CHAPTER 4
OPERATING INSTRUCTIONS

Section I
GENERAL

4-1. SCOPE.

This section provides the operator with the equipment combinations employed to effect a given mode of operation. Detailed information on preparation for use, operation, shutdown, emergency procedures and troubleshooting is also covered in this chapter.

4-2. TWR OPERATING MODES.

The Torpedo Weapons Retriever will either be on a mission or tied up at dockside in readiness for a mission excluding down time for any necessary system repairs. These are the two basic operating craft modes.

4-2.1. MISSION MODE. All systems of the craft must be operational for a mission with the exception of the ship-to-shore telephones which are disconnected except when at dockside. The following systems must be functioning properly to propel and control the craft on open water:

1. Electrical power system including diesel generator(s) and power distribution system which supplies power to all systems except the telephones.
2. Propulsion system with exhaust system which drives the craft forward and aft.
3. Steering system which controls craft direction.
4. Bow thruster system which provides additional craft maneuverability side-to-side.
5. Fuel system which supplies fuel to the diesel engines.
6. Sea water system which supplies cooling for diesel engines, exhaust system, stern tubes and air conditioning unit.
7. Lube oil system to serve diesel engine lubrication needs.
8. Anchor handling system to permit dropping and inhaul of the anchors.
9. Controls and instruments to monitor craft handling.

4-2.1.1. The following systems are essential to the safety and comfort of the crew and to vessel safety:

1. Fire extinguishing systems including Halon system which protects the engine room; galley hood fire suppression system which protects the galley; and portable fire extinguishers for general use.
2. Bilge, ballast and firemain system which removes bilge water, adjusts craft trim, and supplies water to firemains.
3. Fresh water system which provides potable water for personnel and torpedo washdown.
4. Sewage system which permits collection and disposal of waste.
5. Heating, ventilation and air condition system which provides necessary supply air and exhaust to machinery and crew space, and heats and cools space as required.
6. Alarm, indicating and control systems to warn personnel of dangerous system operation, and monitors and controls system operation.
7. Navigation lights, searchlights, signal lights, and general illumination.
8. Ship's announcing system, general alarm system and entertainment system.

4-2.1.2. The following systems are primarily for weapons retrieval and material handling:

1. Hydraulic deck crane.
2. Torpedo handling system.
3. Compressed air system (also used for engine room service).

4-2.1.3. The following systems are for navigation and communication purposes:

1. Electronic and electrical navigation equipment.
2. Radio communications equipment.
3. Underwater communications equipment.
4. Sound-powered telephones.

4-2.2. DOCKSIDE MODE. When at dockside, several systems need not be operational since their functions are for craft handling, navigation and communication purposes. The systems which should be operational and serve the same purpose as on a mission are listed below:

1. Electrical power system which may be supported by:
   a. Shore electrical power or
   b. One or both diesel generator(s), depending on the period at dockside.
2. Fuel system.
3. Lube oil system.
4. Sea water system.
5. Fresh water system.
6. Sewage system.
7. Bilge, ballast and firemain system.
8. Heating, ventilation and air conditioning system.
9. Alarm, indicating and control systems.
10. Fire fighting systems.

11. Sound-powered and ship-to-shore telephones.
12. Announcing and general alarm systems.
13. Ship's entertainment system.
14. Hydraulic deck crane (as required).
15. Compressed air system (as required).

4-3. SYSTEM OPERATING MODES.

4-3.1. PROPULSION SYSTEM. Normally operational for missions only. The propulsion system is supported by the operation of the electrical system, fuel system, sea water system, exhaust system, lube oil system, and propulsion controls and instruments. Each propulsion engine drives a separate sea water pump which supplies sea water to cool the engines.

4-3.1.1. On a mission both propulsion engines should be running. If one engine fails, the craft can be operated in an emergency degraded cruise mode. Refer to paragraph 4-85. If the port engine fails, the bow thruster will be inoperable because the hydraulic pump for the bow thruster system is driven off this engine.

4-3.1.2. The propulsion engine(s) can be operated with the marine reduction gear clutch disengaged for testing. No power will be transferred to the propellers.

4-3.2. FUEL SYSTEM. The primary operating mode of the fuel system is to supply fuel to the diesel engines whenever the engines are running on a mission or at dockside. The fuel system has four basic modes of operation: filling, transfer, stripping and normal fuel supply. The first three modes are normally used before a mission to assure craft readiness. On an extended mission, it may be necessary to transfer fuel to the day tanks and fill and strip the fuel tanks.

4-3.3. LUBE OIL SYSTEM. Operation of the lube oil system is performed before a mission to assure craft readiness. It may be necessary to service the diesel engine on an extended cruise mission.

4-3.4. FRESH WATER SYSTEM. The fresh water tanks should be filled before a mission. At dockside the tanks should be checked and replenished as needed to accommodate the needs of the crew. Operation is the same for mission or dockside modes. Electrical power is required to operate the fresh water pump.

4-3.5. BILGE, BALLAST AND FIREMAIN SYSTEM. This system should always be operational in the event of fire aboard the ship and to dispose of bilge water. The craft should be ballasted or deballasted before mission depending on the load to be carried. It may be necessary to adjust ballast during a mission to trim the craft. Electrical power is required to operate the fire pumps.

4-3.6. SEA WATER SYSTEM. One sea water pump is driven from each propulsion engine so engine cooling sea water is provided whenever the engines are running. If only one engine is running, the remaining sea water pump can supply cooling water to the entire engine cooling system using a crossover connection valve. Electrical power is required to operate the separate air conditioning (A/C) sea water pump. As a secondary operating mode, two emergency shore connections are provided in the system to supply water to the engines and the A/C condenser if the pumps are inoperative.

4-3.7. STEERING SYSTEM. The primary steering mode is operated from the helm steering wheel or the steering lever at the auxiliary conning staion as desired. Secondary degraded steering can be accomplished at the helm in the event of hydraulic pump failure or electrical power failure. Refer to paragraph 4-84. Electrical power is required to operate the steering system in the primary mode.

4-3.8. BOW THRUSTER SYSTEM. This system is used with the rudder steering system for craft control and maneuvering. The hydraulic pump in the bow thruster system is driven from the port propulsion engine so this engine must be running to operate the bow thruster system. Electrical power must also be available to operate the system.

4-3.9. DECK CRANE SYSTEM. This system uses a self-contained hydraulic system which is operational when electrical power is supplied to the power unit. The deck crane can be used with the torpedo handling system for weapon retrieval and separately for loading and unloading material from the craft.

4-3.10. TORPEDO HANDLING SYSTEM. The torpedo handling system requires power from the electrical system. The electrical power drives the motor-driven hydraulic pump to supply hydraulic power to drive the hoist winch, transfer winches and the transfer carriage. The system control station is equipped with start-stop buttons for the hydraulic pump motor, controls for the in-haul and transfer winches and the raise, lower and traverse of the transfer carriage.

4-3.11. ANCHOR HANDLING SYSTEM. The basic functions of the windlass are to lower, raise and stow the anchor and handle towing and mooring lines. The anchor handling system consists of the 7-1/2 HP electric motor, a disc brake, a magnetic controller, gypsy heads, the wildcat, and a four-button pushbutton control. Electrical power is required to operate the anchor windlass.

4-3.12. SEWAGE SYSTEM. The purpose of the sewage system is the collection, holding and transfer of sewage on the craft. It is normally operational at all times.

Collection and holding of sewage from water closets and other drains would be considered one mode of operation. The transfer of sewage from tank to shore facility is a second mode of operation. Electrical power is required to operate the sewage discharge pump and the automatic alarm system.

4-3.13. HEATING, VENTILATION AND AIR CONDITIONING SYSTEM. The air conditioning system works in conjunction with the heating and ventilating system. Electrical power and sea water cooling are required to make the system operational. Sea water is supplied from the motor-driven A/C pump. The supply fans and exhaust fans for ventilation and the heaters all require electrical power to operate. The ventilation and heating systems can be operated in a degraded mode due to an individual unit failure if environmental conditions permit.

4-3.14. COMPRESSED AIR SYSTEM. This system requires electrical power to operate. It is used for torpedo handling service, the air horn and engine room service.

4-3.15. FIRE EXTINGUISHING SYSTEMS. The Halon system for the engine room and the galley fire suppression systems are always operational. Electrical power is required for automatic operation in the primary mode. As a secondary mode of operation, manual release of the fire fighting agents can be accomplished for both systems.

4-3.16. ELECTRICAL POWER SYSTEM. The electrical power system has primary and secondary modes of operation.

4-3.16.1. In the primary operating mode for the electrical system the diesel generators are used to supply power. One diesel generator can be used or both diesel generators used in parallel as controlled by the main electric plant control panel. Sea water must be supplied to the diesel generators to operate. On mission the cooling water is supplied from the sea water pumps which are driven from the propulsion engines. At dockside the cooling sea water can be supplied from a shore based pump as an alternative. A valved connection in the sea water piping permits connection to the shore based pump.

4-3.16.2. In the secondary operating mode, electrical power is supplied from shore power facilities to the shore power connection on the craft. Electrical power is controlled at the electric plant control panel. Power from the diesel generator(s) cannot be electrically connected to the control panel if shore power is used. In this mode, sea water for cooling is not required unless the diesel engines are being run for purposes other than supplying power to the craft.

4-3.17. NAVIGATION SYSTEMS. The navigation systems are normally used for missions only. Electrical power is required to operate the navigation equipment.

4-3.18. COMMUNICATION SYSTEMS. The general alarm and announcing systems are normally operational at all times as well as the sound-powered telephones and ship's entertainment system. The other communication systems are normally used for missions only, except for the ship-to-shore telephone system which must be disconnected for a mission. The radio equipment is then used for ship-to-shore communications. Electrical power is required to operate all communication systems except the telephones.

4-3.19. ALARM, MONITORING AND CONTROL SYSTEMS. These systems should be operational at all times. The control systems may not actually be in use when the related equipment is not operational but are in readiness. Electrical power is required to operate alarm, monitoring and control systems.

Section II
PREPARATION FOR USE

4-4. PREOPERATIONAL CONDITIONS.

This section contains the specific preoperational conditions presumed to be in effect prior to component, system or craft operation. Each system will be covered in general and will be followed by a specific checklist of items that must be verified before operation. References will be given to specific onboard Technical Services Manuals where necessary.

4-5. ELECTRICAL POWER DISTRIBUTION SYSTEM PREOPERATION CONDITIONS.

It is presumed that either shore power is being supplied to the craft or at least one diesel engine driven generator is operating onboard so lighting is available to perform system checks. Refer to Table 4-1.

NOTE

The electric plant control panel P400 is designed for both generators to operate in parallel with each other, but not with shore power. The input power circuit breakers are mechanically interlocked to prevent either generator breaker from being closed while the shore power circuit breaker is closed.

4-6. FUEL SYSTEM PREOPERATIONAL CONDITIONS.

The fuel system shall be checked to be sure all components are operable. See Table 4-2.

4-7. SEA WATER COOLING SYSTEM PREOPERATIONAL CONDITIONS.

The sea water cooling system, cools the engines and also supplies cooling for the air conditioning condenser/compressor and the exhaust system for all engines. This system should be checked for proper water flow to the components it supplies. Refer to Table 4-3 for checklist.

4-8. PROPULSION SYSTEM PREOPERATIONAL CONDITIONS.

Before operation of the propulsion engines, a thorough check of the engines, controls, cooling system, fuel system and the diesel generator engines must be accomplished. Refer to Table 4-4 for detailed checks.

4-9. LUBE SYSTEM PREOPERATIONAL CONDITIONS.

The lube system and components must be checked to be sure all components are operational, that system is filled and that portable unit is available. Refer to Table 4-5 for specific checks.

4-10. FRESH WATER SYSTEM PREOPERATIONAL CONDITIONS.

The fresh water system must be thoroughly checked before the craft leaves on a mission. All tanks and system components must be operable and filled as required. Refer to Table 4-6 for specific checklist.

Table 4-1. Electrical Power System Checklist

1. Check diesel engine starting batteries for adequate charge. Specific gravity of battery electrolyte should be between 1.230 (75% charge) and 1.280 (full charge) as measured with a hydrometer.
2. Make a walk-around check of the diesel engine and generator for loose or damaged parts, components and connections and evidence of leakage.
3. Check diesel engine crankcase oil level. Oil level must be between the ADD and FULL marks on the dipstick. Add oil if necessary.
4. Check the diesel engine jacket coolant level. The coolant level must be at the base of the fill pipe with the engine cold.
5. Check the fuel system. Refer to Table 4-2.
6. Check the sea water system. Refer to Table 4-3.
7. Check to be sure all low voltage shut-off devices (total 16) have been reset.
8. Check all circuit breakers (total of 91) from the power buses for tripped condition which would indicate prior malfunction. Refer to Section 3 of this chapter for circuit breaker data. Any defect in the electrical power distribution system must be corrected before operation.

Table 4-2. Fuel System Checklist

NOTE: Strip tank sumps of all water daily before running engine and before filling tanks. Valves at tank must be kept closed at all times when not in use.

1. Perform all necessary periodic maintenance. Refer to Table 6-1.
2. Check fuel level in all tanks. Fill or transfer fuel, as necessary. Refer to paragraph 4-36.2.
3. Check to be sure fuel supply valves (2, Figure 2-32) at day tanks are open. Emergency fuel shut-off T-handles on main deck, 17 inches forward of frame 23, must be fully in.
4. Open supply valves (30 and 47, Figure 2-32) at engines.
5. Check for air in the fuel system and prime if necessary.
6. Check fuel shut-off T-handles on pilothouse console (Figure 2-6) and at access to engine room (Figure 1-54) to be sure handles are fully in.
7. Check valves (23 and 26, Figure 2-32) at water separator to be sure they are open.
8. Strip day tanks until sight gage shows no water content. Refer to paragraph 4-36.3.

Table 4-3. Sea Water Cooling Checklist

1. Vent the air from the sea water suction line. Suction line must be filled with water to allow the pump to prime. Refer to diesel generator engine technical service manual for pump priming information.
2. Inspect sea water strainers and remove debris if present.
3. Check for electrical power to the system.
4. Be sure supply valves, discharge valves, crossover valve, vent valves and in-line valves are open to all components. Bypass valves are normally closed (Figure 2-32).
5. Check engine mounted sea water pumps for proper operation after propulsion engines are running. Observe overboard discharge.
6. Check for proper operation of A/C sea water pump in engine room by checking overboard discharge.
7. Check for leakage in the system and repair if necessary.

Table 4-4. Propulsion System Checklist

1. Perform all necessary periodic maintenance. Refer to Table 6-1.
2. Be sure required lubrication has been performed. Refer to Tables 6-2 and 6-3.
3. Perform all fuel system preoperational checks. Refer to paragraph 4-5.
4. Check movement of control levers at pilothouse and auxiliary conning station (Figures 2-2 and 2-6). Place levers in neutral position.
5. Check to be sure clutch disconnect T-handles (Figure 2-6) are fully in.
6. Check to be sure electrical power is supplied to the craft.

Table 4-5. Lube System Checklist

1. Check level gages on lube stowage tank to be sure tank is full. Fill if necessary and secure fill connection. Refer to paragraph 4-37.1.
2. Check dirty oil tank to be sure it is empty. Refer to paragraph 4-37.3. for discharge procedure.
3. If dirty oil tank is empty, crank discharge pump to be sure it is operational.
4. Check to be sure grease gun, FLOCS unit and portable service container are on board and stowed properly.
5. Check system for leakage.

Table 4-6. Fresh Water System Checklist

1. Check both potable water stowage tanks to be sure tanks are filled. Fill if necessary and secure fill connections. Refer to paragraph 4-45.1.
2. Be sure supply valves to hot potable water system and all cold potable water outlets are open (Figure 2-33).
3. Check complete system for leakage.
4. Check for electrical power to water pump, hot water heater and booster heater.
5. Check pressure set to be sure system is properly pressurized.

4-11. BILGE, BALLAST AND FIREMAIN PREOPERATIONAL CONDITIONS.

Two 100 GPM pumps are required to control the functions of the bilge, ballast and firemain systems. Refer to Table 4-7 for specific checklist.

4-12. STEERING SYSTEM PREOPERATIONAL CONDITIONS.

The steering system must be thoroughly checked to be sure all components are functioning properly. The checks will include the pilothouse components, the auxiliary conning station components and the components located in the lazarette. Refer to Table 4-8 for specific checklist.

4-13. BOW THRUSTER SYSTEM PREOPERATIONAL CONDITIONS.

The bow thruster system interfaces with the steering system to allow additional maneuverability to the craft. All components must be checked to assure availability of the system when necessary. Refer to Table 4-9 for checklist.

4-14. CRANE PREOPERATIONAL CONDITIONS.

The crane and all its components must be thoroughly checked before starting and operating the unit. Refer to Table 4-10 for checklist.

4-15. TORPEDO HANDLING SYSTEM PREOPERATIONAL CONDITIONS.

Preoperational conditions for the torpedo handling system involve checks for electric power, air supply and water supply as well as all system component checks. Refer to Table 4-11 for checklist.

4-16. ANCHOR HANDLING PREOPERATIONAL CONDITIONS.

The anchor handling procedure is accomplished at the push button station on the main deck and should be checked for proper operation before a mission. Refer to Table 4-12 for checklist.

4-17. SEWAGE SYSTEM PREOPERATIONAL CONDITIONS.

The sewage system components must be thoroughly checked to be sure holding, suction, evacuation and aeration functions of the system are operational. Refer to Table 4-13 for checklist.

Table 4-7. Bilge, Ballast and Firemain Checklist

1. Check that all bilge and ballast system valves (Figures 2-35 and 2-36) at the manifolds are operational.
2. Check remote-controlled valves for ballast and bilge to be sure they are operable (Figures 2-35 and 2-36).
3. Open overboard discharge valves (Figures 2-35 and 2-36).
4. Check supply valves to fire stations to be sure they are open and operable (Figure 2-34).
5. Check fire stations to be sure all equipment is in position and operational.
6. Check to be sure power is supplied to the fire pumps motor controller. Operate pumps briefly to be sure that pumps are working. Refer to paragraph 4-43.
7. Check operation of sump pump by briefly (5 seconds) pressing restart lever on vacuum switch.

Table 4-8. Steering System Checklist

1. Check for electrical power to system.
2. Start up steering system (refer to paragraph 4-46) and operate at helm steering wheel. Check rudder movement at the helm rudder angle indicator.
3. Operate steering system at auxiliary conning station using steering lever. Check rudder movement at the rudder angle indicator on the auxiliary conning station.
4. Rudder movement should be smooth and steady. If it is not, inspect mechanical linkage to rudder stocks and/or hydraulic system for malfunction and repair.

Table 4-9. Bow Thruster System Checklist

1. Check bow thruster reservoir for proper level. Fill if necessary.
2. Check for electrical power to system.
3. Be sure isolation valves (2, 5, 11 and 19, Figure 2-39) are open.

CAUTION

Operate bow thruster carefully and slowly to prevent accidental damage to the craft at dockside. Otherwise test controls after the craft is clear and underway.

4. Start and operate system (refer to paragraph 4-38). Check pressure at gage. Check for operation of controls in pilothouse and at auxiliary conning station if possible.

Table 4-10. Crane Checklist

1. Make sure that the unit has been properly lubricated and serviced. Refer to Tables 6-2 and 6-3.
2. Check to be sure electrical power is being supplied to the crane motor controller.
3. Make sure that pump inlet valve is open. This valve is on the power unit; it is open when the handle is parallel to the valve body.
4. Make sure that control valve handles are in neutral position.
5. Check all guards and covers.
6. Be sure that boom is not lashed down.
7. Inspect wire rope to be sure it is not frayed or damaged.
8. Check that crane work area is clear of personnel and equipment.
9. Turn on electrical power at the controller.

Table 4-11. Torpedo Handling System Checklist

1. Check level in torpedo handling reservoir. Refer to Tables 6-2 and 6-3.
2. Open water supply valves (Figure 3-9) to washdown system on main deck and deluge shower and wash basin.
3. Open air supply valves (1, Figure 2-17) to torpedo ramp connection.
4. Check for electrical power to the system.
5. Operate each of the control handles at winch control station (Figure 3-17) to check that the in-haul winch, transfer winches and transfer carriage are all working properly. Return control handles to neutral position.
6. Check to be sure all bridles and straps are stowed in their proper place.

Table 4-12. Anchor Handling Checklist

1. Perform all necessary periodic maintenance. Refer to Table 6-1.
2. Check for electrical power to anchor windlass controller.
3. Turn handwheel in clockwise direction to be sure hand brake is set.
4. Operate the anchor windlass (refer to paragraph 4-47) to payout and inhaul a small amount of chain and check operation.
5. Secure anchors after operation check.

Table 4-13. Sewage System Checklist

1. Check for electrical power to sewage control panel and remote alarm indicators.
2. Check to be sure sewage tank drain is closed.
3. Check that sewage discharge valve (5, Figure 2-16) is closed.
4. Check that isolation valves (12) are open.
5. Check water closets (14 and 15) for proper flushing.
6. Test system. See onboard Technical Service Manual S9593-BP-MMC-010.

4-18. HEATING, VENTILATION, AIR CONDITIONING PREOPERATIONAL CONDITIONS.

These systems interface due to the air handling system which supplies air through the same ducting to heat, cool or ventilate spaces on the craft. Check all components in these systems to be sure they are operational. Refer to Table 4-14 for checklist.

4-19. COMPRESSED AIR SYSTEM PREOPERATIONAL CONDITIONS.

The compressed air system supplies compressed air to the navigation horn, torpedo ramp on the main deck, the workbench in the engine room and for blow-down of the sea chests. Refer to Table 4-15 for checklist.

4-20. FIRE FIGHTING SYSTEMS PREOPERATIONAL CONDITIONS.

The Halon system must be checked to be sure all components in the system are operational and that system will operate on command. Refer to Table 4-16 for checklist.

4-21. NAVIGATION AND COMMUNICATION SYSTEMS PREOPERATIONAL CONDITIONS.

All electronic and electrical navigation equipment and lights and communications equipment shall be checked before operation. Refer to Table 4-17 for checklist.

Shore power or diesel generator power must be available and applicable distribution panel circuit breakers must be "ON" to check out readiness.

4-22. ALARM AND INDICATING SYSTEMS PREOPERATIONAL CONDITIONS.

All alarm and indicating systems shall be checked before operation. Refer to Table 4-18 for checklist.

Table 4-14. Heating, Ventilation and Air Conditioning Checklist

1. Check to be sure electrical power is being supplied to the air handler, air conditioning plant, heaters and fans.
2. Open sea water cooling supply valves (47, Figure 2-37) to compressor/condenser.
3. Be sure receiver outlet valve and compressor suction and discharge valve are open (Figure 2-43).
4. Turn on exhaust fans in lazarette, pump room, bow thruster space, electrical equipment room and galley to be sure fans are operating (moving air).
5. Turn on all duct heaters, space heaters and convection heaters to be sure heaters are operating and providing heat.
6. Turn on defroster in pilothouse to check operation.
7. Check that all dampers are open to spaces.
8. Inspect and clean, if necessary, all natural air supply screens and louvers.
9. Check all diffusers to be sure air supply is entering spaces.

Table 4-15. Compressed Air System Checklist

1. Check for electrical power to air compressor motor controller. Start air compressor.
2. Check to be sure all manual supply valves (Figure 2-17) are open.
3. Check pressure gage at compressor (Figure 4-10). Pressure should be 120 to 150 PSI.
4. Check pressure gage in pilothouse (Figure 4-11). Pressure should be 120 to 150 PSI. Test horn for proper operation.
5. Check pressure gage in engine room (Figure 4-12). Pressure should be 25 PSI.
6. Check for compressed air at engine room service valves.

Table 4-16. Halon System Checklist

1. Check cylinders to be sure they are full.
2. Check handles on cylinder assemblies to be sure they are in the ON position.
3. Check for electrical power to control panel in pilothouse.
4. Test system. See onboard Technical Service Manual S9555-BH-MMC-010.

Table 4-17. Navigation and Communication Systems Checklist

1. Battery Charging Rectifier. Refer to onboard Equipment Manual NAVSEA SG270-AY-MMC-010 for operation.
2. Loran "C" NAV-XL Set. Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 for operation.
3. Satellite Navigation Set MX5102. Refer to onboard Equipment Manual NAVSEA SE174-AA-MMC-010 for operation.
4. Position Plotting Table Model 4080. Refer to onboard Equipment Manual NAVSEA SE171-AD-MMC-010 for operation.
5. Automatic Direction Finder Model FD-171-ADF. Refer to onboard Equipment Manual NAVSEA SE176-AB-MMC-010 for operation.
6. Depth Indicator Set Model F-360-D. Refer to onboard Equipment Manual NAVSEA SE360-AP-MMC-010 for operation.
7. Gyrocompass Mark 27 Mod I. Refer to onboard Equipment Manual NAVSEA 0924-038-1010 for operation.
8. Underwater Log System Model 3200. Refer to onboard Equipment Manual NAVSEA SE350-AA-EIM-010 for operation.
9. Radar Set. Refer to onboard Equipment Manual NAVSEA SE211-AB-MMA-010 for operation of the Model KAAR LN-66 Radar Unit and Manual NAVSEA SE211-AB-MMC-010 for the True Bearing Unit.
10. Navigation Lights. Operate from the navigation lighting panel to be sure all lights can be lighted. Refer to onboard Equipment Manual NAVSEA S9422-AH-MMC-010 for operation of the panel.
11. Announcing System. Refer to onboard Equipment Manual NAVSEA SE101-AP-MMC-010 for operation.
12. Portable Megaphone. Check operation of battery operated unit.
13. Ship's Entertainment Radios. Refer to onboard Equipment Manual NAVSEA SE101-AN-MMC-010 for operation.
14. UHF Radio Set AN/ARC-159. Refer to onboard Equipment Manual NAVSEA NA16-30-ARC-1594 for operation.
15. HF/VHF Radio Set AN/URC-94. Refer to onboard Equipment Manuals NAVSEA EE100-EA-OMP-010, NAVSEA 100-EA-OMP-020, and NAVSEA 100-EB-OMP-010 for operation.
16. VHF FM Radio Telephone. Refer to onboard Equipment Manual NAVSEA SE150-AV-MME-010 for operation.
17. VHF FM Receiver. Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 for operation.
18. Antenna System. Inspect all antennas for security of mounting and correct connections to applicable equipment.
19. Sonar Unit. Refer to onboard Equipment Manual NAVSEA 0965-LP-490-1640 for operation.
20. Telephone System. Refer to onboard Equipment Manual NAVSEA SE165-AR-MMO-01A for operation.

Table 4-18. Alarm and Indicating Systems Checklist

1. Pilothouse Alarm Panel and Engine Room Remote Alarm Panel. Refer to onboard Equipment Manual NAVSEA SE168-AK-MMC-010 for operation.
2. General Alarm Systems. Check out in conjunction with announcing system check.
3. Sewage Holding Tank Alarm. Check out in conjunction with sewage system check.
4. Bow Thruster Control Panels. Check out in conjunction with bow thruster check.
5. Tachometers. Check out with propulsion engine operation.
6. Rudder Angle Indicator. Check out in conjunction with steering system.
7. Diesel Engine Gage Boards. Check out in conjunction with diesel engine operation.
8. Air Conditioning Unit Gage Board. Check out in conjunction with air conditioning unit operation.

Section III
OPERATION

4-23. OPERATIONAL PROCEDURES.

This section covers the duties of system and craft operators in terms of general responsibility and the step-by-step procedures for operating the systems and craft in all primary modes. Reference is made to illustrations in other chapters in this manual.

4-24. STARTING PROPULSION ENGINES.

The propulsion engines are normally started from the helm control console in the pilothouse. Starting can also be accomplished from the auxiliary conning station or the engine room. During starting procedure from any one of these stations monitoring of the gage panel in the engine room is required (Figure 2-12).

4-24.1. HELM CONSOLE AND AUXILIARY CONNING STATION STARTING. The engine START-STOP buttons, the main engine control head and the engine tachometer for the port and starboard engines are located on the helm console and the auxiliary conning station (Figures 2-2 and 2-6).

WARNING

Make sure no one is working on, or close to the engine or engine driven components before starting.

To start the engine proceed as follows:

1. Place the engine control handles in the neutral position.
2. Press the starter button for the engine to be started.
3. Allow engine to idle for three to five minutes or until water temperature gage has begun to rise.
4. Do not apply load to the engine or increase engine speed until oil pressure gage indicates normal.
5. Operate engine at low speed until all systems reach operating temperatures. Check all gages during warmup period to be sure operating temperatures and pressure readings are within the normal range.
6. Check marine (reduction) gear oil level with engines in low idle with the marine gear engaged.

4-24-2. ENGINE ROOM STARTING. The engines can be started from the local controls on the engine. Refer to onboard Technical Service Manual for starting procedure.

4-25. OPERATING PROPULSION ENGINES.

The marine transmission selector valve is usually operated from the pilothouse but it can be manually operated from the engine room if necessary.

To get underway after the engine has started and is warm proceed as follows:

1. Fully engage the control handle in the desired direction of travel. The handle is moved to either the FWD or REV position which is identified by a detent feel at 30 degrees from the vertical.

NOTE

Additional movement from the vertical position causes a proportional movement of the throttle lever.

2. Allow complete engagement of the clutch and gradually increase engine speed as required.

NOTE

Full speed is approximately at the horizontal position.

4-26. CRAFT HANDLING.

4-26.1. REVERSING DIRECTION. To reverse change direction from forward to reverse or reverse to forward when traveling or docking, stop at least two seconds in the NEUTRAL position to allow the propeller to stop turning.

CAUTION

A direct through-shift will cause severe shock loads to the engine, marine transmission and hull. It may also cause the engine to reverse its rotation causing oil to be pulled from the bearings which will result in severe damage.

To reverse direction proceed as follows:

1. Reduce engine speed to low idle.
2. Move control handle to NEUTRAL position and wait for propeller to stop turning.
3. Move control lever to engaged position. To prevent propeller stalling or reversing of engine rotation, gradually increase engine speed as clutch is engaged.
4. Wait a short time to allow complete engagement of clutch and gradually increase speed as necessary.

4-26.2. STOPPING CRAFT WITHOUT ENGINE SHUTDOWN. For a temporary stop of the craft during which time the engine continues to run proceed as follows:

1. Reduce speed to low idle (600 RPM).
2. Shift control lever to NEUTRAL if water current conditions permit.
3. Maintain engine speed at no more than half engine speed (900 RPM).

2. Post a lookout armed with a rifle, if necessary, to act as a shark watch in the event the swimmer is endangered.
3. In high seas it may be necessary for a swimmer to capture the weapon and lead it to the ramp. Under these conditions a line must be attached to the swimmer and tended by a backup man.
4. Engines must be shut down before swimmer enters the water.
5. After the swimmer leads the weapon to the ramp he must attach a nose hook or nose cage to the weapon for in-hauling. The swimmer should then return onboard the craft.
6. Start up the propulsion engines and proceed forward slowly to trail the weapon astern.
7. The weapon should be in-hauled slowly using the winch to position the weapon at the ramp end. To in-haul the weapon without damage requires coordination between the winch operator and the weapon handling crew.
8. When weapon is on the ramp secure with straps immediately and post-run procedures should be instituted. Refer to NAVSEA OD13104 for torpedo post-run procedures.
9. After post-run procedures are completed straps should be removed and the torpedo should be winched on deck. Movement to its final stowage position will then be accomplished using the transfer winch and carriage as necessary. Refer to paragraph 4-30 for proper procedures.

4-30. TORPEDO HANDLING. (Figure 4-1.)

Torpedo handling on the craft requires operation of the in-haul winch, the transfer winches and the transfer carriage (Figure 4-1). A console located on the main deck aft of the deckhouse allows the operator to control all torpedo handling from one position. To prepare for in-haul refer to paragraph 4-29 for recovery procedures. The torpedo handling power unit is located in the bow thruster area at frame 6, starboard side of the craft. The pressure gage (Figure 4-2) is located above the unit. Normal operating discharge pressure range for the torpedo handling power unit is 50 PSI to 2200 PSI.

4-30.1. IN-HAUL PROCEDURE. The in-haul winch is fitted with a drum containing 200 feet of 5/16-inch diameter cable. A snap shackle with a swivel eye is spliced to the free end of the cable for attachment to the torpedo for in-haul. To operate the in-haul winch proceed as follows:

1. Press the start button located on the winch control console to activate the hydraulic pump motor.

NOTE

Normal operating pressure range for the torpedo handling system is 50 PSI to 2200 PSI.

2. Pay-out winch cable by moving the control handle (1, Figure 3-17) at the winch console forward. Moving the handle further in the forward position increases the drum speed.
3. Attach the cable to the torpedo cage and carefully haul the torpedo into the ramp area. This procedure requires the winch operator and the handling crew members to prevent damage to the weapon and the craft.

NOTE

Do not remove winch cable during post-run procedures.

4. Install straps to secure weapon on ramp rollers and perform post-run procedures as necessary.
5. Remove securing straps and winch torpedo on deck.
6. Refer to paragraph 4-30.2 and transfer weapon to stowage position, secure and perform the remainder of retriever post-run functions.

4-30.2. TRANSFER AND STOWAGE. Transfer and stowage of the torpedo requires the use of the transfer winches and the transfer carriage. This system allows movement forward and aft as well as beam to beam. The transfer winches and transfer carriage are controlled from the winch control console on the main deck. Movement of the weapon requires the operator at the console and the weapons handling crew working together to prevent damage to the craft as well as the torpedo. To transfer and stow the torpedo proceed as follows:

WARNING

Extreme caution must be used during movement of torpedoes to prevent injury to personnel.

NOTE

Normal operating pressure range for the torpedo handling system is 50 PSI to 2200 PSI.

1. Using control lever (4, Figure 3-17) at winch console position transfer carriage directly under torpedo.
2. Lift transfer carriage track by pushing control lever (5) forward until rollers of transfer carriage are supporting the torpedo. Secure torpedo to transfer carriage rollers.
3. Raise transfer carriage track all the way up.
4. Using control lever (4) transfer torpedo to port side so that it is positioned above deck rollers.
5. Remove track lock and lower transfer carriage track. Check to be sure the weapon is positioned properly on the deck rollers. Remove straps and lower track completely.
6. Install snatch blocks in position forward and aft of torpedo and hook transfer winch cable to front and rear of torpedo.

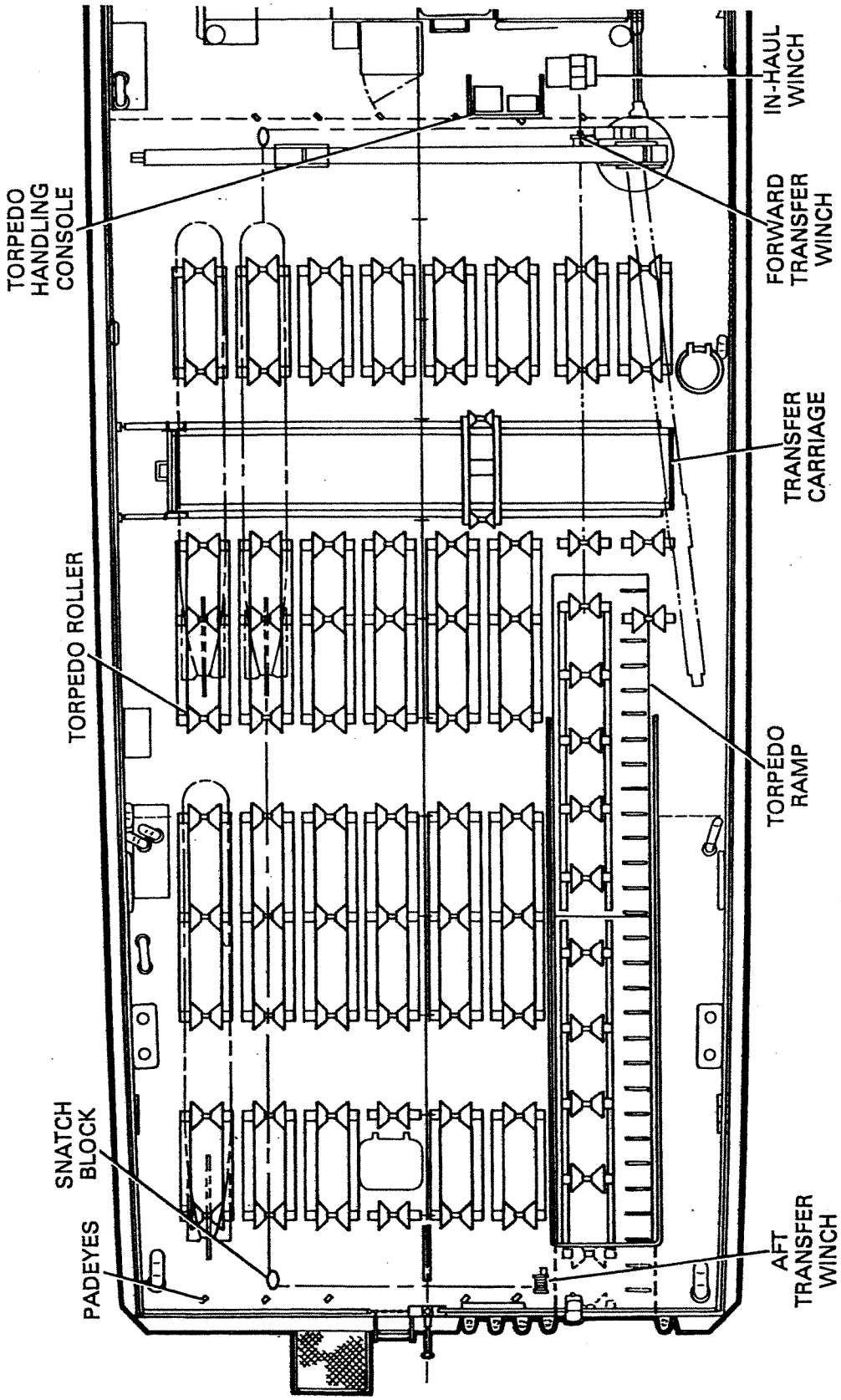


Figure 4-1. Torpedo Handling Components

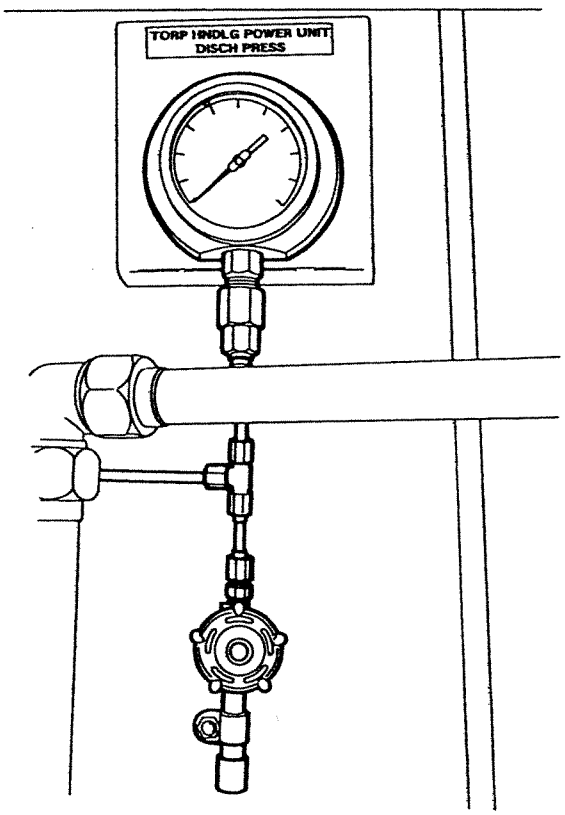


Figure 4-2. Torpedo Handling Power Unit Discharge Pressure Gage (Frame 6, Starboard, Bow Thruster Space)

7. Using winch control levers (2 or 3) carefully winch torpedo to its stowage position. Install preventer bridles to keep torpedo in position and remove winch cables.

4-31. CRANE OPERATION.

The crane mounted on the weather deck starboard side aft of frame 16 is rated at 4000 pounds at 25 feet maximum boom length. The crane is capable of 360 degree rotation and will operate at full capacity at a permanent list of 15 degrees. For complete operational procedures refer to onboard Technical Service Manual SG811-AA-MMC-010.

WARNING

Be sure personnel are clear of work area before operating the crane.

NOTE

Instruction plates are provided covering operating procedures, however these plates are not intended to replace the onboard manual.

4-32. STARTING DIESEL GENERATOR ENGINES.

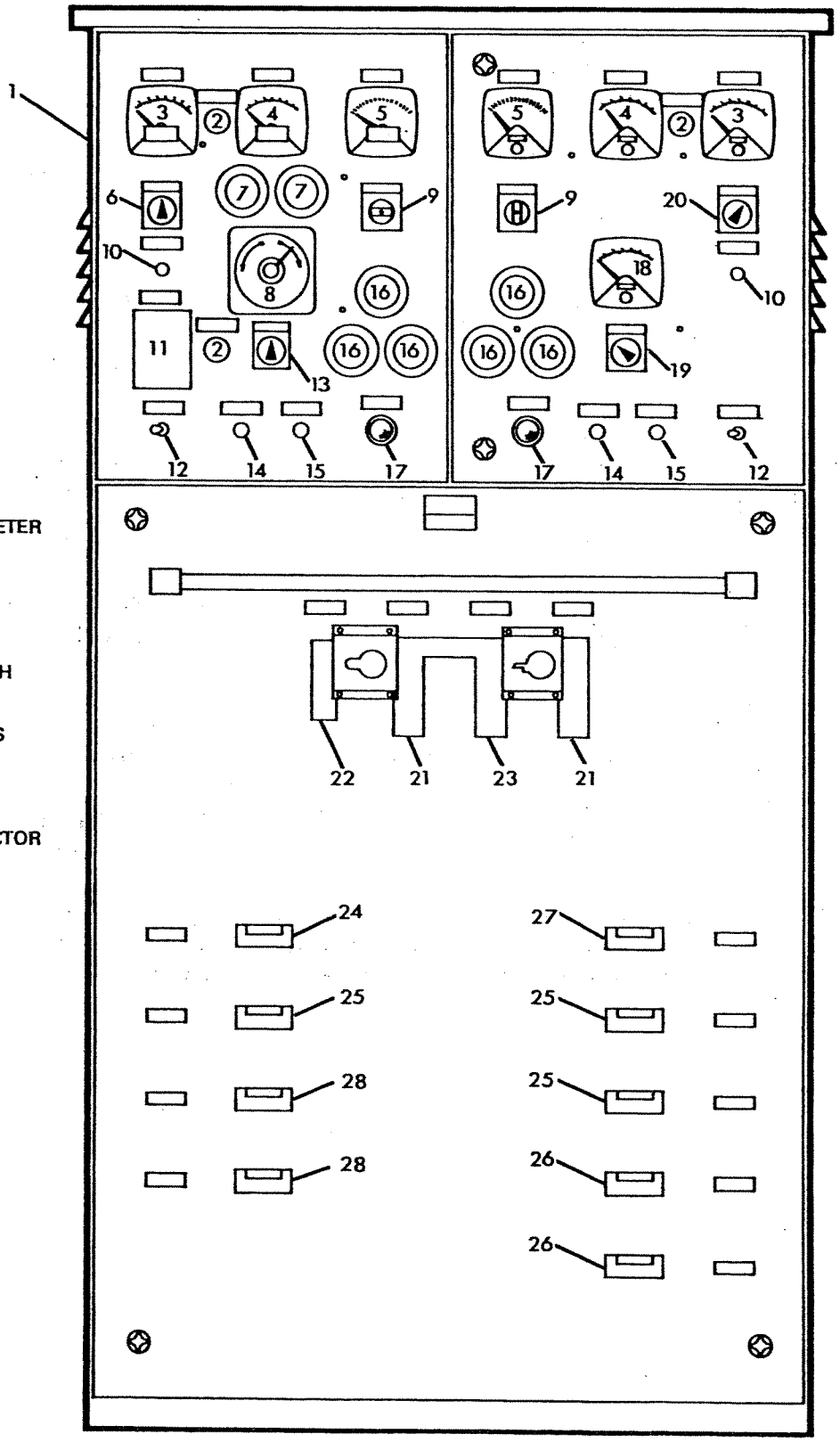
The diesel generator engines are started in the engine room. Refer to the onboard commercial technical manual for diesel generator engine starting procedures.

NOTE

Instruction plates are provided which cover operating procedures. These plates are not intended to replace the onboard manual.

4-33. ELECTRIC PLANT CONTROL PANEL OPERATION.

For complete operation procedure of the electric plant control panel P400 refer to onboard Equipment Manual NAVSEA S9324-BH-MM-010. An illustration of the control panel with controls, meters and circuit breakers identified is shown in Figure 4-3.



1. NEMA 1 ENCLOSURE
2. POWER AVAILABLE LIGHTS
3. A.C. VOLTMETER
4. A.C. WATTMETER INDICATOR
5. A.C. AMMETERS
6. GEN. #1/SHORE POWER VOLTMETER SELECTOR SWITCH
7. SYNC LIGHTS
8. SYNCHROSCOPE
9. AMMETER SELECTOR SWITCH
10. VOLTAGE ADJUST RHEOSTAT
11. PHASE SEQUENCE INDICATOR
12. GOVERNOR RAISE/LOWER SWITCH
13. SYNC SELECTOR SWITCH
14. CIRCUIT BREAKER OPEN LIGHTS
15. CIRCUIT BREAKER CLOSED LIGHTS
16. GROUND DETECTION LAMPS
17. PUSH TO TEST BUTTON
18. FREQUENCY METER
19. FREQUENCY SELECTOR SWITCH
20. GEN. #2/BUS VOLTMETER SELECTOR SWITCH
21. GENERATOR CIRCUIT BREAKERS
22. SHORE POWER BREAKER
23. TIE BREAKER
24. CIRCUIT BREAKER
25. CIRCUIT BREAKERS
26. CIRCUIT BREAKER
27. CIRCUIT BREAKER
28. CIRCUIT BREAKER

Figure 4-3. Electric Plant Control Panel P400
(Engine Room, Frames 22-23, Port)

4-34. DISTRIBUTION PANEL OPERATION.

Circuit breakers in the distribution panels are operated manually to energize or de-energize circuits. Circuit breaker will trip automatically in the event of overload. Specific circuits and related circuit breakers are listed in Tables 4-19 through 4-27. Refer to onboard Equipment Manual NAVSEA SG270-AY-MMC-010 for description and operation of battery chargers (rectifier).

Table 4-19. Electric Plant Control Panel P400 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit
Bus A - 100/70	Torpedo Handling Hydraulic Power Pack
Bus A - 100/70	Deck Crane
Bus A - 58*	Port Steering (Pilothouse Console)
Bus A - 100/90	Engine Room Power Panel P402
Bus B - 100/60	Air Conditioning Compressor
Bus B - 58*	Starboard Steering (Pilothouse Console)
Bus B - 100/60	Lighting Transformer
Bus B - 100/90	Galley Power Panel P403
Bus B - 100/90	Engine Room Power Panel P401

* Instant trip only.

Table 4-20. Power Panel P401 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit
100/15	A/C Sea Water Cooling Pump
100/15	Sewage Discharge Pump
100/25	Fire Pump Number 2
100/25	Engine Room Supply Fan F-1
100/15	Fuel Oil Transfer Pump
100/15	Potable Water Pump

Table 4-21. Power Panel P402 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit
100/25	Hot Water Heater
100/25	Fire Pump Number 1
100/15	Engine Room Space Heater H-7
100/15	Lazarette Space Heater H-8
100/15	Air Compressor
100/15	Starting Batteries 24 VDC Rectifier

Table 4-22. Power Panel P403 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit
100/20	Range
100/15	Booster Water Heater
100/15	Duct Heater H1, Mess/Lounge
100/15	A/C Air Handling Unit
100/15	Window Defroster H4, Pilothouse Starboard
100/15	Galley Exhaust Fan
100/15	Duct Heater H5, Hold Berthing
100/15	Duct Heater H2, C.P.O. and C.O. Staterooms
100/15	Duct Heater H3, Pilothouse Port
100/20	Anchor Windlass
100/15	24 VDC Rectifier

Table 4-23. 120 Volt Main Distribution Panel P100 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit
100/35	To AN/WQC-2A Sonar Communication Set
100/100	Engine Room Lighting Panel L103
100/100	Galley Lighting Panel L102
100/100	Pilothouse Lighting Panel L101

Table 4-24. Pilothouse Lighting Panel P101 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit	
100/15	L101-IL-A	Public Address System
100/15	L101-IL-B	Signal Searchlight (Port)
100/15	L101-IL-C	Signal Searchlight (Starboard)
100/15	L101-IL-D	Radar
100/15	L101-IL-E	Floodlights (3)
100/15	L101-IL-F	Speed Log
100/15	L101-IL-G	Depth Indicator
100/15	L101-IL-H	Bow Thruster Control System
100/15	L101-IL-I	Satellite Navigator
100/15	L101-IL-J	Loran & Loran C Plotter
100/15	L101-IL-L	Exterior Lighting
100/15	L101-IL-M	Searchlight, 1000 Watt - Frame 7 Centerline
100/15	L101-IL-N	Searchlight, 1000 Watt - Frame 15 Starboard
100/15	L101-IL-O	Pilothouse Lighting

Table 4-25. Galley Lighting Panel P102 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit	
100/15	L102-IL-A	Coffee Maker
100/15	L102-IL-B	Refrigerator
100/20	L102-IL-C	Microwave
100/15	L102-IL-D	Watercooler
100/15	L102-IL-E	Icemaker
100/30	L102-IL-F	Toaster
100/15	L102-IL-G	Freezer
100/15	L102-IL-H	Receptacle, Bridge and Main Deck
100/15	L102-IL-I	Spare
100/20	L102-IL-J	Spare
100/20	L102-IL-K	Convection Heater H6 Main Deck Washroom
100/15	L102-IL-L	Main Deck Lighting (Frame 4-15)
100/15	L102-IL-M	Spare
100/15	L102-IL-N	Lighting Hold (Frames 0-12)
100/15	L102-IL-O	Galley Receptacles

Table 4-26. Engine Room Lighting Panel P103 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit	
100/25	L103-IL-A	Fast Lube Oil Change System Pump
100/15	L103-IL-B	Lighting, Hold (Frame 12-23) (Port)
100/15	L103-IL-C	Lighting, Hold (Frame 16-23) (Starboard) and Lazarette
100/15	L103-IL-D	Bow Thruster Room Exhaust Fan F6 (Frame 6)
100/15	L103-IL-E	Receptacles, Hold (Frame 12 thru 28)
100/15	L103-IL-F	Pump Room Exhaust Fan F3 (Frame 15) (Starboard)
100/15	L103-IL-G	Lazarette Exhaust Fan F2 (Frame 18) (Port)

Table 4-26. Engine Room Lighting Panel P103 Load Circuits — Continued.

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit	
100/25	L103-IL-H	Convection Heater H9 (Frame 10) (Crew's Washroom)
100/15	L103-IL-I	Toilet Space Exhaust Fan F5 (Frame 7-3/4) (Starboard)
100/15	L103-IL-J	Sump Pump (Frame 12) (Port, Hold)
100/20	L103-IL-K	Electric Hand Dryer, Pump Room (Frame 14)
100/15	L103-IL-L	Receptacles, Hold (Frame 0 thru 12)
100/15	L103-IL-M	Junction Box UVT-1
100/15	L103-IL-N	Galley Exhaust Fan F4 (Frame 12-1/2) (Bridge Deck)
100/15	L103-IL-N-1	Generator #1 Space Heater
	L103-IL-N-2	Generator #2 Space Heater

Table 4-27. 24 VDC Rectifier Panel P024 Load Circuits

Circuit Breaker Frame Size/Trip Current (Amperes)	Circuit	
100/15	P-024-24P-A	Gyrocompass
100/15	P-024-24P-B	NFU Steering Control
100/15	P-024-24P-C	Pilothouse Alarm Panel
100/15	P-024-24P-D	Instrument Lighting
100/25	P-024-24P-E	HF/VHF System Relay Junction Box
	P-024-24P-E	HF/VHF XCVR
100/15	P-024-24P-F	UHF Radio
100/25	P-024-24P-G	Halon System
100/15	P-024-24P-H-H1	Power Supply — VHF Radio
100/15	P-024-24P-I	Automatic Radio Direction Finder
100/15	P-024-24P-J	Window Wipers
100/15	P-024-24P-K	Rudder Angle Indicator

4-35. LIGHTING SYSTEM OPERATION.

All lighting is turned on or off with switches which are located in the space being illuminated. This includes both white and red lights. Relay lanterns and portable lanterns are operated locally. Floodlights on deck are operated at switches on the pilothouse console.

4-36. FUEL SYSTEM OPERATION.

Operation of the fuel system involves filling, transfer of fuel, stripping of fuel and oily water tanks, and water separation. The following paragraphs will detail each of these primary modes of operation. Pressure gages for the system are mounted in the engine room (Figure 4-4). There are gages for the following: fuel oil pump suction, fuel oil pump discharge, filter inlet pressure, filter outlet pressure.

4-36.1. FILLING PROCEDURE. (Figure 3-1.) The following procedure should be used when filling the fuel tanks. Opening and closing of specific valves is required during this procedure to allow fuel flow to specific tanks. Refer to onboard NAVSEA drawing 261-3003376 for complete fuel oil piping diagram.

WARNING

Do not smoke while filling the fuel tanks or servicing the fuel system. Sparks or flame could cause a fire or explosion resulting in severe injury or death.

1. Open fuel oil fill gate valves to forward port and starboard tanks and midships tank.

NOTE

If fill is required to only one tank, open only the fill valve to that particular tank.

NOTE

Check to be sure high and low suction valves at the stowage tanks and supply valve to the transfer pump are closed.

2. Attach shore hose to fuel oil fill valve at frame 12 on the main deck, port or starboard.
3. Open fuel oil fill valve on deck and supply valve at shore facility.
4. Monitor filling and check tanks at sounding tubes for proper fill level. Refer to Table 4-28 for tank capacities.

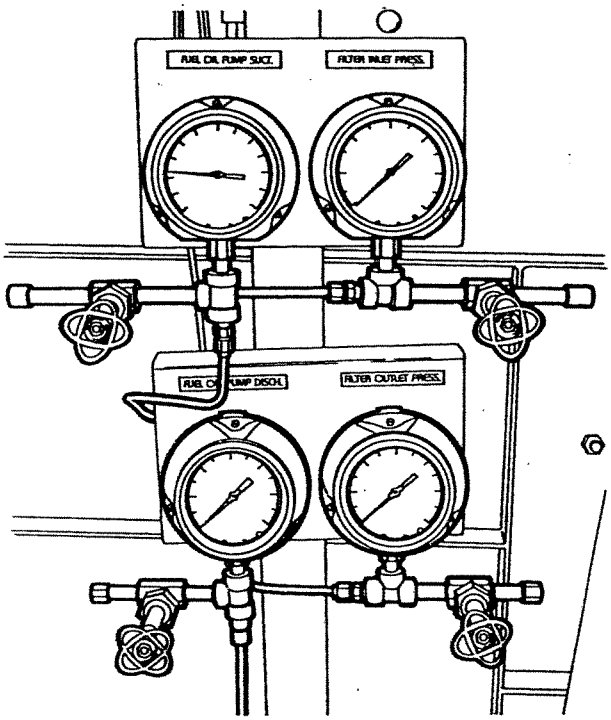


Figure 4-4. Fuel System Gages
(Frame 22, Port, Engine Room)

Table 4-28. Fuel Tank Capacities

Forward Fuel Tanks P/S	1801 gallons each
Amidships Tank	2900 gallons
Day Tank — Port	1130 gallons
Day Tank — Starboard	1081 gallons

5. Close shore fuel supply valve and transfer fuel as necessary to day tanks. Refer to paragraph 4-36.2 for fuel transfer procedure.
6. After transfer of fuel to day tanks top off forward stowage tanks as necessary to bring to full level.
7. When tanks are full, close shore supply valve and fuel oil fill valves on weather decks and at tanks. Remove shore hose.
8. Clean up any spill on main deck and empty containment tank if spill-over has occurred.

4-36.2. FUEL OIL TRANSFER. (Figure 3-2.) The following procedure must be followed when transferring fuel from the forward tanks to the day tanks.

1. Open gate valves (high or low suction) at tank or tanks from which fuel is to be transferred.
2. Open gate valve at frame 22 that supplies fuel to the transfer pump.
3. Open fuel oil transfer suction valve and gate valves on both sides of water separator and separator bypass valve.
4. Open fuel oil day tank suction valves, port side at frame 24 and starboard at frame 23-1/2 in the lazarette.
5. Start fuel oil transfer pump and fill day tanks as necessary.
6. Check pressure gage readings.
7. Check tanks for proper level and close all valves.

4-36.3. STRIPPING PROCEDURE. (Figure 3-5.) The hand operated stripping pump located in the engine room is capable of stripping the three forward tanks as well as the day tanks. It can also be used to drain the oily water tank. Most of the fluid stripped from these tanks is water thus allowing overboard discharge from the stripping pump. A sight gage is fitted into the stripping discharge line to show the pump operator when water is no longer present in the flow (Figure 4-5).

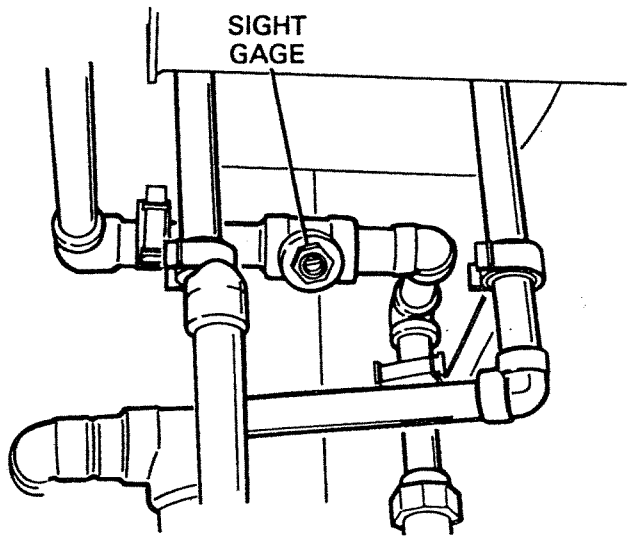


Figure 4-5. Fuel Stripping Sight Gage (Frame 22, Port, Engine Room)

4-36.3.1. Fuel Oil Tanks. To strip the fuel oil tanks proceed as follows:

1. Open the low suction valve at the tank being stripped. Make sure high suction valves at tanks are closed.
2. Open fuel supply valves to stripping pump at frame 22. Open stripping pump bypass valve and return valve.
3. Close valves to transfer pump and supply and return valves at day tanks.
4. Close globe stop check valve in line from transfer pump relief valve.
5. Open discharge valve on weather deck just foward of frame 23.
6. Turn handle of stripping pump until sight gage shows no water flow.
7. Discontinue turning pump handle and open and close valves as necessary and strip the next tank.

4-36.3.2. Oily Water Tank. When the oily water tank is full, the stripping pump can be used to empty the tank to the overboard discharge. To empty the tank proceed as follows:

CAUTION

DISCHARGE OF OIL PROHIBITED

The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters of the United States or the waters of the contiguous zone if such discharge causes a film or sheen upon or discoloration of the surface of the water or causes a sludge or emulsion beneath the surface of the water.

Violators are subject to a penalty of $5,000.

1. Close valves on both sides of transfer pump. Close stripping pump bypass valve and return valve and close supply valves to tanks.
2. Close supply valve to stripping pump.
3. Open both discharge valves and the oily water suction valve.
4. Turn stripping pump handle until water flow is no longer present at sight gage. Stop pump operation.
5. Open or close valves as necessary to resume normal fuel flow.

4-36.4. FUEL SUPPLY AND RETURN. (Figure 3-4.) The fuel supply system provides fuel flow to the diesel generator engines and the propulsion engines. Fuel is also supplied to the priming pumps on the engines. Check to

be sure all the valves in the supply lines are open from the tank and at the engine. The valve in the line to the priming pump must also be open if priming is necessary.

The fuel return system directs fuel oil flow through the heat exchanger back to the fuel oil day tank. A crossover line with a gate valve is installed in the return piping to allow return fuel oil to flow to both day tanks if only one engine is running. This will keep fuel level in both day tanks approximately the same.

4-37. LUBE OIL SYSTEM OPERATION. (Figure 2-14.)

The lube oil system operation consists of filling the tank, changing fuel oil and discharging dirty oil to a shore facility. The following paragraphs will cover each operation or mode necessary to operate the system.

4.37.1. FILLING THE LUBE OIL TANK. The lube oil tank fill connection is located 18 inches forward of frame 23, port side. The lube tank capacity is 250 gallons. The lube oil tank is fitted with a liquid level gage, a vent to space and an overflow to the bilge. To fill the tank proceed as follows:

1. Check bibb cock and drain valve at frame 23 to be sure they are closed.
2. Connect hose from shore facility to fill valve on weather deck.
3. Check level at sight gage before filling to estimate gallon fill required.
4. Open fill valve on weather deck and at shore facility. Fill tank to capacity and turn off both fill valves. Remove hose and clean up any lube oil spilled during filling.

4-37.2. LUBE OIL CHANGE. Changing lube oil in the propulsion engines, marine gears or diesel generator engine is accomplished using the FLOCS unit (Figure 1-11) stowed in the engine room between frames 21 and 22 starboard. Connect FLOCS unit into plug and start with manual starter. The fast lube oil change system when installed on the quick coupling at a unit will evacuate the crankcase and automatically shut off when evacuation is complete. To operate the FLOCS unit refer to onboard Technical Service Manual S9926-AU-MMC-010.

NOTE

After FLOCS unit is installed be sure valve at engine or gear is opened before starting up the unit.

Proceed as follows:

1. Attach the suction line coupling half to the FLOCS coupling half on the engine. To connect the coupling, retract the knurled sleeve, push the coupling halves together and release the sleeve.
2. Press the cycle start button to start the unit. The cycle run signal unit will come on.
3. The unit will shut off automatically when all oil is evacuated. The signal light will shut off. Disconnect the evacuation line.

4-37.3. WASTE OIL TANK DISCHARGE. A waste oil tank is located under the floor plates at frame 15 in the pump room. Discharge of waste oil is accomplished using the hand operated discharge pump located at frame 16, starboard side. To discharge waste oil proceed as follows:

1. Install shore hose on discharge valve on weather deck forward of frame 16. Open discharge valve on deck and valve at shore facility.
2. Turn handle of discharge pump (Figure 1-12) until waste oil is pumped out of tank. Tank capacity is 250 gallons.
3. Check to be sure tank has emptied completely using sounding tube in tank top.
4. Close weather deck valve and shore facility valve and remove shore hose. Clean up all spills.

4-38. SEA WATER COOLING SYSTEM OPERATION.

The sea water cooling system circulates sea water to the propulsion engines, diesel generator engines and the stern tube. Sea water is circulated through the system by pumps mounted on the propulsion engines.

NOTE

An emergency sea water shore connection is provided in the engine room at frame 16-1/2 to provide sea water to the system if pumps are inoperative or if craft is in dry dock for repair.

4-38.1. PROPULSION AND GENERATOR ENGINES AND STERN TUBE COOLING SYSTEM OPERATION. (Figure 2-37.) The sea water pumps taking suction from the sea chests in the engine room circulate the necessary water for cooling. To provide sea water cooling to the system proceed as follows:

1. Check sea water strainers in supply lines to propulsion and generator diesel engines. Remove debris if present.
2. Open sea water supply valves and discharge valves at sea chest.
3. Open inlet and outlet supply valves at the sea water strainers, at sea water pump and in supply bypass line.
4. Open sea water supply valves to fuel oil heat exchanger and discharge valves from heat exchanger.
5. Open supply valve to exhaust system.
6. Open stern tube interconnection valve and stern tube supply valve port and starboard.

7. To supply diesel generator engines open the following valves:
   a. Inlet and outlet valves at strainers.
   b. Supply and discharge valves at generator engines.
   c. Supply valves to exhaust system.
   d. Discharge valves to overboard discharge.
8. Close all valves in piping to A/C sea water cooling system unless system is in use.
9. Close shut-off valve connections located in crossover lines between propulsion engines and in lines between generator engines. These valves are supplied to provide cooling water for engine operation when the craft is out of the water.

Pressure and temperature gages for the sea water system are located in the engine room (Figure 4-6). Normal operating pressure range for the sea water cooling system is:

Generator P/S ..... 2.2 PSIG to 11.7 PSIG
Main Engine P/S..... 4.6 PSIG to 13 PSIG

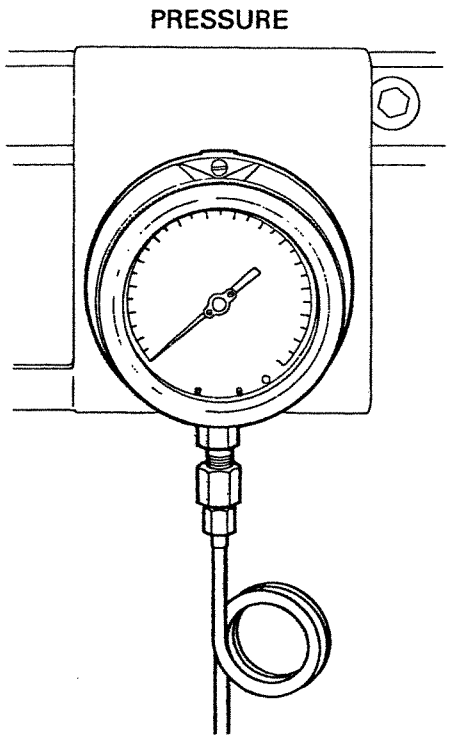
4-38.2. A/C CONDENSER SEA WATER COOLING SYSTEM OPERATION. (Figure 2-37.) The sea water for cooling the A/C condenser is circulated through the system by the A/C sea water pump located on centerline at frame 17 in the engine room. The pump takes suction from the sea chest at frame 21-1/2, port side, in the engine room. To provide sea water cooling to the A/C condenser proceed as follows:

WARNING

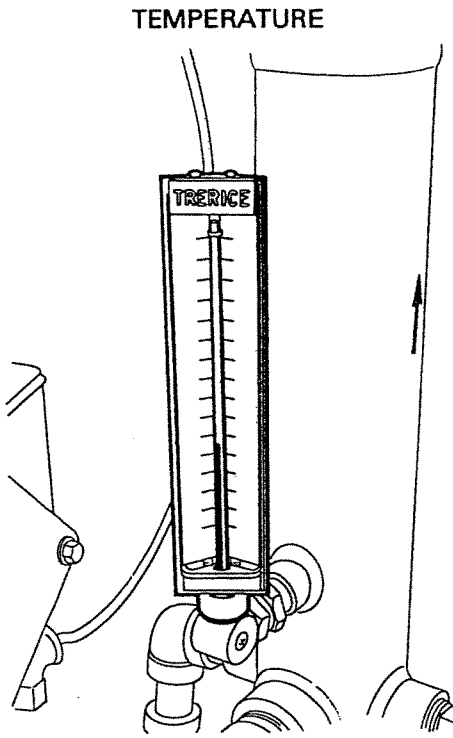
Do not operate this equipment in excess of its rated capacity, speed, pressure and temperature, or other than in accordance with the instructions contained in the pump manual. This seawater cooling pump has been shop tested and found satisfactory for the conditions for which it was installed. But its operation in excess of these conditions will subject it to stresses and strains which it was not designed to withstand.

Failure to heed this warning may result in an accident causing personal injury.

1. Check sea strainer for debris and clean if necessary.
2. Open gate valves at sea chest.
3. Open A/C condenser sea water supply valves on inlet and outlet side of strainer and supply valve on outlet side of sea water pump.
4. Open A/C condenser sea water discharge valves and discharge bypass valve.
5. Open the A/C unit sea water overboard discharge valve.
6. Start sea water pump at controller.



(FRAME 18, CENTERLINE, ENGINE ROOM)



(FRAME 19, CENTERLINE, ENGINE ROOM)

Figure 4-6. Sea Water Gages

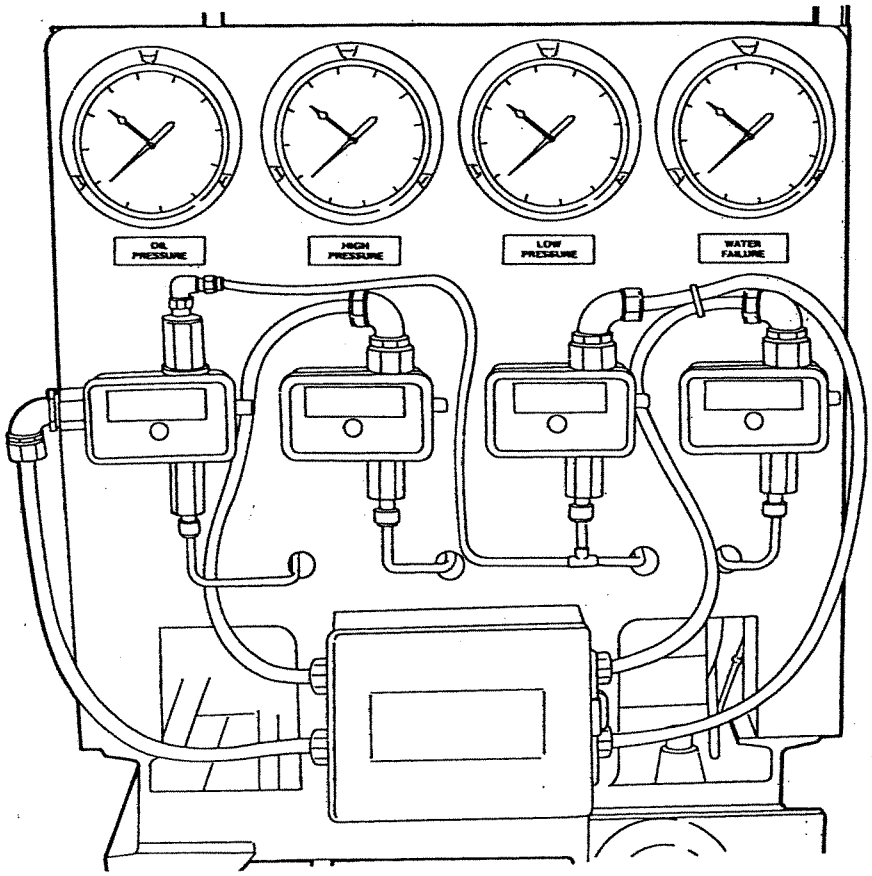


Figure 4-7. Air Conditioning Gage Board
(Engine Room, Frame 19-1/2)

NOTE

Be sure valve (1Q, Figure 2-43) to A/C instrument panel (Figure 4-7) is open to allow flow to water failure switch. This switch will stop the compressor if the sea water flow to the condenser is interrupted.

For complete operating/maintenance instructions see NAVSEA Technical Manual No. S6225-SR-MMC-010. Refer to onboard NAVSEA drawing 256-6003373 for complete sea water cooling system diagram.

4-39. A/C REFRIGERATION SYSTEM OPERATION. (Figure 2-43.)

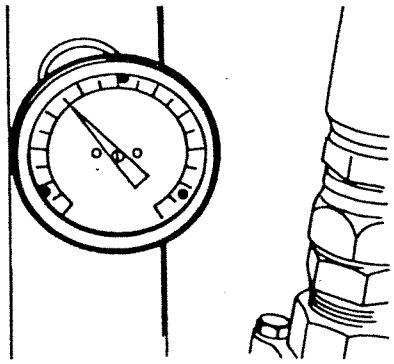
WARNING

Only qualified personnel shall perform maintenance on the refrigeration system. Personnel shall observe all safety precautions regarding ventilation and contact with liquid refrigerant as specified in Technical Manual S9514-B5-MMC-010.

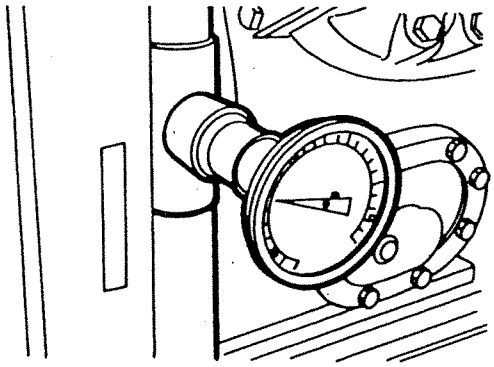
The A/C refrigeration system involves the piping of refrigerant between the air conditioning plant and the air handler to supply cooled air to temperature controlled spaces on the craft. There are six gages on the air conditioning unit to enable setup and monitoring of the system: liquid therm, safety head, CRPSR disch. therm., temperature (2) and refrigerant temperature (Figure 4-8). Gages for the freon temperature and pressure are located in the air handling room (Figure 4-9). For sea water cooling to the plant condenser refer to paragraph 4-38.2. Complete operation details for the A/C refrigeration system are covered in the onboard Technical Service Manual S9514-B5-MMC-010.

4-40. COMPRESSED AIR SYSTEM OPERATION. (Figure 2-17.)

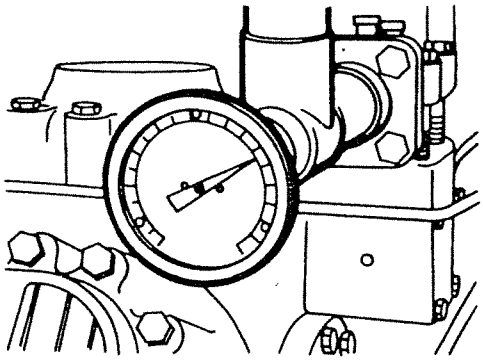
The air compressor is located in the engine room aft of frame 16 starboard side. Compressed air is required for the navigation horn, for low pressure purging of recovered weapons, for blow-down of sea chests and general use in the engine room. For complete operation/maintenance instructions, see NAVSEA Technical Manual No. S6220-CZ-MMO-010.



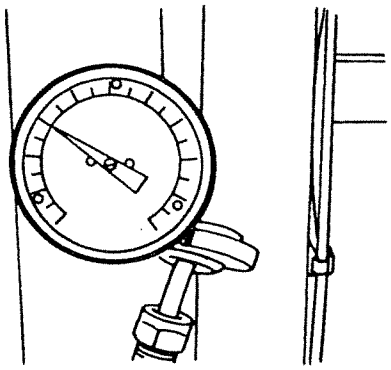
TEMP GAGE



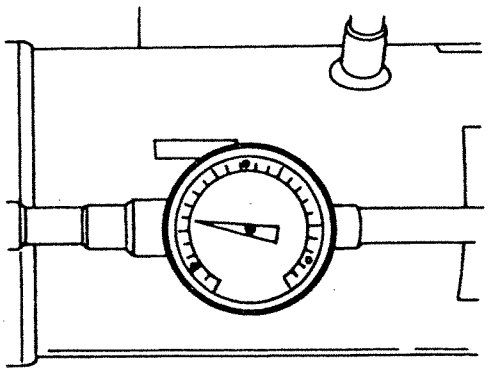
CRPSR DISCH. THERM.



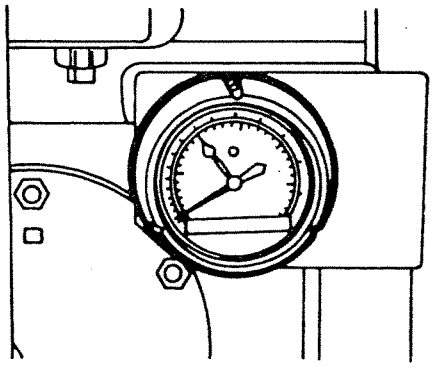
REFRIGERANT TEMP GAGE



TEMP GAGE



LIQUID THERM GAGE



SAFETY HEAD GAGE

Figure 4-8. Air Conditioning Gages
(Engine Room, Frames 18 to 19)

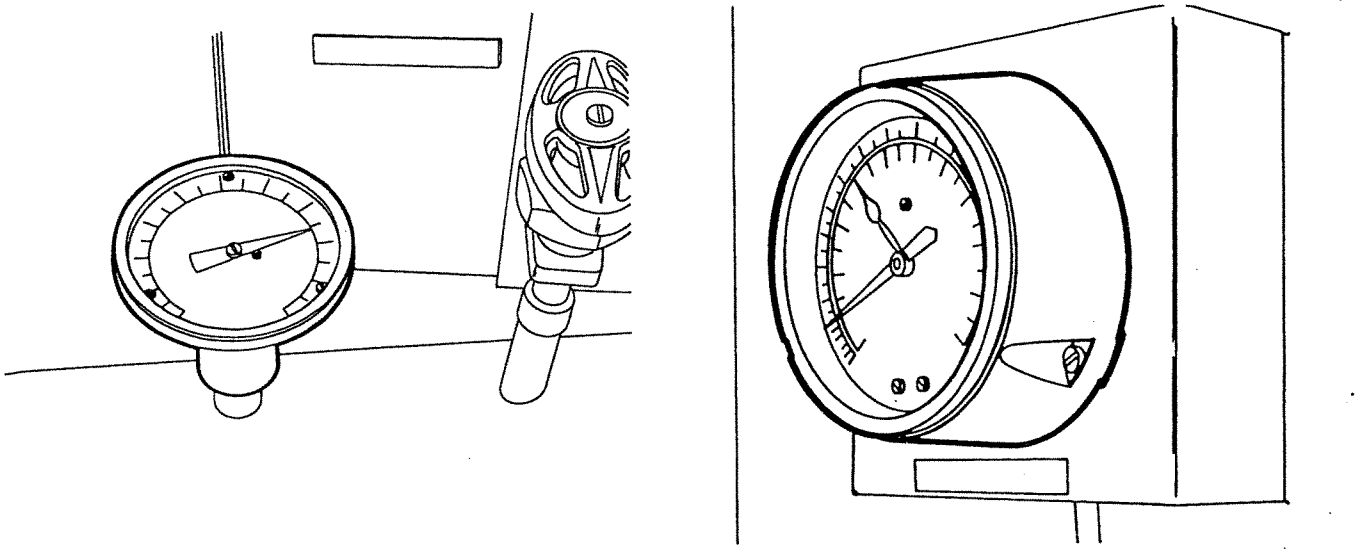


Figure 4-9. Freon Gages
(Air Handling Room, Frames 8 to 9)

WARNING

The compressor is fitted with a relief valve set at 140 PSI to protect the system. Normal operating pressure range for the air compressor is 90 PSI to 120 PSI.

Over-pressurizing the air receiver could cause the air receiver to rupture or explode. The air compressor package unit is protected from over-pressurizing by a safety valve. Do not eliminate, make adjustments, or substitute for this valve.

Occasionally, pull the ring on the safety valve to make sure that the valve operates freely. If the valve is stuck or does not operate smoothly, it must be replaced.

CAUTION

Do not overfill the compressor with oil. Overfilling with oil will cause premature compressor failure.

4-40.1. NAVIGATION HORN. The navigation horn is located on the pilothouse top at frame 8. A manual control valve is located in the pilothouse. To operate the navigation horn proceed as follows:

1. Open compressor discharge valve at frame 17 in the engine room.
2. Start compressor at motor controller.
3. Check pressure gage at compressor to be sure pressure is between 90 and 120 PSI (Figure 4-10).
4. Open air supply valve at frame 11 in pilothouse. Check pressure gage in pilothouse.
5. Check air strainer and moisture trap for clogging. Clean out if necessary.
6. Check pressure gage in pilothouse for reading of 90 to 120 PSI (Figure 4-11).
7. Check operation of horn by pulling manual valve horn handle.

4-40.2. LOW PRESSURE PURGE. An air connection located at frame 22 on the main deck allows personnel to purge recovered weapons with low pressure air. A pressure regulator is installed in the line to reduce pressure from 120 PSI TO 25 PSI. To operate the low pressure purge proceed as follows:

1. Open discharge valve at compressor discharge and start compressor at controller. Check pressure gage for 90 to 120 PSI reading (Figure 4-10).
2. Open air supply valve in low pressure purge line. Install air hose on valve and check air pressure at gage (Figure 4-12). Pressure at air hose should be 25 PSI.
3. Purge weapons as required.

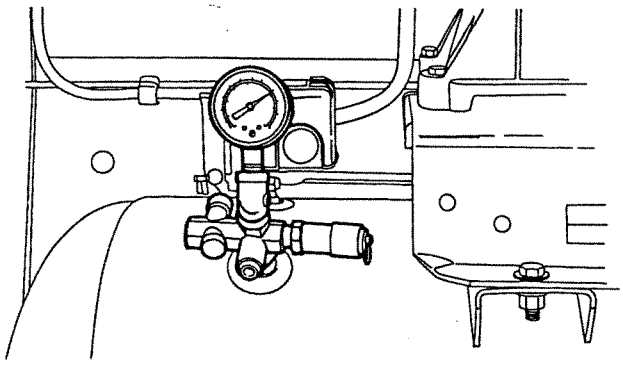


Figure 4-10. Air Compressor Pressure Gage (Engine Room, Frame 17, Starboard)

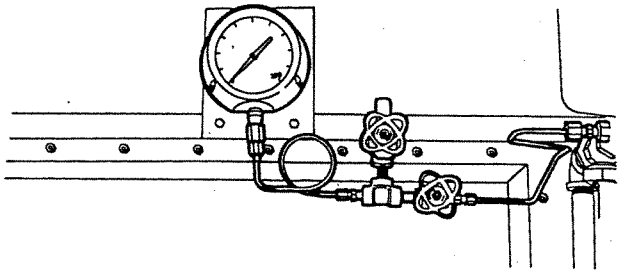


Figure 4-11. Pressure Gage — Pilothouse (Frame 6-1/2)

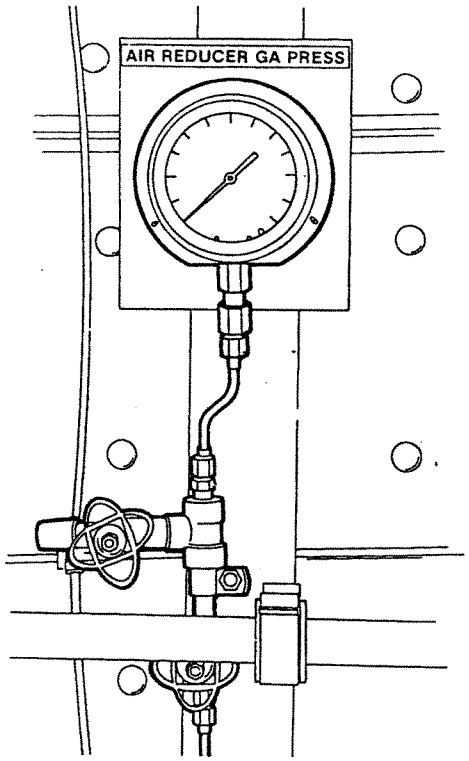


Figure 4-12. Air Reducer Pressure Gage (Engine Room, Frame 22, Starboard)

4-40.3. ENGINE ROOM CONNECTIONS. Air connections are provided in the engine room near the workbench for general use and at frame 21 starboard side for blow-down of sea chests. Both connections are piped from the low pressure side of the regulator through a 3/4 inch gate valve. When compressed air is required in the engine room proceed as follows:

1. Start compressor at controller and open discharge valve.
2. Run compressor until gage (Figure 4-10) reads 90 to 120 PSI.
3. Check air pressure at gage (Figure 4-12).
4. Open supply gate valve to the engine room.
5. Install air hose at connection being used and check for air pressure. Pressure should be 25 PSI at both engine room connections.

4-41. SEWAGE SYSTEM OPERATION. (Figure 2-16.)

The sewage collection holding and transfer system consists of the water closets, holding tank, discharge pump valves and piping required to make the system operational. Refer to onboard Technical Service Manual S9593-BP-MMC-010 for operation of the system.

4-41.1. SEWAGE PIPING FROM WATER CLOSETS (BLACK WATER). The water closets, located in the deckhouse on the main deck and on the first platform drain directly to the sewage collection system. For sewage system to operate, the gate valve in both lines from the water closets must be open. These valves are located aft of frame 13 in the pump room.

CAUTION

Pump holding tanks content out at authorized pump out stations or beyond restricted waters only. Do not open the valve connecting the toilet to the overboard discharge in restricted waters.

4-41.2. AUTOMATIC OPERATION. To set the sewage treatment system for automatic operation, proceed as follows:

CAUTION

Failure to close the discharge valves with the pump switch in the auto position will cause the tank to be completely evacuated through normal use and will require initiation of the commissioning procedure to restore system operation.

1. Turn on electrical power at sewage control panel.
2. Check that voltage supply indicator is lighted.
3. Check that sewage discharge valves are closed.

4. Press lamp test and be sure all other alarm lights are operational.
5. Check that low level alarm light is NOT lighted.
6. Turn MANUAL-OFF-AUTO switch to AUTO.

WARNING

Personnel engaged in sewage transfer hose operations shall not connect or disconnect potable water hoses.

WARNING

Personnel engaged in handling of sewage must wear protective rubber gloves, rubber boots and overalls.

WARNING

Sewage spills, sewage hose connections and solids on the hose exterior shall be washed down with warm water containing a stock detergent.

WARNING

Eating, drinking, or smoking is strictly prohibited during maintenance of sewage system. Do not eat, smoke, or drink until hands and facial areas have been thoroughly washed with soap and hot water.

4-41.3. SEWAGE DISCHARGE OPERATION. To discharge sewage to the pump-out connection on the main deck, proceed as follows:

1. Remove deck pump-out connection with deck plate key and install adapter.
2. Connect port or starboard WASTE transfer hose so cam lock fitting is in LOCK position.
3 Regulate three-way ball valves in discharge line to allow sewage flow to pump-out connection.
4. Open ball valve in discharge line from collection tank.
5. Refer to onboard Technical Service Manual S9593-BP-MMC-010 and follow instructions given to discharge sewage.

NOTE

If sewage is to be discharged overboard, close three-way ball valve in line to pump-out connection and open gag scupper valve in overboard discharge line.

WARNING

Do not disconnect sewage hose while it is pressurized. Depressurize hose and secure discharge cut-off valve prior to disconnecting hose.

6. Flush holding tank and discharge hoses/piping. After flushing, secure flushing valve.
7. Disconnect transfer hose from cam-lock adapter.
8. Remove adapter from flush-mounted deck connection and reinstall "waste" deck connection cover.

4-41.4. PLUMBING AND DECK DRAINS — GRAY WATER. (Figure 2-42.) Drainage from the shower and lavatory on the first platform flows directly to the sump tank in the pump room. The sump tank is drained by an automatic sump pump that discharges overboard aft of frame 12.

Drainage from the main deck discharges overboard through the same globe stop check valve as the sump tank. The following items drain from the deckhouse to the overboard discharge.

1. Deluge shower.
2. Wash basin.
3. Drinking fountain.
4. Galley deck drains (2).
5. Galley sinks.
6. Washroom drains (2).
7. Shower
8. Lavatory.

WARNING

The sump pump motor and switch are not explosion proof. Personal injury, death, and/or property damage may occur in the event of an explosion. Do not use in areas where flammable vapors are present.

NOTE

The valves in this system are always open to allow for overboard discharge at anytime.

4-42. FIREMAIN SYSTEM OPERATION. (Figure 3-10.)

CAUTION

Do not run fire pumps dry. Do not overtighten gland nuts.

The firemain system supplies water to the five fire stations using the two 100 GPM fire pumps which take suction from the sea chests. Refer to Figure 2-34 for system

diagram which identifies and locates all components. To operate the firemain system proceed as follows:

1. Check to be sure suction and discharge valves at the fire pumps are open.
2. Open sea water supply valve.
3. Open all supply valves to fire stations.
4. Start fire pumps at controller.
5. Check pressure at pump suction and discharge gages and eductor suction gage (Figure 4-13). Normal operating pressure for the fire, bilge and ballast pumps is listed below:
   Pump Suction — 40 PSI
   Pump Discharge — 75 PSI
   Eductor Suction — 16 inches Hg Vacuum
6. Connect fire hose to fire station and open valve at station being used.
7. Secure hose at station after use and close supply valve at station.

4-43. BILGE SYSTEM OPERATION. (Figure 3-10.)

CAUTION

Do not run fire pumps dry. Do not overtighten gland nuts.

The bilge system uses both fire pumps which take suction from the bilge manifold and discharge overboard. The bilge manifold has branch lines leading to the lazarette engine room, pump room, bow thruster space and the locker sump. Refer to Figure 2-35 for system diagram which identifies and locates all components. To operate the bilge system proceed as follows:

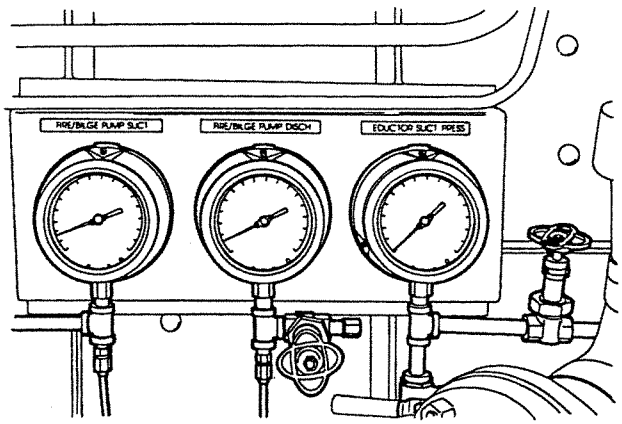
1. Check both fire pumps to be sure suction and discharge valves to the pump are open.
2. Open bilge manifold suction valves to the two fire pumps.
3. Open the bilge manifold suction valves to the area to be pumped (Figure 1-24).
4. Open bilge overboard discharge valves.
5. Close sea chest suction valves port and starboard.
6. Start bilge pumps as necessary. After discharge of bilge open or close valves as required for normal running.

NOTE

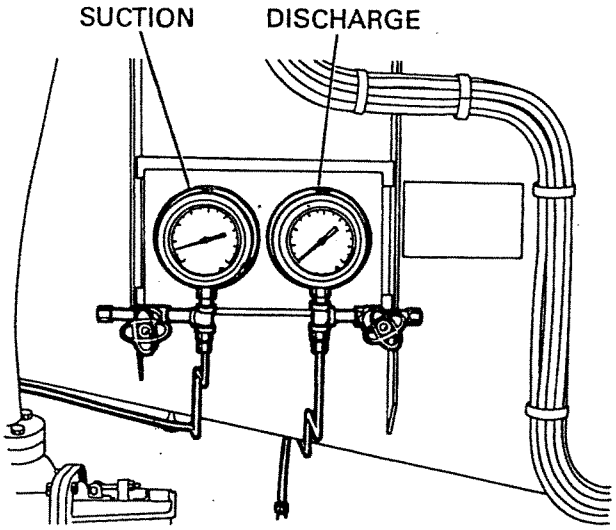
Pressure and vacuum gages are installed at both fire pumps to insure that the pump has enough vacuum and that system pressure is sufficent (Figure 4-13).

4-44. BALLAST SYSTEM OPERATION. (Figure 3-10.)

The fire pump located in the lazarette is used to ballast or deballast the craft as necessary to trim the craft for torpedo recovery or for stability considerations. The pump takes suction from the ballast manifold or the sea chest to accomplish ballasting functions. Refer to Figure 2-36 for system diagram which identifies and locates all components.



FRAME 18, PORT, ENGINE ROOM



FRAME 26, STARBOARD, LAZARETTE

Figure 4-13. Fire Pump Pressure Gages

4-44.1. BALLASTING. To ballast the craft proceed as follows:

NOTE

Ballasting may be required to any one of four ballast tanks or to all tanks at one time. Gate valves located at the ballast manifold in the engine room at frame 23 must be opened or closed depending on the ballast requirements.

1. Open the required suction and discharge valves at the ballast manifold (Figure 1-25) to the tank or tanks needing ballast. Valves are marked for each tank to prevent error in filling.

NOTE

If fill to forepeak tank is required, the remote operated valve must be opened.

2. Close bilge and ballast overboard discharge valve and ballast manifold discharge valve.
3. Close firemain sea water supply valve.
4. Open ballast manifold suction valve and sea water suction sea chest valve at port sea chest.
5. Check to be sure fire pump suction and discharge valves at the pump are open and start fire pump at controller.
6. Fill tanks as necessary and return all valves to their normal position.

4-44.2. DEBALLASTING. When it becomes necessary to deballast proceed as follows:

1. Check to be sure sea water suction valve at the sea chest is closed.
2. Close ballast manifold suction valve and fireman supply valve.
3. Open ballast manifold discharge valves at the fire pump.
4. Open overboard discharge valves.
5. Open the discharge valves at the manifold to the tanks that require deballasting.
6. Start pump at controller and check vacuum and pressure on gages located near pump.
7. Deballast as necessary and return all valves to normal position after deballast is completed.

4-45. FRESH WATER SYSTEM OPERATION.

The fresh water system consists of tank filling, storage and system flow of hot and cold potable water for crew use and cooling of propulsion engines. The following paragraphs will cover filling operation and hot and cool potable water operation. Refer to Figure 2-33 for system diagram which identifies and locates all components.

4-45.1. FILLING OPERATION. (Figure 2-33.) The potable water tanks are located amidships between frames 12 and 16 port and starboard. Each tank has a capacity of 2589 gallons. To fill the potable water tanks proceed as follows:

NOTE

A chlorine tank is furnished which can be moved and installed in the fill lines on the port or starboard side.

1. Open the potable water supply valves to the tanks, port and starboard.
2. Open chlorine mix discharge valve on port or starboard potable water deck supply connection.
3. Open port or starboard potable water supply valve on weather deck at frame 11 depending on where chlorine tank is installed.
4. Install shore facility hose and fill potable tanks to capacity.
5. Remove hose and close all valves. Cap valves on weather deck. Check level indicators on both tanks. Remove hose and stow as required.

4-45.2. EXTENDED BERTHING FILL PROCEDURE. If the craft will be berthed for a long time or if repairs are necessary to the tanks or pressure set, a crossover line from the fill line is provided to allow shore pressurized water to flow through the system without using the pressure set or filter. If this condition arises, proceed as follows:

1. Close the potable water supply valves to the tanks, port and starboard.
2. Open potable water supply valve in crossover line and close pressure set discharge valve and suction pressure set valve.

NOTE

The crossover line is fitted with a relief valve set at 65 PSI to protect the system.

3. Connect supply hose from shore facility and open potable water supply valve.

4-45.3. BASIC SYSTEM OPERATION. The potable water system provides continuous supply from the stowage tanks to the hot water system and to cold potable water outlets throughout the craft (Figure 3-7). A gage board for monitoring suction and discharge of the fresh water pressure set is installed in the pump room (Figure 4-14). Normal operating pressure range for the potable water system is 30 PSI to 50 PSI.

NOTE

Under normal conditions all valves are in the open position to allow water flow to outlet requiring hot or cold potable water. The isolation valve in the

torpedo washdown line is the only valve that can be closed until needed during torpedo recovery. The valve is positioned to isolate both torpedo wash down stations from the rest of the system. If system repair is required, refer to onboard NAVSEA drawing 533-6003427 for system diagram to isolate a specific component.

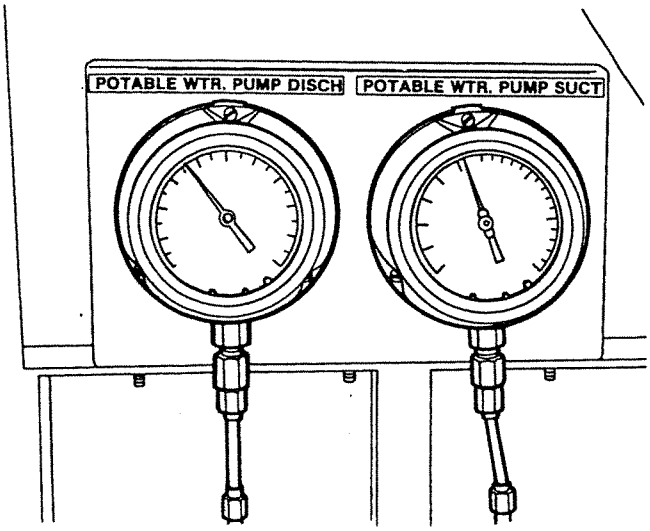


Figure 4-14. Potable Water Gages
(Frame 14, Starboard, Pump Room)

4-45.3.1. Hot Water Heater. Electrical power must be connected to the hot water heater from power panel P402 and the contactor to permit operation.

WARNING

Never operate the heating elements without being certain the water heater is filled with water, and a temperature and pressure relief valve is installed in the relief valve opening.

4-45.3.2. Booster Heater. Electrical power must be connected to the booster heater from power panel P403 and the contactor to permit operation.

CAUTION

Do not turn on current to booster heater until the tank has been filled with water and all air has been vented through the dishwasher rinse nozzle. The heating element will burn out in seconds if operated when they are not immersed in water, unless the heater is equipped with a low-water cut-off.

A dual temperature/pressure gage is installed in the potable water supply to the booster heater (Figure 4-15). Normal operating temperature for the booster heater system is 180 degrees Fahrenheit. Normal operating pressure for the booster heater system is 30 PSI to 50 PSI.

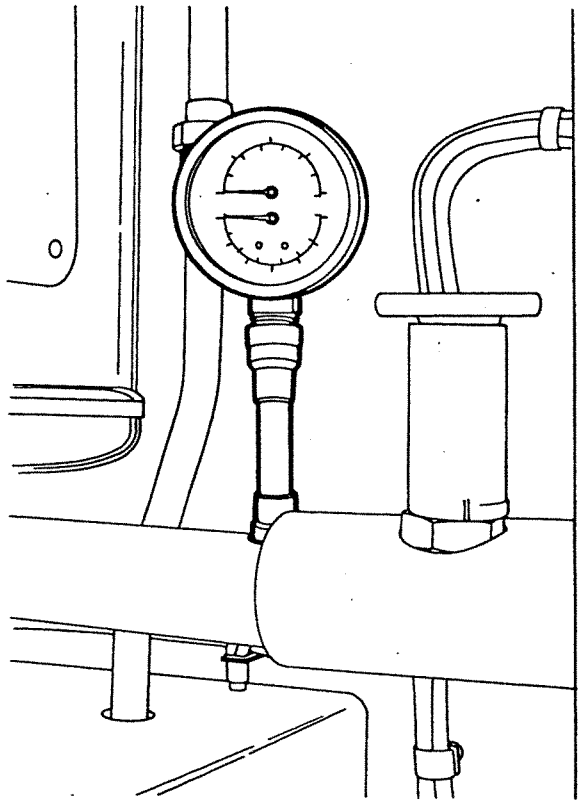


Figure 4-15. Booster Heater Temperature/
Pressure Gage
(Frame 12, Starboard, Provisions Storeroom)

4-45.3.3. Fresh Water Pressure Set. Electrical power must be supplied to the fresh water pump from power panel P401 and the controller to operate.

WARNING

Do not run pump dry.

1. After priming, start pump at push button control with discharge valve fully open. If pressure does not build up within a reasonable length of time, stop pump, reprime and restart.
2. Allow pump to run briefly to purge air from the system before adjusting the regulator to the correct pressure setting (30 to 50 PSI).
3. Open regulator until internal noise increases, then close until pressure gage (Figure 4-14) steadies and internal noise ceases.

4-45.3.4. Water Filters. Change the cartridge filters at least every six months or when the flow rate becomes inconveniently slow. Place the head valve handles in the full counterclockwise position closing the inlet valve to the cartridge filter.

NOTE

Cartridges must be activated one at a time for five minutes each.

4-46. STEERING SYSTEM OPERATION.

Steering can be accomplished at the helm through the helm pump and steering wheel or at the auxiliary conning station using the electrically controlled jog switch. Hydraulic oil for the steering system is pumped from the header tank on the pilothouse roof. To operate the steering system proceed as follows:

1. Start the steering system pump set at the motor controllers.
2. Check steering system pressure gage (Figure 4-16).

NOTE

A pressure gage for the steering system is located in the lazarette. Normal operating pressure range for the steering system is 800 PSI.

3. Turn the steering wheel in a clockwise direction to ensure a solid feel in the system. Reverse direction to ensure a solid feel in counterclockwise direction.
4. Turn wheel clockwise to turn craft in a starboard direction or counterclockwise to turn craft in a port direction. Refer to onboard Technical Service Manual S9561-BD-MMC-010 for complete details.

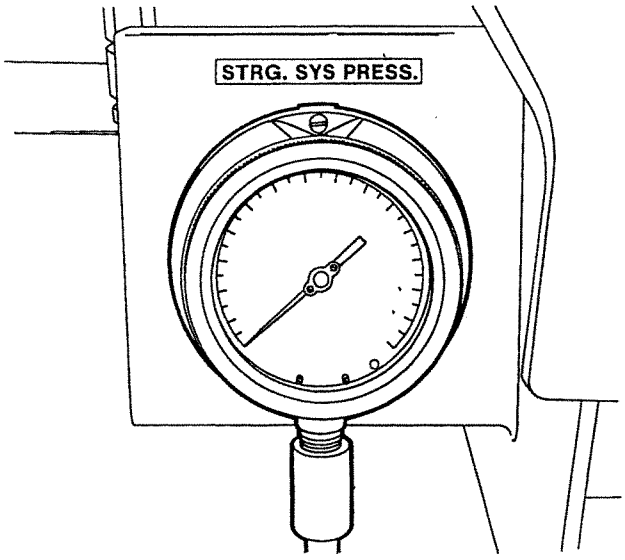


Figure 4-16. Steering System Pressure Gage (Lazarette, Frame 27)

NOTE

Refer to Section V of this chapter for emergency steering procedures.

4-47. ANCHOR HANDLING SYSTEM OPERATION.

The anchor stowage and handling system allows raising and lowering of the anchors and chains and stowage of the chain in a chain locker below the main deck. Refer to onboard Technical Service Manual NAVSEA S9581-A2-MMC-010 for complete operation and maintenance details for the anchor windlass Model X-1885.

During operation of the windlass the operator should follow all safety precautions as noted in the onboard manual. A specific warning plate is attached to the windlass which reads as follows:

WARNING

For personnel protection the brake operator must position himself alongside the motor drive gear on the opposite side of the brake in use.

4-48. BOW THRUSTER SYSTEM OPERATION.

The bow thruster system is designed to be used as a secondary propulsion system to provide lateral thrust to the bow of the craft. It is hydraulically powered and allows maneuverability for docking in close areas and also provides a means of controlling the craft against winds and side currents. Control panels are provided at the helm and the auxiliary conning station (Figures 3-15 and 3-16). The primary control panel at the helm is controlled through a "joystick" on the panel. Movement of the joystick to port will cause the bow of the craft to move in that direction. The secondary control panel can also control the bow thruster but the system is designed so that it cannot override the primary helm control. To operate the bow thruster proceed as follows:

1. Turn panel power switch "ON," green panel power indicator light will glow "green" if there is power to the unit.

NOTE

If there is no power to the unit, check fuse in panel and replace if necessary.

2. Check station transfer lights to be sure bridge light is lit. Selector switch must be turned to bridge selection.
3. If oil temperature or oil level light on alarm panel are lit, turn system off and repair as necessary.
4. Check bow thruster hydraulic pressure gage in engine room (Figure 4-17).

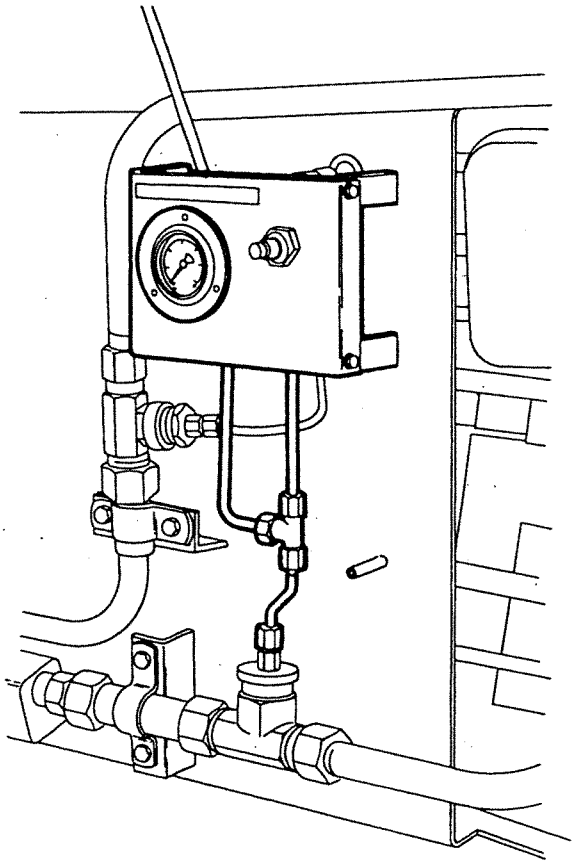


Figure 4-17. Bow Thruster Hydraulic Pressure Gage (Frame 17, Port, Engine Room)

NOTE

Normal operating pressure range for the bow thruster system is 50 PSI to 2500 PSI.

5. Move "joystick" to the port or starboard as necessary to activate the thruster.

NOTE

If remote operation at the auxiliary conning station is necessary, the station transfer selector switch at the helm must be turned to "remote."

Refer to onboard Technical Service Manual S9568-AM-MMC-010 for complete operating procedures.

4-49. HEATING, VENTILATION, AIR CONDITIONING SYSTEMS OPERATION.

The heating, ventilation and air conditioning systems use the same ducting to direct air flow either cool or warm to temperature-controlled spaces. The ducting also supplies natural air ventilation to the spaces that do not have controlled temperatures. Air furnished by the air handler is forced through the duct heaters to the temperature controlled spaces.

4-49.1. DUCT HEATERS. Thermostats are installed in the temperature controlled areas to allow adjustment of heat between 80 degrees and 65 degrees for living areas and 90 degrees and 75 degrees in washroom areas. In-duct heaters are provided in the following spaces:

1. Pilothouse, P, S
2. C.P.O. stateroom
3. Air handling room
4. Mess and lounge

To operate in-duct heaters proceed as follows:

1. Turn heater selector switch to "ON."
2. Adjust thermostat to desired temperature.
3. Heater and fan will run until temperature reaches thermostat setting and will shut off, and will remain shut off until the temperature drops below the thermostat setting.

4-49.2. FORCED AIR/CONVECTION HEATERS. Forced air heaters are installed in the lazarette and the engine room. Convection heaters are installed in both washrooms. These heaters are set to a temperature range between 90 degrees and 75 degrees and once they have been set should not be tampered with unless absolutely necessary. To operate the heater proceed as follows:

1. Turn power switch ON and set thermostat to desired temperature.
2. Unit will now cycle automatically. Do not change setting once it has been made.

4-49.3. VENTILATION. Spaces are supplied with air either by supply fans or by natural supply. The engine room is supplied through a mushroom ventilator with a vane axial fan. A supply trunk supplies 10,000 CFM to the engine room. Natural supply to other spaces is circulated through the air handler or circulates from the main deck through replenishment vents. Refer to Figure 2-44 for HVAC system diagram which identifies and locates all components.

4-49.3.1. Areas supplied naturally are as follows:

1. Bosun's stores
2. Bow thruster space
3. Passageways
4. Provisions storeroom
5. Pump room
6. Lazarette
7. Bosun's locker
8. Air handling room
9. Washrooms

4-49.3.2. Areas supplied mechanically are as follows:

1. Engine room
2. Observer's berthing
3. Crew berthing
4. C.O. stateroom
5. C.P.O stateroom

6. Mess/lounge
7. Galley
8. Pilothouse
9. Electrical equipment room

4-49.3.3. Areas exhausted naturally are as follows:
1. Observer's berthing
2. Crew berthing
3. Engine room
4. Electric equipment room
5. C.O. stateroom
6. C.P.O. stateroom
7. Bosun's locker
8. Pilothouse
9. Pasageways
10. Mess/lounge

4-49.3.4. Areas requiring mechanical exhaust are as follows:
1. Bosun's stores
2. Bow thruster space
3. Pump room
4. Provisions storeroom
5. Washrooms
6. Lazarette
7. Galley
8. Mess/lounge

4-49.4. GALLEY EXHAUST. The galley is fitted with a ventilator hood to exhaust hot air and extract grease. The ventilator is equipped with a 280 degree fuse linked fire damper. In the event of fire the damper will automatically close and the exhaust fan will shut off preventing fire from spreading up the exhaust ducting. Refer to onboard Technical Service Manual S6161-HT-FSE-010 for complete operation details.

4-50. FIRE EXTINGUISHING SYSTEMS.

4-50.1. HALON SYSTEM OPERATION. The fixed Halon system in the engine room provides automatic release and or manual release at the control panel and at the break glass stations. Refer to paragraph 7-8 for operation and onboard Technical Service Manual S9555-BH-MMC-010 for complete details of the system.

4-50.2. GALLEY FIRE SUPPRESSION SYSTEM. This system provides for automatic release or manual release. Refer to paragraph 7-9 for operation.

4-51. ELECTRONIC NAVIGATION EQUIPMENT OPERATION.

4-51.1. LORAN "C" NAV-XL SET. Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 for operation.

4-51.2. SATELLITE NAVIGATION SET MX5102. Refer to onboard Equipment Manual NAVSEA SE174-AA-MMC-010 for operation.

4-51.3. POSITION PLOTTING TABLE MODEL 4080. Refer to onboard Equipment Manual NAVSEA SE171-AD-MMC-010 for operation.

4-51.4. AUTOMATIC DIRECTION FINDER MODEL FD-171-ADF. Refer to onboard Equipment Manual NAVSEA SE176-AB-MMC-010 for operation.

4-51.5. DEPTH INDICATOR SET MODEL F-360-D. Refer to onboard Equipment Manual NAVSEA SE360-AP-MMC-010 for operation.

4-51.6. RADAR SET LN-66. Refer to onboard Equipment Manual NAVSEA SE211-AB-MMA-010 for operation of the Model KAAR LN-66 Radar Unit and Manual NAVSEA SE211-AB-MMC-010 for the True Bearing Unit.

4-52. ELECTRICAL NAVIGATION EQUIPMENT OPERATION.

4-52.1. GYROCOMPASS MARK 27 MOD I. Refer to onboard Equipment Manual NAVSEA 0924-038-1010 for operation.

4-52.2. UNDERWATER LOG SYSTEM MODEL 3200. Refer to onboard Equipment Manual NAVSEA SE350-AA-EIM-010 for operation.

4-52.3. NAVIGATION LIGHTS. These 24 VDC lights are operated from the navigation lighting panel. Refer to onboard Equipment Manual NAVSEA S9422-AH-MMC-010 for description and operation of the panel.

4-53. COMMUNICATION EQUIPMENT OPERATION.

4-53.1. ANNOUNCING SYSTEM. Refer to onboard Equipment Manual NAVSEA SE101-AP-MMC-010 for operation.

4-53.2. SHIP'S ENTERTAINMENT RADIOS. Refer to onboard Equipment Manual NAVSEA SE101-AN-MMC-010 for operation.

4-53.3. UHF RADIO SET AN/ARC-159. (225-400 MHz) with control unit C-10206 and headset RF-3014. Refer to onboard Equipment Manual NAVSEA NA16-30-ARC-1594 for operation.

4-53.4. HF/VHF RADIO SET AN/URC-94. (Consists of transceiver RT-1230, control unit C-10206, handset H189-GR and junction box J-3641.) This unit is used with VHF antenna coupler AS-1729 and 9-foot antenna and antenna coupler CU-2184 and 35-foot antenna. Refer to

following onboard Equipment Manuals for description and operation: NAVSEA EE100-EA-OMP-010 and supplement, NAVSEA 100-EA-OMP-020, and NAVSEA 100-EB-OMP-010.

4-53.5. VHF FM RADIO TELEPHONE. (Intech model 90.) Refer to onboard Equipment Manual NAVSEA SE150-AV-MME-010 for operation.

4-53.6. VHF FM RECEIVER. (Intech model 11.) Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 for description and operation.

4-53.7. SONAR UNIT. Refer to onboard Equipment Manual NAVSEA 0965-LP-490-1640 for operation.

4-53.8. TELEPHONE SYSTEM. Refer to onboard Equipment Manual NAVSEA SE165-AR-MMC-01A for operation.

4-54. ALARM PANEL OPERATION.

Refer to onboard Equipment Manual NAVSEA SE168-AK-MMC-010 for operation of the alarm panels at the pilothouse and engine room. The general alarm system is used with the ship's announcing system.

4-55. INDICATING SYSTEMS OPERATION.

The onboard indicating systems are listed below. These indicators are used with other components and are described with the applicable system.

1. Propulsion engine tachometer indicators are installed in the pilothouse and at the auxiliary conning station console. Used with propulsion engines.
2. The electric rudder angle indicators are installed at the pilothouse steering console and the auxiliary conning station. Used with steering system.
3. The propulsion engines gage board to monitor engine operations.
4. Diesel generator engine gage boards.
5. Electric plant control panel meters.
6. The air conditioning unit gage board, pressure and temperature gages, and freon gages.
7. Fuel system gages.
8. Sea water system gages.
9. Compressed air system gages.
10. Fire pump pressure gages.
11. Fresh water system pressure gages.
12. Bow thruster hydraulic pressure.
13. Booster heater pressure/temperature gage.

Section IV
SHUTDOWN

4-56. SHUTDOWN PROCEDURES.

The following section covers routine shutdown procedures for systems and components on the craft.

4-57. PROPULSION ENGINE SHUTDOWN.

To shut down the propulsion engines proceed as follows:

1. Reduce engine speed to low idle (700 RPM) and continue to anchorage.
2. Shift the transmission to NEUTRAL and secure the craft.
3. Increase engine speed to half engine speed (900 RPM) and idle for five minutes to cool engine.
4. Check crankcase oil while engine is idling. Maintain oil level between ADD and FILL marks and dipstick.
5. Engage marine transmission. Check the marine transmission oil level at low idle. Maintain oil level between ADD and FILL marks on dipstick.
6. Press engine STOP button at pilothouse console or auxiliary conning station.

NOTE

Engine may also be shut down in the engine room.

4-58. FUEL SYSTEM SHUTDOWN.

The shutdown procedures for the fuel system will be detailed according to the primary modes of operation.

4-58.1. FILL SYSTEM SHUTDOWN. (Figure 2-32.) To shut down fill system proceed as follows:

1. Close fuel oil fill valves (43 and 44) on weather decks.
2. Close gate valves (34, 37 and 40) to fuel oil storage tanks.
3. Close gate valve (19) in fuel transfer pump line.

4-58.2. FUEL TRANSFER SYSTEM SHUTDOWN. (Figure 2-32.) To shut down the fuel transfer system proceed as follows:

1. Close gate valves (31, 32, 35, 36, 41 and 42) (high or low suction) at all storage tanks.
2. Close gate valve (13) that supplies transfer pump.
3. Close gate valves (23 and 26) on both sides of oil/water separator.
4. Close stripping valves (54) at fuel oil day tanks.
5. Press stop button at transfer pump motor controller.

4-58.3. STRIPPING SYSTEM SHUTDOWN. (Figure 2-32.) To shut down stripping system proceed as follows:

1. Close all low fuel oil suction valves (36 and 41) at storage tanks and stripping valves (54) at day tanks.
2. Close fuel oil supply valve (55) to stripping pump.
3. Close stripping pump bypass and return valve (56).
4. Close overboard discharge valve (48) on weather deck.
5. Close oily water tank suction valve (14).

4-58.4. FUEL SUPPLY AND RETURN SHUTDOWN. (Figure 2-32.) To shut down fuel supply to engines and return from engines proceed as follows:

1. Close valves to priming pumps on engines.
2. Close supply valves (2) on day tanks.
3. Close supply valves (30 and 47) to all engines.
4. Close crossover return valve (52) to day tanks from engines.

4-59. LUBE OIL SYSTEM SHUTDOWN.

To shut down the lube oil evacuation system proceed as follows (Figure 2-14):

1. Press manual STOP button located on stanchion in engine room.
2. Disconnect fast lube oil unit plug.
3. Close valves at engine (9) or marine gear (11) being evacuated.
4. Remove hoses from waste oil tank and engine or marine gear quick disconnect coupling.
5. Stow FLOCS unit as required.

To shut down waste oil discharge close gate valve on weather deck and disconnect shore hose.

4-60. SEA WATER COOLING SYSTEM SHUTDOWN.

Shutdown procedure is covered in two sub-paragraphs, which cover sea water cooling for engines and stern tubes, and A/C condenser sea water cooling.

4-60.1. ENGINES AND STERN TUBE COOLING SHUTDOWN. (Figure 2-37.) To shut down the system proceed as follows:

1. Close inlet valves at the sea chest (6), sea water pump (38) at the engine and in the by pass line (21).
2. Close stern tube interconnection valve (25) and supply valves (30).
3. Close supply valves (27) to exhaust system.
4. Close supply and discharge valves (35 and 36) at heat exchangers.
5. Close crossover line valve (39) between propulsion engines.
6. Shut down propulsion engine(s).

4-60.2. A/C CONDENSER SEA WATER COOLING SHUTDOWN. (Figure 2-37.) To shut down the system proceed as follows:

1. Close gate valves (6) at sea chests.
2. Close supply valves (37 and 45) to strainers and sea water pump.
3. Close discharge valves (55) and discharge bypass valve (56).
4. Close overboard discharge valve (58).
5. Shut off sea water pump at motor controller.

4-61. A/C REFRIGERATION SYSTEM SHUTDOWN.

For shutdown procedure of the A/C refrigeration system refer to onboard Technical Service Manual S9514-B5-MMC-010. Refer to paragraph 4-60.2 for sea water cooling to the refrigeration system.

4-62. SEWAGE SYSTEM SHUTDOWN.

The sewage system consists of black water holding and gray water holding or overboard discharge.

4-62.1. SEWAGE SYSTEM SHUTDOWN (BLACK WATER). (Figure 2-16.) To shut down the back water sewage system proceed as follows:

1. Close gate valves from water closets (12) to sewage holding tank.
2. Close pumpout ball valve (5).
3. Shut down sewage pump at controller. Refer to onboard Technical Service Manual S9593-BP-MMC-010 for complete shutdown details.

4-62.2. SEWAGE DISCHARGE SHUTDOWN (BLACK WATER). To shut down the sewage discharge proceed as follows (Figure 2-16):

1. Close discharge valve at sewage holding tank.
2. Close three-way ball valves (3 and 4) in discharge line.
3. Remove shore facility hose and close pumpout connection on main deck. Lock connection.

4-62.3. PLUMBING AND DECK DRAINS (GRAY WATER). (Figure 2-42.) The sump pump located in the pump room can be shut down to prevent sump pumpout only. Lines from main deck are automatically discharged overboard.

4-63. FIREMAIN SYSTEM SHUTDOWN.

To shut down the firemain system proceed as follows (Figure 2-34):

1. Shut off fire pumps at controller.
2. Close suction and discharge valves (3, 8, 11 and 23) at fire pumps.
3. Close sea water supply valve.
4. Close supply valves (12, 15 and 17) to fire stations.
5. Close supply valves (13, 16, 18, 19 and 20) at fire stations, disconnect hose and secure fire hose.

4-64. BILGE SYSTEM SHUTDOWN.

To shut down the bilge system proceed as follows (Figure 2-35):

1. Shut down fire pumps at controller.
2. Close fire pump discharge and suction valves (5, 10, 27 and 30).
3. Close bilge manifold suction valves (3, 11, 13, 15, 19 and 24).
4. Close bilge overboard discharge valves (6).

4-65. BALLAST SYSTEM SHUTDOWN.

To shut down ballast system proceed as follows (Figure 2-36):

1. Shut down fire pump at controller.
2. Close suction and discharge valves (16 and 19) at fire pump.
3. Close suction and discharge valves (20 and 21) at the ballast manifold.
4. Close remote operated valve (8) to forepeak ballast tank.
5. Close sea water suction valve (13) at sea chest.

4-66. FRESH WATER SYSTEM SHUTDOWN.

To shut down fresh water system proceed as follows (Figure 2-33):

1. Shut down pump and close pressure set supply valve (20).
2. If craft system is to remain inoperative for an indefinite length of time, drain tanks, heater, booster heater and pressure set.

4-67. STEERING SYSTEM SHUTDOWN.

To shut down the steering system proceed as follows:

1. Shut down the steering pumpset at the controller.
2. Shut off power to all electrical components in the system.
3. Close supply valve (4, Figure 2-38) between header tank and pumpset.

Refer to onboard Technical Service Manual S9561-BD-MMC-010 for complete details of the steering system.

4-68. TORPEDO HANDLING SYSTEM SHUTDOWN.

To shut down the torpedo handling system proceed as follows:

1. Secure in-haul winch and transfer winch.
2. Lower transfer carriage into secure position.
3. Move control handles at winch console (Figure 3-17) to their neutral position.
4. Press stop button at winch console to shut down hydraulic power unit.

4-69. CRANE SHUTDOWN.

To shut down the crane proceed as follows:

1. Position control levers (Figure 1-37) in NEUTRAL.
2. Press the STOP button located on the motor controller (Figure 1-36).
3. Secure crane boom at holddowns on deck.

NOTE

When Crane is not in use, 440 VAC power should be supplied to operate motor and motor controller space heater. If maintenance on the unit is required, the 440 VAC power must be cut by moving the disconnect lever to the OFF position.

For complete details on the crane refer to onboard Technical Service Manual SG811-AA-MMC-010.

4-70. ANCHOR HANDLING SYSTEM SHUTDOWN.

To shut down the anchor handling system proceed as follows:

1. Check anchor chains at windlass to be sure devil's claw (Figure 3-18) is secured.
2. Secure the brake by turning the brakewheel (Figure 1-42) in a clockwise direction.
3. Shut down push button station and windlass at control (Figure 1-43).

Refer to onboard Technical Service Manual NAVSEA S9581-A2-MMC-010/76727 for complete details on the anchor windlass.

4-71. BOW THRUSTER SYSTEM SHUTDOWN.

To shut down the bow thruster system proceed as follows (Figure 2-39):

1. Shut down the port propulsion engine as described in paragraph 4-57.
2. Close all valves (2, 5, 11 and 19) to major components.
3. Shut off power to controls and alarm.

Refer to onboard Technical Service Manual S9568-AM-MMC-010 for complete details on the bow thruster system.

4-72. HVAC SYSTEM SHUTDOWN.

To shut down the HVAC system proceed as follows:

1. Shut off power to air conditioning plant and air handler unit.
2. Close sea water supply valves (47, Figure 2-37) to condenser.
3. Shut off power to A/C condenser sea water pump.
4. Close receiver outlet valve (Figure 2-43).
5. Close compressor suction and discharge valve (Figure 2-43).

6. Turn down duct heater thermostats as applicable or shut off electrical power to heaters.

Refer to onboard Technical Service Manual S9514-B5-MMC-010 for complete details on the air conditioning plant and air handler. For system diagram refer to onboard NAVSEA drawing 512-6003415.

4-73. COMPRESSED AIR SYSTEM SHUTDOWN.

To shut down compressed air system proceed as follows:

1. Shut off compressor at controller.
2. Close all supply valves (4 and 13) in system (Figure 2-17).

4-74. DIESEL GENERATOR ENGINE SHUTDOWN.

Refer to onboard Equipment Manual NAVSEA S9324-BH-MMC-010 for shutdown instructions of the electric plant control panel and diesel engine. Refer to onboard commercial manual for generator diesel engine shutdown.

4-75. DISTRIBUTION SYSTEM SHUTDOWN.

Generally, there is no shutdown required on distribution panels unless repair of equipment or distribution lines is required. In such cases manually place the applicable circuit breakers in the off position. Refer to Tables 4-21 through 4-28.

WARNING

When electrical equipment is being repaired and power is disconnected, place a warning sign on the applicable circuit breaker, disconnect switch or controller to indicate repairs are in progress so that power is not accidentally turned on with possible death or severe injury to personnel.

Shutdown of equipment such as pumps and motors is done at the controller and/or disconnect switch for the equipment.

Refer to onboard Equipment Manual NAVSEA SG270-AY-MMC-010 for shutdown of the battery chargers (rectifiers).

4-76. HALON SYSTEM SHUTDOWN.

Refer to onboard Technical Service Manual S9555-BH-MMC-010 for details on system shutdown.

4-77. ELECTRONIC NAVIGATION EQUIPMENT SHUTDOWN.

4-77.1. LORAN "C" NAV-XL SET. Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 for shutdown procedures.

4-77.2. SATELLITE NAVIGATION SET MX5102. Refer to onboard Equipment Manual NAVSEA SE174-AA-MMC-010 for shutdown procedures.

4-77.3. POSITION PLOTTING TABLE MODEL 4080. Refer to onboard Equipment Manual NAVSEA SE171-AD-MMC-010 for shutdown procedures.

4-77.4. AUTOMATIC DIRECTION FINDER MODEL FD-171-ADF. Refer to onboard Equipment Manual NAVSEA SE176-AB-MMC-010 for shutdown procedures.

4-77.5. DEPTH INDICATOR SET MODEL F-360-D. Refer to onboard Equipment Manual NAVSEA SE360-AP-MMC-010 for shutdown procedures.

4-77.6. RADAR UNIT. Refer to onboard Equipment Manual NAVSEA SE211-AB-MMA-010 for shutdown of the Model KAAR LN-66 Radar Unit and Manual NAVSEA SE211-AB-MMC-010 for the True Bearing Unit.

4-78. ELECTRICAL NAVIGATION EQUIPMENT SHUTDOWN.

4-78.1. GYROCOMPASS MARK 27 MOD I. Refer to onboard Equipment Manual NAVSEA 0924-038-1010 for shutdown procedures.

4-78.2. UNDERWATER LOG SYSTEM MODEL 3200. Refer to onboard Equipment Manual NAVSEA SE350-AA-EIM-010 for shutdown procedures.

4-78.3. NAVIGATION LIGHTS. These lights are normally never shut down except for repairs.

4-79. COMMUNICATION EQUIPMENT SHUTDOWN.

4-79.1. ANNOUNCING SYSTEM. Refer to onboard Equipment Manual NAVSEA SE101-AP-MMC-010 for shutdown procedures.

4-79.2. SHIP'S ENTERTAINMENT RADIOS. Refer to onboard Equipment Manual NAVSEA SE101-AN-MMC-010 for shutdown procedures.

4-79.3. UHF RADIO SET AN/ARC-159 (225-400 MHz). Refer to onboard Equipment Manual NAVSEA NA16-30-ARC-1594 for shutdown procedures.

4-79.4. HF/VHF RADIO SET AN/URC-94. Refer to onboard Equipment Manuals NAVSEA EE100-EA-OMP-010 and supplement, NAVSEA 100-EA-OMP-020, and NAVSEA 100-EB-OMP-010 for shutdown procedures.

4-79.5. VHF FM RADIO TELEPHONE. Refer to onboard Equipment Manual NAVSEA SE150-AV-MME-010 for shutdown procedures.

4-79.6. VHF FM RECEIVER. Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 for shutdown procedures.

4-79.7. SONAR UNIT. Refer to onboard Equipment Manual NAVSEA 0965-LP-490-1640 for shutdown procedures.

4-79.8. TELEPHONE SYSTEM. The telephones are never shut down except for repair.

4-80. ALARM PANEL SHUTDOWN.

The alarm panels are normally never shut down except for repair.

Section V
EMERGENCY PROCEDURES

4-81. GENERAL.

This section covers the emergency procedures to be implemented when an emergency occurs. The following paragraphs cover all probable emergencies that may occur.

4-82. PROPULSION ENGINE EMERGENCY OPERATION.

CAUTION

Shutdown of the propulsion engines with the emergency shutdown controls may cause severe damage to the propulsion engines. Use only as directed.

4-82.1. ENGINE SHUTDOWN. Emergency engine shutdown controls for the propulsion engines are installed at the pilothouse console (Figure 2-6) and at the access to the engine room (Figure 1-54). The controls are push-pull handles and will allow shutdown of the propulsion engines under all conditions. The shut-off device is designed to override all other control features.

4-82.2. FUEL SHUTDOWN. Emergency fuel shut-off for the engine can be accomplished on the main deck (Figure 1-9) and in the lazarette at the valves (Figure 4-18). Controls on the main deck are T-handles which when pulled out will automatically shut off complete supply of fuel to the engines. To shut off fuel supply in the lazarette, the operater must pull the lever on the valve.

4-83. DIESEL GENERATOR EMERGENCY STOPS.

The diesel generators can be stopped in an emergency in the following areas:

1. Deckhouse console — Break glass and push button for generator 1 and 2 below window wipers switches (Figure 2-6).
2. Mess Lounge — Break glass and push button port side of exit door to shelter deck area (Figure 4-19).
3. Lazarette — Pull button to stop at lazarette escape hatch (Figure 4-20).
4. Engine Room — Pull button to stop at engine room escape hatch, frame 19, starboard side. Same as unit used in lazarette.

4-84. STEERING SYSTEM EMERGENCY OPERATION.

In the event of power pump failure, the automatic changeover valve will direct oil from the helm pump directly to the steering actuator. This will allow manual steering from the pilothouse only with a lower response time for rudder movement.

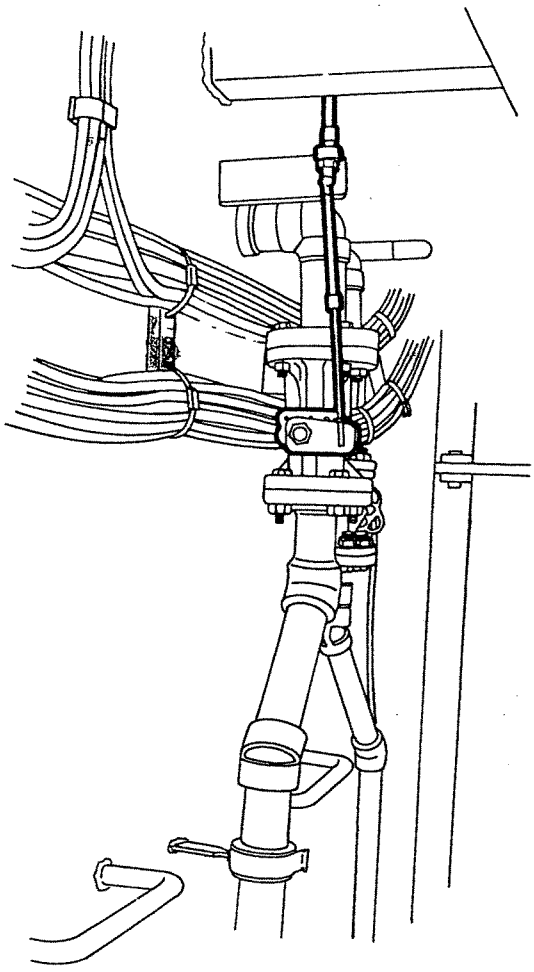


Figure 4-18. Lazarette Emergency Fuel Shut-off (Frame 24, Port and Starboard)

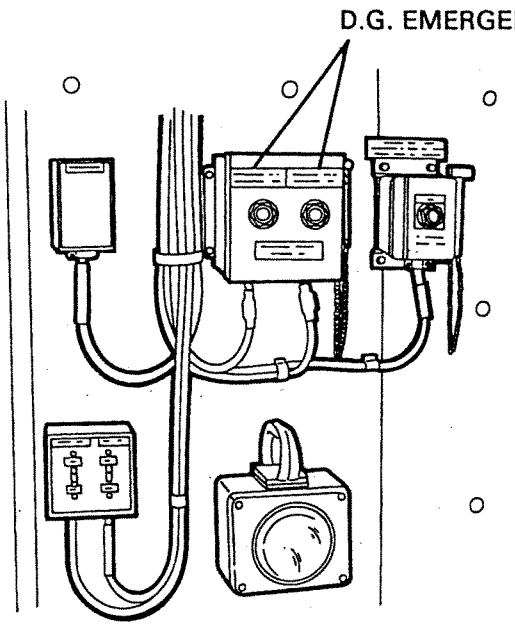


Figure 4-19. Diesel Generator Engine Emergency Stop — Mess/Lounge (Frame 13-1/2, Port Side of Exit Door)

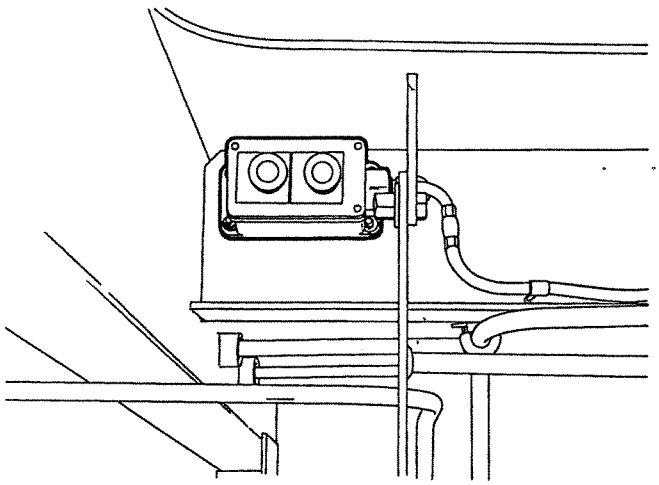


Figure 4-20. Lazarette Generator Emergency Stop Buttons (Frame 26-1/2, Centerline)

4-85. LOSS OF PROPULSION ENGINE.

In the event of breakdown of either propulsion engine, the craft can be operated on a single engine in a degraded cruise mode. Proceed as follows:

1. Move the throttle-reverse control (Figure 2-6) for the down engine to neutral.
2. Pull clutch disconnect lever (Figure 2-6) for down engine. Verify that the clutch is disengaged at the engine linkage (Figure 2-11).
3. Lock the propeller shaft of the down engine (Figure 4-21).
4. Overfill the marine gear for the inoperable engine with lubricating oil.

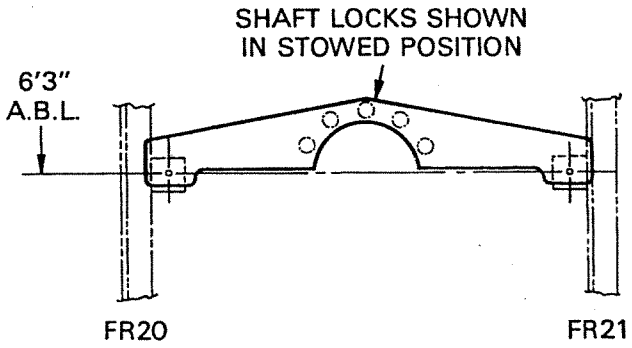


Figure 4-21. Propeller Shaft Locks — Stowed Position

CAUTION

The craft must be operated intermittently at low speed to prevent damage to the marine gear.

5. Carefully operate the craft with the active engine and use the rudder to correct heading angle. Docking in the degraded mode should be attempted with care.

4-86. LOSS OF BOTH ENGINES.

If both engines are down, overfill both marine gears prior to towing the craft and lock propeller shafts of both engines. Refer to paragraph 4-85.

4-87. FIRE FIGHTING PROCEDURES.

Refer to Chapter 7 for fire fighting details.

4-88. PILOTHOUSE EQUIPMENT EMERGENCY OPERATION.

Communication equipment, navigation equipment, navigation lights, window wipers and alarm panels are operational from the 24 VDC batteries when the main power is not available. There is a disconnect switch for the emergency 24 VDC batteries which must be "ON" to connect the batteries to the system. The switch is located in the bow thruster area at frame 4-1/2 starboard side of centerline (Figure 4-22).

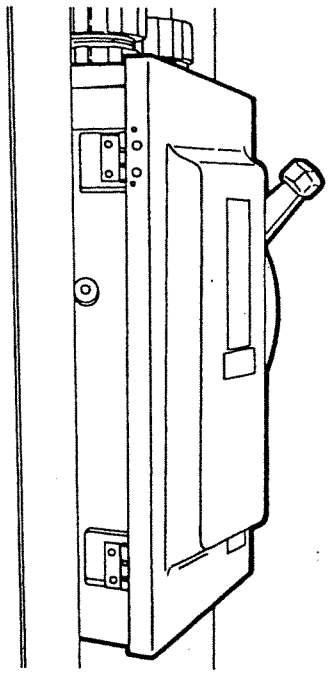


Figure 4-22. Disconnect Switch for Emergency 24 VDC Batteries (Bow Thruster Area, Frame 4-1/2, Starboard)

Section VI
TROUBLESHOOTING

4-89. GENERAL.

This section contains troubleshooting procedures for troubles that may occur during craft operation and also contains the possible remedies to correct the trouble. In the event that trouble should occur, a preliminary check of the system should be made as follows:

1. Check to be sure power is available.
2. Check pump motors and controls operate properly.
3. Be sure switches and contactors are in the correct position.
4. Check that cables and wiring are not defective or disconnected.
5. Check for clogged strainers or filters.
6. Check for proper pump operation.
7. Inspect lines and fittings for leaks.
8. Check that valves are in proper position for proper system operation.

4-90. TROUBLESHOOTING CHART.

Table 4-29 lists the troubleshooting procedures in tabulated form. The first column lists the symptom or apparent trouble, the second column contains the probable cause and the suggested remedy is listed in the third column. Refer to onboard Technical Service Manuals and onboard NAVSEA drawings for specific data on systems and components.

4-91. ELECTRICAL TROUBLESHOOTING.

Trouble in the electrical distribution system due to an overload is the result of a short circuit or equipment malfunction. Starting with the tripped circuit breaker(s) isolate the trouble to the specific line(s) using the wiring diagrams (Figures 3-24 through 3-38). Check operation of the circuit breaker itself. If the circuit breaker trips again and the equipment is not running, the cause of trouble is probably a short circuit in the line or the equipment. Using a multimeter check the circuit back from the equipment to the tripping circuit breaker to further isolate the defective wiring.

If equipment does not operate and the circuit breaker(s) are not tripped, there is an open circuit in the equipment or the wiring. Check the equipment for blown fuses and malfunction; repair as necessary. If the equipment is operational, isolate the open circuit in the wiring using a multimeter; repair as required. Use the elementary wiring diagrams (Figures 3-39 through 3-64) for additional help in locating equipment interconnection troubles.

Table 4-29. Troubleshooting Guide

Trouble	Probable Cause	Corrective Action
	Propulsion System	
1. Engine turns over but fails to start.	a. Lack of fuel.	a. Check fuel tanks.
	b. Water in fuel system.	b. Strip fuel tanks.
	c. Clogged fuel filters.	c. Clean filters. Refer to engine onboard Technical Service Manual.
	d. Emergency shutdown closed.	d. Place shutdown controls in normal open position.
	e. Fuel injection system malfunctioning.	e. Refer to engine onboard Technical Service Manual.
2. Engine runs irregularly.	a. Clogged fuel filter elements.	a. Clean elements.
	b. Water in fuel tanks.	b. Strip fuel tanks.
	c. Engine fuel injection system malfuntioning.	c. Refer to engine Technical Service Manual.
3. Engine overheating.	a. Low fresh water level.	a. Add fresh water.
	b. Partially clogged water cooler.	b. Clean water cooler. See engine onboard Technical Service Manual.
	c. Raw water inlet strainer clogged.	c. Clean or replace strainer.
	d. Defective water pump.	d. Replace pump.
	e. Defective temperature regulating valve.	e. Clean or replace valve.
	f. Discharge valves closed.	f. Check valves.
4. Low lubricating oil pressure indicated.	a. Lack of lubricating oil.	a. Check and fill to proper level.
	b. Defective gage.	b. Replace gage.
	c. Clogged or broken line to gage.	c. Replace or repair broken line.
	d. Lube oil pump or relief valve defective.	d. Repair or replace pump or relief valve.
5. High engine lube oil pressure.	a. Low oil level.	a. Replenish oil supply.
	b. Partially clogged strainer in return line from cooler.	b. Remove and clean strainer.
6. Shaft rotating out of alignment.	a. Loose connections at engine and shafting.	a. Tighten connections.
	b. Damaged hose or base bands at stuffing box.	b. Replace or tighten.
7. Excessive leaking at shaft stuffing box.	a. Loose or defective packing.	a. Tighten packing gland or replace packing.
8. Overheating of exhaust pipes.	a. Sea water strainer clogged.	a. Remove and clean strainer.
	b. Sea water supply valve not open.	b. Open valve.
	c. Break in hose or line.	c. Repair.
	d. Engine pump defective.	d. Refer to engine onboard Technical Service Manual.

Table 4-29. Troubleshooting Guide — Continued.

Trouble	Probable Cause	Corrective Action
	Fuel System	
1. Sufficient fuel not available to engines.	a. Fuel tanks empty.	a. Fill tanks.
	b. Fuel line valves partially closed.	b. Check valves.
	c. Sludge in filter.	c. Clean filter.
	d. Broken lines or loose connections.	d. Repair or replace.
	e. Valve in pump inlet line closed.	e. Open valve.
2. No fuel to engines.	a. Valve in supply line from day tanks closed.	a. Open valve.
	b. Filter in suction line clogged.	b. Remove and clean filter.
	c. Check valve in suction line stuck closed.	c. Free or remove check valve.
	d. Vent on day tank plugged.	d. Disassemble and clean vent terminal.
	e. Defective fuel pump.	e. Repair or replace pump.
3. Fuel transfer from stowage tanks to day tanks not possible.	a. Clogged water separator filter in transfer pump suction line.	a. Clean or replace water separtor filter.
	b. Valves in transfer pump inlet or outlet line closed.	b. Open valves.
	c. Clogged vent on tank from which fuel is being drawn.	c. Disassemble and clean vent terminal.
	d. Transfer pump defective.	d. Repair or replace transfer pump (Technical Manual S6225-SQ-MMC-010).
	Lube Oil System	
1. FLOCS unit not functioning.	a. No power to starter.	a. Check circuit breaker.
	b. Unit defective.	b. Repair or replace unit.
2. No discharge from engine.	a. Engine discharge valve closed.	a. Open discharge valve.
	b. FLOCS system defective.	b. Repair or replace unit.
	Bilge System	
1. Bilge pump will not drain bilge.	a. Bilge suction strainer clogged	a. Clean suction strainer.
	b. Suction line valve closed.	b. Open valve.
	c. Overboard discharge valve closed.	c. Open valve.
	d. Bilge manifold valves closed.	d. Open valves.
	e. Faulty pump.	e. Replace pump. Refer to onboard Technical Manual S6225-SS-MMC-010.
	f. Remote valve to anchor chain sump closed.	f. Check remote linkage and open valve.
2. Sump tank will not drain.	a. Valve to sump pump closed.	a. Open valve.
	b. Sump pump faulty.	b. Repair or replace pump. Technical Manual S6225-BQ-MMC-010.

Table 4-29. Troubleshooting Guide — Continued.

Trouble	Probable Cause	Corrective Action
	Steering System	
1. No steering action.	a. Loose or damaged hydraulic lines.	a. Inspect system for leaks and repair.
	b. Broken mechanical linkage.	b. Inspect and repair.
	c. Steering pumps defective.	c. Repair or replace pumps. Technical Service Manual S9561-BD-MMC-010.
	d. No power to electrical controls.	d. Check wiring and controller.
	e. Defective electric controls.	e. Repair or replace.
	f. Faulty accumotor.	f. Repair or replace. Technical Manual S9561-BD-MMC-010.
2. Sluggish steering.	a. System relief valve bypassing at abnormally low pressure.	a. Repair or replace system relief valve.
	b. Directional valve in power unit sticking.	b. Remove and repair or replace valve.
	c. Hydraulic pump worn or or defective.	c. Repair hydraulic pump.
3. Erratic steering.	a. Faulty hydraulic valves.	a. Inspect and repair.
	b. Defective electric controls.	b. Check wiring repair controls.
	Fresh Water System	
1. No cold potable water at fixtures.	a. Supply in tanks depleted.	a. Replenish supply.
	b. Valves in pump suction lines closed.	b. Open valves.
	c. Valve in pump pressure line closed.	c. Open valves.
	d. Insufficient water pressure.	d. Repair or replace pressure set.
2. No hot water at fixtures.	a. Valve in hot water heater inlet line closed.	a. Open valve.
	b. Gate valve in pressure line closed.	b. Open valve.
	c. Cold potable water system inoperative.	c. Refer to item 1.
	d. Hot water heater defective.	d. Repair or replace hot water heater.
	Sewage System	
1. Toilet does not flush.	a. No water pressure.	a. Check water pressure at flush valve (22 PSI and above).
	b. No vacuum pressure.	b. Clean out vacuum line to toilet.
	c. Discharge valve defective.	c. Replace discharge valve.
2. Pump will not start.	a. Power supply not available.	a. Check out power supply and control circuits.
	b. Water level in sewage tank below low level switch.	b. Fill tank until low water warning lamp goes off.

Table 4-29. Troubleshooting Guide — Continued.

Trouble	Probable Cause	Corrective Action
	Sewage System — Continued.	
2. Pump will not start — Continued.	c. Jammed impeller.	c. Remove impeller obstruction.
	Bow Thruster System	
1. Bow thruster unit not operating.	a. Port propulsion engine shutdown. b. Engine driven pump defective. c. No power to control boards.	a. Start up port propulsion engine. b. Repair or replace pump. c. Check circuit breaker.
2. Insufficient power in system.	a. Defective pump. b. Damaged or leaking lines. c. Relief valve malfunctioning. d. Directional control valve defective.	a. Repair or replace pump. b. Repair or replace defective lines. c. Replace relief valve. d. Replace valve.
3. Hydraulic pump not operating properly.	a. Clogged inlet line or filter. b. Clogged reservoir air vent. c. Pump defective.	a. Clean inlet line and filter. b. Clean or replace air breather. c. Replace pump.
4. No bow thrust when joystick is moved.	a. Directional control valve closed. b. Electric failure. c. Hydraulic pump defective.	a. Turn system off and replace valve. b. Repair faulty connection or broken wire. c. Replace pump.
	Torpedo Handling System	
1. In-haul winch does not operate.	a. Supply valves closed. b. No power to motor controller. c. No power to pushbutton (start-stop). d. Insufficient pressure in system.	a. Open valves. b. Check circuit breaker on electric plant control panel. c. Check out power supply. d. Check power unit.
2. Winch controls not operating properly.	a. System pressure too low. b. Valve malfunctioning or lines damaged.	a. Check pump sections for proper output. b. Repair or replace valve, repair damaged lines.
3. Transfer carriage does not operate.	a. No power to power unit. b. Insufficient system pressure. c. Hydraulic cylinders leaking or defective. d. Carriage motor defective. e. Filter or strainers clogged. f. Insufficient hydraulic oil in reservoir.	a. Check for power at controller. b. Check pump for proper output. c. Repair or replace cylinders. d. Replace carriage motor. e. Clean filters and/or strainers. f. Fill reservoir to capacity.

Table 4-29. Troubleshooting Guide — Continued.

Trouble	Probable Cause	Corrective Action
	Ballast System	
1. Cannot fill ballast tanks.	a. Aft fire pump not operating.	a. Check for power to controller.
	b. Defective pump or motor.	b. Repair or replace pump or motor.
	c. Suction or discharge valves closed.	c. Open all valves.
	d. Strainers at sea chests clogged.	d. Clean strainers.
	e. Proper valves at manifold closed.	e. Open proper manifold valves.
2. Cannot de-ballast.	a. Fire pump not operating.	a. Check for power to controller.
	b. Fire pump or motor defective.	b. Repair or replace motor or pump.
	c. Valves at manifold not open.	c. Open proper manifold valves.
	Firemain System	
1. No pressure at fire stations.	a. Fire pumps not operating.	a. Check for power at controller.
	b. Valves in system closed.	b. Open all valves.
	c. Defective pumps or motors.	c. Repair or replace pumps or motors.
	d. Overboard discharge valve open.	d. Close overboard discharge valve.
2. Low pressure at fire stations.	a. One pump or motor not functioning.	a. Repair or replace defective pump.
	b. Sea chest strainers clogged.	b. Clean strainers.
	c. Valves not fully open.	c. Check valves and open if necessary.
	Sea Water Cooling System	
1. No sea water pressure to system.	a. Propulsion engines shut down.	a. Start propulsion engines.
	b. Pump or pumps defective.	b. Repair or replace engine driven pumps.
	c. Supply valves closed.	c. Open all supply valves.
2. Low sea water pressure.	a. Pumps malfunctioning.	a. Repair or replace pumps.
	b. Sea chest strainers clogged.	b. Clean strainers.
	c. Valves not fully open.	c. Open all valves.
	Halon System	
1. Flame detector failure.	a. Faulty indicator lamp.	a. Check wiring and lamp.
	b. Faulty wiring.	b. Repair or replace wiring.
	c. Defective control amplifier.	c. Test amplifier and replace if necessary (see onboard manual S9555-BH-MMC-010).
2. Cylinders do not discharge Halon.	a. Cylinders empty.	a. Replace with full cylinders.
	b. Discharge valve in OFF position.	b. Open discharge valve.
	c. Cylinders damaged.	c. Replace cylinder.
	d. No power to system.	d. Check circuit breaker.

Table 4-29. Troubleshooting Guide — Continued.

Trouble	Probable Cause	Corrective Action
	Galley Fire Extinguisher	
1. Cylinder does not discharge.	a. Cylinder empty.	a. Replace with full cylinder or recharge with 20 lb. of PLUS-FIFTY C
	b. Automan release not cocked.	b. Open release box and cock release.
	c. Tension lever in the "up" position.	c. Place tension lever in the "down" position.
	d. Wire rope knotted or jammed.	d. Check wire rope elbows and conduit for foreign objects or deformation. Replace as required.
	e. Defective fusible link.	e. Replace defective fusible link. NOTE: Be sure link is 360° F rated.
2. Little or no chemical discharge at nozzles.	a. Defective cartridge.	a. Replace defective cartridge.
	b. Nozzles clogged or not opening.	b. Clean and replace as necessary.
	c. Defective rupture disc.	c. Replace rupture disc.
	Crane	
1. Crane does not operate.	a. No power.	a. Check crane motor controller.
	b. Defective motor.	b. Repair or replace motor (see onboard manual SG811-AA-MMC-010).
	c. Defective pump.	c. Repair or replace pump (see onboard manual SG811-AA-MMC-010).
	d. Defective control valve.	d. Repair or replace control valve (see onboard manual SG811-AA-MMC-010).
2. Insufficient pressure in system.	a. Pump malfunctioning.	a. Repair or replace pump.
	b. Damage or leakage in lines.	b. Repair or replace lines.
	c. Hydraulic oil level low in reservoir.	c. Fill reservoir.
3. Winch will not lift load.	a. Load exceeds rating.	a. Reduce load.
	b. System pressure low.	b. Adjust pump compensator.
	Compressed Air System	
1. Air horn will not operate.	a. Compressor not receiving power.	a. Check power at controller.
	b. Supply valves closed.	b. Open supply valves.
	c. Insufficent pressure from compressor.	c. Repair or replace compressor (see onboard manual S6220-CZ-MMC-010).
	d. Manual horn valve defective.	d. Replace manual horn valve.
2. System pressure incorrect.	a. Relief valve inoperative.	a. Replace relief valve.
	b. Pressure switch malfunctioning.	b. Replace switch.
	c. Pressure regulator malfunctioning.	c. Replace pressure regulator.

Table 4-29. Troubleshooting Guide — Continued.

Trouble	Probable Cause	Corrective Action
	Electrical Power System	
1. No power supply to craft.	a. Main circuit breakers not closed. b. Shore power not plugged in (diesel generators secured).	a. Close main circuit breakers. b. Check shore power connection.
2. No power to any given equipment or distribution panel.	a. Circuit breaker not closed. b. Open wiring.	a. Close circuit breaker. b. Repair wiring.
3. Circuit breaker tripped on any given circuit.	a. Circuit overload. b. Defective circuit breaker.	a. Refer to paragraph 4-91. b. Replace circuit breaker.