atmosphere the safety lamp burns with a normal flame. If the oxygen content becomes lower than normal, the flame grows dim. When the oxygen content gets as low as 16.25 percent, the flame will go out. This is its primary purpose and the only one for which it should intentionally be used.

2. Lamp Not for Use in Flammable Gases. If there is any suspicion that a compartment or space may contain flammable or explosive gases, the flame safety lamp should not be used. There are combustible gas indicators for this purpose. However, if the flame safety lamp is inadvertently taken into a space which contains flammable or explosive gases, it is very important that the operator understand its indications.

3. Indications of Flammable Gases. In air containing flammable gases, some of the gas inside the lamp nearest the flame will burn and thus increase the length of the lamp flame. If there is a sufficient concentration of explosive gas, an explosion will occur inside the lamp, but the cooling effect of the gauzes will keep the explosion inside the lamp. The lamp will not give protection, however, against explosive mixtures of hydrogen or acetylene and must therefore never be taken into spaces where these gases may exist.

a. Action of Flame.	Condition of Air.
Goes out rapidly.	Lack of sufficient oxygen to support combustion.
Goes out with slight "pop".	Concentration of explosive gases.
Flares up brightly.	Lean concentration of explosive gases.
Flares up, then goes out.	Rich concentration of explosive gases.

b. Any time the flame changes from its normal height and condition, carefully remove the lamp and check the air with an explosimeter, if available. Otherwise, after removing the lamp slowly and cautiously, ventilate the space thoroughly before testing again.

c. The person using the lamp must be competent, careful, and possess good eyesight. He must not be color blind.

d. Grasp the lamp by the fuel font and hold it upright. Do not set it on the deck, as it may be knocked over. It is much safer to hang it up somewhere.

e. Place the lamp into and withdraw it from the compartment very slowly. Hasty entry or withdrawal will tend to draw the flame through the gauzes, igniting any gas in the immediate vicinity. (You are there, too!)

f. When the presence of flammable or explosive gas is indicated, do not move the lamp any farther into the area. Get out and report the lamp's indications. You might be approaching layers of gas that

will explode. (With you right in the middle.)

H. Safety Precautions in the Use of the Flame Safety Lamp.

1. NEVER use the lamp in any space suspected or known to contain acetylene or hydrogen. These gases are so light that they will penetrate the gauzes, be ignited by the flame, and result in a violent explosion.

2. Always examine the lamp carefully before using it.

3. Do not use a lamp that has rust, dirt, soot or oil on the gauzes. Clean them with a fine wire bristle brush.

4. Do not use gauzes for any great length of time. Heat of the flame oxidizes the wire, increasing the size of the mesh openings and rendering the lamp dangerous.

5. Do not use a lamp with a gummy, sooty or crusted wick. It produces an unstable flame.

6. Do not carry the key with the lamp.

a. Any attempt to open the lamp in area tested if the flame goes out is hazardous.

b. The lamp should only be lit or relit outside suspect area, and only with the built-in spark igniter.

7. Having detected gas, do not repeatedly put the lamp into the area.

a. Remove gas by thorough ventilation.

b. Inspect for possible leaks before retesting.

8. Avoid getting water on the glass chimney when the lamp is in operation.

9. Do not let the flame smoke.

10. Do not set the lamp down on deck. It may be knocked over. Hang it up by its hook.

11. After fueling:

a. Invert the lamp and remove excess fuel.

b. Thoroughly wipe the outside of the font dry. Excess fuel remaining on font may evaporate when the lamp warms up, enter the flame chamber, and give false indications or possibly cause an explosion.

12. When assembling the lamp, use only replacement parts for the particular make of lamp you have. Parts are not interchangeable.

13. Make sure there are no parts missing.

14. Always put the lamp into, or remove the lamp from, a suspect area slowly and with care. Too rapid movement may draw flame through the gauzes and ignite gases present, causing an explosion.

I. Stowage of Lamp.

1. Examine and clean the lamp thoroughly.

2. Stow upright in a clean, dry place.

a. Hang up by the hook on the bonnet.

b. Stow in a box or wall cabinet used for this purpose only.

3. Locations. One in each damage control locker (in MSTS ships).

V. SUMMARY.

A. Review the history and construction of the flame safety lamp.

B. Preparation of lamp for use.

C. Fueling lamp.

D. Assembly of lamp.

E Use of lamp.

1. Sole intended use is to detect oxygen deficiency in spaces.

2. To a limited extent, it will detect explosive gases but should not intentionally be used for this purpose. The action of the flame indicates flammable gases as shown in the table in the body of this lesson.

3. The person using the lamp must not be color blind.

4. Light the lamp about 5 minutes before using to allow the flame to reach normal operating temperature.

5. Hold the lamp by its font and hold it upright.

6. Place it into and withdraw it from suspect area slowly.

7. Check the lamp continuously for indications as per table in lesson.

8. When gas is indicated, do not repeatedly put the lamp into the area. Ventilate thoroughly before retesting.

F. Review safety precautions.

G. Demonstrate preparation, use, disassembly, cleaning, and reassembly of the lamp and have crew members do the same under supervision.

VI. TEST AND APPLICATION.

A. Test. Use these and additional questions as an oral quiz.

1. Q. For what specific use was the flame safety lamp designed?
A. To detect oxygen deficiencies in atmospheres where men must work.

2. Q. What other conditions, if any, will it indicate?
A. To a limited extent, it will indicate the presence of concentrations of explosive gases in the air. The indications are detected by observing the action of the flame.

3. Q. If, when testing a compartment, the flame goes out with a slight "pop", what would that indicate?
A. The presence of a concentration of explosive gases would be indicated.

4. Q. Why should the lamp be put into and withdrawn from a suspect area very slowly?
A. Too rapid movement of the lamp may cause the flame to be drawn through the gauzes and ignite the gases present.

5. Q. What precaution must be observed in fueling the lamp? Why?

A. Saturate the cotton in the font, then turn it upside down and remove any excess fuel. After tightening the filler plug, carefully wipe away any fuel on the outside of the font. If this is not done, when the lamp warms up, the fuel may evaporate and enter the flame, causing false indications.

6. Q. When the lamp is ready for use, to what height should the flame be adjusted?
A. When burning in normal atmosphere, 1/2 inch.

7. Q. What is the main safety feature of the lamp?
A. The cooling effect of the two wire gauzes over the top of the glass chimney and interior ventilation through underfeed of intake air.

8. Q. What fuel should be used in the flame safety lamp?
A. Only approved naphtha should be used as fuel.

9. Q. Where and how is the flame safety lamp stowed?
A. In the repair locker, hung in upright position.

10. Q. In what atmospheres would it be dangerous to use the flame safety lamp?

A. The flame safety lamp would be dangerous and should not be used in any atmosphere containing inflammable or explosive gases, particularly in the presence of hydrogen or acetylene concentrations.

B. Application. Have each crew member demonstrate his ability to prepare, light, use, describe the lamp's indications, disassemble, clean, and reassemble the flame safety lamp.

ISOLATING AND PATCHING FIRE MAIN
LANT - BAYONNE SCHOOL

CHAPTER 3

ADVANCED DAMAGE CONTROL - For Deck and Engine Personnel (Lesson Plans)

Section 3.5

FIREMAIN SYSTEM

I. OBJECTIVES.

A. To give ship's repair parties a working knowledge of the fire main system, its valves and outlets.

B. To show that damage to the fire main system will result in loss of pressure and that trained personnel can isolate the damaged sections and rig jumpers to supply fire main water.

C. To present the measures to be taken if collision or other primary damage causes a break in the system.

II. MATERIAL.

A. Training Aids.

1. Ship's fire main and piping systems.

2. Jubilee pipe patches.

3. Plastic pipe patch kit.

B. References.

1. BUSHIPS Manual, Chapter 48, Piping System.

2. BUSHIPS Manual, Chapter 88, Section II, Practical Damage Control.

III. INTRODUCTION.

A. Introduce self and subject (Fire Main System).

B. Purpose of Fire Main System:

1. To provide water for fighting fire.

2. To provide water pressure to activate eductors for unwatering flooded compartments.

3. To create a fog curtain in the ABC washdown counter measure.

4. The fire main system is also used for necessary general utility washdown purposes but these must not interfere with its readiness for the above primary functions.

C. Marking. The fire main system is stenciled "FIRE MAIN".

D. Other piping systems aboard include systems for fresh water, drainage, fuel oil, diesel oil, lubricating oil, compressed air, steam, electrical conduits, voice tubes and ventilation ducts.

IV. PRESENTATION.

A. Types of Fire Mains. There are two types of fire mains:

1. Single Line. The single line fire main is generally found in cargo ships and in P2-S1 ships (Barrett class). Fire pumps are the reciprocating double-acting type with a capacity of 400 GPM. Some ships have one centrifugal pump and one reciprocating pump. In addition, an electrical centrifugal pump may be located in the after part of the shaft alley. P2-S1 ships have electric fire pumps located in the engine room and in the shaft alley. They also have emergency diesel fire pumps, one forward and one aft, with 1,000 GPM capacity.

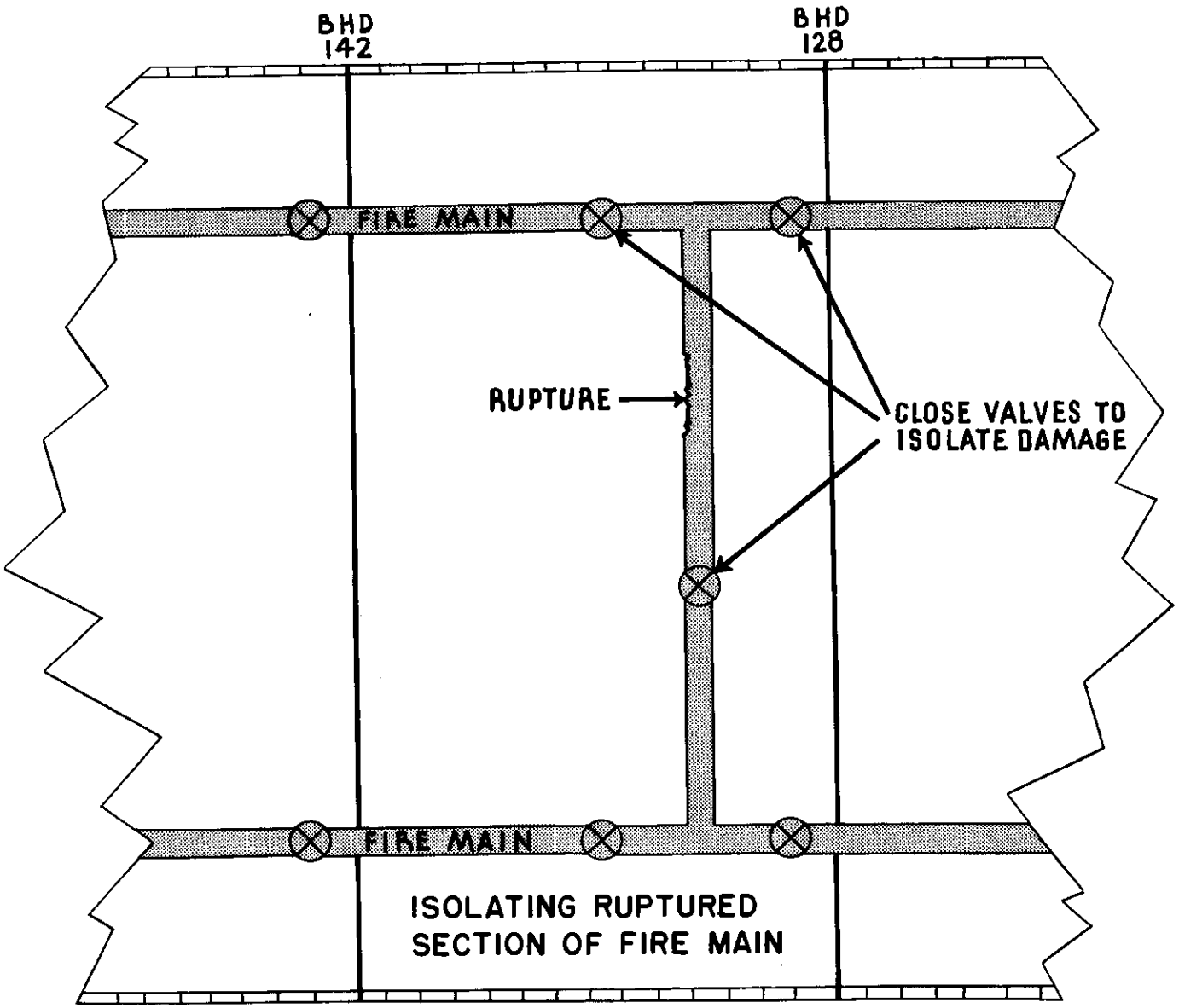
2. Continuous Loop. The continuous loop fire main is found in C-4 and P-2 (electric) ships.

a. C-4 ships have three fire pumps -- two electric centrifugal pumps and one steam double-acting reciprocating pump. Each pump has a capacity of 400 GPM. In addition, C-4's have two emergency diesel fire pumps installed in watertight pump rooms, one forward and one aft, and connected to the fire main loop by risers. Each emergency diesel fire pump has a capacity of 1,000 GPM.

b. P-2 (electric) ships have four fire pumps -- two in each of the two engine rooms. These fire pumps are centrifugal, two-stage pumps, each with a capacity of 400 GPM at 125 PSI.

B. Cutout Valves.

1. Cutout valves are installed in the fire main system for


BHD
142
BHD
128
FIRE MAIN
RUPTURE
CLOSE VALVES TO
ISOLATE DAMAGE
FIRE MAIN
ISOLATING RUPTURED
SECTION OF FIRE MAIN

four purposes:

a. To isolate ruptured sections so that fire main pressure will be maintained.

b. To reduce a main loop system to several smaller loops in an emergency.

c. To rig jumpers in order to by-pass a break.

d. To protect against freezing.

2. Normally, cutout valves are in an open position and sealed. Padlocks are not permitted. Some valves may have remote control mechanisms at a higher deck level.

C. Branch Line Valves. (also called root or isolation valves).

1. Branch line valves are located in branches off the main line. Their purposes are:

a. To isolate a ruptured branch.

b. To rig jumpers to by-pass a break in the branch line.

c. To protect against freezing.

2. Branch line valves are not required to be sealed but must be marked to indicate the spaces served.

D. Fire Stations.

1. The fire stations are served by branches from the fire main system. In most ships, weatherdeck fire station outlets are $2\frac{1}{2}$" in diameter and those below decks are $1\frac{1}{2}$". Fire stations are so located that any part of the ship, other than machinery spaces, can be reached by two streams of water from separate outlets, at least one of which must be from a single shot of hose. This is a USCG regulation.

2. Self-cleaning strainers are installed at fire stations to flush out scale and marine growth in the fire main so that fog nozzles will not clog.

a. Show proper position of handle (as shown in BUSHIPS Manual, Chapter 93, Figure 93-1) and demonstrate operation on a strainer or deck.

b. Always flush the line out before opening the valve to the fire hose in order to clear the line of sediment and avoid logging the fog nozzle.

E. Operation and Maintenance.

1. Flushing. The fire main system should be flushed weekly with clear sea water and whenever fresh water is available ashore or in such places as Gatun Lake. This loosens marine growth. Also, fresh water can be left to stand in the system for a period of time. This will kill marine growth.

2. Procedure for flushing with clear sea water.

a. Before starting the fire pumps, clean the discharge strainers, if so equipped. Then flush the fire main for at least five minutes under full pressure.

b. At each fire station, open the quick cleaning strainer and flush. Below decks use a GI can or run the hose to the nearest drain.

c. Allow water to run until clear.

3. Procedure for flushing with fresh water.

a. Secure the fire pumps.

b. Drain the fire main system at its lowest point and then close the drain valves.

c. Connect fresh water hose from shore to the ship's fire main shore connection.

d. Flush the self-cleaning strainer at each fire station.

e. When system is full, allow the water to stand at least 24 hours to kill marine growth. Then flush out again.

4. In the Panama Canal (fresh water) use procedure in 2 above as for clear sea water.

5. Leaks and Seals. All hands must be instructed to report any and all leaks and broken seals on cutout valves.

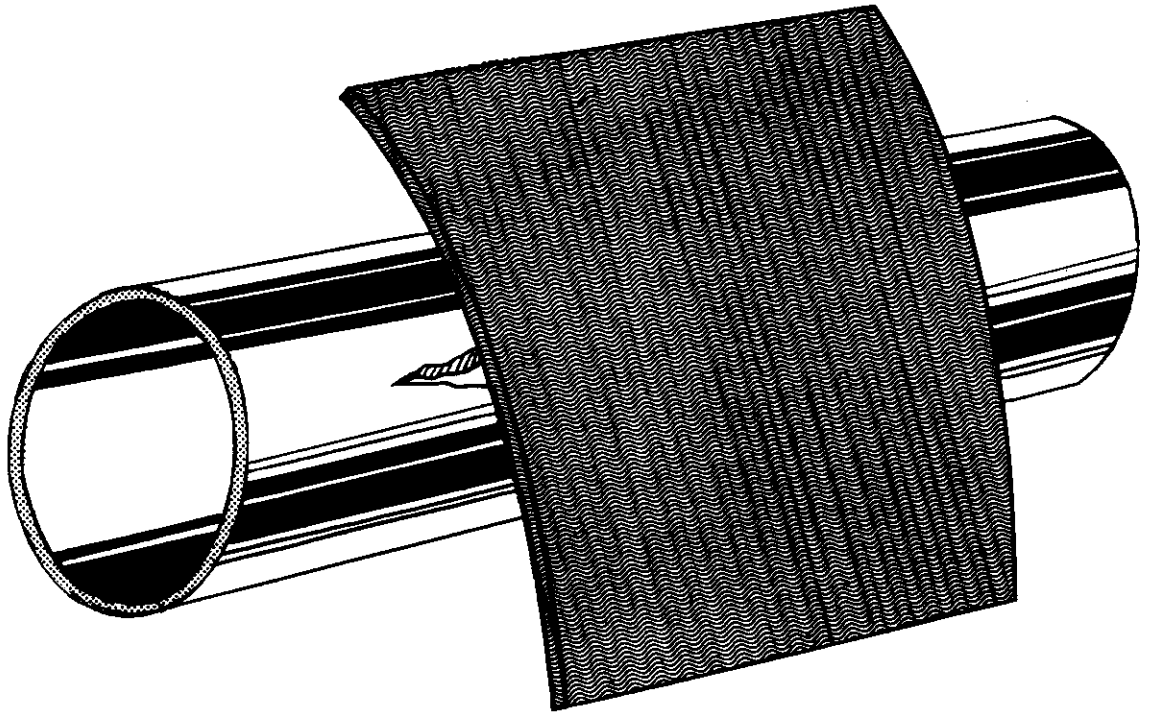
6. Other Maintenance.

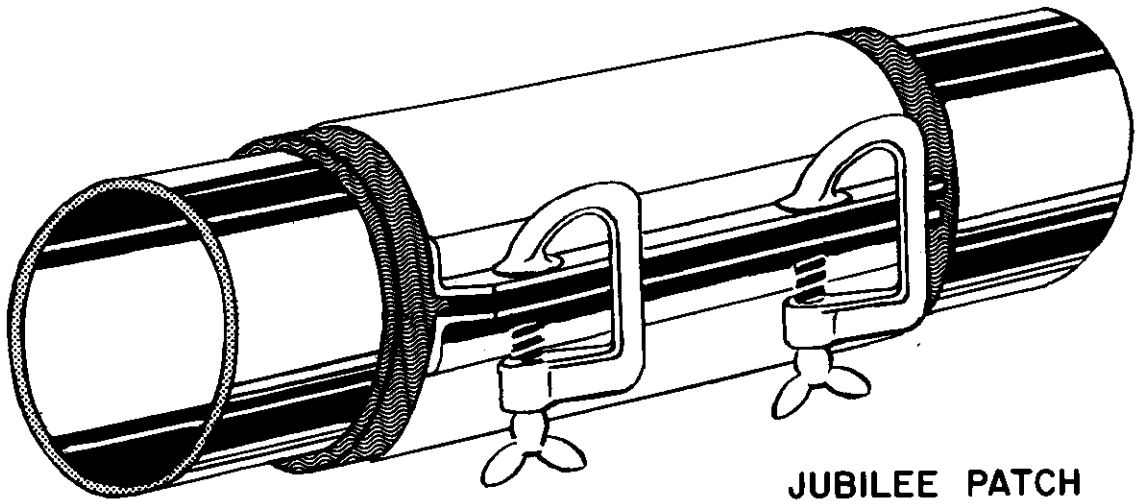
a. Test operate all valves on the fire main system periodically. Re-seal all broken seals.

b. Test relief valves located at pumps periodically.

c. The fire main system is tested hydrostatically during the annual overhaul period.

d. Replace bent valve stems immediately.





JUBILEE PATCH

E. Rigging Jumpers.

1. Jumpers are rigged when damage occurs in the single line system or in the risers to a continuous loop system.

2. Procedure:

a. Determine where the break is.

b. Close valves on both sides of break.

c. Connect hose to one valve.

d. At other valve, use a double female adapter to connect the other end of the hose.

e. Open both fire station valves while tending the hose for kinks.

F. Pipe Repair. In an emergency, there may not be time to replace ruptured pipe. Therefore the following means of repairing ruptured pipe in place can be used:

1. Jubilee pipe patch (soft patch). A jubilee patch is a piece of sheet rubber or other packing held over the break by a metal clamp. (See BUSHIPS Manual, Chapter 88, Section II, pages 71-77). It is the quickest patch to apply and the most common.

2. Plastic pipe patch. A plastic pipe patch kit can be used by trained personnel. Synthetic resins are mixed and, when applied and allowed to cool, they harden to great strength. (See NavPers 91845, Emergency Damage Control Metallic Pipe Patch and Lesson Plan 4.4).

V. SUMMARY.

A. Emphasize the importance of maintaining the fire main system in readiness for emergencies:

1. For fire fighting.

2. For emergency unwatering using eductors.

3. To provide the washdown countermeasure in ABC defense.

B. Review key points of lesson.

1. Single line and continuous loop fire mains.

2. Use of cutout valves and branch line valves.

3. Operating and maintenance procedures.

4. Emergency repairs to fire main.

VI. TEST AND APPLICATION.

A. Test. Use these and additional questions as an oral quiz:

1. Q. What are the two types of fire main systems generally found aboard ships?

A. The two types of fire main systems generally found aboard ships are the single line system and the continuous loop system.

2. Q. What provision is made in the fire main system in case of rupture of the main pipe line?

A. At strategic locations cutout valves are installed in the line so that ruptured sections may be isolated for repair, or jumpers may be rigged to by-pass the break without loss of fire main pressure.

3. Q. In what position are these cutout valves required to be kept -- open, closed, sealed or locked?

A. All fire main cutout valves are required to be kept open and secured with a seal.

4. Q. What other purpose is served by fire main cutout valves?

A. In some vessels having a continuous loop system with the fire pumps in dispersed locations, certain cutout valves, when closed, divide the main loop into a number of smaller loops for split-system operation during an emergency.

5. Q. What is the most common type of patch used for pipe repair?

A. The jubilee patch is the most commonly used type of repair.

6. Q. What is the USCG requirement in regard to location of fire stations?

A. Fire stations are located so that any part of the vessel, other than machinery spaces, can be reached with at least two streams of water from separate outlets, at least one of which shall be from a single length of hose.

7. Q. What is the purpose of the self-cleaning strainer required at fire stations?

A. To prevent foreign matter, such as scale and possible marine growth, from clogging fog nozzles.

8. Q. How frequently should fire mains be flushed with fresh water and why should this be done?

A. Whenever fresh water is available, ships should completely fill and flush their fire mains with fresh water to take advantage of the fact that marine growth dies upon exposure to fresh water.

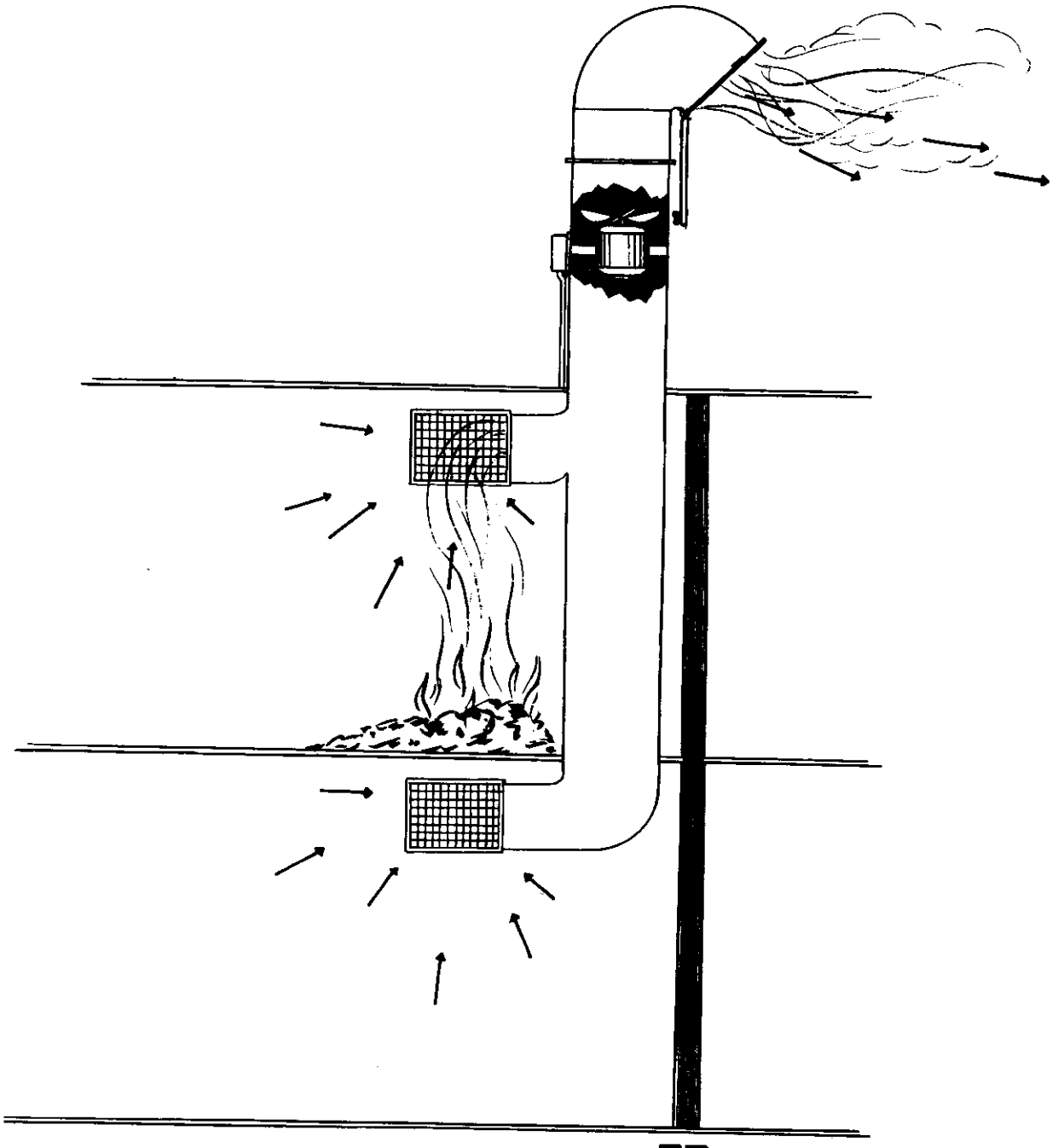
9. Q. What sizes of fire station outlets and hoses are used and where is each size required?

A. Fire station outlets are of $2\frac{1}{2}$" and $1\frac{1}{2}$" diameter. All outside outlets are $2\frac{1}{2}$" and inside outlets are $1\frac{1}{2}$".

10. Q. What knowledge of the ship's fire main system is necessary for all repair party members and why is this knowledge important?

A. All repair party members should know the layout and location of the fire main piping system, cutout valves, branch line valves, and all remote control locations for these valves. This knowledge is important since it may be necessary to isolate sections for repair in case of casualty and yet maintain service pressure throughout the rest of the system.

B. Application. Have crew members demonstrate how to operate a self-cleaning strainer, isolate a leaking section of the fire main, rig a jumper, or install a jubilee pipe patch.



SPREAD OF FIRE
BY EXHAUST BLOWER

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CHAPTER 3

ADVANCED DAMAGE CONTROL - For Deck and Engine Personnel (Lesson Plans)

Section 3.6

VENTILATION

I	Objectives	IV	Presentation
II	Material	V	Summary
III	Introduction	VI	Test and Application

I. OBJECTIVES.

A. To familiarize personnel with the purpose of the ship's ventilation system.

B. To stress to zone area personnel the importance of preserving the watertight and firetight integrity of the ventilation system.

C. To impress upon crew members the importance of understanding the relationship of the ventilation system to successful firefighting and damage control.

II. MATERIAL.

A. Training Aids.

1. Ship's booklet of damage control display plans.

2. Ship's blueprints.

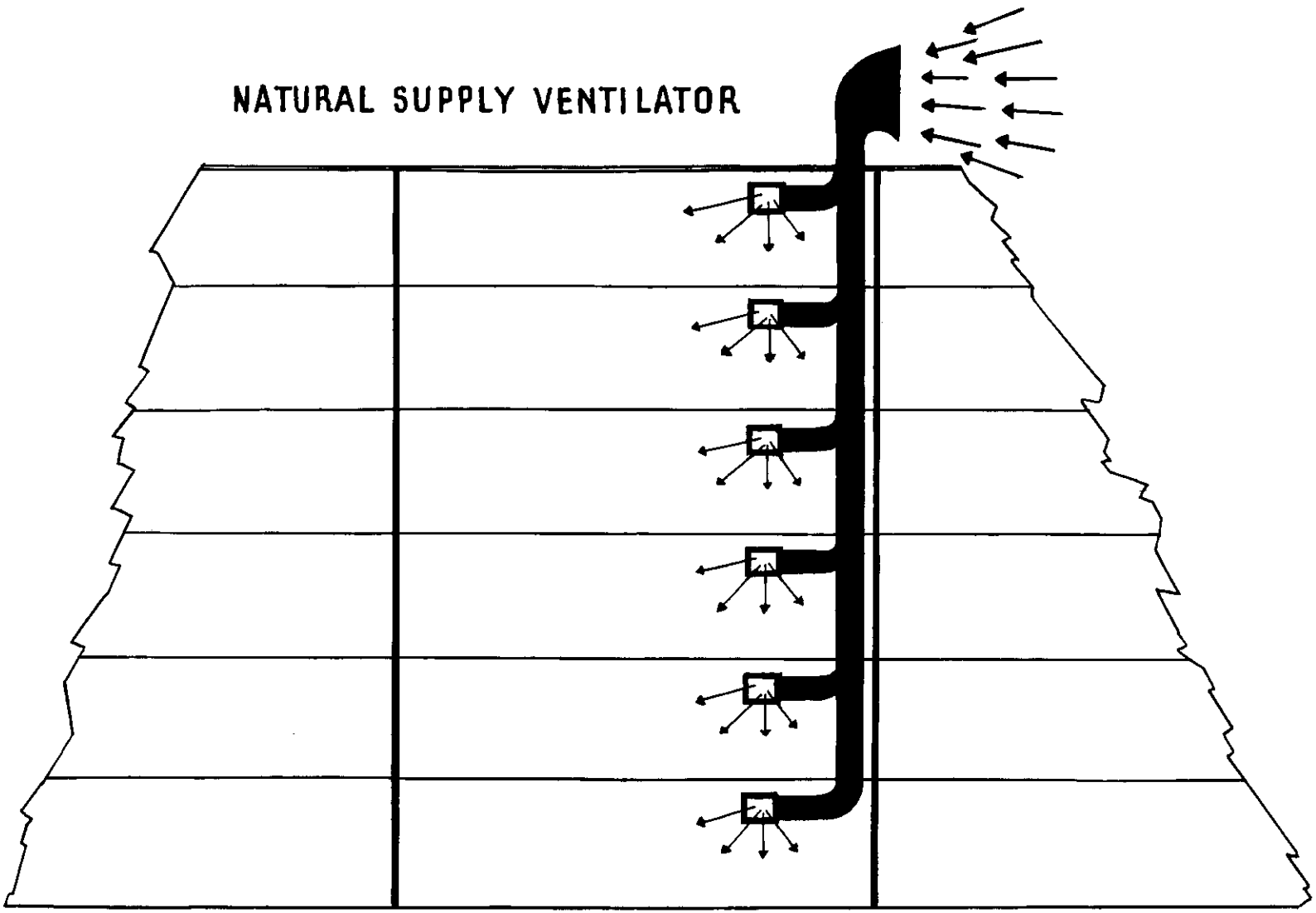
B. References.

1. COMSTS INSTRUCTION 9280.3A (Effective Revision) - "Designation and Marking of Hull Structure".

2. CG 256, Rules and Regulations for Passenger Vessels.

3. CG 257, Rules and Regulations for Cargo Vessels.

4. BUSHIPS Manual, Chapter 38, Ventilation & Heating.



NATURAL VENTILATION

5. BUSHIPS Manual, Chapter 88, Section II, Practical Damage Control.

6. BUSHIPS Manual, Chapter 93, Firefighting, Ship.

III. INTRODUCTION.

A. Introduce self and subject (Ventilation).

B. Explain why a knowledge of the ventilation system is important.

1. In case of fire, it is important to secure ventilation to avoid spreading or fanning the fire through the ventilation system. Overheated ducts can spread fire to adjacent flammable material.

2. In case of flooding, compartments can be quickly flooded if water has entered the ventilation system.

IV. PRESENTATION. Shipboard ventilation may be either natural ventilation or by mechanical means, with heat or cooling and various controllers.

A. Natural supply and exhaust - In the natural system, air is supplied to and/or removed from spaces without any mechanical aid. There are three possibilities - supply only, exhaust only, or both supply and exhaust. Ventilators and ducting are used as shown in the illustration. Ventilators on deck are trimmed to achieve the intake and exhaust ventilation desired.

B. Mechanical supply and exhaust - With a mechanical ventilation system, air is supplied to and/or removed from spaces by supply blowers or exhaust fans. Once again there are three possibilities - supply only, exhaust only, or both supply and exhaust. Fan rooms may be located in any part of the ship. Filters are installed in the ventilation supply systems before the blower fans.

C. Heating and Cooling - In the mechanical supply system, the air may be heated by steam or cooled by refrigerants, as necessary.

D. Controllers.

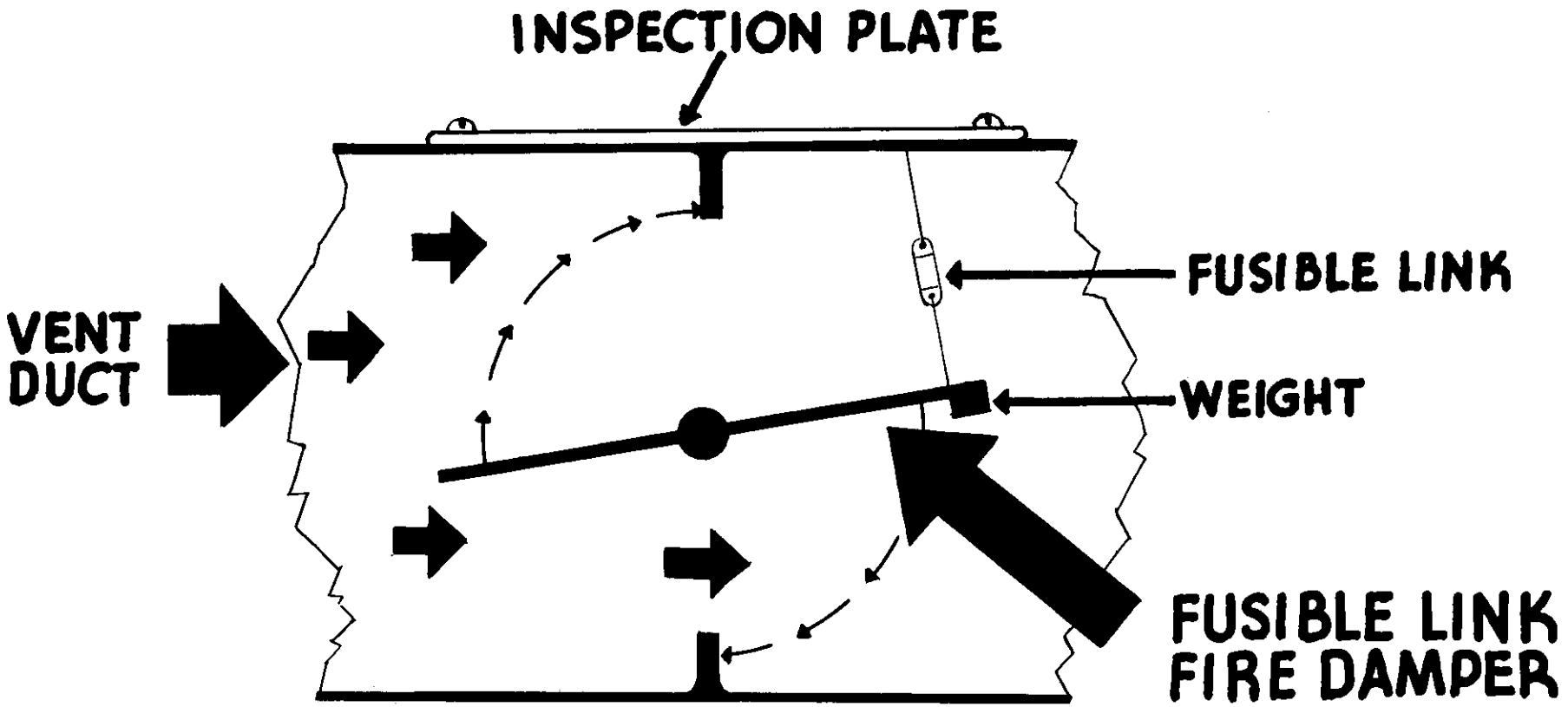
1. Bridge control. This is an emergency ventilation cutout switch for the whole ship. It is used only for fire and ABC defense.

2. Engine room remote control station. This is a cutout switch for engine room ventilation only. It is used in event of engine room fires, to shut off the ventilation from outside the engine room.

3. Thermostats. Control temperature only, They may be located in spaces served by heated ventilation supply.

4. Manual speed controls regulate the speed of the fans.

5. Fire dampers are located throughout the ventilation system,



AUTOMATIC FIRE DAMPER

in both supply and exhaust ducts. They are used to cut off ventilation in any particular section, automatically or manually, in event of fire.

a. Fusible link (automatic) fire dampers. There are two different melting points in automatic fire damper links, - 165 degrees and 212 degrees. The 212 degree link is for galleys. When the link melts, a weight closes the damper and shuts off any draft. (See illustration, Automatic Fire Damper.)

b. Manual fire damper. The handle of the manual fire damper is in same position as the damper behind it. Rotate it through 90 degrees to close it. All zone area personnel should know the locations of manual fire dampers in their zones. In case of fire, close all manual fire dampers in the fire area without waiting for specific orders.

6. CO^2 cut-out. When the CO^2 cylinders are released into a specific area, the pressure of the CO^2 gas automatically trips and shuts off the ventilation to that area. This prevents dissipation of the CO^2.

E. Watertight Integrity. This is achieved by not having any ventilation duct in the ship cut through a watertight bulkhead. However, ventilation ducts may go above the watertightness level and then into the adjacent watertight compartment.

F. Firetight Integrity. This is achieved in two ways as follows:

1. Galley exhausts are insulated. They also have filters in the hoods over the galley ranges for removing grease from the fumes. These filters should be cleaned at least weekly.

2. Fire dampers are located wherever a duct crosses a main vertical zone bulkhead. Also, wherever else deemed necessary in the ventilation system.

G. Ventilation Markings.

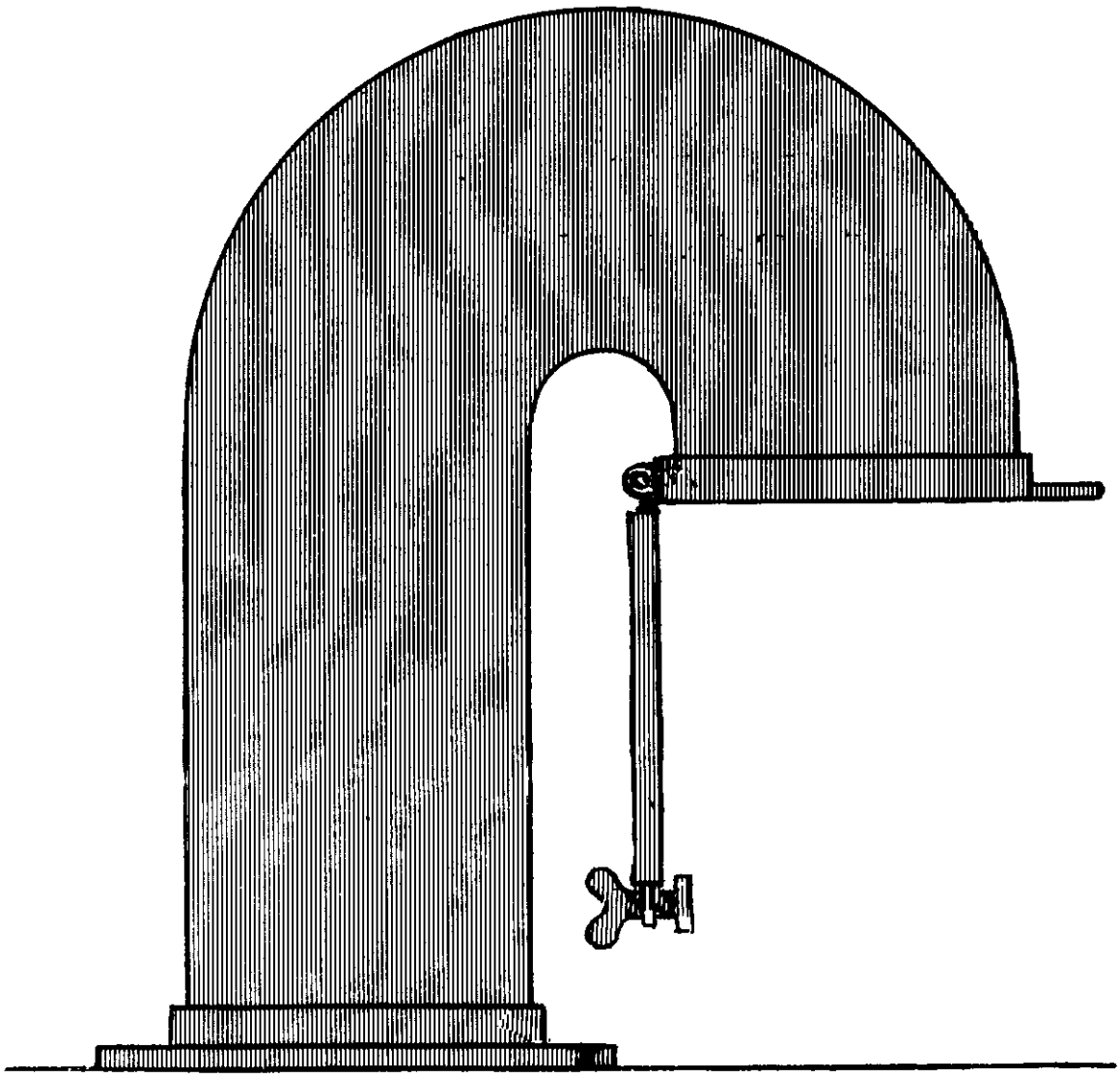
1. The ventilation system is labelled in accordance with the latest revision of COMSTS INSTRUCTION 9280.3 (Designation and Marking of Hull Structure). All parts of the system are labelled, such as weather openings, fans and their controllers, ducts and dampers. Also, as appropriate, labels indicate whether the system is supply or exhaust.

2. Natural systems are identified either as "NAT EXHAUST" or "NAT SUPPLY". Also, each controller and fan label plate indicates the fan number and all areas served. For example -

Vent Fan 2-28-2

Supply 3-15-2-L, 3-19-2-A

H. Maintenance and Operation of Dampers.



TOPSIDE VENT OPENING

1. All manual fire dampers should be tested periodically for smooth operation and a good fit.

2. All fusible link automatic fire dampers should be tested periodically by removing the link to see if damper drops freely; also, to see if the damper fits properly. Check to see if the indicating arrow correctly shows the position of the damper.

V. SUMMARY.

A. Review the importance of confining fires, cutting off oxygen, and retarding flooding if water enters the ventilation system.

1. Mechanical ventilation must be shut off in event of fire and for ABC defense. In addition, topside vent openings must be closed to shut off natural ventilation and to avoid the spread of fire or of contamination in ABC defense.

2. For emergency purposes, the locations of all manual dampers must be known by all zone area personnel for their respective zones. Repair party personnel depend upon zone area personnel for this knowledge and emergency action as appropriate.

B. Practical Demonstrations.

1. Conduct tour of a zone area, pointing out all ventilation features and their markings.

2. If possible, examine an installed fusible link automatic fire damper.

3. Operate a manual damper.

C. Review key points of lesson.

1. Types of ventilation systems - natural and mechanical.

2. Controllers.

3. Importance of maintaining watertight and firetight integrity.

4. Ventilation markings.

5. Operation of fire dampers.

VI. TEST AND APPLICATION.

A. Test. Use these and additional questions as an oral quiz:

1. Q. What is the purpose of a ventilating system?
A. To supply fresh air, or remove stale air from one or more compartments, or both. This is sometimes combined with a heating or cooling process.

2. Q. Why is it important that personnel understand the ship's ventilating system?

A. This is essential to successful firefighting. If not properly controlled, hot gases can cause fire through overheated ducts, spread fire by supplying air (oxygen) to smoldering embers, or fan and spread a fire which does start.

3. Q. How is watertight integrity maintained in the ventilation system?

A. Ventilation ducts do not traverse watertight bulkheads below the watertightness level.

4. Q. How is firetight integrity obtained?

A. By having fire dampers installed in ventilation ducts, and by insulating around the galley exhausts.

5. Q. How are the ventilation systems marked?

A. By label plates in accordance with the effective revision of COMSTS INSTRUCTION 9280.3 (Designation and Marking of Hull Structure). Markings indicate the type of ventilation system, location of fan or control, and location of compartment served.

6. Q. What are the two types of fire dampers?

A. Manual and automatic fusible link fire dampers.

7. Q. Where are the high temperature (212 degrees) automatic fusible link fire dampers installed?

A. In galley exhausts, usually over the ranges, where high temperatures prevail.

8. Q. Where are filters found in ventilation systems?

A. In the ducts before the blower fans and in the hoods over galley ranges.

9. Q. What are thermostats used for?

A. To control the temperature of the spaces they serve.

10. Q. In fire and ABC defense, what action is taken with respect to the ventilation system?

A. In ABC defense, the ventilation is shut down completely except for essential operating areas such as the engine room. Even here, plans should provide for direct intake and exhaust so as to avoid contamination. In case of fire, ventilation is shut off to the fire and surrounding areas and topside vent openings leading to these compartments must be closed.

B. Application. Have crew members point out the location of manual fire dampers in their zone areas and explain when and how they would operate them.

CHAPTER 3

ADVANCED DAMAGE CONTROL - For Deck and Engine Personnel (Lesson Plans)

Section 3.7

SMOKE DETECTING AND CO_2 EXTINGUISHING SYSTEMS

I	Objectives	IV	Presentation
II	Material	V	Summary
III	Introduction	VI	Test and Application

I. OBJECTIVES.

A. To acquaint personnel with the operation of the smoke detecting system.

B. To impress crew members with the value of CO^2 as an extinguishing agent.

C. To familiarize personnel with the operation of the CO^2 fire extinguishing systems.

II. MATERIAL.

A. Training Aid. - Ship's built-in CO^2 system and control chart.

B. References.

1. BUSHIPS Manual, Chapter 93, "Fire Fighting-Ship".

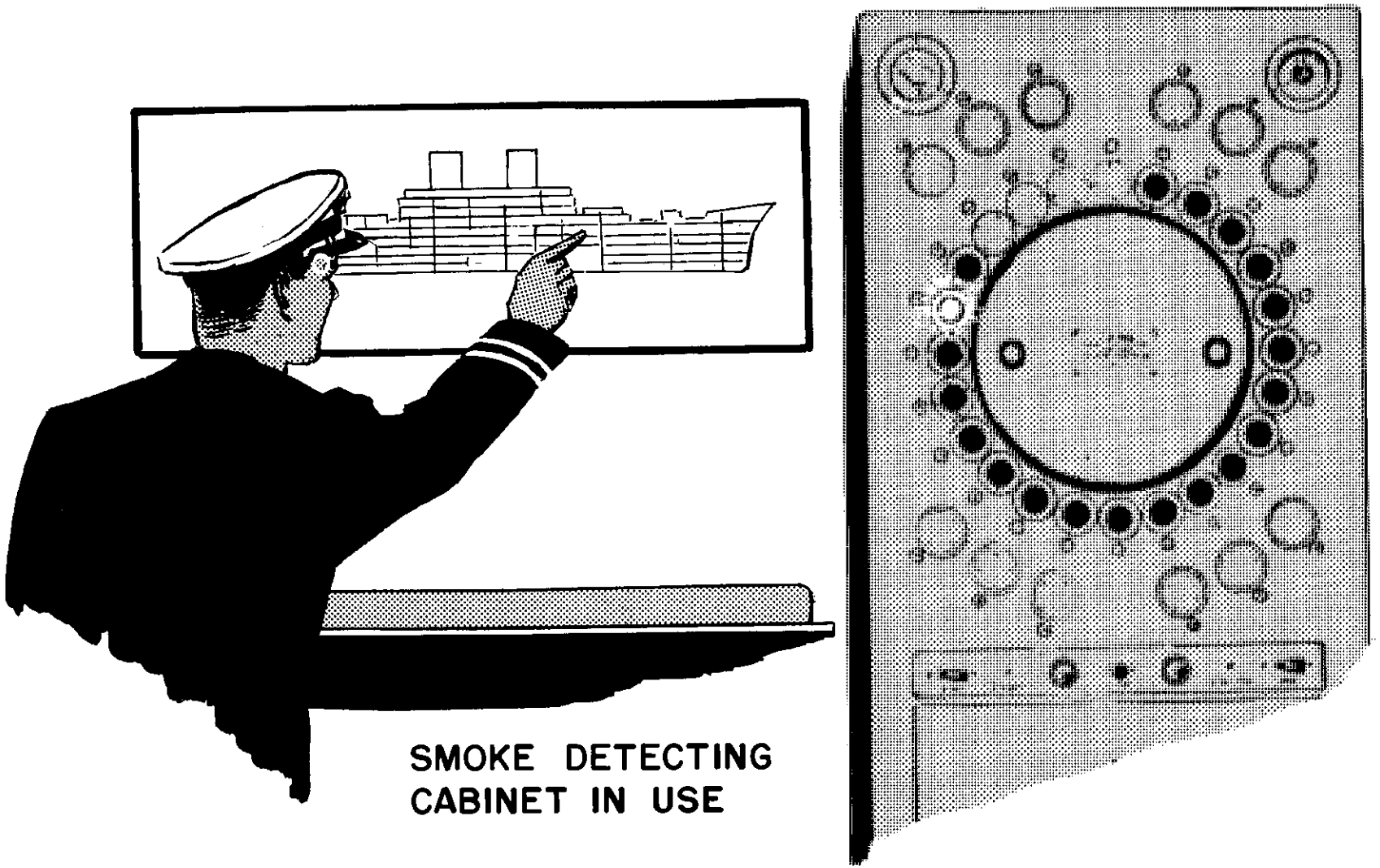
2. CO^2 Instruction Manual for installed type.

3. CG 256 - Rules and Regulations for Passenger Vessels.

4. CG 257 - Rules and Regulations for Cargo Vessels.

III. INTRODUCTION.

A. The purpose of the smoke detecting system is to warn the bridge



SMOKE DETECTING
CABINET IN USE

automatically of the outbreak of fire in any compartment (normally unmanned) which is covered by the system.

B. The purpose of the CO^2 extinguishing system is to put out a fire in a compartment by smothering it with CO^2 from the control manifold without having to enter the burning compartment. CO^2 is effective in putting out oil and electrical fires.

C. It is important that these systems be maintained in top operating condition at all times since they cover compartments not normally manned, compartments frequently containing much combustible material. (Give examples of such compartments in your ship.)

IV. PRESENTATION.

A. The Smoke Detecting System.

1. The smoke detecting system consists of:

a. The detecting cabinet, usually located on the bridge. It is generally in the wheelhouse in cargo ships and in the fire control room in passenger ships. It provides a visual and audible warning, with an auxiliary audible alarm in the engine room.

b. A system of piping connecting the cabinet with the various cargo, storeroom and other compartments covered by the system.

c. A pair of exhaust fans either contained within the cabinet or mounted in another weather-proof cabinet on top of the wheelhouse directly above the detector cabinet. These exhaust fans can be alternated in service, permitting maintenance without shutdown of the system.

d. In some cases the smoke detector system and the CO^2 extinguishing system are tied together to utilize the same piping for both systems through two-way valves at the CO^2 manifold.

e. Briefly, a sampling of air is drawn continuously from all compartments connected to the system and passed through the detector cabinet.

(1) Smoke contained in this exhaust air will interrupt the beam of a photo-electric cell in the numbered exhaust horn for the compartment concerned, setting off the audible alarm (a bell or buzzer.)

(2) A check of the cabinet will visually indicate which exhaust horn is emitting the smoke and its number will identify the specific compartment. In the horn is a small light and a white silk thread which stands out in the airstream through the pipe. This makes smoke readily apparent when present.

(3) A sufficient quantity of exhaust from the detecting cabinet is discharged into the wheelhouse to permit detection of smoke by its odor. A valve is installed to direct this exhaust, if obnoxious, to the outside.

(4) A framed chart or diagram is posted in the wheelhouse, near the detecting cabinet, indicating the location of the various zones, and giving instructions for the operation, maintenance, and testing of the system. This chart, or a separate card or booklet kept near it, has tabulated spaces for date and signature of the ship's officer who conducts the required periodic tests.

2. Operation and maintenance of smoke detecting system.

a. The smoke detecting system is kept in continuous operation at all times when the ship is operating.

b. The watch officer should periodically check the cabinet just in case the alarm may be out of order. (Fuses may blow or short circuits occur.)

c. Maintenance consists of regular periodic checks of electrical circuits by means of test switches on the cabinet front and check of the fuses. Also, by periodic cleaning and lubrication of bearings on motor and fan units.

B. The Fixed CO^2 Extinguishing System. This system consists of:

1. The bottle storage room in which the steel bottles or cylinders of liquid CO^2 are stored, arranged in banks and connected to the piping and release mechanism. (Surrounding temperature shall not exceed 130° F.)

2. The CO^2 manifold which is a series of valves labeled to identify the spaces to which they are connected by the piping.

3. The piping system may be the same system of pipes used for the smoke detecting system or an independent piping system.

a. All piping, valves and fittings have a bursting pressure of not less than 6000 p.s.i. and specified weights.

b. A pressure relief valve, or equivalent, set to relieve between 2400 and 2800 p.s.i. is installed in the distributing manifold to protect the piping in the event all branch line shut-off valves are closed, when CO^2 is discharged.

c. The piping shall be used for no other purpose except for fire detecting.

d. Piping is of such size that the entire CO^2 charge to a space can be discharged in two minutes.

(e) Drains and dirt traps are fitted where necessary to prevent accumulation of dirt or moisture in the piping.

(f) No drains or other openings in piping are located within any living spaces.

4. Alarms are installed in spaces protected by the CO^2 extinguishing system and normally accessible to personnel, except in paint and lamp lockers, etc. The alarm is set off by the pressure in the piping when the CO^2 is released into the space. These alarms are conspicuously located and marked.

(a) Where CO^2-protected spaces, except cargo spaces, are ventilated mechanically, the ventilation system is automatically shut down by operation of the CO^2 system (a pressure-activated cut-out switch in the piping).

(b) Where natural ventilation is provided in such spaces, provision is made for closing off the ventilation.

(c) Means are provided for closing all openings to such spaces from outside the space.

C. Small Independent Fixed CO^2 Systems. These consist of one or two 50 lb. cylinders which may be installed in small isolated spaces such as in paint and lamp lockers and in the emergency generator room. In these cases, the CO^2 cylinders may be stored inside the space protected, if necessary, but the controls must be located outside the protected space.

D. Semi-fixed CO^2 Systems. These are installed in certain spaces such as the engine room and auxiliary engine rooms. They consist of one or two 50 lb. cylinders of CO^2 connected to a reel of hose with a valve and nozzle. The hose is long enough to reach all portions of the space covered. Maintenance of semi-fixed CO^2 systems is as follows:

1. Keep the hose neatly reeled when not in use, and keep it clean and protected from damage.

2. Periodically check weight of cylinder(s) to maintain full volume of CO^2 when needed.

3. Make certain that all connections are tight and that there are no breaks or damaged areas in flexible connections.

E. Safety Precautions for All CO^2 Extinguishing Systems.

1. Make sure all cylinders are properly positioned in their racks and secured.

2. See that all branch shut-off valves at the CO^2 manifold, or other operation station, are closed and that the lock pin is in place except when open to operate the system.

3. See that flexible connectors are undamaged and tight.

4. See that weight record cards on cylinders are properly filled out and that periodic required weighing is accomplished.

5. See that cable connections to the discharge heads on CO^2 cylinders are properly secured and the cable is free in the conduit.

6. Before releasing CO^2 into a protected space, make sure that all personnel have been evacuated and accounted for.

7. If the space is not already buttoned-up, secure all closures while CO^2 is discharging.

8. When a compartment has been flooded with CO^2 gas, make sure it is thoroughly ventilated before permitting anyone to enter. First man to enter should wear an OBA and carry a flame safety lamp to test for oxygen content.

F. Discrepancies. Administrative inspections of CO^2 systems have revealed an alarming number of serious discrepancies. Some of the discrepancies found were:

1. Nameplates on manifold valves changed around, thus permitting the unintentional flooding with CO^2 of a space other than the one intended.

2. Cylinder discharge cables connected incorrectly, resulting in the discharge of CO^2 in amounts other than as desired. In some cases, the resulting poor leads prevented activation of the system because the release levers of the cylinders could not be rotated sufficiently to cut the seals. In one such bank installation, the discharge of one bank would have discharged both banks because the movement of the cylinder release levers of one bank would have rotated the levers on the other bank.

3. Cylinders frequently found to have rotated in the racks to such an extent that rotation of the cutter lever was impossible with the remote control wires, since they no longer exerted pressure in the direction required to rotate the cutter levers.

4. Some time after completion of repair periods, CO^2 systems were found still wired down, preventing operation of the system.

V. SUMMARY. Review the key points:

A. The smoke detecting system.

1. Cabinet.

2. Piping.

3. Exhaust fans.

4. Tie-in with CO^2 extinguishing system.

5. Signals--testing.

a. Visual.

b. Audible - auxiliary signal in engine room.

c. Odor.

6. Operation and maintenance.

B. The CO^2 extinguishing system.

1. Bottle storage room.

2. CO^2 manifold and controls.

3. The piping system.

a. Relief valve.

b. Complete discharge in two minutes.

c. Drains and dirt traps - (not in living spaces).

4. Alarms.

5. Automatic ventilation shut-off.

6. Manual closures where ventilation is natural type.

C. Small Fixed Systems.

D. Semi-fixed Systems.

E. Safety Precautions - All Systems.

F. Common Discrepancies--testing by weighing.

G. Demonstration. Explain the use of the smoke detecting system on the bridge. Show how the alarm is given, and how the compartment is identified. Then, at the CO^2 bottle room, show the CO^2 installation precautions and proper method of discharging CO^2 into specific spaces.

VI. TEST AND APPLICATION.

A. Test. Use these and additional questions as an oral quiz.

1. Q. How does CO^2 gas extinguish a fire?

A. Since it is heavier than air and displaces oxygen, it literally smothers the fire.

2. Q. Where is the smoke detecting cabinet located?
A. On the bridge, in the wheelhouse or in the fire control room.

3. Q. How is the presence of smoke in the system indicated?
A. Visually, in the detecting cabinet; audibly, by an automatic alarm; and by the odor of smoke discharge from the detecting cabinet.

4. Q. What classes of fires is CO^2 particularly effective against?
A. Oil and electrical fires.

5. Q. What spaces are protected by the CO^2 system?
A. Engine spaces and hazardous spaces not normally occupied by crew or passengers.

6. Q. How is CO^2 in a cylinder or extinguisher measured?
A. It is weighed, subtracting the known weight of the cylinder and fittings from the total.

7. Q. What precautions should be taken before entering a compartment that has been flooded with CO^2?
A. Make sure it has been thoroughly ventilated before permitting anyone to enter. The first man to enter should wear an OBA and carry a flame safety lamp to test for oxygen content.

8. Q. How long does it take to completely discharge the CO^2 bank?
A. Two minutes.

9. Q. What would you do if you were in a compartment when the CO^2 alarm sounded?
A. Get out immediately, making sure to close and secure the door and other openings.

10. Q. How is the smoke detecting system tested?
A. By holding a bucket of burning rags near one of the smoke accumulators and observing if the alarm is sounded and if smoke is observed visually or by smell on the bridge.

B. Application. Have crew members demonstrate how they would set off CO^2 discharge into various spaces and the precautions they would observe.

CHAPTER 3

ADVANCED DAMAGE CONTROL - For Deck and Engine Personnel (Lesson Plans)

Section 3.8

UNWATERING EQUIPMENT

I	Objectives	IV	Presentation
II	Material	V	Summary
III	Introduction	VI	Test and Application
		VII	Handout

I. OBJECTIVES.

A. To familiarize personnel with unwatering (pumping) equipment.

B. To explain how to unwater a compartment in an emergency.

C. To stress safety precautions necessary when operating equipment.

II. MATERIAL.

A. Training Aids.

1. Film - MN-6774, Method of Unwatering Flooded Compartments, 18 minutes.

2. Ship's portable pumping equipment -- peri-jet eductor and electrical submersible pump.

B. References.

1. BUSHIPS Manual, Chapter 88, Section II, - Practical Damage Control.

2. BUSHIPS Manual, Chapter 93, Firefighting, Ship.

3. NAVPERS 10572-B, Damage Controlman 1 and Chief.

4. NAVPERS 10571-C, Damage Controlman 3 and 2.

III. INTRODUCTION.

A. Introduce self and subject (Unwatering (Pumping) Equipment).

B. Unwatering (pumping) equipment aboard ship is a very important aspect of damage control. A damage control organization maintaining this equipment in good operating condition, and knowing how to use it effectively under varying conditions, will find it to be of great value in an emergency.

C. In case of flooding of a compartment, it is important to know immediately the location and use of valves and pumps necessary for unwatering. Ships have been needlessly lost due to lack of knowledge by their crews of the use of unwatering equipment.

D. The ship's built-in system, including permanently installed eductors which are activated from the fire main, is the primary means of unwatering a compartment. This can be augmented by the use of portable emergency unwatering equipment.

E. By studying their ship's unwatering (pumping) equipment, all officers and men of the damage control organization will know the ability of their ship to sustain damage and remain afloat, and will be better able to keep it afloat in event of flooding casualty.

IV. PRESENTATION.

A. Bilge Pumps.

1. Types of bilge pumps permanently installed aboard ships are:

a. Steam driven double-acting reciprocating pumps used for ballast and general services, and also for cross-connection into the bilge manifold. Their pumping capacity is approximately 400 GPM.

b. Electrically driven centrifugal pumps, for fire, bilge, ballast and general service, are cross-connected into the bilge manifold. Their usual capacity is about 300 GPM (although they may be larger). Vacuum pumps are used to prime centrifugal bilge pumps in most ships.

c. Eductors or jet pumps. Very simply stated, these are syphons. By pumping water down into them under pressure, an additional equal amount is "syphoned" up and both input and pickup are discharged.

d. The main circulating pump has direct suction connections with non-return valves, in the machinery space. It cannot be connected to any other compartment.

2. Location. Practically all bilge, ballast, general service and circulating pumps are located in the engine room or auxiliary engine room.

3. Suction. The pumps are able to take suction from the sea chest (seacock) into the bilge manifold for ballasting and priming purposes.

4. The bilge manifold consists of many non-return check valves. Each compartment is served by its own individual branch suction line and valve.

B. Fixed Electrical Submersible Bilge Pump. This is a centrifugal, electric motor, completely enclosed, with a capacity up to 600 GPM.

1. Location. It is usally located within the engineering spaces.

2. Power. The source of power (the emergency generator) is located above thebulkhead deck. Electric power is supplied from the emergency switchboard.

3. Manifolds. Passenger vessels have their bilge manifolds arranged so that in the event of flooding, this pump can take suction from any compartment. Valves can be either manually controlled at the manifolds or by remote control through piping or shafting arrangement.

4. Suction can be taken from clean ballast main, port engine room, starboard engine room, or bilge main.

5. Discharge is either overboard or into clean ballast main.

C. Emergency Portable Electric Submersible Pump. (Show a pump while explaining its use.)

1. Purpose. Portable electric submersible pumps are used for pumping compartments not drained by the installed drainage system. They are used by repair parties to pump every type of compartment, including the main machinery rooms.

2. Stowage. The portable submersible pumps are stowed in or near repair lockers, or other suitable locations which are indicated on check lists in repair lockers. (Show the stowage facilities for all portable submersible pumps aboard.)

3. Rigging the pump.

a. The pump should not be lifted or handled by the electric cable. Each pump is provided with a bridle and a 3" manila rope for manhandling and lowering into the flooded compartment.

b. The electric cable is married to the handling line about every three feet. Allow a small amount of slack in the cable every three feet. This will put the weight of the pump on the handling line instead of on the electric cable.

c. A cap with a handle is provided for lifting and handling

LOWERING PORTABLE ELECTRIC SUBMERSIBLE PUMP, WITH BASKET STRAINER.

the pump. It should be kept screwed on the 2½" discharge outlet for this purpose, and will also serve to protect the male threads from damage.

d. A basket strainer will improve the efficiency of the pump by avoiding fouling. Simply hook a 2½" hose onto the discharge connection of the pump, lower the pump into the flooded compartment by means of its handling line, and plug its electric cable into a proper outlet.

4. Operation.

a. When submerged in water the pump needs no priming.

b. Use of a suction hose requires a foot valve.

c. Use standard 2½" fire hose for discharge.

d. Do not operate the pump unless the suction is submerged and has its strainer attached. The pump should be operated only in its vertical position.

e. Large basket strainers should be fabricated by ship's force and kept available at repair lockers for use with the portable pump. These strainers can be made from expanded metal or wire mesh having openings no larger than 1/4" square. They should be 17" in diameter by 30" deep. Basket strainers are necessary for most shipboard pumping because debris will clog the pumps.

f. See that the cable is plugged into the proper electrical outlet to operate the pump.

g. When unwatering against high discharge heads, two submersible pumps can be used in series. The lower pump lifts water into the suction intake of the higher pump, which discharges overboard. Connecting and discharge hose must be kept free of kinks.

5. Maintenance. The most critical point on these pumps is where the electric cable passes through the watertight casing to the motor. The packing gland at this point should be carefully checked, together with the electric cable and connections. The pump should be tested monthly by using a GI can full of water. Too much emphasis cannot be placed on the care and upkeep of submersible pumps, since they are usually required in an emergency and therefore must be in top operating condition.

6. Pump capacities, the law of diminishing return.

a. The pump is rated to discharge water through a 2½" hose at a rate of 140 GPM against a 70'foot head (approximately 30 PSI).

b. Approximately 180 GPM (20 PSI) against a 50 foot head.

c. 15 feet is its practical limit of suction lift. If a suction hose is put into the water instead of lowering the pump in, a foot valve is necessary. The greater the lift from the water to the pump, the less water will be pumped. Power expended pulling water up to the pump inlet reduces volume at the pump discharge. Therefore it is generally best to lower the pump directly into the water.

d. Like any other centrifugal pump, the discharge will be greatest at the lowest head for any given suction. Also, keep the hose free of kinks.

7. Safety Precautions.

a. Do not use the electric submersible pump without strainer.

b. Do not run it without water circulation -- keep the suction in the water.

c. Never use this pump as a fire fighting pump since the back pressure of the nozzle will rupture its seals.

d. No nozzle or other restrictive device should ever be used on the end of the discharge hose. It must be kept clear and free of kinks for best discharge.

e. Submersible pumps are not designed for pumping gasoline or oils. Gasoline or oil will deteriorate the seals in pump. Also, since the liquid pumped circulates around the motor for cooling purposes, there is a possibility of gasoline leaking into the motor to form an explosive mixture. Should this pump be used to pump heavy fuel oil, the high viscosity would impose an undue load on the motor and the oil would not carry heat away sufficiently. Therefore, there would be increased danger of burning out the motor. Therefore, do not use the electric submersible pump to pump gasoline or oil, or where gasoline fumes are present.

If the emergency warrants pumping heavy fuel oil where the safety of the ship over-rides the possibility of burning up the pump, use two pumps in series.

8. Power sources and discharge outlets.

a. The pump has either an AC or a DC motor connected directly to a small, high speed centrifugal pump.

b. The power outlets for the pumps are located in various parts of the ship. These locations must be known by members of the repair party.

c. The pumps are requisitioned according to the type of electric power aboard ship. They are available for 230 volts DC and 220 or 440 volts AC.

d. Discharge hose from the pump should be led to the nearest available overboard discharge. Some ships are provided with permanent overboard discharge connections for this purpose.

9. Pumping demonstration. Rig and operate an electric submersible pump to demonstrate its use.

a. Use a suction hose attached to the suction end of the pump and attach a foot valve to the lower end of the suction hose.

b. The pump will then have to be primed.

(1) This can be done by lowering the pump into the water without the discharge hose attached, allowing the water to fill the pump and the suction hose.

(2) If this cannot be done, use a fire hose or any other water supply to fill pump and hose.

(3) The foot valve will keep the water from draining out of the hose.

c. The pump, when submerged in water, needs no priming.

d. Remove the suction hose and demonstrate operation of the pump by lowering it directly into the water. Show how kinking the discharge hose will reduce the pump's effectiveness.

10. Responsibilities in rigging and tending the electric submersible pump.

a. The electrician should be the only man to normally connect the electric cable to the outlet.

b. The electrician should stand by in the vicinity of the pump or operating switch at all times it is in use.

c. The pump should be operated in a vertical position. This will prevent the discharge hose from kinking.

d. Two men can rig and lower the pump into a compartment.

e. After the pump is lowered to its proper position and secured, only one man need stand by the pump.

D. Gasoline Handy-billy (P-60) and the P-500 Pump.

1. The handy-billy and P-500 are normally not included in USNS ships allowances because of the fire hazard of stowing gasoline. However, the P-500 pump is provided in ships which are engaged in operations which may require its emergency use, as in Arctic operations. The pump is sent ashore upon completion of the specific assignment.

2. The handy-billy pump (P-60) is a lightweight, compact, portable fire fighting apparatus complete with rotary-type pump, and driven by a two-cylinder, two-cycle gasoline engine. It will deliver 60 gallons of water per minute with a pressure of 100 PSI. Maximum suction lift is 20 feet. However, the electric submersible pump may be used to lift water and discharge it into the intake of the handy-billy pump where higher lifts are required.

3. The P-500 operates on the same principle as the handy-billy except that it is larger, utilizing four cylinders instead of two. While the model P-500 (500 GPM at 100 PSI) pump was originally developed for firefighting, it can be used successfully for salvage operations, pumping large volumes of water at low pressure. It delivers 500 GPM at 100 PSI with a suction lift of 16 feet. With an eductor the lift may be increased to 50 feet or more, but the discharge drops in proportion to the increased lift.

E. Eductors. Eductors are a very simple and yet extremely useful "syphon" for unwatering compartments. Activated by fire main water pressure they will discharge both their activating water and an approximately equal amount which they syphon or pick up. There are two types of eductors:

1. Old type.

a. The old type jet eductor has a single jet, with its intake and discharge openings offset (not in line). Any small foreign matter may clog its suction chamber, therefore a strainer with foot valve is provided.

2. Peri-jet eductor. (Show the eductor while describing it and explaining its use.)

a. The new peri-jet eductor is constructed of aluminum and is light in weight. It is activated by a $2\frac{1}{2}$" fire hose using fire main water pressure and discharges through a 4" hose. A 4" hose can also be used on the suction end.

b. The peri-jet eductor operates by jet action in a vacuum chamber, leaving a straight bore of approximately $2\frac{1}{2}$ inches through the eductor base into the discharge section.

c. This $2\frac{1}{2}$" opening permits passage of debris through the eductor and the discharge hose.

d. A 4" hard rubber hose may be used for the suction end of the eductor or the eductor can be lowered directly into the water.

e. Discharge is through a 4" hose, preferably hard rubber. The discharge hose must be free of kinks to prevent reverse flow from flooding the compartment being pumped out. (This generally occurs with the use of the 4" canvas hose.)

3. Reverse Flow Valve. The reverse flow valve is a spring-loaded quick-closing valve for use with peri-jet eductors only. The valve is connected on the discharge end of the 4" hose. In the event the eductor is unable to pass debris, close the valve and this will clear the debris by forcing water back through the intake.

4. Advantages of the Peri-jet Eductor.

a. It is independent of any electrical equipment, since it can be activated by fire main water pressure which may be provided by the emergency deisel fire pump in ships so equipped.

b. It does not require a strainer.

c. It is rugged, simple and requires little time to rig and ready for operation.

d. In tankers, when conditons require the use of portable pumping equipment, the peri-jet eductor eliminates all danger of igniting explosive oils or gases.

e. It is about seven percent more efficient than the single-jet, old-type eductor. For example, with a fire main pressure of 100 PSI at the eductor, about 182 GPM is required to activate the eductor. The old type will pick up and discharge an additional 151 GPM against a discharge head of 40 feet. The new peri-jet eductor will discharge an amount equal to or slightly more than its input. With a good pressure and low discharge head, 250 GPM input can be put into the peri-jet and an additional 300 GPM picked up and discharged.

5. Uses.

a. Eductors perform low head unwatering operations at a greater rate of discharge than can be obtained by straight pumping with available emergency pumps.

b. They are used for pumping liquids which portable pumps cannot handle directly.

c. Peri-jet eductors will pass reasonably small particles of debris through the eductor and discharge hose.

d. The old type eductor is suitable for use as a P-500 pump suction supply. The peri-jet eductor has no foot valve and is not suitable for use with P-500.

6. Demonstration. Rig and demonstrate the hookup and operation of the peri-jet eductor.

V. SUMMARY

A. When unwatering against high discharge heads, two submersible pumps can be used in series, the first pump at the lower level lifting water into

the suction inlet of the second pump which will be located at a higher level. The submersible pump must not be used for oil or explosive gases.

B. When using an eductor for unwatering, it should be kept in mind that pressure of the activating water must always be substantially greater than the pressure against which the eductor is required to discharge, otherwise the activating water will back up through the eductor into the compartment and add to the already existing flooding. (Ratio should be about 3 to 1.)

C. While the eductor's hydraulic efficiency is low, it performs low head unwatering operations at a greater rate of discharge than can be obtained by straight pumping with the available emergency pumps.

D. The eductor working against a head of 40' will pick up 151 GPM from the compartment. With a fire main pressure of 100 PSI at the eductor, approximately 182 GPM of water is required for the operation of the eductor and the peri-jet eductor will pick up and discharge about 200 GPM additional.

E. A low fire main pressure might easily result in introducing additional water into the compartment.

F. It is imperative that the eductor discharge hose be kept free of kinks. Otherwise, water will back up in the flooded compartment.

G. Arrange for a demonstration of the operation of all unwatering equipment aboard ship.

H. Introduce and show film MN-6774 - "Method of Unwatering Flooded Compartments", 18 minutes.

I. Reproduce and distribute VII, Handout, Tips for Testing Peri-jet Eductors or discuss its key points.

VI. TEST AND APPLICATION.

A. Test. Use these and additional questions as an oral quiz.

1. Q. Name two main types of pumping equipment used for unwatering.

A. Fixed or built-in pumps, such as bilge and ballast pumps and portable emergency pumps and eductors.

2. Q. Name three types of pumps which comprise a ship's built-in bilge system.

A. Steam-driven reciprocating, centrifugal, and electric submersible pumps.

3. Q. Where are the ship's bilge pumps normally located?

A. These pumps are usually located in the engine room spaces.

4. Q. From where is the power supplied for the fixed electrical submersible pump?

A. Electrical power is supplied from the emergency switchboard.

5. Q. How are a ship's fixed pumps connected to the various compartments for unwatering?
A. They are connected through the bilge manifold by piping having non-return check valves.

6. Q. What is the common practice when unwatering against high discharge heads with the portable submersible pump?
A. Two submersible pumps should be used in series.

7. Q. What is the most critical maintenance point on the portable electric submersible pump?
A. It is where the electric cable passes through the watertight casing to the motor.

8. Q. What is the electric submersible pump rated to deliver?
A. 140 GPM at a 70' head and 180 GPM at a 50' head.

9. Q. What type of current and voltage is used aboard MSTS ships for submersible pump outlets?
A. 220 Volts DC, or 220 Volts AC, or 440 Volts AC.

10. Q. What should you be careful about when lowering the electric submersible pump?
A. Never lower it by the electric cable; use the hand line.

11. Q. What two types of portable eductors may be found aboard ship?
A. The "old" type of eductor and the peri-jet.

12. Q. Which eductor is activated by six (6) jets?
A. The peri-jet eductor.

13. Q. Which eductor requires a strainer and foot valve?
A. The "old" type eductor.

14. Q. Which eductor is not suitable for use with the P-500 pump? Why?
A. Peri-jet. It has no foot valve.

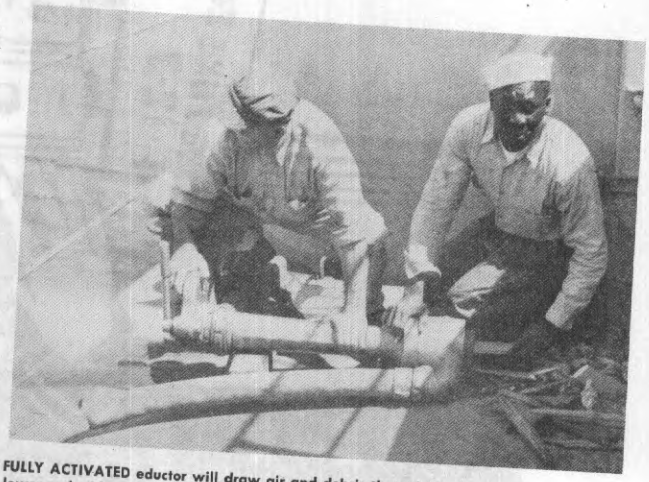
15. Q. What is the purpose of the reverse flow valve on the peri-jet eductor?
A. In the event the eductor is unable to pass any debris, the reverse flow valve is closed to clear the debris by forcing water back through the intake.

B. Application. Divide the class into several groups and have each group hook up and operate an electric submersible pump and an eductor.

VII. HANDOUT. Tips for Testing Peri-jet Eductors.

Reprinted from MSTS Magazine August 1958

Tips for Testing Peri-Jet Eductors



FULLY ACTIVATED eductor will draw air and debris through the lower end without leakage. Test can be conducted in dry space.

The old axiom that says: "It's one thing to read how to do something in a book, but it's another thing to actually do it," is especially true of damage control equipment. Reference manuals often are prepared primarily for technical personnel and are technically worded.

For example, some crewmembers in MSTS ships have reported that they find it difficult to understand the capabilities of the Peri-jet eductor described in *BuShips Manual*, Chapter 93.

Boiled down to simple terms, the eductor is nothing more than a portable siphon. It is operated by fire main pressure provided by the ship's fire pumps or by the emergency diesel fire pump.

By pumping water into the eductor through a 2½-inch fire hose input, an approximate equal amount is picked up and discharged through a 4-inch output hose.

For instance, with a fire main pressure of 100 p. s. i. (pounds-per-square-inch) at the eductor, about 182 g. p. m. (gallons-per-minute) will be required to activate it. The old-type eductor will pick up and discharge an additional 151 g. p. m. against a discharge head of 40 feet. The new Peri-jet eductor is more efficient and will discharge an amount equal to or slightly greater than its input.

However, if the activating pressure falls too low, or the discharge pressure is too great, the eductor will operate in reverse and will flood the compartment.

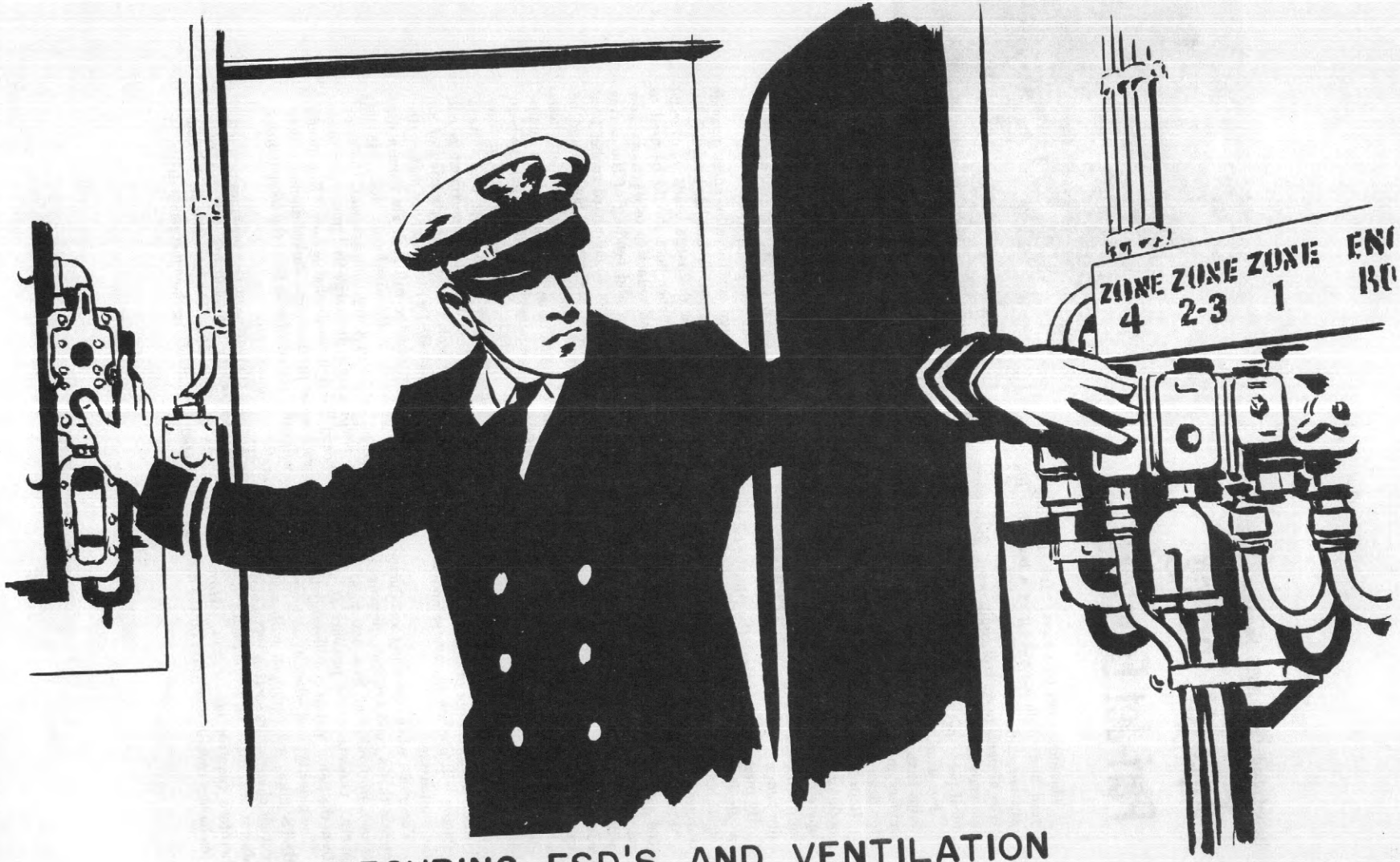
Therefore, when operating an eductor, make certain that a good fire main pressure is maintained, preferably at least 120 p. s. i. at the pump. Obviously, the pressure at a distance from the pump will be considerably less.

The older type of eductor, no longer used in MSTS ships, was equipped with a strainer to prevent clogging its suction. The new Peri-jet eductor will pass large pieces of debris and therefore requires no strainer. However, it does have a reverse flow valve on the discharge end of its 4-inch hose. Closing this valve will clear any debris by forcing water back through the intake. The Peri-jet eductor is aluminum and hence easier to handle. It also has a somewhat greater discharge capacity.

MSTS damage control allowances provide lengths of 4-inch canvas and hard rubber discharge hose. For discharge heads of over 20 feet, the hard rubber hose should be used to avoid friction and reduction of discharge flow caused by kinking and bending of the canvas hose. If there is not enough hard rubber hose to lead overboard, the canvas hose should be attached to the outboard end of the hard hose.

Eductors should be tested in realistic pumping exercises, against a practical discharge head pressure. A shaft alley escape trunk or forepeak tank provides a good test area. As a matter of fact, a flooded compartment is not required to check the proper operation of an eductor. Activated with a good fire main water pressure, an eductor will suck air from a dry compartment if the discharge hose has no kinks. Used in a dry compartment, the eductor will simply discharge its input water overboard through the discharge hose. But insufficient water pressure or a kinked discharge hose will cause the eductor to flood the compartment rather than suck air.

The dry compartment test provides a practical check on the fire main pressure in various parts of the ship. The test should be conducted as part of regular emergency drills. □



SECURING FSD'S AND VENTILATION

CHAPTER 3

ADVANCED DAMAGE CONTROL - For Deck and Engine Personnel (Lesson Plans)

Section 3.9

EMERGENCY REMOTE CONTROL SYSTEMS

I. OBJECTIVES.

A. To provide a knowledge of remote control operating gear, valves and fittings.

B. To develop an understanding of the purpose of remote controls.

C. To train shipboard personnel to properly use and maintain remote control operating gear.

II. MATERIAL.

A. Training Aids.

1. Ship's control display plans.

B. References.

1. BUSHIPS Manual, Chapter 88, Section II, Part 7.

III. INTRODUCTION.

A. Introduce self and subject (Emergency remote control systems).

B. Arouse interest by stressing the importance and use of:

1. Remote controls in emergency.

2. Types of remote-operating controls.

a. Ventilation controls.

b. Watertight door controls.

c. Fire screen door controls.

d. Equalizer valve controls.

3. Main drainage and secondary drainage remote controls.

4. Key engine room machinery controls.

IV. PRESENTATION.

A. Purpose of Remote Control Systems. These systems provide for:

1. Remote control of areas without violating their watertight integrity or at times these areas may be inaccessible due to smoke, fire or flooding.

a. They safeguard inaccessible locations.

b. They protect compartments not manned.

2. Time-saving in emergency as remote controls operate doors or valves on various decks away from the control station.

B. Types of Power for Operating Remote Control Systems.

1. Mechanical (Hand-operated) Controls.

a. Reach rods - rigid type.

(1) Emergency cutout valves to engine and firerooms.

(2) Firemain cutout valves.

(3) Feed (auxiliary) check valves to boilers.

(4) Watertight doors.

(5) Steering from the after docking bridge.

(6) Bilge valves.

b. Reach rods - flexible type.

(1) Fuel oil settling and service tank suction valves for emergency use.

(2) Fire pump suction and discharge valves in some cases.

(3) Firemain cutout valves.

2. Hydraulic (Power-operated) Controls.

a. Hand-operated gear pumps may close watertight doors and various firemain, steam and fuel oil valves.

b. Lever-operated oil pumps may be found in some ships where they close watertight doors.

c. Motor-driven pumps operating remote controls are in use in ships like the SS United States and USNS Point Barrow for operating large sea valves.

d. Telemotor systems for remote control of steering utilizing hand-operated piston or rotary pumps.

3. Pneumatic (Power-operated) Controls.

a. Various automatic regulators in engine room.

b. Fuel oil tank gauges.

c. Bilge suction valves in some cases.

4. Electrically-operated controls permit:

a. Closing watertight doors from the bridge in passenger ships.

b. Closing of fire screen doors from the bridge.

c. Securing all ventilation systems from the bridge in the event of an emergency.

d. Operation of the fixed submersible pump and shaft alley fire pump from a remote station.

e. In general, electrically operated controls may be found throughout every ship operating system and equipment from remote stations. Examples of these are:

(1) Gyro steering on the bridge.

(2) Emergency fire pumps.

C. Maintenance of Remote Control Systems.

1. Remote controls must be operated periodically and logged to insure proper operation when and if an emergency should occur.

2. Improper or defective operation of any remote controls should be immediately reported to the damage control office and/or the chief engineer.

3. Remote controls requiring lubrication should be oiled or greased periodically to insure smooth and easy operation.

D. Importance of Remote Control. Improper knowledge or defective remote control systems may prove costly in case of an emergency and may result in:

1. Loss of ship due to progressive flooding.

2. Smoke from a fire traveling throughout the ship and delaying the repair party and causing panic among passengers.

3. Loss of the main plant in heavy weather with resultant casualties and possibly the loss of the ship, passengers, and crew.

V. SUMMARY.

A. Review the types of remote controls.

1. Ventilation.

2. Watertight doors.

3. Fire screen doors.

4. Equalizer valves.

5. Drainage.

6. Machinery.

B. Review the importance of remote controls and how they can save ships and lives.

C. Stress the need for proper knowledge and operation of all remote controls on board ship.

D. Take the group on a tour of the ship to point out the various remote controls; how they are operated; the systems they control; and their effect.

VI. TEST AND APPLICATION.

A. Test. Use these and additional questions as an oral quiz.

1. Q. What are the four types of power for operating remote control systems?
A. Mechanical, hydraulic, electrical and pneumatic.

2. Q. What types of remote controls are used for the bilge system?
A. Hydraulic, pneumatic, and mechanical.