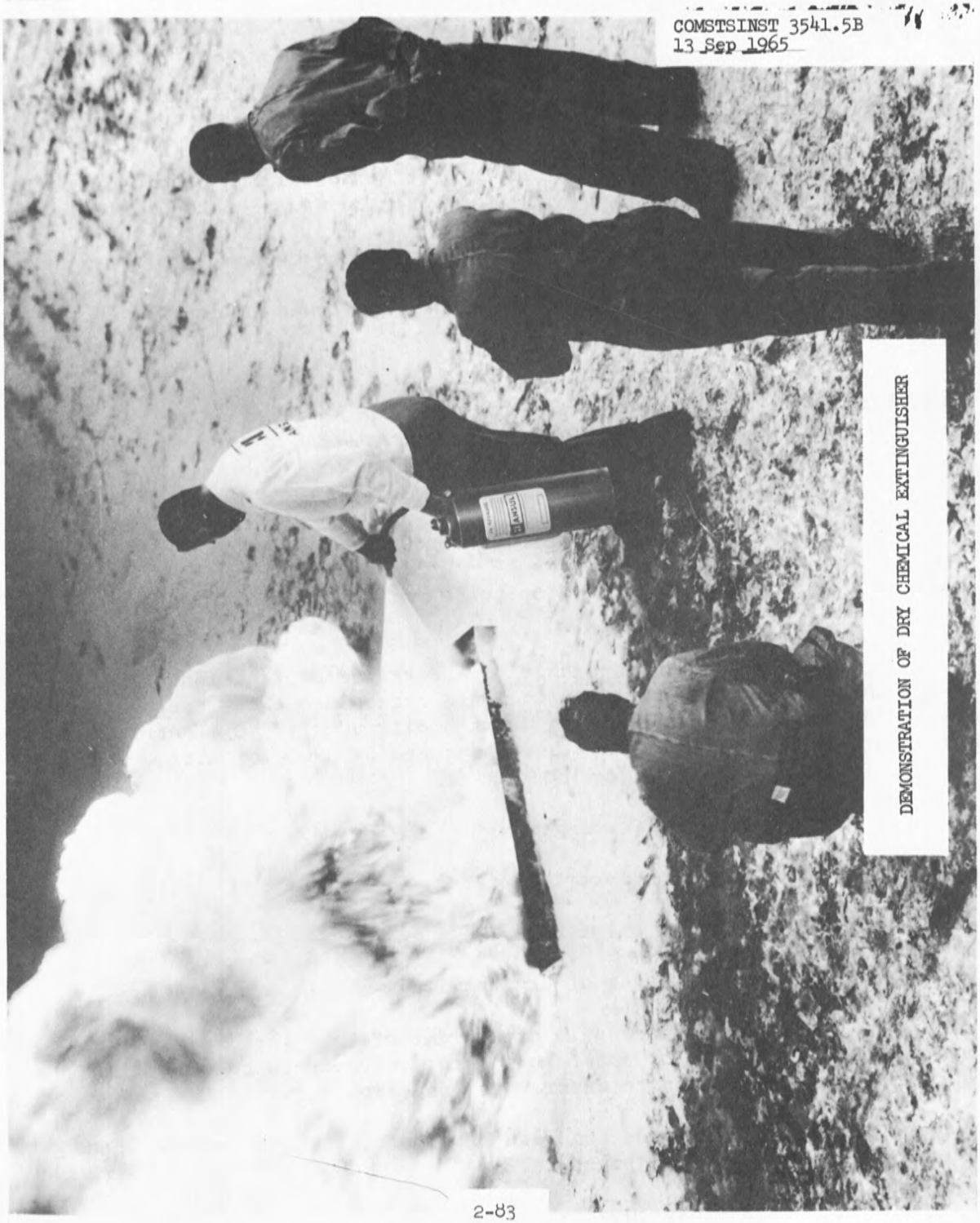


DEMONSTRATION OF DRY CHEMICAL EXTINGUISHER

a. Observe care when discharging in confined spaces since CO2 breathed in quantities will cause suffocation.

b. Never direct discharge at personnel and never carry the extinguisher on your shoulder - (demonstrate and squeeze handle).

c. Hold the horn only by its wooden handle.

d. CO2 snow may cause burns if allowed to remain on the skin.

e. Never replace empty or partially full extinguishers on their hangers. Turn them in immediately to the appropriate officer for replacement by spares and recharging in port.

8. Requirements.

a. Maintain 50% spares over USCG requirements.

b. Re-charge only up to 90% of capacity in the engine room and boiler room.

C. Dry Chemical Extinguishers. A detailed explanation of the use of dry chemical extinguishers is included here since these extinguishers have been found very effective on Class B oil and Class C electrical fires. Dry chemical extinguishers have been approved by USCG for marine use and are included in allowances for MSTS ships.

1. Purpose. To extinguish:

a. Class C electrical fires.

b. Class B oil fires.

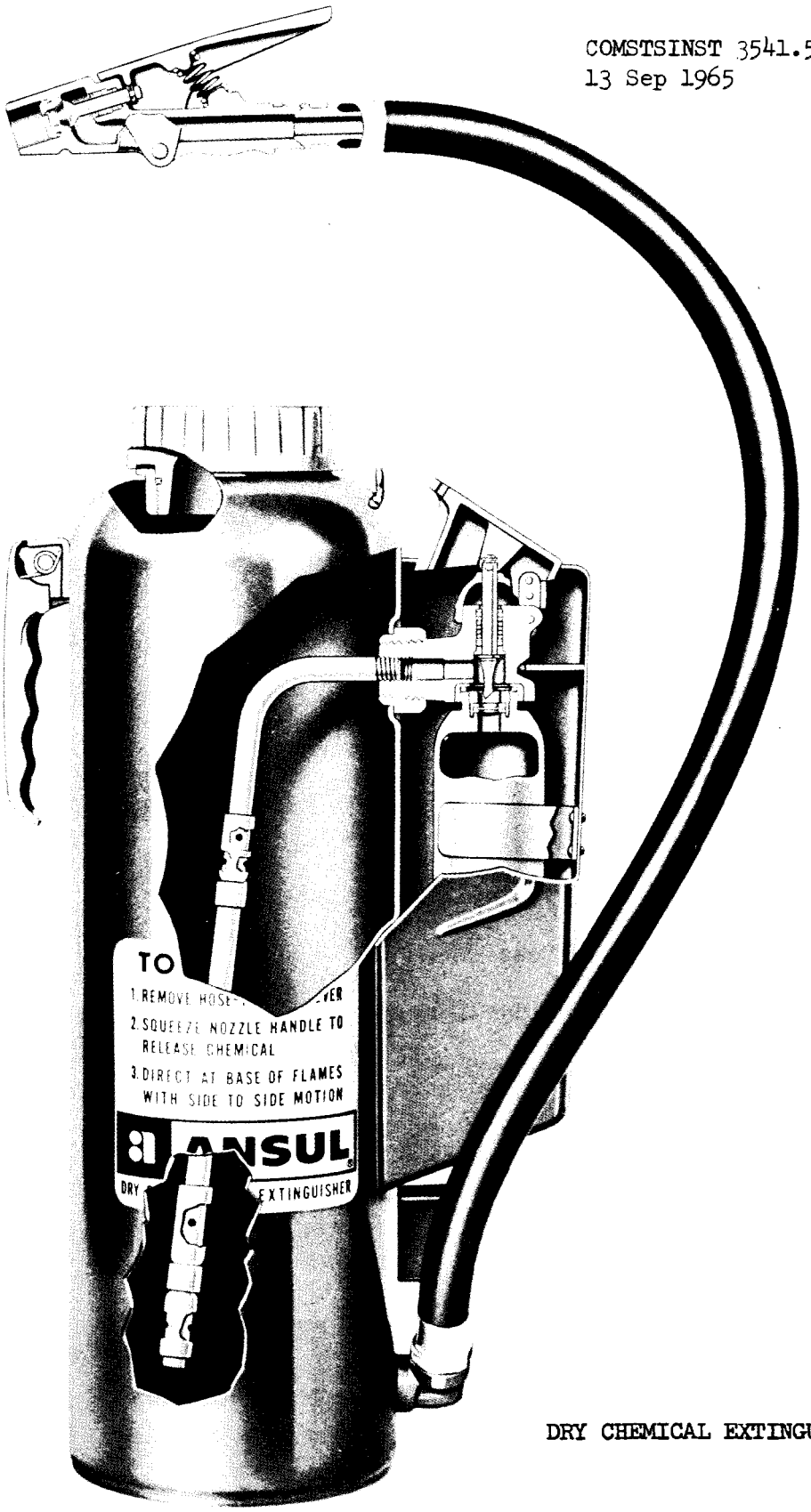
2. Characteristics of dry chemical.

a. It is stowed in dry powder state. The dry powder is principally bicarbonate of soda plus secret ingredients to make it resistant to moisture and to assure its free-flowing.

b. It expands hundreds of times its stowed volume when discharged by means of gas pressure.

c. Its dry chemical has a blanketing and smothering effect on all classes of fires and, at flame temperatures, the dry chemical also releases some inert gases which aid in extinguishing the fire.

d. Dry chemical features are:



DRY CHEMICAL EXTINGUISHER

(1) Water repellent.

(2) Non-toxic.

(3) Non-corrosive.

(4) Non-abrasive.

(5) Non-conductor of electricity.

(6) Will not freeze.

(7) Will not cake, deteriorate or evaporate.

(8) Not affected by normal temperature extremes.

3. Construction and contents.

a. The extinguisher is a cylindrical steel shell.

b. Attached to it is a release unit which may consist of the following parts:

(1) Nozzle.

(2) Fill cap.

(3) Carrying handle.

(4) Gas tube.

(5) Cartridge lever.

(6) Puncture pin.

(7) Gas cartridge.

(8) Cartridge guard.

c. The cylinder contains 20 lbs. of dry chemical. Various other sizes are also made - 5 lbs., 10 lbs., 30 lbs., and stationary units.

d. The cartridge contains approximately $5\frac{1}{2}$ ounces of carbon dioxide. Other sizes have correspondingly appropriate weights of CO_2 cartridges.

e. Extinguisher's charged weight is $38\frac{1}{2}$ lbs. (approximately). The CO_2 cartridge is checked by its weight.

4. To operate.

a. Remove hose.

b. Push cartridge lever down.

c. Squeeze nozzle handle.

d. Direct nozzle into flames toward base so that heat will be effective. Then use sweeping motion.

5. To recharge.

a. Release pressure by inverting the extinguisher and opening the nozzle (this procedure also clears hose of dry chemicals).

b. Return to upright position and remove fill cap (the nozzle can be used as a wrench to loosen fill cap).

c. Fill with dry chemical powder to top of extinguisher.

d. Replace fill cap tightly.

e. Pull up cartridge lever.

f. Replace hose.

g. Remove cartridge guard.

h. Remove empty pressure CO2 cartridge (left hand thread).

i. Replace with full pressure CO2 cartridge screwed tightly in place.

j. Replace cartridge guard.

k. Seal hose and cartridge lever with visual seal.

6. Maintenance and inspection. Inspect dry chemical extinguishers when you inspect the CO2 portable extinguishers as follows:

a. Remove cartridge guard.

b. Unscrew cartridge and inspect cartridge disc to see that it has not been punctured.

c. Weigh cartridge and check with weight stamped on cartridge. If weight is $\frac{1}{4}$ oz. less than that stamped on cartridge, replace it with a full cartridge.

d. Lift hose clear and operate cartridge lever to see that it works freely. If puncture pin does not move smoothly, lubricate it but only with a silicone grease.

e. Check the hose to ensure that it is clear. Do this by bending the hose double.

f. Squeeze the nozzle and shake dry chemical out of hose to ensure that nozzle is not obstructed. If the nozzle release does not move freely, lubricate the nozzle plunger with silicone grease.

g. Replace the hose, with its nozzle in the holder.

h. Check gasket in cartridge receiver to see that it is in good condition.

i. Screw cartridge tightly into place.

j. Replace cartridge guard.

k. Remove fill cap, see that dry chemical chamber is full.

l. Examine fill cap gasket to see that it is in good condition.

m. Screw fill cap tightly in place.

n. Seal cartridge lever with visual seal and record inspection on tag attached to extinguisher.

V. SUMMARY.

A. Types of Portable Extinguishers.

1. Soda acid, $2\frac{1}{2}$ gallon capacity.

2. CO_2, 15 lb. capacity.

3. Dry chemical, 20 lb.

B. Use of Portable Extinguishers.

1. Soda acid.

a. Used on Class A rubbish or trash fires - bedding, paper, wood, etc.

b. Produces a stream of water.

(1) Thirty feet.

(2) For about one minute.

2. CO_2 extinguisher.

a. Used on Class B oil and Class C electrical fires - oil, grease, electric motors, etc.

b. Produces a heavy, inert gas that blankets and smothers the fire.

3. Dry chemical.

a. Used on Class B oil and Class C electrical fires - oil, grease, electric motors, etc.

b. Heat of the fire releases carbon dioxide and water vapor from the dry chemical.

c. It blankets and smothers the fire.

C. Safety Precautions.

1. Do not use soda-acid extinguishers on Class B oil or Class C electrical fires.

2. Never point the nozzle or horn of either type toward anyone.

3. Never replace empty or partially full extinguishers on their brackets or hangers.

4. Exercise care in using CO_2 extinguishers in confined spaces.

5. Hold CO_2 extinguishers by the wooden handle provided for this purpose.

D. Location.

1. Check for location of portable extinguishers:

a. Near your room.

b. Near your working space.

c. In the vicinity of your emergency station.

VI. TEST AND APPLICATION.

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

1. Q. What general types of portable fire extinguishers are approved for use aboard MSTS ships?
A. CO2, soda-acid and dry chemical extinguishers.

2. Q. Soda-acid extinguishers may be used safely on Class C electrical fires. Answer true or false, and state why.
A. False. The soda-acid extinguisher discharges a stream of water. Since water is a conductor of electricity, the soda-acid extinguisher would be very dangerous on Class C electrical fires and would result in the operator receiving an electrical shock.

3. Q. Soda-acid extinguishers are located in: engineering spaces, living spaces, or galleys spaces?
A. Living spaces.

4. Q. How would you put a soda-acid extinguisher into operation?
A. Remove it from its bulkhead bracket, carry it to the scene of the fire, turn it bottom up, rest its top on the deck and direct its nozzle and stream at the base of the fire.

5. Q. What should be done when an extinguisher has been used?
A. Turn it in for re-charging.

6. Q. CO2 provides a "blanket" over the fire and smothers it. (True or False?)
A. True.

7. Q. Where are CO2 extinguishers located?
A. In areas containing electrical or electronic equipment. boiler rooms, and engine rooms.

8. Q. How do you put the CO2 extinguisher into operation?
A. Remove it from its bracket, carry it to the scene of the fire, remove the seal and pull its locking pin. Squeeze the grip (squeeze grip-type), hold the horn by its wooden handle, direct discharge at base of the fire in a swinging motion and discharge in short bursts.

9. Q. The dry chemical extinguisher is effective on what types of fires?

A. Class B and C - liquid oil and electrical fires - oil, grease, electric motors, etc.

10. Q. What is the major factor in extinguishment by the dry chemical extinguisher?

A. The release of carbon dioxide and water vapor from the dry chemical at flame temperature smothers the fire by blanketing action.

B. Application. Make a short tour through the ship having individual crew members point out locations of portable extinguishers, explain what type each is, why each type is located in each area, and have them demonstrate how each would be operated (without actually discharging them). Just before or at annual inspection, crew members may be permitted to discharge soda-acid extinguishers. Partially discharged CO2 extinguishers may be used for demonstration practice during training sessions.

CHAPTER 2

BASIC DAMAGE CONTROL - For All Hands (Lesson Plan)

Section 2.7

FIRE PREVENTION AFLOAT

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

I. OBJECTIVES.

A. To stress the importance of preventing fire.

B. To acquaint all-hands with the fundamentals of fire prevention techniques.

C. To encourage greater interest in and practice of fire prevention techniques.

II. MATERIAL.

A. Training Aids.

1. Film MN-8330B, "Fire Prevention - Know Your Fire Hazards" (16 minutes).

2. Charts of the Fire Triangle, Oxygen/Heat Angle. (Reproduce from the charts in this lesson plan or draw them on the blackboard.)

3. Safety matches.

4. Film MN-6931[illegible], Damage Control-Shipboard Fire Protection and Prevention (15 min).

B. References.

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

2. Fundamentals of Petroleum - NAVPERS 10883.

3. Rules and Regulations for Tank Vessels, CG-123.

4. Electrical Engineering Regulations, CG-259.

5. U. S. Navy Safety Precautions, OPNAV 34P1.

6. Explosives or other Dangerous Articles on Board Vessels, CG-187.

C. Handouts.

1. "Fire Hazard Areas in Ships" (Handout).

2. "Fire Hazard Fuels in Ships". (Handout)

3. "How Careless Personnel Build the Fire Triangle". (Handout)

III. INTRODUCTION.

A. Introduce Self and Subject, Fire Prevention Afloat.

B. State the Objectives.

C. Outline the Scope of the Lesson.

1. Review of the fire triangle.

2. Illustration of basic principles for preventing fire.

3. Discussion of those areas that are most inviting to fire.

4. Identification of the more common fuels which support shipboard fires.

5. Survey of actions taken by personnel which tend to increase frequency of fires.

D. Arouse General Interest. Approximately 99.9% of all peacetime fires could have been prevented by somebody. The other .1% result from what we call an "Act of God", such as lightning striking or eruption of a volcano.

E. Develop Personal Interest. We therefore need not worry about

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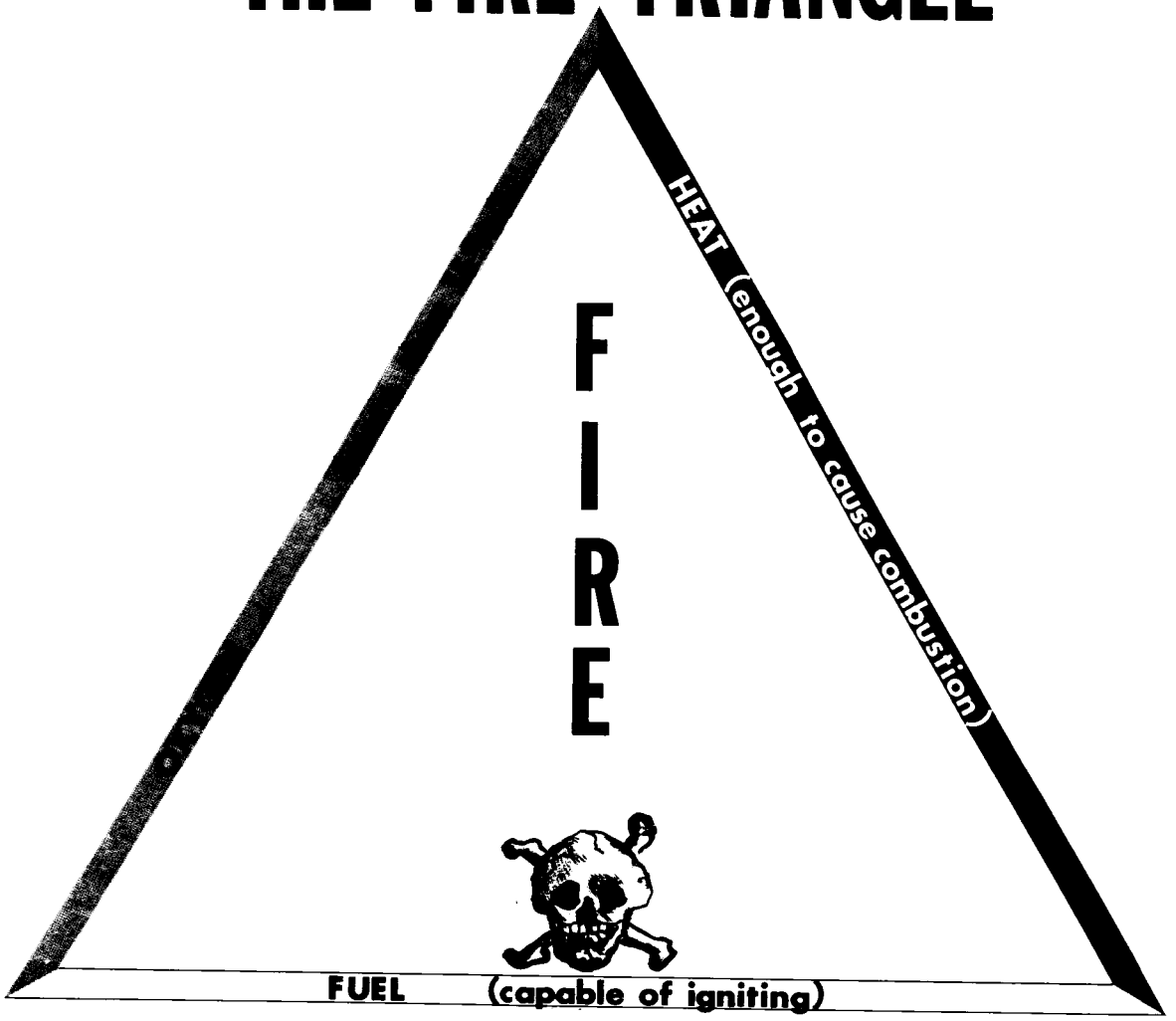
THE FIRE TRIANGLE



THE FIRE TRIANGLE IS BUILT MOST OFTEN BY CARELESS PERSONNEL. IT REQUIRES ALL THREE ELEMENTS.

that small percentage beyond our control but should concentrate on the 99.9% that you or I might be able to prevent. Knowledge of fire prevention afloat will help you through:

1. Increased interest in a subject that may protect you and your possessions.

2. Improved knowledge of fire chemistry that you can frequently use to advantage.

3. Knowing how to identify hazardous conditions which invite fire and knowing how to prevent fires.

IV. PRESENTATION.

A. The Fire Triangle. (See illustration.)

1. Remind the group that their original study of the fire triangle was intended to show basic principles that guide all fire fighters in extinguishing fires.

2. Impress upon the group the important fact that all three elements in the fire triangle must be present in order to have any combustion, that any missing element makes the incidence of fire physically impossible.

B. Oxygen/Heat Angle. (Show or draw this chart on the blackboard.)

1. Deprive a fire of fuel. What happens? It can only burn as long as fuel can be acted upon by the other two necessary elements, heat and oxygen. For example, a candle will continue to burn until all the tallow has been converted to vapors and burned.

2. Imagine that you have a hazardous fuel such as oil and deprive it of heat or oxygen, or both. Could you then have a fire? Of course not! All three elements are required to support fire.

C. Oxygen/Fuel Angle. (Show or draw this chart on the blackboard.)

1. Deprive a fuel of the amount of heat it needs to ignite or to sustain combustion. Would you then have fire? Of course not! Demonstrate by first striking a safety match lightly, then hard. Draw obvious conclusions that heat is one of the three elements necessary for ignition and that fire cannot occur without heat.

D. Elements of Fire Prevention. Fire prevention is like certain diseases of which it is said, "an ounce of prevention is worth a pound of cure". But, fire prevention consists simply of denying the fire

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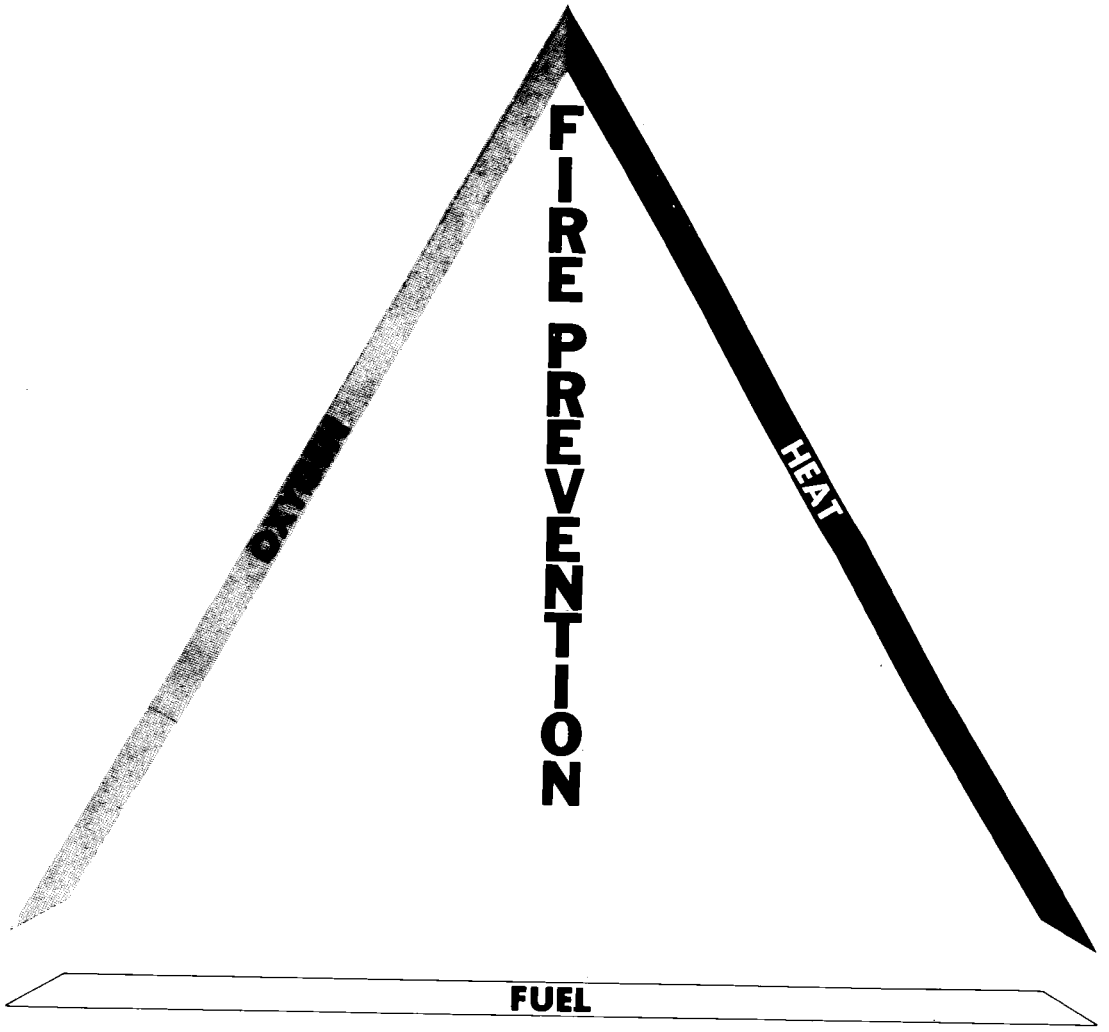
OXYGEN / HEAT ANGLE



FUELS ARE KEPT AWAY FROM THE REST OF THE TRIANGLE BY GOOD HOUSEKEEPING.

triangle any one of the three elements it needs for combustion. So, if the fuel area is very hot, remove the fuel or reduce the heat. If the heat is great, reduce it or remove the fuel. And, if it is impossible to do either, decrease the oxygen to a point lower than 15% content by volume by smothering the fire.

E. Areas of Excessive Heat. Areas in the ship that are exposed to the greatest heat as a normal operational hazard are:

1. Engine rooms.

2. Auxiliary engine rooms.

3. Steering engine room.

4. Generator rooms.

5. Boiler and fire rooms.

6. Motor rooms.

7. Emergency generator room when on emergency power.

8. Fan rooms.

9. Pump rooms when in long use.

10. Galleys.

11. All non-insulated spaces adjoining and above exceptionally warm areas, especially near galley ranges, boilers, and uptakes to stacks.

12. On warm days, all areas below exposed steel decks that are not adequately insulated.

13. Distribute handout, "Fire Hazard Areas in Ships".

a. Explain that this handout is a list of the more important hazardous areas. Remind class that these are areas from which one must keep combustible materials as much as possible.

b. Point out that stowage regulations concerning combustible materials require adequate insulation around or stowage away from heat sources.

F. Hazardous Materials.

1. What kind of materials stowed in our ship are hazardous,

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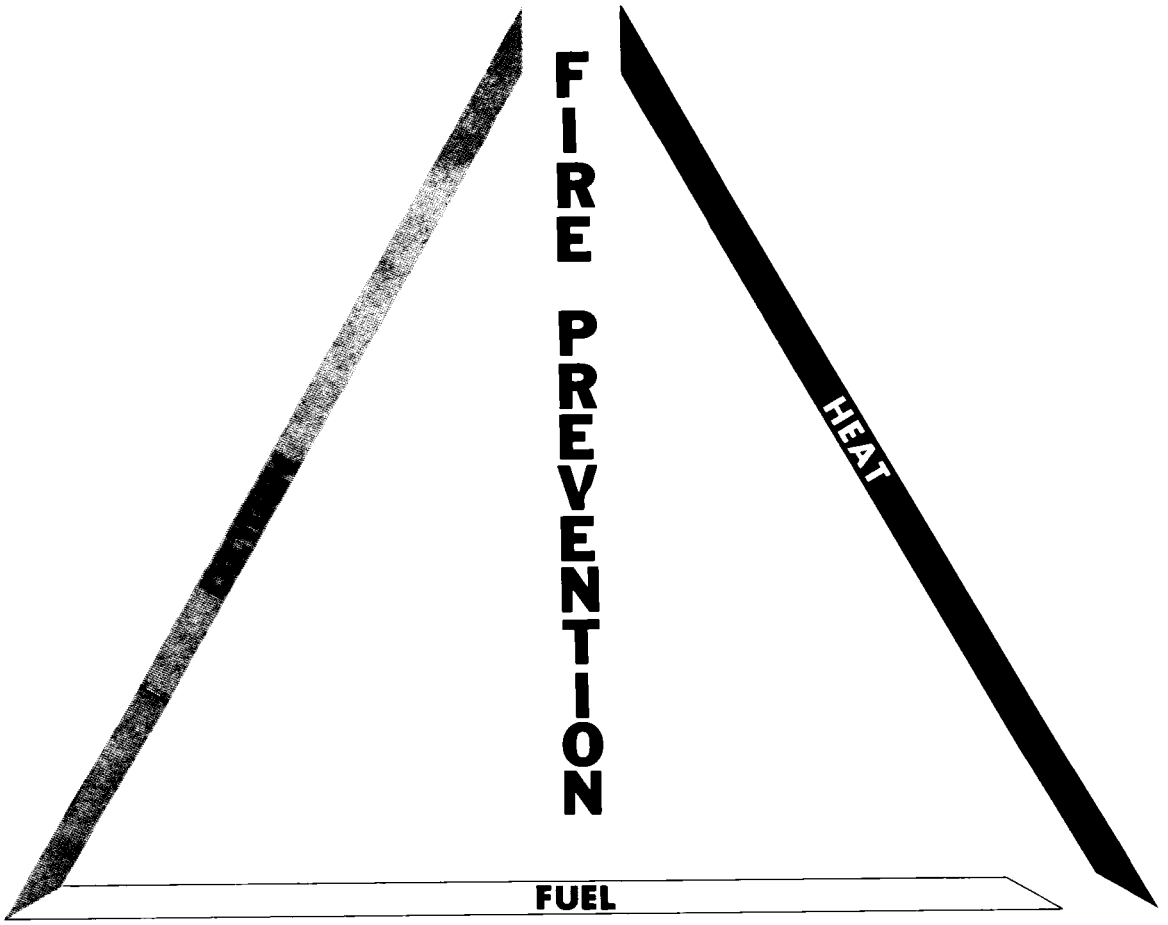
OXYGEN / FUEL ANGLE



HEAT SOURCES ARE KEPT AWAY FROM THE REST OF THE TRIANGLE BY YOUR KNOWLEDGE AND APPLICATION.

especially so when exposed to heat? These fall into definite classes and may be flammable liquids, flammable solids, combustible liquids, explosives, or flammable gases.

a. Flammable liquids found aboard ship include:

(1) Naptha.

(2) Gasoline (in tankers).

(3) Paint.

(4) Paint removers and paint thinners.

(5) Kerosene.

(6) Alcohol.

(7) Certain acids.

(8) Fuel oil.

b. Flammable solids include any solids which will ignite when sufficient heat is applied, for example:

(1) Coal.

(2) Charcoal.

(3) Wood.

(4) Paper.

(5) Cotton.

(6) Wool.

c. Most explosives are developed from nitrite products and, in ships, are primarily:

(1) Ammunition.

(2) Pyrotechnics.

d. Flammable gases include:

(1) Acetylene.

(2) Carbon monoxide.

GOOD HOUSEKEEPING

(3) Coal gas.

(4) Hydrogen.

(5) Liquified petroleum gas.

NOTE: A complete list may be found in CG-187. Explosives or other Dangerous Articles on Board Vessels. Distribute handout, "Fire Hazard Fuels in Ships" and explain that the list is greatly reduced to emphasize materials most usually found in quantity aboard ship.

G. Fire Prevention Combines Maintenance and Accident Prevention.

1. Ship's maintenance program will:

a. Prevent introduction of heat by:

(1) Inspection and replacement of all moving parts which, if neglected, would cause burning through friction.

(2) Inspection and replacement of all wiring which, if worn, would cause fires through short circuits.

(3) Periodic inspection of boilers, blowers, heaters, uptakes, and other areas where flammable fuels may accumulate.

(4) Regular checks of thermometers for accuracy.

b. Prevent accumulation of fire hazards by:

(1) Blowing tubes regularly.

(2) Cleaning soot pots.

(3) Removing explosive or flammable gases by blowers, etc.

(4) Periodic cleaning of galley stacks on oil-fired stoves in ships so equipped.

(5) Regular annual overhaul cleaning of supply and exhaust ducts and filters in vent systems.

2. The ship's accident prevention program will:

a. Prevent accumulation of hazards by:

(1) Good housekeeping. Clean up oil and grease spills immediately.

(2) Removal of waste. Be on the alert to prevent spontaneous heating and ignition. Although conditions for spontaneous combustion vary, a common example consists of cotton rags used to wipe up linseed oil in a paint locker and then bunched together in a corner of the paint locker.

(3) Removal of dangerous fumes by adequate ventilation.

b. Make personnel more safety conscious by:

(1) Safety training and safety committee meetings and activities.

(2) Posting safety instructions, warnings, and safety information throughout the ship.

NOTE: Distribute handout - "How Careless Personnel Build the Fire Triangle", and explain that it summarizes some typical incidents that cause shipboard fires.

V. SUMMARY.

A. Fire prevention is action taken to prevent the completion of the fire triangle.

B. Typical preventative measures include:

1. Removal of fire hazards from sources of heat and, in the case of particularly dangerous fuels, stowing them in protected spaces and the lockers provided for them.

2. Good housekeeping to assure prompt removal of rubbish, oil and grease spills.

3. Reduction of heat by proper maintenance of, and proper attention to, all equipment and supplies capable of emitting a potentially high temperature.

4. Since only .1% of fires are caused by "Acts of God", it can be stated that the most dangerous fire hazards in ships are due to CARELESS PEOPLE. Therefore the primary responsibility for fire prevention rests with YOU and with everyone in the ship.

VI. TEST.

A. Quiz. Use these and additional questions as an oral quiz. Select a crew member to answer after first stating the question.

1. Q. What is fire prevention?

A. Action taken to prevent completion of the fire triangle and thus to prevent the start and spread of the fire.

2. Q. Name the two principle ways in which fire is prevented.

A. (1) Keep heat or potential heat sources away from flammable materials. (2) Insulate heat from or reduce heat at flammable materials when they cannot be moved.

3. Q. How does good housekeeping prevent fires?

A. It prevents fuel sources from accumulating and provides for proper stowage of hazardous materials.

4. Q. If a fire started in a blower fan, what might have been the causes?

A. Faulty wiring, worn rings, poor brushes, overworn contacts, and other mechanical problems may have produced heat by shorting or friction. These are direct causes but faulty maintenance may have been an indirect cause.

5. Q. What is the basic cause of almost all fire hazards in ships?

A. Careless personnel.

B. Application. If time permits, take class on tour of proper stowage facilities for paints, oily rags, rubbish, and pyrotechnics.

VII. HANDOUTS.

A. Fire Hazard Areas in Ships (Handout).

1. A fire hazard area is any compartment in a ship where excessive heat may be present due to necessary operational equipment being installed there or where failure of fixed equipment may cause excessive heat to be generated.

2. Fire hazard fuels are discussed separately in Handout B.

3. Areas where fire hazards exist vary with each ship to a slight degree. Therefore, a general summary of most hazardous areas will be given.

a. Compartments:

(1) Engine and auxiliary engine rooms.

(2) Boiler and Fire rooms.

(3) Motor room.

(4) Generator and emergency generator rooms (when activated).

(5) Fan room.

(6) Steering engine room (when in use).

(7) Pump room (when pumps are in use).

b. Shops:

(1) Machine shop.

(2) Plumbing shop.

c. Flats:

(1) Evaporator flat.

(2) Reefer flat.

d. Galleys.

e. All areas above or adjacent to an area where excessive heat is generated, especially near galleys and boilers. Stack uptakes are particularly dangerous areas because they are above the boilers.

f. All areas below steel decks when exposed to a hot sun.

g. Electrical areas such as resistor and controller rooms.

4. The secret of good fire prevention is simply applying basic principles of good housekeeping.

a. Keep flammable rubbish away from areas having excessive heat or heat potential.

b. Clean up oil spills and other flammable liquids as soon as possible; do not wait.

c. If you must have fuels, such as paint or rags, in heated areas, be sure to stow them in their assigned area; never leave them unattended.

B. Fire Hazard Fuels in Ships (Handout).

1. Fire hazard fuels are solids, semi-solids, fluids, and gaseous substances which can be ignited and will continue to burn after the initial igniting source has been removed or has dissipated.

2. Fuels, like fires, are classified also. The basic classes of dangerous fuels are:

a. Flammable liquids, such as:

(1) Naptha.

(2) Gasoline.

(3) Paints (not all kinds).

(4) Paint removers and thinners (most types).

b. Flammable solids, such as:

(1) Matches.

(2) Paper (under most conditions).

(3) Cotton and wool products (when oily or greasy).

(4) Numerous solid products shipped as dry cargo (especially chemicals).

c. Combustible liquids, such as:

(1) Kerosene.

(2) Alcohol (some compounds; may also be flammable liquid).

(3) Acids (certain kinds).

(4) Fuel oil.

d. Explosives, such as:

(1) Pyrotechnics.

(2) Ammunition.

e. Flammable gases, such as:

(1) Acetylene.

(2) Carbon monoxide.

(3) Coal gas.

(4) Hydrogen.

(5) Liquified petroleum gas.

3. Characteristics of these classes of fuels are:

a. Flammable liquids give off vapors at or below 80 degrees F.

b. Flammable solids are substances of solid appearance which will ignite by friction, absorption of moisture, through spontaneous chemical changes, or as a result of retained heat from manufacturing or processing.

c. Combustible liquids give off vapors above 80 degrees F.

d. Explosives release gas and heat almost instantaneously.

e. Flammable gases include compressed vapors which usually burn quickly, sometimes fast enough to resemble an explosion.

4. The basic principle of fire prevention in dealing with fire hazard fuels is keeping heat away from them and preventing conditions where heat might be generated within the product itself.

5. Personnel interested in stowage details of all known hazards of the above classifications are urged to read BUSHIPS Manual, Chapter 30 : Stowage of Safe, Semi-safe, and Dangerous Materials, or CG-187; Explosive or other Dangerous Articles on Board Vessels.

REMEMBER: HEAT IS KEPT AWAY FROM FUELS BY YOUR KNOWLEDGE AND CONSCIENTIOUSNESS

C. How Careless Personnel Build the Fire Triangle (Handout).

1. The most significant fire hazard in ships today is CARELESS PERSONNEL. Other than a few fires defined by law as "Acts of God", such as lightning or extremely heavy seas, almost all fires are caused by careless people.

2. Millions have been spent in research, training, and equipment designed to eliminate fires caused by personnel. Tests have been conducted on almost every item carried in a ship as cargo or as supplies and complete knowledge of their reaction to fire is available. Volumes of regulations regarding fire-hazardous materials have been distributed or made available to all personnel responsible for preventing fires which might originate independently; that is, without the help (or carelessness) of any person. The investments made in fire prevention have reduced the frequency of fire at sea. Yet, we still have fires. Why?

3. Investigations of fires in ships today always leads to the conclusion that somebody had built a fire triangle. Somebody had:

a. Allowed hazardous materials improperly marked or crated to be loaded in a ship.

b. Permitted an identifiable hazard to be stowed improperly or in a hazardous location.

c. Failed to maintain good housekeeping standards which would have prevented accumulation of fire hazards such as soot, dust, and flammable waste products.

d. Neglected to stow, or to stow properly, flammable material such as paint or oily rags.

e. Ignored smoking regulations.

f. Exposed heat to fuel or fuel to heat without being fully aware of the disastrous consequences.

4. You can prevent fires by following a few simple rules:

a. Obey the regulations in identifying, handling, and stowing fire-hazardous materials.

b. Abide by all rules regarding smoking, using an open flame, or activating equipment which might emit excessive heat or flammable fuel.

c. Exercise good judgment in situations not covered by instructions. Every day you can look about and ask yourself these questions:

(1) Is there a fire hazard nearby?

(2) Is anybody smoking, burning or welding where they should not?

(3) Is there any possible way that "heat" and "fuel" can combine in the presence of oxygen to start a fire?

REMEMBER: FIRES DON'T HAPPEN: <u>THEY ARE CAUSED</u>. THEY ARE CAUSED BY <u>CARELESS PERSONNEL</u>. JUST AS SURELY AS THEY ARE CAUSED, <u>FIRES CAN BE PREVENTED</u>.

COMSTSINST 3541.5B
13 Sep 1965

FIRE DOWN BELOW

(Reprinted from "Proceedings of the Merchant Marine Council," USCG, October 1962)

By Thorolf Wikborg of Oslo, Norway

A SHIP TODAY is a cosy place to live in and the risk is small—if those on board, officers, crew passengers, visitors and repairers, keep in mind the danger of fire.

There is much that is combustible in a ship. Owners and builders have tried increasingly to furnish public rooms with panels, textiles and furniture to make them all look as much as possible like a pleasant home—in the belief and the hope that those on board would behave themselves as though they were at home. But there seem to be considerable shortcomings in the matter of sensible smoking habits. Cigarettes are left on the top of piles of ashes and stumps in ashtrays without the embers being extinguished. They are thrown glowing over the rail or on deck and people go to sleep with them in their hands. There seems to be an innate resistance against extinguishing the embers of cigarettes. At home, in a railway carriage, or in an aeroplane you do not discard a cigarette until it is extinguished. If you are not so careful on board ship it must either be attributed to the fact that you consider that it cannot be so dangerous with so much water about or that you have never learned proper smoking routine. Perhaps it has never been learned ashore and smoking has only begun when one is a first voyage sailor and gets cheap tax-free cigarettes on board.

It is dangerous to smoke carelessly on board a ship. It is, in fact, more dangerous than ashore. Fire is easily fed because of wind currents and artificial ventilation and spreads easily through narrow corridors and staircases. Persons live closer together on board ship and the smoke from a fire can take your breath away before you get a chance to escape and raise the alarm. In harbour it may be some time before the watchman discovers the fire and can help you out for he cannot be in all places at one time, whereas if fire gets the upper hand while you are on the high seas it can mean an unpleasant and dangerous rowing excursion in the life boats.

Here are some examples from recent years.

Fire broke out in the interior of the midshiphouse which was completely destroyed, eleven persons being unable to escape.

Fire broke out in some goods in sacks on deck aft of the midshiphouse, very probably as a result of a cigarette end being thrown from the boatdeck to windward. The flames spread into the midshiphouse and thence to the engineroom and cargo holds. The vessel was completely destroyed and four lives were lost.

The following article is not written in technical terms, and the reader may well question some of the statements made, for example, that sparks or open flame are necessary for the ignition of combustible materials. Nevertheless, the article is interesting, easy to read, and the over-all presentation is considered to be worthwhile and of interest to ships' personnel.

Acknowledgment and thanks are given to the following firms who have given us permission to reprint: The British & Foreign Marine Insurance Co., Ltd.; the Thames & Mersey Marine Insurance Co., Ltd.; and the Royal-Globe Insurance Co. ED.

Fire broke out in the midship saloon at night and the midshiphouse was entirely destroyed. Two passengers were unable to escape and the captain who went in to rescue them also lost his life.

Fire broke out in the electrician's cabin aft of the midshiphouse. Within a quarter of an hour the whole house was in ruins.

The night after arrival in a United States harbour the crew returned on board after shore leave in an unsteady state. Two of them continued to drink and smoke in one of the cabins and this was seen by the watchman but he did not speak to them. One lay on a sofa, the other in the cabin with a lighted cigarette. The whole of the crew's accommodation was burnt. The one who started the fire managed to save himself but two men were lost and one was maimed through hanging half out of a ventilator while the fire service sprayed water into the cabin through another ventilator.

. . . smoking has only begun . . .

A boatswain came on board at night after shore leave. An hour later a cry was heard from his cabin; but, before they managed to get him out, he was choked with smoke. The boy who looked after the cabin related afterwards that he had often seen holes burned in the boatswain's pyjamas, blankets, and sheets.

In a South American harbour fire broke out in the crew's quarters and four men lost their lives.

A mess boy was sitting and smoking in his cabin; he threw his cigarette down and went out. There was a regular fire patrol in this ship and the fire was discovered early enough to limit the fire to the cabin by using hand-extinguishing apparatus. The mess boy was heavily fined for having endangered the lives of 50 men and was made responsible for replacing the damage done.

Examples could be multiplied but it is sad reading. Let us turn to a little science.

Cigarette embers maintain 350 to 400° C. If the cigarette paper ignites, the temperature goes up to twice these figures. Wool ignites at 200°, paper at 250°, wood at 300 to 350°, jute, hemp, etc. from 370 to 400°. Cotton waste impregnated with vegetable oil or animal oil (linseed oil, hemp oil, whale oil, codliver oil) will spontaneously heat while the oil dries and can ignite if it lies in such a manner that the heat is not conducted away.

IT IS DANGEROUS

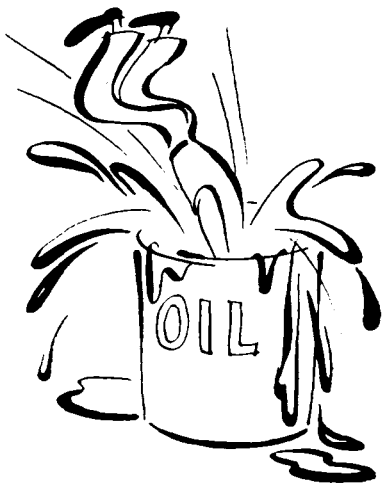
1. To leave a lighted cigarette. Cigarettes do not go out by themselves. Notice the ugly brown marks on tables. Regard a burning cigarette on the top of a heap of stumps and ashes in an ashtray as an abomination instead of an ornamentation as seems to be the "style" on board ship. Why wait for it to be emptied when the mess or saloon boy goes his rounds when you now know that such smouldering cigarette ends have caused

severe losses of lives and property due to the embers falling on table or deck and being nursed by draughts when doors are opened or when forced ventilation is switched on?

2. To smoke in the bunk. Remember that you do not know when you are falling asleep. The cigarette or pipe drops on the bedclothes. Flames do not perhaps immediately rise up so that you do not wake with scorching but it smoulders, carbon monoxide develops and you do not wake again.

3. To smoke by open hatches or on deck if there is combustible cargo in the hold or on deck. If the stevedores' people commit such careless acts, it is the duty of one and all to report them. A fire in the hold in port is perhaps not so dangerous to life but think of the destruction of property. And property lost means higher insurance premiums and dearer goods, i.e. a lower standard of living. The commencement of a fire during loading or discharge is often only discovered long after the hatches are closed and the ship miles away.

Cigarettes thrown overboard without being thoroughly stubbed can be blown by the wind round the deck until they find something to ignite or be sucked in by ventilators to the cargo where they can smoulder for a long time before being noticed on deck. This can also happen through sparks from the engine or galley funnel. Be on your guard for these sparks and see that the spark arresters on the air pipes are in place and in order.



. . sooner or later every seaman comes in contact with oil . . .

4. To strike a match by holding it by the tips and striking it away from you. If it breaks, the flame can easily lodge on something inflammable where it is difficult to reach. A seaman holds the middle finger in the centre of the match and strikes it towards him. Landlubbers and women strike away from themselves.

That is all. So you see there are no more safety regulations required at sea than those it is natural to observe at home. Those who cannot or will not behave as reasonable people must be spoken to. It will perhaps be said that this is easier said than done. There is, of course, nothing which offends you so much as when someone is concerned about your behavior. So you do this. You take one of these brochures, underline something you think one of your comrades is apt to overlook and put it in his cabin. Then he can muse over the matter and consider whether it was his guardian angel who thus stole a march on the demon of calamity. And perhaps he will mend his ways.

OIL ON BOARD

Sooner or later every seaman comes in contact with oil, especially those concerned with engines, tanks or galley. Do all know sufficiently about the characteristics of oil? Everyone knows that petrol is highly inflammable. Petrol gives off vapour even at the lowest temperatures and this vapour mixed with air ignites with the smallest spark—you know this from your experience with lighters—the spark arises either through steel objects striking or electrically (contact breakers motor brushes, etc.)

Oil, except crude oil, does not give off vapour at normal temperatures. There are fixed temperature limits for the various types of oil in use. If the temperature is lower, the oil is said not to "flash," i.e. to flare up if a lighted match is held over the surface. The border temperature is known as the flashpoint. Note the following flashpoints:

	°C.	°F.
Petroleum, paraffin, kerosene	22	80
Solar oil, light diesel oil	65	150
Ordinary diesel oil	80	176
Fuel oil	100	212
Lubricating oil	180	370

C. means Centigrade (or Celcius) and this thermometer is used in all but English-speaking countries. 0° is the freezing point of water, 100° is the boiling point of water. F. means Fahrenheit, the thermometer which is

. . . oil is not dangerous so long as it does not get loose . . .

used in English-speaking countries but also often found aboard Scandinavian ships. 0° C. corresponds to 32° F., 100° C. corresponds to 212° F. 0° F. corresponds to −17.6° C., i.e. the lowest temperature which could be reached (with ice and salt) when the Fahrenheit thermometer was made a couple of hundred years ago. It is a pity there has been no world agreement on the subject of a standard thermometer. Fateful mistakes are happening and everyone on board who has to measure temperatures must know beforehand what kind of thermometer he has in his hands. And remember always to report C. or F.

A LITTLE SCIENCE AGAIN

Oil does not burn by itself. It cannot under normal temperatures combine with oxygen in the air. The oil must be heated over the flashpoint when it gives off vapour, which combines with the air, and which is combustible if the proportion of the mixture is more than 1.4% vapour in comparison with the volume of air. If the mixture is stronger than 8%, the gas is not combustible. In a closed room the combustion will take the character of an explosion. Oil floats on water but the oil vapour is heavier than air and will therefore remain in the bottoms of empty tanks, pumprooms and near the floors in cabins, etc. When a tank is steamed the oil gases will rise in the tank and, as a consequence of heating the increased pressure, float up through the hatches.

ENGINE ROOM PEOPLE SHOULD KNOW:

Oil in use is not dangerous so long as it does not get loose.

. . . keep the fire pumps going . . .

. . . an unpleasant rowing excursion

BUT:

if it leaks out of a flanged joint; or if there is an overflow in the tanks because someone has forgotten to stop the transfer pump in time; or, if there is back pressure against the pumping from a bottom tank to another tank so that the oil rises in the sounding pipes or air pipes and these are not tight; then there is the danger of a catastrophic fire.

Oil may spout on to hot exhaust valves on the engine top or on to exhaust pipe flanges or on to a boiler or running electric motor or generator where it may be heated over the flashpoint and the gas may then be ignited by sparks or by an uninsulated part of the exhaust pipe or by other means.

AN EXAMPLE:

Light diesel oil was being bunkered. A motorman had orders to sound the depth of oil and if it came over a certain level to open a valve to another bottom tank. While he was sounding he fixed open the self-locking valve on the sounding pipe and forgot to close it when he went to open the valve to the other tank. In the meantime, a gush of oil came up through the sounding pipe, came in contact with a running electric motor, the temperature of which was more than the flashpoint of the oil. Gas was therefore formed which was ignited by the commutator sparks and fire burnt freely over bulkheads, paint and spilt oil in the cables and spilt oil under the floor plates.

The heat was strong enough to go through the casings and the whole of the midshiphouse went up in flames. There was later an explosion in the refrigerated stores chamber on account of carbon monoxide from smouldering cork insulation ignited by a smoker's match and fire broke out in one of the deep tanks forward of the engine room bulkhead. The explosion cost the lives of five men.

If the man had closed the valve of the sounding pipe or if he had only, for example, used his hand to lead the oil jet in a direction where it could not be heated, nothing serious could have happened.

It is, of course, wrong to allow sounding pipes on the engine floor to remain open. They should have self-closing cocks kept in good order. When not in use a blind flange should be screwed down over it and when in use you must never think of fixing the valve open. If you cannot take soundings and at the same time hold the valve open yourself, two men should do the job.

Oil bunkering also involves other risks and the correct routine should be to keep the fire pump going with water on the decks and firehoses clear preferably supplied with spray nozzles.

Fires in motor rooms or oil-burning boiler rooms are frequently due to oil having become loose by overpumping daytanks or pipeline leakage, and coming in contact with hot parts, and they may develop to catastrophes if air is allowed into the rooms. The first thing to do is to shut skylight and ventilators and other openings and turn on carbon dioxide (where installed) and try to cool the burning oil with foam or spray.

TANK PERSONNEL MUST KNOW:

Serious accidents have occurred and still occur because tank personnel do not realize that crude oil contains a large proportion of petrol which gives off vapour at any temperature. They believe that "dirty" oil is less dangerous than petrol, and as far as fuel oil is concerned it is true (flashpoints from 65° to 100° C.) but it is a perilous mistake to think that crude oil behaves the same way. Crude oil, as a matter of fact, is much more dangerous than petrol. After a petrol cargo the gas will evaporate readily and the tanks are easily cleaned, but after crude oil cargoes the oil sticks to bulkheads and floors and produces a gas as long as there is only a patch of oil left. Such patches can give off gas even after a tank has been certified gas free. One must always remember that, while the petrol has been refined away from fuel oils, the crude oil contains its original full amount of petrol.

During loading of crude oil or petrol the gas concentration in the tanks will generally be so strong that it will not be inflammable except at the openings where it mixes with air. During discharge, on the contrary, air is drawn into the tank and makes inflammable and explosive gas. When ballasting this gas will be pressed out of the tank openings.

Therefore; during loading and discharging of crude oil or petrol and during ballasting, ventilating and cleaning of tanks after such cargo:

Never use any other lights on deck than fixed mastlights and approved battery torches.

Never keep doors or portholes in the front of the poop on maindeck open, as gas may pass through them into the accommodation.

Never smoke on board the ship during loading or discharging, and otherwise, when tanks are open, only in such places where the Master has expressly permitted it. Never carry a lighter in the pocket.

Never use lamps connected by cable to the electrical mains near to open hatches or in the tanks, for instance while fixing the Butterworth or cleaning the tanks, unless it has been ascertained by a reliable gas indictator immediately before that the gas concentration is less than one-half percent. Never rely upon your nose as a gas indicator. Even the so-called flameproof lamps (F.L.P.) must not be used. If the cable is damaged and short-circuited or the lamp falls down, the spark thus created will cause an explosion.

EXAMPLES:

During a ballast voyage after carrying crude oil the tanks had been ventilated a considerable time with windsails. When steaming and washing down the tanks an electrical lamp "cluster" was used at the tank hatch to see how the washing down was going on. There was a terrific explosion cutting the ship in two and killing the three who were near the hatch.

During cleaning of tanks after carrying crude oil a tank had been "butterworthed" for 4 hours and ventilated by windsail for 24 hours. A man then went down into the tank in order to fix the Butterworth in a lower position. A F.L.P. lamp was used, and as far as could be ascertained something happened to the lamp or its cable. The man in the tank and two men standing near the hatch were killed by the explosion and the ship was severely damaged.

During spraying of a tank which had carried crude oil, a deckboy bent over the hatch to see how the washing was going on. He lost a lighter, which

. . . the crew returned . . .

If, in spite of all this . . .

he carried unlawfully in the pocket of his boiler suit, and the lighter hit a step of the ladder, opened and caused an explosion severely damaging the ship. The boy had an air trip but landed unconscious on the deck and could later confess what was the cause of this explosion.

There is little doubt that most explosions on tankers are due to lack of knowledge or caution when dealing with gas-containing compartments.

When you have learned what is said above, and act accordingly together with your colleagues, your life on board a tanker will be as safe as anywhere else.

SHIPYARD PEOPLE SHOULD KNOW:

All that is written in this brochure. And that sparks from burning and welding apparatus ignite oil vapor and that insulation is a very inflammable material. The welding of the outside of a plate with interior insulation has in too many cases led to catastrophical fires. Fire can smoulder for a long time in the insulation before it breaks out, perhaps long after working hours.

AN EXAMPLE:

A change was to be made in the oil pipe in the engines. It was not the intention to use a cutting apparatus but two men found it was easier to use one. Loose oil took fire and the two workers lost their lives while the repairs cost $300,000.

CARBON MONOXIDE:

Carbon monoxide forms by fire smouldering (burning without sufficient ingress of air) in wood, coal, cork, etc. The gas is odourless but very poisonous. Carbon monoxide alone cannot ignite but mixed with air it is very susceptible to ignition, fire and explosion. No matches or sparks must be near when a space is being opened where there may be carbon monoxide. It is somewhat lighter than air and comparatively easy to eliminate.

IF, IN SPITE OF ALL THIS, THERE SHOULD BE A FIRE ALARM:

If the advice which is given in this brochure is followed, the danger of fire on board will be considerably reduced. Fires due to technical faults are rare. In cargoes, fire can arise through spontaneous combustion but these fires can be held in check comparatively easily by shutting out air and by injecting carbon dioxide or steam until the ship arrives in harbour. Most fires are caused by ignorance or carelessness.

Ships can hardly be built completely fireproof and foolproof. Ships are, therefore, equipped to avoid outbreaks of fire. There are fire pumps in the engineroom and on large ships also outside the engineroom. There are hose pipe connections in the engineroom and on deck. There are carbon dioxide or steam pipe conduits to the holds and there are hand fire extinguishing apparatus everywhere. Most outbreaks of fire can easily be put out in their early stages. But they must be dealt with quickly. Every man should know the ship's fire routine by heart and take part in fire extinguishing practice. Every man should know the right thing to do in any given case without the need for orders. The one nearest the seat of the fire must do what he can to put it out at the same time as he gives the alarm.

The one nearest the seat of the fire . . .

It should be known that there is no fire without air (excepting in the case of certain chemical cargoes). The first thing you do is to get hold of the nearest hand-fire extinguishing apparatus but it is equally important to stop the ingress of air. If this can be done, the fire will soon die. In the case of fires in accommodation rooms, ventilators and doors must be shut immediately and the artificial ventilation must be stopped. The watch in the engineroom should start the fire pumps and the watch on deck attend to the water service pipe lines, valves and hoses. In the case of fire in the holds, hatches and ventilators must be made airtight as quickly as possible. If carbon dioxide or steam is used as an extinguisher a small opening must be maintained under strict control in order that displaced air can escape satisfactorily. If a fire occurs in the engine room, the skylight and doors must be shut immediately, the ventilating fans must be stopped and the ventilators plugged or dampers shut.

All hose nozzles on board a ship should be supplied with gear enabling them to be used either for straight stream or for spray. Spray extinguishing is much more effective than straight stream. It cools better and protects the operator better and all the water attacks the fire, while in the case of ordinary extinguishment with straight jets only a small portion of the water works on the fire and the rest destroys anything susceptible to water damage and gives the ship a list if it accumulates in large quantities on board. In the engineroom spray extinguishment will also be suitable but foam or CO_2 extinguishment probably better. If there is nothing more combustible in an engineroom than a little spilled oil under the floor plates, the prevention of an ingress of air will unquestionably be the best method of procedure while efforts are made, if feasible, to direct a fire hose towards the pipe lines which lead to and from the day tanks.

If you are unfortunate enough to be involved in a fire, you must remember:

To bend down or crawl in a smoke filled corridor. Carbon monoxide (CO) concentrates higher up. In the event of carbon dioxide (CO_2) having been used for fire extinguishment, however, you must walk upright. Carbon dioxide is mostly concentrated near the floor.

If your clothes are alight, you must not run further than is necessary but roll on the deck or plating.

. . . head down or crawl . . .

CHAPTER 2

BASIC DAMAGE CONTROL - For All Hands (Lesson Plan)

Section 2.8

NAVY STANDARD COUPLINGS, HOSES, AND NOZZLES

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

I. OBJECTIVES.

A. To acquaint all-hands with Navy standard couplings, hoses, and nozzles.

B. To show all-hands how to operate this equipment.

C. To acquaint all-hands with the care and maintenance of this equipment.

II. MATERIAL.

A. Training Aids. Use the following regular ship's equipment.

1. 1 length $1\frac{1}{2}$" fire hose, coiled for stowage.

2. 1 all-purpose nozzle, $1\frac{1}{2}$".

3. 1 applicator, 4 foot.

4. Fittings.

a. Y-gate.

b. $1\frac{1}{2}$" double female coupling.

c. $1\frac{1}{2}$" double male coupling.

d. Reducer coupling, $2\frac{1}{2}$" to $1\frac{1}{2}$".

e. Spanner wrench.

f. Gaskets, $1\frac{1}{2}$".

5. Foam equipment.

a. Mechanical foam nozzle.

b. NPU tube.

c. Can of foam.

6. Film MN-6931B "Shipboard Firefighting Equipment and Its Uses". (32 min.)

B. Reference. BUSHIPS Manual, Chapter 93--Fire Fighting.

III. INTRODUCTION.

A. Introduce self and subject (Navy Standard Couplings, Hoses, and Nozzles).

B. Arouse interest.

1. To successfully combat a shipboard fire, water will be required for cooling and extinguishing.

2. USCG regulations require that any part of the ship be within reach of a hydrant with one length (50 feet) of fire hose. In order to get more than one hose to a fire, it will be necessary to use additional hoses and couplings.

3. You must know how to rig and couple hoses and nozzles in order to quickly get effective coverage of the fire itself as well as to cool down surrounding hot decks, bulkheads and overheads.

C. Scope of lesson.

1. Types and sizes of hoses, couplings, and nozzles.

2. How to connect hoses, couplings, and nozzles together.

3. The specific uses of nozzles and applicators.

IV. PRESENTATION.

A. Fire Hose.

1. Two sizes, $1\frac{1}{2}$" and $2\frac{1}{2}$".

2. 50-foot lengths, cotton, rubber-lined.

3. Fitting at each end; one male, one female, (National Standard hose threads.)

4. Faking hose.

a. On racks at fire stations.

b. Female end secured to hydrant.

c. Nozzle on male end on outside ready to run out and use.

5. Rolling hose.

a. Fire hose should be rolled for stowage, as in repair lockers.

b. Procedure.

(1) Lay hose out on deck stretched out its full length.

(2) Double the hose up with its male end brought to about 4 feet short of the female end.

(3) Start rolling at the fold, toward the ends.

(4) When completely rolled, the male end will be inside the outer roll of the hose, thus protecting its threads.

(5) Secure the coil with small line.

6. Care of hoses.

a. Insure that hoses are well drained before faking or rolling.

b. Keep oil and grease off hose as it causes deterioration of rubber lining.

c. Scrub hose with fresh water only - use soap only if absolutely necessary.

NAVY STANDARD COUPLINGS & HOSES

d. Keep couplings clean and guard against damaged threads.

e. Stow hose in a cool dry place.

B. Fire Hose Fittings.

1. Y-gate.

a. Reduces from $2\frac{1}{2}$" to two $1\frac{1}{2}$" outlets.

b. Permits two hoses off $2\frac{1}{2}$" hydrant or hose.

c. Controls flow of either outlet at the Y-gate.

2. Double female coupling.

a. Two sizes, $2\frac{1}{2}$" and $1\frac{1}{2}$".

b. Used to connect two male fittings together.

(1) When rigging a jumper around a broken firemain section. (This is its most general use.)

(2) Any time two male fittings require connection.

3. Double male coupling.

a. Two sizes, $2\frac{1}{2}$" and $1\frac{1}{2}$".

b. Used to connect two female fittings together.

4. Reducer coupling.

a. Female $2\frac{1}{2}$" down to male $1\frac{1}{2}$".

b. For connecting $1\frac{1}{2}$" hoses to $2\frac{1}{2}$" hydrant or hose.

5. Spanner.

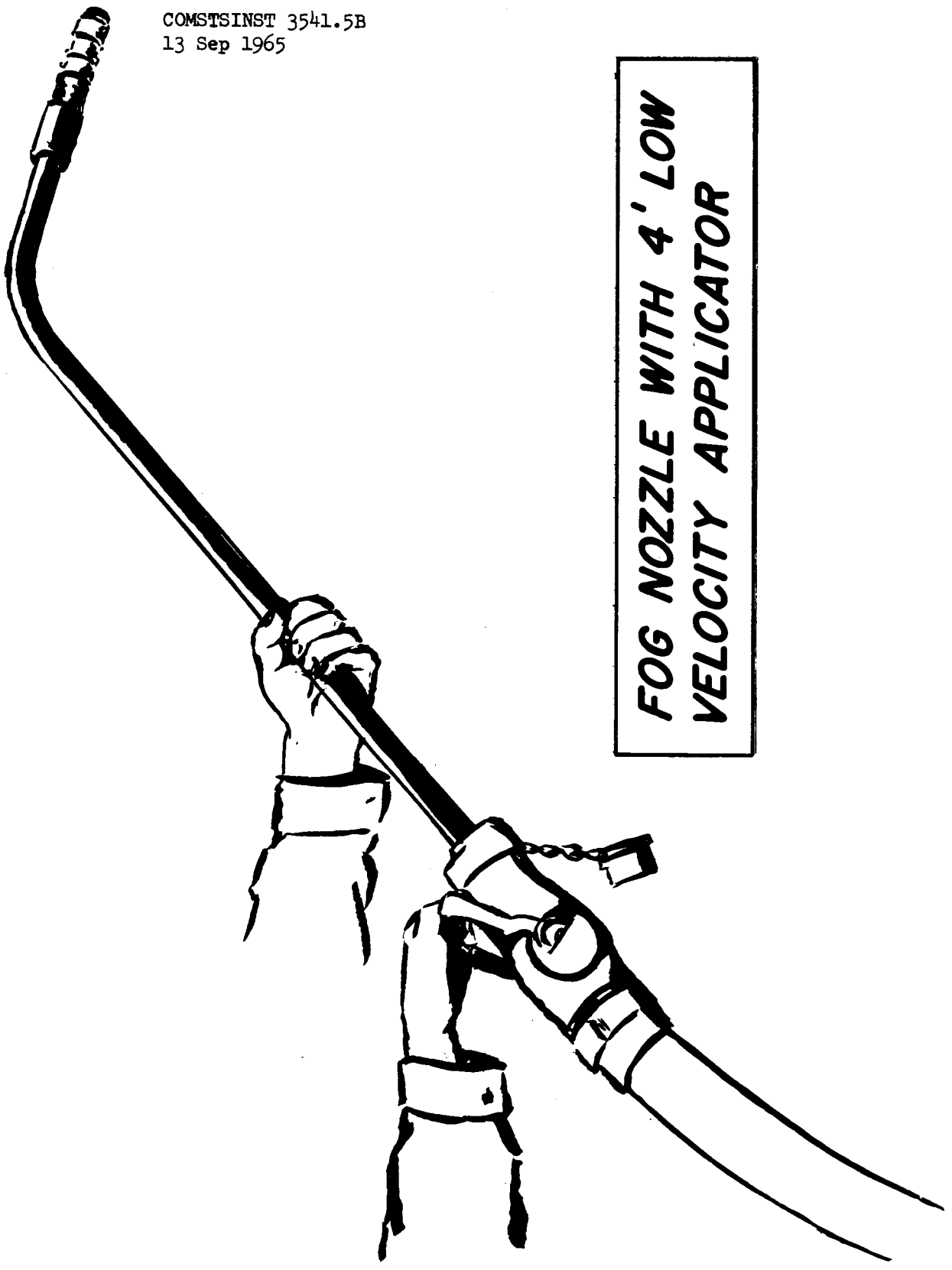
a. For coupling and uncoupling hosesand fittings.

b. Adjustable and fits both $2\frac{1}{2}$" and $1\frac{1}{2}$" sizes.

6. Gaskets.

a. Required to prevent leaking connections.

(1) Rubber, $2\frac{1}{2}$" and $1\frac{1}{2}$".



FOG NOZZLE WITH 4' LOW VELOCITY APPLICATOR

(2) Must not project into the water stream.

(3) Check by feeling to insure there is a gasket and that it is in place.

7. Care of fittings.

a. Protect threads.

b. Prevent corrosion.

c. Do not drop.

C. All-purpose Nozzle.

1. Two sizes - 2½" and 1½".

2. Has female hose fittings.

3. Valve has three positions:

a. Forward position - shut off.

b. Up and down position - fog

(1) High velocity - with H.V. tip.

(2) Low velocity - with applicator replacing tip.

(a) 4-foot applicator - 60° bend, 1½" nozzle.

(b) 10-foot applicator - 90° bend, 1½" nozzle.

(c) 12-foot applicator - 90° bend, 2½" nozzle.

c. Aft position - straight stream.

4. Many Navy all-purpose nozzles and high and low velocity nozzles are exposed to the weather. They should not be cleaned with brightwork polish or emery cloth since this will clog the outlets. Instead, brass parts of the NAP and fog nozzles should be kept clean with fine steel wool and wiped lightly with rust preventive compound. The nozzles should be covered with saran-wrap paper or equivalent to keep them clean and ready for use.

D. Foam Equipment.

1. Mechanical foam nozzle.

a. 21" section of asbestos composition or flexible metal.

b. 2" diameter outlet.

c. Suction chamber.

d. Air port (aspirating cage).

e. Female hose fitting, 1½" at suction chamber end.

2. Pickup tube (NPU tube).

a. Short piece of 5/8" hose.

b. Short length of flexible hose.

c. Threaded fitting on hose fits into suction chamber of mechanical foam nozzle.

3. Mechanical foam.

a. Liquid, in 5 gallon cans, 50 lbs. per can.

b. Drawn into suction chamber of mechanical foam nozzle through pickup tube.

c. 5 gallons of liquid makes approximately 660 gallons of foam in $1\frac{1}{2}$ minutes by mixing with water and air.

E. Quick-cleaning Strainer.

1. Provided to prevent clogging of nozzles by marine growth, salt and rust.

2. Built into fire hydrants.

3. Has two outlets.

a. Hose outlet is open at all times.

b. Cleaning outlet is controlled by handle.

(1) In closed position, all water from hydrant goes to hose.

(2) In open position, water goes through cleaning outlet to deck.

c. To operate:

(1) Open hydrant all the way.

(2) Then, open strainer to flush out.

(3) Strainer should be flushed out each time hydrant is used.

F. Capabilities and Use of Nozzles.

1. All-purpose nozzle.


"ALL-PURPOSE NOZZLE"

a. High velocity fog, $2\frac{1}{2}$" and $1\frac{1}{2}$".

(1) Provides circle of fog 8' in diameter, 20' from nozzle, at 100 lbs. pressure.

(2) Excellent for cooling rubbish and oil fires.

(3) Pushes flame and smoke away from nozzle.

(4) Provides protection for nozzlemen.

b. Low velocity fog.

(1) $2\frac{1}{2}$" with applicator provides circle of fog 22 feet in diameter at 100 lbs. pressure.

(2) $1\frac{1}{2}$" with applicator provides circle of fog 16 feet in diameter at 100 lbs. pressure.

(3) Spray is right at the fog head.

(4) It provides a finer spray than the high velocity fog.

(5) It is excellent for cooling bulkheads, decks, and areas in which fire has been extinguished.

(6) It provides an excellent protective screen for fire parties or for a team applying foam.

c. Straight stream, $2\frac{1}{2}$" and $1\frac{1}{2}$".

(1) Projects stream approximately 70 feet at 100 lbs. pressure.

(2) Excellent for penetrating and breaking up rubbish fires.

(3) Never use a straight stream of water on oil fires as it will spread the fire.

2. Mechanical foam nozzle.

a. Essential to make foam from liquid foam.

b. Mixes foam and water.

c. Then mixes in large quantities of air in the air port.

d. Discharges 660 gallons of mechanical foam for each 5-gallon can of liquid foam.

e. Excellent for smothering oil fires.

(1) Flows over burning surfaces and cuts off oxygen.

(2) Stream of foam should be directed against bulkhead.

(3) If foam is pointed directly at the fire, it will not provide an unbroken blanket; thus permitting re-ignition.

(4) It flows freely around stanchions and other obstructions.

V. SUMMARY.

A. Fire Hose.

1. Faking - insure that nozzle end is on the outside ready to be run out.

2. Rolling.

a. Male threads protected.

b. Hose is easily run out, male end toward fire.

B. Fittings.

1. Y-gate.

2. Double female coupling.

3. Double male coupling.

4. Reducer coupling.

5. Spanner.

6. Gasket, always check by feeling.

C. All-purpose Nozzle.

1. Fog.

a. High velocity.

b. Low velocity.

2. Straight stream.

D. Mechanical Foam Nozzle.

1. NPU tube.

2. Five gallons of liquid makes 660 gallons of foam in 1½ minutes.

E. Quick-cleaning Strainer.

VI. TEST AND APPLICATION.

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

1. Q. Describe how to coil a hose for stowage in repair lockers.

A. Lay hose out on deck full length and then double it up with the male end brought about 4 feet short of the female end. Start rolling at the fold, toward the ends. When completely rolled, the male end will be inside the outer roll of hose, thus protecting the threads. Secure coil with small line.

2. Q. Describe the valve controls of an all-purpose nozzle.

A. Handle forward is the shut-off position; handle straight up and down is the fog position; handle aft is the straight-stream position.

3. Q. What three things are mixed in a mechanical foam nozzle?

A. Liquid foam, water, and air.

4. Q. State the differences between high velocity and low velocity fog.

A. High velocity fog is projected in a cone for some distance from the nozzle. Low velocity fog is a finer spray provided by an applicator inserted into the all-purpose nozzle. It covers a larger area but is centered right at the fog head.

5. Q. What is the most general use for a double female coupling?

A. Rigging a hose jumper around a broken firemain section.

6. Q. How do you make sure there is a gasket in place in a fitting or nozzle?

A. Check by feeling the gasket with your hand.

7. Q. How long does it take to use up a 5-gallon can of foam?

A. Approximately 1½ minutes.

8. Q. Why is a straight stream of water not used on all classes of fires?

A. It is used only on rubbish and trash fires. A straight stream of water will not extinguish an oil fire; it will cause it to spread. Water will conduct electricity, making a straight stream dangerous on electrical fires.

9. Q. Which end of a hose is led toward the fire? Why?

A. The male end. All nozzles have female fittings which are screwed onto the male end of the hose. The other female end of the hose is screwed onto the hydrant.

10. Q. When do you flush out fire mains with the quick-cleaning strainer?

A. Each time you use the hydrant.

B. Application. Take the group to a convenient hydrant on the open deck and demonstrate and have them perform the following operations.

1. Placing Y-gate on hydrant.

2. Uncoiling $1\frac{1}{2}$" hose.

3. Connecting hose to Y-gate.

4. Putting all-purpose nozzle on hose.

5. Opening hydrant valve.

6. Flushing out quick-cleaning strainer.

7. Opening valve on Y-gate.

8. The three control positions of the all-purpose nozzle.

9. Inserting a 4-foot applicator.

10. Low velocity water fog from the applicator.

11. Connecting the mechanical foam nozzle and NPU tube.

12. Discharging water through mechanical foam nozzle (foam may be used if convenient).

13. Draining hose.

14. Coiling hose.

15. Faking hose.

CHAPTER 2

BASIC DAMAGE CONTROL - For All Hands (Lesson Plan)

Section 2.9

FIRE DETECTING SYSTEM (HIGH TEMPERATURE)

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

I. OBJECTIVES.

A. To explain the purpose of the fire detecting system.

B. To present the functions of manual boxes, test boxes, thermostats, and fire detecting circuits.

C. To explain maintenance techniques for the fire detecting system.

D. To demonstrate detection of individual circuits at the control panel on the bridge.

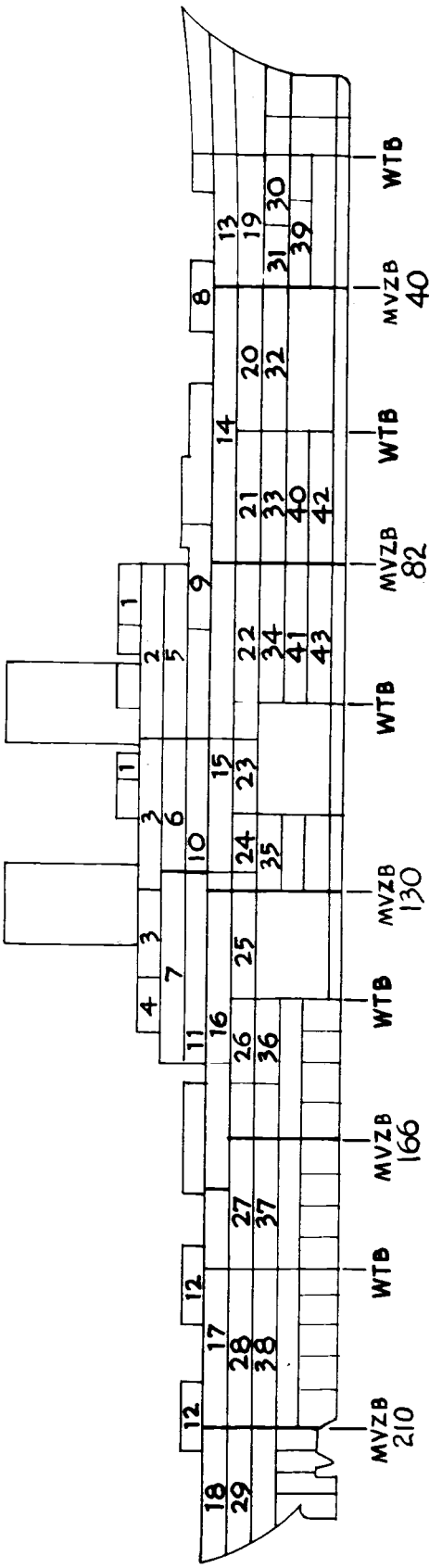
E. To explain USCG regulations concerning this installation.

II. MATERIAL.

A. Training Aids.

1. Plans, poster or sketch of ships' fire detecting system, zones and circuits.

2. Ship's thermostats, key box and manual break-glass box.



FIRE DETECTING CIRCUITS IN A P-2

B. References.

1. Ship's instruction book on installed fire detecting system.

2. Ship's damage control display plans.

3. CG-256, Rules & Regulations for Passenger Vessels, 76.27.

4. Operating instructions on battery charging.

C. Handout. The presentation portion (VI) of this lesson plan may be mimeographed as a handout.

III. INTRODUCTION.

A. Introduce self and subject (zonit fire detecting system (high temperature)).

B. Arouse interest by stressing the importance of:

1. Knowing the location of the nearest manual break-glass station.

2. Knowing the proper operation of the detecting cabinet in order to locate the general area of a fire.

3. Maintaining thermostat units free of paint.

4. Conducting routine inspections and tests of fire detecting and alarm units.

5. Knowing of the dual power supply for the fire detecting system.

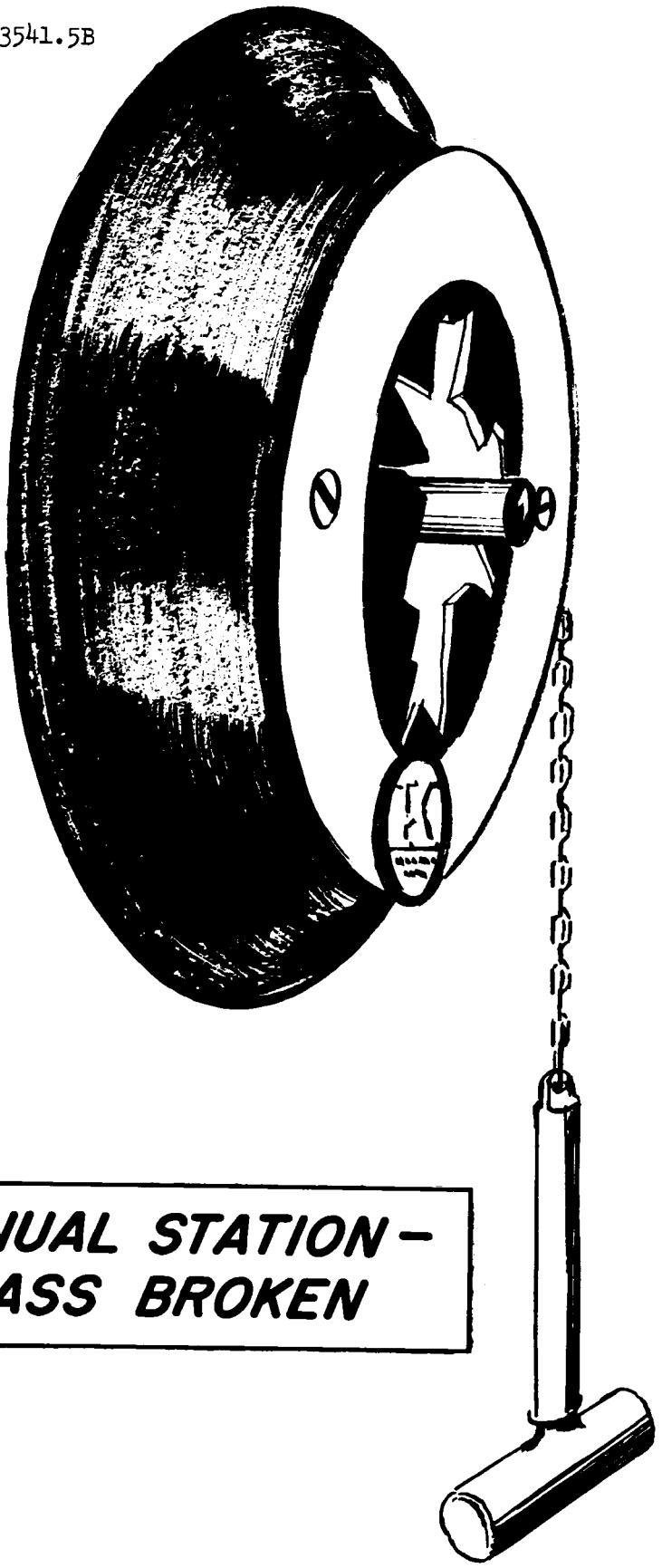
C. Explain that the degree of interest and detailed knowledge of the system will depend upon the rating, but that all-hands must know the general operation of the system, how to turn in an alarm, precautions against false alarms, and proper routine maintenance procedures.

IV. PRESENTATION.

A. Purpose of the Fire Detecting System.

1. It is a combination automatic and manual fire detecting system to communicate the occurrence, presence and general location of fire to the bridge.

2. It provides for detection of fires in protected spaces.



MANUAL STATION - GLASS BROKEN

3. It provides for protection of passengers and crew.

4. It also provides protection of cargo (if so installed).

B. Description of the System.

1. The fire detecting system is an automatic, electrically-controlled fire alarm system. It is a closed-circuit system of manual alarm stations and thermostatic circuits throughout all protected areas of the ship. An alarm is sounded on the bridge when either a fixed-temperature thermostat or a manual break-glass station is activated or when a circuit is tested at its key test station.

a. To report a fire by the break-glass system, stand on either side of the box to protect your eyes. Break only the glass! This releases the plunger. If you press in on this plunger you will shut off the alarm and cause unnecessary delay at the control panel.

2. Blackboard diagram explanation. (Copy diagram from your ship's instruction book on the fire detecting system.)

a. The system consists of a series of thermostats, manual break-glass stations, and a number of key-test stations.

b. All components are connected in series but are divided into groups or zones by the return wires to the main panel on the bridge.

c. Any open circuit will ring the alarm gong or bell in the panel box on the bridge and will also set off an alarm in the engine room.

d. The detection zone or area in which the alarm originates is located by operation of the fire zone locating switches on the panel and then referring to the system's chart.

e. Key test stations located near each manual break-glass stations are used to check circuits by opening the circuit test switch with a special key. When inserted and turned, the alarm is set off.

f. Thermostats are of the bimetallic type; normally closed; they set off the alarm when opened by excessive heat. Ordinarily 135° F. thermostats are used but higher rating thermostats are used in galleys.

g. The detection system obtains electrical power from the ship's normal supply or through batteries in case of ship's power failure. Batteries are kept fully charged by connection to the ship's power at all times.

C. Location of Equipment.

1. The master or control panel is located on the bridge, in the wheelhouse, chart room, or some place under constant observation.

2. Branch circuits from the main panel lead to thermostats which are located in such spaces as required by Coast Guard regulations.

3. Branch circuits which control the thermostats are divided into zones or spaces as prescribed by Coast Guard regulations.

4. Location of circuits depends on these factors:

a. Size of ship.

b. Design of ship.

c. Areas to be protected.

d. Number of compartments to each zone.

e. Number of circuits required.

D. USCG Regulations. (NOTE: It will generally be sufficient to mention that USCG requires a fire detecting system and fire watch in passenger ships. These details may be omitted but are included as background information.) Passenger ships of 50 passengers or more:

1. Must have a fire-detecting system.

2. Must have a manual-operating fire alarm system and a fire watch, with the watchman reporting to the bridge hourly.

3. The fire detecting system must have a suitable number of stations.

4. Thermostats must not be installed over 15 feet apart.

5. The area protected by any single thermostat must not exceed 200 square feet.

6. Thermostat wire must not exceed 1000 feet in any one circuit.

7. Zoning.

a. Single circuits do not include more than 50 individual rooms or storage lockers.