TM 4-15.21

Maritime Standards and Safety

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Maritime Standards and Safety

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Preface

TM 4-15.21 provides detailed information on guidance and technical information relevant to safety and survival equipment/systems used by United States Army watercraft. The manual contains guidance, instructions, technical data, illustrations, and procedures pertinent to the application, inspection, modification, maintenance, and the use of safety equipment, safety policies, and survival systems for Army watercraft.

This manual applies to all Soldiers and first-line supervisors that operate Department of the Army-controlled or leased watercraft used in support of maritime operations and as directed during logistics over-the-shore operations.

Commanders, staffs, and subordinates must ensure that their decisions and actions comply with applicable United States, international, and, in some cases, host-nation laws and regulations. Commanders at all levels will ensure that their Soldiers operate in accordance with the law of armed conflict and the rules of engagement. (See FM 6-27/MCTP 11-10C.)

TM 4-15.21 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. For definitions shown in the text, the term is italicized, and the number of the proponent publication follows the definition. This publication is not the proponent for any Army terms.

Digital Use: The digital version of this publication contains certain features to improve the convenience of using this manual and increase the user's efficiency. These features include—

- Table of Contents: This provides direct links to each section.
- Bookmarks: Bookmarks generally appear to the left of an open document within the navigation pane, in the form of a list of contents with links to each entry.
- Search: Searchable text so that the user can search for a particular word or phrase and find each place that the text appears in the manual.

The proponent of TM 4-15.21 is the United States Army Transportation Corps Branch Standards Office. The preparing agency is the G-3/5/7 Doctrine Division, United States Army Combined Arms Support Command. Send comments and recommendations on a DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) to Commander, United States Army Transportation Corps Branch Standards Office, ATTN: ATZF-S, Joint Base Langley-Eustis, VA 23604-5407 or submit an electronic DA Form 2028 by email to: maritimesafety@army.mil and us.army.lee.tradoc.mbx.lee-cascom-doctrine@army.mil.

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Introduction

TM 4-15.21 contains guidance, instructions, technical data, drawings, illustrations, procedures, and descriptions pertinent to the configuration, modification, application, inspection, fabrication, maintenance and repair, and use of safety and emergency equipment. The Maritime Standards and Safety Office (MSSO), Joint Base Langley-Eustis, VA, will formulate, produce, and distribute applicable changes to the equipment and to respective chapters of this manual.

This manual is intended to be used as a companion guide in conjunction with the applicable platform-specific Watercraft Safety Survey Checklist. This will assist Army watercraft crews in preparing for Maritime inspections, surveys, and vessel readiness. Safety survey and inspection checklists are platform-specific and available from the MSSO and the TACOM-Unique Logistics Support Applications (TULSA) portal under Safety First or upon request from the MSSO at maritimesafety@army.mil.

Note: Deviations from configurations of equipment presented in this manual are not authorized. To maintain standardization and preclude the dangers of operating with potentially unsafe equipment, modifications to rescue equipment and survival systems are not authorized.

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this manual.

WARNING

Operating or maintenance procedures and techniques that may result in personal injury or loss of life if not carefully followed.

CAUTION

Operating or maintenance procedures and techniques that may result in damage to equipment if instructions are not carefully followed.

Note: Operating or maintenance procedures and techniques that are considered essential to emphasize.

The following definitions apply to the words “shall, will, may, and should” throughout this manual.

Use of “shall and will” indicates a mandatory requirement.

Use of “may and should” indicates an acceptable or suggested means of accomplishment.

Surveys and inspections will be conducted in accordance with AR 56-9 and AR 385-10 and performed using this manual and the appropriate vessel-specific Watercraft Safety Survey Checklist. Inspections and surveys serve to identify hazards and ensure regulatory compliance in accordance with AR 385-10. Hazards identified during inspections and surveys should be corrected or mitigated and used to educate personnel.

Safety survey and inspection checklists are platform-specific and are periodically updated as both vessel safety equipment and governing laws/regulations change. Watercraft Safety Survey Checklists are available from the MSSO and the TULSA portal under Safety First or upon request at the email below. See the references section in the back of this manual for the link to this web site.

Safety surveys and inspections will assure that a safe operating condition is maintained. Copies of annual inspections will be forwarded to the MSSO at maritimesafety@army.mil. Engagement with the MSSO and use of the appropriate vessel safety checklist and this technical manual is paramount in preparation and execution. Items to be laid out are identified in the Watercraft Safety Survey Checklist table of contents with an asterisk (*). Watercraft surveys and inspections require maximum engagement from the command and the crew. Full crews should be onboard to operate various machinery and equipment and support the inspectors. Vessel safety survey training can also be obtained by contacting the MSSO at the email above.

TM 4-15.21 contains seven chapters and seven appendices:

Chapter 1 discusses the many components of the marine safety program; accident reporting, certificates, documents posted, drills, Global Maritime Distress and Safety System and very high frequency radio logs, logbook entries, organizations, records, and rough logs.

Chapter 2 discusses the components of marine engineering; storage batteries, battle lanterns, bulkhead preparations, chain falls or housing equipment, compressed gas cylinders, crash panels/emergency escapes, deck lighting, deck machinery, deck plates, electrical safety, emergency machinery/valve shutdowns, emergency loads, fuel oil/hazardous materials/pollution prevention, lagging/splash guards, main and auxiliary machinery spaces, pipe markings and valve color coding, and void covers/access panels.

Chapter 3 provides information on firefighting agents, fixed systems and their limitations, personnel protection, turnout gear, and self-contained breathing apparatus. Firefighting techniques and portable firefighting equipment are addressed in Appendix C. Damage control lists the objectives of shipboard damage control and describes the equipment used when an emergency occurs at sea.

Chapter 4 discusses in detail the vessel components found aboard watercraft. This chapter provides information on a wide range of equipment from accommodation spaces to ventilation. The chapter provides a description and discusses their usage and inspection criteria.

Chapter 5 discusses rescue equipment and personal flotation devices in detail. The chapter provides a description and discusses their usage and inspection criteria.

Chapter 6 provides an overview of equipment and materiel used to conduct navigation aboard watercraft. This chapter provides information on a wide range of equipment from boat hooks to wheelhouse windows. The chapter provides a description and discusses their usage and inspection criteria.

Chapter 7 discusses in detail the requirements and operations to mitigate occupational risks on a maritime vessel; confined spaces, confined spaces sampling devices, first aid equipment, hazardous materials communication, hearing, potable water hose, protective clothing, safety harness, and vision protection.

The below appendices have been built to align with the above chapter topics and provide the reader with further discussion on actions, principles, and uses in order to execute maritime safety operations:

Appendix A, Administration.

Appendix B, Engineering.

Appendix C, Firefighting and Damage Control Equipment.

Appendix D, General Safety.

Appendix E, Lifesaving Equipment.

Appendix F, Navigation Safety.

Appendix G, Occupational Safety.

Note: Any hazards not identified in this publication may be marked by the crew. Marking should be done on a placard with a white background and contain the following information using red font, red stencil, or appropriate sticker:

- Identify the hazards.
- Basic processes to mitigate those hazards.
- All loose and float free equipment that does not have a specific marking requirement identified in this manual will be marked at a minimum with the vessel name and/or hull number.

For any questions or concerns contact the MSSO at maritimesafety@army.mil.

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Chapter 1
Administration

This section provides baseline administrative requirements and information, and helps vessels and inspectors plan, organize, and prepare for safety inspections and surveys. Army watercraft systems support joint force operations in the maritime domain which includes oceans, seas, bays, estuaries, islands, coastal areas, and the airspace above these, including the littorals (JP 3-32).

ACCIDENT REPORTING

1-1. An accident is any unplanned event or series of events that result in death, injury, or illness to personnel, or damage to or loss of equipment or property. Accident is synonymous with mishap.

1-2. Accident reporting is critical for the safety of all Mariners. Every maritime mishap that occurs is used to address issues that may exist across the fleet whether they be maintenance, procedural or human factors. In addition to local accident reporting procedures, all maritime accidents and mishaps will be reported within 24 hours by any electronic means available to the Maritime Standards and Safety Office (MSSO) at maritimesafety@army.mil or by calling (757) 878–1327/5685/6782.

1-3. For accident reporting, use the Combat Readiness Center website. Publications relevant to Army safety and accident reporting are as follows:

- AR 385-10.
- DA PAM 385-40.
- Department of Defense instruction (DODI) 6055.07.

CERTIFICATES AND RECORDS

1-4. During any inspection or survey, all current certificate and records binders, logbooks, standard operating procedures (SOPs), and organizational memos required shall be ready and available for review at one time.

1-5. Certificates may be disposed of once they have been updated. Any retention requirement is identified within the specific section identified in table 1-1.

Table 1-1. Certificates and records

Document	*Reference Section*
Accident reports (retained 5 years)	DA PAM 385-40
Aqueous film forming foam testing	Chapter 3
Confined space entry permits	Chapter 7
Emergency position-indicating radio beacon (EPIRB) Joint Search and Rescue Satellite Aided Tracking (SARSAT) Electronic Tracking System (JSETS) registration	Chapter 6
Fire detection system certification	Chapter 3
Fixed firefighting systems	Chapter 3
Fast rescue boat launching appliance certificate	Chapter 5

Table 1-1. Certificates and records (*continued*)

Document	*Reference Section*
Life raft and hydrostatic release (MK7 Navy or Commercial)	**Chapter 5**
Load line certificate	Appendix A
Quality Assurance (QASAS) Inspection	Chapter 5, DA PAM 742-1
Self-contained breathing apparatus (SCBA) bottle air quality test results	Chapter 3
SCBA flow/function test	Chapter 3

POSTED DOCUMENTS

1-6. Table 1-2 identifies required document posting locations on Army watercraft.

Table 1-2. Document posting areas

Document	*Posting Requirement*	*Reference Section*
Fire Control and Emergency Equipment plan	Locations according to the fire control plan (FCP).	Chapter 3
Emergency Steering Instructions	On bridge and at emergency steering station.	Chapter 6
Fixed Firefighting System Operating Instructions	At firefighting equipment.	Chapter 3
Fixed Foam Extinguishing Operating Instructions	At activating remote station.	Chapter 3
Garbage Discharge Placards (International Convention for the Prevention of Pollution from Ships [MARPOL] Annex V)	Galley, mess areas, garbage locker.	Appendix A
Global Maritime Distress and Safety System (GMDSS) Operators Guidance for Ships in Distress (International Maritime Organization 969E)	Bridge (each Army vessel outfitted with GMDSS on bridge near main radio transmitter).	Chapter 6
Lifesaving Signals	Bridge.	PUB 102, NAV RULES #37
Maneuvering Characteristics	Pilot house.	Appendix F
National Response Center contact number	Pilot house and conspicuous locations at and around all transfer locations.	Chapter 2, TB 55-1900-252-14
Radio call signs	On the bridge near main radio transmitter.	Chapter 6
Ship’s radio authorization	On the bridge near main radio transmitter.	Appendix A
Stability Letter	Bridge.	Appendix A
Station Bill (complete and current)	Engine room, common areas (for example, passageways, mess decks), bridge.	Appendix A
Watch Officers’ Licenses	Bridge.	AR 56-9
Water pollution placards	In a conspicuous place in each machinery space, or at the bilge and ballast pump control station.	Appendix A

LOGBOOK ENTRIES AND REPORTS (DECK AND ENGINE)

1-7. All events of importance, interest, or historical value about the crew, passengers, operation, location, condition, and safety of Army watercraft will be recorded daily in the appropriate logbook. A report of inspections, including a statement as to the condition of the equipment, must be recorded in the vessel's official logbook. Log entries pertinent to emergency response (drill or actual) must detail the sequence of events. Drills must, as far as practicable, be conducted as if there were an actual emergency. This section does not cover all tests, drills, and inspections (TDIs). For vessel-specific TDIs refer to the vessel-specific technical manual (TM).

1-8. Logbooks will be prepared per instructions in AR 56-9, DA PAM 750-8, and the logbook itself. The local command may require additional entries.

1-9. Logging entries are not always specifically in the physical logbook applicable to vessel type. Logging may also be achieved through digital records such as Global Combat Support System–Army.

DRAFT READINGS (LEAVING/ARRIVING PORT)

1-10. The master of every vessel subject to a load line shall enter the drafts of the vessel (forward and aft) in the official logbook when leaving and arriving in port.

FUEL OIL DATA

1-11. Fuel oil data will be entered into the logbook as required by the instructions located in the applicable logbook. This is in addition to the Oil Record Book as required.

OIL RECORD BOOK

1-12. This is required for all vessels of 400 gross tons and above.

1-13. Oil Record Books printed by the United States (U.S.) Government are available from any United States Coast Guard (USCG) Sector Office, Marine Inspections Office, or Captain of the Port Office.

1-14. Bunkering is defined as the act of filling a ship's tanks with fuel from an outside source.

CREW QUALIFICATIONS LOGGED

1-15. Crew military occupational specialty qualifications (certificate/license number and watch-standing certifications with expiration date) will be entered into the logbook as required by the instructions located in the applicable logbook.

SWIMMER/NON-SWIMMER LOGGED

1-16. Swimmers and non-swimmers will be identified in the remarks section of the list of crew members in the applicable logbook.

PASSENGER SAFETY BRIEF

1-17. Whenever personnel in addition to the crew embark, a safety briefing must be given immediately before sailing and logged appropriately. Passengers must be instructed on the following at a minimum:

- The fire and emergency signal.
- Their muster station.
- The essential actions they must take in an emergency.
- The location of lifejackets, including child-size lifejackets.
- The method of donning lifejackets.
- Additional instructions as mission dictates.

PRE-DEPARTURE CHECKS

1-18. The checks prior to sailing identified in AR 56-9 are the minimum inspections required to be conducted by the vessel master, coxswain, or their delegate. The local command may require additional items for inspection.

TESTS, DRILLS, AND INSPECTIONS

1-19. Tables 1-3 through 1-9 outline weekly through quinquennial TDIs.

Table 1-3. Weekly Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference Section*
Emergency response drills	Appendix A; TC 4-15.51
Emergency lighting	Chapter 2
Fast Rescue Boat (FRB) and launching appliance inspection	TM 55-1940-328-10, Chapter 5
General alarm test	Chapter 4
Global Maritime Distress and Safety System (GMDSS) emergency power	Chapter 6
Self-Contained Breathing apparatus (SCBA) inspection	TM 10-4240-343-13&P
Survival craft radio (SCR)/search and rescue transponder (SART) test	Chapter 6
Visual life raft and hydrostatic release inspection	Chapter 5

Table 1-4. Monthly Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference Section*
Battery-operated fire/smoke detection test	Chapter 3
Bilge alarm and float switch test	Chapter 2
CO2 fixed firefighting system inspection	Chapter 3
Confined space meter calibration	Chapter 7
Emergency generator 2hr load test	Chapter 2
Emergency response drills	Appendix A, Table A-1; TC 4-15.51
Emergency Position-Indicating Radio Beacon (EPIRB) test	Chapter 6
Fire extinguishers inspection	Chapter 3
FM-200 pressure-operated siren test	Chapter 3
FM-200 log	Chapter 3
Galley inspection	Appendix A
Life ring buoy and life ring buoy light test	Chapter 5
P-100 operation and inspections	TM 10-4320-405-13&P
Personal flotation device (PFD) inspection	Chapter 5
Sanitary inspections	Appendix A
Self-Contained Breathing apparatus (SCBA) cylinder visual inspection	TM 10-4240-343-13&P
Self-Contained Breathing apparatus (SCBA) inspection	TM 10-4240-343-13&P
Water washdown and piping tested/inspected	Chapter 3
Watertight doors and hatches	Chapter 4

Table 1-5. Quarterly Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference Section*
Emergency breathing air compressor (EBAC) air sample test	Chapter 3
Immersion suit drill	Appendix A
Line throwing device training	DA PAM 350-38
Blower, ventilation (RAMFAN) test	Chapter 3
Steering casualty drill	Chapter 6
Stokes litter inspection	Appendix G

Table 1-6. Semi-Annual Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference Section*
Environmental response drill	TB 55-1900-252-14
Stokes litter sling proof test	Appendix G
Storage batteries for emergency lighting and power systems tested	Chapter 2

Table 1-7. Annual Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference*
Aqueous film forming foam (AFFF) testing	Chapter 3
Chemical, biological, radiological, and nuclear (CBRN) washdown test	Chapter 3
Confined space entry drill	Chapter 7
Emergency escape breathing device (EEBD) inspection and training	Appendix E
Fire hose pressure test	Chapter 3
Fire main pressure relief valve test	Chapter 3
Firefighter’s ensemble (FFE) inspection	Chapter 3
Fixed firefighting systems (FM-200, CO2, Gaylord)	Chapter 3
Fast Rescue Boat (FRB) Launching appliance test and inspection	Chapter 5
Life raft (Commercial)	Chapter 5
Life ring buoy Light Battery	Chapter 5
Lifting device test and inspection	Chapter 2
LPU-40 inspection and function test	TM 1-1680-377-13&P-4
Portable fire extinguisher inspection	Chapter 3
Quality Assurance (QASAS) class V inspection	Chapter 5, DA PAM 742-1
Safety inspection	Introduction and Appendix A; AR 56-9; AR 385-10

Table 1-8. Triennial (3-Year) Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference*
Safety survey	Introduction and Appendix A; AR 56-9
Self-Contained Breathing apparatus (SCBA) function/flow test	TM 10-4240-343-13&P

Table 1-9. Quinquennial (5-Year) Tests, Drills, and Inspections

Tests, Drills, and Inspections (TDI)	*Reference*
Fast Rescue Boat (FRB) lifting appliance certification	Chapter 5
Life raft and hydrostatic release (Mk 7 Navy)	Chapter 5
Load line certification	Appendix A

ADDITIONAL LOGS

1-20. Vessel crews must also maintain the logs listed in table 1-10.

Table 1-10. Additional logs

LOG	*Reference*
Garbage log	Appendix A
Lockout / tagout log	Chapter 2
Potable water	Chapter 7
Radio log	Appendix A

ORGANIZATION

STANDARD OPERATING PROCEDURES

1-21. SOPs will be written and maintained using the applicable references listed in Table 1-11.

Table 1-11. SOPs

SOP	*Reference*
Accident reporting	Chapter 1; AR 56-9; DA PAM 385-40
Confined spaces	29 Code of Federal Regulations (CFR) 1915.11–1915.16
Engineering department	Chapter 2
Environmental response	TB 55-1900-252-14
Hazardous materials (HAZMAT) communication	DODI 6050.05
Hearing conservation	DODI 6055.12
Heat stress and cold weather	TB MED 507 and TB MED 508
Hot work	29 CFR 1915.14
Lifting devices	Chapter 2
Lock-out/tag-out	Appendix B
Petroleum, oils, and lubricants **(**POL)/sewage transfer procedures	Chapter 2; TB 55-1900-252-14; TB 55-1900-206-14
Tests, drills, and inspections (TDIs)	AR 56-9 and all applicable tables in this chapter

DIGITAL LIBRARY

1-22. The following is a minimum list of regulations required to be carried on board all Class A vessels. Class B and other classes may maintain these at their support offices. These must be up to date and may be printed or digital:

- 29 Code of Federal Regulations (CFR) Parts 1900–1910.999 and 1911–1925.
- 33 CFR Parts 125–199 and 200–END.
- 46 CFR Parts 1–40, 90–139, and 166–199.

- 47 CFR Part 80 (Global Maritime Distress and Safety System [GMDSS] required).
- 49 CFR Parts 100–180.
- AR 56-9.
- AR 385-10.
- TB 43-0144.
- TB 43-0153.
- TB 55-1900-206-14.
- TB 55-1900-252-14.
- TC 4-02.1.
- TM 4-15.21.
- DA PAM 350-38.
- DA PAM 385-10.
- DA PAM 385-40.
- DODM 4715.06 Vol 1.
- DODM 4715.06 Vol 2.
- DODM 4715.06 Vol 3.

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Chapter 2

Engineering

This section provides information not covered in other applicable TMs, and addresses baseline engineering systems and their associated inspection and maintenance requirements during inspections and surveys. This section covers some preventive maintenance checks and services but not all. Consult the appropriate TM for full preventive maintenance checks requirements.

CAUTION

Use of personal electronic devices in engineering spaces is prohibited while underway, on watch, and during official duties engaged in the safe operation of Army watercraft.

Note: Any hazards not identified in this TM may be marked by the crew. Marking should be done on a placard with a white background, and contain the following information using red font, red stencil, or appropriate sticker:

- Identify the hazard.
- Basic processes to mitigate the hazard.
- All loose and float free equipment that does not have a specific marking requirement identified in this manual will be marked at a minimum with the vessel name and/or hull number.

AUTOMATION

2-1. Automation is provided for vital systems which are automatically controlled and/or monitored. These automation systems shall function according to design as applicable to the vessel. Non-functioning automation must be identified on a Composite Risk Management Worksheet, with increased oversight/engagement in relation to the affected area and/or system.

BATTERIES, STORAGE

2-2. Storage batteries are found throughout the vessel, they are located on the interior as well as the exterior of the vessel. Care must be taken to properly maintain and inspect the batteries according to the vessel maintenance plan and applicable TMs.

2-3. Each battery must be secured to prevent shifting, which may be accomplished by chocking with non-conductive material or brackets to secure the battery. Each battery tray or box must provide adequate accessibility for installation, maintenance, and removal of the batteries. Battery boxes with lids shall have the lids secured to prevent injury in the event of a battery explosion.

2-4. Refer to applicable TM and/or system drawing to ensure the proper battery type is used. Ensure the battery chargers are working and providing the necessary charge to the appropriate battery banks. The electrolyte level in the batteries must always be maintained above the plates in each cell.

CAUTION

Using batteries not designed for the system have the potential to cause damage or bodily injury.

2-5. All batteries should be installed in a well-ventilated area. Each battery box on a weather deck must have an unobstructed ventilation duct at least 4 feet above the box ending in a gooseneck or mushroom head that prevents entrance of water. If this ventilation is missing or damaged it must be corrected according to original configuration.

Note: New batteries in storage should be kept in a temperature-controlled environment away from heat and humidity. Ideally, they should be stored with humidity levels below 50% and temperatures at or around 50 degrees.

2-6. Battery hazards will be identified as follows:

BATTERIES

SHOCK HAZARD.

EXPLOSIVE GASES.

WEAR PROPER PPE.

NO SMOKING, SPARKS OR OPEN FLAME WHILE WORKING.

Location: Conspicuously on or near battery banks or boxes.
Placard: White background with red letters.
Stencil: Red letters no more than 1".
Sticker with similar warning.

BULKHEAD PENETRATIONS

2-7. There are many locations throughout the vessel where piping and electrical wiring enter through bulkhead penetrations. These penetrations are to be watertight, either by welding or utilizing stuffing tubes. There must be no evidence of rust or corrosion, which indicates a loss of watertight integrity. There should not be any evidence of unnecessary openings or holes in the decks, bulkheads, or overheads which would affect the watertight integrity of the vessel.

2-8. In addition to the watertight integrity of the bulkhead, penetrations in a Class-A fire control boundary must be constructed to prevent the passage of flame and smoke for one hour.

COMPRESSED GAS CYLINDERS

STOWAGE

2-9. Compressed gas cylinders should be stowed in the following manner:

- Secured in the upright position.
- Stowed to ensure there is no metal-to-metal contact.
- Ensure safety covers are installed over the valves when cylinders are not in use.
- Ensure all cylinders are generally rust-free so that markings are legible.
- Marked appropriately indicating the date of last hydrostatic testing.

2-10. Consult Appendix B for cylinder marking identification information. Oxygen and acetylene bottles must be stored at least 20 feet away from each other and from any other fuel sources in accordance with (IAW) AR 700-68. Storage places for all cylinders shall be located where cylinders will not be knocked over or damaged by passing or falling objects, and not stored in unventilated enclosures such as lockers. Compressed gas cylinders should be periodically inspected for serviceability and ensure hydrostatic testing has not expired.

CERTIFICATION

2-11. Hydrostatic testing is done every time the bottle is refilled or every 5 years. If the bottle is stamped with a star, it is authorized for a 10-year hydrostatic test requirement. If a cylinder is identified with a specific service life, it will not be requalified and must be replaced with a new cylinder. See Appendix B for further information on cylinder markings.

COLOR CODING

2-12. All compressed gas cylinders shall be properly color coded IAW MIL-STD-101C. Refer to Appendix B for more information on color coding.

HAZARDOUS MATERIAL MARKINGS

2-13. Compressed gas cylinders must have hazardous materials (HAZMAT) labels affixed to them identifying them appropriately as defined in Appendix B.

CYLINDER CONDITION

2-14. If the cylinder shows evidence of dents, excessive corrosion, cracked areas, leakage, or thermal damage, it must be turned in IAW local policies and replaced with a new cylinder.

2-15. To minimize corrosion around the protective cap threading, application of polytetrafluoroethylene (PTFE) tape (plumbers' tape) is recommended.

ACCESSORIES

2-16. Flame arresters and reverse flow check valves shall be on hand for inspection and serviceable. These are typically found in the welder's toolbox or the torch kit on the vessel. See Appendix B for detailed information on these two items.

DECK MACHINERY

2-17. Personnel will not operate any deck machinery without training and knowledge of proper operation of these machines. There are proper sequences when starting up, operating, and shutting down, and if they are not followed according to the applicable TM they could result in injury to personnel or damage to machinery. The following paragraphs discuss steps to remember when operating and inspecting any deck machinery.

CAUTION

Any personnel observing or working on or adjacent to hydraulically powered equipment must exercise caution when choosing a location or position to prevent injury in the event of a hydraulic line failure with the power unit either running or shut down, loss of power, pump/motor failure, or movement of machine components during the normal operating cycle or as a result of component malfunction or failure.

Before removing or performing maintenance on any hydraulic system, components that have an electrical interface must lock-out and tag-out electrical power to the power unit and/or control system.

Hydraulic fluids may be irritating or injurious to the eyes and skin. Check with the safety data sheets for the effects of the fluid which is used. Avoid bodily contact with those harmful fluids.

BEFORE

2-18. Be sure all hydraulic connections which may have been removed, replaced, or disconnected during an equipment shut down have been reconnected securely before starting the hydraulic power unit.

2-19. Return all movable items, valves, and controls to their normal start-up conditions before starting the hydraulic power unit.

2-20. Be sure all personnel and loose items are clear of machinery before starting the hydraulic power unit.

2-21. Maintain and keep in place any equipment guards such as coupling guards, chain guards, and protective cowlings. Do not wear loose clothing or jewelry that could get caught in moving parts.

DURING

2-22. Any personnel working near the equipment should wear ear protection if the noise level is high enough to require protection.

2-23. Before shutting down the hydraulic power unit, block up or lock in position any machine members which may move and cause damage to personnel, products, or equipment upon loss of hydraulic flow and pressure.

2-24. Clear all personnel, products, and work pieces from the machinery before shutting down the hydraulic power unit.

2-25. If any personnel are required to work on equipment in the vicinity of the hydraulic system while the hydraulic power unit is running, they should always wear eye protection to prevent any eye injury in the event of a hydraulic line rupture and high velocity oil leak.

AFTER

2-26. If the hydraulic system has oil accumulators in circuit, drain pressurized oil from all accumulators (if automatic drainage is not built into the circuit) as soon as hydraulic unit is shut down. If accumulator has a shut-off valve, shut the valve off also.

2-27. Shut down the power unit and relieve pressure from all pressurized accumulators, actuators, and lines before removing, tearing down, or performing maintenance on any remotely located actuators, hoses, filters, valves, or piping.

GROUND TACKLE

2-28. Inspect all windlass components for corrosion or cracked welds of reinforced deck and associated mounting components. Machinery shall be free of hydraulic oil leaks, fully operational, and current on all maintenance requirements. For preventive maintenance checks and services (PMCS), lubrication, and maintenance procedures, refer to the vessel TM and the manufacturer's recommendations. TC 4-15.51 outlines good practices for ground tackle operation and maintenance.

Anchor Windlass Brake

2-29. Thoroughly inspect the brake for proper operation, ensuring it holds the anchor as designed.

Windlass Clutch

2-30. Inspect the windlass clutch for proper operation. Clutch should move freely to each position for proper operation of the windlass.

Controls

2-31. Inspect and operate all local and remote electrical controls. All controls should be free of corrosion. Repair or replace any damaged or missing components.

Brake Pads

2-32. Inspect the brake pads for serviceability and ensure there is no paint, excessive wear, or corrosion of the brake pad band.

Anchor Chain

2-33. Inspect the anchor chain (or cable) for any corrosion, deformation, cracks, or any other defects. Inspect the swivels and detachable links ensuring they are not damaged or corroded and that the taper pin is present. See TC 4-15.51 for more anchor chain maintenance information.

Riding Pawl and Chain Stopper

2-34. Inspect the riding pawl and chain stopper for any damage, cracked welds, excessive wear, and corrosion. Ensure riding pawl is lubricated and can move freely. A lanyard of no less than 2 feet should be attached to the riding pawl to ensure safe operation. Check the chain stopper turnbuckle for free movement. See Figures 2-1 and 2-2 on page 2-6.

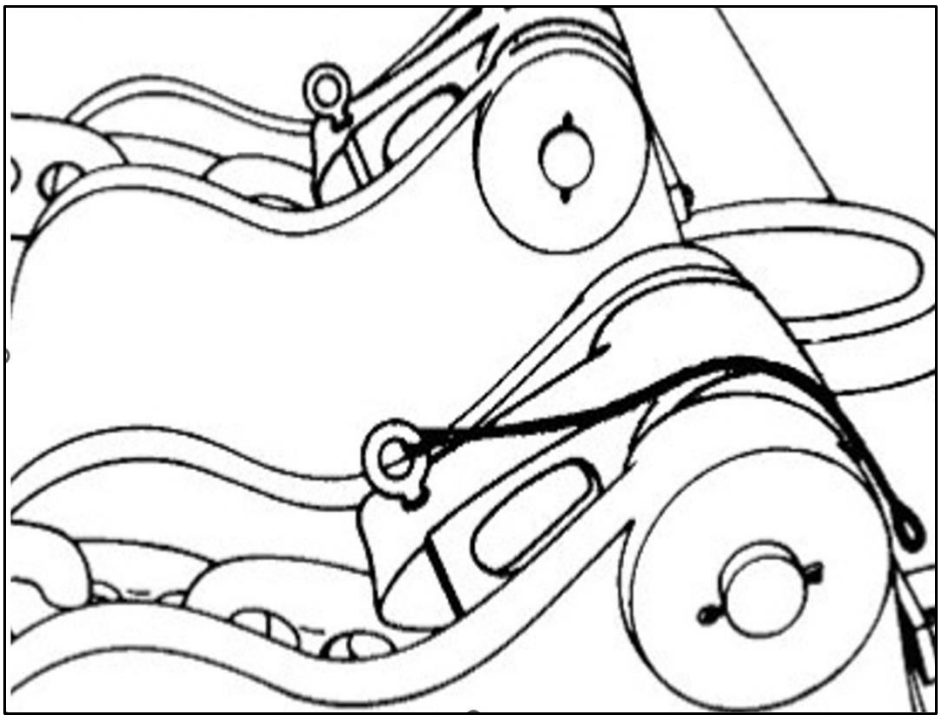

Figure 2-1. Riding pawl

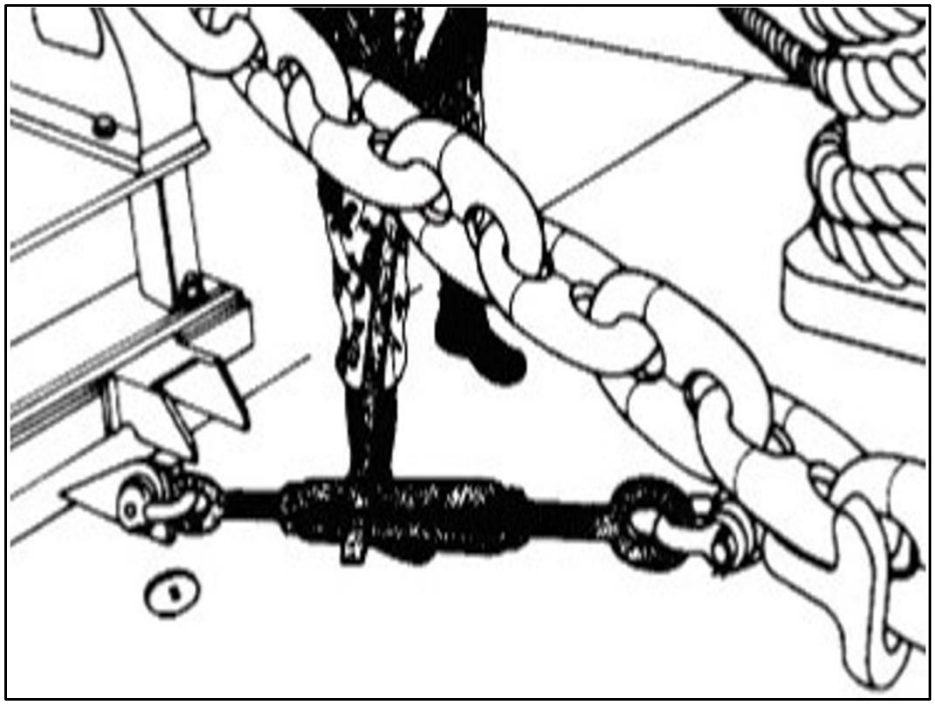

Figure 2-2. Chain stopper

RAMPS

2-35. Inspect all ramp components for corrosion, cracked welds, and damaged or missing hardware, paying special attention to the ramp hinges. Machinery shall be free of hydraulic oil leaks, fully operational, and

current on all maintenance requirements. For PMCS, lubrication, and maintenance procedures, refer to the vessel TM, lubrication order, and the manufacturer's recommendation.

Ramp Gasket

2-36. The ramp gasket is designed to prevent seawater from flooding the main deck. Open the bow ramp hinge plates to inspect the gasket for accumulation of debris and cracks. Check the entire length of the gasket to ensure the gasket has not exceeded more than 50% compression, which does not allow for a proper seal. Check the bow ramp hinges for cracks, breaks, corrosion, and missing bolts.

CAUTION

Use caution when opening and closing hinge plates. Injury to personnel may occur due to the excessive weight of the hinge plates.

DO NOT drop the hinge plates. Freely dropping hinge plates may damage hardware and welds.

Wire Rope

2-37. Inspect the cable according to Appendix B, wire rope inspection.

Controls

2-38. Inspect and operate all local and remote electrical controls. All controls should be free of corrosion. Repair or replace any damaged or missing components.

Brake Pads

2-39. Inspect the brake pads for serviceability and ensure there is no paint, excessive wear, or corrosion of the brake pad band.

DECK PLATES

2-40. Debris or excess items can create a fire hazard, hinder dewatering processes, and become trip hazards. All deck plating shall be fastened securely to prevent tripping hazards and free of any oil to prevent slipping hazards. If deck plates are painted, ensure hinges operate freely. Hinged deck plates shall have hazard markings IAW TB 43-0144.

ELECTRICAL SAFETY

CABLE AND WIRE SPLICING

2-41. Cable and wire splicing should be avoided whenever possible, but, when necessary, they must be done following procedures outlined in TC 55-509.

CIRCUIT BREAKER PANELS

2-42. Inspect all power and lighting distribution panels and ensure that no wiring is exposed, and all spare positions are covered. The doors of all panels must be fully operational and close securely to prevent injury or entry of contaminants.

SURGE PROTECTION DEVICES

2-43. Ensure that any power strips (surge protection devices) used on the vessel are designed for shipboard service and are Underwriters Laboratories (UL) 1449 rated. The following precautions should be followed:

- Only permitted for use onboard once approved by the chief engineer.
- Remove from service if it is hot to touch.
- Unplugged when not in use.
- Regularly inspected for damage or wear.
- Limited to one surge protection device per single duplex receptacle outlet and never daisy chained.
- Prevented from use in excessively humid or moist environments.
- Provided air circulation and not covered with carpet or other items.
- Checked to ensure all plugs are fully engaged.

2-44. For proper surge protection device ordering information consult the Maritime Standards SharePoint Library or contact the MSSO at maritimesafety@army.mil.

CAUTION

Never use an extension cord or power hand tool without it being properly grounded. Extension cords are designed for temporary use only, not for use as permanently installed wiring. No extension cords shall be brought onboard the vessel without approval from the chief engineer. All extension cords must be of the three-prong type and must be UL listed. The grounding prong creates an emergency path for current flow if there is a short or a fault within the device connected to it.

PROPER WIRE HANGERS

2-45. Cables should be supported in metal hangers or trays. Metal bands or clips are the preferred method of securing the cables to the tray or hangers. Cables shall be supported in a way that prevents sagging and applied so they remain tight without unnecessary damage to the cables. Cable retention devices should be installed not less than every 24 inches on vertical runs and not less than every 8 feet on horizontal runs. Nylon or plastic retaining devices may be used in horizontal runs where cables will not fall if the retention devices fail. When nylon or plastic cable retaining devices are employed on exterior cable runs, they should be of a type resistant to ultraviolet light (sunlight).

GROUNDING STRAPS

2-46. Exposed, non-current-carrying metal parts of fixed equipment that may become energized because of any condition must be grounded. These can be found on generators, electric motors, ladders, stairs, and masts. If the installation of the electrical equipment does not ensure a positive ground to the metal hull or equivalent conducting body, the apparatus must be grounded to the hull with a grounding conductor. Ground current detectors are present on some vessels, and they indicate when there are ground faults on the systems they monitor.

CABLE INSULATION

2-47. Inspect wiring throughout the vessel to ensure there are no signs of chaffing (holes, tears, missing insulation/armor), damage, or any exposed cables in the insulation and/or armor. Any damage must be repaired to prevent electrocution or an electrical fire.

DISTRIBUTION PANELS AND SWITCHBOARDS

2-48. All switchboards shall have wooden or similar non-conductive handrails attached to the front of them. Distribution panels and switchboards must be installed correctly with no exposed wiring or electrical components.

2-49. Distribution panels and switchboards that are accessible from the rear must be clear of obstructions and constructed to prevent a person from accidentally contacting energized parts.

2-50. Working space must be provided around all main distribution panels and switchboards of at least 24 inches in front of the switchboard, and at least 18 inches behind the switchboard.

2-51. Rear access is prohibited when the working space behind the switchboard is less than 18 inches.

2-52. Non-conducting deck coverings, such as non-conductive matting or gratings suitable for the specific switchboard voltage, must be installed for personnel protection at the front and rear of the switchboard. They must extend the entire length of and be of sufficient width to suit the operating space (within arm's length).

ELECTRICAL TOOL KIT

2-53. Most vessels have electrical and electrician's tool kits assigned based on basic issue items (BII) or modified table of organization and equipment. If the vessel does not have one of these kits assigned, ensure properly insulated electrical tools are used to perform tasks needed for troubleshooting or repairs of electrical equipment. Ensure electrical tools are serviceable and properly insulated to prevent injury or shock.

EMERGENCY MACHINERY/VALVE SHUTDOWNS

SUPPLY AND EXHAUST FAN SHUTDOWNS

2-54. All supply and exhaust fan shutdown controls must be marked appropriately and suitably protected against accidental operation and tampering.

FUEL OIL SYSTEM SHUTDOWNS

2-55. All fuel oil systems controls must be marked appropriately and suitably protected against accidental operation and tampering.

EMERGENCY SHUT-OFF VALVES AND REACH RODS

2-56. If the valve is not marked by the manufacturer, then each valve shall be marked or labeled on or near the valve with "OPEN" and "CLOSE" and directional arrows to identify direction for proper operation. Remote valve controls that are not readily identifiable as to service must be fitted with nameplates.

2-57. All valves shall be labeled and color coded IAW TB 43-0144. Spray paint is recommended to avoid excessive paint buildup.

EMERGENCY POWER

EMERGENCY GENERATOR

2-58. Internal combustion engine driven emergency generators shall be operated under load for at least 2 hours at least once every month. Due to the sporadic nature of Army missions, vessels may remain moored for extended periods of time. This TDI should still be conducted monthly. The date of the tests and the condition and performance of the equipment shall be noted in the appropriate log.

Note: The emergency generator must start automatically upon loss of power and operate under load automatically within 45 seconds.

2-59. Battery chargers for the emergency batteries must be fully operational and charging the batteries according to the manufacturer's recommendation. The batteries for the emergency generator must have the energy-storage capability to provide three consecutive starts of the engine.

EMERGENCY LOADS

2-60. With loss of power on the vessel, the systems listed in table 2-1 on page 2-10 must be able to operate under temporary and final emergency power.

Table 2-1. Emergency loads

Temporary (Battery Backup)	*Final (Emergency Generator)*
General alarm system	Smoke detectors
Public address system	General alarm system
Fire detection and fire alarm systems	Internal communications equipment
Global positioning System (GPS) (one integrated)	One bilge pump
Speed log	Emergency fire pump
Gyro compass	Steering gear
Electronic chart display information systems **(**ECDIS)	Steering failure alarm
	Engine room exhaust fans
	Charging system for emergency batteries and emergency generator starting batteries

2-61. In addition to table 2-1, the emergency lighting listed below must operate under temporary and final power and must be marked IAW TB 43-0144:

- At all embarkation stations.
- At service passageways, and exits.
- At all life raft stations.
- Machinery spaces, control stations, and control/emergency switchboards.
- At all stowage spaces for firefighter's outfits.
- At steering gear compartment.
- At fire and emergency bilge pumps.
- Installed emergency lights stenciled "E" IAW TB 43-0144.

WEEKLY EMERGENCY LIGHTING AND EMERGENCY POWER SYSTEMS TEST

2-62. All emergency lighting and emergency-associated power systems shall be operated and inspected once a week to ensure all components of each system are fully operational. This test is not required under temporary or final power and can be completed under normal ship's power.

2-63. Battle lanterns are portable emergency lighting and shall be checked at the same frequency as emergency lighting. Batteries will be replaced prior to expiration. The expiration date will be identified on the outer shell of the battle lantern. All battle lanterns shall be marked IAW TB 43-0144. Quantities are indicated in the vessel's BII, and mounting locations shall be IAW the fire control plan (FCP). Testing of battle lanterns can be found in Appendix B.

SEMI-ANNUAL STORAGE BATTERY TEST FOR EMERGENCY LIGHTING AND EMERGENCY POWER SYSTEMS

2-64. Storage batteries for emergency lighting (not battle lanterns) and associated power systems shall be tested at least once every 6 months by operating them under temporary battery power for at least 30 minutes. Emergency power systems include all loads on the emergency circuit with battery backup. Due to the sporadic nature of Army missions, vessels may remain moored for extended periods of time. This TDI should still be conducted semi-annually. The date of the tests and the condition and performance of the apparatus shall be noted in the appropriate logs.

FUEL OIL/HAZARDOUS MATERIALS/POLLUTION

DISCHARGE CONTAINMENT

2-65. Every containment must have a mechanical means of closing with either a valve or a plug (wood is prohibited). Plugs must be attached to a keeper chain to prevent loss. Inspect the condition of the valve or plug and ensure it is serviceable and not corroded to the point where it does not function as designed. Ensure all containments are closed for the applicable system being operated. When not in use, valves shall remain open and plugs shall be removed. This prevents accumulation of rainwater and seawater, which reduces the amount of available space if there were anything to discharge from the vent.

2-66. Vessels 300 gross tons or more must have discharge containment capable of holding at least one-half barrel (approximately 21 gallons) per containment. Ensure there is no amount of excess or residual liquid in the containment prior to transfer operations. Vessels less than 300 gross tons shall equip all fuel oil overflow vents and fill pipes during transfer operations with a portable container of at least a 5-gallon capacity, or if the vessel has a fill fitting for which containment is impractical, use an automatic back pressure shut-off nozzle.

VENT FLAME SCREENS

2-67. All tank vents shall have a vent flame screen installed that is not damaged or corroded and covers the entire vent opening.

STANDARD DISCHARGE CONNECTION

2-68. Vessels 400 gross tons and above shall have a standard discharge connection onboard. This comes as a kit and should not be confused with the international shore connection for firefighting. The standard discharge connection has six slots, where the international shore connection has four slots. See Figure 2-3 for a standard International Maritime Organization (IMO) flange.

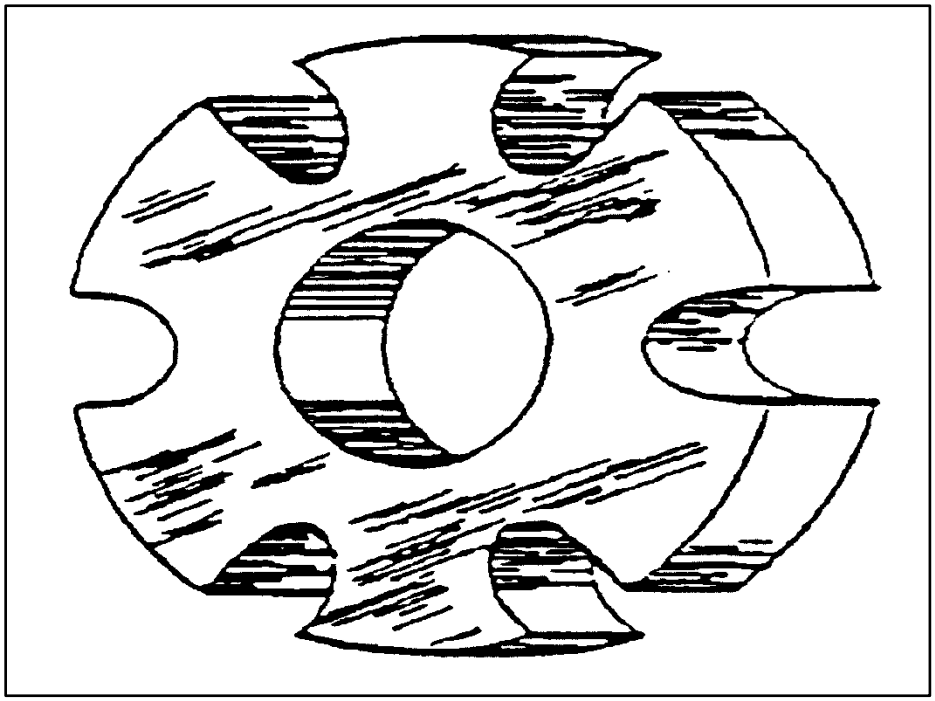

Figure 2-3. Standard IMO flange

OILY WASTE STORAGE

2-69. Army watercraft have the ability to retain oily mixtures on board. If equipped with an oily water separator (OWS), piping diagrams shall be posted near the tank detailing proper operation. If a sight glass is installed, ensure it is legible and has impact guards installed. These guards and the sight glass shall be intact and unbroken.

WARNING

No person may intentionally drain oil or hazardous material from any source into the bilge of a vessel.

SPILL CLEANUP MATERIALS

2-70. Each Army vessel must have at least one oil spill response kit onboard that shall be stowed and maintained according to TB 55-1900-252-14.

TRANSFER HOSES

2-71. All transfer hoses shall be maintained IAW TB 55-1900-206-14, stowed appropriately to prevent damage, and inspected for the following:

- Any signs of damage.
- Kinks.
- Bulges.
- Soft spots.
- Rips.
- Tears.
- Hose opening for gasket or damaged gasket.

2-72. Dispose of any hoses that fail inspection according to local HAZMAT guidelines.

PETROLEUM, OILS, AND LUBRICANTS/SEWAGE TRANSFER PROCEDURES

2-73. Each product transferred to or from the vessel must have transfer procedures that include the following information:

- Generic or chemical name.
- A description of each transfer system on the vessel, including a line diagram posted of the vessel's transfer piping showing the location of each valve, pump, control device, vent, and overflow.

2-74. Procedures for transfers must be detailed in the vessel's SOP, and the crew shall follow the U.S. Army Watercraft Oil Spill Contingency Plan outlined in TB 55-1900-252-14. During all transfers and bunkering operations, identify duties of the crew members using the Operational Spills Checklist in the TB and any other local policies at the transferring facility location.

2-75. Additional information on hazardous product transfers can be found in TB 55-1900-252-14 and TB 55-1900-206-14.

NATIONAL RESPONSE CENTER

2-76. The phone number to the National Response Center shall be posted in the pilot house and conspicuous locations at and around all transfer locations. The National Response Center number is: 800-424-8802 or 202-267-2675, TELEX number is: 892427.

MARINE SANITATION DEVICE

2-77. If a vessel is equipped with a marine sanitation device (MSD) it must be operational IAW Department of Defense manual (DODM) 4715.06, Volume 1.

2-78. If the vessel is operating in a location where discharge of sewage is prohibited according to TB 55-1900-206-14, *Summary of Discharge Restrictions* or if the MSD is inoperable, overboard discharge must be prevented by using the following options:

- Closing the overboard discharge valve and removing the handle.
- Padlocking the overboard discharge valve in the closed position.
- Using a non-releasable wire tie to hold the valve in the closed position.
- Locking the door to the space enclosing the toilets with a padlock or door handle key.
- Always follow the lock-out/tag-out procedures listed in Appendix B when securing the overboard discharge.

LAGGING/SPLASH GUARDS

2-79. All hot surfaces of equipment, including exhaust pipes and other lines which may create a fire hazard, shall be provided effective protection by lagging or shielding, or by guards or engine enclosures.

2-80. Electrical panels, switchboards, and other electrical equipment should be protected from fluids by such means as splash guards.

LIFTING DEVICES AND CRANES

LIFTING DEVICES

2-81. Hoisting equipment such as chain falls, J-davits, lifting slings, and ratchet-type hoists must be inspected before and after each use and on an annual basis. 881A2s shall, by appointment of the commander, manage oversight of their unit's lifting device program and maintain records of all inspections performed. These records shall identify specific lifting devices by unique designators and date of inspection. These records shall be made available for inspection.

2-82. Consult TB 43-0142 for proper inspection procedures of lifting devices and hoists.

WARNING

This section does not apply to the fast rescue boat (FRB) launching appliance. For FRB launching appliance inspections consult Chapter 5.

2-83. Each vessel must verify BII allowances with applicable TMs. Each vessel platform has a different requirement for on-hand quantities.

CRANES

2-84. LCM-8 Mod2 crews will follow the vessel TM for inspection and testing of their cranes.

LIGHTING

DECK LIGHTING

2-85. All deck lighting on the exterior of the vessel shall be operational. This includes lighting at personnel and embarkation areas. During preparation, launching, and recovery, each life raft and fast rescue boat (FRB), its launching appliance, and the area of water into which it is to be launched or recovered must be adequately

illuminated by lighting supplied from the emergency power source. Gangways shall also have adequate lighting provided for personnel as they embark/debark the vessel.

EXPLOSION-PROOF FIXTURES

2-86. For lighting installed in hazardous locations that have the potential for explosive gasses, such as paint lockers, the lighting fixtures must be of suitable explosion-proof construction approved as meeting UL 1203. Depending on the type, many explosion-proof globes also have wire cages over the clear lens. These cages are also screwed over the lens to prevent impact to both the globe and the bulb. The globe is designed to contain any spark which may be caused by a light bulb should it be broken. If any damage is found with these fixtures, they are no longer explosion proof and repairs must be made to return them to original configuration. This also applies to portable explosion-proof lighting.

IMPACT GUARDS

2-87. Each fixture (other than explosion proof) must have a guard or be made of high-strength material to prevent damage from impacts. The guards are made of heavy clear glass or plastic lenses with metal cages that screw over a light bulb or into the light fixture. The cages are designed to prevent impact to both the globe and bulb. Fluorescent lights will have covers intact. This also applies to portable lighting.

LOCK OUT/TAG OUT

2-88. Lock out/tag out (LOTO) of energy sources is required due to hazards which could result in injury or death to personnel. This LOTO program is required for all Army watercraft. The program is designed to notify personnel that locked/tagged equipment or systems are NOT to be operated under any circumstances.

2-89. All vessels must have an SOP covering their program and a log containing all the documentation (LOTO Index and LOTO Record Sheets), which shall be kept for one year after clearing the tag. All crewmembers must be familiar with the program and follow the procedures set forth in this TM. Tags are only authorized for 30 days, at which time they must be cleared and removed or revalidated in the LOTO log.

2-90. See Appendix B for further guidance on the LOTO program.

MAIN AND AUXILIARY MACHINERY

MACHINERY LEAKS

2-91. All machinery of any type shall be free of leaks, including exhaust leaks. Evidence of an exhaust system leaking is identified by black soot on exhaust lagging or heat shielding. When inspecting for fluid leaks, start from the lowest point looking for drips or runs. Follow the trail to the source of the leak. Leaks of any sort can lead to further issues and can create fire hazards. Identify any leaks and make repairs as necessary. Leaks are classified as follows:

- Class I: Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
- Class II: Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.
- Class III: Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

Note: Equipment operation is allowable with minor leaks (Class I or II) except for fuel leaks.

PIPING

2-92. All piping must be in good condition. Inspect for signs of wear, deterioration, damage, or leaks. Ensure piping is labeled according to TB 43-0144.

PROPER APPLICATION OF HOSES

2-93. All nonmetallic flexible hoses installed on equipment shall be SAE J1942 compliant. SAE J1942 is the standard for hydraulic hoses for marine use and shall be used for saltwater systems, non-vital pneumatic systems, lube oil and fuel systems, and hydraulic systems. Nonmetallic flexible hoses must not exceed 30 inches, shall NOT be painted, and must have hose end fittings complying with SAE J1475.

BILGES

2-94. All bilge pumps shall be serviceable and operational from all local and remote stations.

2-95. Remote bilge level sensors, where provided, must be located to detect flooding at an early stage and to provide redundant coverage. These sensors are considered automation. If they are not operational, this lack of automation shall be identified in the vessel's DD Form 2977 (*Deliberate Risk Assessment Worksheet*) for each mission and additional checks of the bilges shall be conducted every 15-20 minutes while vessel is manned.

2-96. Monthly tests must demonstrate the proper operation of the float switches, alarms, power sources, and safety controls. Float switches will be tested IAW appropriate TM. Verify the appropriate alarm sounds (high water, low water) at all monitoring locations.

CAUTION

Accumulation of oily waste or debris in bilges is a fire hazard.

Debris is fuel for fires and will prevent proper dewatering operations in emergency situations and during normal operation.

MACHINERY GUARDS

2-97. All rotating machinery capable of injuring personnel shall be provided with adequate covers or guards and identified according to TB 43-0144.

OILY WATER SEPARATORS

2-98. OWS shall be maintained and operated IAW the applicable TM, TB 55-1900-206-14, and DODM 4715.06 V2.

2-99. Vessels are not authorized to discharge anything that produces a sheen within the territorial seas (0-3 nautical miles) and the contiguous zone (3-12 nautical miles) of the United States, regardless of oil content. Vessels operating in these waters may process oily waste using their OWS through an operational oil content monitor limiting the overboard discharge to 15 parts per million or less. Discharge through the oil content monitor over 15 parts per million will be returned to the bilge or holding tank for re-processing. Vessels will not discharge anything if operating within the special areas identified in MARPOL Annex I.

2-100. Any discharge from the vessel, whether using the OWS or not, shall be annotated in the appropriate logs.

WARNING

Bypassing the oil content monitor in any way is NOT authorized.

PRESSURE VESSEL DATA PLATES

2-101. Pressure vessel data shall be identified on the pressure vessel (air flasks/receivers, potable and seawater pressure tanks). In the event that the portion of the pressure vessel upon which the data is stamped

is to be insulated or otherwise covered, the data shall be reproduced on a metal nameplate and securely attached by alternate means. The data shall be readily visible, legibly stamped, and shall not be obliterated during the service life of the pressure vessel.

SKIN VALVES

2-102. All skin valves which have the ability to allow seawater to enter the vessel or the vessel's piping systems must be secured when the vessel is unmanned and/or locked up for a period longer than 12 hours. This is to prevent any possible flooding due to faulty piping, strainers and/or valves within the particular system. SOPs must be in place for the engineering department to ensure these valves are closed appropriately.

PIPE MARKINGS AND VALVE COLOR CODING

2-103. TB 43-0144 shall be used for guidance on properly marking piping systems.

VOID COVERS/ACCESS PANELS

2-104. Void covers should be checked for the presence of a gasket and excessive corrosion that could affect the gasket's ability to prevent water intrusion into the void. All bolts should be present, torqued appropriately, and corrosion free.

2-105. When replacing the void covers, the bolts should not be over-tightened to prevent damage to the gasket. Torque specifications are based on the bolt grade, size of the bolt, thread count, and the material of the bolt or screw.

2-106. In the event that torque specifications cannot found in the vessel's TM, contact an Army Materiel Command watercraft logistics assistance representative at watercraftlarsupport@army.mil.

Chapter 3

Firefighting and Damage Control Equipment

This chapter discusses techniques and practices in the maintenance and performance elements of firefighting and damage control equipment. Damage control techniques can be found in TC 4-15.51 and firefighting theories and techniques can be found in Appendix C.

BLOWER, VENTILATION

3-1. Ensure the proper quantity is onboard, serviceable, and operational.

3-2. The RAMFAN ventilation blower will require little preventative maintenance when properly operated according to the procedures below. Performing the checks listed below on a quarterly basis will help ensure safe operation and maximum service life:

- To ensure dissipation of static electric charge, the static cord/clip and duct should be periodically checked for continuity. The teeth on the static clip should be wire brushed to remove any oxidation or foreign matter. The flange surfaces of all duct adaptors should be maintained free of surface oxidation. The studs and nuts used to attach the duct adaptors to the blower housing should be regularly inspected and cleaned. The grounding connection located on the side of the carrying handle should be kept tight and free of corrosion.
- Flush with fresh water after each use to avoid saltwater corrosion.
- Exercise care during deployment and storage to prevent physical damage. For further sustainment details on this piece of equipment contact an Army Materiel Command watercraft logistics assistance representative at watercraftlarsupport@army.mil.

CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR COUNTER MEASURE WASH DOWN SYSTEM

3-3. Logistics support vessels (LSVs) and landing craft utility (commonly known as LCUs) have a system to provide counter measures during an actual or suspected chemical, biological, radiological, or nuclear attack. This wash-down system must be maintained IAW with the vessel's TM, ensuring that at a minimum the following actions are conducted or items are inspected:

- Systems operated annually.
- All control valves properly marked to identify the function and space they protect.
- All sprinkler heads and guards installed and free from damage and obstructions.
- Drain traps maintained IAW the applicable TM.

DAMAGE CONTROL EQUIPMENT

3-4. Refer to TC 4-15.51 for damage control processes and procedures.

DAMAGE CONTROL GEAR

3-5. Each vessel must verify BII allowances with applicable TMs. Each vessel platform has a different requirement for on-hand quantities. These items should be stowed according to the FCP and properly maintained. Any deviations from the FCP stowage of damage control gear must be non-permanently annotated on the FCP.

3-6. The ships maul may be used to destroy sensitive radio equipment in the event vessel security has been compromised.

WARNING

The use of self-combusting or extremely flammable preservatives (such as linseed oil) on this tool is unauthorized.

DAMAGE CONTROL LOCKER

3-7. Damage control lockers should be marked "Damage Control Equipment" IAW TB 43-0144.

PUMP, PORTABLE (P-100)

3-8. Follow the procedures listed in TM 10-4320-405-13&P for maintenance of the P-100 and associated BII. The items listed for inspection on the watercraft survey checklist are based on this TM.

3-9. During an annual inspection, triennial survey, and as part of routine PMCS, the P-100 will be operated with a minimum of two suction hoses connected drawing water from the side of the vessel.

3-10. The 1.5" hoses that are part of the equipment BII must be used. Removing fire hoses from fire stations to enable proper operation reduces the firefighting capability for the vessel in the event of an emergency and should not be considered common practice.

FIRE AXES

3-11. Inspect the fireman's axe for the following items to ensure serviceability:

- Blade sharp not gouged.
- Point sharp, not broken or cracked.
- Handle clean, not broken, no splinters, secure in head.
- Marked with vessel name or hull number.
- Axe head shall be painted to prevent corrosion. The color shall be red to signify firefighting equipment.
- Paint may be used to preserve the life of the wood.

WARNING

The use of self-combusting or extremely flammable preservatives (such as linseed oil) on this tool is unauthorized.

FIRE CONTROL AND EMERGENCY EQUIPMENT PLAN

3-12. FCPs provide the vessel firefighting teams with detailed information of vessel layout. This information gives the damage control team strategic options for an aggressive interior attack during a shipboard fire. Plans shall be legible, current, and permanently exhibited.

3-13. The shore-side FCP enclosure should be readily available to shore-side firefighting personnel so that any fire on board will not readily cut off access to it.

3-14. The enclosure shall be painted according to TB 43-0144. The enclosure should be capable of being opened easily and located as identified on the FCP.

FIRE EXTINGUISHERS

3-15. All fire extinguishers shall be labeled according to TB 43-0144.

DRY CHEMICAL

3-16. All dry chemical portable and semi-portable fire extinguishers shall be inspected on a monthly basis. Monthly inspection of the dry chemical extinguisher shall include the following:

- Ensure extinguisher is located in location designated according to the FCP and is easily accessible (not covered or blocked).
- Ensure markings for location and extinguisher are legible.
- Ensure labelling on the extinguisher is legible.
- Inspect for corroded nozzles.
- Inspect hoses for cracks and dry rotting.
- Remove all removable extinguisher boots and foot rings to accommodate thorough examination for corrosion.
- Ensure pressure gauge is in the operable position or range.
- Ensure certification has not expired. See following paragraphs for certification intervals.
- Check that seals are not broken.
- Ensure dry chemical is free by turning the extinguisher upside down and check for shifting of the extinguishing agent inside of the extinguisher.

3-17. In addition to the monthly inspections, dry chemical fire extinguishers require an annual examination. Annual inspections will include all of the monthly inspection criteria with the addition of the following:

- Remove pull pin tamper seal or locking device.
- Reinstall new tamper seal.

Note: These annual examinations may be conducted by the owning unit with National Fire Protection Association (NFPA) 10 certified personnel.

3-18. Any deficiencies identified during any inspection or examination shall be corrected immediately. Dry chemical fire extinguishers require additional tests beyond the monthly and annual inspections. These tests shall be performed by certified service providers at the intervals prescribed below:

- Internal examination every six years.
- Hydrostatic testing every twelve years.

CO2

3-19. All carbon dioxide (CO2) portable and semi-portable fire extinguishers shall be inspected on a monthly basis. Monthly inspection of the CO2 extinguisher shall include the following:

- Ensure extinguisher is located in designated location according to the FCP and is easily accessible (not covered or blocked).
- Ensure markings for location and extinguisher are legible.
- Ensure labelling on the extinguisher is legible.
- Inspect for corroded nozzles.
- Inspect hoses for cracks and dry rotting.
- Remove all removable extinguisher boots and foot rings to accommodate thorough examination for corrosion.
- Ensure pressure gauge is in the operable position or range.
- Ensure certification has not expired. See following paragraphs for certification intervals.
- Check that seals are not broken.

3-20. In addition to the monthly inspections, CO2 fire extinguishers require an annual examination. These annual inspections include the following:

- Weighing of cylinder. (Recharge if weight loss exceeds 10% of weight of charge.)
- Conductivity test.
- Nozzle and hose check.
- For wheeled units, the discharge hose shall be completely uncoiled and examined for damage.

Note: The annual weighing must be conducted by certified service providers. The conductivity test, nozzle inspection, and wheeled unit hose inspection may be conducted by the owning unit with NFPA 10 certified personnel.

3-21. Any deficiencies identified during any inspection or examination shall be corrected immediately. CO2 fire extinguishers require additional tests beyond the monthly and annual inspections. These tests shall be performed by certified service providers at the intervals prescribed below:

- Internal examination every five years.
- Hydrostatic testing every five years.

FIREFIGHTER'S ENSEMBLE

Note: The following inspection procedures are required to be conducted after every fire, fire drill, and on an annual basis unless otherwise directed in applicable TMs.

3-22. During use of the firefighter's ensemble (FFE), avoid direct contact with flames and avoid sharp and pointed objects which may tear or puncture the suit.

3-23. Soot and dirt buildup on the surface of the fire protective gear may eventually contribute to reduced thermal protection, especially at extreme temperatures found in shipboard fires. The threat of heat exhaustion increases when the pores of the outer shell and moisture barrier become clogged with soot and dust. Instructions for routine shipboard cleaning are contained below.

3-24. Professional cleaning is warranted for more intensive cleaning or decontamination of fire protective gear exposed to hazardous substances. Professional cleaning can only be accomplished by the authorized service centers listed in Appendix C.

3-25. For canvas repair of the ensemble bag only, contact your local logistics readiness center for capability and maintenance submission procedures before pursuing commercial repair.

3-26. The FFE shall be stowed IAW the FCP so that it is readily accessible. Before being stowed, ensure that the ensemble is clean and dry. Stowage locations shall be labeled IAW TB 43-0144.

CAUTION

No part of the FFE shall be dry cleaned. Chlorine bleach should never be used under any conditions.

SELF-CONTAINED BREATHING APPARATUS

3-27. Self-contained breathing apparatus (SCBAs) will be stowed with fully charged cylinders, ready for use, according to TM 10-4240-343-13&P and the FCP.

3-28. Maintenance of SCBA packs should follow PMCS procedures outlined in TM 10-4240-343-13&P. The equipment should also be visually checked every time the SCBA is used and put away. Some common items to check include—

- Bolts, clamps, nuts, and screws. Continuously check for looseness. Look for chipped paint, bare metal, rust, or corrosion around bolt and screw heads and nuts, and tighten them if loose.
- Welds. Many items are welded. To check these welds, look for chipped paint, rust, corrosion, or gaps.
- Electrical wires, connectors, and harnesses. Tighten loose connectors. Look for cracked or broken insulation, bare wires, and broken connectors.
- Hoses. Look for wear, damage, and leaks. Make sure clamps and fittings are tight.
- Face piece lens. Look for cracks or loss of tightness with the face piece rubber. Verify that the lens is not broken, cracked, or has scratches that would impair vision. Isopropyl alcohol or rubbing alcohol wipes will not be used to clean the rubber components of the facemask as prolonged exposure may cause crazing or stiffening which will result in loss of elasticity.

3-29. SCBA function/flow tests must be conducted by an authorized service provider IAW TM 10-4240-343-13&P. Test results shall be maintained in the certificate/records binder until replaced by a current test.

EMERGENCY BREATHING AIR COMPRESSOR

3-30. Maintenance of the emergency breathing air compressor (EBAC) should follow PMCS procedures outlined in TM 10-4310-503-13&P.

Note: Pay special attention to the P1 filter and bleed valve. This valve is to remain closed for stowage.

3-31. An air sample test must be conducted on each SCBA bottle every three months IAW the EBAC TM and annotated on the EBAC log sheets and other appropriate logs. Any unit that owns SCBAs but cannot perform these tests must receive a copy of the test results from the agency or unit performing the test. The test results for any and all air sample tests conducted shall be replaced by current test results.

FLASHLIGHT

3-32. Flashlight should be verified that it is of the explosion-proof type and is serviceable.

HELMET (INCLUDING ANTI-FLASH HOOD)

3-33. Inspect the following parts of the helmet for damage, deterioration, and manufacturing defects:

- Inspect helmet shell for cracks or holes. Replace the helmet if the shell (gelcoat) is cracked.
- Check suspension liner for proper functioning. Replace the helmet if the suspension is damaged.
- Check face shield for scratches which impair adequate vision. Replace the face shield if large scratches on either side of the shield obstruct the view.
- Check ear flap for frayed edges or tears.

3-34. Inspect and clean the anti-flash hood as follows:

- Inspect for frayed edges or tears. Replace the anti-flash hood if it has been damaged in any way.
- Inspect face opening to determine if elastic has adequate tension to maintain close fit around the SCBA mask.
- Inspect for dirt and debris.

3-35. If cleaning is necessary, machine wash the anti-flash hood in lukewarm water and laundry detergent. Machine dry using low heat setting.

BOOTS

3-36. Footwear should be inspected for the following:

- Cleanliness.
- Physical damage such as—

- Cuts, tears, and punctures.
- Thermal damage (charring, burn holes, melting, or discoloration of any layer).
- Exposed or deformed protective toe, protective midsole, or shank.
- Loss of water resistance.
- Loss of seam integrity and broken or missing stitches.

GLOVES

3-37. Inspect and clean gloves as follows:

- Inspect inner insulation and outer leather surface for damage, deterioration, and manufacturing defects.
- Replace gloves if inner vapor barrier or shell is torn or punctured.
- Inspect gloves for dirt, debris, and mildew.
- If cleaning is necessary, machine wash gloves in lukewarm water and laundry detergent to remove dirt, debris, or mildew. Do not machine dry gloves. Drip dry gloves in open area.

COVERALLS/OUTFIT

3-38. Inspect the following parts for damage, deterioration, manufacturing defects, and cleanliness of coverall/fire protective garment:

- Collar.
- Zippers (apply bee's wax to zippers, if required).
- Knit sleeve cuffs.
- Pant cuffs.
- Outside shell material.
- Removable inner liner for dirt, debris, and mildew.

3-39. Replace protective garment if zippers are damaged or deteriorated or if white vapor barrier is torn. Replace the fire protective gear if material tears penetrate the vapor barrier or if the shell is torn more than 2 inches in any one direction. Major repairs, such as replacing a zipper, torn sections, or damaged components, can only be accomplished by authorized service centers. Replacing such parts is cost effective and is recommended instead of procuring a new item. See Appendix C for a list of authorized repair facilities.

3-40. If cleaning is necessary, remove dirt, debris, or mildew by machine washing coverall/fire protective garment and removable inner liner in lukewarm water and laundry detergent. The liner in the fire protective garment should be removed from the outer garment and washed separately.

3-41. To drip-dry coverall/fire protective garment or removable inner liner, hang in open area by garment loop or on non-metal hanger. When completely dry, return coverall/garment/garment liner right side out. Ensure removable inner liner is properly reinstalled.

CAUTION

High heat setting could damage coverall/fire protective garment and removable inner liner.

Do not store or hang liner in direct sunlight.

3-42. To machine dry coverall/fire protective garment or removable inner liner, turn coverall/fire protective or removable inner liner inside out and tumble dry using low heat. When completely dry, return coverall/garment/garment liner right side out. Ensure removable inner liner is properly reinstalled.

FIRE HAZARDS

3-43. Ensure vessel is clear of all fire hazards or increased fire load items such as plastic trashcans and unauthorized flammable paneling. General housekeeping will also keep fire hazards to a minimum.

3-44. Plastic trashcans are not authorized onboard and are not an acceptable replacement for the BII.

CAUTION

Fire-rated doors shall not be made fast to a retaining device in a manner that prevents it from opening or that holds the door open. Improper use of fire-rated doors alters the fire boundary of a protected space.

FIRE MAIN SYSTEMS

3-45. Each pump must be capable of delivering water simultaneously to the two farthest outlets from the fire pump at a pressure of approximately 50 pounds per square inch (psi).

3-46. Fire pumps must be fitted with a relief valve on the discharge side of the pump(s) set to relieve at 25 psi over the pressure necessary to maintain the requirements above, or 125 psi, whichever is greater.

3-47. During annual testing and inspections, fire stations will be tested to ensure they can produce sufficient pressure.

FIRE STATIONS

3-48. Marking of fire stations and hoses shall be IAW TB 43-0144.

3-49. All stations will be inspected at weekly fire drills and after each use. Inspection will include the following:

- Clear of obstructions in and around fire stations.
- No damage to nozzle tip.
- Inspect hose to ensure there is no evidence of mildew, rot, or damage by chemicals, burns, cuts, abrasions, and vermin.
- Full operation of adjustments to appropriate spray patterns.
- Proper operation of shutoff valve (no standing water in hose).
- No parts missing.

FIRE HOSES

3-50. Fire hose and couplings will be tested annually to the maximum pressure which they may be subjected in service, but not less than 100 psi. Pressure tests may be performed by vessel's crew. Test procedures can be found in Appendix C. Fire hoses will be marked with the pressure tested to (psi) and test date.

3-51. If the hose fails the visual inspection, it must be removed from service, destroyed, and replaced. Follow proper local Command Supply Discipline Program procedures when discarding unserviceable fire hoses.

3-52. International shore connections shall be maintained as applicable by vessel BII and stored according to the FCP. See Appendix C for proper connection operations.

FIRE/SMOKE/HEAT/CARBON MONOXIDE DETECTION SYSTEM

3-53. Smoke/heat/carbon monoxide detectors shall be free of damage, tested, and maintained according to manufacturer guidelines. Fire detection panels require an annual inspection by an authorized service provider to ensure proper operation.

3-54. Battery-operated smoke alarms shall be inspected, tested, and cleaned with a lint-free cloth no less than monthly.

FOAM EXTINGUISHING SYSTEMS

3-55. Aqueous film forming foam (AFFF) is a protein-based alcohol-resistant foam concentrate and is required to demonstrate manufacturing consistency through an annual small-scale test IAW NFPA 11 Chapter 10 through a recognized test laboratory.

3-56. When drawing the sample from the storage tank, ensure it is taken directly from the tank and not via the sounding tube. Sounding tubes are not typically required to be maintained and may introduce debris into the sample cup which could result in a failed sediment test.

3-57. Authorized sealed AFFF containers are exempt from annual testing. The shelf-life of these containers is 20 years.

3-58. Ensure the following items are in place and inspected on a regular basis:

- All valves turn freely.
- No evidence of leaks or corrosion throughout the system and at monitor valves.
- Storage tanks are full and free of leaks.
- Operating instructions and system diagram posted at or near the controls.

FIXED FIRE EXTINGUISHING SYSTEMS

CO2

3-59. Fixed CO2 systems shall be maintained according to the applicable TM. Operating instructions and system diagrams will be posted at all bottle banks. Manual activation pull stations will have a placard identifying the station and the compartment affected.

3-60. The crew will inspect fixed CO2 systems on a monthly basis at a minimum. Annual maintenance must be conducted by an authorized service provider.

Monthly

- Make sure that there are no obstructions around the CO2 bottles or pull stations.
- Check the discharge nozzles for dirt and physical damage. Clean the nozzles that are dirty or clogged as follows:
  - Clean the outside of the nozzles with a rag or soft brush.
  - Check the discharge orifices for damage or blockage. If the nozzles are blocked, unscrew nozzles and clean and dry the nozzles thoroughly with lint-free cloth.
- Start the ventilation fans as required.
- Activate the CO2 pressure switch by pulling out the plunger.
- Check that all the ventilation fans stop.
- Reset the alarm in the pilot house and start the ventilation fans as required.

Annually

- Check and test the CO2 system for operation.
- Check that there have been no changes to the size, type, and configuration of the hazard and system.
- Check and test all time delays for operation.
- Check and test all audible alarms for operation.
- Check and test all visible signals for operation.
- Check that all warning signs are installed.
- Check and test each detector.

3-61. The CO2 theory of operation can be found in Appendix C.

FM-200

3-62. Heptafluoropropane (hydrofluorocarbon [HFC]-227EA) is known by the common name FM-200. This system shall be maintained and inspected according to the applicable TM, and annual maintenance must be conducted by an authorized service provider. Operating instructions and system diagrams will be posted at all bottle banks. Manual activation pull stations will have a placard identifying the station and the compartment affected. The FM-200 theory of operation can be found in Appendix C.

3-63. In addition to the required maintenance procedures, the following shall be tested, maintained, and inspected:

FM-200 Log Maintained

- Monthly cylinder gauge readings, agent tests with readings.
- Monthly gauge and tape readings should be maintained in a running log to enable identification of any leaks.
- Pressure-operated siren tested monthly.

Galley

3-64. The galley fire suppression system shall be maintained and inspected according to the applicable TM. Special attention must be paid to the following:

- Fusible link cleanliness and replacement date.
- Nozzle tips free from damage and obstructions.
- Fire curtains operate freely.

3-65. All the fusible links for the system shall be replaced annually when the system is serviced for its annual inspection. If the link does not have the date stamped on it, the vessel shall maintain documentation indicating when the link was replaced.

3-66. Food service personnel must be trained in the operation and maintenance of the galley fire suppression system on their assigned vessel. The galley extinguishing system theory of operation can be found in Appendix C.

Water Washdown System and Piping Tested and Visually Inspected

3-67. Sprinkler heads and piping shall be visually inspected and tested according to the applicable TM and logged in the appropriate log.

3-68. In addition to the steps listed in applicable TMs, conduct following processes monthly:

- Inspect discharge nozzles for dirt and buildup.
- Ensure valves are free from corrosion.
- Charge the system with compressed air ensuring air flow is detected at all nozzles.

GALLEY

3-69. In order to keep grease from building up and creating a fire hazard, the wash down must be used on a daily basis while the galley is being used to cook and serve food. Ensure the solution tank is filled to the appropriate level before each use.

CAUTION

The only approved cleaning solution for Gaylord systems is G-510 (G-510EF). Use of any other cleaning solution will damage the system and its gaskets.

Chapter 4

General Safety Equipment

This section covers equipment that is not specific to any single system covered in this manual but is critical to the vessel, its mission, and daily operations.

Note: Any hazards not identified in this TM may be marked by the crew. Marking should be done on a placard with a white background, and contain the following information using red font, red stencil, or appropriate sticker:

- Identify the hazard.
- Basic processes to mitigate the hazard.
- All loose and float free equipment that does not have a specific marking requirement identified in this manual will be marked at a minimum with the vessel name and/or hull number.

ACCOMMODATION SPACES

4-1. Accommodation spaces shall be inspected during the monthly sanitary inspections. The inspection shall include, but is not limited to the following:

- Bunk lights operational and not obscured.
- Overhead lighting operational.
- Free of damage.
- Heating/cooling operational and ducts clean.
- Washroom and toilets operational.
- No excessive gear or equipment.
- General cleanliness.

ADDITIONAL AND EXCESS EQUIPMENT

4-2. Any additional emergency and safety equipment carried on board for specific mission requirements must still comply with the standards outlined in this TM and other applicable policies.

4-3. Excess equipment includes any equipment carried in excess of BII requirements for general purposes or specifically to be used by the crew for training. Excess emergency and safety equipment must be serviceable and properly maintained. If excess equipment is onboard as a training aid it must be conspicuously marked “Training Only” and carried in a location where it is not readily accessible or confused for operational emergency or safety equipment.

FREEING PORTS

4-4. Drainage must be adequate from every weather deck area and not blocked. Particular attention is given to potential water-trapping areas such as wells formed by structure or pockets formed by cargo or equipment.

Example: A vessel’s deck that measures 37 feet by 14 feet having only one inch of water covering it equates to 2,763 pounds of surplus liquid weight. The additional weight on deck, above the vessel’s center of gravity, will have a negative impact on the vessel’s stability. When an external force (such as waves and wind) rolls the vessel from side to side, the trapped water on deck will also slosh from side to side, causing a free surface effect.

GANGWAY

4-5. Ensure the following are adhered to at a minimum:

- Gangway secured to the vessel and structurally sound.
- Rails and stanchions secured.
- Properly trimmed (max 30°/gangway and 55°/accommodation ladder).
- Save-all net (or side curtains) if gangway overhangs water.
- Chains properly installed.
- Safe access, adequate lighting, and clear of obstructions.

4-6. For further information on proper gangway maintenance refer to Appendix D.

GENERAL ALARM

4-7. General alarms shall be tested weekly and logged in the appropriate log. During testing, all general alarm bells shall be checked according to the applicable TM, Appendix D, and the minimum guidelines as follows:

- All bells sound appropriately.
- General alarm lights are operational in spaces with high noise levels.
- Contact makers operational (typically found in the bridge and electric optic systems).
- All alarm bells are painted red.
- All bells, lights, and actuators properly marked (TB 43-0144).

HATCHES, EMERGENCY ESCAPES, AND DOORS

4-8. For the purpose of this manual, hatches allow transit from level to level vertically, and doors allow transit from space to space on the same level.

FIRE DOORS

4-9. Fire rated doors shall not be made fast to a retaining device in a manner that prevents them from opening or that holds the doors open. Improper use of fire rated doors alters the fire boundary of a protected space.

WATERTIGHT DOORS AND HATCHES

4-10. All watertight doors in subdivision bulkheads will be kept properly closed during—

- Navigation, except when necessarily opened for working of the vessel. In such cases, they must always be ready to be closed immediately.
- Periods when the vessel is unmanned.

4-11. All watertight doors must be stenciled on both sides with the words “KEEP DOOR CLOSED.” The lettering height of the label will not be less than 1 inch.

4-12. The following test and inspections shall be conducted monthly and logged appropriately:

- Check for damage to the door, dogs, and opening mechanism:
  - Ensure dogs and opening mechanisms operate freely.
  - Perform chalk test found in Appendix D to ensure knife edge is straight and even.
  - Check gaskets for dry rot, paint, rust or other foreign material.
  - Check windows for cracks and damage that impairs vision.
  - Lubricated IAW applicable LO.
  - Ensure holdback/restraining device is operational.
  - Dogging wrenches and T-handles used in the application of securing a hatch shall be painted IAW TB 43-0144.

- Pilot access doors should operate freely and be capable of being secured. Securing appliances for these doors shall be operational.

EMERGENCY ESCAPES

4-13. Escape hatches, scuttles, and crash panels shall always remain unblocked and operational to prevent injury to personnel when an emergency situation arises that requires them to escape from the space. Refer to TB 43-0144 for proper marking of emergency exits and crash panels.

INTERNAL COMMUNICATIONS

4-14. Internal communications can mean several different communication devices. These devices encompass any means of communication throughout the vessel. These include, but are not limited to, sound powered phones, intercom systems, megaphones (both electrical and non-electrical), as well as lights. Internal communication devices will be functional to all locations installed and enable communication to the following areas at a minimum:

- Navigation bridge.
- Steering gear room.
- Alternative steering stations.
- Engine control room (if the vessel has an engineer operating station).
- Maneuvering platform (if the vessel has no engineer operating station).

4-15. These communications should function under emergency power as identified in Chapter 2.

4-16. Sound-powered phones should be checked for proper functioning of the crank and handset, ensuring clear communication between stations. Ensure station location placards are present and accurate.

MOORING LINES

4-17. Inspect mooring lines and associated attachments prior to, during, and after use to prevent the deterioration of mooring lines to a condition which may result in the failure of the line during mooring operations.

4-18. The requirements for inspection of individual mooring lines will be specific to the type of mooring line and will be based on manufacturer recommendations. Basic inspections will be visual inspections of the following:

- Outside of the mooring line to identify—
  - Excessive wear or damage.
  - External abrasions.
  - External cuts.
  - Kinking.
  - Heat damage such as fusion and slackening or fraying of eye splices.
- Internal inspections of the mooring line to identify—
  - Integrity of internal fibers.
  - Cuts to yarns and strands.
  - Powdery areas or fused yarns showing overloading or internal yard abrasion.

4-19. Follow proper local Command Supply Discipline Program procedures when a mooring line is deemed condemned. Common industry disposal procedures for condemned mooring lines entail the line being removed from service by cutting into unusable sections to prevent inadvertent use.

4-20. To preserve the design life of mooring lines and reduce the potential for failure during mooring operations, any storage provided for additional (loose) mooring lines should minimize the exposure to harmful environments (UV light, water, chemicals, cargo, and extreme temperatures).

NON-SKID DECK

4-21. Non-skid or slip-resistant coverings shall be applied IAW TB 43-0144. Ensure excess paint has not accumulated over the non-skid surface so that it eliminates the effectiveness of the non-skid coating.

OBSTRUCTIONS

4-22. The following items shall be inspected during the sanitary inspection (Appendix A):

- Tripping hazards.
- Obstruction of passageways.
- Obstructions of emergency escapes.
- Obstructions of lifesaving/firefighting equipment.
- Interference with other machinery operation.
- Interference with any ship's safety evolution.

4-23. These inspections are meant to ensure there are at least two means of escape from all general areas accessible to the passengers, if carried, or where the crew may be quartered or normally employed.

PORTABLE FUEL STOWAGE

4-24. No flammable or combustible liquids may be stowed in any accommodation, control, or service space. Each portable container of flammable or combustible liquid used for portable auxiliary equipment must be stowed in a paint locker or an open location. These containers shall be marked according to TB 43-0144.

RAILS, GUARDS

4-25. SOUM 09-22 provides clear guidance on proper configuration and inspection criteria for guarded openings, rails and stanchions, and lifelines. Vessels which are not in compliance with this message are non-mission capable.

VENTILATION

4-26. All enclosed spaces shall be properly vented or ventilated. Due to the construction of certain platforms, if the vessel is capable of securing vents or ventilation, a means shall be provided to close off all vents, and a means of securing all electrical ventilation systems in case of a fire. Manual dampers must be free and clear of all debris and shall be marked "OPEN/CLOSE" and display the direction of opening and closing. Dampers shall be identified according to the applicable vessel TM.

Chapter 5
Lifesaving Equipment

This chapter contains information for inspection and maintenance of lifesaving equipment.

DISTRESS SIGNALS

WARNING

Personnel handling pyrotechnic signal flares shall comply with all existing safety requirements and precautions. Pyrotechnics are hazardous due to the nature of their explosive, flammable, or toxic filler.

5-1. DO NOT remove the signal device from its hermetically sealed container until immediately before use.

- Read and follow the firing instructions on the signal body.
- Handle pyrotechnic flares with the same care as high explosives.
- Protect flares and signals from moisture.
- Remove and replace flares when there is evidence of moisture.
- Disassembly of flares is strictly prohibited.
- DO NOT use flares when they are rusted, dented, or deformed. (They must be segregated for disposal.)
- Avoid any rough handling, throwing, or dropping of pyrotechnics.
- DO NOT look into the firing end of any signaling device.
- Remove flares and signals from watercraft placed in storage.

5-2. The Class V distress markers (flares and signals) on Army watercraft are classified as operational load within the Total Ammunition Management Information System. Because they are classified as operational, all lifesaving signals obtained through the Total Ammunition Management Information System require an annual inspection by the local quality assurance specialist (ammunition surveillance) (QASAS). Follow all recommendations resulting from this inspection as soon as possible.

5-3. Consult DA PAM 350-38 when forecasting training requirements and requesting Class V for shipboard distress signals and line-throwing device training.

5-4. See Appendix E for QASAS contact information.

Note: Commercially obtained distress signals are not authorized unless they are mission essential and approved according to DA PAM 385-64.

5-5. Consult Appendix E for care of use and detailed information of maritime distress signals.

SMOKE MARKER

5-6. The smoke marker is a white phosphorous pyrotechnic. Great care should be used when handling this Class V as it is water activated and burns with intense heat that cannot be easily extinguished.

5-7. Ensure the plastic cover is present to protect the activating pull tab from exposure to moisture, and that the phosphorus warning label is present. The smoke marker should also be marked with the hull number.

5-8. Smoke markers are typically housed in a PVC tube on the bridge wings. Ensure the cap of this tube is easily removable, and that there is a drain hole in the bottom of the housing tube as well as a small block of non-absorbent material to ensure drainage of any moisture that may accumulate in the tube.

5-9. It is good practice to apply a thin layer of marine grease to the bottom of the smoke marker to help prevent corrosion.

5-10. Appendix E details information on care, storage, and use of the L583 and Mk58 smoke marker.

MAGAZINES/PYROTECHNIC LOCKERS

5-11. The only required hazard markings for pyrotechnic lockers are the hazard placards required for the classification of the Class V stored in them. When pyrotechnic lockers are empty there are no hazard markings required.

5-12. It is only required to store distress signals on the navigation bridge level while underway. While in port, it is good practice to store distress signals in the vessel's arms room for increased security and to reduce corrosion.

5-13. Regular checks of the pyrotechnic lockers should be made to ensure there is no moisture accumulation. Moisture inside the locker is a sign of a failed gasket or closures.

EMERGENCY ESCAPE BREATHING DEVICE

5-14. Emergency escape breathing devices (EEBDs) are inspected on an annual basis. They should also be trained on once a year using the appropriate training unit that is associated with the EEBDs on board.

5-15. See Appendix E for inspection, care, and use instructions.

FAST RESCUE BOAT

FAST RESCUE BOAT AND EQUIPMENT

5-16. The FRB shall be ready for immediate use at all times. This includes the following at a minimum:

- Fully inflated.
- Fiberglass hull free from cracks or damage.
- Engine securely mounted to transom.
- Engine and propeller in good running condition.
- Propeller guard installed.
- Attachments secure to the FRB (becketed lines, painter lines, equipment sockets).
- Fuel tank full.
- Battery charged.
- All gear properly stowed.
- FRB and associated gear properly marked with "US Army" and hull number.
- Drain plug properly installed.
- Self-righting pull pin present (See TM 55-1940-328-10).

5-17. The FRB shall also be inspected and maintained according to TM 55-1940-328-10. Repairs to the fiberglass hull of the FRB will only be conducted by USCG production facilities or by facilities properly equipped and/or designated specifically for fiberglass hull repair. Only repair and maintenance procedures identified in TM 55-1940-328-10 and TM 55-1940-328-23&P should be performed by shipboard personnel.

5-18. All components of the FRB BII identified in TM 55-1940-328-10 shall be present and ready for inspection.

LAUNCHING APPLIANCE

5-19. A launching appliance is a means of transferring an FRB from its stowed position safely to the water.

5-20. Similar to the lifting devices and cranes program identified in Chapter 2, 881A2s shall, by appointment, manage oversight of the unit launching appliance program and maintain records of all inspections performed. This program is applicable to routine inspections with the exception of the quinquennial (5 year).

5-21. Five-year thorough examinations must be conducted by an authorized service provider and the certificate retained with vessel certificates and records. Authorized service provider requirements are outlined in Appendix E. The safe working load and last weight test shall be conspicuously and legibly marked on the launching appliance.

5-22. Slings used to hoist the FRB will be inspected and managed according to Chapter 2, Lifting Devices.

5-23. Launching appliances for Army watercraft will be inspected as described below:

Weekly Visual Inspection

- Inspect hooks (not painted, corroded, or cracked, properly set, and ready for use).

Annual

- Inspect wire and sheaves for damage, corrosion, and proper lubrication (See Appendix E).
- Examine the launching appliance structure for corrosion, misalignments, deformation, and excessive free play following the winch brake test.
- Operation of release gear.
- Hooks not painted.
- Operation of limit switches and electrical system.
- Dynamic winch brake test.
- Mass of the FRB without personnel or equipment (See Appendix E for details).

Note: The setting and maintenance of release gear are critical operations with regard to maintaining the safe operation of FRBs. Utmost care shall be taken when carrying out all inspection and maintenance operations on the equipment.

Note 2: No maintenance or adjustment of the release gear shall be undertaken while the hooks are under load.

Quinquennial (5 year)

5-24. Inspection (performed by an authorized service provider) includes the following:

- Proof load dynamic winch brake test.
- 110% the weight of the FRB with full complement of persons and equipment.
- Examination of vital parts for defect or cracks following the dynamic winch brake test.
- Hook release mechanism disassembly, reassembly, and adjustment.
- Any other overhaul if required.

5-25. Details for performing and conducting these test and inspections can be found in Appendix E.

LIFE RAFTS

5-26. This section contains information about inflatable life rafts used on U.S. Army watercraft as well as life raft recertification requirements, description, location, and stowage. These life rafts include the following:

- Navy Mark 7.
- Commercial, USCG-approved.

NAVY MARK 7

5-27. Crew servicing is limited to a weekly visual inspection only. The results of this inspection shall be logged in the appropriate log.

5-28. Weekly inspections shall include the following (see Appendix E for details):

- Inspect hydrostatic release.
- Check for dents or cracks which could leak water.
- Check cables for chafing, cuts, or loose connections.
- Repair or replace cables if defective.

5-29. The Mk-7 life raft has a certified service period of five years. When the life raft reaches its certification expiration, it must be taken to a U.S. Navy-approved life raft certification facility identified in Appendix E. The certificates received upon completion must be retained with the vessel's certificates and records.

Markings

5-30. Life rafts will be marked IAW TB 43-0144. Place instructions for launching and inflating the raft, righting the raft, and any other instructions in a conspicuous lighted area near the life raft.

Sea Painter

5-31. The life raft sea painter shall be attached directly to the ship structure. The Navy life raft sea painter will detach from the life raft upon completion of inflation.

CAUTION

Rubber stoppers are inserted into the end of the sea painter line assembly to prevent entry of water into the life raft assembly and prevent accidental pay out of the painter line from its internal spool. If the stopper falls out, it is possible for high winds or seas to cause the entire 100' of spooled line to pay out, thus rendering the life raft inoperable and requiring its removal and transfer to a Navy repair facility for replacement of the sea painter spool. Properly installed rubber stoppers should be inserted until 1/8" to 1/16" of the stopper is visible uniformly about the circumference of the stopper on the outside of the life raft container. If there is ¼" or more of the rubber stopper exposed outside the life raft container, there is insufficient interference between the stopper and hole to prevent the stopper from coming loose in heavy weather. In no case shall the stopper be pushed flush or into the assembly.

Hydrostatic Release Device

5-32. The Navy calls for the hydrostatic release device (HRD) to be recertified every 5 years. This is the same time frame as for the life rafts. The HRD does not have a serial number or other identifying markings, therefore inspection certification tags should be specifically requested when submitting the HRD for recertification.

5-33. Installation procedures can be found in Appendix E.

5-34. The hydrostatic release assembly shall be visually checked weekly. The Thanner DK84.1M device has a safety pin to prevent inadvertent release, so the pushbutton of that device should face toward traffic for easy release provided it does not cause any safety hazard to those passing by the life raft stowage (see Figure 5-1).

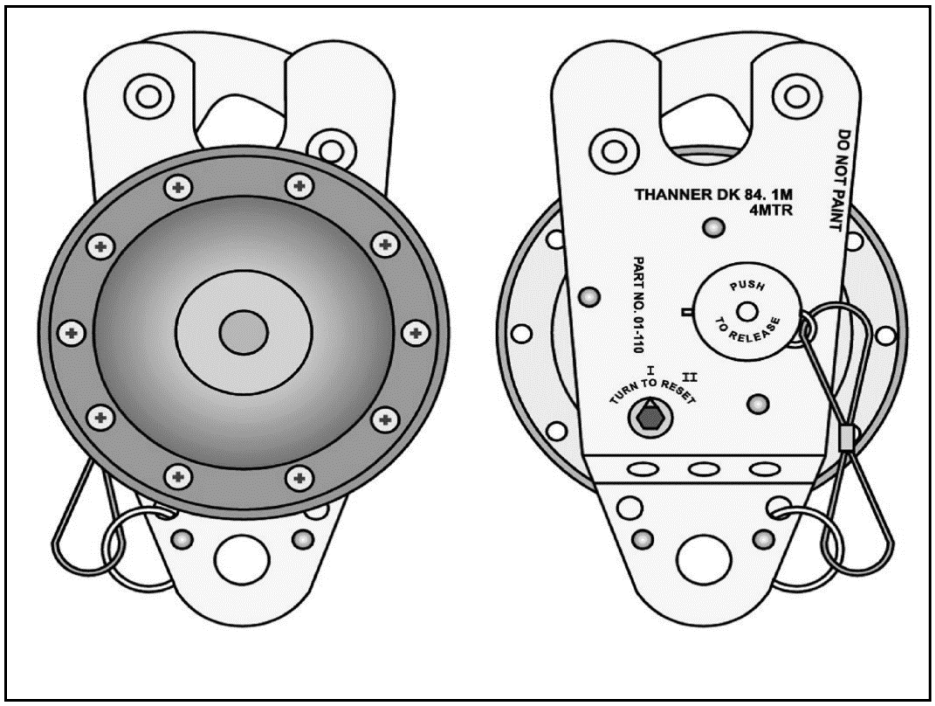

Figure 5-1. Hydrostatic release device (Thanner DK84.1-M)

5-35. Inspect the HRD according to the list below. Inspect—

- Device for damage, distortion, corrosion, or missing parts.
- External surfaces for paint or lubricants (in event the release assembly is painted, it shall be removed and replaced).
- Static ports for clogging. Paint or lubricant on external surfaces may clog static ports and prevent release device from operating.
- Connecting linkage for corrosion, cracks, distortion, and burrs.
- Safety pin for corrosion and installation.
- Plunger for clogging or distortions by pushing on the plunger with the safety pin installed.
- Diaphragm halves mounting bolts for loose or missing bolts or nuts.
- Device for correct securing harness tightness.

COMMERCIAL LIFE RAFTS

5-36. Commercial life rafts must be serviced annually at an approved servicing facility. The servicing facilities must be approved by the life raft manufacturer, inspected by the USCG, and issued a letter of approval by the USCG Commandant.

5-37. Each inflatable life raft and container will have a substantial nameplate of compatible material permanently attached that is embossed or imprinted with the name of the manufacturer. The nameplate must also have the approval number, the manufacturer's model and serial number, the number of persons for which the inflatable life raft is approved, lot number, the marine inspection office identification letters, the date, and the letters "USCG" imprinted. The raft container will also be provided with a stainless steel plate for showing a stamped record of the data of the annual inspections and the gas inflation tests described respectively.

5-38. Particular attention should be given to life raft launching arrangements when converting to commercial life rafts due to mission requirements.

5-39. Commercial life rafts have an annual recertification requirement plus a five-year inflation test recertification. Any USCG-approved commercial life raft maintenance facility can conduct recertification.

5-40. Commercial life rafts need to secure their sea painter IAW the manufacturer's instruction.

DEBARKATION LADDERS

5-41. Vessels with debarkation ladders assigned in BII should have the assigned quantity onboard in good working order ready for deployment at all times.

LINE THROWING DEVICE

5-42. If a line throwing device is required in the BII, it shall be ready for inspection and all components must be clean and in good working order, to include 25 M32 .45-70, rounds. These rounds follow the same inspection and training requirements as the distress signals at the beginning of this chapter.

5-43. Consult DA PAM 350-38 for forecasting training requirements and requesting Class V for shipboard distress signals and line throwing device training.

5-44. For all line throwing device BII and PMCS, follow TM 9-1095-214-13&P.

PERSONAL FLOTATION DEVICES

WARNING

The personal flotation devices listed in this section will not be worn over or with tactical outfits including improved outer tactical vests.

5-45. Personal flotation devices (PFDs) consist of the following:

- Flotation coveralls (anti-exposure coveralls).
- Life jackets.
- Immersion suits (Gumby suits).
- Work vests.

Note: It is the responsibility of the commands being supported, not the vessel or the vessel's command, to provide appropriate PFDs for any passengers who embark on board Army watercraft other than those vessels specifically designed and equipped for passenger-carrying. Any additional equipment for mission requirements must be inspected according to guidelines contained in this section.

INSPECTION AND MAINTENANCE

5-46. All PFDs require a monthly inspection. The results of these inspections will be logged in the appropriate log. The inspection criteria can be found in the applicable vessel TM and Appendix E.

PERSONAL FLOTATION DEVICE ATTACHMENTS

5-47. All PFDs should have the following attachments in a serviceable condition:

- Distress marker light.
- Duo-tone whistle (ball type or multi-channel type).

STOWAGE

5-48. PFDs should be stored in a dry place out of direct sunlight. Heat, moisture, and light contribute to the deterioration of the PFD. PFDs should be stowed according to the FCP. Stow PFDs so they are readily accessible to the individuals for whom they are intended with container handles exposed, or according to

manufacturer's directions. Ensure suits are dry and clean. Excessive stacking can compress suits at the bottom of the pile, eventually damaging the buoyant insulating foam. Keep all PFDs away from oil, paint, and greasy substances.

CAUTION

Do not stow any PFDs inside a locked container.

5-49. PFDs are equipped with reflective tape/material when they are manufactured. The material is positioned to make a person wearing the PFD in the water as visible as possible under nighttime search conditions. Only replace unserviceable reflective tape/material with approved safety of life at sea (SOLAS) retro-reflective tape. Contact the MSSO for ordering information.

LIFE RING BUOYS

5-50. Life ring buoys will be inspected on a monthly basis, and results will be annotated in the appropriate log. Detailed information can be found in Appendix E.

5-51. Life ring buoy:

- BII allowance on board.
- Grab lines and webbing show no sign of deterioration.
- SOLAS retro-reflective tape attached.
- Buoy material in good condition.
- Marker and buoy marked with hull number.

5-52. With marker light:

- Marker light attached with 2–4' of line, line shows no sign of deterioration.
- Marker light tested/correct battery installed and operational.
- 1" SOLAS retro-reflective tape attached to marker light (ensure instructions are not obstructed).
- Battery replaced yearly or prior to expiration date.
- Marker light and bracket show no signs of damage.
- No retrieval lines.

5-53. With retrieval line:

- The longer of twice the distance to waterline or 100' of line attached.
- Line shows no sign of deterioration.
- No marker lights.

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Chapter 6
Navigation Safety

This chapter covers items and equipment that are crucial to the safe navigation of watercraft.

CAUTION

Use of personal electronic devices is prohibited while underway or on watch and during official duties engaged in the safe operation of Army watercraft.

BOAT HOOK

6-1. Vessel must have BII onboard, in serviceable condition, and marked with hull number.

6-2. Inspect boat hooks periodically. They should be clean and repaired as necessary. The pike end should be kept free of burrs and replaced if broken. The handle should be tight in the head and free of splits and splinters. Paint may be used to preserve the life of the wood.

WARNING

The use of self-combusting or extremely flammable preservatives (such as linseed oil) on this tool is unauthorized.

CHARTS

6-3. As appropriate for the intended voyage, all vessels except barges, vessels operating exclusively on rivers, and motorboats other than those certificated for ocean or coastwise route must carry adequate and up-to-date charts. Charts may either be paper or electronic. If approved for electronic chart display information systems (ECDIS), see below:

- ECDIS must be updated to the latest edition for the vessel's operating area.
- Class A vessels have two ECDIS units onboard, one main and a backup, and at a minimum the local area Digital Nautical Chart (DNC) region database on both. ECDIS must have Global Positioning System (GPS), gyro, and speed log input at all times while underway.

COMPASS

GYRO

6-4. All Class A vessels must be fitted with a gyrocompass in addition to the magnetic compass.

6-5. Gyro repeaters shall have operational lights and proper heading information.

MAGNETIC AND ELECTRO-MAGNETIC

6-6. Ensure lights are operational and the compass can be read either in the pilothouse or directly at the binnacle.

6-7. Magnetic compasses are required to be checked and updated annually. Use of Pub 226 is required to make adjustments to the compass. These checks will be updated on the deviation card which must be signed by the vessel master or other qualified civilian personnel.

6-8. Electro-magnetic compasses must be validated when energized.

DAY SHAPES

6-9. All vessels will have, at a minimum for safe navigation, three black balls and one black diamond in good shape and serviceable.

DEPTH SOUNDING DEVICE

6-10. Tested and operational (electronic). If required by BII, vessels must ensure the manual sounding device (hand lead) is properly marked, shows no evidence of rot, and is coiled and ready for use.

6-11. The hand lead line is the oldest and most reliable depth-finding device for shallow depths. It consists of a lead weight (7–14 pounds) attached to a 20-fathom line marked as shown in Figure 6-1 below. For detailed information on the hand lead see Appendix F.

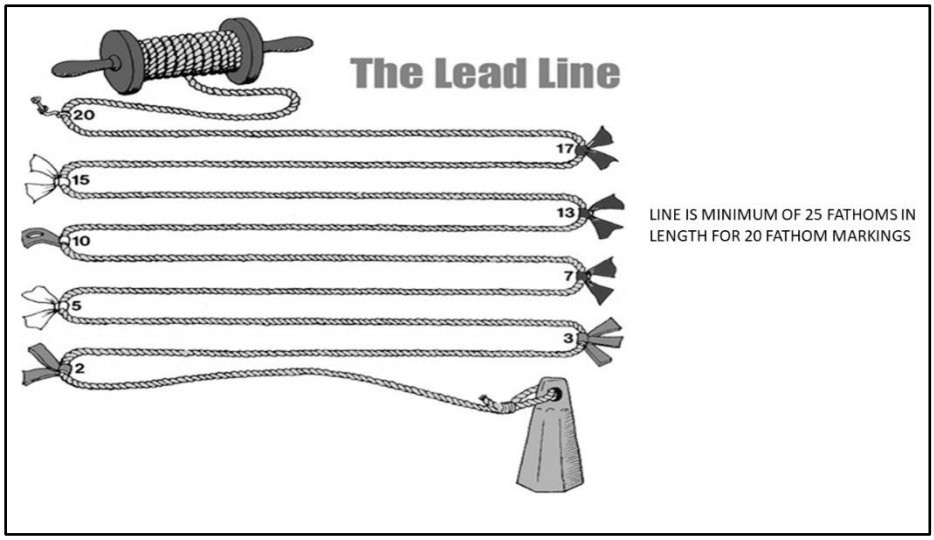

Figure 6-1. Hand lead depth sounding device

DRAFT AND LOAD LINE MARKINGS

6-12. Vessels that are subject to a load line shall have permanent draft and load line markings (for example, with weld bead) plainly and legibly marked.

DRAFT MARKINGS

6-13. Draft marks must be separated so that the projections of the marks onto a vertical plane are of uniform height equal to the vertical spacing between consecutive marks. Draft marks must be painted in contrasting color to the hull. Consult TC 4-15.51 for information on reading draft marks.

LOAD LINE

6-14. Load lines are issued to vessels to establish a safe loading limit and provide for the safety of crewmembers through structural adequacy and watertight integrity. Load lines are marks located on both sides of a vessel to show the limiting draft of which a vessel may be loaded. See Appendix F for more information on load lines and draft markings.

6-15. The load line mark shall consist of a ring 12" in outside diameter and 1" wide which is intersected by a horizontal line 18" in length and 1" in breadth, the upper edge of which passes through the center of the ring. The center of the ring shall be placed amidships and at a distance equal to the assigned summer freeboard measured vertically below the upper edge of the deck line.

EMERGENCY POWER

6-16. All emergency lighting and associated emergency power systems shall be operated and inspected once a week to ensure all components of each system are fully operational. This test is not required under temporary or final power and can be completed under normal ship's power.

6-17. With loss of power on the vessel, the systems listed in Table 6-1 must be able to operate under temporary and final emergency power.

Table 6-1. Emergency power

Temporary (Battery Back Up)	*Final (Emergency Generator)*
General alarm system	Daylight signaling light
Public address system	Depth sounder
Fire detection and fire alarm systems	Electronic Chart Display and Information System (ECIDS) main and backup
Global positioning System (GPS) (one integrated)	Fire detection and fire alarm systems
Speed log	Global Maritime Distress and Safety System (GMDSS) console
Gyro compass	Global positioning System (GPS) (one integrated)
Electronic Chart Display and Information System (ECDIS)	Gyro compass
	Main radio installation transmitter and receiver
	Radar 10cm and 3cm
	Rudder angle indicator
	Speed log
	Vessel navigation lights and whistle

ENGINE ORDER TELEGRAPH

6-18. The engine order telegraph communicates (audibly and visually) the desired propeller speed and direction from the bridge to the engine room when the bridge is not in direct control. It should be tested for proper operation and relay information between the bridge and engine room.

6-19. Consult the vessel TM for proper operation of the engine order telegraph.

EMERGENCY POSITION-INDICATING RADIO BEACON

6-20. Each vessel must have only the BII allowance onboard, operational, and marked with the hull number and have the hydrostatic release mechanism current (less than two years old). The battery will be within shelf life. Do not extend the battery service life beyond the date shown on the battery label.

6-21. The emergency position-indicating radio beacon (EPIRB) must be mounted according to the FCP in an area free of obstructions to include rigging that might prevent the device from floating free of the vessel.

The unit must be free of damage, corrosion, wear, and salt buildup. Unit will be assigned to a position on the station bill.

6-22. Every EPIRB must be registered with Joint Search and Rescue Satellite Aided Tracking (SARSAT) Electronic Tracking System (JSETS). Every JSETS registration must have a valid 24-hour emergency point of contact listed. This may be an emergency operations center or brigade or higher staff duty. It will not be a personal phone number or office that is not manned 24 hours a day.

6-23. The EPIRB must be tested monthly using the integrated test circuit and output indicator to determine that it is operative. This inspection and any deficiencies must be recorded in the appropriate log.

6-24. Follow proper Command Supply Discipline Program procedures. It is vital that you follow manufacturer guidance on how to properly disable the beacon to eliminate false activations. Most manufacturers recommend removing the beacon's battery when disposing of it to prevent false activations. Once the beacon has been permanently disabled, the remaining parts (including the battery and electronics) should be disposed of in a manner that does not present a threat to the environment. In addition to containing traces of lithium, distress beacons may contain lead and brominated flame retardants, both in the housing material and circuit boards. Do not simply discard the beacon along with residential garbage or in a community landfill.

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM

COMMUNICATION SUITE

6-25. The crew should demonstrate knowledge on tests and proper operation of the GMDSS suite.

6-26. Refer to Appendix A for logging requirements and details.

6-27. Proper Maritime Mobile Service Identity (MMSI) will be verified throughout the system.

6-28. The GMDSS equipment integrates with the integrated bridge system equipment through the common use of antennas, exchange of positioning information, and vessel identification information.

6-29. Ensure proper operation of the system by performing the following tests:

- Medium frequency/high frequency digital selective calling test.
- Inmarsat-C terminal operational with loop-back messaging.

6-30. Medium frequency/high frequency Narrow Band Direct Printing /Radio telex terminal operational capable of time sensitive target plus.

6-31. Ensure printers are operational with sufficient paper supplies.

6-32. Ensure GMDSS Operators Guidance for Ships in Distress (IMO 969E) is posted near the main GMDSS radio transmitter. Contact the MSSO for a copy of IMO 969E.

NAVIGATIONAL TELEX

6-33. Navigational Telex receivers and alarms should be tested prior to departure and operational while underway. Ensure there is a sufficient supply of paper. The crew shall perform a self-test during inspections and surveys to verify crew knowledge on proper operation.

SEARCH AND RESCUE TRANSPONDER (SART)

6-34. Vessel will have BII allowance on board. Unit will be free of damage, corrosion, wear, and salt build up.

6-35. The battery must be within the expiration date, and the unit will be marked with “US Army” and hull number.

6-36. Due to the sporadic nature of Army missions, vessels may remain moored for extended periods of time. This test should still be conducted weekly. The date of the tests and the condition and performance of the apparatus shall be noted in the appropriate logs.

6-37. For more information on SART operation, see Appendix F.

SURVIVAL CRAFT RADIO

6-38. Vessel will have BII allowance on board. Unit will be free of damage, corrosion, wear, and salt build up.

6-39. The battery must be within expiration the date, and the unit will be marked with "US Army" and hull number.

6-40. Due to the sporadic nature of Army missions, vessels may remain moored for extended periods of time. This test should still be conducted weekly. The date of the tests and the condition and performance of the apparatus shall be noted in the appropriate logs.

6-41. Crews will demonstrate proper operation of the survival craft radio (SCR) during inspections and surveys.

6-42. Emergency batteries must be replaced after emergency use (other than testing) or when expired.

6-43. For more information on SCR operation, see Appendix F.

GLOBAL POSITIONING SYSTEM

6-44. Vessels equipped with a GPS must have an operational GPS while underway. Ensure GPS feeds all appropriate systems on the bridge.

HEAVING LINE

6-45. Vessel will have the full BII allowance onboard, and all will be serviceable and free of knots.

INTERNATIONAL CODE FLAGS

6-46. Vessel will have the full BII allowance onboard, and all will be serviceable.

MANEUVERING CHARACTERISTICS

6-47. Vessel will have the maneuvering characteristics prominently displayed in the pilothouse. See Appendix F for more information.

NAVIGATION LIGHTS

6-48. Each self-propelled vessel must have a navigation light indicator panel in the navigating bridge to control side, masthead, and stern lights. The panel must visually and audibly signal the failure of each of these navigation lights. The wheelhouse navigation light panel will be operational and labeled.

6-49. All navigation lights will be tested and operational during inspections and surveys and prior to getting underway. All lenses will be intact and clean.

NAVIGATION PUBLICATIONS AND INFORMATION

6-50. Updated navigation publications and information for the operating area will be retained onboard during all operations and during inspections and surveys. These may be stored as digital files. If stored digitally, they must be on government-provided equipment. These publications include—

- Tides and Currents.
- Coast Pilot (Sailing Directions).
- Light list (List of Lights).
- Notice to Mariners (electronically available).
- Navigation Rules and Regulations Handbook.

- Intl Code of Signals (PUB 102).
- US National SAR Supplement to International Aeronautical Maritime Search and Rescue (IAMSAR) Manual.
- CHART No. 1.

RADAR

6-51. Port and Starboard 3cm (X band) and 10cm (S band) radars operational. Minimum input consists of compass heading and speed.

RADIO INSTALLATION (BRIDGE TO BRIDGE)

6-52. Ensure bridge to bridge radios have the proper MMSI loaded, call signs posted near the main radio transmitter, and are capable of communicating on very high frequency (VHF) channel 22A, 13, and 16.

6-53. During each inspection or survey a radio check will be conducted to ensure proper operation.

6-54. On the navigable waters of the United States, channel 13 (156.65 megahertz) is the designated frequency required to be monitored.

6-55. Channel 16 is the international distress and hailing frequency. No person may use the frequency to transmit any information other than what is necessary for the safe navigation of vessels.

6-56. On those navigable waters of the United States within a vessel traffic service area, the designated vessel traffic service area frequency is the designated frequency required to be monitored.

RELATIVE MOTION PLOTTING

6-57. When using paper charts, the vessel shall have adequate plotting gear to fix, track, and ensure the safety of the vessel all times.

SEARCHLIGHT

6-58. Every vessel will have a searchlight that is operational.

SHIP'S BELL

6-59. Every vessel 65' in length or more will have a ships bell that is operational.

SHIP'S WHISTLE/HORN

6-60. Every vessel 39' in length or more will have a ship's whistle that is operational.

STEERING SYSTEM

6-61. At all steering stations, there shall be installed a suitable notice on the wheel or device or in such other position as to be directly in the helmsman's line of vision, to indicate the direction in which the wheel or device must be turned for ''right rudder'' in green (or contrasting color with green background) and for ''left rudder'' in red (or contrasting color with red background) IAW TB 43-0144.

6-62. On all vessels making a voyage of more than 48 hours duration, the entire steering gear shall be examined and tested by an officer of the vessel within a period of not more than 12 hours prior to departure.

6-63. Emergency steering drills shall be conducted and logged every three months. This shall be annotated in the appropriate logs. Consult the vessel TM for proper steering inspection procedures.

WHEELHOUSE WINDOWS

6-64. Clear visibility in inclement weather is vital to safe navigation. Ensure that heaters, wipers, or clear views are always fully operational.

6-65. Ensure that all wheelhouse windows are free of any cracks and that seals are in serviceable condition.

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Chapter 7
Occupational Safety

This chapter covers all occupational safety equipment and practices.

CONFINED SPACES

> **CAUTION**
>
> Should there be an indication that other atmospheric hazards may exist but cannot be identified at the unit level, contact a certified industrial hygienist or marine chemist for a consultation.

7-1. Confined space means a space which has any of the following characteristics:

- Limited openings for entry and exit.
- Inadequate ventilation.
- Is not designed for continuous work or occupancy.

7-2. All spaces that have the potential to contain atmospheric or other serious hazards must be marked using a "Danger Confined Space" sign and secured, if possible, to prevent unauthorized entry.

CONFINED SPACE ENTRY PERMITS

7-3. Retain each cleared or canceled entry permit for at least one year to facilitate the review of the permit-required confined space program. Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

CONFINED SPACE ENTRY DRILL

7-4. Ensure that rescue teams practice making permit space rescues at least annually, by means of simulated rescue operations in which they remove dummies or mannequins from the actual permit spaces or from a representative permit spaces. These drills shall be logged in the logbook.

CONFINED AND HAZARDOUS SPACE SAMPLING DEVICES

7-5. The vessel will have the BII allowance on board with inventory list by manufacturer.

7-6. At a minimum, the following items must be present within the kit, show no sign of damage, wear, or deterioration, and be fully charged (where applicable):

- Gas meter:
  - Meter operational.
  - Sample line.
  - Probe.
  - Alkaline battery pack.
  - Pump module.
  - Pelican case (to hold instrument).
  - Calibration regulator.

  - Calibration gases (not expired).
  - Tubing (sufficient length for use and calibration).
  - Filters.
  - Sensors within 1 year shelf life.
- Quick Draw Pump (Hydrogen Fluoride (HF) Gas):
  - BII allowance on board.
  - Detection tubes within shelf life.
  - Bellows and sample hose show no sign of deterioration or cracking.

CONFINED SPACE METER CALIBRATION

7-7. Calibration must be done prior to each daily use but will not exceed monthly if the meter is not in use. This calibration shall be annotated in the appropriate log.

FIRST AID EQUIPMENT

LITTER, STOKES

7-8. Stokes litters shall be configured with a flotation kit. This assembly along with the stokes litter consists of the following:

- Two flotation tubes with covers.
- One chest pad with cover.
- Five restraint straps.
- One ballast bar.
- Slat set.
- Hoisting slings.
- Tending lines.

7-9. The stokes litter requires a semi-annual proof test, which falls under the Lifting Device Program addressed in Chapter 2. Instructions for the proof test can be found in Appendix G.

FULL BODY SPLINT/LITTER

7-10. The full body splint/litter is designed for removing an injured person from engine room spaces, holds, and other compartments. This is used when areas are too small to permit the use of regular stretchers or litters.

FIRST AID KITS

7-11. First aid kits should be strategically placed throughout the vessel IAW the FCP in case of an emergency. Before placing kits into service, they must be inspected and inventoried.

7-12. The inventory checklist will be posted on the inside cover of the kit annotating all items that have a specific shelf life along with the expiration date of that item. The kit must have an inventory conducted annually at a minimum.

BURN TREATMENT

7-13. Burn treatment kits should be strategically placed throughout the vessel IAW the FCP in case of an emergency. Before placing kits into service, they must be inspected and inventoried. The inventory checklist will be posted on the inside cover of the kit annotating all items that have a specific shelf life along with the expiration date of that item. The kit must have an inventory conducted annually at a minimum.

EYE WASH

7-14. Ensure eye wash stations are operational and configured properly at all locations identified on the FCP. Special attention should be given to any fungicide treatment requirements or expiration dates of portable units. Appendix G contains detailed information on portable and plumbed eye wash stations.

HAZARDOUS MATERIALS COMMUNICATION

7-15. Each vessel will have copies of safety data sheets (SDS) for all HAZMAT onboard and readily accessible in a master binder. Prudent practice is to tab sections for easy identification of materials and compartments or departments. Ensure operational material is identified in this binder (fuel oil, lube oil, hydraulic oil, coolant)

7-16. If a crew member is injured or exposed to a substance for which an SDS or other similar written information is required to be kept on board, that SDS or written information shall be made available to the medical facility treating the exposed entrant.

HEARING

7-17. Adequate hearing protection shall be provided for all personnel onboard.

7-18. Hearing hazard areas will be identified as follows:

CAUTION

High Noise Levels

May Cause Hearing Damage

Wear Hearing Protection

Location: high noise areas (such as engine room, or emergency generator flat).
Placard: white background with red letters.
Stencil: red letters no more than 1".
Sticker with similar warning.

7-19. Vessels shall follow the hearing conservation program covered in DA PAM 40-501.

POTABLE WATER

POTABLE WATER TESTING

7-20. Potable water testing and logging procedures shall follow NAVMED P-5010-6.

FLUSHING

7-21. Vessel personnel shall flush all potable water supply points on a rotational basis for a minimum of ten minutes, ensuring all points are completed once in a 30-day period. If a vessel is equipped with a potable water circulation pump, proper operation and usage must be adhered to IAW the applicable TMs.

TESTING

7-22. Personnel shall test the forward air controller of the vessel's potable water system weekly. Prior to sampling, the system will be flushed for a minimum of ten minutes. Samples shall be taken from a different water supply point for each weekly test to include plumbed eye wash stations as applicable.

LOGGING

7-23. All testing and flushing shall be recorded in a vessel waterlog.

HOSES

7-24. Painting and marking of hoses and potable water risers shall follow TB 43-0144 and TB 43-0153.

7-25. Hoses shall be in satisfactory condition (no rot, mildew, wear, or damage). Properly stowed with ends coupled together in a stowage locker labeled "POTABLE WATER HOSE" IAW TB 43-0153.

7-26. Vessel connection shall be labeled "POTABLE WATER" and capped.

PERSONAL PROTECTIVE EQUIPMENT

FALL PROTECTION

CAUTION

Body belts are prohibited as part of a personal fall arrest system.

7-27. Vessels will have the applicable BII allowance of harnesses and lanyards onboard and in a serviceable condition. Serviceable condition means the metal components will be generally free from corrosion and not seized. The webbing, fabric, and lanyard will not be torn or ripped.

7-28. Appendix G details specific use, wear, and maintenance of this equipment.

CAUTION

The Kuroda class (LSV-7 and LSV-8) has a specialized fall arrest system for the main mast. SOUM 07-023 contains detailed information on utilizing the safety sleeve on the main mast.

OUTFITS/CLOTHING

7-29. Vessels will have the applicable BII allowance onboard and in a condition that does not degrade the level of protection for the following items:

- Welders outfit:
  - Gloves.
  - Helmet—visor intact, proper lenses, fitting straps.
  - Jacket or apron.
- Chemical protection:
  - Apron.
  - Gloves (not electrical gloves).
  - Eye protection—indirect vented or non-vented (see Appendix G).
  - Face shield.
- Hard hats—no sign of damage, fitting straps functional.
- Electrical gloves:
  - Rubber—not chemical gloves, no holes or deterioration.
  - Leather shell—no holes or deterioration.
- Working gloves—no holes or deterioration.

WARNING

Ensure electrical gloves are rated for maximum working voltage.

VISION PROTECTION

7-30. Soldiers must use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, acids or caustic liquids, or other liquid chemicals, chemical gases or vapors, or potentially hazardous light radiation sources.

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Appendix A

Administration

This section provides baseline administrative requirements and information to help vessels and inspectors plan, organize, and prepare for safety inspections and surveys.

DOCUMENTS POSTED

GARBAGE DISCHARGE PLACARD

A-1. Every ship of 12 meters or more in length overall and fixed or floating platforms shall display placards which notify the crew and passengers of the discharge requirements. Contact the MSSO for the revised MARPOL placard.

SHIP RADIO AUTHORIZATION

A-2. Current ship radio authorization to be maintained IAW AR 5-12, and posted in the bridge near the main radio transmitter. These are valid for three years.

A-3. Every ship radio authorization must have a valid 24-hour emergency point of contact listed. This may be an emergency operations center or brigade or higher staff duty. It will not be a personal phone number or office that is not manned 24 hours a day.

STABILITY LETTER

A-4. If a stability letter is issued, it must be posted under glass or other suitable transparent material inside the bridge of the vessel.

STATION BILL

A-5. Army watercraft use standardized emergency signals beyond the legally required signals to communicate both interior to the vessel and external to other vessels. Table A-1 lists the specific signals and instructions that are part of the vessel's station bill that is required to be posted in various areas throughout the vessel.

Table A-1. Station billing instructions

Type of Emergency	*Corresponding Signal*
Fire and Damage Control	Continuous sounding of the ship's whistle and the general alarm for not less than 10 seconds.
Battle Stations	Multiple short rings for a period of at least 30 seconds on the general alarm followed by the announcement "General Quarters, Man Your Battle Stations"
Man Overboard	Hail and pass the word to the bridge, raise international code flag "Oscar" and pass the announcement "Man Overboard".
Abandon Ship	More than 6 short (1 second) blasts and 1 long blast (not less than 10 seconds) on the ship's whistle and general alarm. Followed by the announcement "Abandon Ship".

Table A-1. Station billing instructions (continued)

Type of Emergency	*Corresponding Signal*
Sea and Anchor Detail	The passing of the announcement “Set sea and anchor detail”.
Chemical, Biological, Radiological, and Nuclear (CBRN) Stations	Multiple short rings for a period of at least 30 seconds on the general alarm followed by the announcement “CBRN Stations”.
Instructions	
General: **1.** Establish personnel accountability. 2. Entire crew shall familiarize themselves with the location and duties of their emergency stations immediately upon reporting aboard. 3. Each crewmember shall be provided with an individual supplementary station bill card, which must show in detail the specific duties to perform. 4. Entire crew shall be instructed in the performance of their specific duties and crew on watch will remain on watch until properly relieved. 5. Emergency signals shall be supplemented with specific directions given on the public address system.	
Fire and Damage Control: 1. Emergency squads will assemble at designated areas with their personal protective equipment to respond to fire or damage control. 2. Person discovering fire shall immediately notify the bridge by sounding the nearest alarm and fight the fire with available equipment. 3. Start fire pumps. Close all watertight doors, fire doors, ports, and air vents. Stop all fans and blowers. Secure air conditioning plant. Start the emergency generator.	
Sea and Anchor Detail/Battle Stations/CBRN Stations: 1. Entire crew will report to their designated stations. 2. Each station will notify the bridge when manned and ready. 3. When battle stations are set, the entire crew will report to their stations with assigned weapon and CBRN individual protective equipment on hand and at mission oriented protective posture (MOPP) Level 0 unless otherwise specified in the announcement. 4. MOPP levels will increase or decrease by direction of the vessel master through the announcement system.	
Man Overboard: 1. Hail and pass the word “Man Overboard” to the bridge. Throw life rings in water. 2. Establish personnel accountability. 3. Post lookouts. Maneuver vessel to recover person. Prepare to launch rescue boat. Hoist Oscar flag.	
Abandon Ship: 1. All persons shall don their life preserver or exposure suit as directed. 2. Establish personnel accountability.	
Collision: 1. Close all watertight hatches and standby for violent vessel maneuvering. 2. Prepare to perform damage control duties or abandon ship.	

WATER POLLUTION PLACARDS

A-6. Ships more than 26 feet in length must have a placard of at least 5 by 8 inches, made of durable material, fixed in a conspicuous place in each machinery space or at the bilge and ballast pump control station, stating the information depicted in Figure A-1.

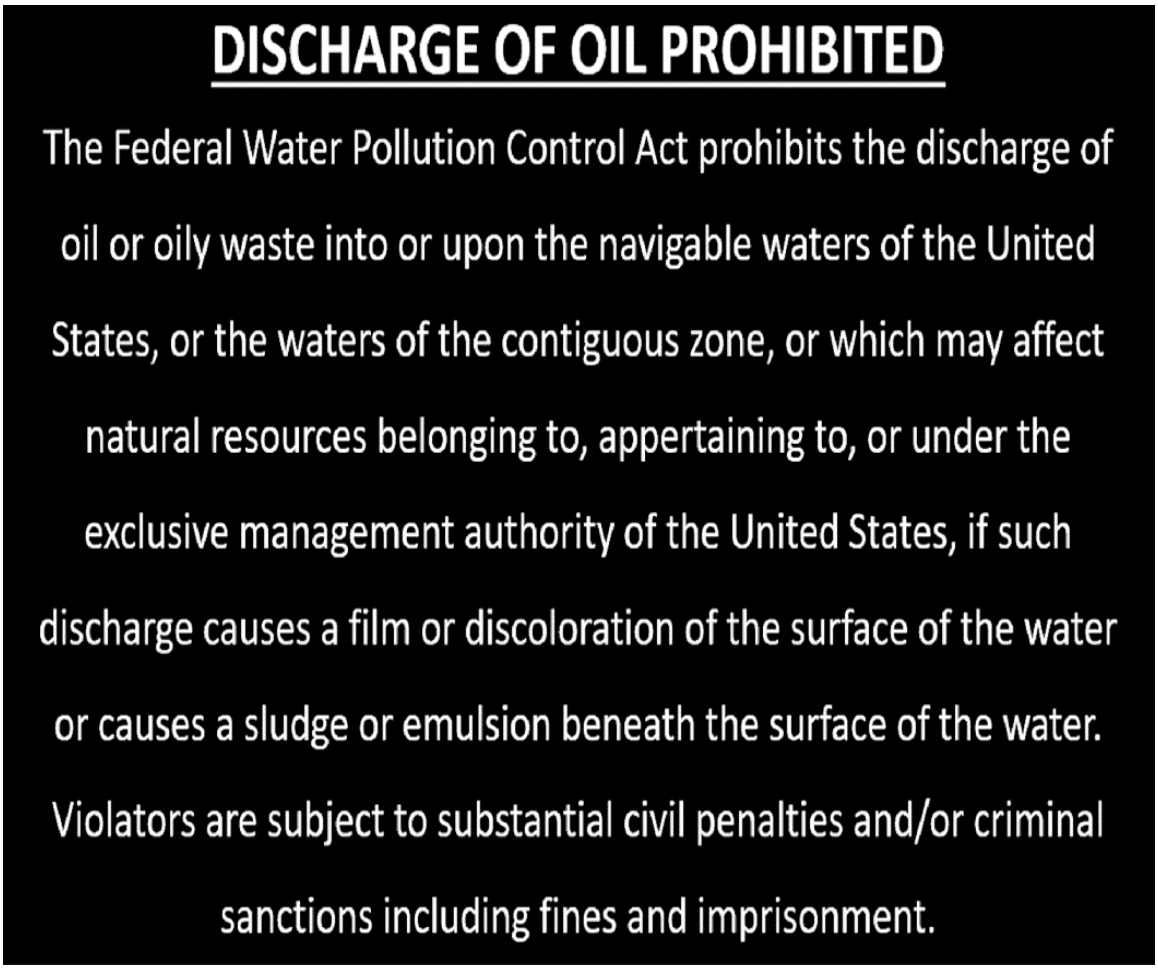

Figure A-1. Discharge of oil prohibited

LOGBOOK ENTRIES AND REPORTS (DECK AND ENGINE)

EMERGENCY RESPONSE DRILLS

A-7. The sporadic nature of Army missions and the frequency of crew turnover require that vessel masters or coxswains conduct other drills in addition to the monthly emergency response drills. Procedures for emergency response drills can be found in this section and in TC 4-15.51. The vessel master or coxswain shall conduct the following drills within 24 hours of the vessel getting underway and weekly while underway to further enhance crew and vessel survivability at sea:

- Abandon ship drill.
- Fire and emergency response drill.
- Man overboard drill.

Abandon Ship Drills

A-8. Abandon ship drills must include—

- Summoning persons on board to muster stations with the general alarm followed by drill announcements on the public address or other communication system and ensuring that the persons on board are made aware of the order to abandon ship.
- Reporting to stations and preparing for the duties described on the muster list.
- Checking that persons on board are suitably dressed.

- Checking that lifejackets or immersion suits are correctly donned.

A-9. Abandon ship drills should also include conducting a mock search and rescue of passengers or personnel trapped in their staterooms and giving instructions in the use of radio lifesaving appliances.

A-10. As far as is reasonable and practicable, FRBs must be launched with their assigned crew aboard and maneuvered in the water each month. Such launching and maneuvering must occur at least once every 3 months.

A-11. If FRB launching drills are carried out with the vessel making headway, such drills must, because of the dangers involved, be practiced in sheltered waters only and be under the supervision of an officer experienced in such drills.

A-12. All crewmembers aboard a vessel that carries immersion suits shall don them at least once every quarter during an abandon ship drill.

Fire Drills

A-13. Fire drills must be held before sailing when a vessel enters service for the first time, after modification of a major component, or when a new crew is engaged. The master shall conduct sufficient fire drills to make sure that all crew members are familiar with their duties in case of a fire.

A-14. Each fire drill must include—

- Summoning passengers on an overnight voyage to muster or at designated locations identified during the 1`passenger brief.
- Summoning the crew to report to assigned stations and to prepare for and demonstrate assigned duties.
- Instruction in the use and location of fire alarms, extinguishers, and any other firefighting equipment on board.
- Each fire drill must, as far as practicable, be conducted as if there were an actual emergency.

A-15. Firefighting drills and training shall be logged or otherwise documented for review upon request. The drill entry shall include the following information:

- Date of the drill and training.
- General description of the drill scenario and training topics.

SANITARY INSPECTIONS

A-16. The master and chief engineer are responsible for seeing that the vessel (the quarters in particular) is in a clean and sanitary condition. The chief engineer is responsible only for the sanitary condition of the engineering department.

A-17. An inspection of quarters, toilet and washing spaces, serving pantries, and galleys shall be made at least once in every month. The date of the inspection and the condition of the areas inspected shall be noted in the official logbook.

GALLEY INSPECTIONS

A-18. Galley inspections are different than sanitary inspections in that galley inspections are performed by Army or Navy preventive medicine. The Navy is the only authorized inspection agency for international travel. Operations afloat are treated as highly susceptible populations and should be inspected monthly (when preventive medicine support is available) while active. While the galley is inactive between missions an inspection is not required but must be conducted prior to any mission that will use the galley. Galley inspections for operations afloat and points of contacts for galley inspections are addressed in TB MED 530, which categorizes operations afloat as highly susceptible populations.

A-19. Perform a food facility risk assessment using the guidance in TB MED 530 and DD Form 2972 (*Food Facility Risk Assessment Survey*) to determine the food operation risk category. Some smaller galleys will likely fall under the high-risk category rather than extremely high-risk category even though the supported

population is counted as a highly susceptible population. In those cases, quarterly inspections for active galleys could be justified.

SAFETY INSPECTION

A-20. Army watercraft units have a requirement to conduct an annual safety inspection per AR 385-10 and AR 56-9. Commanders will appoint a person in writing to manage the unit's Annual Safety Survey Program. This individual is responsible for the unit administration and coordination of the safety equipment inspection and maintenance requirements outlined in this manual. This additional duty does not relieve ship's personnel from their duties as they pertain to safety IAW AR 56-9.

A-21. Records may be retained at the vessel support office for Class B vessels during normal operation, but onboard for inspection during annual inspections and triennial surveys. Three years of surveys consist of two annual inspections and one triennial survey.

A-22. Each international and coastwise load line certificate is issued for 5 years and receives an annual endorsement within 90 days of the certificate anniversary date. This certificate must be maintained with all other certificates and be made available for inspection.

ADDITIONAL LOGS

Garbage Log

A-23. Vessels 400 gross tons or more shall ensure that a written record is maintained on the ship of each of the following garbage discharge or disposal operations:

- Discharge to a reception facility or to another ship.
- Incineration on the ship.
- Discharge into the sea.
- Accidental or other exceptional discharges.

Radio Log Maintained

A-24. Logs of ship stations must contain the following applicable log entries and the time of their occurrence:

- A summary of all distress and urgency communications affecting the station's own ship.
- All distress alerts relayed by the station's own ship.
- All distress call acknowledgements and other communications received from search and rescue authorities.
- A summary of safety communications on other than VHF channels affecting the station's own ship.
- The time of any inadvertent transmissions of distress, urgency, and safety signals including the time and method of cancellation.
- An entry that pre-departure equipment checks were satisfactory and that required publications are on hand.

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Appendix B

Engineering

This section provides information not covered in applicable TMs and addresses baseline engineering systems and their associated inspection and maintenance requirements during inspections and surveys. This section covers some PMCS but does not cover all PMCS. Consult the appropriate TM for full PMCS requirements.

BATTERIES

B-1. Before working with batteries, Soldiers should be trained in proper handling procedures. Personal protective equipment should be worn at all times. This includes—

- Chemical splash goggles.
- Face shield.
- Acid-resistant equipment such as gauntlet style gloves, apron, and boots.

B-2. The sulfuric acid (electrolyte) in batteries is highly corrosive. Acid exposure can lead to skin irritation, eye damage, respiratory irritation, and tooth enamel erosion. Remember the following safety precautions:

- Never lean over a battery while testing or charging it.
- In marine environments, do not allow the battery solution to mix with salt water; it can produce hazardous chlorine gas.
- If acid splashes on the skin or eyes, immediately flood the area with cool running water for at least 15 minutes and seek medical attention immediately.
- Always practice good hygiene and wash your hands after handling a battery and before eating to prevent lead exposure. Signs of lead exposure include loss of appetite, diarrhea, constipation with cramping, difficulty sleeping, and fatigue.

B-3. The chemical reaction by-products from a battery include oxygen and hydrogen gas. These can be explosive at high levels. Overcharging batteries can also create flammable gases. For this reason, it is very important to store and maintain batteries in a well-ventilated work area away from all ignition sources and incompatible materials. Cigarettes, flames, or sparks could cause a battery to explode.

B-4. Before working on a battery, disconnect the battery cables. To avoid sparking, always disconnect the negative battery cable first and reconnect it last. The electrical voltage created by batteries can ignite flammable materials and cause severe burns. Soldiers have been injured and killed when loose or sparking battery connections ignited gasoline and solvent fumes during maintenance.

B-5. Battery maintenance tools should be properly insulated to avoid sparking. Place protective rubber boots on battery cable connections to prevent sparking on impact if a tool does accidentally hit a terminal. Always remove personal jewelry before working on a battery. A short-circuit current can weld a ring or bracelet to metal and cause severe burns.

B-6. Batteries can be very dense and heavy, so use proper lifting techniques to avoid back injuries. Battery casings can be brittle and break easily; they should be handled carefully to avoid an acid spill. Make sure that a battery is properly secured and upright. If a battery shows signs of damage to the terminals, case, or cover, replace it with a new one and turn in the old battery IAW local policies and guidelines.

EMERGENCY POWER (BATTLE LANTERN TESTING)

B-7. Required emergency lighting utilizing battery powered emergency lights, exit signs, or both shall be tested annually. The emergency lights and exit signs shall be tested for proper operation for the time period established.

B-8. Battle lantern testing should be conducted using the following procedures:

- Line up battle lanterns facing a bulkhead at a distance of no less than 2 feet.
- Activate battle lanterns.
- Let sit for no less than 2 minutes, then inspect for any noticeable decrease in luminosity.
- Replace any batteries that exhibited a decreased luminosity after testing.

LIFTING DEVICES AND CRANES (WIRE ROPE INSPECTION)

B-9. Do not use wire rope or rope slings having any of the following conditions:

- 10 randomly distributed broken wires in one rope lay or 3 or more broken wires in one strand in 1 rope lay.
- Kinking, crushing, bird caging or other damage resulting in distortion of the wire rope structure.
- Evidence of heat damage.
- Excessive wear or corrosion, deformation, or other defect in the wire or attachments, including cracks in attachments.
- Any indication of strand or wire slippage in end attachments.
- More than one broken wire close to a socket or swaged fitting.

B-10. See Figure B-1 for information on wire length and Figure B-2 for examples of wire issues.

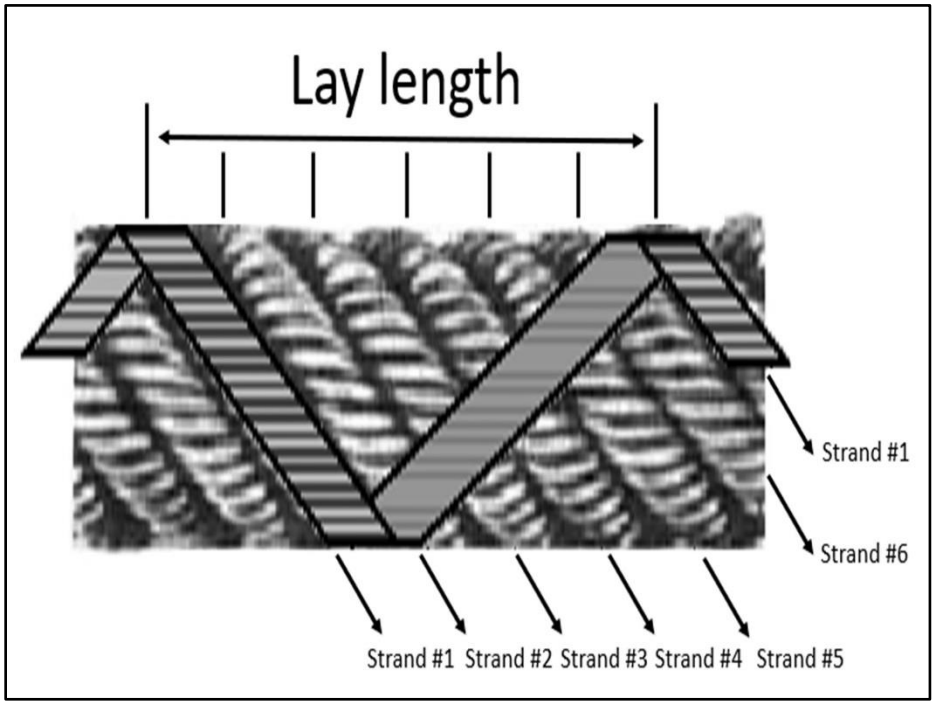

Figure B-1. Wire length

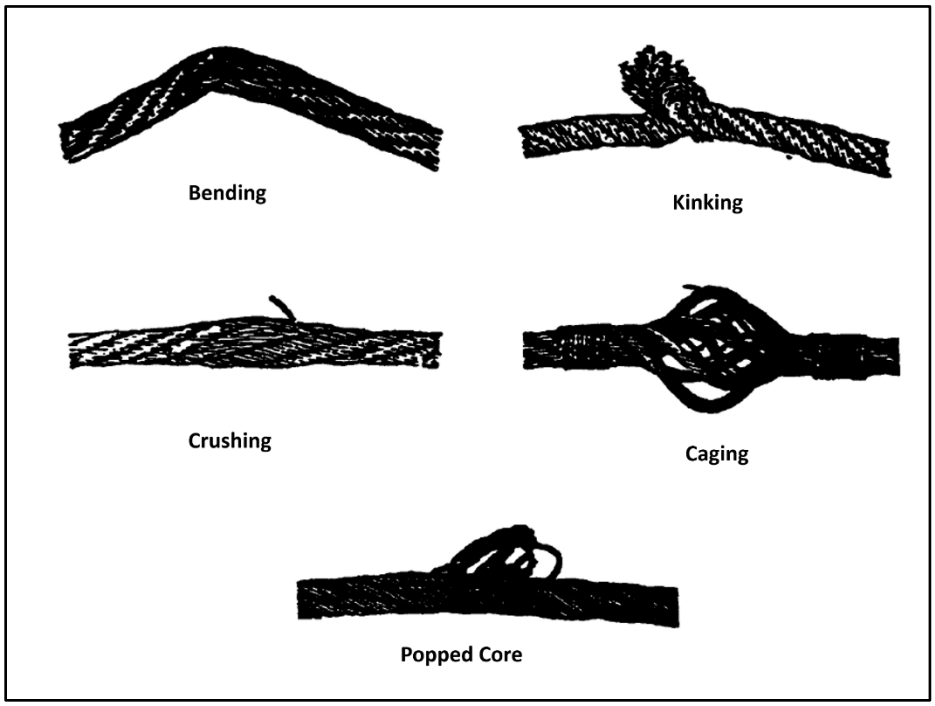

Figure B-2. Wire issues

COMPRESSED GAS CYLINDERS

B-11. Oxygen cylinders will be painted green, acetylene cylinders yellow, and nitrogen bottles will be painted grey. Refrigerant cylinders will also be color coded and marked according to the type of refrigerant they contain. Color alone should not be used to identify the contents; read the contents label affixed to the bottle for an accurate description of what the cylinders contain. Color identification should be IAW MIL-STD-101C.

B-12. Gas cylinders will be marked with one or more HAZMAT labels (for example, flammable gas, non-flammable gas, or oxidizer). Additional markings are stamped on the neck or collar area of the bottle to identify it as a Department of Transportation (DOT)-approved cylinder and what the cylinder material is, such as DOT-3AA for steel cylinders and DOT-3AL for aluminum cylinders. These are two common cylinders found on Army watercraft.

B-13. Figure B-3 on page B-4 identifies common markings found the neck and collar area of most compressed gas cylinders. These include—

1. Cylinder specification:
   - DOT, which is the regulatory body that governs the use of cylinders.
   - Specification of the cylinder type of material of construction (for example, 3AA).
   - Service or working pressure in pounds per square inch (for example, 2,265 PSI).
2. Cylinder serial number.
3. Date of manufacture. This date also indicates the original hydrostatic test.
4. Neck ring identification. The cylinder neck ring displays the name of the original owner of the cylinder.
5. Retest markings. The format for a retest marking is Month–Facility–Year–Plus Rating–Star Stamp. The + symbol (plus rating) indicates that the cylinder qualifies for a 10% overfill. The ★(star stamp) indicates that the cylinder meets the requirements for 10-year retest instead of a 5-year retest.

6. Bar code label. The bar code label provides a unique cylinder identifier and is used by computer systems to track cylinders throughout the fill process. This bar code label can also have the national stock number (NSN), part number, or cage code for that particular gas.
7. Cylinder manufacturer's inspection marking (if applicable)
8. Cylinder tare (empty) weight. This value may be preceded by the letters TW.

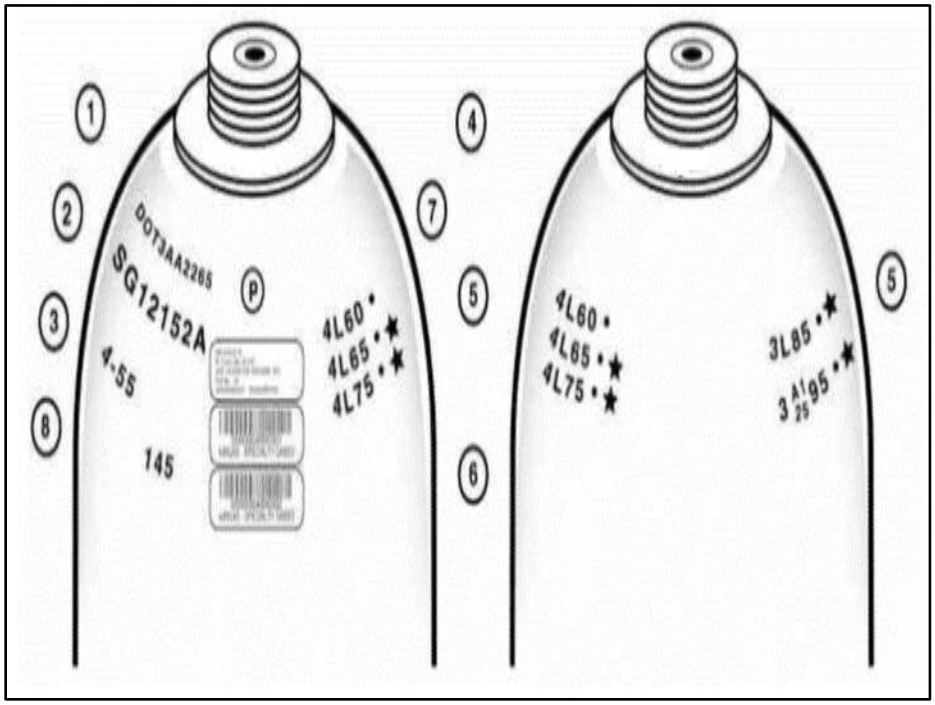

Figure B-3. Gas cylinder common markings

B-14. HAZMAT labels found on compressed gas cylinders are not to be removed and are used to indicate the general hazards associated with the contents of the gas stored within the cylinders. For complete HAZMAT information, refer to the SDS.

B-15. Items required for the safe operation of the oxy-acetylene torch assembly are check valves and flashback arrestors. These items serve two different functions and must be used together with the torch assembly.

B-16. Reverse-flow check valves (see Figure B-4) prevent the flow of gas back through the hoses, making a dangerous and possible explosive mixture of the two gasses. Quantities are determined by the vessel's BII, and they are installed between the hoses and the torch. Typically, these are found in the welder's toolbox or the torch kits on the vessel.

B-17. Flame arresters (see Figure B-5) are devices that prevent the flame from traveling upstream past the regulator and into the cylinder. Quantities are determined by the vessel's BII, and they are installed between the hose and the regulator.

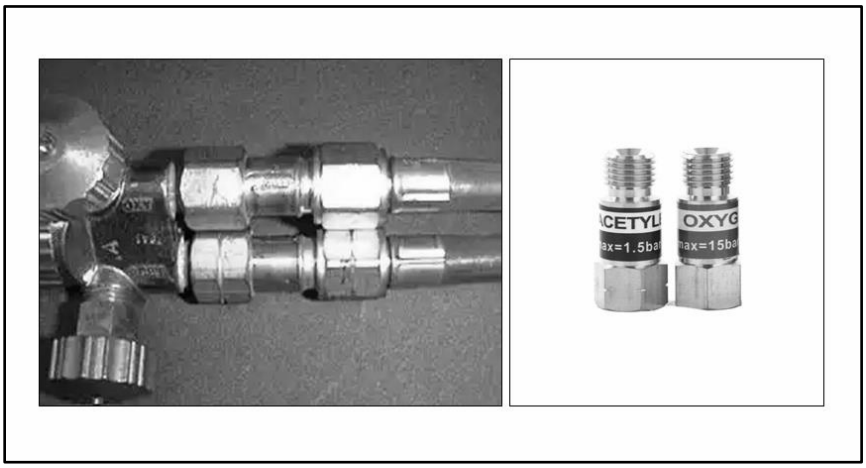

Figure B-4. Oxy-acetylene torch handle check valves

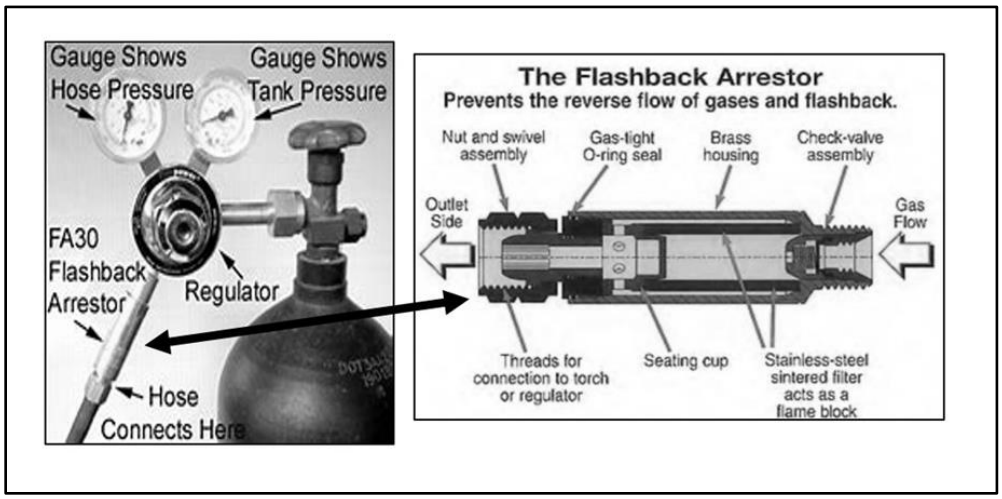

Figure B-5. Flashback arrestors

LOCK OUT/TAG OUT

LOCK OUT/TAG OUT PROCEDURES

B-18. The LOTO system consists of a series of locks and tags that are attached to individual components to indicate that they are restricted from operation (Danger Tag) or as a precaution before operation (Caution Tag). Each tag contains the necessary information to prevent a possible injury to personnel or damage to installed equipment. Tags associated with the tag out procedure should never be used for valve identification, for marking leaks, or any other purpose not specified in this tag out procedure. Locks must be placed on the initial energy source (whether electrical, air, or fluid) nearest the item to be tagged. Use of locking devices is mandatory so that equipment needing or under repair/replacement cannot be energized. Both the red DANGER tags and the yellow CAUTION tags are available through the supply system. However, if these are not available any tags (EXCEPT reusable, laminated tags) are authorized as long as they contain the same information and authorizing signatures.

B-19. The use of tags or other labels is not a substitute for other safety measures such as chaining or locking valves, removing fuses, or using specific lockout devices with padlocks. If any component has more than one type of tag or sticker attached, the DANGER (red) tag, when present, will take precedence over all other tags or stickers. Standard LOTO procedures are to be used for all maintenance, including work to be done by

support maintenance units, divers, and local contractors. Each maintenance action will require its own set of tags even if two or more maintenance actions require the same equipment to be tagged. Never rely on the tags from other maintenance actions to provide protection for the work you are assigned to do. LOTO procedures will be enforced at all times. Violation of any tag compromises the entire tag out system and could in itself have serious consequences. Therefore, strict adherence to the tag out procedure without exception is required by all personnel. LOTO training should be conducted for all crewmembers to ensure they are familiar with all procedures and meaning of the various tags.

RESPONSIBILITIES

B-20. Vessel masters are responsible for ensuring these procedures are properly used aboard their assigned vessels. They are also responsible for ensuring their vessels have an established LOTO program with an accompanying SOP.

B-21. Chief engineers are the authorizing officers aboard their assigned vessels. They ensure all crewmembers are familiar with LOTO procedures and tag meanings.

B-22. Company/detachment commanders are responsible for ensuring the unit complies with these procedures. Commanders ensure these procedures are addressed within unit SOPs, to include the proper indoctrination of new unit personnel.

B-23. Vessel support officers and/or battalion marine maintenance officers will routinely audit individual vessels to ensure compliance with this program.

APPLICATION

B-24. These requirements apply to all maintenance actions performed aboard Army watercraft where the unexpected energizing, startup, or release of stored energy of equipment would be likely to endanger personnel or the equipment itself.

B-25. The following describes terms related to LOTO procedures:

- Authorizing officer—The authorizing officer for LOTO on Army watercraft will be the chief engineer.
- Energy isolating device—A mechanical device that physically prevents the release or transmission of energy. These devices include, but are not limited to, manually operated breakers, motor controllers, disconnects or switches, valves, and blank flanges.
- Energy source—Any device, component, or system which contains potential energy capable of injuring personnel or damaging installed equipment. Energy sources may be electrical, pneumatic, hydraulic, thermal, chemical, or in a mechanical form such as a rotating element.
- Lockout device—A device that uses a positive means such as a lock to hold an energy isolating device in a safe position preventing the energizing of equipment or the release of another form of energy. Lockout devices include any device which mechanically prevents the energy isolating device from being repositioned.
- Maintenance action—Any preventive or corrective maintenance performed by the vessel's crew and support maintenance personnel and private contractor personnel. Each maintenance action will require its own set of tags. This does not include maintenance performed during a cyclic maintenance period. LOTO will be maintained and monitored by the shipyard performing the cyclic maintenance.
- Tagout—Tags affixed to energy isolating devices for warning purposes. They DO NOT provide the physical restraint that lockout devices provide. These tags are as follows:
  - Danger tag—This tag is red. It prohibits the operation of equipment that could jeopardize the safety of personnel or endanger equipment and associated systems. Under no circumstances will equipment be operated when danger tags are attached. Laminated danger tags intended for repeated use will not be used aboard Army watercraft.
  - Caution tag—This tag is yellow It is used as a precaution to advise personnel of temporary special instructions or to indicate that unusual caution must be exercised to operate equipment. These instructions must state the specific reason why the tag is installed.

- LOTO Log—The tag out log consists of the Department of the Army (DA) Form 7912 (*Danger/Caution Tag Out Index Sheet*), DA Form 7911 (*Lock Out/Tag Out Record Sheet*), and the inactive record sheets. The DA Form 7912 and DA Form 7911 are required to be filled out and kept in the LOTO log, ensuring cleared record sheets are kept for a period of 1 year. The tag out index and tag out record provide a means of tracking actions, ensure that serial numbers are sequentially issued, and assist in conducting audits and reviews of the tag out program for the vessel. They also provide a ready means of referral for the crew. Both forms are available on the Army Publishing Directorate website.

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Appendix C

Firefighting and Damage Control Equipment

Firefighting is the use of strategy, personnel, equipment, and systems to extinguish fires. This appendix begins with explaining the chemistry of a fire and the theory of extinguishment, which aids in developing a firefighting strategy. It also discusses the firefighting agents and systems specific to Army watercraft. The last part of this section describes personnel protection and firefighting equipment.

CHEMISTRY OF FIRE

C-1. Matter exists in one of three states: solid, liquid, and gas (vapor). For a solid or liquid fuel to burn, enough heat must be applied for vapors to form on the surface. These vapors must intermix with the oxygen in the surrounding air in order for a flammable mixture to form.

C-2. Fuel, oxygen, and heat are required for combustion. The fire triangle represents these requirements. The three sides of the fire triangle represent fuel, oxygen, and heat. If any side of the triangle is missing, a fire cannot start. If any side of the fire triangle is removed the fire will go out. The ignition temperature of a substance is the lowest temperature at which sustained combustion will occur without the application of a spark or flame. The flashpoint is the lowest temperature at which a liquid gives off sufficient vapor to form an ignitable mixture. Sustained combustion takes place at a slightly higher temperature above flashpoint (referred to as the fire point of a liquid).

C-3. The fire tetrahedron (see Figure C-1) is a better representation of the combustion process. The four sides of the tetrahedron represent: fuel, oxygen, heat, and the chain reaction. Combustion is sustained through a chemical chain reaction. Disrupting the chain reaction is a means of extinguishing a fire.

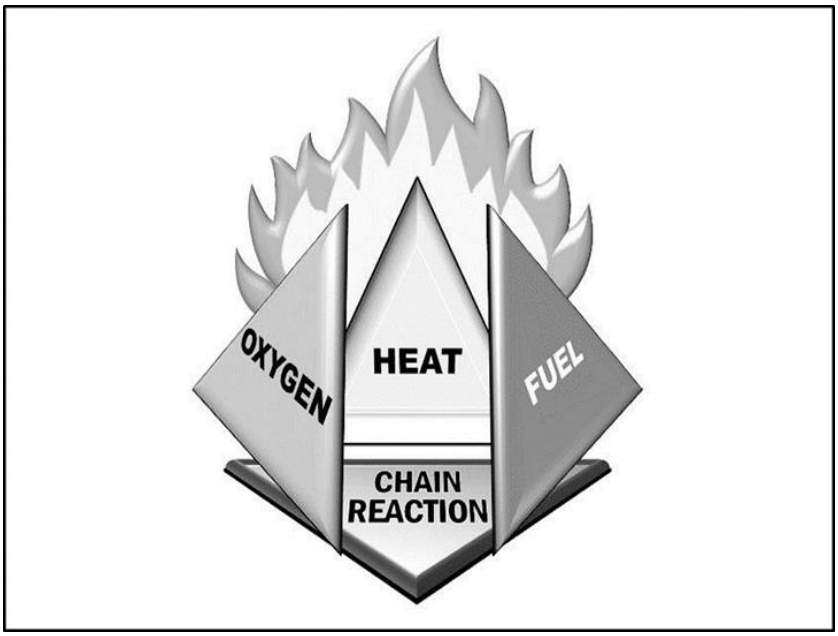

Figure C-1. Fire tetrahedron

C-4. Oxidation is a chemical process in which a substance combines with oxygen. Rusting iron/rotting wood are examples of slow oxidation. Fire (or combustion) is an example of rapid oxidation. During oxidation, energy is given off, usually in the form of flames. When a substance combines with oxygen at a very high rate, the energy given off as heat and light is so rapid that we can feel the heat and see the light in the form of flames.

C-5. Combustion is the rapid oxidation of millions of vapor molecules. During combustion, radiant heat is released, which radiates in all directions. Heat that radiates back to the fuel is called radiation feedback. The radiation feedback creates more vapors from the fuel source. A self-sustaining reaction starts; burning vapor produces heat which releases and ignites more vapor. This chain reaction will continue as long as fuel, oxygen and sufficient heat are generated to create more vapors and raise the vapors to the fuel's ignition temperature.

C-6. **EXTREME HEAT.** Unless removed, the heat released by a fire will raise the temperature of a compartment. Even protected firefighters will be driven from the oven-like temperatures common to fires in enclosed spaces. As flammable materials are heated, they pyrolyze (give off combustible gases). When the self-ignition temperature of these gases is reached, the entire compartment quickly becomes engulfed in flame. This condition is known as flashover. The firefighter can use several techniques to remove heat. Cutting a hole in the bulkhead, at least one foot square, allows the hot air to escape. For best results, this hole should be in the uppermost portion of a compartment. A fire may burn its own hole through aluminum bombs and missiles creating its own vent path. A continuous thin film of water running across a deck or down a vertical bulkhead will carry away virtually all the heat. A water spray introduced into a fire space will also cool the compartment effectively. Overhead sprinklers, if installed, are ideal for cooling.

C-7. Heat transfer occurs through one or more of three different modes: conduction, radiation, and convection. Conduction is the transfer of heat through a solid body. Radiation is the transfer of heat across an intervening space with no material substances involved. Convection is the transfer of heat through the motion of circulating gases or liquids.

C-8. Flames and heat are obvious hazards of any fire, yet gases generated by combustion are also lethal. Carbon monoxide is an abundant byproduct of combustion that results from incomplete combustion. CO2 is also an abundant byproduct, resulting from complete combustion. Both of these gases can be harmful, but carbon monoxide is a poison and the more dangerous of the two. The presence of byproduct gases reduces the oxygen content of the surrounding air, which is normally 21 percent. Carbon monoxide works on the respiratory system. Above normal carbon monoxide concentrations in the air reduce the amount of oxygen that is absorbed in the lungs, impairing muscular control. Smoke generated by a fire creates an atmosphere that reduces visibility and impairs breathing.

THEORY OF EXTINGUISHERS

C-9. A fire can be extinguished by the following methods:

- Removing the fuel. Removing the fuel source from a fire will extinguish the fire.
- Removing the oxygen. A fire can be extinguished by reducing the oxygen percentage in the air. Lowering the oxygen content in the air will decrease the intensity of the fire, eventually extinguishing the fire depending on the properties of the fuel. Fires can smolder in as low as 6% oxygen content.
- Removing the heat. Water, applied as a low velocity fog is the most effective means of removing heat from ordinary combustible material.
- Break the chain reaction. A fire can be extinguished by disrupting the chemical process that sustains the fire.

C-10. For firefighting purposes, there are four classes of fire: class A, class B, class C, and class D.

- Class A fires involve wood and wood products, cloth, textiles and fibrous materials, paper and paper products and are extinguished with water. High velocity fog is the preferred method of extinguishing a class A fire.
- Class B fires involve gasoline, solvents, oil, and other flammable liquids. These fires are extinguished with water fog, AFFF, FM-200, or CO2. Flammable gas fires should never be

extinguished unless there is a reasonable certainty that the flow of gas can be secured. An explosive condition can result, which can be a greater hazard than the fire.

- Class C fires are energized electrical fires that are attacked using nonconductive agents such as CO2 or FM-200 at prescribed distances. The most effective tactic is to de-energize and handle the fire as a class A or B fire.
- Class D fires involve combustible metals such as magnesium and titanium. Dry powders are the only agent used for extinguishing class D fires. DO NOT use water on a class D fire; water will increase the intensity of the fire and spread it. Do not confuse dry powder with dry chemical.

C-11. Table C-1 shows the basic classes of fire, examples of the types of materials consumed, and the types of agents used to extinguish the fires.

Table C-1. Fire classifications and extinguishing agents

Fire Classification	*Examples of types of materials*	*Type of extinguisher to be used*
Alpha	Wood, paper, cloth, upholstery.	Water, and A, B, and C multipurpose dry chemical.
Bravo	Flammable liquids, gasoline, jet fuel, paint, oil, grease.	AFFF, A, B, and C multipurpose dry chemical, FM-200, Carbon Dioxide (CO2), and water fog.
Charlie	Electrical equipment and wiring.	CO2, A, B, and C multipurpose dry chemical, and FM-200 are preferred but Purple Potassium (k) Powder (PKP) can also be used.
Delta	Combustible metals such as magnesium, titanium, zirconium, lithium, potassium, and sodium.	Jettison from ship or extinguish with special dry powders based on sodium chloride or other salts; clean dry sand can also be used.

FIREFIGHTING AGENTS

C-12. An extinguishing agent is a substance that will put out a fire. Every extinguishing agent operates by attacking one or more sides of the fire triangle. The following paragraphs detail the various types of substances that are used as firefighting agents aboard Army watercraft:

- Cooling. Reduces the temperature of the fuel below its ignition temperature. This is a direct attack on the heat side of the fire triangle (see Figure C-2 on page C-4).
- Smothering. Separates the fuel from the oxygen. This can be considered as an attack on the edge of the fire triangle where the fuel and oxygen sides meet (see Figure C-3 on page C-4).
- Oxygen dilution. Reduces the amount of available oxygen below that needed to sustain combustion. This is an attack on the oxygen side of the triangle (see Figure C-4 on page C-4).

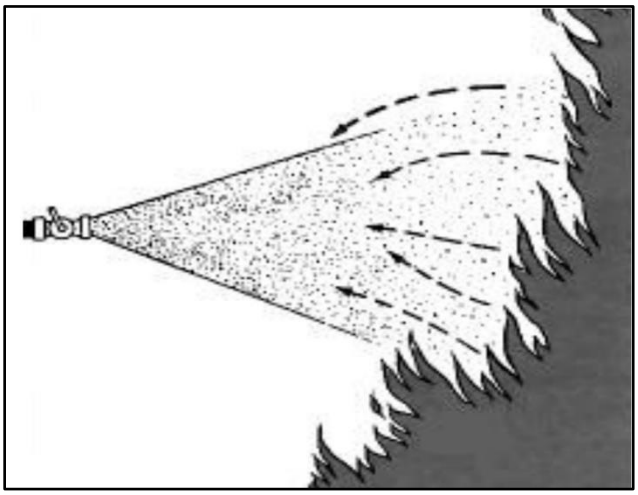

Figure C-2. Cooling

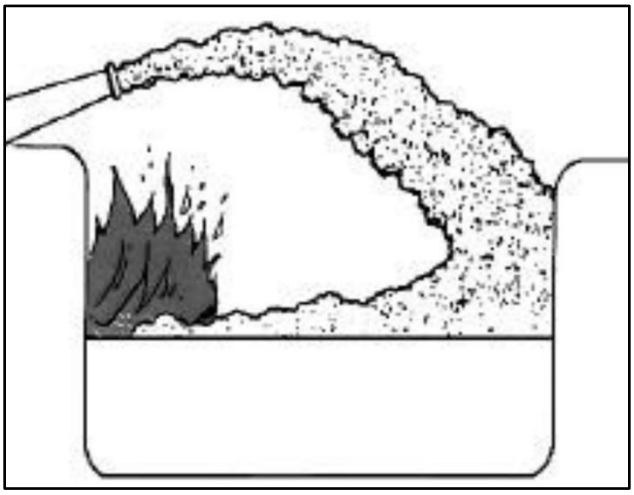

Figure C-3. Smothering

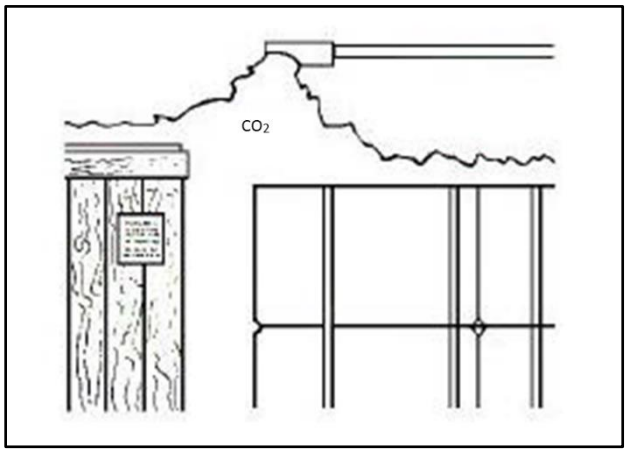

Figure C-4. Oxygen dilution

WATER

C-13. There are many materials that may be used as firefighting agents. Water is used primarily as a cooling agent. If the surface temperature of a fire can be lowered below the fuel's ignition point, the fire will be extinguished. A secondary method of water extinguishment is caused by steam smothering. Army watercraft are equipped with the U.S. Navy's shipboard Vari-Nozzle for this purpose.

FIRE HOSE NOZZLE

C-14. The Vari-Nozzle is used on fire hoses and can deliver water in the form of a straight stream and high/low velocity fog patterns. The nozzle tip is rotated to deliver required firefighting stream patterns.

FOAM

C-15. There are two basic types of foam: chemical and mechanical. Due to recent legal actions, foam can only be used during real emergencies on board Army watercraft. Crew training using foam must be conducted in a controlled, land-based environment following Department of Defense policies and Environmental Protection Agency standards. Foam is found on vessels that have manned machinery spaces, carry large capacity petroleum tanks, or tow fuel barges great distances. Foam is carried either in 5-gallon sealed plastic containers located in the manned machinery spaces or in large holding tanks. The shelf life of foam is 25 years; however, should the foam become contaminated or diluted then it must be replaced. Foam stored in tanks must be tested every 2 years, while foam in 5-gallon plastic containers is serviceable until exposed to the elements. Army watercraft use the 6% concentrate foam in either gel or liquid form. Foams can be used on class A and B fires.

C-16. Chemical foam is formed by mixing an alkali (usually sodium bicarbonate) with an acid (usually aluminum sulfate) in water. Chemical foam has been phased out for shipboard use in favor of mechanical foam. Mechanical foam is produced by mixing foam concentrate with water to produce a foam solution. This foam solution is then mixed with air creating finished foam. The bubbles are formed by the turbulent mixing of air and the foam solution. AFFF provides three fire extinguishing advantages:

- An aqueous film is formed on the surface of the fuel which prevents the escape of hydrocarbon fuel vapors.
- The layer of foam effectively excludes oxygen from the fuel surface.
- The water content of the foam provides a cooling effect (see Figure C-5 on page C-6).

C-17. Limitations of foam:

- Electrically conductive and should not be used on live electrical equipment.
- Should not be used on combustible metal fires.
- Should not be used on fires involving gases.

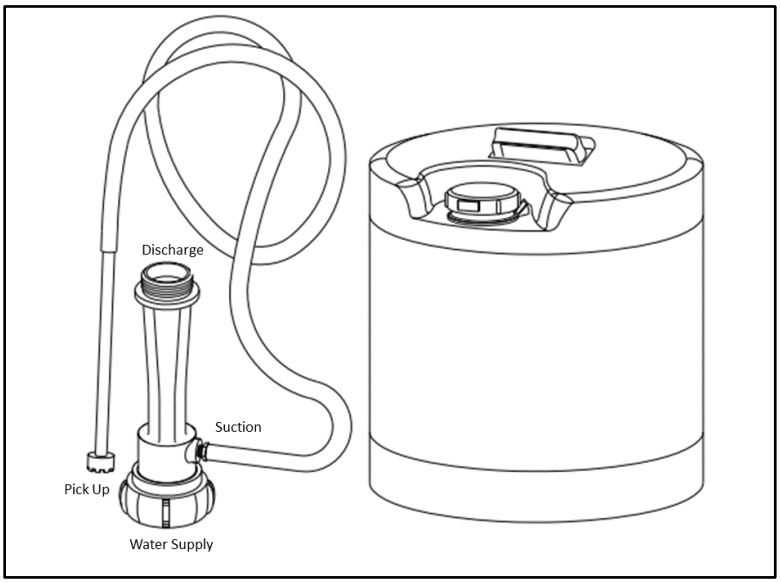

Figure C-5. Production of mechanical (air) foam

FIREFIGHTING SYSTEMS

C-18. This section discusses the different types of firefighting systems used to combat fires aboard Army watercraft.

FM-200/Heptafluoropropane (HFC-227EA)

C-19. FM-200 is the most common fixed firefighting system on Army watercraft. FM-200 is the brand name for heptafluoropropane (HFC-227EA). HFCs are composed of carbon, fluorine, and hydrogen atoms. FM-200 extinguishes fire through heat absorption and to a lesser extent, chain breaking. The class of compound FM-200 belongs to are HFCs. HFCs are used in refrigeration and are a very effective heat transfer agent. HFCs remove heat energy from a fire so the fire cannot sustain itself. FM-200 also releases small amounts of free radicals upon exposure to flames. Free radicals inhibit the chain reaction responsible for combustion.

C-20. FM-200 will not damage delicate equipment because it does not have particulates or oily residues. It does not significantly reduce oxygen levels when deployed, making it safer for people. FM-200, when exposed to temperatures in excess of 1300 degrees F, will break down chemically and create hydrogen fluoride gas. This system must be recertified annually by a manufacture's certified technician. The bottles have a shelf life of twelve (12) years between hydrostatic testing unless they have been discharged.

WARNING

Hydrogen fluoride gas is very toxic to humans. Concentrations above three parts per million can be harmful and/or fatal.

C-21. Benefits of using FM-200 include the following:

- Fast-acting FM-200 can stop fires in just seconds.
- Extinguishing fires quickly means less damage and repair costs and extra safety.
- FM-200 has been tested extensively to ensure it is safe for exposure to humans.
- FM-200 does not leave oily residues, particulates, water, or corrosive material. This eliminates collateral damage to delicate equipment.

- FM-200 has a low environmental impact because it has a low atmospheric lifetime. It also has zero potential to deplete the ozone layer.
- Small space requirement compared to other fire suppression systems such as C02 and inert gases that require as much as seven times more storage space.
- Globally accepted FM-200 is the most widely accepted clean agent in the world. It is used in many fire suppression systems.

C-22. The systems are fixed, total flooding fire extinguishing systems (see Figure C-6), with a general arrangement of actuation station, cylinder storage, alarms, and spaces protected by individual cylinder banks. Some exceptions are:

- The flammable liquid storage space.
- New systems to be installed for the LSV flammable liquid storage spaces.

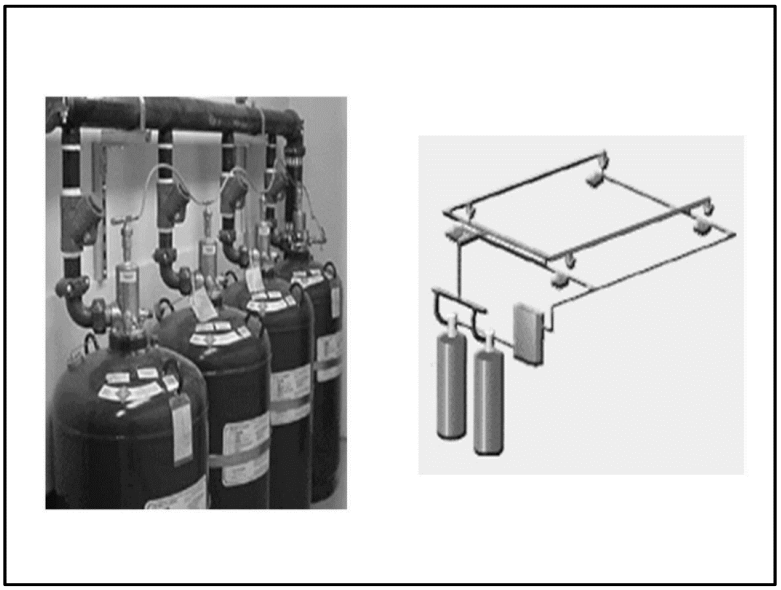

Figure C-6. HFC-227EA (FM-200) fire extinguishing systems

WARNING

When alarm sounds, vacate and secure the space to keep the FM-200 from escaping out of the compartment.

C-23. The control cabinets or spaces containing valves or manifolds will be conspicuously identified in red letters at least 2 inches high. Example: "HFC-227EA (or trade name FM-200) FIRE APPARATUS."

C-24. FM-200 systems use CO2 gas to operate the time delay and alarm portion of the firefighting system. The time delay and alarms allow up to 60 seconds for individuals in the spaces to escape before the main extinguishing agent is discharged. However, there is sufficient CO2 gas in the time delay and alarm operating system to cause breathing problems for anyone in the space when the devices are activated. Take care to ensure that all individuals safely evacuate the space.

Water Washdown System

C-25. The water washdown system can be used separately as a stand-alone system, but it is integral to the FM-200 system. Only occupied machinery spaces have this system added to the FM-200 system. It is part of the fire main system but is activated at locations outside the space being energized. This system must be activated prior to activating the FM-200 system and must continue until a minimum of 15 minutes AFTER

the FM-200 bottles are emptied. Its primary purpose is to ensure that the space temperature remains below 1300 degrees Fahrenheit in order to minimize the creation of hydrogen fluoride gas. As a stand-alone system it can be energized repeatedly as a firefighting device.

Carbon Dioxide

C-26. The fixed CO2 system is sized to the machinery space that it is designed to protect. It can be activated from one of two locations: locally at the bottles and external to the space being protected. This system must be recertified annually by a manufacture's certified technician. The bottles have a shelf life of 12 years between hydrostatic testing unless they have been discharged. Due to the oxygen displacement characteristics of this gas, there is a time delay of 60 seconds from the instant controls are activated until the actual gas is released. This time delay allows the space occupants to leave before the gas is released.

Note: CO2 is a dry, non-corrosive gas, which is inert when in contact with most substances and will not leave a residue to damage machinery and electrical equipment. CO2 has limited cooling capabilities. The firefighter should have backup extinguishers.

C-27. CO2 extinguishes the fire by diluting and displacing its oxygen supply. Individuals employing CO2 systems need to be aware of the dangerous situation caused by using CO2 in closed spaces.

Galley Fire Suppression System

C-28. The galley fire suppression system is proven and reliable. It is always there and will act as designed when needed. However, there are fundamental actions that can be accomplished that will prevent the need for its use. There are different types of systems on Army watercraft: fire suppression with nozzles and ventilation blocking which prevents the fire from spreading through the ventilation systems. The following actions will help prevent a galley fire:

- Keep all galley equipment clean and free of grease buildup.
- Never use flammable solvents or cleaners on the galley equipment. Flammable residues could be left behind and could ignite during subsequent use of the galley equipment.
- Operate the galley exhaust system when the heat producing equipment is preheating, cooking, or cooling after use. This helps to prevent excessive heat buildup which could cause unnecessary system actuation.
- Never operate the hood without the filters in place. Excessive grease could build up in the hood and ductwork. Clean the filters regularly.
- Never restrict the air intake passages. This reduces the efficiency of the hood exhaust system and could lead to excessive heat buildup and accumulation of fumes.
- Properly operate the grease extractors to ensure effective grease removal from the hood and duct system.
- Never tamper with the fire suppression system components such as the heat detectors, nozzles, agent storage canister, cables, or the fusible links.
- Report any damaged or suspect components to the vessel master and chief engineer or the assistant chief engineer immediately.
- Ensure that portable fire extinguishers are properly placed, installed, inspected, and available for use.

Note: U.S. Army vessels use a variety of galley equipment fire suppression systems. Reference the appropriate vessel TMs and manufacturer's documentation with regard to the specific system installed on board your assigned vessel. Maintenance and operation procedures will vary between systems and due care must be taken to ensure that proper procedures are followed for each system.

C-29. Food service personnel must be trained in the operation and maintenance of the galley fire suppression system on their assigned vessel.

Portable Fire Extinguishers

C-30. Portable extinguishers can be carried to the fire area for a fast attack. However, they contain a limited supply of extinguishing agent. The agent is quickly expelled from the extinguisher, and in most cases, continuous application can be sustained for only a minute or less. For this reason, it is extremely important to back up the extinguisher with a hose line. If the extinguisher does not have the capacity to put the fire out completely, the hose line can be used to finish the job. A crewman who is using an extinguisher cannot advance a hose line at the same time, so the alarm must be sounded as soon as a fire is discovered to alert the ship's personnel to the situation.

C-31. There is a right way and many wrong ways to use a portable fire extinguisher. Crew members who have had little training with these appliances waste extinguishing agent through improper application. At the same time, untrained personnel tend to overestimate their extinguishing ability. Periodic training sessions, including practice with the types of extinguishers carried onboard, are the best insurance against inefficient use of this equipment. Extinguishers that are due to be discharged and inspected may be used in these training sessions.

CLASSES OF FIRE EXTINGUISHERS

C-32. Every portable extinguisher is classified in two ways, with one or more letters and with a numeral. The letter or letters indicate the classes of fires on which the extinguisher may be used. These letters correspond exactly to the four classes of fires. For example, Class A extinguishers may be used only on Class A fires-those involving common combustible materials. Class AB extinguishers may be used on fires involving wood or diesel oil or both.

C-33. The numeral indicates either the relative efficiency of the extinguisher or its size. This does not mean the size of fire on which to use the extinguisher; rather, the numeral indicates how well the extinguisher will fight a fire of its class.

C-34. The NFPA rates extinguisher efficiency with Arabic numerals. The UL tests extinguishers on controlled fires to determine their NFPA ratings. A rating such as 2A or 4A on an extinguisher would be an NFPA rating. (A 4A rating will extinguish twice as much Class A fire as a 2A rating; a 20B rating will extinguish four times as much Class B fire as a 5B rating.)

C-35. The USCG uses Roman numerals to indicate the sizes of portable extinguishers. The numeral I indicates the smallest size and V the largest. A USCG rating of BIII indicates a medium-sized extinguisher suitable for fires involving flammable liquids and gases. The USCG ratings of the different types of extinguishers are shown in Table C-2.

Table C-2. United States Coast Guard extinguisher classification table

TYPE	*SIZE*	*DIOXIDE (POUNDS)*	*CHEMICAL (POUNDS)*
A	II		
B	I	4	2
B	II	15	10
B	III	35	20
B	IV	50	30
B	V	100	50
C	I	4	2
C	II	15	10

GENERAL SAFETY RULES FOR PORTABLE EXTINGUISHERS

C-36. The following are some general safety rules to follow when using portable extinguishers:

- Upon discovering a fire, call out the discovery, sound the fire alarm, and summon help.
- Never pass the fire to get to an extinguisher. You can get trapped in a dead-end passageway.

- If it is necessary to enter a room or compartment to combat the fire, keep an escape path open. Never let the fire get between you and the door.

C-37. If you enter a room or compartment and your attack with a portable extinguisher fails, get out immediately. Close the door to confine the fire and prepare to fight the fire while waiting for previously summoned help. Your knowledge of the situation will aid those responding.

Carbon Dioxide Extinguisher

C-38. These are used primarily on Class B and Class C fires. The most common sizes of portable extinguishers contain from 5 to 20 pounds of CO2, not including the weight of the relatively heavy shell. The CO2 is mostly in the liquid state at a pressure of 850 psi at 21C (70F). The 5-pound size is rated 5B:C and the 15-pound size has a rating of 10B: C. Depending on the size of the extinguisher, the range varies between 3 to 8 feet and the duration between 8 to 30 seconds.

C-39. Carry the extinguisher to the fire in an upright position. The short range of the CO2 extinguisher means the operator must get fairly close to the fire. Place the extinguisher on the deck and remove the locking pin. The discharge is controlled either by opening a valve or by squeezing two handles together. The operator must grasp the hose handle and not the discharge horn. The CO2 expands and cools very quickly as it leaves the extinguisher. The horn gets cold enough to frost over and cause severe frostbite. When a CO2 extinguisher is used in a confined space, the operator should guard against suffocation by wearing a breathing apparatus.

Class B Fires

C-40. The horn should be aimed first at the base of the fire nearest the operator. The discharge should be moved slowly back and forth across the fire. At the same time, the operator should move forward slowly. The result should be a "sweeping" of the flames off the burning surface, with some CO2 "snow" left on the surface.

C-41. Whenever possible, a fire on a weather deck should be attacked from the windward side. This will allow the wind to blow the heat away from the operator and to carry the CO2 to the fire. CO2 extinguishers generally do not perform well in windy conditions. The blanket of CO2 gas does not remain on the fire long enough to permit the fuel to cool down.

Class C Fires

C-42. The discharge should be aimed at the source of a fire that involves electrical equipment. The equipment should be de-energized as soon as possible to eliminate the chance of shock and the source of ignition.

Maintenance of CO2 Extinguishers

C-43. Several times each year, CO2 extinguishers should be examined for damage and to make sure that they are not empty. These extinguishers should be weighed at annual inspection. The manufacturer should recharge any extinguisher that has lost more than 10 percent of its CO2 weight. Recharge a CO2 extinguisher after each use, even if it was only partly discharged.

Mechanical Foam Nozzle With Pickup Tube

C-44. When using, attach the mechanical foam nozzle with pickup tube to a standard hose line from the fire-main system. It draws air in through an aspirating cage in its hose line end. At the same time, it introduces mechanical foam concentrate into the water stream through a pickup tube. When the air and foam solution mix, foam is discharged from the nozzle.

C-45. One type of nozzle consists of a 21-inch length of flexible metal hose or asbestos-composition hose, 2 inches in diameter, with a solid metal outlet. A suction chamber and an airport in the hose line end form the aspirating cage. The pickup tube is a short piece of 5/8-inch metal pipe with a short piece of rubber hose on one end. It is used to draw up the contents of a 5-gallon container of foam concentrate. The pickup tube operates on suction created in the suction chamber of the nozzle.

C-46. The mechanical foam nozzle is screwed onto the fire hose and the pickup tube is screwed into the side port in the base of the nozzle. The metal pipe at the end of the pickup tube is inserted into the foam-concentrate container. When water pressure is applied to the hose, foam concentrate is drawn up to the nozzle where it mixes with the air and water. The resulting foam is applied in the usual manner. The mobility of the foam nozzle is improved if one fire fighter operates the nozzle while another follows with the concentrate container.

APPLIANCES

Spanner Wrench

C-47. A spanner wrench (Figure C-7) is a special tool designed specifically for tightening or breaking apart fire-hose connections. The spanner should match the hose size and butt configuration. Hose-butt lug designs change over the years, making some spanner wrenches obsolete. When new hose is ordered, the available spanner wrenches must be compatible with the new hose couplings or new spanner wrenches must also be ordered.

Note: Most hose connections can be made hand-tight and do not require excessive force.

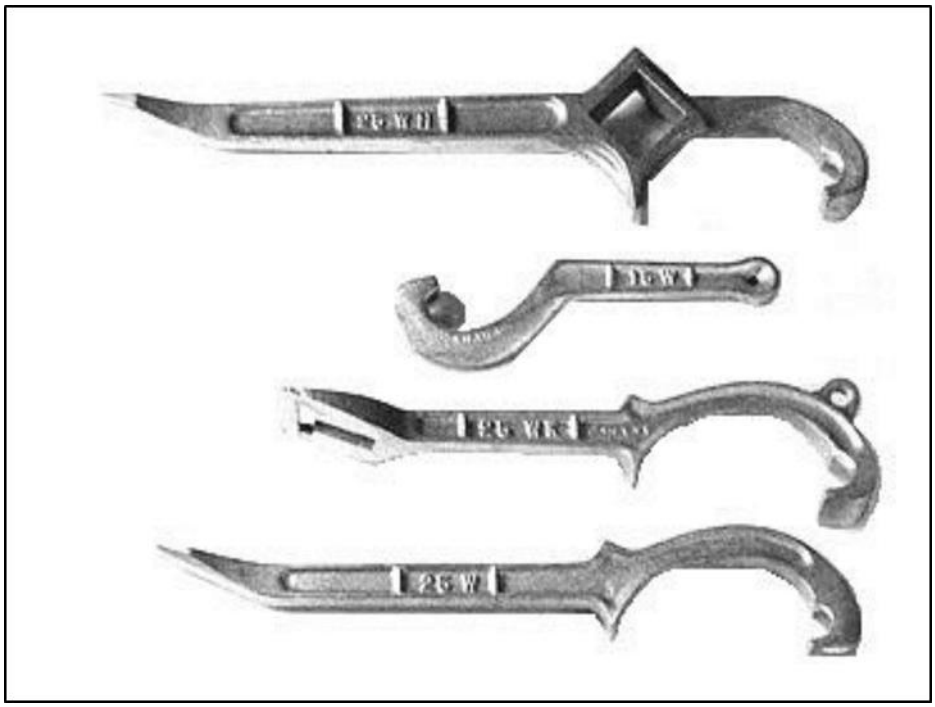

Figure C-7. Spanner wrench

Fire Axe

C-48. The pike head fire axe (Figure C-8 on page C-12) is a multipurpose, portable fire-fighting tool. The pike (pointed) end of the axe may easily be driven through light metal, including metal clad fire doors and some Class C bulkheads. It can be used to make openings quickly and to check for smoke or fire extension. It is also useful for tearing apart mattresses and upholstered furniture and for shattering heavy glass (including tempered glass) when necessary. The broad end of the axe can be used to pry open hinged doors, to remove paneling and sheathing to expose recesses and voids (avenues of fire travel), or to chock doors open.

C-49. Crew members must be cautious when using axes to force a door or break glass. They should wear gloves and other protective clothing if available. A door should be forced only when necessary. The door

should first be checked to see if it is unlocked. If locked, there may be time to obtain a key (especially if the fire is a minor one and lives are not in danger). Otherwise, if a door must be forced, it must be done without hesitation.

C-50. Inspect axes periodically. They should be sharpened, cleaned, or repaired as necessary. The blade and pike ends should be kept sharp and free of burrs. The handle should be tight in the axe head and free of splits and splinters. An occasional light oiling will keep the head from rusting.

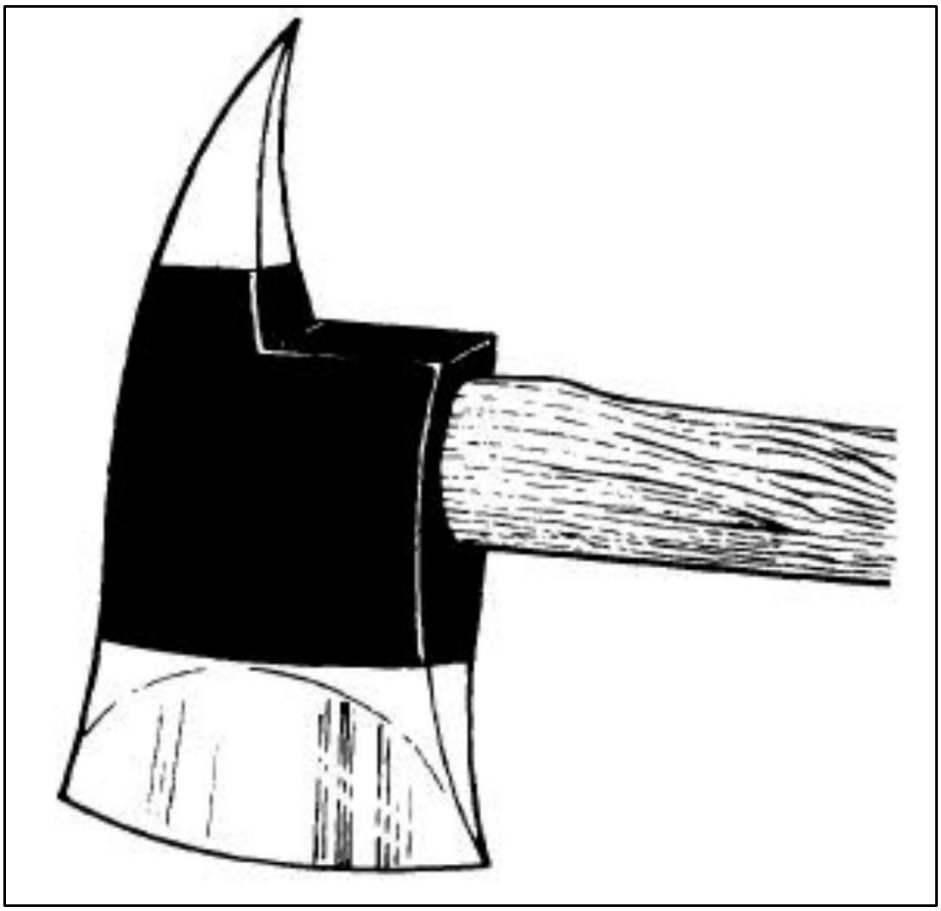

Figure C-8. Pike head fire axe

REPORTING A FIRE

C-51. The crew member who discovers the fire or the indication of fire must sound the alarm promptly.

WARNING

The fire signal is a continuous blast of the ship's whistle for not less than 10 seconds supplemented by the continuous ringing of the general alarm bells for not less than 10 seconds.

C-52. No crew member should ever attempt to fight a fire, however small it may seem, until the alarm has been passed to the bridge.

C-53. The crew member who sounds the alarm must be sure to give the exact location of the fire, what class of fire, and as much information as is available when passing word to the bridge.

C-54. Before a compartment or bulkhead door is opened to check for fire, the door should be examined. Look for the following:

- Discolored or blistered paint indicates fire behind the door or smoke puffing from cracks at the door seal.
- The bulkhead or door should be checked for heat with the back of the hand; touching the door is not necessary to feel the heat.
- Once a hidden fire has been located, the door to the area should not be opened until directed by the on-scene leader. Cool the door with water, if necessary, before opening.
- Always open the door from a position clear of the opening and opposite the hinges.

FIRE DRILLS AND TRAINING

C-55. The best organization and equipment are useless without trained personnel. Properly drilled crewmembers will lessen confusion during fires, increase the probability of proper initial actions taken against a fire, and enhance the predictability of firefighting responses and uses. Vital to the effort, however, is continuity of personnel. That is, people assigned to the firefighting party should retain that position even if other shipboard duties change. All members of a fire party should be cross trained for at least one other position on the fire party in order to provide frequent rotation. Ideally, everyone on the ship should be training to serve on a fire party since they may be needed to fight a major fire.

Note: It is also important to use the drill as an opportunity to test, inspect, and repair all firefighting equipment. Each fire drill should have different locations and techniques from the previous drill. Do not use the same fire hose stations for each drill.

Required Features

C-56. Effective fire drills do not happen automatically. Careless effort will result in useless drills which do not improve the crew's capability or bad drills which train poor habits. Each fire drill should include training elements which touch on all phases of firefighting. One example is training in combating a deep fat fryer fire. These drills will ensure personnel know how and when to secure the fryer and extinguish the fire. As a firefighting party improves, realism can be incorporated. One realistic means of ensuring the crew knows initial reporting procedures is to use red rags and signs to indicate presence and class of a fire. When a crewmember discovers the fire, they must report the simulated fire using proper procedures. Fire drills should incorporate the following:

- Time compression is the most important feature to incorporate. A fire can grow from a tiny flicker to a life-threatening blaze in a few minutes. Every delay in detection, notification, firefighting, and space isolation could cost a life or another burned-out compartment. Drills must be practiced at real-time speed. This creates two important conditions: the urgency of the situation and the inevitable problems with donning personal protection.
- Training in the use of the EEBD should be emphasized. Quickly donning the EEBD should be stressed as a way of saving time and improving the chances of survival when escaping a fire or smoke-filled space.
- The effects of smoke must also be included. These effects include the loss of visibility, loss of staging areas, loss of equipment in lockers which cannot be reached, and the extra confusion caused by all the above.
- Cascading casualties are also common in fires, as a fire spreads or damages vital services. Realistic, effective drills shall include these effects.
- Machinery space fires can grow out of control in seconds. For this reason, abandon the space evacuation drills should be conducted. Such drills should be focused on how to abandon the spaces quickly and safely.

Critiques

C-57. Critiques after every fire drill will help ensure that the maximum learning takes place. They should examine the underlying causes for successful or failed drills. They should include a thorough discussion of the rationale for each decision made on attack points, ventilation, and so on. This is the perfect time to review the results of firefighting equipment performance/accountability and plan any repair or procurement.

FIRE SCENARIOS

C-58. The following discusses special hazards for firefighting in shipboard galley spaces. It also includes some useful techniques for fighting fires in these types of spaces.

C-59. This section is structured to provide a basis for the proper actions and decisions regarding a machinery space fire and will discuss the following:

- Fire prevention.
- Firefighting systems capabilities and limitations.
- Considerations necessary in choosing the correct firefighting equipment.
- Actions necessary both internal and external to the affected space in the case of a major oil leak, a class B fire, and a fire which grows out of control.

C-60. This information is presented in a manner to allow a ship's force to properly identify the phase of a machinery space fire and how best to deal with it. It also defines personnel responsibilities and scenarios that can easily be developed for use in individual machinery space fire doctrine on most ships but will not be applicable in every case. The ship's machinery space fire-fighting doctrine and associated equipment isolation and controls lists shall be readily available in damage control.

Deep Fat Fryer Fire

C-61. Fires in deep fat fryers generally result from overheating of cooking oils and fats. Fires involving cooking oils and fats are class B fires. Most fires occur when personnel fail to remain at the units when operating or failing to properly secure the units after use. Factors contributing to the intensity and spread of the fires include the following:

- Delayed discovery of fire.
- Grease laden ducts and hoods.
- Splashing and overflow of burning fat by solid stream hose lines or portable extinguishers discharged directly onto the fat liquid surface.

C-62. Each galley should be provided with a fixed fire suppression system, a 10-pound extinguisher, and at least one 4-foot, low velocity, water fog applicator. In the event of a fire in the fryer, sound the alarm and actuate the system and ensure that power to the fryer is secured.

C-63. Concurrently, as time and personnel permit and if accessible, close the damper in the galley exhaust by operating the damper control on the grease interceptor hood. A backup method for extinguishing deep fat fryer fires is to use the following procedure, which requires at least three people if the oil has ignited.

C-64. At the first sign of overheating (white smoke), shut off fryer and place cover securely on the fryer. Leave the cover on the fryer for at least 5 minutes. This will allow the hot oil to cool down enough to prevent it from igniting. Perform the following if oil has ignited:

- Sound the alarm, secure power to fryer, and deploy a portable extinguisher to the scene.
- Play out a 1 1/2-inch hose line with a Navy all-purpose nozzle with a 4-foot low velocity fog applicator attached. Apply low velocity fog to the fire while simultaneously discharging the portable fire extinguisher for 3 seconds.
- Look to be sure the fire is out.
- If the oil reignites, again apply extinguisher and low velocity water fog for approximately 3 seconds. THE POWER TO THE FRYER MUST BE OFF TO ALLOW COOLING AND PREVENT REIGINITION.

- Check exhaust ductwork and adjacent compartments for signs of burning and initiate firefighting in these areas if necessary.

Machinery Space Fire Fighting For Class B Fires in Army Vessels

Damage Control/Central Control Station, Pilot-house, and Each Machinery Space

C-65. There can be no substitute for prudent, common sense, on-the-scene decisions which may dictate variations to this guidance. Restricted maneuverability may require departure from this guidance.

Purpose

C-66. The purpose of this doctrine is to provide Army guidance for machinery space class B firefighting procedures. It also clarifies the role that various firefighting systems may play in such a fire. This doctrine delineates the training philosophy and procedures associated with the use and operation of ship systems in combatting machinery space fires.

Flow Charts

C-67. The following flow charts (Figures C-9 through C-15) trace the steps associated with procedures in the doctrine. The flow charts show the preferred sequence of events and are not intended to prevent use of alternatives when appropriate.

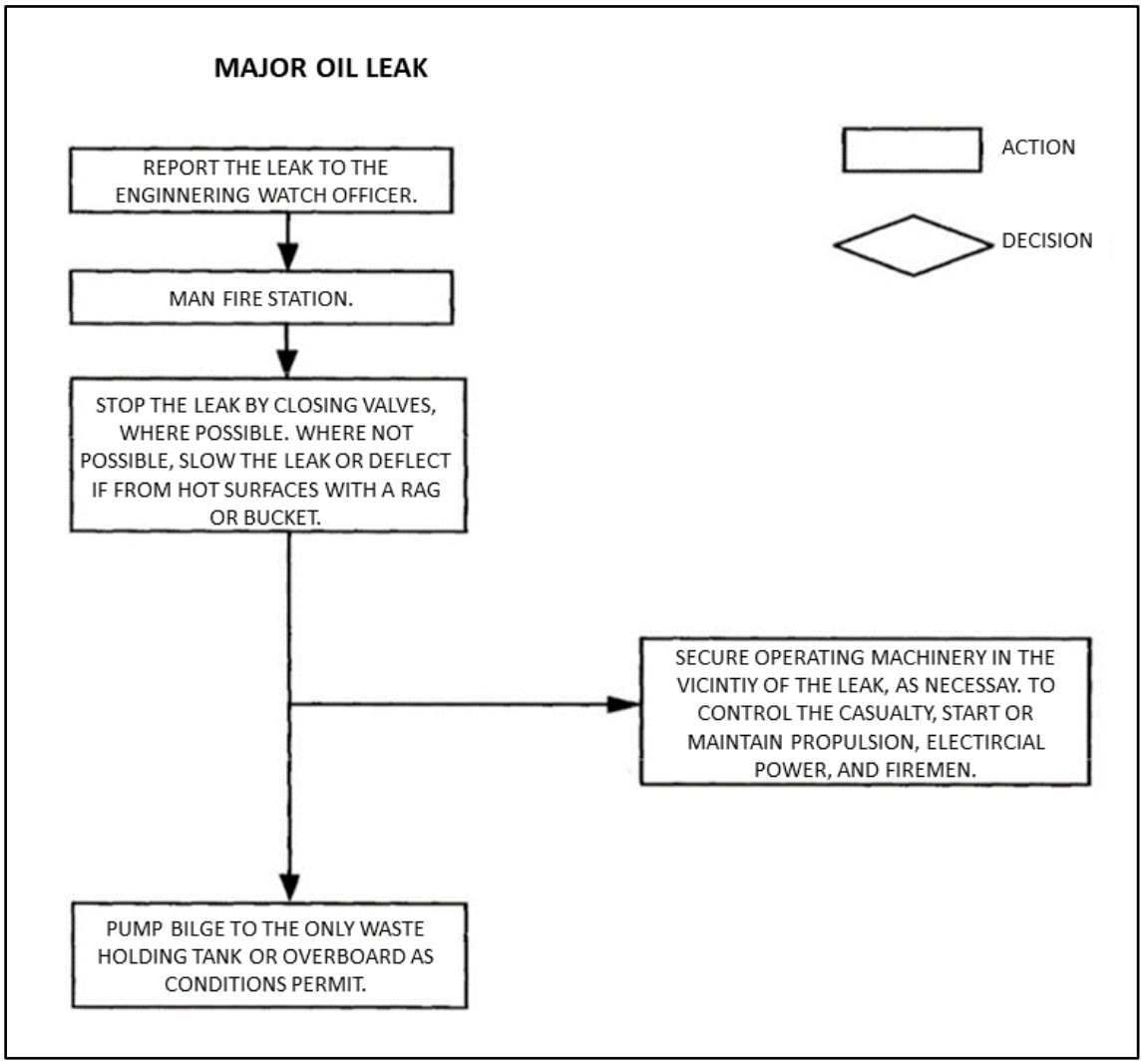

Figure C-9. Procedures in a class bravo fire

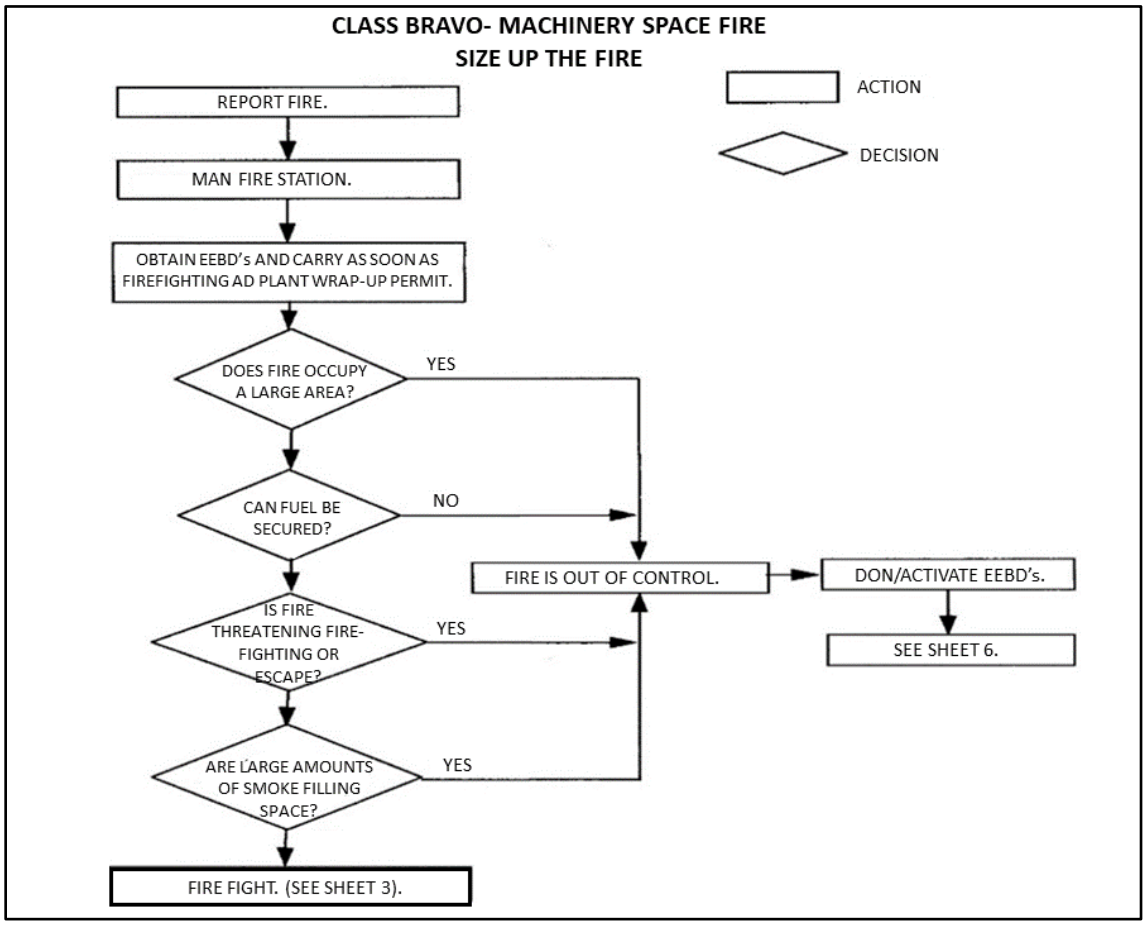

Figure C-10. Procedures in a class bravo fire (size up the fire)

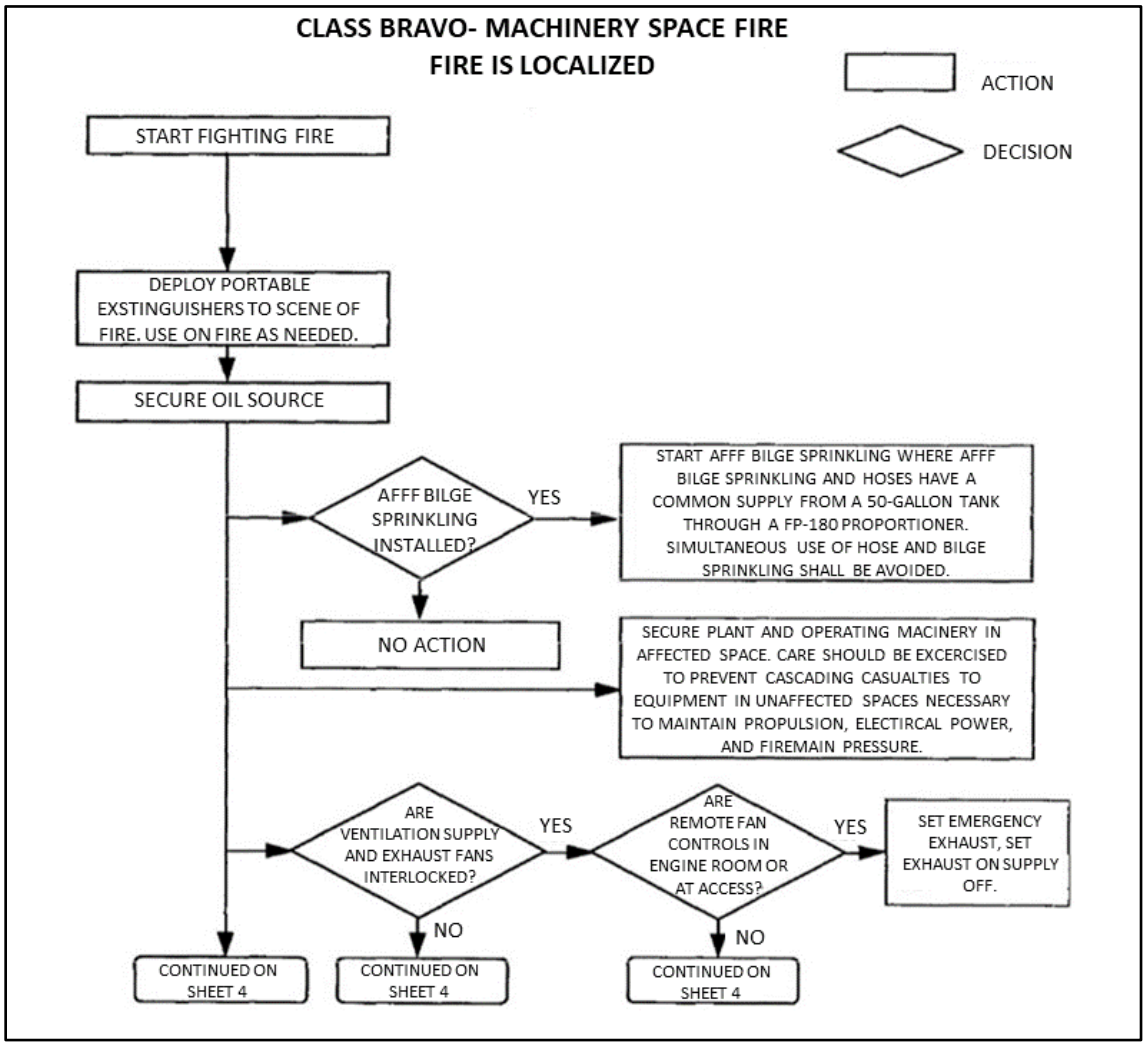

Figure C-11. Procedures in a class bravo fire (fire is localized)

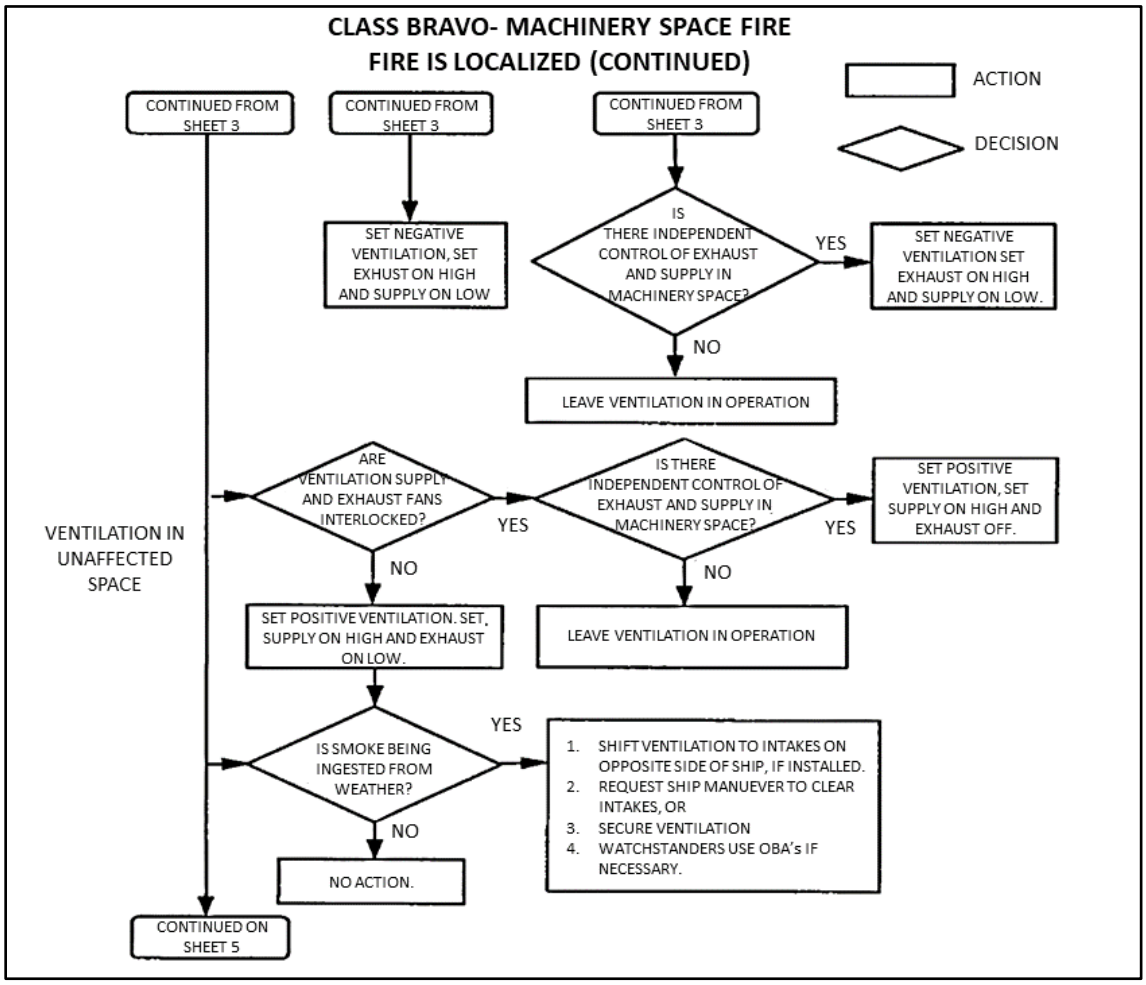

Figure C-11. Procedures in a class bravo fire (fire is localized–continued)

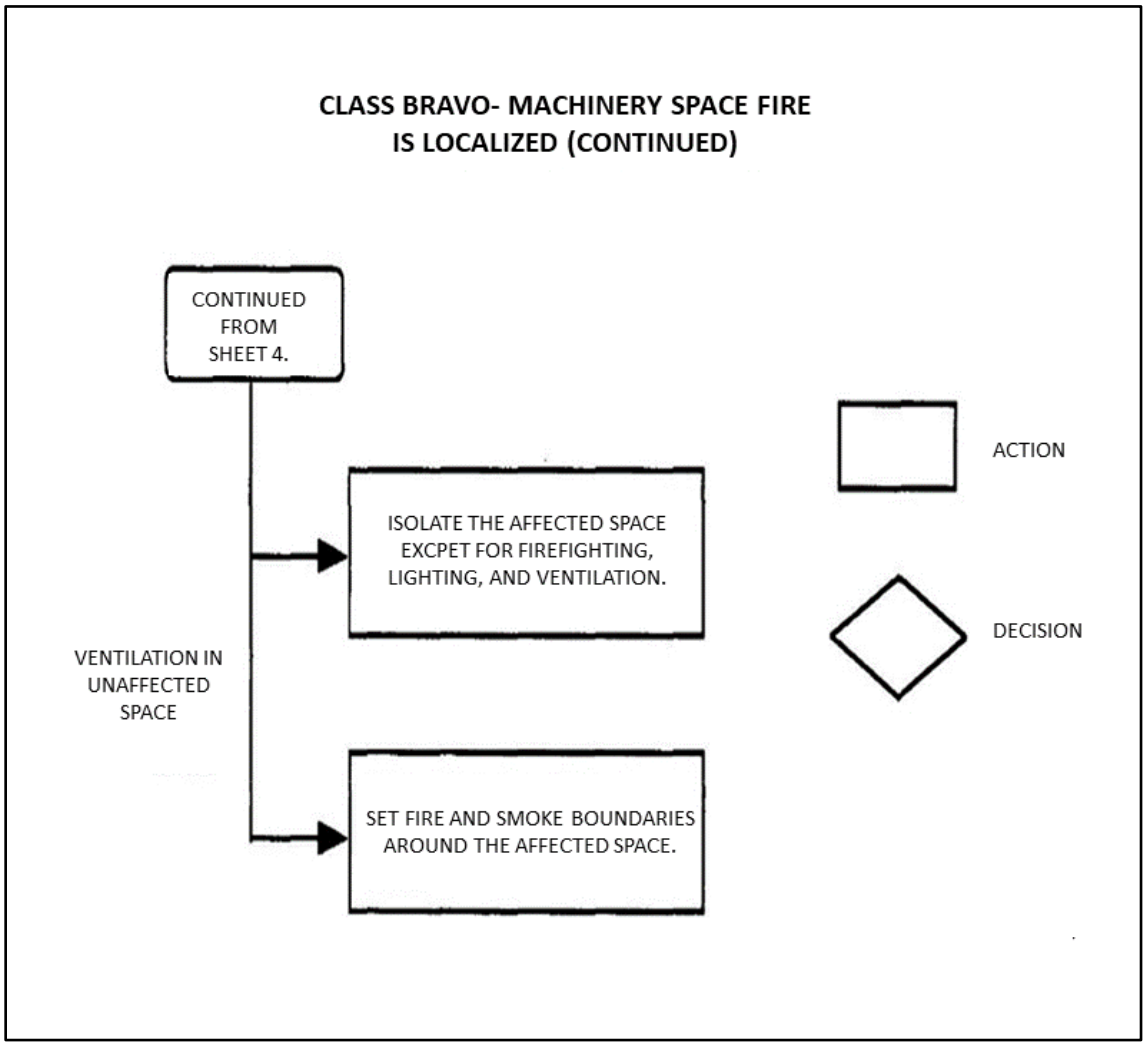

Figure C-11. Procedures in a class bravo fire (fire is localized–continued)

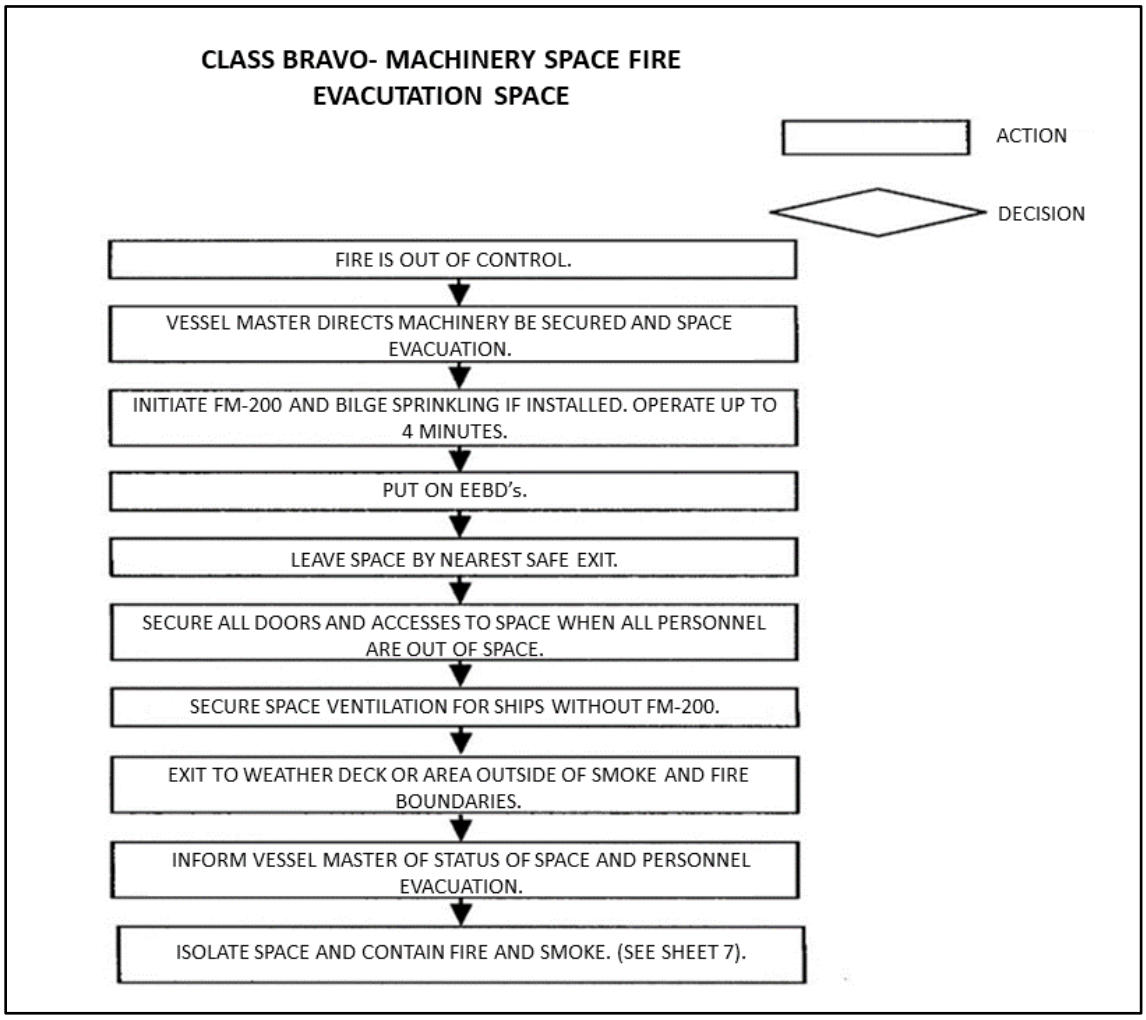

Figure C-12. Procedures in a class bravo fire (evacuate space)

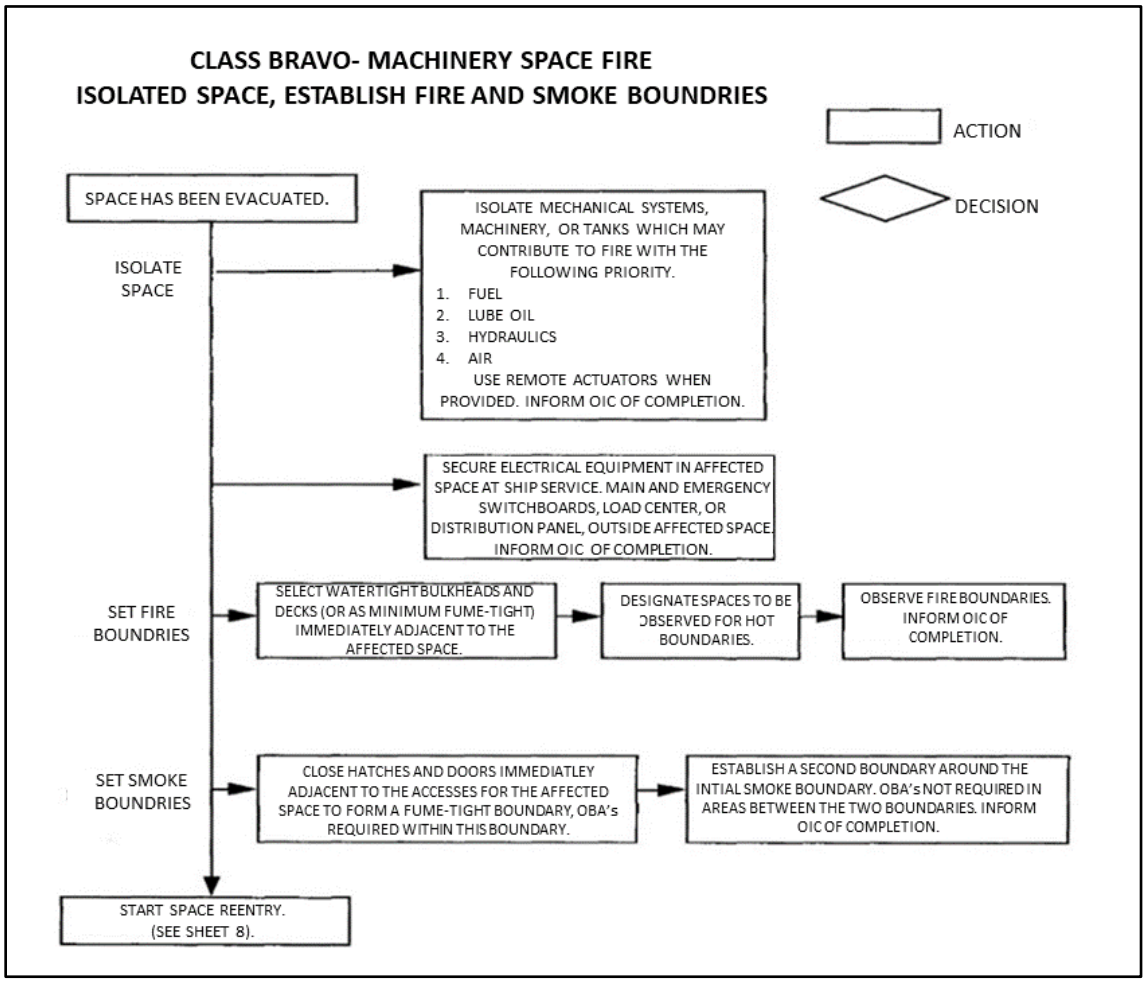

Figure C-13. Procedures in a class bravo fire (isolated space, establish fire and smoke boundaries)

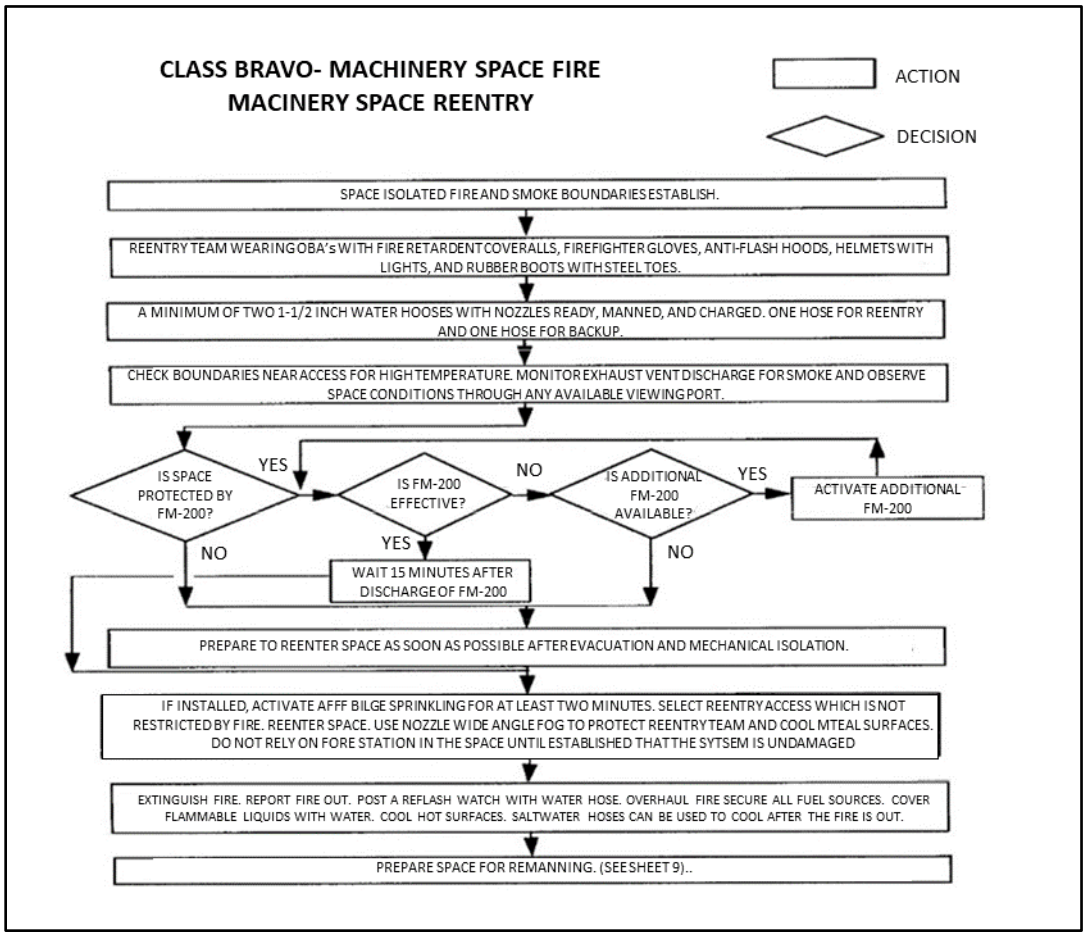

Figure C-14. Procedures in a class bravo fire (machinery space reentry)

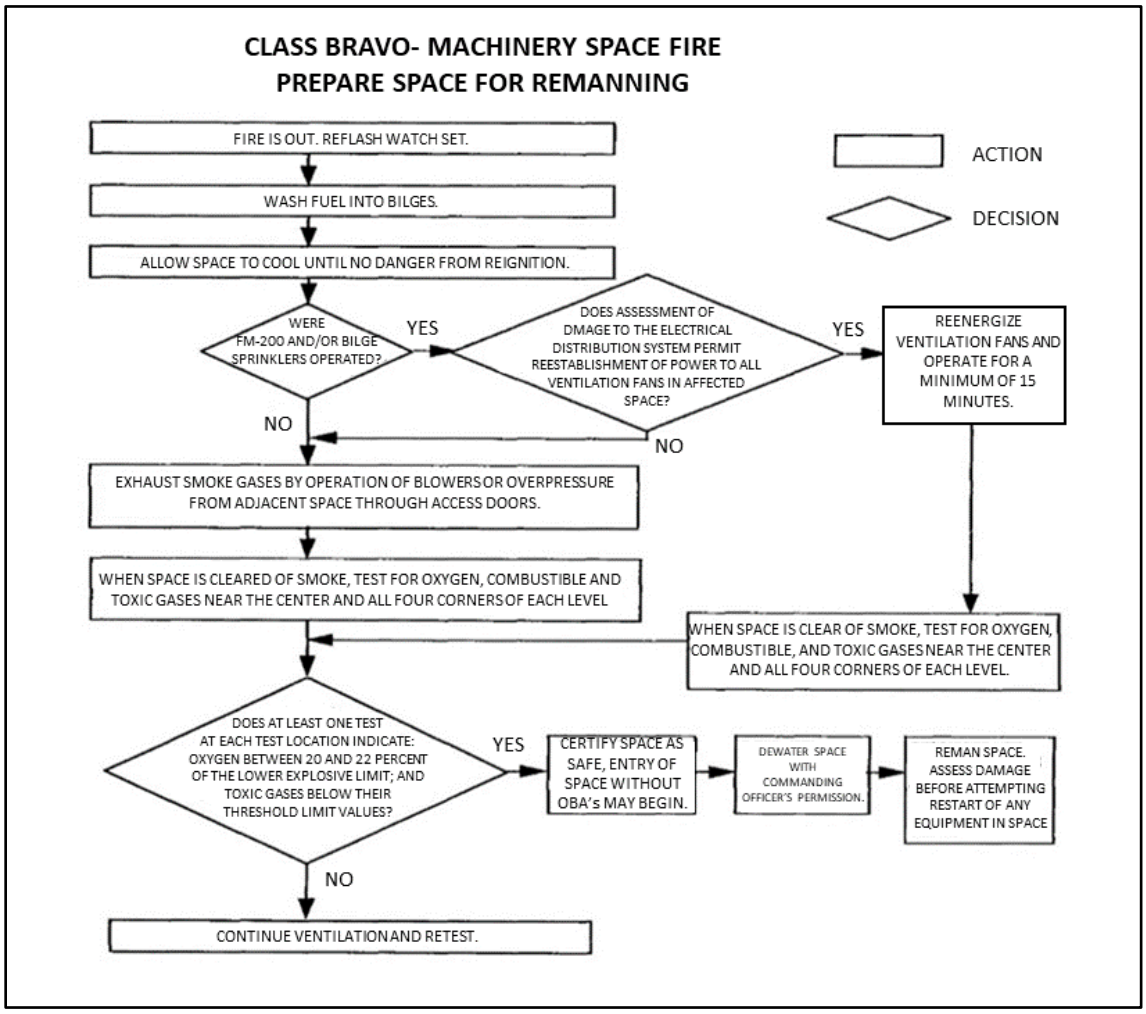

Figure C-15. Procedures in a class bravo fire (prepare space for remanning)

Major Oil Leak Scenario

C-68. Any major flammable liquid leak presents an immediate hazard which should be dealt with quickly to reduce the threat of fire. An oil leak which forms a spray can ignite when it comes in contact with any hot surface or equipment capable of arcing. Rapid securing of the oil source and the use of AFFF to cover liquid surfaces will greatly reduce the risk of fire. The following general guidelines are provided for dealing with a major oil leak:

- Report the leak—Immediately report the leak to the engineer on watch.
- Man the foam proportioning station—Man the machinery space fire stations upon notification of major oil leak in the space.
- Secure the source—Stop the leak as quickly as possible. This can be done locally or remotely by closing system cutout valves or shutdown valves, therefore isolating the leak. Even the application of a rag or bucket can significantly reduce the flow of oil and deflect it away from hot surfaces.
- Apply AFFF—Activate the AFFF hose reel and use AFFF to remove oil accumulation on deck plates or bulkheads and wash oil into the bilge. Water may also be used. Rags that have been used for cleanup shall be placed in a suitable container. Discharge water spray into the bilge to prevent ignition of the oil.
- Concurrent actions—Accomplish the following concurrent actions as time and personnel permit:

- Secure operating machinery as necessary in the vicinity of the leak to control the casualty. Start or maintain equipment in unaffected spaces to maintain propulsion, electrical power, and firemain pressure.
- Remove the oil—Pump bilge to the oily waste holding tank or overboard as conditions permit.

Class Bravo Fire Scenario

C-69. A class B fire can result from any pooled oil and can quickly develop from an oil spray or atomized fuel. The following guidelines are provided for a class B fire.

Report the Fire

C-70. Immediately report the fire to the space supervisor to allow for concurrent actions. When fire or smoke is reported and as soon as firefighting and plant-securing efforts allow, personnel in the space should obtain and carry an EEBD. EEBDs are designed for escape only and shall not be used for firefighting purposes.

Man Foam Proportioning Station

C-71. Man the machinery space fire stations upon notification of a fire in the space.

Size Up the Fire

C-72. Assess the size and location of the fire. If the fire is localized, activate the AFFF hose reel and extinguisher (where installed) and attack the fire by advancing toward it and extinguish the bilge fire at the deck or bilge areas. One AFFF hose reel and portable extinguisher require two people. When within 20 feet of the oil spray or leak, direct as needed to prevent re-ignition. Discharge AFFF to the residual fire on the deck, in the bilge, and over the surrounding area until the fire is extinguished.

Secure the Oil Source

C-73. Stop the leak as quickly as possible. This can be done locally or remotely by closing system cutout valves or shutdown valves, therefore isolating the leak. Even the application of a rag or bucket can significantly reduce the flow of oil and deflect it away from the hot surface.

Concurrent Actions

C-74. Accomplish the following concurrent actions as time and personnel permit:

- Deploy additional portable extinguishers to the scene of the fire.
- Secure the plant and operating machinery in the affected space. Start or maintain equipment in unaffected spaces to maintain propulsion, electrical power, and firemain.
- Set ventilation according to the following:
  - In affected machinery space:
    - Set negative ventilation (exhaust on high and supply on low).
    - On ships with interlocked fans and remote controls with emergency exhaust button, set emergency exhaust on high and supply off.
    - On ships with fans interlocked through a local master switch but with independent control on controllers inside the space, set negative ventilation.
    - On other ships with interlocked fans, the ventilation system shall remain operating.
  - In unaffected machinery spaces:
    - Set positive ventilation (supply on high and exhaust off). Setting positive ventilation is intended to prevent smoke on the damage control deck from entering unaffected spaces.
    - On ships with fans interlocked through a local master switch inside the space but with independent control on controllers, set positive ventilation.
    - On other ships with interlocked fans, the ventilation system shall remain operating.

- If smoke is ingested into adjacent machinery spaces from the weather, shift ventilation supply to intakes on opposite side of ship (if installed) or maneuver the ship to clear the vent intakes or secure ventilation. Watchstanders may require SCBA to prevent premature evacuation of unaffected spaces because of smoke.
- Isolate the affected space with the exception of firefighting equipment, lighting, and ventilation.
- Set fire and smoke boundaries around the affected space to prevent the spread of fire and smoke throughout the ship. The ship may want to set general quarters to facilitate the complete isolation of the affected space and the rapid establishment of fire and smoke boundaries. In setting boundaries, consider the trade-off between impeding personnel egress versus spread of smoke to unaffected spaces.

Out-of-Control Class Bravo Fire Scenario

C-75. A class B fire, especially one that has burned for a period of time or is fed by an unsecurable oil source, can become out of control within seconds. When this happens, operating machinery and the plant should be secured and the space evacuated. The following guidelines are also provided for consideration when faced with an out-of-control fire.

Size of the Fire

C-76. If the fire occupies a large area, is fed by an oil source which cannot be secured, or is threatening firefighting and escape, the space should be evacuated. Even a small fire, if not extinguished rapidly, can generate large volumes of smoke and toxic gases that can force a space to be evacuated.

Evacuation

C-77. Once the decision is made by the officer in charge to evacuate the space, the fixed firefighting system will be activated (if installed) and all personnel should don their EEBD and exit the nearest safe access. To prevent running the system dry, operate the system no longer than 4 minutes. Never operate the system when the concentrate level in the tank sight glass is not visible. Immediate manning of the AFFF proportioner is essential to expedite tank replenishment. Access doors, hatches, and scuttles shall be secured when all personnel are out of the space. At this time, ventilation shall be secured for ships without the fixed firefighting system. The escapees should congregate at a safe, predetermined location outside the space where EEBDs can be removed, and a muster taken. A safe location is outside fire and smoke boundaries or a weather deck. Notify the officer in charge that the following actions were taken:

- Lighting to space has remained on.
- Ventilation to the space has been shut down.
- Fixed firefighting system has been activated, if installed.
- The space is evacuated, and all personnel are accounted for.
- The space supervisor has completed briefing the officer in charge on the location of the fire and plant status.

CONSIDERATIONS NECESSARY IN CHOOSING CORRECT FIREFIGHTING EQUIPMENT

C-78. The proper choice of firefighting equipment should be based on an on-the-scene estimate of the situation. This estimate should be done quickly and should consider the volume of flammable liquid released and its form (atomized or spilled), the area occupied by the flammable liquid (confined or unconfined), the ability to quickly secure the oil source, and how rapidly flame, heat, and smoke are threatening firefighting and escape. The following general guidelines are provided for consideration when selecting the proper class B firefighting equipment.

C-79. Small pool fires (less than 10 square feet). Use readily accessible portable extinguishers or AFFF hose reel. CO2 portable extinguishers will not be used on fires greater than 4 square feet.

C-80. Oil spray fires. An oil spray fire resulting from the ignition of atomized flammable liquids should not be attacked. Loss experience and fire testing have demonstrated that a pressurized release of a flammable liquid can create a fire that is unapproachable. Life threatening conditions created by extreme heat, smoke,

and toxic gases can occur, especially on the upper level, in as little as 60 seconds. The only prudent action under such conditions, time permitting, is to secure the propulsion plant, don EEBDs, and evacuate. Oil spray fires may occur around fuel and lube oil strainers, recently repaired flanges and valves, and flexible line failures. An oil spray fire can grow out of control within seconds. Such fires are commonly fueled by an oil source which cannot be quickly and completely secured, including those fires with a fuel source from an oil tank sounding tube terminating in a machinery space, and will most likely grow out of control thereby requiring space evacuation. Fires which spread to overhead insulation and cables, or which produce sufficient products of combustion (flame, heat, smoke, and gases) can also force space evacuation.

PREVENTION

C-81. The following eight principles shall be enforced to reduce fire hazards:

1. The engineer officer or principal assistant(s) shall make regular and frequent inspections and report conditions to the vessel master
2. Properly stow and protect all combustibles.
3. Test and inspect flammable systems after repairs.
4. Educate all personnel in the reduction of fire hazards and perform frequent fire drills.
5. Enforce fire prevention policies and practices. These are as follows:
    - For main and auxiliary machinery spaces on Army vessels, maintain flange shields on those flammable liquid pipelines for flanged joints (including simplex strainer flanged covers) and flanged valve bonnets in piping containing flammable fluid.
    - Provide spray shields for flammable fluid piping flanged joints and flanged valve bonnets located in the direct plane of an electrical switchboard, electrical equipment enclosure, or motor. Figures C-16 and C-17 show the different ways to install spray shields.
    - Install spray shields to cover the perimeter of the flanged joint with an overlap sufficient to achieve complete enclosure. The side overlap will extend down to cover the bolts and nuts of the bolt circles on either side of the joint. Tightly pull and securely fasten the side drawstring so the bolt circles are overlapped completely. This may or may not bring the shield into contact with the pipe. In cases where flanges are solidly butted against machinery, such as lube oil piping flanges mounted on reduction gear casings, tightly secure the shield to the flange by fitting a metal band or hose clamp arrangement around the shield, over the perimeter of the flanged joint. Pull the wire drawstring tight as noted.

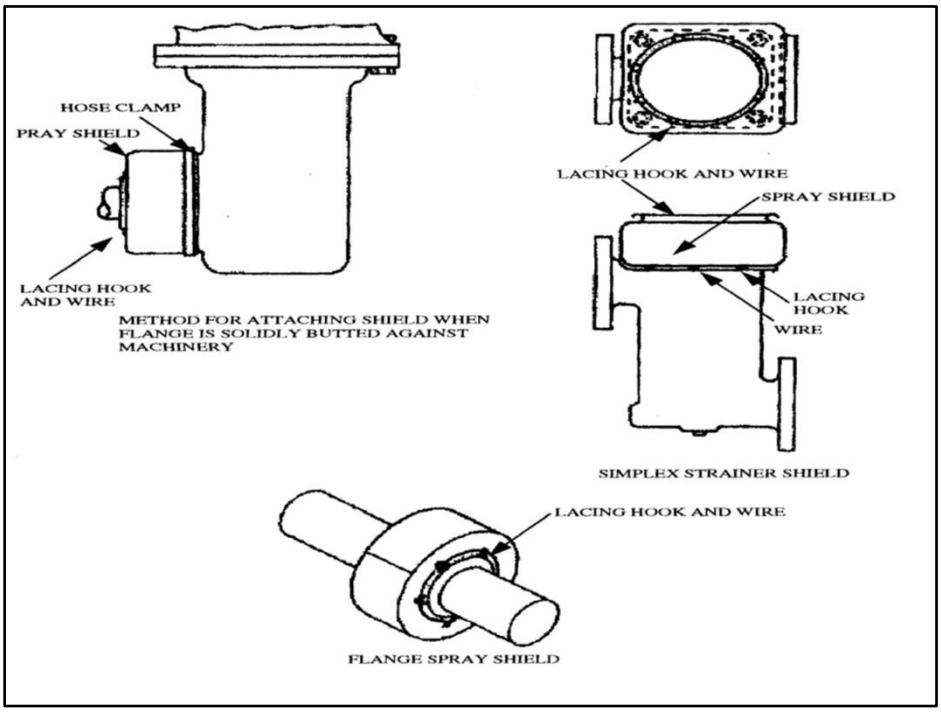

Figure C-16. Flange spray shield

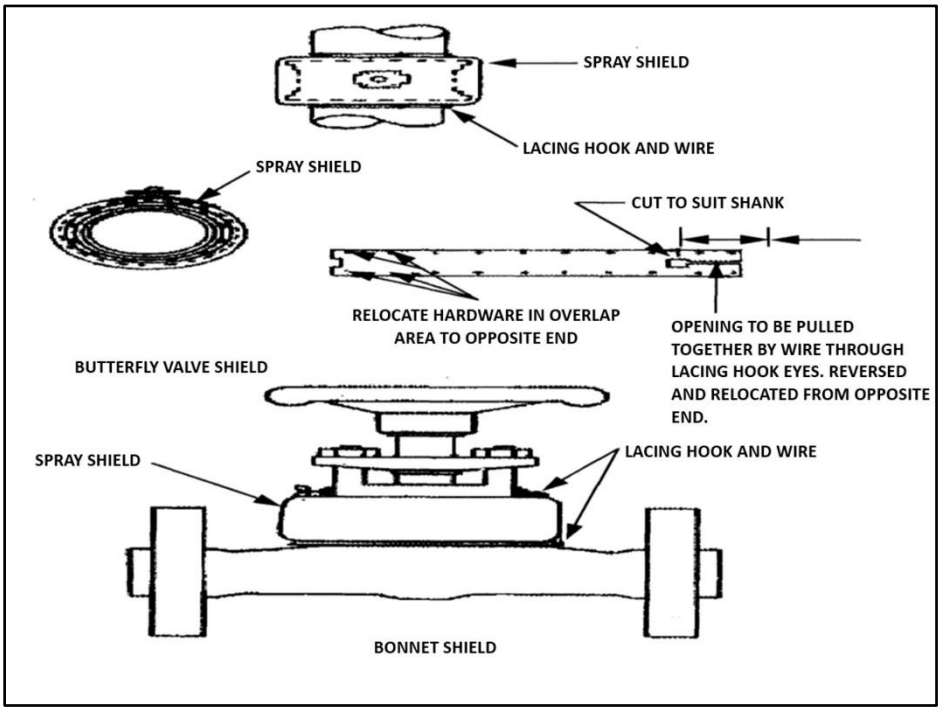

Figure C-17. Bonnet shield

- Inspect spray shields quarterly to ensure that they are tightly secured and that they are not damaged to the point where they are unable to contain oil spray. Take care to protect shields from abrasion or tearing. Shields do not require painting—avoid such practice. However, do not replace shields already painted on that basis alone.

- Spray shields are NOT required for the following:
  - Piping not subject to pump discharge pressures. For example, lube oil storage tank gravity fill lines and pump suction piping that cannot be pressurized through across connection with or as part of the operation of another system.
  - Piping located in voids of cofferdams.
  - Bilge pump discharge piping, except where the pump is part of a tank stripping system.
  - Tank sounding tubes, air escapes, vents, and overflows.
  - Gauge line piping downstream of a root valve, except for flanged connections.
  - Joint located within metal shielding enclosures for duplex strainers.
  - Piping on weatherdeck.
  - Piping below deck plates.
  - Union and union-type fittings.
- Maintain proper covers on flammable liquid strainers and keep sounding tube caps in place and isolation valves closed. Ensure all flammable liquid sounding tubes terminating in machinery spaces are properly equipped with ball check valves, isolation valves, and sounding tube caps.
- Immediately stop oil leaks and repair.
- Wipe up spilled or leaked oil.
- Keep ventilation ducts free of oil residue.
- Keep bilges free of oil and trash.
- Prevent stockpiling of excess or unauthorized flammables.
- Ensure uptake spaces are not used as storerooms for combustible materials.

6. Properly maintain all firefighting equipment.
7. Operate and maintain systems and equipment according to authorized procedures.
8. Properly maintain all machinery space damage control closures and fittings.

C-82. In some instances, there may be an obstruction between the fire and the nozzleman. Then the stream can be bounced off a bulkhead or the overhead to get around the obstacle. This method can also be used to break a solid stream into a spray type stream, which will absorb more heat. It is useful in cooling an extremely hot passageway that is keeping fire fighters from advancing toward the fire. A combination fog-solid nozzle could be opened to the fog position to achieve the same results.

FIREFIGHTING SYSTEMS CAPABILITIES AND LIMITATIONS

C-83. All ships are provided with one or more of the firefighting systems or equipment as described in the following paragraphs. Each has capabilities and limitations which shall be known and understood by firefighting personnel to ensure quick and proper selection of equipment. Fixed gaseous firefighting systems are the primary firefighting agent for extinguishing class B fires in machinery spaces except for those cases where the fire can be extinguished by handheld equipment.

Fire Pumps (Fire Main System)

C-84. Centrifugal fire pumps are installed for seawater supply to the fire main system. The fire main system will be kept intact so that water is available for cooling and the production of AFFF. Water is useful for cooling hot bulkheads in those spaces adjacent to the fire and extinguishing ordinary combustible (class A) fires. When a hose line attack is needed to extinguish a flammable liquid fire and AFFF is not available, high velocity water fog may be used. However, time to fight the fire will be longer, more firefighters will be needed, increased fire damage can be expected, and a greater risk of re-flash will be present.

Aqueous Film Forming Foam

C-85. AFFF concentrate, when mixed with water, creates foam for application to surfaces. AFFF has a shelf life of 25 years when the storage container is not opened and exposed to contamination. It can be applied by a separate fire plug and hose with portable foam proportioned (inline eductor). It is effective on bilge fires to

smother burning liquids, prevent large scale re-flash, and for use during space reentry. When a hose line attack is made to extinguish a flammable liquid fire, AFFF shall be used unless expended or out of commission. In this event, use of water fog is acceptable.

Required Capabilities

C-86. The following is required of all systems:

- All systems are capable of total fire extinguishment and provide 15 minutes of re-flash protection.
- The systems will be designed to be acceptable for marine use, compatible with existing ships systems and working environments. The normal operating temperature range of the spaces protected will vary from 32 to 130 degrees F.
- All systems will be equipped with time delays and pre-discharged alarms based on personnel evacuation time or to prepare the hazard area for discharge. Also, time delays will have the capability to be manually bypassed (EXCEPTION: time delays are not required for flammable liquid storage).
- All systems will be manually activated. Actuation will be accomplished by either mechanical or pneumatic means. Electrical actuation will not be allowed. Also, for those cylinders located within the space protected, automatic activation by a heat actuator will be provided.
- Natural and forced ventilation to the protected spaces will be secured prior to system activation. Automatic shutdown of powered ventilation and procedures for securing of natural ventilation prior to system activation will be required.
- All internal combustion engines located in protected spaces which draw intake air from within the protected spaces will be equipped with shutdown devices which are automatically actuated in the event of the fire extinguishing system activation. All internal combustion engines located in protected spaces which draw intake air from outside the protected spaces will be equipped with shutdown devices which are manually actuated in the event of the fire extinguishing system activation.
- All agent storage cylinders will be securely supported and rigidly fastened and be equipped with pressure gauges and magnetic liquid level indicators.
- System designs will be based on watercraft being fully operational, as opposed to cold iron. Maintenance and training requirements will include winterization, lay-up, and reactivation procedures.
- System installation will permit normal operations required in walking and working areas without undue interferences; clear headroom of 6 feet 3 inches is required in all walking and working spaces.

System Details

C-87. Design concentration, total flooding quantity, and discharge rate for fire extinguishing agent are based on the minimum amount of agent concentration supplied by each system for fire extinguishment and on cup burner extinguishment concentration plus a 40 percent safety factor at 20 degrees Celsius (68 degrees Fahrenheit). In no case will the design concentration exceed the lowest observed adverse effect level of 10.5 percent at the highest ambient temperature expected in the hazard areas at 54 degrees Celsius (130 degrees Fahrenheit).

C-88. The total flooding quantity required will be calculated IAW NFPA 2001, Section 3-5.

FIREFIGHTING SYSTEMS SPECIFIC TO ARMY WATERCRAFT

C-89. The following sections provides information on firefighting systems that are specific to Army watercraft.

Alarms

C-90. Alarms are used to alert and warn personnel to the dangers of a fire. There are three types of alarms used on Army watercraft: audible, visual, and time delay.

Audible Alarms

C-91. All protected spaces will be equipped with pre-discharge alarms (audible and visual). The alarms will be conspicuously marked. The audible alarm will sound for the required duration prior to release of the agent into the space. The audible alarm will be sirens powered only by the agent released. Also install an electric alarm bell outside each protected space. The bell will be activated by means of a pressure switch actuated by the release of agent. This alarm bell will sound continuously until manually reset. The alarm bells will be powered by the watercraft's emergency power source. This is to warn the ship's personnel that the system has been deployed. For engine room spaces, the sirens must be audible above the sounds of operating machinery and be audible in the control room (where applicable), as well as in the machinery space.

Visual

C-92. All protected spaces will be equipped with visual alarms. The visual alarms will be an amber strobe light activated by means of a pressure switch actuated by the release of agent. Multiple spaces protected within a compartment will require a strobe light for each space. Lights will be powered by the watercraft's emergency power source. Paint lockers are not required to have visual alarms.

Time Delays

C-93. All systems will be fitted with an approved time delay so that the alarms will operate before the agent is released into the space. Also, time delays will have the capability to be manually by-passed. Paint lockers are not required to have time delays. Time delay bottles contain CO2 gas when released, the amount of CO2 that is released is sufficient enough to cause unconsciousness and death to all individuals within the space.

Controls and Valves

C-94. Where necessary, excessively tight compartments such as small paint lockers will be provided with suitable means for relieving excessive pressure accumulating within the compartment when the agent is released and allowing for proper agent progressive mixing within the protected space atmosphere. Controls and valves for operation of the system will not be located in any space that might be cut off due to a fire in any space protected (exception: paint lockers). Some suitable means are as follows:

- Manual and automatic actuation control stations.
- Remote and automatic shutdown devices.
- Audible and visual activation alarms.

C-95. Two independent manual actuation control stations are to be provided, one of them being positioned at the cylinder storage location and the other in a readily accessible position as convenient as practical to the main escape from the space. Also, for standardization, provide a third remote manual actuation station outside on the main deck for the main propulsion engine rooms as presently located on the majority of watercraft. These actuations control stations will be mounted in one corrosion-resistant watertight enclosure capable of withstanding heavy sea conditions and will be quick-acting to open. Placard directions will be mounted on the inside cover.

C-96. Systems will be actuated from the actuation stations by two control levers. One control lever operates the stop valve to the space and the other control lever is a separate control that releases the agent. These controls will be in individual pull boxes clearly identified for the particular space. Actuation stations will be conspicuously mounted to facilitate operation in an emergency. Actuation stations will be standardized (same manufacturers) throughout the fleet (exception: paint lockers will be actuated by one control level releasing the agent (break glass, pull lever).

C-97. All systems will be manually controlled. For systems where the cylinders are stored within the protected space, the system will be fitted with an automatic heat actuator device. This device, in the event of an undetected fire in the protected space, will allow the system to safely release the contents of the cylinders into the protected space. These spaces will also have two independent manual-operated releases as previously specified.

PERSONNEL PROTECTION AND FIREFIGHTING EQUIPMENT

C-98. The proper use of personnel protection and firefighting equipment is required to reduce the risk of injury and facilitate extinguishing the fire. Some general considerations for those individuals who enter the space include the following:

- SCBA, with voice amplifier if on ship's allowance list, should be worn by all personnel within buffer zone or when entering the affected space until the atmosphere is declared safe. When smoke is present, breathing apparatus activation should be ordered and reported to the officer in charge.
- Clothing. FFE shall be appropriately pre-positioned to be readily available to fire party personnel when the fire party is called away. Personnel required to wear the FFE are the scene leader, nozzle men, and hose men. Support personnel such as phone talkers, plug men, electricians, and medical personnel outside the fire boundary shall wear duty uniforms, anti-flash hoods, and gloves.
- Hoses. As a minimum, a single attack 1 1/2-inch saltwater hose shall be used by the reentry team. The hose and nozzle provide added protection for the nozzle-man and hose tenders. Before the single attack hose enters the space, a second backup attack saltwater hose should be manned and charged to render assistance. When assigned by the scene leader, each hose team will be led by an attack team leader. Sufficient distance shall be maintained between the first and second hoses to prevent maneuverability and firefighting progress from being impaired. Reentering the space may be a lengthy and awkward process; saltwater hoses should therefore be used to cool access doors, hatches, and scuttles. Saltwater hoses should not enter the space where they will impair the effectiveness of the AFFF hose teams. To conserve AFFF, hoses equipped with inline eductors can discharge saltwater if pickup tubes are removed from AFFF 5-gallon cans. The eductor will continue to function with reinsertion of the pickup tube into the AFFF containers.

Clothing/Firefighter Ensemble

WARNING

The ensemble does not offer protection against chemical, biological, or radiological effects. The firefighter ensemble is intended to protect the firefighter from flame (flash) exposure, heat, and falling debris.

C-99. The FFE consists of the following:

- Firefighter's coveralls.
- Anti-flash hood.
- Anti-flash gloves.
- Damage control/firefighter's helmet.
- Firefighter's gloves.
- Firemen's boots.
- Stowage bag.
- Flashlight, explosion proof.
- SCBA.

Note: The NFPA recommends that all firefighting suits be replaced after ten years.

Firefighter's Coverall

C-100. The firefighter's coverall design is a one piece, jump suit style (see Figure C-18). The coverall has a tough outer shell, a vapor barrier, and an inner fire-retardant thermal liner. The knees, bottoms of the thigh pockets, and bottoms of the legs are reinforced with leather padding for extra protection. As an additional

safety feature, the coverall has reflective markings around the upper arms, lower legs, and torso to highlight the outline of the firefighter so they can be seen in dense smoke or dim light. The front closure and inside lower legs have brass zippers. There are bellow pockets with hook-and-loop closures on the outside of each thigh and on the front of the upper left arm. The coveralls have a corduroy-faced collar with snap fasteners. The sleeves have an integral knit wristlet for wrist protection and small loops (thumb holes) on the ends of the sleeve wristlets to insert your thumbs to anchor and keep the sleeve from riding up the arm. The coveralls are available in five sizes (small through extra-large-tall).

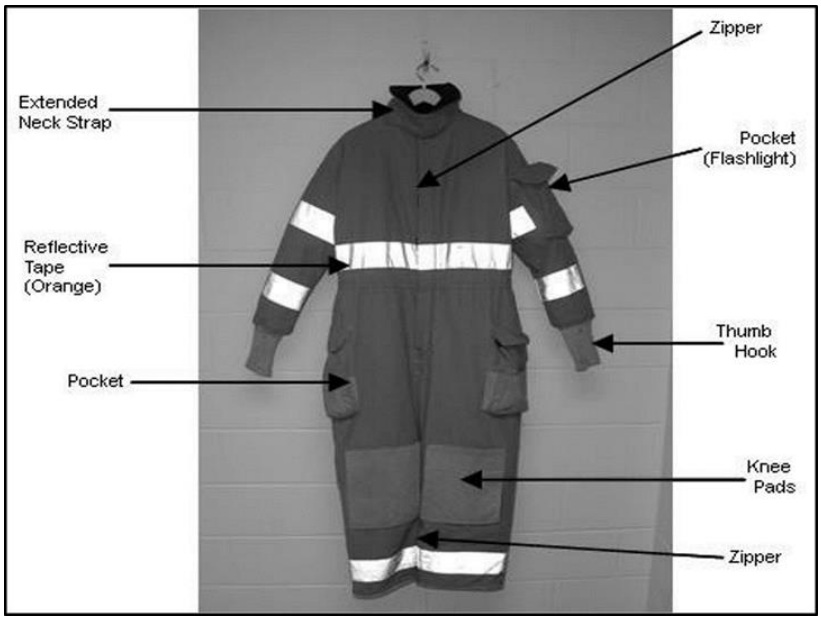

Figure C-18. Firefighter's coverall

C-101. These professional cleaning and repair facilities are authorized to restore the coverall to its original protective effectiveness. All repairs performed by these facilities meet U.S. Navy manufacturer's guidelines and national (NFPA) standards. The facilities offer free garment inspection/evaluation and repair costing to the Navy. The facilities are as follows:

National Safety Clean, Inc.

225 Birch Street
Kennett Square, PA 19348
610-444-1700
Fax: 610-444-0135
800-253-2690
Email: sales@natsafe.com
www.natsafe.com

8484 Gulf Freeway
Houston, TX 77017
713-644-7400
Fax: 713-644-8848

SeaWestern Fire Apparatus and Equipment

12815 N.E. 124th Street, Suite H
Kirkland, WA 98034
800-327-5312
425-821-5858
Fax: 425-823-0636
Email: info@seawestern.com
www.seawestern.com

Gloves Inc.

1950 Collins Blvd.
Austell, GA 30106
800-476-4568
770-944-9186
Fax 770-944-0012
http://glovesinc.com.

Firefighter's Anti-Flash Hood

C-102. The firefighter's anti-flash hood in Figure C-19 provides protection to the head, neck, and face (except the eyes). The hood can be worn with the SCBA. It has an elastic face closure and is available in a single size which fits all users. The face portion can be pulled up over the nose for additional protection of the face.

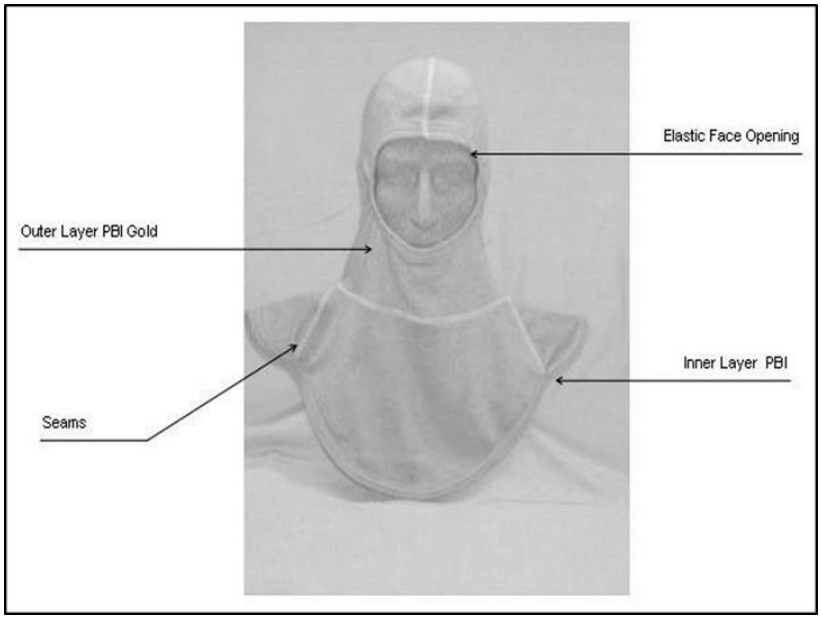

Figure C-19. Fire fighter's anti-flash hood

Anti-Flash Gloves

C-103. Anti-flash gloves are depicted in Figure C-20. The use of the gloves is to protect personnel from elevated air temperatures resulting in burns caused by fire. The gloves are made from fire retardant cotton and one size fits all.

Figure C-20. Anti-flash gloves

Damage Control/Firefighter's Helmet

C-104. The helmet (Figure C-21) is designed to protect the head, neck, and face from flame (flash) exposure, heat, and falling objects. The helmet shell material is heat resistant fiberglass and is provided with a face shield, chin strap, adjustable suspension, reflective markings, and a liner that covers the side of the head and neck.

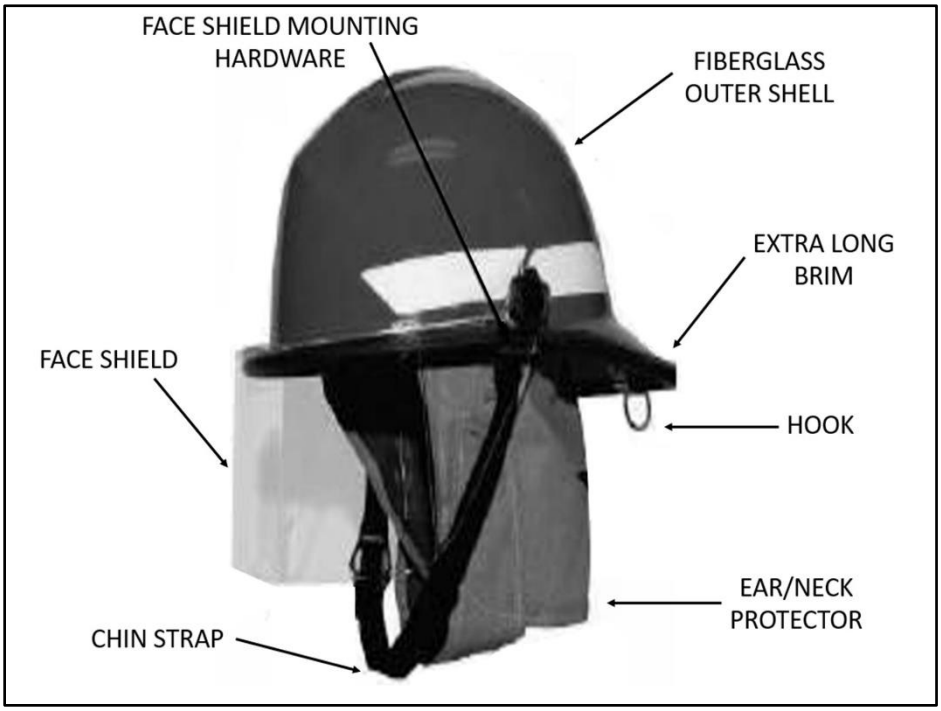

Figure C-21. Damage control/firefighter's helmet

CAUTION

Do not modify the helmet in any manner, including removing the face shield and drilling holes to attach a light. Modification will reduce the protection provided by the helmet.

Firefighter's Gloves

C-105. Firefighter's gloves (Figure C-22 on page C-36) protect against abrasions, short duration flame (flash) exposure, and heat. The five-finger cut, gauntlet gloves are fabricated from leather and have a waterproof vapor barrier and fire-retardant liner. The gauntlet provides wrist protection. The gloves are available in five sizes (extra-small through extra-large).

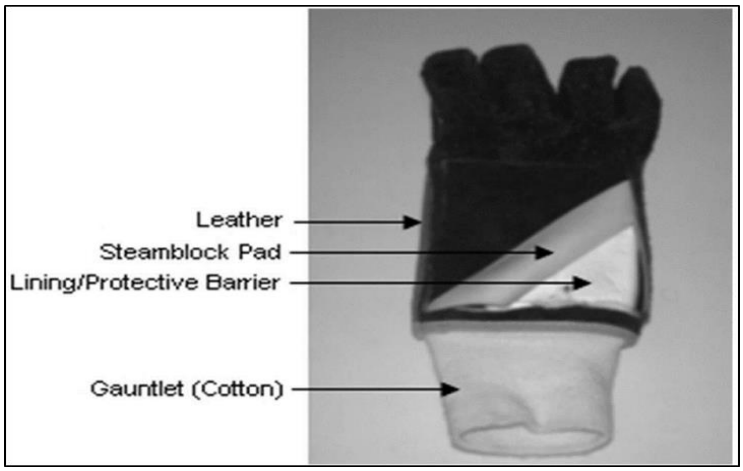

Figure C-22. Firefighter's gloves

Firefighters' Boots

C-106. These rubber boots (Figure C-23) have steel safety toes and puncture-proof steel insoles. Fireman's boots are available in two models, knee high and hip length. The U.S. Army is currently using the knee-high version. Knee-high boots are worn inside the coveralls and are available in sizes 5 through 15.

Figure C-23. Firefighter's boots

Donning and Adjusting

C-107. An integral part of the FFE is the type A-4 SCBA. The following steps will instruct the user on how to don and adjust the FFE including the SCBA:

- The SCBA is stowed with an anti-flash hood protecting the face piece lens. Remove the anti-flash hood from the SCBA face piece lens ring and put the hood over the face.

- Keep pants and shirts on. Remove shoes or boots and remove anything else that will interfere with donning the coverall, such as items in pockets.
- Put on the coveralls and pull them up and over the shoulders.
- Insert thumbs through the small loops on the ends of the sleeve wristlets to anchor and keep the sleeves over the wrists and under the gloves.
- Step into the fireman's boots. Never put on the boots before putting on the coveralls.
- Secure the two zippers on the bottom of the coverall legs.
- Stand up the coverall collar and ensure the anti-flash hood is fully inside the collar and down the chest as far as possible.
- Close the coverall front body zipper and the two collar snaps.
- Don the SCBA. Do not secure the face piece.
- Pull the anti-flash hood face opening down around the neck.
- Put on the SCBA face piece, tighten straps, and check for face piece straps, with the elastic opening over the face. Secure the hook-and-loop-closure on the coverall collar.
- Put the helmet on, secure helmet liner flap hook-and-loop fastener and fasten the chin strap.
- Loosen face shield fasteners on the sides of the helmet brim and rotate the face shield over the SCBA face piece to protect the breathing apparatus from debris and water.
- Remove the gloves from the leg pockets and put them on. Ensure they cover the coverall wristlets.

Note: Keep the SCBA breathing tubes outside the coverall and the flap of the helmet liner.

Removal of Gear

C-108. To take off the gear, reverse the donning order. Remove the gloves, pull up the helmet face shield, loosen the helmet liner flap hook-and-loop-fastener, take the helmet off, and open the coverall collar closure. Pull the anti-flash hood down around the neck and take off the SCBA face piece. Take off the SCBA, pull off the anti-flash hood, step out of the boots, and remove the coveralls.

Stowage

C-109. The FFE should be stowed in the ensemble kit bag. The ensemble shall be preassembled, and the bags located in, or near, damage control lockers so that they are easily accessible. Before stowing, ensure the ensemble is clean and dry. Stow the anti-flash hood over the face piece of the SCBA.

WARNING

DO NOT stow firefighter's protective clothing, SCBA, and SCBA cylinders inside the vessel's super structure or engine room.

HOSES

C-110. This section contains inspection and maintenance information about fire hose and fire hose nozzles used aboard Army watercraft. Fire hoses and nozzles will be of national hose thread specifications that shall be serviceable and connected to all fire stations. Fire hoses and nozzles will be maintained IAW this section.

Visual Inspection

C-111. Visual inspections will be made on fire hoses, nozzles, and hose couplings. The following describes the inspection of each of these items.

Fire Hose

C-112. Inspect each fire hose during weekly fire drills to determine that the hoses and nozzles are serviceable. Check to make sure that the fire hoses are free of debris. Inspect hose to ensure there is no evidence of mildew or rot, or damage by chemicals, burns, cuts, abrasions, and vermin. If the hose fails the visual inspection, it must be removed from service, destroyed, and replaced.

Nozzles

C-113. All nozzles will be inspected at weekly fire drills and after each use. Inspection will include the following:

- Clear of obstructions in waterway.
- No damage to tip.
- Full operation of adjustments to appropriate spray patterns such as flat spray, hollow cone, or full cone patterns.
- Proper operation of shutoff valve.
- No parts missing.

Note: If the nozzle fails the inspection for any reason, it must be removed from service and repaired or replaced. Nozzles attached to in-service fire hoses will be kept in the closed position. If during use there is an obstruction that cannot be removed by flushing the nozzle, disconnect the nozzle from the hose and remove the obstruction through the hose connection end. Attempting to force the obstruction out through the tip may damage the nozzle. Handle nozzles with care. Avoid dents or nicks in nozzle tips, as this may seriously affect the reach of the stream. Nozzle control valves will be opened and closed slowly to reduce pressure surges. This would eliminate unnecessary strain on the hose and couplings. After use, all nozzles will be flushed and inspected before being placed back in service.

C-114. Depending on the position of its handle, the combination nozzle will produce a straight stream or high-velocity fog stream.

C-115. Combination nozzles are available for use with 1 1/2 and 2 1/2-inch hoses. Reducers can be used to attach a 1 1/2-inch nozzle to a 2 1/2-inch hose.

C-116. Create a straight stream by pulling the nozzle handle all the way back toward the operator. Create a fog stream by pulling the handle back halfway where the handle is perpendicular to the plane of the nozzle. Shut down the nozzle from any opened position by pushing the handle forward as far as it will go.

HOSE COUPLINGS

C-117. Couplings will be kept in serviceable condition. Visually inspect after use and during each pressure test of the hose for the following:

- Damaged threads.
- Corrosion.
- Slippage on the hose.
- Out-of-round.
- Swivel (not rotating freely).
- Missing lugs.
- Other defects that impair operation.
- Gasket for presence, tight fit, and deterioration.

Note: Couplings found defective will be removed from service and replaced. Do not drop couplings on steel deck or other hard surfaces. Doing this can cause damage to the threads. Do not allow vehicles to drive over couplings. Aluminum hose connections are not allowed. Per Title 46, Chapter 1, Part 95; "connections shall be brass, bronze, or other equivalent metal."

HOSE AND COUPLING PRESSURE TEST PROCEDURE

C-118. Fire hose and couplings will be tested annually to the maximum pressure they may be subjected in service, but not less than 100 psi. Pressure tests may be performed by vessel's crew. Any length of hose that fails the visual inspection or service test will be removed from service and destroyed.

C-119. The following pressure test procedures will be followed:

- Total length of test hose line will not exceed 300 feet. The hose line shall be straight without kinks or twists.

WARNING

Questionable hose or hoses that have been repaired or re-coupled will be tested one length at a time.

- Connect the test hose line to a fire station valve. This valve must be manned during the test to prevent discharging a large volume of water in the event of a hose bursting during the test.
- Attach a nozzle to the far end of the hose line.
- With the fire station valve open and the end nozzle open, gradually increase the pressure to approximately 45 psi.
- Slowly close the end nozzle when the hose line is free of air and full of water.
- Close the fire station valve.
- Secure the hose line to avoid possible whipping or other uncontrolled reaction in the event of a hose burst.

WARNING

Clear all personnel from the area except those required to perform the remainder of the test procedure.

- Check hose line for leakage at the couplings. Tighten couplings with a spanner wrench where necessary.
- Mark each hose at the back of each coupling with a felt tip marker to determine if the coupling moves on the hose during the test.
- Slowly increase the pressure to test pressure (not less than 100 psi) and hold for five minutes.
- Inspect for leaks, bubbles, and separation from ends while the hose line is at the test pressure.

WARNING

Personnel shall never stand in front of the free end of the hose, within 15 feet to the side of the hose, or straddle a hose during the pressure test.

- If a section of the hose is leaking or bursts, terminate the test. Drain the hose line and remove and destroy the failed hose.

- After the five-minute pressure test, shut down the pump, open the end nozzle to relieve the pressure, and drain the hose line.
- Observe the marks placed on the hose at the back of the couplings. If the coupling has slipped or twisted, the hose has failed the test. Remove and destroy the failed hose.
- Enter the test results in the ship's log.
- All hoses shall be cleaned, drained, and dried before being placed in service or storage.

DESMOKING AND ATMOSPHERIC TESTING

C-120. Once a fire is extinguished, specific actions must be taken to return the compartment or space damaged by the fire to a condition suitable for remaining. These actions include the following: desmoking, atmospheric testing, dewatering, and a thorough follow-up inspection.

Desmoking

C-121. Active desmoking is the process of removing smoke and heat from the buffer zone prior to extinguishing a fire. This action aids firefighting efforts and helps prevent the spread of smoke throughout the ship. Desmoking may be accomplished using ventilation fans in adjacent compartments or with portable fans. There will be some smoke in surrounding areas; smoke boundaries will help slow the spread of smoke. This type of desmoking should not be confused with the desmoking process of the affected compartment after the fire has been overhauled.

C-122. When a class Bravo fire has been extinguished, combustible gases may be present. Operating electric controllers to start ventilation fans may ignite these gases. Desmoking with installed ventilation can proceed with minimal risk once specific conditions are met. These conditions include the following:

- The fire is extinguished and overhauled.
- The AFFF bilge sprinkling has been operated.
- The source of the fuel for the fire is secured.
- The space has been allowed to cool.
- All fuel has been washed to the bilges.
- No damage has been sustained to the electrical distribution system.

C-123. Desmoking should begin once the compartment has cooled sufficiently so there is no danger of reignition. Circuit breakers that have tripped should not be reset until qualified personnel can make a damage assessment. Examine the electrical distribution system and, if possible, reestablish power to the installed ventilation fans. If the fans are fully operational, run them on high speed for a minimum of 15 minutes to remove smoke and toxic gases. If the installed system is partially operational or inoperative, desmoking will take longer but can be accomplished by using portable blowers or providing a positive ventilation from adjacent spaces. On ships without AFFF bilge sprinkling, the safest method of desmoking is to exhaust the compartment with portable fans or provide a positive ventilation pressure from adjacent compartments.

Portable Fans and Blowers

C-124. Different types of fans and blowers are available for desmoking, and each has different advantages. Some are electric motor driven and are not to be used in explosive environments. Other blowers are powered by the firemain; these require that the firemain be available and that hoses be rigged to supply them. These fans require cleaning, inspection, and maintenance to ensure their reliability, and this may be your responsibility. Additionally, you may be involved in repairs and/or component replacement and will use PMCS and the manufacturer's technical manuals to ensure quality maintenance.

C-125. Fans or blowers are often used to recirculate or remove large volumes of air. Electric "box" fans are convenient and easy to rig but pose risks when operating in (or removing) explosive atmospheres. Additionally, these fans require that power be available for operation. Water-driven blowers do not pose this threat (as long as they are properly grounded), but other considerations do apply. The firemain is the motive force for this blower and must be rigged to supply it and have a discharge hose.

Portable Water-Driven Fan

C-126. The portable water-driven fan (Figure C-24) is one of the primary fans used aboard ships for desmoking or introducing ventilation into a compartment. The firemain or a P-100 pump supplies the power for the fan through a 1 1/2-inch hose connection. A water turbine operates the fan blades, which may rotate in excess of 10,000 rpm (depending on firemain pressure). The fan is compact (18 inches in diameter) and weighs less than 35 pounds, allowing easy transport.

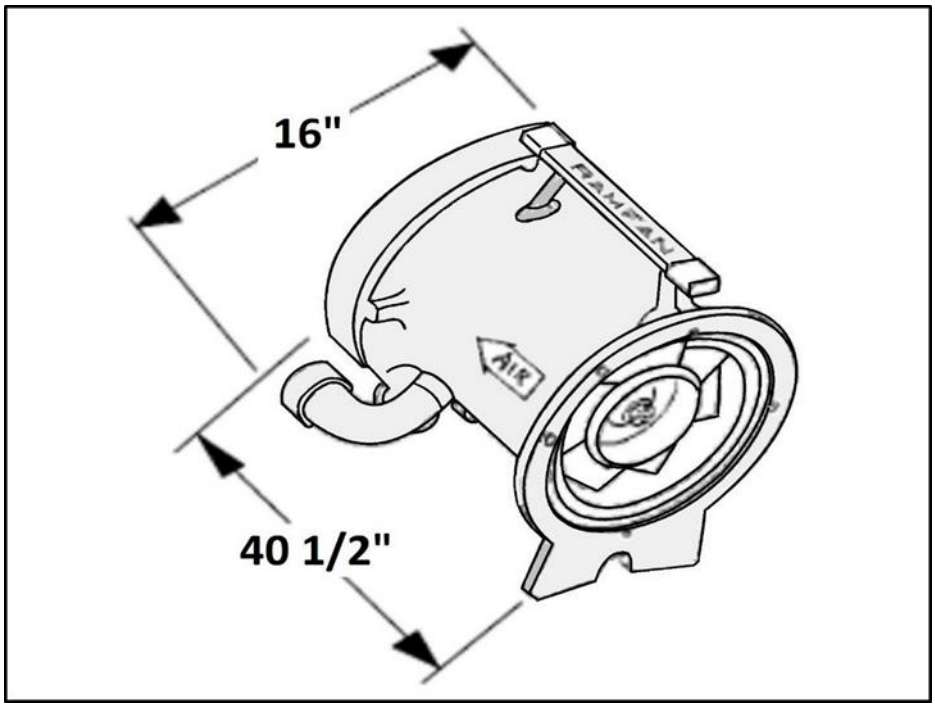

Figure C-24. Water-driven fan

WARNING

Exhausting gases through ducts can create a static electric charge. It is important to ensure positive contact to ground to avoid unwanted discharge while operating around explosive atmospheres.

Portable Electric Desmoking Fans

C-127. The medium capacity fan is a portable electric fan designed to be used by damage control personnel for rapidly desmoking compartments in areas where exhaust ducting is not needed. It produces a tight spiral of air or smoke to prevent recirculation into the area being desmoked.

C-128. The portable desmoking fan should be inspected for damage before use. Careful inspection of the electrical cord is necessary to prevent shock hazards, and the tamper seal on the electric motor must be intact. If this seal is broken, the fan must not be used in any explosive environments. Ensure that the screen guards are in place before operation.

C-129. The portable electric desmoking fan operates using 115 volts ac; simply plug it in and turn it on. Damage control plates and main space fire doctrine will assist you in determining the most efficient desmoking methods.

C-130. Cleaning, inspection, and testing of these fans must be accomplished according to PMCS and the manufacturer's TM.

C-131. The intent of this chapter is to give you a basic overview of certain portable equipment. To become proficient, you must train with this equipment under proper supervision and familiarize yourself with the TMs.

Atmospheric Testing

C-132. Atmospheric tests are always conducted after desmoking is complete. An oxygen analyzer is unreliable when its sensor is exposed to excess moisture or comes in contact with particulates found in a post-fire atmosphere.

C-133. When the space is clear of smoke, test the atmosphere for oxygen, combustible gases, and toxic gases. The level of oxygen must be between 19.5 and 22 percent. Combustible gases must be less than 10 percent of the lower explosive limit, and all toxic gases must be below their threshold limits before the space is certified safe for personnel without breathing devices. After a class Bravo fire, the compartment should be tested for the following gases:

- Hydrocarbons.
- CO2.
- Carbon monoxide.
- Hydrogen chloride.
- Hydrogen cyanide.

C-134. Shipboard personnel authorized to conduct these tests aboard ship are the gas free engineer and the gas free designated representative. Required tests shall be conducted near the center and at all four corners, on each level of the compartment. At least one satisfactory reading at each location must be obtained.

Dewatering

C-135. Dewater the compartment with the commanding officer's permission and IAW operating procedures. Dewatering a class Bravo pool fire will not commence until the space is completely overhauled, except in extreme conditions where ship stability is threatened. Dewatering will affect the vapor barrier on top of pooled flammable liquid. Extreme caution must be exercised to ensure the AFFF blanket is maintained until completion of overhaul. Following overhaul, normal dewatering may be conducted or completed at the same time as desmoking or post-fire gas free testing.

Compartment Remaining

C-136. Once the space is certified safe, remaining can begin. A careful damage assessment is conducted, and once individual equipment or systems are verified operational and safe, then may be placed in service.

REENTRY

C-137. Reentry to a machinery space that has been evacuated because of fire is the most critical part of the firefighting evolution and potentially the most dangerous. The primary function of the reentry team is to attack and extinguish the fire, ensure the source of oil is secured, and cool the space so ventilation may be started.

C-138. When the fixed firefighting system has been activated:

- If the evidence is that the fire is extinguished, do not attempt reentry for at least 15 minutes after the discharge.
- If conditions in the affected space indicate that the fire has not been extinguished and continues to grow after the fixed firefighting system has been discharged:
  - Feel bulkheads for temperature near the desired access.
  - Monitor exhaust vent discharge for smoke.
  - If CO2 equipped vessel, ventilate space and test BEFORE entry attempt.

- If FM-200 equipped vessel, test space using damage control hand pump with ampulets.
- Monitor conditions through the engineering operating station windows or peephole in escape doors.

- Extinguish fires after reentry to the space. Reopen when the fire is out, re-flash watch is set, and fire overhauled. Ensure all sources of fuel are secured and covered with AFFF. To conserve AFFF, saltwater hoses should be used to cool the space after the fire is out. It should be assumed that AFFF hose reels in the space have been damaged by the fire and they should not be relied on until it can be established that the system has not been damaged by fire.

C-139. When FM-200 is not installed:

- Electrical isolation, with the exception of lighting, shall be completed as specified in Emergency Operations Control Center immediate actions. Electrical isolation, although ongoing, should not delay space reentry.
- Reentry should be made through the access, main door, hatch, or escape trunk, whichever is not obstructed by the fire. The conditions in the affected space should be checked before entry by feeling bulkheads for temperature near the desired access, monitoring exhaust vent discharge for smoke, and monitoring operating conditions through the engineering operating station windows or peephole in escape trunk doors.
- Repeated efforts may be necessary to gain access to the space. The nozzleman uses the reentry hose wide-angle fog to cool metal surfaces and protect themself. It should be assumed that the hose reels in the space have been damaged by the fire and they should not be relied on for use until it can be established that the system has not been damaged by fire.
- Once inside the space, locate, extinguish, and report: fire out and set re-flash watch. Report that re-flash watch is set. Overhaul the fire. Secure and cover all flammable liquids with AFFF. Allow the space to cool. To conserve AFFF, saltwater hoses should be used to cool the space after the fire is out.

INVESTIGATION

C-140. After overhaul, the fire should be investigated to determine the point of origin, types of combustibles involved, path of fire spread, ignition source, and significant events in the growth and eventual extinguishment of the fire. Starting from the point of farthest fire spread, burn patterns will usually extend back to the area of origin. Efforts should be directed toward recreating the conditions that caused the fire and identifying any changes in design or procedures that could have prevented the fire or lessened its spread and intensity. These changes are very helpful to ship designers and operators. Photographs, material samples, metallurgical samples, and failed equipment assist in reconstructing a fire history. If there is a major fire which involves significant damage or loss of life, a Naval Sea Systems Command technical expertise team is available to investigate and develop lessons learned from a ship design and material standpoint.

HEAT CASUALTIES

C-141. Extreme compartment heat, weight of the FFE, carrying heavy equipment, and handling a fire hose are contributing factors to heat injuries. As fire fighters rotate out of the compartment, the team leader and scene leader will coordinate relief personnel. Under harsh conditions, personnel working hard (such as the nozzleman) will need to leave the compartment sooner than others. A complete relief team should be standing by, ready to enter as needed, to relieve personnel in the space.

C-142. Heat training for management of heat casualties is conducted as part of “all hands” training, and personnel must be aware of the symptoms and required treatment. The symptoms of heat stress are as follows:

- The skin appears ashy gray; the skin is moist and clammy.
- The pupils of the eyes may be dilated (enlarged).
- Vital signs are normal; but the victim may have a weak pulse and rapid shallow breathing.
- Heavy sweating.

C-143. You may observe these symptoms in one of your shipmates after leaving the compartment. The treatment for heat stress is as follows:

- Loosen clothing; apply cool wet cloths.
- Move the victim to a cool or air-conditioned space and fan the victim.
- Do not allow the victim to become chilled.
- If the victim is conscious, provide a solution of 1 teaspoon of salt dissolved in a quart of water.
- If vomiting occurs, do not give any more fluids.
- Transport the victim to sickbay (if manned) or the nearest battle dressing station for treatment.

HEAT STROKE

C-144. The symptoms of heat stroke are as follows:

- High body temperature.
- No sweating—skin is hot and dry.
- Pupils of the eyes may become constricted.
- Strong rapid pulse.
- Possible unconsciousness.

C-145. During heatstroke, the body is no longer able to sweat, preventing removal of excess heat. If the internal temperature of the body rises above 105°, the brain, kidneys, and liver may all suffer permanent damage. In its earlier stages, the victim may have shown symptoms of heat exhaustion as detailed above. The treatment of heat stroke may include the following:

- Immediately informing medical personnel, moving the victim to the coolest possible area, and removing clothing.
- Reduce body temperature immediately by dousing the body with cold water or by applying cold, wet towels to the body.
- Ensure the victim has an open airway.
- Place victim on their back, head and shoulders slightly raised.
- If cold packs are available, place them under the arms, around the neck, at the ankles, and on the groin. This helps lower internal body temperature.
- Give the victim cool water to drink. Do not give any hot drinks or stimulants.

C-146. This chapter provided information pertaining to the tactics and strategies involved in firefighting. Although every fire is different, certain practices apply to all fires. While the information is located in this Appendix, there is no substitute for actual hands-on training. As you become proficient you will train your shipmates in firefighting, as well as other aspects of damage control. A properly trained in-port fire party or attack team may make the difference between dealing with a small easily controlled fire, and one that threatens the entire vessel.

FIRE HOSE TEST PROCEDURES

C-147. The following pressure test procedure will be followed:

- Total length of test hose line will not exceed 300 feet. The hose line shall be straight without kinks or twists.

WARNING

Questionable hose or hoses that have been repaired or re-coupled will be tested one length at a time.

- Connect the test hose line to a fire station valve. This valve must be manned during the test to prevent discharging a large volume of water in the event of a hose bursting during the test.
- Attach a nozzle to the far end of the hose line.
- With the fire station valve open and the end nozzle open, gradually increase the pressure to approximately 45 psi.

- Slowly close the end nozzle when the hose line is free of air and full of water.
- Close the fire station valve.
- Secure the hose line to avoid possible whipping or other uncontrolled reaction in the event of a hose burst.

WARNING

Clear all personnel from the area except those required to perform the remainder of the test procedure.

- Check hose line for leakage at the couplings. Tightened couplings with a spanner wrench where necessary.
- Mark each hose at the back of each coupling with a felt tip marker to determine if the coupling moves on the hose during the test.
- Slowly increase the pressure to test pressure (not less than 100 psi) and hold for five minutes.
- Inspect for leaks, bubbles, and separation from ends while the hose line is at the test pressure.

WARNING

Personnel shall never stand in front of the free end of the hose, within 15 feet to the side of the hose, or straddle a hose during the pressure test.

- If a section of the hose is leaking or bursts, terminate the test. Drain the hose line and remove and destroy the failed hose.
- After the five-minute pressure test, shutdown the pump, open the end nozzle to relieve the pressure, and drain the hose line.
- Observe the marks placed on the hose at the back of the couplings. If the coupling has slipped or twisted, the hose has failed the test. Remove and destroy the failed hose.
- Enter the test results in the ship's log.
- All hoses shall be cleaned, drained, and dried before being placed in service or storage.

INTERNATIONAL SHORE CONNECTION PROCEDURES

- Isolate the AFFF and/or sewage tanks, if applicable, by closing appropriate valves.
- Isolate overboard discharge and pump discharge by closing appropriate valves.
- 46 CFR 95.10 requires a relief valve for the operating fire system, your relief valve will not work if your system is not operating.
- Slowly introduce water into the system, continuously checking for leaks or dangerous pressure situations.
- Maintain communication with all parties involved.
- Check with local port authority on proper use of pier hydrants.

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Appendix D

General Safety

This section covers equipment that is not specific to any single system already covered in this manual but is critical to the vessel, its mission, and daily operations.

GANGWAYS

D-1. Gangways are walkways that provide access from land to a structure on the water and vice versa. The following information provides characteristics and safety considerations for gangways that are used on Army watercraft.

CHARACTERISTICS

D-2. Whenever practicable, a gangway of not less than 20 inches (.51 m) in width, of adequate strength, maintained in safe repair and safely secured shall be used. Each side of the gangway and the turntable, if used, shall have a handrail with a minimum height of 33 inches (.84 m) measured perpendicularly from rail to walking surfaces at the stanchion, with a mid-rail. Rails shall be of wood, pipe, chain, wire, rope, or materials of equivalent strength and shall always be kept taut. Portable stanchions supporting railings shall be supported or secured to prevent accidental dislodgement.

SAFETY CONSIDERATIONS

D-3. Gangway access shall be illuminated for its full length. The gangway shall be kept properly trimmed at no more than a 30-degree angle from the horizontal. Vessels that moor in areas that have greater tide ranges will most likely need a step-down platform on the shore side to reduce the gangway angle. Gangways that overhang the water must have side skirts (or other means to prevent persons from falling between the rails), or a net suitable for protecting persons from falling into the water. Unobstructed passage must be provided, and any hazards that cannot be removed will be marked. Handrails and walking surfaces of gangways shall be maintained in a safe condition to prevent Soldiers from slipping or falling. Gangways cannot be secured to handrails unless the railing is designed for that purpose. Gaps between the gangway and railings must be properly secured. Gangways should be repaired as needed. Moving parts such as wheels should turn freely and be greased as needed. The underside of gangways should be examined at regular intervals.

GENERAL ALARM

GENERAL ALARM BELL

D-4. The minimum sound pressure levels for the emergency-alarm tone in interior and exterior spaces must be a sound level of not less than 80 dB(A), or at least 10 dB(A) above the background noise level unless flashing red lights are used. Measurements will be taken from 10 feet away.

D-5. Typical general alarm bells can be adjusted to improve or repair sound quality. Contact the MSSO for updated troubleshooting procedures.

D-6. When painting general alarm bells, it is recommended to use spray paint. Using a brush has the tendency to apply too much paint, dampening the sound of the bell further preventing the audible alarm from sounding at the appropriate sound level.

GENERAL ALARM LIGHT

D-7. The general alarm light is a red-flashing light or rotating beacon, in addition to the general emergency alarm signal, that—

- Has sufficient intensity above the background lighting that would alert personnel in the space.
- Is activated whenever the general emergency alarm signal in the space is activated.
- Is supplied by the general emergency alarm system power supply or the vessel emergency power source through a relay that is operated by the general emergency alarm system.

WATERTIGHT DOORS – CHALK TEST

D-8. Watertight doors (WTDs) are essential and critical parts of a ship's safety infrastructure; in the event of a major incident they will block and contain ingress of water. Watertight hatch cover and watertight doors' tightness can be check by chalk method or hose methods.

D-9. Steps for conducting a chalk test on watertight doors are as follows:

- Clean the knife-edge of the watertight door and the gasket with a wire brush or rag. Rub chalk on the knife-edge of the watertight door. Close the dog and watertight door tightly.
- While the watertight door is dogged down, check for loose dogs. Ensure the knife-edge of the watertight door bears down to the gasket firmly and evenly all around for 15 sec.
- Open the watertight door and observe the chalk imprint on the gasket. The chalk line should be continuous along the entire gasket. Figures D-1 through D-3 depict different types of watertight doors.

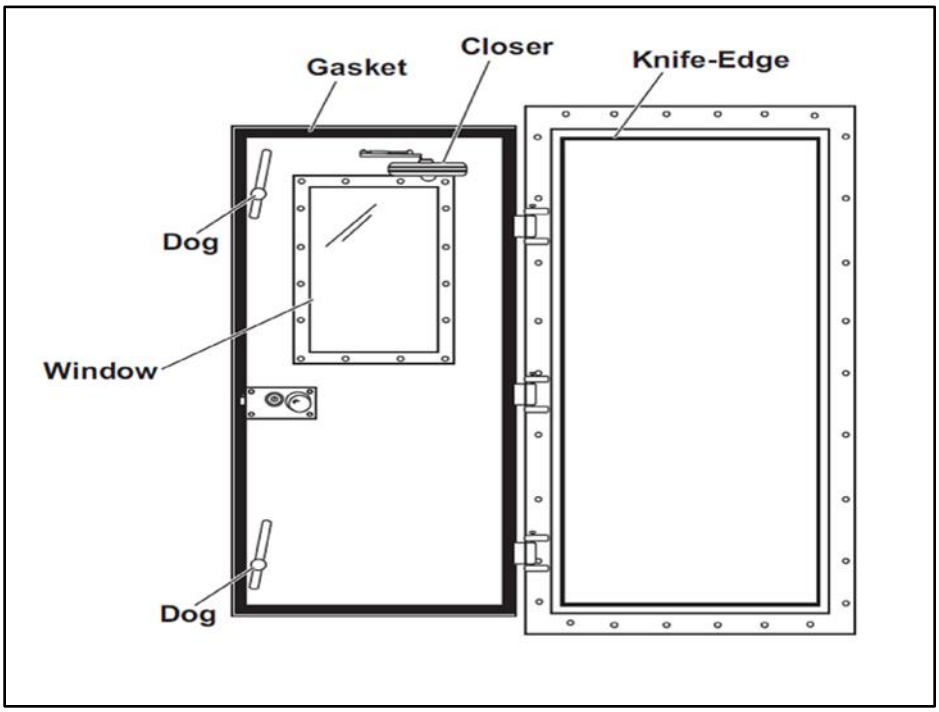

Figure D-1. Watertight door

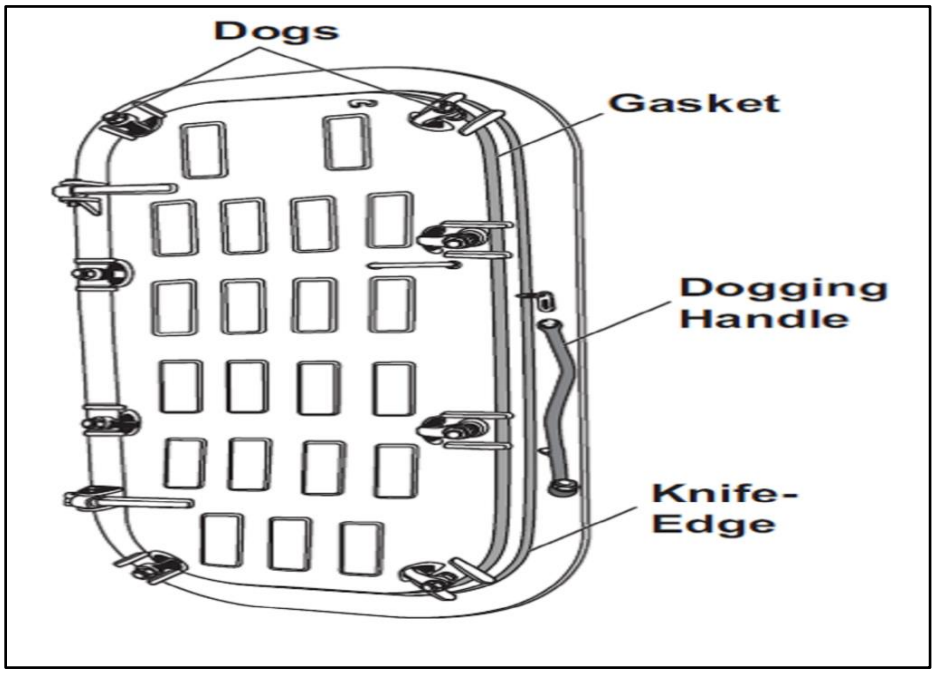

Figure D-2. 8-Dog quick-acting watertight door

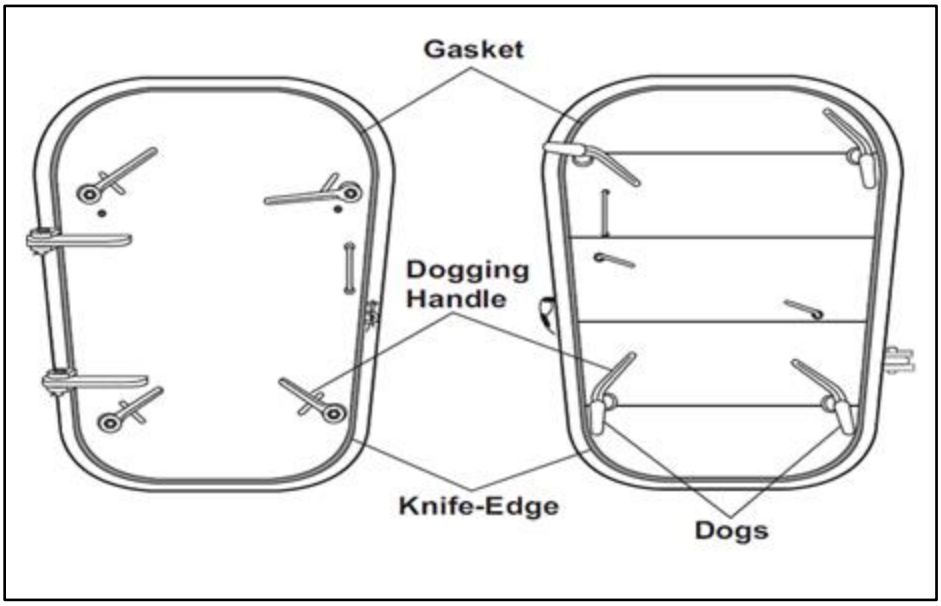

Figure D-3. 4-Dog watertight door

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Appendix E

Lifesaving Equipment

This appendix covers the use, storage, and maintenance of various pieces of lifesaving equipment found on Army watercraft.

DISTRESS SIGNALS

DISPOSAL

E-1. All unserviceable pyrotechnics should be turned in to the local ammunition supply point for proper disposal.

MISFIRES

E-2. Misfired signals must NOT be approached until at least 30 minutes have elapsed after firing was attempted. All misfires and malfunctions involving these signals will be reported through the appropriate munitions supply channels.

SIGNAL, ILLUMINATION, GROUND, RED STAR, PARACHUTE, M126A1 (L311)

E-3. The M126A1 signal flare is a rocket-propelled, fin-stabilized, hand-launched distress signal for watercraft operating in ocean or coastal waters. The signal is shown in Figure E-1.

Figure E-1. Signal, illumination, ground, red star, parachute, M126A1 (L311)

E-4. When fired vertically, the signal projects to an altitude of 650 to 800 feet. It also produces a parachute-suspended red star that burns for approximately 50 seconds while descending at the rate of 8 feet per second.

Firing Instructions

E-5. Firing illustrations are depicted in Figure E-2.

- Remove the signal from its container IAW the instructions printed on the container.
- Hold the signal in the left hand, red knurled band up, with thumb and forefingers in alignment with the red band.
- Withdraw the firing cap from the lower end of the signal.
- Point the ejection end of the signal (the end opposite the red knurled band) away from the body and away from friendly personnel, equipment, and materials, and SLOWLY push the firing cap onto the primer (red band) end until the cap is aligned with the lower edge of the knurled band. DO NOT permit the cap to go beyond the lower edge of the band.
- Hold the signal FIRMLY at arm's length with the left hand in a truly vertical position, firing cap downward.
- Turn your head away from the signal to avoid injury to your face and eyes from particles ejected by the small rockets.
- Strike the firing cap bottom sharply with the palm of the right hand keeping the left arm rigid.

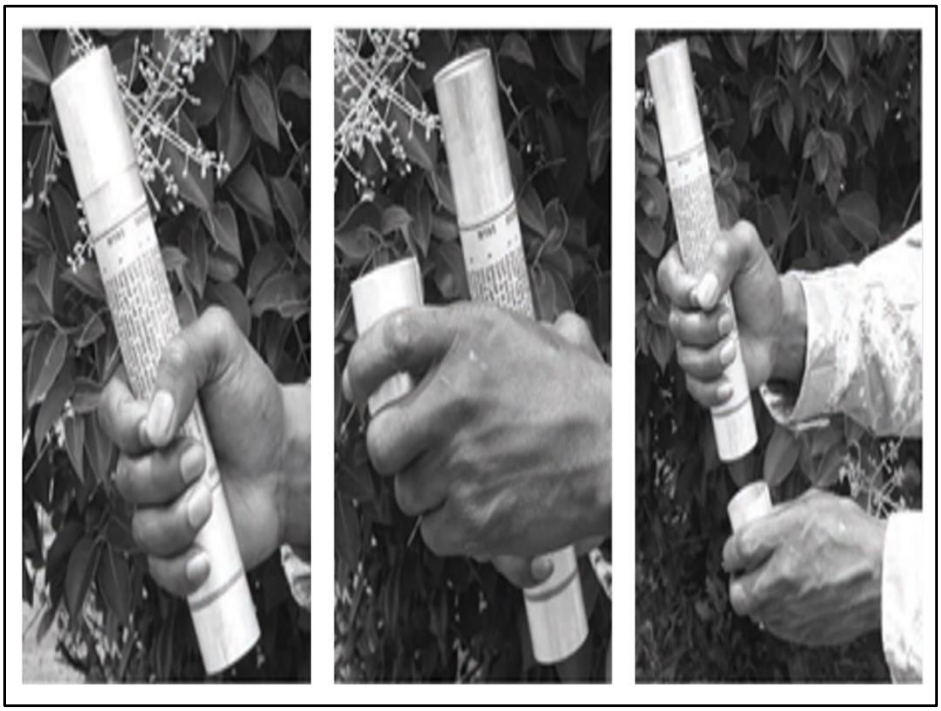

Figure E-2. Firing a signal flare

Figure E-2. Firing a signal flare (continued)

WARNING

DO NOT FIRE A HANDHELD SIGNAL IN AN AREA WITHOUT OVERHEAD CLEARANCE. WHEN FIRED IN AN AREA WITHOUT OVERHEAD CLEARANCE, THE SIGNAL CAN CAUSE FIRE, INJURY, OR DEATH.

CAUTION

When firing handheld signals by hand, avoid contact with the bones of the hand. This can result in injury to the hand. Instead, use the meaty portion of the hand.

Handling and Storage

E-6. This signal shall be handled and stored IAW the general precautions outlined at the beginning of this section. In addition, the following special rules apply:

- The signal must not be removed from its hermetically sealed container until immediately before it is to be used.
- No signal shall be stored or restored unless it is securely sealed in its steel container.
- Take care to avoid striking the signal primer during all handling.
- Dented, cracked, or otherwise damaged signals must not be used. Carefully segregate them in a completely dry storage location for return to a shore station for appropriate disposal.
- If a signal misfires, place it in a secure position to prevent personnel from being impacted should the signal fire. The signal must not be approached for at least 30 minutes.

Safety Precautions

E-7. In addition to the handling and storage instructions above, strictly observe the following special rules:

- DO NOT remove the signal from its hermetically sealed container until immediately before use.
- DO NOT attempt to use dented, cracked, or otherwise damaged or deteriorated signals. They must be segregated for early disposal.
- Before installing the firing cap over the primer end of the signal, be sure to avoid striking the primer.
- Read and follow the firing instructions on the signal body.
- The person firing the signal and all friendly personnel in the immediate vicinity should wear helmets to avoid injury by the falling spent rocket motor and other debris.
- When pushing the firing cap onto the primer end of the signal, be sure that the signal is not pointed toward your own body or toward friendly personnel, equipment, or materials.
- Push the firing cap SLOWLY over the primer end of the signal, being sure not to push it beyond the lower edge of the red knurled band.
- Exercise due care to prevent the expended rocket body from falling on friendly personnel or flammable materials.
- Misfired signals must NOT be approached until at least 30 minutes have elapsed after firing was attempted.

Firing Angles

E-8. Normally, this signal is held in a vertical position (90 degrees elevation) when firing. However, other angles of elevation may be used under the following circumstances:

- To compensate for high wind velocities.
- To place the signal display in a better position to be seen by search and rescue aircraft that are flying lower than the signal's maximum altitude of functioning.
- To compensate for and take advantage of widely different topographical elevations in ground-to-ground signaling, such as would be advantageous for personnel on a mountain to attract the attention of those in an adjacent valley, or for personnel in a valley to attract the attention of personnel beyond an intervening ridge or other obstruction.

Note: If the signals are fired at angles of less than 90 degrees, the altitude attained is reduced and the altitude of candle burnout is correspondingly lessened. If the firing angle is 60 degrees or less, the candle will, in almost all cases, still be burning after it strikes the surface.

Maintenance

E-9. Handheld signals require PMCS when exposed to the environment. The color-coded forward end seal can deteriorate if exposed to moisture for long periods of time or submerged in water. If not removed, dirt or sand can cause the handheld signal to malfunction.

Cleaning

E-10. To clean the handheld signal:

- Wipe the dirt off the launcher tube and the firing cap using a clean, dry, lint-free cloth.
- Use a fine-bristled camel hairbrush to remove any foreign matter or debris.

MARKER, LOCATION, MARINE, MK 58 MOD 1 (L580)

E-11. This marker consists of a cylindrical tin can approximately 21.78 inches long and 5 inches in diameter. The can contains two pyrotechnic candles containing 1000 grams and 870 grams of a red phosphorus composition. The can is strengthened, and the candles are supported by foamed-in-place polyurethane. The ignition end of the marker has three holes, two for smoke and flame emission and one for entry of water to

the Mk 72 Mod 1 water activated battery. Adhesive foil discs hermetically seal the two emission holes and a reinforced adhesive foil strip with a rectangular pull hermetically seals the battery cavity hole. The adhesive foil seals are protected during handling and shipping by a replaceable polyethylene protective cover. A graphic depiction of the MK 58 Mod 1 marker and an example of the PVC container used for deck stowage are illustrated in Figure E-3.

Figure E-3. Marker, location, marine, mark (MK) 58 mod 1 and PVC container

Handling and Storage

E-12. All pyrotechnic and smoke-screening devices are designed to withstand normal handling. However, they should still be handled as little as possible to lessen the chances of damage which might cause accidental ignition or leakage. Many devices contain materials of a dangerous nature and are therefore designed with safety features which must be maintained in good operating condition. Dents, deformations, or cracks in the outer body may interfere with the proper functioning of these safety features or might cause ignition during handling or storage. It is therefore imperative that extreme care be taken to prevent damage to containers of pyrotechnics and screening devices, and to the devices themselves.

E-13. The marker will be stowed on bridge port and starboard wings in PVC container. This PVC container can be constructed by the crew. Materials needed to construct container are listed below:

- 1 – 17” piece of 6” ID PVC, schedule 40.
- 2 – 6” high pressure PVC end caps.
- 4 – #8 sheet metal screws.
- 1 – 14” long piece of 1/16” plastic coated cable.
- 2 – solderless wire connectors (for 1/16” cable).
- 1 – 4” galvanized screen door handle.

E-14. The steps for fabricating the container are listed below:

- Cut 6” ID PVC to 17” in length.
- Drill 3/8” drain hole in the bottom/center of one end cap.
- Glue end cap with the 3/8” drain hole to the bottom of the 17” length of PVC.

- Fit the second end cap to the top of the 17" length of PVC (file or sand this end so the cap can be easily removed).
- Fasten the 4" screen door handle to the top end cap using 2 #8 screws.
- Connect the solderless wire connectors to each end of the plastic-coated cable.
- Fasten the cable to the top end cap and to the side of the 17" length of PVC using 2 #8 screws (this is to prevent losing the cap).
- Paint container gray to match the bridge exterior, stencil "SMOKE MARKER MK58 MOD 1" on the container (white letters, 1 1/2" high).
- Use non-rusting material to mount the holder, vertically with the drain hole down, on the inside of the bridge railing next to the life ring with light (ensure that the cap can be easily removed).
- Place the marine location marker in the container with the polyethylene protective cover pointing up.
- Install the top end cap.

Note: Condensation will build up around the base of marker and the container. Vessel crews should place a non-corrosive, non-absorbent object in the base of the container to keep the marker from resting at its base on the container. Ensure that the drain hole is not blocked. DO NOT MOUNT TO BALLISTIC STEEL.

E-15. Due to the need for special handling, it is recommended that the MK 58 be stored in an approved ammunition or pyrotechnic locker aboard the vessel when not underway.

Intended Use

E-16. This marker is designed for day or night use in any condition calling for long-burning, smoke and flame reference-point marking on the ocean surface. It produces yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes which is visible for at least three miles under normal operating conditions.

Operation for Launching

E-17. Surface launching is usually done by hand and requires only the removal of the protective cover and the pull ring-reinforced adhesive foil strip over the battery-cavity hole before throwing the marker into the water. Perform the following steps to launch the location marker:

- Remove the polyethylene protective cover.
- Remove the pull ring reinforced adhesive foil strip.
- Throw the signal overboard with life ring. The signal will activate within 25 seconds of impacting.

WARNING

Entrance of water into the battery cavity of this marker will activate the electric squib which will ignite the candle. Extreme care must be exercised to avoid premature removal of the reinforced adhesive foil that seals the battery cavity. The battery must be kept dry until it is intended that the marker function.

Safety Precautions

E-18. All pyrotechnic and screening devices, while designed and tested to be safe under normal conditions, can be subject to accidental ignition because of a wide variety of circumstances. The general rule to follow is to be constantly aware that pyrotechnics contain chemical components that are intended to burn with intense heat and act accordingly.

Protecting the Initiation Mechanism

E-19. Pyrotechnic and screening devices are normally equipped with some type of safety pin, lock, or tape that is designed to prevent accidental activation of the initiation mechanism. Such equipment must not be tampered with, struck, bent, or otherwise damaged; nor should it be removed until immediately before it is intended to launch the device. Any devices that show signs of damage to safety features are considered unserviceable and must be carefully segregated for prompt disposition.

Results of Accidental Initiation

E-20. If a pyrotechnic device is accidentally ignited, its functioning will, in all cases, result in a fire hazard. In a confined area, the gases generated by this combustion could present a serious toxic hazard. Signaling devices containing propellant charges which are designed to propel the pyrotechnic candle into the air create an extremely dangerous missile hazard if they are accidently ignited.

Fighting Pyrotechnic Fires

E-21. Pyrotechnic compositions characteristically contain their own oxidants and therefore do not depend on atmospheric oxygen for combustion. For this reason, the exclusion of air, by whatever means, from a pyrotechnic fire is usually ineffective. Many pyrotechnic mixtures, particularly illuminating flare compositions, burn with intense heat (up to 4,500 degrees F). Normally available extinguishers are of little or no value in fires of this kind. It is recommended, therefore, that water, in flooding quantities and at low pressure, be used to cool the surrounding area thus to prevent the spread of the fire.

Toxic Hazards

E-22. Many chemicals used in pyrotechnics are poisonous if taken internally. This also applies to the residues of burned pyrotechnics. From the inhalation standpoint, the products of pyrotechnic devices and smoke generators often present a serious problem. Although many of the smokes and fumes given off by pyrotechnics and screening devices are considered non-toxic and are only mildly irritating to the eyes and nasal passages when encountered in relatively light concentrations out of doors, heavy concentrations in closely confined spaces are dangerous and may be lethal if for no other reason than that they reduce the amount of available oxygen in the air. Anything more than a brief exposure to the gases of combustion or to screening smokes should be avoided or should be protected against through the use of appropriate breathing apparatus.

MARINE, SMOKE AND ILLUMINATION SIGNALS, MK 124 MOD 0 (L283) AND MK 13 (L275)

E-23. These signals are made of metal cylinders filled with illuminant composition in one end and smoke in the other. Each end is fitted with a plastic cap. The cap on the flare end has molded protrusions or beads on the face for night identification. The smoke (day signal) end cap is smooth. A label around the signal body further identifies each end and provides precise instructions for use. The MK 124 Mod 0 and the MK 13 smoke and illumination signals are shown in Figures E-4 and E-5 respectively on page E-8.

Figure E-4. Signal, smoke, and illumination, marine MK124 mod 0

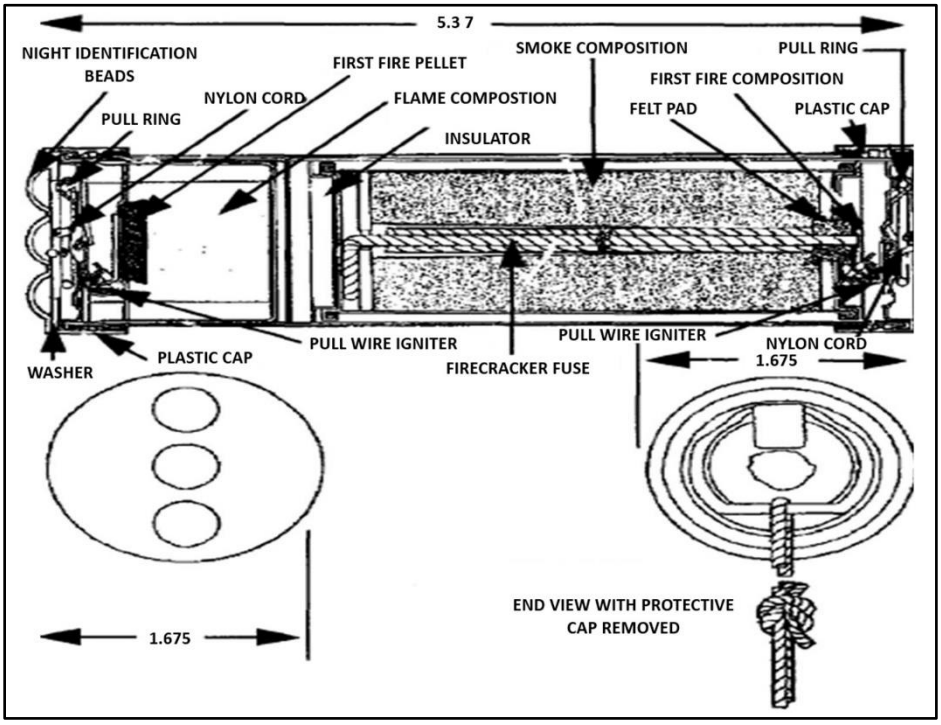

Figure E-5. Marine smoke and illumination signal, MK 13

Storage Locations

E-24. The smoke and illuminations signals, MK 124 Mod 0 and the MK 13 will be stored IAW the FCP for that specific vessel class.

Intended Use

E-25. This signal is intended to be used for either day or night signaling, as appropriate, by personnel on land or sea. The signal is a one-handed operable device intended for rescue use. Its light weight (237 grams) and small size permit if to be carried in life vests and on life rafts.

Functional Description

E-26. The lever must be extended to the armed position and then depressed to cock and release the firing pin. This action allows the striker on the firing pin to hit the primer which ignites the flare candle (night) or the smoke candle (day) depending on the display desired. The signal emits an orange smoke colored flare for approximately 20 seconds.

Operating Instructions

WARNING

Do not ignite both ends of the MK 124 Mod 0 signal at the same time. Prior to pulling the lever downward, position all fingers below top of signal.

Hot drippings and/or sparks from signal can cause burns and damage inflatable equipment.

E-27. After choosing the type of display desired (smoke for day or flare for night), operate the signal as follows:

- Remove the protective cap from the end to be ignited.
- Slide the lever horizontally to the fully extended position.
- Pull the lever downward until firing pin is released.
- If the smoke-end flames, briefly immerse in water or hold against a solid object.
- During and after ignition, hold signal firmly with arm fully extended overhead at an angle of 45 degrees horizontal from the body to prevent burns from hot drippings.
- DO NOT direct either end of the signal toward user or other personnel.
- After using one end, douse the signal in water to cool; if on land, place the signal on a non-combustible surface to cool. Save for use of the other end in case it is needed.

Safety Precautions

E-28. Devices that function completely while being held in the hand must be pointed to leeward and held at arm's length and an angle of approximately 45 degrees above the horizontal to prevent burns caused by hot drippings. Under NO circumstances shall both ends of this signal be ignited at the same time.

QASAS Contacts

- Ft. Eustis QASAS:
  406th AFSB 757-878-1736
- Hawaii QASAS:
  POHAKULOA TA (HI) DSN 315 469-2481
  SCHOFIELD BRKS (HI) DSN 315 456-9020
- Okinawa QASAS:
  403rd AFSB- USFK-Korea DSN 315 763-4621 (SCR) or DSN 315 755-3446 (LSTR)

EMERGENCY ESCAPE BREATHING DEVICE

WARNINGS AND CAUTIONS

WARNING

1) WEARERS MUST BE FULLY TRAINED IN THE USE AND CARE OF THE EQUIPMENT.

2) FAILURE TO ADHERE TO INDIVIDUAL WARNINGS COULD RESULT IN INJURY AND OR DEATH OF PERSONNEL.

3) THE M-20.2 EEBD MUST NOT BE USED FOR PURPOSES OTHER THAN THOSE OUTLINED IN THIS MANUAL.

4) THE M-20.2 EEBD IS NOT TO BE USED UNDERWATER.

CAUTION

1) THE M-20.2 EEBD MUST BE REGULARLY INSPECTED TO ENSURE OPERATIONAL READINESS.

2) IF THE M-20.2 EEBD FAILS ANY OF THE INSPECTIONS, REMOVE THE UNIT FROM SERVICE IMMEDIATELY.

3) REMOVE THE UNIT FROM SERVICE IF THE TAMPER BALL IS MISSING.

4) THE FLOW OF OXYGEN WILL BEGIN AUTOMATICALLY WHEN THE UNIT IS REMOVED FROM its BASE. YOU SHOULD NOT EXPECT TO HEAR THE FLOW OF OXYGEN OR SEE THE BREATHING BAG INFLATE.

HOW TO INSPECT THE M-20.2 EEBD

E-29. The inspections for the M-20.2 EEBD are annual visual inspections. DO NOT lift the yellow latch or open the clear case to inspect the M-20.2 EEBD.

E-30. The inspections described below shall be performed on each M-20.2 EEBD upon deployment. Subsequently, if the M-20.2 EEBD is belt-worn, the inspection shall be performed at the beginning of each work shift that the device is worn. If stored, the following visual inspections should be conducted every year:

- Presence of tamper indicating ball on the latch lever (see Figure E-6).

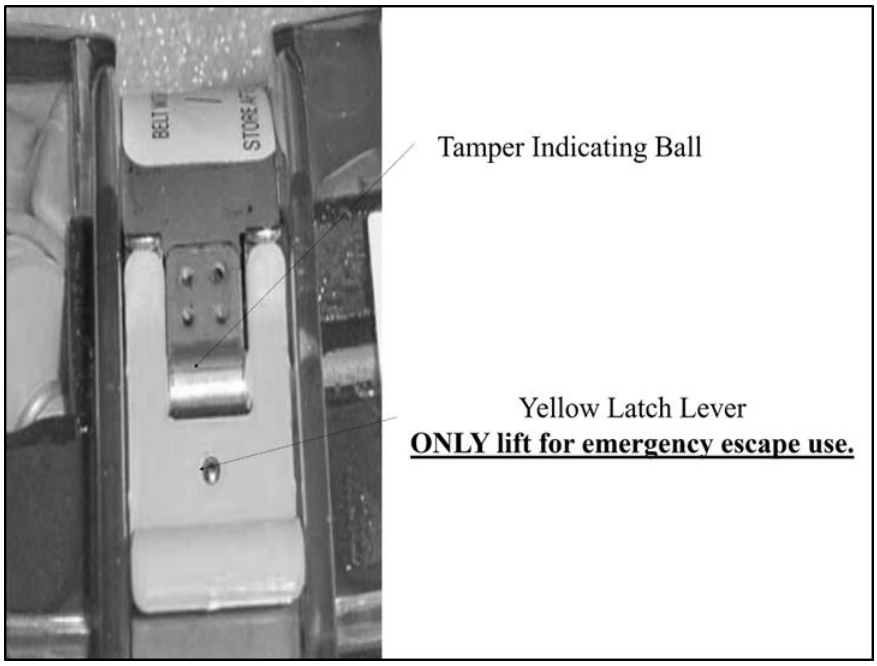

Figure E-6. How to inspect the M-20.2 EEBD

WARNING

DO NOT use unit if tamper indicating ball is missing or latch has been opened. Remove unit immediately from service if the unit has been tampered with or if tamper indicating ball is missing. Lifting yellow latch lever voids the warranty.

- Read the pressure gauge: The tip of the needle on the gauge is normally in the green zone. If the needle is in the red or on the white zero pressure mark, remove the M-20.2 EEBD from service immediately. If the view of the gauge is obstructed, the M-20.2 EEBD must be removed from service. If the surrounding air temperature is above 120°F (49°C) and the needle is above the green zone, the unit can remain in service. The needle should return to the green zone when unit is removed from the high temperature.
- Visually inspect the apparatus for indications of high force impacts. Indications of high force impacts are listed below. If any of these signs are present the M-20.2 EEBD must be removed from service:
  - Case cracked, burned, deformed, or excessively worn.
  - Excessive gap between the cover and base.
  - Damaged latch or cover band.
  - Dirt, debris, or moisture visible through the gauge window.
  - Broken belt loops.
- Ensure that the M-20.2 EEBD has not exceeded the life date printed on the information label.
  - Ensure belt worn period (5 consecutive years) has not expired.

WARNING

If the M-20.2 EEBD fails any of the above inspections or if at any time during its life the pressure gauge is out of the green zone or the indications of force impacts are observed, the unit should be removed immediately from service.

CLASSIFICATION OF THE M-20.2 EEBD

E-31. The Ocenco M-20.2 is a belt worn or stored, compressed-oxygen EEBD. The M-20.2 EEBD instantly provides breathable air, independent of the surrounding atmosphere, to a person escaping from any area of toxic gas or oxygen deficiency.

E-32. The M-20.2 EEBD meets or exceeds the EEBD requirement for confined spaces onboard ships in the U.S. Navy, the 10-minute self-contained closed circuit breathing apparatus requirement for escape from confined space, and the EEBD requirement for use in maritime shipboard confined spaces as required in the SOLAS Convention.

METHOD OF OPERATION

E-33. Figure E-7 provides a graphic depiction of EEBD method of operation, which is as follows:

- Oxygen automatically and continuously flows from the cylinder to the breathing bag when the unit is pulled from the base.
- During inhalation and whenever the bag flattens, the oxygen regulator increases the oxygen flow into the breathing bag.
- During inhalation, oxygen passes from the breathing bag through the scrubber and into the mouthpiece.
- During exhalation, CO2-laden air is exhaled through the scrubber and then into the breathing bag.
- During inhalation and exhalation, CO2 is absorbed by the lithium hydroxide scrubber.
- Occasionally, during low work rates, the oxygen regulator supplies more oxygen than the user can consume. When this occurs, the excess gas automatically vents through the relief valve.
- The starting of the oxygen flow, the increased flow rate during high work rates, and the occasional venting of gas through the relief valve, all occur automatically—the user needs only to breathe.

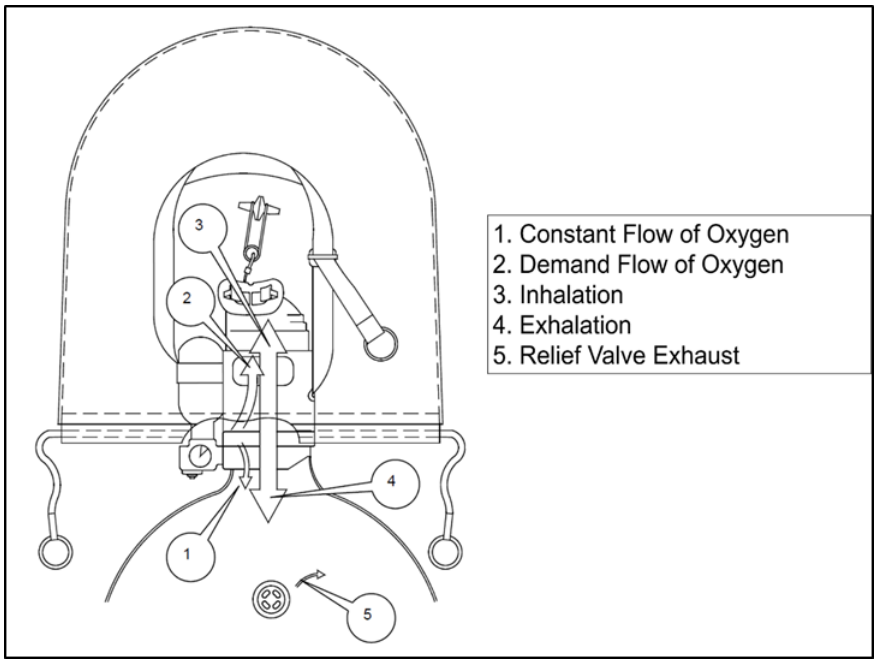

Figure E-7. M-20.2 EEBD

DONNING PROCEDURES

E-34. Figure E-8 demonstrates the donning steps for the stored configuration of the M-20.2 EEBD. These six steps must be practiced numerous times until they become second nature.

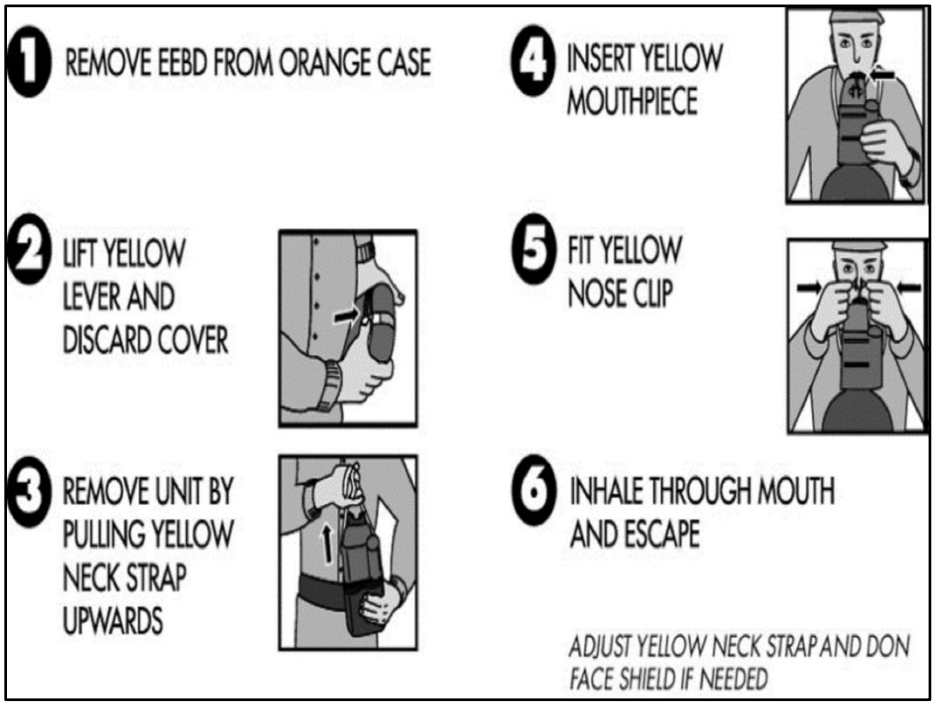

Figure E-8. EEBD donning procedures

E-35. The following additional guidance will assist in the proper fit and wear of the EEBD:

- To fit the neck strap, simply place the neck strap over the head and pull upward on the O-ring to shorten the neck strap.
- To fit the face shield, simply pull the face shield over the head and pull outward on the O-rings to tighten the face shield around the neck.
- In the unlikely event that moisture on the inside of the face shield distorts your vision, simply press or rub the face shield against the face with your hand.

CAUTION

The flow of oxygen will begin automatically when the unit is removed from its base. You should not expect to hear the flow of oxygen or see the breathing bag inflate.

COMPONENTS

E-36. Please refer to the illustration of components in Figure E-9:

1. **Nose clip:** The yellow nose clip is attached to the mouthpiece and is used to close the nasal passage during use of the EEBD.
2. **Mouthpiece:** The yellow mouthpiece is placed in the mouth such that the flange seals between the lips and gums. The bits should be between the upper and lower teeth. Gently bite on the bits.
3. **Neck strap:** Place the yellow neck strap over the head for support and adjust for fit.
4. **Oxygen cylinder:** The stainless-steel cylinder holds 100% medical grade oxygen.
5. **Oxygen regulator:** Starts the flow of oxygen and increases the oxygen flow during high work rates.
6. **Activation cable:** The stainless-steel activation cable is attached to the oxygen regulator and permanently attached to the inside of the base.
7. **Gauge:** Indicates the amount of oxygen in the cylinder. The green zone indicates the M-20.2 EEBD is ready for use. The red zone indicates the cylinder is low on oxygen and should be removed from service. The gauge is visible through the clear case and the orange secondary container.
8. **Scrubber:** A chamber containing lithium hydroxide that removes CO2 from the exhaled air.
9. **Breathing bag:** Air reservoir that receives oxygen from the regulator and exhaled air from the user.
10. **Relief valve:** A one-way valve that automatically allows excess air in the breathing bag to vent.
11. **Yellow latch lever:** The yellow latch lever is lifted upwards to open the M-20.2 EEBD (only lift latch during emergency use).
12. **Cover:** The cover has an integral yellow tab that, when lifted, releases any possible vacuum which may have developed due to change in atmospheric pressure.
13. **Base:** Features integral belt loops. If belt worn, the base stays on the belt after the M-20.2 EEBD has been removed from the case. The base has an overcase that provides increased abrasion and impact resistance.
14. **S-Hook:** The metal hook that receives the cover latch on the belt side.
15. **Face shield:** In the event the user requires head protection from smoke or chemical vapor, the face shield may be pulled up over the head and secured around the neck by pulling outward on the draw strings. This should be done only after inserting the mouthpiece and applying the nose clips.
16. **Bag shield:** A cover providing additional protection to the breathing bag to protect against heat, punctures, or chemicals.
17. **Tamper Indicating Ball:** The presence of a stainless-steel ball bearing located in the center of the yellow lever assures that the unit has not been opened (unit must be removed from service if the tamper ball is missing).
18. **Band label:** Is a user-completed label indicating the commencement date of belt worn service.
19. **Information label:** Contains the following information:
    - MFG Date: XX/XX the date of manufacture as month/year.
    - Life Date: XX/XX the end of service life date as month/year.
    - Serial No: X123456 the traceable serial number of the M-20.2 EEBD.

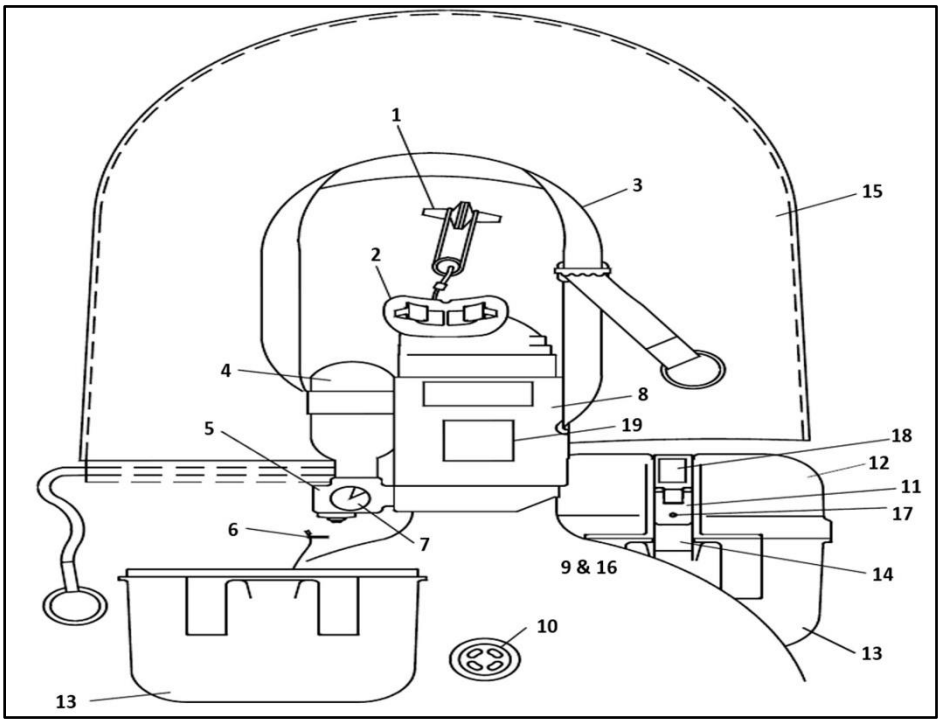

Figure E-9. EEBD components

SPECIFICATIONS

Duration:

- 10 minutes, US 42 CFR 84, Dept. of Health and Human Services, National Institute for Occupational Safety and health (NIOSH).
- 10 minutes, European Standard EN400, EC mark CE0194/EN400.
- 15-18 minutes, U.S. Navy Test Protocol, Naval Surface Warfare Center.
- 32 minutes, at rest, as determined by US 42 CFR 84 manifest number 5.

Dimensions:

- 6.9 x 16.7 x 15.5 cm (2.75 x 7.0 x 6.1 in)

Weight:

- 900 grams, breathing apparatus only (2.0 lb.)
- 1410 grams, with case and overpads (3.1 lb.)

Storage temperature:

- Minimum: 10° F (-12.2° C)
- Maximum: 149° F (65° C)

SERVICE LIFE

E-37. The M-20.2 may remain in service for fifteen years from the date of manufacture, provided the conditions of use are observed.

E-38. The M-20.2 must be either stored or belt worn, according to the conditions of use, throughout its service life. The M-20.2 may be deployed in the belt worn configuration for 5 continuous years during its 15-year service life.

E-39. After the M-20.2 has been deployed in the belt worn configuration for 5 continuous years, it may be stored for the remainder of the service life, or it may be returned to Ocenco Incorporated to be refurbished.

After the M-20.2 has been refurbished by Ocenco, it may be re-deployed in the belt worn configuration for 5 years.

CONDITIONS OF USE

1. The visual inspections described in this manual must be performed.
2. Proper care described in this manual must be performed.
3. When stored, the M-20.2 EEBD must be contained in an Ocenco, Incorporated secondary container (P/N648000) and then placed in a rigid bracket securely fastened to a wall or other substantial structure.
4. If belt worn, the M-20.2 EEBD must be worn on the person and initial date of use recorded on the band label.
5. The M-20.2 EEBD is not to be shoulder carried in the secondary container. Use of the secondary container strap is intended for emergency egress only.

DURATION

E-40. Five factors affect the duration of the M-20.2 EEBD:

1. The amount of work required to escape affects the duration. Low ceilings, steep inclines or ladders, and irregular floors increase the work required to escape. Less work results in greater duration.
2. The physical condition or fitness of the user affects the duration. A high heart rate, age, and high percent of body fat decrease the fitness of the subject. The more fit the user, the greater the duration.
3. Regardless of the physical fitness of the user, the amount of oxygen required is proportional to the user's weight. The less the user weighs, the greater the duration.
4. The user's breathing rate affects the duration. The rate can be increased by excitement and fear. The lower the breathing rate, the greater the duration.
5. The degree of training and familiarity can affect the duration. The more training and experience the subject has with the M-20.2 EEBD, the more his breathing will be calm and controlled. If a subject is familiar with a particular escape-way, it may improve the mechanics of his escape. The greater the training and familiarity, the greater the duration.

HOW TO CARE FOR THE M-20.2 EEBD

E-41. Your life may depend on the care you give your M-20.2 EEBD. Avoid the most common abuses:

- Do not drop the M-20.2 EEBD, particularly when taking off the belt to which it is attached.
- If the M-20.2 EEBD is accidentally opened, do not close it. Remove from service.
- Do not clean the M-20.2 EEBD with anything other than a soft brush (only outside case).
- Do not immerse the M-20.2 EEBD in water.
- Do not sit on the M-20.2 EEBD.
- Do not drag the M-20.2 EEBD on the ground.
- Do not place the M-20.2 EEBD near heat greater than 149°F (65°C).
- Do not put tape or stickers on the M-20.2 EEBD that would impede its opening or the reading of the gauge.

WHEN TO USE THE M-20.2 EEBD

E-42. The M-20.2 EEBD should be used immediately at the first indication of a fire or explosion, even if smoke is not visible. Carbon monoxide is odorless and colorless. You could breathe a fatal amount of carbon monoxide before smoke is present. If you suspect an oxygen deficient atmosphere, put on the M-20.2 EEBD—DO NOT WAIT. Some of the possible indications of an emergency are:

- Sight of smoke.
- Smell of smoke.
- Sight of fire.
- Fire or toxic gas alarm.
- Sudden increase of air temperature.

- Sound of an explosion.
- Vibrations of an explosion.
- Interruption of air flow.
- Someone around you has difficulty breathing or passes out.

E-43. In the event of an emergency, always don your M-20.2 EEBD before attempting to escape or help others.

DISPOSAL AND RETURN INSTRUCTIONS

E-44. Safe disposal is necessary after the M-20.2 EEBD has been used, fails inspection, or has exceeded the fifteen-year service life. Expended Ocenco EEBDs must be disposed of IAW HAZMAT disposal regulations. The units can be returned to Ocenco with a return material authorization (RMA) obtained from Ocenco.

M-20.2T TRAINER INFORMATION

Note: The M-20.2T trainer is identified by a blue secondary container and a blue scrubber.

WARNING

The M-20.2T trainer provides NO protection from hazardous atmospheres and is to be used for training purposes only.

It is critical that the M-20.2T trainer be segregated from regular workspaces so it is not mistaken for an actual M-20.2 EEBD unit.

E-45. The M-20.2T Trainer is designed to look like, don like, and have breathing resistance similar to the M-20.2 EEBD.

E-46. Opening and donning an M-20.2 EEBD is a motor skill. The most effective method of teaching a motor skill is to have the student repetitively perform the motor skill.

E-47. It is essential that the students have hands-on experience with the M-20.2T trainer. The more often students have the M-20.2T trainer in their hands and the more often the M-20.2T trainer is donned in practice, the better their recall will be. Periodic training is highly recommended to achieve proficiency.

E-48. The following describes the theory of operation of the M-20.2T trainer:

- The M-20.2T trainer is worn on the belt to demonstrate the proper orientation on the belt or is placed in the blue secondary container to simulate the stored position.
- The latch assembly is identical to the M-20.2 EEBD so that the opening of the M-20.2T trainer is practiced hands-on.
- As the unit is pulled from the base by the neck strap, the activation cable snap disconnects from the oxygen regulator, simulating the oxygen activation of the M-20.2 EEBD.
- During inhalation, air is supplied to the student from the atmosphere through holes in the mouthpiece.
- During exhalation, air is exhaled into the mouthpiece, passing through the holes in the mouthpiece to the atmosphere. During inhalation and exhalation, the breathing resistance through the mouthpiece holes simulates the breathing resistance of the M-20.2 EEBD.

E-49. The following are steps to clean and re-pack the M-20.2T trainer:

- Remove the mouthpiece from the scrubber by pressing the release button with a standard pencil eraser or similar object and pulling upwards on the mouthpiece removing it from the scrubber.
- Sanitize the mouthpiece using one of the following methods:

  - Immerse mouthpiece for 2 minutes in warm water 110°F (43°C) solution of hypochlorite solution (approximately one milliliter of liquid laundry bleach to 1 liter of water).
  - Immerse mouthpiece for 2 minutes in a warm water 110°F (43°C) solution of Wescodyne (approximately 2 tablespoons of Wescodyne per 1 ½ gallons of water).
- Rinse under clean running warm water at a temperature of about 110°F; DO NOT exceed 122°F (50°C).
- Allow mouthpiece to air dry. DO NOT dry mouthpiece by placing near heat or in direct sunlight.
- Wipe remainder of the M-20.2T trainer with a sponge dampened in cleaning solution.
- Air dry in a clean, uncontaminated area in such a way as to prevent distortion of mouthpiece.
- Snap the mouthpiece onto the scrubber spring clips.
- Fold the breathing bag into a rectangle no larger than the bottom of the scrubber.
- Snap the activation cable onto the oxygen regulator.
- Carefully set the M-20.2T trainer into the base while holding the breathing bag (folded) against the bottom of the scrubber. It may be helpful to use a packing strap to help hold the breathing bag in place. Remove the strap after the M-20.2T trainer is in the base.
- Hold the mouthpiece and nose clip and fold the neck strap on top of the mouthpiece and cylinder. It may be helpful to use a packing strap to hold in place.
- Place the cover on the base; make sure to remove the packing strap if it was used.
- Hook the S-hook on the belt loop side of the base assembly with the two hooks curling away from the case.
- Hook the latch assembly on the front side of the base, making sure it is correctly secure in the slot as shown in Fig. E-10 and not incorrectly as shown in Fig. E-11.
- Bring the latch assembly over the cover and engage the two yellow forks on the lever in the curled tabs of the S-hook and push down on the yellow lever.

Figure E-10. Hook latch assembly (correct band position)

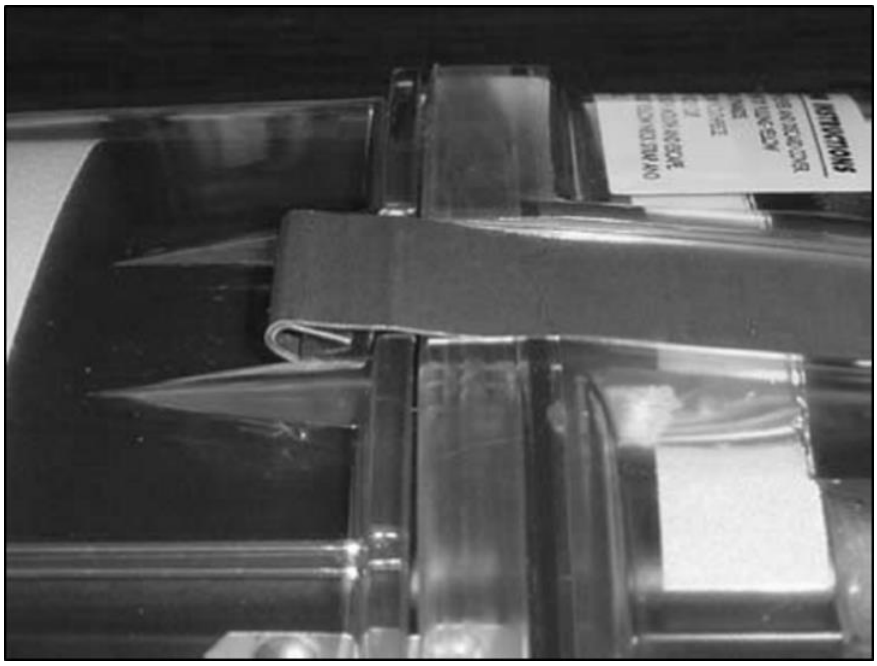

Figure E-11. Hook latch assembly (incorrect band position)

SPECIAL USER INSTRUCTIONS

- Failure to properly use and maintain this product could result in injury or death.
- All approved respirators shall be selected, fitted, used, and maintained IAW Mining Safety and Health Organization, Occupational Safety and Health Administration, and other applicable regulations.
- Never substitute, modify, add, or omit parts.
- Refer to the user instructions and maintenance manuals for information on the use and maintenance of this respirator.
- Special or critical user instructions and specific use limitations apply. Refer to instruction manual before donning.
- Approved for use at temperatures above 10° F (-12.2° C).

FAST RESCUE BOAT

E-50. Operational on-load test functions:

- Position the boat partially in the water such that the mass of the boat is substantially supported by the falls and the hydrostatic interlock system, where fitted, is not triggered.
- Operate the on-load release gear.
- Reset the on-load release gear.
- Examine the release gear and hook fastening to ensure that the hook is completely reset, and no damage has occurred.

E-51. Operational off-load test functions:

- Position the boat so that it is fully waterborne.
- Operate the off-load release gear.
- Reset the off-load release gear.
- Recover the boat to the stowed position and prepare for operational readiness.

E-52. During the test prior to hoisting, check that the release gear is completely and properly reset. The final turning-in of the boat shall be done without any persons on board.

DYNAMIC WINCH BRAKE TEST

E-53. This is a dynamic test of the winch brake at maximum lowering speed lowering the empty craft. When the craft has reached its maximum lowering speed and before the craft enters the water, abruptly apply the brake. Following these tests, the stressed structural parts shall be re-inspected where the structure permits the re-inspection. The load to be applied shall be the mass of the survival craft or rescue boat without persons on board.

WIRE ROPE INSPECTION

E-54. Do not use wire rope or rope slings that have any of the following conditions:

- 10 randomly distributed broken wires in one rope lay or 3 or more broken wires in one strand in 1 rope lay.
- Kinking, crushing, bird caging, or other damage resulting in distortion of the wire rope structure.
- Evidence of heat damage.
- Excessive wear or corrosion, deformation, or other defects in the wire or attachments, including cracks in attachments.
- Any indication of strand or wire slippage in end attachments.
- More than one broken wire close to a socket or swaged fitting.

E-55. See Figure E-12 wire length and E-13 wire issues below.

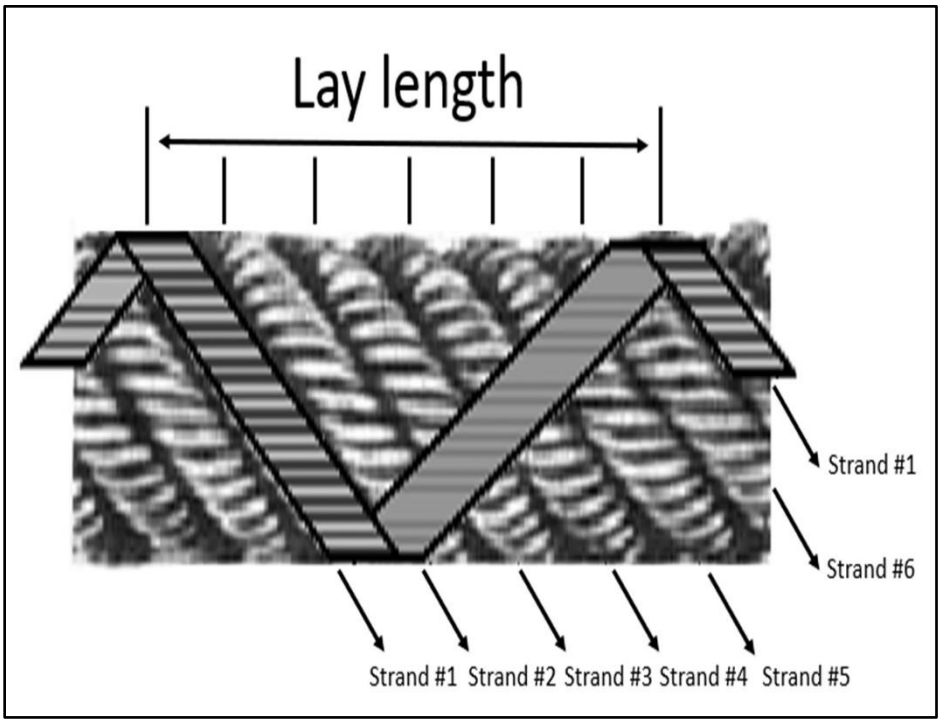

Figure E-12. Wire length

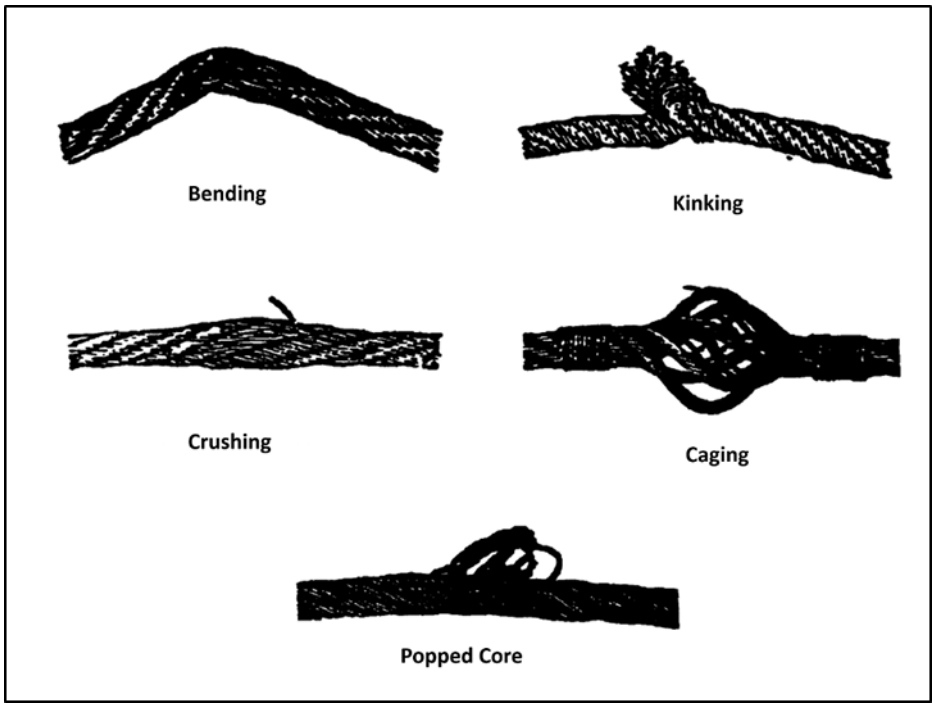

Figure E-13. Wire issues

E-56. Requirements for authorization of service providers shall include, as a minimum, demonstration of:

- Employment and documentation of personnel certified IAW a recognized national, international, or industry standard as applicable, or a manufacturer's established certification program.
- Availability of sufficient tools (in particular any specialized tools specified in the manufacturer's instructions), including portable tools as needed for work to be carried out on board ship.
- Access to appropriate parts and accessories as specified for maintenance and repair.
- Availability of the manufacturer's instructions for repair work involving disassembly or adjustment of on-load release mechanisms and launching appliance winches.
- A documented and certified quality system which covers at least the following:
  - Code of conduct for personnel involved in the relevant activity.
  - Maintenance and calibration of measuring tools and gauges.
  - Training programs for personnel.
  - Supervision and verification to ensure compliance with SOPs.
  - Recording and reporting of information.
  - Quality management of subsidiaries and agents.
  - Job preparation.
  - Periodic review of work process procedures, complaints, corrective actions and issuance, maintenance, and control of documents.

LIFE RAFTS

NAVY MARK 7

E-57. The Navy Mark 7 (Mk7) is constructed of polyurethane coated nylon fabric that is radio frequency welded, making the Mk-7 very abrasion and puncture resistant with strong, durable seam construction. The periphery of the life raft bottom is arrayed with a series of weighted ballast bags that fill with water when the life raft is inflated providing stability to the life raft and reducing the possibility that the raft can be capsized

by wind and sea. An inflatable boarding ramp with webbing ladder projects from the life raft hull to provide easy entry from the water. In the event the life raft was to inflate upside down, a righting ladder is attached to the bottom so that one person can easily right the life raft. The Mk-7 is covered with a high visibility, double layered canopy which can be secured closed to protect the occupants from the weather. The canopy is equipped with a port so that a lookout can be placed to observe rescue craft with the canopy remaining closed. The canopy is also equipped with reflector tape to increase the visibility of the raft to rescue craft and a rain catchments system to collect rainwater to augment drinking water supplies. Lifelines are located both inside and outside the life raft. The life raft floor is covered with an aluminized foam panel to provide the survivors thermal protection from cold seawater. The Mk-7 is equipped with a breathable air inflation system that can inflate the life raft in less than 30 seconds. The inflatable chambers have pressure relief valves to vent any excess air pressure and topping-off valves so that air can be added to maintain adequate air pressure and rigidity.

Automatic Inflation

E-58. If the ship sinks prior to a manual launch of the life raft, the hydrostatic pressure, at a depth of 5 to 15 feet, will actuate the HRD. Once the HRD has released the stowage harness, the life raft will float free and up to the surface. As the ship continues to sink, the sea painter will deploy; upon reaching the end of the sea painter, the downward pull of the sinking ship will actuate the inflation system. The buoyancy of the inflating life raft will cause the sea painter or weak link to part, allowing the life raft to float free on the surface.

E-59. A sea anchor is deployed upon inflation to reduce drift of the life raft from the area. Once the life raft is inflated, activate flashing lights on the canopy at night to allow survivors and rescue craft to locate the life raft.

E-60. See Figure E-14 for deck-mounted single life raft.

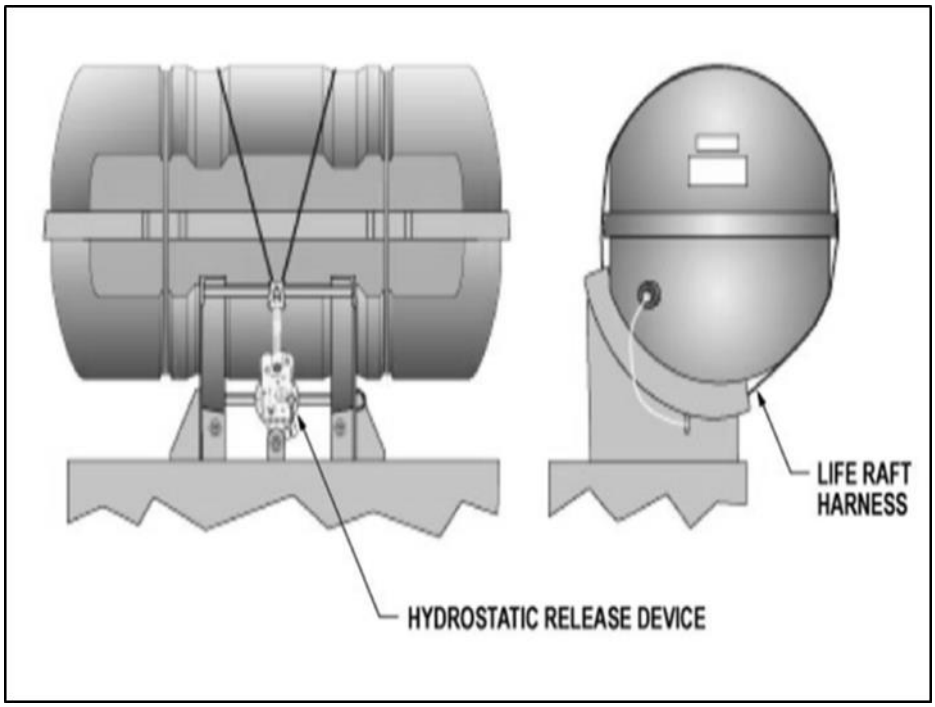

Figure E-14. Deck-mounted single life raft

Righting An Inverted Life Raft

E-61. It is possible that a life raft may inflate inverted. The life raft is equipped with a righting ladder so that one person should be able to right the inverted life raft. Use the follows steps to right an inverted life raft (refer to Figure E-15):

1. One person swims to the bottom side of the life raft where the inflation cylinders are attached. This is usually on the side of the bottom that is closest to the water surface.
2. Place the feet on the bottom of the lower buoyancy tube, grasping the righting ladder, and stand up on the bottom of the buoyancy tube.
3. Lean backwards, shifting weight away from the life raft. This causes the life raft to flip over, right side up.
4. Using the lifelines, move around to the boarding platform and enter the life raft.

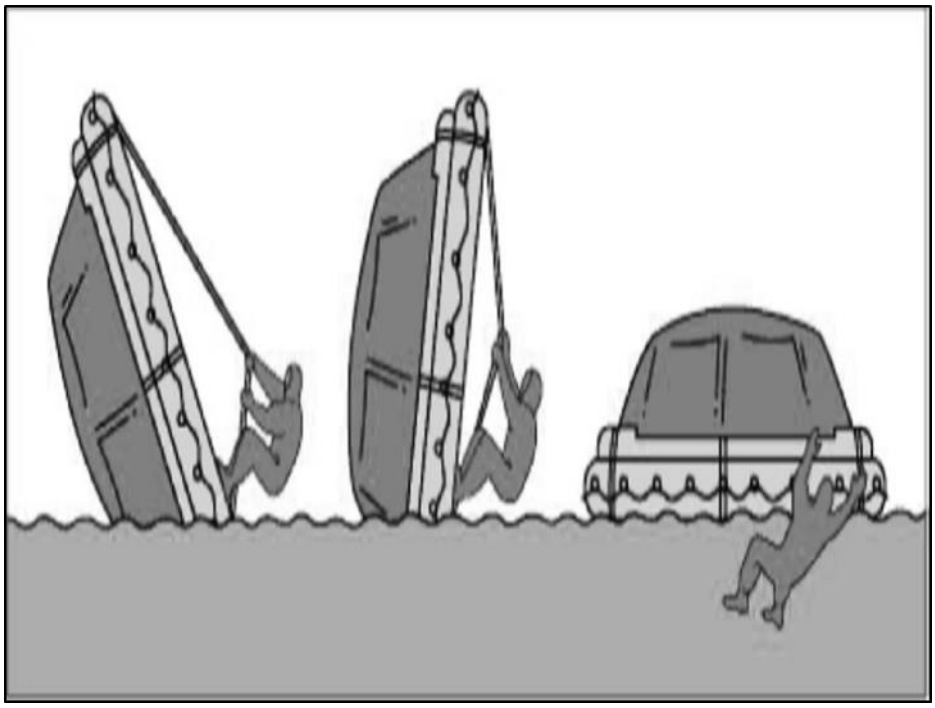

Figure E-15. Righting an inverted life raft

WARNING

Ensure other personnel are not in the way of the righting life raft as it flips over. Be careful of the life raft as it flips over so that it does not strike the person righting it.

SECURING

E-62. Equipment for securing the life rafts in their stowage mounts will include a hydrostatic release assembly that permits automatic and manual release. This provides for quick release of the life raft from its stowage for manual launching or release from its stowage from hydrostatic pressure. The stowage securing harness shall be inspected to ensure proper tension and shall be tightened until the life raft is securely seated in its cradle but so as not to damage the life raft container.

HYDROSTATIC RELEASE DEVICE

E-63. To replace and install the Release Hydrostatic, Thanner DK84.1-M:

- Remove previously installed release hydrostatic.

- Install the release lifesaving equipment by connecting the fixed end to the cradle or ship's structure and the release pawl end to the retaining harness with PUSH TO RELEASE plunger facing inboard.
- Ensure that the safety pin is installed to avoid inadvertent release.
- Tighten the retaining harness until the life raft is securely seated in the cradle, but not so much as to damage the life raft container.

E-64. To activate the release lifesaving equipment:

- Remove safety pin.
- Strike the PUSH TO RELEASE plunger with the palm of your hand to free the release pawl.

E-65. To reset the release lifesaving equipment:

- Insert an 8 mm Allen wrench into the TURN TO RE-SET well and turn it counterclockwise from the II to I position until an audible click is heard. This indicates that the release pawl is reset to the locked position.
- Install safety pin.

E-66. As previously mentioned, recertification of the release lifesaving equipment is required every five years. Recertification can be accomplished by authorized commercial recertification centers and at the naval facilities listed below. Shipping must be funded to and from point of destination.

Mid-Atlantic Regional Maintenance Center (MARMC)
Commanding Officer
Norfolk Naval Shipyard
Life Raft RRC Bldg. 369
Portsmouth, VA 23709
Phone: 757-396-2057

South-East Regional Maintenance Center (SERMC)
Bldg. 1488 Code 937G
N.S. Mayport, FL 32228
Phone: 904-270-5126 Ext. 3171

South-West Regional Maintenance Center (SWRMC)
Commanding Officer
U.S. Naval Station
3985 Cummings Road Bldg. 116
San Diego, CA 92136
Phone: 619-556-2957

U.S. Naval Ship Repair Facility (USNSRF)
Code C-310H
PSC 473 Box 8
FPO AP 96349-0008
Phone: 011-81-46-816-5235/5814

COMMERCIAL LIFE RAFTS

E-67. Inflatable life raft stowage should be located to provide the following for each life raft:

- Stowed so that when the vessel sinks the survival craft floats free and, if inflatable, inflates automatically.
- Stowed in a position that is readily accessible to crewmembers for launching in less than 5 minutes or provided with a remotely operated device that releases the life raft into launching position or into the water.
- Stowed in a way that permits manual release from its securing arrangements without shifting in its mount.

- Ready for immediate use so that crewmembers can carry out preparations for embarkation and launching.
- Stowed in a way that neither the life raft nor its stowage arrangements will interfere with the embarkation and operation of any other life raft at any other launching station.
- Stowed in a way that any protective covers will not interfere with launching and embarkation.
- Stowed, as far as practicable, in a position sheltered from breaking seas and protected from damage by fire.

E-68. A mechanical, manually operated device to assist in launching a life raft must be provided—

- If the life raft weighs more than 90.7 kilograms (200 pounds).
- If the life raft requires lifting more than 300 vertical millimeters (one vertical foot) to be launched.
- To permit ready manual overboard launching into the water without hitting obstructions.
- To be clear of overhead obstructions.
- To avoid the effects of heavy seas.
- To interfere as little as possible with normal shipboard activity.
- They shall be located, longitudinally, where they will provide the maximum practical distribution of lifesaving facilities. Furthermore, instructions shall be plainly visible and the station lighted by the vessels emergency lighting system.

PERSONAL FLOTATION DEVICES

FLOTATION COVERALLS (USCG SERIES 160.053/TYPE III/V)

E-69. Personnel operating in a cold, wet environment should wear the flotation coverall when they need protection from hypothermia or when operating in an area where the water temperature condition is conducive to accelerated hypothermia. It provides flotation similar to that provided by the work vest.

E-70. The main advantages of the flotation coverall are its wearability, ease of donning, and simple construction. The disadvantages are limited flotation (no righting moment) and minimum buoyancy.

E-71. The flotation coverall PFD is not universally sized. There are four different sizes available in the supply system: small, medium, large, and extra-large.

E-72. The flotation coverall is made of orange urethane-coated nylon exterior fabric with a closed-cell foam interlining to provide thermal protection. The coverall allows full freedom of movement. The coverall features an attached, orally inflated pillow to support the wearer's head in the water. It also has an attached hood for extra thermal protection and reflective tape/material on the hood and shoulders for better visibility at night.

E-73. Don flotation coveralls in the same fashion as standard coverall.

Inspection and Maintenance

E-74. Units shall inspect the flotation coveralls upon initial issue and monthly thereafter. To inspect the coverall, follow guidance provided in TM. Complete the following at minimum:

- Lubricate the zipper with beeswax.
- Lay out suit and check for obvious damage.
- Work entry zipper up and down to check for ease of operation. Rubbing beeswax over edges of zipper will ease operation.
- Check buoyancy chamber and inflation tube for obvious damage.
- Inflate buoyancy chamber and check for leaks.
- Deflate chamber.
- Inspect and test the whistle and distress marker light.

E-75. Flotation coveralls have a ten-year life span. (Manufacture dates can be determined by lot number or manufactured date. These markings vary by manufacturer.)

Cleaning

E-76. To clean the flotation coverall, follow the manufacturer cleaning instructions on the label. When coveralls have been submerged or exposed to salt water or salt spray, wash them in a shower with a mild soap. To dry the coveralls, hang on a wooden hanger in a cool, dry, well-ventilated area. Do NOT dry in direct sunlight.

CAUTION

Do not machine wash or dry as this will damage the suit.

Do not use thinners, solvents, or similar agents for cleaning.

IMMERSION SUITS (USCG SERIES 160.171 / TYPE V)

E-77. Immersion suits are worn by crewmembers when abandoning ship. The suit affords protection from exposure to cold water, wind, and spray. The foam fabric is a durable and elastic material with high flotation characteristics.

E-78. The approved immersion suit is a one-piece garment constructed from 3/16-inch nylon-lined neoprene or PVC foam.

E-79. The buoyancy provided to the lower torso will cause the wearer to float horizontally either face up or face down in rough seas. Additional flotation, such as the inflatable collar provided with the suit, must be used to assure face up flotation. The adult universal immersion suit is designed so that one size will fit most persons (weighing between 110 and 330 pounds). Other sizes are available. The thermal qualities of the fabric/foam laminate will keep personnel warm whether they are wet or dry.

E-80. To don the immersion suit, proceed as follows:

- Remove suit from stowage bag with a sharp jerk of the carrying bag.
- Insert the non-dominate arm first, then don the hood, then insert the dominate arm.
- Close the zipper completely. To avoid problems zipping up the suit, arch your back to remove wrinkles in the fabric.
- Close the spray shield and inflate the collar for additional flotation.

E-81. Table E-1 contains information about hypothermia and describes its effects on most adults. Consult TB MED 508 for more cold weather precautions and identification.

Table E-1. Hypothermia Table

Water temperature in degrees F	*Exhaustion or unconsciousness*	*Expected time of survival*
32.5	Under 15 minutes	Under 15 to 45 minutes
32.5 to 40	15 to 30 minutes	30 to 90 minutes
40 to 50	30 to 60 minutes	1 to 3 hours
50 to 60	1 to 2 hours	1 to 6 hours
60 to 70	2 to 7 hours	2 to 40 hours
70 to 80	2 to 12 hours	3 hours to indefinite
Over 80	Indefinite	Indefinite

WARNING

The immersion suit provides the best protection from hypothermia in the water. However, it is extremely bulky and awkward to work in and is therefore limited to use for crews operating in cold weather when abandoning ship.

The flotation coverall provides good durability and out of water protection from the elements. It provides limited protection from hypothermia to crewmembers in the water.

Inspection and Maintenance

E-82. Inspect the immersion suit upon initial issue and monthly thereafter. To inspect the suit, follow guidance provided in TM and complete the following at a minimum:

- Stowage bag - Check condition of snaps on bag for ease of operation. Repair as needed or replace the bag when no longer serviceable.
- Suit - Lay out on a flat, clean surface and check for obvious damage.
- Work entry zipper up and down to check for ease of operation. Rubbing beeswax over edges of zipper will ease operation.
- Inflatable collar - Check collar for obvious damage.
- Inspect and test the whistles and distress marker lights.

E-83. The immersion suit has a ten-year life span. (Manufacture dates can be determined by lot number or manufactured date. These markings vary by manufacturer.)

Note: Periodically inflate collar and allow it to stand overnight. If the collar does not stay firmly inflated overnight the suit should be repaired or replaced. Inspect lock screw on inflatable collar inflation tube to ensure that it is in the unlocked position.

Repairs

E-84. The only unit repair authorized is to the retro-reflective tape. Only replace unserviceable reflective tape/material with approved SOLAS retro-reflective tape.

E-85. The stowage bag may have minor repairs completed by the local logistics readiness center fabric repair facility.

E-86. Repairs beyond unit level must be conducted by the manufacturer or authorized repair facility.

Packing

E-87. To repack the survival suit after inspection, follow the manufacturer's instructions or proceed as follows:

- Ensure entire suit is completely dry prior to stowage.
- Lay out suit on a flat clean surface with front up and arms out.
- Make sure entry zipper is open to within approximately 1" from the bottom to allow freeing from entanglement of clothing.
- Roll or fold suit, feet first, up to chin, making sure not to bend inflation tube.
- Place suit in bag and close snaps.
- Stow bag with handle exposed.

Cleaning

E-88. To clean the immersion suit, follow the manufacturer cleaning instructions on the label. When suits have been submerged or exposed to saltwater spray, suits shall be washed under a shower with a mild soap. Do NOT wring out immersion suits. To dry the suit, hang it on a wooden hanger in a cool, dry, well-ventilated area. Do NOT dry in direct sunlight.

LIFE PRESERVERS (USCG SERIES 160.155 / TYPE I)

E-89. The life preserver allows a person to relax completely, extending survival time and allowing the person to assume a position to protect the body from hypothermia. The main disadvantages of this PFD are its bulk (which restricts freedom of movement) which hampers egress from a capsized boat or swimming under water to avoid burning oil.

E-90. When assessing risk, the commanding officer or master/coxswain should consider factors such as vessel size, time required to recover a person overboard, water and air temperature, sea and weather conditions, and the degree of mobility necessary for personnel to complete a task.

E-91. Inspect the life preserver upon initial issue and monthly thereafter. The only unit repair authorized is to the retro-reflective tape. Only replace unserviceable reflective tape/material with approved SOLAS retro-reflective tape.

E-92. To inspect the preserver, follow guidance provided in the applicable TM and complete the following at minimum:

- Inspect for tears, rips, and missing webbing, tapes, and hardware.
- Inspect and test the whistles and distress marker lights.
- Inspect the reflective tape/material for cracking, peeling, and discoloration.
- Inspect all straps and ties to check for rotted fabric or broken stitching.

WORK VESTS (USCG SERIES 160.053 / TYPE III/V)

E-93. The USCG 160.053 (Type III/V) PFD provides less flotation than the USCG 160.155 (Type I). It will not hold the head of an unconscious person face up to ensure survival. Its use may be appropriate when greater freedom of movement is needed. The work vest may be used aboard Army watercraft in favorable conditions. Its main disadvantages are limited flotation, the tendency to ride up on the wearer, and requiring conscious effort to keep the wearer's head out of the water.

E-94. Inspect the work vest upon initial issue and monthly thereafter. The only unit repair authorized is to the retro-reflective tape. Only replace unserviceable reflective tape/material with approved SOLAS retro-reflective tape.

E-95. To inspect the vest, follow guidance provided in the applicable TM but complete the following at a minimum:

- Inspect for tears, rips, and missing webbing, tapes, and hardware.
- Inspect and test the whistles and distress marker lights.
- Inspect the reflective tape/material for cracking, peeling, and discoloration.
- Inspect all straps and ties to check for rotted fabric or broken stitching.

DISTRESS MARKER LIGHT

E-96. The following provides descriptive information on the Model ALX marine lifejacket light, operating instructions, information for its maintenance and overhaul, instructions concerning the proper mounting of the light on lifejackets to ensure compliance with minimum performance standards, and limitations for the device.

Description of Device

E-97. The Model ALX is a SOLAS-approved flashing lifejacket light that is activated automatically when immersed in water and can be deactivated manually. The ALX consists of a battery and light encased in one plastic housing. The battery consists of alkaline cells incorporated into a watertight sealed housing. The housing has two exposed water sensor contacts. The electronic circuit detects water and activates the light. The design prevents inadvertent extinguishing of the light if the water sensor is not continuously immersed in water. The housing also has a button for the manual switching of the light.

E-98. The light is a LED covered by a plastic cover.

Operating Instructions

E-99. The ALX is activated automatically following immersion of the water sensor in fresh water or seawater. The ALX can be turned off by pressing the button on the top of the housing as seen in Figure E-16.

Figure E-16. Model ALX

Maintenance and Overhaul Information

E-100. Maintenance or periodic overhaul is not required. Overhaul at end of life is not possible.

E-101. Recommended inspection of the ALX includes the following:

- Electrical test of battery and lamp:
- Creating an electrical short between the exposed electrical contacts using tweezers or other conductive wire or dipping the ALX in water.
- In models with manual activation, one can press the button on the top of the housing.
- Check that the lamp starts flashing. An inoperative light should be rejected.
- Press the button on the top of the housing to switch the light off.
- Visual inspection – Replace product if the battery housing shows obvious signs of mechanical damage (for example, cracking or discoloration of the plastic or bulging of the case).

E-102. Defective units should be returned to the manufacturer or otherwise disposed of (see below under Limitations of the Device).

Instructions for Mounting on Lifejackets

E-103. Methods for mounting the ALX on lifejackets are as follows:

- The ALX light should be placed at the top or on the front of the shoulder of the lifejacket.
- Attach the ALX firmly to a strap in its designated position on the lifejacket using the plastic clip bracket provided with the ALX. Feed the strap along the back of battery and fasten the bracket to the battery by pushing the clip's plastic hooks through the corresponding holes on the battery housing. The plastic spikes should face inwards, holding the strap firmly in place.
- Once fastened with the clip, the light cannot be removed without breaking the clip.

Limitations of the Device

- The device is designed to provide effective luminous intensity of at least 0.75 candlepower in all directions of the upper hemisphere of the lens, as required under IMO SOLAS regulations, for a minimum of eight (8) hours after activation.
- The device is limited to a service life of five (5) years from the date of manufacture. Until then, it is considered usable as a safety appliance under IMO SOLAS regulations if the battery does not show signs of mechanical damage and the lightbulb is operative.
- Storage – Avoid extreme humidity and temperatures.
- Disposal – Dispose of used batteries IAW local regulations.

LIFE RING BUOYS

E-104. The standard ring buoy is a 30-inch diameter, inherently buoyant buoy. Ring buoys are intended to be used when a person falls overboard. All ring buoys will be stowed according to the FCP. All ring buoys will have 2" wide SOLAS-approved reflective tape attached, wrapped completely around, and spaced 90 degrees apart. All ring buoys will have the hull number of the vessel and "U.S. ARMY" printed in 2" block capital letters. See Figure E-17.

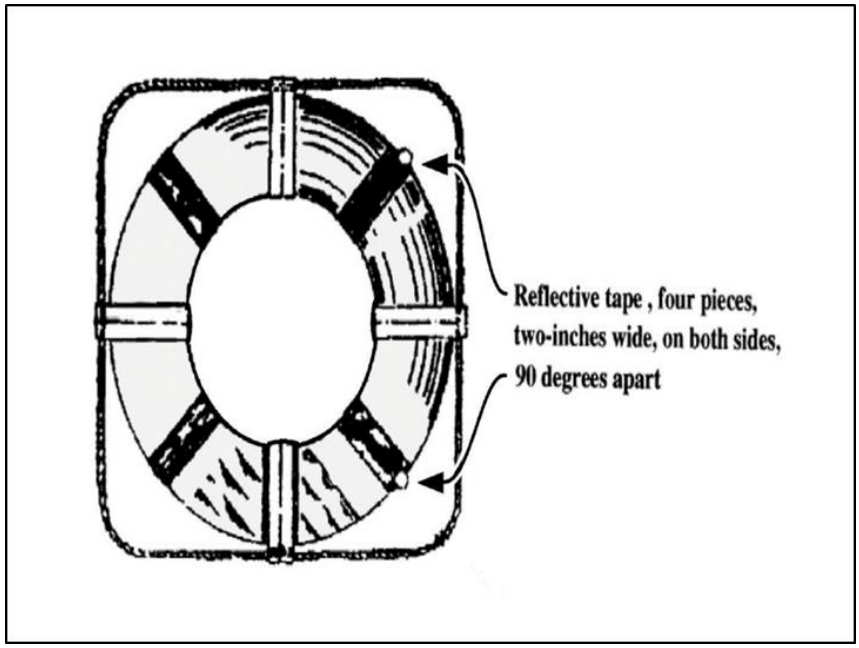

Figure E-17. Life ring buoy

E-105. The minimum number requirements for 30-inch ring buoys and the minimum number which shall have distress markers or retrieving lines shall be IAW the vessel's BII.

E-106. Ring buoys are deployed as follows:

- When "Man Overboard" occurs, a ring buoy with distress marker is immediately thrown towards the individual in the water.
- The buoys have a two-fold purpose:
  - To mark the spot where the individual entered the water so that the area will be visible to the turning vessel.
  - To give the individual some additional buoyancy to hold on to.

E-107. When the vessel is close enough to the individual, the ring buoy with the retrieving line is used. The bitter end of the retrieving line is either tied to the vessel or held by the Soldier throwing the ring buoy to the individual in the water. After the individual gains control of this ring buoy, the individual is drawn to the vessel's side and hoisted on board the vessel. Reflective tape or material assists in locating the ring buoy at night.

RING BUOY WITH LIGHT

E-108. The floating distress marker is a watertight, vapor-proof, battery-operated flashing light normally used during darkness to mark the location of objects in the water.

E-109. It is attached by 2'-4' of 5/16" diameter polyethylene/polypropylene line to ring buoys used at man overboard and lookout stations. On the opposite end of the line, it shall have a halyard snap attaching it to the life ring.

E-110. The capacitor discharge xenon flashtube emits flashes of light at a rate of 60 +/- 10 flashes per minute for a minimum duration of 15 hours. The mounting bracket is designed to hold the light in an inverted position yet release when a pull of 20 to 40 pounds is applied. External parts of the light other than the lens are international orange.

E-111. The floating distress marker will be modified by the crew by adding 1" of reflective tape just below the light housing when the light is in the "on" position (upright) and marking the outer casing with the vessel's hull number and "U.S. ARMY" (see Figure E-18).

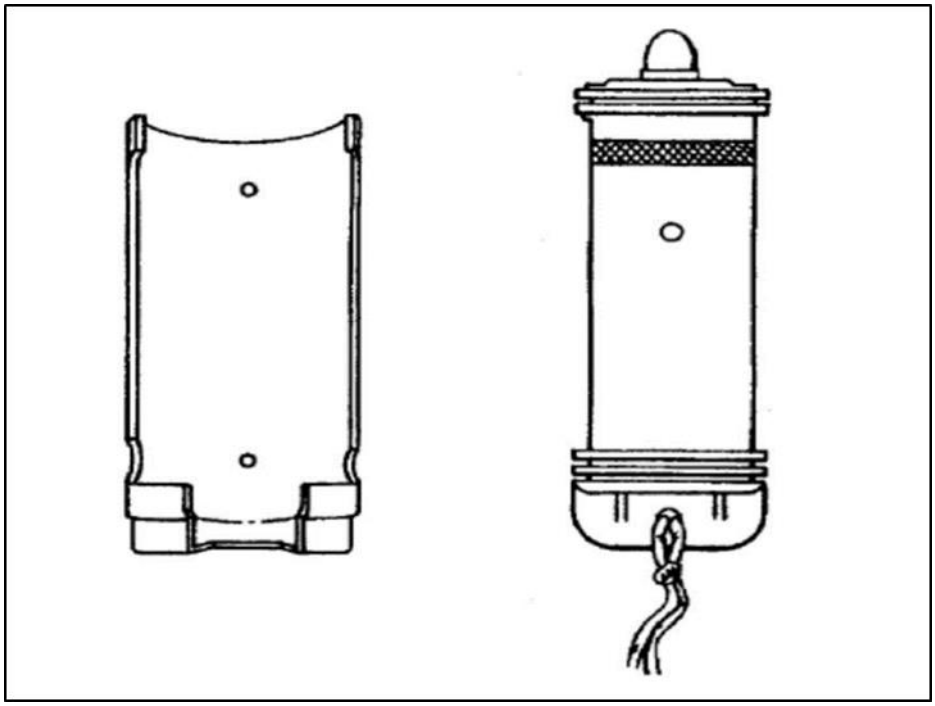

Figure E-18. Floating distress marker

Note: Weak batteries, internal corrosion, and lack of water tightness are major reasons for failure of floating lights.

Marine smoke/flame location marker may accompany the ring buoy with distress marker light located on the port and starboard bridge wing but will NOT be attached to either.

E-112. The floating distress marker light shall be inspected before placing the light into service and every month thereafter. Maintenance of the floating distress marker light is limited to inspection, replacement of batteries, and cleaning. To inspect the light, complete the following steps:

- Remove light from bracket, ensuring its easy removal.
- Remove battery from light.
- Inspect lens and case for interior condensation and cracks.
- Inspect condition and security of lanyard and halyard snap hook. Replace as necessary.
- Inspect battery compartment for corrosion or signs of battery leakage. Clean and dry all contacts.
- Clean exterior of light using a mild soap and water solution and a soft cloth.
- Thoroughly dry exterior of light.
- Replace any cracked or broken gaskets.
- Install a new battery. Maximum battery weight is 1.49 pounds. Batteries heavier than this will cause the light to sink. Refer to manufacture instructions for exact battery types. The battery will have the screw terminal posts; spring type battery posts are NOT to be used.
- Test the light by inverting it (lens up). The light should come on and flash at a rate of 60 +/- 10 flashes per minute.
- Test internal switch by turning light upside down (lens down); light should extinguish. If light does not flash or extinguish, replace light.
- Verify the battery is not expired.
- Ensure date of inspection is documented under TDIs in the vessel's official deck logbook.
- Replace light in bracket with lens down.

CAUTION

Do not keep the lamp in a lighted position more than necessary since operating life will be reduced.

RING BUOY WITH LINE

E-113. Ring buoys without floating distress markers must have a lifeline attached at least twice the height where it is stowed above the waterline with the vessel in its lightest seagoing condition, or 30 meters (100 feet) in length, whichever is the greater. The line must be buoyant and of a type certified to be resistant to deterioration from ultraviolet light.

E-114. Inspect ring buoys monthly as follows:

- Inspect the general condition of inherently buoyant material for holes, cracks, and rips.
- Inspect condition of lifeline and replace as required.
- Inspect retrieving line for condition and security. The retrieving line shall be securely attached to the ring buoy lifeline with an eye splice. Retrieving lines shall be stowed in a loose coil and lashed in place on the ring buoy with an easily breakable cotton thread.
- Inspect the reflective tape/material for tears and missing pieces.
- Ensure that the ring buoy is orange in color (international) and stenciled with the vessel's hull number and "U.S. ARMY".
- If a ring buoy is found unserviceable, remove it from the watercraft immediately.

Appendix F

Navigation Safety

This appendix covers items and equipment that are crucial to the safe navigation of watercraft.

CHARTS

F-1. Army watercraft operators must be able to read and understand their charts rapidly and accurately. How much information they get from a chart will depend on how well they read the chart and interpret the various symbols and abbreviations. Even though there is little room on a chart, much information must be shown on a chart for the safe navigation of vessels. Symbols and abbreviations are used for this reason.

F-2. The mariner must be able to identify and describe the following:

- Basic charts used aboard ship.
- Chart numbers.
- Correct charts.
- Basic navigation publications.
- Agencies that are responsible for updating, publishing, and issuing charts and publications.

F-3. The mariner must also be able to interpret chart numbers, use basic navigation publications, and know how to requisition charts and publications.

BASIC INFORMATION SHOWN ON CHART

F-4. The chart's legend will show the title of the chart which describes the waters covered, type of projection used, the scale, unit of measurement used for water depths (feet, fathoms, or meters), and the datum plane for the soundings.

F-5. Other useful information can also be listed on the chart (where space is available). This information could include the meanings to special abbreviations, cautions, special markings, and any other information that may be of value to the mariners. Boxes and notes may be printed in the margins or on the face of the chart at locations where it will not block out other navigational information.

CHART SYMBOLS AND ABBREVIATIONS

F-6. There are many symbols and abbreviations used on charts. These symbols and abbreviations are a type of graphic shorthand to tell you the physical characteristics of the area and the details of the available aids to navigation. These symbols and abbreviations are standardized but are subject to some variation depending on the series or scale of chart used.

CARE OF CHARTS

F-7. Charts are one of the most important aids to the navigator and they must be treated as such.

F-8. Charts should be kept dry and clean. Permanent chart corrections should be made in ink so that they cannot be erased. All other lines and markings should be made in pencil so that they can be erased. To avoid confusion, lines drawn on a chart should be drawn no longer than necessary, and they should be labeled. After you have finished using the chart, all lines should be erased. The chart should be inspected for damage and stored flat with the least amount of folding.

F-9. Print on demand is no longer available except in urgent cases. In order to request prints or chart inquiries, contact one of the printing offices below with the following information:

- Chart number or NSN.
- Quantity.
- Required delivery date (RDD).
- Unit UIC.

F-10. Printing offices contact information:

- MSO Norfolk at (757) 278-8410 or mmsonorfolk@dla.mil.
- MSO Hawaii at (808) 473-9580 or mmsonorfolk@dla.mil.

COMPASS

F-11. The magnetic compass is one of the oldest items of navigational equipment. It gets its source of power from the earth's magnetic field. Despite the rising importance and great convenience of the gyrocompass, the magnetic compass still retains its importance because of its simplicity and reliability. The magnetic compass will remain operative even when a ship is subjected to—

- Electrical power failure.
- Fire.
- Collision.
- Grounding.
- Other hazards.

DEPTH SOUNDING DEVICE

F-12. The hand lead line is the oldest and most reliable depth-finding device for shallow depths (see Figure F-1). It consists of a lead weight (7 to 14 pounds) attached to a 20-fathom line marked as follows:

- 2 fathoms – 2 strips of leather.
- 3 fathoms – 3 strips of leather.
- 5 fathoms – white rag.
- 7 fathoms – red rag.
- 10 fathoms – leather with hole.
- 13 fathoms – same as 3 fathoms.
- 15 fathoms – same as 5 fathoms.
- 17 fathoms – same as 7 fathoms.
- 20 fathoms – line with two knots.

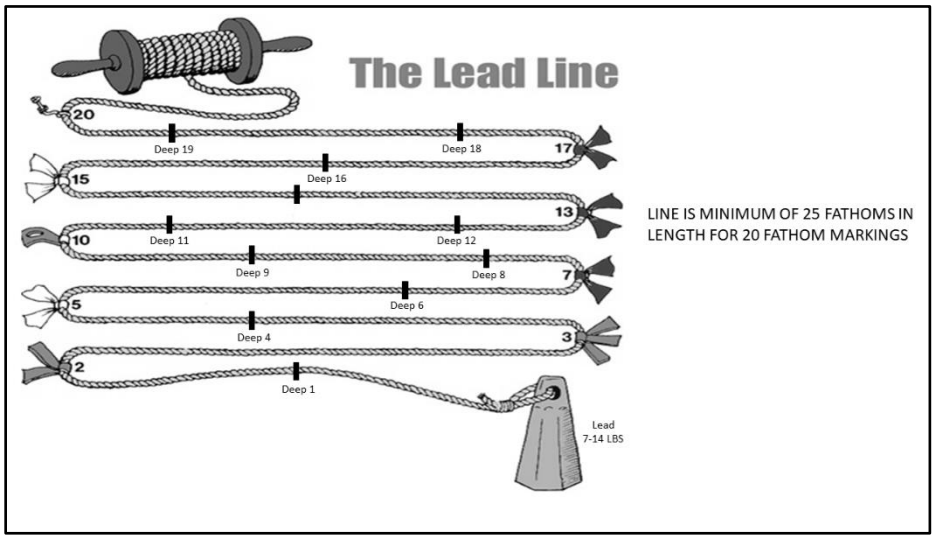

Figure F-1. Depth sounding device

F-13. On the hand lead, there are 9 "Marks" and 11 "Deeps" which are spoken of together as the “Marks and Deeps of the Lead Line”. Deeps are unmarked. If the depth obtained corresponds with any of the Marks, the leadsman sings out "BY THE MARK 5," "BY THE MARK 13," or whatever mark registers the depth of the water. If the depth is greater than any of the marks, but not one-half greater, they sing out "AND A QUARTER 5," "AND A QUARTER 13," or whatever the registered depth may be. If the depth is one-half more than any of the marks, they sing out "AND A HALF 5," or "AND A HALF 13," or whatever the depth may be. If the depth is a quarter of a fathom less than any mark, they sing out "QUARTER LESS 5," or "QUARTER LESS 13," or whatever the depth may be. The number of fathoms always forms the last part of the call. If the leadsman judges, by the distance between any two of the marks, that the depth of the water is 4, 6, 8, 9, 11, 12, 14, 16, 18, 19, or 21 fathoms, they say, "BY THE DEEP 4," or "BY THE DEEP 6," or whatever the sounding may be. Mark twain was a riverboat term meaning two fathoms (a depth of 12 feet or 3.6 meters), which was considered to be the minimum safe water depth for navigation.

DAY SHAPES

F-14. Shapes shall be black and of the following sizes:

- A ball with a diameter of not less than 0.6 meter.
- A cone with a base diameter of not less than 0.6 meter and a height equal to its diameter.
- A diamond shape shall consist of two cones (as defined above) having a common base.

F-15. The vertical distance between shapes shall be at least 1.5 meter.

F-16. In a vessel of less than 20 meters in length, shapes of lesser dimensions but commensurate with the size of the vessel may be used and the distance apart may be correspondingly reduced.

EMERGENCY POSITION-INDICATING RADIO BEACON

F-17. The EPIRB is a long-range search and rescue aid used in the event of vessel abandonment. The EPIRB is mounted IAW the FCP in a hydrostatic-release case that will automatically release the EPIRB should it become submerged. Upon submersion, the EPIRB will float to the surface and automatically start transmitting vessel information, including location, on a frequency of 406 megahertz. The strobe light will flash every few seconds to indicate that the EPIRB has been activated. The EPIRB operates best floating in the water and should be secured to the life raft using the lanyard to mark the position of the survivors. The EPIRB will operate for a minimum of 48 hours.

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS)

F-18. The integrated bridge system (IBS) is an interconnected combination of systems and equipment that permit centralized access to sensor information. The IBS also provides command and control functions from the ECDIS display consoles.

F-19. The IBS is part of the command, control, communication, computers, collaboration, intelligence, surveillance, and reconnaissance suite. The objective of the IBS is to improve safety, enhance navigation, increase vessel control efficiency, and provide effective management of bridge operations. A steady flow of navigational information from the vessel's sensors (position, heading, course, and speed) is continuously processed by the IBS and graphically displayed. The IBS provides position, radar, and speed data to the ECDIS, which allows personnel to optimize systems more efficiently.

LOAD LINE MARKINGS

F-20. The load line mark shall consist of a ring 12 inches in outside diameter and 1 inch wide, which is intersected by a horizontal line 18 inches in length and 1 inch in breadth, the upper edge of which passes through the center of the ring. The center of the ring shall be placed amidships and at a distance equal to the assigned summer freeboard measured vertically below the upper edge of the deck line (see Figure F-2).

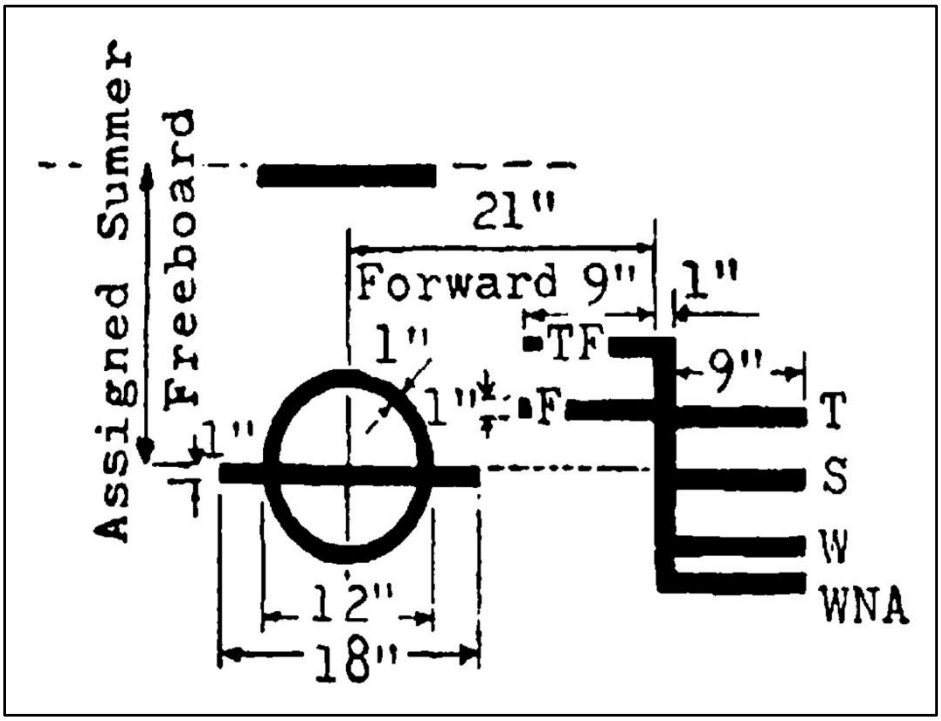

Figure F-2. Load line markings

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM

GMDSS AND VHF RADIO LOGS

F-21. The log must be kept in an orderly manner. The log may be kept electronically or in writing. Corrections must be made only by the person originating the entry by striking out the error, initialing the correction and indicating the date of correction. With respect to electronic logs, striking out the error is to be accomplished using a strike-through formatting effect or a similar software function, and the correction is to

be acknowledged through a dated electronic signature at the location of the strike-through. GMDSS sea areas are depicted in Figure F-3.

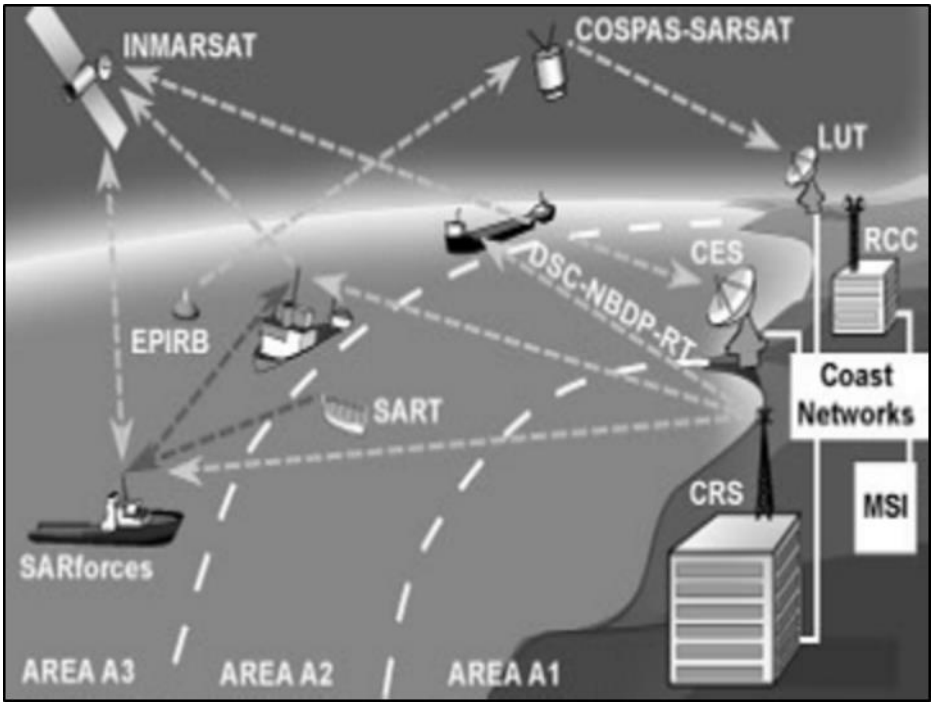

Figure F-3. GMDSS sea areas

F-22. GMDSS sea areas:

- Sea Area A1: An area within the radiotelephone coverage of at least one VHF coast station in which continuous digital selective calling (CH 70) alerting and radiotelephony services are available, as defined by the IMO.
- Sea Area A2: An area, excluding Sea Area A1, within the radiotelephone coverage of at least one medium frequency coast station in which continuous digital selective calling (2187.5 kHz) alerting and radiotelephony services are available, as defined by the IMO.
- Sea Area A3: An area, excluding sea areas A1 and A2, within the coverage of an International Maritime Satellite geostationary satellite in which continuous alerting is available.
- Sea Area A4: The area outside that covered by areas A1, A2, and A3 is called Sea Area A4 (polar regions).

Pre-Departure Checklist Completed For Every Underway

F-23. An entry is required to show that pre-departure equipment checks were satisfactory according to manufacturer's instructions and that required publications are on hand.

Continuous Message Log Sheet Up To Date

F-24. Ship station logs must identify—

- The vessel name.
- Country of registry.
- Official number of the vessel.

F-25. The date and time of each occurrence or incident required to be entered in the log must be shown opposite the entry and the time must be expressed in Coordinated Universal Time.

F-26. ‘‘ON WATCH’’ must be entered by the operator beginning a watch, followed by the operator’s signature for stations maintaining written logs. ‘‘OFF WATCH’’ must be entered by the operator being relieved or terminating a watch, followed by the operator’s signature for stations maintaining written logs. All log entries must be completed by the end of each watch.

F-27. During the watch, all calls and replies to and from the station must be entered to include the time, frequencies, and call letters of the station communicated with or heard. Also, any messages exchanged must be entered to include the time, frequency, and call letters of the station(s) communicated with or heard.

F-28. The following must be entered, together with the time of such observation or occurrence and the position of the ship or other mobile unit in need of assistance:

- All distress calls.
- Automatic alarm signals.
- Urgency and safety signals made or intercepted (the complete text, if possible).
- Distress messages and distress communications.
- Any incidents or occurrences which may appear to be of importance to safety of life or property at sea.

F-29. The position of the ship must be annotated at least once per day.

F-30. A daily entry must be made comparing the radio station clock with standard time, including errors observed and corrections made. For this purpose, authentic radio time signals received from land or fixed stations will be acceptable as standard time.

F-31. All test transmissions must be entered, including the time of the transmissions and the approximate geographical location of the vessel.

F-32. Any failure of equipment to operate as required and any incidents tending to delay communications must be entered.

Logs For The Past Two Years On-Hand

F-33. Logs must be retained for a period of two years from the date of entry, and, when applicable, for such additional periods as required by the following paragraphs:

- Logs relating to a distress situation or disaster must be retained for three years from the date of entry.
- In the event of an investigation, the related logs must be retained until the licensee is specifically authorized in writing to destroy them.
- Logs relating to any claim or complaint must be retained until the claim or complaint has been satisfied or barred by statute limiting the time for filing suits upon such claims.

Individual Equipment Operator Test Procedures Available

F-34. Test procedures for the equipment shall be available to the GMDSS operators for use during all tests.

Individual Equipment Maintenance Records Available

F-35. An entry is required at least once every thirty days to show that the batteries or other reserve power sources have been checked and are functioning properly. Results of required equipment tests, including specific gravity of lead-acid storage batteries and voltage reading of other types of batteries are provided as a part of the compulsory installation.

F-36. A GMDSS radio log entry shall be made whenever GMDSS equipment is exchanged or replaced (ensuring that ship MMSI identifiers are properly updated in the replacement equipment) or when major repairs to GMDSS equipment are accomplished.

SEARCH AND RESCUE TRANSPONDER

F-37. The SART is a battery-powered transponder used in an emergency by survivors of sinking Army vessels. The SART must be mounted in the life raft one meter above the sea. The SART has a built-in test capability and should be tested monthly. While underway, a weekly log entry is required stating that the portable SCR gear and radar transponders have been tested.

SURVIVAL CRAFT RADIO

F-38. The SCR is provided for on-scene emergency communications between survival craft and rescue units. The SCR is a portable two-way radio that will transmit or receive on either VHF channel 6 or 16. The SCR's operating life is approximately eight hours. To conserve battery life, the radio will automatically turn off after a period of 20 to 30 minutes of idle radio activity.

F-39. These radios are a vital tool in abandon ship situations. It is vital that they be ready for use at all times.

MANUEVERING CHARACTERISTICS

F-40. The following maneuvering information must be prominently displayed on a fact sheet posted in the pilothouse for each ocean and coastwise vessel of 1,600 gross tons or over:

- For full and half speed, a turning circle diagram to port and starboard that shows the time and the distance of advance and transfer required to alter the course 90 degrees with maximum rudder angle and constant power settings.
- The time and distance to stop the vessel from full and half speed while maintaining approximately the initial heading with minimum application of rudder.
- For each vessel with a fixed propeller, a table of shaft revolutions per minute for a representative range of speeds.
- For each vessel with a controllable pitch propeller a table of control settings or a representative range of speeds.
- For each vessel that is fitted with an auxiliary device to assist in maneuvering such as a bow thruster, a table of vessel speeds at which the auxiliary device is effective in maneuvering the vessel.
- The maneuvering information must be provided in the normal load and normal light condition with normal trim for a particular condition of loading assuming the following:
  - Calm weather—wind 10 knots or less, calm sea.
  - No current.
  - Deep water conditions—water depth twice the vessel's draft or greater.
  - Clean hull.
- The following statement must appear at the bottom of the fact sheet:

WARNING

The response of the (name of the vessel) may be different from those listed above if any of the following conditions, upon which the maneuvering information is based, are varied:

1. Calm weather—wind 10 knots or less, calm sea.
2. No current.
3. Water depth twice the vessel's draft or greater.
4. Clean hull.
5. Intermediate drafts or unusual trim.

- The information on the fact sheet must either be verified six months after the vessel is placed in service or modified six months after the vessel is placed into service and verified within three months thereafter.

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Appendix G

Occupational Safety

This appendix covers all occupational safety equipment and practices.

CONFINED SPACES

G-1. Commanders are responsible for the following:

- Establishing a confined space entry SOP within each organization conducting entry operations.
- Ensuring recommended equipment to support confined space entry operations is purchased and maintained.
- Ensuring personnel assigned confined space entry duties are adequately trained and certified.
- Maintaining an inventory of all confined spaces within the organization.
- Establishing risk approval procedures within the organization.
- Appointing a confined space entry supervisor. This is usually the vessel support officer, chief engineer, or other confined space trained personnel.

G-2. The entry supervisor is responsible for the following actions:

- Before entry, the supervisor verifies that the confined space entry permit is filled out completely, all steps listed on it are taken, and then signs the entry permit. Use General Services Administration Form 3625 (*Confined Space Entry Permit*).
- Eliminates hazards through cleaning, removal, and/or guarding.
- During entry, the entry supervisor checks conditions to make sure they stay safe throughout the work.
- If conditions become unsafe, the permit is cancelled, and everyone is ordered out of the space.
- The entry supervisor sees that any unauthorized people are removed.
- When the work is finished, the entry supervisor cancels the permit and concludes the operation.

CAUTION

Inert spaces create an oxygen-deficient atmosphere.

Hot work permits are only approved and issued by a marine chemist or industrial hygienist.

G-3. The entrant must—

- Know hazards that may be faced during entry.
- Be able to recognize signs or symptoms of hazard exposure and understand the consequences of such exposure.
- Use equipment properly.
- Maintain communication with the attendant.
- Alert the attendant to hazards discovered while in the space.
- Exit the space quickly when required.

G-4. The attendant must:

- Know hazards that may be faced during entry.
- Be able to recognize signs or symptoms of hazard exposure.

- Maintain accurate entrant identification.
- Remain outside the space at all times.
- Maintain communication with the entrant and be able to communicate with the entry supervisor when needed.
- Monitor entry activities.
- Summon rescue services when needed.
- Prevent unauthorized entry.
- Perform non-entry rescue.
- Perform no conflicting duties.

PREVENTING UNAUTHORIZED ENTRY

G-5. Each organization responsible for entering confined spaces must maintain an inventory of such spaces. The inventory must be organized so that the locations of referenced spaces are easily identified. All spaces that have the potential to contain atmospheric or other serious hazards must be marked using a "Danger Confined Space" sign and secured, if possible, to prevent unauthorized entry. All entries must be approved by a certified entry supervisor. During entry operations, an attendant will be positioned at the point of entry to ensure that only authorized entrants are allowed in the space. Attendants will summon the entry supervisor should unauthorized individuals interfere with safe operations. The entry supervisor will remove such individuals. To aid in preventing unauthorized entry, a safe zone must be identified around the point of entry using barricade tape or other means to warn individuals of a restricted area. Also, a "Danger Confined Space" sign must be posted at the point of entry.

CONFINED SPACE ENTRY EQUIPMENT

G-6. Organizations required to enter confined spaces will maintain a meter capable of measuring oxygen, flammability, and any toxic gases that can reasonably be expected to exist in the space atmosphere. Other equipment required for safe entry is identified on the entry permit and must be maintained and issued. Should such equipment not be available in the organization, entry may not proceed until it is obtained. Such equipment includes tripod with winch, lifeline and harness, non-sparking tools, lighting approved for hazardous atmospheres, ventilation blower, eye protection, hearing protection, and gloves.

EVALUATING CONFINED SPACE HAZARDS

G-7. Use the following steps to evaluate confined space hazards:

- Step 1. The confined space must meet the following atmospheric criteria prior to entry:
  - Percent of oxygen not below 19.5 percent or above 22 percent.
  - Percent of lower explosive limit not above 10 percent.
  - Carbon monoxide not above 35 parts per million.
  - Other atmospheric hazards not above the published permissible exposure limit. See the material SDS for specific contaminants.

Note. Should there be an indication that other atmospheric hazards may exist but cannot be identified at the unit level, contact the supporting medical department activity for a consultation.

- Step 2. Visual inspection of the space prior to entry should identify other hazards that may exist. These may include noise, fall hazards, entrapment hazards, heat/cold, high-pressure lines, inadequate lighting, chemicals, piping carrying HAZMAT, moving machinery, electrical hazards, biohazards, and radiation hazards.

CONFINED SPACE SAMPLING DEVICE

G-8. Calibration must be done prior to each daily use; will not exceed monthly if the meter is not in use.

G-9. Standard procedures for regular calibration that conform to the manufacturer's instructions, internal company policy, and/or the appropriate regulatory agency guidelines will help to ensure that calibration procedures are readily followed by the operators and that the instruments are operable and accurate when used. Employers should keep calibration records for the life of each instrument.

FIRST AID EQUIPMENT

STORAGE LOCATIONS

G-10. Storage locations for the various first aid equipment used aboard Army watercraft will be IAW the vessel's FCP.

STOKES LITTER

Configuration

G-11. Stokes litters shall be configured for their intended application and shall not be used otherwise.

G-12. Stokes litter (over water)

- Over-water Stokes litters used for transporting a person onboard a boat, over the water, or retrieving a person overboard shall be configured with a flotation kit assembly (includes two flotation tubes with covers, one chest pad with cover, five restraint straps, and one ballast bar), slat set, hoisting slings, and tending lines (see Figure G-1).

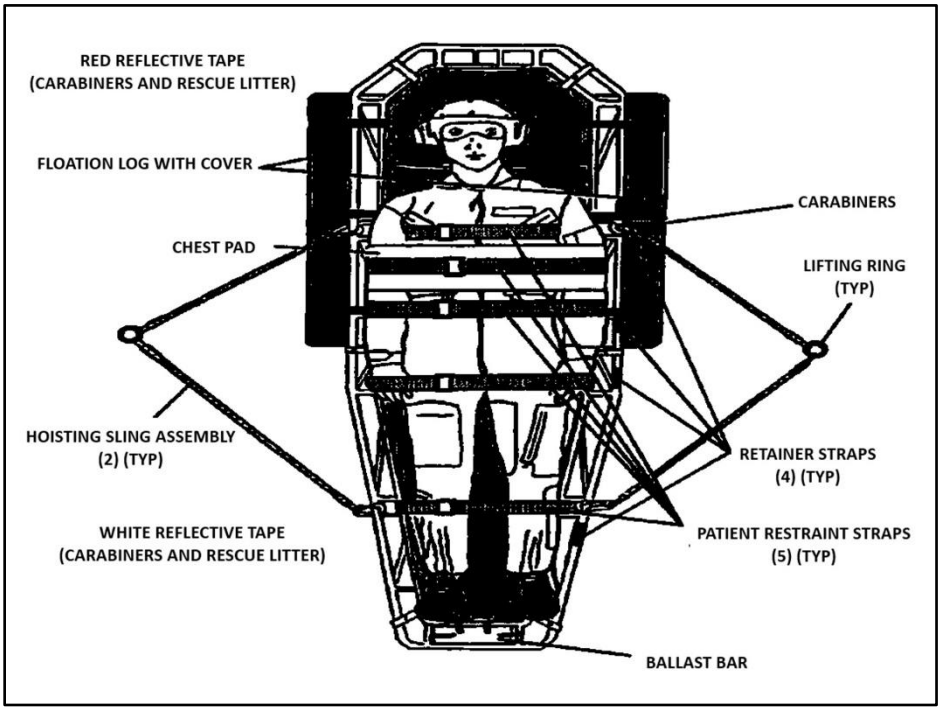

Figure G-1. Stokes litter.

G-13. Stokes litter (over water and hoist ready)

- Hoisting Stokes litters intended for shipboard or helicopter-hoisting operations (using the ship's or aircraft's hoist) shall be equipped with the standard hoisting sling.
- Hoisting sling assembly is constructed of two sets of stainless steel 5/32-inch cables. Each cable set contains two lengths of cable (33 inches and 41 inches) which are attached to one another by a 1 ½-inch by 5/16-inch stainless steel lift ring. Each cable set has a pair of thimbles, two swaging sleeves, and two color-coded locking carabiners. The 33-inch cable is attached to the head of the

litter by the red color-coded carabiner, and the 41-inch cable is attached to the foot of the litter by the white color-coded carabiner.

WARNING

Only steel litters are authorized for hoisting operations. Improper use of the Stokes Litter could result in damage to equipment, injury, or death.

Inspection

G-14. Stokes litters and associated equipment shall be inspected after each use but not less than once every three (3) months. The latest date of inspection and proof test shall be stenciled on the bottom of the slat set (in trunk section of litter). The stencil shall be of ½-inch letters.

G-15. The following paragraphs contain requirements for inspection of the litter, flotation equipment, hoisting sling, and tending lines.

Litter

G-16. Inspect litter for cracked welds, cracked tubes, rust, pinholes, security and condition of wire mesh, and evidence of wear on the sling attachment points. Inspect restraint straps for security, condition, and quantity (minimum of four per litter).

Flotation Equipment

G-17. After use in salt water, rinse flotation equipment in fresh water and dry before storage. Thoroughly inspect flotation equipment for wear, rotting, mildew, mold, tears, cuts, broken stitches, and frayed fabric.

Hoisting Sling

G-18. Hoisting slings fall under the Lifting Device Program addressed in Chapter 2. They will be inspected semi-annually for corrosion, fraying, or deterioration.

Tending Lines

G-19. Inspect manila tending lines for condition and security. Replace lines that are frayed or show signs of weathering or rot.

Proof Testing

G-20. Litters equipped with a hoisting sling shall be proof tested semi-annually IAW the Lifting Device Program in Chapter 2. To proof-test litter, complete the following steps:

- Distribute 500 pounds evenly in the litter and hoist clear of the deck.
- With litter suspended, inspect litter and sling for deformities.
- Inspect sling for even load distribution at all attachment points.
- Hoist the litter (while loaded) a few inches off the floor for a minimum of 30 minutes.

Maintenance

G-21. Maintenance of the litter, hoisting slings, flotation equipment, and chest pad consists of minor repairs, replacement, and cleaning. Repairs for aluminum litters are limited to removal of surface corrosion and application of primer to rework areas. Cracked welds or cracked tube members are cause for replacement.

G-22. To maintain equipment, complete the following steps:

- Replace hoisting slings that show signs of corrosion, fraying, or deterioration.

- After each use in salt water, remove flotation collar and chest pad from the litter, rinse in fresh water, and dry before reinstallation.

WARNING

No weld repairs shall be attempted on aluminum litters. Aluminum litters shall be marked "NOT TO BE USED FOR HOISTING OR HIGH-LINE OPERATIONS."

FULL BODY SPLINT/LITTER

G-23. The full body splint/litter is designed for removing an injured person from engine room spaces, holds, and other compartments. This is used where access hatches, narrow passageways, and ladder wells are too small to permit the use of regular stretchers or litters.

BURN TREATMENT

G-24. Burn treatment is a unique multi-use product for emergency burn care and fire protection. This patented product is designed to help save lives, increase the relief of pain and suffering, and reduce tissue damage caused by burns.

G-25. Burn treatment is a one-step system that combines a scientifically formulated gel and a special carrier material. Burn treatment can be carried anywhere. When placed on the burn victim, it extinguishes the flames and immediately lowers and stabilizes skin temperature, helping to ease the pain and calm the victim. Because the product is bacteriostatic, the covered wound is protected from further contamination. In addition to providing essential burn care, burn treatment performs other lifesaving tasks. The product is water soluble, making removal of burnt clothing and jewelry easier. Burn treatment may also be used by a rescuer to shield themself and the victim from the intense heat and flames of a fire. In its larger sizes, burn treatment may be used to extinguish a small fire and help provide a means of escape from larger fires. Burn treatment comes in a variety of sizes, from a 6-foot by 5-foot fire blanket to a 4-inch by 4-inch sterile burn dressing.

EYE WASH

A-1.Chemical burns of the eyes need immediate first aid attention. Any delay in treatment will generally aggravate and intensify the injury. Flush the eyes with water for a minimum of 15 minutes. Seek medical attention as soon as possible. DA PAM 40-506 provides detailed information for first aid and eye wash standards.

Plumbed Eye/Face Wash Units

G-26. A plumbed eye/face wash unit is a permanently installed station that has a continuous supply of water (see Figure G-2 on page G-6). The supply line for plumbed units will provide an uninterruptible supply of water at approximately 30 psi. When installed, the actuation valve will be operated to determine that both eyes will be washed simultaneously at a velocity low enough not to cause injury to the user.

Portable Eye/Face Units

G-27. Nozzles shall be protected from airborne contaminants (Figure G-3 on page G-6).

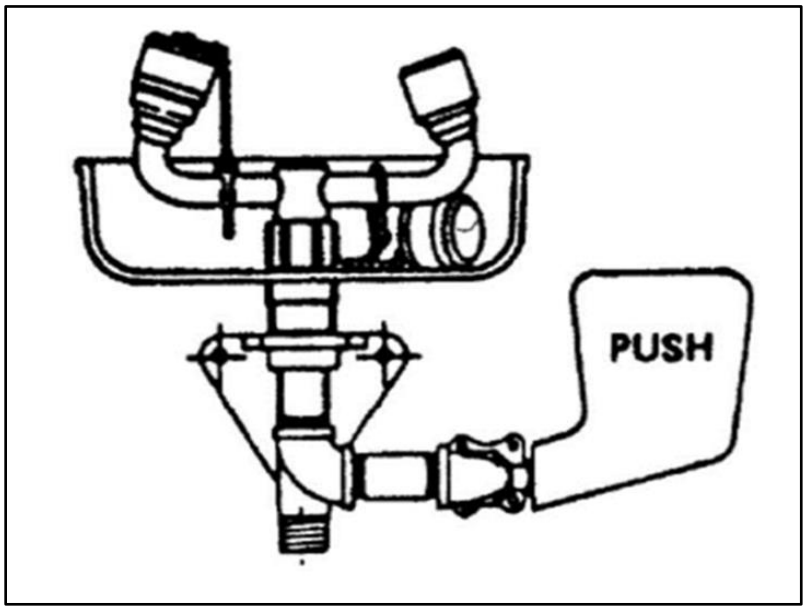

Figure G-2. Plumbed eye/face wash

Figure G-3. Portable eye/face wash

PERSONAL PROTECTIVE EQUIPMENT

FALL PROTECTION

G-28. The risks of sustaining injuries from falls are greater onboard Army watercraft. This section provides information on a number of control measures that are implemented to reduce those risks.

Fall Protection Systems

G-29. Fall protection systems can consist of devices that arrest a free fall or devices that restrain a Soldier in position to prevent a fall from occurring. A fall arrest system is employed when a Soldier is at risk of falling from an elevated position. A positioning system restrains the elevated Soldier, preventing them from getting into a hazardous position where a fall could occur and also allows hands-free work. Both systems have three components: harnesses or belts, connection devices, and tie-off points.

Harness

G-30. Full-body harnesses are types of harnesses that wrap around the waist, shoulders, and legs. A D-ring located in the center of the back provides a connecting point for lanyards or other fall arrest connection devices. In the event of a fall, a full-body harness distributes the force of the impact throughout the trunk of the body, not just in the abdominal area. This allows the pelvis and shoulders to help absorb the shock, reducing the impact to the abdominal area.

G-31. Maximum force arrest on a full-body harness, which is used for the most severe free-fall hazards, is 1800 pounds. Full-body harnesses come with optional side, front, and shoulder D-rings. The side and front D-rings are connection points used for work positioning, and the shoulder D-rings are for retrieval from confined spaces.

G-32. Three factors determine the arresting force from a fall: lanyard material type, free-fall distance, and the weight of the Soldier. The use of a shock-absorbing lanyard or a higher tie-off point will reduce the impact force.

Connection Devices

G-33. Connection devices attach the harness to the final tie-off point. This can be one device, such as a lanyard, or a combination of devices, such as lanyards, lifelines, work lines, rope grabs, tie-off straps, and safety hooks.

Lanyards

G-34. Lanyards are used both to restrain Soldiers in position and to arrest falls. When using a lanyard as a restraining device, the length is kept as short as possible, as a restraining lanyard should not allow a Soldier to fall more than two feet. Restraining lanyards are available in a variety of materials, including steel cables, rebar chain assemblies, and nylon rope. Fall protection lanyards can be made of steel, nylon rope, or nylon or Dacron webbing. Fall protection lanyards may also have a shock-absorbing feature built in, thus reducing the potential fall arrest force. Remember that maximum arrest force is 1800 pounds for full-body harnesses. A lanyard used for a fall is limited to allow a maximum six-foot free fall. For this reason, most lanyards are a maximum of six feet long. However, if a higher tie-off point is used, the lanyard can be longer if the free fall distance does not exceed 6 feet.

Lifelines/Safety Hooks

G-35. Lifelines add versatility to the fall arrest system. When used in conjunction with rope grabs, a lifeline allows the Soldiers to move along the length of the line rather than having to disconnect and find a new tie-off point. The rope grab is engineered to arrest a fall instantly. A rope grab and lifeline system is a passive form of protection, allowing the user to move as long as tension is slack on the lifeline. If a fall occurs, the tension on the rope grab triggers the internal mechanism to arrest the fall. Retractable lifelines automatically retract any slack line between the Soldiers and the tie-off point. While this type of line doesn't require a rope grab, it must be kept directly above the Soldiers to eliminate any potential swing hazard if the Soldier falls.

G-36. A cross-arm strap is used at a tie-off point with a large diameter, such as an I-beam, to which a lanyard or lifeline cannot directly attach. Using a cross-arm strap ensures the lanyard or lifeline doesn't become abraded from wrapping around the I-beam. A safety hook works in the same situations. It is used for tie-off points with a diameter of one to five inches, and then the lanyard is attached to the safety hook.

Other Devices

G-37. For confined space applications, a tripod and winch system is used as both the tie-off point and connection device. It is used in conjunction with a full-body harness to lower and raise Soldiers into tanks or manholes. Make sure that the tripod system you choose is designed for your application. Never use a material-handling device for personnel unless it is specifically designed to do so.

G-38. Ladder systems are lifelines attached directly to a ladder. The systems consist of a cable or channel, with a grabbing device attached for a connection point.

INSPECTION AND MAINTENANCE

G-39. Regulations require that all fall arrest equipment be inspected prior to its use. This includes looking for frays or broken strands in lanyards, belts and lifelines, and oxidation or distortion of any metal connection devices. To properly maintain the devices, periodic cleaning is necessary. Clean all surfaces with a mild detergent soap, and always let the equipment air dry away from excess heat. Follow the manufacturer's instructions for cleaning and maintenance.

Note. Any equipment exposed to a fall must be taken out of service and not used again for fall protection.

VISION PROTECTION

G-40. Eye/face wash units should be in accessible locations that require no more than 10 seconds to reach and should be within a travel distance no greater than 100 feet from the hazard. Specific installation instructions include that the unit be positioned about 45 inches from the floor. Each eye/face wash station shall be identified with a highly visible sign. The area around or behind, or both, the eye/face wash station will be painted a bright color and will be well lighted. If there is a specific working area that is used for only hazardous chemicals, then the wash station would be immediately adjacent to or within 10 feet.

G-41. All personnel who might be exposed to chemical splash will be instructed in the proper location and use of emergency eye/face wash stations.

EYE PROTECTION

G-42. Face shields are used in operations when the entire face needs protection and to protect the eyes and face against flying particles, metal sparks, and chemical or biological splash hazards. Face shields must be used in combination with goggles when there is a potentially significant chemical splash hazard or when there is a potentially severe exposure to flying fragments or objects, potential splash from molten metal, or extreme temperatures.

G-43. Standard safety glasses are designed to protect against flying particles. Soldiers must use safety eyewear with side protection when there is a hazard from flying objects. Detachable side protectors (clip-on or slide-on shields) are acceptable if they meet the American National Standards Institute requirements.

G-44. Goggles offer the best all-around impact protection of all eyewear types because they form a positive seal around the eye area. Welders' goggles provide protection from sparking, scaling, or splashing metals and harmful light rays. Welding shields must be provided to protect Soldiers' eyes and face from infrared or radiant light burns, flying sparks, metal spatter, and slag chips encountered during welding, brazing, soldering, resistance welding, bare or shielded electrical arc welding, and oxyacetylene work. Lenses are impact resistant and are available in graduated shades of filtration.

G-45. Soldiers must use equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation. Tinted and shaded lenses are not filter lenses unless they are marked or identified as such.

G-46. While engaged in operations that involve eye hazards, Soldiers who wear prescription lenses must either wear eye protection that incorporates the prescription in its design or wear eye protection that can be worn over the prescription lenses without disturbing their proper positioning.

G-47. Ventilated goggles allow air circulation while providing protection against airborne particles, dust, liquids, or light. There are three types of goggles relative to the type of ventilation provided. They include—

- Direct Ventilation (see Figure G-4):
  - Resist direct passage of large particles into the goggle.
  - Prevent fogging by allowing air circulation.

Figure G-4. Direct ventilation goggles

- Indirect Ventilation (see Figure G-5):
  - Prevent fogging by allowing air circulation.
  - Protect against liquid or chemical splash entry.

Figure G-5. Indirect ventilation goggles

- Non-ventilation goggles (see Figure G-6):
  - Do not allow the passage of air into the goggle.
  - Prevent splash entry.
  - May fog and require frequent lens cleaning.

Figure G-6. Non-ventilation goggles.

MAINTENANCE OF PROTECTIVE EYEWEAR

G-48. Safety glasses and other eye and face protection should be stored carefully to prevent scratches or damaged. In general, do not store this equipment where it would be exposed to high heat or sunlight.

G-49. Inspect eye and face protection prior to use. If the equipment is damaged or broken, do not use it because it may not be able to fully resist impact.

G-50. Pitted lenses, like dirty lenses, make it more difficult for an employee to see and should be replaced.

G-51. Lenses that are pitted or deeply scratched are more prone to break under impact and should be replaced.

G-52. Clean eye and face protection according to the manufacturer's instructions. If the manufacturer's instructions are not available, clean with a mild soap and water solution by soaking in the soap solution for ten minutes. Rinse thoroughly and allow to air dry.

Glossary

TM 4-15.21 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. For definitions shown in the text, the term is italicized, and the number of the proponent publication follows the definition. This publication is not the proponent for any Army terms.

SECTION I – ACRONYMS AND ABBREVIATIONS

AFFF	aqueous film forming foam
AR	Army regulation
ATSM	American Society for Testing and Materials
BII	basic issue item
CFR	Code of Federal Regulations
CO2	carbon dioxide
DA	Department of the Army
DA PAM	Department of the Army pamphlet
DD	Department of Defense
DODI	Department of Defense instruction
DODM	Department of Defense manual
DOT	Department of Transportation
EBAC	emergency breathing air compressor
ECDIS	electronic chart display information systems
EEBD	emergency escape breathing device
EPIRB	emergency position-indicating radio beacon
FCP	fire control plan
FFE	firefighter's ensemble
FM	field manual
FRB	fast rescue boat
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GSA	General Services Administration
HAZMAT	hazardous materials
HFC	hydrofluorocarbon
HRD	hydrostatic release device
IAW	in accordance with
IMO	International Maritime Organization
JP	joint publication
LOTO	lock out/tag out
LSV	logistics support vessel

MIL STD	military standard
MMSI	Maritime Mobile Service Identity
MSSO	Maritime Standards and Safety Office
NAVMED	Naval Medical Command
NFPA	National Fire Protection Association
OWS	oily water separator
PFD	personal flotation device
PMCS	preventive maintenance checks and services
psi	pounds per square inch
SAE	service acquistions executives
SART	search and rescue transponder
SCBA	self-contained breathing apparatus
SCR	survival craft radio
SDS	safety data sheet
SOLAS	safety of life at sea
SOP	standard operating procedure
TB	technical bulletin
TB MED	technical bulletin (medical)
TC	training circular
TDI	tests, drills, and inspections
TM	technical manual
UL	Underwriters Laboratories
U.S.	United States
USCG	United States Coast Guard
VHF	very high frequency

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