CHAPTER 3
SYSTEM FUNCTIONAL DESCRIPTION

Section I
GENERAL

3-1. SCOPE.

This chapter contains functional descriptions of the following systems on the Torpedo Weapons Retriever.

1. Propulsion System — Includes propulsion engines, engine controls, exhaust system, propeller shafts and propellers (Section II).
2. Fuel System — Includes fuel tanks, pumps and valving necessary to supply fuel to propulsion and diesel generator engines (Section III).
3. Lube Oil System — Includes Fast Lube Oil Change System (FLOCS) and lube oil storage, dirty oil tank, discharge pump and containment tank (Section IV).
4. Fresh Water System — Includes tank filling, stowage, transfer and arrangements for potable water and propulsion engine cooling and chlorine treatment (Section V).
5. Bilge, Ballast and Firemain System — Includes pumps, manifolds, sumps, ballast tanks and overboard discharge (Section VI).
6. Machinery Sea Water Cooling System — Includes pump, strainers, sea chests, valving, and all components supplied (Section VII).
7. Hydraulic Systems — Includes hydraulic systems for bow thruster, torpedo handling and steering. Also covers information on the crane hydraulics (Section VIII).
8. Anchor Handling System — Includes windlass, hawse pipes and fittings and anchor chain and stowage (Section IX).
9. Sewage System — Includes collection, holding and transfer and other components incorporated in the system (Section X).
10. HVAC System — Includes air handling system, air conditioning unit, heaters, fans and ducting (Section XI).
11. Compressed Air System — Includes air compressor, manual horn valve, pressure regulator and other valving (Section XII).
12. Fire Extinguishing System — Includes Halon system portable fire extinguishers, PE-250 portable pump and fire station information (Section XIII).
13. Electrical and Electronic System and Monitoring Equipment — Includes complete coverage of power generation and distribution components and navigation, communication and alarm and monitoring equipment (Section XIV through XVIII).

3-2. PURPOSE.

The purpose of this chapter is to functionally describe each system on the craft to give the crew sufficient information on how the systems operate and the interface required between systems.

Section II
PROPULSION SYSTEM

3-3. PROPULSION SYSTEM BASIC DESCRIPTION.

3-3.1. PROPULSION ENGINES AND MARINE GEAR. The propulsion engines are Model 3512 diesel units manufactured by Caterpillar Tractor Co. Leading particulars for the engines are listed in Table 3-1. The engines are coupled to the propeller shafts through a Caterpillar marine gear Model 7241 with a 2.94 to 1.0 ratio. The reduction (marine) gear provides a propeller speed of approximately 600 RPM at full power operation (Figure 2-8). When viewed from the transom, the reduction gear provides clockwise rotation of the starboard propeller and counterclockwise rotation of the port propeller. Refer to onboard commercial technical manuals for details of propulsion engines and marine gear.

3-3.1.1. Components. The propulsion engines are fitted with the following components:

1. Oil and fuel coolers.
2. Heat exchangers.
3. Oil filters and fuel filters and strainers.
4. Governors.
5. Starting motors.
6. Emergency shutdown devices.
7. Auxiliary drives.
8. Cold weather starting aids.
9. Priming pumps.
10. Gage boards.

Table 3-1. Diesel Propulsion Units

Manufacturer	Caterpillar Tractor Co.
Type	Model 3512 V-12
Rating	1140 shp at 1800 rpm
No. of Cylinders	12.
Bore	6.7 inches
Stroke	7.5 inches
Total displacement	3158 cu. inches
Marine gear	Caterpillar Tractor Co.
Type	Model 7241
Ratio	2.94 to 1.0

3-3.1.2. Controls. Engine instruments and controls are located at the console in the pilothouse and the auxiliary conning station located at frame 15 on the bridge deck. Refer to paragraph 3-5 for detailed description of controls, instruments and emergency shut-offs.

3-4. PROPELLERS AND SHAFTS BASIC DESCRIPTION. (Figure 2-8.)

The propeller shafts are 5-1/2 inch diameter stainless steel (AQUAMET 17). The shaft couplings are flange-type, tapered bore with the shafts keyed to the coupling. The shaft bearings are grooved synthetic rubber which are bonded to sleeves of fibrous material impregnated with phenolic resin. The bearings are installed with a light push-fit and are secured with stainless steel setscrews. The stuffing box assemblies, with waxed flax packings, are attached to the stern tube with studs and nuts. The propellers are keyed to the trailing tapered end of the propeller shafts, and secured with jam nuts and cotter pins. The stub shaft is installed on the reduction gear flange and secured to the shaft coupler. The strut fairwaters and rope guards are constructed of split sections to allow replacement without shaft removal. Shaft locks are provided to lock the shaft through the bolting of the shaft coupling to the yokes. Refer to Table 3-2 for leading particulars of the shafts and propellers. See onboard drawing NAVSEA 243-6003369 for propeller shaft details.

Table 3-2. Propellers and Shafts

Propellers	
Material	Manganese bronze
Diameter	54 inches
Pitch	46.8 inches
Blades	4
Balance	Static
Finish	63 micro inches max. surface roughness
Shafts	
Material	Stainless Steel (AQUAMET 17)
Diameter	5-1/2 inch
Length (overall)	27 feet 10 inches
Bearings	B.F. Goodrich Cutless
Stuffing Boxes	Johnson Rubber

3.5 ENGINE CONTROLS AND INSTRUMENTS. (Figures 2-2 and 2-6.)

3-5.1. TOPSIDE CONTROLS. Mechanical single lever remote controls are provided for the propulsion units. The controls are located in the pilothouse and at the auxiliary conning station. The levers are placed close together and angled toward each other allowing the levers to be grasped in one hand. Each lever controls the reverse and forward throttle of one propulsion engine. Forward movement of the lever produces forward motion of the craft, backward movement past neutral produces movement aft. Refer to Table 3-3 for leading particulars of the controls.

3-5.1.1. Neutral start interlock is provided to prevent starting the engine except when the control is in the neutral position.

3-5.1.2. The control system is equipped with clutch disconnect controls at the pilothouse console. This allows for accelerating the engine with the reduction gear locked in the neutral disengaged position.

CAUTION

Pulling the emergency engine shut-off controls cuts off air intake to the engines which may damage the engines. Do not use these controls except for emergency conditions.

3-5.1.3. The engine start-stop buttons, the engine operating levers and the emergency engine shut-off controls are located on the console in the pilothouse. Engine operating levers and normal stop buttons are also located on the auxiliary conning station console.

3-5.1.4. Emergency engine shut-off controls (Figure 1-9) are also provided in the galley at the top of the inclined ladder.

3-5.2. CONTROL CONNECTIONS. The control levers (Figures 2-2 and 2-6) are connected by mechanical push-pull cables to the clutch and throttle (governor). The transfer unit (Figure 2-9) for each propulsion engine is mounted in the engine room above the engine it controls. Control cables from the control head in the pilothouse and the conning station are routed to the engine room transfer units. The clutch disconnect cable from the pilothouse console enters the same side of the transfer case as the control cables. The output cables (clutch and throttle) from the transfer unit are routed out the back of the unit to the engines. See Figure 2-31 for arrangement of controls and cables. Refer to onboard Technical Service Manual S9252-A2-MMC-010 for complete details of the propulsion controls.

3-5.3. LOCAL OPERATION. The engine room transfer unit (Figure 2-9) is capable of local operation with the installation of the manual control lever. In case of malfunction in the input cable network the manual control lever can be installed and will operate in the same manner as the control station levers (i.e., forward movement of the lever causes forward motion of the craft).

Table 3-3. Engine Control Components

Propulsion Controls	
Manufacturer	Panish
Type	Single Lever
Series	5000

Section III
FUEL SYSTEM

3-6. FUEL SYSTEM BASIC DESCRIPTION. (Figure 3-1.)

The fuel system supplies diesel fuel to the propulsion and generator diesel engines from the day tanks located at frame 23 in the hold, port and starboard. Total fuel oil capacity for the system is 8700 gallons. Fuel oil fill connections with 42 gallon containment tanks are located on the main deck at frame 12-1/2 port and starboard. Fill connections are fitted with gate hose valves, caps and chains. Refer to Table 3-4 for leading particulars on fuel system components.

3-7. FUEL TRANSFER BASIC DESCRIPTION. (Figure 3-2.)

The day tanks are filled using the fuel transfer pump (Figure 1-7). With pump operating, fuel can be transferred from the forward fuel tanks through the water separator to the day tanks. The fuel oil transfer pump is located in the engine room, aft of frame 22, port side. The fuel/water separator is mounted on the port side of the craft at frame 23. Flow through the fuel/water separator prevents water from entering the fuel supply to the engines. The fuel transfer pump is a positive displacement unit and is fitted with a relief valve set at 24 PSI to protect the system.

CAUTION

Pulling T-handles to shut off fuel to the engine can cause damage to the engines. Use only in emergency situations.

3-8. EMERGENCY FUEL SHUTOFF.

Ball valves (Figure 3-3) located in the passageway between the fuel tanks are fitted with levers connected to push-pull cables and T-handles on the main deck (Figure 1-9). These valves are in the main supply lines to the engines. Pulling the T-handles on the deck will automatically cut-off fuel supply to all engines.

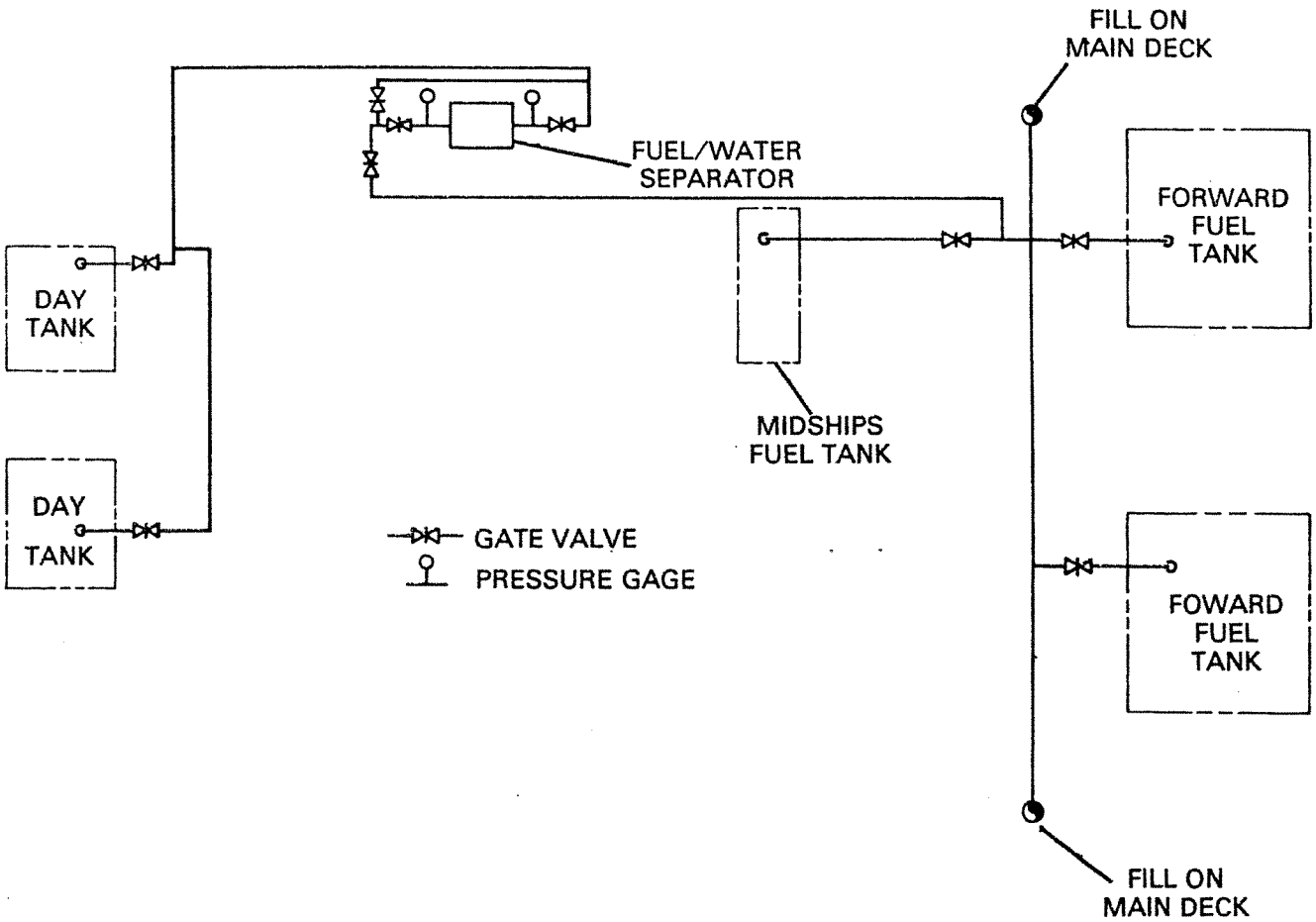


Figure 3-1. Fuel Fill Diagram

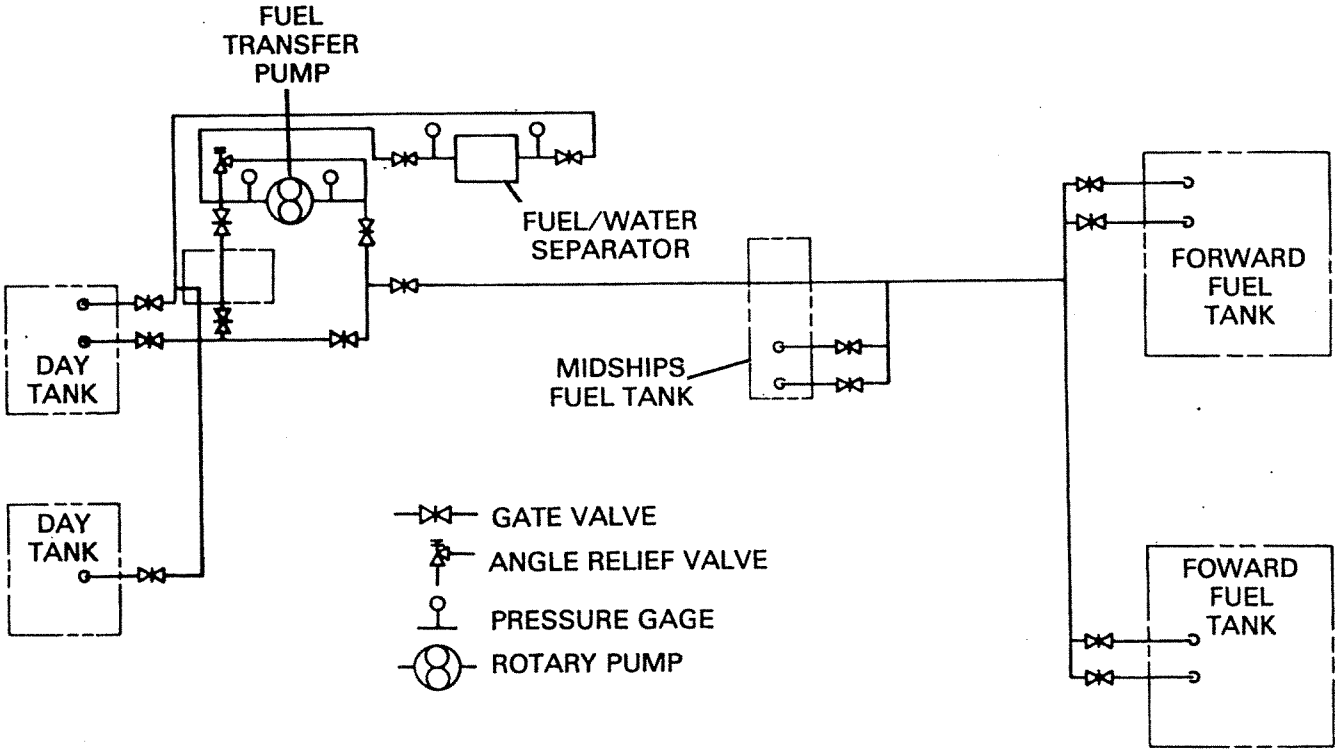


Figure 3-2. Fuel Transfer Diagram

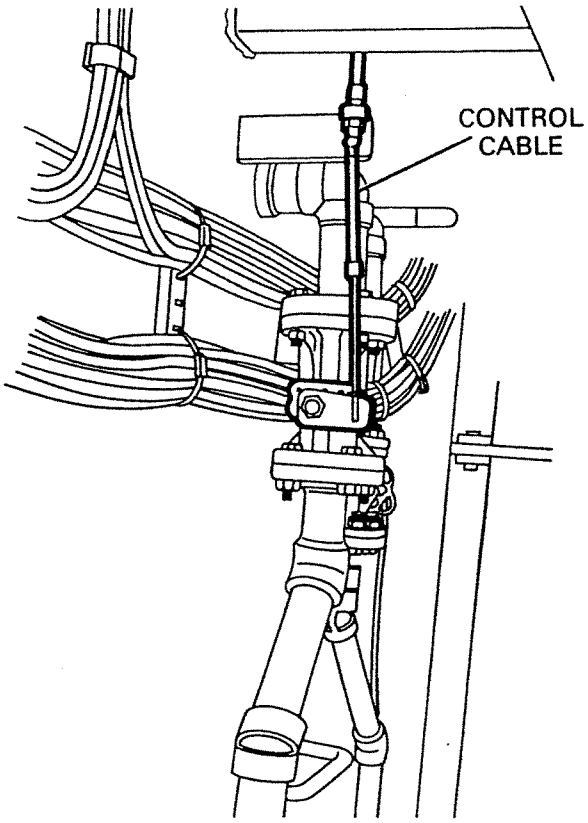


Figure 3-3. Fuel Supply Shut-Off Valve
(Frame 23, Centerline, Lazarette)

3-9. ENGINE SUPPLY AND RETURN BASIC DESCRIPTION. (Figure 3-4.)

Fuel is supplied to the engines through gate valves and swing check valves using rubber hose and bronze end fittings. Return fuel from the propulsion engines flow through the sea water cooled heat exchanger back to the fuel tanks.

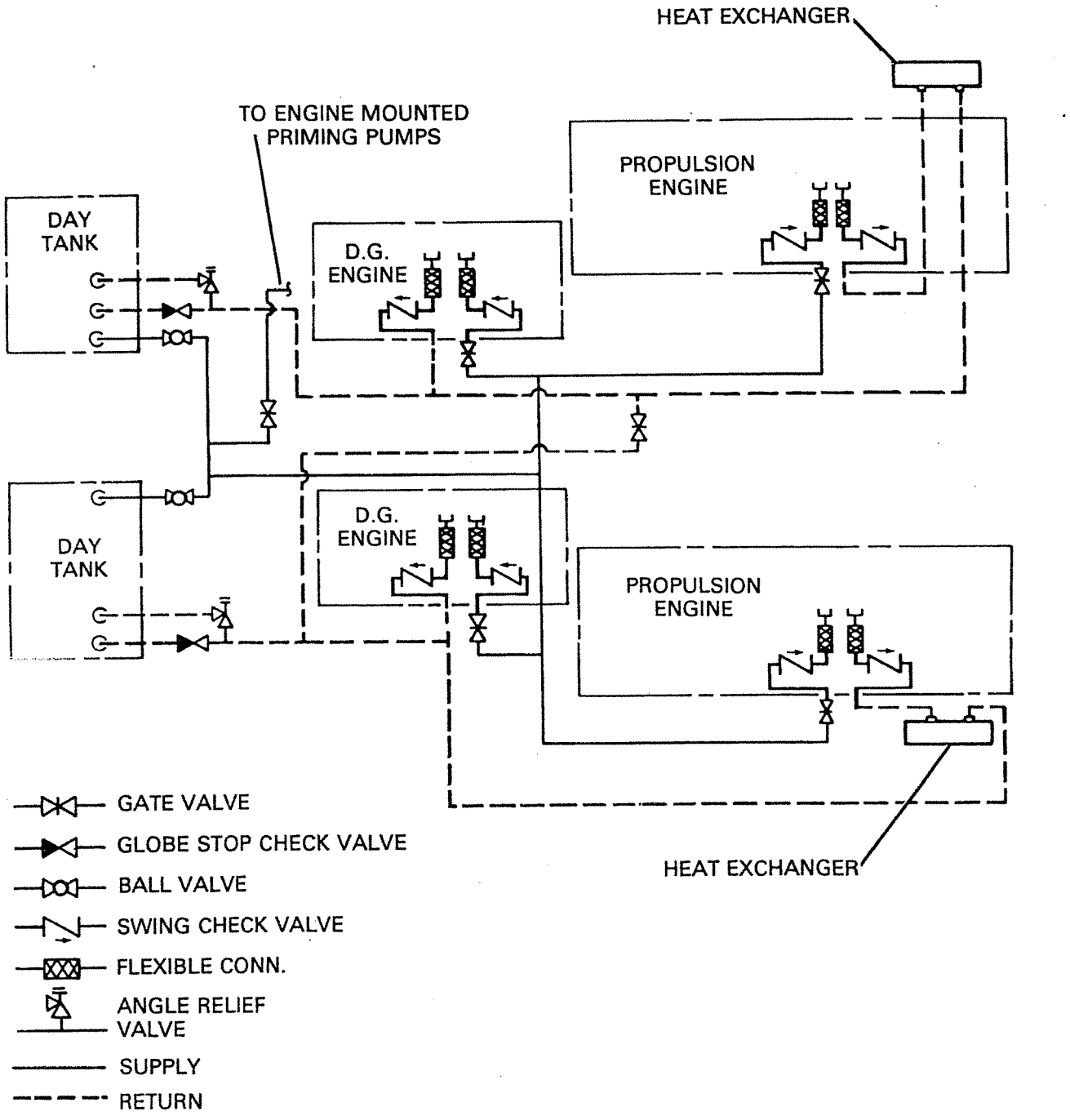


Figure 3-4. Fuel Supply and Return Diagram

Table 3-4. Fuel System

Fuel Tank Capacity	
Day Tanks	1130 gal., port
	1081 gal., starboard
Amidship's tank	2900 gals.
Forward Tanks	1801, port and starboard
Fuel Transfer Pump	
Make	Viking Pump
Model	HJ-193D
Motor	1 HP
Capacity	10 GPM
Fuel/Water Separator	
Make	Facet Enterprises
Model	VFCS-21C
Element	Disposable Type
Stripping Pump	
Make	Dover Corp.-Blackmer Pump Div.
Model	PAB 414
Capacity	14 GPM Nominal

3-10. STRIPPING PUMP BASIC DESCRIPTION. (Figure 3-5.)

A hand-operated stripping pump is installed in the system to strip the day tanks. The piping from the stripping pump discharges overboard forward of frame 23. A sight gage is installed in the piping to allow personnel operating the hand pump to see when water flow is no longer present. The stripping pump can also be used to empty the oily water tank which receives oily water from the fuel/water separator.

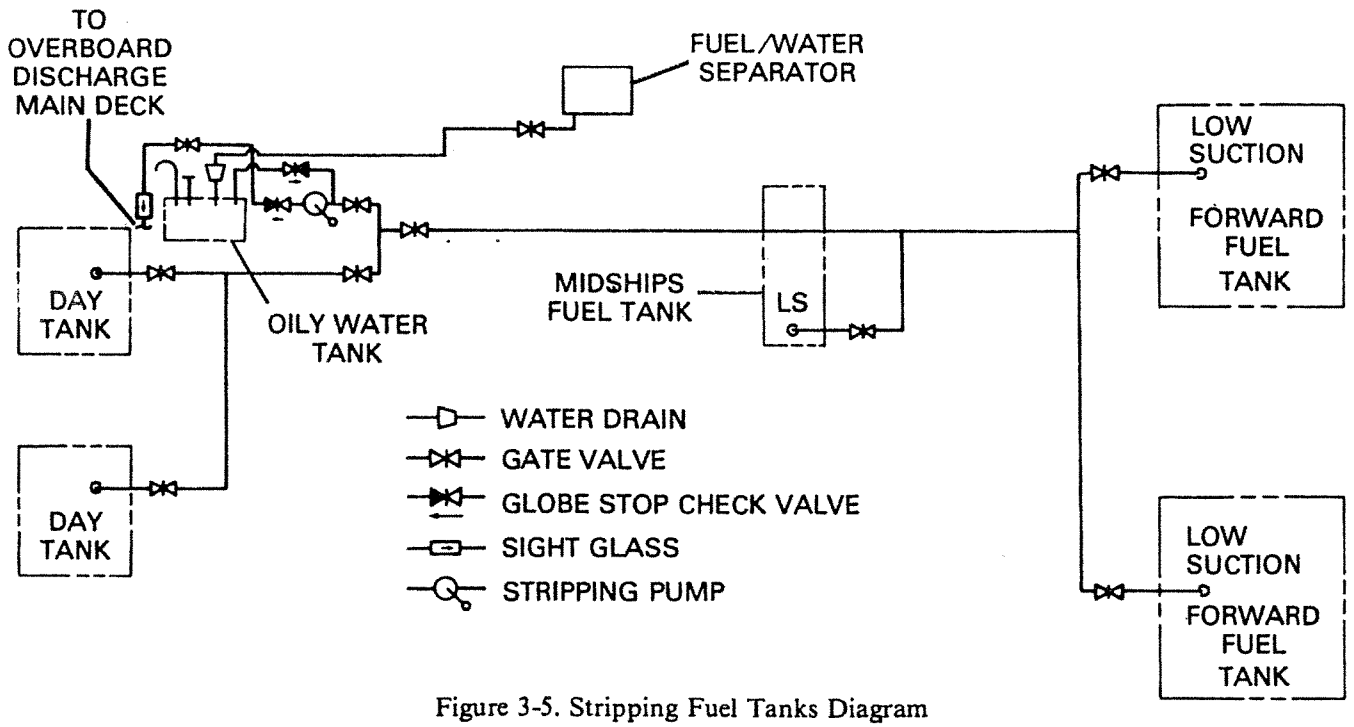


Figure 3-5. Stripping Fuel Tanks Diagram

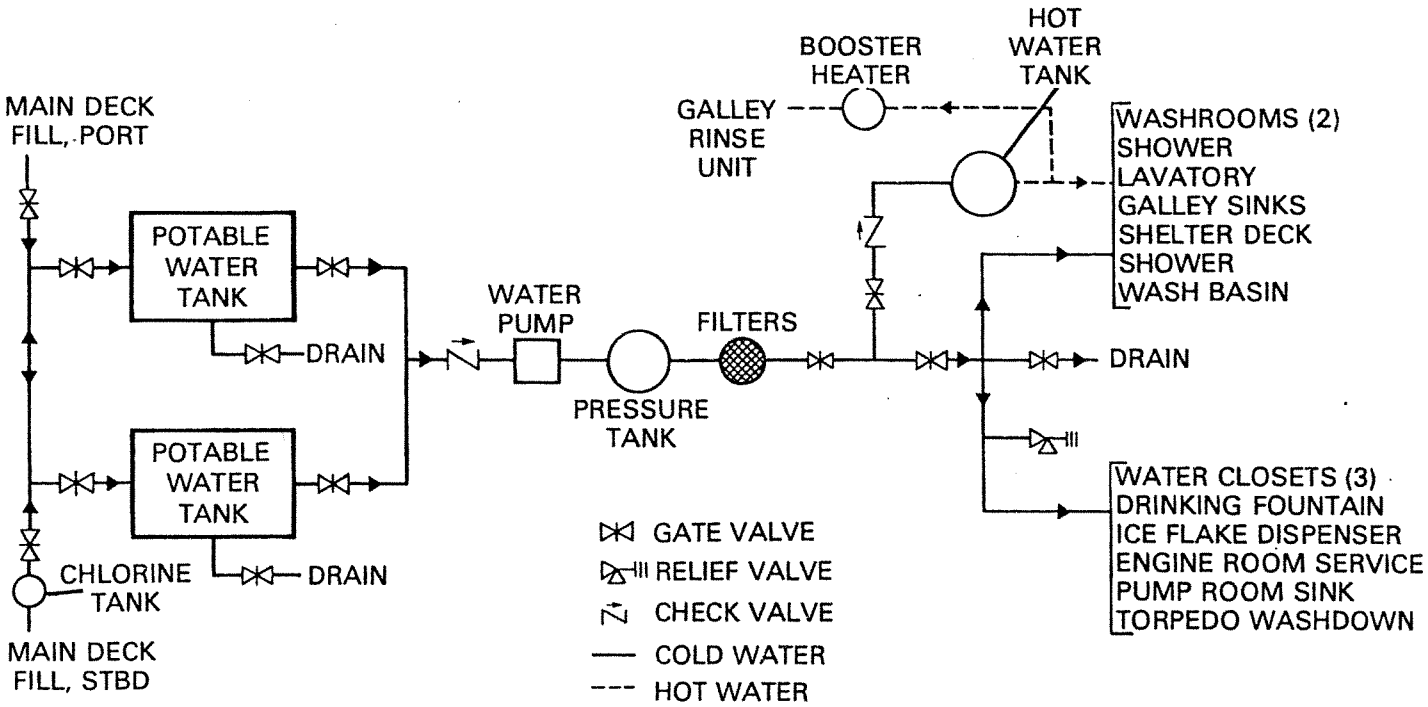


Figure 3-7. Fresh Water System Schematic Diagram

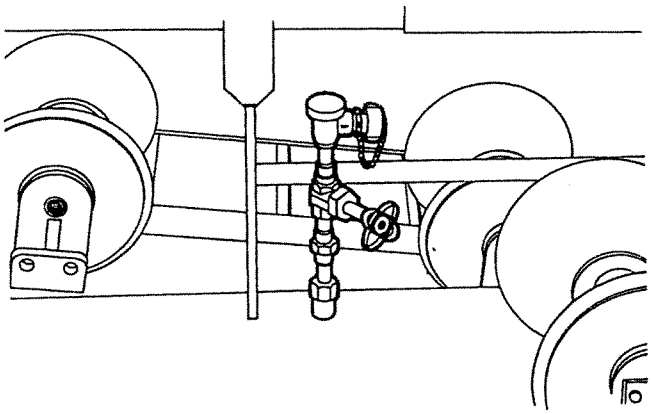


Figure 3-8. Torpedo Washdown Connection
(Frames 22-3/4 and 25, Starboard, Main Deck)

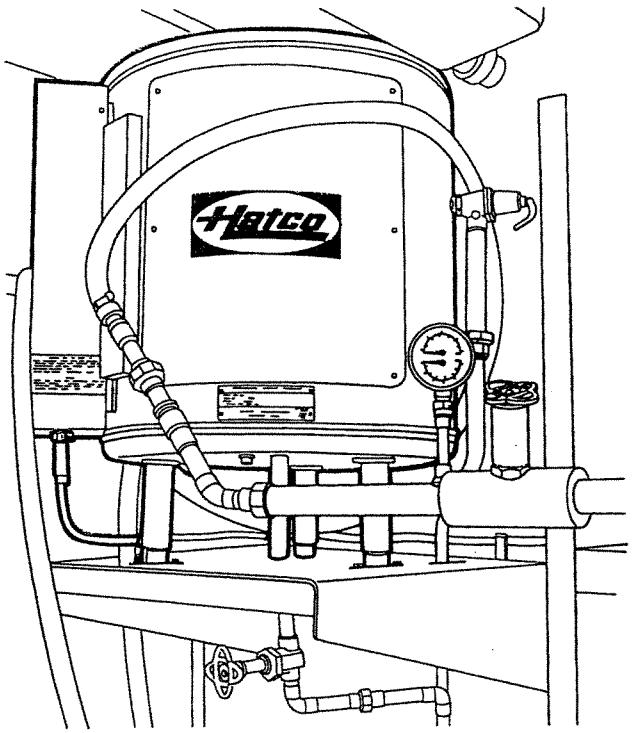


Figure 3-9. Booster Heater
(Frame 12, Starboard, Provisions Storeroom)

Table 3-6. Fresh Water System

Booster Water Heater	
Make	Hatco Corp.
Model	PMC-9
Capacity	16 gallons
Electrical Rating	9 Kw
Hot Water Heater	
Make	A.O. Smith Corp.
Model	DSE-11-15
Capacity	100 gallons
Fresh Water Filter	
Make	Everpure, Inc.
Model	9274-03
Element	Replaceable
Water Pump	
Make	Grundfos
Model	CP3-40KV
Rated	25 GPM
Type	4-Stage Centrifugal
Motor	2 HP, 450V, 3PH, 60 HZ
Water Cooler	
Make	Halsey Taylor Co.
Model	S-10D
Electrical Rating	120V, single phase, 60 hertz
Motor	1/4 HP

Section VI
BILGE, BALLAST AND FIREMAIN SYSTEM

3-17. BILGE SYSTEM BASIC DESCRIPTION. (Figure 3-10).

The bilge system requires the use of both 100 GPM fire pumps that take suction from the sea chests and discharge overboard through an eductor. The eductor suction is connected to the bilge manifold and has independent suction from the engine room and pump room. The manifold has branch lines leading to voids and bilges in the lazarette, engine room, pump room, bow thruster space and to a sump under the anchor chain locker. The anchor chain locker sump is fitted with a remote operated gate valve located in the bosun's stores space at frame 2. The valve is controlled from the main deck aft of frame 2 (Figure 1-24) using the tee wrench which is located on the deckhouse exterior bulkhead at frame 4-1/2, 12 inches off centerline. Bilge water in the other spaces is controlled through the globe stop check valves at the bilge manifold (Figure 1-23) which will allow discharge of bilge water from a given area overboard as necessary. Bilge level sensors are installed on the craft to sense bilge flooding. An alarm indicator on the pilothouse alarm panel provides visual indication of flooding conditions. Refer to Chapter 3, Section XVIII. Refer to Table 3-7 for leading particulars on the bilge system and Figure 2-35 for complete system diagram which identifies and locates all components.

3-18. BALLAST SYSTEM BASIC DESCRIPTION. (Figure 3-10).

The fire pump in the lazarette takes suction from the sea chest. The pump will supply ballast water from the sea chest to the ballast tanks if required or deballast the tanks overboard through the eductor suction. The eductor suction is connected to the ballast manifold. Bellmouths are fitted at each ballast tank and the manifold (Figure 1-

25) is fitted with gate valves labeled for the tank it controls. The ballast tanks are located as follows:

1. Forepeak tank — 10.6 tons capacity.
2. Forward tanks (Frame 6) — 5.5 tons.
3. Aft tank (Frame 23-port) — 11.1 tons.
4. Aft tank (Frame 23-starboard) — 10.7 tons.

Ballast discharge overboard is located aft of frame 20, starboard side. Valves in the system are closed or opened as required for the specific mode of operation. Ballast or deballast of the forepeak tank is controlled by a remote operated gate valve located at frame 2 in the bosun's stores. Valve control is accomplished from the main deck with the tee wrench located on the deckhouse exterior bulkhead. Refer to Table 3-7 for leading particulars of system components. Refer to Figure 2-36 for a complete system diagram which identifies and locates all components.

3-19. FIREMAIN SYSTEM BASIC DESCRIPTION. (Figure 3-10).

The firemain system is a one-line distribution system extending fore and aft under the main deck with branches to fire plugs. The two 100 GPM fire pumps provide service to the firemain system from the sea chests in the engine room. Refer to Table 3-7 for leading particulars of the system components. Refer to Figure 2-34 for a complete system diagram which identifies and locates all components.

3-19.1. FIRE STATIONS. The system provides pressurized water to the five fire stations located as follows:

1. Top of pilothouse, aft of frame 7, port side.
2. Main deck, forward of frame 3, port side.
3. Main deck, aft of frame 15, port side.
4. Engine room, aft of frame 18, at centerline.
5. Crew berthing space, at frame 7, port side.

The following equipment is supplied at each fire station:

1. Fire plug — 1-1/2-inch angle male hose valve.
2. "Y" type strainer with lever handle ball valve.
3. Two 50-foot lengths of fire hose (only one 25-foot length is furnished in the engine room).
4. All purpose nozzle — 1-1/2 inch, 3 position.
5. Low velocity fog applicator — 4 foot.
6. Spanner wrench.
7. Inline foam inductor with pickup tube.
8. Spray nozzle — variable pattern.
9. Three 5-gallon type AFFF foam concentrate.

3-19.2. EMERGENCY FIRE PUMP. The PE-250 emergency fire fighting pump (Figure 1-21) located on the main deck at frame 15 can be used to pressurize the firemain during total electric failure. During other emergencies the pump can be used as a portable fire pump or for de-watering. Fire pump accessories are stowed in the deck shelter area above the fire pump.

Table 3-7. Bilge, Ballast and Firemain System Components

Fire Pumps	
Make	Paco Pumps, Inc.
Model	10-15701
Capacity	100 GPM at 75 PSI
Electric Rating	440/460VAC, 3 phase, 60 hertz
Sump Pump	
Make	ITT Jabsco
Model	11810-0001
Electric Rating	115VAC, 1 phase, 60 hertz
Emergency Fire Pump	
Make	Prosser East Div. of Purex
Model	PE-250
Type	Gasoline
Capacity	250 GPM
Pressure	100 PSI

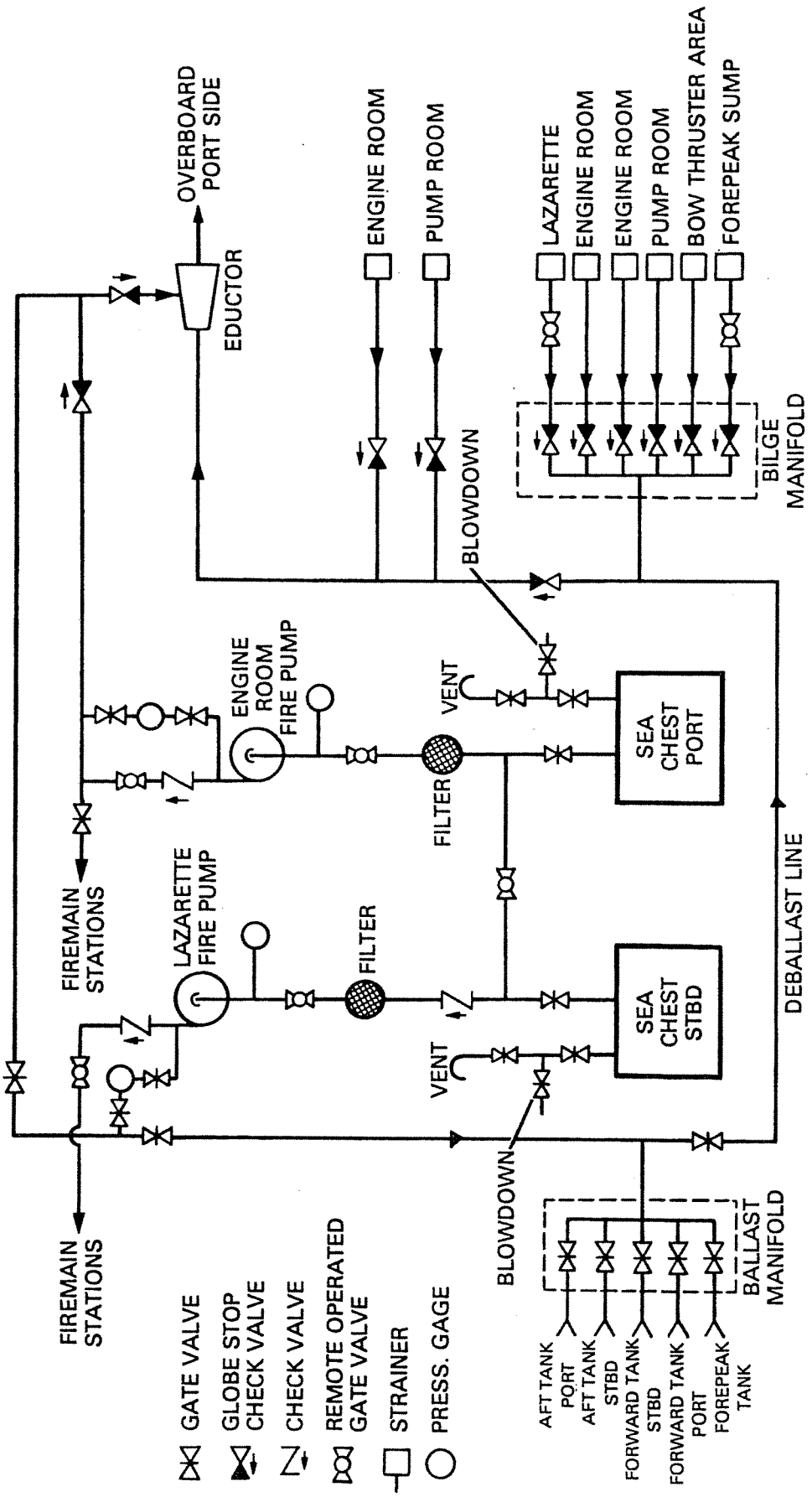


Figure 3-10. Bilge, Ballast and Firemain Schematic Diagram

Section VII
MACHINERY SEA WATER COOLING

3-20. MACHINERY SEA WATER COOLING BASIC DESCRIPTION. (Figure 2-37.)

3-20.1. PROPULSION ENGINE DRIVEN SEA WATER PUMPS. (Figure 2-37.) Sea water cooling is provided by two separate propulsion engine driven sea water pumps that circulate the sea water through the cooling system. Refer to Table 3-8 for leading particulars on the system components. Sea water cooling services the following components for each side of the system:

1. Propulsion engine heat exchanger.
2. Generator engine heat exchanger.
3. Reduction gear heat exchanger.
4. Engine fuel cooler.
5. Forward stern tube shaft bearings.
6. Exhaust system cooling.
7. Bow thruster hydraulic oil cooler (port side only).

3-20.1.1. Water is drawn from the sea chest through gate valves, ball valves and the simplex strainer to the sea water pump (Figure 1-26). The pump then circulates the sea water through the heat exchangers, the fuel oil coolers, the stern tube stuffing boxes port and starboard and the bow thruster hydraulic oil cooler. After the cooling water passes through the fuel oil heat exchanger it flows to the propulsion engine exhaust system and to the overboard discharge through locked open globe valves.

3-20.1.2. Sea water drawn from the sea chest passes through the filter to the diesel generator and flows to the generator exhaust and discharges overboard through a locked open globe valve.

3-20.2. A/C SEA WATER PUMP. (Figure 2-37.) Water drawn from the sea chest passes through ball valves, a filter and a simplex strainer to a 15 GPM pump (Figure 1-27) which circulates sea water to the A/C condenser.

3-20.3. STRAINERS. Sea water strainers incorporated in the system are the simplex type with transparent plastic sumps. The strainers are mounted upright and connected in the piping so that foreign material will be held in the basket. The basket is removable from the top by removing the cap and thumbscrew.

3-20.4. SHORE SEA WATER CONNECTION. An emergency sea water supply connection is provided in the engine room to supply the cooling system if pumps are inoperative or if the craft is in dry dock for repair. The connection is fitted with a 4-inch gate valve.

Table 3-8. Sea Water System Components

Sea Water Cooling Pump (A/C)	
Make	Worthington
Model	D-1021, 3X1.5X5
Capacity	90 GPM
HP	5
Strainer	
Make	Kraissl
Type	Simplex
Sump	Plastic
Size	2-1/2 inch and 4 inch

Section VIII
HYDRAULIC SYSTEMS

3-21. STEERING SYSTEM BASIC DESCRIPTION.

The steering system requires both electrical power and hydraulic oil supply to be operational. Steering can be accomplished at the steering wheel in the pilothouse (Figure 2-6) or at the steering lever on the auxiliary conning station console (Figure 2-2). Hydraulic oil is delivered to the twin pumpsets (Figure 1-28) and the helm pump from the 9-gallon header tank (Figure 1-29) located on the pilothouse top. The tank is fitted with a low level sensor which sets off an alarm if tank level drops too low. Rudder angle indicators located in the pilothouse and at the auxiliary conning station are connected to the follow-up unit in the lazarette (Figure 3-11). The follow-up unit sends electrical signals to the rudder angle indicators which show rudder position at all times. Refer to Table 3-9 for leading particulars of the steering system components. The steering system consists of the following major components:

1. Steering wheel and helm pump (Helm)
2. Header tank
3. Twin 3 HP pumpsets
4. T-15 Ram actuator
5. Mini-accumotor
6. Rudder angle indicator
7. Rudder follow-up unit
8. Rudders and rudder stock
9. Steering lever (Auxiliary Conning Station)

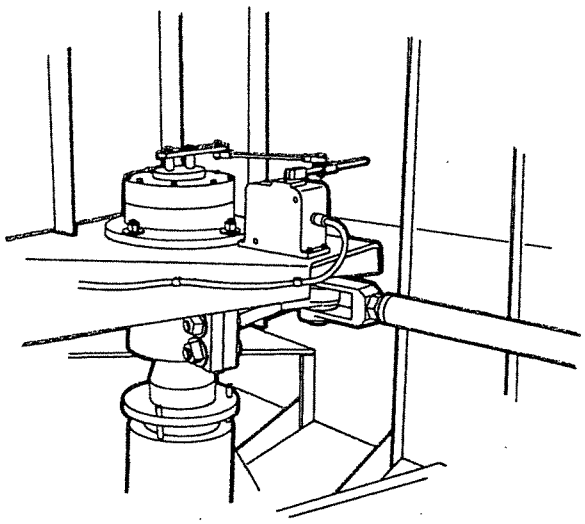


Figure 3-11. Follow-up Unit (Lazarette, Frame 27, Port)

3-21.1. PILOTHOUSE STEERING. (Figure 3-12.)

3-21.1.1. Helm Pump Action. The helm pump (6) takes commands from the bridge through the steering wheel mounted on the pump shaft. Turning the steering wheel to the right forces hydraulic oil out the right side of the pump to the accumotor that houses the power steering valves. Oil flow then activates the accumotor cylinder (3) which moves the spool of the pressure compensated 4-way valve (8) through mechanical linkage. This valve delivers oil from the power pump sets (10) to the steering actuator (1) to give right rudder. As the rudder stock rotates, the rudder stock clamp actuating the follow up rod rotates the cross bar. This rotation re-centers the pressure-compensated 4-way and valve shuts off oil supply to the steering actuator. This sequence has shifted the valve spool of the 4-way directional to the right of its neutral position giving right rudder to the craft. Turning the steering wheel to the left would give left rudder in the same way.

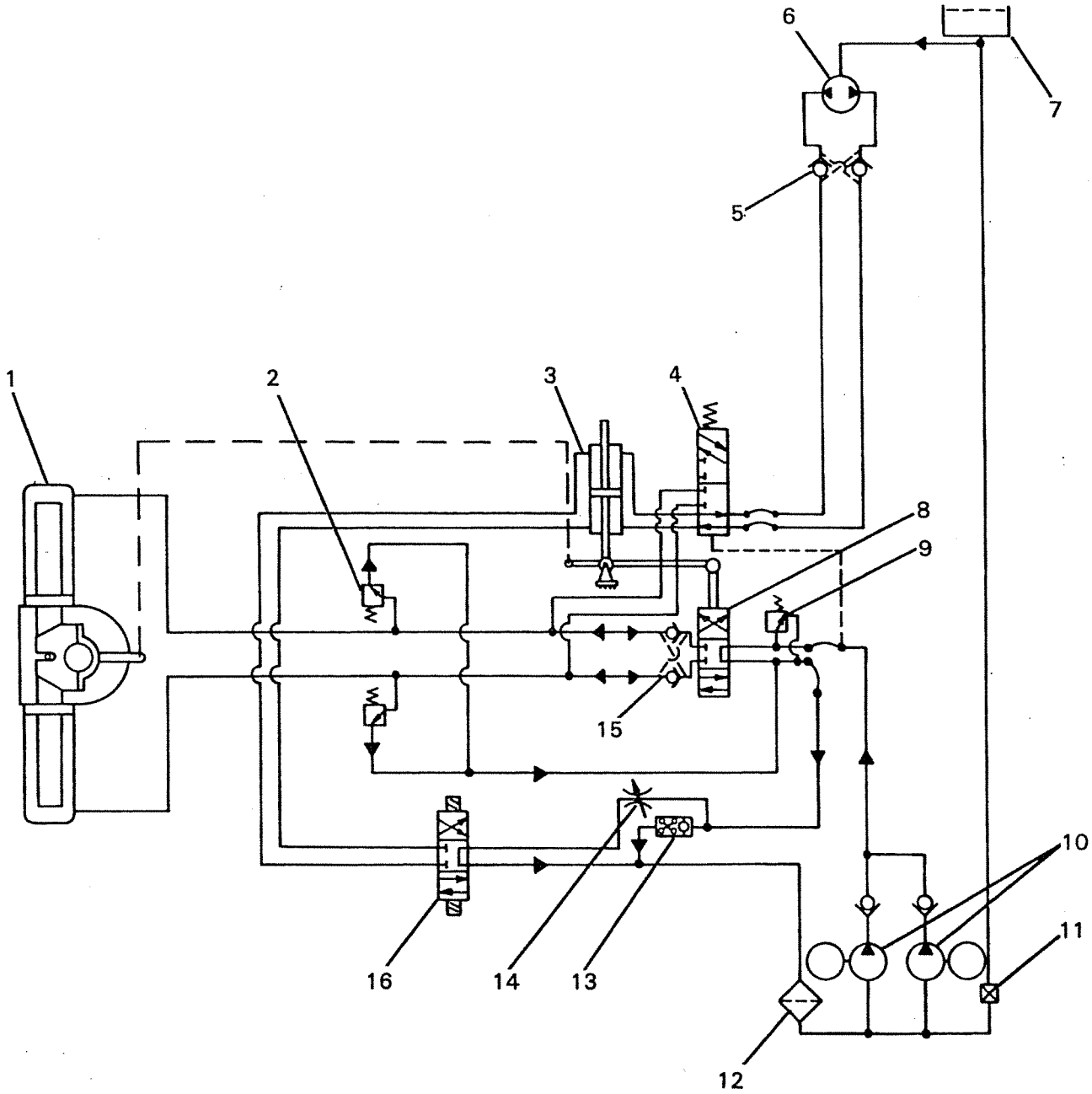
3-21.1.2. Double-Acting Relieve Valve. The double acting relief valves (2) are connected to each steering actuator inlet port. In the event the rudder strikes an underwater obstruction, the relief valves vent the tank to prevent damage to the steering actuator.

3-21.1.3. Automatic Changeover Valve. The purpose of the automatic changeover valve (4) is to supply emergency manual steering in the event of a power pump failure. When the power pump fails or is turned off, the changeover valve spool directs the oil from the helm pump directly to the steering actuator rather than to the accumotor cylinder first.

3-21.1.4. System Relieve Valve. The system relief valve (9) limits the maximum oil pressure supplied to the steering actuator. The valve is adjustable to increase or decrease pressure in the system.

3-21.1.5. Helm Pump Lockvalves. The purpose of the helm pump lockvalves (5) is to permit the use of more than one helm station. The lock valve is manifolded to the rear of the helm pump and permits one helm to be isolated from the other.

3-21.1.6. Lockvalve. The purpose of the lockvalve (15) is to hold the steering actuator in position when the pressure compensated 4-way valve (8) is in its neutral centered position.



1. STEERING ACUATOR AND BYPASS VALVE
2. DOUBLE ACTING RELIEF VALVE (PART OF ACCUMOTOR)
3. ACCUMOTOR CYLINDER
4. AUTOMATIC CHANGEOVER VALVE (PART OF ACCUMOTOR)
5. HELM PUMP LOCK VALVE
6. HELM PUMP AND STEERING WHEEL
7. HEADER TANK (9 GALLON)
8. 4-WAY DIRECTIONAL VALVE (PART OF ACCUMOTOR)
9. SYSTEM RELIEF VALVE (PART OF ACCUMOTOR)
10. PUMPSETS
11. SHUT-OFF VALVE
12. FILTER
13. BACK PRESSURE VALVE (PART OF ACCUMOTOR)
14. FLOW CONTROL VALVE (PART OF ACCUMOTOR)
15. LOCKVALVE (PART OF ACCUMOTOR)
16. SOLENOID OPERATED 4-WAY VALVE

Figure 3-12. Steering System Schematic Diagram

Table 3-9. Steering System Components

Pumpsets	
Motor	
Manufacturer	Baldor
Model	CM3611T
Type	Squirrel Cage Induction
Electric Rating	440/460VAC, 3 phase, 60 hertz, 3 HP
Duty	Continuous
Pump	
Manufacturer	Vickers
Type	Vane
Model	V110 — 2.5
Pressure Rating	800 PSI
Capacity	2.5 GPM
Steerer Lever	
Manufacturer	Wagner Eng. Ltd.
Switching	SPDT, Center off, spring return
Current	10 Amp at 125 VAC
Part No.	510-031
Rudder Angle Indicator	
Manufactuer	Wagner Eng. Ltd.
Model	202
Max. Angle Indicated	2 x 45 degrees
Solenoid Valve	
Manufacturer	Vickers
Model	DG4V3
Electric Rating	230VAC, 60 hertz

3-21.1.7. Bypass Valve. The bypass valve when opened, will short circuit the oil flow from one end of the steering actuator (1) to the other. This free flow of oil permits the use of an emergency tiller on the rudder stock. If the emergency tiller is used, the bypass valve must be turned to the bypass position.

3-21.2. AUXILIARY CONNING STATION STEERER. (Figure 3-13.) The steerer lever located on the auxiliary conning console is moved to port or starboard as desired to provide non follow-up electric control of the steering gear. The lever works in conjunction with the solenoid-operated 4-way valve (16, Figure 3-12) that delivers oil to either end of the accumotor cylinder when the steerer lever is being used. The electrically energized solenoid-operated 4-way valve serves the same purpose as the manually-operated helm pump.

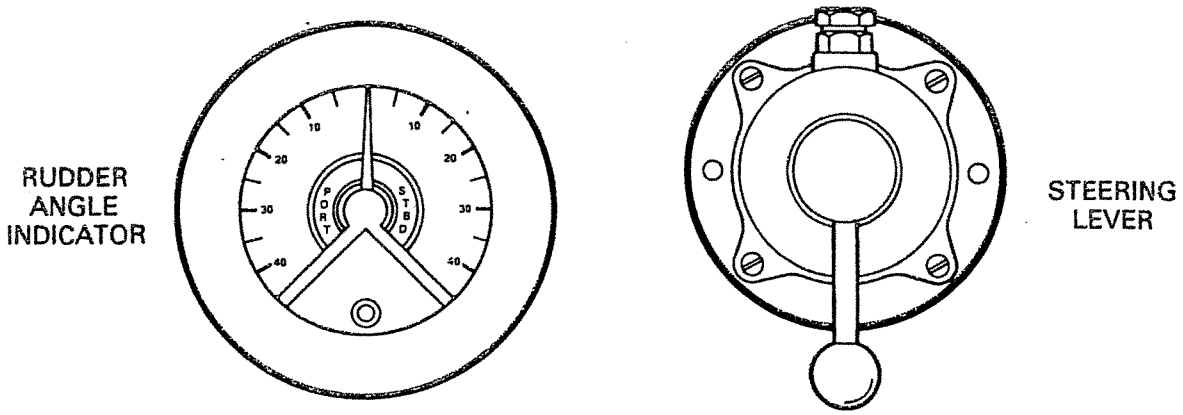


Figure 3-13. Steering Lever and Rudder Angle Indicator — Auxiliary Conning Station (Frame 15, Starboard)

3-21.2.1. Back-Pressure Valve. The back pressure valve (13) directs some of the return oil in the system to the solenoid-operated 4-way valve (16).

3-21.2.2. Flow Control Valve. The flow control valve (14) regulates the amount of oil going to the pressure port of the solenoid-operated 4-way valve (16). The flow adjustment only regulates the speed of the steering gear when the solenoid-operated 4-way valve operates. It does not regulate the speed when the helm pump is operated.

3-22. BOW THRUSTER HYDRAULIC SYSTEM BASIC DESCRIPTION. (Figure 3-14.)

The bow thruster hydraulic-powered propulsion system provides lateral thrust to the bow of the craft. It also provides added maneuverability when docking in close areas. The bow thruster employs a constant speed, rotary hydraulic motor to drive the thruster propeller. Hydraulic power for the thruster motor is supplied by the hydraulic pump directly driven off the starboard propulsion engine. This pump supplies the flow and pressure to operate the system. Refer to Table 3-10 for leading particulars.

3-22.1. THRUSTER CONTROL. The directional flow control valve is controlled from the main panel (Figure 3-15) in the pilothouse or the secondary panel (Figure 3-16) at the auxiliary conning station. To activate the system place the "on-off" switch in the "ON" position and move the "joystick" to starboard or port. The control panel at the auxiliary conning station is equipped with push buttons rather than a "joystick." The system is designed so that the control at the auxiliary conning station cannot override the pilothouse control.

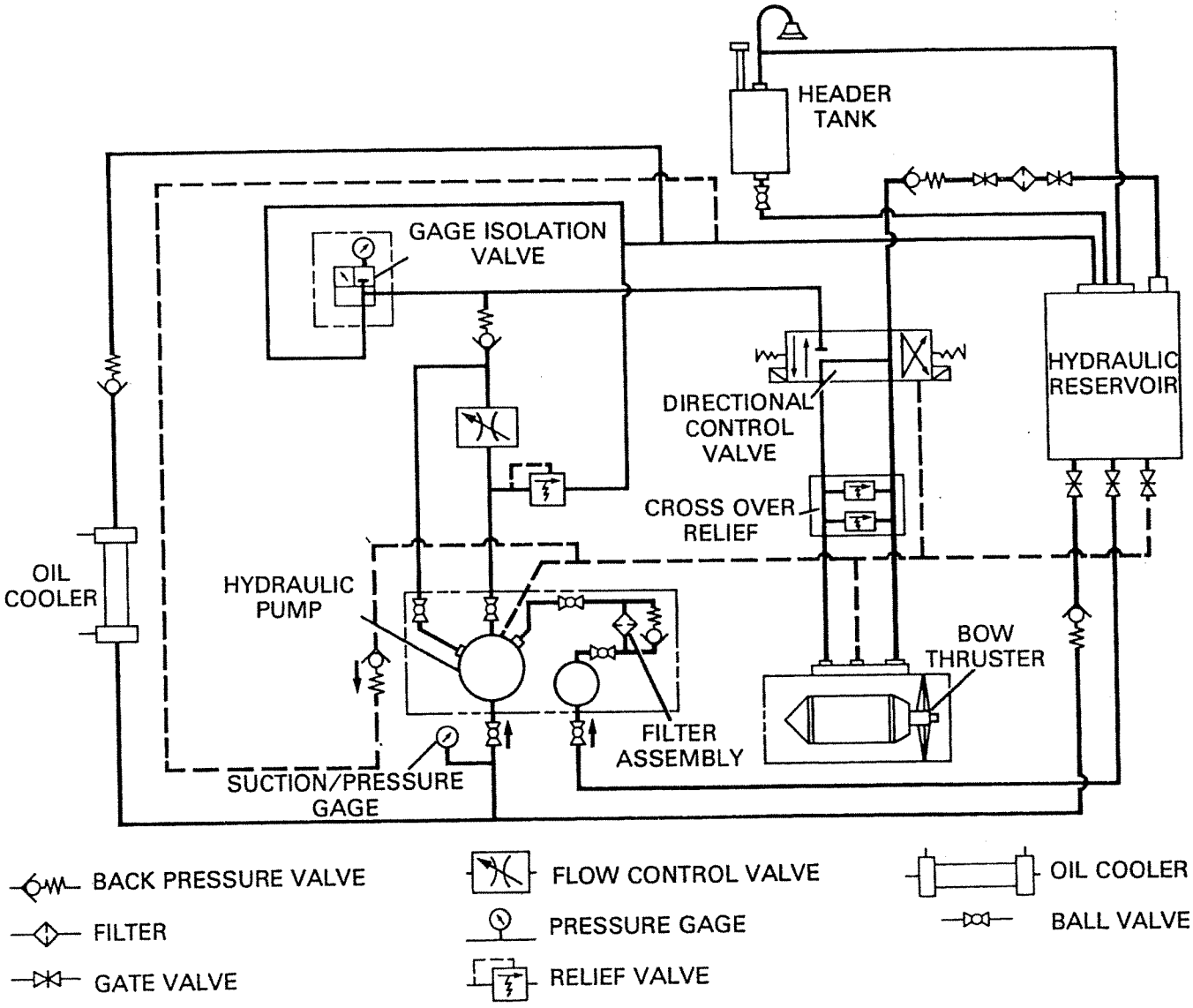
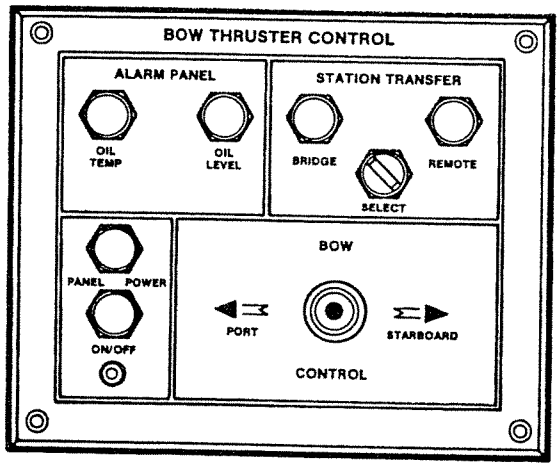


Figure 3-14. Bow Thruster System Schematic Diagram

Table 3-10. Bow Thruster

Bow Thruster System	
Make	Thrust Master Inc.
Model	TMM-16
Power Source	Ship's engine
Pressure	2500 PSI
Rated Output	60 HP
Reservoir Capacity	125 Gallons
Power Requirements	110 VAC
Thrust	1270 lbs.



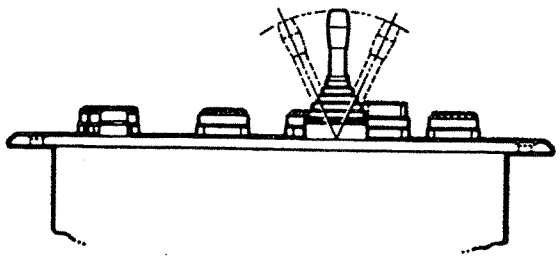


Figure 3-15. Bow Thruster Control Panel (Pilothouse Console, Frame 7)

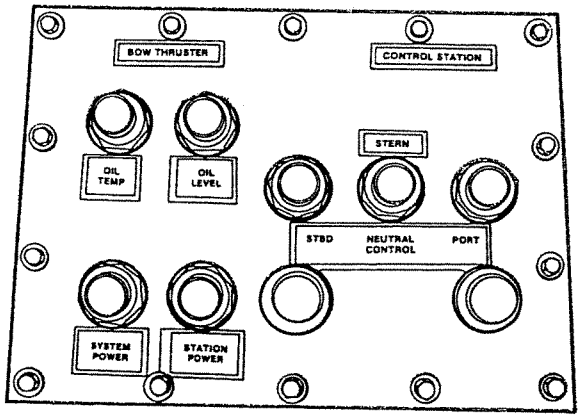


Figure 3-16. Bow Thruster Control Panel (Auxiliary Conning Station, Frame 15, Port)

3-22.2. SYSTEM PROTECTION. The system is equipped with "LOW OIL" and "HIGH TEMPERATURE" warning lights and a relief valve to protect the system if pressure goes beyond 2500 PSI.

CAUTION

Immediate shutdown of the system must be implemented if "LOW OIL" or "HIGH TEMPERATURE" lights are illuminated to prevent damage to the thruster motor.

3-22.3. TANKS. The hydraulic reservoir (Figure 1-32) located in the bow thruster space has a 125 gallon capacity. The tank is fitted with a temperature gauge and a temperature/level alarm switch. A drain is installed through the access cover to allow complete draining of the tank. The header tank (Figure 1-33) for the bow thruster is located on the bridge deck mounted to the pilothouse bulwark.

3-23. CRANE SYSTEM BASIC DESCRIPTION.

The crane located on the starboard side of the main deck aft of the deck house is hydraulically powered from a self-contained power pack (Figure 2-40). Refer to Table 3-11 for leading particulars. The hydraulic system consists of the following major components:

1. Power pack
2. Control valve
3. Swing motor and brake
4. Cylinders
5. Winch

3-23.1. POWER UNIT. The power pack (Figure 1-35) located at frame 14 port side of the bridge deck is a self-contained unit including the electric motor, hydraulic pump and the hydraulic oil reservoir with filters and liquid level gauge. The motor controller for the power unit is mounted on the life rails aft of the power unit.

3-23.2. CONTROL STAND. The crane control stand (Figure 1-37) is located on the bridge deck starboard side of the auxiliary conning. The control stand contains the control valve, the four control levers and a 0-3000 PSI pressure gauge. The four levers are required to operate the swing, jib, winch and boom. A load chart nameplate is located on the stand. The multiple-section hydraulic control valve contains four manual, spring centered to neutral, spool sections. The farther a spool is moved off its neutral position the greater the delivered flow of hydraulic fluid.

3-23.3. CRANE SWING. The crane swing drive consists of two planetary gear boxes mounted on the spindle and driven by hydraulic motors. Each gear box is fitted with spring set, hydraulically released, failsafe brakes for positive braking. The crane is capable of 360 degree rotation.

Table 3-11. Crane

Crane	
Model	KB4-25-25
Rating	4000 lbs. at 24 feet
Weight	6500 lbs.
Power Requirement	440VAC, 3 phase, 60 hertz
Motor Controller	
Manufacturer	General Electric
Type	4
Size	2
Electric Rating	440VAC, 3 phase, 60 hertz
Hydraulic Motor	
Manufacturer	General Electric
Horsepower	25
Rating	440VAC, 3 phase, 60 hertz
Type	K
Planetary Winch	
Manufacturer	Gear Products, Inc.
Series	PG 105
Capacity	5,600 lbs.
Power	Hydraulic motor
Cylinder	
Manufacturer	Victor Fluid Power
Operating Pressure	2500 PSI
Bore Diameter	7.00

3-23.4. JIB BOOM. Articulation of the jib boom is accomplished using a 7-inch bore hydraulic cylinder. A load holding valve in the cylinder prevents involuntary retraction if power is lost or hydraulic lines are damaged.

3-23.5. MAIN BOOM. Raising and lowering of the main boom is accomplished by hydraulic cylinder. The cylinder is capable of lifting the boom at approximately 3 degrees per second. This cylinder is also equipped with a load holding valve.

3-23.6. CRANE WINCH. The crane winch is driven by a hydraulic motor through a planetary drive unit. The integral static brake is capable of holding approximately 150 per cent of the rated load. The winch drum contains 120 feet of 1/2-inch diameter wire rope with a swivel safety hook and headache ball. Line speed is 60 FPM on the bare drum and winch static capacity on the top layer of rope is 4000 pounds.

3-24. TORPEDO HANDLING SYSTEM BASIC DESCRIPTION. (Figure 2-41.)

The torpedo handling hydraulic system provides for the handling, transferring and stowage of torpedoes. Refer to Table 3-12 for leading particulars of the torpedo handling system. Detailed information on the major components of the system can be located in the onboard Technical Service Manuals. The system consists of the following major components:

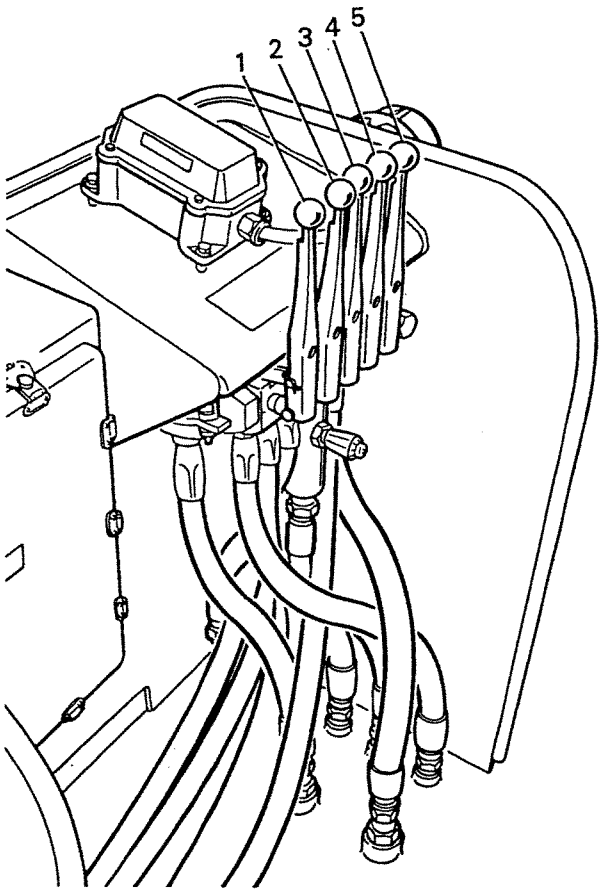
1. Hydraulic power unit
2. In-haul winch
3. Transfer winches
4. Transfer carriage
5. Control station
6. Motor controller

3-24.1. HYDRAULIC POWER UNIT. The hydraulic power unit (Figure 1-38) located in the bow thruster area provides the hydraulic energy to drive the winches, transfer motor and the cylinders in the system. The hydraulic pump and electric motor are mounted on the hydraulic reservoir. The reservoir provides hydraulic oil storage which is cooled and separated from air and moisture. The tank capacity is 80 gallons.

3-24.1.1. An in-tank suction filter prevents injection of foreign objects or particles that could damage or clog the system components. A 5 PSIG bypass valve in the filter provides cavitation protection for the pump.

3-24.1.2. The return line filter is located between the main torpedo winch/carriage control valve and the reservoir. The filter prevents foreign particles present in the oil from entering the hydraulic reservoir.

3-24.2. HYDRAULIC CONTROL. (Figure 3-17.) The control station for the torpedo handling system is located on the main deck aft of the deckhouse. The control valve mounted at the station provides directional control for the system and also system pressure relief to protect against overpressurizing of the hydraulic power unit. The control valve is made up of seven valve segments which are bolted together and sealed with o-rings. The first valve segment contains the inlet port where hydraulic fluid from the power unit enters the control valve. This segment is fitted with a relief valve factory set at 2200 PSIG. Flow from the relief valve bypasses the control segments of the valve and exits at the common return port in the last valve segment.



1. TRACK-LIFT AND LOWER
2. CARRIAGE TRANSVERSE
3. AFT TRANSFER WINCH
4. FORWARD TRANSFER WINCH
5. IN-HAUL WINCH

Figure 3-17. Torpedo Handling Hydraulic Controls (Frame 16, Starboard, Main Deck)

3-24.2.1. The first control handle (1, Figure 3-17) provides directional control for the main torpedo handling winch. Moving the valve handle allows for in-haul of torpedoes up the torpedo ramp.

3-24.2.2. Control valve handles (2) and (3) provide directional control for the forward transfer winch and the aft transfer winch, respectively. These controls allow movement of the torpedoes for stowage on the torpedo rollers.

3-24.2.3. Control valve handle (4) provides control for the transfer carriage hydraulic motor. This allows transverse movement of the torpedoes on the deck rollers.

3-24.2.4. Control valve handle (5) controls the double acting hydraulic cylinder which raises or lowers the torpedo carriage track during handling operation.

3-24.2.5. Refer to Table 3-12 for leading particulars of the torpedo handling system. Detailed information on the major components of the system can be located in the onboard Technical Service Manuals.

Table 3-12. Torpedo Handling System Components

Pump	
Make	Commercial Shearing Inc.
Model	P50
Primary Output	30 GPM
Secondary Output	9 GPM
Output Pressure	850 PSIG
Maximum Working Pressure	2200 PSIG
Motor	
Make	Baldor Electric
Model	42M
Rating	25 HP
In-Tank Filter	
Make	Gresen
Model	FST120-1
Filtration Rating	60 Micron
In-Line Filter	
Make	Gresen
Model	FLR312-1GF1E
Filtration Ratings	10 Micron
Bypass	25 PSI
In-Haul Winch	
Make	Pullmaster Winch Corp.
Model	H7A-3-30
Drum Torque & RPM	26250 lb. in./69 RPM
Max. Operating Pressure	2000 PSI
Transfer Winch (2)	
Make Pullmaster	Winch Corp.
Model	PL2
Drum Torque/RPM	7025 lbs. in/49 RPM
Max. Operating Pressure	2200 PSI

Section IX
ANCHOR HANDLING SYSTEM

3-25. ANCHOR HANDLING BASIC DESCRIPTION. (Figure 2-15.)

The anchor handling system is designed to insure efficient handling and securing of the anchors without damage to the hull, hull appendages or equipment when dropping, weighing or riding at anchor. Hawse pipes secured to the deck allow the anchor chains to be dropped or weighed without damage to the craft. Two bitter end connections are installed in the chain locker bulkhead at frame 2 to connect the end link of the chain anchor. This connection prevents the anchor chain and anchor from being dropped at sea. Anchor chain for the starboard side requires 5 15-fathom lengths and the port side requires 4 15-fathom lengths. A 350 pound anchor is secured to each anchor chain.

3-25.1. DEVILS CLAW. The devils claw (Figure 3-18) and turnbuckle is attached to an anchor plate welded to the windlass bed plate. The claw is positioned on each anchor chain when chain is lowered to hold chain from slipping.

3-25.2. ANCHOR WINDLASS. The anchor windlass (Figure 1-42) consists of an electric motor, brake, gypsy heads, wildcat and magnetic controller. The magnetic controller for the windlass is located below deck. See Table 3-13 for leading particulars.

3-25.2.1. Windlass operation is accomplished using the pushbutton station (Figure 1-43) mounted on the deckhouse at frame 4-1/2. The control allows fast and slow operation in the hoist or lower mode. A "dead man" type switch is incorporated in the control to stop operation of the windlass when operator pressure is released at the pushbutton station. The windlass is driven by an electric motor and is equipped with a disc brake, set by spring pressure and released by an electric magnet. The brake stops the motor and holds the load through gearing. The motor is started and stopped by the magnetic controller.

3-25.2.2. The gypsy heads are driven by two sets of gears and are capable of pulling 2,900 pounds of line at approximately 56 feet per minute. The chain wheel is sized for 5/8-inch stud link chain and can hoist two 350 pound anchors from a depth of 30 fathoms at a rate of 33 feet per minute.

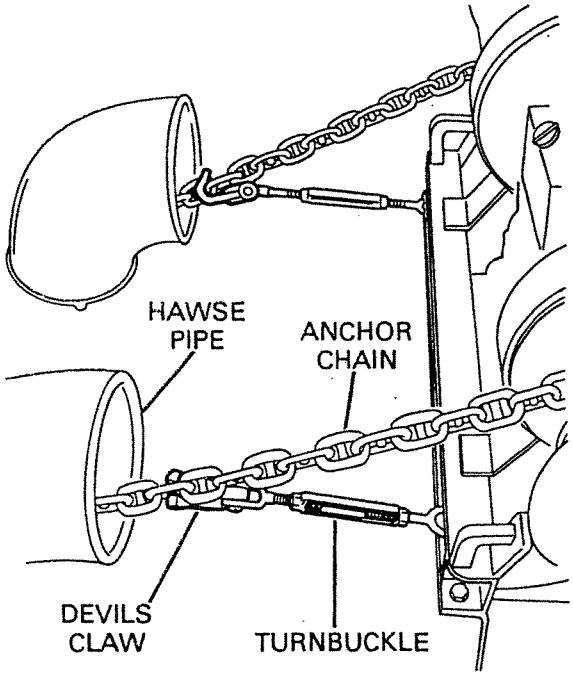


Figure 3-18. Devils Claw
(Frame 2, Centerline, Main Deck)

Table 3-13. Anchor Windlass

Windlass	New England Trawler Equipment Co.
Model	X-1885
Horsepower	7.5/1.88
Rating	440VAC, 3 phase, 60 cycles
Brake Rating	25 pound foot
Chain Size	5/8-inch
Gypsy Head Diameter	12 inches
Chain pull	4,900 pounds
Chain Speed	33 feet per minute
Line Pull	2,900 pounds
Line Speed	56/14 feet per minute

Section X
SEWAGE SYSTEM

3-26. SEWAGE SYSTEM BASIC DESCRIPTION. (Figure 2-16.)

The sewage system consists of collection, holding and transfer of sewage from water closets on the main deck and the first platform. Sewage is piped to the collection tank via vacuum sewage mains, through a water jet ejector into the tank. The water jet ejector generates the vacuum pressure in the pipelines by circulating the sewage from an outlet at the bottom of the tank through the circulation pump and external pipelines back into the tank through the ejector. The pump is automatically controlled to stop recirculation when maximum vacuum pressure is reached. A pre-set minimum pressure will re-start the pump to re-establish adequate pressure in the system. Circulation of the sewage through the ejector also aerates and homogenizes the sewage to start disintegration and prevent odor problems. Refer to Table 3-14 for leading particulars of the system.

Table 3-14. Sewage System Components

Collection Unit	
Manufacturer	Evak Systems
Model	1111
Tank Capacity	520 gallons
Vacuum Toilet Assembly	
Working Vacuum	8.0 Hg.
Water Pressure	36.3 lb/in^2
Flushing Time	5 to 8 seconds
Flush Valve Part No.	43525.9
Discharge Valve Part No.	43501.3
Centrifugal Pump	
Type	Herborner 5.5/QSH 101 F
Minimum flon	60 GPM
Voltage	440/450VAC, 3 phase, 60 hertz
Motor	5 HP
Sewage Discharge Valve	
Type	Ball
Size	2.0 inch
Level Switch	
Type	Tri Mod Series 60, Modular 3 piece
Vacuum Pressure Switch	
Adjustable Range	1.0" Hg to 30.0" Hg
Voltage	120VAC at 60 hertz
Current	15 amp.
Vacuum Pressure Gauge	
Type	Bourdon tube
Vacuum Range	0" Hg to 30" Hg
Sump Drain Pump	
Model	11810-0001
Motor HP	1/3
Electric Rating	115VAC, Single Ph., 60 HZ
Vacuum Switch	
Model	4732-0000
Mounting	Remote
Type	Manual Restart

3-26.1. COLLECTION AND HOLDING TANK. (Figure 1-44.) The collection and holding tank is equipped with a recirculation pump, ejector, discharge valve, isolation gate valve and fluid level sensors. Tank capacity is 506 gallons and the tank is vented 8 feet above the main deck. The fluid level sensors on the tank are connected to an automatic alarm system which will indicate when tank is filled to 90 per cent capacity. Summary alarm indicators are located at the water closets, in the pilothouse and on the control panel in the pump room.

3-26.2. SEWAGE SYSTEM CONTROL PANEL. (Figure 1-45.) The sewage system control panel is mounted on the aft bulkhead of the pump room, port side of engine room access. In addition to the disconnect switch on the control panel, there are switches for sewage pump starter, reset and manual-off-auto with run light, and a pump elapsed time meter. The control panel has alarm components as follows:

1. Alarm sewage pump overload light
2. Alarm sewage low level light
3. Alarm sewage high level light
4. Alarm sewage system low vacuum light
5. Alarm sewage pump over run light
6. Alarm acknowledge/test switch
7. Alarm reset light and switch
8. Alarm horn which sounds when an alarm condition exists

Lamps illuminate on the panel to advise personnel of power supply (green), high level (red), low level (amber) and operation (amber). The lamp test push button is installed to check lamp operation. When lamp test button is pressed all lamps should light at half brightness.

3-26.3. SEWAGE DISCHARGE. When the collection tank is full discharge to the deck pump out connection or the overboard discharge (if allowed) will be necessary. To discharge sewage open the discharge valve on the tank. Pressure for discharge is provided by the circulating pump on the holding tank.

NOTE:

Only 1/2 of the sewage in the tank will be discharged due to need to re-circulate to build vacuum in system. The two three-way scupper valves must be opened to allow discharge to the deck pump out connection.

Section XI
HEATING, VENTILATING AND AIR CONDITIONING SYSTEM

3-27. AIR CONDITIONING BASIC DESCRIPTION.

The air conditioning system consists of a 13.3-ton direct-expansion air conditioning unit and the air handling unit both manufactured by Borg-Warner. The system provides central mechanical cooling with temperature-controlled air ducted from a central expansion coil to the various spaces served. Refer to Figure 2-43 for A/C refrigeration piping diagram. For detailed information on the air conditioning plant and air handler refer to onboard Technical Service Manual S9514-B5-MMC-010.

3-27.1. AIR HANDLING UNIT. The air handling unit is located in the air handling space on the main deck at frame 9. The unit consists of the following major components:

1. Fan motor
2. Belt driven fan
3. Direct expansion coil
4. Cleanable filters
5. Pressure and temperature gages

3-27.2. AIR CONDITIONING UNIT. The air conditioning unit (Figure 1-50) is located in the engine room at frame 19. The unit consists of the following major components:

1. Compressor/condenser
2. Receiver
3. Heat exchanger
4. Motor
5. Filter/drier
6. Instrument panel

3-27.3. SYSTEM OPERATION. The refrigerant vapor from the cooling coils is compressed to condenser pressure and flows to the condenser. The refrigerant vapor is cooled enough in the condenser to condense into a liquid which drains into the receiver. Liquid refrigerant then flows through the filter/drier and the heat exchanger. Liquid refrigerant is then expanded to the air handler. The air handler unit interfaces with the air conditioning plant by means of a thermostat which senses the temperature of the air entering the air handler unit. The thermostat energizes or de-energizes the liquid solenoid valve, thus starting or stopping flow of refrigerant to the air handler. Refer to Table 3-15 for leading particulars on the air conditioning system components.

Table 3-15. Air Conditioning System Components

Air Handling Unit	
Make	York
Model	CS-SV74
Motor	440VAC, 3 phase, 60 hertz
Fan	1340 RPM
Air Capacity	3900 CFM
Cooling Capacity	13.3 Tons
Air Conditioning Plant	
Make	York
Model	SQ83-5089
Cooling Capacity	13.3 Tons
Compressor Speed	1750 RPM
Suction Pressure	79 PSIG
Discharge Pressure	208 PSIG
Refrigerant Charge	72 lbs., Refrigerant 22
Compressor	
Model	FS32
Drive	V-Belt
Oil Charge	4 Qts.
Oil Pressure	60-70 PSIG Above Suction Pressure
Motor	
Make	Siemens-Allis
Horsepower	20
RPM	1750
Power Requirements	440/460VAC, 3 phase, 60 hertz
Condenser	
Type	Marine, horizontal, 3 pass
Size	8 inches x 3 foot-6 inches
Number of Tubes	45
Flow	68 GPM (max)

3-28. VENTILATION — AIR SUPPLY. (Figure 2-45.)

The ventilation system provides mechanical or natural air supply to enclosed spaces on the craft. Spaces where internal heat gain removal is required are mechanically supplied and have natural exhaust. Spaces requiring removal of toxic fumes or stale air have natural supply and mechanical exhaust. The galley has both mechanical supply and exhaust.

3-28.1. ENGINE ROOM. The engine room air supply is furnished through a 32-inch mushroom ventilator located on the bridge deck at frame 15 (Figure 3-19). The ventilator is fitted with a 10,000 CFM vane axial fan that supplies air through the supply trunk directly to the engine room. Refer to Table 3-16 for leading particulars of the supply fan.

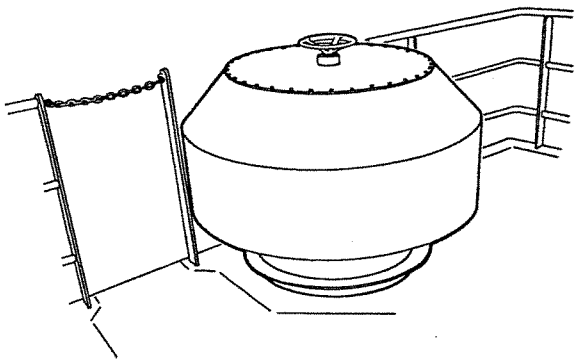


Figure 3-19. Engine Room Ventilator (Frame 15, Bridge Deck)

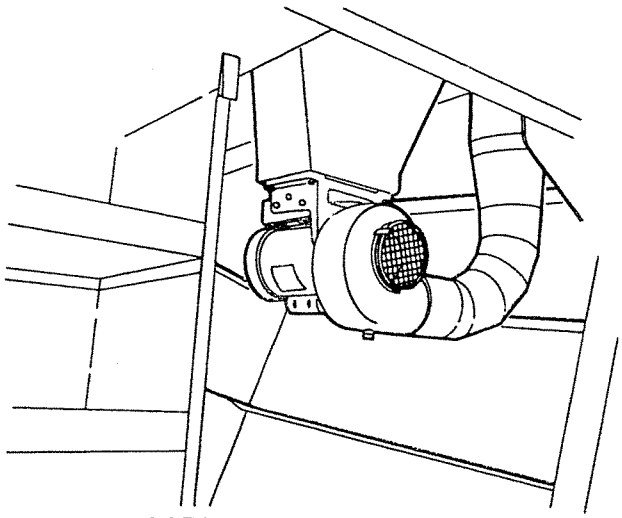
3-28.2. AIR HANDLER. The air handler space between frames 8 and 9 on the main deck is supplied with replenishment air through ducting from the bridge deck. The air handler unit circulates the air to the pilothouse, mess/lounge, galley, crew berthing, observers berthing, C.O. stateroom, CPO stateroom and the electrical equipment room.

3-28.3. NATURAL AIR SUPPLY. Natural air supply from the weather decks is ducted to the lazarette, pump room, bosun's stores, bow thruster space and the bosun's locker. Natural air supply to the washrooms, provisions storeroom and the passageways is supplied by natural circulation from adjacent areas.

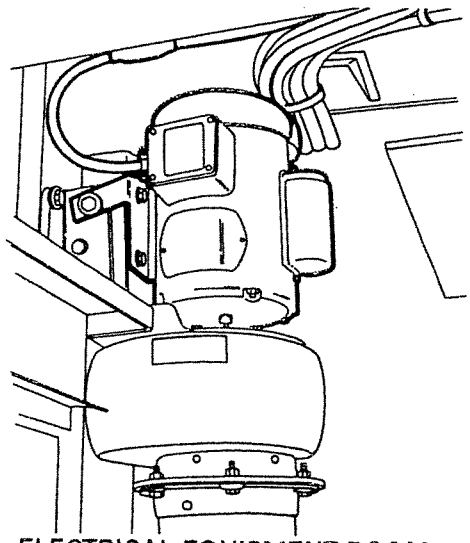
3-28.4. DUCTS. All ventilation ducts that pass through the decks are watertight to prevent entrance of water through the ducting to compartments. Weather openings are located to prevent shipping sea water, driving rain or spray. All spaces with natural supply are provided with vents fitted with ratproof screen. Supply inlets and exhaust outlets are located to prevent recirculation.

3-29. VENTILATION — EXHAUST. (Figure 2-45.)

Mechanical exhaust is provided for the lazarette, pump room, bosun's storeroom, washrooms, provisions storeroom and the galley. Refer to Table 3-16 for leading particulars of the exhaust fans. Centrifugal fans are located in the lazarette, pump room and the bosun's storeroom to exhaust these spaces. Exhaust from the washrooms and the provision storeroom is delivered through the ducting to the electrical equipment space and mechanically exhausted through a screened air lift located on the deckhouse bulwark at frame 7 (Figure 3-20). A stainless steel exhaust hood is located in the galley at frame 12, starboard side. The hood is fitted with a stainless steel grease filter and a fire suppression system. A 750 CFM axial fan is installed to mechanically exhaust to the gooseneck on the bridge deck at frame 12 (Figure 3-21). Power for exhaust fan operation is supplied through the power panel P403 to the motor controller. Refer to onboard Technical Service Manual S6161-HT-FSE-010 for complete information on the galley exhaust hood.



LAZARETTE EXHAUST FAN
(FRAME 28, PORT, LAZARETTE)



ELECTRICAL EQUIPMENT ROOM
EXHAUST FAN
(FRAME 7, STARBOARD, DECK HOUSE)

Figure 3-20. Exhaust Fans

Table 3-16. Supply and Exhaust Fan List

SERVICE	QTY.	TYPE	CFM	T.P. (PSI)	HP	RPM	MANUFACTURER	MODEL
Engine Room Supply	1	Vane Axial	10,000	5.2	10	1800	Buffalo Forge	32 lb.
Lazarette Exhaust	1	Centrif.	300	0.9	1/3	3450	Buffalo Forge	BVS B 1/3
Pump Room Exhaust	1	Centrif.	400	0.9	1/4	1725	Buffalo Forge	BVS D 1/4
Galley Hood Exhaust	1	Axial	750	2.3	1/3	3450	Buffalo Forge	A 1/2
House Exhaust	1	Centrif.	160	1.5	1/3	3450	Buffalo Forge	BVS B 1/3
Bosun's Storage Exhaust	1	Centrif.	200	1.5	1/3	3450	Buffalo Forge	BVS B 1/3

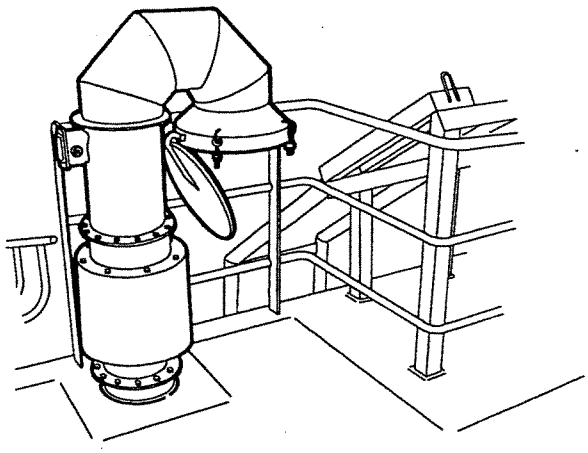


Figure 3-21. Galley Exhaust Gooseneck
(Frame 12, Starboard, Bridge Deck)

3-30. HEATING. (Figure 2-45.)

Interior spaces on the craft are heated by duct heaters, forced air heaters or convection heaters. Thermostats are mounted in the temperature controlled areas to maintain acceptable temperatures for craft personnel. Refer to Table 3-17 for leading particulars on heaters.

3-30.1. DUCT HEATERS. Five flanged duct heaters are installed in the duct work to supply heated air to the following spaces:

1. CO Stateroom
2. CPO Stateroom
3. Mess/Lounge
4. Galley
5. Pilothouse
6. Observer's Berthing
7. Crew Berthing

3-30.2. CONVECTION HEATERS. Bulkhead mounted convection heaters are located in the washrooms on the main deck and first platform. Refer to onboard Technical Service Manuals S9511-AW-MMC-010 and S9511-AR-MMC-010 for complete details on the convection heaters.

3-30.3. FORCED AIR HEATERS. Free standing forced air heaters are located in the engine room and the lazarette (Figure 1-49). Refer to onboard Technical Service Manuals S9511-AV-MMC-010 and S9511-AU-MMC-010 for complete details on the forced air heaters.

3-30.4. PILOTHOUSE WINDOW DEFROSTER. A defroster system is installed in the pilothouse to remove moisture and frost from the forward windows. The system consists of the following components:

1. Heater
2. Blower
3. Controllable louvers
4. Ducting and dampers

The blower forces heated air through the ducting and dampers to the louvers located below the forward windows. By adjusting the louvers, the air is distributed to the necessary areas on the windows. Refer to onboard Technical Service Manual S9511-AT-MMC-010 for complete details.

Table 3-17. Heater List

QTY.	CONSTRUCTION	KW	VOLTS	PHASE	HEATING STAGES	CONTROL VOLTAGE	DUCT WIDTH	DUCT HEIGHT
1	Flanged	4.5	450	3	2	115	12	6
1	Flanged	5.5	450	3	2	115	12	6
1	Flanged	4.5	450	3	2	115	12	6
1	Flanged	4.5	450	3	2	115	12	6
1	Flanged	7.5	450	3	2	115	8	6
1	Blkd. Mounted	1.5	115	1	1	115	Valad DFMH-16-1 Convect.	
1	Free Standing	3.0	450	3	1	120	Valad 207 Forced Air	
1	Free Standing	2.0	450	3	1	120	Valad 207 Forced Air	
1	Blkd. Mounted	2.0	450	3	1	115	Valad DFMH-16-1 Convect.	

Section XII
COMPRESSED AIR SYSTEM

3-31. COMPRESSED AIR BASIC DESCRIPTION. (Figure 2-17.)

The compressed air system consists of an air compressor, the air horn, a manual air valve, a pressure regulator, gate valves, pressure gages and the necessary fittings and piping to make the system operational. Power is supplied to the air compressor from the engine room power panel P402. The compressor (Figure 1-51) is located in the engine room aft of frame 16, starboard side.

3-31.1. AIR HORN. Compressed air at 120 PSI is supplied to the air horn on the pilothouse roof at frame 8. Control for the horn is located in the pilothouse (Figure 3-22).

3-31.2. LOW PRESSURE PURGING. Compressor air is also supplied to the main deck aft of frame 22 on the starboard side. The air is piped through a pressure regulator which reduces 120 PSI to 25 PSI for low air purging of recovered weapons.

3-31.3. GENERAL COMPRESSED AIR OUTLETS. Two compressed air outlets are provided in the engine room. One is located near the workbench for general use and the other is located at frame 21 starboard side for blow-down of the sea chests.

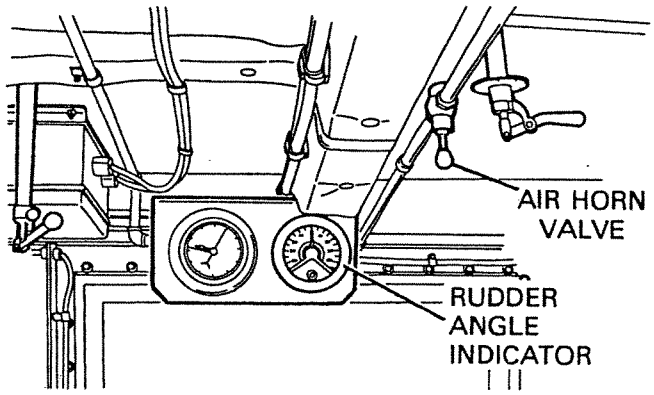


Figure 3-22. Horn Control (Pilothouse, Frame 6)

Table 3-18. Air Compressor

Air Compressor	
Manufacturer	Energair America, Inc.
Model	3B30E30
Horsepower	3
Rating	450 VAC, 3 phase

Section XIII
FIRE EXTINGUISHING SYSTEMS

3-32. HALON SYSTEM. (Figure 2-18.)

The Halon system is a closed system that protects the engine room only. The system employs high speed flame detectors, signal conditioning amplifiers, Halon extinguisher assemblies, 180-degree fan discharge nozzles and a control panel for detection warning and extinguishing. The system can be activated automatically or manually from the control panel, or manually at the break glass stations or manually at the T-handles at the top of the inclined ladder in the pump room. Primary and secondary extinguishing cycles are provided in the system. When fire is first detected, the primary cycle activates and discharge Halon 1301 into the compartment. At this point a 10-second time delay occurs. If after this delay any flame detector still senses flame the secondary cycle activates, causing a secondary discharge of Halon 1301. Pressure switches are installed in the engine room to provide for automatic shutdown of compartment exhaust fans when Halon is discharged. Refer to Table 3-19 for leading particulars.

3-32.1. EMERGENCY RELEASE. Break glass stations (Figure 1-53) for manual release of Halon in the engine room are located port side of access door to pump room in the galley area. Release of primary and secondary cycles can be accomplished from this area. Full manual release of all Halon cylinders can be accomplished by pulling the T-handles (Figure 1-54) at the top of the inclined ladder in the pump room to the fully out position.

3-32.2. CONTROL PANEL. (Figure 1-52.) The main control panel for the Halon system is located in the pilothouse, port side. The panel allows for automatic and manual modes of operation. Discharge of Halon activates audible alarms at the control panel and in the engine room. The alarm can be turned off at the panel. The control panel also has a visual alarm light. The control panel has MODE indicator lamps labeled AUTO, MAN and TEST in the upper right-hand corner. One of these lamps is always illuminated when the system is operational. Power is supplied to the control panel through the 24 VDC distribution panel P204 located in the pilothouse.

3-32.3. HALON CYLINDERS. Halon 1301 is stored in cylinder and valve assemblies located in the engine room. Each cylinder is equipped with a check valve, a pressure switch and a solenoid valve. The Halon is distributed through piping to the 180 degree fan nozzles located forward and aft of each engine.

Table 3-19. Halon System

Flame Detector	
Power Requirements	21 to 32 VDC
Control Amplifier	
Operating Voltage	18 to 32 VDC
Operating Current	5 MA
Alarm Current	50 MA
Pressure Switch	
Pressure Range	20 to 100 PSIG
Electrical Rating	5A at 28 VDC

3-33. GALLEY FIRE SUPPRESSION SYSTEM.

The galley fire suppression system (Figure 3-23) provides automatic activation in the event of a fire at the range. Manual actuation is also possible at the release and chemical shell or a release in the mess/lounge. The system consists of a dry chemical chamber and the release assembly mounted on the galley bulkhead aft of frame 10 and the necessary nozzles, pulley elbows, wire rope piping, a fusible link, a detector and conduit to make the system operable. The fusible link is mounted in the center of the exhaust hood above the filters on the detector hinge. The link will separate at 360° F and activate the system. When the fusible link separates, the tension on the wire rope is reduced thus activating the release assembly in the unit. Actuation of the release assembly forces dry chemical through the piping to the nozzles in the duct, the plenum and on the top of the range. Blowers in the system are left on to assist the movement of the dry chemical through the system aiding in extinguishment as well as cooling the duct system after discharge. Refer to Table 3-20 for leading particulars on the system.

Table 3-20. Galley Fire Suppression System

Fire Suppression System	
Manufacturer	Ansul
Model No.	R-101-20
Type	Dry Chemical
Fusible Link Rating	360° F
Nozzles	4

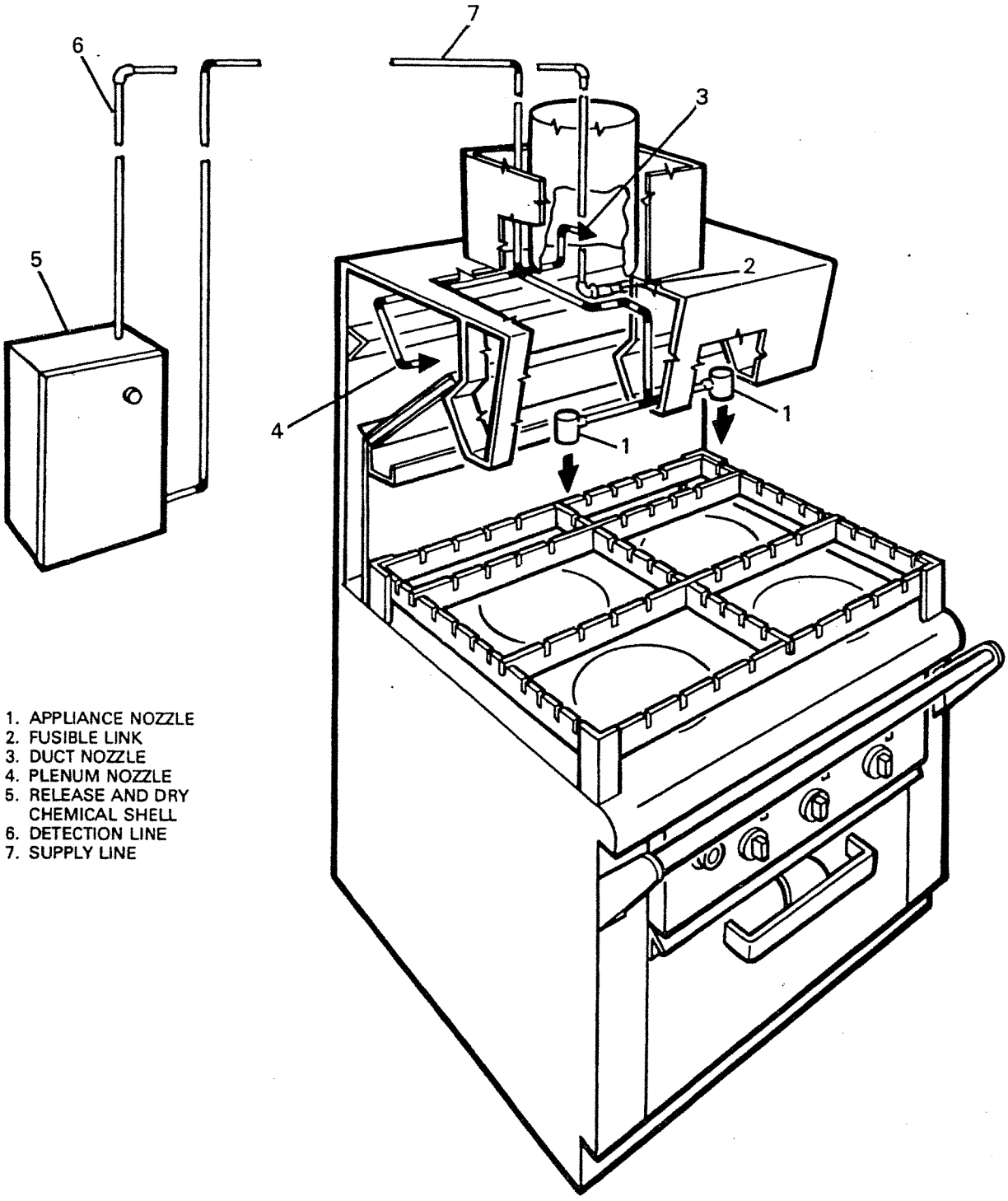


Figure 3-23. Galley Fire Suppression System
(Frame 11-1/2, Starboard, Galley)

Section XIV
POWER DISTRIBUTION SYSTEM

3-34. 440 VAC POWER SYSTEM.

Electrical power is provided by either the ship's service diesel generators or shore power facilities (Figure 3-24). If shore power is used, it is connected to the shore power receptacle and to Bus A of the electric plant control panel P400 through a circuit breaker. A mechanical interlock prevents the input power circuit breaker for either diesel generator from being closed while the shore power circuit breaker is closed.

NOTE

When using shore power, the ship's load must be reduced so the 100 ampere circuit breaker does not trip.

After starting the diesel generators, the power is connected to the electric plant control panel: starboard unit to Bus A, port unit to Bus B. Normally both buses are interconnected through a non-automatic circuit breaker for parallel operation. The electric plant control panel employs a ground detection system for each bus which will visually indicate a ground condition. Emergency shutdown of the diesel generator is accomplished through circuits K1EC-1 and 2 and K2EC-1 and 2 which are connected to break glass stations. Refer to paragraph 3-36. for additional information. Each load circuit from the electric plant control panel P400 is shown in Figure 3-24 with circuit designation, cable size and circuit breaker size. Circuits for steering system hydraulic pumps, air conditioning compressor and torpedo handling power pack are protected by low voltage magnetic starters. The load circuits for the power panel P401, P402 and P403 are shown in Figures 2-25, 2-26 and 2-27 respectively. A list of symbols and components is given in Table 3-21 to define the single line diagrams.

3-35. 120 VAC POWER SYSTEM.

All 120 VAC power is derived through the 45KVA lighting transformer and the 120V main distribution panel L100 (Figure 3-28). The lighting panels L101, L102 and L103 and sonar communications set are supplied from panel L100. A ground detection device unit indicating light is incorporated on panel L100. Single line diagrams are shown for lighting panels L101, L102 and L103 which show load circuit, circuit breaker size, circuit designation and cable size (Figure 3-29, 3-30 and 3-31).

Table 3-21. Single Line Diagram Symbols

LVR	Magnetic motor starter with low voltage release
LVP	Magnetic motor starter with low voltage protection
1C	One-stage heating contactor
2C	Two-stage heating contactor
T	Thermostat
PB	Pushbutton station
PS	Pressure switch
2KW	Electrical power consumption device 2KW
25	Motor, 25 HP
100/20 3	Three-pole, 100 ampere frame, 20 ampere trip circuit breaker with under voltage trip.
DS	Disconnect switch, 3 pole, 600 volt, non-fusible
RC	Remote control switch
SP	Shore power receptacle
BG	Break glass pushbutton station
CB	Connection box
MS	Magnetic switch

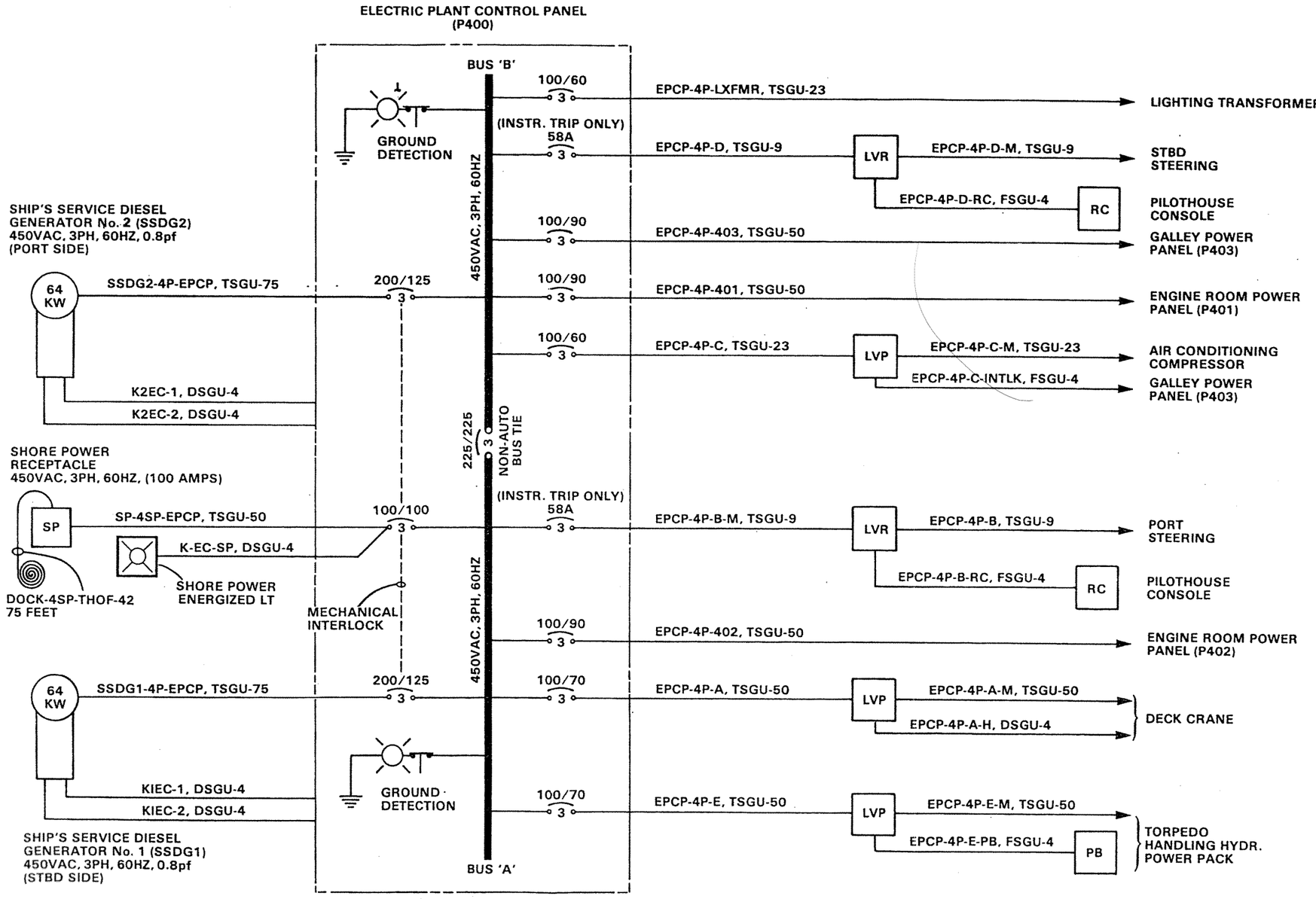


Figure 3-24. Electric Plant Control Panel P400 Single Line Diagram

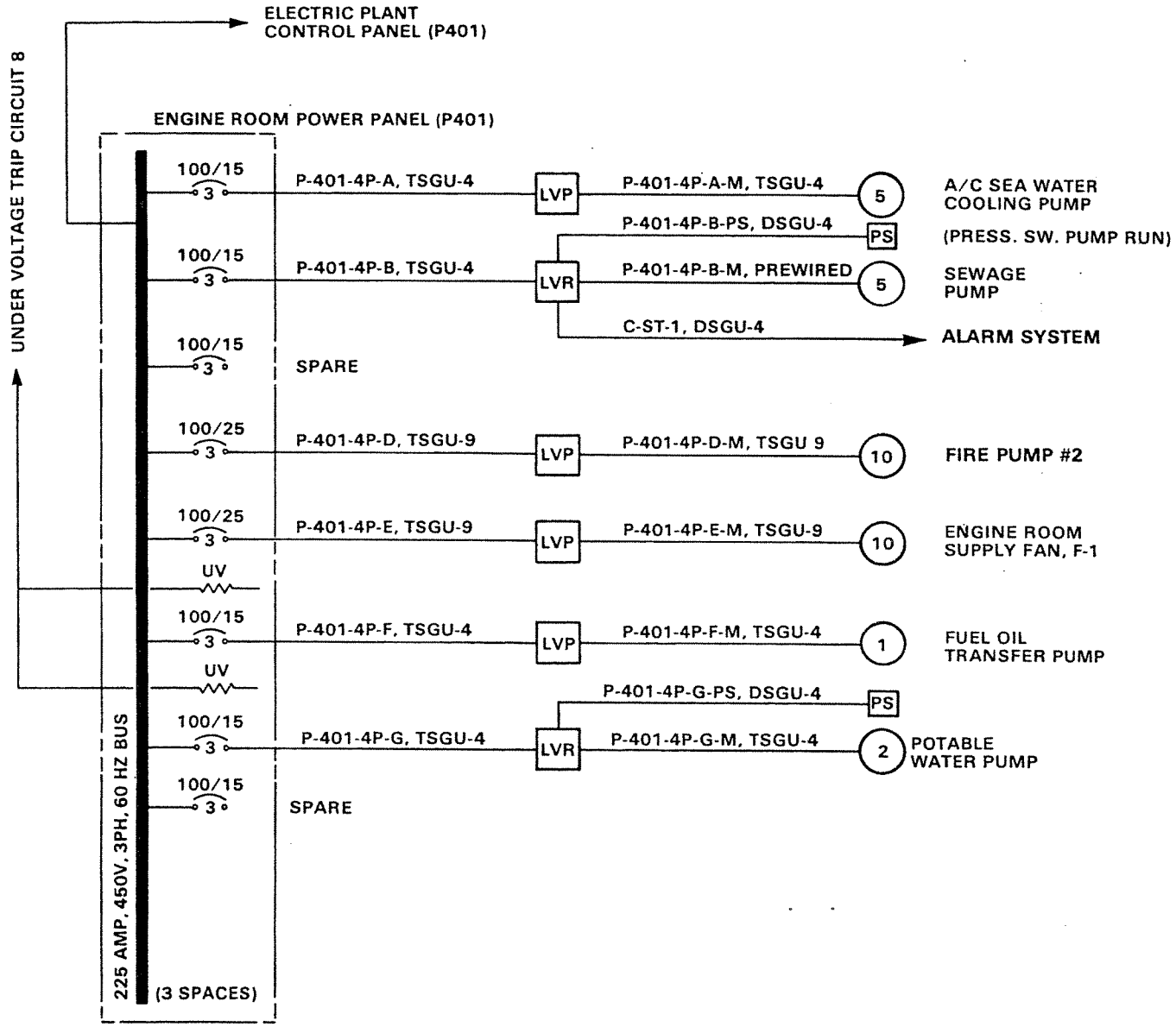


Figure 3-25. Power Panel P401 Single Line Diagram

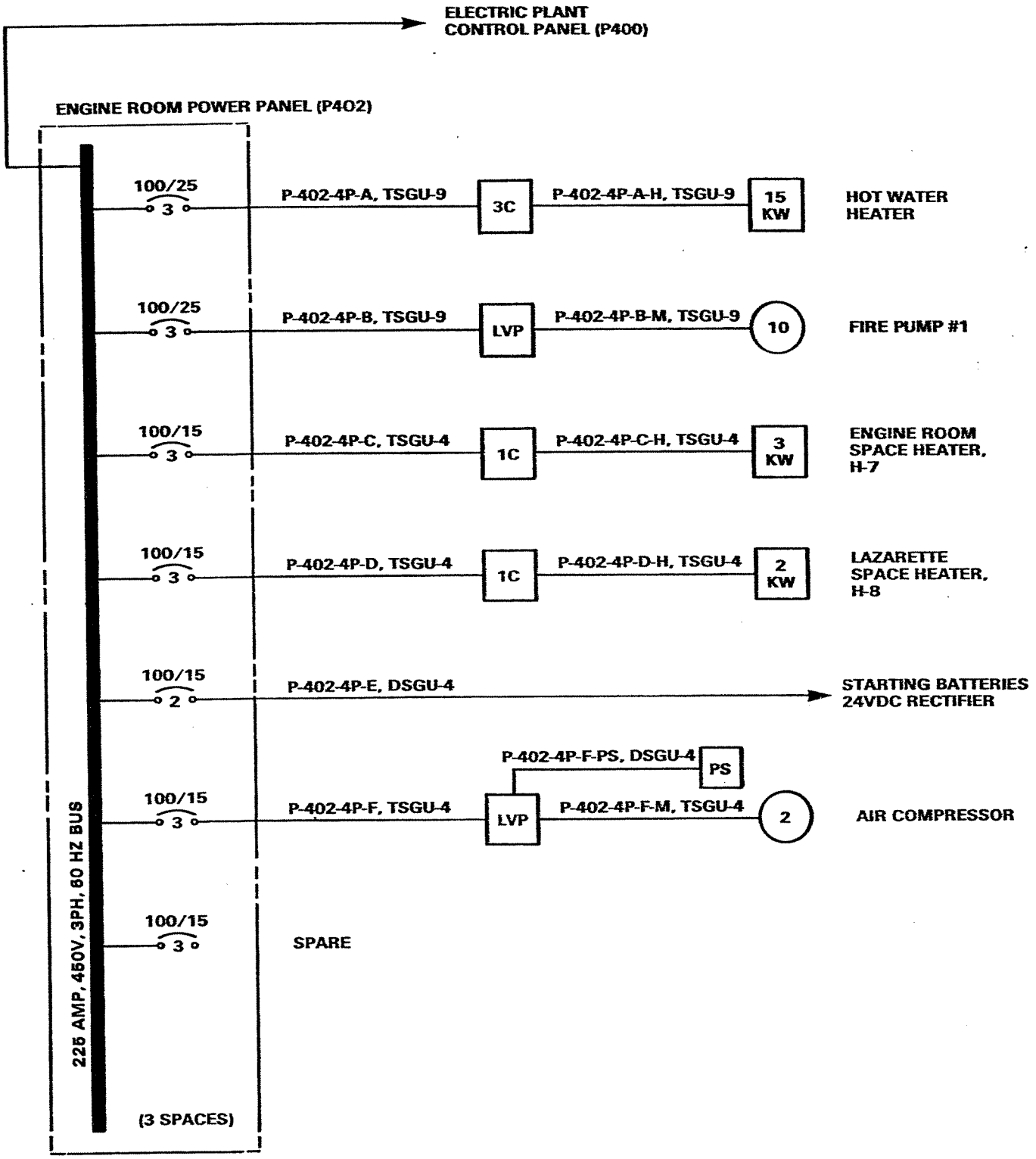


Figure 3-26. Power Panel P402 Single Line Diagram

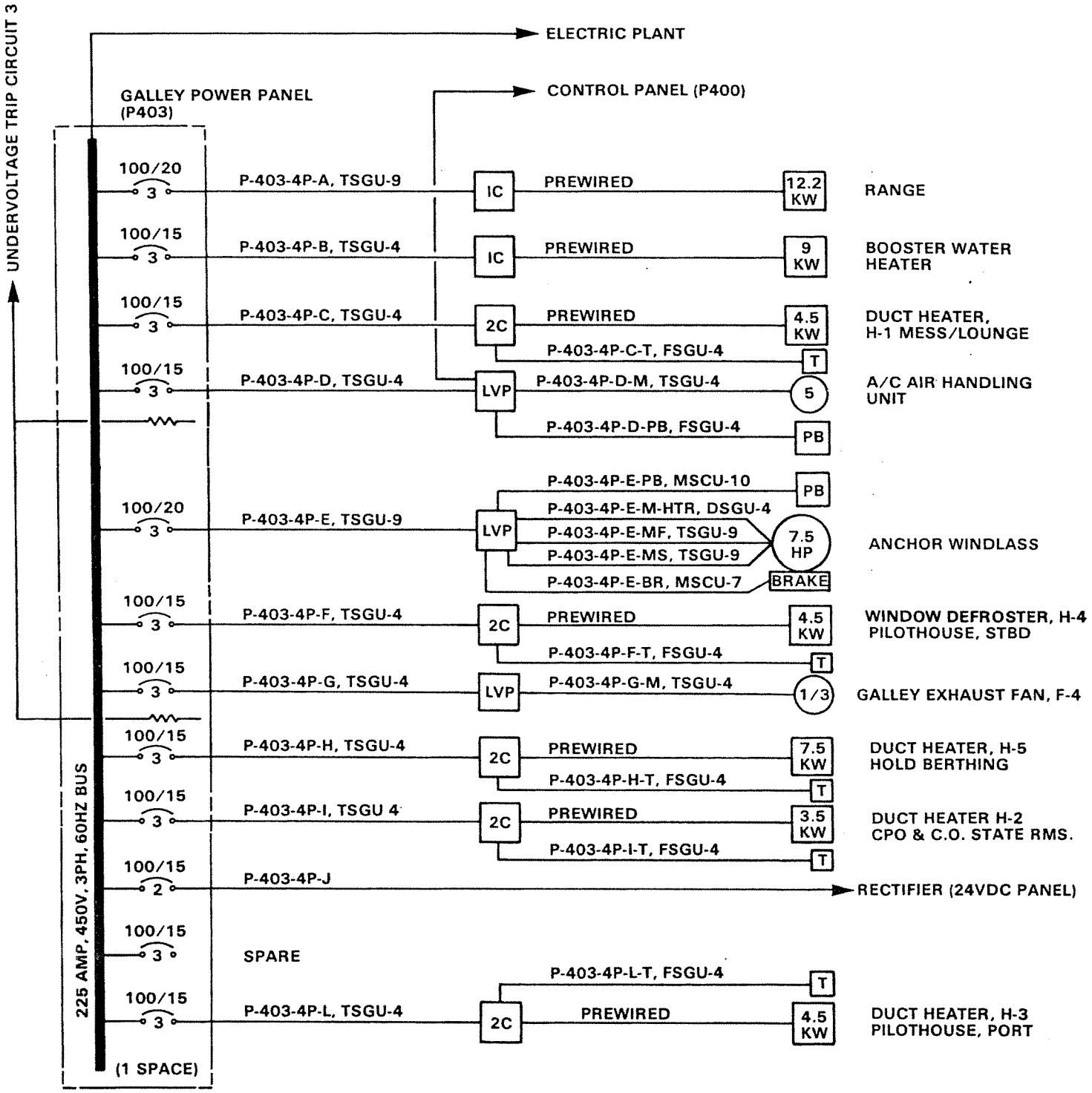


Figure 3-27. Power Panel P403 Single Line Diagram

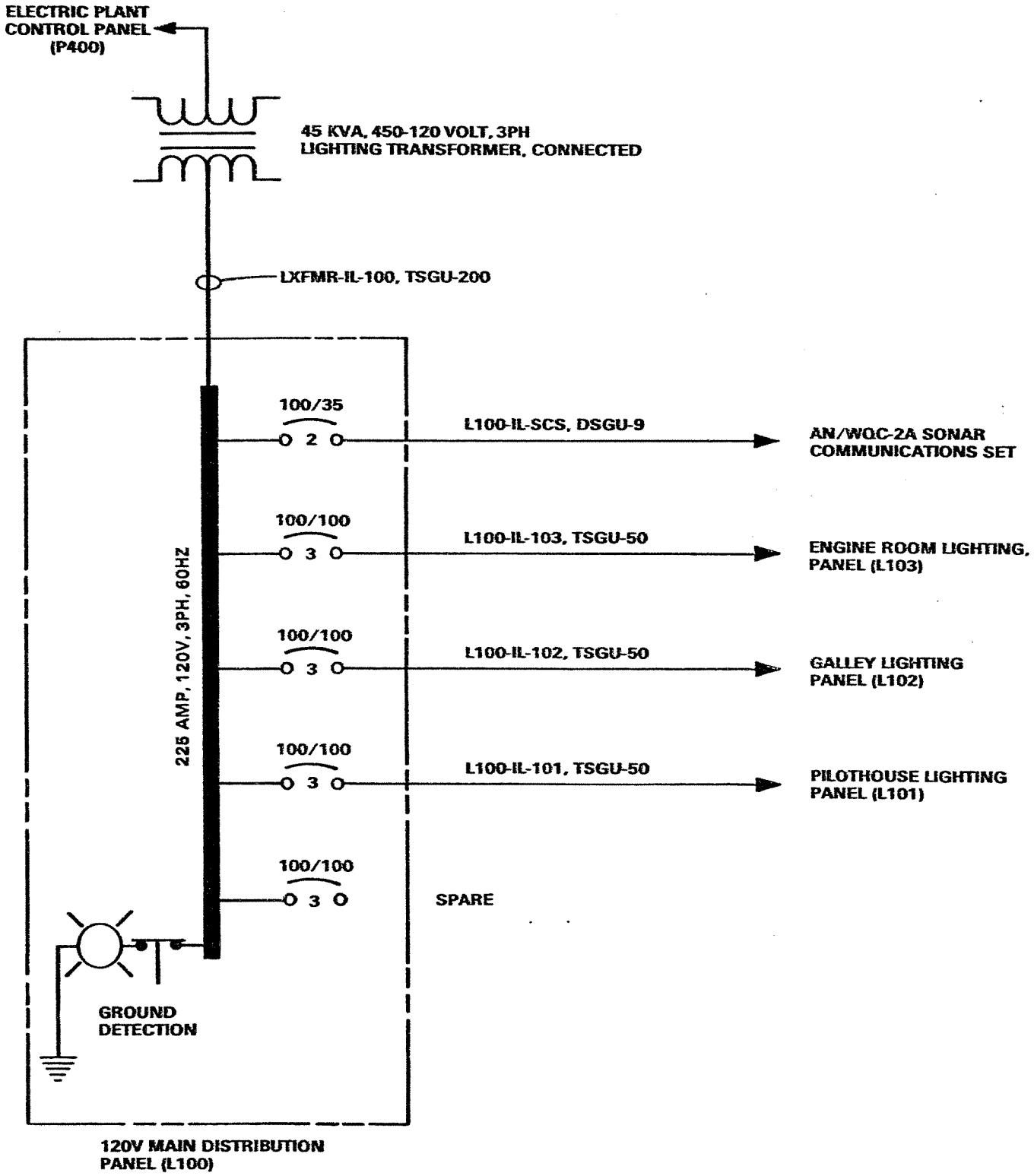


Figure 3-28. 120 Volt Main Distribution Panel L100
Single Line Diagram

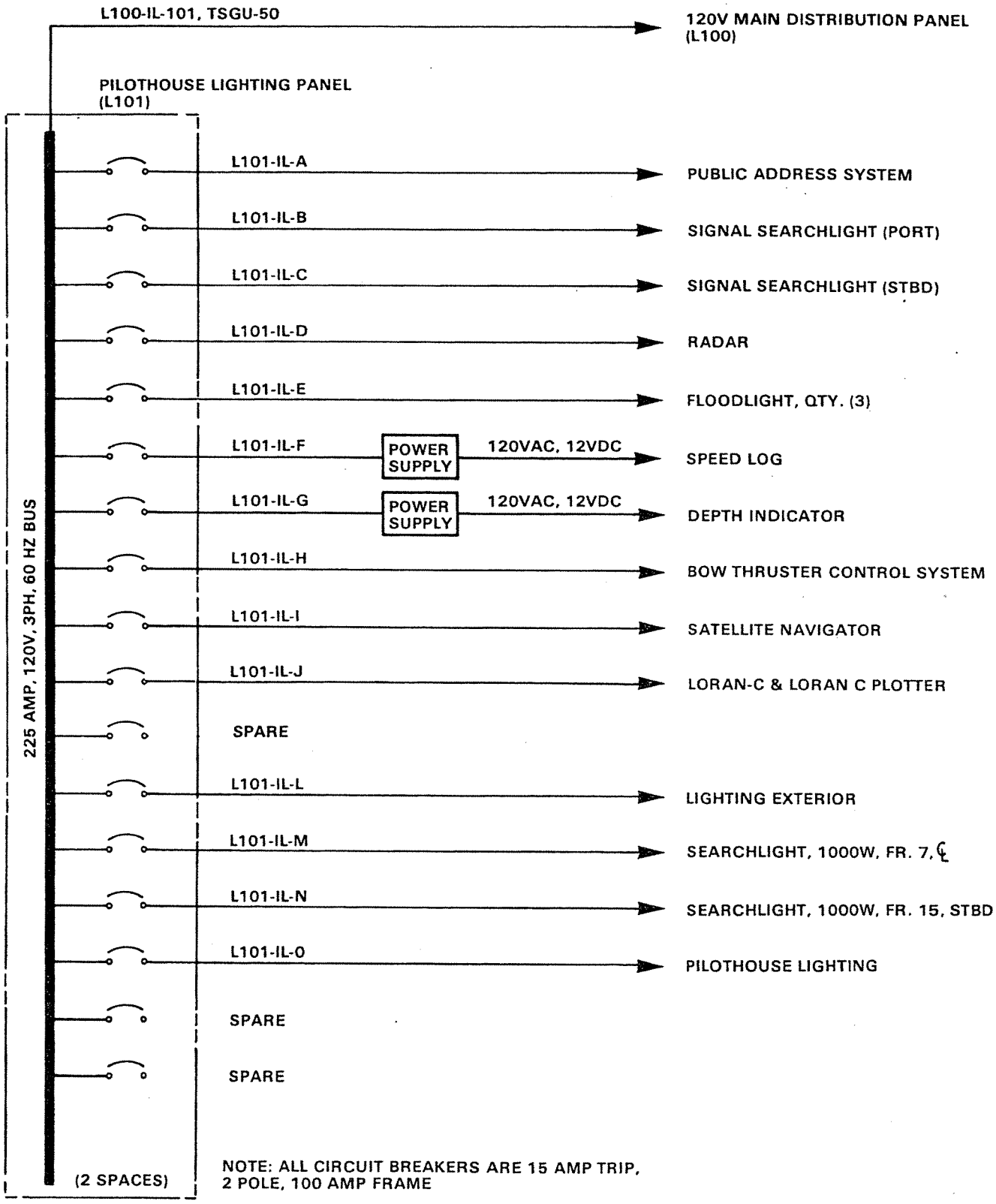


Figure 3-29. Pilothouse Lighting Panel L101
Single Line Diagram

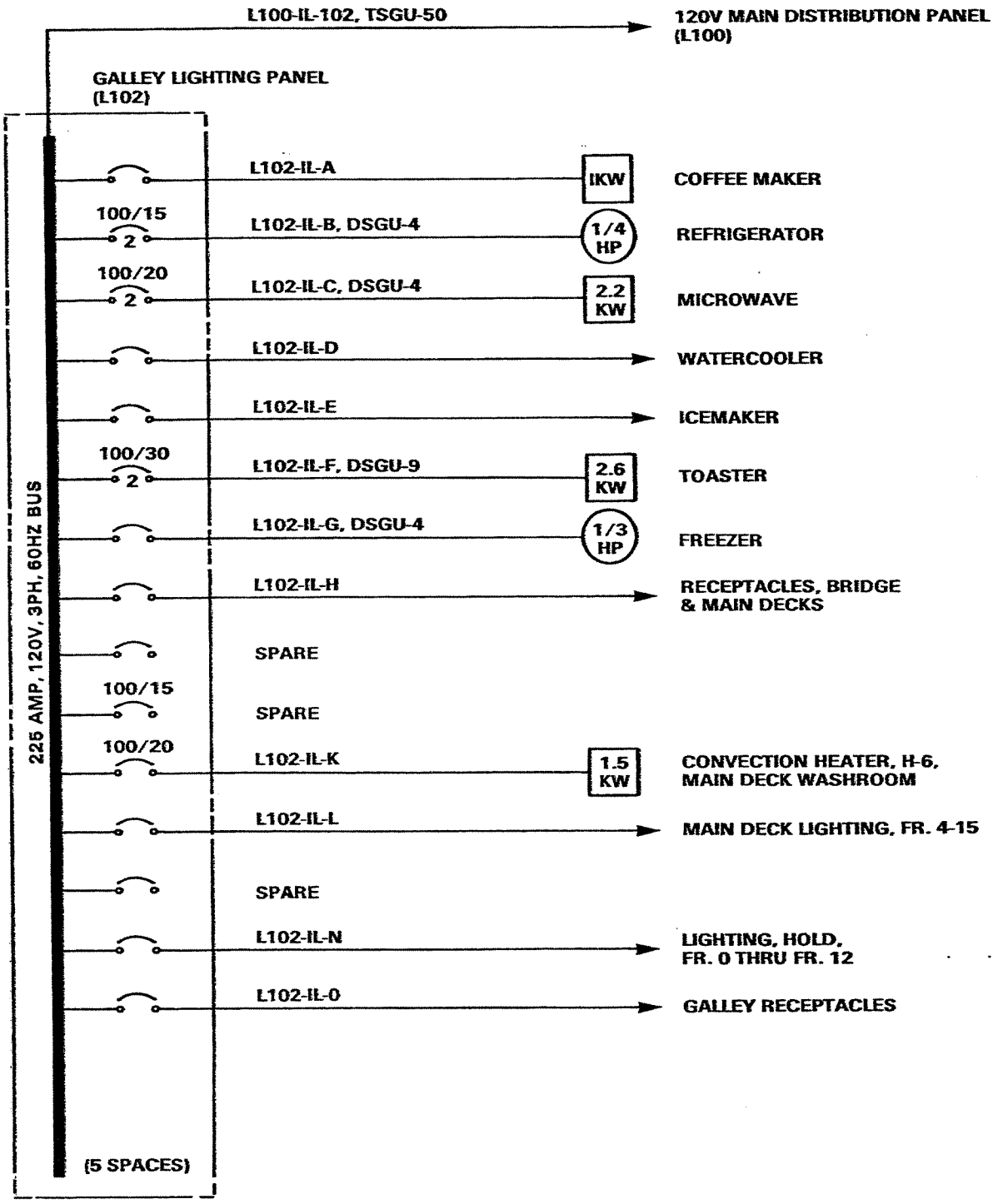


Figure 3-30. Galley Lighting Panel L102
Single Line Diagram

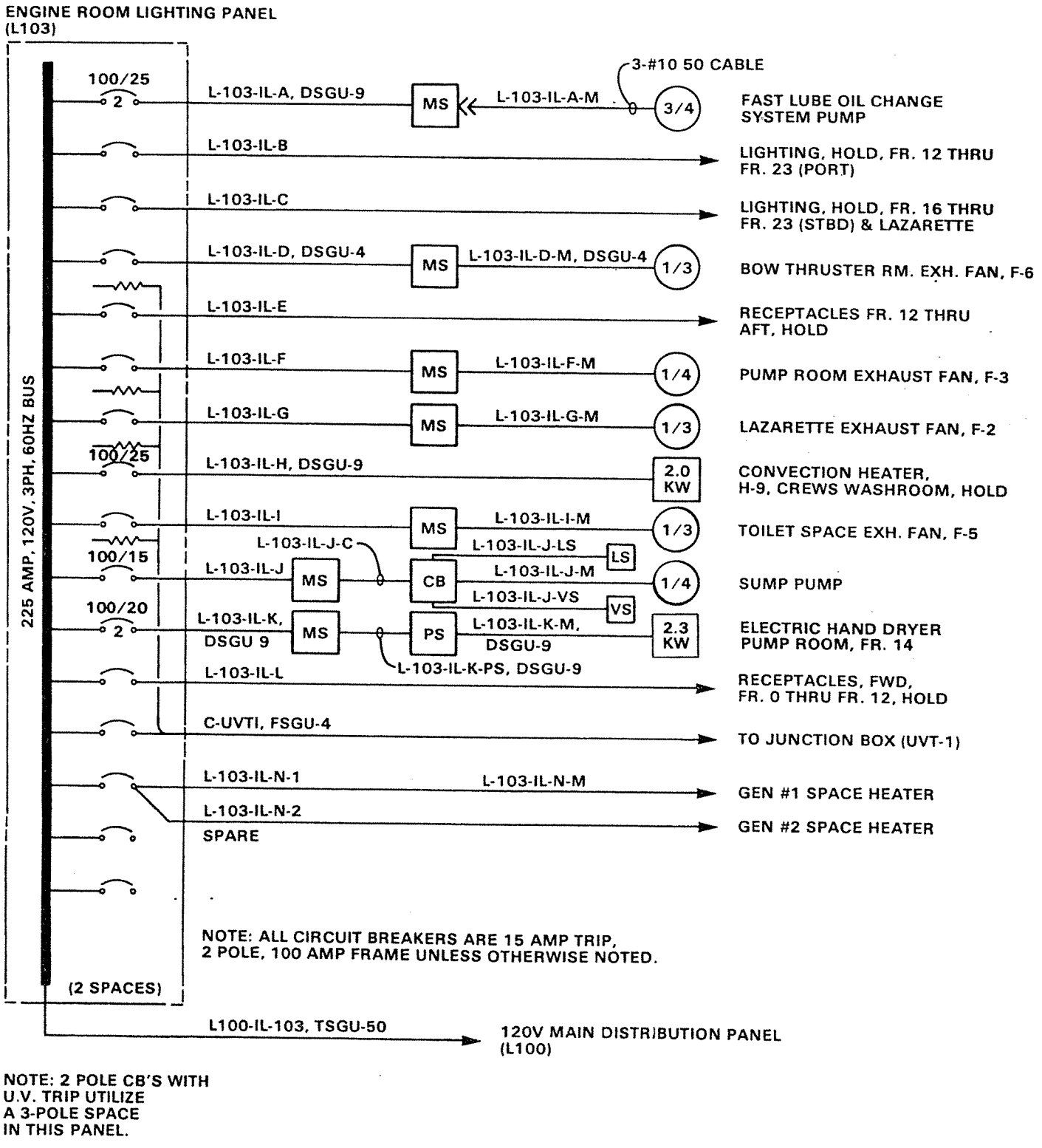


Figure 3-31. Engine Room Lighting Panel L103
Single Line Diagram

3-36. POWER SHUTDOWN SYSTEMS.

3-36.1. DIESEL GENERATOR CONTROL. The elementary wiring diagram for the diesel generator control circuits KE-C is shown in Figure 3-32. The governor raise/lower switch on the electric plant control panel P400 is connected to the diesel generator governor motor. The voltage adjust rheostat is connected to the diesel generator voltage regulator. These circuits allow adjustment and matching of the generator voltages. The four emergency stop stations are connected to the electric plant control panel. Actuation of any emergency stop station will cause the generator input power circuit breakers to trip.

3-36.2 UNDERVOLTAGE TRIP CIRCUITS. Two power panels P401 and P403 and one lighting panel L103 have circuit breakers which incorporate trip coils and a green "power applied" light (Figure 3-33). All these circuit breakers and lights are energized through two break glass stations, the galley hood damper switch and the halon system release relay. If either break glass station is manually opened (glass is broken), halon is released, or the galley hood temperature exceeds 280 degrees F., the series circuit will open and all applicable circuits and the green lights will trip off. When the undervoltage circuit breakers are tripped, the following circuits are off:

Power panel P401 — Engine room air supply fan F1 and fuel oil transfer pump.

Power panel P403 — Air conditioning air handling unit and galley hood exhaust fan.

Lighting panel L103 — Exhaust fans in bow thruster room, pump room, lazarette, and toilet space.

3-37. ILLUMINATION.

Lighting fixtures are installed in spaces and compartments to provide uniform illumination. Lighting fixtures with amber globes are provided on the weather deck to permit ready safe passage of personnel in areas of heavy traffic, abrupt changes of deck level and at corners or bends. Floodlights are installed for crane operation, boat handling and launch and recovery of torpedoes.

3-37.1. RED LIGHT ILLUMINATION. Red light illumination is provided to provide a low level of illumination in berthing areas and to provide illumination for special applications involving darkened ship operation. Red illumination is also used in areas where the illumination will afford the least amount of interference with dark-adapted vision in access routes to topside watch stations and in special compartments and stations.

3-37.2. OTHER LIGHTS. The searchlight and floodlights are operated at switches on the pilothouse console (Figure 3-34). The lights receive 120 VAC power from lighting panel L101. Relay lanterns and portable lanterns are provided to provide a limited amount of illumination when other lighting sources fail. A five-inch magnetic compass is installed in the pilothouse on the console.

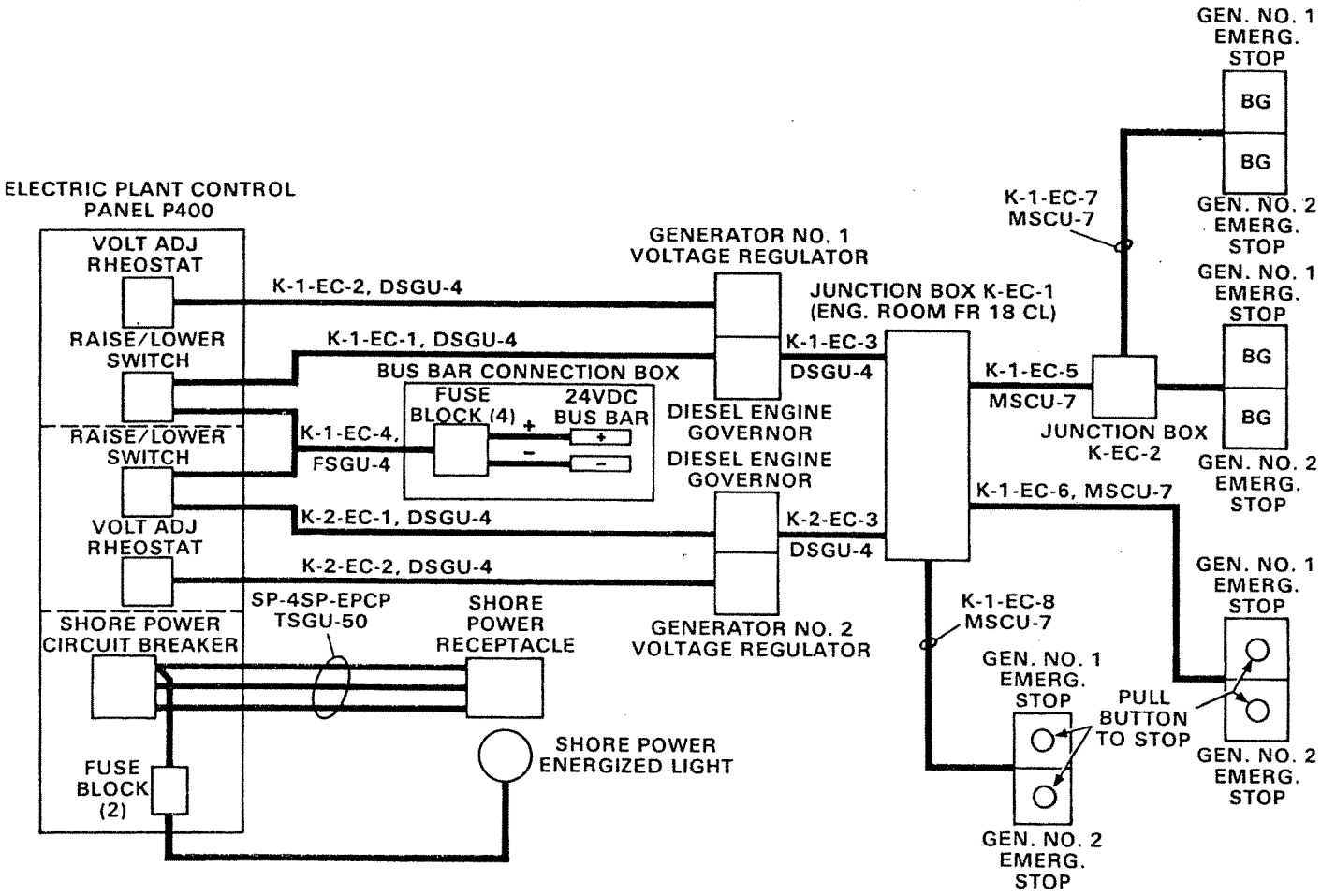


Figure 3-32. Diesel Generator Control Circuit Elementary Wiring Diagram

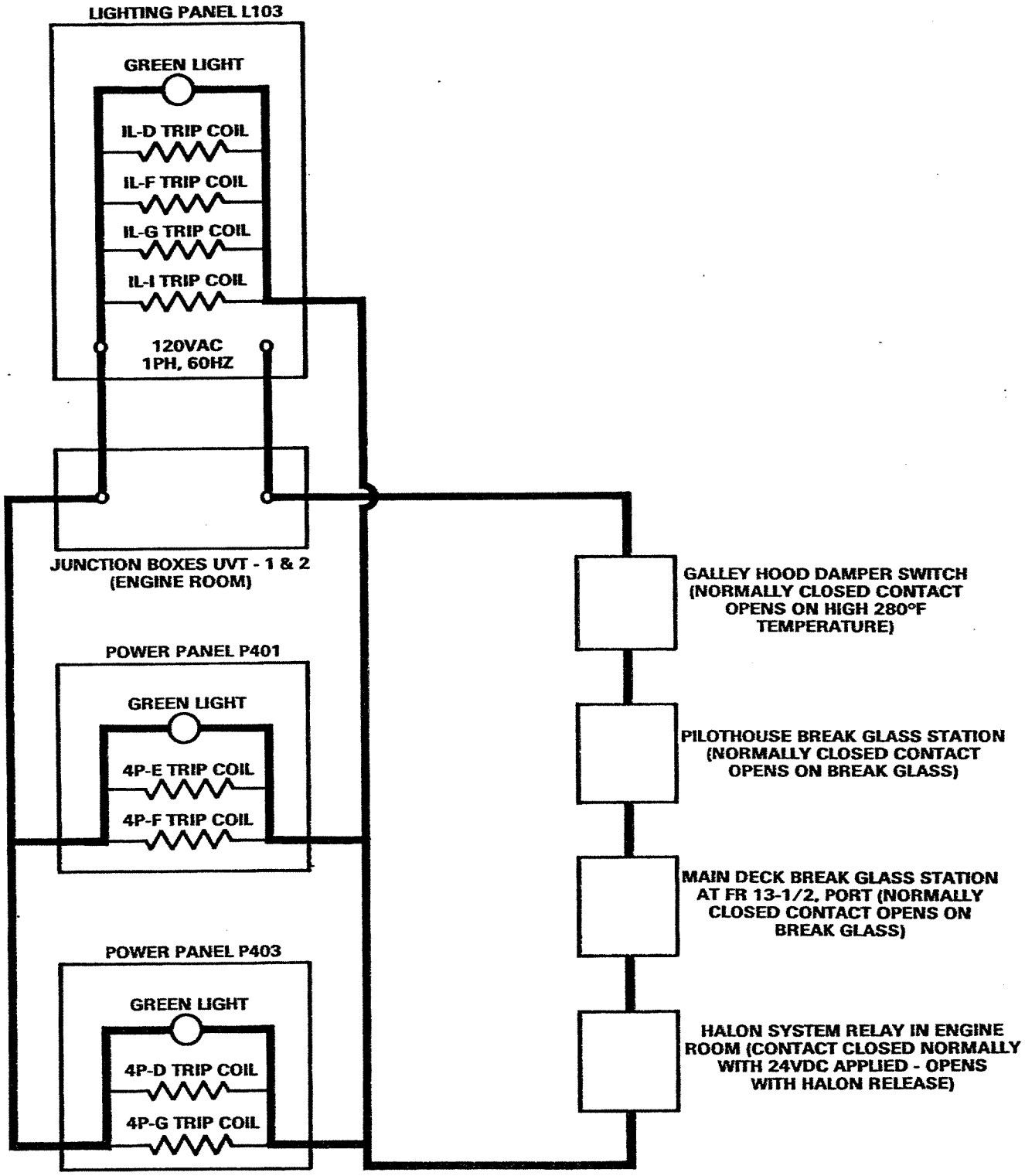


Figure 3-33. Undervoltage Trip Circuit
Elementary Wiring Diagram

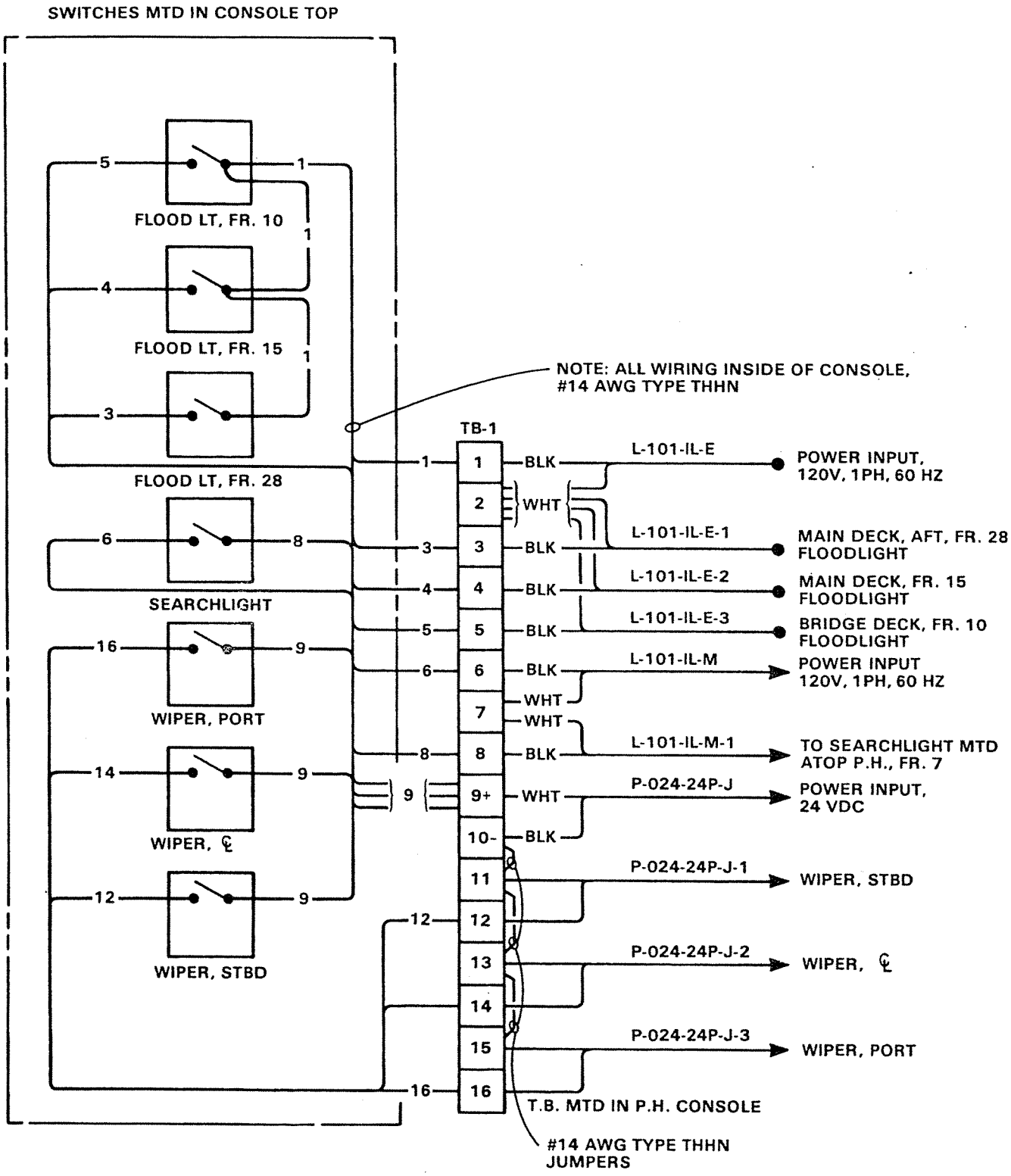


Figure 3-34. Floodlight Single Line Diagram

Section XV
24 VOLT POWER SYSTEMS

3-38. STARTING BATTERY SYSTEM.

The 24 VDC power which is required to start the diesel engine is supplied by six 12 VDC storage batteries connected in series-parallel (Figure 3-37). The batteries are connected to bus bars in a connection box which are, in turn, connected to the diesel generator starters. The 24 VDC rectifier is connected to the battery buses to permit charging the batteries and if input power is available, also aid in diesel engine starting. Input power to the rectifier is supplied from power panel P402.

3-39. PILOTHOUSE EQUIPMENT SYSTEM. (Figure 3-39.)

The 24 VDC distribution panel P024 (Figure 3-35) distributes power to electronic equipment, the Halon system, alarm panels, window wipers, navigation lights (Figure 3-36), and instrument lighting. The 24 VDC power to the distribution panel is supplied by a 24 VDC rectifier and/or four storage batteries. Input power to the rectifier is from the power panel P403. The storage batteries are connected through a disconnect switch (Figure 3-39) which allows operation of critical components in the event of total main power failure.

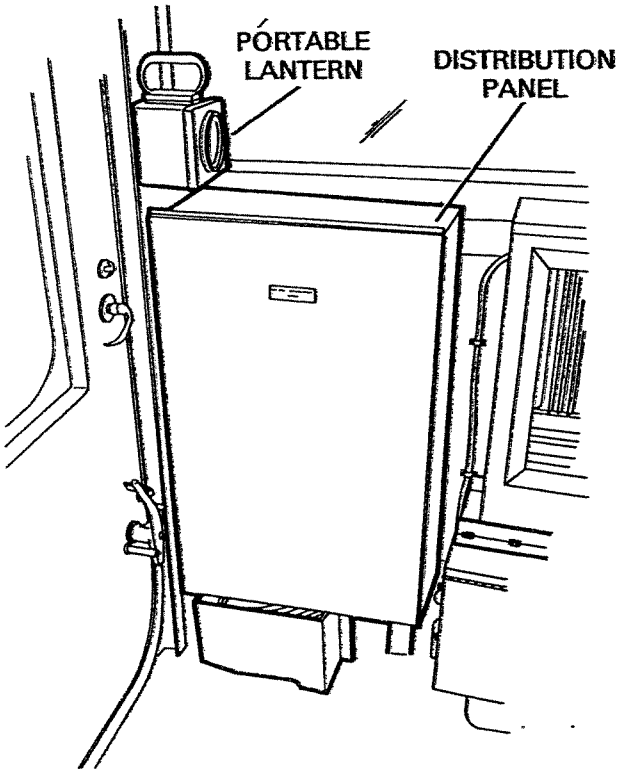


Figure 3-35. 24 VDC Distribution Panel (Frame 8-1/2, Port, Pilothouse)

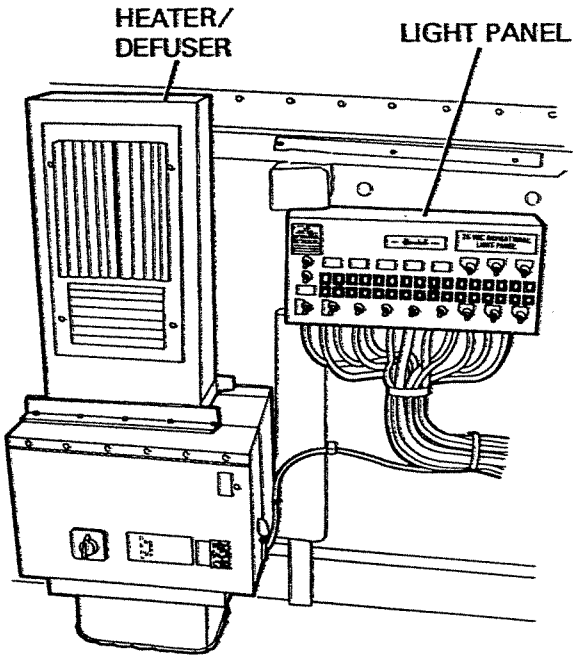


Figure 3-36. Navigation Light Panel (Frame 9, Starboard, Pilothouse)

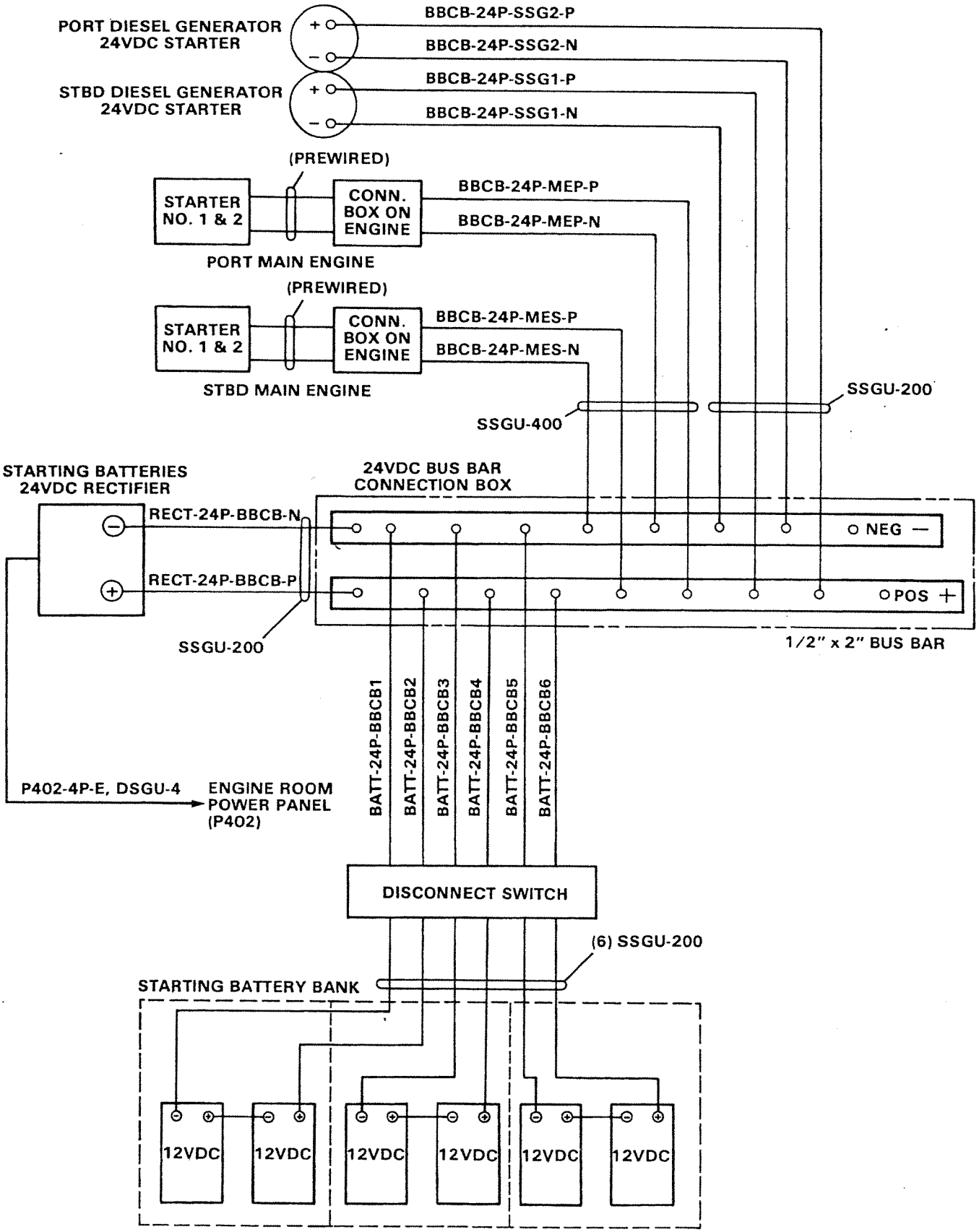


Figure 3-37. Diesel Engine 24 VDC Starting Circuit Single Line Diagram

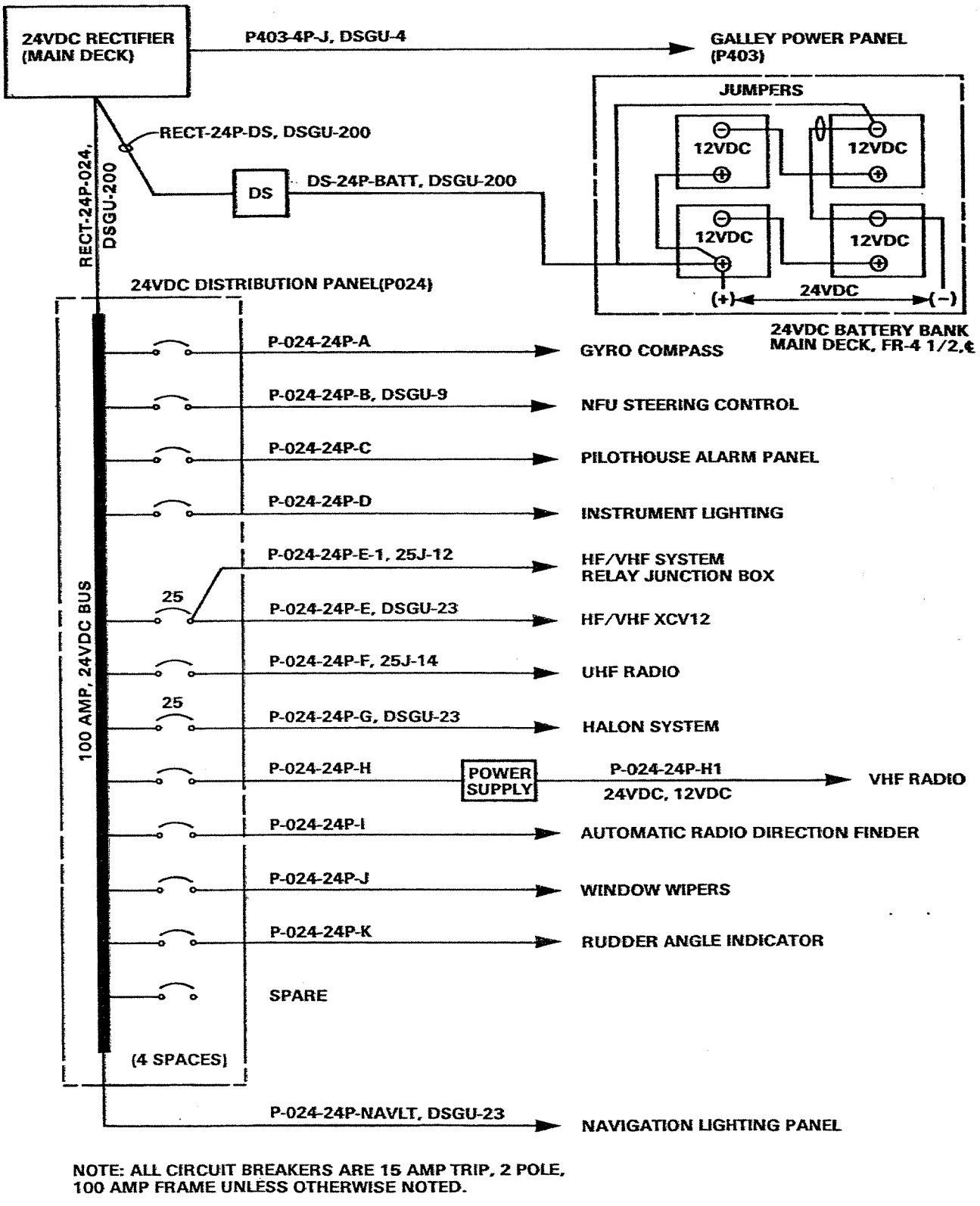
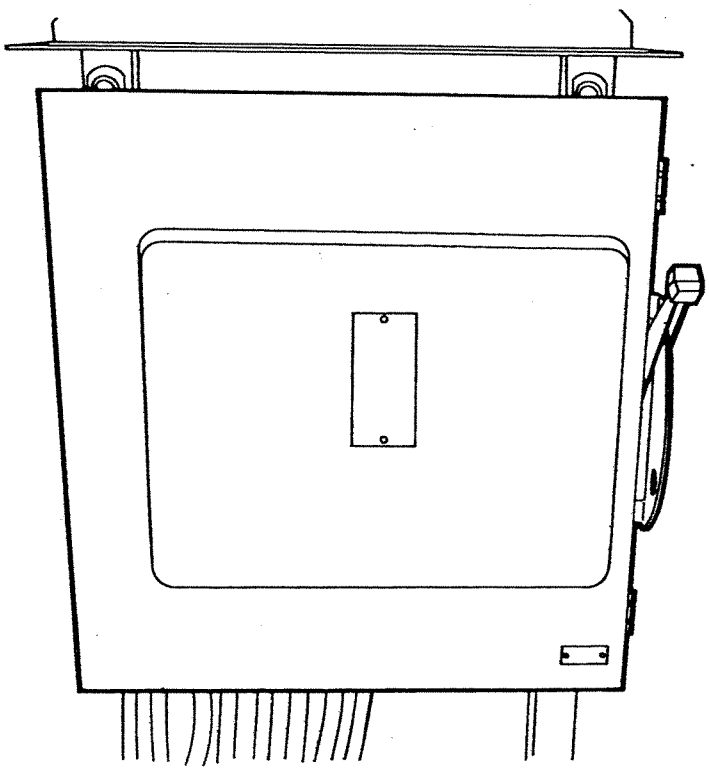
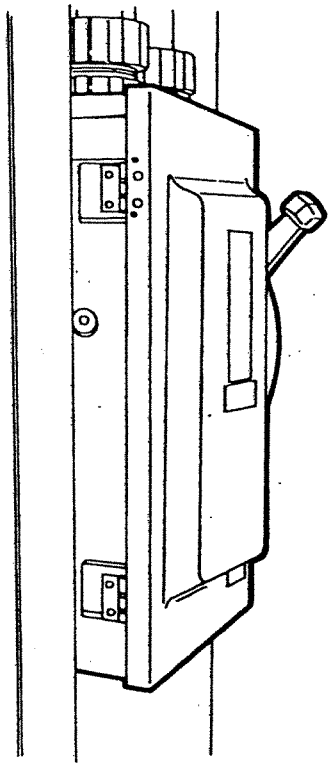


Figure 3-38. Pilothouse Equipment 24 VDC Circuits Single Line Diagram



STARTING BATTERIES
(FRAME 20-1/2, PORT, ENGINE ROOM)



EMERGENCY BATTERIES
(FRAME 5-1/2, STARBOARD,
BOW THRUSTER SPACE)

Figure 3-39. Disconnect Switches

Section XVI
NAVIGATION SYSTEMS

3-40. ELECTRONIC NAVIGATION SYSTEMS.

3-40.1. LORAN EQUIPMENT. The Loran Equipment consists of a Loran C Unit and C-Plot Plotter with antenna and coupler and interconnecting cables (Figure 3-40). Power to circuit RC is supplied from lighting panel L101. Refer to onboard Equipment Manual NAVSEA SE171-AC-MMC-010 and SE171-AD-MMC-010 for description of the Loran Equipment. The position plotting table is shown in Figure 3-41.

3-40.2. SATELLITE NAVIGATION SET. The Satellite Navigation Set consists of a receiver, power converter, antenna/pre-amplifier and interconnecting cables (Figure 3-42). Power is supplied to circuit RS from lighting panel L101 to the junction box. Signals from the gyro switching unit and speed log are transmitted to the receiver through the junction box. Refer to onboard Equipment Manual NAVSEA SE174-AA-MMC-010 for description of the Navigation Set.

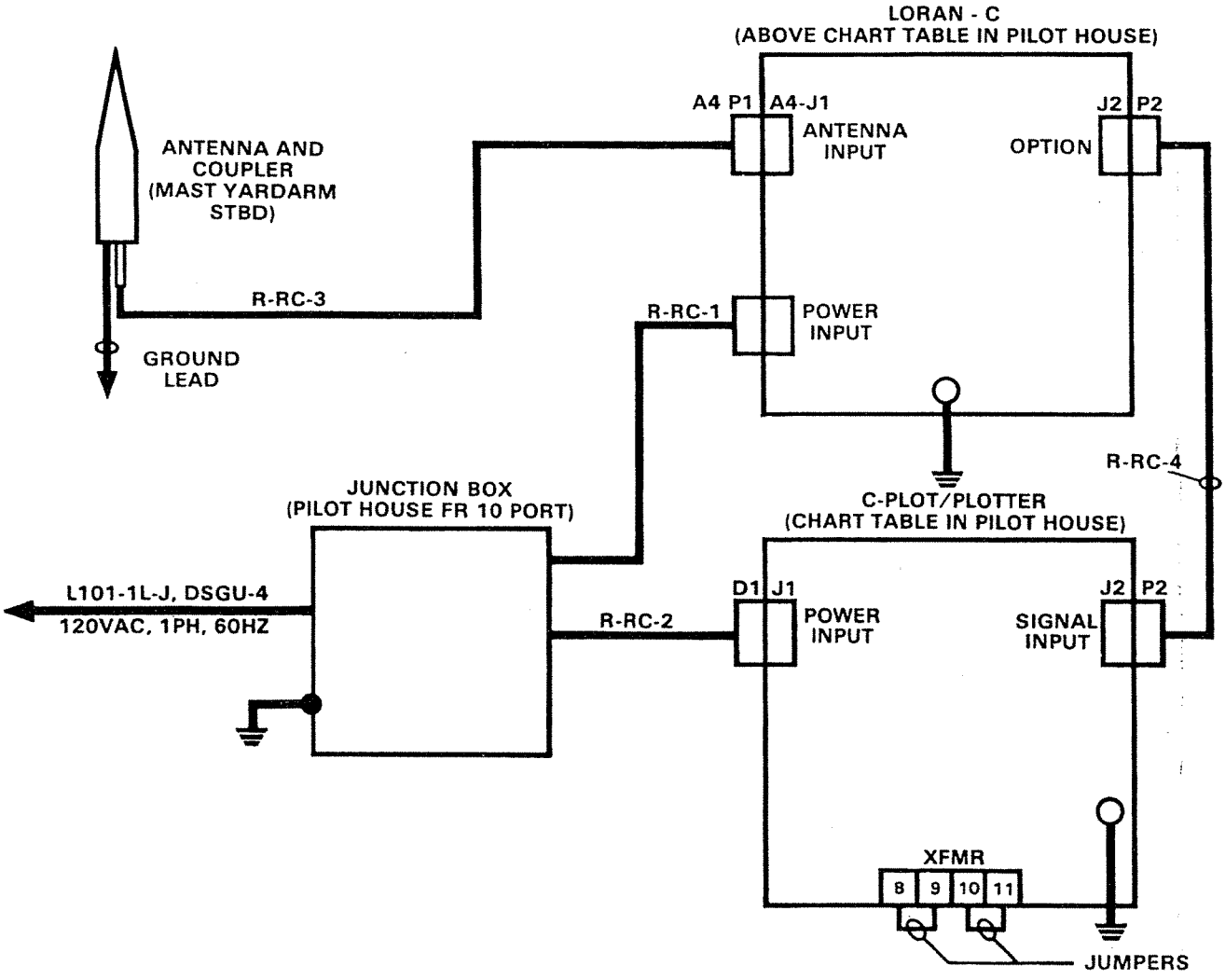


Figure 3-40. Loran C System Elementary Wiring Diagram

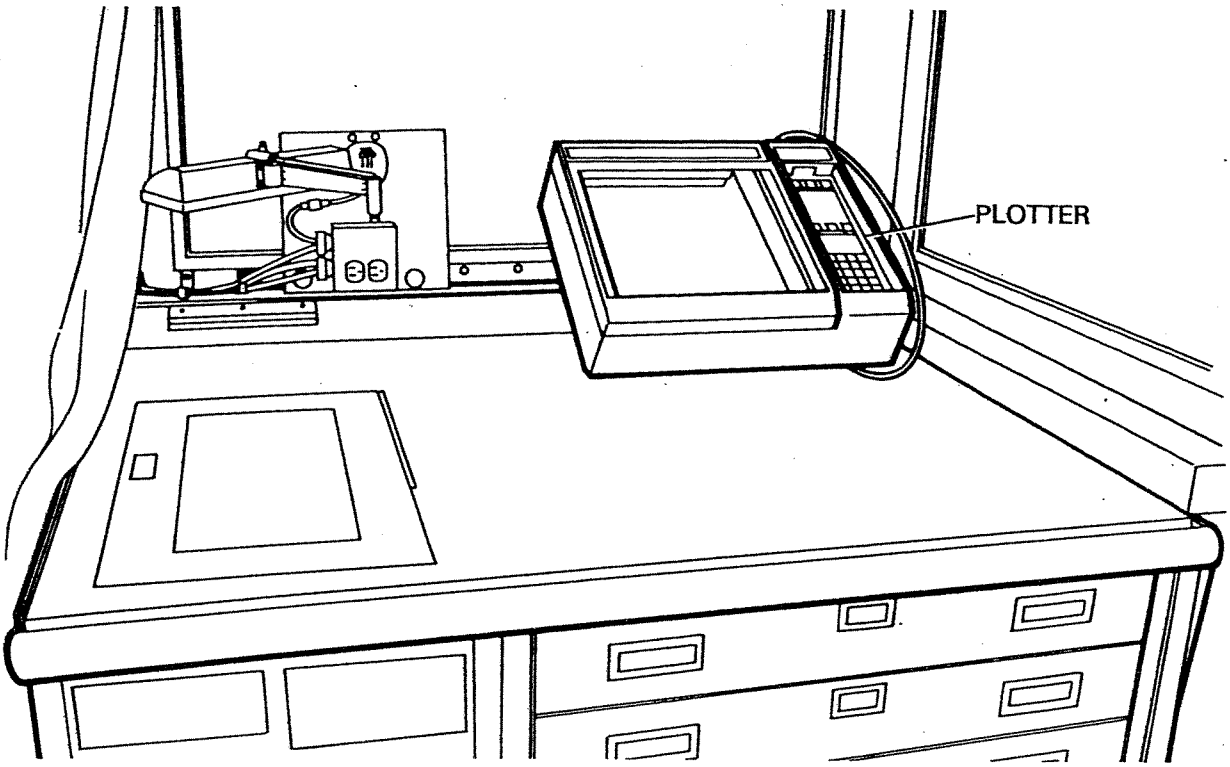


Figure 3-41. Position Plotting Table
(Pilothouse, Frame 9-1/2)

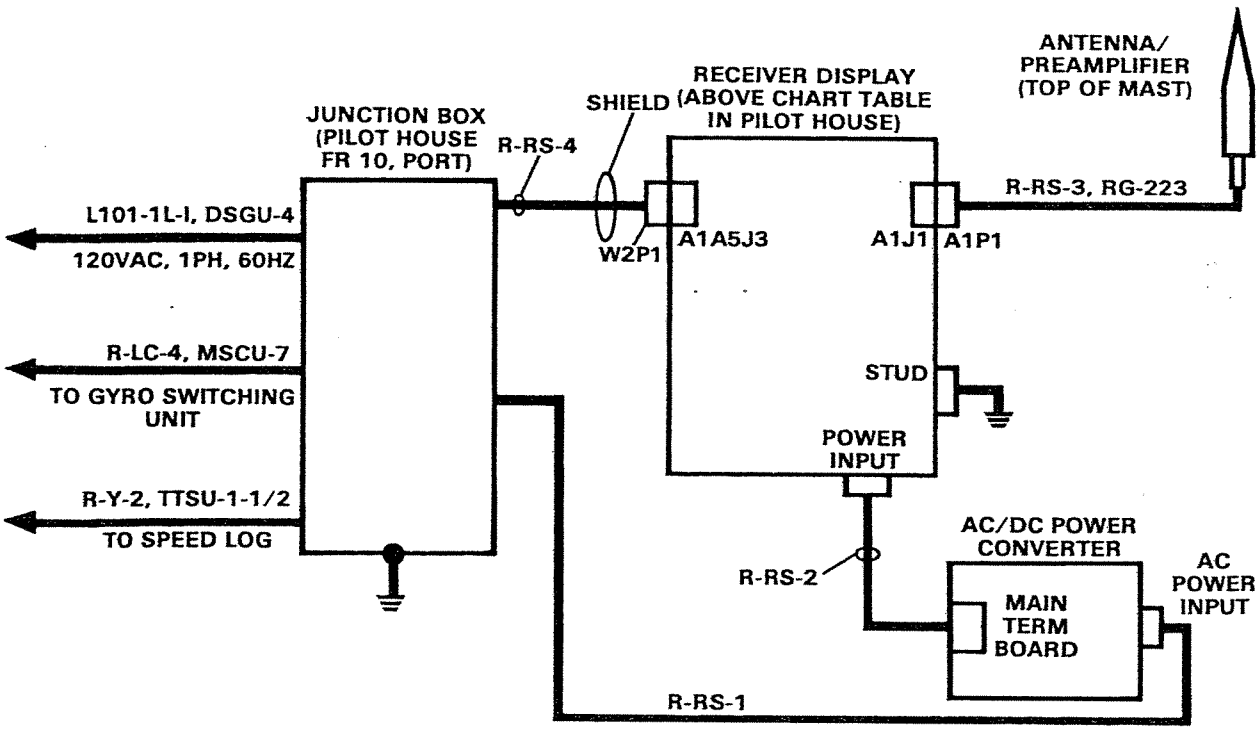


Figure 3-42. Satellite Navigation Set Elementary Wiring Diagram

3-40.3. AUTOMATIC DIRECTION FINDER. The Automatic Direction Finder is used with a loop antenna and interconnecting cable (Figure 3-43). Power is supplied to circuit RDF from the 24 VDC distribution panel P024. Refer to onboard Equipment Manual NAVSEA SE176-AB-MMC-010 for description of the Direction Finder.

3-40.4. DEPTH INDICATOR. The Depth indicator consists of a depth sounder, power supply, transducer, connection box and interconnecting cables (Figure 3-44). Power to circuit R-ES is from lighting panel L101. Refer to onboard Equipment Manual NAVSEA SE360-AP-MMC-010 for description of the Depth Indicator.

3-41. ELECTRICAL NAVIGATION SYSTEMS.

3-41.1. GYROCOMPASS. The Gyrocompass consists of a master gyrocompass, electronic control, switching unit and interconnecting cables (Figure 3-45). Power to the electronic control is from the 24 VDC distribution panel P024. The electronic control also sends signals to the Satellite Navigation Set and Radar True Bearing Unit. Refer to onboard Equipment Manual NAVSEA 0924-038-1010 for description of the Gyrocompass.

3-41.2. UNDERWATER LOG SYSTEM. The Underwater Log System consists of a speed log, transducer power and interconnecting cables (Figure 3-46). Power to circuit R-Y is from lighting panel L101. The power also supplies power to the gyrocompass through a rheostat. Refer to onboard Equipment Manual NAVSEA SE350-AA-EIM-010 for description of the Underwater Log System.

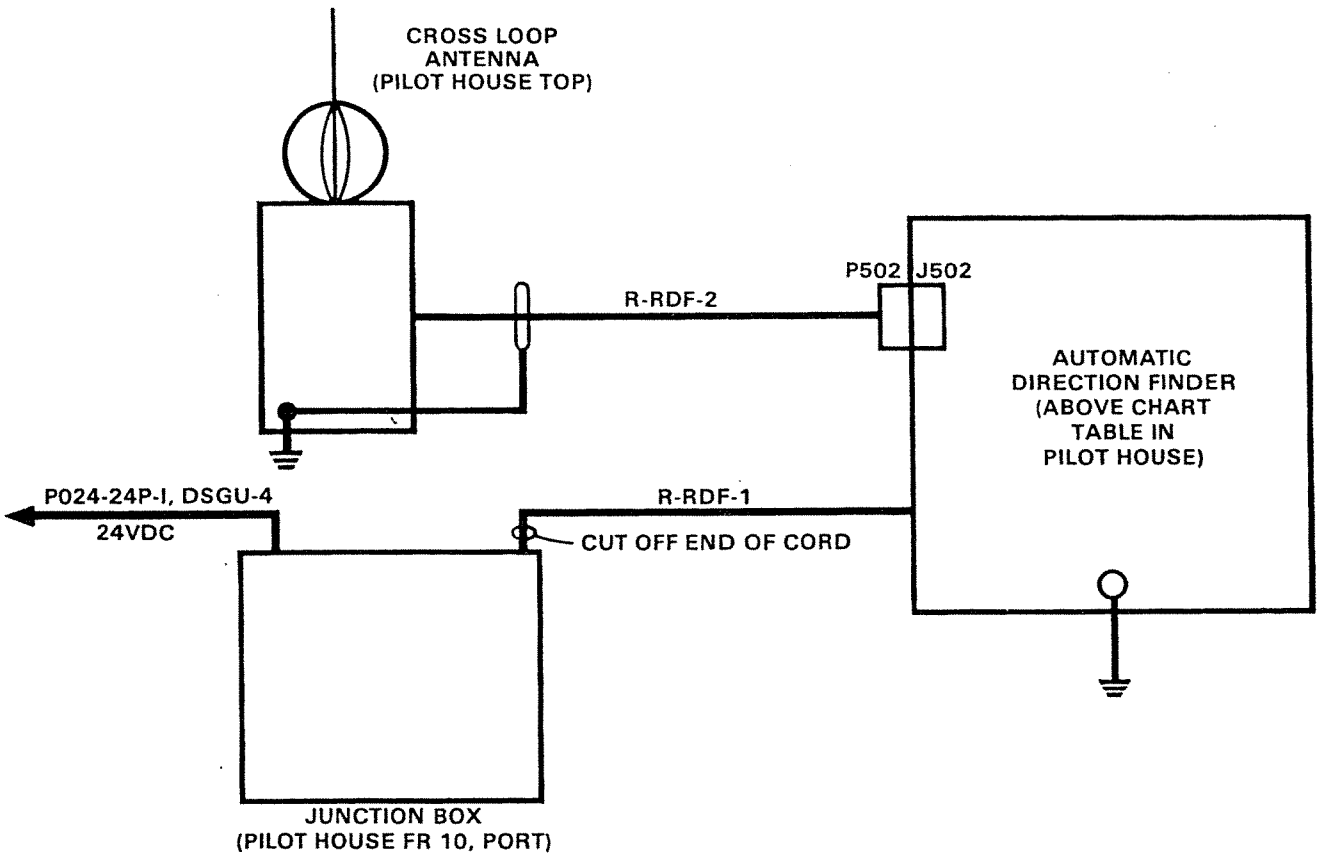


Figure 3-43. Automatic Direction Finder Elementary Wiring Diagram

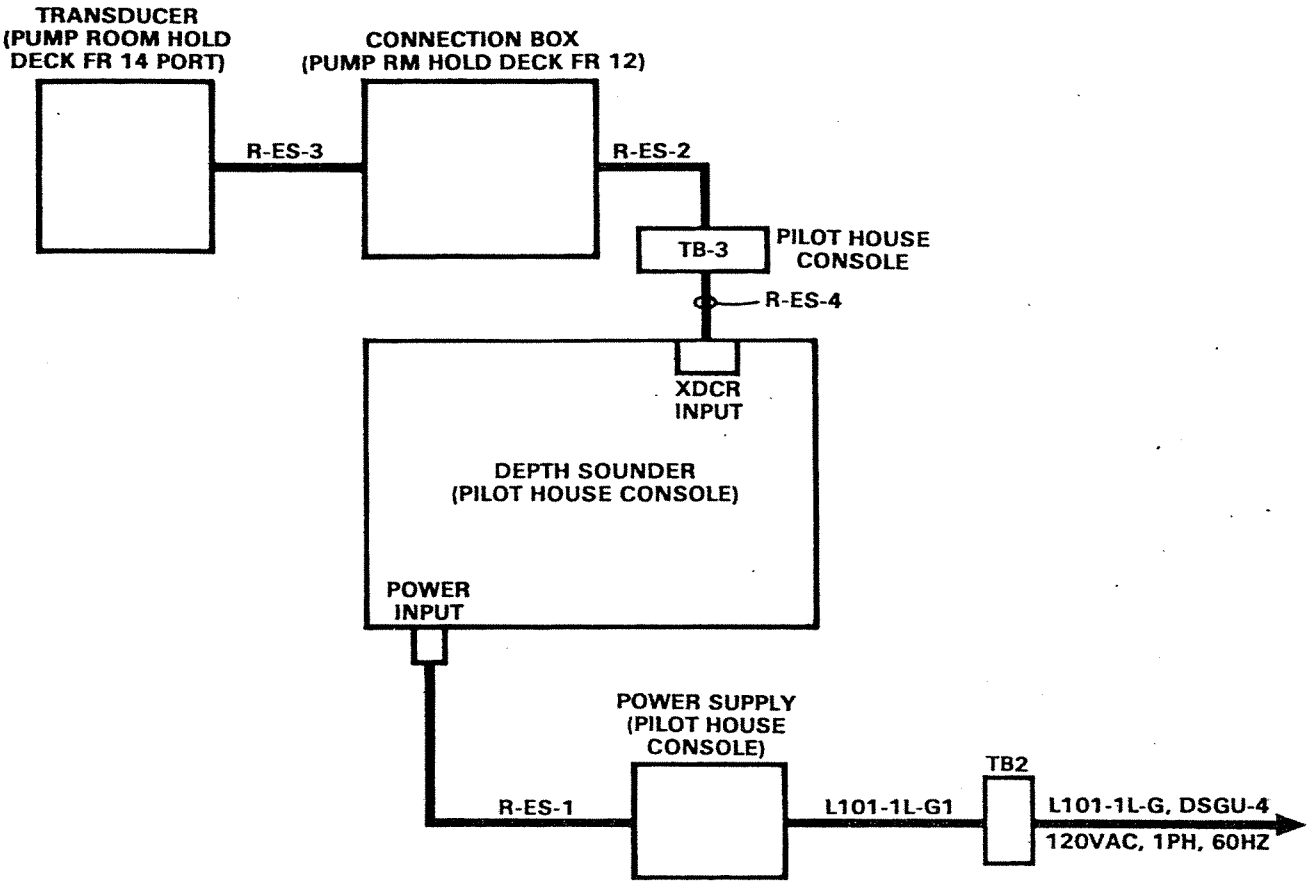


Figure 3-44. Depth Indicator Elementary Wiring Diagram

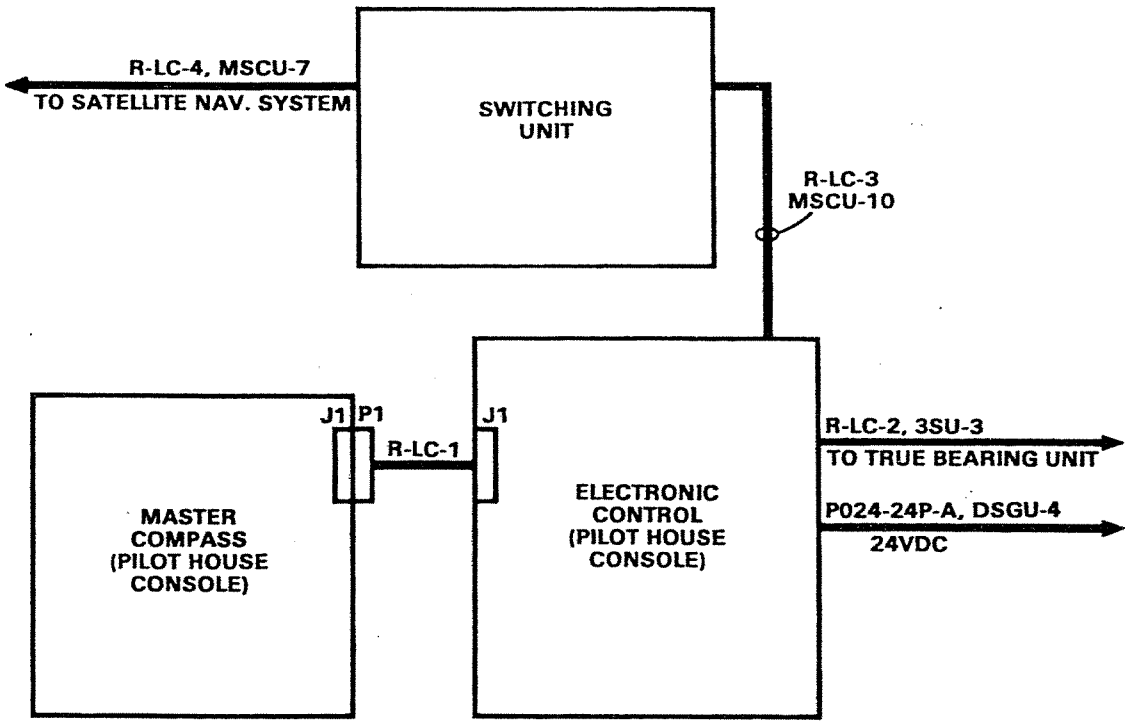


Figure 3-45. Gyrocompass Elementary Wiring Diagram

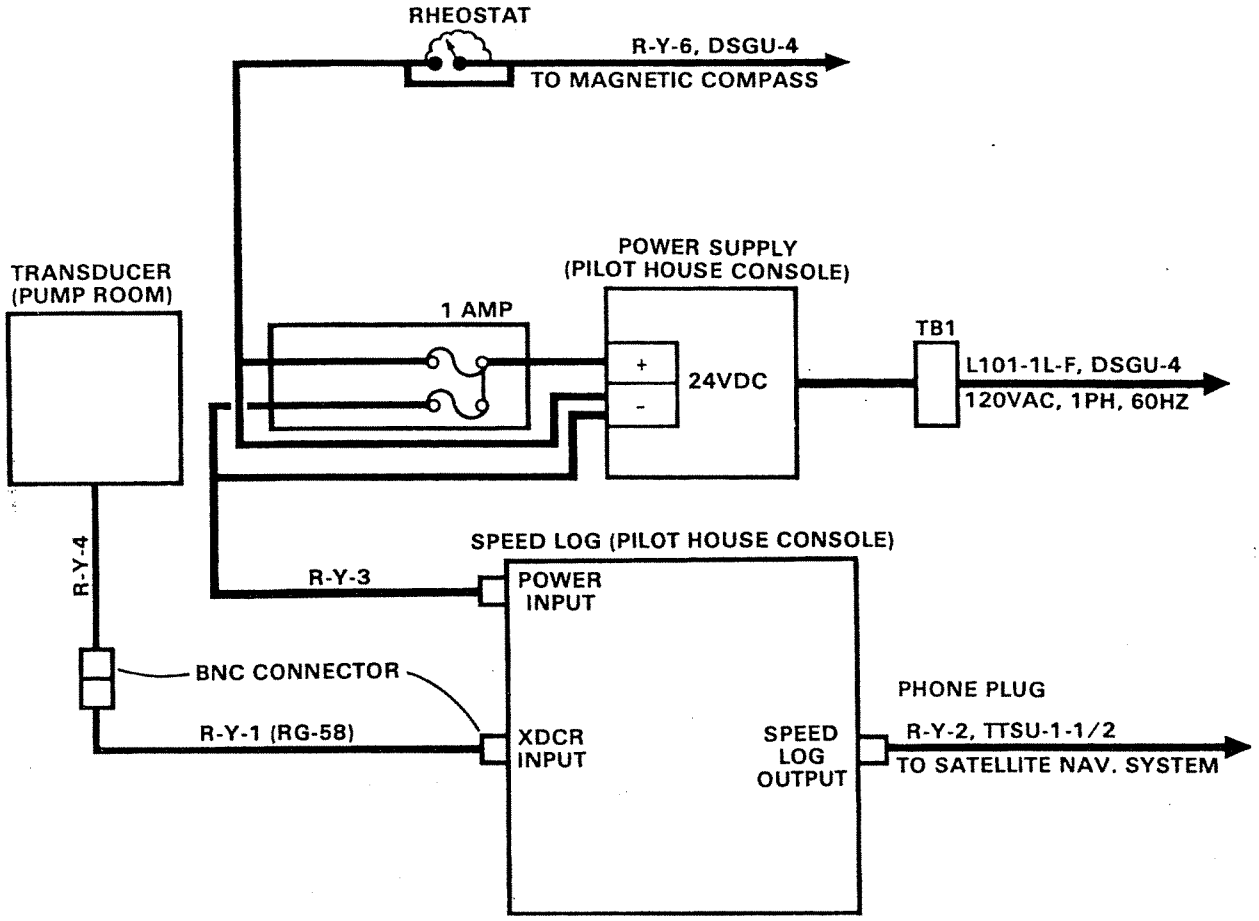


Figure 3-46. Underwater Log System Elementary Wiring Diagram

3-42. RADAR SYSTEM.

The Radar System consists of a receiver/transmitter, display unit, true bearing unit, antenna unit, power supply and interconnecting cables (Figure 3-47). Power is supplied to circuit R-ER from lighting panel L101. Signals from the gyrocompass are transmitted to the true bearing unit. Refer to onboard Equipment Manuals NAVSEA SE211-AB-MMA-010 and SE211-AB-MMC-010 for description of the Radar System.

WARNING

The disconnect switch in the radar power circuit is normally closed to operate the radar system. This switch must be opened when maintenance is being performed on the radar, antenna or other mast components to prevent accidental injury due primarily to radar antenna movement or radiation.

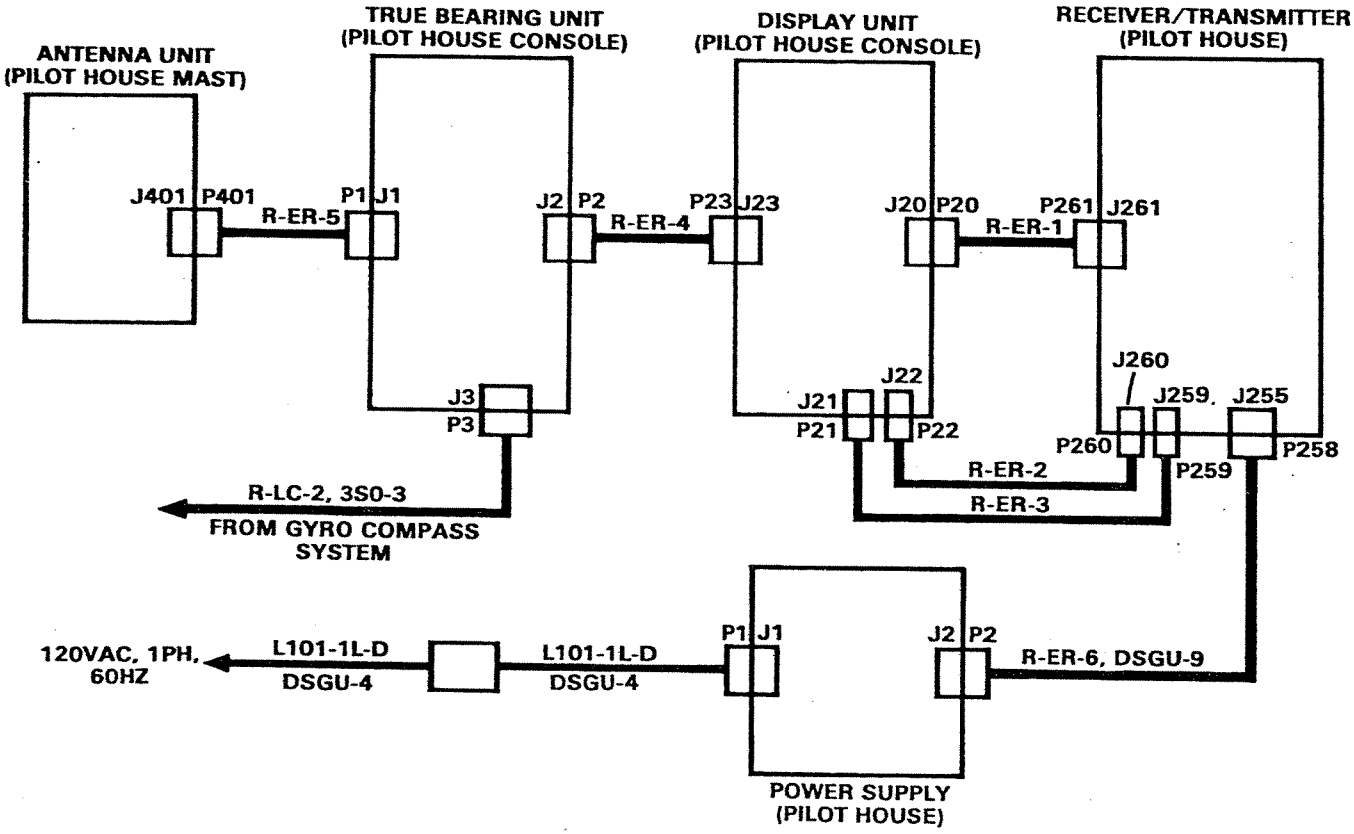


Figure 3-47. Radar Unit Elementary Wiring Diagram

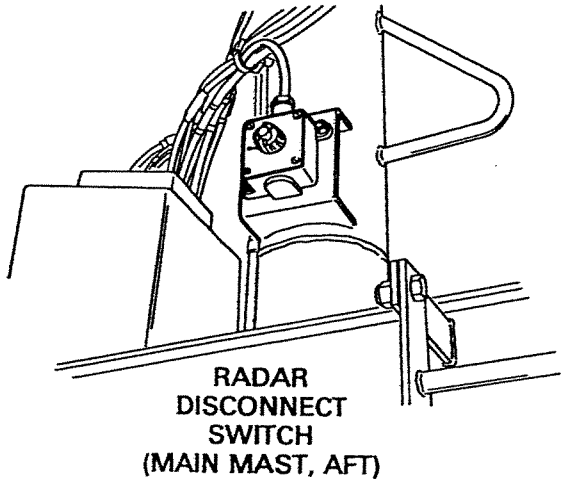


Figure 3-48. Radar Antenna Disconnect Switch

Section XVII
COMMUNICATION SYSTEMS

3-43. TELEPHONE SYSTEMS.

3-43.1. SOUND POWERED TELEPHONES. The six sound powered telephone sets are connected as shown in Figure 3-49. Each set has a handset and ringer. Power for the horn is supplied from lighting panel L103. Refer to onboard Equipment Manual NAVSEA SE165-AR-MMO-01A for description of the entire telephone system.

3-43.2. DIAL TELEPHONES. The ship-to-shore dial telephones are connected as shown as Figure 3-49. Power for the system is from lighting panel L102.

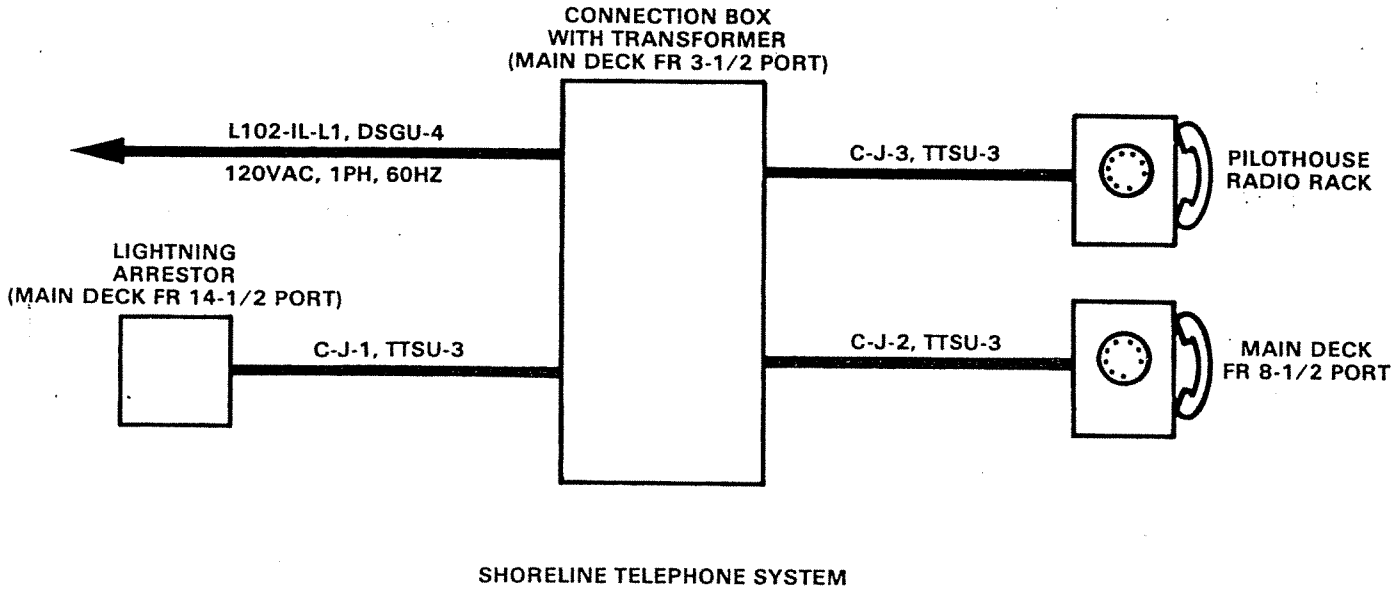


Figure 3-49. Telephone Systems Elementary Wiring Diagram (Sheet 1 of 2)

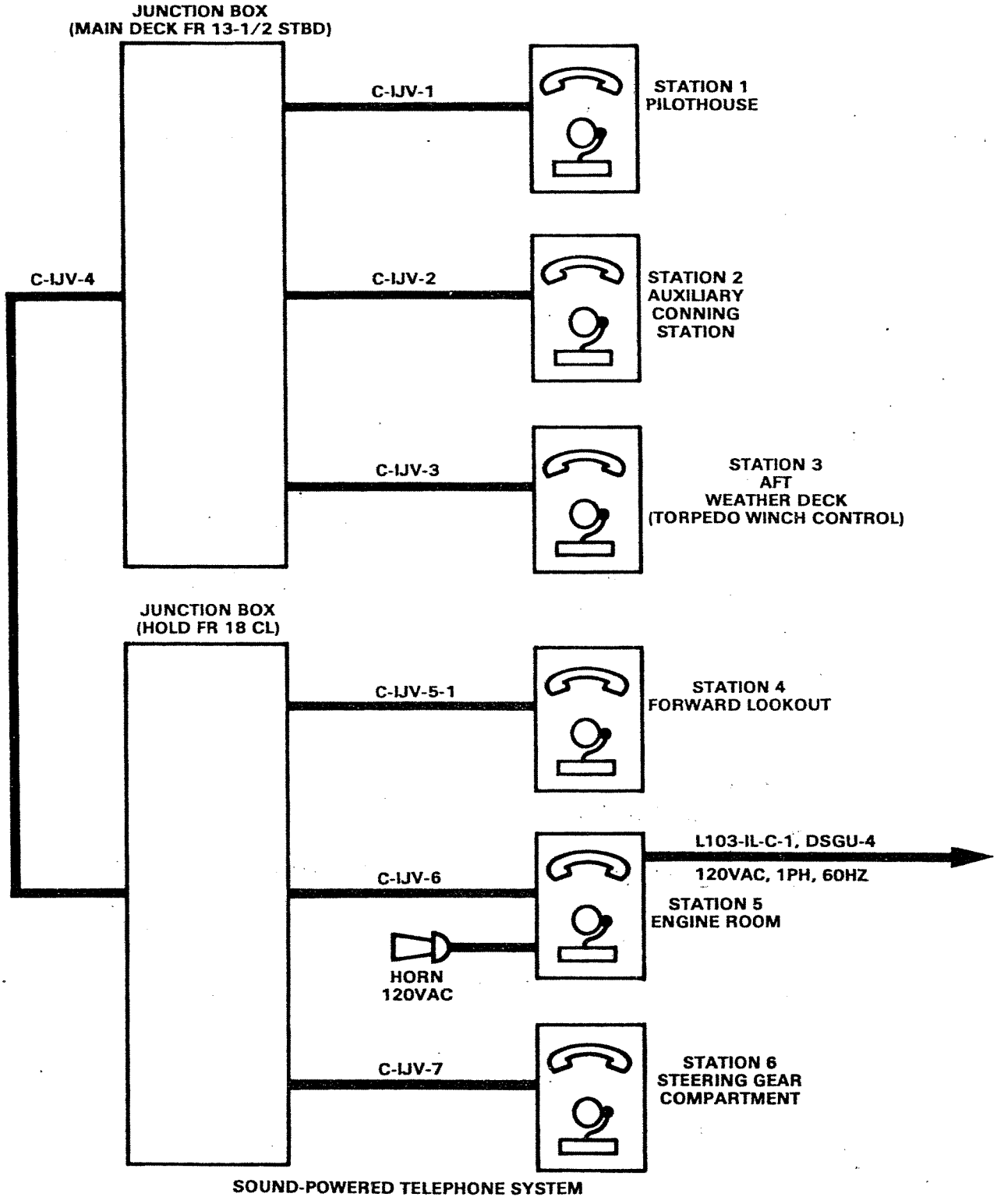


Figure 3-49. Telephone Systems Elementary Wiring Diagram (Sheet 2 of 2)

3-44. ANNOUNCING SYSTEMS.

The announcing system consists of a PA amplifier, six loudspeakers, a loudhailer, microphone, three alarm contactors, junction box and interconnecting wiring (Figure 3-50). General alarm, chemical attack alarm and collision alarm use this system. Power for circuit C-DA is from lighting panel L101. Refer to onboard Equipment Manual NAVSEA SE101-AP-MMC-010 for description of the announcing system.

NOTE

A portable megaphone is stowed in the pilothouse.

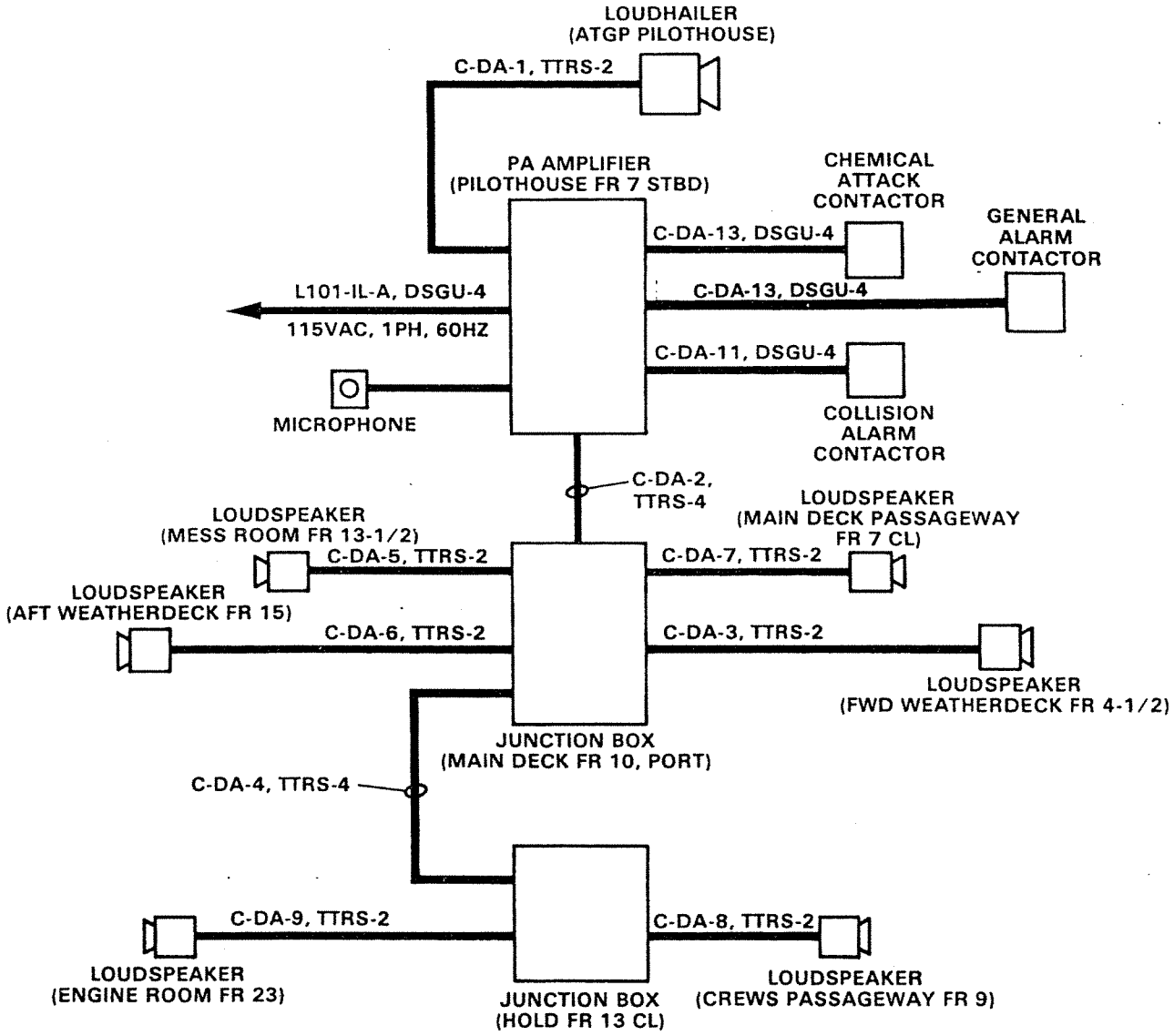


Figure 3-50. Announcing System Elementary Wiring Diagram

3-45. SHIPS ENTERTAINMENT SYSTEM.

Four radios with cassette player make up the ship's entertainment system. The units are installed in the mess room, C.O. stateroom, C.P.O. berthing space and the crew's berthing space. The receivers are connected to a common antenna system and obtain power from the general purpose receptacle in each space. Refer to onboard Equipment Manual NAVSEA SE101-AN-MMC-010 for description of the radio cassette players.

3-46. RADIO SYSTEMS.

3-46.1. UHF RADIO SET AN/ARC-159. The UHF radio system consists of a transceiver with mounting base, remote control unit with headset, audio switching unit, antenna, connection box, interconnecting cables and connectors (Figure 3-51). Power is supplied from 24 VDC distribution panel P024. The switching unit is connected to a second switching unit, part of the HF/VHF radio system. Refer to onboard Equipment Manual NAVSEA NA16-30-ARC-1594 for description of the radio set.

3-46.2. HF/VHF RADIO SET AN/URC-94. The radio set consists of a transceiver, control unit with handset, audio switching unit, relay junction box, two antennas and couplers and interconnecting cables (Figure 3-52). Power is supplied to the radio set from the 24 VDC distribution panel P024. Refer to the following onboard Equipment Manuals for description and operation: NAVSEA EE100-EA-OMP-01A and supplement, NAVSEA 100-EA-OMP-020, and NAVSEA 100-EB-OMP-010.

3-46.3. VHF/FM RADIO EQUIPMENT. The VHF/FM equipment consists of a radio telephone (transceiver) with microphone, VHF/FM receiver, power supply, antenna and interconnecting coaxial cable and connectors (Figure 3-53). Power is supplied from the 24 VDC distribution panel P024. Refer to onboard Equipment Manuals NAVSEA SE150-AV-MMC-010 and NAVSEA SE171-AC-MMC-010 for description of the radio equipment.

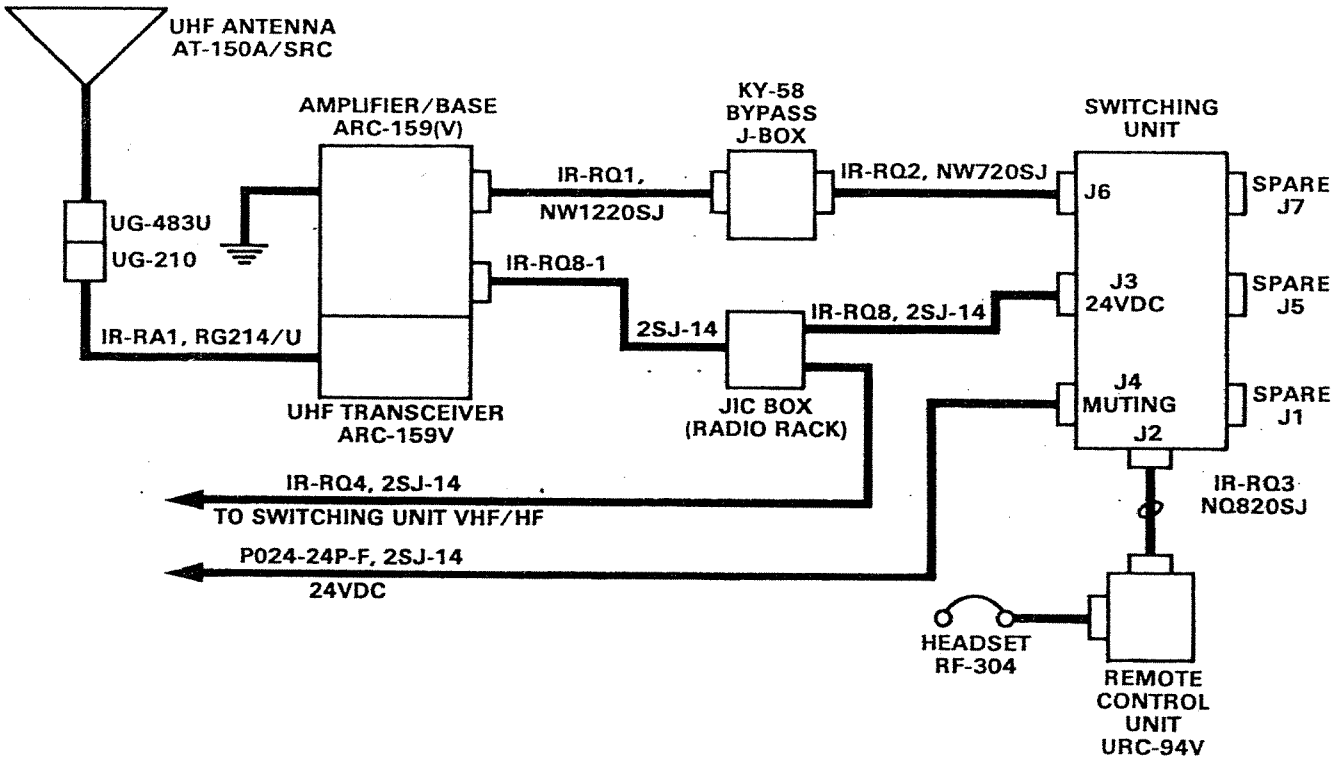


Figure 3-51. UHF Radio Set Elementary Wiring Diagram

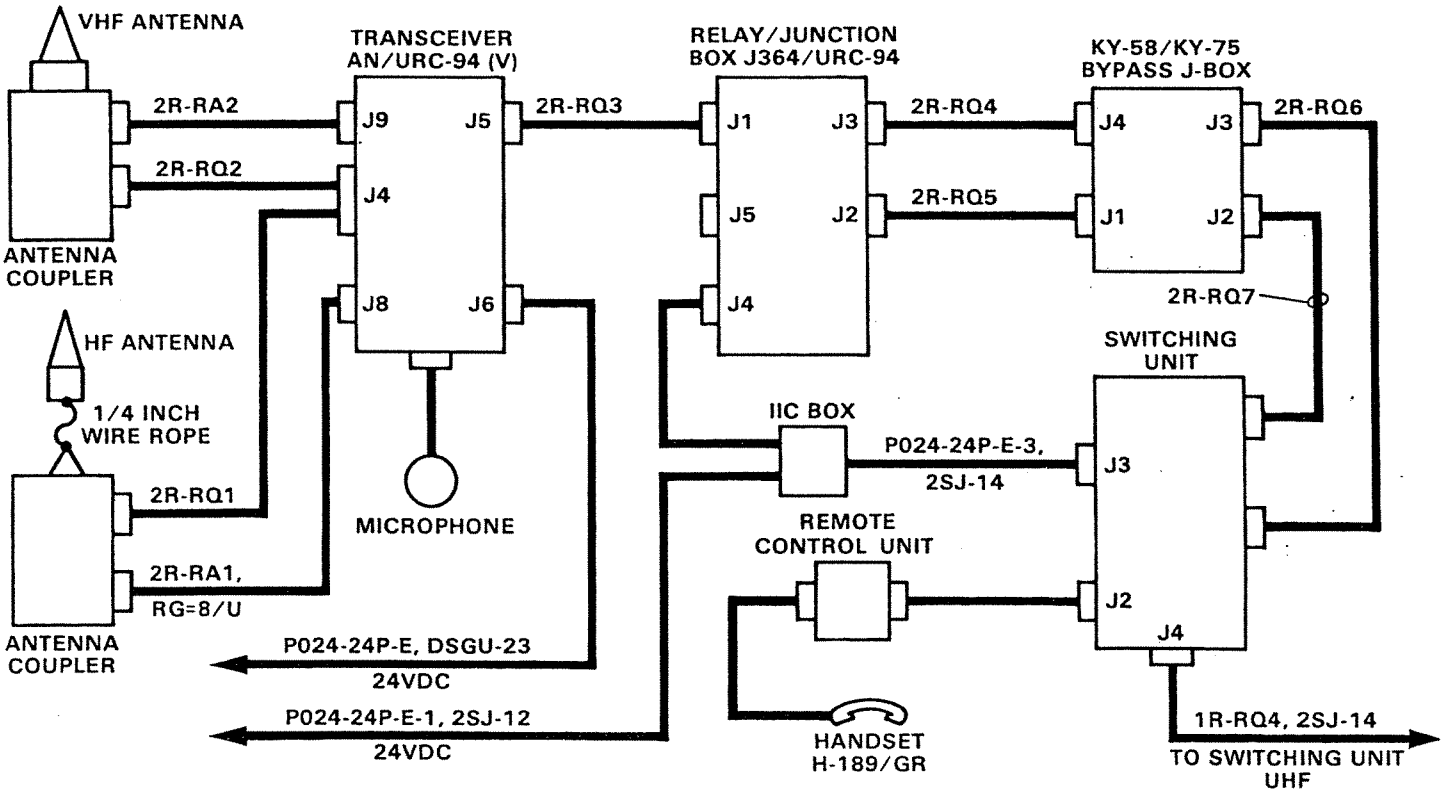


Figure 3-52. HF/VHF Radio Set Elementary Wiring Diagram

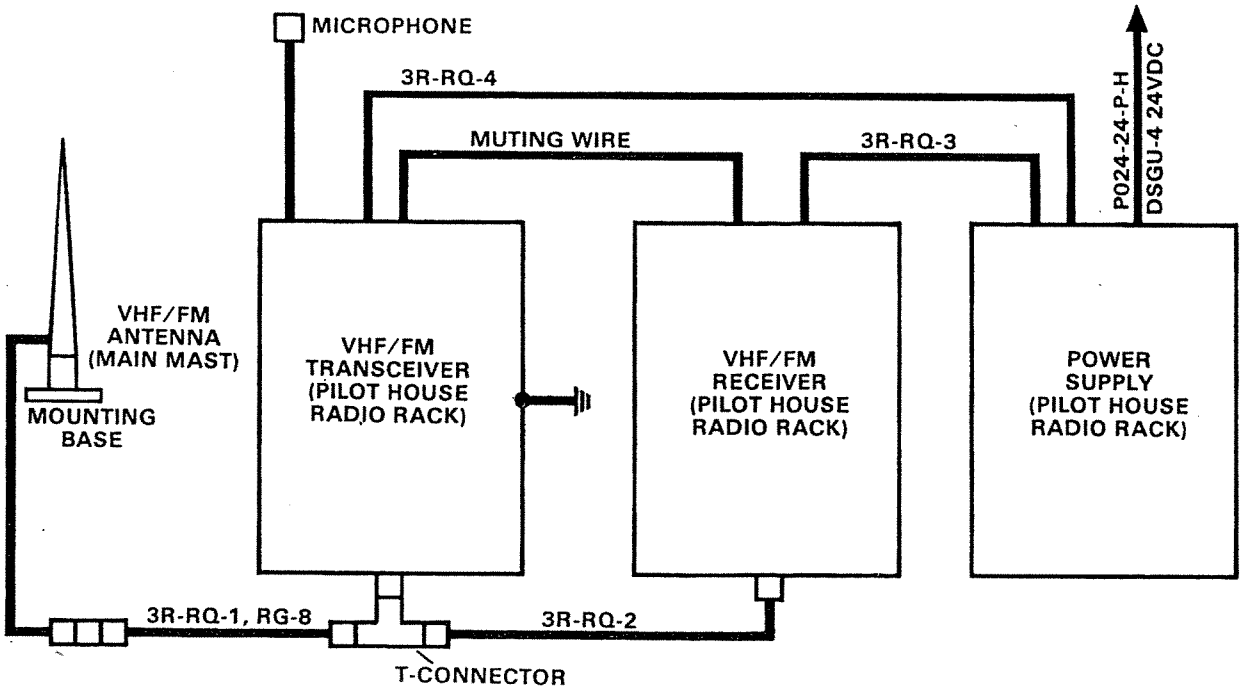


Figure 3-53. VHF/FM Radio Equipment Elementary Wiring Diagram

3-47. SONAR UNIT.

The sonar unit (underwater communications) consists of two control units, a receiver/transmitter, two transducers (Figure 3-55), an isolation transformer, and interconnecting cables (Figure 3-54). Power is supplied to the transformer from the 120 volt main distribution panel P100. Refer to onboard Equipment Manual NAVSEA 0965-LP-490-1640 for description of the equipment.

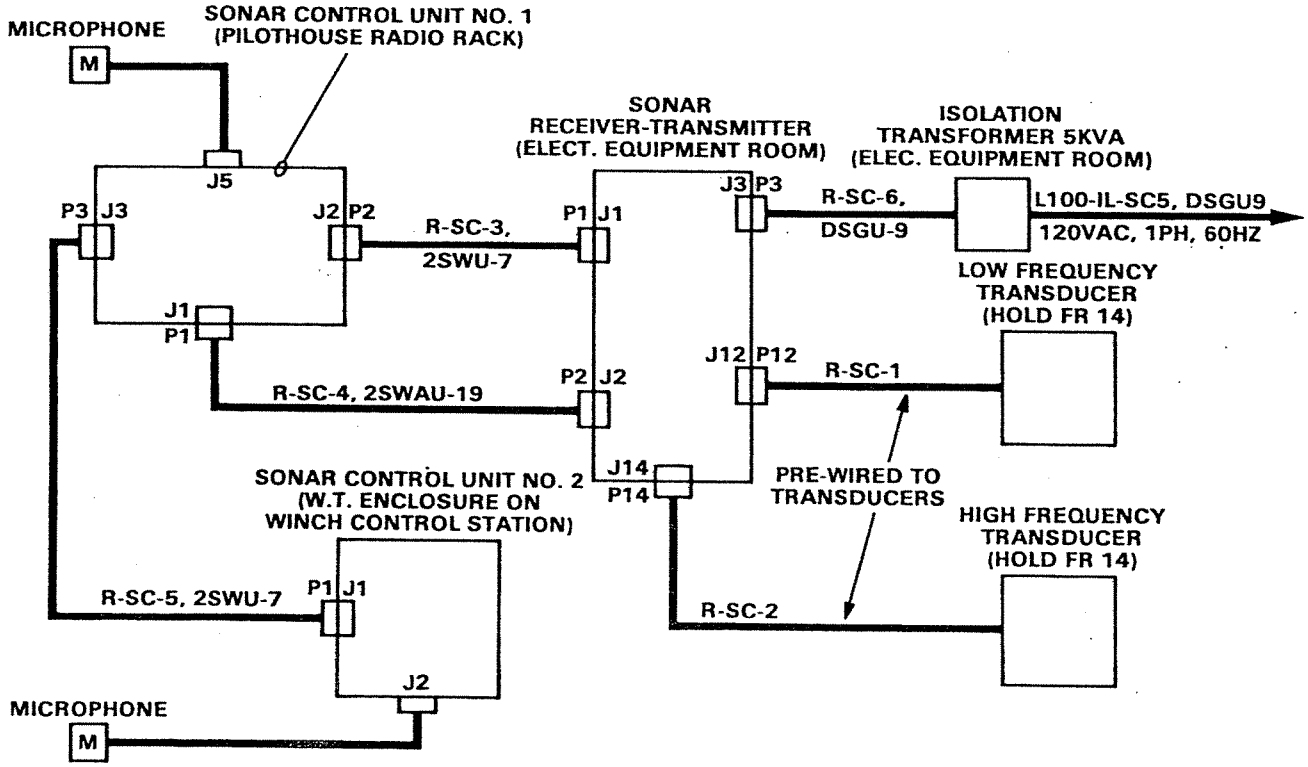


Figure 3-54. Sonar Unit Elementary Wiring Diagram

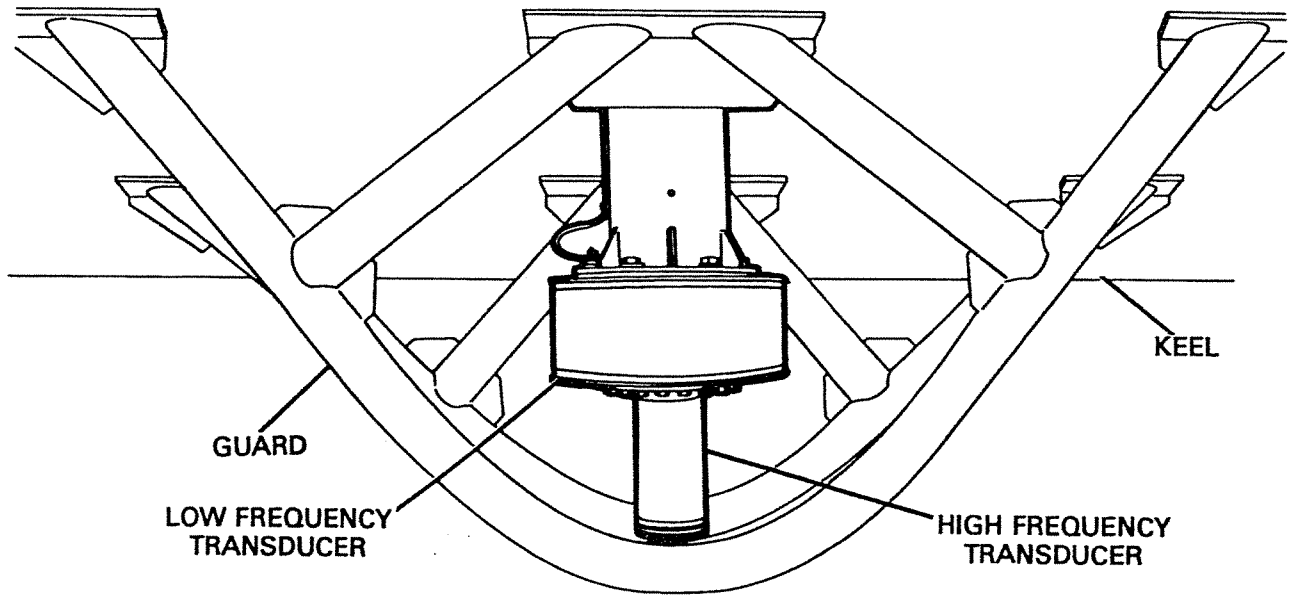


Figure 3-55. Sonar Transducers
(Hull, Frame 14)

Section XVIII
ALARM, MONITORING AND CONTROL SYSTEMS

3-48. ALARM PANELS.

3-48.1. MASTER AND REMOTE ALARM PANELS. The basic alarm system consists of the pilothouse (master) alarm panel, remote steering gear alarm panel, sensing devices or switches, an alarm horn and interconnecting lines (Figure 3-56). Power to the alarm system is supplied from the 24 VDC distribution panel P024 and from the electric power control panel P400 at the terminal block (120VAC). Refer to onboard Equipment Manual NAVSEA SE168-AR-MMC-010 for a complete description of the alarm panels. Alarm signals from the diesel engines, steering gear controllers and heater tank, and bilge level switches are transmitted to the master alarm panel through junction boxes and relays (in some cases). In addition, the halon release signal and sewage summary signal are also transmitted to the master alarm panel. The alarm conditions are shown visually on the master alarm panel and indicated audibly by an alarm horn. Steering gear alarm conditions are also shown on the remote alarm panel. The master alarm panel has a test switch and alarm acknowledge switch. The bilge level switches are connected in parallel; any high level condition in the bilge areas will signal bilge flooding.

3-48.2. SEWAGE ALARM SYSTEM. (Figure 3-57.) The sewage alarm system consists of two vacuum switches and two level switches on the sewage holding tank and four warning lights, one in the pilothouse, and one each in the toilet spaces (Figure 3-58). Whenever the holding tank is 90 per cent full or an improper vacuum condition exists in the tank, the four "sewage summary fault alarm" lights will go on. The toilet spaces should not be used until the fault is corrected. There are also alarm switches on the sewage pump control panel. Refer to paragraph 3-26.2. for description of control panel switches and lights and Figure 1-45 for an illustration of the sewage control panel.

3-49. INDICATING SYSTEMS.

3-49.1. RUDDER ANGLE INDICATOR. The rudder angle indicator consists of two indicators, a rudder angle follow-up unit, junction boxes and interconnecting lines (Figure 3-59). The follow-up unit is mounted above and mechanically linked to the starboard rudder. The position of the rudder causes the follow-up unit to generate signals which are proportional to the rudder angle. These signals are transmitted to the indicator through the junction boxes and lines. Power for the circuit C-N is from the 24 VDC distribution panel P024. Refer to onboard NAVSEA drawing 437-6003403 for additional information on the rudder angle indicator system.

3-49.2. PROPULSION ENGINE TACHOMETERS. The system consists of four tachometers, two on the bridge and two at the auxiliary conning station, tach drives and interconnecting lines (Figure 3-60). One tach drive is mounted on each propulsion engine. The signals generated by the tach drives are proportional to the engine RPM and are transmitted to the respective tachometers on the bridge and auxiliary conning station. Power for circuit C-KM is from the 24 VDC distribution panel P024. Refer to onboard NAVSEA drawing 437-6003403 for additional information.

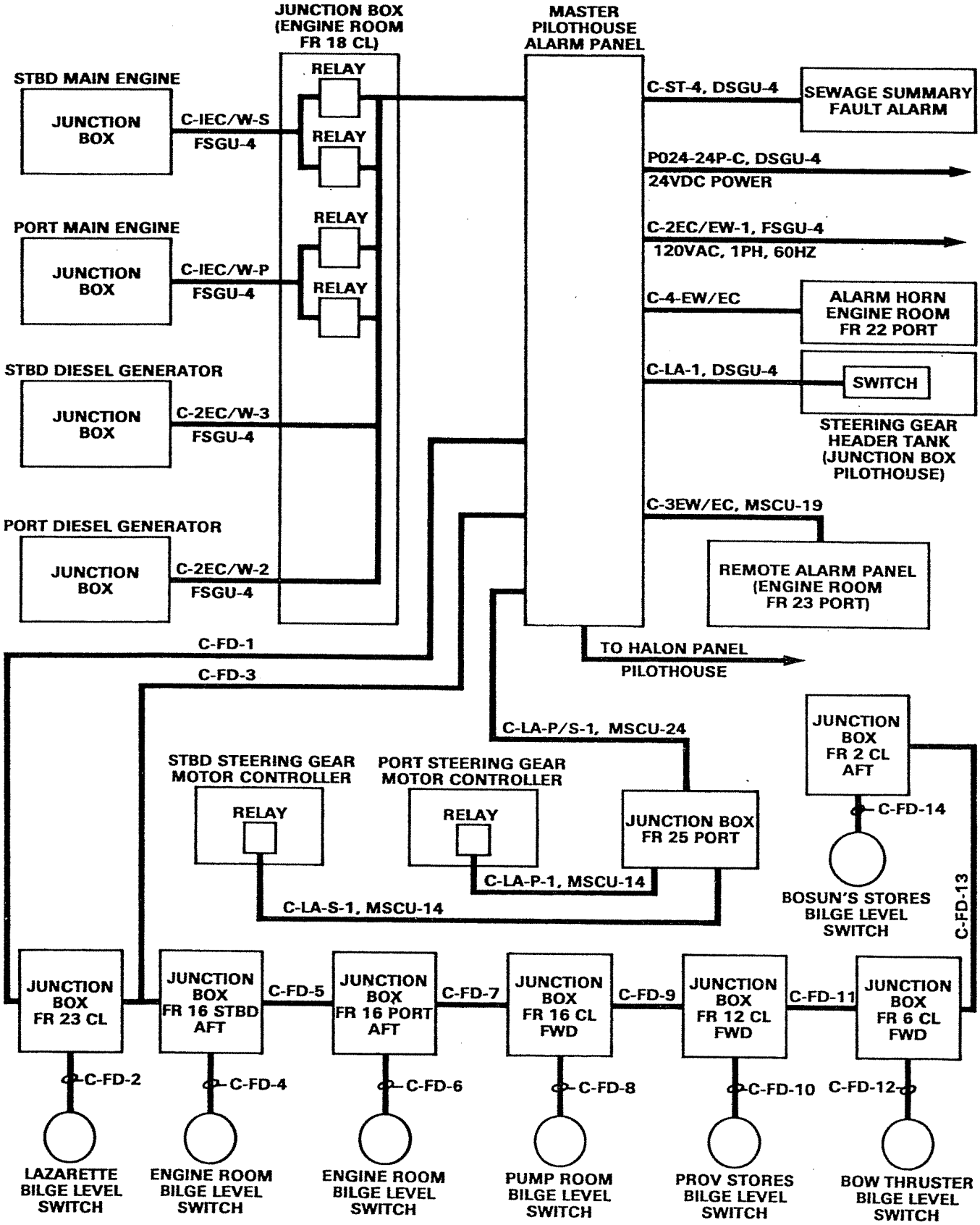


Figure 3-56. Alarm System Elementary Wiring Diagram

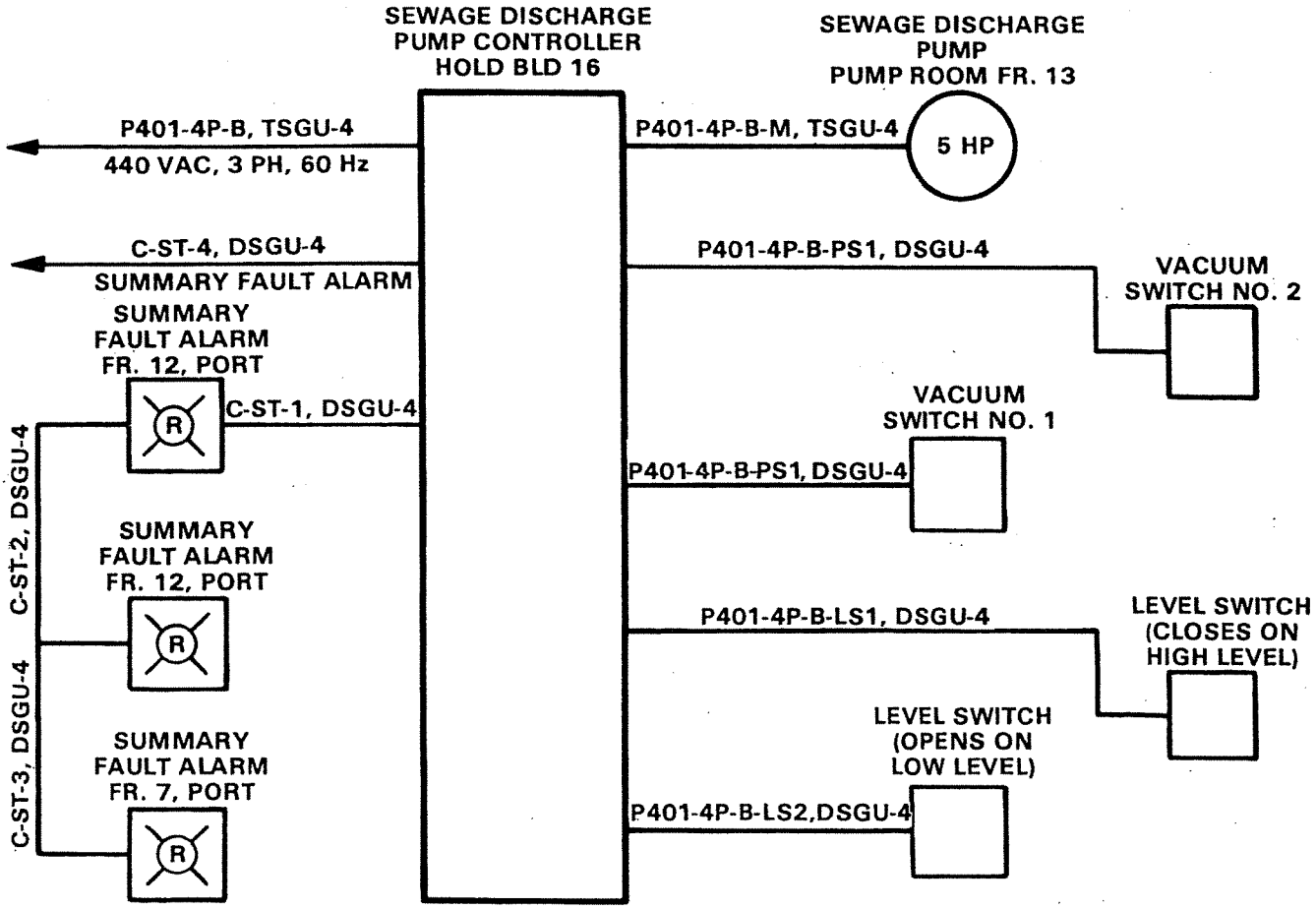


Figure 3-57. Sewage Alarm System Elementary Wiring Diagram

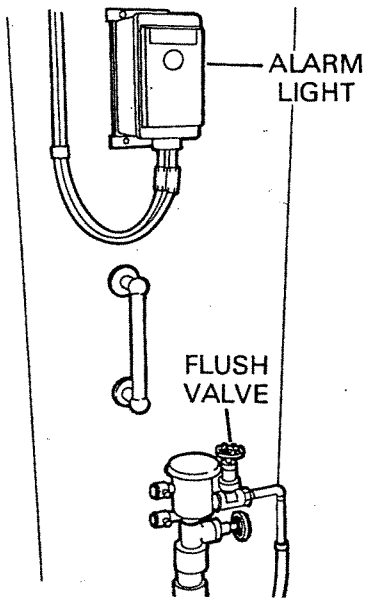


Figure 3-58. Water Closet Alarm Light
(Frame 12, Port, Main Deck and 1st Platform)

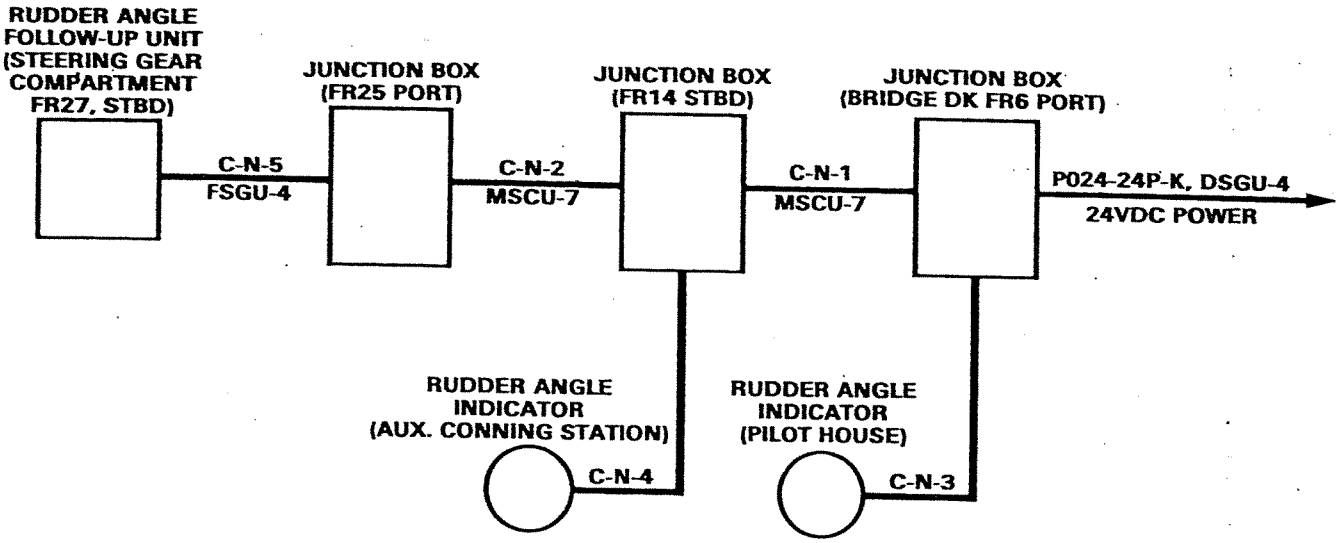


Figure 3-59. Rudder Angle Indicator Elementary Wiring Diagram

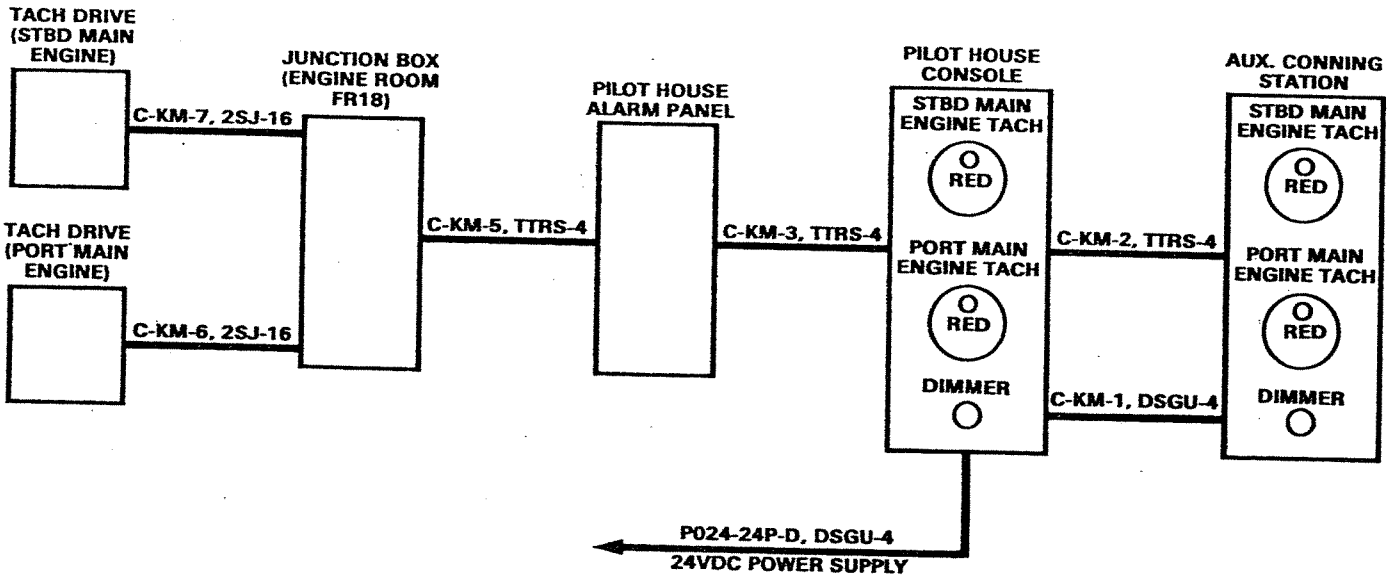


Figure 3-60. Propulsion Engine Tachometer Elementary Wiring Diagram

3-50. CONTROL SYSTEMS.

3-50.1. PROPULSION ENGINE START/STOP CIRCUITS. The propulsion engines can be started at the pilothouse console or remotely at the engines (Figure 3-61). The starters push buttons are connected to the engine starter through transmission interlock switches so the transmissions must be in neutral to start the engines. The propulsion engines can be stopped (normal) at the pilothouse console or the auxiliary conning station.

3-50.2. DIESEL GENERATOR CONTROL CIRCUITS. Refer to paragraph 3-36.1 and Figure 3-32 for description of diesel generator control circuits.

3-50.3. HVAC CONTROL CIRCUITS. Power for the air conditioning unit is supplied from the electric plant control panel P400 through the controller (Figure 3-62). The air compressor motor and king solenoid are energized on demand; the compressor crankcase heater is energized when the compressor is not running. Power for the air handling unit is supplied from power panel P403 through the controller. Operation of the fan motor and liquid control solenoid are controlled by the thermostat. The controller for the air handling unit and air conditioning unit are interlocked so one unit cannot operate without the other. Refer to onboard Technical Manual NAVSEA S9514-B5-MMC-010 for a complete description of the air conditioning plant. The five duct heaters are controlled by individual thermostats for the applicable space. Power to the duct heaters is supplied from power panel P403.

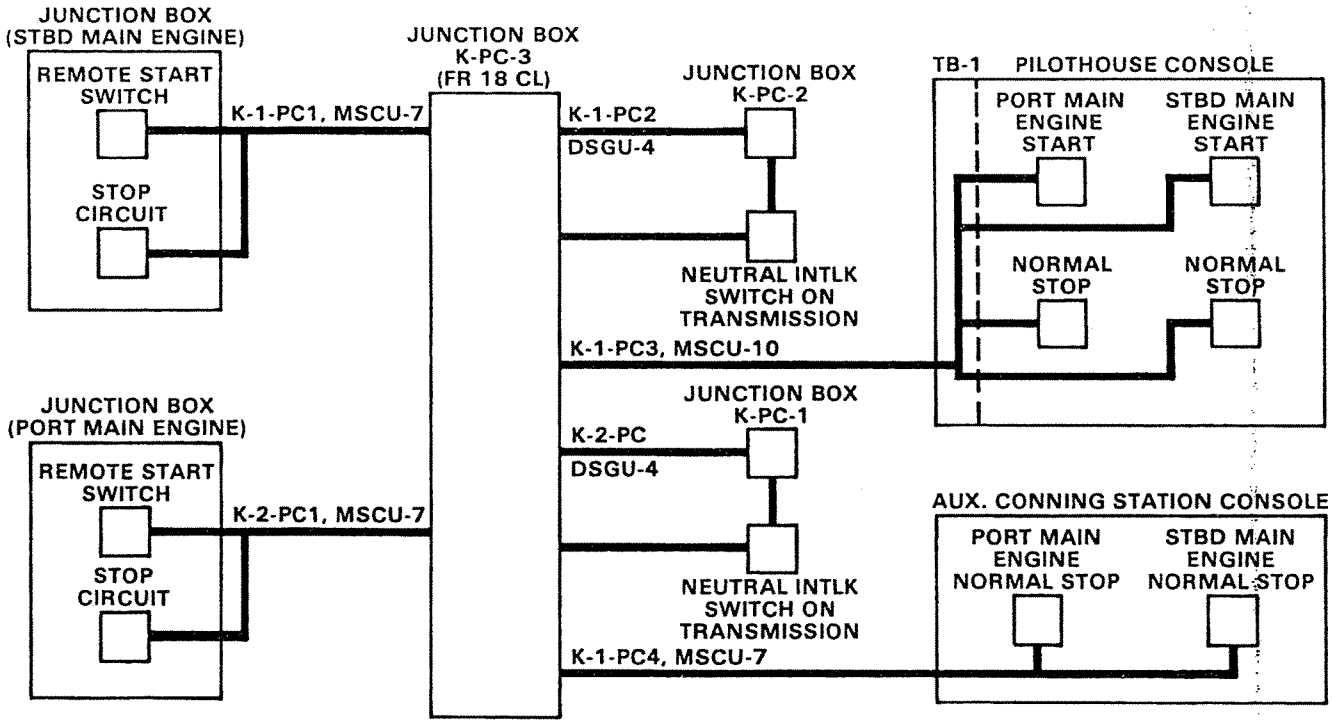


Figure 3-61. Propulsion Engine Start/Stop Circuit Elementary Diagram

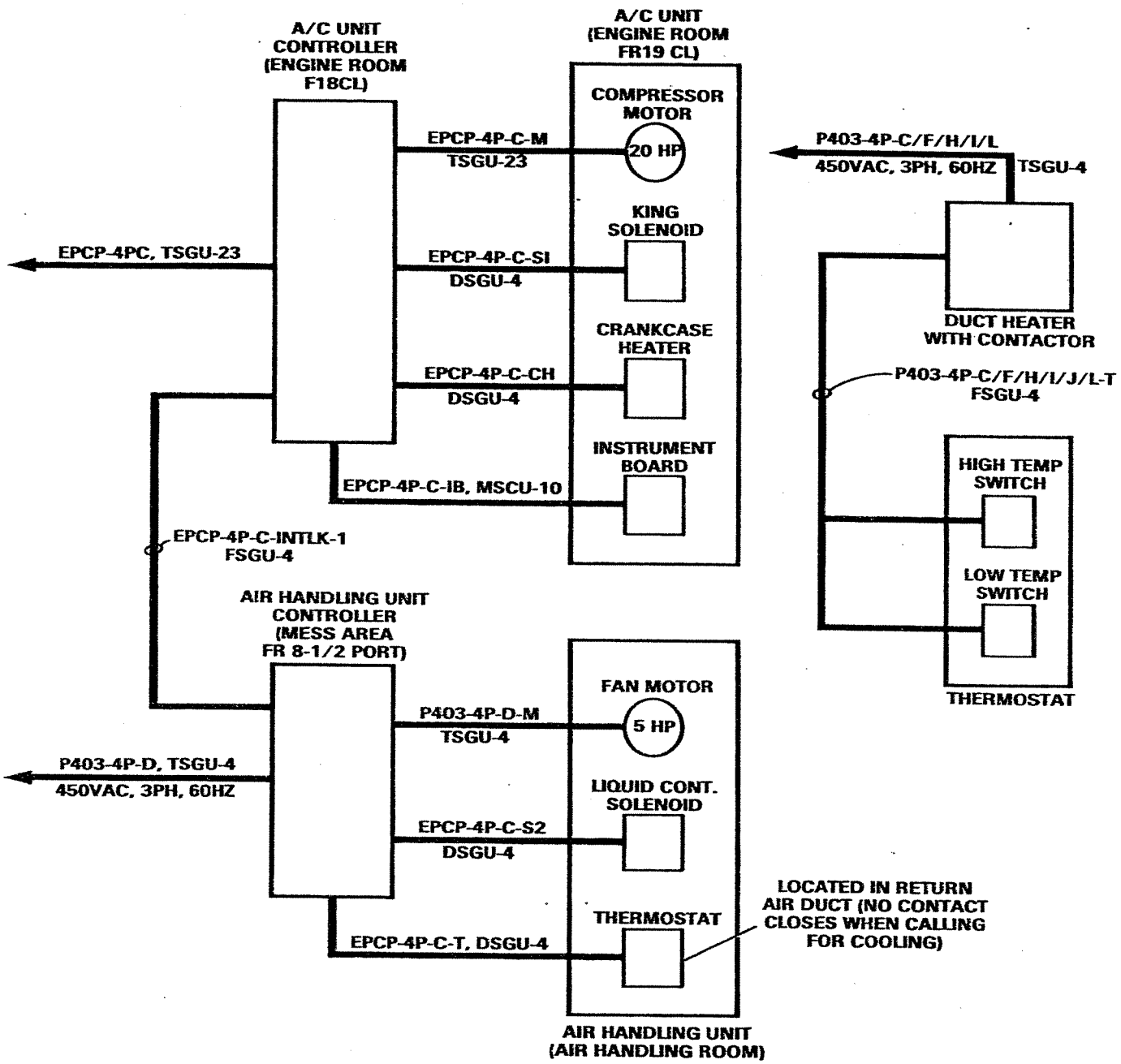


Figure 3-62. HVAC Control Circuit Elementary Wiring Diagram

3-50.4. NFU CONTROL CIRCUIT. (Figure 3-63.) When non follow-up steering is desired at the auxiliary conning station, power is supplied to the steering control through the disconnect switch from the 24 VDC power panel as indicated by the "power available" light. The steering control regulates the 4-way solenoid valve. Refer to paragraph 3-21. for a description of NFU steering.

3-50.5. BOW THRUSTER CONTROL CIRCUIT. (Figure 3-64.) The bow thruster can be operated at either the pilothouse console or auxiliary conning station. Power for the system is supplied from lighting panel L101. The directional control for the bow thruster is controlled at either control panel. The low level switch and over-temperature switch will close energize fault indicating lights on the control panels. Refer to paragraph 3-22. for a description of the bow thruster hydraulic system. Refer to onboard NAVSEA drawing 426-6003396 for additional information.

3-50.6. ANCHOR WINDLASS CONTROL CIRCUITS. Refer to onboard technical manual S9581-A2-MMC-010 for a complete description of anchor windlass control circuits and operation.

3-50.7. CRANE CONTROL CIRCUITS. Refer to onboard Technical Manual SG811-AA-MMC-010 for a complete description of crane control circuits and operation.

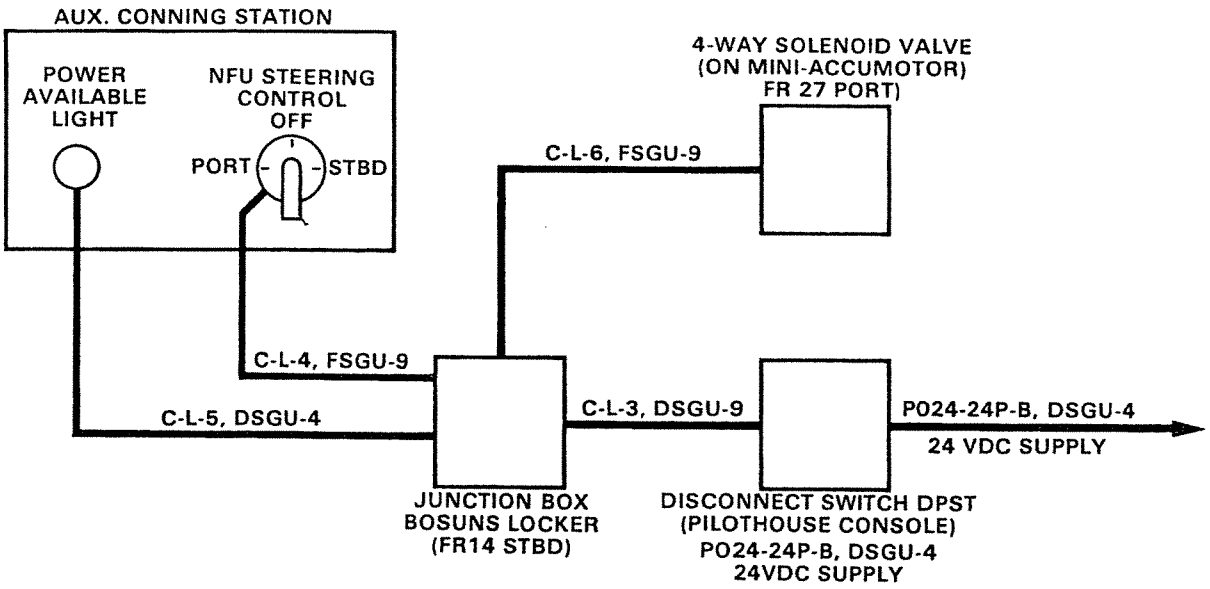


Figure 3-63. NFU Steering Control Circuit Elementary Wiring Diagram

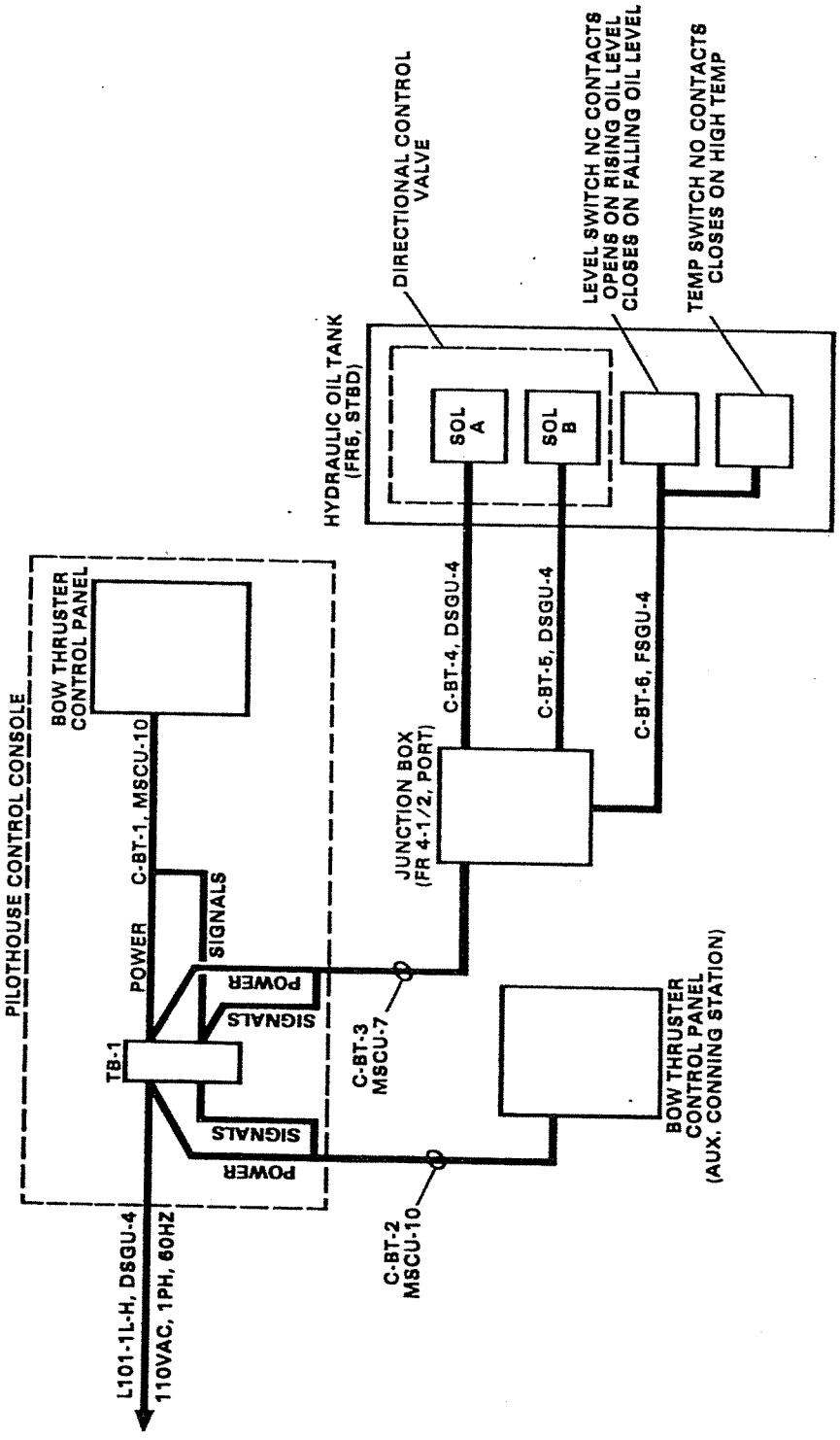


Figure 3-64. Bow Thruster Control Circuit Elementary Wiring Diagram