CHAPTER III. OPERATION

SECTION 1. PREPARATION FOR USE

3-1. PRE-OPERATIONAL CHECKS

3-2. The following pre-operational checks must be performed prior to operating the PCF.

a. Fill fresh water tank (paragraph 3-8) with potable water.

b. Make sure aft fuel tanks are full using fuel sounding rod. Add fuel as required (paragraph 3-5).

Note

Each aft fuel tank has a capacity of 279 gallons. Fuel sounding rods are calibrated in 10-gallon units.

c. Make sure forward fuel tank is full by checking fuel tank indicator in pilothouse. Add fuel as required (paragraph 3-5).

d. Remove sludge and water from each fuel tank (paragraph 3-55).

Note

It is only necessary to fuel strip each tank prior to first operation each day.

e. Select fuel tank or tanks to be used (paragraph 3-52, 3-53 , or 3-54) and make sure fuel valves listed in Table 3-1 are open.

f. Make sure seawater cooling system valves (Table 3-1) for engines and ac diesel generator are open.

g. Check water level in batteries, located in engine room. Add water as required.

h. Perform engine pre-operational checks as outlined in J-71 Engine Operators Manual, 65E-215.

i. Perform generator preparation instructions as outlined in Operator's Manual and Parts Catalog for Onan Electric Generating Plant, Series MDJB.

j. Make sure 24 VDC SOP switch in engine room is at ON.

k. Make sure AC SOP switch in engine room is at OFF.

l. Make sure engine room cowl vents are not obstructed.

m. Make sure PRIMARY and BACK-UP GUN CIRCUIT main switches in engine room are at ON.

n. Make sure engine control levers in pilothouse are at center position (neutral).

o. Check operation of all lighting systems, windshield wipers, and siren (paragraphs 3-27 through 3-38)

3-3. SERVICING INSTRUCTIONS.

3-4. The PCF fuel system, propulsion system, ac diesel generator, fresh water system, starting batteries, head chlorinator, and ac system are serviced as indicated in paragraphs 3-5 through 3-11, respectively.

3-5. FUEL SYSTEM. To service each fuel tank (2 and 16, Figure 1-28)

Table 3-1. Valves

Valve	Index & Fig. No.
FUEL SYSTEM	
STBD ENG SUPPLY valve	14, 1-28
PORT ENG SUPPLY valve	13, 1-28
GEN SUPPLY valve	22, 1-28
STBD ENG RETURN valve	6, 1-28
PORT ENG RETURN valve	11, 1-28
GEN RETURN valve	8, 1-28
Fwd Fuel Tank	
Supply valve*	19, 1-28
FWD TANK SUPPLY valve*	23, 1-28
FWD TANK RETURN valve*	10, 1-28
Stbd Aft Fuel Tank	
Supply valve*	1, 1-28
STBD TANK SUPPLY valve*	24, 1-28
STBD TANK RETURN valve*	3, 1-28
Port Aft Fuel Tank	
Supply valve*	4, 1-28
PORT SUPPLY valve*	12, 1-28
PORT RETURN valve*	9, 1-28
ENGINE SEAWATER COOLING SYSTEM	
Suction valve	1-31
Overboard discharge valve	1-31
Bilge prime valve	32, 1-33
GENERATOR SEAWATER COOLING SYSTEM	
Suction valve	1-32
* Valve to be opened if fuel tank is selected for use.	

remove caps from fill lines. Fill each tank with diesel fuel, ASTM Designation D975-60T No. 1D (summer) or 2D (winter. Install caps.

Note

Aft fuel tanks have a capacity of 279 gallons each and forward tank has a capacity of 270 gallons.

3-6. PROPULSION SYSTEM. Service the propulsion engine

as outlined in V-71 Engines Operators Manual, 6SE-215 and the marine gear as outlined in Service Manual SM-118.

3-7. AC DIESEL GENERATOR. Service the ac diesel generator (2 , Figure 1-21) as outlined in Operator's Manual and Parts Catalog for Onan Electric Generating Plants, Series MDJB.

3-8. FRESH WATER SYSTEM. To service the fresh water tank (Figure 1-30) remove cap from fill line. Fill tank with potable water. Install cap.

Note

Tank has capacity of 51 gallons.

3-9. STORAGE BATTERIES. To service each of the five storage batteries (1 and 2 , Figure 1-16 and 3 , Figure 1-21), remove caps. Fill each battery with distilled water. Install caps.

3-10. HEAD CHLORINATOR. To service the head chlorinator (16, Figure 1-21), disconnect and remove chlorine siphon from chlorine bottle. Add disinfectant or bleach, such as Clorox, containing at least 5 percent sodium hypochlorite by weight. Install chlorine siphon.

3-11. AC ELECTRICAL SYSTEM, EXTERNAL SOURCE. To supply ac power to the PCF, connect an ac power supply capable of supplying 6 KW, 120-volt, 60-cycle, single phase ac to the ac shore power receptacle (19, Figure 1-21).

3-12. WARM-UP TIMES.

3-13. PROPULSION ENGINE. Allow each propulsion engine to warm up until water temperature gauge indicates 160° to 180°F before applying a load.

3-14. AC DIESEL GENERATOR. Allow the ac diesel generator to warm up until water temperature gauge indicates 160° to 170°F before applying full load.

SECTION 2. OPERATING PROCEDURES

3-15. FUNCTION OF CONTROLS AND INDICATORS

3-16. The function, location, normal in use indication of each PCF control and indicator is presented in Table 3-2, and Figure 3-1.

3-17. PCF OPERATION.

3-18. UNDERWAY CRUISING.

Note

Do not allow fuel tank or tanks to run dry; engine restart will require bleeding air from engine fuel injectors.

Table 3-2. Controls and Indicators

Control and Indicators	Figure No.	Function	Normal in Use Indication
Tachometer (2)	3-1	Registers speed of propulsion engine in rpm	
Water temperature gauge, engine (2)	3-1	Resisters temperature of coolant in propulsion engine	After warmup, engine coolant temperature should be 160° to 185°F
Oil pressure gauge, engine (2)	3-1	Registers pressure of lubricating oil in propulsion engine	Pressure should not fall below 25 psi at 1200 rpm or 30 psi at 2100 rpm. Note Gauge should start to register as soon as engine is started.
Clutch drive oil pressure gauge (2)	3-1	Registers pressure of lubricating oil in twin disc marine gear.	At neutral, pressure should not fall below 60 to 65 psi and engaged should not fall below 185 to 195 psi.
Ammeter (2)	3-1	Shows current flow to and from the load and engine starting batteries.	After engine starts, the ammeter registers a high charge rate at rated propulsion engine speed. This is the rate of charge received by the start battery to replenish the current used to start the engine. As engine continues to operate, the ammeter shows a decline in charge rate to the storage battery.
FWD FUEL TANK gauge	3-1	Indicates fuel oil level in forward fuel tank.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
ONAN OIL PRESSURE gauge	3-1	Registers pressure of lubricating oil in diesel engine of ac diesel generator.	Pressure should not fall below 20 psi.
ONAN WATER TEMP gauge	3-1	Registers temperature of coolant in diesel engine of ac diesel generator	After warmup, coolant temperature should be 165° to 170°F.
BATTERY PARALLELING switch	3-1	Used to parallel load and engine start batterics when start battery does not have sufficient power to start propulsion engine.	
ENGINE ALARM light	3-1	Indicates engine fuel oil pressure and lube oil pressure is low and engine water temperature is excessive.	
Rudder angle indicator	3-1	Indicates position of port and starboard rudders.	
Compass	3-1	Indicates heading PCF is travelling.	
START button, engine (2)	3-1	Used to energize the starting motor of the propulsion engines.	
STOP button, engine (2)	3-1	Used to shut down the propulsion engines.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
Engine control levers	3-1	Increase or decrease engine speeds and engage and change direction of propellers.	Neutral is obtained by placing the control levers at the center position. Propulsion engine clutch action occurs in the first 30 degrees of travel on each side of neutral, while the remaining 60 degrees of travel provides the governor action from idle to full ahead or astern.
Neutral throttle control T-handle (2)	3-1	Used for engine warm-up.	
Emergency fuel tank shutoff control T-handle (3)	3-1	Used to shut off fuel at each fuel tank.	
Fathometer	3-1	Provide continuously accurate sounding from 0 to 60 feet and from 0 to 60 fathoms. Refer to Raytheon Company, Operations and Maintenance Manual, Model DE736 Depth Sounder.	
START-STOP switch, generator	3-1	Used to energize or deenergize starting motor on ac diesel generator.	
GLO-PLUG switch, generator	3-1	Used to energize the ac diesel generator manifold heater	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
COMPASS LIGHT switch	3-1	Used to energize or de-energize compass light.	
FUEL GAUGE switch	3-1	Used to energize or de-energize FWD FUEL TANK gauge	
RADAR ANTENNA light	3-1	Used to indicate radar scanner unit is operating.	
PANEL LIGHT switch	3-1	Used to energize or de-energize two panel lights.	
DIMMER rheostat	3-1	Used to dim or brighten the compass and panel lights.	
AC INDICATOR light	3-1	Used to indicate ac power is being supplied by either ac diesel generator or shore power.	
SIREN switch	3-1	Used to energize or de-energize sirens located on top of pilothouse.	
Windshield wiper switch (3)	3-1	Used to energize or de-energize each windshield wiper.	
Searchlight switch (2)	3-1	Used to energize or de-energize searchlights on top of pilothouse.	
RED LTS. toggle switch	1-22	Used to energize or de-energize 2 red lights and 2 utility lights in pilothouse, 1 red light in crew quarters, and 2 red lights and 2 utility lights in deckhouse.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
IDENT LTS toggle switch	1-22	Used to energize or de-energize top, center, and bottom identification lights.	
ANCHOR LTS toggle switch	1-22	Used to energize or de-energize anchor light on mast head.	
RUNNING LTS toggle switch	1-22	Used to energize or de-energize bow, stern, and 2 side lights.	
GEN LTS toggle switch	1-22	Used to energize or de-energize the dome light in pilothouse, four dome lights in deckhouse, and one bulkhead light in crew quarters.	
PILOT HSE BLOWER circuit breaker, 15-amp	1-23	Used to energize or de-energize circuit to pilothouse exhaust blower and protect circuit from overload.	
PORT RECEPT circuit breaker, 15-amp	1-23	Used to energize or de-energize circuit to port signal light receptacle and protect circuit from overload.	
COMPRESSOR circuit breaker, 15-amp	1-23	Used to energize or de-energize circuit to refrigerator compressor and protect circuit from overload.	
RADIO ROOM RECEPT circuit breaker, 15 amp.	1-23	Used to energize or de-energize circuit to ac receptacle in deckhouse and protect circuit from overload.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
CREW QTRS BLOWER circuit breaker, 15-amp	1-23	Used to energize or de-energize circuit to crew quarters exhaust blower and protect circuit from overload.	
STBD RECEPT circuit breaker, 15-amp	1-23	Used to energize or de-energize circuit to starboard signal light receptacle and protect circuit from overload.	
TOILET MOTOR circuit breaker, 15-amp	1-23	Used to energize or de-energize circuit to chlorinator and protect circuit from overload.	
STOVE circuit breaker, 30-amp	1-23	Used to energize or de-energize circuit to griddle and cooker fixture and protect circuit from overload.	
RADAR circuit breaker, 30-amp	1-35	Used to energize or de-energize circuit to D202 radar and protect circuit from overload.	
RF-301 RADIO circuit breaker, 15-amp	1-35	Used to energize or de-energize circuit to AN/URC-58 radio set and protect circuit from overload.	
VRC-46 RADIO NO. 1 circuit breaker, 15-amp	1-35	Used to energize or de-energize circuit to AN/VRC-46 radio set No. 1 and protect circuit from overload.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
VRC-46 RADIO NO.2 circuit breaker, 15-amp	1-35	Used to energize or de-energize circuit to AN/VRC-46 radio set No. 2 and protect circuit from overload.	
FLOODLIGHT SOP switch	1-16	Used to energize or de-energize circuit to floodlight from engine starter battery.	
Floodlight switch (2)	1-16	Used to energize or de-energize circuit to floodlight.	
24 VDC SOP switch	1-16	Used to energize or de-energize complete dc system from load battery or engine alternators.	
PRIMARY GUN CKT main switch	1-17	Used to energize or de-energize primary gun circuit.	
BACKUP GUN CKT main switch	1-17	Used to energize or de-energize backup gun circuit.	
PRIMARY GUN CKT switch	1-17	Used to energize or de-energize primary gun circuit.	
BACKUP GUN CKT switch	1-17	Used to energize or de-energize backup gun circuit.	
AC SOP switch	1-21	Used to energize or de-energize complete ac system from either ac diesel generator or external source.	
CLORINATOR switch	1-21	Used to energize or de-energize circuit to chlorinator.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
Utility light switch (3)	1-18	Used to energize or de-energize circuit to utility light.	
Engine room, lazarette, and crew quarters bulkhead light switches (4) (switch located on light fixture)		Used to energize or de-energize circuit to bulkhead light.	
Pilothouse and deckhouse dome light switches (5) (switch located on light fixture)		Used to energize or de-energize circuit to dome light.	
Crew quarters berth light switch (6) (switch located on light fixture)		Used to energize or de-energize circuit to berth light.	
D202 radar display unit		Refer to Decca Transar Ships Manual, D202	
Radio set, AN/URC-58		Refer to Instruction Manual, NAVSHIPS 0967-034-8000 and Instruction manual PM-0152	
Radio set, AN/VRC-46		Refer to Technical Manuals, TM 11-5820-401-10 and TM 11-5820-401-20.	
.50 caliber machine gun		Refer to Technical Manual, TM9-1005-213-34.	
81 mm mortar		Refer to Technical Manual OP1743.	

Table 3-2. Controls and Indicators (Continued)

Control and Indicators	Figure No.	Function	Normal in Use Indication
RADAR DISABLING switch	1-34	Used to de-energize radar scanner unit circuit.	
BLOWER switch, pilothouse	1-21	Used to energize or de-energize pilothouse exhaust blower.	
BLOWER switch, crew quarters	1-21	Used to energize or de-energize crew quarters exhaust blower.	
PLT HOUSE, GUN TUB, AFT, and RADIO RM pushbuttons	1-38	Used to energize or de-energize the intercommunication system buzzers at the pilothouse, gun tub, radio area, and aft gun.	

a. Perform pre-operational checks as outlined in paragraph 3-1.

b. Start ac diesel generator as outlined in paragraph 3-42.

c. Run generator at no load until water temperature reaches 160° to 170°F.

CAUTION

Overloading a cold generator will cause high temperatures and serious damage to generator winding could occur.

d. Start propulsion engines as outlined in paragraph 3-46.

e. Using neutral throttle control T-handles, in pilothouse, run engine at no load until water temperatures reach 160° to 185°F. After warm-up, push in neutral throttle control T-handles.

f. With engine and generator running at operating temperature, check for water, fuel, and lubricating oil leaks. Tighten line connections where necessary to stop leaks.

g. Release pressure inside engine heat exchanger and generator water tank by slowly rotating tank caps.

WARNING

Always remove tank cap slowly and carefully to avoid possible flash of hot cooling liquid.

h. Remove tank caps and inspect coolant level. Add fresh water as necessary.

Note

The coolant level should be near the top of opening.

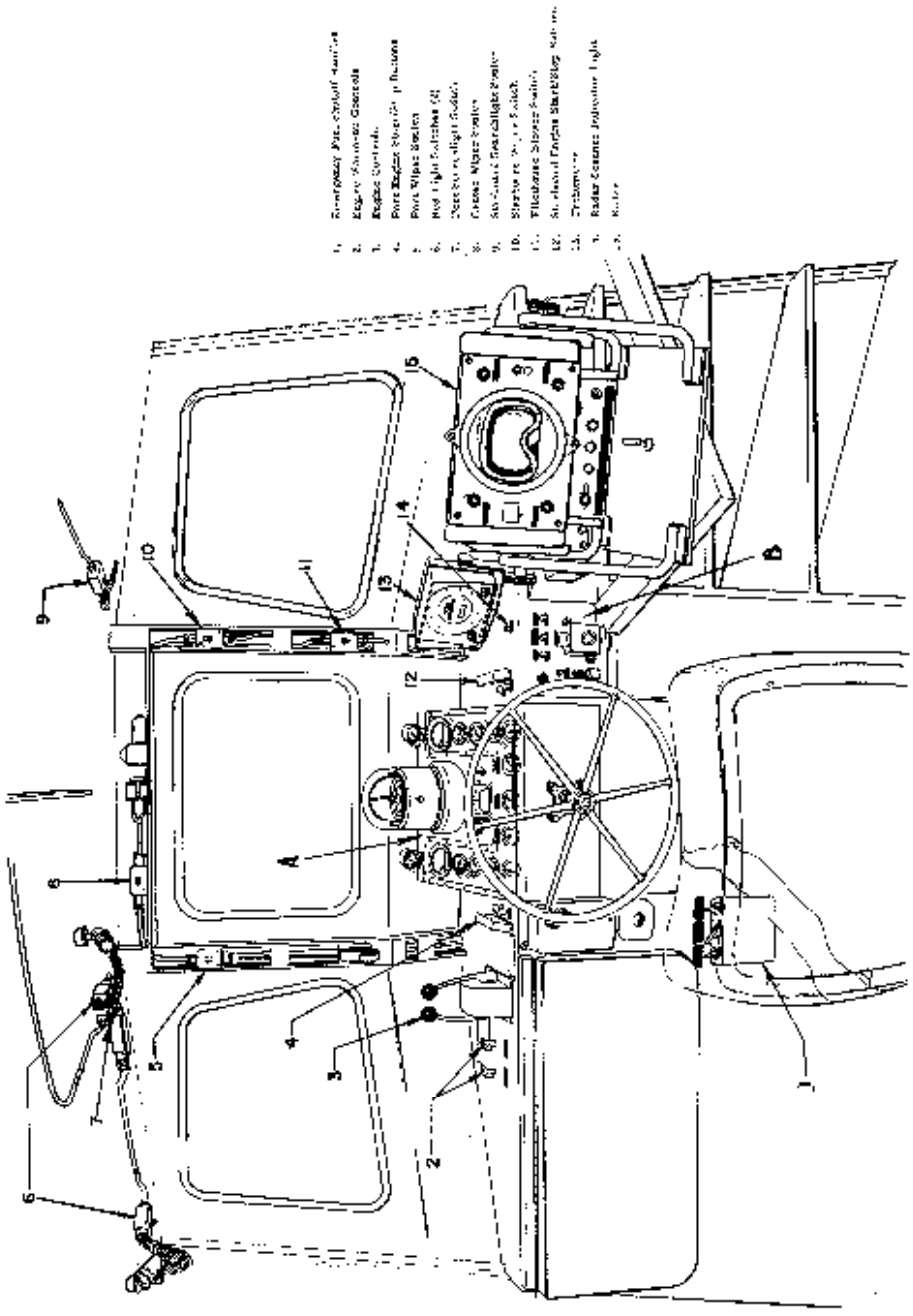

Figure 3-1. Pilothouse Controls and Indicators (Sheet 1 of 3)

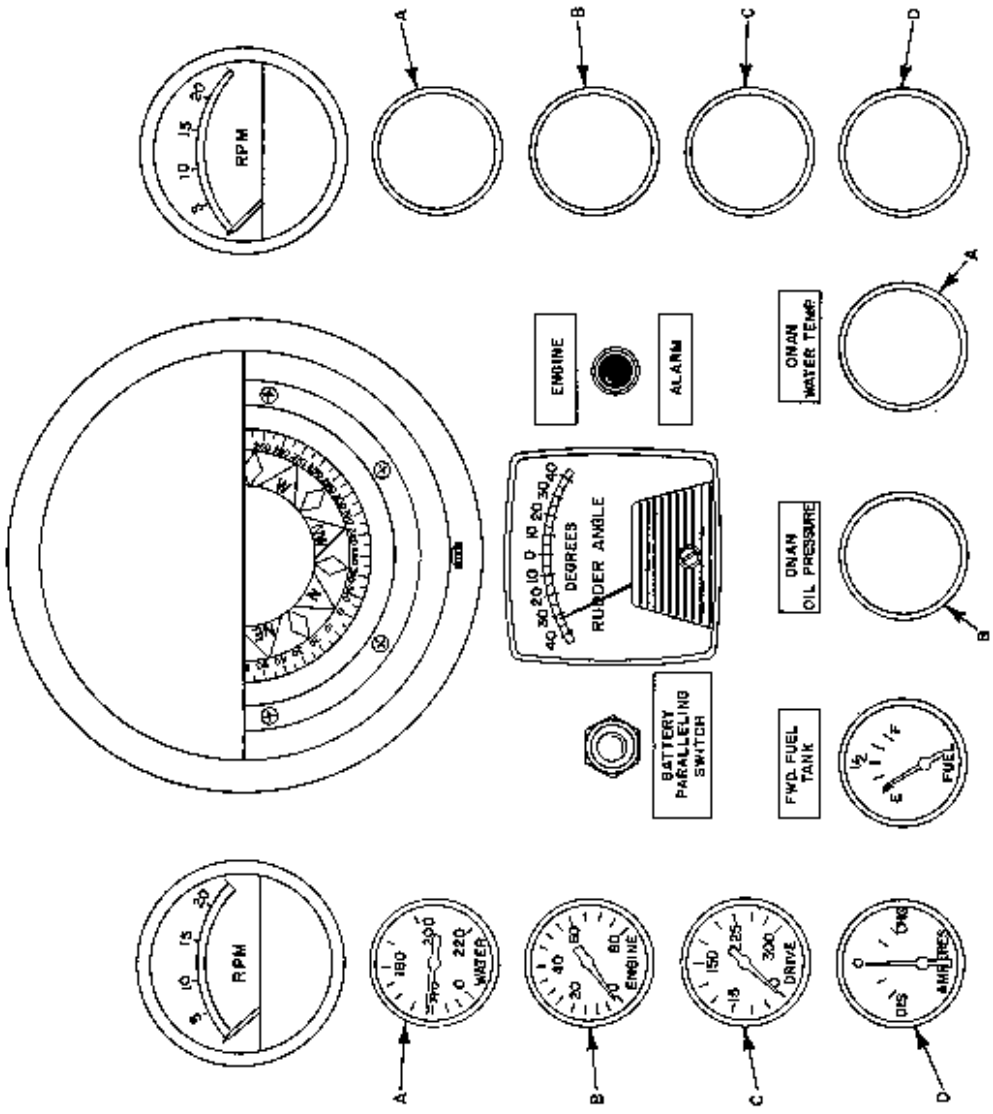

Figure 3-1. Pilothouse Controls and Indicators (Sheet 2 of 3)

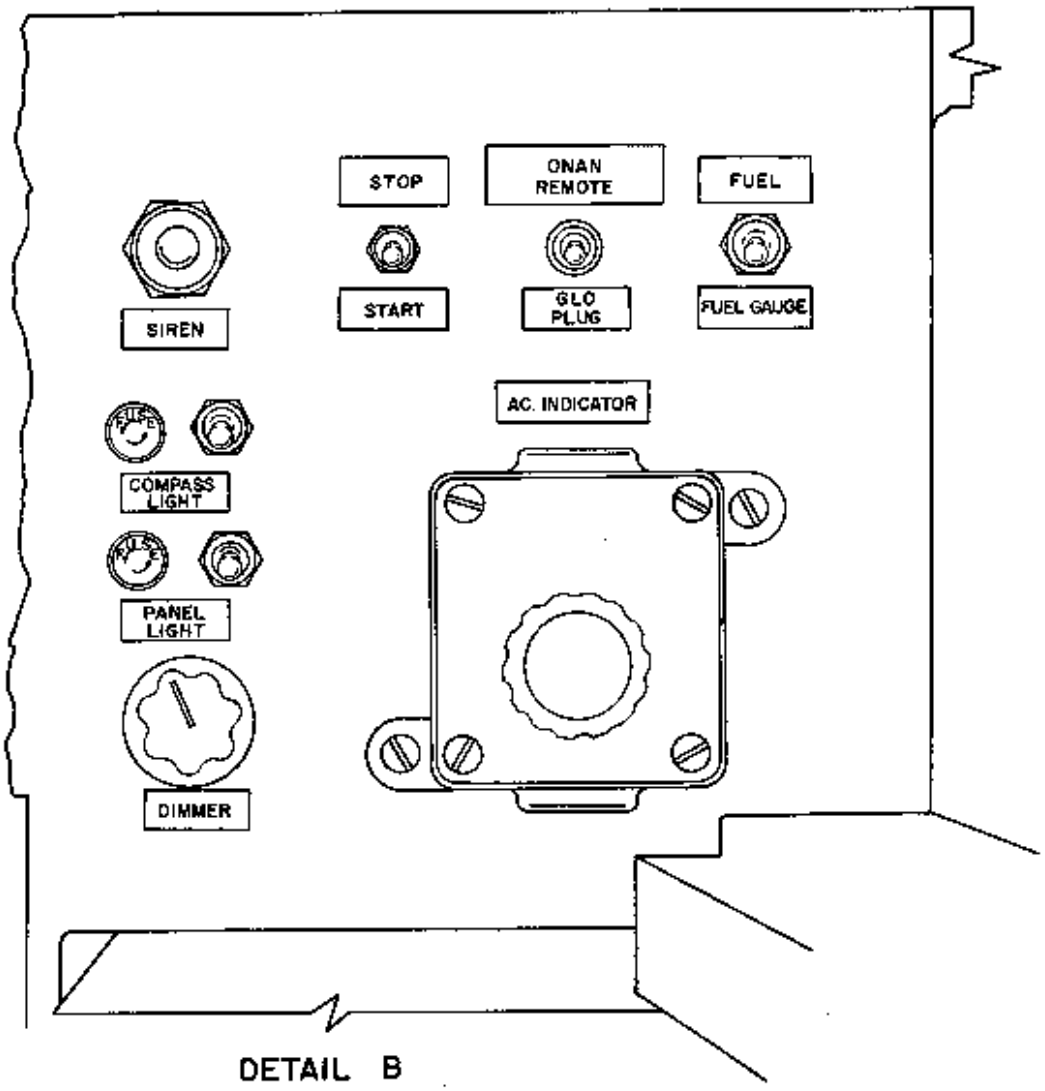

Figure 3-1. Pilothouse Controls and Indicators (Sheet 3 of 3)

i. Release all tie-lines between dock and PCF. Maneuver PCF away from dock proceeding with caution.

j. Advance engine control levers in pilothouse or on deckhouse forward, observing tachometers.

Note

Cruising rpm is 2100 and maximum rpm is 2300.

3-19. LOITERING. To loiter the PCF with the engine operating, perform the following procedure:

a. Stop the PCF moving forward or astern (paragraph 3-21).

b. By manipulating the engine control levers forward or astern as required, PCF can be loitered.

3-20. BACKING. With the engine operating, the PCF can be backed as follows:

a. If the PCF is moving forward, move the engine control levers aft to neutral. Then continue moving levers aft to desired speed, proceeding with caution.

b. If the PCF is loitering, move control levers aft to desired speed and proceed with caution.

3-21. STOPPING.

Note

The procedure to stop the PCF when backing is the same as when moving forward except the movement of engine control levers is reversed.

a. Disengage engine marine gear clutch by moving the engine control levers aft to neutral.

b. Allow PCF to coast, then move levers aft to astern position, and then return to neutral.

3-22. EMERGENCY STOP. With PCF cruising at maximum forward or astern speed, the PCF can be stopped within 50 feet by placing engine control levers at either FULL ASTERN or FULL AHEAD. After the PCF has stopped, place control levers at NEUTRAL.

WARNING

Prior to initiating this maneuver, inform the crew.

CAUTION

This procedure is not to be used unless an emergency situation exists.

3-23. SHUTTING DOWN PCF.

a. Pump bulge water from each compartment as required (paragraph 3-66 or 3-67).

b. Shut down propulsion engines (paragraph 3-47).

c. Shut down ac diesel generator (paragraph 3-43).

d. Fill forward and aft fuel tanks (paragraph 3-5).

Note

If possible, each fuel tank should be filled after each mission. This action will minimize condensation.

e. Close seawater cooling suction valves.

3-24. SYSTEM OPERATION.

3-25. ELECTRICAL SYSTEM.

3-26. DC DISTRIBUTION SYSTEM. To operate the dc distribution system, perform the following:

a. Place 24 VDC SOP switch (3 , Figure 1-16), located in engine room, to ON. This allows dc power from the load battery (1) to be supplied to all lighting systems (except floodlights), windshield wipers, fuel gauge, AN/VRC-46 radio sets, AN/URC-58 radio sets, fathometer, D202 radar, siren, searchlights, and intercommunication system.

b. Place switch to OFF. This removes dc power from systems listed in step a above.

3-27. RED LIGHTING SYSTEM.

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Place RED LTS switch (4 , Figure 1-18) at ON. Five red lights (1 , 9 , and 16) should illuminate.

c. Place utility light switches (3, and 14) at ON.

d. Each utility light (2 and 13) has a DIM/BRT/OFF control located on rear of light and an adjustment control for red or white light on face of light. Operation of DIM/BRT/OFF control controls the light.

e. Place utility light switches and RED LTS switches to OFF. Five red lights should go out.

3-28. IDENTIFICATION LIGHTING SYSTEM.

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Place IDENT LTS switch (24, Figure 1-19) at ON. Three identification lights (3 , 5 , and 6) should illuminate.

c. Place switch at OFF. Identification lights should go out.

3-29. ANCHOR LIGHTING SYSTEM.

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Place ANCHOR LTS switch (25 , Figure 1-19) at ON. Anchor light (2) should illuminate.

c. Place switch at OFF. Anchor light should go out.

3-30. RUNNING LIGHTING CIRCUIT.

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Place RUNNING LTS switch (26, Figure 1-19) at ON. Bow, stern, and two side running lights should illuminate.

c. Place switch at OFF. Running lights should go out.

3-31. GENERAL LIGHTING CIRCUIT.

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Place GENERAL LTS switch (7 , Figure 1-20) at ON.

c. Each dome light (5 and 4) and bulkhead light (6) is equipped with an on-off switch. Operation of this switch controls operation of applicable light.

d. Place GENERAL LTS switch at OFF.

3-32. SIREN CIRCUIT.

a. Make sure 24 VDC SOP switch (3, Figure 1-16) is placed at ON.
b. Depress and hold SIREN push-button switch (15, Figure 1-19). Siren (10) should sound as long as switch is held.
c. Release switch. Siren should stop sounding.

3-33. WINDSHIELD WIPERS CIRCUIT.

a. Make sure 24 VDC SOP switch (3, Figure 1-16) is placed at ON.
b. Place PORT WIS WIPER (15, Figure 1-18) switch at ON. Wiper (10) for port windshield should operate.
c. Place CENTER W/S WIPER switch (12) at ON. Wiper (10) for center windshield should operate.
d. Place STBD W/S WIPER switch (11) at ON. Wiper (10) for starboard windshield should operate.
e. Place each wiper switch at OFF. Windshield wipers should stop operating.

3-34. SEARCHLIGHT CIRCUIT.

a. Make sure 24 VDC SOP switch is placed at ON.
b. Place PORT SEARCH LT switch (12, Figure 1-19) at ON. Port searchlight (11) should illuminate.
c. Place STBD SEARCH LT switch (13) at ON. Starboard searchlight (14) should illuminate.
d. Place switches at OFF. Searchlights should go out.

3-35. CREW QUARTERS LIGHTING CIRCUIT. There are six berth lights for the crew quarters.

a. Make sure 24 VDC SOP switch (3, Figure 1-16) is placed at ON.
b. Each light (10, Figure 1-20) is equipped with an on-off switch. Operation of this switch controls the light.

3-36. CONTROL PANEL AND COMPASS LIGHTING CIRCUIT.

a. Place PANEL LIGHT switch (42, Figure 1-16) at ON. Two panel lights (40) should illuminate.
b. Place COMPASS LIGHT switch at ON. Compass light (41) should illuminate.
c. Rotate DIMMER rheostat (46) clockwise. Illumination intensity of panel and compass lights should increase.
d. Rotate rheostat counterclockwise. Illumination intensity of panel and compass lights should decrease.
e. Place switches at OFF. Panel lights and compass lights should go out.

3-37. ENGINE ROOM AND LAZARETTE LIGHTING CIRCUIT. The engine room has two bulkhead lights (3, Figure 1-20) and lazarette has one bulkhead light (1).

a. Make sure 24 VDC SOP switch (3, Figure 1-16) is placed at ON.
b. Each bulkhead light is equipped with an on-off switch. Operation of the switch controls operation of applicable light.

3-38. FLOODLIGHT CIRCUIT.

a. Place FLOODLIGHT SOP switch (5 , Figure 1-16) at ON. This switch supplies dc power from engine start battery to two floodlights (7).

b. Place floodlight switch (6) at on. Floodlight should illuminate.

c. Place floodlight switch at off. Floodlight should go out.

d. Place FLOODLIGHT SOP switch at OFF.

3-39. PRIMARY AND BACKUP GUN CIRCUIT.

a. Make sure PRIMARY and BACK-UP GUN CKT main switches (Figure 1-17) are at ON.

b. Place PRIMARY GUN CKT switch at ON. This supplies dc power to the MK56 gun mount and .50 caliber machine guns.

c. In event primary gun circuit fails, the backup gun circuit can be utilized. Place BACKUP GUN CKT switch at ON.

d. Place switch at OFF. This removes dc power from MK56 gun mount.

3-40. AC DISTRIBUTION SYSTEM. The ac distribution system can be supplied ac power from the ac diesel generator (2 , Figure 1-21) or an external power source. This is either BOAT POWER or SHORE POWER. If an external power is used, the power source must be capable of delivering 6 KW, 120-volt, 60-cycle, single phase ac and must be connected to the ac shore power receptacle (19). The ac diesel generator or the external source supplies ac power to the griddle and cooker fixture (4), refrigerator compressor (5), pilothouse and crew quarters exhaust blowers (7 and 14), chlorinator (16), port and starboard ac receptacles (6 and 8), and galley receptacle (18).

Note

The port and starboard receptacles are used to connect the signal light on either side.

3-41. SIGNAL LIGHT.

a. Connect male plug of signal light to either the port or starboard ac receptacle (6 or 8 , Figure 1-21).

b. Make sure AC SOP switch (1) is placed at BOAT POWER or SHORE POWER as applicable.

c. Make sure applicable circuit breaker, PORT or STBD RECEPT, located on ac distribution panel (Figure 1-23) in pilothouse, is placed at ON.

d. Operate signal light as outlined in Wilmer Manufacturing Company Instruction Manual for Multi-purpose Signal Light, MS 19106.

3-42. STARTING AC DIESEL GENERATOR.

a. Perform pre-operational checks as outlined in paragraph 3-1.

Note

AC diesel generator can be started at either the pilothouse or engine room. The procedures are the same. Therefore the procedures for starting in the pilothouse are presented below.

b. Depress and hold GLO PLUG switch (10, Figure 1-21) for one minute; release switch. Then depress and hold START/STOP switch (11) at START.

c. Release switch as soon as engine starts. Engine start is evidenced by pressure buildup in oil pressure gauge.

d. Observe oil pressure gauge.

Note

Oil pressure should read at least 20 psi.

3-43. SHUTTING DOWN AC DIESEL GENERATOR

CAUTION

Carbon in exhaust system will occur in diesel engines operated consistently at light loads. Operate the generator engine at full load for approximately 5 minutes just before stopping to clean out the exhaust system.

a. Place and hold START-STOP GEN switch to STOP.

b. Release switch as soon as generator stops. Engine stop is evidenced by decrease of pressure on oil pressure gauge.

Note

If generator fails to stop, close GEN SUPPLY fuel valve (22, Figure 1-28).

3-44. PROPULSION SYSTEM.

3-45. To operate the propulsion system perform the following:

a. Start each propulsion engine as outlined in paragraph 3-46.

b. Using engine control levers, one for each in engine, in pilothouse or atop port side of deckhouse, position control levers forward to approximately 30 degrees. Through mechanical linkage this should engage the clutch of propulsion engine marine gear.

c. Position control levers to 90 degrees forward or FULL AHEAD, position. Through mechanical linkage this should engage the throttle of the propulsion engine and increase rpm output of engines. PCF should move ahead.

d. Position control levers to center position or NEUTRAL position.

e. Position control levers to appoximately 30 degrees aft. Through mechanical linkage this should engage clutch of propulsion engine marine gear.

f. Position control levers to 90 degrees aft or FULL ASTERN position. Through mechanical linkage this should engage throttle of propulsion engine and increase rpm output of engines. PCF should move astern.

g. Position control levers to NEUTRAL position.

h. Shut down propulsion engine as outlined in paragraph 3-47.

3-46. STARTING PROPULSION ENGINE

Note

One engine should be started and operating prior to starting other engine. The procedures for starting one engine are presented below.

a. Perform pre-operational checks as outlined in paragraph 3-1.

b. Lift engine start button guard and press START button. If engine fails to start within 30 seconds, release button

and allow engine starting motor to cool a few minutes before trying again. If engine fails to start after four attempts, an inspection should be made to determine cause. (Refer to Engine Operation Manual 6SE-215.

CAUTION

Pressing START button with engine operating can cause damage to starting motor of engine.

c. Observe oil pressure gage immediately after starting engines.

CAUTION

If there is no oil pressure indicated within 10 to 15 seconds, stop engine (paragraph 3-46) immediately and check lubricating system.

Note

The pressure should not fall below 25 psi at 1200 rpm or 30 psi at 2100 rpm, and normal operating pressure should be higher.

d. Pull out partly and lock neutral throttle control T-handle, in pilothouse.

Note

Twisting the T-handle in either direction locks the control in desired setting.

e. Run engine at no load for approximately five minutes, allowing it to warm up. Unlock neutral throttle control T-handle and push in.

3-47. SHUTTING DOWN PROPULSION ENGINE.

a. Position engine control levers, in pilothouse, to neutral.

b. Pull out partly and lock neutral throttle control T-handle, in pilothouse.

Note

Allow engines to run at half speed or lower for 4 to 5 minutes.

c. Unlock and push neutral throttle control T-handle in.

d. Lift engine STOP button guards and press STOP buttons.

e. If engines fail to stop perform emergency shutdown procedure. (Refer to V-71 Engine Operator's Manual, 6SE-215.)

CAUTION

Emergency shut-down system should never be used to stop the engine except in an emergency. Use of the emergency shutdown can cause oil to be sucked past the engine and seals into the blower housing.

3-48. MANUAL SHUT-DOWN OF PROPULSION ENGINES. Refer to V-71 Engine Operator's Manual, 6SE-215, for procedures of manually shutting down propulsion engines.

3-49. AUTOMATIC ELECTRICAL SHUT-DOWN OF PROPULSION ENGINES. Refer to V-71 Engine Operator's Manual, 6SE-215, for procedures of automatically shutting down the propulsion engines.

3-50. FUEL SYSTEM.

3-51. Perform the following to operate the fuel system:

a. Make sure fuel tank vents are not obstructed.

b. Make sure emergency fuel tank supply control T-handles (28, Figure 1-28) are pushed in.

c. Remove sludge and water condensation from each fuel tank as outlined in paragraph 3-55.

Note

Fuel tank stripping should be performed only once a day and should be accomplished prior to the first operation.

d. Select fuel tanks to be used as outlined in paragraphs 3-52, 3-53, and 3-54.

Note

One or any combination of the fuel tanks can be used.

e. Open STBD ENG SUPPLY, GEN SUPPLY, and PORT ENG SUPPLY valves (14, 22, and 13, Figure 1-28) at supply manifold.

f. Open STBD ENG RETURN, GEN RETURN, and PORT ENG RETURN valves (6, 8, and 11) at return manifold.

g. Open STBD FUEL SHUTOFF and PORT FUEL SHUTOFF valves (15 and 20).

h. To shut down fuel system, perform steps i and j below.

i. Close valves opened in steps d, e, and f above.

j. Close fuel tank valves, as applicable, opened in paragraph 3-52, 3-53, or 3-54.

k. In event of fire or fuel line rupture, pull emergency fuel tank shutoff control T-handles (28).

3-52. FORWARD FUEL TANK.

a. Make sure fuel oil stripping valve (29, Figure 1-28) is closed.

b. Open supply valve (19), located in storage compartment

c. Open FWD TANK SUPPLY valve (23) at supply manifold.

3-53. STARBOARD AFT FUEL TANK.

a. Make sure fuel oil stripping valve (25, Figure 1-28) is closed.

b. Open supply valve (1), located in lazarette.

c. Open STBD TANK SUPPLY valve (24) at supply manifold.

d. Open STBD TANK RETURN valve (7) at return manifold.

3-54. PORT AFT FUEL TANK.

a. Make sure fuel oil stripping valve (26, Figure 1-28) is closed.

b. Open supply valve (4), located in lazarette.

c. Open PORT TANK SUPPLY valve (12) at supply manifold.

d. Open PORT TANK RETURN valve (9) at return manifold.

3-55. FUEL TANK STRIPPING. Sludge and water condensation shall be removed from the forward and aft fuel tanks at least once a day. This fuel stripping should be accomplished prior to the first operation of the day. Perform the following procedure to fuel strip the fuel tanks:

a. To fuel strip forward fuel tank (16, Figure 1-28), open valve (29).

b. Place bucket underneath discharge port of pump (27). Operate pump until water and sludge have been removed from tank.

c. Close valve (29).

d. To fuel strip aft starboard fuel tank (2), open valve (25).

e. Perform step b above.

f. Close valve (25).

g. To fuel strip aft port fuel tank (2), open valve (26).

h. Perform step b above.

i. Close valve (26).

3-56. EMERGENCY FUEL TANK SHUTOFF. To shut off fuel from each fuel tank, three emergency fuel tank shutoff control T-handles (28, Figure 1-28), one for each tank, are located in the pilothouse. Pulling these T-handles outward closes valves (1, 4, and 19) at the full tank.

Note

These controls are to be used only in case of fire or in the event of a fuel line rupture.

3-57. STEERING SYSTEM.

3-58. Steering the PCF can be performed at the pilothouse or the aft port side of the deckhouse.

Note

To use deckhouse steering wheel, engage clutch by moving clutch handle.

b. Rotate either steering wheel counterclockwise. The PCF should turn to port and rudder angle indicator should indicate position of rudder.

c. For emergency steering operation, refer to paragraph 3-88.

3-59. FRESH WATER SYSTEM.

3-60. Potable water is supplied to the sink, located in the deckhouse, from the fresh water tank, located in the lazarette (Figure 1-30). To operate the system, open the valves located in the lazarette and stowage compartment and manually operate the pump at the sink.

3-61. PROPULSION ENGINE SEAWATER COOLING SYSTEM.

3-62. The seawater cooling systems for the port and starboard propulsion engines are identical. Therefore, the procedures for operating the system for only one engine are presented below.

Note

If only one engine is operating, the seawater system for the other engine should be shut down.

a. Open suction valve (Figure 1-31) overboard discharge valve, and bilge prime valve.

b. With engine operating, seawater should be flowing overboard at overboard discharge and exhaust ports and priming bilge manifold and engine-driven bilge pump.

c. To shut down cooling system, shut down engine (paragraph 3-49) and close valves opened in step a above.

3-63. AC DIESEL GENERATOR SEAWATER COOLING SYSTEM.

3-64. To operate the ac diesel generator seawater cooling system, perform the following:

a. Open suction valve, (Figure 1-32).

b. With generator operating, seawater should be flowing overboard at generator exhaust port.

c. To shut down system, shut down generator (paragraph 3-43) and close suction valve.

3-65. BILGE SYSTEM.

3-66. BILGE DRAINAGE (PROPULSION ENGINE OPERATED). With the propulsion engines operating, bilge water can be drained from the forepeak, crew quarters, stowage compartment, engine room, and lazarette by using either one or two engine-driven pumps. Usually, only one compartment is drained at a time but if necessary all five compartments or any combination thereof can be drained. This drainage is accomplished by opening and closing valves. The following is the procedure for pumping bilge water.

Note

If more than one compartment is being drained, observe the water level in each compartment. As one compartment is drained dry, close the control valve for that compartment. This is necessary to prevent the pumps from pumping air rather than water.

a. Using port and starboard engine-driven bilge pumps (13 and 29, Figure 1-33), make sure deck pump valve (5) for hand-operated bilge pump (2) at manifold (33) is closed.

b. Make sure valves (7, 18, 19, and 20) used for deck washdown and valves (21 and 26) at sea suctions are closed.

c. Open priming valve (32) at manifold. This allows seawater from propulsion engine to prime the manifold.

d. Open port and starboard discharge valves (12, 14, 17, and 30) at manifold and port and starboard discharge ports. Observe port and starboard overboard discharge ports for water.

e. Open applicable valve or valves (6 through 11) for compartment or compartments to be drained. Make sure valves for compartments not being drained are closed.

Note

If forepeak is to be drained, make sure valve (24), in crew quarters, is open.

f. As soon as compartment is pumped dry, close compartment valve.

g. Using either port or starboard engine-driven pumps, the procedure is same as steps a through f above for using both pumps, except that either PORT or STBD BILGE PUMP valve (12 or 17) is closed.

3-67. BILGE DRAINAGE (HAND-OPERATED BILGE PUMP). The forepeak, crew quarters, stowage compartment, engine room, and lazarette can be drained by using the hand-operated bilge pump (2, Figure 1-33). Only one compartment at a time should be drained. The following is a procedure for draining a compartment:

a. Make sure PORT and STBD BILGE PUMP valves (12 and 17) at manifold (33) are closed.

b. Open DECK PUMP valve (5) for hand-operated bilge pump at manifold.

c. Open applicable valve (6 through 11) for compartment to be drained. Make sure valves for compartments not being drained are closed.

Note

If forepeak is to be drained, make sure valve (24), in crews quarters, is open.

d. Install handle in pump.

e. Move handle back and forth. Water should flow out discharge port of pump. Continue pumping until compartment is dry. Close valves.

3-68. DECK WASHDOWN OR FIRE EXTINGUISHING. With the propulsion engine operating, seawater can be supplied for deck washdown or fire extinguisher purposes by using either one or two engine-driven bilge pumps (13 and 29, Figure 1-33). The following is a procedure for pumping the seawater for these systems.

a. Using port and starboard engine-driven pumps, connect hoses to angle valves (1) on deck.

b. Make sure DECK PUMP valve (5) for hand-operated pump is closed.

c. Make sure bilge compartment drainage valves (6 through 11) at manifold (33) are closed.

d. Make sure port and starboard bilge valves (14 and 30) at port and starboard discharge ports are closed.

e. Open port and starboard deck washdown valves (18 and 19), in engine room.

f. Open priming valve (32) at manifold.

g. Open PORT and STBD BILGE PUMP valves (12 and 17) at manifold.

h. Open valves (21 and 26) at sea suctions.

i. Open bypass washdown valve (20) in engine room.

Note

By opening and closing this valve, flow to either engine-driven bilge pump can be accomplished.

j. After deck washdown or fire extinguishing has been accomplished, close all valves which have been opened.

3-69. ELECTRONIC SYSTEMS.

3-70. RADIO SET, AN/URC-58.

a. Make sure 24 VDC SOP switch (3, Figure 1-16) is placed at ON.

b. Place RF-301 RADIO circuit breaker (Figure 1-35) at ON.

c. For operation of the radio set, refer to RF Communications, Inc., Instruction Manuals NAVSHIPS 0967-034-8000 and PM-0152A.

3-71. RADIO SET, AN/VRC-46.

a. Make sure 24 VDC SOP switch, (3, Figure 1-16) is placed at ON.

b. Place VRC-46 No. 1 and No. 2 circuit breakers (Figure 1-35) at ON.

c. For operation of radio set, refer to TM 11-5820-401-10 and TM 11-5820-401-20.

3-72. RADAR, D202.

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Place D202 circuit breaker (Figure 1-35) at ON.

c. For operation of the radar, refer to Decca Transar Ships Manual, D202.

3-73. FATHOMETER, DE736 (Figure 1-37).

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. For operation of fathometer, refer to Raytheon Operation and Maintenance Manual for Depth Sounder, Model DE736.

3-74. INTERCOMMUNICATIONS SYSTEM. The intercommunications system (Figure 1-38) has four stations (pilothouse, gun tub, radio area, and aft gun mount). The pilothouse and radio area are equipped with handsets and plug-in chest sets. The gun tub and aft gun mount are equipped with plug-in chest sets. To operate the system, perform the following:

a. Make sure 24 VDC SOP switch (3 , Figure 1-16) is placed at ON.

b. Plug-in chest sets into jacks at gun tub and aft gun mount.

Note

If required, chest sets can be plugged into jacks at pilothouse and radio area.

c. To call one station from another station, depress applicable pushbutton, marked PLT HOUSE, RADIO RM, GUN TUB, and AFT. Buzzer at station called should buzz. Release pushbutton and buzzer should stop buzzing.

d. To talk to one station from another station, depress and hold push-button located on handset or chest set phone.

3-75. VENTILATING SYSTEM.

3-76. To operate the pilothouse and crew quarters exhaust blowers, perform the following:

a. Make sure AC SOP switch (1 , Figure 1-21) is placed at BOAT POWER or SHORE POWER, as applicable.

b. Make sure PILOT HSE and CREW QTRS BLOWER circuit breakers (Figure 1-23) are placed at ON.

c. Place BLOWER switch (9) in pilothouse, at ON. Pilothouse exhaust blower should operate. Place at OFF. Blower should stop operating.

d. Place BLOWER switch (15) in crew quarters, at ON. Crew quarters exhaust blower should operate. Place

switch at OFF. Blower should stop operating.

3-78. RANGE.

3-79. To operate the range, make sure the AC SOP switch (1, Figure 1-21) is placed at either BOAT POWER or SHORE POWER and RANGE circuit breaker is placed at ON. Operate the range controls as outlined in NAVSHIPS 334-1214.

3-80. REFRIGERATOR.

3-81. To operate the refrigerator, make sure the AC SOP switch (1, Figure 1-21) is placed at either BOAT POWER or SHORE POWER and COMPRESSOR circuit breaker (Figure 1-23) is placed at ON.

3-82. ARMAMENT.

3-83. The 50-caliber machine guns are operated as outlined in TM 9-1005-213-34 and the 81-mm mortar is operated as outlined in OP1743.

SECTION 3. EMERGENCY DAMAGE CONTROL PROCEDURES

3-84. GENERAL.

3-85. The three basic objectives of PCF damage control are:

a. To take all practicable preliminary measures before damage occurs, such as maintenance of watertight integrity, provision of stability, removal of fire hazards, and upkeep and distribution of emergency equipment.

b. To minimize and localize such damage as does occur, by such measures as controlling flooding, preservation of stability, combating fires, and first aid treatment of personnel.

c. To accomplish, as quickly as possible, emergency repairs or restorations, after occurence of damage, by measures such as supplying of casualty power, regaining of a safe margin of stability and buoyancy, replacement of essential structure, and manning of equipment.

3-86. Damage control is concerned not only with battle damage but also with non-battle damage such as fire, collision, grounding, or explosion. Damage control may be necessary in port as well as at sea and may involve the use of personnel and facilities of an undamaged ship.

3-87. Damage control requires a detailed knowledge of PCF construction, compartmentation, characteristics, stability, those accessories placed on board the PCF to prevent or control damage should the PCF be endangered, and the damage control information contained within Bureau of Ships Technical Manual, NAVSHIPS 0901-000. Basically, the control of damage depends upon the ability and initiative of personnel to take prompt corrective action, using the materials which are readily available. In addition, having a thorough knowledge of the PCF will enable personnel to determine readily the corrective action to be taken.

3-88. EMERGENCY STEERING.

3-89. If the steering system is damaged beyond repair, two alternate methods of steering the PCF can be used. One method is using the emergency tiller (paragraph 3-90) and the

other method is using the engine control levers (paragraph 3-91).

3-90. EMERGENCY TILLER OPERATION (Figure 3-2).

a. Remove emergency tiller deck plate.

b. Position emergency tiller and attach to starboard tiller.

Note

Emergency tiller is located on aft end of 81-mm ready mortar box.

c. In lazarette, disconnect steering shaft between port tiller and steering gear.

d. Movement of the emergency tiller to port will turn PCF to starboard and movement to starboard will turn PCF to port.

3-91. EMERGENCY STEERING WITH ENGINE CONTROL LEVERS. If both rudders of the PCF are inoperable, the PCF can be steered with the engine control levers (Figure 1-25). This steering is accomplished by manipulating one engine control lever forward and the other aft to make a turn. To move forward or aft, both engine control levers should be advanced or retarded the same degree. A port turn can be accomplished by moving the starboard engine control lever forward and the port engine control lever aft. A starboard turn can be accomplished by reversing the positions of the above mentioned control levers.

Note

A minimum engine speed should be maintained when steering with the engine control levers.

3-92. FIRES

3-93. Since this manual cannot cover all fire situations which could exist, only recommendations for preventing and fighting fires are presented.

a. Establish a definite fire fighting plan. This plan should be general in nature and should assign personnel to specific tasks.

b. Familiarize each crew member in the location of the three CO_2 fire extinguishers (Figure 3-2), controls and equipment for the deck washdown system, three emergency fuel shutoff T-handles, and oxygen breathing apparatus. The T-handles are located in the pilothouse and are used to shut off fuel supply at applicable fuel tank.

c. Train each crew member in the use and operation of the fire extinguishers, deck washdown system (paragraph 3-68), and oxygen breathing apparatus. The deck washdown system is used for other type fires. The oxygen breathing apparatus should be worn by personnel inspecting for or fighting fires below deck.

d. Each crew member should be familar with the operation of each PCF system.

e. Establish a housekeeping plan. If the plan is maintained, unnecessary fire hazards such as waste paper, soiled cleaning cloths, etc., should be eliminated.

f. One portable CO_2 extinguisher is placed in the pilothouse and two CO_2 fire extinguishers are placed in the deckhouse (Figure 3-2) throughout the ship at strategic points. A monthly inspection should consist of weighing the extinguishers. Should they contain less than 90 percent of their proper charge, they should be replaced by a fully charged spare and recharged as

other method is using the engine control levers (paragraph 3-91).

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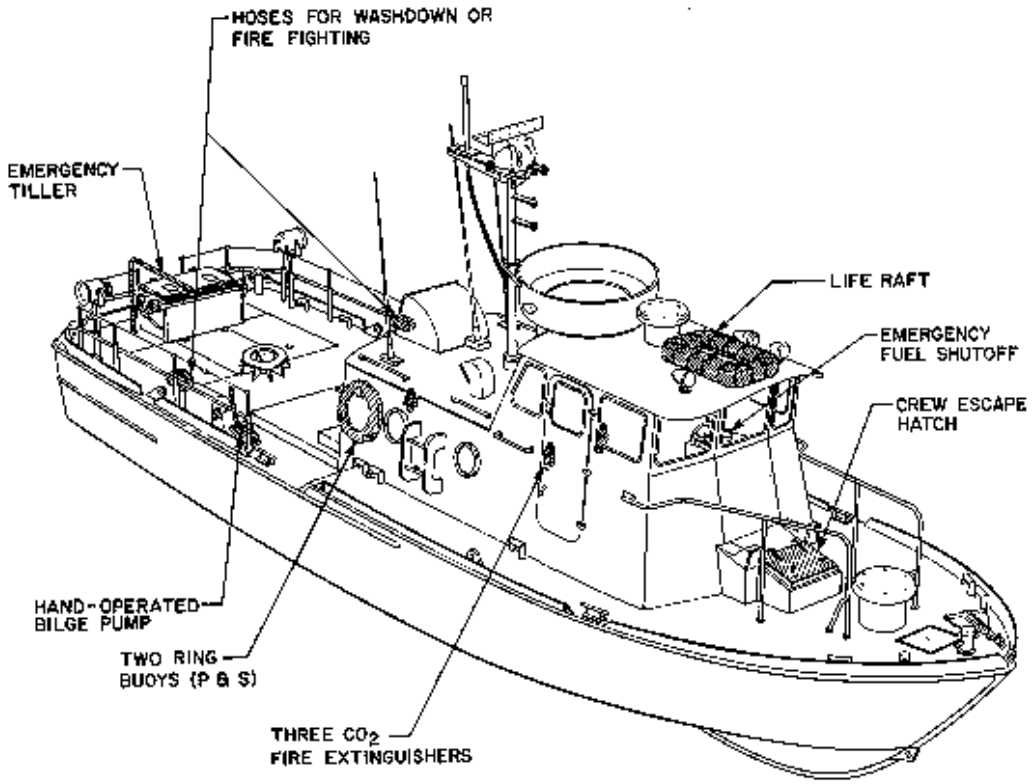

Figure 3-2. Emergency Equipment

soon as possible. The empty cylinder weighs approximately 35 pounds. The weight and date of inspection should be entered on a tag attached to the cylinder. A quarterly inspection made by the damage control organization should consist of weighing (as described in monthly inspection), an inspection of all parts of the extinguisher, and ascertaining that assigned extinguishers are located in their proper places.

g. The quantities of inflammable materials, such as fuel, ammunition, grease, paper, soaps, cloths, etc., should only be the amounts required to operate and maintain the PCF.

h. Proper, safe stowage of combustible materials and protection of those which cannot be safely stowed are most important to fire prevention.

i. Since the most volatible compartments are the lazarette, engine room, and stowage compartment, fires should be fought in these compartments first.

WARNING

Ammunition is stored in the stowage compartment.

j. If it is necessary to shut down the propulsion engine and since the pumps of the deck washdown system are propulsion engine driven, it may be necessary to form a bucket brigade to fight fires.

3-94. COMBAT AND COLLISION.

3-95. It is important to know methods of repairing damage during and immediately after action or after a collision so that PCF may remain available for further action or be able to return to a base for extensive repairs. The following list contains the types of damage the PCF's crew can repair while still in a battle area.

a. Large holes in the underwater hull.
b. Small holes and cracks in the underwater hull.
c. Holes in hulls above water.
d. Punctured, weakened, or distorted bulkheads.
e. Flooded compartments.
f. Warped or sprung doors and hatches.
g. Weakened or ruptured beams, supports, and other strength members.
h. Ruptured or weakened decks.
i. Wreakage interferring with operation of PCF.
j. Ruptured or cracked pipe lines.
k. Severed electric cables.
l. Broken or distorted foundations under machinery.
m. Broken or pierced machinery units.
n. Fire with its attendant heat, smoke, and other damage.

For methods of repairing the above listed types of damage, refer to paragraphs 3-97 through 3-134 and Bureau of Ships Technical Manual NAVSHIPS 0901-000.

3-96. The following equipment/system can be used for damage control.

a. Bilge system - To pump out flooded compartments.
b. Blankets - To plug holes in hull, deck, or superstructure.

c. Mattress - To plug holes in hull, deck, or superstructure.

d. Pillows - To plug holes in hull, deck, or superstructure.

e. Conical wooden plugs (1, 2, and 5 inches) - To plug holes in hull, deck, or superstructure.

f. Dust pan - To remove hot material.

g. Asbestos gloves - To handle hot material.

h. Rubber matting - To stand on when repairing electrical damage.

i. Wooden wedges (2-1/4 and 4 inches thick) - To shore up damaged bulkheads.

j. Spare parts (refer to Table 1-4) - For repair of equipment.

k. Tools (refer to Table 1-2).

3-97. PENETRATIONS

3-98. FLOODING EFFECT OF HOLES. The amount of water that will come into a ship through a hole, or which will flow from one compartment to the next, varies directly as the area of hole and the square root of its depth. It makes no difference whether the hole is made by a shell, a torpedo, a splinter, a defective gasket, or an unpacked stuffing tube; if one side of the hole is submerged, water will flow through it in accordance with that formula. The ingress of water can be reduced by doing either of two things: (a) listing the ship to raise the level of the hole, or (b) by reducing the area of the hole. The former is rather impracticable (though not wholly so); the latter is highly practicable in many cases, and its effect is very pronounced.

3-99. PLUG HOLES PROMPTLY. Table 3-3 shows the flooding effect of unplugged holes, and of the same holes after inserting the most simple types of plugs. The volumes of flooding water are given in gallons and also in terms of the number of portable electric submersible pumps required to handle the flooding. The pump capacities used are considerable under the rated capacities, but if the strainers are clogged with debris, the actual capacities may be much less. It should be obvious that prompt plugging of holes is desirable, to save the ship, to release pumps for elsewhere, and to save wear and tear on those in use.

3-100. TYPES OF HOLES. Holes through watertight boundaries may be of almost any size or shape. Shell holes are frequently several times as large as the projectile causing them. Projectiles and bombs rarely make circular holes; more often they strike the ship at an angle, and hence make elongated holes -- sometimes a gouge 6 or 8 feet long. Richochets make make the familiar keyhole. Splinters make weired patterns, from fuzzy circular holes burned through aluminum plating to odd-shaped rectangles through steel plates.

3-101. JAGGED PROTRUSIONS. In almost every case the projectile punches out part of the metal completely, and bends the rest of it inward to form jagged protrusions. Plating may be rumpled in the vicinity of the hole. In a number of cases ragged edges of torn plating have projected both inward and outward in the same hole, indicating that the shell may have exploded while passing through the plate. Spidery cracks or cuts may radiate from the hole. All of these features complicate the job of making effective repairs.

are principles which can be applied by using either prefabricated patches or materials which may be adrift and which can be used to good effect if the ship's force knows how. No temporary patch will be perfectly watertight, but if it can reduce the ingress of water by as much as only 50 percent, it may be possible to control the flooding with the pumps. All of these patches - all of the principles behind them - have been proven in battle. They have helped to bring ships and men home safely. Some of them have enabled ships to remain at sea and in battle for months after the original damage was received. It may be found that one type of patch does not work. Perhaps it is the wrong type for the particular leak, or is not being employed properly.

3-104. METHODS OF REPAIRING HOLES. There are two general methods of repairing a hole; either put something into it or put something over it. In either case try to reduce the area through which water can enter the ship, or through which it can pass from one compartment to another.

3-105. WOODEN PLUGS. Wooden plugs provide the most simple method of repairing small holes. Plugs made of soft wood have been found effective under battle conditions, especially in holes not over 3 by 3 inches. They have held up well in even much larger holes. Every ship should have a large assortment of conical, square-ended, and wedge-shaped wooden plugs at each repair station. The plugs should not be painted, as unpainted soft wood absorbs water and grips better. The plugs should be stowed in canvas bags secured to the overhead. Combinations of conical, square-ended and wedge-shaped plugs may be used to get better conformation with the shape of the hole. It is best to wrap the plugs with lightweight cloth before inserting. The cloth will help the plugs to grip better, and will also fill some of the gaps between plugs. In most cases wooden plugs will not make a watertight fit, but by calking the remaining leaky area with rags, oakum, and smaller wedges, the ingress of water can be greatly reduced. Square-ended plugs hold better than conical plugs in holes in plating one-fourth inch or less in thickness. (See Figure 3-3.)

3-106. Most wooden plugs are inserted from inside the ship. In that case they have to contend with metal edges protruding inward. Plugs driven in from outside may not have as much interference, but outside plugs cannot be tended readily, and because they are often knocked about by the action of the sea, they do not seem to hold up as well over extended periods of time. The use of a line secured to the inboard end of a plug by means of a screw eye and the line made fast to a stanchion might help to overcome this difficulty. Whether to insert a plug from inside or outside the ship may depend upon several factors, such as access, flooding, wreckage, etc.

3-107. PILLOWS AND MATRESSES. Pillows and matresses are rolled up and shoved into holes. They are rolled around a wooden plug or a timber to increase their size and to provide rigidity. Wrapping them in a blanket sometimes helps. Such plugs cannot be relied upon as they have a tendency to be torn out of the holes by waves.

3-108. CLOTH PLUG. A most effective plug was made by a ship after an enemy shell had torn a 8 by 10-inch

are principles which can be applied by using either prefabricated patches or materials which may be adrift and which can be used to good effect if the ship's force knows how. No temporary patch will be perfectly watertight, but if it can reduce the ingress of water by as much as only 50 percent, it may be possible to control the flooding with the pumps. All of these patches - all of the principles behind them - have been proven in battle. They have helped to bring ships and men home safely. Some of them have enabled ships to remain at sea and in battle for months after the original damage was received. It may be found that one type of patch does not work. Perhaps it is the wrong type for the particular leak, or is not being employed properly.

3-104. METHODS OF REPAIRING HOLES. There are two general methods of repairing a hole; either put something into it or put something over it. In either case try to reduce the area through which water can enter the ship, or through which it can pass from one compartment to another.

3-105. WOODEN PLUGS. Wooden plugs provide the most simple method of repairing small holes. Plugs made of soft wood have been found effective under battle conditions, especially in holes not over 3 by 3 inches. They have held up well in even much larger holes. Every ship should have a large assortment of conical, square-ended, and wedge-shaped wooden plugs at each repair station. The plugs should not be painted, as unpainted soft wood absorbs water and grips better. The plugs should be stowed in canvas bags secured to the overhead. Combinations of conical, square-ended and wedge-shaped plugs may be used to get better conformation with the shape of the hole. It is best to wrap the plugs with lightweight cloth before inserting. The cloth will help the plugs to grip better, and will also fill some of the gaps between plugs. In most cases wooden plugs will not make a watertight fit, but by calking the remaining leaky area with rags, oakum, and smaller wedges, the ingress of water can be greatly reduced. Square-ended plugs hold better than conical plugs in holes in plating one-fourth inch or less in thickness. (See Figure 3-3.)

3-106. Most wooden plugs are inserted from inside the ship. In that case they have to contend with metal edges protruding inward. Plugs driven in from outside may not have as much interference, but outside plugs cannot be tended readily, and because they are often knocked about by the action of the sea, they do not seem to hold up as well over extended periods of time. The use of a line secured to the inboard end of a plug by means of a screw eye and the line made fast to a stanchion might help to overcome this difficulty. Whether to insert a plug from inside or outside the ship may depend upon several factors, such as access, flooding, wreckage, etc.

3-107. PILLOWS AND MATRESSES. Pillows and matresses are rolled up and shoved into holes. They are rolled around a wooden plug or a timber to increase their size and to provide rigidity. Wrapping them in a blanket sometimes helps. Such plugs cannot be relied upon as they have a tendency to be torn out of the holes by waves.

3-108. CLOTH PLUG. A most effective plug was made by a ship after an enemy shell had torn a 8 by 10-inch

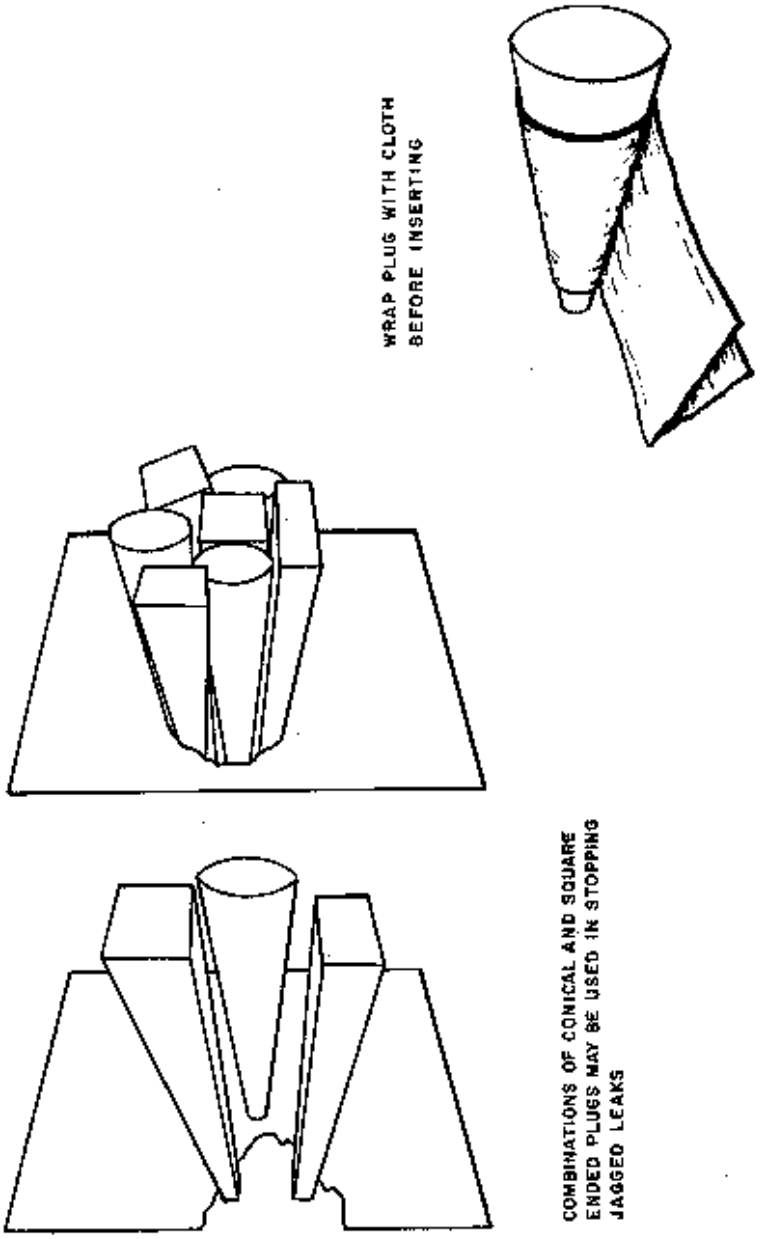

Figure 3-3. Hole Plugging

hole in the side at the waterline. Unable to make repairs from inside because of wreckage, the ship made a built-up conical plug of cloth. The core was a piece of heavy line three feet long. An eye was spliced into each end of this core line which was then wrapped with strips of blanket until a cone was built up, 2 inches in diameter at one end and 2 feet in diameter at the other end. Lines were secured to the eyes in the core line, and by means of these lines the plug was lowered over the side and pulled into place. Such a plug has flexibility; it will adapt itself to irregular shapes. Furthermore, it will absorb water and swell, tending to make it more effective.

3-109. SHORING

3-110. SHORING EQUIPMENT. Shoring is the process of placing supports against the side of, beneath, or above a structure to prevent metal fatigue, sagging, and bulging. Ships often have had to support ruptured decks, strengthen weakened bulkheads and decks, build up temporary bulkheads and decks against the sea, to support hatches and doors and to provide supports for equipment that has broken loose. This is accomplished largely by shoring.

a. A shore is a portable beam.

b. A wedge is a block, triangular on the sides and rectangular on the butt end.

c. A shole is a flat plate which may be placed under the end of a shore to distribute weight or pressure.

d. A strongback is a bar or beam of wood or metal, often shorter than a shore, and used to distribute pressure or to serve as an anchor for a patch over a hole.

The following is often used in connection with shoring:

a. Battens, wooden.
b. Hammers, claw.
c. Mauls and sledges.
d. Saw, hand.
e. Mattresses, pillows.
f. Chisels, cold.
g. Chisels, wood.
h. Plugs, wooden, conical.
i. Axes.
j. Hatchets.
k. Nails.
l. Bolts, nuts, and washers.
m. Wedges, wooden.
n. Packing sheet.
o. Clamps, wood.
p. Turnbuckles.

3-111. MISCELLANEOUS EQUIPMENT ON ALLOWANCE LIST (Figure 3-4). The Allowance List will also indicate a large number of miscellaneous items that should be carried in repair party lockers. Nails, bolts, sheet rubber, sheet packing, wire, tools, etc., are but a few. Small items may be stowed in canvas bags to reduce their danger as splinter hazards. The bags should be stenciled with a statement of their contents. Materials should be preserved and regularly inspected to prevent rusting and deterioration, and to insure that a full kit is available. Repair party lockers should carry 8d, 12d, and 20d wire nails. A few assorted bolts and nuts should be provided. Blank flanges and flanged couplings should have bolts, nuts, and washers secured in the flange holes so that they will be ready for immediate use.

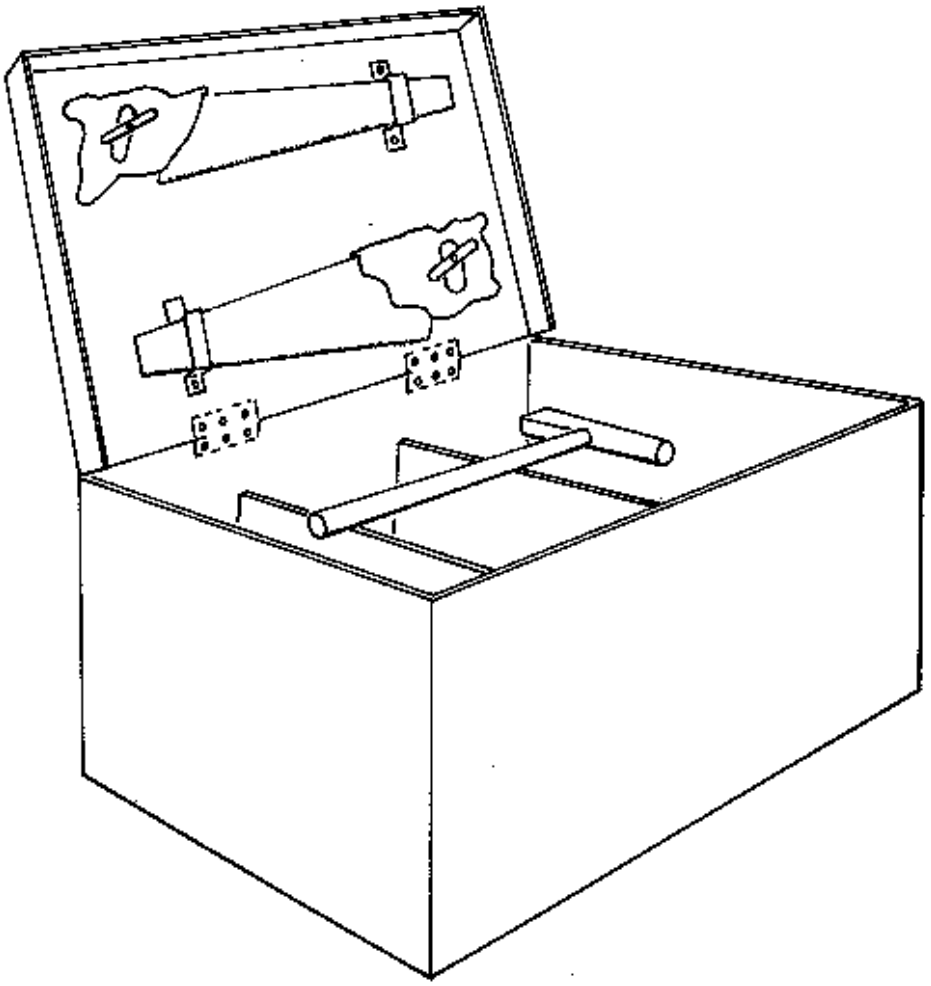

Figure 3-4. Repair Party Locker

3-112. PRECAUTION IN USE OF NAILS. Nails are used to secure battens and cleats on shoring structures to reduce the possibilities of their jumping and slipping. They are also used to hold members of a shoring structure in place temporarily before making final adjustments. Generally, there is a tendency to use nails where they may do little or no good and where they may actually do harm by splitting shores and wedges (Figure 3-5).

3-113. WATER PRESSURE IN FLOODED COMPARTMENTS. The pressure on a bulkhead or deck of a flooded compartment is caused by:

a. The depth of flooding.
b. The flooded area.
c. Additional pressure caused by the ships motion.
d. Whether or not the compartment is open to the sea.

The water pressure at any point on a submerged bulkhead is the weight of the column of water over it. Therefore, the pressure is directly proportional to the height of the water column, and for that reason watertight bulkheads on naval vessels are built progressively stronger as they approach the ship's bottom.

3-114. WHEN TO USE SHORING. When to shore is a problem that cannot be solved by the application of any rigid rule or set of rules. Mere depth of water with consequent pressure is no criterion. A low level bulkhead will have more pressure exerted upon it, but it will be able to withstand the greater pressure because of its heavier construction. Also, a bulkhead may be weakened by corrosion; or the force of an explosion may crack beams, shear plates, part seams, and otherwise damage bulkhead with subsequent loss of strength.

3-115. After inspecting the damaged area, the exercise of good judgment will be the only guide for action. Deep bulges in plating, bowed frames and stanchions, loose rivets, cracked seams, and panting of bulkheads are indications of the need of shoring. Panting is a dangerous condition as it causes metal fatigue which in time will result in cracking and splitting. Experience indicates a tendency to shore when such action is not necessary. Oil being replaced by water in a fuel-oil tank is not a reason to suppose that the tank bulkheads require shoring. IF IN DOUBT, ALWAYS SHORE.

3-116. The need for shoring patches and loose machinery is in most cases obvious. However, weakened supports under guns and machinery units may not be readily noticed, and it is recommended that a careful inspection be made of this equipment whenever damage is sustained in their vicinity, and that they are shored whenever necessary so that further operation will not cause greater damage.

3-117. SHORING DECK AND OVERHEAD. When a compartment is flooded, the deck and all bulkheads around it, and possibly the overhead, are subject to pressure. It may be necessary to shore the entire containing structure with priority given to any bulkhead that may have been weakened or is subject to the greatest pressure. Decks of flooded upper compartments must be shored form next lower decks.

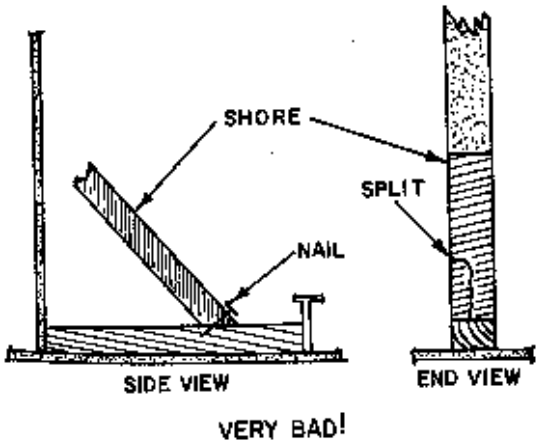

Figure 3-5. Proper Use of Nails

3-118. PLANS FOR SHORING MAJOR BULKHEADS. It is advisable to have some plan for shoring each major bulkhead, including consideration for such impediments as boilers, pumps, pipelines, lockers, stores, sheathing, etc. This plan should include the locations of shoring supplies and how to move them to the desired point with the least interruption of watertight integrity. Wherever possible stores should be stowed away from sides and bulkheads so that there will be a ready access for shoring and patching.

3-119. DC OR AC POWER FAILURE.

3-120. For procedures to repair a dc or ac power failure, refer to Bureau of Ships Technical Manual, NAVSHIPS 0901-000 and paragraphs 3-121 through 3-134.

3-121. PRECAUTION. Before beginning repairs on any damaged electric circuit, remove power from the circuit. This may be done by opening switches, tripping circuit breakers, or removing fuses. When installing cables or jumpers, it is best to start from the dead end of the circuit and work back toward the power source. Do not energize circuit until all connections have been made.

3-122. SMALL CONDUCTORS. When small single conductors are cut, the damage may be repaired by skinning back the insulation on both the jumper and the original conductor and splicing a jumper across the break. Clean the wires. After cleaning the wires, solder or twist and lock them together in such a manner that they cannot be pulled apart making sure to have a good metal-to-metal contact. Then wrap the exposed metal joint tightly with insulating tape.

3-123. LARGE CONDUCTORS. The procedure for inserting jumpers in large conductors is much the same as for small conductors (paragraph 3-122), except that the larger size of the wire requires the use of different methods for securing the conductors to each other. In an emergency, almost any type of cable clamp will suffice. These joints, too, must be carefully bound with insulating tape.

3-124. MULTIPLE CONDUCTOR CABLES: IDENTIFICATION. Each conductor is covered with an insulation of a different color combination. These color combinations may be used to identify conductors so that the wires may be joined correctly in a short time. If connected red to red, black to black, and so on, the circuits will be restored correctly and all equipment will work properly.

3-125. INSULATION. Each individual joint made by joining conductors must be thoroughly insulated with tape, and when several such unions are made in a cable repair, the whole area should be securely wrapped with waterproof tape to avoid contact with salt water or the ship's structure.

3-126. ELECTRIC WIRING CASUALTIES. In any casualty involving damage to electrical cable and equipment, electrical circuits may be a hazard if they remain energized. The individual circumstances surrounding each case of damage will dictate the action to be taken. In cases of serious damage, it

is usually necessary to remove electrical power from all cables in the damaged area to prevent the ignition of combustible liquids and gases. However, continued operation may require reestablishment of power to undamaged circuits, particularly those which extend through the damaged area. The facility with which this can be accomplished will in a large measure depend on the familiarity with the ready availability of information on the ship's electric plant.

3-127. All personnel should be made familiar with the purpose and use of electrical damage control equipment.

3-128. In practically every case where electrical cable or electrical equipment is damaged, fire results. In combatting electrical fires, the use of CO_2 is preferred. Should CO_2 not be available, water fog may be used with good results. Solid water or foam should not be used as either will cause damage to electrical equipment.

3-129. JUMPERS. Breaks in wiring and cables are frequently repaired by inserting short pieces of new cable, called jumpers. All repairmen should know that each cable is identified by a number on a metal tag where the cable is secured in a junction box, and also by colored metal tags, where the cable goes through a deck or a bulkhead.

3-130. SCOPE. The scope of this system is limited to the bare minimum of facilities which are required in the event of damage to keep the ship afloat and get it out of a danger area so that temporary repairs of a more extensive and time-consuming nature can be accomplished. Thus, the general application is limited to the most vital maneuvering auxiliaries. The single exception is the conclusion of casualty power supply to guns. Important features of the basic design of the calualty power supply system include the following:

a. Preservation of the weathertight integrity of the vessel.
b. Simplicity of installation and operation.
c. Flexibility of application.
d. Interchangeability of parts and equipment.
e. Minimum of weight and space requirements.
f. Ability to accomplish desired functions.

The casualty power system is a temporary means of providing power and is not a means of making temporary repairs.

3-131. The casualty power system is purposely limited in its scope so as to retain its effectiveness. The more equipment that is added and the more the system is expanded, the greater is the possibility of error in making connections and the possibility that faults at relatively unimportant equipment will cause loss of power at vital equipment. It is also probable that the casualty power system so expanded would be burdened with miscellaneous loads at a time when its use would be essential for vital loads.

3-132. PORTABLE CABLES. The casualty power supply system contains no permanently installed circuits. The ends of the portable casualty power cables should be maintained in good order at all times.

3-133. CONNECT FROM LOAD TO POWER SOURCE. Portable cable connections should always be made by connecting first at the load and then working back to a source of power. This method will eliminate the necessity of handling live cables and reduce the hazard to personnel. Aside from the personnel hazards, the possible shorting of live conductors may damage the cables, fuse the cable ends, and trip protective devices, thus causing unnecessary delays. If there is doubt whether or not a circuit is energized, it should be tested.

3-134. DISCONNECT PERMANENT CABLES. In making casualty power connections at a load, it is best first to disconnect the incoming feeder as it is possible that the feeder may be faulted by the casualty which caused the loss of power. Such a faulted feeder would probably cause the circuit breakers in the casualty power system to open, resulting in delay while the source of trouble was being investigated. A second reason for disconnecting the incoming feeder is that it may be reenergized, presenting a hazard to personnel handling casualty power cables and presenting the possibility of paralleling generators through the casualty power system. The feeder cable may be either disconnected or cut near the point where casualty power connections are to be made. The conductors on the load side should be spread and taped to prevent possible grounding and shorting.

3-135. ABANDONING SHIP.

3-136. If the PCF is damaged beyond repair and it becomes necessary to abandon ship, the PCF is equipped with the following life preserving equipment (Figure 3-2).

a. 6-man life raft.
b. Ring buoy (2).
c. Briefcase. The briefcase, with a 10-pound weight, can be used for sinking classified information.
d. Dry battery, 1.5 volt (24).
e. Hand held compass.
f. Flourecein sea marker dye.
g. Lifeboat equipment container.
g. Lifeboat first aid kit.
i. Abandon ship food packet.
j. Inflatable life vest (6).
k. Life jacket distress light (6).
l. Distress light marker, ring buoy (2).
m. Vest life preserver (6).
n. Emergency signal mirror.
o. Very signal kit.

3-137. MAINTAINING WATER TIGHTNESS.

3-138. Watertight integrity can be maintained by periodically inspecting through hull and bulkhead penetrations for leakage; door, hatch, and port lights gaskets for damage; and door and hatches for damage. Upon finding leakage or damaged equipment, repair or replace as necessary. Each compartment of the PCF can be made watertight by performing the operation listed in Table 3-4 and shown in Figure 3-6.

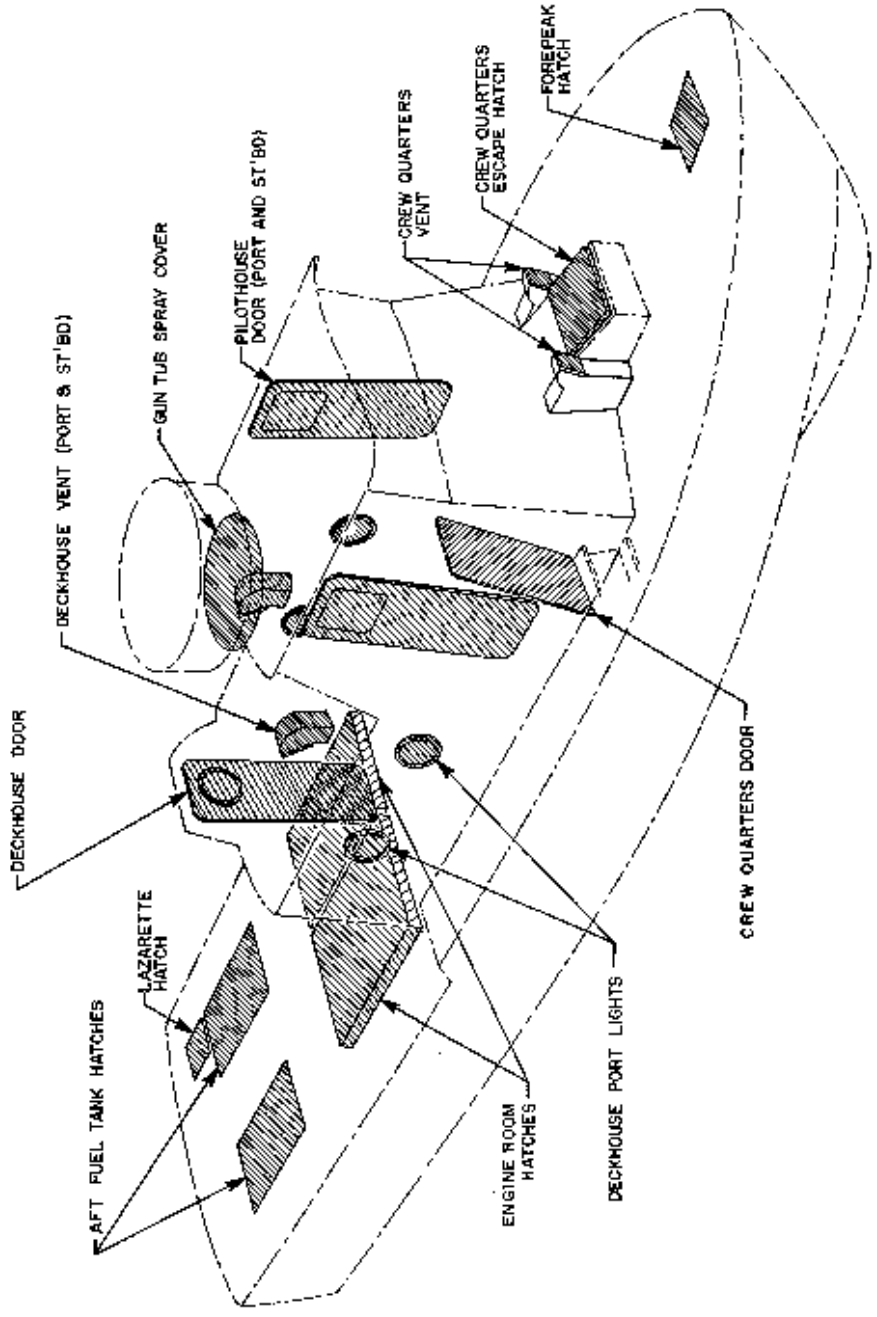

Figure 3-6. Watertight Openings

Table 3-4. Watertight Operations

Compartment	Operation
Crew Quarters	
Escape hatch	Closed and secured
Ventilating ducts (2)	Closed and latched shut
Access door	Closed and secured
Pilothouse	
Port and starboard access doors	Closed and secured
Gun tub	Install gun tub cover
Deckhouse	
Portlights (4)	Closed and secured
Access door	Closed and secured
Engine room	
Hatch covers (2)	Closed
Lazarette	
Access hatch	Closed
Hatch covers (2)	Closed and secured
Forepeak	
Access hatch	Closed and secured

SECTION 4. OPERATOR MAINTENANCE

3-139. GENERAL

3-140. This section presents the special tools required and procedures necessary for the operator to maintain the PCF.

3-141. SPECIAL TOOLS

3-142. No special tools are required except those listed in the manuals referenced in this section.

3-143. PERIODIC INSPECTION

3-144. Table 3-5 presents the periodic inspection which the operator must perform and the corrective action to be taken.

3-145. CLEANING

3-146. AC DIESEL GENERATOR. Clean the generator as outlined in Operator's Manual and Parts Catalog for Onan Electric Generating Plants Series MDTB.

3-147. PROPULSION ENGINES. Clean the propulsion engines as outlined in V-71 Engines Operators Manual 6SE-215.

3-148. BILGE AND SEAWATER STRAINERS FILTER AND GLASS. To clean the filter and glass of the strainers, remove the wing nut, washer, nut cover, and filter. The filter and glass should be washed in warm soapy water, then rinsed. Replace filter, cover, washer, and nut.

Table 3-5. Operator Periodic Inspections

Inspection	Daily	Weekly	Monthly	Quarterly	Corrective Action
ELECTRICAL SYSTEM					
1. Burned out bulbs	X[1]				Replace
2. Blown fuses	X[1]				Replace
3. Specific gravity of electrolyle in starting batteries			X[2]		Using hydrometer, specific gravity should be 1.200 to 1.280. Add electrolytic as required.
a. Level of electrolyte.	X[1]				
4. Ac diesel generator refer to Operators Manual and Parts Catalog for ONAN Electric Generating Plants, Series					
5. Loose generator mounting			X		Tighten loose connection.
6. Loose electrical connections.				X	Tighten as required.
7. Damaged wiring				X	Refer to higher echelon of maintenance.
8. Damaged windshield wiper blade.			X		Replace
PROPULSION SYSTEM					
1. Engine controls for binding.	X[1]				Refer to higher echelon of maintenance.

Table 3-5. Operator Periodic Inspections (Continued)

Inspection	Daily	Weekly	Monthly	Quarterly	Corrective Action
2. Engine controls for corrosion			X		Remove corrosion.
3. Engines, refer to V-71 Engine Operator Manual 6SE-215.					
4. Excessive leakage at stuffing box		X			Repair as outlined in paragraph 3-167. Refer to higher echelon of maintenance.
5. Loose connections at engine and shafting		X			Tighten connections
6. Damaged hose connecting stuffing box and shaft log			X		Refer to higher echelon of maintenance.
7. Loose engine mounting			X		Tighten loose connections.
8. Damaged engine exhaust system				X	Refer to higher echelon of maintenance.
FUEL SYSTEM					
1. Sludge and water condensation in fuel tanks.				X[1]	Fuel strip each tank as outlined in paragraph 3-55.
2. Fuel oil level in fuel tanks		X[1]			Keep each fuel tank full to minimize water condensation.

Table 3-5. Operator Periodic Inspections (Continued)

Inspection	Daily	Weekly	Monthly	Quarterly	Corrective Action
3. Sludge in filter		X			Refer to higher echelon of maintenance.
4. Fuel oil leakage		X			Tighten loose connections or replace defective hose as outlined in 3-170.
5. Obstructed fuel tank vents.			X		Remove obstruction.
6. Emergency fuel shutoff controls for loose connection and corrosion.			X		Tighten loose connections and remove corrosion.
7. Emergency fuel shutoff controls for binding			X		Refer to higher echelon of maintenance.
STEERING SYSTEM					
1. Binding	X[1]				Adjust as outlined in paragraph 3-161. Refer to higher echelon of maintenance.
2. Broken or loose chains			X		Tighten loose chain (paragraph 3-161) and repair or replace broken chain (paragraph 3-172).
3. Worn bearings, universal joints, and sprockets				X	Refer to higher echelon of maintenance.

Table 3-5. Operator Periodic Inspections (Continued)

Inspection	Daily	Weekly	Monthly	Quarterly	Corrective Action
4. Damaged linkage rods				X	Refer to higher echelon of maintenance.
5. Loose connections			X		Tighten connections.
FRESH WATER SYSTEM					
1. Leakage of potable water			X		Tighten loose connections.
2. Damaged tank				X	Refer to higher echelon of maintenance.
SEAWATER COOLING SYSTEMS ENGINES AND GENERATOR					
1. Leakage of seawater		X			Tighten loose connections.
2. Damaged flexible hose.			X		Replace as outlined in paragraph 3-178.
3. Clogged strainer			X		Clean as outlined in paragraph 3-148.
4. Broken strainer glass			X		Replace as outlined in paragraph 3-177.
BILGE SYSTEM					
1. Leakage at connections		X			Tighten connections.
2. Clogged strainers		X			Clean as outlined in paragraph 3-148.

Table 3-5. Operator Periodic Inspections (Continued)

Inspection	Daily	Weekly	Monthly	Quarterly	Corrective Action
3. Damaged hand pump			X		Replace diaphram as outlined in paragraph 3-180 or refer to higher echelon of maintenance.
4. Damaged PVC pipe.				X	Repair as outlined in paragraph 3-182 or refer to higher echelon of maintenance.
5. Damaged engine-driven pump			X		Replace impeller as outlined in paragraph 3-181 or refer to higher echelon of maintenance.
6. Damaged engine-driven pump belt		X			Replace as outlined in paragraph 3-183.
ELECTRONIC SYSTEM					
1. Loose electrical connections		X			Tighten loose electrical connections.
2. Radio set AN/ARC-58 refer to Instruction Manuals Navships 0967-034-8000 and FM-0152.					
3. Radio set, AN/VRC-46 TM11-5820-401-10 and TM 11-5820-401-20.					

Table 3-5. Operator Periodic Inspections (Continued)

Inspection	Daily	Weekly	Monthly	Quarterly	Corrective Action
4. Radar D202 refer to Decca Transcar Ships Manual D202					
5. Depth sounder, DE736 refer to Raytheon Operation and Maintenance Manual for Depth Sounder Model DE736.					
VENTILATING SYSTEM					
1. Obstructed forepeak, crew quarter, pilothouse, deckhouse, stowage compartment, engine room and lazarette vents.		X			Remove obstruction.
2. Damaged exhaust blower, pilothouse and crew quarters.			X		Refer to higher echelon of maintenance.
GRIDDLE AND COOKER FIXTURE					
1. Damaged controls			X		Refer to higher echelon of maintenance.
2. Cleanliness	X				Clean as outlined in paragraph 3-146.
REFRIGERATOR					
1. Damaged compressor			X		Refer to higher echelon of maintenance.