

CHAPTER 1

ENGINEERING ADMINISTRATION

The Navy has many programs that will affect you at some time in your Navy career. In this chapter you will learn the basics of some of the programs that will affect you as a Fireman. This chapter is not designed to make you an expert in any of these programs, rather it will make you aware of their existence and advise you where to seek more in-depth information. Programs we discuss include only those you will need to know about while carrying out your assigned duties.

After studying this chapter, you should be able to identify the organizational structure of the engineering department, have a general understanding of each engineering rating, and be able to incorporate general safety precautions to perform your day-to-day tasks. You should be able to discuss with some accuracy the various programs pertinent to you as an engineer; that is, the planned maintenance system (PMS), the equipment tag-out program, and the engineering operational sequencing system (EOSS).

STANDARD SHIP ORGANIZATION

The responsibility for organization of the officers and crew of a ship belongs to the commanding officer by U.S. Navy regulations. The executive officer is responsible, under the commanding officer, for organization of the command. The department heads are responsible for the organization of their departments for readiness in battle and for assigning individuals to stations and duties within their respective departments. The *Standard Organization and Regulations of the U.S. Navy* manual (SORM), OPNAVINST 3120.32B, prescribes this administrative organization for all types of ships.

ORGANIZATION OF THE ENGINEERING DEPARTMENT

The SORM organizes the engineering department for the efficient operation, maintenance, and

repair of the ship's propulsion plant, auxiliary machinery, and piping systems. The engineering department is responsible for (1) damage control, (2) operation and maintenance of electric generators and distribution systems, (3) repair to the ship's hull, and (4) general shipboard repairs.

The organization of each engineering department varies according to the size of the ship and the engineering plant. For example, forces afloat, such as repair ships and tenders, have a separate repair department with many engineering ratings responsible for off-ship repair and maintenance. These ships also have a standard ship's force engineering department. Smaller ships, because of the smaller number of engineering ratings aboard, combine many ratings into one division.

Figure 1-1 is an example of the organizational structure of the engineering department aboard any large ship. Note that the administrative assistant and the special assistants are aides to the engineer officer. These responsibilities are often assigned as additional duties to officers functioning in other capacities.

The three main assistants to the engineer officer are the main propulsion assistant (MPA), the electrical officer, and the damage control assistant (DCA). Each assistant is assigned the division(s) shown on the organization chart.

The division officers are responsible for the various divisions. The organization of each division by sections is set up by the watch, quarter, and station bill.

ENGINEER OFFICER

The engineer officer is the head of the engineering department. Besides the duties as a department head, the engineer officer is responsible for the following areas:

- Operation, care, and maintenance of all propulsion and auxiliary machinery
- Control of damage

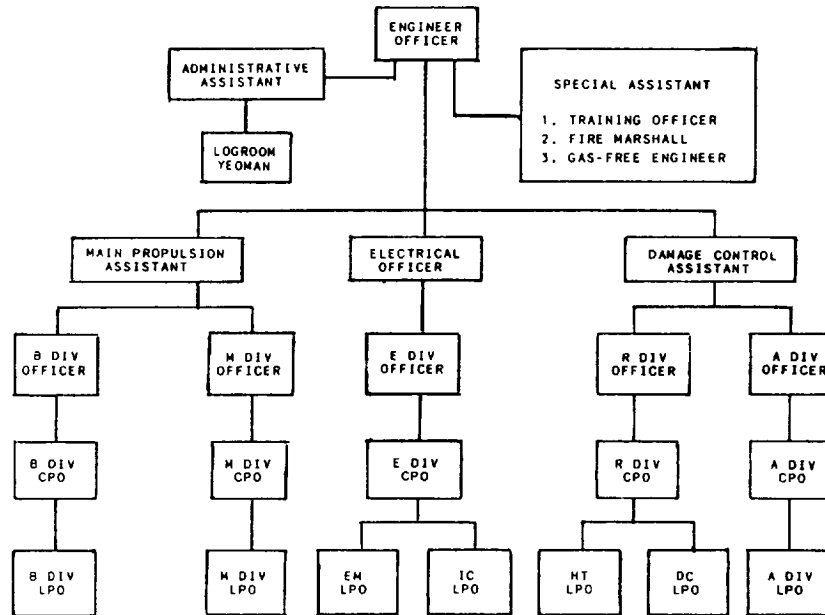


Figure 1-1.—Typical engineering department.

- Completion of all repairs within the capacity of the shops in the engineering department

For more detailed information about the duties and responsibilities of the engineer officer, refer to the *U.S. Navy Regulations*, the *Engineering Department Organization and Regulations Manual* (EDORM), and the SORM.

Assistants to the Engineer Officer

The engineer officer is assigned assistants for main propulsion, electrical, damage control, and other specific duties that are required for the proper performance of the functions of the engineering department. The engineer officer must make sure the assistants perform their assigned duties. In the following paragraphs, we will describe the duties of the administrative assistant, training officer, fire marshal, gas-free engineer, MPA, electrical officer, and DCA.

ADMINISTRATIVE ASSISTANT.— The department administrative assistant functions as an aide to the engineer officer in the details of administration. The responsibilities and duties of the department administrative assistant are as follows:

- Supervise the operation of the department administrative office; this includes the

upkeep of assigned office spaces and the care and maintenance of office equipment.

- Screen all department incoming correspondence and initiate required action; also, screen and ensure correct preparation of all outgoing correspondence.
- Assist in the preparation of all department directives and exercise control over their issuance.
- Supervise the maintenance of department records and maintain a tickler file on all required reports.
- Coordinate the preparation of the department daily watch bill.
- Assign tasks to, and evaluate the performance of, department yeomen and other enlisted personnel assigned to the department office.

In an engineering department without an administrative assistant billet, the engineer officer may delegate the duties of such a billet to any competent person.

TRAINING OFFICER.— The duties of a department training officer are delegated by the

engineer officer to an assistant. Some of these duties include the following:

- Develop a department training program in support of the training objectives of the ship.
- Carry out approved training plans and policies within the department.
- Coordinate and assist in the administration of division training programs within the department. This includes supervision of the preparation of training materials and review of curricula, training courses, and lesson plans. It also includes assisting in the selection and training of instructors, observation of instruction given at drills, on watch, on station, and in the classroom. It further includes procurement of required training aids and devices.
- Maintain department training records and training reports.
- Disseminate information concerning the availability of fleet and service schools.
- Requisition training supplies and materials.

FIRE MARSHAL.— The fire marshal works under the engineer officer and the DCA and is responsible for the maintenance and readiness of the ship's fire-fighting equipment. The fire marshal is also responsible for the prevention and elimination of fire hazards on the ship.

GAS-FREE ENGINEER.— The duties and responsibilities of the gas-free engineer are described in *Naval Ships' Technical Manual*, chapter 074, volume 3, "Gas-Free Engineering." Briefly, the gas-free engineer tests and analyzes the air in sealed compartments or voids that are being opened for inspection. The engineer determines whether such spaces are safe for personnel to enter without danger of poisoning or suffocation. The engineer also determines whether it is safe to perform welding or cutting within or in the vicinity of such spaces. Such hot work is dangerous and can cause fires and explosions.

MAIN PROPULSION ASSISTANT.— The responsibilities of the MPA are as follows:

- Operation, care, and maintenance of the ship's propulsion machinery and related auxiliaries
- Care, stowage, and use of fuels and lubricating oils
- Preparation and care of the Engineering Log and the Engineer's Bell Book
- Preparation of operation and maintenance records and procedures

The MPA also has the responsibility as division officer for the boiler and machinery divisions. These divisions are discussed in the following paragraphs.

Boiler (B) Division.— The B division operates the boilers and the fireroom auxiliary machinery. If you are assigned to this division, your work station may be in a fireroom. The firerooms are usually located midships on the lower level. There may be as many as eight firerooms, depending on the size and type of ship. Ships with only one fireroom will have two boilers. They are installed either facing each other or side by side. The boilers are arranged so any number of them supply steam to the ship's engines. The firerooms are separated by watertight bulkheads. This allows any fireroom to be sealed off in case of a casualty. The ship can operate on the remaining boilers.

On your first trip through the fireroom, you will notice many sizes of pipes and valves. These lines (pipes) carry steam, water, fuel oil, and air. You will become familiar with a few of them at a time. Gradually, you will learn all their purposes and functions.

The lines that carry steam or water are covered by insulation and lagging. This is done to ensure personnel safety and to prevent heat loss and condensation. Stencils on the lines show the fluid carried and the direction of flow.

During your training, you will trace these lines from one unit to another throughout each system. The ship's blueprints and drawings will help you trace out systems in the engineering plant.

Machinery (M) Division.— The M division is responsible for the safe operation of the main engines, reduction gears, shafting, bearings, and all associated auxiliary machinery that supports

this equipment. When assigned to this division, you will work in one of the engine rooms. The engine rooms are generally located immediately aft of the firerooms that supply them with steam.

ELECTRICAL OFFICER.— The electrical officer is designated E division officer and electrical safety officer. The electrical officer is responsible to the engineer officer. The following are the specific duties and responsibilities of the electrical officer:

- Routinely observe the performance of personnel and equipment to ensure efficiency and safety and take action to correct deficiencies
- Administer and execute the ship's electrical safety program using the most up-to-date instructions and notices
- Provide training to the crew routinely on electrical safety

The E division has charge of enforcing the electrical safety program for both personal and shipboard electrical equipment. It maintains generators, power and lighting distribution, gyrocompasses, intercommunications, and other electrical equipment throughout the ship. If assigned to this division, you may work in the main motor rooms, the engine rooms, the electric repair shop, or in the interior communications (IC) rooms.

DAMAGE CONTROL ASSISTANT.— The DCA is responsible for the prevention and control of damage. This includes control of stability, list, and trim. Material conditions of readiness, watertight integrity, and compartment testing are carried out under the supervision of the DCA. The DCA administers various training for ship's personnel. This training includes damage control, fire fighting, emergency repair work, and nonmedical defensive measures for chemical, biological, and radiological (CBR) defense.

The DCA is in charge of the hull maintenance (R division) and the auxiliary machinery (A division) shops. In these shops repairs to the ship's hull and the ship's boats, which are within the ship's capabilities, are made by the assigned personnel. These divisions are described in the following paragraphs.

Repair (R) Division.— The R division is responsible for keeping the ship watertight. The

R division operates the hull maintenance shops. This division maintains damage control and fire-fighting equipment and assists in damage-control training for shipboard personnel.

Auxiliary (A) Division.— The A division operates the refrigeration plant, air compressors, emergency fire pumps, emergency diesel generators, and the ventilation, heating, and air-conditioning systems. They are the boat engineers in small boats. They also maintain the ship's steering engines. If assigned to this division, you may work in the auxiliary spaces or parts of the ship under A division's authority. The equipment assigned to A division is found throughout the ship.

Division Officer

The duties of a division officer are described in the *U.S. Navy Regulations* and the SORM. The following are specific duties and responsibilities of the division officer:

- Direct the division through work center supervisors.
- Assign watches and duties within the division.
- Ensure that division personnel receive indoctrination and military and professional training.
- Prepare enlisted performance evaluation sheets for personnel of the division.
- Maintain a division notebook containing personnel data cards, training data, a space and equipment responsibility log, and the watch and battle stations requirements. The notebook also has data useful for ready reference and for the orientation of a relief officer.
- Account for all forms, reports, and correspondence originated or maintained by the division.
- Establish and maintain a division organization manual and other directives necessary for the administration of the division.
- Ensure that prescribed security measures are strictly observed by division personnel.

- Recommend to the department head personnel transfers and changes in the division allowance.
- Forward requests for leave, liberty, and special privileges. This includes making recommendations for their disposition.
- Conduct periodic inspections, exercises, and musters.
- Evaluate the performance and discipline of the division.

The division chief petty officer (CPO) and division leading petty officer (LPO) are assigned to aid the division officer in the administrative, organizational, and disciplinary duties. Their function within the division is discussed in the following paragraphs.

DIVISION CHIEF PETTY OFFICER.— The function of a division CPO is to assist the division officer in coordinating and administering the division. The duties, responsibilities, and authority of the division CPO depends on the division organization. The division CPO may be required to perform the following tasks:

- Supervise the preparation and maintenance of the watch, quarter, and station bill.
- Formulate and implement policies and procedures for the operation of the division.
- Supervise the division in the performance of its daily routine and conduct inspections.
- Administer discipline within the division.
- Complete Enlisted Performance Evaluation Reports (NAVPERS 1616/24) after evaluating individual performances. The LPO assists the CPO in this task.
- Provide counsel and guidance to division personnel.
- Ensure routine logs and records are maintained correctly and required division reports are prepared properly.
- Act as the division officer in his or her absence.
- Perform other duties assigned by the division officer.

DIVISION LEADING PETTY OFFICER.—

The LPO appointed by the division officer or CPO is usually the senior petty officer in the division. The LPO will assist in the administration, supervision, training, and watch standing qualifications of division personnel.

ENLISTED PERSONNEL

Besides the general ratings, some specific billets or assignments require special mention. Two of these billets are the oil and water king and the boat engineer.

Oil and Water King

On large ships, the billet for oil and water king is divided into two billets—one for fuel oil and the other for potable (fresh) water and feedwater.

On steam-driven ships, the oil and water king could be either a Boiler Technician or a Machinist's Mate. On diesel- and gas turbine-driven ships, the oil and water king is an Engineman or a Gas Turbine Systems Technician. The responsibilities of an oil and water king are as follows:

- Supervise the operation of all valves in the fuel oil and transfer system and the freshwater system, as prescribed by the casualty control bills for those systems.
- Properly maintain fuel oil service tanks and shift suction among service tanks.
- Maintain the distribution of fuel oil and water so the ship can remain on an even keel and in proper trim.
- Prepare fuel and water reports.
- Test and record the pH, phosphate, chloride content, hardness, and other properties of feed and boiler water.
- Test and record fuel oil samples. For detailed information on these tests, refer to *Naval Ships' Technical Manual*, chapter 541, "Petroleum Fuel Stowage, Use, and Testing," and chapter 220, volume 2, "Boiler Water/Feedwater Tests and Treatment."

Refer to *Basic Military Requirements*, NAVEDTRA 10054-F, chapter 19, for information on safety precautions to be observed when handling fuel oil.

Small Boat Engineer

Firemen, Enginemen, or Machinist's Mates from the A division are detailed as boat engineers. Boat engineers operate, clean, and inspect the section of the boats assigned to them. Boat engines are repaired by Enginemen.

When a ship is at anchor, the officers and crew usually travel to and from the shore in small boats. As a Fireman, you may be assigned as an engineer on one of these boats. You will be responsible for operating the boat's engine(s). A coxswain will be in charge of the overall operation of the boat. On some boats, two seamen may act as bow and stern hooks, or one seaman may act as bowhook and the engineer may act as sternhook.

For additional information on small boats and boat safety, refer to *Basic Military Requirements*, NAVEDTRA 10054-F, and *Seaman*, NAVEDTRA 10120-J.

ENGINEERING DEPARTMENT RATINGS

In general, the engineering department ratings require (1) an aptitude for mechanical knowledge, (2) a degree of skill in mathematics and physics, and (3) some experience in repair work. A knowledge of mechanical drawing is also desirable. Training manuals (TRAMANs) and nonresident training courses (NRTCs) covering many aspects of basic engineering are available to help you.

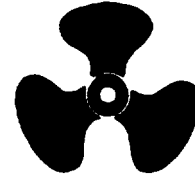
Schools for engineering ratings are available to those who qualify. You can find a list of all schools and their requirements in the *Catalog of Navy Training Courses* (CANTRAC), NAVEDTRA 10500.

In this section we will describe the titles and jobs of the various engineering ratings. The engineering ratings are classified into two occupational fields—marine engineering and ship maintenance.

MARINE ENGINEERING OCCUPATIONAL FIELD

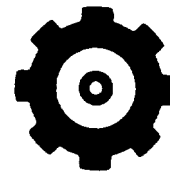
The marine engineering occupational field includes the Machinist's Mate, Engineman, Boiler Technician, Electrician's Mate, Interior Communications Electrician, Gas Turbine Systems Technician (Electrical), and Gas Turbine Systems Technician (Mechanical) ratings. In the

following paragraphs we will describe these ratings:



Machinist's Mate (MM)

MACHINIST'S MATES operate and maintain ship propulsion machinery, reduction gears, condensers, and air ejectors. They are also responsible for miscellaneous auxiliary equipment. This includes pumps, air compressors, turbine-driven generators, distilling units, valves, oil purifiers, oil and water heaters, governors, air-conditioners, refrigeration, propeller shafts, potable water systems, and ship's steering and various other hydraulic systems.



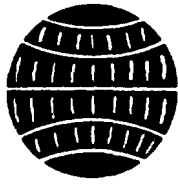
Engineman (EN)

ENGINEMEN work primarily with reciprocating engines (diesel and gasoline). They operate, maintain, and repair diesel propulsion plants and diesel engines used for ship's service generators, and supporting auxiliary equipment. Such equipment includes refrigeration and air-conditioning systems, pumps, air compressors, auxiliary boilers, distillers, and various kinds of hydraulic equipment.



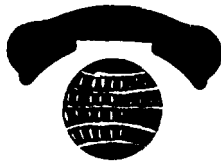
Boiler Technician (BT)

BOILER TECHNICIANS operate, maintain, test, and repair marine boilers, heat exchangers, pumps, and forced draft blowers. They also transfer, test, and take soundings and inventory of fuel and feedwater tanks.



Electrician's Mate (EM)

ELECTRICIAN'S MATES stand watch on generators and switchboards. They maintain and repair power and lighting circuits, electrical fixtures, motors, generators, distribution switchboards, and other electrical equipment. They test for grounds, or other casualties, and repair or rebuild electrical equipment in the electrical shop. They also maintain motion-picture equipment aboard ship.



Interior Communications Electrician (IC)

INTERIOR COMMUNICATIONS ELECTRICIANS operate, maintain, and repair IC systems. These systems include gyrocompass, voice interior communications, alarm, warning, ship's control, entertainment, and plotting. They also stand watches on related equipment.



Gas Turbine Systems Technician (GS)

The **GAS TURBINE SYSTEMS TECHNICIAN** rating is divided into two groups: the Gas Turbine Systems Technician (Electrical) (GSE) and the Gas Turbine Systems Technician (Mechanical) (GSM).

The GSEs operate, repair, and perform preventive and corrective maintenance on the electrical components of gas turbine engines, main propulsion machinery, auxiliary equipment, propulsion control systems, electrical and electronic circuitry in the engineering spaces, and alarm and warning circuits.

The GSMs operate, repair, and perform preventive and corrective maintenance on

mechanical components of gas turbine engines, main propulsion machinery (gears, shafts, and controllable pitch propellers), auxiliary equipment in the engineering spaces, and propulsion control systems.

**SHIP MAINTENANCE
OCCUPATIONAL FIELD**

The ship maintenance occupational field includes the Hull Maintenance Technician, Damage Controlman, Machinery Repairman, Molder, Instrumentman, Opticalman, and Patternmaker ratings. In the following paragraphs we will describe these ratings:



Hull Maintenance Technician (HT)

HULL MAINTENANCE TECHNICIANS plan, supervise, and perform tasks to fabricate, install, and repair various structures, shipboard and shore-based plumbing, and piping systems.



Damage Controlman (DC)

DAMAGE CONTROLMEN are qualified in the skills and techniques of damage control, fire fighting, and CBR defense. They must be able to take all measures required to maintain the watertight integrity of the ship. They must also be able to coordinate damage-control efforts and instruct other ratings in damage-control procedures.



Machinery Repairman (MR)

MACHINERY REPAIRMEN make all types of machine shop repairs on shipboard machinery. This work requires skill in using lathes, milling machines, boring mills, grinders, power hacksaws, drill presses, and other machine tools. It also requires skill in using hand tools and measuring

instruments usually found in a machine shop. The job of restoring machinery to good working order may range from making a simple pin or link to the complete rebuilding of an intricate gear system. Often, without dimensional drawings or other design information, a Machinery Repairman must depend on ingenuity and know-how to machine a repair part successfully.



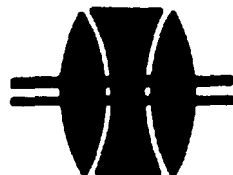
Molder (ML)

MOLDERS operate foundries aboard ship and at shore stations. They make molds and cores, rig flasks, prepare heats, and pour castings of ferrous, nonferrous, and alloy metals. They also shake out and clean castings and pour bearings.



Instrumentman (IM)

INSTRUMENTMEN perform preventive and corrective maintenance and calibration on mechanical instruments and standards and Navy timepieces. They use Navy or mechanical instrument repair and calibration shop (MIRCS) procedures.



Opticalman (OM)

OPTICALMEN perform preventive and corrective maintenance on small navigational instruments, binoculars, gun sights, range finders, submarine and turret periscopes, night vision sights, and other optical instruments.



Patternmaker (PM)

PATTERNMAKERS make wooden, plastic, plaster, and metal patterns used by Molders in a Navy foundry. They mount patterns on matchboard/match plates for production molding. Patternmakers make master patterns, full-scale layouts of wooden patterns, coreboxes, and templates. They also index and store patterns.

SAFETY PROGRAM

The objective of the Navy's Safety Program is to enhance operational readiness by reducing the frequency and severity of on- and off-duty mishaps to personnel and the cost of material and property damage attributed to accidental causes. The use of the term *safety program* in this chapter signifies both occupational safety and health.

Operating and maintenance personnel must be familiar with technical manuals and other publications concerning equipment they are working with. Personnel must continuously exercise good judgment and common sense in the setting-up and operation of all equipment to prevent damage to the equipment and injury to personnel.

Personnel can prevent damage to machinery by properly preparing and operating the equipment by following instructions and procedures outlined in the EOSS (which is discussed later in this chapter) and by being completely familiar with all parts and functions of the machinery.

You can prevent damage to the ship by operating the machinery so no loss of power occurs at an inopportune time, by keeping engines ready for service in any emergency, and by preventing hazardous conditions that may cause fire or explosion. Always maintain fire-fighting equipment in a "ready to use" state.

You can prevent injury to personnel by having a thorough knowledge of duties, by knowing how to properly handle tools and operate equipment, by observing normal precautions around moving parts, and by receiving constant training.

Other everyday safety habits you should follow include (1) preventing the accumulation of oil in the bilges or other pockets or foundations and subbases; (2) taking care, particularly when on an uneven keel, that water in the bilges does

not reach electrical machinery or wiring; and (3) ensuring that safety guards are provided at potential danger points, such as rotating and reciprocating equipment.

For personnel and machinery safety, you must adhere to the following safety precautions specifically related to the engineering department:

- Do not attempt to operate equipment by overriding automatic shutdown or warning devices.
- Tag-out and disconnect batteries or other sources of electrical power before performing maintenance. This prevents injuries from short circuits and accidental start-up of equipment.
- Avoid holding or touching spark plugs, ignition units, or high-tension leads while they are energized.
- Do not use oxygen to pressure test fuel lines and equipment.
- Take precautions to avoid inhaling vapors of lacquer thinner, trichlorethylene, and similar solvents.
- Do not wear jewelry or watches while working in machinery spaces.
- Take precautions to avoid touching exposed hot parts of an engine. Do not perform maintenance work until the engine has been shut down and cooled.
- Wear proper ear protection in all main machinery spaces.

It is the responsibility of supervisory personnel to ensure that their subordinates are instructed in and carry out the applicable safety precautions. Each individual is responsible for knowing and observing all safety precautions applicable to their living or working spaces. Refer to *Navy Safety Precautions for Forces Afloat*, OPNAVINST 5100.19.

SHIPS' MAINTENANCE AND MATERIAL MANAGEMENT (3-M) SYSTEMS

The *Ships' Maintenance and Material Management (3-M) Manual*, OPNAVINST 4790.4, describes in detail the Ships' 3-M Systems. The

primary objective of the Ships' 3-M Systems is to provide for managing maintenance and maintenance support in a way to ensure maximum equipment operational readiness. The Ships' 3-M Systems is divided into two subsystems. They are the planned maintenance system (PMS) and the maintenance data system (MDS).

PURPOSES OF PMS

The PMS was established for the following purposes:

- To reduce complex maintenance to simplified procedures that are easily identified and managed at all levels
- To define the minimum planned maintenance required to schedule and control PMS performances
- To describe the methods and tools to be used
- To provide for the detection and prevention of impending casualties
- To forecast and plan personnel and material requirements
- To plan and schedule maintenance tasks
- To estimate and evaluate material readiness
- To detect areas requiring additional or improved personnel training and/or improved maintenance techniques or attention
- To provide increased readiness of the ship

BENEFITS OF PMS

The PMS is a tool of command. By using PMS, the commanding officer can readily determine whether the ship is being properly maintained. Reliability and availability are improved. Preventive maintenance reduces the need for major corrective maintenance, increases economy, and saves the cost of repairs.

The PMS assures better records because the shipboard maintenance manager has more useful data. The flexibility of the system allows for programming of inevitable changes in employment schedules. This helps to better plan preventive maintenance.

The PMS helps leadership and management reduce frustrating breakdowns and irregular hours of work, and thus improves morale. It enhances the effectiveness of all hands.

LIMITATIONS OF PMS

The PMS is not self-starting; it does not automatically produce good results. It requires considerable professional guidance and continuous direction at each level of the system's operation. One individual must have both the authority and the responsibility at each level of the system's operation.

Training in the maintenance steps as well as in the system is necessary. No system is a substitute for the actual technical ability required of the petty officers who direct and perform the upkeep of the equipment. Because of rapid changes in the Ships' 3-M Systems, always refer to a current copy of the 3-M *Manual*.

EQUIPMENT TAG-OUT PROGRAM

An effective tag-out program is necessary because of the complexity of modern ships as well as the cost, delay, and hazard to personnel that could result from the improper operation of equipment. The equipment tag-out program is a procedure to prevent improper operation of a component, equipment, system, or part of a system that is isolated or in an abnormal condition. This procedure is also used when safety devices, such as blank flanges on piping, are installed for testing, maintenance, or casualty isolation.

The use of **DANGER** or **CAUTION** tags is not a substitute for other safety measures, such as locking valves or pulling fuses. Tags applied to valves, switches, or other components should indicate restrictions on their operation. Never use tags for identification purposes.

The procedures in this program are mandatory to standardize tag-out procedures used by all ships and repair activities. The program also provides a procedure for use when an instrument is unreliable or is not in normal operating condition. It is similar to the tag-out procedure. However, labels instead of tags are used to indicate instrument status. The tag-out program must be enforced during normal operations as well as during construction, testing, repair, or maintenance. Strict enforcement of tag-out procedures

is required by both you and any repair activity that may be working on your equipment.

RESPONSIBILITY

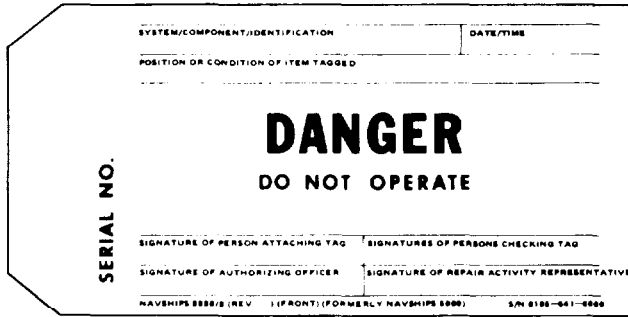
The commanding officer is responsible for the safety of the entire command. It is the duty of the commanding officer to ensure that all personnel know all applicable safety precautions and procedures and to ensure compliance with the program. The engineer officer is responsible to the commanding officer for ensuring that personnel assigned to the engineering department understand and comply with this program.

When repairs are done by a repair activity (other than ships' personnel), a dual responsibility exists for the safety of the personnel making repairs. The ship tended is responsible for controlling the tag-out program and ensuring that the systems that require work are properly tagged-out. The repair activity is responsible for ensuring that this is done properly. They verify this by signing the appropriate space on the tag-out sheet and the tag.

PROCEDURES

After identifying the need to tag-out an item or a system, you must get permission from an authorizing officer. The authorizing officer for the engineering department is the engineering officer of the watch (EOOW) while under way or the engineering duty officer (EDO) while in port. If the item or system tagged is placed out of commission, the authorizing officer must get permission from the engineer officer and the commanding officer. When permission has been received, the authorizing officer then directs you to prepare the tag-out record sheet and tags.

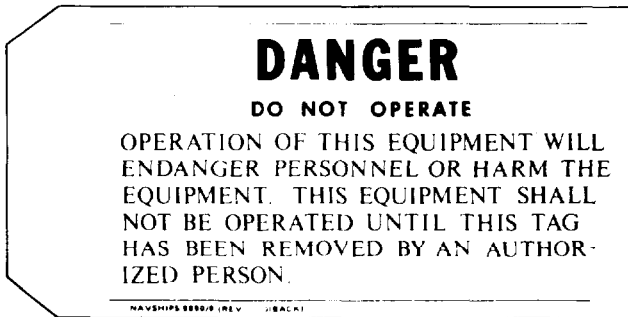
Normally, the petty officer in charge of the work fills out and signs the record sheet and prepares the tags. The record sheet is filled out for a stated purpose. All tags for that purpose are normally listed on one record sheet. Each sheet is assigned a log serial number. All tags associated with it are given the same log serial number and a sequential number is entered on the record sheet. For example, tag E107-4 is the fourth tag issued on the record sheet with the log serial number 107 for engineering.



BLACK LETTERING ON RED TAG

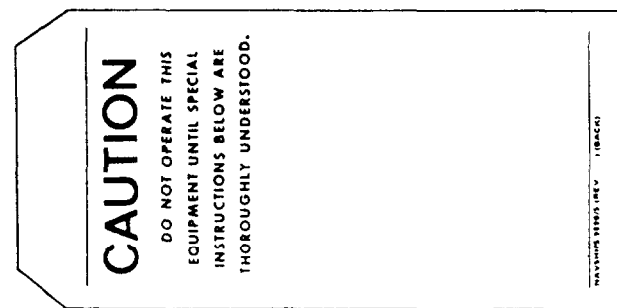


BLACK LETTERING ON YELLOW TAG



67.330

Figure 1-2.—Danger tag.



67.329

Figure 1-3.—Caution tag.

The record sheet includes reference to any documents that apply—such as PMS, technical manuals, and other instructions, the reason for the tag-out, the hazards involved, any amplifying instructions, and the work necessary to clear the tags. Use enough tags to completely isolate the item or system being worked on. This will prevent operation from any and all stations that could exercise control. Indicate the location and condition of the tagged item by the simplest means (for example, FOS-11A, closed).

When attaching the tags, you must ensure that the item is in the position or condition indicated on the tag. As you attach each tag, you then must sign the tag and initial the record sheet. After all tags are attached, a second qualified person ensures the items are in the position and condition indicated, and verifies proper tag placement. That person also signs the tags and initials the record sheet.

TYPES OF TAGS

The following sections describe the various tags and the applications required to be used from time to time.

Danger Tag

A danger tag is a **RED** tag (fig. 1-2) used to prohibit the operation of equipment that could jeopardize the safety of personnel or endanger equipment. Under no circumstances should equipment be operated when tagged with **DANGER** tags.

Caution Tag

A caution tag is a **YELLOW** tag (fig. 1-3) used as a precautionary measure to provide temporary special instructions or to indicate that unusual caution must be exercised to operate equipment. These instructions must give the specific reason that the tag was installed. The use of such phrases as **DO NOT OPERATE WITHOUT EOOW PERMISSION** is **NOT APPROPRIATE** since equipment or systems are not operated unless permission has been granted by responsible authority. A **CAUTION** tag is **NOT** used any time personnel or equipment can be endangered while performing evolutions using normal operating procedures; a **DANGER** tag is used in this case.

OUT OF COMMISSION	
SERIAL NO.	DATE
AUTHORIZED BY/ CONCURRENCE	
BY	
TAG BY	TIME

Figure 1-4.—Out-of-commission label (colored red).

Out-of-Commission Labels

Out-of-commission labels are **RED** labels (fig. 1-4) used to identify instruments that do not work properly because they are defective or isolated from the system. This indicates the instrument cannot be relied on and must be repaired and recalibrated, or be reconnected to the system before use.

Out-of-Calibration Labels

Out-of-calibration labels are **ORANGE** labels (fig. 1-5) used to identify instruments that are out of calibration and may not work properly. This label indicates the instrument may be used for system operation only with extreme caution.

ENFORCEMENT

The tag-out log is kept in a designated space, usually CCS. Supervisory watch standers review the log during watch relief. Active tag-outs are spot checked periodically to ensure tag integrity is being maintained.

An audit of the tag-out log is conducted by the EDO every 2 weeks while in port, prior to getting under way, and weekly if in the yards or at a maintenance availability. Results of the audit are reported to the engineer officer.

OUT OF CALIBRATION	
SERIAL NO.	DATE
AUTHORIZED BY/ CONCURRENCE	
BY	
TAG BY	TIME
ERROR	

Figure 1-5.—Out-of-calibration label (colored orange).

To ensure that tag-out procedures are enforced properly, the engineer officer checks the log frequently, noting any errors and bringing them to the attention of the proper personnel.

ENGINEERING OPERATIONAL SEQUENCING SYSTEM

The Navy has developed a system known as EOSS. Essentially, the EOSS is to the operator as the PMS is to the maintainer.

Main propulsion plants in Navy ships are becoming more technically complex with each new class of ship. Increased complexity requires increased engineering skills for proper operation. Ships that lack experienced personnel have material casualties. These casualties jeopardize operational readiness. Rapid turnover of engineering personnel further compounds the problems of developing and maintaining a high level of operator and operating efficiency.

The Navy has been increasingly aware of these problems. An evaluation of the methods and procedures used in operating engineering plants has been completed. The results of these studies show that sound operating techniques were not always followed. Some unusual circumstances found to be prevailing in engineering plants are as follows:

- The information needed by the watch stander was scattered throughout publications that were not readily available.
- The bulk of the publications were not systems oriented. Reporting engineering personnel had to learn specific operating procedures from “old hands” presently assigned. Such practices could ultimately lead to misinformation or degradation of the transferred information. These practices were costly and resulted in nonstandard operating procedures, not only between adjoining spaces, but also between watch sections within the same space.
- Posted operating instructions often did not apply to the installed equipment. They were conflicting or incorrect. Procedures for aligning the various systems with other systems were not provided.

- The light-off and securing schedules were prepared by each ship and were not standardized between ships. The schedules were written for general, rather than specific, equipment or systems. They did not include alternatives between all the existing modes of operation.

Following these studies, NAVSEA developed the EOSS. It is designed to help eliminate operational problems. The EOSS involves the participation of all personnel from the department head to the watch stander. The EOSS is a set of systematic and detailed written procedures. The EOSS uses charts, instructions, and diagrams developed specifically for the operational and casualty control function of a specific ship's engineering plant.

The EOSS is designed to improve the operational readiness of the ship's engineering plant. It does this by increasing its operational efficiency and providing better engineering plant control. It also reduces operational casualties and extends the equipment life. These objectives are accomplished first by defining the levels of control; second, by operating within the engineering plant guidelines; and last, by providing each supervisor and operator with the information needed. This is done by putting these objectives in words they can understand at their watch station.

The EOSS is composed of three basic parts.

- *The User's Guide*
- The engineering operational procedures (EOP)
- The engineering operational casualty control (EOCC)

EOSS USER'S GUIDE

The *User's Guide* is a booklet that explains the EOSS package and how to use it to the ship's best advantage. It has document samples and explains how they are used. It provides recommendations for training the ship's personnel using the specified procedures.

The EOSS documentation is developed using work-study techniques. All existing methods and procedures for plant operation and casualty control procedures are documented. These include the actual ship procedures as well as those procedures contained in available reference sources.

Each action is subjected to a serious review to measure the completeness of the present methods. At the completion of this analytic phase, new procedural steps are developed into an operational sequencing system. Step-by-step, time-sequenced procedures and configuration diagrams are prepared to show the plant layout in relation to operational components. The final step in the development phase of an EOSS is a validation on board ship. This is done to verify technical accuracy and adequacy of the prepared sequencing system. All required corrections are made. They are then incorporated into the package before installation aboard ship.

The resulting sequencing system provides the best tailored operating and casualty control procedures available that apply to a particular ship's propulsion plant. Each level is designed with the information required to enable the engineering plant to respond to any demands placed upon it.

ENGINEERING OPERATIONAL PROCEDURES

The EOP has all the information necessary for the proper operation of a ship's engineering plant. It has guides for scheduling, controlling, and directing plant evolutions through operational modes. This includes receiving shore services, to various modes of in-port auxiliary plant steaming, to underway steaming.

The EOP documentation exists for specifically defined operational stages. These are defined as stages I, II, and III.

Stage I deals with the total engineering plant under the direct responsibility of the plant supervisor (EOOW). The EOOW coordinates the placing in operation and securing of all systems and components normally controlled by the various space supervisors. This person also supervises those functions that affect conditions internal to the engineering plant, such as jacking, testing, and spinning main engines. The EOP documentation helps the plant supervisor guarantee optimum plant operating efficiency, proper sequencing of events in each evolution, and the training of newly assigned personnel. During a plant evolution, the EOOW appoints control and operation of the following systems and components:

- Systems that interconnect one or more engineering plant machinery spaces and electrical systems.

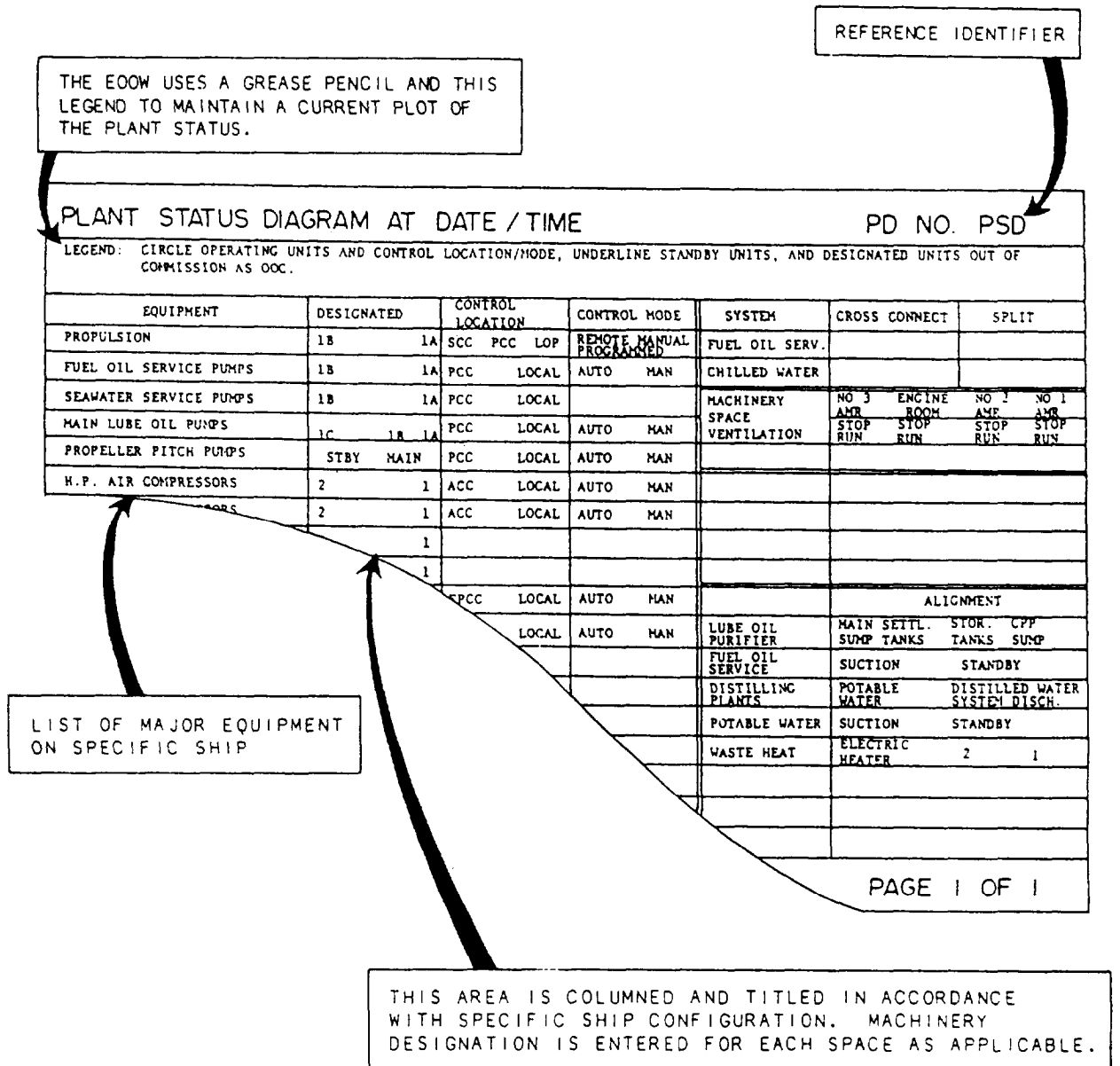


Figure 1-6.—Sample plant status diagram.

- Systems and components required to support the engineering plant or other ship functions, such as distilling plants, air compressors, fire pumps, and auxiliaries. These are placed in operation or secured in response to demand upon their services.

To assist the plant supervisor with these operations, the EOP section provides the following documents:

- Index pages listing each document in the stage I station by identification number and title.

- Plant status diagrams (fig. 1-6) providing a systematic display of the major systems and cross-connect valves as well as a graphic presentation of the major equipment in each machinery space. These diagrams are used to maintain a current plot of systems' alignment and equipment operating status.

- A diagram for plant steaming conditions used to outline the best generator combinations. This diagram shows the preferred electric power generator combinations for

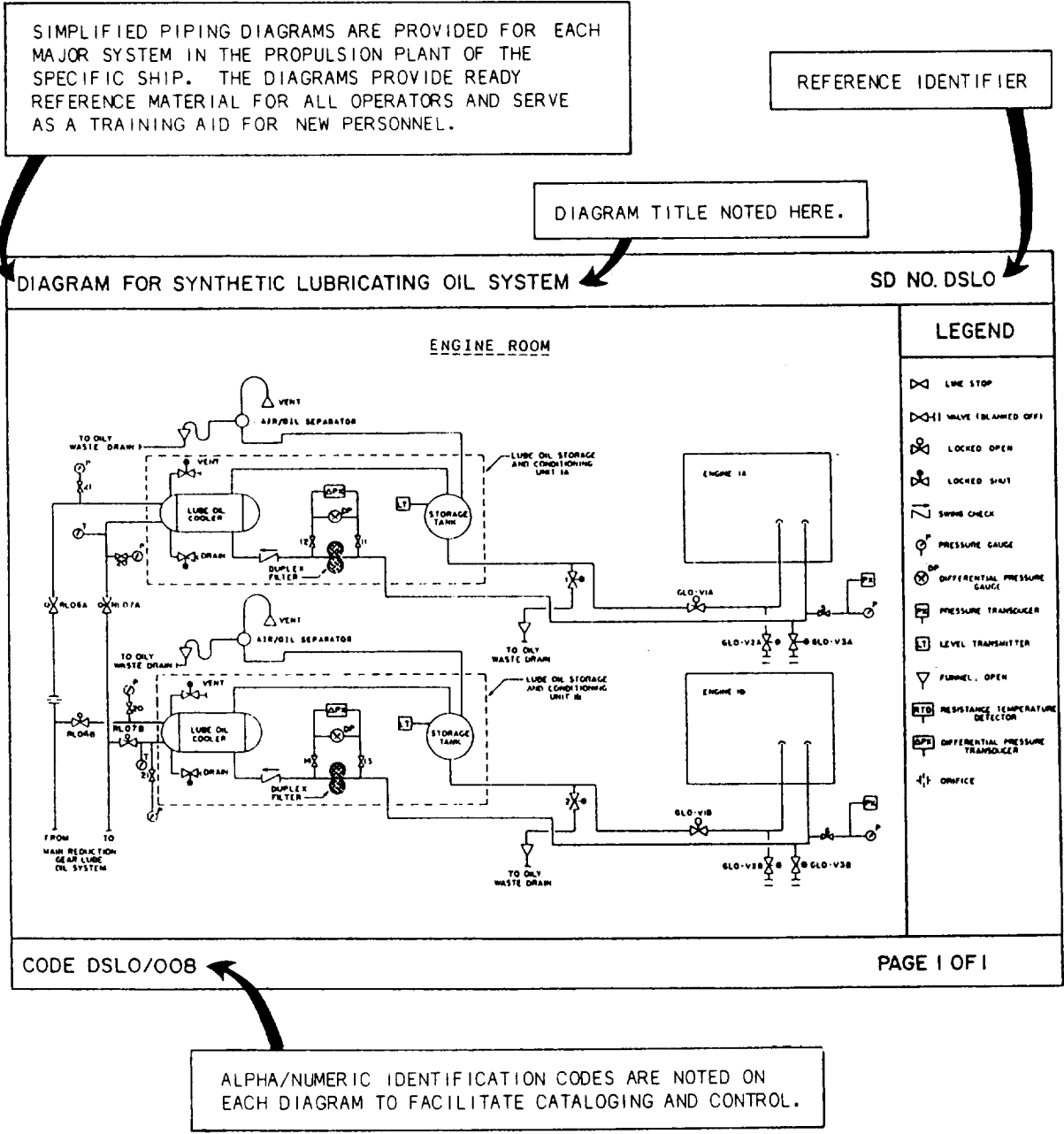


Figure 1-7.—Sample training diagram.

- the various plant operating conditions. This diagram is also provided in the stage II electrical documentation.
- System alignment diagrams showing the preferred initial and final alignment for each engineering plant.
- A diagram for equipment versus speed requirement delineating the equipment normally required for various ship speeds.
- A diagram that shows the location of shore service connections. This diagram traces the connections for steam, electrical power, feedwater, potable water, firemain, and fuel oil.
- Training diagrams (fig. 1-7) outlining each major piping system to aid in plant familiarization and training of personnel. These diagrams indicate the relative locations of lines, valves, and equipment.

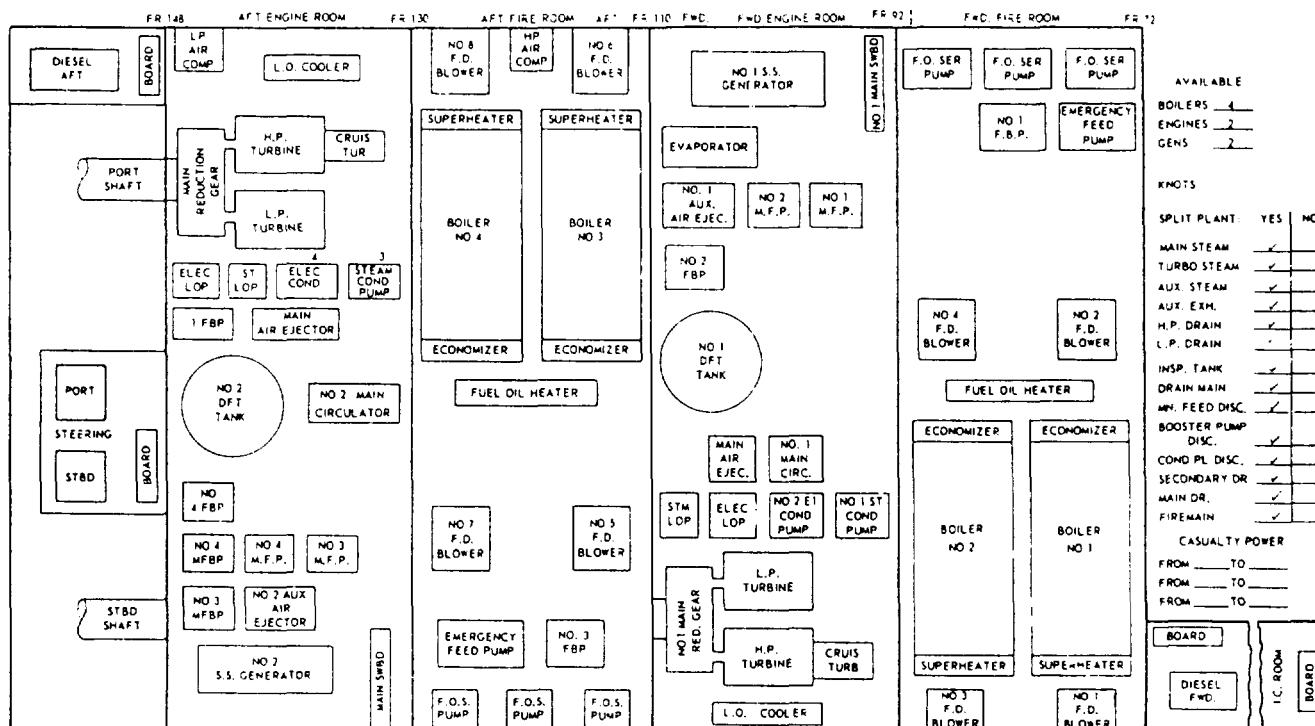


Figure 1-8.—Casualty control board.

Stage II deals with the system component level under supervision of the space supervisor. In stage II, the space supervisor accomplishes the tasks delegated by the plant supervisor (EOOW under way and EDO in port). The EOP documentation assists the space supervisor in properly sequencing events, controlling the operation of equipment, maintaining an up-to-date status of the operational condition of the equipment assigned, and training personnel. To assist the space supervisor in the effort, the EOP section provides the following stage II documents:

- Index pages listing each document by identification number and title for each specified operating group, such as engine rooms (ERs), auxiliary machinery rooms (AMRs), or electrical systems.
- Space procedure charts providing the step-by-step procedures to accomplish and support the requirements of the plant procedure charts.
- Space status board providing a layout of major systems. Allows maintenance personnel and watch standers a visual plot as to the systems alignment and equipment operating status. This board is similar in configuration to the casualty control board

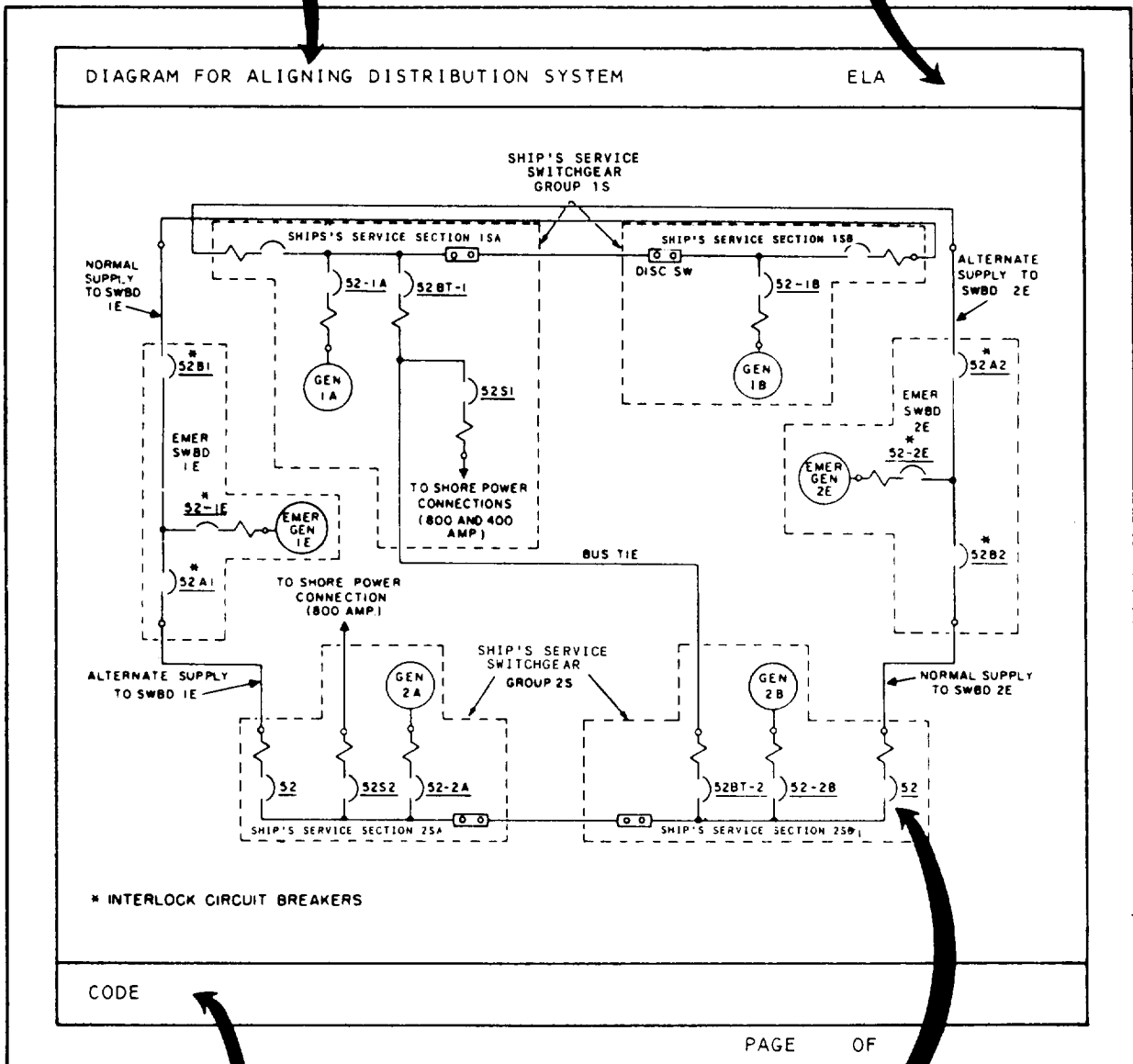
for the stage I documentation shown in figure 1-8.

- Diagram for electrical plant status showing generators, switchboards, and shorepower connections within the electrical distribution systems. This diagram is provided in both the electrical operating group and in the stage I (EOOW) documentation for maintaining a plot of the system alignment.
- Diagram for plant steaming conditions used to plan the best generator combinations provided in the electrical operating group documentation. This specifies the preferred electric power generator combination. This diagram is the same as that provided in the stage I documentation.
- Training diagrams of each major piping system developed for stage I. Other diagrams include individual systems, such as the fuel oil and main engine lube oil systems located within the machinery spaces.

Stage III deals with the system component level under the supervision of component operators. The component operators place

DESCRIPTION OF SPECIFIC DIAGRAM. OPERATIONAL DIAGRAM IS PROVIDED WHEN NECESSARY TO CLARIFY OPERATIONAL PROCEDURE SET FORTH IN A COMPONENT/SYSTEM PROCEDURE CARD.

REFERENCE IDENTIFIER



IDENTIFIER FOR CATALOGING AND DOCUMENT CONTROL.

SIMPLIFIED SCHEMATIC OF SPECIFIC SYSTEM UNDER CONSIDERATION. COMPONENT IS NUMBERED TO FACILITATE SYSTEM ALIGNMENT BY OPERATOR AS HE REFERS TO THE RELATED PROCEDURE CARD.

Figure 1-9.—Component/system alignment diagram.

equipment in and out of operation, align systems, and monitor and control their operation. Stage III documents include the following:

- Index pages listing each document by identification number and title for each specific system, such as the fuel oil and lube oil service systems.
- Component procedure cards providing step-by-step procedures for systems' alignment or component operation.
- Component procedure cards as required to support each operation or alignment.
- Alignment diagrams (fig. 1-9) amplifying the written procedure to assist the component

operator in proper systems' alignment. An alignment diagram is used whenever two or more alignment conditions exist for a given system or component.

The operational use of EOP documentation is of primary importance at all levels in controlling, supervising, and operating the engineering plant.

ENGINEERING OPERATIONAL CASUALTY CONTROL

The EOCC is the casualty control portion of the EOSS. It contains information relevant to the recognition of casualty symptoms and their probable causes and effects. Also, it has information on actions taken to prevent a casualty. It specifies procedures for controlling single- and multiple-source casualties.

Casualty prevention must be the concern of everyone on board. Proper training of all personnel must provide an adequate knowledge and experience in effective casualty prevention. The EOCC manual has efficient, technically correct casualty control and prevention procedures. These procedures relate to all phases of an engineering plant. The EOCC documents possible casualties that may be caused by human error, material failure, or battle. The EOCC manual describes proven methods for the control of a casualty. It also provides information for prevention of further damage to the component, the system, or the engineering plant.

The EOCC manuals (books) are available at each watch station for self-indoctrination. The manuals contain documentation to assist engineering personnel in developing skills in controlling casualties to the ship's propulsion plant.

Skill in EOCC procedures is maintained through a well-administered training program. Primary training concentrates on the control of single-source casualties. These are casualties that may be attributed to the failure or malfunction of a single component or the failure of piping at a specific point in a system. Advanced training concentrates on controlling multiple casualties or on conducting a battle problem. An effective, well-administered watch-stander training program will contain, as a minimum, the following elements:

- Recognition of the symptoms
- Probable causes

- Probable effects
- Preventive actions that may be taken to reduce, eliminate, or control casualties

An EOSS package is not intended to be forgotten once it is developed and installed aboard a ship. It offers many advantages to the ship's operational readiness capabilities. It also provides detailed step-by-step sequencing of events for all phases of the engineering plant operation. Because it is work studied and system oriented, the EOSS provides the basic information for the optimum use of equipment and systems. It does this by specifying correct procedures tailored for a specific plant configuration.

The EOSS is not intended to eliminate the need for skilled plant operators. No program or system can achieve such a goal. The EOSS is a tool for better use of personnel and skills available. Although the EOSS is an excellent tool for shipboard training of personnel, it is primarily a working system for scheduling, controlling, and directing plant operations and casualty control procedures.

WATCH-STANDING DUTIES AND RESPONSIBILITIES

As a Fireman, you maybe assigned to one of many different types of ships. On these ships, the engineering spaces vary in size and appearance. On a steam-driven ship, the boilers, the main engines, and their associated equipment may be in one space; or the boilers and their equipment may be in one space and the main engines and their equipment in another. Regardless of the number of boilers and main engines, the watches on most ships are basically the same. Therefore, this information is general in nature and does not apply to a specific class of ship.

When working with a variety of propulsion, auxiliary, and electrical equipment, you will stand various watches that range from main switchboards to security watches or other watches, depending on your ship's organization. When standing these watches, you will be required to perform many tasks. These include logging meter readings, inspecting equipment for leaks, and preventing fire hazards. This section has information on watches and duties that you may be required to perform. As you progress and become better acquainted with the fireroom and engine room, you will stand watches under the

supervision and instruction of a petty officer. You will learn to operate equipment using EOSS by following the ship's EOP and EOCC procedures.

In the following paragraphs we will discuss the EOOW, the watch stander from whom you will take your directions. We will also describe the various watches that pertain directly to you.

ENGINEERING OFFICER OF THE WATCH

The EOOW is the officer on watch in charge of the main propulsion plant and of the associated auxiliaries. On some types of ships, the EOOW is normally a senior petty officer. The EOOW is primarily responsible for the safe and efficient performance of the engineering department watches (except damage control) associated with the equipment in his or her charge. The engineer officer determines if an officer or petty officer of the engineering department is qualified to perform the duties of the EOOW. When the engineer officer considers the officer or petty officer qualified in all respects, he or she assigns that person to the watch. The engineer officer or, in his or her absence, the MPA is authorized to direct the EOOW concerning the duties of the watch when such action is considered necessary.

DAMAGE CONTROL CENTRAL WATCH

Damage control central (DCC) on most ships is manned around the clock when the ship is in port and under way. The DCC watch is responsible for the supervision and maintenance of the material condition of readiness in effect on the ship at all times. As a watch stander in DCC, you will be required to maintain the Damage Control Closure Log. You will also be responsible for the damage control log. On this log you will make entries of the firemain pressure, the number of pumps on the firemain, and several other entries. You will also make hourly status reports to the officer of the deck (OOD).

SOUNDING AND SECURITY

As a Fireman, you will be required to stand sounding and security watches. While on this type of watch, you are the ship's first line of defense in maintaining watertight integrity. Your primary mission is to look for fire and flooding hazards. On some ships, this watch is set from the end of the working day until 0800 the next morning. It

is also in effect during holiday routine. The watch is particularly needed at these times because fewer personnel are working aboard the ship; certain spaces that require frequent observation are not under the normal observation of personnel working in or near them. On most ships, sounding and security watches are stood around the clock. When standing this watch, besides looking for fire and flooding hazards, you may take readings on the air-conditioning and refrigeration plants. You may also have to ensure no freshwater spigots are leaking or have been left running in heads, laundries, galleys, and pantries. Another of your responsibilities is to maintain the proper material readiness conditions by checking all watertight air ports, doors, hatches, scuttles, and other damage-control fittings. You must report any irregular condition (change in soundings, violations of material condition, fire hazards, and so forth) to your watch supervisor.

You will use a sounding tape to take soundings. The sounding tape is a steel tape coiled on a reel suitable for being held while the tape is lowered. The tape is weighted at the end so that it can be lowered into the sounding tube.

When taking a sounding, you will notice that water is relatively hard to see on a brass or bronze sounding rod. If you have problems reading the level, dry the rod or tape thoroughly and coat it with white chalk or indicating paste before you take a sounding. When the chalk becomes wet, it turns to a light-brown color. For example, if there are 6 inches of water in a tank when you take a sounding, the light-brown color of the chalk will be distinctly visible up to the 6-inch mark. The remainder of the sounding rod will still be covered with the white chalk.

NOTE: The chalk method is used only where water may be present. Water-indicating paste will not change color with fuel oil and is often used by the oil king to determine if there is water at the bottom of a fuel tank. Always remember never to use the same sounding tape in a fresh water tank sounding that had been used for fuel, oil, or any other purpose other than fresh water.

MESSENGER OF THE WATCH

The messenger of the watch performs a number of important duties that involve great responsibility. The messenger is usually assigned as the sound-powered telephone talker. This occurs when the ship is undergoing close maneuvering conditions with other ships, entering

or leaving port, or refueling or replenishing from another ship. Since the sound-powered telephones provide communications between all the engineering spaces, you must know the proper procedures. When you talk, speak slowly and distinctly. Pronounce the syllables of each word very clearly. When you receive a message, or are given a message to transmit, repeat it word for word, exactly as it was given to you. Do not engage in any idle chatter.

As the messenger of the watch, you will also perform other duties as assigned by the petty officer of the watch. These duties include checking operating machinery and recording temperature and pressure readings in the appropriate logs.

The operating log is an hourly record of operating pressures and temperatures of almost all operating machinery. The log readings include lube oil and boiler pressures and temperatures, pump suction and discharge pressures, and other items needed to operate the engineering plant. You will have to write and print legibly. You also have to spell common Navy terms correctly and maintain your logs neatly and accurately. You should know the proper operating and limiting or danger pressures and temperatures of your equipment. This allows you to know when a piece of machinery or equipment is not operating properly.

COLD-IRON WATCH

When a ship stops operating its own plant and is receiving services from shore or other ships, the ship is considered to be in a cold iron status. A security and fire watch is usually set by each department. This watch is called the cold-iron watch.

Each cold-iron watch makes frequent inspections of the assigned area and looks for fire hazards, flooding, or other unusual conditions throughout the area. The watch sees that no unauthorized persons are in the watch area; that all spaces are cleaned; and that no tools, rags, gear, and the like are left adrift. The watch also keeps the bilges reasonably free of water. (**NOTE:** You must get permission to pump water from the duty engineer officer and the OOD.)

The watch makes hourly reports to the OOD or the DCC watch on all existing conditions. Any unusual conditions are reported to the OOD or DCC immediately. They can notify the department responsible to take the necessary corrective measures.

When hot work is done in the watch area, the cold-iron watch ensures that a fire watch is stationed. The fire watch stands by with a CO₂ extinguisher. If a fire watch has not been stationed, the cold-iron watch stops all work until a fire watch can be stationed. The cold-iron watch then carries out all pertinent orders.

If the ship is in dry dock, the cold-iron watch will check all sea valves after working hours. This is to ensure that the valves are secure or blanked off. The cold-iron watch also ensures that no oil is pumped into the dry docks at any time. The watch will not allow any weights, such as fuel oil or feedwater, to be shifted without permission of the engineer officer or DCA.

BURNERMAN

The burnerman is responsible for cutting burners "in" and "out" as directed by the boiler technician of the watch (BTOW). The burnerman must keep a close check for dirty atomizers and change them when authorized by the BTOW. The burnerman must always be assisted by another watch stander when lighting fires or cutting in additional burners. This procedure will ensure that fires are safely lit and are burning properly, that no fuel leaks, and that fires can be quickly secured if a casualty occurs.

CHECKMAN/UPPER-LEVEL WATCH

On ships that do not have automatic feedwater controls, the checkman is responsible for operating the feed check valve and maintaining the proper water level in the steam drum. This is the checkman's only responsibility. On ships that have automatic feedwater controls, a checkman is not needed unless the control is shifted from automatic to manual. The responsibilities of the upper-level watch include (1) the operation of the forced draft blowers, deaerating feed tank, and all boiler-related equipment on the upper level; (2) surface blowing; (3) starting and stopping machinery; (4) opening and closing valves; (5) monitoring gauges; and (6) aligning systems.

FIREROOM LOWER-LEVEL

The fireroom watch is responsible for starting, stopping, and maintaining proper levels and pressures on all boiler-related equipment on the lower level. This equipment will normally include the main feed booster pumps and the fuel oil

service pumps. The fireroom watch may also assist the burnerman in lighting fires in the boiler. This watch may also assist in shifting suction tanks on fuel oil, fresh water, feedwater, and shifting cooling water strainers and fuel oil strainers.

THROTTLE WATCH

The tasks of a throttleman at the main engines are critical. Orders from the bridge concerning the movement of the propellers must be complied with immediately. To make correct adjustments for the required speed, you must keep a close watch on the revolutions-per-minute (rpm) indicator on the throttle board. You have to open or close the throttle, as required, to achieve or maintain the necessary rpm. Besides handling the throttle itself, you may also have to operate a variety of associated valves; accurately log all speed changes in the Engineer's Bell Book; visually check all gauges (pressure, temperature, vacuum, and so forth) installed on the throttle board; and keep the petty officer in charge informed of any abnormal gauge readings.

You should become thoroughly familiar with all the gauges, instruments, and indicators on the throttle board to know what the normal readings are. Some of these include the steam, feedwater, and cooling water pressure gauges, steam temperature thermometers, the rpm indicator, the EOT, gauges indicating the vacuum obtained in the main engine low-pressure turbine, and others. Whenever an opportunity presents itself, study the throttle board and ask questions. Do not hesitate to ask the operator which readings are normal. Ask which readings are appropriate for steaming conditions. After learning the difference between a normal reading and an abnormal reading, you will be able to help prevent a major casualty. You will recognize an abnormal reading and can report it to the petty officer in charge of the watch.

ENGINE ROOM UPPER-LEVEL WATCH

When you are assigned to the duties of the upper-level watch in the engine room, you will have to perform the following tasks:

- Record periodic temperature and pressure readings from various gauges on, or connected to, the upper-level machinery.
- Make required valve adjustments to correct conditions indicated by slight

variations from the normal readings, and report unusual conditions to the petty officer in charge.

- Maintain a normal water level in the deaerating tank, if it is located in the engine room, by adjusting the excess and makeup feed valves.
- Light off and secure turbogenerators and other upper-level machinery, as ordered.
- Maintain an adequate gland seal pressure on the turbogenerator.

ENGINE ROOM LOWER-LEVEL WATCH

You will be assigned to the engine room lower level to assist the lower-level watch (pumpman). You will be involved with a number of pumps and other auxiliary machinery. Some of the pumps and equipment with which you will work are the main lube oil pumps and lube oil coolers; the main condensate pumps and main condenser; the main feed pumps; the main feed booster pumps; the fire pumps; and when they are installed in the engine room, air compressors.

Besides learning the proper procedures for starting, operating, and stopping the pumps and equipment, you must make various checks of the operating machinery. Some of the checks for the main feed pump, the lube oil pump, and the main condensate pump are described in the sections that follow.

Main Feed Pump

You will have to comply with the posted instructions and safety precautions for the machinery and equipment at the main feed pump station. When assisting the pumpman, you will also perform the following duties:

- Maintain the main feed pump discharge pressure at a predetermined value by adjusting the constant pressure governor.
- Keep the main feed pump bearings at the proper temperature by regulating the flow of water through the feed pump lube oil cooler.
- Check to ensure the lube oil pressure to the bearings is correct.

- Keep the shaft packing glands adjusted properly. A small amount of leakage is necessary to prevent burning out the packing, but excessive leakage wastes boiler feedwater.
- Check and maintain the proper lube oil level in the main feed pump sump tank.
- Keep the valve packing glands tightened to prevent leakage.
- Keep the watch station clean; remove fire hazards by wiping up oil and picking up rags and other stray gear.
- Keep alert for unusual sounds, vibrations, temperatures, and pressures from operating equipment.
- Keep the standby pump ready for instant use.

Lube Oil Pump

The following are duties you will perform while assisting the pumpman at the lube oil pump station:

- Maintain the proper lube oil pump discharge pressure and the proper lube oil temperature.
- Keep the standby pump on automatic standby.
- Shift and clean the main lube oil strainers at least once each watch.
- Check the lube oil system for leaks, and maintain the proper oil level in the main engine sump tank.
- Operate the lube oil purifier as directed.
- Regulate the cooling water flow through the lube oil cooler to maintain the correct oil outlet temperature.

Main Condensate Pump

The following are duties you will perform while assisting the pumpman at the main condensate pump station:

- Keep the condensate in the condenser hot well at the proper level.

- Frequently check the exhaust trunk and main condenser overboard for abnormal temperatures.
- Check the main condensate pump bearings for proper oil pressure and temperature.
- Start or secure an additional pump, as required, to keep the condensate level at the correct height.
- Constantly check for unusual conditions (vibrations, sounds, and high or low temperatures or pressures) of operating equipment.

All watch standers should be constantly alert for signs of leakage in all parts of the steam and water systems. The following are some of the more common causes of feedwater waste:

- Leaks in pipe fittings, flanges, valve and pump packing glands, pump housings, and relief valves
- Excessive gland sealing steam

Remember, a poorly operated plant reflects on the ability of the watch stander.

SHAFT ALLEY WATCH

Another main engine duty is that of keeping watch on the bearings of the propeller shafts leading from the reduction gears (or motors of a turboelectric-driven ship) to the ship's propellers. As a shaft alley watch stander, you may perform the following duties:

- Check all spring bearings for proper lubrication. This includes correct oil level, condition of the oil, proper operation of self-oiling devices (ring or chain), and bearing temperature.
- Check and adjust the stern tube gland for the correct amount of leak-off.
- Pump the shaft alley bilge, as authorized by the EOW and OOD.
- During high speed, keep alert and observe any abnormal rise in bearing temperature.
- Report hourly, by phone, to the control engine room under normal conditions and if abnormal conditions develop.
- Operate the main thrust bearing when it is located in the shaft alley.

EVAPORATOR WATCH

A ship requires a large amount of pure fresh water daily for use as boiler feedwater, for corrosion control (freshwater wash down), and for the crew's consumption. However, a ship can only store enough water to last a few days. Therefore, proper and careful watches must be maintained on the evaporators whenever they are in operation. An evaporator watch has to constantly check on pressures, temperatures, vacuum, and salt content of the distilled water. A ship cannot operate if the distilled water for feedwater contains more than the maximum allowable amount of salt.

WATCH, QUARTER, AND STATION BILL

Each division officer prepares a watch, quarter, and station bill for his or her division. You will generally find the following information on this bill:

- Organization of the division (sections and watches).
- A listing of each person as to billet number, locker number, bunk number, compartment number, name, rating, and rate (actual and allowance).
- Watch assignments for each person under various conditions of battle readiness.
- The station and job each person will have in emergency situations, such as fire, rescue and assistance, and general emergency.

- The special duties and stations each person will have. The special duties may include visit and search party, landing force, special sea detail, and other special duties.

The watch, quarter, and station bill tells you where you fit into the ship's organizational picture. Check it frequently; it is your duty to know where you belong under all conditions. **THERE IS NO EXCUSE FOR NOT KNOWING.** The bills may be designed differently for different ships, but the stations and duties are always about the same. The bill assignments are for actual emergencies and drills. Billets are assigned according to the skills and the qualifications of the personnel in the division. Refer to *Basic Military Requirements*, NAVEDTRA 10054-F, for more information about the watch, quarter, and station bill.

SUMMARY

This chapter has covered information on standard ship and engineering organization and engineering administration, ratings, and programs, such as safety, PMS, tag-out, and EOSS. You have learned about the various watches of the engineering department. Do not become overwhelmed by the many things you must learn to be an effective watch stander. Keep your ears and eyes open, and above all, ASK QUESTIONS. If you desire to advance in the Navy, you should study the publications mentioned in the *Advancement Handbook for Apprenticeships*, NAVEDTRA 71700, and the *Advancement Handbook for Petty Officers* (the NAVEDTRA number is rate specific; ask your division training officer for assistance).

