON switch (figure 2, item 3) to the ON position.

d. Set the HIGH FREQUENCY switch (figure 2, item 4) to the OFF position.

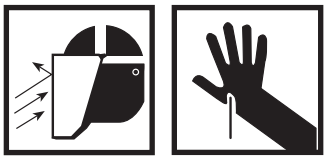
e. Set the AMPERAGE PANEL switch (figure 2, item 5) to the PANEL position.

f. Set the AMPERAGE ADJUSTMENT control (figure 2, item 6) to the desired position.

g. Set the START AMPERAGE ADJUSTMENT OFF-ON switch (figure 2, item 7) to the desired position.

h. If the START AMPERAGE OFF-ON switch (figure 2, item 7) was set to the ON position, set the START AMPERAGE ADJUSTMENT control (figure 2, item 8) to the desired amperage.

WARNING



Wear leather gloves, dry insulating clothing, and a welding helmet with a properly fitting lens when performing welding operations. Failure to comply could result in serious personal injury or death.

i. Connect the work clamp to clean, bare metal at work piece.

j. Select and obtain proper electrode; insert the electrode into the electrode holder.

k. Press the POWER ON pushbutton (figure 2, item 9) to begin welding.

3. To shut down the arc welder:

a. Stop welding.

b. Press the POWER OFF pushbutton (figure 2, item 10).

c. At 440V power panel No. 5, set the WELDING MACHINE. circuit breaker (figure 1, item 1) to OFF.

DRILL PRESS

WARNING

Always wear eye protection when operating the drill press to prevent eye injury. Never operate the drill press while wearing jewelry or loose clothing. Always remove the chuck key before starting the drill press. Serious injury or death could result.

1. On the load center distribution panel, set the MACHINE SHOP EQUIPMENT JUNCTION BOX. (LATHE/GRINDER/ DRILL PRESS). circuit breaker (figure 3, item 1) to ON.

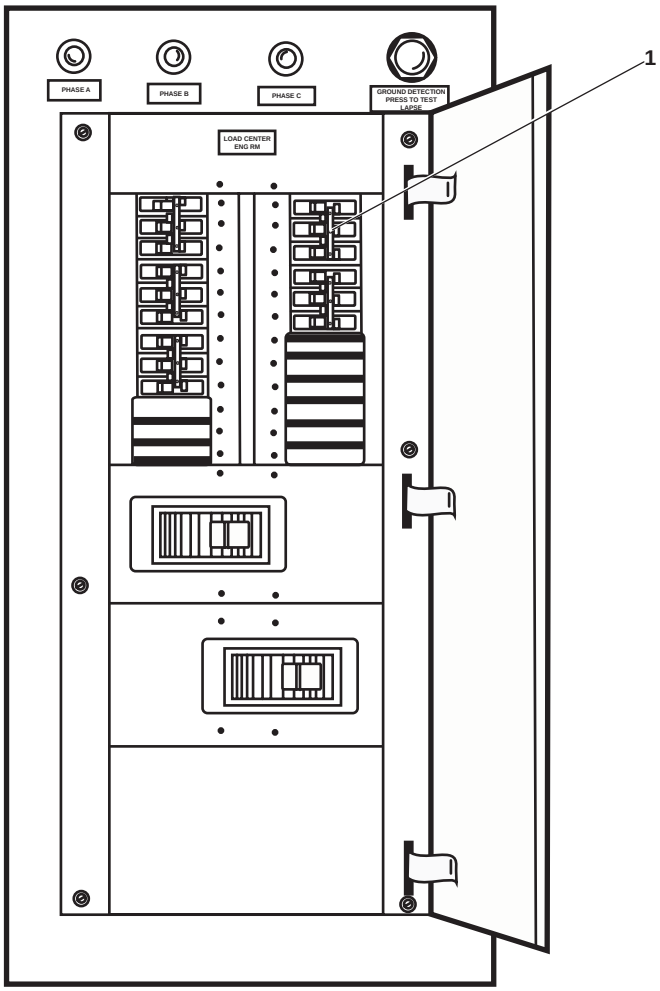


Figure 3. Load Center Distribution Panel

2. To operate the drill press:

   a. Install the drill bit into the chuck (figure 4, item 1).

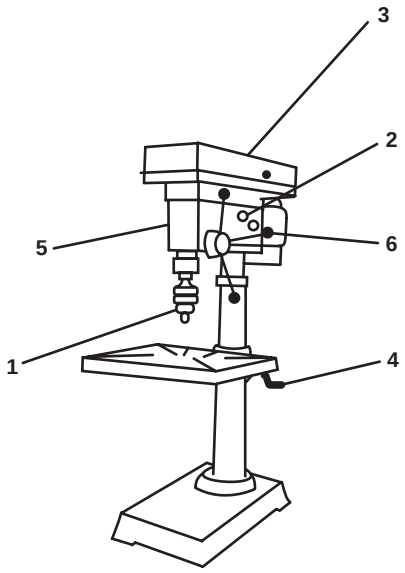


Figure 4. Drill Press

   b. To select correct drilling speed:

⚠ CAUTION

Always ensure that the drill press has completely stopped before changing speeds. Damage to the drill press could result.

(1) Loosen the slide bar bolts.

(2) Pull the cam handle (figure 4, item 2) toward the front of the drill press.

(3) Open the top cover (figure 4, item 3).

(4) Relocate the belts on the appropriate pulley rings for the desired spindle speed. Refer to the diagram attached to the top cover (figure 4, item 3).

(5) Close the top cover (figure 4, item 3).

(6) Push the cam handle (figure 4, item 2) toward the motor.

(7) Tighten the slide bar bolts.

WARNING

Work should never be held by hand. The force of the drill bit could "throw" work and seriously injure or kill the operator.

⚠ CAUTION

Always place a piece of scrap material below work to protect the table from damage.

c. Secure the work to the table by blocking and clamping securely to the table.

d. To adjust the table height:

(1) Loosen the column lock handle.

(2) Turn the table crank handle (figure 4, item 4) to the desired height.

(3) Tighten the column lock handle.

e. To operate the drill press:

(1) Set the M (motor) power switch (figure 4, item 5) to ON.

(2) Set the L (light) switch (figure 4, item 5) to ON.

(3) Turn the handle (figure 4, item 6) to lower the bit and drill the hole.

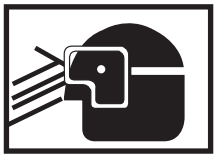
3. To secure the drill press:

a. Raise the spindle to the UP position by turning the handle (figure 4, item 6).

b. Turn off the drill press by setting the M and L power switches (figure 4, item 5) to OFF.

BENCH GRINDER

WARNING



Keep guards in place and in working order. Remove adjusting keys and wrenches. Ensure that these items are removed from the grinder before turning it on. Keep the work area clean.

Avoid a dangerous environment. Do not use power tools in a wet location. Keep work area well lit. Use the right tool. Do not force tools or attachments to do a job for which they are not designed. Wear appropriate apparel. Do not wear loose clothing or jewelry, which can get caught in moving parts. Rubber-soled footwear is recommended for best footing. Use safety glasses. Secure material. Use clamps or a vise to hold work at all times. Do not overreach. Keep proper footing and balance at all times. Disconnect tools before servicing. Avoid accidental starting. Ensure switch is in the OFF position before plugging in. Use only recommended accessories. Check for damaged parts before using. Severe personal injury or death could occur.

1. Check that the ON-OFF switch (figure 5, item 1) is in the OFF position and that the grinder wheel (figure 5, item 2) rotates freely.

2. Check that the eye shield (figure 5, item 3) is in place.

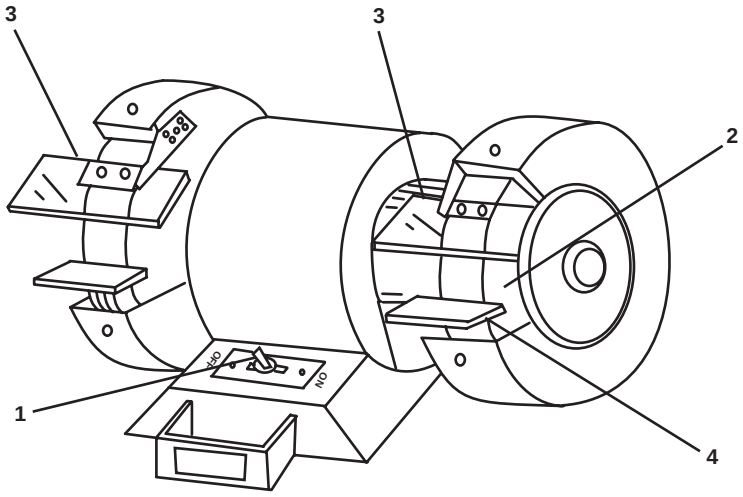


Figure 5. Bench Grinder

3. Check that the tool rest (figure 5, item 4) has 1/16-inch clearance from the grinder wheel (figure 5, item 2).

4. Set the ON-OFF switch (figure 5, item 1) to ON.

NOTE

Allow the bench grinder to reach full running speed before starting to grind.

5. Hold the piece being ground firmly against the grinder wheel (figure 5, item 2) with a light but steady pressure.

⚠ CAUTION

Excessive or sudden pressure slows grinding action, overloads the motor and puts dangerous stresses on the wheel, gouging the wheel and causing rough grinding with reduced accuracy.

6. Keep the tool rest (figure 5, item 4) adjusted to within 1/16-inch of the grinder wheel (figure 5, item 2).

7. When finished, set the ON-OFF switch (figure 5, item 1) to OFF.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
LIFE RAFTS

INITIAL SETUP:

Personnel Required:
Two Crewmembers, Any MOS

PRE-OPERATION

1. Secure the life raft painter line (figure 1, item 1) to the life raft launching ramp (figure 1, item 2).

2. Visually inspect the pelican hook (figure 1, item 3), locking ring (figure 1, item 4), and the retainer strap (figure 1, item 5) for damage. Notify the maintenance supervisor of any damage.

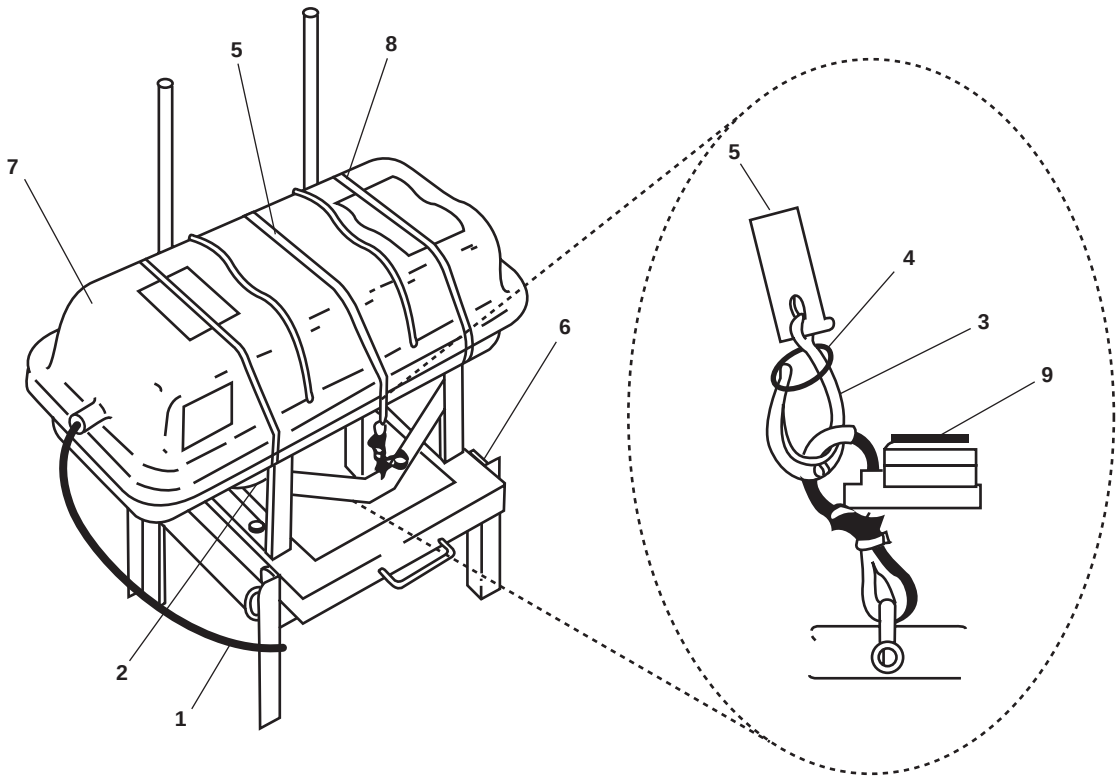


Figure 1. Life Raft

MANUAL LIFE RAFT LAUNCH

To manually launch the life raft, perform the following steps:

1. Open the pelican hook (figure 1, item 3) by prying the locking ring (figure 1, item 4) up and over the end of the hook.

2. The retainer strap (figure 1, item 5) is released.

3. Remove the two retaining pins (figure 1, item 6).

NOTE

The life raft frame tilts outboard.

4. Two crewmembers should tilt the life raft container (figure 1, item 7) and launch it over the side of the vessel.

5. If the life raft does not inflate after hitting the water, pull sharply on the painter line (figure 1, item 1).

NOTE

Three container straps (figure 1, item 8) that are secured around the life raft container (figure 1, item 7) will release as the life raft inflates.

6. After boarding the life raft, cut the painter line (figure 1, item 1).

AUTOMATIC LIFE RAFT LAUNCH

Life rafts are equipped with hydrostatic releases (figure 1, item 9) designed to release the life raft when submerged.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
CONNECTING SHORE POWER AND RIGGING THE GANGPLANK

INITIAL SETUP:

Personnel Required:
One Watercraft Operator, 88K
One Watercraft Engineer, 88L

References:
WP 0076 00
WP 0086 00

SHORE POWER CABLE CONNECTION

WARNING

Ensure that the power cable does not enter the water. Electrocution, serious injury, death, or equipment damage can occur during connection if the cable connector gets wet.

1. Remove the power cable from the stowage rack.
2. Position the cable end through the bottom section of the handrail.
3. Tie one end of the heaving line to the cable end.
4. Throw the heaving line to dockside facilities.
5. Release the waterproof covers from the cable connectors.

NOTE

There is 75 feet (22.9 m) of cable; direct attention to the amount of cable remaining on the deck. There should be a sufficient amount of cable on the deck to prevent it from paying out completely. Attach a preventer line to prevent complete cable runoff.

6. Coordinate cable payout between the onboard and the dockside crew.

WARNING

Ensure that electrical power is OFF at the dock shore power panel prior to connecting the shore power cable. Electrocution could result in serious injury or death.

7. Ensure that the electrical power is OFF at the dock shore power connector.
8. At the dock shore power panel, connect the shore power cable.
9. At the vessel shore power connector, turn the handle (figure 1, item 1) OPEN the cover (figure 1, item 2).
10. Align the cable connector and insert slot over the tongue (figure 1, item 3).
11. Secure the cable clamp (figure 1, item 4) on the bottom of the cable connector with the shore power connector.
12. At the dock shore power panel, set the power switch to ON.

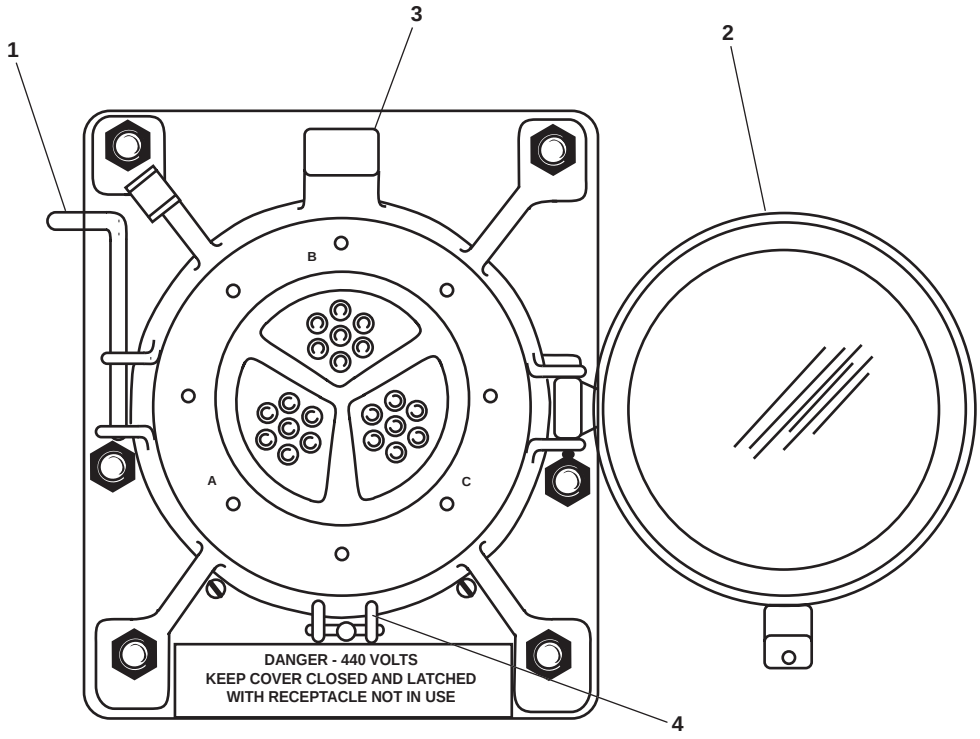


Figure 1. Shore Power Connector

SHIFTING TO SHORE POWER

1. At the main switchboard:

NOTE

Place all electronic and unnecessary equipment on standby while shifting from ship power to shore power.

a. Ensure that the PHASE SEQUENCE METER (figure 2, item 1) indicates the correct phase of shore power.

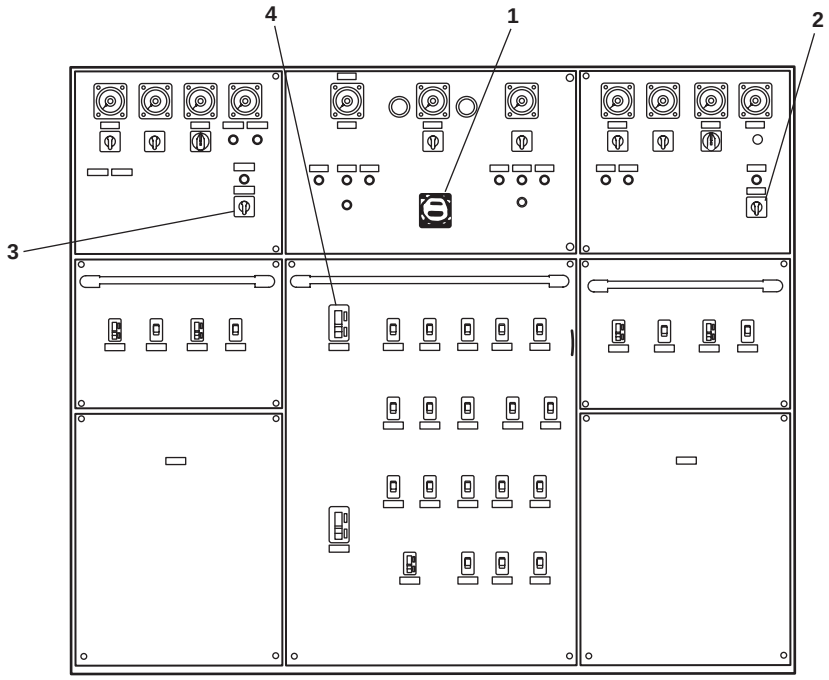


Figure 2. Main Switchboard

⚠ CAUTION

If the shore power phase meter indicates incorrect phasing of shore power, equipment will be damaged. Refer to unit maintenance.

NOTE

Ensure that the shore power indicator light is ON, the shore power frequency meter indicates 60 Hz, and the shore power voltmeter indicates 440 volts.

b. Set the GENERATOR 1 CKT. BKR. (figure 2, item 2) or GENERATOR 2 CKT. BKR. (figure 2, item 3) to OFF.

c. Quickly set the SHORE POWER CKT. BKR. (figure 2, item 4) to ON, energizing the switchboards.

2. At the emergency switchboard, complete the following:

   a. Ensure that the MAIN SWBD BUS TIE CKT. BKR. CLOSED indicator (figure 3, item 1) is ILLUMINATED.

   b. Turn the ENGINE CONTROL SW. MAN. OFF AUTO. switch (figure 3, item 2) to the MAN. position.

   c. Push the MAIN SWBD BUS TIE CKT. BKR. CLOSED pushbutton (figure 3, item 3) to ON.

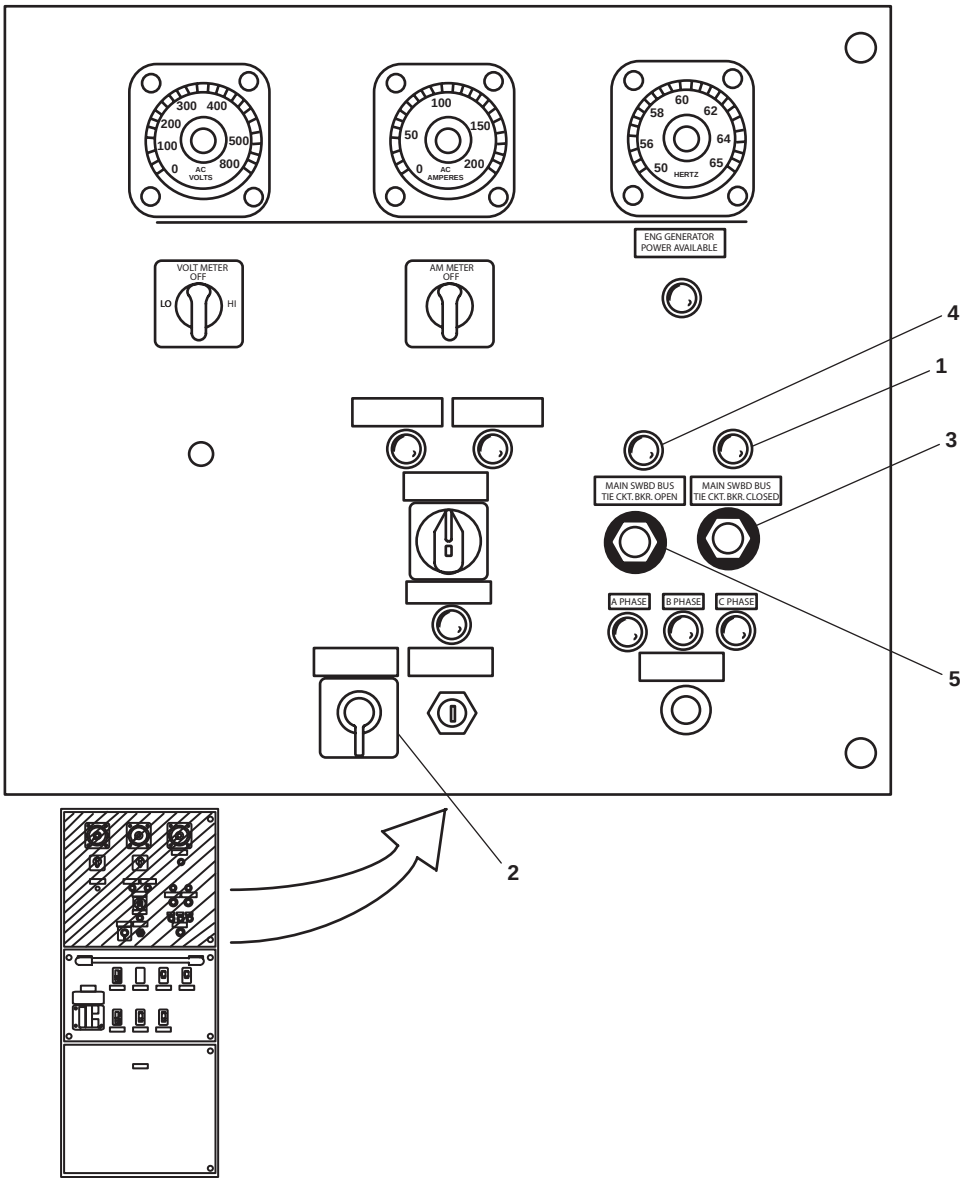


Figure 3. Emergency Switchboard

SHORE POWER CABLE DISCONNECTION

WARNING

Ensure that the power cable does not enter the water. Electrocution, serious injury, death or equipment damage can occur during connecting or disconnecting if the cable connector gets wet.

NOTE

Place all electronic and unnecessary electrical equipment in standby while shifting from shore power to ship power. Ensure that the selected ship's service diesel generator is operating and ready to accept an electrical load.

1. On the main switchboard:
   a. Set the SHORE POWER CKT. BKR. (figure 2, item 4) to OFF.
   b. Quickly set the GENERATOR 1 CKT. BKR (figure 2, item 2) or GENERATOR 2 CKT. BKR. (figure 2, item 3) to ON.
   c. Ensure that the MAIN SWBD BUS TIE CKT. BKR. OPEN indicator (figure 3, item 4) is illuminated.
2. At the emergency switchboard:
   a. Set the ENGINE CONTROL SW. MAN. OFF AUTO. switch (figure 3, item 2) to the MAN. position.
   b. Push the MAIN SWBD BUS TIE CKT. BKR. OPEN pushbutton (figure 3, item 5) to the ON position.
   c. Ensure that the MAIN SWBD BUS TIE CKT. BKR. OPEN indicator (figure 3, item 4) is illuminated.
3. At the dock shore power panel, set the power switch to OFF.

WARNING

Ensure that the electrical power switch is OFF at the dock shore power panel. Electrocution can result in serious injury or death.

4. Remove the shore power cable at the dock shore power panel.
5. Stop-off one end of the heaving line to the cable end at dockside.

6. Remove the cable from the shipboard shore power connector (figure 1).

7. CLOSE and secure the shore power connector.

8. Coordinate the cable haul-in between the onboard and the dockside crew.

9. Stow the shore power cable in the stowage rack.

RIGGING THE GANGPLANK

Never use the crane for any type of human support or transportation. The operator will never lift a load over other personnel. Personnel will not walk under a hoisted load. Operator will not attempt to hoist the load until conditions allow safe operation. Ensure that the load comes to a complete stop and is stable before changing direction of travel of the crane boom. Failure to observe these warnings could result in serious injury or death.

1. Start the central hydraulic system (WP 0076 00).

2. Operate the crane (WP 0086 00) into position over the gangplank (figure 4, item 1).

3. Ensure that the lifting sling (figure 4, item 2) is securely attached at lift points (figure 4, item 3).

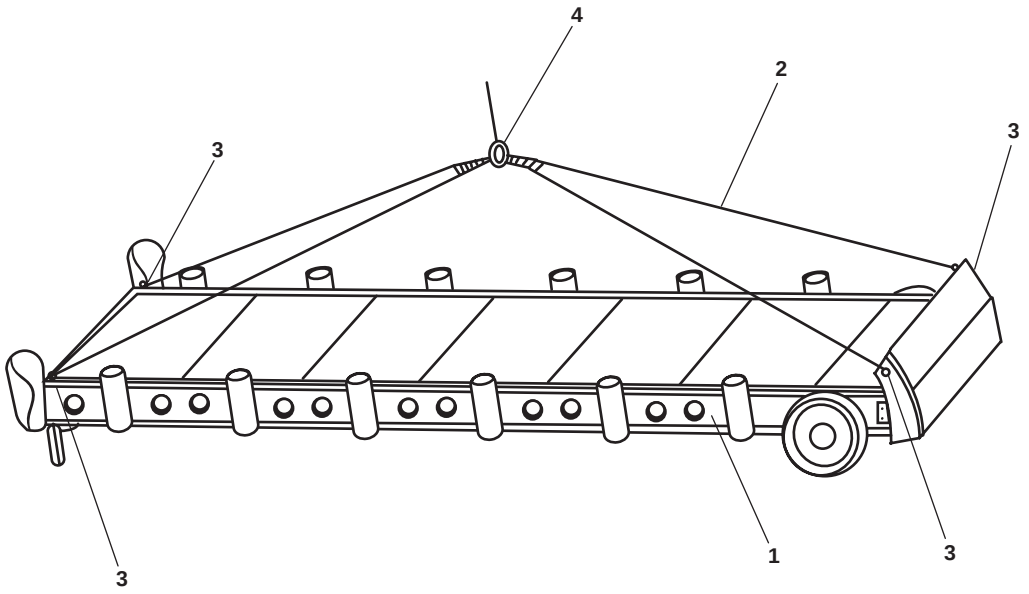


Figure 4. Rigging the Gangplank

4. Attach the crane hook to the sling lifting ring (figure 4, item 4).
5. Operate the crane (WP 0086 00) to move the gangplank (figure 4, item 1) into position.
6. Install the side rails on the gangplank (figure 4, item 1).
7. Remove the sling from the gangplank (figure 4, item 1) and secure the crane (WP 0086 00).
8. Secure the gangplank to the vessel by placing lines through each end slot and securing the lines to the vessel.
9. Secure the central hydraulic system (WP 0076 00).

STOWING THE GANGPLANK

Never use the crane for any type of human support or transportation. The operator will never lift a load over other personnel. Personnel will not walk under a hoisted load. Operator will not attempt to hoist the load until conditions allow safe operation. Ensure that the load comes to a complete stop and is stable before changing direction of travel of the crane boom. Failure to observe these warnings could result in serious injury or death.

1. Start the central hydraulic system (WP 0076 00).
2. Operate the crane (WP 0086 00) into position over the gangplank (figure 4, item 1).
3. Remove the handrails from the gangplank (figure 4, item 1).
4. Ensure that the lifting sling (figure 4, item 2) is securely attached at the lift points (figure 4, item 3).
5. Attach the crane hook to the sling lifting ring (figure 4, item 4).
6. Prepare the gangplank by removing the lines securing the gangplank to the LT.
7. Operate the crane (WP 0086 00) as necessary to position the gangplank on the storage brackets.
8. Secure the gangplank in the stowed position.
9. Remove the sling and secure the crane (WP 0086 00).
10. Secure the central hydraulic system (WP 0076 00).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
RIGGING TO TOW

1. Refer to WP 0089 00 for the towing machine operating procedures.

2. Refer to WP 0086 00 for the crane operating procedures.

3. Refer to the U.S. Army Towing Manual TB 55-1900-232-10 to rig the Large Tug (LT) to tow. Receive specific towing instructions from the towing vessel master.

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
GETTING UNDERWAY

INITIAL SETUP:

Personnel Required:
Two Watercraft Operators, 88L
Two Watercraft Engineers, 88K

References:
TM-55-5825-311-10-1
WP 0068 00
WP 0069 00
WP 0070 00
WP 0071 00
WP 0072 00
WP 0073 00
WP 0074 00
WP 0075 00
WP 0076 00
WP 0077 00
WP 0080 00
WP 0081 00
WP 0082 00
WP 0094 00
WP 0137 00 (volume 2)
WP 0138 00 (volume 2)
WP 0139 00 (volume 2)

References (continued):
WP 0140 00 (volume 2)
WP 0141 00 (volume 2)
WP 0142 00 (volume 2)
WP 0143 00 (volume 2)
WP 0144 00 (volume 2)
WP 0145 00 (volume 2)
WP 0146 00 (volume 2)
WP 0147 00 (volume 2)
WP 0148 00 (volume 2)
WP 0149 00 (volume 2)
WP 0150 00 (volume 2)
WP 0151 00 (volume 2)
WP 0152 00 (volume 2)
WP 0153 00 (volume 2)
WP 0154 00 (volume 2)
WP 0155 00 (volume 2)
WP 0156 00 (volume 2)
WP 0157 00 (volume 2)
WP 0158 00 (volume 2)
WP 0159 00 (volume 2)
WP 0160 00 (volume 2)

GETTING UNDERWAY

Prior to getting underway, the following must be accomplished:

1. All BEFORE Preventive Maintenance Checks and Services (PMCS) items (WP 0137 00 – WP 0160 00, volume 2).
2. Vessel prepared for use (WP 0068 00).
3. Ship's Service Diesel Generator (SSDG) online; vessel on ship's service power (WP 0069 00).
4. Compressed air system pressurized (WP 0070 00).
5. Fire main and general service water systems online and pressurized (WP 0071 00).
6. Main propulsion engines running and at operating temperature (WP 0072 00).
7. Lube oil purification operating (as appropriate) (WP 0073 00).
8. Fuel oil transferred to appropriate day tanks (WP 0074 00).
9. Bow thruster engine running and at operating temperature (as required) (WP 0075 00).
10. Central hydraulic system online (as required) (WP 0076 00).
11. Steering system operating (WP 0077 00).
12. Potable water system online and hydropneumatic tank pressurized (WP 0080 00).

13. Marine sanitation device online and operating in appropriate mode (WP 0081 00).
14. Heating, air conditioning, and refrigeration units operating as appropriate (WP 0082 00).
15. Gyrocompass online and ready for use (TM 55-5825-311-10-1).
16. External communication gear operating (as required) (TM 55-5825-311-10-1).
17. Shore power cable disconnected and stowed (WP 0094 00).
18. Gangplank stowed (WP 0094 00).

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
MAIN PROPULSION SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

STARBOARD MAIN ENGINE SHUTDOWN

1. At the EOS console, verify that the CONTROL AIR TRANSFER valve (figure 1, item 1) is in the EOS position.

2. At the EOS console, place the STBD MN ENG THROTTLE/CLUTCH lever (figure 1, item 2) in the NEUTRAL (straight UP) position.

3. Verify that the governor maintains the engine at idle speed. If idle speed cannot be maintained, notify the maintenance supervisor.

⚠ CAUTION

If ambient raw water temperature is above 90 ºF (32.2 ºC), it may be necessary to cool the main engine for at least 20 minutes.

Stopping an engine without a proper cooldown can result in damage to the engine.

4. Let the starboard main engine idle for at least 15 minutes to allow cooling water to remove excess heat.

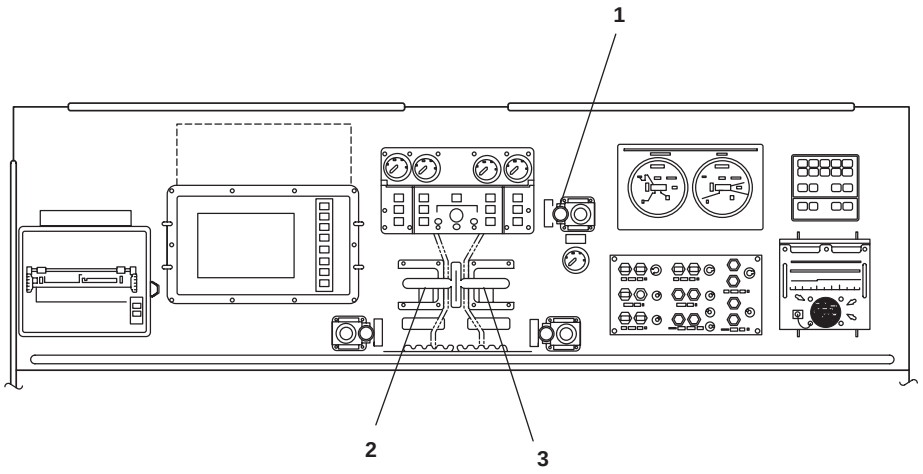


Figure 1. EOS Console

⚠ CAUTION

If the turbocharger lube oil pump fails to operate when the engine is shut down and the low turbo oil pressure alarm sounds, restart the engine immediately. Idle the engine 15 additional minutes with no load to prevent turbocharger damage.

If engine restart is not possible within 2 minutes, do not restart the engine until the turbocharger lube oil pump has been restored and the engine has been allowed to cool, or damage to the turbocharger could result.

NOTE

The starboard main engine can also be stopped by pressing the starboard main engine STOP pushbutton on the EOS control panel.

5. At the starboard main engine control panel, STOP the starboard main engine by pressing the ENGINE STOP pushbutton (figure 2, item 1).

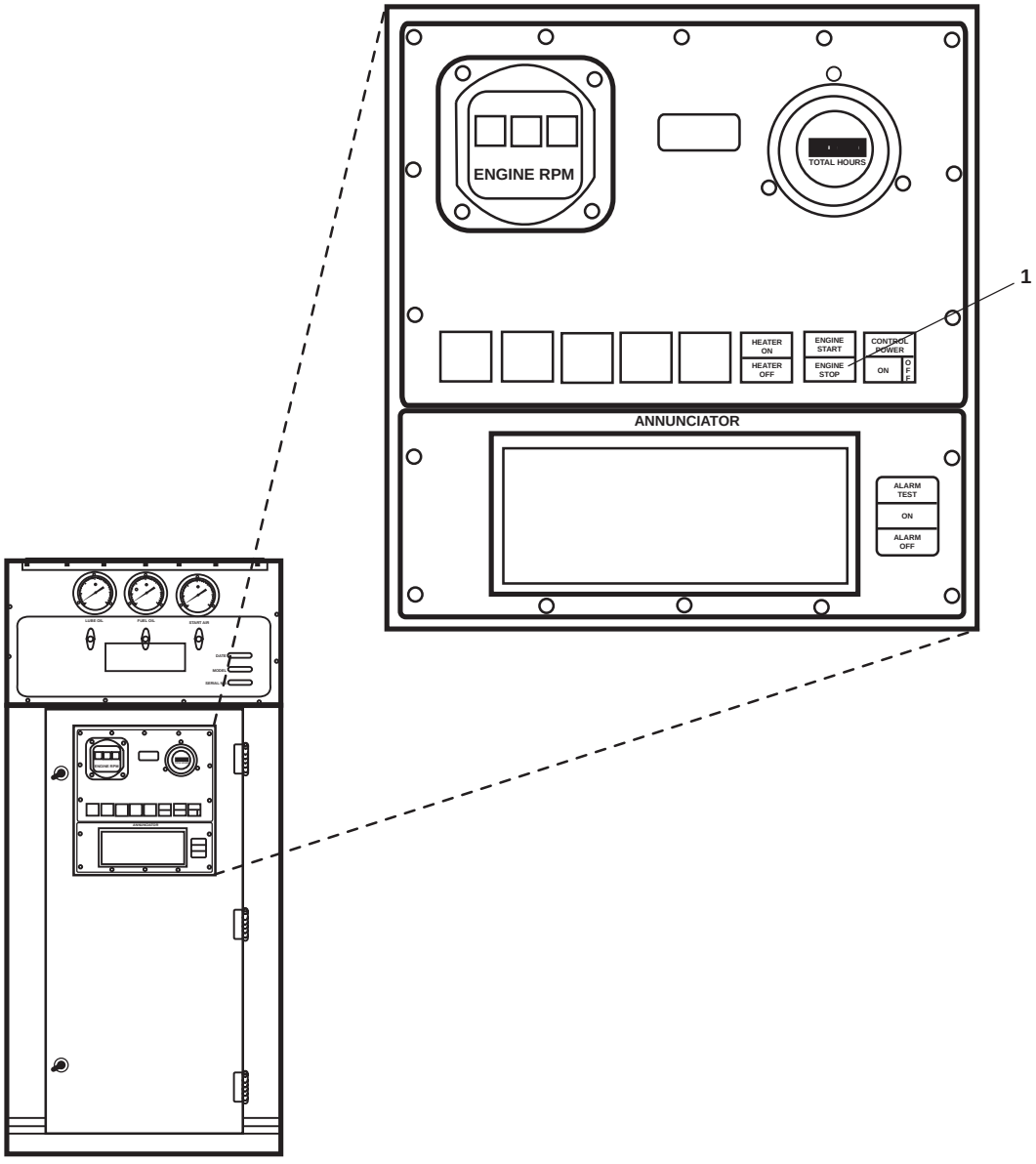


Figure 2. Main Engine Control Panel

6. On the aft engine room bulkhead, at the reduction gear 1 fresh water cooling pump motor controller, perform the following actions:

   a. Press the STOP pushbutton (figure 3, item 1).

   b. Verify that the MOTOR RUN indicator (figure 3, item 2) goes out.

   c. Set the ON-OFF switch (figure 3, item 3) to the OFF position

   d. Verify that the POWER AVAILABLE indicator (figure 3, item 4) goes out.

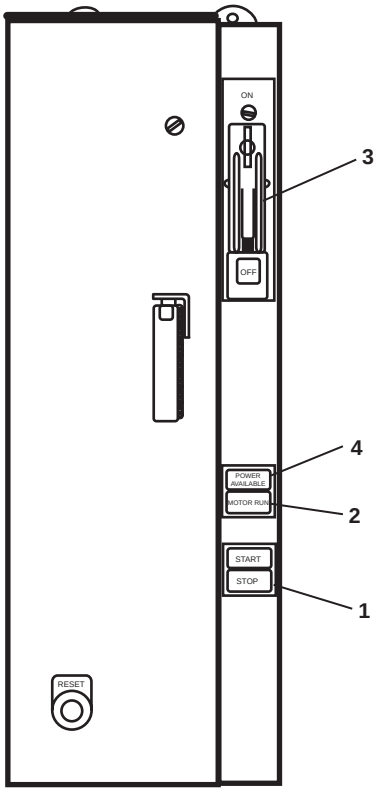


Figure 3. Fresh Water Cooling Pump Motor Controller

7. CLOSE the following valves:

   a. FO-20, F.O. SPLY TO STBD ME No. 1 (figure 4, item 1)

   b. FO-14, F.O. SERV CRSVR (figure 4, item 2)

   c. FO-15, F.O. SERV. SUCT. STBD (figure 4, item 3) (remote operator in the galley)

   d. FO-35, F.O. RTN TO DAY TK. STBD (figure 4, item 4)

e. FO-34, F.O. RTN CRSVR (figure 4, item 5)

f. Fwc-15, F.W. FR. KEEL CLR TO RED. GEAR No. 1 (figure 4, item 6)

g. Fwc-13, F.W. FR. RED. GEAR No. 1 TO KEEL CLR (figure 4, item 7)

h. Fwc-1, F.W. FR. KEEL CLR TO M.E. N0. 1 (figure 4, item 8)

i. Fwc-3, F.W. FR. M.E. No. 1 TO KEEL CLR. (figure 4, item 9)

j. CA-9, STG AIR TO ME #1 (figure 4, item 10)

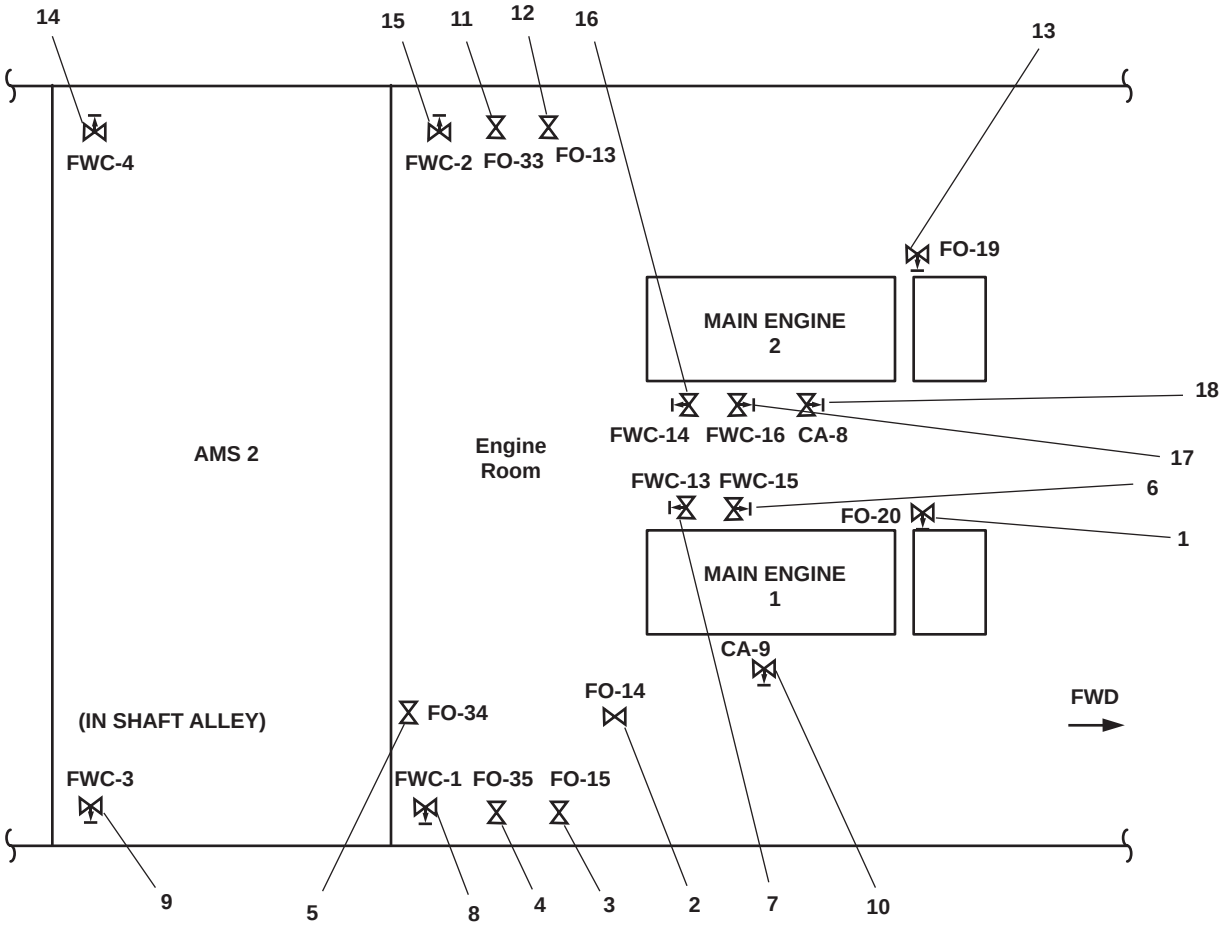


Figure 4. Main Propulsion System Valve Locations

8. At 440V power panel No. 1, set to OFF the following circuit breakers:

   a. FRESH WATER PUMP No.1 (REDUCTION GEAR). (figure 5, item 1)

   b. MAIN ENGINE LUBE OIL PRIMING PUMP No.1. (figure 5, item 2)

   c. MAIN ENGINE JACKET WATER HEATER No. 1./TURBO OIL PUMP No. 1./WATER LAY OVER PUMP No. 1. (figure 5, item 3)

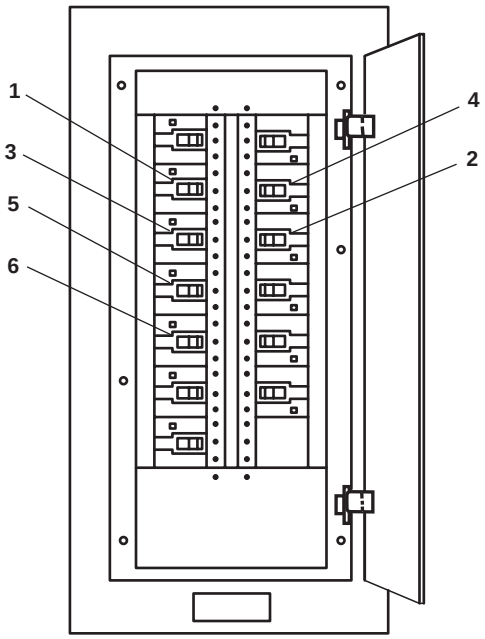


Figure 5. 440V Power Panel No. 1

PORT MAIN ENGINE SHUTDOWN

1. At the EOS console, verify that the CONTROL AIR TRANSFER switch (figure 1, item 1) is in the EOS position.

2. At the EOS condole, place the PORT MN ENG THROTTLE/CLUTCH lever (figure 1, item 3) in the NEUTRAL (straight UP) position.

3. Verify that the governor maintains the engine at idle speed. If idle speed cannot be maintained, notify the maintenance supervisor.

⚠ CAUTION

If ambient raw water temperature is above 90 ºF (32.2 ºC), it may be necessary to cool the main engine for at least 20 minutes.

Stopping an engine without a proper cooldown can result in damage to the engine.

4. Let the port main engine idle for at least 15 minutes to allow cooling water to remove excess heat.

⚠ CAUTION

If the turbocharger lube oil pump fails to operate when engine is shut down and the low turbo oil pressure alarm sounds, restart the engine immediately. Idle the engine 15 additional minutes with no load to prevent turbocharger damage.

If engine restart is not possible within 2 minutes, do not restart the engine until the turbocharger lube oil pump has been restored and the engine has been allowed to cool, or damage to the turbocharger could result.

NOTE

The port main engine can also be stopped by pressing the port main engine STOP pushbutton on the EOS control panel.

5. At the port main engine control panel, STOP the port main engine by pressing the ENGINE STOP pushbutton (figure 2, item 1).

6. On the aft engine room bulkhead, at the reduction gear 2 fresh water cooling pump motor controller, perform the following actions:

   a. Press and release the STOP pushbutton (figure 3, item 1).

   b. Verify that the MOTOR RUN indicator (figure 3, item 2) goes out.

   c. Set the ON-OFF switch (figure 3, item 3) to the OFF position.

   d. Verify that the POWER AVAILABLE indicator (figure 3, item 4) goes out.

7. CLOSE the following valves:

   a. FO-33, F.O. RTN TO DAY TK. PORT (figure 4, item 11)

   b. FO-13, F.O. SERV. SUCT. PORT (figure 4, item 12) (remote operator in the main deck fan room)

   c. FO-19, F.O. SPLY TO PORT ME No. 2 (figure 4, item 13)

   d. Fwc-4, F.W. FR. M.E. No. 2 TO KEEL CLR. (figure 4, item 14)

   e. Fwc-2, F.W. FR. KEEL CLR TO M.E. No 2 (figure 4, item 15)

   f. Fwc-14, F.W. FR. RED. GEAR No. 2 TO KEEL CLR (figure 4, item 16)

   g. Fwc-16, F.W. FR. KEEL CLR TO RED. GEAR No. 2 (figure 4, item 17)

   h. CA-8, STG AIR TO ME #2 (figure 4, item 18)

8. At 440V power panel No. 1, set to OFF the following circuit breakers:

   a. FRESH WATER PUMP No. 2, (REDUCTION GEAR) (figure 5, item 4)

   b. MAIN ENGINE LUBE OIL PRIMING PUMP No. 2. (figure 5, item 5)

   c. MAIN ENGINE JACKET WATER HEATER No. 2/TURBO OIL PUMP No. 2./WATER LAY OVER PUMP No. 2. (figure 5, item 6)

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
BOW THRUSTER SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

1. At the pilothouse console:

   a. Verify that the COMMAND TRANSFER plunger (figure 1, item 1) is UP in the engaged position, and that the pilothouse console has control of the bow thruster.

   b. Place the bow thruster engine throttle control lever (figure 1, item 2) in the NEUTRAL (center) position.

2. In AMS 1, secure the bow thruster by completing the following actions:

   a. Place the governor control lever (figure 2, item 1) in the IDLE position (local control and locked).

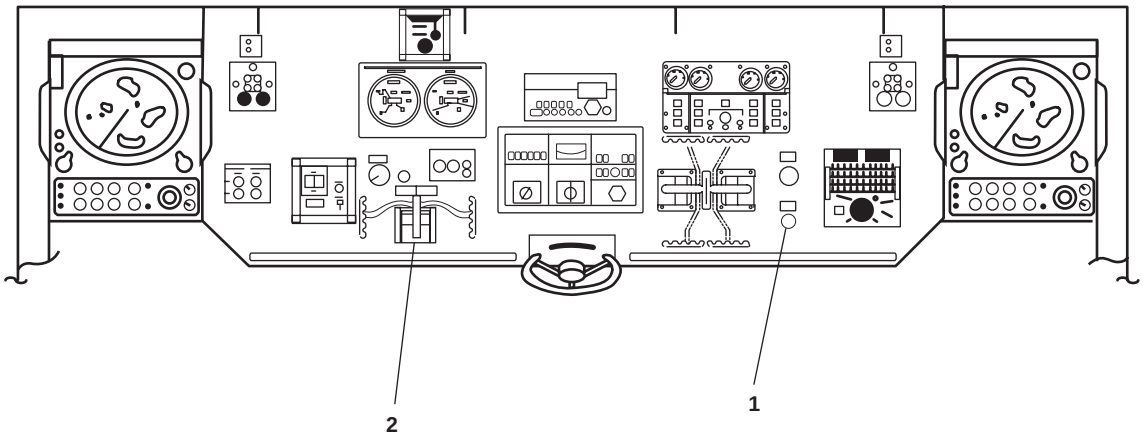


Figure 1. Pilothouse Console

   b. Allow the bow thruster engine to idle for at least 5 minutes.

   c. Set the START-STOP switch (figure 2, item 2) to the OFF position, or push the governor control lever (figure 2, item 1) in the aft direction until the engine stops.

   d. Push in the EMERGENCY STOP pushbutton (figure 2, item 3).

3. Wait until the bow thruster engine stops completely, then push the shaft brake plunger (figure 3, item 1) DOWN to lock the bow thruster shaft.

4. Secure the bow thruster engine fuel oil system by placing the following valves in the CLOSED position:

   a. Fuel filter/water separator inlet and outlet valves (figure 4, item 1), located on the bow thruster engine

   b. FO-30, F.O. SPLY TO BOW THRUSTER ENG (figure 4, item 2)

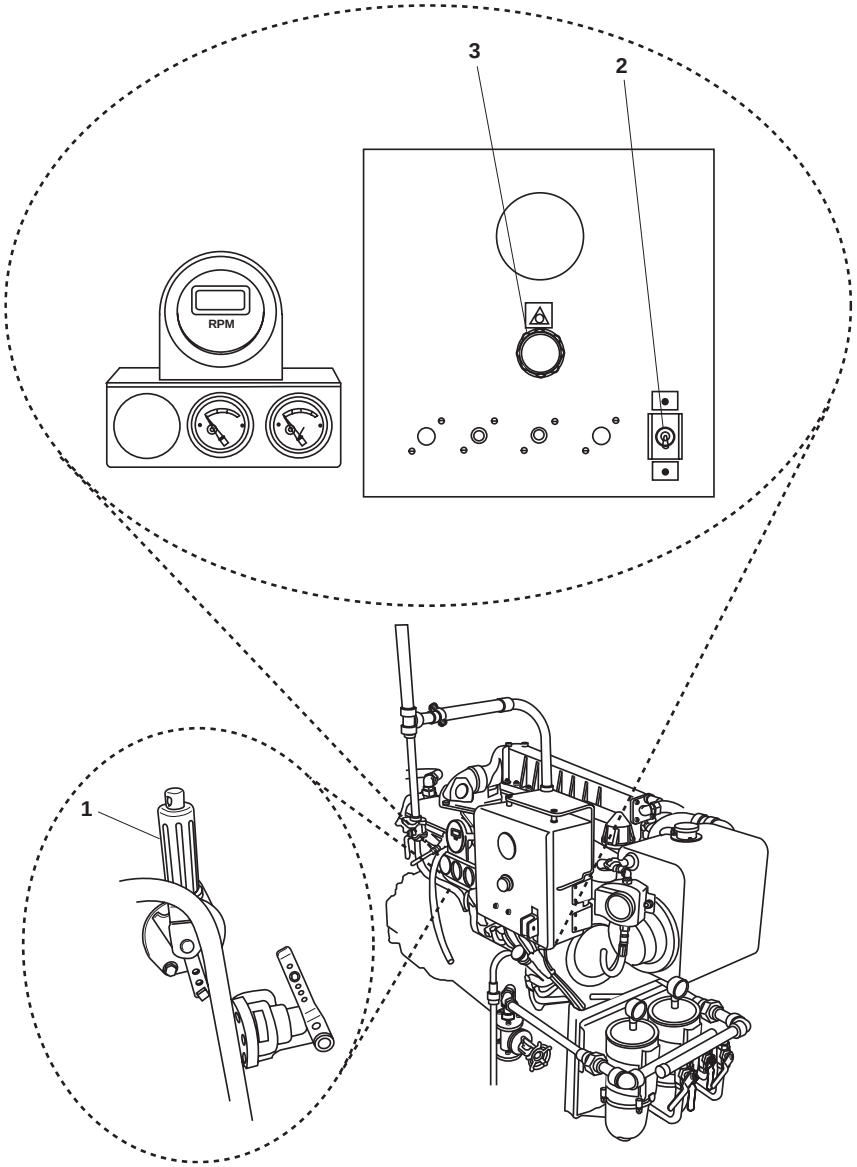


Figure 2. Bow Thruster Engine Controls

5. Secure the bow thruster engine compressed air system by placing the following valves in the CLOSED position:

   a. CA-5, STG AIR TO BOW THRUSTER ENG (figure 4, item 3)

   b. CA-62, STARTING AIR GAUGE -COV (figure 4, item 4)

6. Secure cooling water to the bow thruster engine by placing the following valves in the CLOSED position:

   a. ASW-18, S.W. TO BOW THRUSTER ENG. (figure 4, item 5)

   b. ASW-21, S.W. FR. BOW THRUSTER ENG. TO OVB'D DISCHARGE (figure 4, item 6)

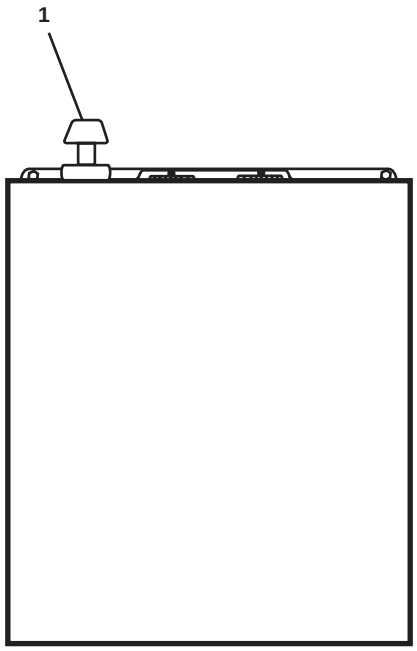


Figure 3. Bow Thruster Shaft Brake Plunger

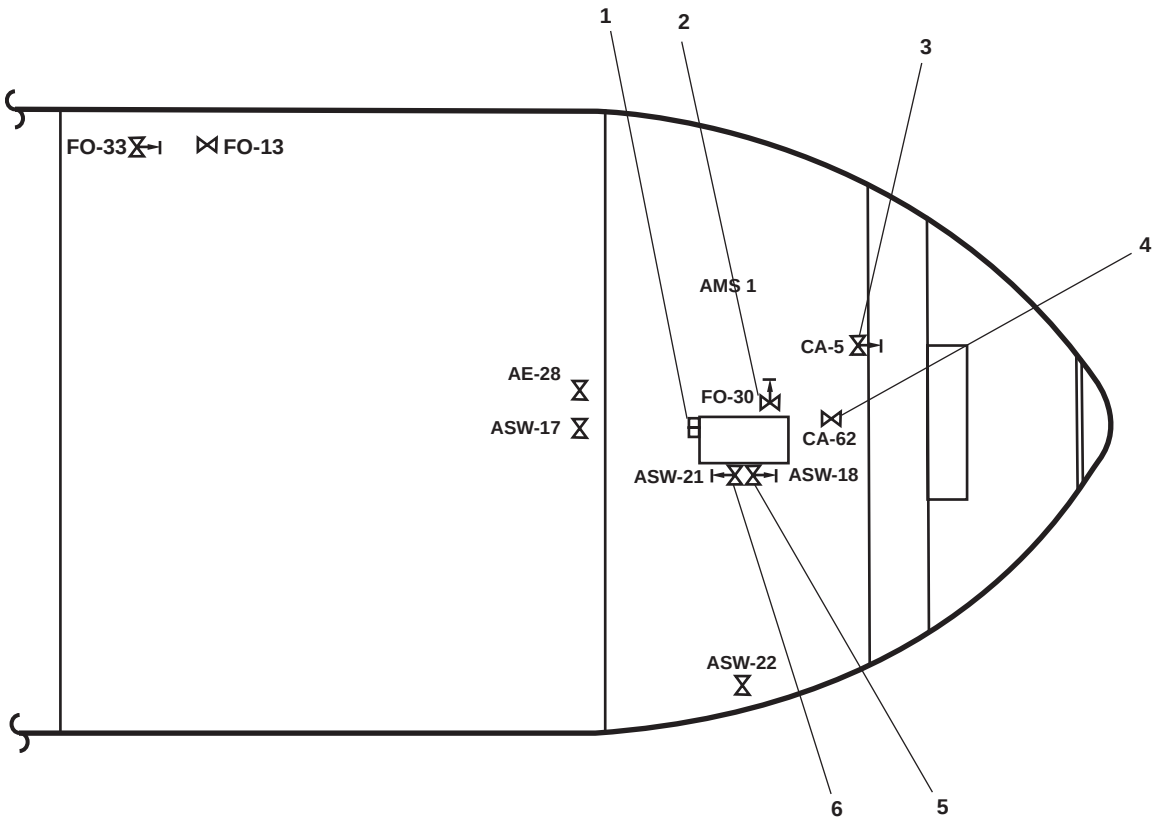


Figure 4. Bow Thruster Valve Locations

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
STEERING SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

SECURE THE STEERING HYDRAULIC SYSTEM

1. To secure the steering gear motor controllers 1 and 2:

   a. Place the change-over switches (figure 1, item 1) to the 2 position for STOP.

   b. Set the ON-OFF POWER switches (figure 1, item 2) to OFF.

   c. Verify that the POWER ON indicator (figure 1, item 3) goes out.

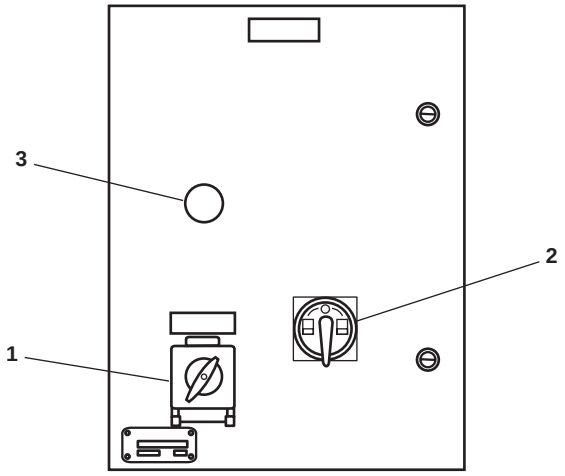


Figure 1. Steering Gear Motor Controllers

2. To secure the steering hydraulic pump station, CLOSE the following valves:

   a. SH-5, RUD. MOT NO. 1 SUMP (figure 2, item 1)

   b. SH-6, RUD. MOT No. 2 SUMP (figure 2, item 2)

   c. SH-4, C.O.V. -RUD. MOT. No.2 PRESS / RTN (figure 2, item 3)

   d. SH-2, C.O.V. -RUD MOT. No.2 PRESS / RTN (figure 2, item 4)

   e. SH-3, C.O.V. -RUD. MOT. No. 1 PRESS / RTN (figure 2, item 5)

   f. SH-1, C.O.V. -RUD. MOT. No. 1 PRESS / RTN (figure 2, item 6)

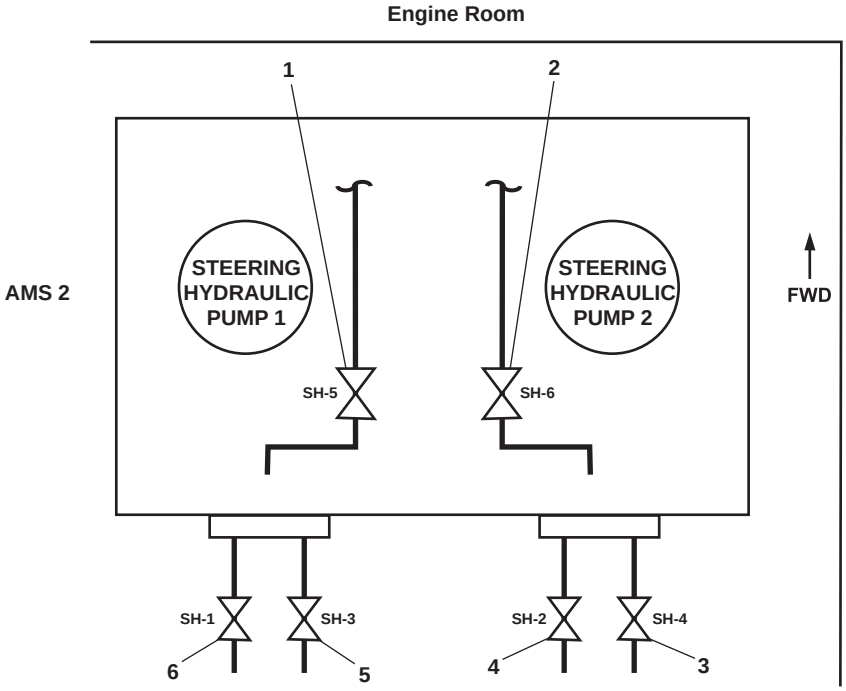


Figure 2. Steering Hydraulic Pump Station

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
BILGE/BALLAST SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
TM 55-1925-285-13&P

GENERAL

This work package contains the following procedures:

1. Oil Water Separator (OWS) and Oil Content Monitor (OCM) shutdown
2. Secure the bilge/ballast pumps
3. Secure the oily bilge, OCM and OWS piping system
4. Secure the bilge/ballast piping system
5. Secure the bilge eductor piping system
6. Secure the electrical system

OWS AND OCM SHUTDOWN

1. Set the OWS control panel switch (figure 1, item 1) to OFF.
2. Set OPERATION SELECTOR switch A1S1 (figure 2, item 1) to OFF.
3. Perform OCM backflush by OPENING OCM 2 (figure 3, item 1) and CLOSING OCM 1 (figure 3, item 2). Continue OCM backflush until all liquid from the OCM discharge tube (figure 2, item 2) is clear.
4. Perform OWS manual backflush (TM 55-1925-285-13&P).
5. Return all valves from table 1 to the CLOSED position.
6. At 120V distribution panel No. 4, set the following circuit breakers to OFF:
    a. OILY WATER SEPARATOR (figure 4, item 1).
    b. OIL CONTENT MONITOR (figure 4, item 2).

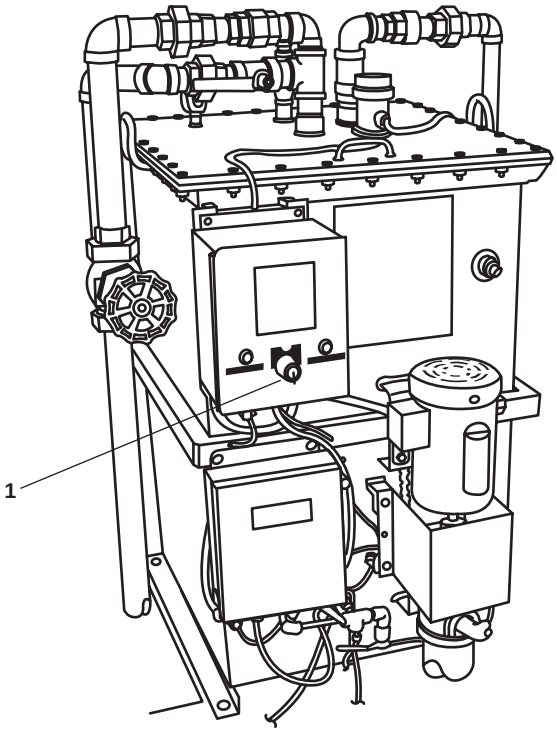


Figure 1. OWS Control Panel

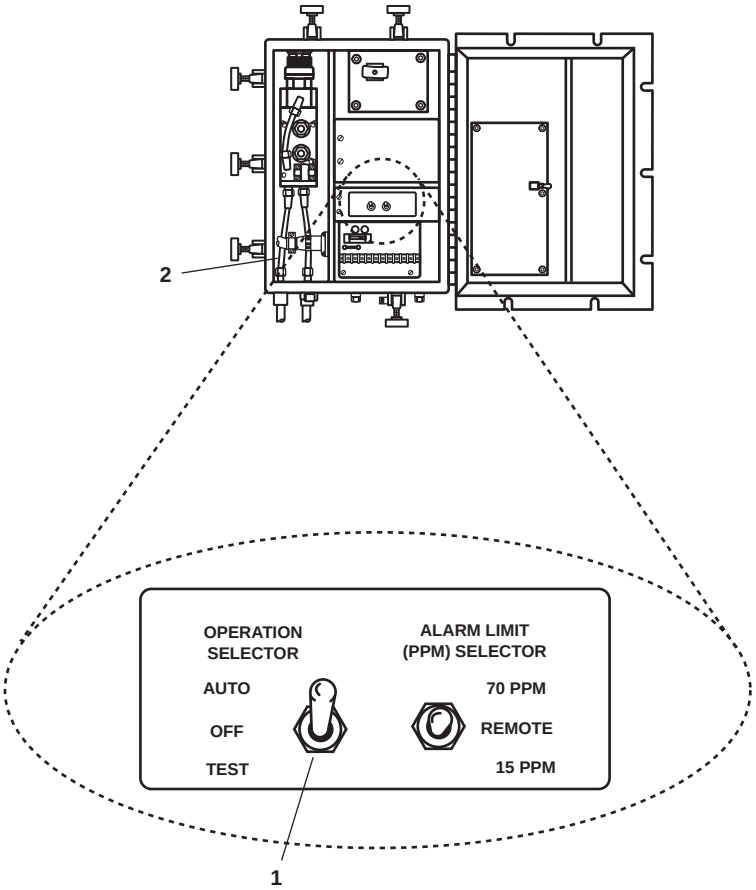


Figure 2. Sampling/Sensor Assembly Interior

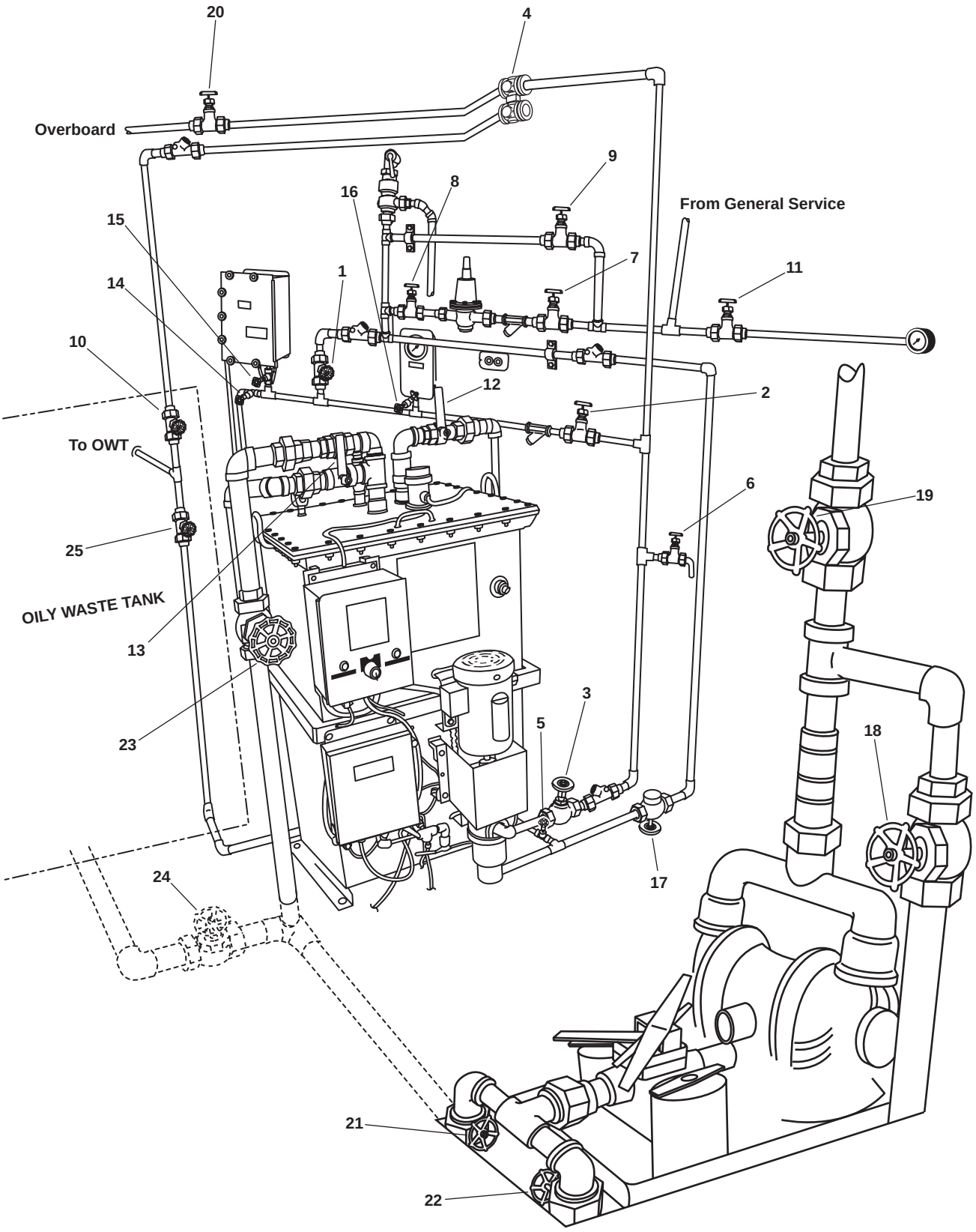


Figure 3. OWS, OB, and OCM Piping

Table 1. Valve Positions During Operation Under Usual Conditions

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OCM-2	OCM BACKFLUSH WATER	CLOSED
2	OCM-1	OCM NOZZLE SAMPLER COV	OPEN
3	OWS-3	OWS PUMP DISCHARGE	OPEN
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	OPEN
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	OPEN
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	OPEN
12	OWS-2	OWS DISCHARGE	OPEN
13	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	OPEN
16	OCM-8	OCM GAGE ISOLATION	OPEN
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	OPEN
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	OPEN
24	OB-16	WATER FROM OWT COV	OPEN
25	OB-17	OILY WATER TANK INLET	OPEN

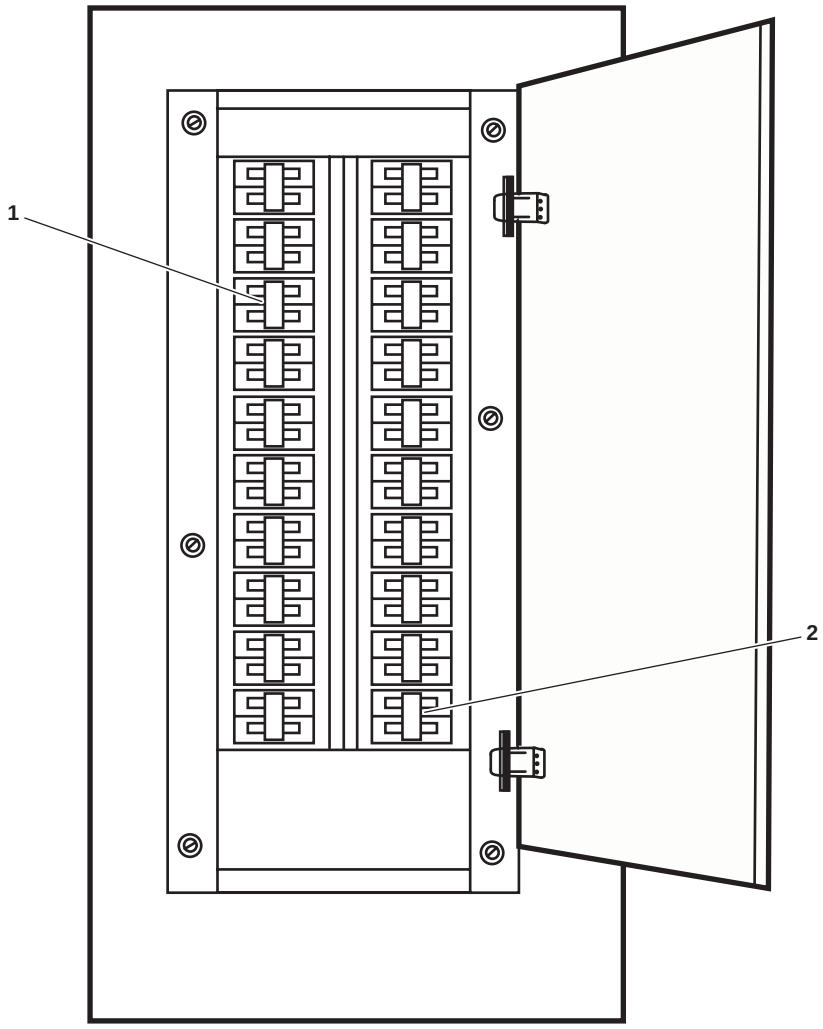


Figure 4. 120V Distribution Panel No. 4

SECURE THE BILGE/BALLAST PUMPS

1. At the bilge pump 1 and 2 motor controllers:

    a. Press the STOP pushbuttons (figure 5, item 1).

    b. Verify that the MOTOR RUN indicators (figure 5, item 2) are out.

    c. Set the ON-OFF switches (figure 5, item 3) to OFF.

    d. Verify that the POWER AVAILABLE indicators (figure 5, item 4) are out.

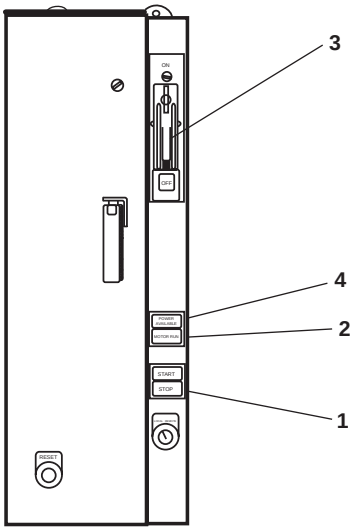


Figure 5. Bilge Pump Motor Controller

SECURE THE OILY BILGE, OCM, AND OWS PIPING SYSTEM

1. To secure the oily bilge system piping, CLOSE the following valves:
   a. OB-18, HOSE CONN.- OILY BILGE SUCT. (figure 6, item 1)
   b. OB-2, OILY BILGE SUCT. (figure 6, item 2)
   c. AMS 1 1½" flush connection (figure 6, item 3)
   d. OB-1, OILY BILGE SUCT. (figure 6, item 4)
   e. OB-16, OILY WASTE STOR. TK. SUCT. (figure 6, item 5)
   f. OB-10, OWS OVERBOARD DISCHARGE (figure 6, item 6)
   g. OB-15, OWS INLET (figure 6, item 7)
   h. OB-9, XFER PUMP DISCH TO SHORE (figure 6, item 8)
   i. OB-5, OILY BILGE SUCT. . ENG. RM. (figure 6, item 9)
   j. OB-3, OILY BILGE SUCT. SHAFT ALLEY (figure 6, item 10)
   k. OB-7, OILY DR. TK. SUCT. (figure 6, item 11)
   l. PORT shaft alley 1½" flush connection (figure 6, item 12)
   m. OB-4, OILY BILGE SUCT. SHAFT ALLEY (figure 6, item 13)
   n. OB-6, OILY BILGE SUCT. ENG. RM. (figure 6, item 14)
   o. OB-21, HOSE CONN. – OILY BILGE SUCT. (figure 6, item 15)

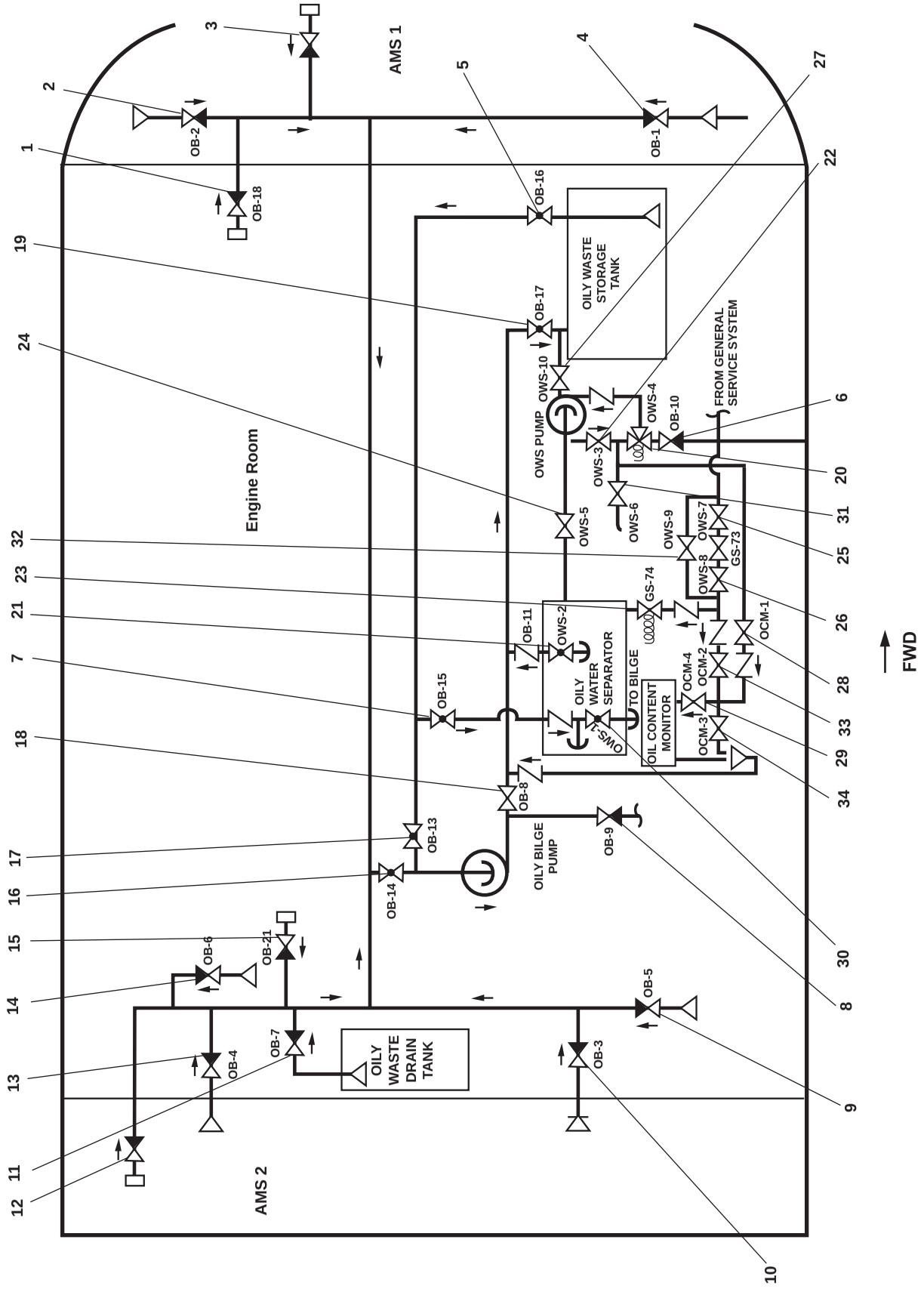


Figure 6. Oily Bilge Pump Piping System

p. OB-14, C.O.V. – OILY BILGE PMP. SUCT. (figure 6, item 16)

q. OB-13, OWT TO XFR PUMP SUCTION (figure 6, item 17)

r. OB-8, OILY BILGE PMP DISCH. TO OILY WST.STOR. TK (figure 6, item 18)

s. OB-17, OILY WATER TANK INLET (figure 6, item 19)

2. To secure the OWS piping, CLOSE the following valves:

a. OWS-4, OCM 3-WAY DIVERTER (figure 6, item 20), operator to LOCAL/SHUT

b. OWS-2, OWS DISCHARGE (figure 6, item 21)

c. OWS-3, OWS PUMP DISCHARGE (figure 6, item 22)

d. GS-74, OWS BACKFLUSH INLET SOLENOID (figure 6, item 23)

e. OWS-5, OWS DISCHARGE (figure 6, item 24)

f. OWS-7, BACKFLUSH WTR TO PRESS RDCR (figure 6, item 25)

g. OWS-8, BACKFLUSH WTR FROM PRESS RDCR (figure 6, item 26)

h. OWS-10, OWS RECIRCULATING COV (figure 6, item 27)

3. To secure the OCM piping, CLOSE the following valves:

a. OCM-1, OCM NOZZLE SAMPLER COV (figure 6, item 28)

b. OCM-4, OCM INLET (figure 6, item 29)

c. OWS-1, OWS MANUAL BACKFLUSH (figure 6, item 30)

d. OWS-6, OWS PITOT SAMPLE (figure 6, item 31)

e. OWS-9, BACKFLUSH WTR PRESS RDCR BYPASS (figure 6, item 32)

f. OCM-2, OCM BACKFLUSH WATER (figure 6, item 33)

g. OCM-3, OCM SAMPLING VALVE (figure 6, item 34)

SECURE THE BILGE/BALLAST PIPING SYSTEM

To secure the bilge/ballast piping system, CLOSE the following valves:

1. BB-12, BLST. TK. No. 1 SUCT. COV (figure 7, item 1)

2. BB-25, BLST MANF TO PMPS OUTLT (figure 7, item 2)

3. BB-34, B/B PMP No. 1 OVBD DISCH. (figure 7, item 3)

4. BB-32, B/B PMP No.2 OVBD DISCH (figure 7, item 4)

5. BB-29, B/B PMP No. 1 BILGE SUCT. (figure 7, item 5)

6. BB-30, B/B PMP. No. 2 BILGE SUCT. (figure 7, item 6)

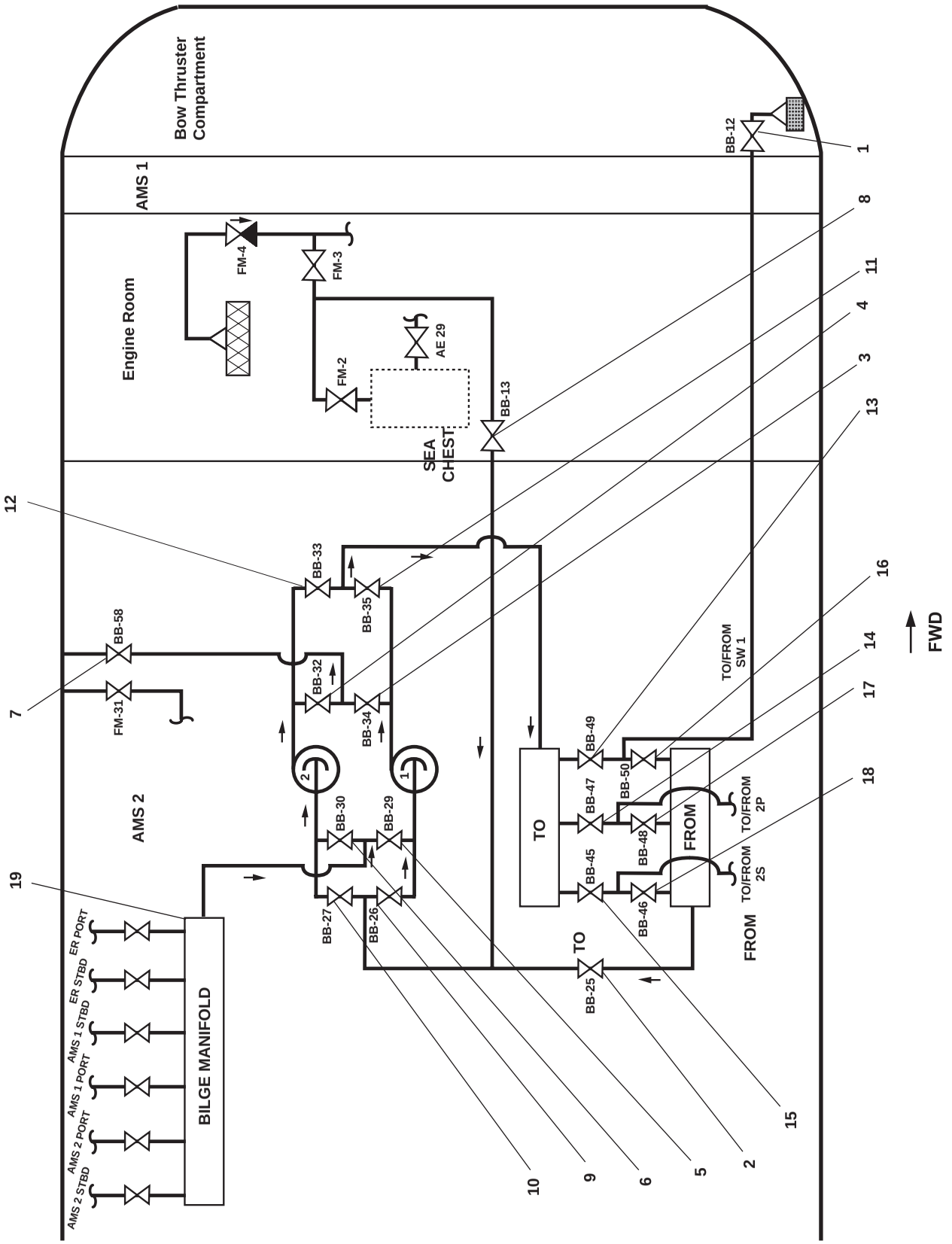


Figure 7. Bilge/Ballast System Valve Locations

7. BB-58 (figure 7, item 7), bilge/ballast overboard discharge
8. BB-13, S.W. TO BLST. PMPS (figure 7, item 8)
9. BB-26, B/B PMP No. 1 BLST. SUCT (figure 7, item 9)
10. BB-27, B/B PMP. No.2 BLST. SUCT (figure 7, item 10)
11. BB-35, B/B PMP No.1 BLST. TO MANF. (figure 7, item 11)
12. BB-33, B/B PMP. No.2 BLST TO MANF. (figure 7, item 12)
13. BB-49, BLST TK No.1 FILL (figure 7, item 13)
14. BB-47, BLST TK No.2P FILL (figure 7, item 14)
15. BB-45, BLST TK No.2S FILL (figure 7, item 15)
16. BB-50, BLST TK No.1 SUCT (figure 7, item 16)
17. BB-48, BLST TK No.2P SUCT (figure 7, item 17)
18. BB-46, BLST TK No.2S SUCT (figure 7, item 18)
19. All valves on the bilge manifold (figure 7, item 19)

SECURE THE BILGE EDUCTOR PIPING SYSTEM

To secure the bilge eductor piping system, CLOSE the following valves:

1. BB-10 (figure 8, item 1), chain locker bilge eductor overboard discharge
2. GS-44, BILGE EDUC (figure 8, item 2)
3. BB-9, OVBD. DISCH . BILGE EDUC (figure 8, item 3)
4. GS-45, BILGE EDUC (figure 8, item 4)
5. BB-11, OVBD. DISCH . BILGE EDUC (figure 8, item 5)
6. GS-47, BILGE EDUC (figure 8, item 6)
7. BB-37, BILGE EDUCT SUCT COV (figure 8, item 7)
8. GS-46, BILGE EDUC (figure 8, item 8)
9. BB-36, BILGE EDUCT SUCT C.O.V. (figure 8, item 9)

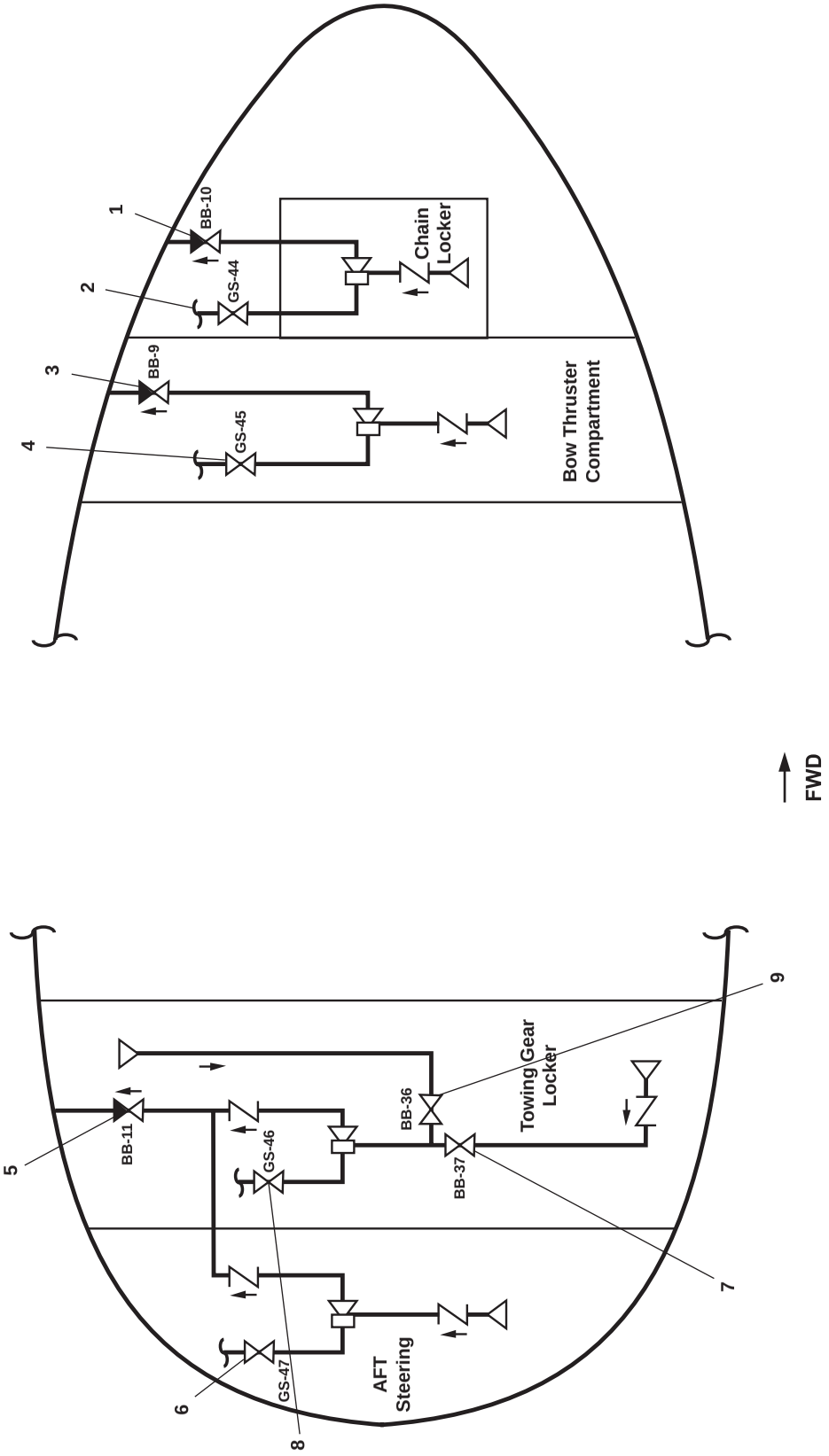


Figure 8. Bilge Eductor System

SECURE THE ELECTRICAL SYSTEM

1. To secure the electrical system:

   a. At the EOS main switchboard, set the BILGE PUMP NO. 2 circuit breaker (figure 9, item 1) to OFF.

   b. At the EDG emergency switchboard, set the BILGE PUMP #1 circuit breaker (figure 10, item 1) to OFF.

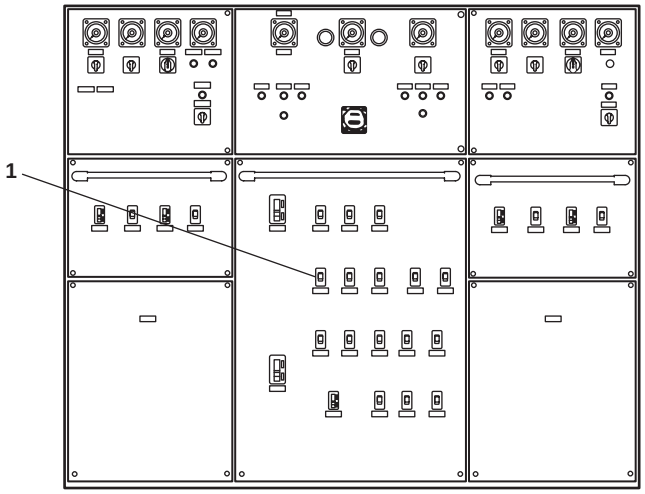


Figure 9. EOS Main Switchboard

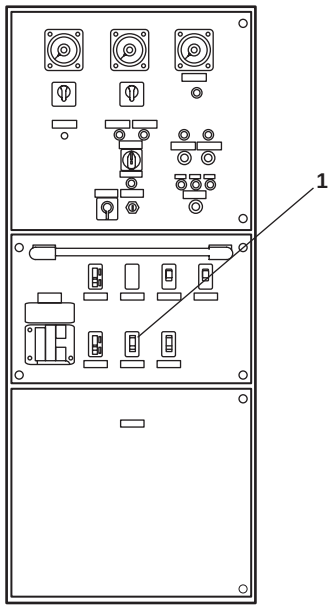


Figure 10. EDG Emergency Switchboard

2. At 120V distribution panel No. 4, set the following circuit breakers to OFF:

   a. OILY WATER SEPARATOR (figure 11, item 1)

   b. OIL CONTENT MONITOR (figure 11, item 2)

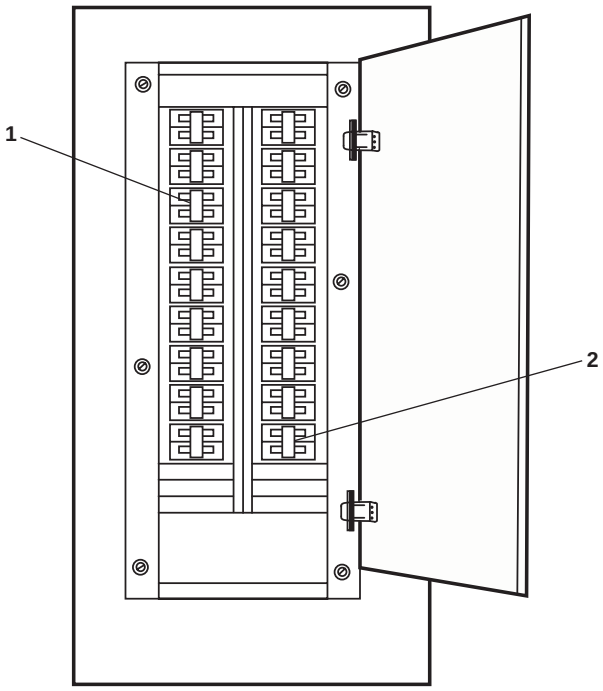


Figure 11. 120V Distribution Panel No. 4

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
TANK LEVEL INDICATOR SYSTEMS SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

SHUTDOWN

1. On the 11 channel master Tank Level Indicator (TLI) panel in the EOS, set the ON-OFF switch (figure 1, item 1) to OFF.
2. On the 7 channel master TLI panel in the EOS, set the ON-OFF switch (figure 2, item 1) to OFF.
3. Verify that the POWER indicator for each TLI panel (figures 1 & 2, item 2) goes out.
4. At 120V emergency distribution panel No. 1, set the TLI SYSTEM circuit breaker (figure 3, item 1) to OFF.

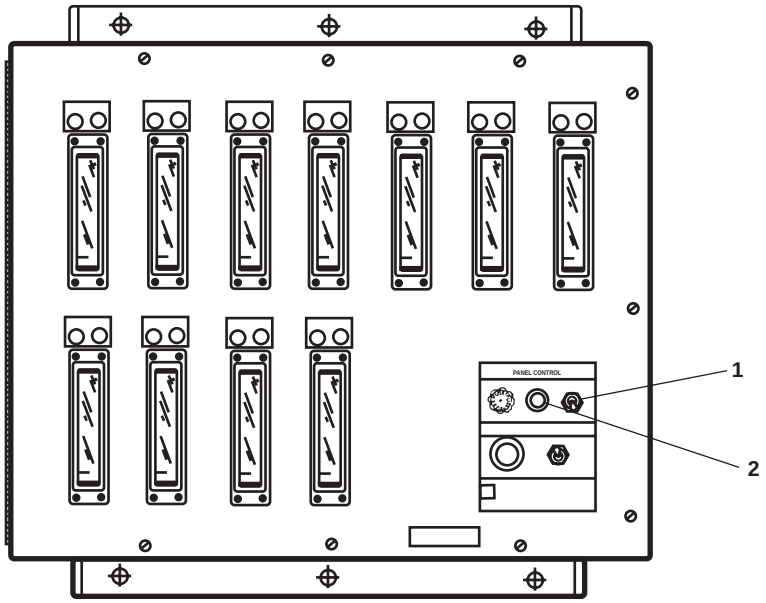


Figure 1. 11 Channel Master TLI Panel

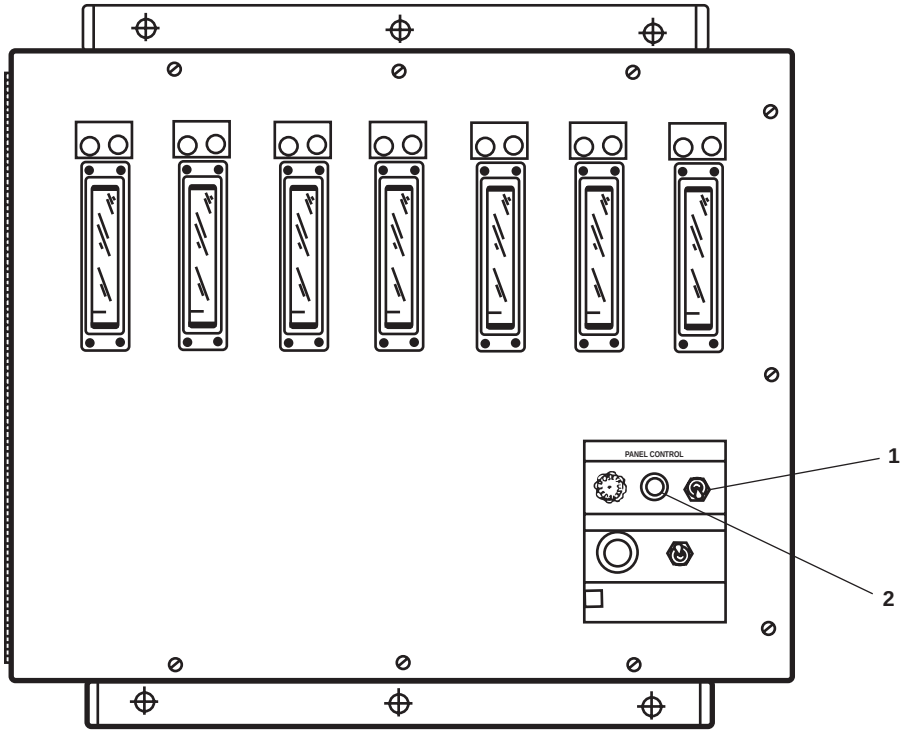


Figure 2. 7 Channel Master TLI Panel

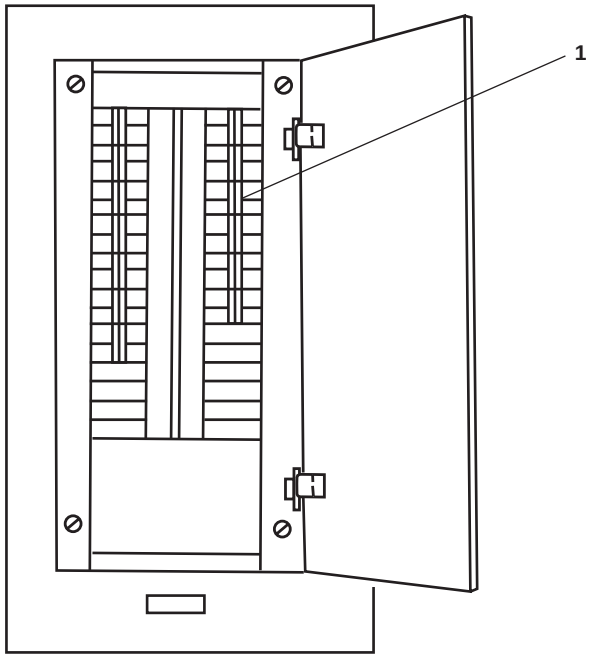


Figure 3. 120V Emergency Distribution Panel No. 1

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
HYDRAULIC SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0076 00

PURPOSE

This work package provides instructions for the shutdown of the central hydraulic system under usual conditions.

CENTRAL HYDRAULIC SYSTEM HYDRAULIC POWER UNIT (HPU) SHUTDOWN

1. If local operation was selected during the startup procedure (WP 0076 00), press the STOP pushbutton (figure 1, item 1) at the central HPU motor controller. If remote operation was selected during the startup procedure (WP 0076 00), press the STOP pushbutton (figure 2, item 1) at the remote control station.

2. Verify that the RUNNING indicator(s) (figure 1, items 2 and/or 3) extinguish for the selected pump(s).

3. Set to OFF the REMOTE/OFF/ON switch (figure 1, item 4) on the central HPU motor controller.

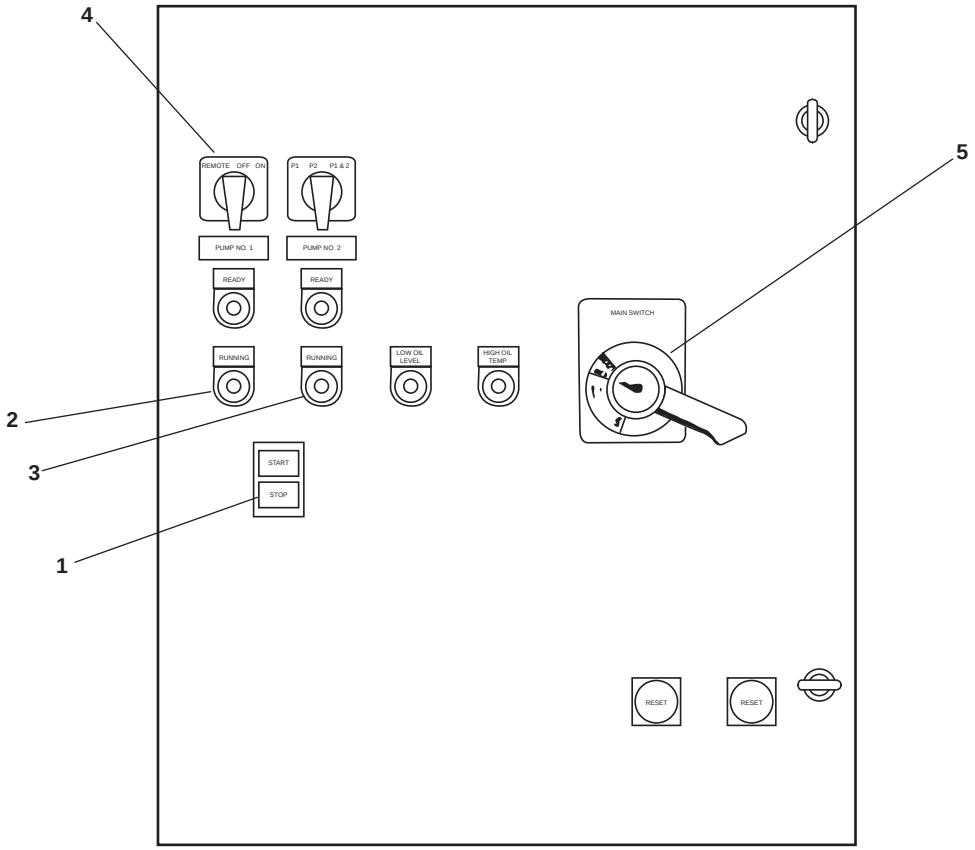


Figure 1. Central Hydraulic System HPU Motor Controller

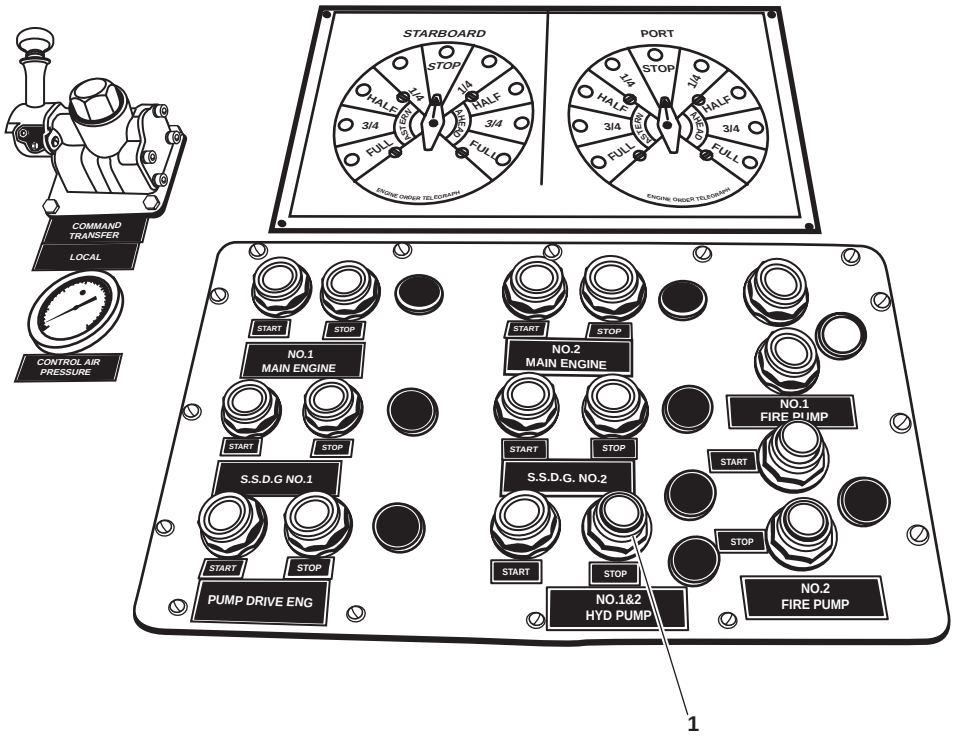


Figure 2. Remote Control Station (EOS)

4. Set to OFF the MAIN SWITCH (figure 1, item 5) on the central HPU motor controller.

5. Set to OFF the CENT HYD SYS POWER UNIT NO. 1 & 2 circuit breaker (figure 3, item 1) on the main switchboard.

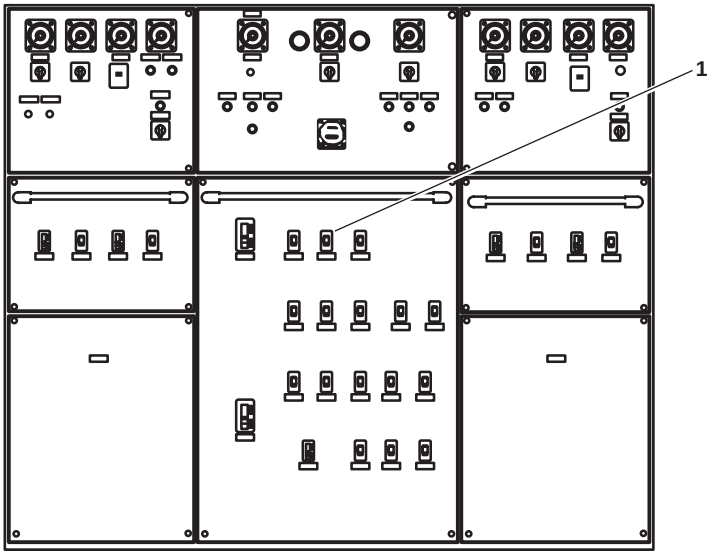


Figure 3. Main Switchboard

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
LUBE OIL PURIFICATION AND TRANSFER PIPING SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

GENERAL

The following procedures are included in this work package:

1. Stop and secure the lube oil purifier.
2. Secure the electrical system.
3. Secure the lube oil piping system.

STOP AND SECURE THE LUBE OIL PURIFIER

⚠ CAUTION

Verify that the lube oil purifier heater elements are cool prior to securing the lube oil purifier. Securing oil flow before the heater elements are sufficiently cooled can cause damage to the purifier.

1. In the engine room, on the port bulkhead, at the lube oil purifier control panel:
   a. Set the HEATER switch (figure 1, item 1) to OFF.
   b. Verify that the HEATER ON indicator (figure 1, item 2) goes out.
   c. Press the STOP pushbutton (figure 1, item 3).
   d. Verify that the MOTOR RUN indicator (figure 1, item 4) goes out.
   e. Set the CONTROL POWER switch (figure 1, item 5) to OFF.
   f. Set the MAIN CIRCUIT BREAKER (figure 1, item 6) to OFF.
2. At the main switchboard in the EOS, set the LUBE OIL PURIFIER circuit breaker (figure 2, item 1) to OFF.
3. At the lube oil purifier:
   a. CLOSE the shutoff valve (figure 3, item 1).
   b. CLOSE the needle valve (figure 3, item 2).

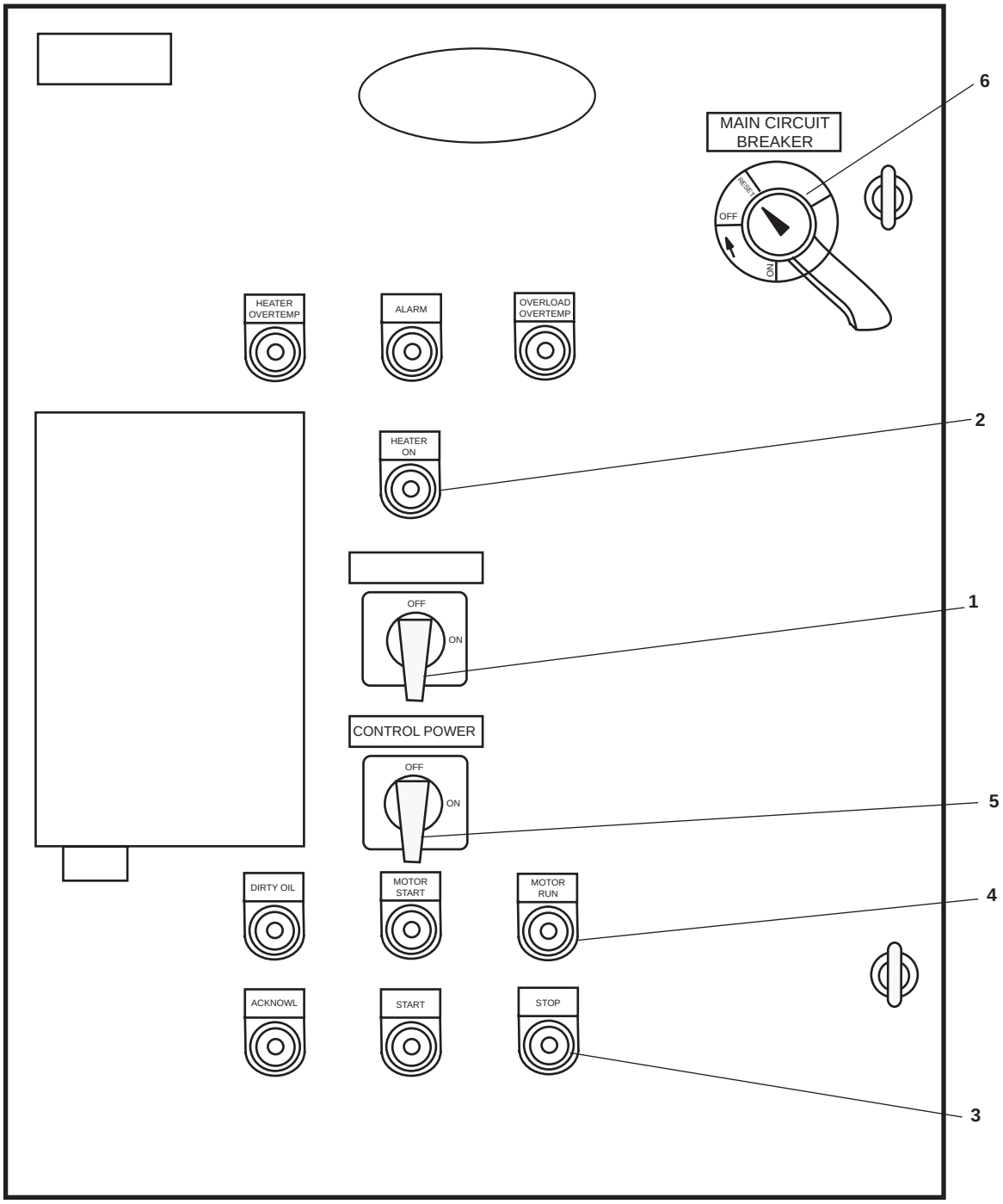


Figure 1. Lube Oil Purifier Control Panel

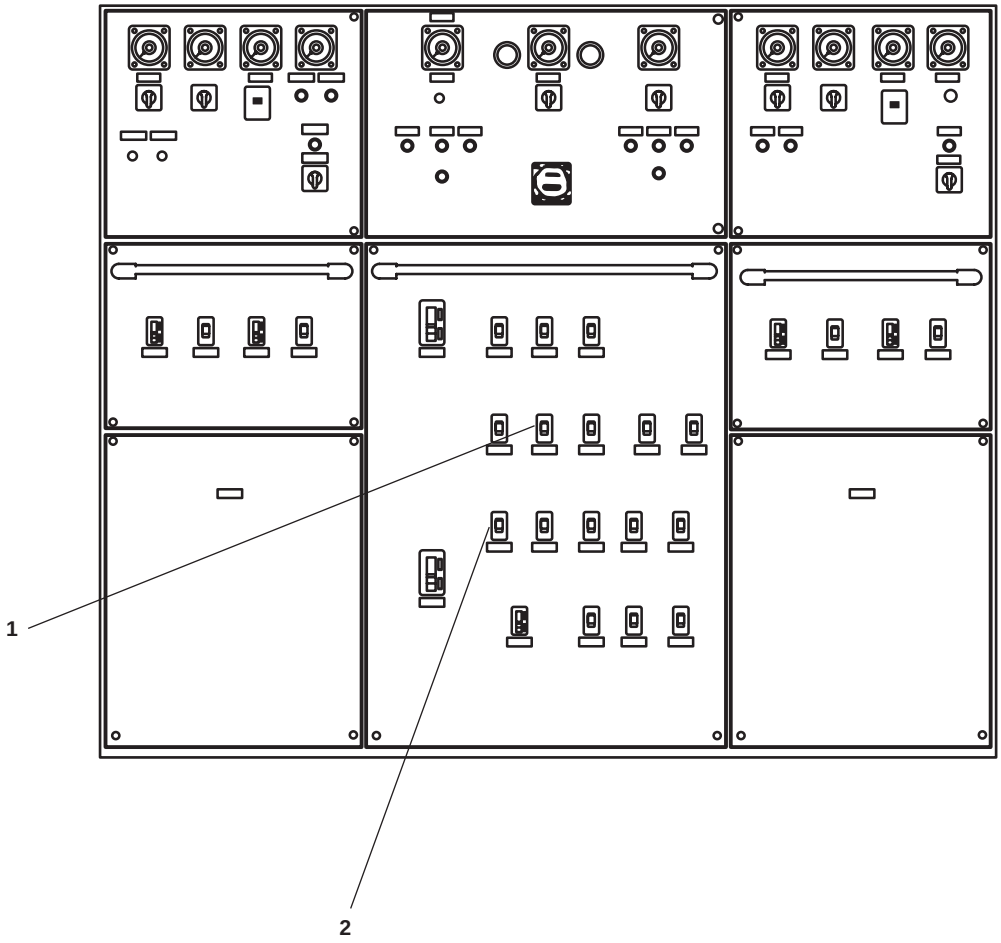


Figure 2. EOS Main Switchboard

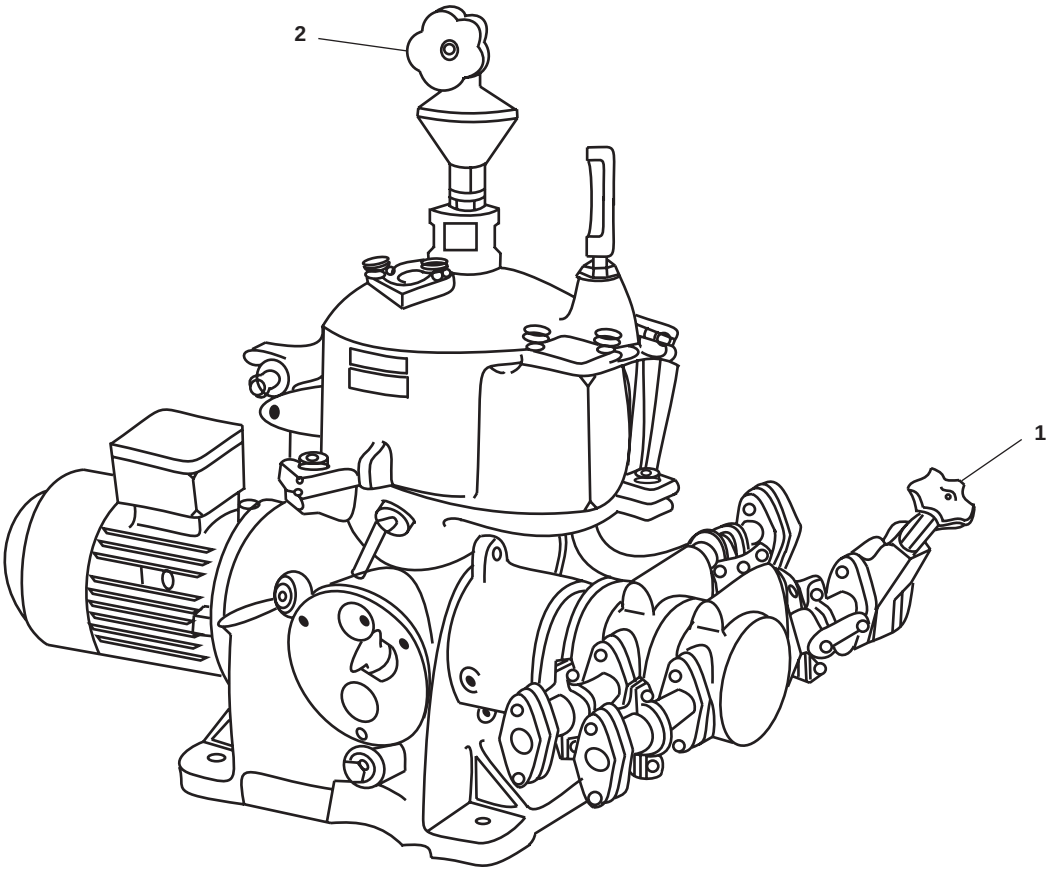


Figure 3. Lube Oil Purifier

SECURE THE LUBE OIL ELECTRICAL SYSTEM

1. STOP the lube oil transfer pump by completing the following actions at the lube oil transfer pump motor controller:
   a. Press the STOP pushbutton (figure 4, item 1).
   b. Verify that the MOTOR RUN indicator lamp (figure 4, item 2) goes out.
   c. Set the ON/OFF switch (figure 4, item 3) to the OFF position.
   d. Verify that the POWER AVAILABLE indicator (figure 4, item 4) goes out.
2. At 440V power panel No. 1, set the LUBE OIL TRANSFER PUMP. (figure 5, item 1) circuit breaker to OFF.

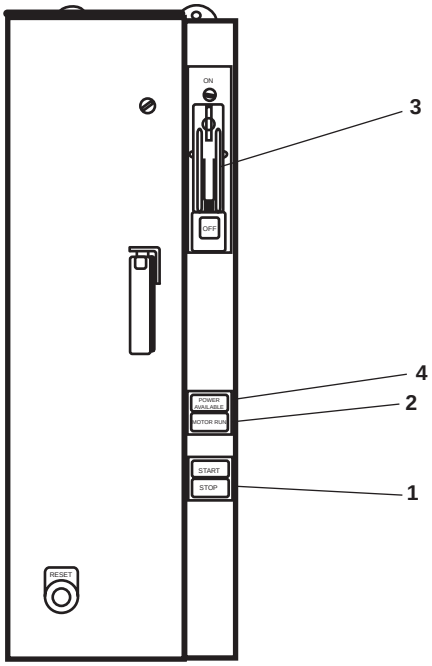


Figure 4. Lube Oil Transfer Pump Motor Controller

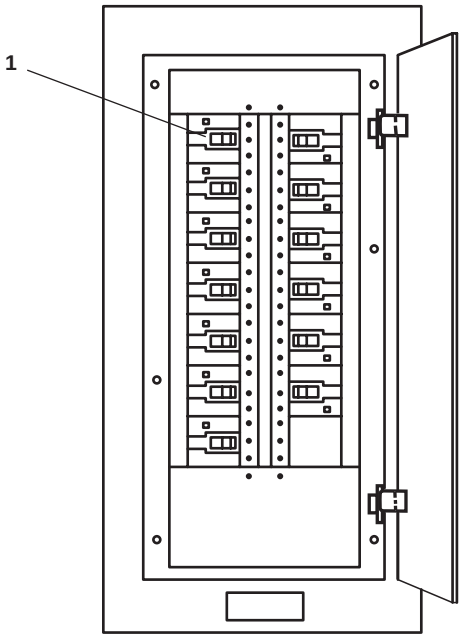


Figure 5. 440V Power Panel No. 1

SECURE THE LUBE OIL PIPING SYSTEM

1. Place lube oil system fill and drain valves in the CLOSED position as follows:
   a. Lo-28, LUBO DR. FR. RED. GEAR No. 2 (figure 6, item 1)
   b. At main engine 2:
      (1) Lo-30, M.E. No. 2 - LUBO PUR. SUCT (figure 6, item 2)
      (2) Lo-32, M.E. No. 2 - LUBO PUR DISCH. / FILL. (figure 6, item 3)
      (3) Lo-6, LUBO DR TO OILY DR. TK. (figure 6, item 4)
   c. At Ship's Service Diesel Generator (SSDG) 2:
      (1) Lo-10, LUBO TO S.S.D.G. No. 2 (figure 6, item 5)
      (2) Lo-4, LUBO DR TO OILY DR. TK. (figure 6, item 6)
   d. At bow thruster engine:
      (1) Lo-2, LUBO DR TO OILY DR. TK. (figure 6, item 7)
      (2) Lo-8, LUBO TO BOW THRUSTER ENG. (figure 6, item 8)

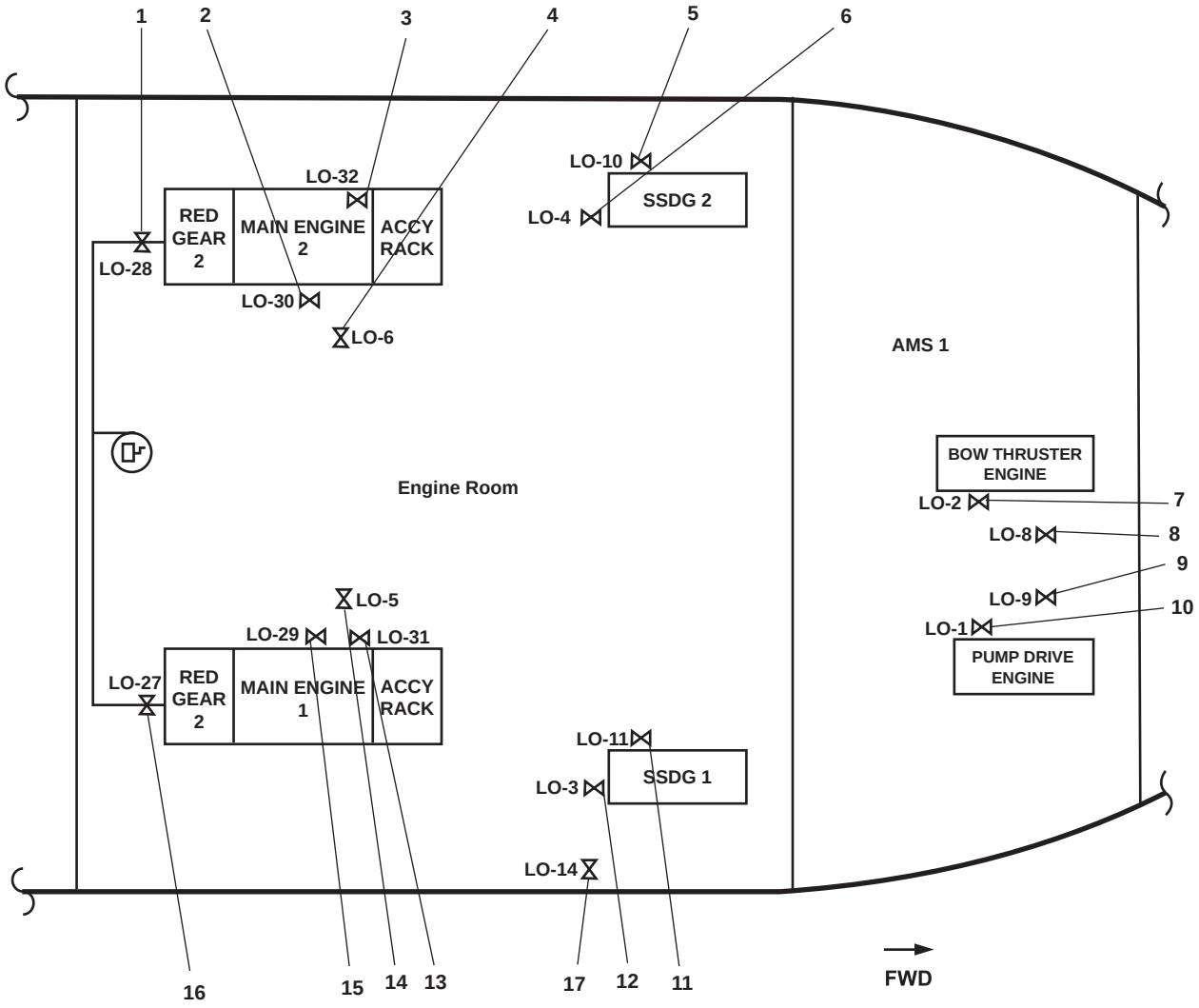


Figure 6. Lube Oil System Valve Locations

e. At pump drive engine:

(1) Lo-9, LUBO TO PUMP DRIVE ENG. (figure 6, item 9).

(2) Lo-1, LUBO DR TO OILY DR. TK. (figure 6, item 10).

f. At SSDG 1:

(1) Lo-11, LUBO TO S.S.D.G. No. 1 (figure 6, item 11).

(2) Lo-3, LUBO DR TO OILY DR. TK. (figure 6, item 12).

g. At main engine 1:

(1) Lo-31, M.E. No. 1 - LUBO PUR DISCH. / FILL (figure 6, item 13).

(2) Lo-5, LUBO DR TO OILY DR. TK. (figure 6, item 14).

(3) Lo-29, M.E. No. 1 - LUBO PUR. SUCT (figure 6, item 15).

h. Lo-27, LUBO DR. FR. RED. GEAR No. 1 (figure 6, item 16).

i. Lo-14, LUBO XFER. TO OILY WST. STOR. TK. (figure 6, item 17), located on the starboard engine room bulkhead, aft of SSDG 1.

2. To secure the lube oil manifold and circuit valves:

a. CLOSE the following valves:

(1) Lo-15, LUBO STOR. TK. OUT. (figure 7, item 1), located in the engine room, on the port side, below deck level.

(2) LO-7, C.O.V. - LUBO XFER PMP. SUCT (figure 7, item 2), located in the engine room, on the port side, below deck level.

(3) LO-33, LUBO TO MAIN ENGS (figure 7, item 3), lube oil manifold isolation valve.

(4) LO-17, BKT. FILL CONN (figure 7, item 4).

(5) All valves on the lube oil manifold (figure 7, item 5).

b. Line up LO-18, LUBO SPLY (figure 7, item 3) to the manifold position.

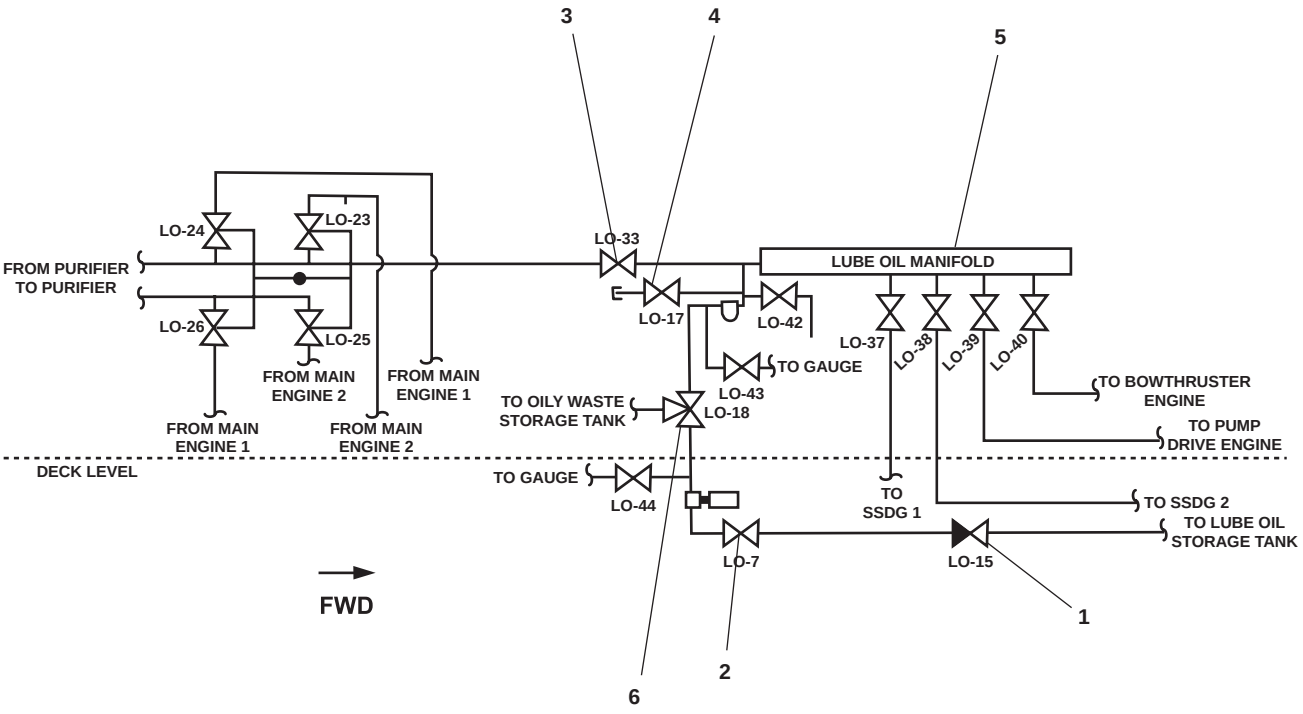


Figure 7. Lube Oil Manifold and Circuit Valve Locations

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
FUEL OIL FILL, TRANSFER, AND SUPPLY SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

PURPOSE

This work package provides the user with instructions for shutting down the fuel transfer system under usual conditions. The following procedures are contained within this work package:

1. Secure the fuel oil transfer piping system.

2. Secure the electrical system.

SECURE THE FUEL OIL TRANSFER PIPING SYSTEM

1. Verify/perform the following actions at the fuel oil transfer pump motor controllers 1 and 2:

   a. Press the STOP pushbuttons (figure 1, item 1).

   b. Verify that the MOTOR RUN indicators (figure 1, item 2) go out.

   c. Set the ON-OFF switches (figure 1, item 3) to OFF.

   d. Verify that the POWER AVAILABLE indicators (figure 1, item 4) go out.

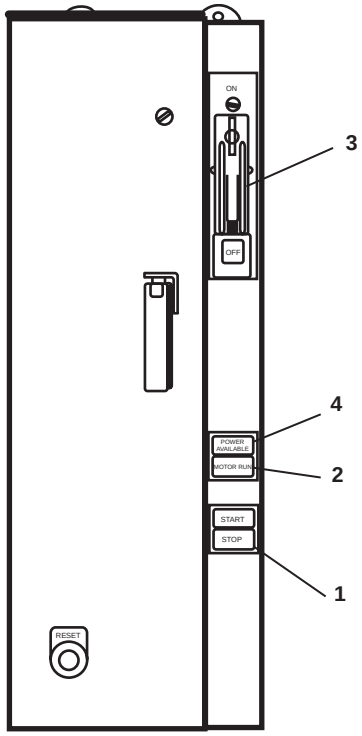


Figure 1. Fuel Oil Transfer Pump Motor Controller

2. At the fuel filter/water separator control panel, set the OFF/ON (figure 2, item 1) switch OFF.

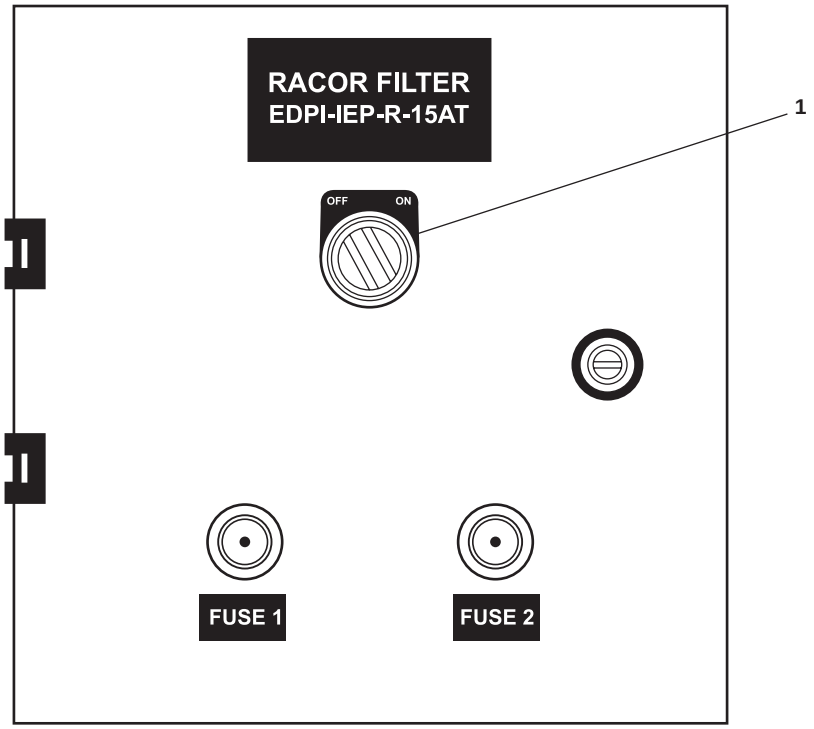


Figure 2. Fuel Filter/Water Separator Filter Control Panel

3. To secure the fuel oil transfer piping, verify that the following valves are CLOSED:

   a. F.O-3, DK. FILL CONN (figure 3, item 1)

   b. FO-4, DK. FILL CONN (figure 3, item 2)

   c. FO-5, F.O.DAY TK EMERG FILL (figure 3, item 3)

   d. FO-6, C.O.V. - F.O. XFER PMP N0.1 SUCTION (figure 3, item 4)

   e. FO-8, C.O.V. - F.O. XFER PMP No.1 DISCHARGE (figure 3, item 5)

   f. FO-7, C.O.V. - F.O. XFER PMP No.2 SUCTION (figure 3, item 6)

   g. FO-9, C.O.V.- F.O. XFER PMP No.2 DISCHARGE (figure 3, item 7)

   h. FO-17, F.O. FLTR / WATER SEP OUTLET. COV (figure 3, item 8)

   i. FO-42, F.O. FLTR / WATER SEP BYPASS COV (figure 3, item 9)

   j. FO-16, F.O. FLTR / WATER SEP INLET. COV (figure 3, item 10)

   k. FO-11, F.O. TO E.D.G. DAY TK (figure 3, item 11)

l. FO-12, E.D.G. DAY TK FILL (figure 3, item 12)

m. FO-1, F.O. DAY TK. FILL (figure 3, item 13)

n. FO-2, F.O. DAY TK. FILL (figure 3, item 14)

o. All valves on the suction side of the fuel oil manifold (figure 3, item 15)

p. All valves on the fill side of the fuel oil manifold (figure 3, item 16)

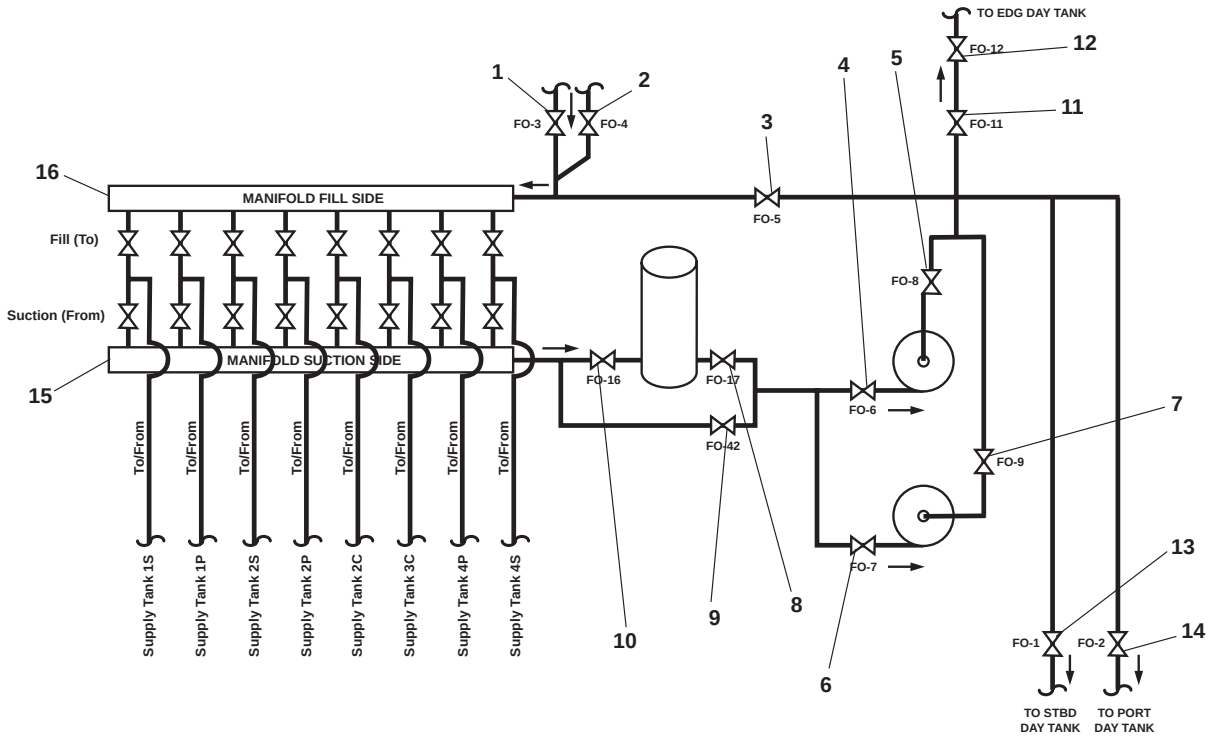


Figure 3. Fuel Oil Valve Locations

4. Verify that the fuel supply line connection valves, located on the 01 level weather decks outboard the stacks, are secured by ensuring that the following valves are CLOSED:

   a. FO-18, F.O. FILL CONN PORT (figure 4, item 1).

   b. FO-39, F.O. FILL CONN. STBD (figure 4, item 2).

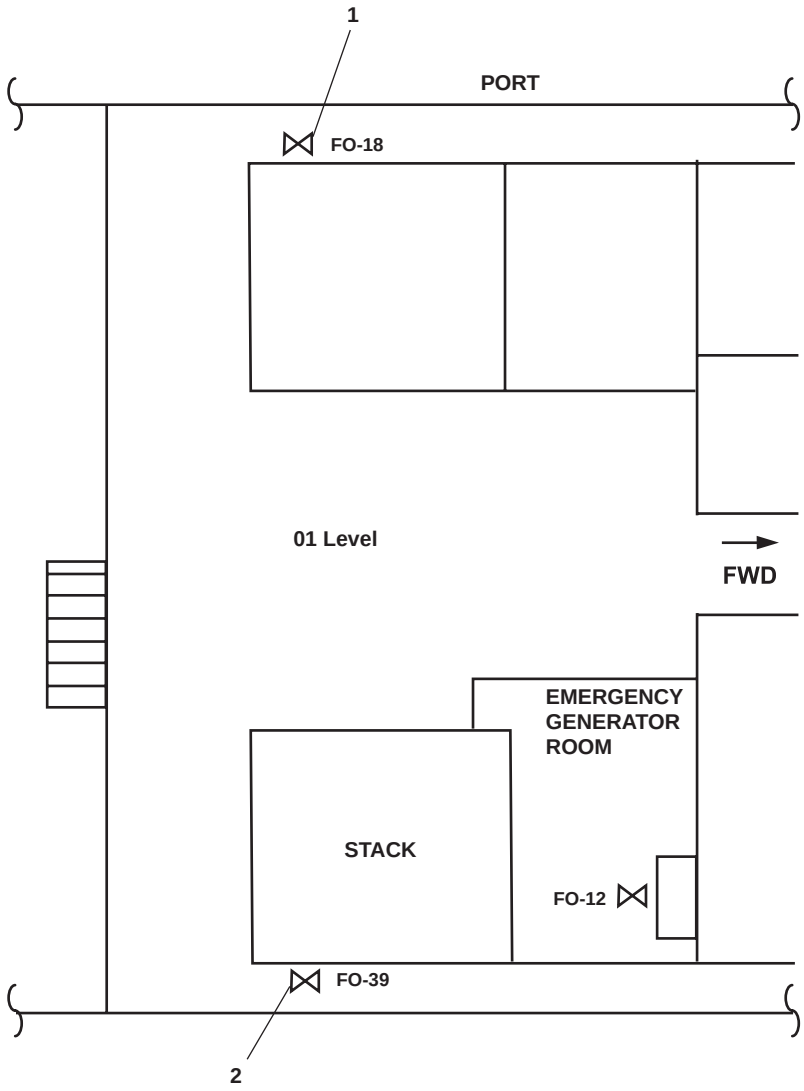


Figure 4. Fuel Oil Supply Line Connection Locations

SECURE THE ELECTRICAL SYSTEM

1. At the emergency switchboard, set to OFF the FO XFER PUMP NO. 1 circuit breaker (figure 5, item 1).

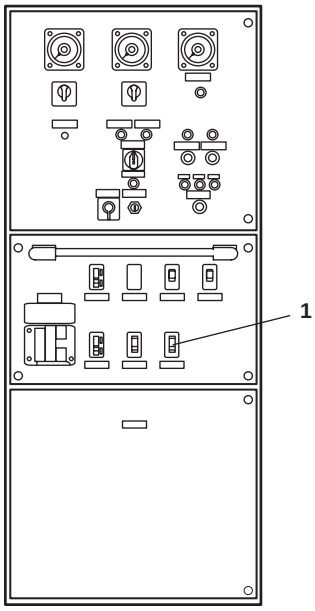


Figure 5. EDG Emergency Switchboard

2. At 440V power panel No. 1, set to OFF the FUEL OIL TRANSFER PUMP No. 2. circuit breaker (figure 6, item 1).

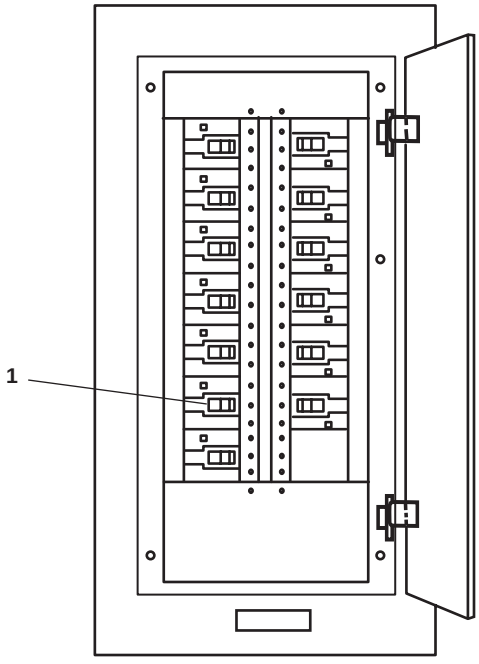


Figure 6. 440V Power Panel No. 1

3. At 120V emergency distribution panel No. 1, set to OFF the RACOR FILTER circuit breaker (figure 7, item 1).

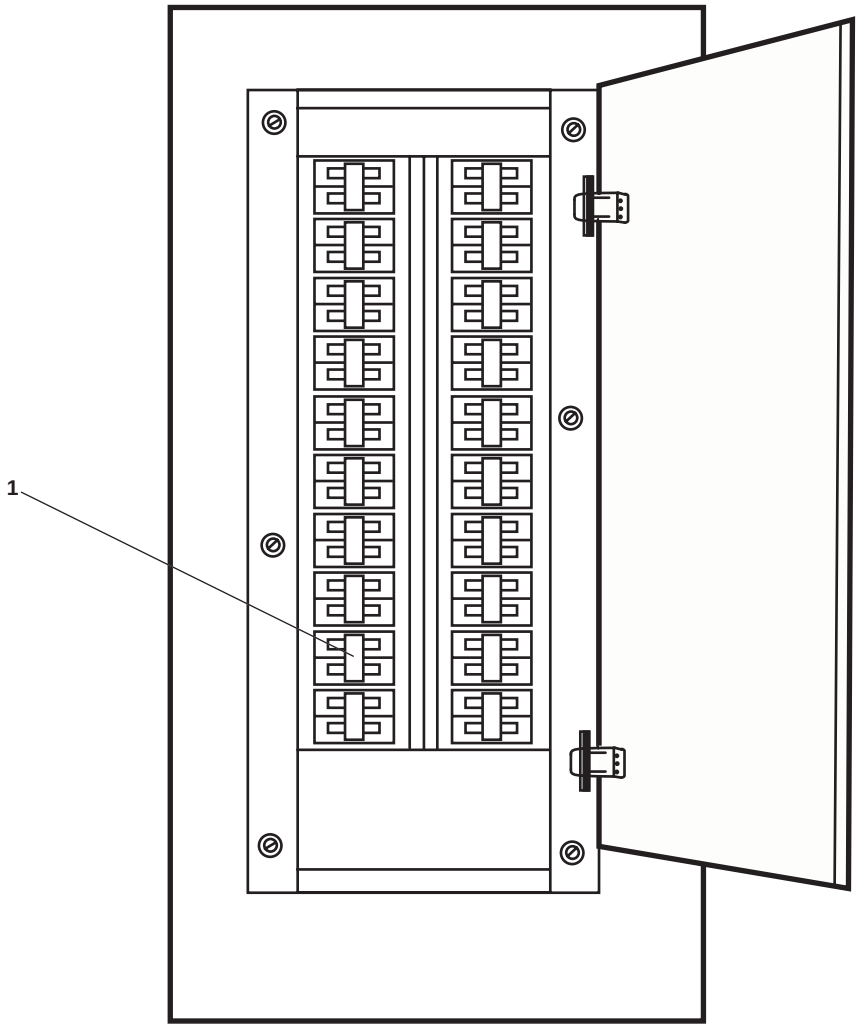


Figure 7. 120V Emergency Distribution Panel No. 1

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
POTABLE WATER SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0080 00

GENERAL

This work package contains the following procedures:

1. Secure the potable water electrical system.
2. Secure the potable water system piping and valves.
3. Reverse Osmosis Water Purification Units (ROWPU) shutdown procedure.
4. Brominator shutdown procedure.

SECURE THE POTABLE WATER ELECTRICAL SYSTEM

1. On the main switchboard in the EOS, set the following circuit breakers to OFF:
   a. HOT POTABLE WTR HTR NO.2 (figure 1, item 1).
   b. HOT POTABLE WTR HTR NO.1 (figure 1, item 2).

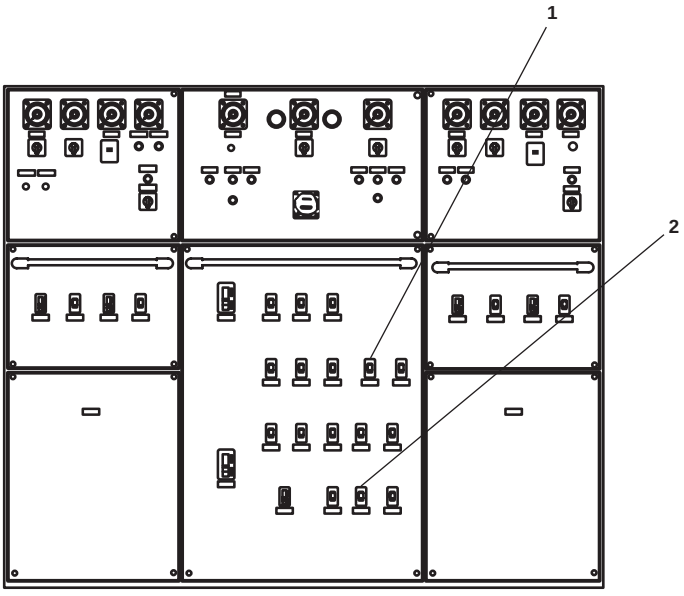


Figure 1. EOS Main Switchboard

2. Complete the following actions at the hot potable water recirculating pump motor controller:

   a. Press and release the STOP pushbutton (figure 2, item 1).

   b. Verify that the MOTOR RUN indicator (figure 2, item 2) goes out.

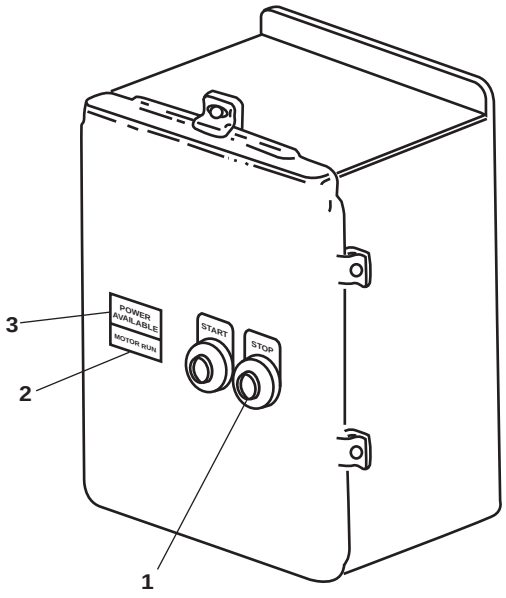


Figure 2. Hot Water Recirculating Pump Motor Controller

3. At the 440V power panel No. 4, set the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker (figure 3, item 1) to OFF.

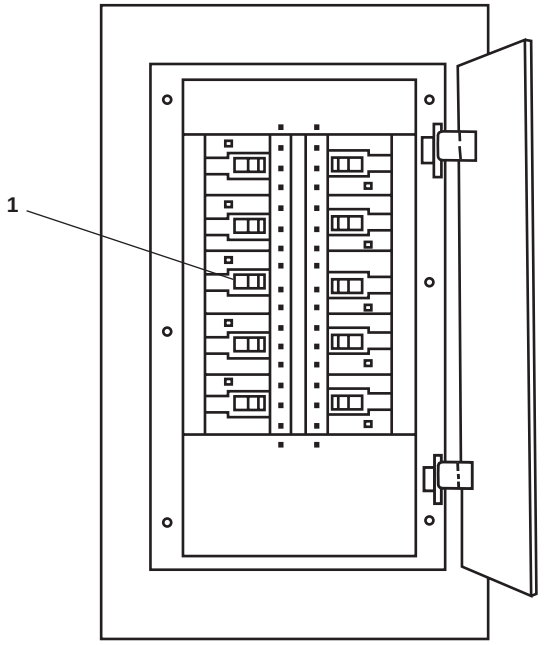


Figure 3. 440V Power Panel No. 4

4. At the hot potable water recirculating pump motor controller, verify that the POWER AVAILABLE indicator (figure 2, item 3) goes out.

5. In AMS 2, at the potable water pump 1 and 2 motor controllers:

   a. Press the STOP pushbuttons (figure 4, item 1).

   b. Verify that the MOTOR RUN indicators (figure 4, item 2) go out.

   c. Set the ON-OFF switches (figure 4, item 3) to OFF.

   d. Verify that the POWER AVAILABLE indicators (figure 4, item 4) go out.

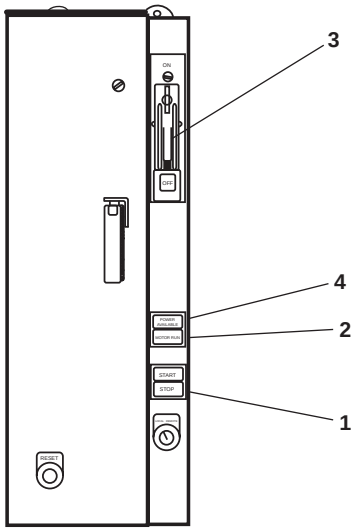


Figure 4. Potable Water Pump 1 and 2 Motor Controller

6. At the 440V power panel No. 5, set the following circuit breakers to OFF:

   a. POTABLE WATER PUMP No. 1. (figure 5, item 1)

   b. POTABLE WATER PUMP No. 2. (figure 5, item 2)

7. At the 120V distribution panel No. 3, set the MAIN DECK DRINKING FOUNTAIN. circuit breaker (figure 6, item 1) to OFF.

8. At the 120V distribution panel No. 2, set the following circuit breakers to OFF:

   a. 01 LEVEL DRINKING FOUNTAIN. (figure 7, item 1).

   b. PILOT HOUSE DRINKING FOUNTAIN & COFEE MAKER. (figure 7, item 2).

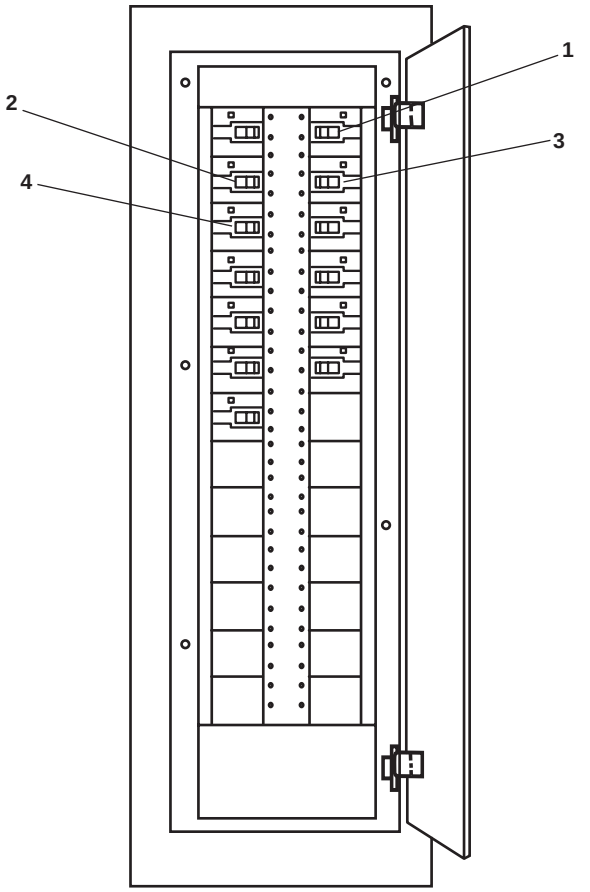


Figure 5. 440V Power Panel No. 5

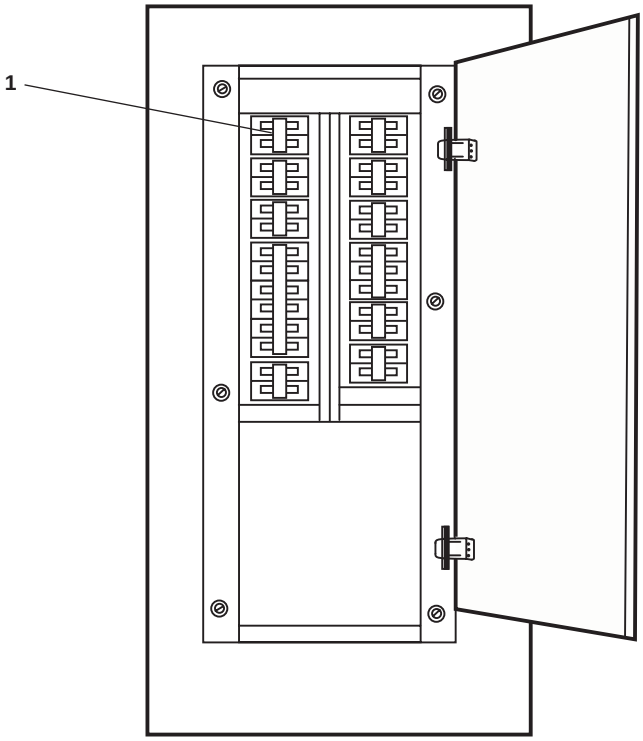


Figure 6. 120V Distribution Panel No. 3

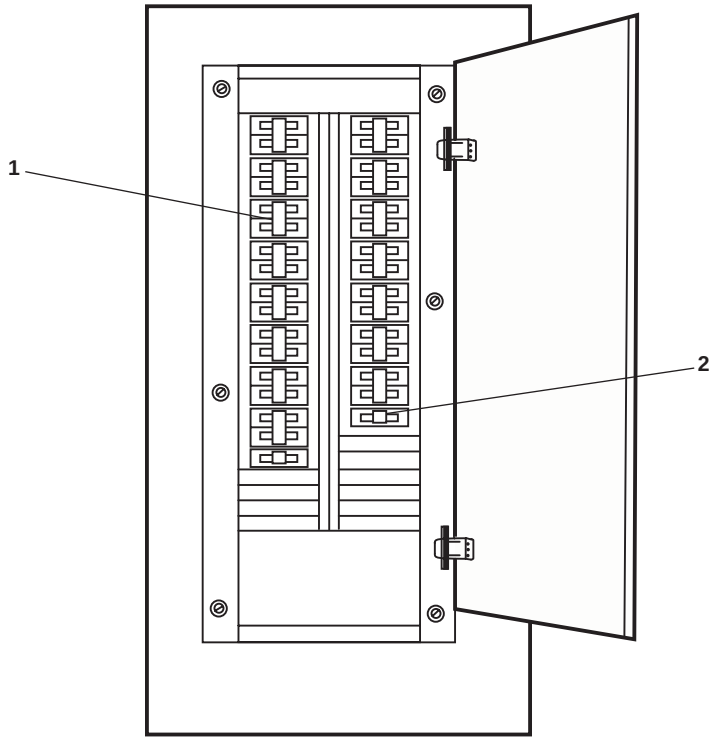


Figure 7. 120 V Distribution Panel No. 2

SECURE POTABLE WATER SYSTEM PIPING AND VALVES

1. To secure the main potable water system piping and valves, CLOSE the following valves:

   a. In AMS 2:

      (1) PW-14, POT. WTR. TK. PORT SUCT (figure 8, item 1)

      (2) PW-15, POT. WTR. TK. STBD SUCT (figure 8, item 2)

      (3) PW-16, C.O.V. –POT. WTR. PMP. No. 1 SUCT (figure 8, item 3)

      (4) PW-17, C.O.V. –POT. WTR. PMP. No. 2 SUCT (figure 8, item 4)

      (5) PW-78, C.O.V. HYDR. PNEU TK. OUTLET (figure 8, item 5)

      (6) PW-18, HYDRO. PNEU TK INLET (figure 8, item 6)

      (7) PW-76, C.O.V. POT. WTR. PMP. No. 1 DISCH (figure 8, item 7)

      (8) PW-77, C.O.V. POT. WTR. PMP. No. 2 DISCH (figure 8, item 8)

   b. In AMS 1:

      (1) PW-42, HW RECIRC. PMP. SUCT. (figure 8, item 9)

      (2) PW-43, RECIRC TO H.W. HEATER (figure 8, item 10)

(3) PW-44, RECIRC TO H.W. HEATER (figure 8, item 11)

(4) PW-79, POT. WTR.TO H.W. HTR. (figure 8, item 12)

(5) PW-80, POT. WTR. TO H.W. HTR. (figure 8, item 13)

(6) PW-81, H.W. HTR OUT (figure 8, item 14)

(7) PW-82, H.W. HTR OUT (figure 8, item 15)

(8) PW-22, C.W. TO W.C. (figure 8, item 16)

c. In the towing gear locker:

(1) PW-10, POT. WTR. TK. PORT DR. (figure 8, item 17)

(2) PW-11, POT. WTR. TK. STBD. DR. (figure 8, item 18)

d. In AMS 2:

(1) PW-12, POT. WTR. TK. PORT FILL (figure 8, item 19)

(2) PW-13, POT. WTR. TK. STBD FILL (figure 8, item 20)

(3) PW-36, BYPASS BROMINATOR (figure 8, item 21)

(4) PW-37, BROMINATOR INLET (figure 8, item 22)

(5) PW-38, BROMINATOR OUTLET (figure 8, item 23)

(6) PW-83, POT.WTR.TO. MN. DK. WSH. DN (figure 8, item 24)

(7) PW-35, M.E. KEEL CLR WTR FILL CONN. (figure 8, item 25)

(8) PW-84, POT. WTR.TO BROMINATOR (figure 8, item 26)

e. In the engine room:

(1) PW-40, ENG. FILL CONN. PORT (figure 8, item 27)

(2) PW-39, ENG. FILL CONN.STBD (figure 8, item 28)

(3) PW-21, C.W. TO W.C. (figure 8, item 29)

(4) PW-20, C.W. TO W.C. (figure 8, item 30)

2. Secure the ship wide potable water system by verifying that the following valves are CLOSED.

a. In the galley:

(1) PW-29 (figure 9, item 1), sprinkler supply to the GAYLORD HOOD

(2) PW-33 (figure 9, item 2), galley hot water supply

(3) PW-34 (figure 9, item 3), galley supply

(4) PW-32 (figure 9, item 4), hot water to the dishwasher

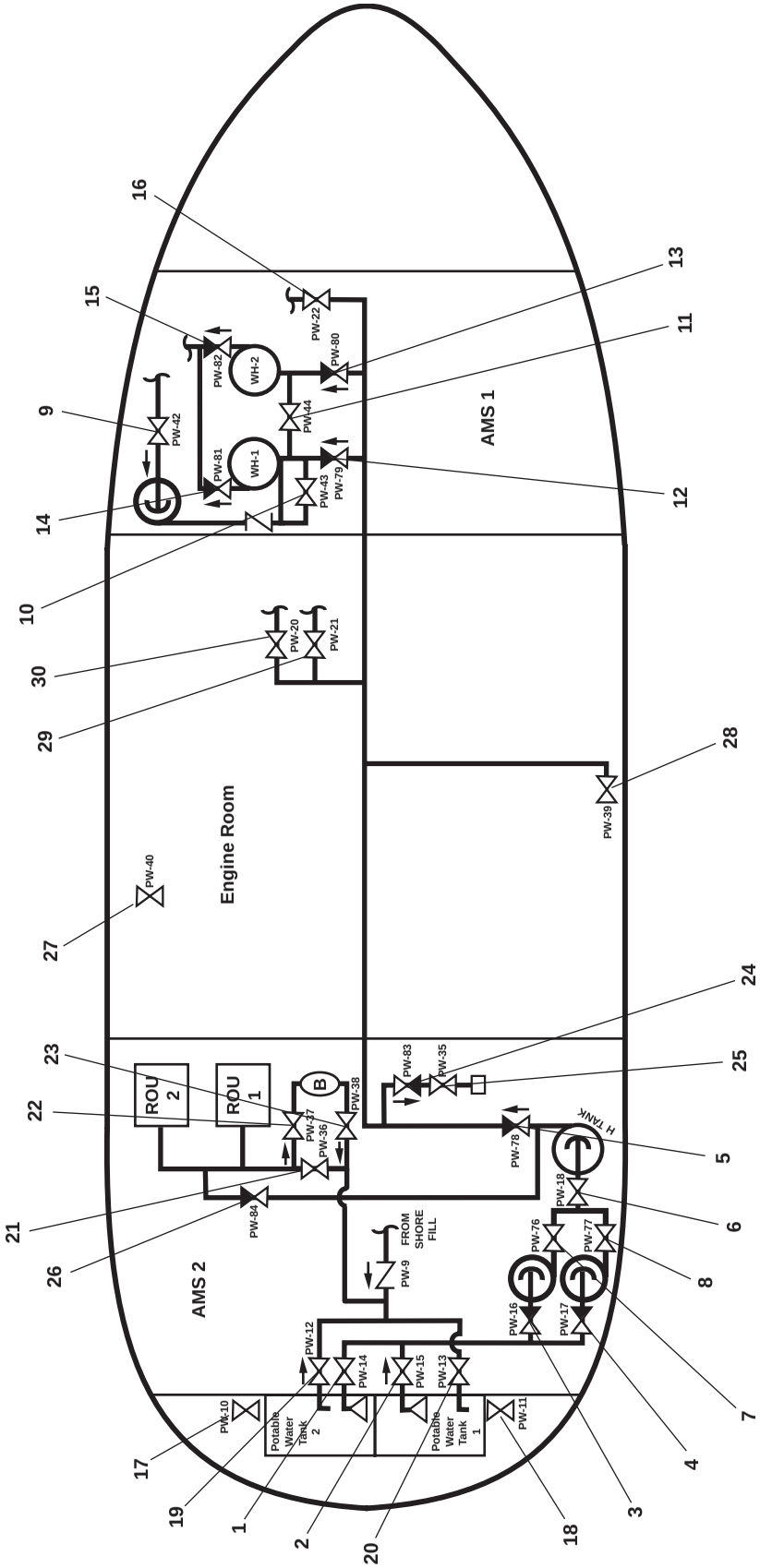


Figure 8. Main Potable Water System Valves

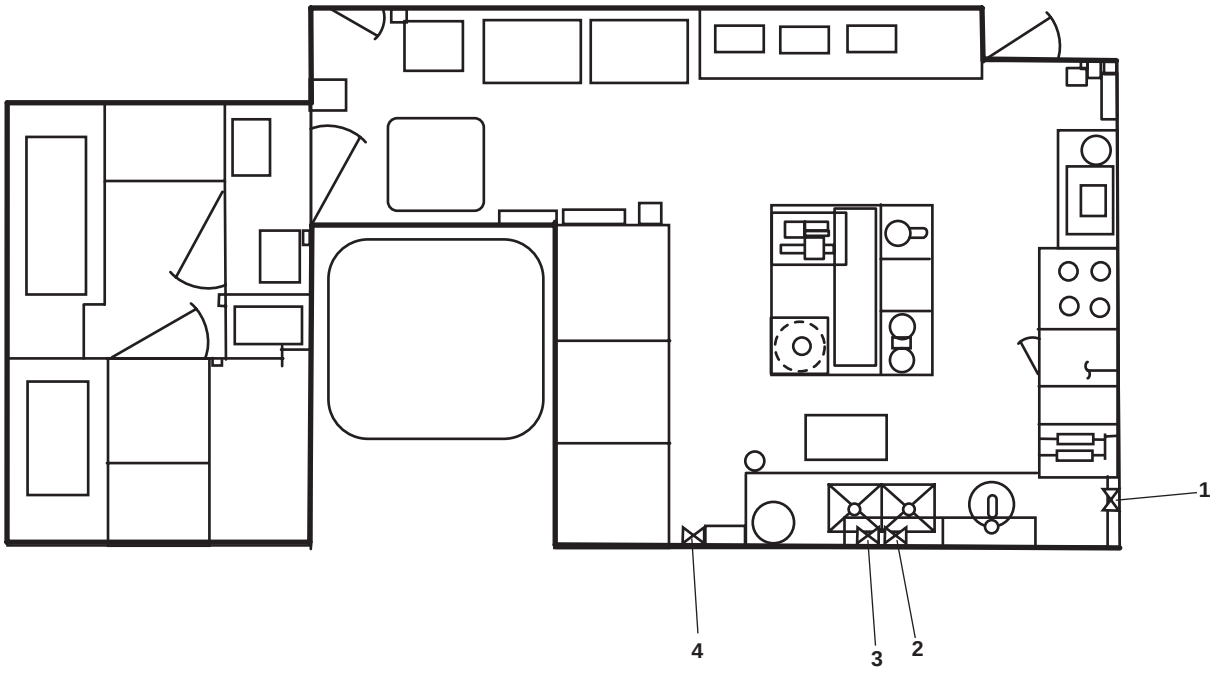


Figure 9. Galley Valve Locations

b. In the crew's mess:

(1) PW-25, C.W. TO W.C. (figure 10, item 1)

(2) PW-67 (figure 10, item 2), supply to drinking fountain

(3) PW-93, C.W. TO ICE MAKER (figure 10, item 3)

c. In the crew's sanitary space:

(1) PW-53 (figure 11, item 1), cold potable water to the sanitary space

(2) PW-52 (figure 11, item 2), hot potable water to the sanitary space

(3) PW-51 (figure 11, item 3), cold potable water to the sanitary space

(4) PW-50 (figure 11, item 4), hot potable water to the sanitary space

d. In the crew's state room #3 and sanitary space:

(1) PW-24, C.W. TO W.C. (figure 11, item 5) (overhead)

(2) PW-48 (figure 11, item 6), hot potable water to the sanitary space

(3) PW-49 (figure 11, item 7), cold potable water to the sanitary space

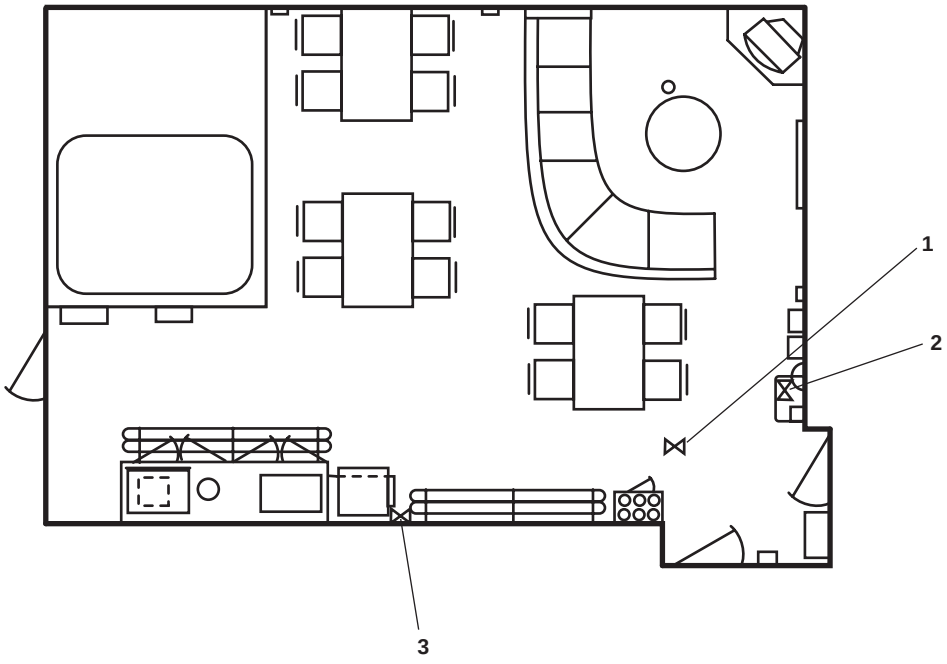


Figure 10. Crew's Mess Valve Locations

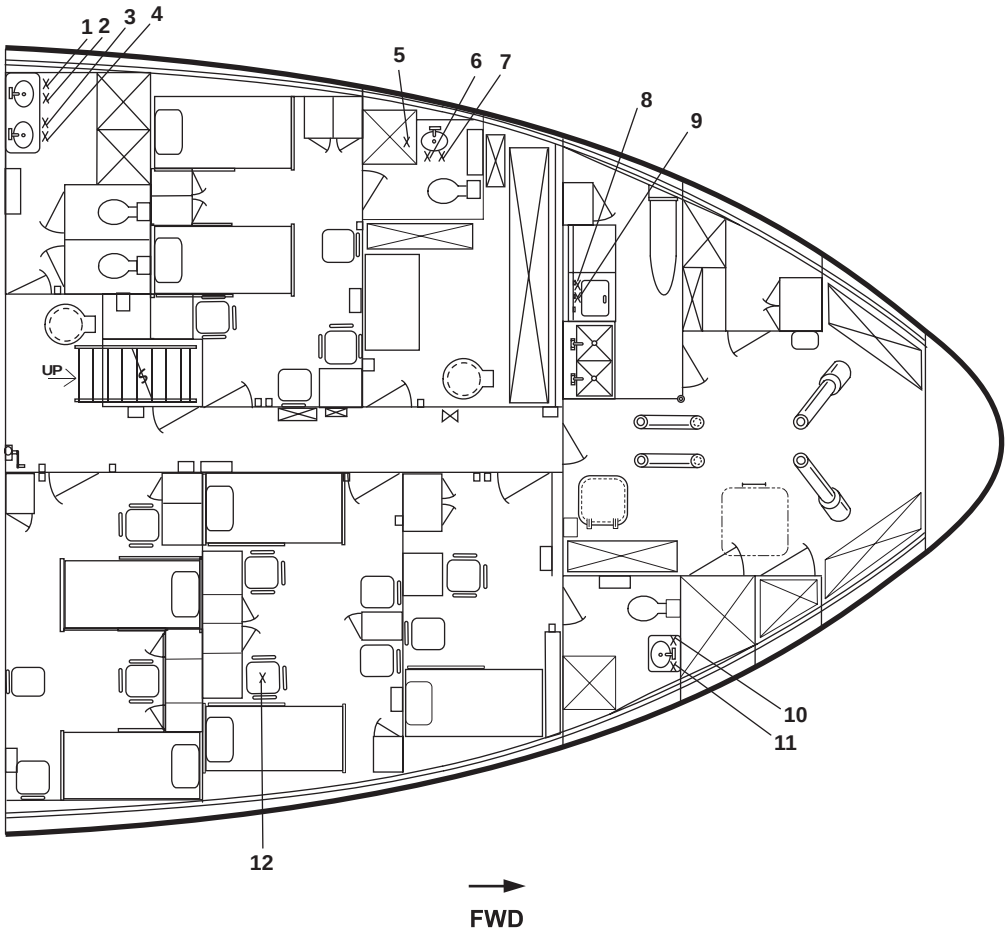


Figure 11. Main Deck Potable Water Valve Location

e. In the laundry room:

(1) PW-30 (figure 11, item 8), hot potable water to the sanitary space

(2) PW-31 (figure 11, item 9), cold potable water to the sanitary space

f. In crew's stateroom #1 sanitary space:

(1) PW-46 (figure 11, item 10), hot potable water to the sanitary space

(2) PW-47 (figure 11, item 11), cold potable water to the sanitary space

g. In crew's stateroom #2: PW-23 (figure 11, item 12), cold water to the water closet

h. In officer's stateroom #2 and sanitary space:

(1) PW-61 (figure 12, item 1), cold potable water to the sanitary space

(2) PW-26, C.W. TO W.C. (figure 12, item 2)

i. In the chief engineer's stateroom and sanitary space:

(1) PW-56 (figure 12, item 3), cold potable water to the sanitary space

(2) PW-58 (figure 12, item 4), hot potable water to the sanitary space

j. In the 01 level passageway:

(1) PW-68 (figure 12, item 5), supply to drinking fountain

(2) PW-62, C.W. TO W.C (figure 12, item 10)

k. In the captain's stateroom and sanitary space:

(1) PW-55 (figure 12, item 6), cold potable water to the sanitary space

(2) PW-57 (figure 12, item 7), hot potable water to the sanitary space

l. In the officer's stateroom #1 sanitary space:

(1) PW-60 (figure 12, item 8), hot potable water to the sanitary space

(2) PW-59 (figure 12, item 9), cold potable water to the sanitary space

m. In the NCO's sanitary space:

(1) PW-63 (figure 12, item 11), cold potable water to the sanitary space

(2) PW-64 (figure 12, item 12), hot potable water to the sanitary space

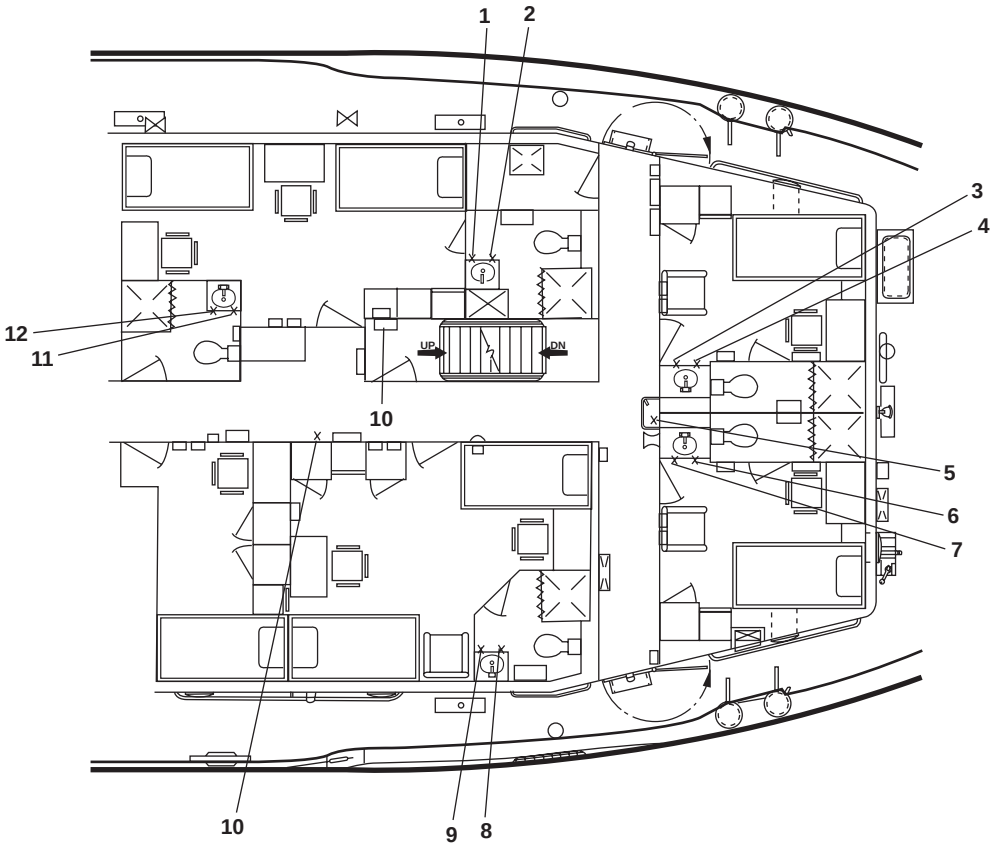


Figure 12. 01 Level Potable Water Valve Locations

REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) SHUTDOWN PROCEDURE

ROWPU 1 SHUTDOWN

1. At the ROWPU 1 flow control panel (figure 13, item 1):

    a. Slowly decrease system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve (figure 13, item 2) in the counterclockwise direction to the fully OPEN position.

    b. Observe that the SYSTEM OPERATION PRESSURE gauge (figure 13, item 3) reads less than 50 PSI (3.4 bar).

2. At the ROWPU 1 system controller:

    a. Press the STOP pushbutton (figure 14, item 1).

    b. Observe that the BOOSTER PUMP indicator (figure 14, item 2) goes out.

    c. Observe that the SYSTEM OFF indicator (figure 14, item 3) illuminates.

3. CLOSE RO-V-1-1 (figure 13, item 4), ROWPU 1 inlet sea water supply.

4. At 440V power panel No. 5, set the REVERSE OSMOSIS WATER MAKER No. 1. circuit breaker (figure 5, item 3) to OFF.

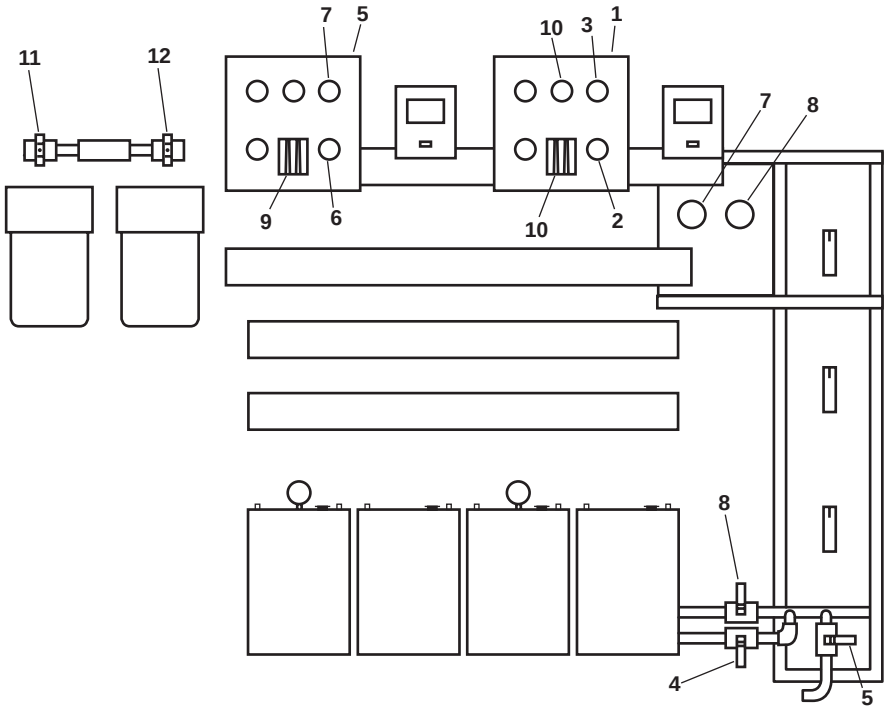


Figure 13. ROWPU System, Front View

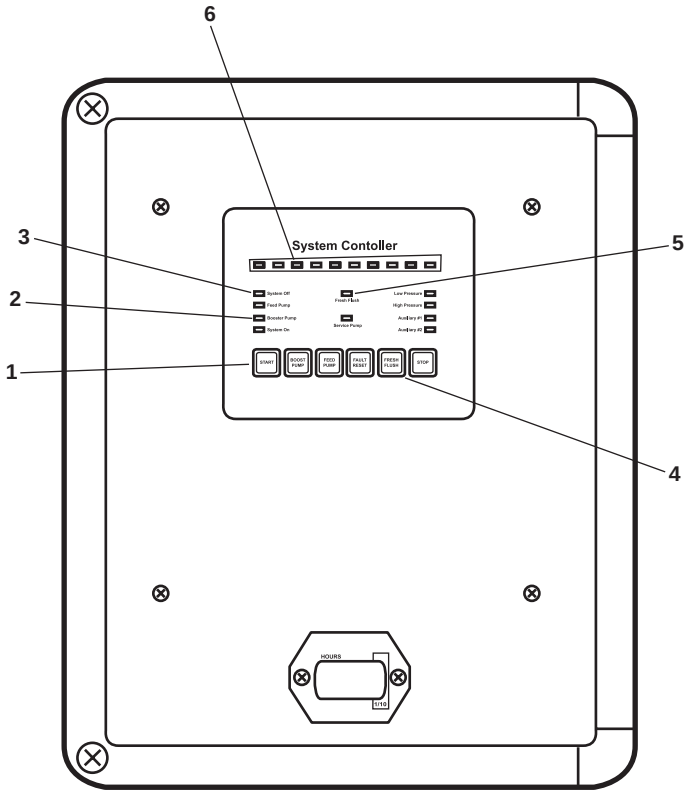


Figure 14. System Controller

ROWPU 2 SHUTDOWN

1. At the ROWPU 2 flow control panel (figure 13, item 5):

    a. Slowly decrease system pressure by rotating the SYSTEM HIGH PRESSURE REGULATOR valve (figure 13, item 6) in the counterclockwise direction to the fully OPEN position.

    b. Ensure that the SYSTEM OPERATION PRESSURE gauge (figure 13, item 7) reads less than 50 PSI (3.4 bar).

2. At the ROWPU 2 system controller:

    a. Press the STOP pushbutton (figure 14, item 1).

    b. Observe that the BOOSTER PUMP indicator (figure 14, item 2) goes out.

    c. Observe that the SYSTEM OFF indicator (figure 14, item 3) illuminates.

3. CLOSE RO-V-2-1 (figure 13, item 8), ROWPU 2 inlet sea water supply.

4. At 440V power panel No. 5, set the REVERSE OSMOSIS WATER MAKER No. 2. circuit breaker (figure 5, item 4) to OFF.

ROWPU SYSTEM SHUTDOWN

⚠ CAUTION

Perform ROWPU system shutdown only when both ROWPU 1 and ROWPU 2 are secured, and both high pressure pumps are OFF. Equipment damage could result from improper shutdown procedures.

1. Ensure that both high pressure pumps are OFF by verifying that the SYSTEM OFF indicators (figure 14, item 3) are illuminated at the ROWPU 1 and ROWPU 2 system controllers.

2. CLOSE the following valves:

    a. RO-V-1 (figure 15, item 1), main sea water supply

    b RO-V-2 (figure 15, item 2), media filter supply

    c. RO-V-3 (figure 15, item 3), media filter discharge

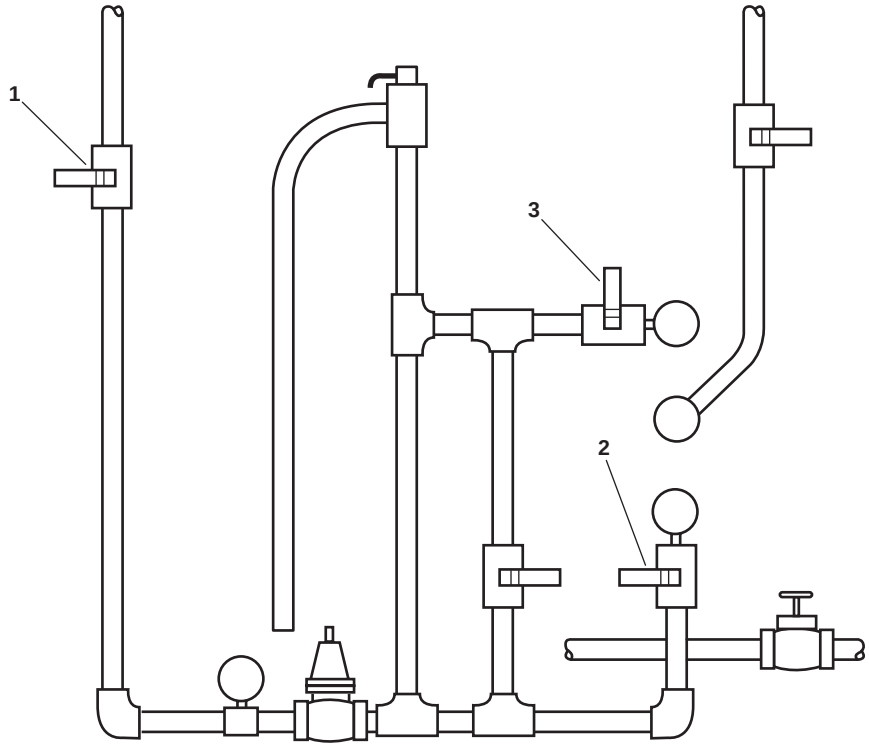
    d. RO-V-8 (figure 16, item 1), product water discharge

3. At the 440V power panel No. 5, set the following circuit breakers to OFF:

    a. REVERSE OSMOSIS WATER MAKER No. 1. (figure 5, item 3)

    b. REVERSE OSMOSIS WATER MAKER No. 2. (figure 5, item 4)

4. Perform the Media Filter Backflush procedure (WP 0080 00).



Items Not Shown Omitted for Clarity

Figure 15. ROWPU System as Viewed from Starboard Side

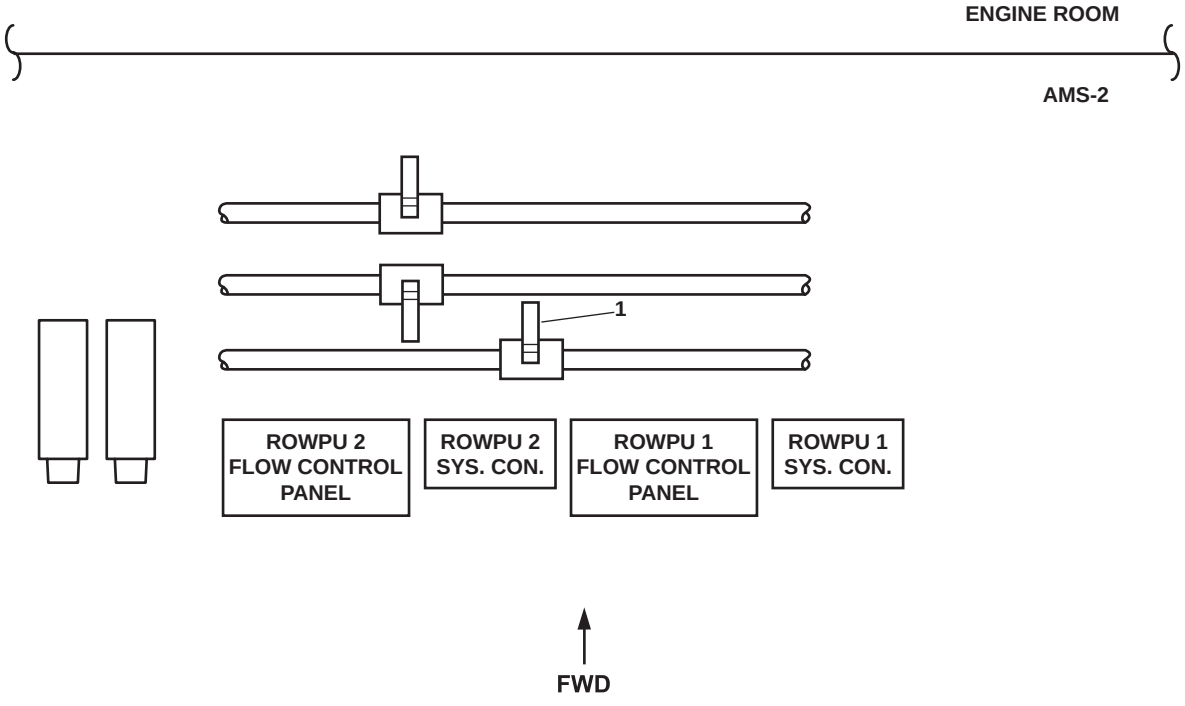


Figure 16. ROWPU System as Viewed from Above

ROWPU FRESH WATER FLUSH

NOTE

Always perform a fresh water flush after ROWPU operations, and at least once a week when the ROWPU is in layup.

1. Perform the ROWPU System Shutdown procedure in this work package.

⚠ CAUTION

If valves RO-V-1-1 and RO-V-2-1 are not CLOSED, the fresh water flush will not be effective, and the service life of the reverse osmosis membrane elements will be shortened.

2. CLOSE the following valves:

   a. RO-V-1-1 (figure 13, item 4), ROWPU 1 inlet sea water supply

   b. RO-V-2-1 (figure 13, item 8), ROWPU 2 inlet sea water supply

3. OPEN the following valves:

   a. RO-V-9 (figure 17, item 1), fresh water flush pump supply

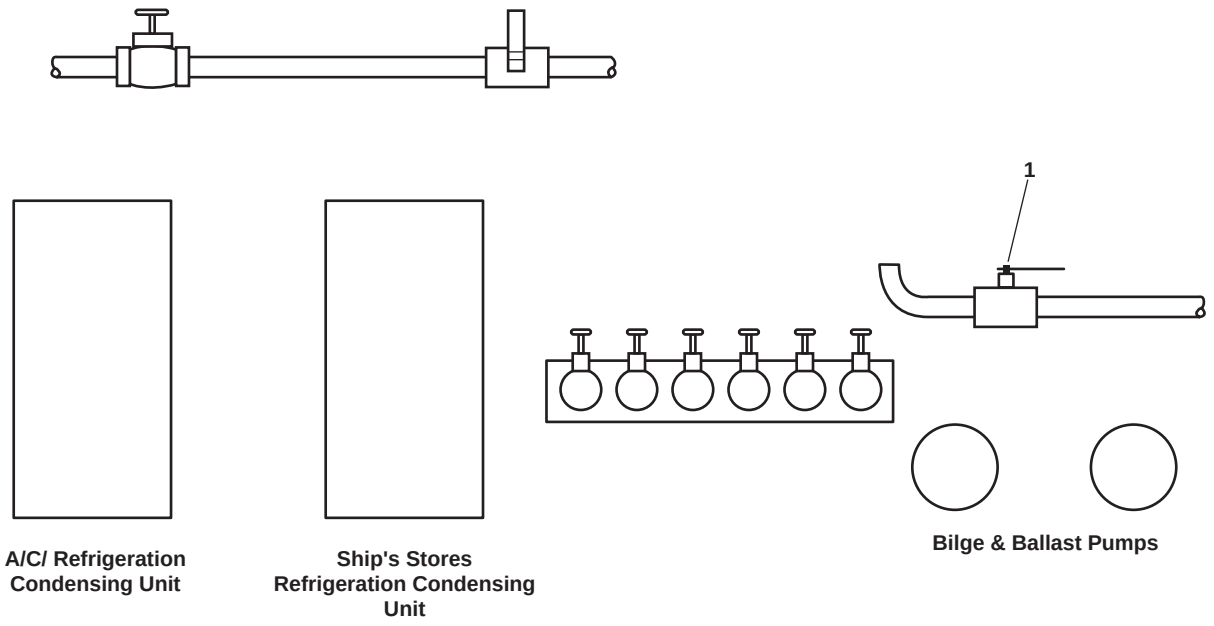


Figure 17. Potable Water Valves on AMS 2 Aft Bulkhead

b. RO-V-6 (figure 13, item 11), backflow preventer discharge

c. RO-V-7 (figure 13, item 12), backflow preventer supply

d. Fresh water flush pump outlet valve (figure 18, item 1)

4. At the ROWPU 1 and ROWPU 2 system controllers:

a. Verify that the SYSTEM OFF indicators (figure 14, item 3) are illuminated.

b. Press the FRESH FLUSH pushbuttons (figure 14, item 4).

c. Observe that the FRESH FLUSH indicators (figure 14, item 5) are illuminated.

d. Verify that the fresh water flush pump (figure 18, item 2) starts.

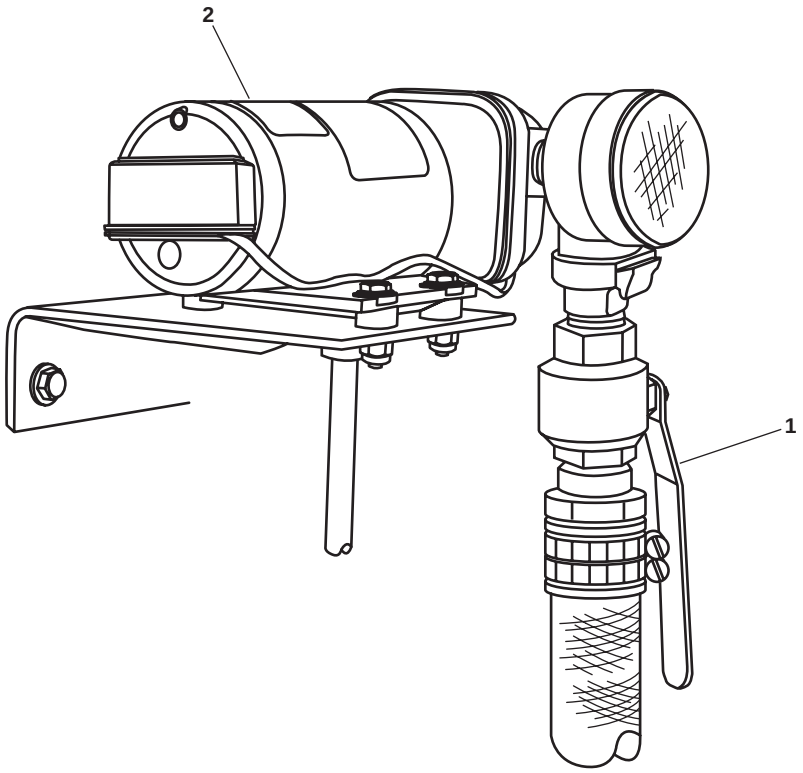


Figure 18. Fresh Water Flush Pump

NOTE

During fresh water flush cycles, a brine flow meter reading of less than 1 gallon (3.8 liters) per minute is an indication that the carbon filters may be clogged. Clogged carbon filters can cause shortened service life of the reverse osmosis membrane elements.

5. At each flow control panel, verify that the BRINE flow meters (figure 13, items 9 and 10) read approximately 1 gallon (3.8 liters) per minute during the fresh water flush cycle.

ROWPU SYSTEM LAYUP

1. Perform the ROWPU System Shutdown procedure in this work package.

2. Perform the Media Filter Backflush procedure (WP 0080 00).

3. Perform the ROWPU Fresh Water Flush procedure in this work package.

4. Upon completion of the fresh water flush cycles, observe the following indications at the ROWPU 1 system controller (figure 13, item 1) and at the ROWPU 2 system controller (figure 13, item 5):

NOTE

During ROWPU system layup cycles, the FRESH FLUSH indicator blinks occasionally to indicate that the layup cycle is active.

a. FRESH FLUSH (figure 14, item 5) indicators blinking occasionally.

NOTE

During ROWPU system layup cycles, the SALINITY METER acts as a system clock and counts down from seven to zero indicating the number of days remaining until the next fresh water flush cycle.

b. Verify that the SALINITY METER (figure 14, item 6) displays the number of days until next fresh water flush cycle.

BROMINATOR SHUTDOWN PROCEDURE

1. OPEN PW-36, BYPASS-BROMINATOR valve (figure 19, item 1).

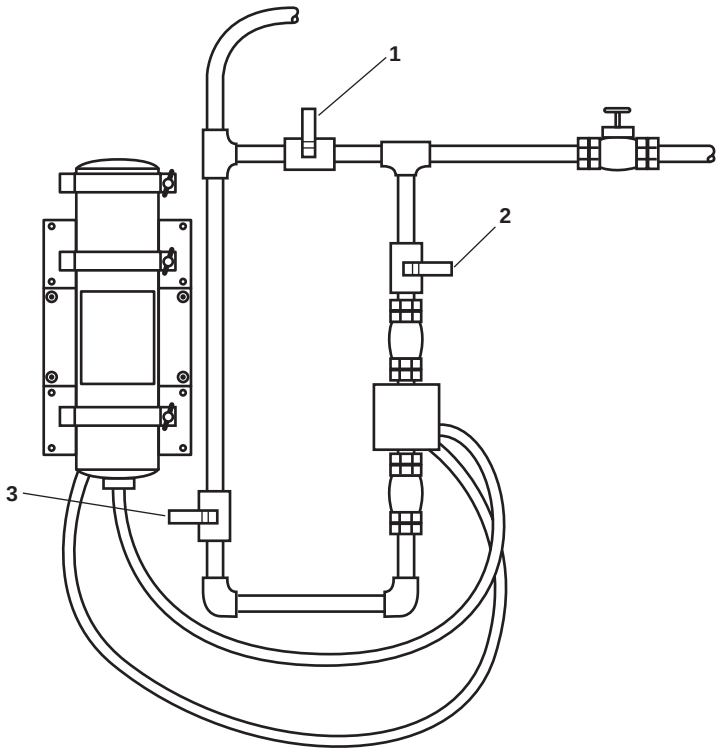


Figure 19. Brominator

2. CLOSE the following valves:

   a. PW-37, BROMINATOR INLET (figure 19, item 2).

   b. PW-38, BROMINATOR OUTLET (figure 19, item 3).

3. At the 120V emergency distribution panel No. 1, set the BROMINATOR. circuit breaker (figure 20, item 1) to OFF.

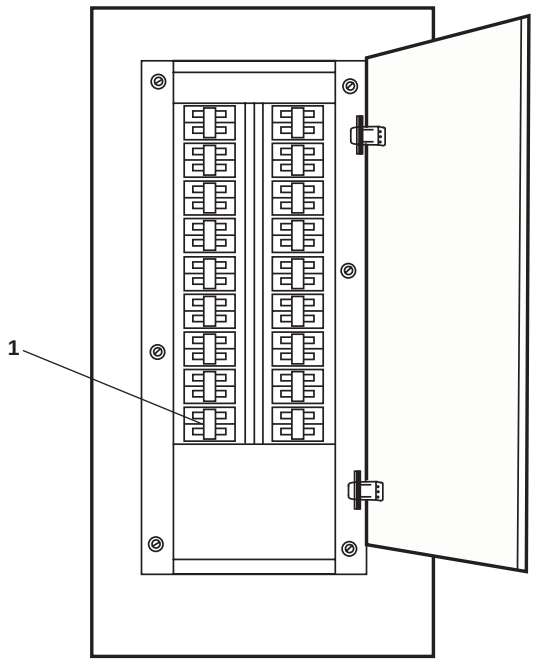


Figure 20. 120V Emergency Distribution Panel No. 1

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
MARINE SANITATION DEVICE SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0081 00

SYSTEM SHUTDOWN

NOTE

The System Shutdown procedure is performed for the following reasons: System Lay Up, System Overhaul, Air Scour and Pump Out of the Media Tank, and Cleaning of the Media Tank.

1. Perform the Sewage Holding Tank To Shore Connection procedure (WP 0081 00).

2. Set the PUMP HAND/OFF/AUTO switch (figure 1, item 1) on the MSD control panel to OFF.

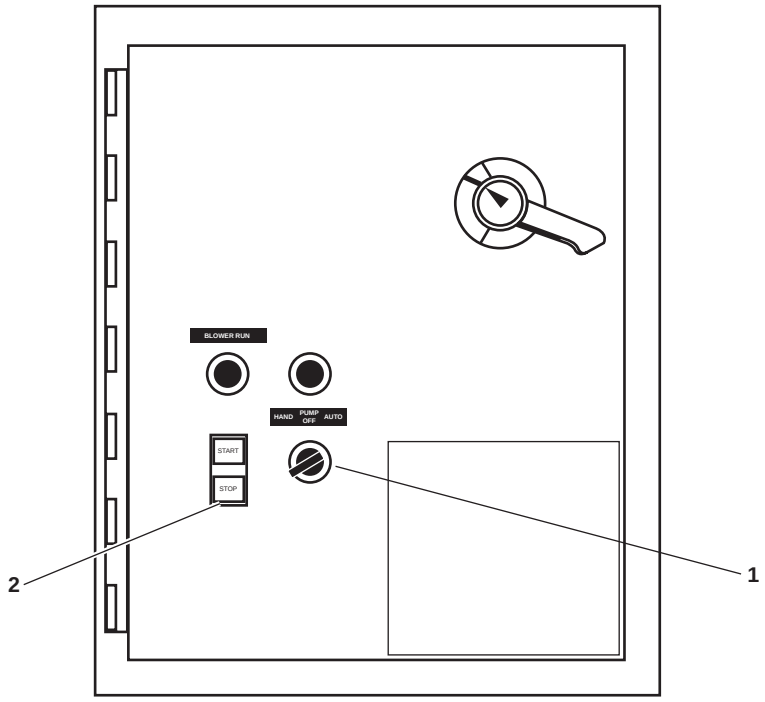


Figure 1. MSD Control Panel

3. Set to OFF the aeration blower by pressing the STOP button (figure 1, item 2) on the MSD control panel.

4. Set to OFF the MSD DISCHARGE PUMP AND BLOWER. circuit breaker (figure 2, item 1) in 440V power panel No. 4.

5. Set to OFF SEWAGE DISCHARGE PUMP No. 1. circuit breaker (figure 3, item 1) and SEWAGE DISCHARGE PUMP No. 2. (figure 3, item 2) circuit breaker in 440V power panel No. 1 (figure 3, item 2).

6. Align the valves for the MSD as specified in figure 4 and table 1.

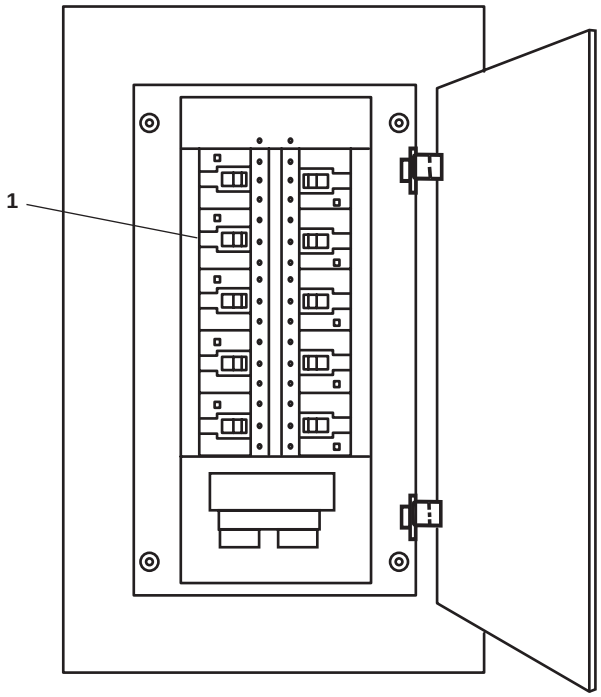


Figure 2. 440V Power Panel No. 4

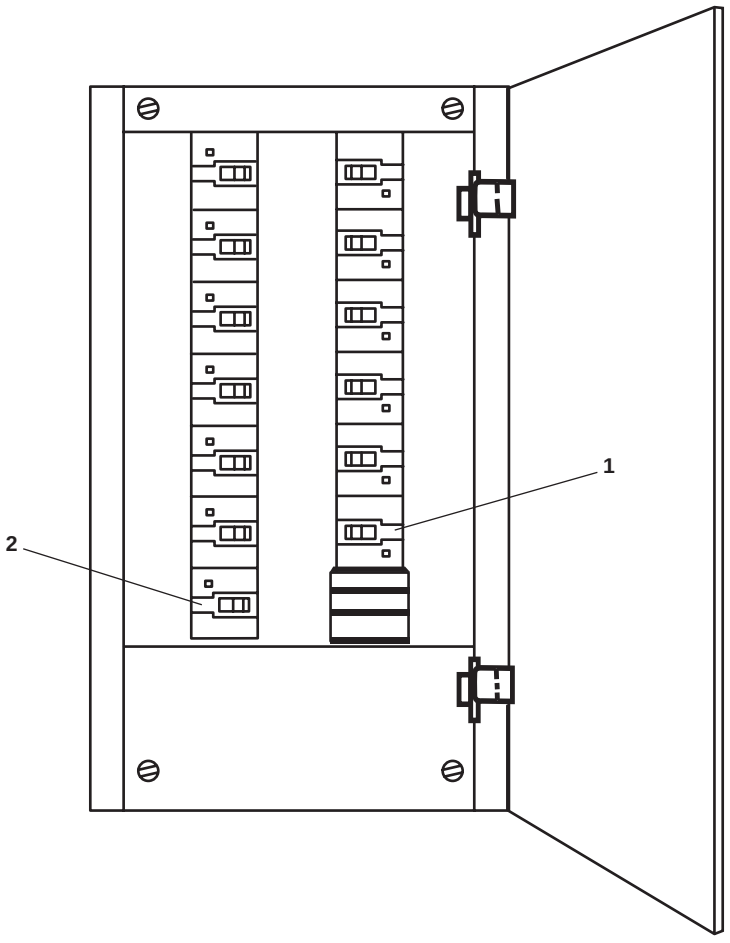


Figure 3. 440V Power Panel No. 4

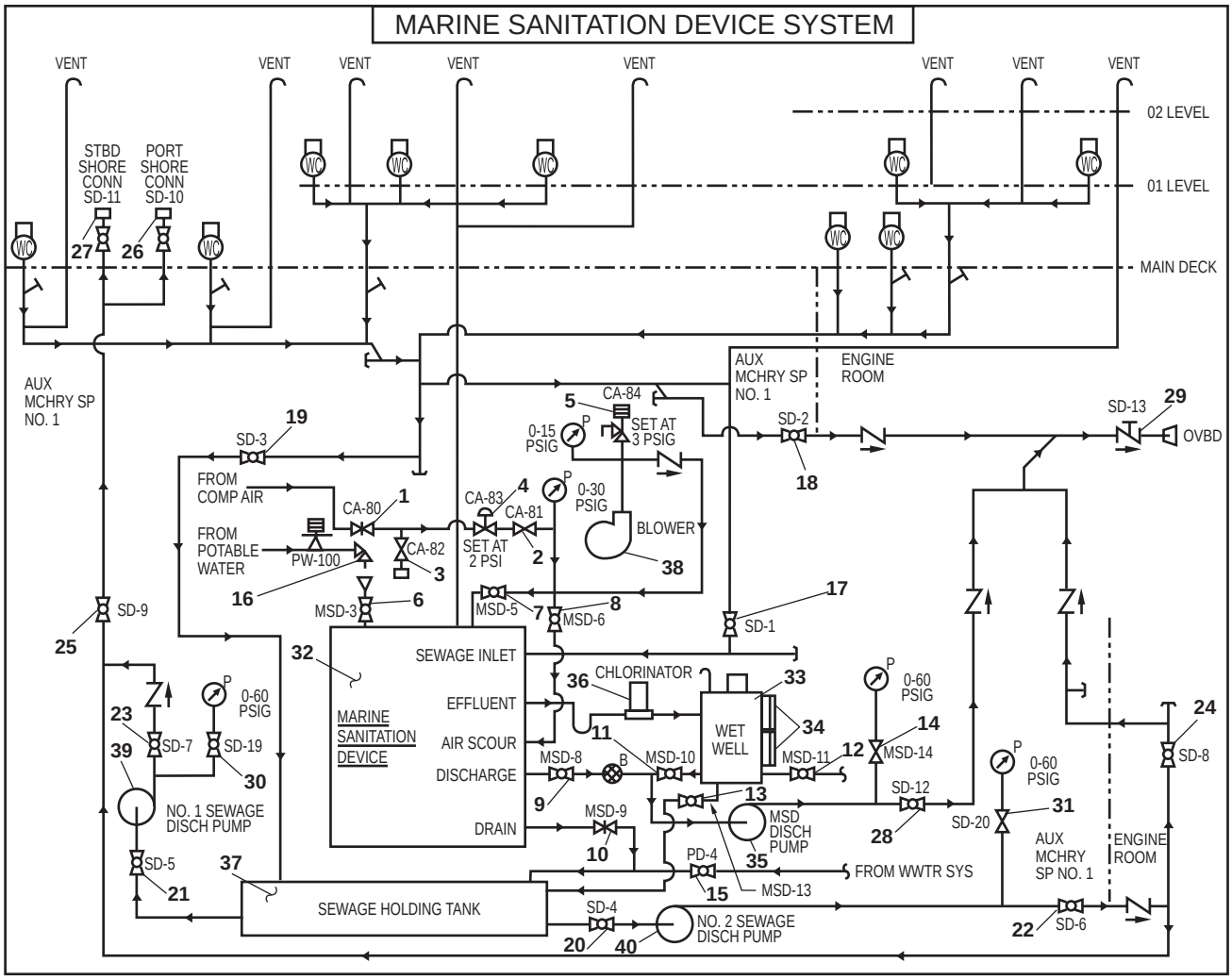


Figure 4. MSD System Schematic

Table 1. Valve Alignment for Sewage Holding Tank To Shore Connection

Item Number (Figure 4)	Valve Number	Function	Position During Operation Under Usual Conditions
1	CA-80	COV-LP AIR	CLOSED
2	CA-81	COV-LP AIR	CLOSED
3	CA-82	LP AIR HOSE SHUTOFF	CLOSED
4	CA-83	PRV-SET AT 2PSIG	Factory Set
5	CA-84	RV-SET AT 3 PSIG	Factory Set
6	MSD-3	POTW FILL TO MSD ISLN	CLOSED
7	MSD-5	BLOWER DISCHARGE SHUTOFF	CLOSED

Table 1. Valve Alignment for Sewage Holding Tank To Shore Connection (continued)

Item Number (Figure 4)	Valve Number	Function	Position During Operation Under Usual Conditions
8	MSD-6	BLOWER DISCH TO AIR SCOURING SOV	CLOSED
9	MSD-8	MEDIA TANK PUMP-OUT DR	CLOSED
10	MSD-9	MEDIA TANK DRAIN	CLOSED
11	MSD-10	WET WELL DISCHARGE	CLOSED
12	MSD-11	WET WELL SAMPLE	CLOSED
13	MSD-13	WET WELL DRAIN TO HOLDING TANK	CLOSED
14	MSD-14	MSD DISCH PUMP GAGE ISLN	CLOSED
15	PD-4	WASTE WTR TO SEW HLDG TANK	OPEN
16	PW-100	POTW ISOLATION	CLOSED
17	SD-1	SEWAGE INLET TO MSD	CLOSED
18	SD-2	SEWAGE OVERBOARD DISCHARGE	CLOSED
19	SD-3	SEWAGE DRAIN TO HOLDING TANK	CLOSED
20	SD-4	COV-SEW DISCH PMP NO. 2 SUCT	CLOSED
21	SD-5	COV-SEW DISCH PMP NO. 1 SUCT	CLOSED
22	SD-6	COV-SEW DISCH PMP NO. 2 DISCH	CLOSED
23	SD-7	COV-SEW DISCH PMP NO. 1 DISCH	CLOSED
24	SD-8	SEWAGE OVERBOARD DISCHARGE	CLOSED
25	SD-9	SEWAGE TO SHORE CONN	CLOSED
26	SD-10	SEWAGE SHORE CONN PORT	CLOSED
27	SD-11	SEWAGE SHORE CONN STBD	CLOSED
28	SD-12	MSD OVERBOARD DISCH PMP DISCH	CLOSED
29	SD-13	SEWAGE OVERBOARD DISCHARGE	CLOSED
30	SD-19	SEW PMP NO. 1 DISCH PRESS GAGE ISLN	CLOSED
31	SD-20	SEW PMP NO. 2 DISCH PRESS GAGE ISLN	CLOSED

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
HEATING, VENTILATION, AIR CONDITIONING, AND REFRIGERATION (HVACR) SYSTEMS SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

GENERAL

This work package provides the following procedures:

1. Secure the condenser units.
2. Secure condenser cooling water.
3. Secure the air conditioning plant piping system.
4. Secure the reefer plant piping system.
5. Secure the heating and ventilation systems.
6. Secure the EOS marine air conditioning unit.
7. Secure the electrical system.

SECURE THE CONDENSER UNITS

At the condensor units in AMS 2,

1. Place the dehydrator inlet valve (figure 1, item 1) at all operating condensing units to the CLOSED position.
2. Allow the condensers to operate until they shut down automatically by their suction pressure switch.
3. Place the compressor suction valve (figure 1, item 2) of each condensing unit in the CLOSED position.
4. Place the compressor discharge valve (figure 1, item 3) of each condensing unit in the CLOSED position.
5. Set the following switches to the OFF position on the all condenser units:
    a. Main power disconnect switches (figure 1, item 4)
    b. Power ON/OFF switches (figure 1, item 5)

⚠ CAUTION

Use a refrigeration ratchet wrench to open and close refrigeration system valves, or damage may occur to the piping system.

6. Secure the refrigerant piping by place the following valves in the CLOSED position at all condenser units:
    c. Condenser outlet valve (figure 1, item 6)

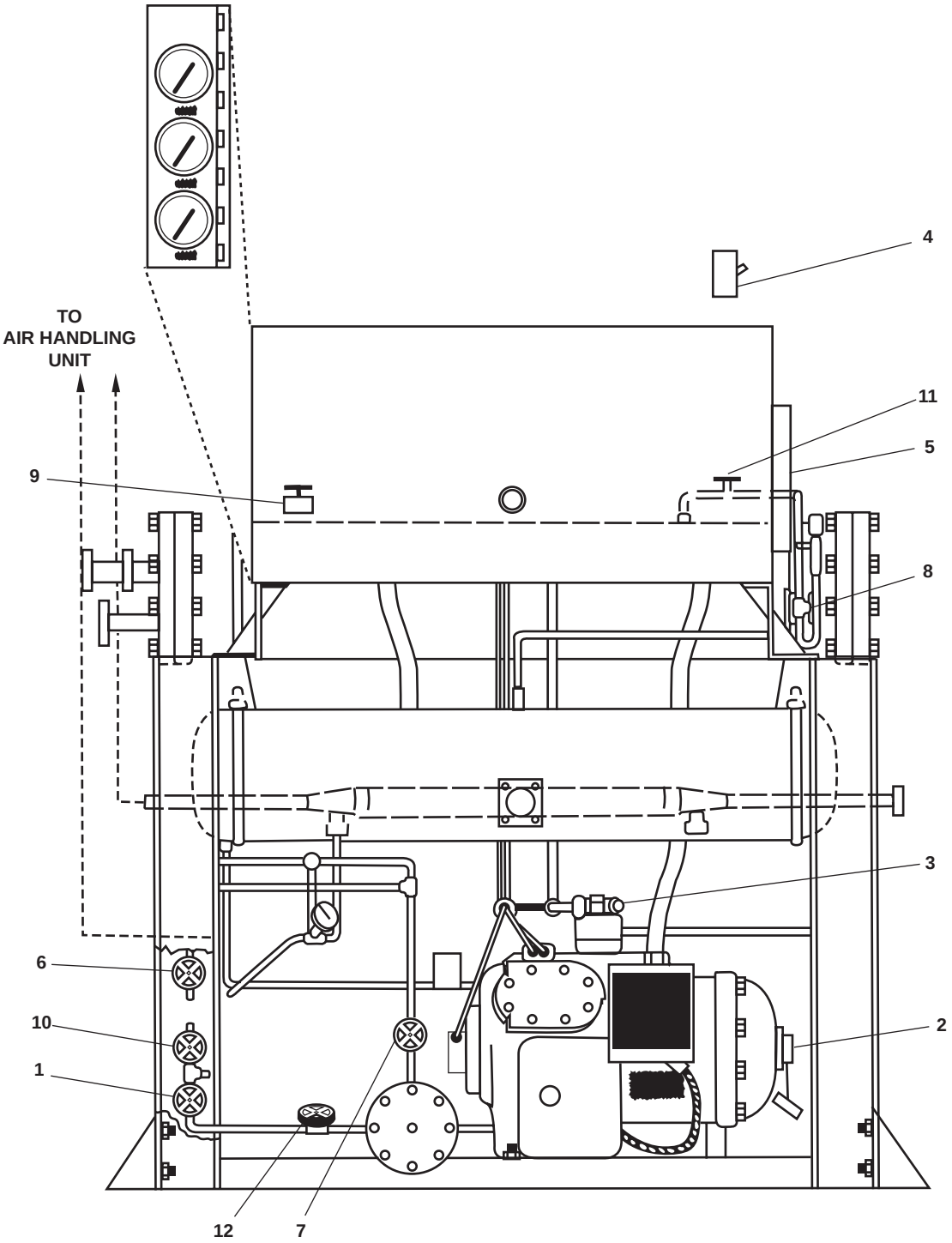


Figure 1. Condensing Unit Valves and Switches

d. Dehydrator outlet valve (figure 1, item 7)

e. Dehydrator inlet valve (figure 1, item 1)

f. Equalizing line valve (figure 1, item 8)

g. Water regulator valve actuating line valve (figure 1, item 9)

h. Compressor suction valve (figure 1, item 2)

i. Dehydrator bypass valve (figure 1, item 10)

j. Purge valve (figure 1, item 11)

k. Charge and drain valve (figure 1, item 12)

SECURE CONDENSER COOLING WATER

1. Secure general service piping by placing the following valves in the CLOSED position:

   a. For air conditioning condensing unit 1:

      (1) GS-33, A/C COND No.1 SPLY (figure 2, item 1), air conditioning condenser 2 supply

      (2) GS-36, WTR RGLTR COV (figure 2, item 2), water regulator inlet

   b. For air conditioning condensing unit 2:

      (1) GS- 34, A/C COND No.2 SPLY (figure 2, item 3), air conditioning condenser 1 supply

      (2) GS-37, WTR RGLTR COV (figure 2, item 4), water regulator inlet

   c. For reefer condensing unit 1:

      (1) GS-38, RETR COND No.1 SPLY (figure 2, item 5), reefer condenser 2 supply

      (2) GS-48, WTR RGLTR COV (figure 2, item 6), water regulator inlet

   d. For reefer condensing unit 2:

      (1) GS-39, RETR COND No.2 SPLY (figure 2, item 7), reefer condenser 1 supply

      (2) GS-49, WTR. RGLTR COV (figure 2, item 8), water regulator inlet

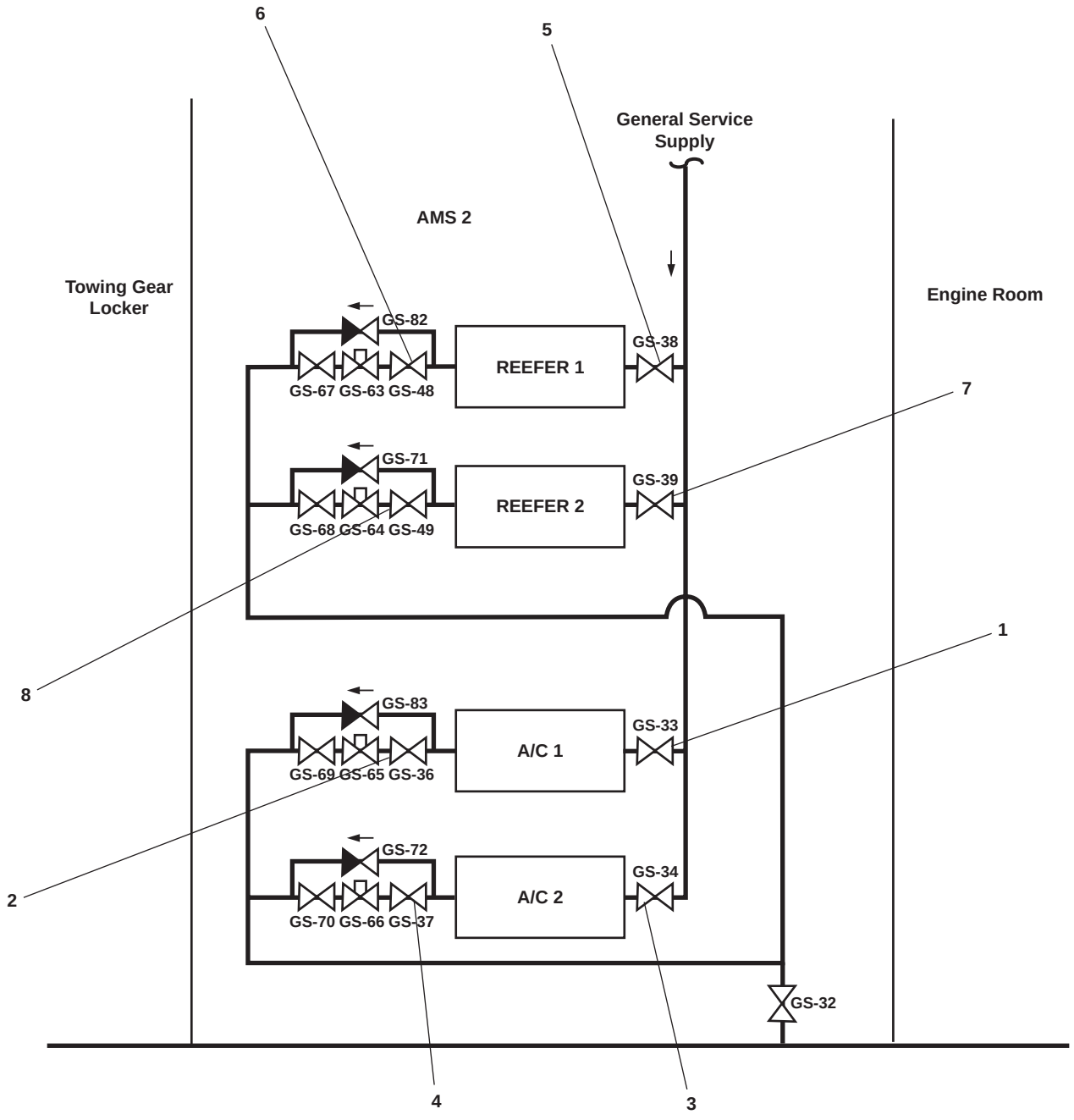


Figure 2. Condenser Cooling Water Valves

SECURE THE AIR CONDITIONING PLANT PIPING SYSTEM

1. In AMS 2, CLOSE the following valves:

    e. RFAC-39, LIQUID LINE CRVR COV, air conditioning liquid line crossover cutoff, located overhead

    f. RFAC-41, SUCT LINE CRSVR COV, air conditioning suction line crossover cutoff, located overhead

2. In the main deck fan room, CLOSE the following valves:

    a. RFAC-29, EQL LINE (figure 3, item 1), air conditioning 2 equalizing line

    b. RFAC-30, EQL LINE (figure 3, item 2), air conditioning 1 equalizing line

    c. RFAC-33, TXV/STNR/LLSV COV, R1-25-2, 4 COIL (figure 3, item 3), TXV strainer and low-level cutoff from air conditioning 2

    d. RFAC-34, TXV COV, R01-32-2 (figure 3, item 4), TXV strainer and low-level cutoff from air conditioning 2

    e. RFAC-36, TXV/STNR/LLSV COV, R1-25-2, 8 COIL (figure 3, item 5), TXV strainer and low-level cutoff from air conditioning 1

    f. RFAC-37, TXV/STNR/LLSV COV, R1-25-2, 8 COIL (figure 3, item 6), TXV strainer and low-level cutoff from air conditioning 1

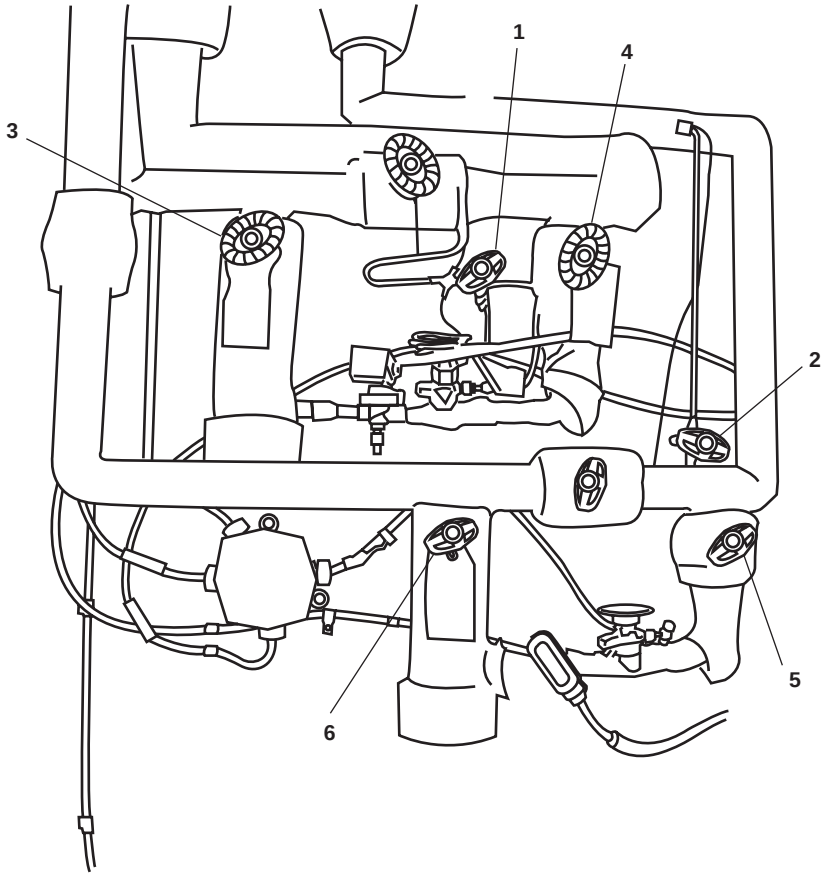


Figure 3. Main Deck Fan Room Air Conditioning Refrigerant Valves

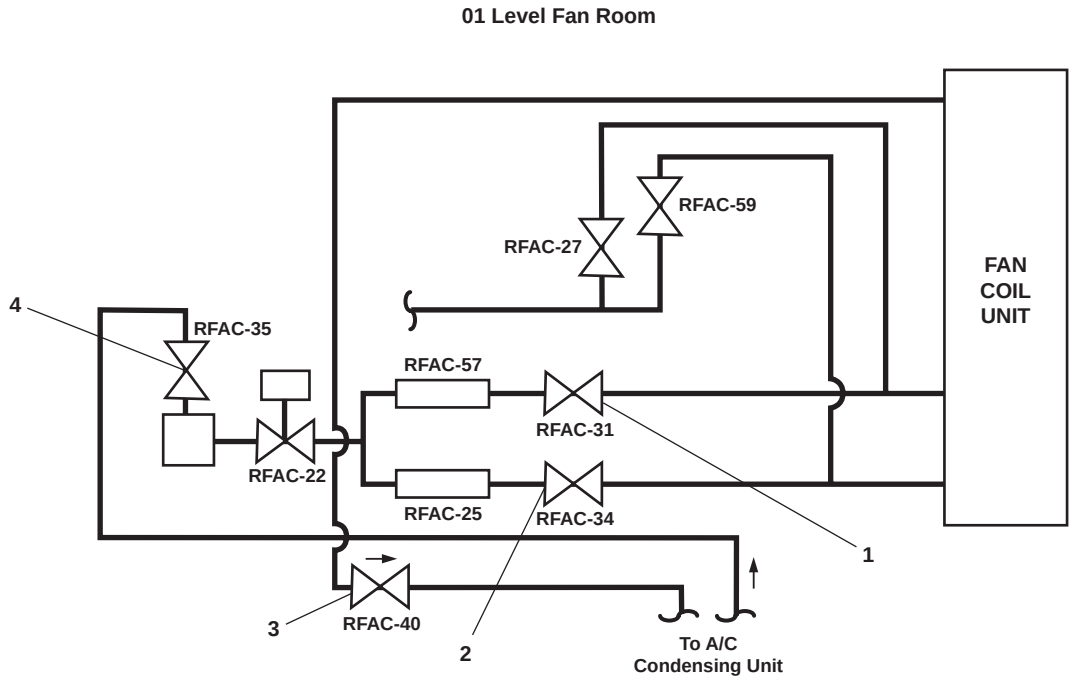


Figure 4. 01 Level Fan Room Air Conditioning Refrigerant Valves

g. RFAC-38, 4 COIL SUCT, COV R1-25-2 (figure 3, item 9), coil suction

h. RFAC-42, 8 COIL SUCT COV, R1-25-2 (figure 3, item 10), coil suction

3. In the 01 level AFT fan room, CLOSE the following valves:

a. RFAC-31, EQL LINE (figure 4, item 1), TXV outlet

b. RFAC-34, TXV COV, R01-32-2 (figure 4, item 2), TXV outlet

c. RFAC-40, COIL SUCT COV, R01-32-2 (figure 4, item 3), coil suction

d. RFAC-35, TXV COV,R01-32-2 (figure 4, item 4), TXV inlet

SECURE THE REEFER PLANT PIPING SYSTEM

1. On the engine room aft bulkhead, CLOSE the following valves:

a. RFSS-13, LIQUID LINE CRSVR COV (figure 5, item 1), liquid line crossover cut out

b. RFSS-14, TXV/STNR/LLSV COV (figure 5, item 2), TXV strainer low-level suction

c. RFSS-11, TXV/ STNR / LLSV COV (figure 5, item 3), TXV strainer low-level suction

d. RFSS-8, TXV/ STNR / LLSV COV (figure 5, item 4), equalizing line

e. RFSS-12, TXV / STNR / LLSV COV (figure 5, item 5), TXV strainer low-level suction

f. RFSS-15, TXV/STNR/LLSV COV (figure 5, item 6), TXV strainer low-level suction

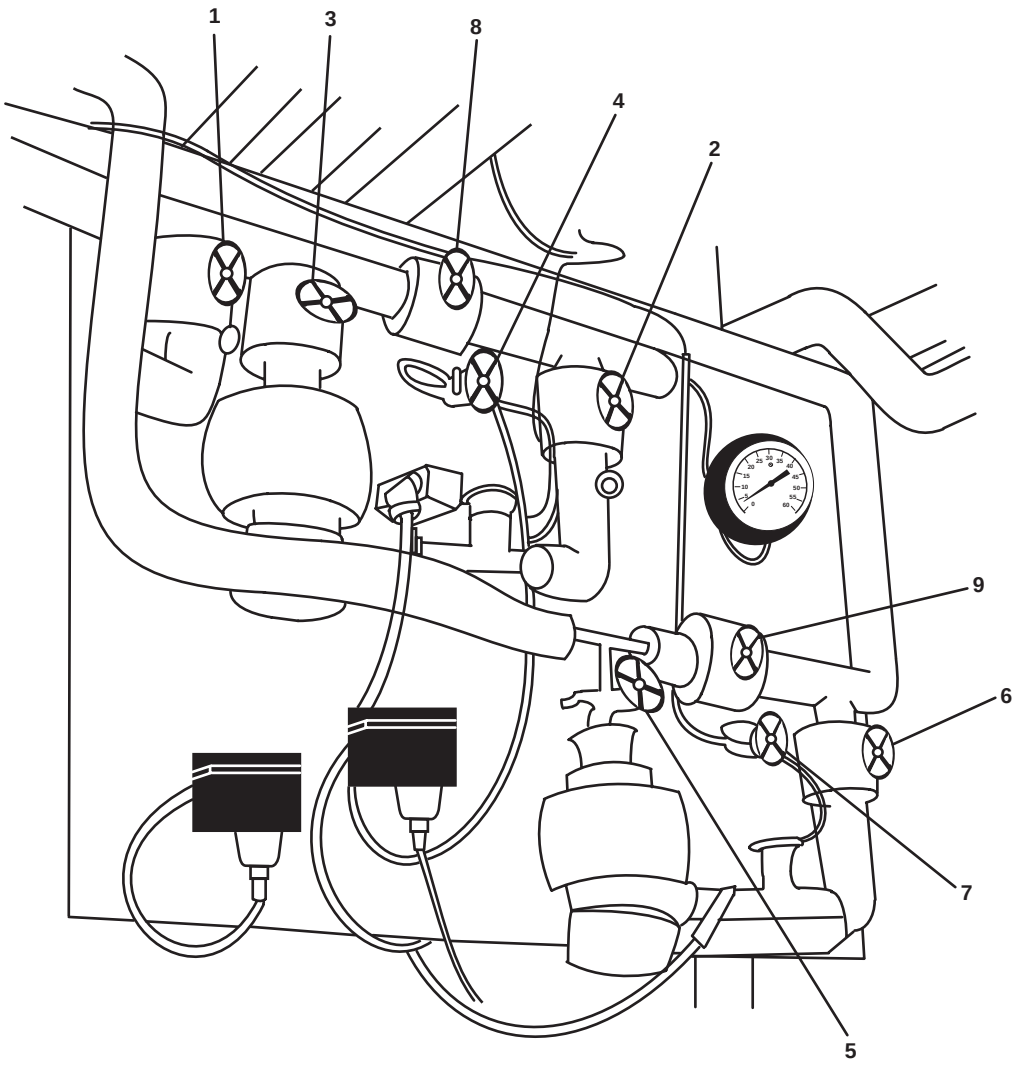


Figure 5. Reefer Refrigerant Piping Valves

g. RFSS-9, EQL LINE (figure 5, item 7), equalizing line

h. RFSS-6, HAND EXP V (figure 5, item 8)

i. RFSS-7, HAND EXP V (figure 5, item 9)

SECURE HEATING AND VENTILATION

1. Position all preheater ON/OFF switches (figure 6, item 1) to OFF.
2. Position all reheater ON/OFF switches (figure 7, item 1) to OFF.
3. Position all convection heater power ON switches (figure 8, item 1) to OFF.
4. Position all space heater ON-OFF switches (figure 9, item 1) to OFF.
5. At the 01, 02, and pilothouse fan coil, R01-32-2 motor controller, perform the following actions:

   a. Press the STOP pushbutton (figure 10, item 1).

b. Verify that the MOTOR RUN indicator (figure 10, item 2) goes out.

c. Set ON-OFF switch (figure 10, item 3) to OFF.

d. Verify that the POWER AVAILABLE indicator (figure 10, item 4) goes out.

6. In the boatswain's locker, at the boatswain's store room supply fan motor controller, perform the following actions:

a. Press the STOP pushbutton (figure 11, item 1).

b. Verify that the FAST speed indicator (figure 11, item 2) or SLOW speed indicator (figure 11, item 3) goes out.

c. Set the ON-OFF switch (figure 11, item 4) to OFF.

d. Verify that the POWER AVAILABLE indicator (figure 11, item 5) goes out.

7. In the boatswain's store, at the arms locker exhaust fan motor controller, perform the following actions:

a. Press the STOP pushbutton (figure 11, item 1).

b. Verify that the FAST speed indicator (figure 11, item 2) or SLOW speed indicator (figure 11, item 3) goes out.

c. Set the ON-OFF switch (figure 11, item 4) to OFF.

d. Verify that the POWER AVAILABLE indicator (figure 11, item 5) goes out.

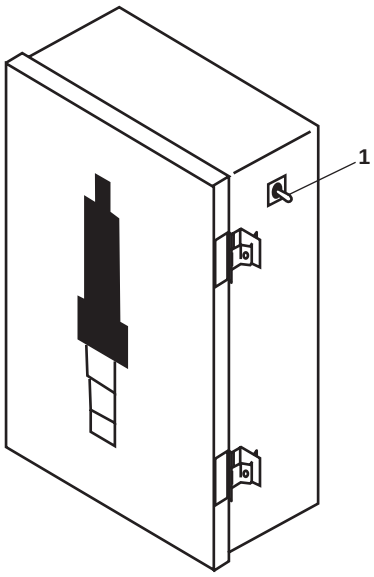


Figure 6. Preheater ON/OFF Switch

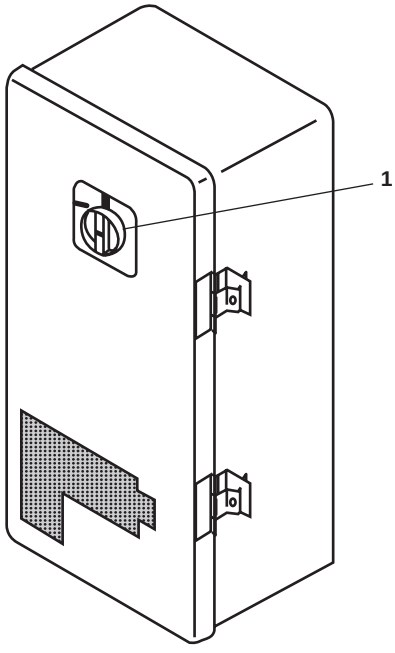


Figure 7. Reheater ON/OFF Switch

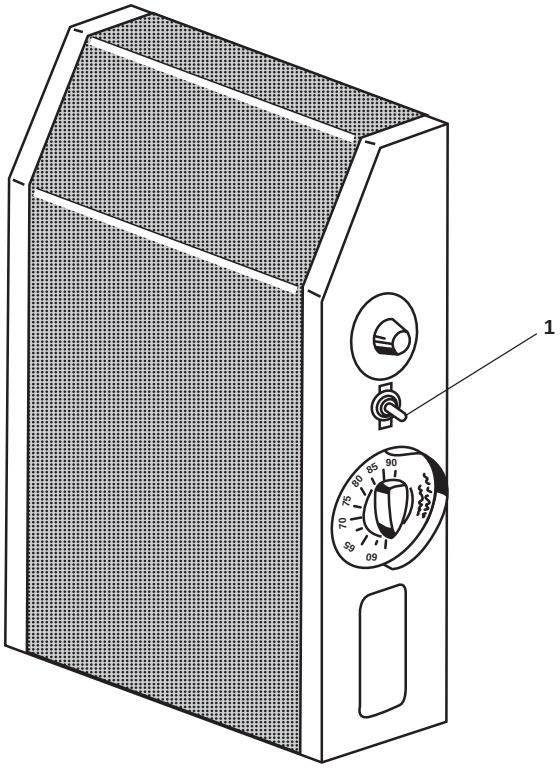


Figure 8. Convection Heater

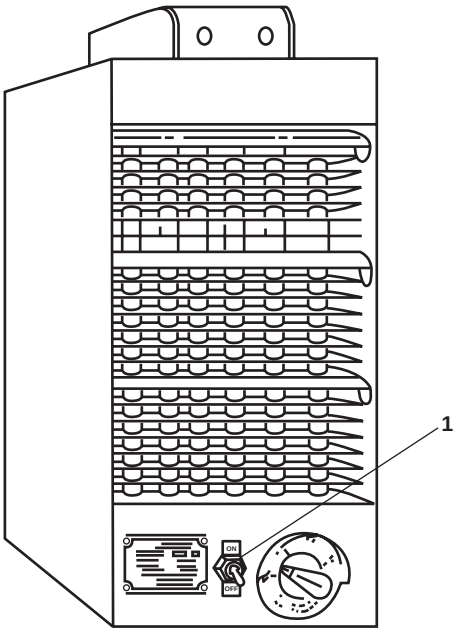


Figure 9. Space Heater

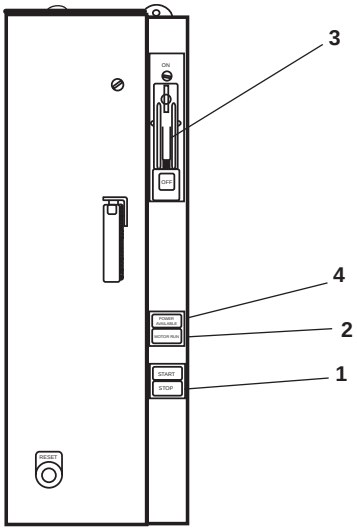


Figure 10. Single Speed Fan Motor Controller

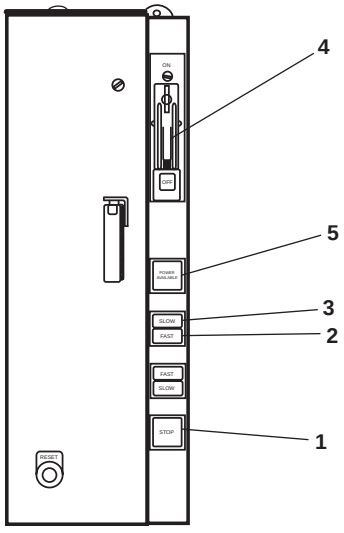


Figure 11. Dual Speed Fan Motor Controller

8. In AMS 1, at the AMS 1 supply fan motor controller.
    a. Press and release the STOP pushbutton (figure 11, item 1).
    b. Verify that the FAST speed indicator (figure 11, item 2) or SLOW speed indicator (figure 11, item 3) goes out.
    c. Set the ON-OFF switch (figure 11, item 4) to the OFF position.
    d. Verify that the POWER AVAILABLE indicator (figure 11, item 5) goes out.
9. In AMS 2, at the workshop exhaust fan motor controller, perform the following actions:
    a. Place the ON-OFF switch (figure 12, item 1) in the OFF position.
10. At the sanitary spaces exhaust fan motor controller perform the following:
    a. Press and release the STOP pushbutton (figure 10, item 1).
    b. Verify that the MOTOR RUN indicator (figure 10, item 2) goes out.
    c. Set ON-OFF switch (figure 10, item 3) to OFF.
    d. Verify that the POWER AVAILABLE indicator (figure 10, item 4) goes out.

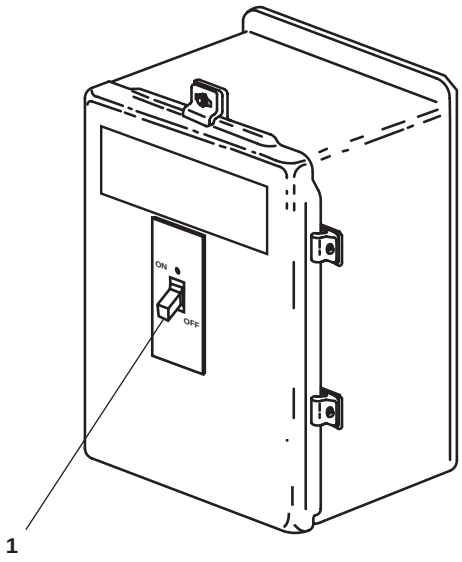


Figure 12. Workshop Exhaust Fan Motor Controller

SECURE THE EOS MARINE AIR CONDITIONING UNIT

At the EOS marine air conditioning unit control panel, set the MASTER CONTROL switch (figure 13, item 1) to OFF.

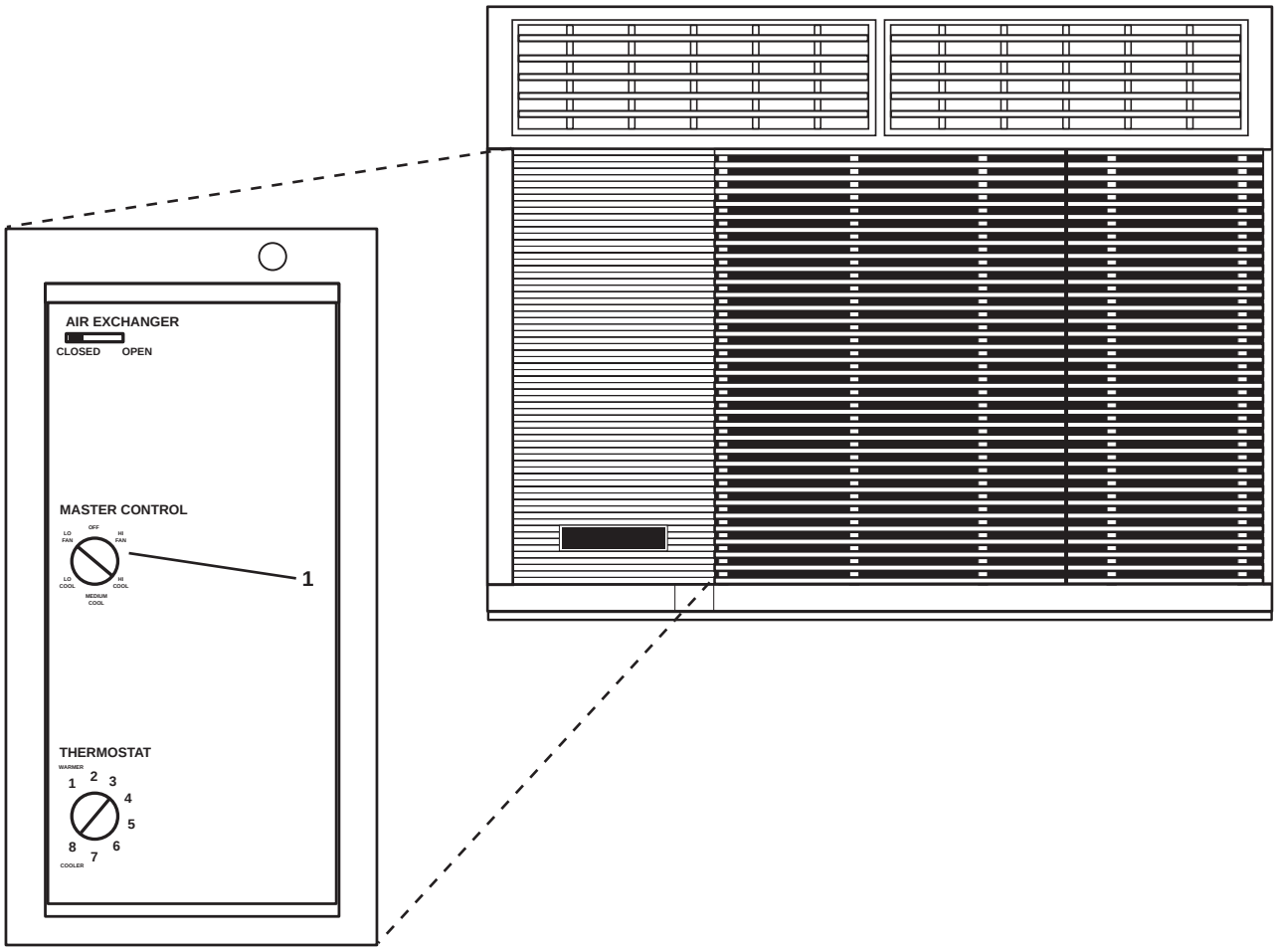


Figure 13. EOS Marine Air Conditioning Unit

SECURE THE ELECTRICAL SYSTEM

1. At 120V distribution panel No. 4, set the following circuit breakers to OFF:
   a. ENGINEERS OPERATING STATION R2-40-1. (figure 14, item 1)
   b. WORKSHOP EXHAUST FAN E02-16-1. (figure 14, item 2)
   c. J.B. FOR SS REFG Nos. 1 & 2. (INC. FAN COIL AND CONTROLLERS). (figure 14, item 3)
   d. J.B. FOR A/C REEF SYSTEMS Nos.1 & 2 (INCL LIQUID LINE SOLENOID VALVES) (figure 14, item 4)
   e. SHIPS SERVICE DIESEL GENERATOR SPACE HEATER No. 2. (figure 14, item 5)
   f. SHIPS SERVICE DIESEL GENERATOR SPACE HEATER No.1. (figure 14, item 6)

2. At 440V power panel No. 1, set the ENGINE ROOM UNIT HEATER. (figure 15, item 1) circuit breaker to OFF.
3. At 440V power panel No. 5 set the following circuit breakers to OFF:
   a. AIR CONDITIONING REFRIGERATION PLANT No. 2. (figure 16, item 1)
   b. STORE REFRIGERATION PLANT No. 2. (figure 16, item 2)
   c. TOWING GEAR LOCKER UNIT HEATER. (figure 16, item 3)
   d. STORE REFRIGERATION PLANT No. 1./FREEZE BOX DEFROST HTR. (figure 16, item 4)
   e. AIR CONDITIONING REFRIGERATION PLANT No. 1. (figure 16, item 5)
   f. UNIT HEATER. (AUXILIARY MACHINERY SPACE No. 2.). (figure 16, item 6)
4. At 440V power panel No. 4, set the following circuit breakers to the OFF position:
   a. UNIT HEATER BOW THRUSTER. (figure 17, item 1)
   b. AUXILIARY MACHINERY SPACE No. 1. UNIT HEATER. (figure 17, item 2)
   c. AUXILIARY MACHINERY SPACE No. 1. SUPPLY FAN. (figure 17, item 3)

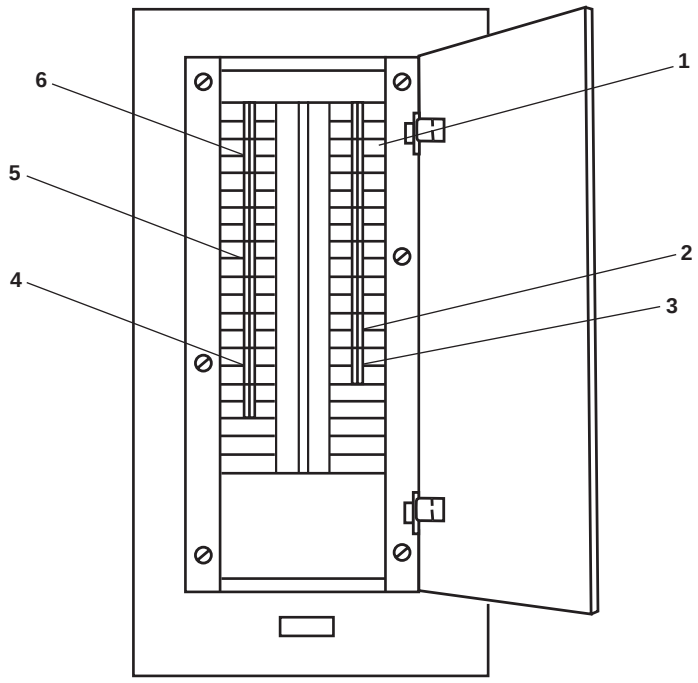


Figure 14. 120V Distribution Panel No. 4

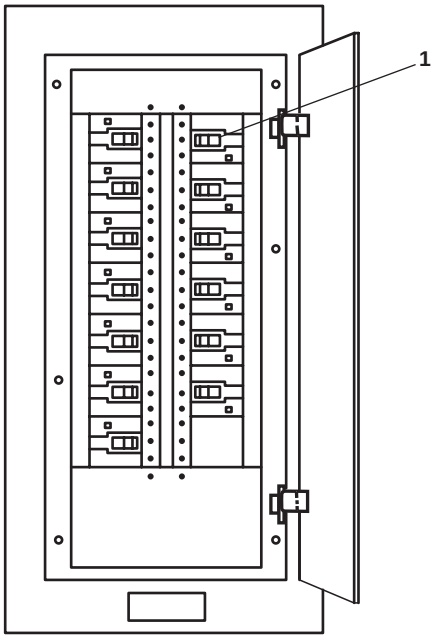


Figure 15. 440V Power Panel No. 1

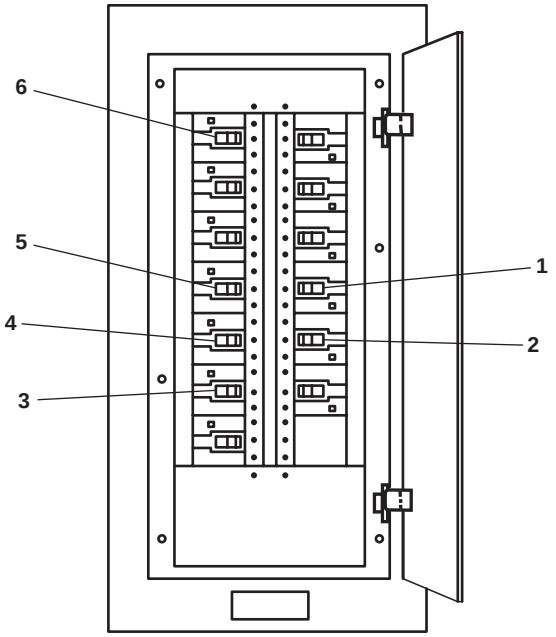


Figure 16. 440V Power Panel No. 5

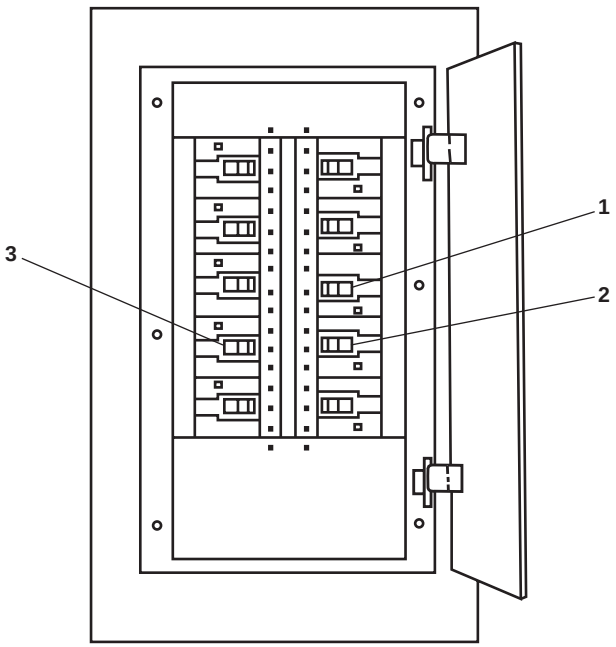


Figure 17. 440V Power Panel No. 4

5. At 120V distribution panel No. 3, set the following circuit breakers to OFF:

   a. 01 & 02 LEVEL REHEATER FUSE BOX No. 1. (figure 18, item 1)

   b. MAIN DECK REHEATER FUSE BOX No. 3. (figure 18, item 2)

6. At 440V power panel No. 3, set the following circuit breakers to OFF :

   a. PREHEATER 1-25-2. (figure 19, item 1)

   b. BOSUN STORE REHEATER 1-57-1. (figure 19, item 2)

   c. REHEATER 01-32-2. (figure 19, item 3)

   d. CREW'S MESS CRSR FAN COIL R1-25-2. (figure 19, item 4)

   e. LAUNDRY SPACE EXHAUST FAN E1-62-2 / CONTROLLER FOR BOSUN STORE & LAUNDRY SPACE SUPPLY FAN S1-58-1. (figure 19, item 5)

   f. SANITARY SPACE EXHAUST FAN E01-44-2. (figure 19, item 6)

   g. 01 & PILOTHOUSE LEVEL FAN COIL R01-32-2. (figure 19, item 7)

   h. BOSUN STORE & LAUNDRY SPACE SUPPLY FAN S1-58-1 / CONTROLLER FOR LAUNDRY SPACE EXHAUST FAN E1-62-2. (figure 19, item 8)

   i. PREHEATER 01-31-2. (figure 19, item 9)

   j. AUXILIARY MACHINERY SPACE No. 2. SUPPLY FAN 1-22-2. (figure 19, item 10)

   k. PREHEATER 1-23-4. (figure 19, item 11)

7. At 120V distribution panel No. 1, set the following circuit breakers to OFF :

   a. REFRIGERATOR. (figure 20, item 1)

   b. GAYLORD CONT CABINET. (figure 20, item 2)

   c. FREEZER. (figure 20, item 3)

8. At 120V distribution panel No. 2, set the 1 & 01 LEVEL CONVECTOR HEATER FUSE BOX No. 2. circuit breaker (figure 21, item 1) to OFF.

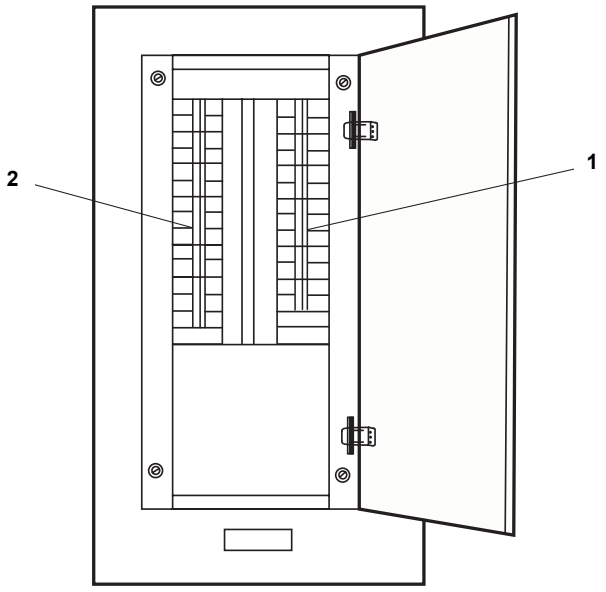


Figure 18. 120V Distribution Panel No. 3

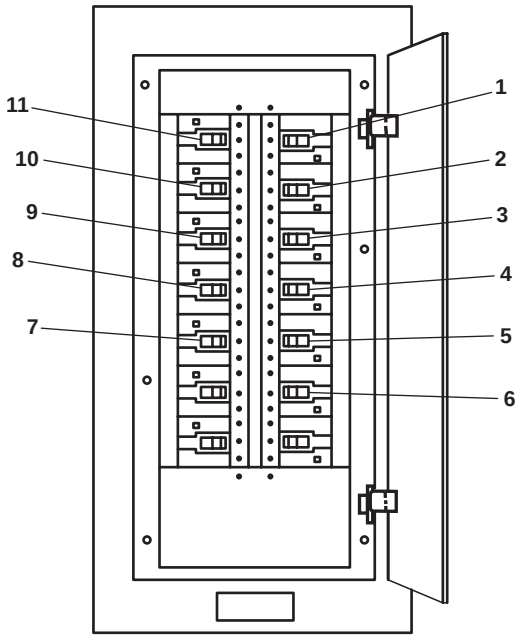


Figure 19. 440V Power Panel No. 3

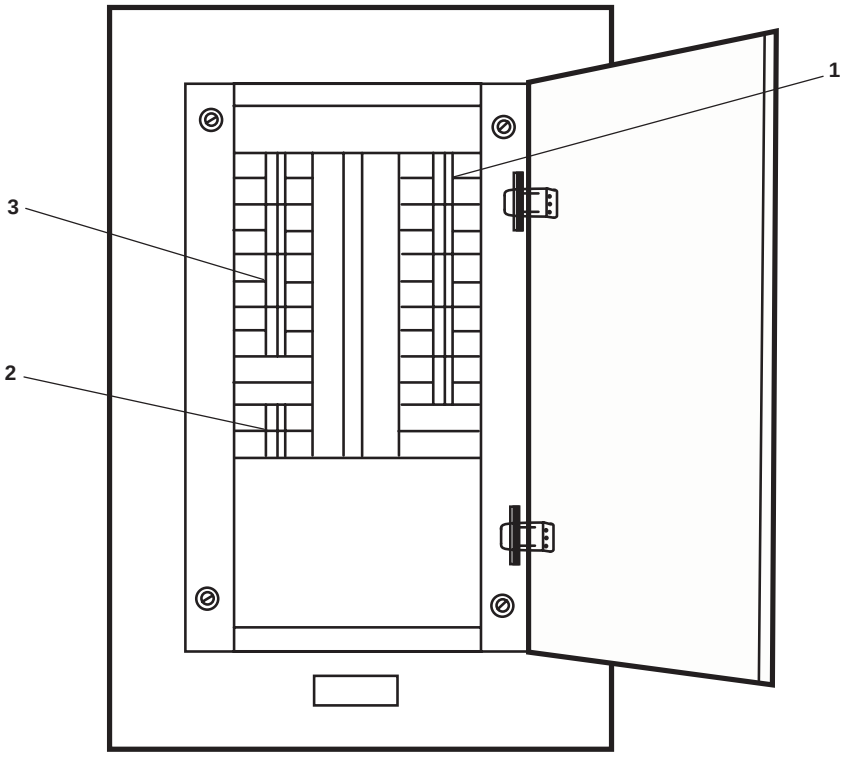


Figure 20. 120V Distribution Panel No. 1

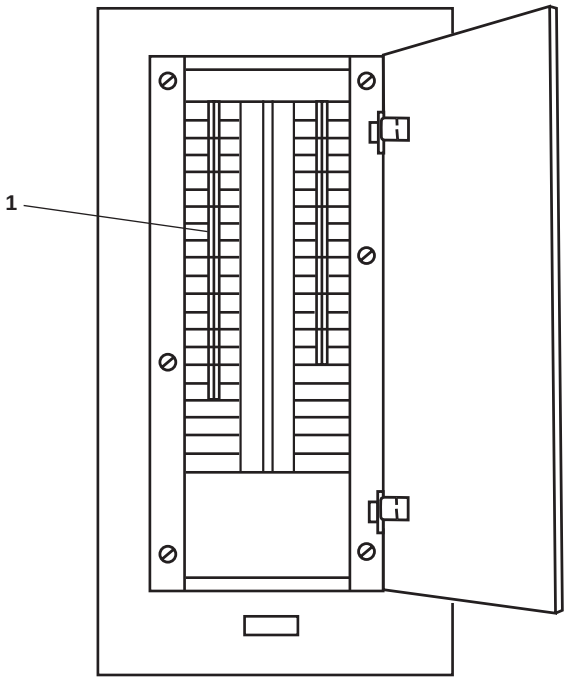


Figure 21. 120V Distribution Panel No. 2

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
COMPRESSED AIR SYSTEM SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

SYSTEM SHUTDOWN

1. Set the motor controller MANUAL-AUTO switch (figure 1 item 1) for both compressors to MANUAL.

2. On each motor controller, PUSH the STOP pushbutton (figure 1, item 2) and observe that the MOTOR RUN indicator light (figure 1, item 3) goes out and that the affected air compressor stops running.

3. Set both motor controllers' ON-OFF switches (figure 1, item 4) to OFF and observe that the POWER AVAILABLE indicator light (figure 1, item 5) goes out.

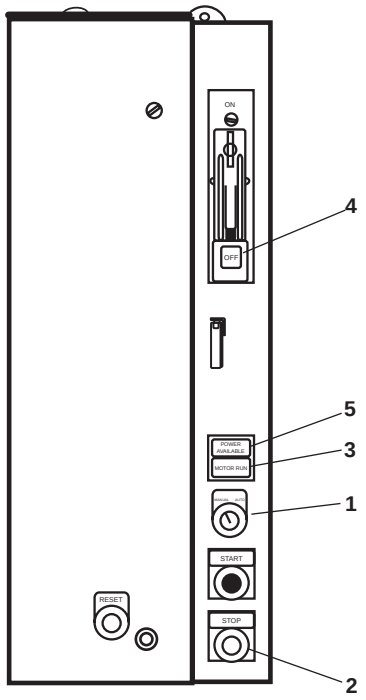


Figure 1. Air Compressor Motor Controller

4. At 440V power panel No. 4, set the following circuit breakers to OFF:

   a. AIR COMPRESSOR No. 1. (figure 2, item 1)

   b. AIR COMPRESSOR No. 2. (figure 2, item 2)

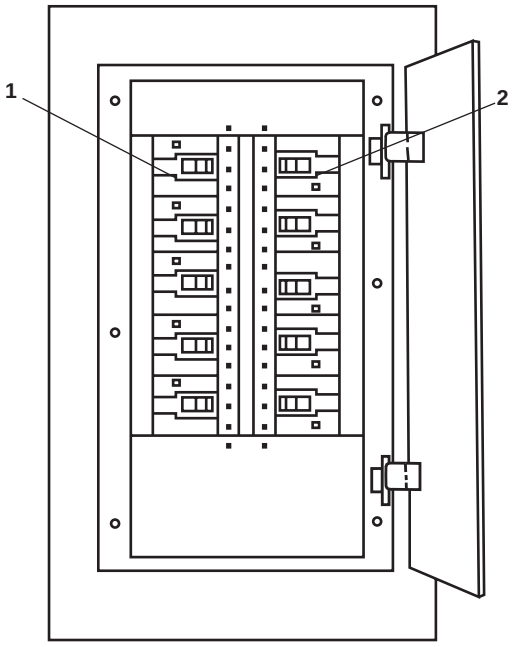


Figure 2. 440V Power Panel No. 4

5. Ensure that valve CA-48, SVCE AIR TK DR (figure 3, item 1) is CLOSED.

6. CLOSE valves CA-13, SVCE AIR TK INL (figure 3, item 2), CA-51, AUTO DR (figure 3, item 3), and CA-14, SVCE AIR TK OUT (figure 3, item 4).

7. CLOSE valves CA-40, SVCE AIR TK INL (figure 4, item 1) and CA-39, SVCE AIR TK INL (figure 4, item 2).

8. Ensure that valves CA-47, STG AIR TK DR (figure 3, item 5) and CA-46, STG AIR TK DR (figure 3, item 6) are CLOSED.

9. CLOSE valves CA-50, AUTO DR (figure 3, item 7) and CA-49, AUTO DR (figure 3, item 8).

10. CLOSE valves CA-11, STG AIR TK INL (figure 3, item 9) and CA-12, STG AIR TK INL (figure 3, item 10).

11. CLOSE valves CA-1and CA-2, COV COMPR DISCH (figure 5, item 1), and CA-87 and CA-88, COV COMPR DISC (figure 5, item 2).

12. Ensure that valves CA-89 and CA-90, COV COMPR DISCH (figure 5, item 3), and CA-93 and CA-94, MOISTURE SEP DR (figure 5, item 4) are CLOSED.

13. CLOSE valves CA-4, STG AIR TK OUT (figure 3, item 11) and CA-3, STG AIR TK OUT (figure 3, item 12) at the starting air receivers (figure 3, item 13).

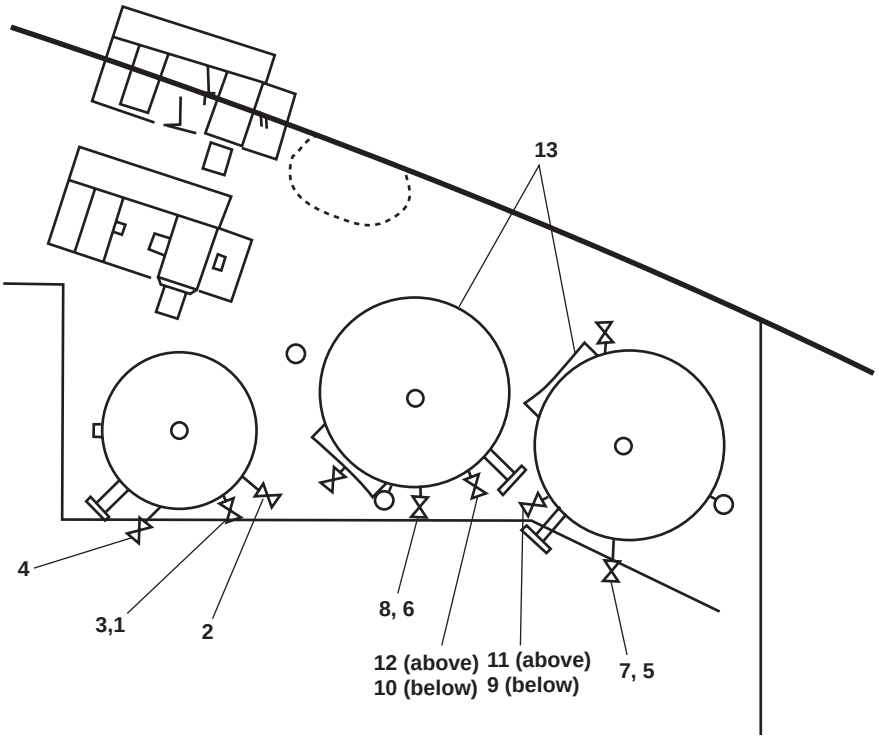


Figure 3. Compressed Air System Component Locations

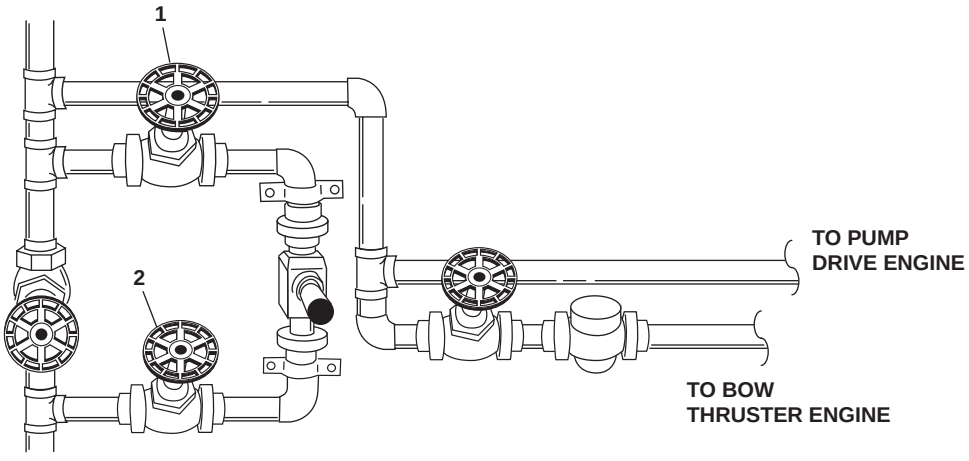


Figure 4. Ship's Service Air System Valve Locations (Forward Bulkhead)

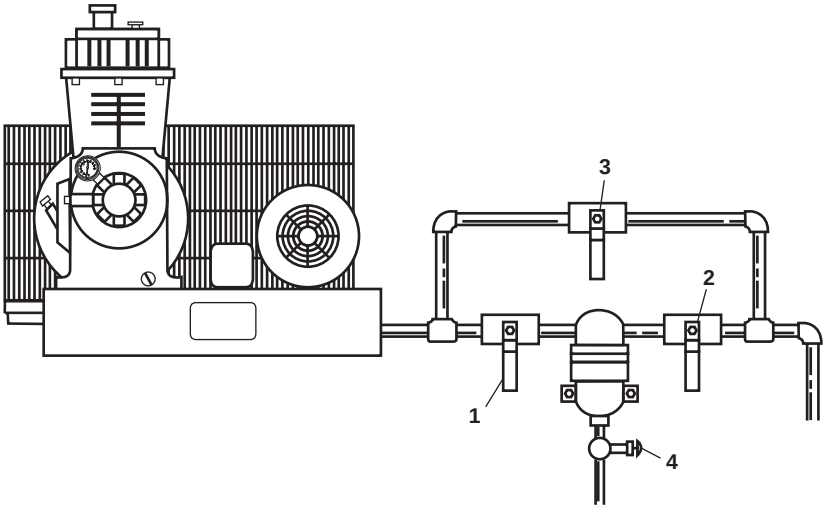


Figure 5. Dryer Valve Locations

14. To secure the control air system:

    a. Secure the control air dryer by completing the following actions:

        (1) In the forward port corner of the engine room, above SSDG 2, set the control air dryer switch (figure 6, item 1) to OFF.

        (2) Set the J.B. FOR AUTO DRAIN ON AIR RECEIVER. (INC REFER. DRYER.) circuit breaker (figure 7, item 1) on 120V distribution panel No. 4 to OFF.

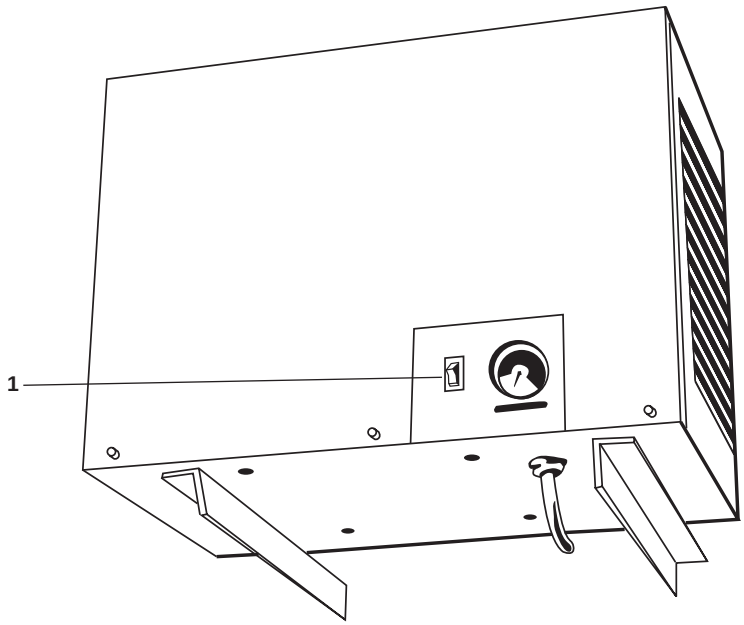


Figure 6. Control Air Dryer

b. To align the air dryer piping and valves:

(1) CLOSE the air dryer inlet valve (figure 8, item 1).

(2) CLOSE the air dryer outlet valve (figure 8, item 2).

(3) CLOSE the transducer valve (figure 8, item 3).

(4) CLOSE the filter valve (figure 8, item 4).

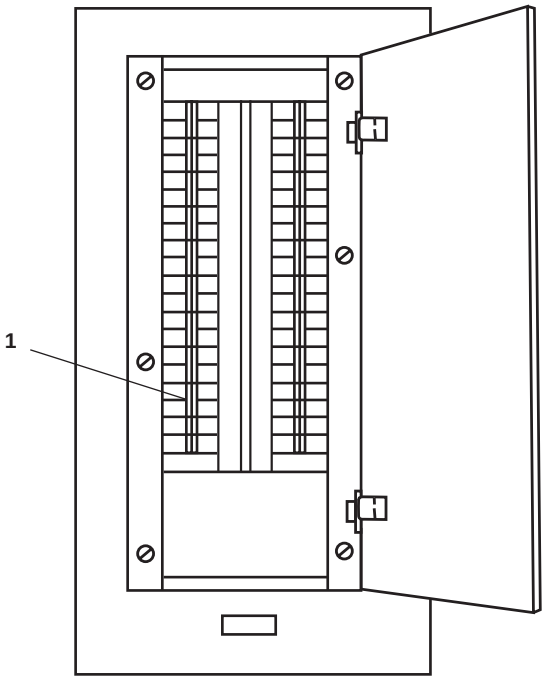


Figure 7. 120V Power Panel No. 4

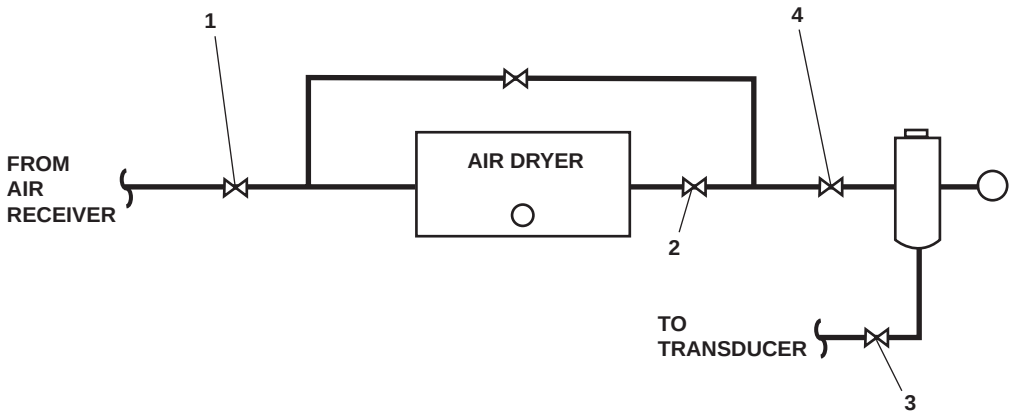


Figure 8. Control Air Dryer Valve Locations

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
FIRE MAIN, GENERAL SERVICE, AQUEOUS FILM FORMING FOAM (AFFF), AND WASHDOWN COUNTERMEASURE SYSTEM (WDCM) SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

PURPOSE

This work package provides the user with instructions for the shutdown of the fire main, general service, AFFF, and WDCM systems under usual conditions. The following procedures are included in this work package:

1. Shut down the pumps and secure the electrical system
2. AFFF system shutdown
3. Pump drive engine shutdown
4. WDCM system shutdown

SHUT DOWN THE PUMPS AND SECURE THE ELECTRICAL SYSTEM

1. To secure the fire and general service pumps, complete the following at each motor controller:
   a. Set the LOCAL-REMOTE switch (figure 1, item 1) for each controller to the LOCAL position.
   b. Press the STOP pushbutton (figure 1, item 2).
   c. Verify that the MOTOR RUN indicator (figure 1, item 3) goes out.
   d. Set the ON-OFF switch (figure 1, item 4) for each controller to OFF.
   e. Verify that the POWER AVAILABLE indicator (figure 1, item 5) for each controller goes out.

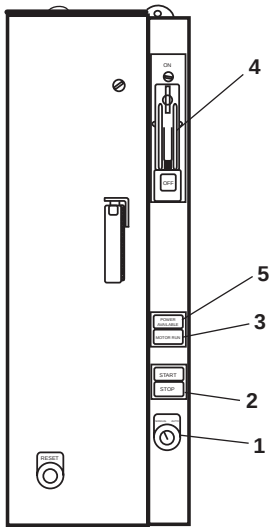


Figure 1. Fire Pump Motor Controllers

2. At the emergency switchboard, in the emergency diesel generator room, set the FIRE PUMP NO. 1 circuit breaker (figure 2, item 1) to OFF.

3. At the main switchboard, in the EOS, set the FIRE PUMP NO. 2 circuit breaker (figure 3, item 1) to OFF.

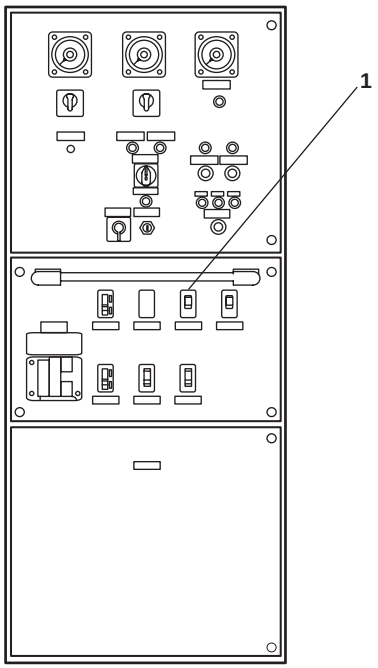


Figure 2. Emergency Switchboard

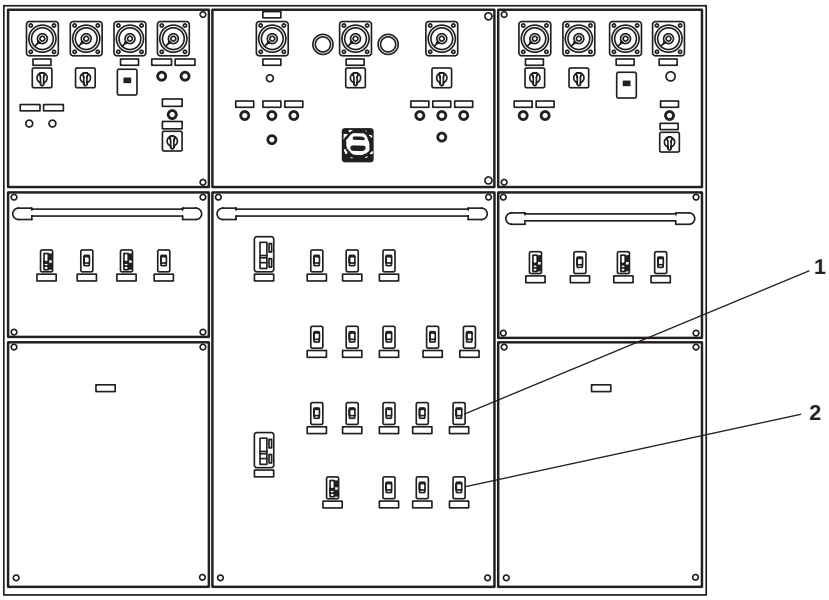


Figure 3. Main Switchboard

AFFF SYSTEM SHUTDOWN

1. To shut down the AFFF pump, complete the following at the AFFF motor controller:
   a. Press the STOP pushbutton (figure 4, item 1).
   b. Observe that the MOTOR RUN indicator (figure 4, item 2) goes out.
   c. Set the ON-OFF switch (figure 4, item 3) to OFF.
   d. Observe that the POWER AVAILABLE indicator (figure 4, item 4) goes out.
2. On the main switchboard in the EOS, set the AFFF PUMP circuit breaker (figure 3, item 2) to OFF.
3. To isolate the AFFF system, CLOSE valve FM-84, AFFF TK SUCT (figure 5, item 1).

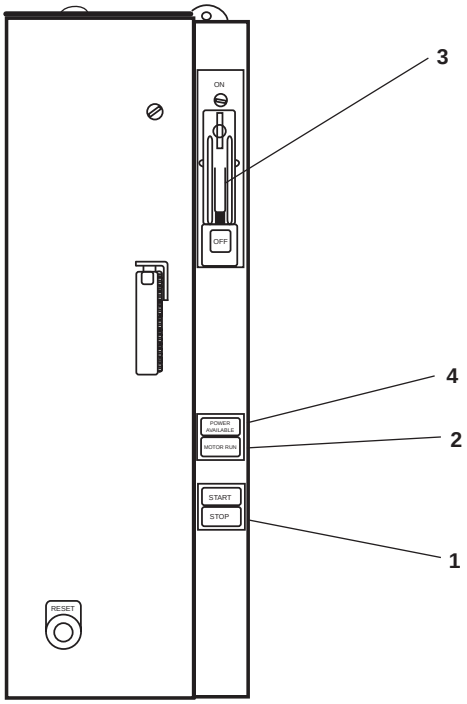


Figure 4. AFFF Pump Motor Controller

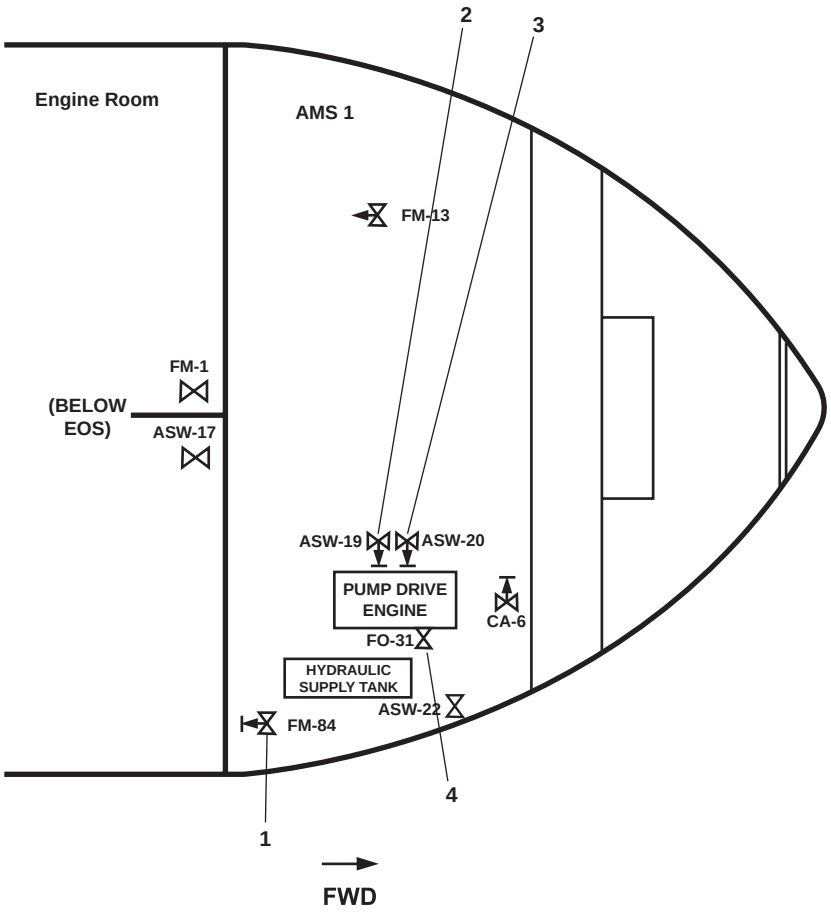


Figure 5. Pump Drive Engine and Firefighting Pump Valve Locations

PUMP DRIVE ENGINE SHUTDOWN

1. To unload and cool down the pump drive engine:

   a. Move the governor control lever (figure 6, item 1) to half engine speed position.

   b. Place the power take-off control lever (figure 6, item 2) in the disengaged (aft) position.

⚠ CAUTION

Stopping the engine without a cool down period may cause accelerated wear of engine components. Follow the stopping procedure to avoid damage to the engine.

   c. Allow engine to idle with no load for at least 5 minutes.

   d. Pull upward on the governor control lever (figure 6, item 1) and move the lever to OFF.

   e. Place the OFF-RUN-START toggle switch (figure 6, item 3) to OFF.

   f. Push in the START/STOP pushbutton (figure 6, item 4).

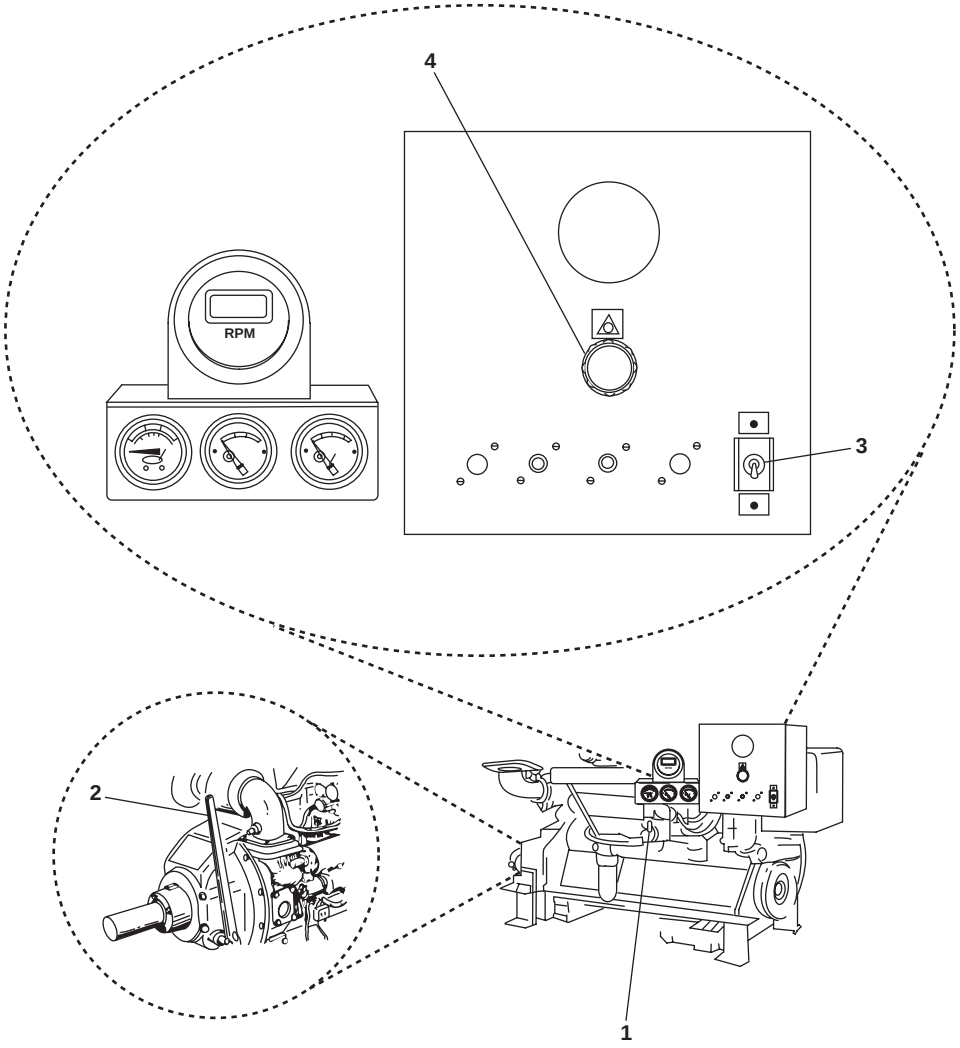


Figure 6. Pump Drive Engine

2. To secure the pump drive engine system piping, CLOSE the following valves:

   a. Asw-19, S.W. TO PUMP DRIVE ENG (figure 5, item 2)

   b. Asw-20, S.W. FR. PUMP DRIVE ENG. TO OVB'D DISCHARGE (figure 5, item 3)

   c. FO-31, F.O. SPLY TO PMP DRV ENG (figure 5, item 4)

WDCM SYSTEM SHUTDOWN

To shut down the WDCM system, CLOSE valve WDCM-11, WDCM SPLY (figure 7, item 1).

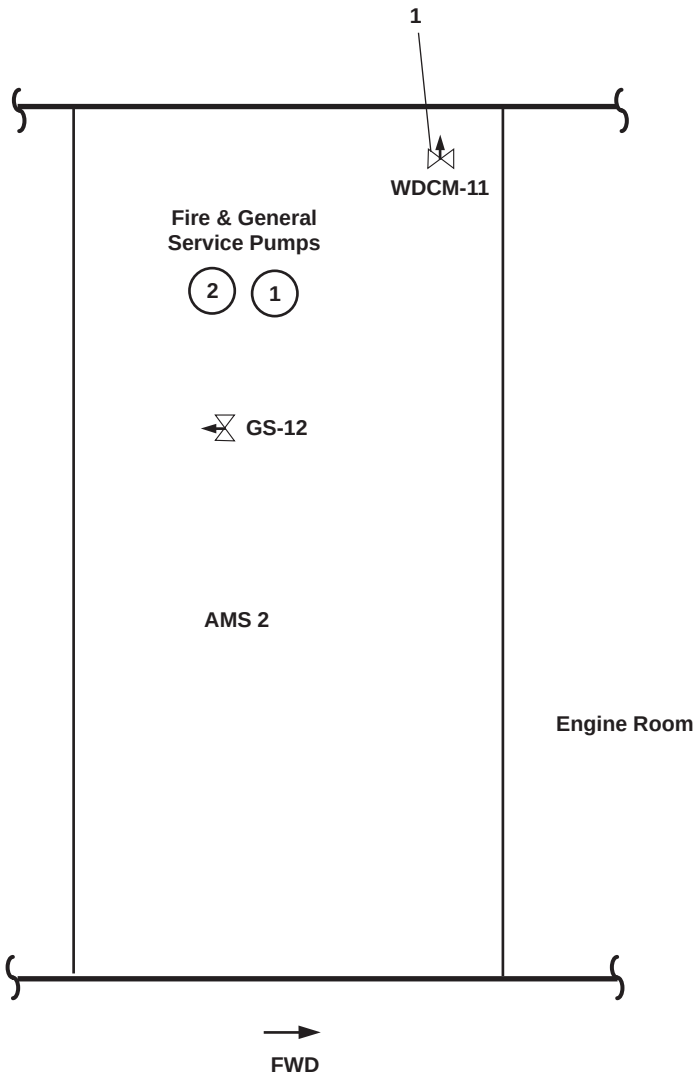


Figure 7. General Service Valves

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
EMERGENCY GENERATOR AND SWITCHBOARD SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

SECURE THE EMERGENCY DIESEL GENERATOR FROM AUTOMATIC START

NOTE

Verify that all functions that use the emergency switchboard as backup are operating normally before running this procedure.

1. At the Emergency Diesel Generator (EDG) control panel in the EDG room, complete the following actions:

   a. Place the RESET control switch (figure 1, item 1) in the RESET position.

   b. Push the red START/STOP pushbutton (figure 1, item 2) to the IN position to disconnect the starting circuit.

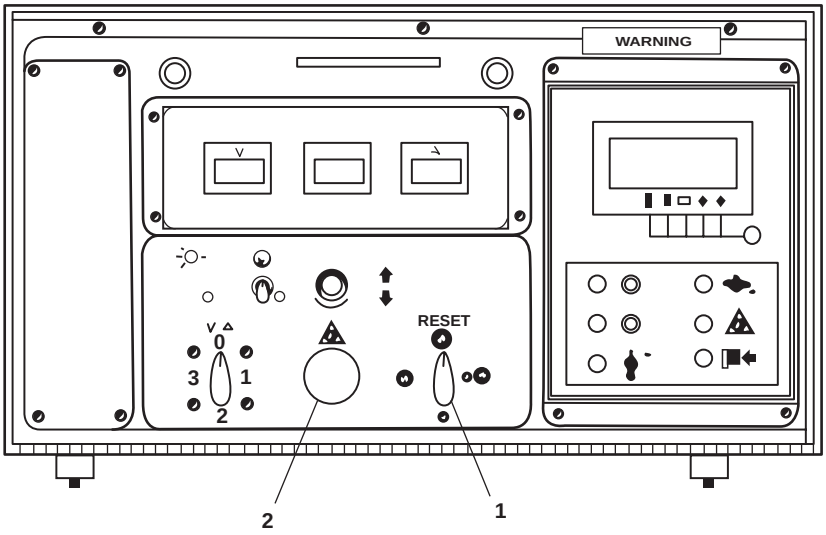


Figure 1. EDG Control Panel

2. At the emergency switchboard in the EDG room, complete the following actions:

   a. Set the ENG. CONTROL SW. (figure 2, item 1) to OFF.

   b. Push the main switchboard bus-tie circuit breaker (figure 2, item 2) to the OPEN position.

   c. Set the ENG GENERATOR circuit breaker (figure 2, item 3) to OPEN.

   d. Set the AMMETER switch (figure 2, item 4) to OFF.

   e. Set the VOLTMETER switch (figure 2, item 5) to OFF.

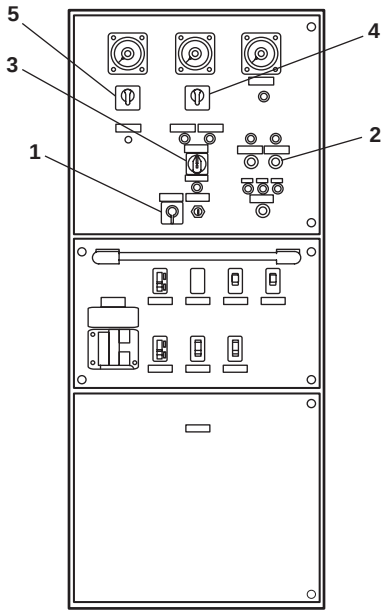


Figure 2. Emergency Switchboard

3. CLOSE the following valves (located in the EDG room overhead):

   a. FO-32, F.O. SPLY TO ENG valve (figure 3, item 1)

   b. FO-12, E.D.G. DAY TK FILL valve (figure 3, item 2)

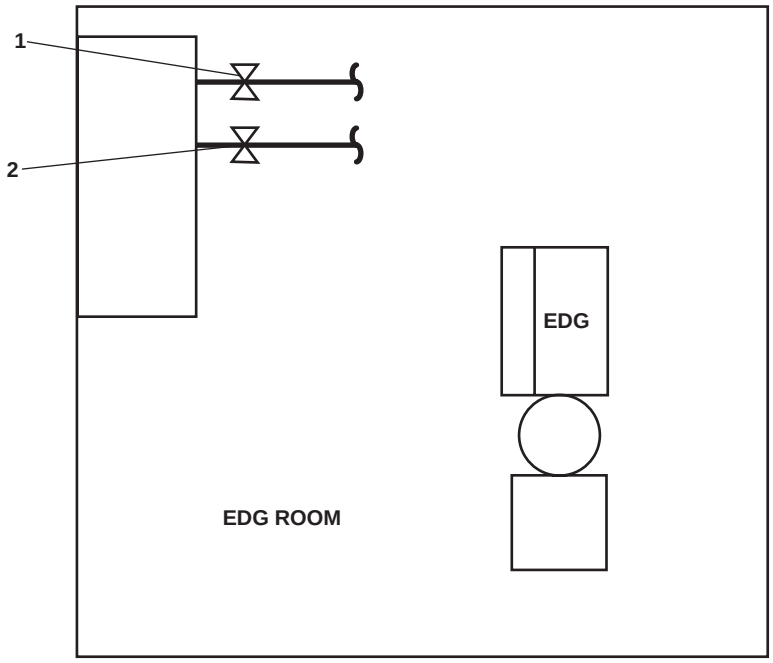


Figure 3. EDG Day Tank Valves

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
SHIPS SERVICE DIESEL GENERATOR SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0094 00

GENERAL

This work package contains the following procedures:

1. Transfer the load from SSDG 1 to SSDG 2
2. Transfer the load from SSDG 2 to SSDG 1
3. Shift to shore power/Shut down a single SSDG

NOTE

This procedure assumes that both SSDGs are operating in parallel. Select the appropriate section in this procedure to remove the desired SSDG from load. If only one generator is operating, proceed with the single generator shutdown procedure, and shut down SSDGs when the load is transferred to shore power.

TRANSFER THE LOAD FROM SSDG 1 TO SSDG 2

⚠ CAUTION

Ensure that the total load does not exceed the capacity of the SSDG, or damage could result.

1. Reduce the shipwide electrical load by setting all non-essential circuit breakers to OFF.
2. Transfer the load from SSDG 1 to SSDG 2 by completing the following actions at the main switchboard in the EOS:
   a. Set the BUS GEN. 1 switch (figure 1, item 1) to 1-2, 2-3, or 3-1 position.
   b. Set the AC AMMETER switch (figure 1, item 2) to 1, 2, or 3 position.
   c. Set the BUS GEN. 2 switch (figure 1, item 3) to 1-2, 2-3, or 3-1 position.
   d. Set the AC AMMETER switch (figure 1, item 4) to 1, 2, or 3 position.

⚠ CAUTION

Do not make one large adjustment to load sharing. Instead, make several small adjustments. Transferring too large a load too quickly could cause power failure and damage to the generator windings.

e. Increase the load on SSDG 2 by positioning GEN 2 GOVERNOR RAISE LOWER control (figure 1, item 5) towards the RAISE position and GEN 1 GOVERNOR RAISE LOWER control (figure 1, item 6) towards LOWER position.

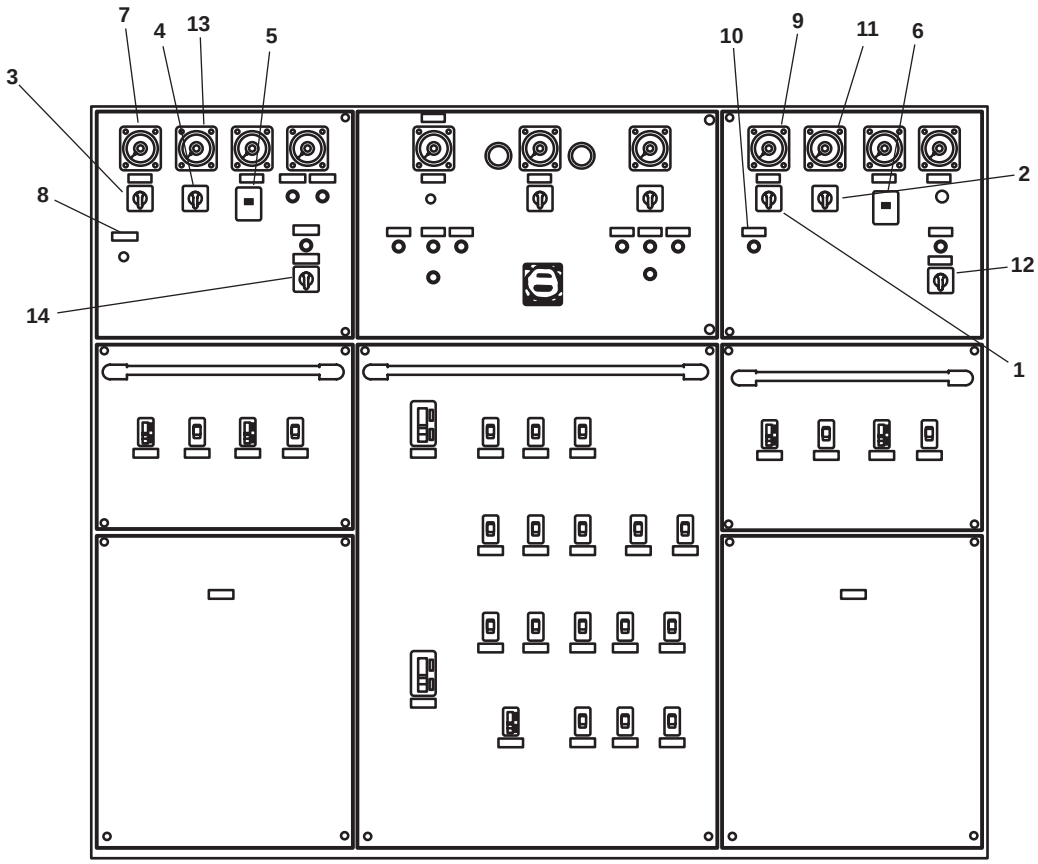


Figure 1. EOS Main Switchboard

f. Adjust voltage shown on AC VOLTS (figure 1, item 7) as necessary using GEN 2 AUTO VOLT RHEO. control (figure 1, item 8) to maintain 440 volts.

g. Adjust voltage shown on AC VOLTS (figure 1, item 9) as necessary using GEN 1 AUTO VOLT RHEO. control (figure 1, item 10) to maintain 440 volts.

h. Repeat steps e-g until AC AMPERES meter (figure 1, item 11) for generator 1 reads as low as possible (near 0).

3. To take SSDG 1 offline, complete the following at the EOS main switchboard:

⚠ CAUTION

AC AMPERES meter must read at or near 0 or damage to the SSDGs could result.

a. Set the GEN #1 CKT BKR (figure 1, item 12) to OPEN.

b. Adjust voltage to 440 using GEN 2 AUTO VOLT RHEO as necessary (figure 1, item 8).

c. Adjust frequency to 60 hertz using GEN 2 GOVERNOR RAISE LOWER control (figure 1, item 5) as necessary.

TRANSFER THE LOAD FROM SSDG 2 TO SSDG 1

⚠ CAUTION

Ensure that the total load does not exceed the capacity of the SSDG, or damage could result.

1. Reduce the shipwide electrical load by setting all non-essential circuit breakers to the OFF position.

2. To transfer the load from SSDG 2 to SSDG 1:

a. Set the BUS GEN. 1 switch (figure 1, item 1) to 1-2, 2-3, or 3-1 position.

b. Set the AC AMMETER switch (figure 1, item 2) to 1, 2, or 3 position.

c. Set the BUS GEN. 2 switch (figure 1, item 3) to 1-2, 2-3, or 3-1 position.

d. Set the AC AMMETER switch (figure 1, item 4) to 1, 2, or 3 position.

⚠ CAUTION

Do not make one large adjustment to load sharing. Instead, make several small adjustments. Transferring too large a load too quickly could cause power failure and damage to the generator windings.

e. Increase the load on SSDG 1 by positioning GEN 1 GOVERNOR RAISE LOWER control (figure 1, item 6) towards the RAISE position, and the GEN 2 GOVERNOR RAISE LOWER control (figure 1, item 5) towards the LOWER position.

f. Adjust voltage shown on AC VOLTS (figure 1, item 9), as necessary, using GEN 1 AUTO VOLT RHEO. control (figure 1, item 10) to maintain 440 volts.

g. Adjust voltage shown on AC VOLTS (figure 1, item 7), as necessary, using GEN 2 AUTO VOLT RHEO. control (figure 1, item 8) to maintain 440 volts.

h. Repeat steps e through g above until AC AMPERES meter (figure 1, item 13) for generator 2 reads as low as possible (at near 0).

3. To take SSDG 2 offline:

⚠ CAUTION

AC AMPERES meter must read at or near 0 or damage to SSDGs could result.

a. Set the GEN #2 CKT BKR (figure 1, item 14) to OPEN.

b. Adjusting voltage to 440 using GEN 1 AUTO VOLT RHEO. control (figure 1, item 10) to maintain 440 volts.

c. Adjusting frequency to 60 hertz using GEN 1 GOVERNOR RAISE LOWER control (figure 1, item 6) as necessary.

SHIFT TO SHORE POWER/SHUT DOWN SINGLE SSDG

1. Reduce the load by securing unnecessary loads throughout the vessel.

2. Transfer the load to shore power (WP 0094 00).

3. To disconnect the load from the SSDG:

   a. For SSDG 1, set the GEN. 1 CKT BKR (figure 1, item 12) to OPEN.

   b. For SSDG 2, set the GEN. 2 CKT BKR (figure 1, item 14) to OPEN.

⚠ CAUTION

Stopping the engine without proper cooldown can result in damage to the engine. If ambient raw water temperature is greater than 90 ºF (32.2ºC) it may be necessary to allow the engine to idle and cool down for at least 20 minutes.

4. Allow the engine to idle for at least 15 minutes to allow cooling water to remove excess heat.

5. To STOP the engine:

   a. To shut down SSDG 2 at the engine control panel:

      (1) Set the START switch to (figure 2, item 1) to OFF (DOWN).

      (2) Push the emergency stop pushbutton (figure 2, item 2) to IN.

b. To shut down SSDG 1:

      (1) Set the OFF/RUN/START switch (figure 2, item 3) to OFF.

      (2) At the SSDG 1 engine control panel, set the emergency stop pushbutton (figure 2, item 4) to IN.

⚠ CAUTION

The procedures that follow are intended for engines that have been shut down. Severe damage to the engine could result if these procedures are performed on a running engine.

6. Place the following valves in the CLOSED position on the secured engine:

   a. If SSDG 1 is shut down:

      (1) Fuel oil filter outlet valve

      (2) Fuel oil filter inlet valve (figure 2, item 5)

      (3) FO-21, F.O. SPLY TO S.S.D.G. No. 1 (figure 3, item 1)

      (4) Fwc-9, F.W. FR. KEEL CLR TO S.S.D.G. No. 1 (figure 3, item 2)

(5) FWC-11, F.W. FR. S.S.D.G. No. 1 TO KEEL CLR. (figure 3, item 3)

(6) FO-15, F.O. SERV. SUCT. STBD (figure 3, item 4)

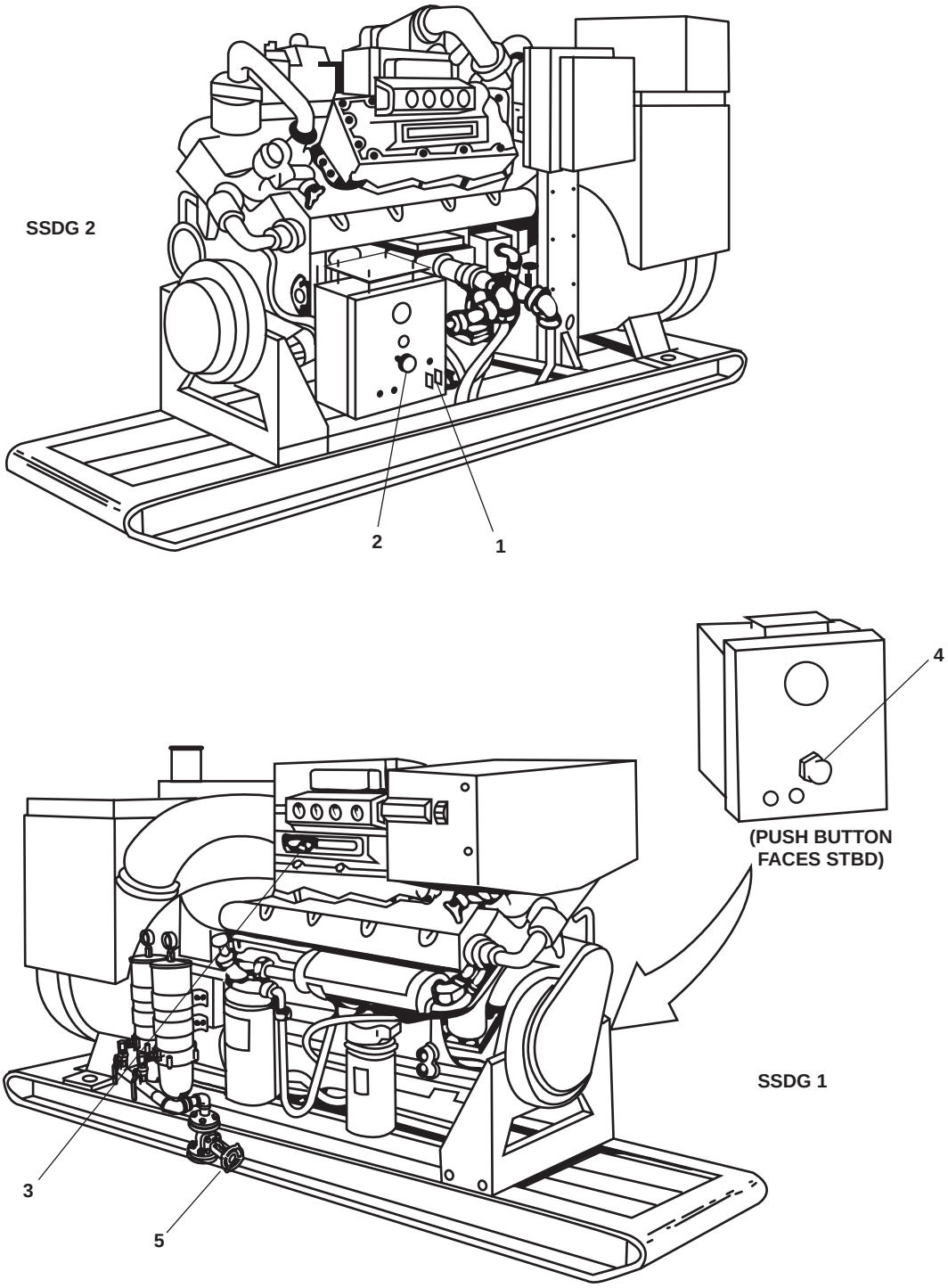


Figure 2. SSDG Engine Control

b. If SSDG 2 is shut down:

(1) Fuel oil filter outlet valve

(2) Fuel oil filter inlet valve (figure 2, item 5)

(3) FO-33, F.O. RTN TO DAY TK. PORT (figure 3, item 6)

(4) FO-13, F.O. SERV. SUCT. PORT (figure 3, item 7)

(5) Fwc-12, F.W. FR. S.S.D.G. No. 2 TO KEEL CLR. (figure 3, item 8)

(6) Fwc-10, F.W. FR. KEEL CLR TO S.S.D.G. No. 2 (figure 3, item 9)

(7) FO-22, F.O. SPLY TO S.S.D.G. No.2 (figure 3, item 10)

7. To secure starting air, CLOSE valve CA-7, STG AIR TO DSL GEN (figure 3, item 11).

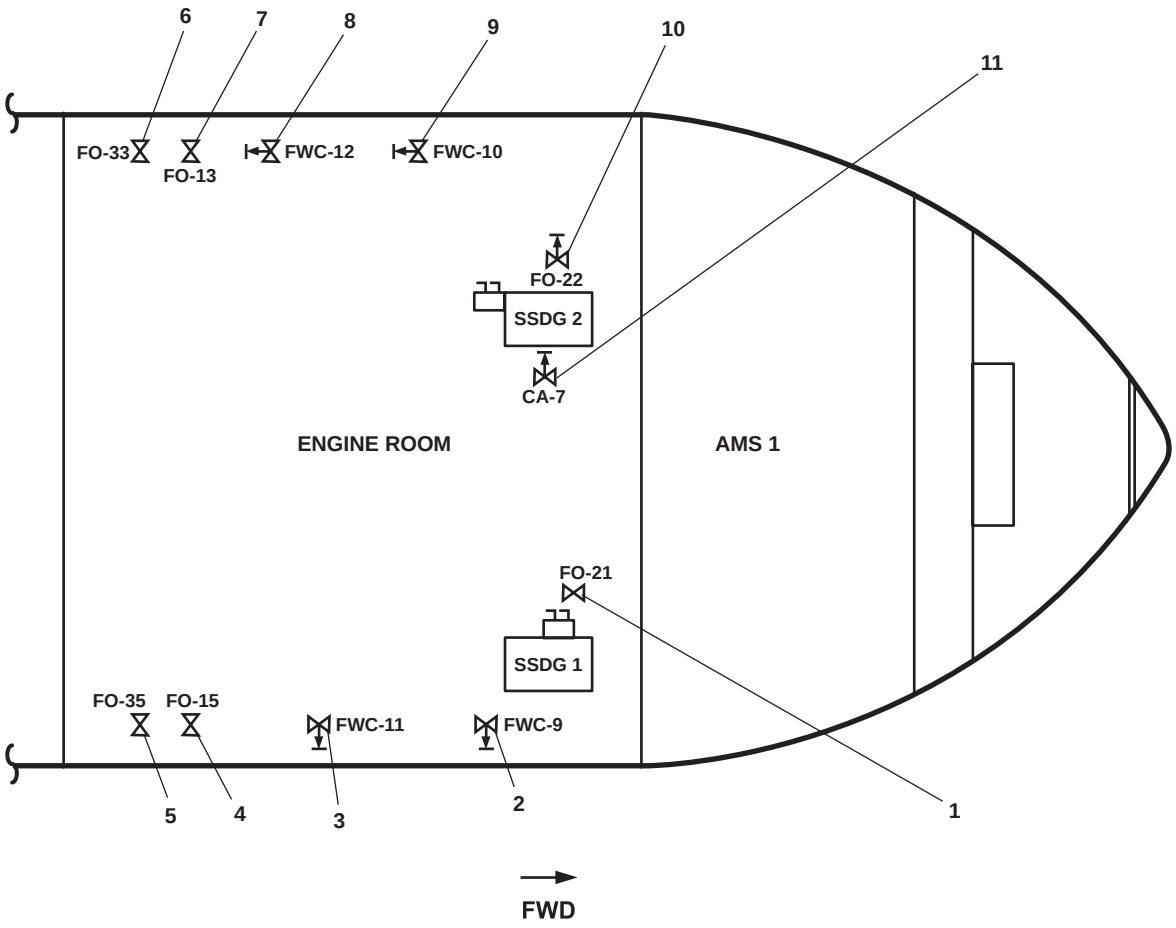


Figure 3. SSDG Valve Locations

END OF WORK PACKAGE

OPERATOR'S MANUAL
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS
FINAL SHUTDOWN

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0110 00
WP 0111 00

FINAL SHUTDOWN

1. Secure the emergency diesel generator (WP 0110 00).
2. Verify that the vessel is operating on shore power (WP 0111 00).
3. Secure the ship's service diesel generators 1 and 2 (WP 0111 00).
4. Verify that all major equipment on the vessel has been properly shut down.
5. Ensure that an external lighting source, such as a flashlight, is available to all personnel onboard the vessel when performing this procedure.
6. Set all circuit breakers and switches to OFF on the panels and switchboards that are listed as follows:
   a. 120V pilothouse emergency distribution panel No. 1 (figure 1), located in the 01 level passageway.

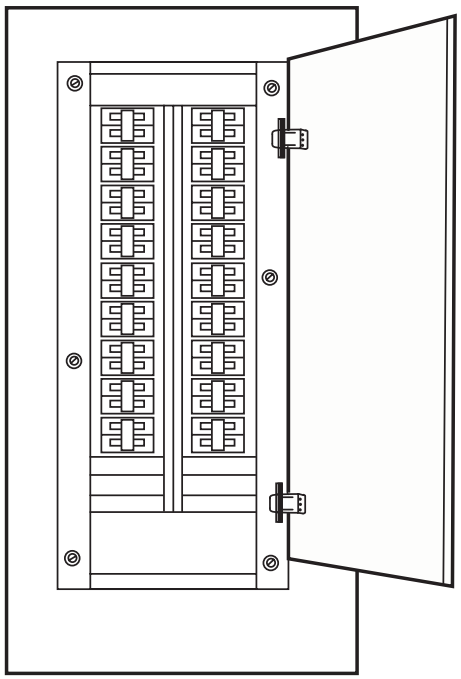


Figure 1. 120V Pilothouse Emergency Distribution Panel No. 1

b. 24V radio room DC electronics distribution panel (figure 2).

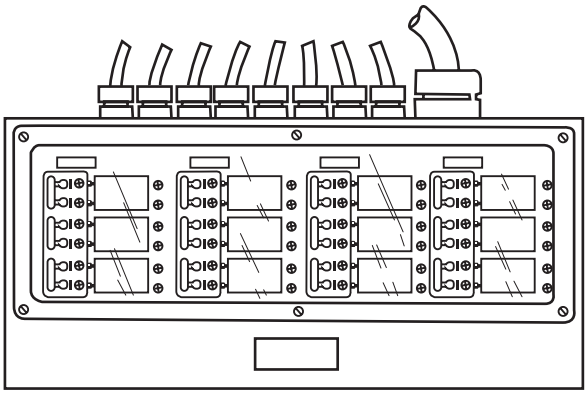


Figure 2. 24V Radio Room DC Electronics Distribution Panel

c. 120V main deck 01 & 02 emergency lighting panel No. 1 (figure 3), located in the crew's mess.

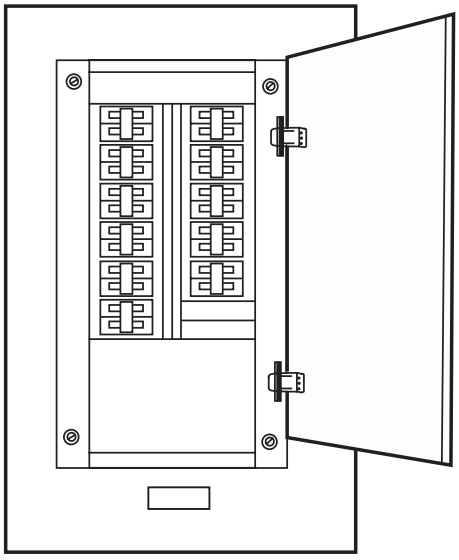


Figure 3. 120V Main Deck 01 & 02 Emergency Lighting Panel No. 1

d. 120V exterior emergency lighting panel No. 2 (figure 4), located aft in the 01 level passageway.

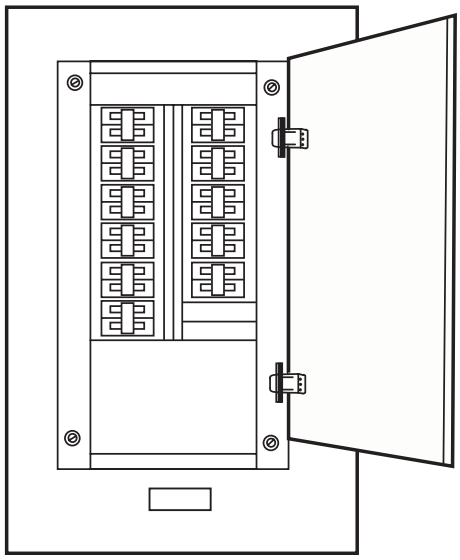


Figure 4. 120V Exterior Emergency Lighting Panel No. 2

e. 120V emergency distribution panel No. 1 (figure 5), located in the engine room on the starboard side.

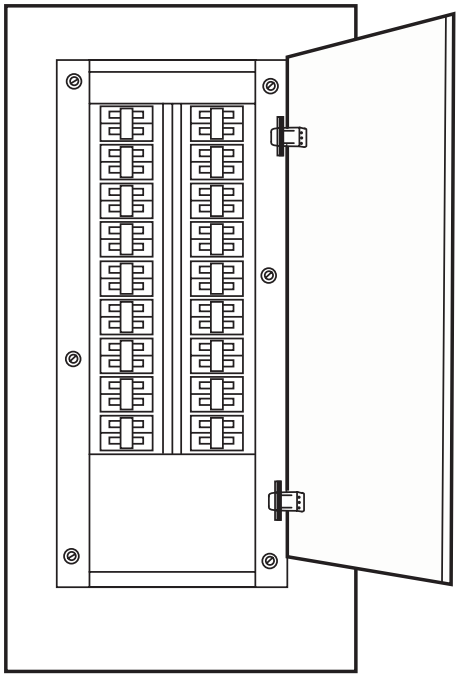


Figure 5. 120V Emergency Distribution Panel No. 1

f. 120V distribution panel No. 2 (figure 6), located in the 01 level vestibule passageway, starboard side.

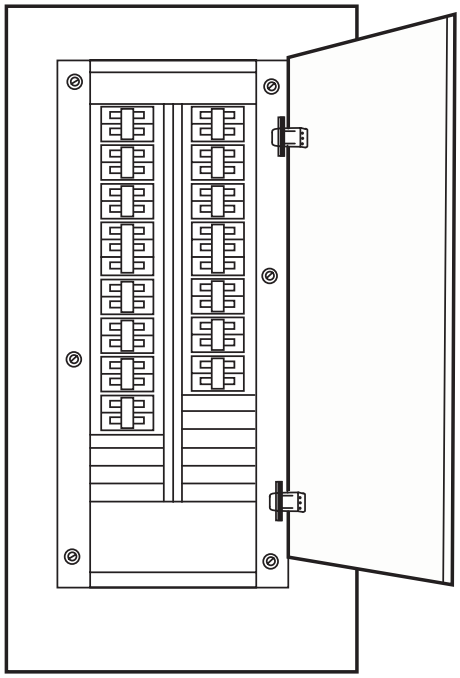


Figure 6. 120V Distribution Panel No. 2

g. 120V distribution panel No. 3 (figure 7), located in the main deck passageway, starboard side.

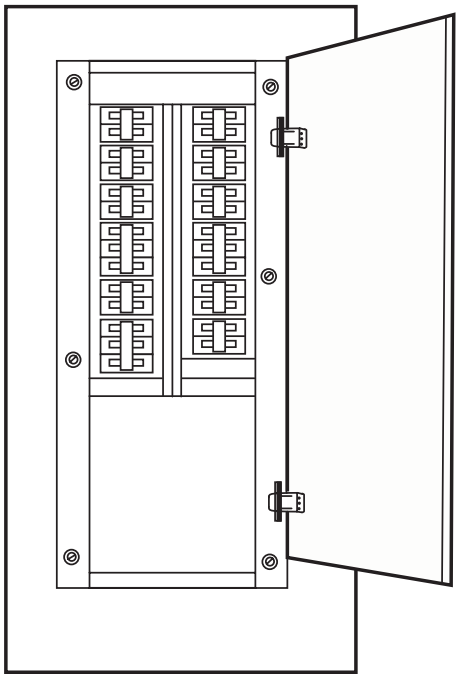


Figure 7. 120V Distribution Panel No. 3

h. 120V distribution panel No. 1 (figure 8), located in the galley.

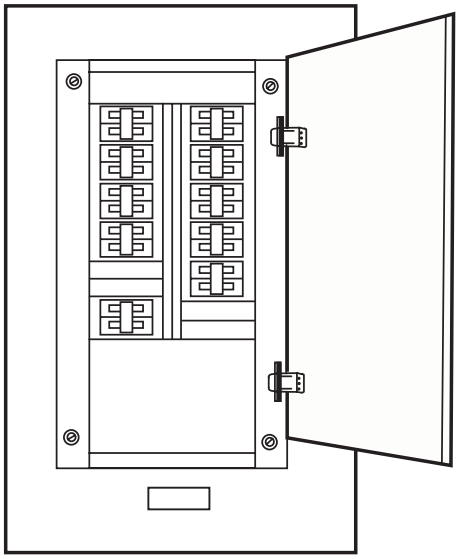


Figure 8. 120V Distribution Panel No. 1

i. 120V distribution panel No. 4 (figure 9), located in the engine room on the aft bulkhead of the EOS.

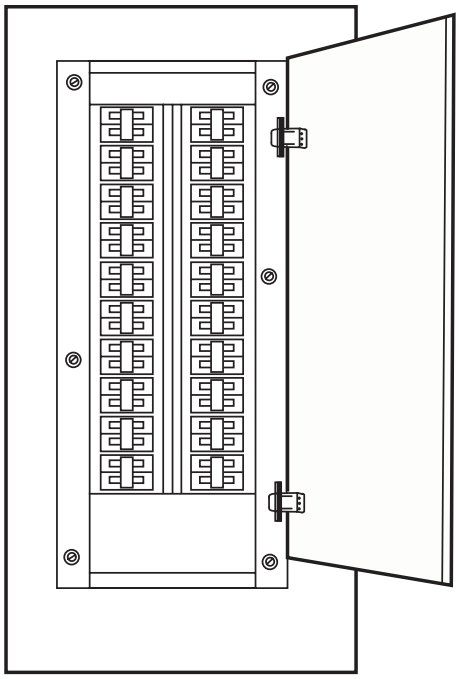


Figure 9. 120V Distribution Panel No. 4

j. 120V emergency distribution panel No. 1 (figure 10), located in the engine room on the aft bulkhead of the EOS.

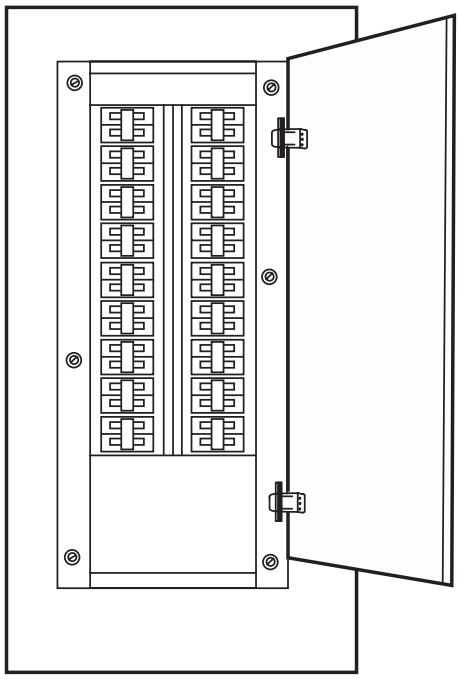


Figure 10. 120V Emergency Distribution Panel No. 1

k. Machinery DC control distribution panel (figure 11), located in the engine room on the aft bulkhead of the EOS.

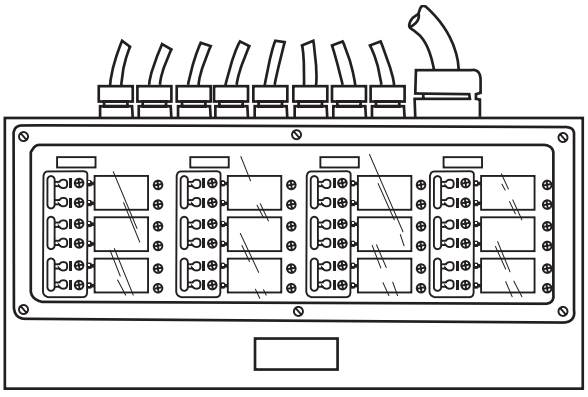


Figure 11. Machinery DC Control Distribution Panel

l. Load center distribution panel (figure 12), located on the aft bulkhead of the EOS.

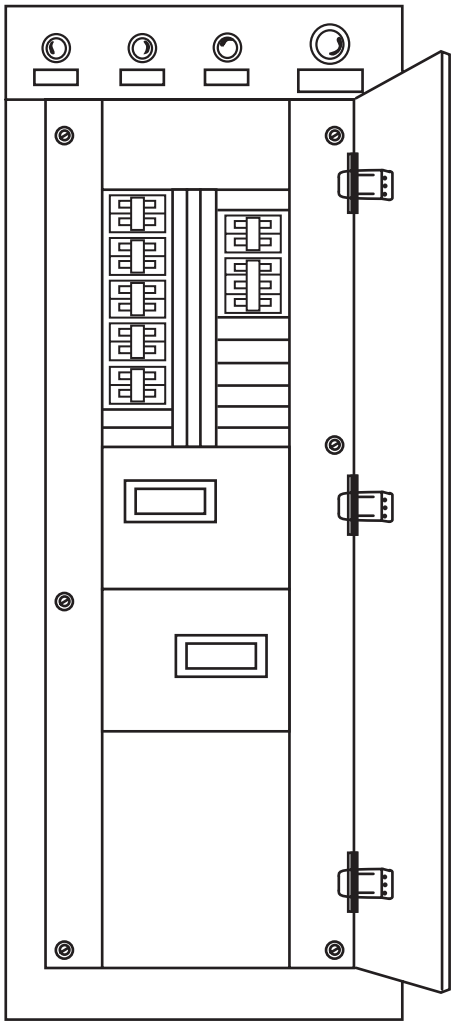


Figure 12. Load Center Distribution Panel

m. 120V emergency load center distribution panel (figure 13), located in the emergency diesel generator room.

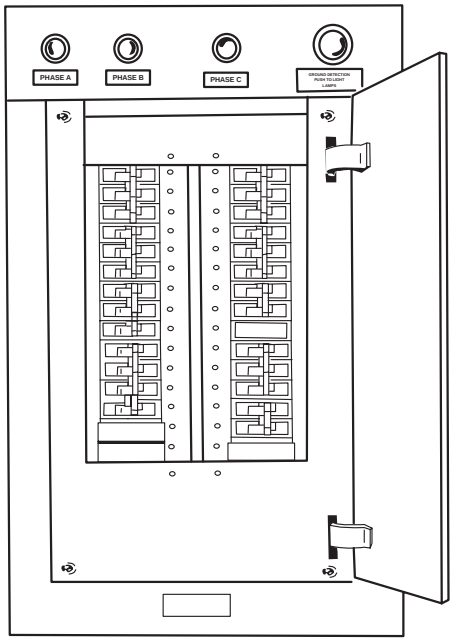


Figure 13. 120V Emergency Load Center Distribution Panel

n. Main switchboard (figure 14) in the EOS.

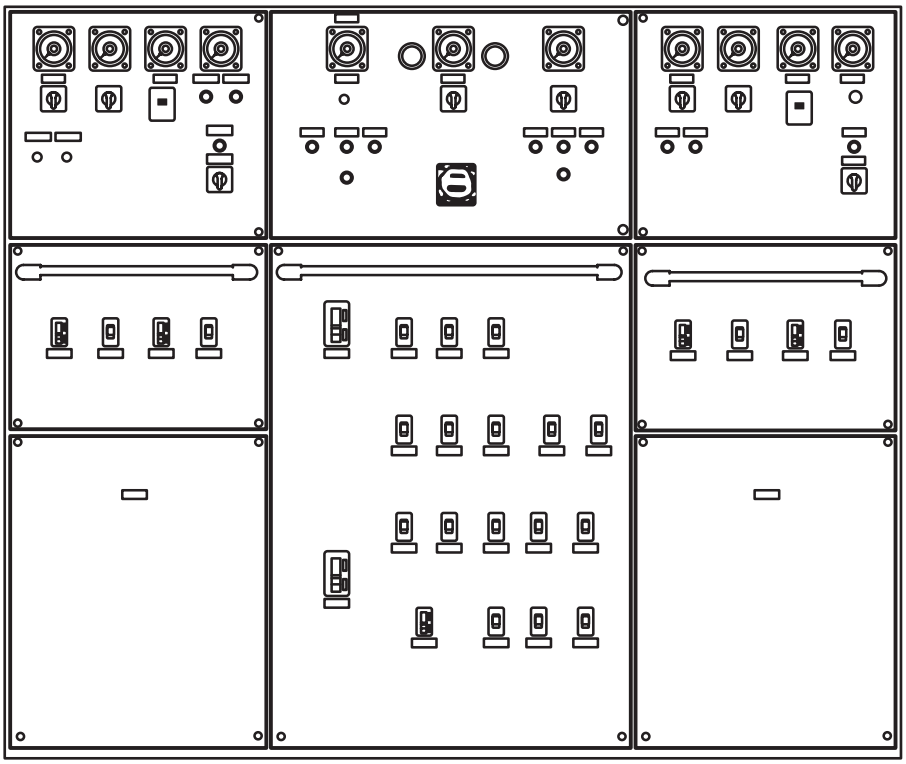


Figure 14. Main Switchboard

o. Emergency switchboard (figure 15), located in the emergency diesel generator room.

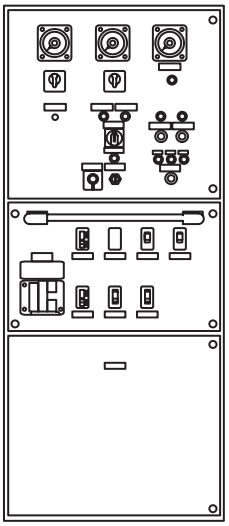


Figure 15. Emergency Switchboard

END OF WORK PACKAGE

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army

0529210

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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: whomever@avma27.army.mil
To: TACOM-TECH-PUBS@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:*** 55-1915-200-10
9. ***Pub Title:*** TM
10. ***Publication Date:*** 11-APR-88
11. ***Change Number:*** 12
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.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: Date form is filled out.

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*

Mailing address found on title block page.

FROM: *(Activity and location) (Include ZIP Code)*

Your mailing address.

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER:	DATE:	TITLE:
TM X-XXXX-XXX-XXX	Date of the TM.	Title of TM.

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)
	0019 00 1	3	1	1		Step No. 2 says to secure doors open with locking bar or hooks from where to what? The bars or hooks are not identified.
	0019 00 4	4	1	1		Step No. 19 states to remove locking bars, pins or hooks from where to what? The bars, pins or hooks are not identified. Where are they stored?

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Doe, John, CPL	755-1313	*CPL John Doe*

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE:

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER:	DATE:	TITLE:
TM X-XXXX-XXX-XXX	Date of the TM.	Title of TM.

PAGE NO.	COLM NO.	LINE NO.	FEDERAL 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.)

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Doe, John, CPL	755-1313	*CPL John Doe*

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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
TM 55-1925-273-10-1		Operator's Manual for Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013 (EIC XAG)

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

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
TM 55-1925-273-10-1		Operator's Manual for Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013 (EIC XAG)

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.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

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
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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

Metric Conversion Factors

Mc x F = Cf		
Measurement to be Converted (Mc)	Factor (F)	Converted Measurement (Cf)
Meters (m)	x 39.37	= Inches (in.)
Meters (m)	x 3.281	= Feet (ft)
Meters (m)	x 1.094	= Yards (yd)
Inches (in.)	x 25.40	= Millimeters (mm)
Inches (in.)	x 2.54	= Centimeters (cm)
Inches (in.)	x 0.0254	= Meters (m)
Inches (in.)	x 25400	= Micrometers (µm)
Feet (ft)	x 0.305	= Meters (m)
Square feet (ft^2)	x 0.093	= Square meters (m^2)
Foot-Pounds	x 1.35582	= Newton meters (N m)
Newton meters (N m)	x 0.73756	= Foot Pounds
Yards (yd)	x 0.914	= Meters (m)
Square yards (yd^2)	x 0.836	= Square meters (m^2)
Square Inches (in^2)	x 6.452	= Square Centimeters (cm^2)
Cubic Inches (in^3)	x 16.39	= Cubic Centimeters (cm^3)
Cubic Centimeters (cm^3)	x 0.061	= Cubic Inches (in^3)
Cubic Feet (ft^3)	x 0.028	= Cubic Meters (cm^3)
Gallons (gal)	x 3.785	= Liters (L)
Liters (L)	x 0.2642	= Gallons (gal)
Kilometers (km)	x 0.5397	= Nautical miles (nmi)
Meters (m)	x 0.0005397	= Nautical miles (nmi)
Nautical miles (nmi)	x 1.853	= Kilometers (km)
Fluid Ounces (oz)	x 29.574	= Milliliters (mL)
Pounds (lb)	x 0.4536	= Kilograms (kg)
Kilograms (kg)	x 2.2046	= Pounds (lb)
Kilopascals (kPa)	x 0.145	= Pounds (lb) per Square Inch (psi)
Pounds per Square Inch (psi)	x 6.895	= Kilopascals (kPa)
Degrees Centigrade (°C)	(°C x 1.8) + 32	= Degrees Fahrenheit (°F)
Degrees Fahrenheit (°F)	(°F-32) ÷ 1.8	= Degrees Centigrade (°C)
Bar	x 14.5	= Pounds per Square Inch (psi)
Pounds per Square Inch (psi)	x 0.06894	= Bar
Horsepower (hp)	x 0.746	= Kilowatt (kW)
Kilowatt (kW)	x 1.341	= Horsepower (hp)

PIN: 082850-000