Chapter 18: Fire Fighting, Rescue, and Assistance

Introduction

As a Division boat crewmember you have an important responsibility in maintaining their vessels and assisting those in distress. A primary responsibility of a boat crew is to save lives, not property. However, when and where possible, while managing risks, a boat crew will attempt to save property. Boat crewmembers may be called upon to react to a fire on their own boat, dewater vessels, and right vessels. This chapter discusses:

- Safety and prevention measures to take when on a boat or assisting a distressed vessel.
- How to assess emergency situations.
- How to prevent, identify, and extinguish boat fires.
- How to dewater vessels.
- Several methods on how to right overturned vessels.
- How to control flooding.

In This Chapter

This chapter contains the following sections:

WARNING! The wearing of jewelry, including rings, wristwatches, necklaces or other items not consisting of organizational clothing, PPE, or uniform articles by boat crew members engaged in hoisting, towing, or other deck evolutions where the potential for snagging exists, is highly discouraged.

Section A. Safety and Damage Control

Introduction
Safety is paramount during all emergency evaluations that a member of a boat crew will be involved in. Mishaps resulting in death or injury have occurred when boat crews responded to vessels in distress. Nearly every mishap that resulted in serious injuries had a common denominator. Serious injuries happen when common sense and a continuing regard for safety give way to reckless urgency.

A boat crewmember's primary responsibility in emergency assistance is saving lives, not property. Boat crews must be aware of their limited roles in emergency assistance, particularly when responding to fire emergencies. Safety begins with assessing primary responsibilities and capabilities for the variety of emergency situations encountered.

A.1. Division Fire Fighting Activities Policy
Although the Division will help fight fires involving vessels or waterfront facilities belonging to the Division, it is not a primary response capability. Local authorities are responsible for maintaining adequate firefighting capabilities within their jurisdiction. The Division will render requested assistance as time and resources are available, based on the level of personnel training and adequacy of equipment available for specific situations at hand.

A.2. Safety Assessment and Management Guidelines
Emergency situations can cause people to panic or act before thinking despite the best of training and preparation. Therefore, boat crews must work together as a team to minimize any potential or immediate jeopardy for both civilian casualties and themselves. An emergency situation should never be entered without first:

- Assessing the risk involved for the boat crewmembers and civilian victims (risk assessment).
- Being aware of the dynamics of the emergency situation (situational awareness).
- Implementing a control plan that fits each unique emergency (damage control risk management).

A.2.a. Risk Assessment
Risk assessment starts with realizing why mishaps occur. The responsibility for identifying and managing risk lies with every member of a boat crew. Realistic training based on standard techniques, critical analysis, and debriefing missions will help every person in a boat crew to contribute to developing and implementing a risk management plan. A risk management plan identifies and controls risk according to a set of preconceived parameters. Refer to *Chapter 4* of this Manual for a complete discussion of risk assessment and risk management plans.

A.2.b. Situational Awareness
Situational awareness is an important skill to develop as part f learning risk assessment. Situational awareness is the accurate perception of factors and conditions affecting the boat crew at any given time during any evolution. More simply, situational awareness is knowing what is going in the surrounding environment at all times.

Any time there is an indication that situational awareness is about to be lost, a decision must be made as to whether or not to continue with the rescue attempt. Everyone in the crew owns some responsibility for making these important decisions. These decisions take the form of action/reaction and communication.

NOTE: Crews who have a high level of situational awareness perform in a safe manner.

A.2.c. Damage Control Risk Management

The precautions listed below include many of the considerations that can form a basis for a general damage control risk management plan. Boat crews should keep in mind that each emergency situation will be unique; therefore the plan must only be used as a general guideline. The experience and knowledge of each boat crew should be merged into a risk management plan and used to fine-tune this list.

- Attempt to account for all persons.
- Ensure all persons onboard the vessel in distress have donned PFDs, if possible.
- Attempt to have all lines (rigging, etc.) removed from the water to avoid fouling the propellers.
- Maintain communications between the VO and crewmembers.
- Have all required equipment tested and ready.
- Approach distressed vessel with fenders rigged and lines at the ready.
- Approach a vessel on fire from the windward side.
- Remove survivors first, then back off, and evaluate the fire.
- If the risk of explosion is not known (cannot determine what cargo is onboard), back off and do not attempt to fight the fire.
- Situations may dictate that survivors enter water to be rescued.
- When necessary, dewater the distressed vessel while keeping all equipment aboard the assisting vessel.
- Always keep the IC informed.

Section B. Boat Fire Prevention and Susceptible Areas

Introduction

Fire is the greatest single potential for disaster on a boat. The possibility of fire can never be completely eliminated and is always a threat.

Boat crewmembers must be especially alert for fire, its possible causes, and areas on a boat that are very susceptible to fire. There are some causes of fire that are more frequently encountered on boats. Crewmembers should learn to be especially watchful for them.

In This Section

This section contains the following information:

Preventive Actions

B.1. Description
In dealing with fire on a boat, the single most important consideration is prevention. During boat and equipment checks, all systems should be inspected including the fuel, oil system, and wiring. Crewmembers should check for abrasions, cracked wiring, loose connections, or pinholes in oil and fuel lines. Any discrepancy must be corrected before the vessel is operated. This may mean a simple repair that can be done at the marina. Or it may mean a more thorough repair completed by a trained and certified Division mechanic.

B.2. Measures of Practice
The following are also good fire prevention measures for you to practice:

- Keep oil and grease out of bilges.
- Identify and correct any sources of fuel or oil leaks.
- Clean up any spilled fuel or lube oil immediately and properly dispose of it ashore
- Stow cleaning materials off the boat.
- Keep all areas free of waste material.
- Use proper containers for flammable liquids.
- Be alert for suspicious odors and fumes, and vent all spaces thoroughly before starting engine(s)

Susceptible Areas

B.3. Spontaneous Ignition
This source of fire is often overlooked as a cause of fire aboard a boat. Many common materials are subject to this dangerous chemical reaction. A spontaneous ignition can easily occur aboard a boat when an oil or paint soaked rag is discarded in the corner of a compartment or engine room.

B.3.a. Oxidation
When an area is warm and there is no ventilation, oil on a rag begins to oxidize (to react chemically with the oxygen in the warm air around it). Oxidation is a natural process that produces heat. Heat produced by oxidation causes any remaining oil to oxidize even faster and produce still more heat.

B.3.b. Ventilation
Since heat is not drawn away by ventilation, it builds up around a rag and causes it to get hot enough to burst into flames, after which it can ignite any nearby flammable substances and start a major fire. All of this occurs without any additional or outside source of heat. In this case, fire prevention is a matter of good housekeeping. Cleaning rags and waste should be stored in closed or sealed metal containers and discarded as soon as possible.

B.4. Engine Room Fires
Engine rooms are partially vulnerable to electrical, fuel, and oil fires. There are several ways that engine room fires can readily start. Water spraying form ruptured seawater lines can cause severe short-circuiting and arcing in electric motors (alternators), electrical panels and other exposed electrical

equipment. This, in turn, can ignite insulation and nearby combustible materials. Even more serious than leaking seawater lines are ruptured fuel and oil lines near electrical equipment.

B.4.a. Electrical System
The electrical system can short and cause a fire. These fires are typically small and easily controlled with either carbon dioxide (CO2) or dry chemical (PKP extinguishers.

B.4.b. Fuel Line
If fittings leak, fuel can drip onto a hot manifold and ignite. This situation could continue unnoticed for some time, allowing a major fire to develop when a manifold finally gets hot enough to ignite all leaked fuel.

B.4.c. Lube Oil Line
This line, if leaking or ruptured, will allow lube oil to spill onto a hot engine. As the burning lube oil collects on and around an engine, the engine's fuel supply line would probably be burned through. This would provide a fire with a continuous fuel supply, even after engines have been shut down. Fuel continuing to spill into the bilges, fires can spread and block access to the engine compartment, eventually leading to the development of a major fire.

CAUTION! An explosion is a common accident for boats when bilges are not properly ventilated before starting engines. A spark from "turning the key" can instantly ignite the trapped gas creating a potentially deadly explosion.

B.4.d Bilge Areas
Fire occurs in bilge areas because of fuel or oil accumulation. Most often, oil or gas leaks into bilges from an undetected break in a fuel or lube oil line. The oil vaporizes, and flammable vapors build up in and around bilge areas. Once these vapors are mixed with air in the right proportions a spark can ignite them and cause a fire or explosion. Bilge fires can move very quickly around machinery and piping and are not easily controlled. They are more difficult to extinguish than most other types of engine room fire. Bilge areas should be watched closely. Oil in a bilge nearly always indicates a leak, and all fuel and lube oil lines should be checked until the leak is found.

B.5. Electrical Circuits and Equipment
With properly insulated and wired equipment, electricity is a safe and convenient source of power. However, when electrical equipment exceeds its useful life, is misused, or is improperly wired, it can convert electrical energy to heat. Equipment then becomes a source of ignition and a "fire hazard." For this reason, electrical equipment must be installed, maintained, tested and repaired in strict accordance with manufacturer's recommendations.

NOTE: All work on electrical equipment must be completed by qualified personnel.

B.5.a. Replacement Parts and Equipment
Standard residential or industrial electrical equipment does not last very long at sea. The salt air causes "corrosion," the boat's vibration breaks down equipment and a steel hull can cause erratic operation or a short circuit. As a result, equipment or its wiring may overheat or arc, causing a fire when flammable materials are located nearby. For this reason, only approved replacement parts and equipment should

be installed aboard small boats. Given proper maintenance, these parts and equipment are designated to withstand the strenuous conditions encountered at sea.

WARNING: When a fuse or circuit breaker in a particular circuit is too large, a circuit will not "break" when overloaded. Instead, increased current will continue, a circuit will overheat, and eventually insulation will burn and may ignite other combustible material in the vicinity.

B.5.b. Wiring and Fuses
Insulation on electrical wiring will not last forever. With age and use, it can become brittle and crack. It may be rubbed (chafed) through or broken by abuse or by the vibration of a boat. Once insulation is broken, bare wires may be exposed and are dangerous. A single exposed wire can arc to any metal object. If multiple wires are exposed, they can touch each other and cause a short circuit. Either conditions could produce enough heat to ignite insulation on wiring or some other flammable material nearby. Install only fuses and circuit breakers of the proper size for their circuits.

B.5.c. Temporary and Unauthorized Repairs and Patches
"Jury-rigging" of electrical panels to serve additional equipment is a dangerous practice. Wiring in every electrical circuit is designed to carry a specific maximum load. When circuit wiring is overloaded with too many pieces of operating equipment, in addition to possibly damaging the equipment, it can overheat and burn its insulation. Hot wiring can also ignite flammable materials surrounding areas.

B.5.d. Electric Motors (Alternators)
Faulty electric motors are major causes of fire. Problems may result when a motor is not properly maintained or when it exceeds its useful life. A motor requires regular inspection, testing, lubrication, and cleaning. Sparks and arcing can result if a winding becomes short-circuited or grounded or if the brushes do not operate smoothly. If a spark or an arc is strong enough, it can ignite nearby combustible material. Lack of lubrication may cause the motor bearings to overheat, with the same result.

CAUTION! Battery gases are highly explosive. Ever smoke around a battery and never disconnect, change out, or perform maintenance on a battery until the surrounding space has been thoroughly ventilated.

B.5.e. Charging Batteries
When batteries are charging, they emit hydrogen, a highly flammable gas that is potentially explosive. Hydrogen is lighter than air and will rise as it is produced. If sufficient ventilation is not available at the highest point above where a battery is being charged, hydrogen will collect at the overhead. Then, any source of ignition will cause an explosion and fire.

Section C. Fire Theory, Classification, and Fuel Source

Introduction
As a boat crewmember, it is important to understand the theory of fire, the different classifications of fire, and the types of fuels that perpetuate fires. This knowledge will enable boat crewmembers to identify the type of precautions, equipment, and extinguishing agents required to successfully fight fires.

C.1. Fire Theory
Fire is a chemical reaction known as combustion. It is defined as rapid oxidation of combustible material accompanied by a release of energy in the form of heat and light.

C.1.a. Fire Triangle
For years, a 3-sided figure called the fire triangle has been used to describe the combustion and extinguishing theory. This theory states that proper proportions of oxygen, heat, and fuel are required for a fire. If any one of the 3 elements is removed, a fire will cease to exist. (See **Figure 18-1**)

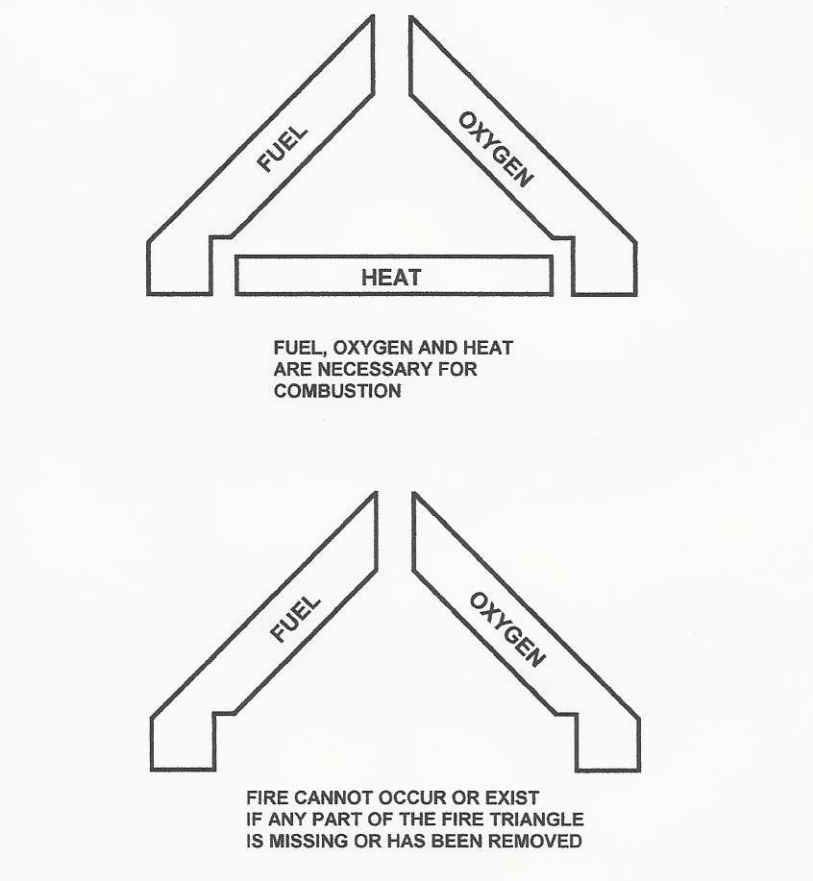

Figure 18-1
Fire Triangle

C.1.B. Fire Tetrahedron
A new theory has been developed to further explain fire combustion and extinguishment. This theory can be represented by a 4-sided geometric figure, a tetrahedron. The base of this figure represents a chemical reaction. The 3 standing sides of the figure represent heat, oxygen, and fuel. Removing one or more of the 4-sides will make a tetrahedron incomplete and cause a fire to be extinguished. (See **Figure 18-2**)

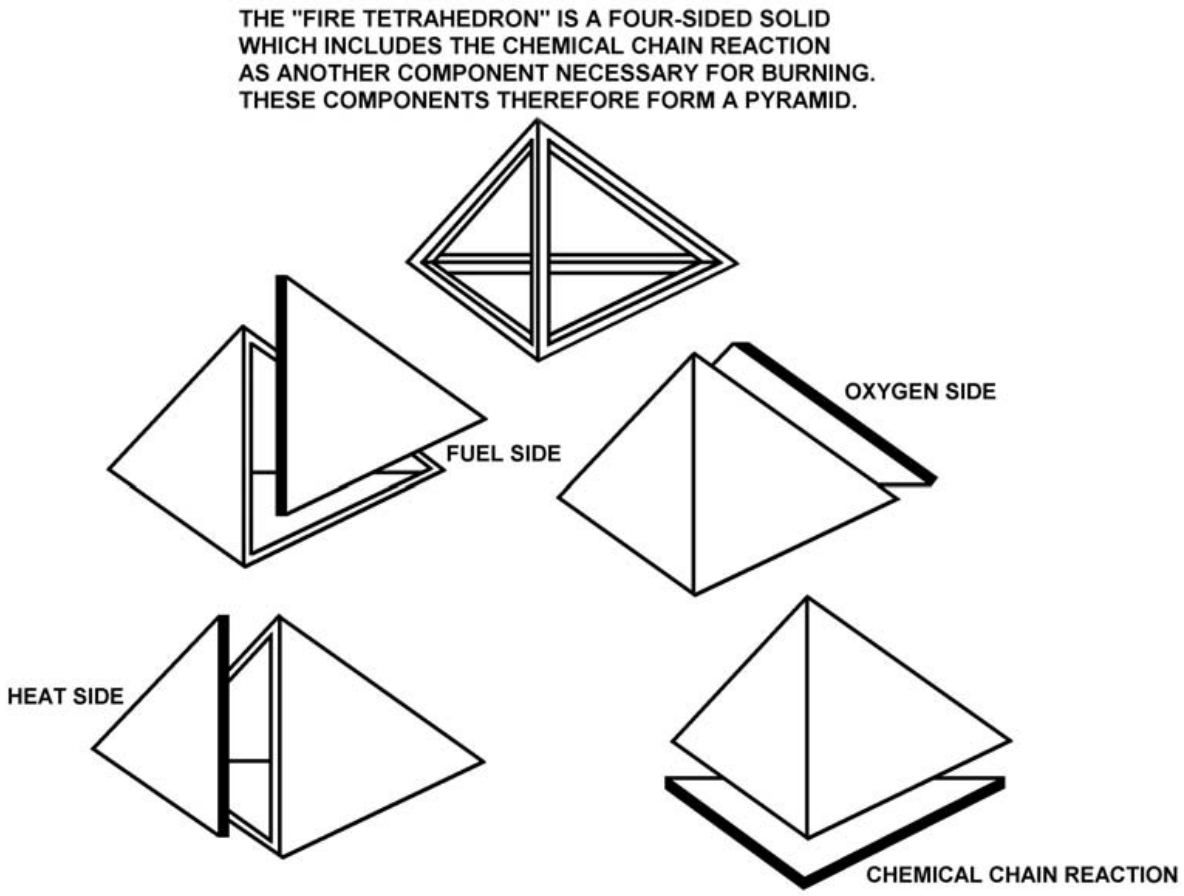

Figure 18-2
Fire Tetrahedron

C.2.a. Class A
A Class A fire involves common combustible materials. Fuel sources within this class include wood and wood-based materials, cloth, paper, rubber and certain plastics.

C.2.b. Class B
A Class B fire involves flammable or combustible liquids, flammable gases, greases, and similar products. Fuel sources within this class include petroleum products.

C.2.c. Class C
A Class C fire involves energized electrical equipment, conductors, or appliances.

C.2.d. Class D
A Class D fire involves combustible metals. Fuel sources within this class include sodium, potassium, magnesium, and titanium.

Section D. Description and Application of Extinguishing Agents

Introduction
Extinguishing agents are defined as anything that eliminates one or more "sides" of a fire tetrahedron. When any one is removed, fire can no longer exist.

Extinguishing agents can be applied in more than one way. Selecting the most appropriate method for applying extinguishing agents depends on the situation. Below are some general guidelines for applying different agents. Later, the equipment that must be used to apply these extinguishing agents will be addressed.

In This Section
This section contains the following information:

How Extinguishing Agents Work

D.1. Description
Extinguishing agents put out fires by breaking one or more of the four elements of a fire tetrahedron. The work by cooling, smothering, chain breaking, or by a process called oxygen dilution.

- Cooling reduces the temperature of a fuel source below the fuel's ignition point.
- Smothering separates a fuel source form its oxygen supply.
- Chain breaking disrupts the chemical process necessary to sustain a fire. The element of a chain that is broke n depends upon the class of fire and the type of extinguishing agent used.
- Oxygen dilution is a smothering process that reduces the amount of oxygen available to a level below that required to sustain combustion.

The different fire classes, the fuel source for each class, the type of extinguishing agent for each class, and the primary effect of each agent are described as follows:

Class	Fuel Source	Primary Extinguishing Agent	Primary Effect
A	Common combustible materials such as wood and wood-based materials, cloth paper, rubber, and certain plastics	• Water • PKP (dry chemical)	Removes the heat element

B	Flammable or combustible liquids, flammable gases, greases, petroleum products, and similar products.	• Foam Aqueous Film • Forming Foam (AFFF) • Co2 • PKP (Dry Chemical	Removes the oxygen element.
C	Energized electrical equipment conductors, or appliances.	• CO2 (Carbon Dioxide) • PKP (dry chemical)	Removes the oxygen element, and temporarily removes elements of oxygen and heat.
D	Combustible metals, such as sodium, potassium, magnesium, and titanium.	• Water (high velocity fog) • Sand (placed underneath the metal	Removes the heat and oxygen elements.

Applying Water

D.2. Description
Water is applied to a fire using one of three ways:

- Straight (solid) stream.
- High-velocity fog.
- Low-velocity fog.

D.3. Straight (Solid) Stream
A straight solid stream of water is used when long reach and penetrating power are critical.

D.3.a. Class A Fires
On Class A fires, its primary purpose is to break up burning material and to penetrate the base of a flame. Therefore, a solid stream must be directed at the base of flames in a Class A fire.

D.3.b. Class B Fires
A solid stream of water is not effective for extinguishing Class B fires. It can cause a violent fire reaction if a water stream atomizes fuel into the air causing an increased surface area. It could also splash the burning liquids spreading the fire to different areas.

D.3.c. Class C Fires
A straight solid stream of water should not be used on a Class C fire because it is a conductor of electricity. Electric current could travel back through a solid stream of water and be hazardous to a fire fighting team.

D.3.d. Class D Fires
A straight solid stream can also be used on Class D fires for cooling and to wash burning materials over the side.

Applying Chemical Agents

D.4. Description
Chemical agents can be very effective fire fighting tools. However, they can be ineffective and sometimes dangerous if they are not used properly. Learning the proper use of each chemical agent, including its advantages and disadvantages, before using it to fight a fire is essential. Two chemical agents are discussed below:

- Carbon dioxide (CO2).
- Potassium Bicarbonate (PKP).

D.5. Carbon Dioxide (CO2)
CO2 is a colorless gas about 50 percent heavier than air. When released from its container, the gas expands to 450 times its stored volume and smothers a fire by temporarily removing the oxygen. Because it is a nonconductor of electricity, CO2 is the primary agent used against electrical fires.

CAUTION! CO2 should never be used alone to fight a major fire.

D.5.a. CO2 Effectiveness
CO2 is effective on small class A, B, and C fires. It has a very limited cooling capacity and does not permanently remove oxygen from a fuel source. Therefore, CO2 is only effective in knocking down flames. Unless CO2 is used continuously until all flames are extinguished, the fire could re-ignite (re-flash). In fact, the likelihood of a re-flash is greater when CO2 is used against a fire than any other type of agent.

A continuous discharge of CO2 from a fully charged 10-pound extinguisher will last approximately 40 to 45 seconds. The effective range for the portable CO2 extinguisher is approximately 5 feet. A distance of more than 5 feet may cause the CO2 to mix with the air and become ineffective.

WARNING: CO2 is extremely cold when discharged. The rapid expansion of the gas creates a "snow" that can "burn" or raise blisters if it comes in contact with bare skin. Keep hands on the insulated horn handle when using the CO2 extinguisher.

D.5.b. Discharging CO2
CO2 gas is not a conductor of electricity. However, when discharging CO2, static electricity may build up in the horn. This could be quite dangerous when extinguishing a fire where explosive gases are present. The cylinder should always be kept grounded to the deck when discharging to prevent static charge buildup. CO2 is most effective in closed spaces away from the effects of strong winds. The following are the operating procedures for the CO2 extinguisher: (See **Figure 18-3)**

Step	Procedure
1	Remove the locking pin from the valve.
2	Carry the extinguisher in an upright position, approaching the fire as close as safety permits.
3	For the smaller 5-pound size, swing the horn up to a horizontal position.
4	For larger CO2 extinguishers, ensure the CO2 bottle is in contact with the deck to prevent a

	static charge from building up within the extinguisher.
5	Grasp the insulated horn handle and squeeze the release lever to start the extinguisher.
6	Direct the flow of CO2 toward the base of the flame and attack the flame with a sweeping movement of the nozzle.

Figure 18-3
Operating the CO2 Extinguisher

CAUTION: PKP, like CO2, should never be used alone against a major fire for it presents the same hazard of a re-flash as CO2.

D.6. Potassium Bicarbonate (PKP)

PKP is also known as purple K powder. The ingredients used in PKP are non-toxic. When PKP is applied, a dense cloud is formed in the combustion area that limits the amount of heat that can be radiated back to the heart of the fire. Fewer fuel vapors are produced due to the reduced radiant heat. The dry chemical PKP extinguishes flames by breaking the combustion chain.

D.6.a. PKP Effectiveness

PKP does not have cooling capability. PKP may be effective as a temporary measure for extinguishing a flame, but it dissipates rapidly. Therefore, all hot spots must be cooled to prevent re-ignition. It is effective to some degree on all types of fires, but is particularly effective when used against burning liquids. By first extinguishing a burning liquid with PKP and then laying down a blanket of AFFF to prevent re-flash, dealing with a Class B fire is very effective. Most PKP extinguishers have an effective range of 10-12 feet and will last between 8—20 seconds in continuous use.

D.6.d. Discharging Dry Chemicals

The dry chemical or powder contained in these portable containers is expelled by either a gas cartridge or by stored pressure within the container. The following are procedures for using this type of extinguisher: (See **Figure 18-4**)

Step	Procedure
1	Operate the dry chemical extinguisher by following the instructions printed on the extinguisher.
2	Control the discharge of the dry chemical by the nozzle shutoff valve for both cartridge-operated and pressurized dry chemical extinguishers.
3	Approach the fire as close as safety will allow.
4	Remove pin.
5	Squeeze trigger.
6	Direct the discharge at the base of the flame and attack with a sweeping movement.

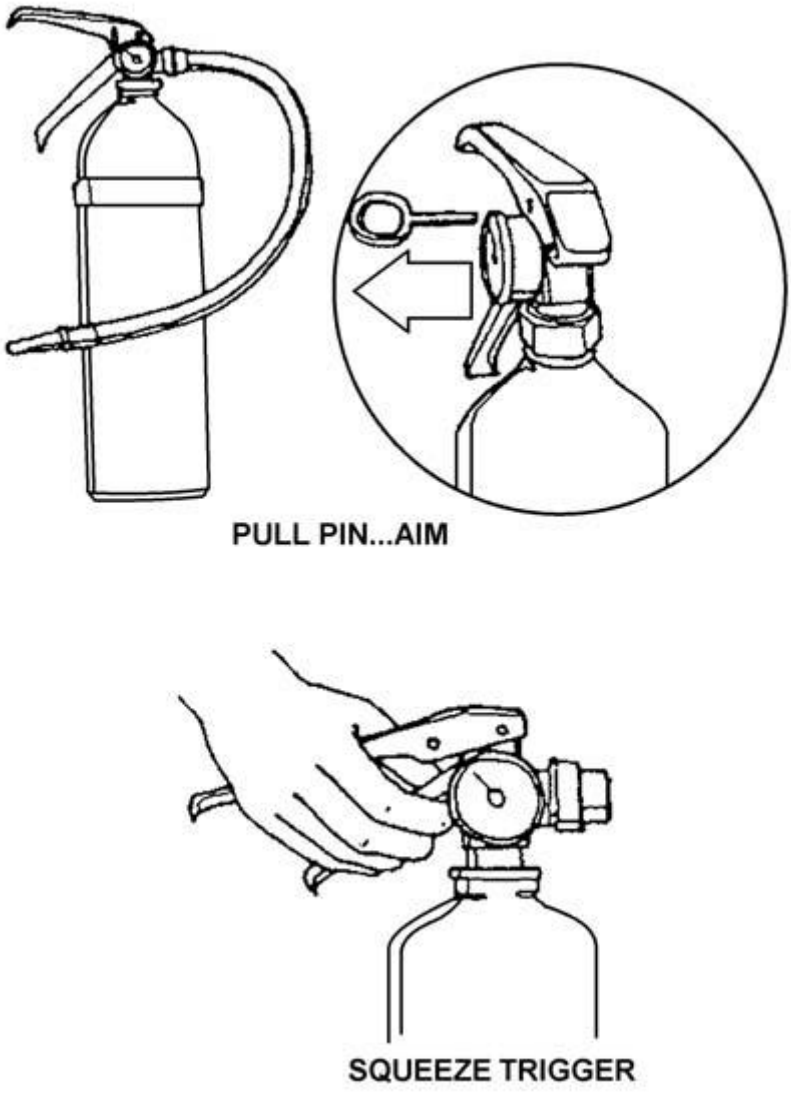

Figure 18-4
Dry Chemical Extinguisher

Applying Halon

D.7. Description
Halon, a liquefied compressed gas is odorless, colorless, and electrically nonconductive. Halon differs from the other extinguishing agents in the way it extinguishes fires. It has some of water's cooling effect and some of CO2's smothering power. But Halon actually reacts chemically with the fire to interrupt the chain reaction that causes fire to spread. This process is known as chain breaking, which was discussed earlier in this section.

Halon flooding systems are typically used to extinguish fires in machinery spaces where Class B and C fires occur.

CAUTION! Personnel should not remain in a space where Halon has been released unless an oxygen breathing apparatus (OBA) is worn.

D.8. Storage and Safety
All Halon is stored in liquid form in steel storage cylinders. Inside the cylinders, liquid Halon is pressurized using super-pressurized nitrogen. When activated, Halon is expelled as a gas. A Halon flooding system rapidly distributes a 5 to 7 percent concentration evenly throughout any space.

In a space where Halon was released, ventilation must be run on high for a minimum of 15 minutes before personnel re-enter that space without a breathing device. On vessels that have no mechanical ventilation, the space must be thoroughly ventilated using natural ventilation.

D.9. Halon Effectiveness
The mechanism by which Halon extinguishes a fire is not completely understood. Basically, Halon acts by removing active chemicals from spaces involved in a flame chain reaction. Halon complements a total fire fighting system as a final line of defense after other alternatives such as portable extinguishers (if possible) have been used.

Section E. Fire Fighting Procedures

Introduction
The following paragraphs will explain some safety precautions that must be observed when fighting fire as well as some tactical procedures to follow.

E.1. Division Fire Fighting Duty
Boat crewmembers must always remember that boat crews are not fire fighting professionals. Boat crews are to support fire fighting professionals if necessary. However, if a boat crew were to be the first on the scene of a boat fire or be the victims of a boat fire, their primary responsibility is to save lives, not property. Evacuate all people from a burning vessel, and then follow a risk assessment plan if capable.

Refer to *Chapter 4* for a discussion of a risk management plan.

E.2. Safety Precautions
Fire fighting can be very hazardous to anyone involved. Division personnel must always be alert and aware of their actions and decisions to avoid being injured or incapacitated performing fire fighting duties that are not their responsibility. Losing the services of any Division person may keep a boat crew from preventing other injuries, loss of life, or loss of property. Refer to *Chapter 4* of this Manual for a discussion of risk assessment and risk management.

E.2.a. Toxic Hazard
Shipboard and waterfront fires frequently involve toxic or chemical hazards for firefighters. These hazards may be the source of the fire or produced as a byproduct of fire. Therefore, caution must always

be exercised before attempting to fight any type of fire. Requesting trained assistance before becoming involved in fighting a fire of unknown material would be prudent.

E.2.b. Smoke Plumes
VO's must always stay well clear of smoke plumes rising form a fire because they greatly reduce visibility and can pose a health hazard. Smoke is a visible product of fire and carries water vapor, acids, and other chemicals produced by fire and can be irritating or toxic when inhaled. A smoke plume is made of suspended particles of carbon and other unburned substances. These products of combustion are released into the atmosphere and travel downwind.

E.2.b.1. Staying Upwind
As a plume expands downwind and outward from a fire, toxic products will be less concentrated. The more toxic a product is, the larger the unsafe area will be, both downwind and to the sides of a plume. The decision to set a perimeter upwind of a toxic smoke or fire plume must be considered and executed when prudent. Individuals who remain a safe distance upwind should not be affected by unseen dangers of a smoke plume.

NOTE: Generally speaking, remaining upwind of the fire provides a safe area away from toxic hazards that are released in a fire plume.

E.2.b.2. Maintaining a Safe Distance
Other decisions, such as determining a safe distanced from a plume of smoke, should be made and constantly reevaluated as an incident develops. Any change in weather conditions could dictate a need to increase the initial size of a perimeter. A crewmember is considered to be in a danger zone if a smoke plume is visible and radiant heat is felt.

E.2.b.3. Awareness of Gases and Vapors
Smoke plumes also have other factors that must be considered such as the behavior of gases and vapors that extend beyond a perimeter of visible smoke and fire. Burning plastics and rubber products produce gases, heat, flame, and smoke. These byproducts may contain elements of a toxic or lethal nature.

There are many other products of combustion that are dangerous and can be lethal under certain conditions.

E.3. Operations
A boat crew is faced with several responsibilities and decisions when a vessel or waterfront fire occurs. Decisions made may affect lives and millions of dollars in property. When determining a unit's assistance posture, the following should be considered

- Level of the threat of fire.
- Jurisdictions involved.
- Capabilities of local fire departments.
- Availability of Division equipment.
- Level of Division personnel training.

Generally, Division personnel should not engage in independent fire fighting operations except to save a life or in the early stages of a fire, where they may avert a significant threat without undue risk. Division personnel should not engage in fire fighting except in support of a regular fire fighting organization.

E.4. Action

When a Division boat crew becomes involved in fire fighting operations, the situation will typically be one that fosters a great sense of urgency to extinguish a fire as rapidly as possible. All members of a boat crew must remember that haste and lack of a coordinated effort by boat crewmembers can recklessly endanger a boat and all crewmembers.

E.4.a. Crew Brief

A boat VO must brief crewmembers before arriving at the scene of a fire. This briefing details each crewmember's assignments and emphasizes safety. Crewmembers are responsible for all duties assigned and must request clarification from the VO if the do not clearly understand the tasks assigned. They must break out all necessary gear. All personnel must don PPE before arriving on scene.

E.4.b. Initial Action

The following are procedures initially performed when responding to a fire:

Step	Procedure
1	Approach the boat from upwind.
2	Immediately upon arriving on scene, all crewmembers should check the surrounding vicinity for PIW's.
3	Recover and evacuate all survivors to the Division vessel.
4	Evaluate their physical conditions and render first aid if necessary.
5	If the extent of injury requires more than minor first aid, immediately transport the injured so they can receive professional medical assistance.
6	Inform IC and EMS if necessary, of the situation.

These procedures are to be taken before attacking the fire, remembering that life comes before property. If there are no survivors or those recovered are in good physical condition and have been evacuated to a safe place, the next step is to stop and evaluate the fire.

WARNING: If the risk of explosion is not certain, back off a safe distance and establish a safety zone. Do not attempt to fight the fire.

CAUTION! A crewmember's decision regarding his or her role in the overall situation must be constantly reexamined.

E.4.c. Situation Evaluation

The VO and crew must evaluate the following elements of the situation:

- Location and extent of a fire.
- Class of fire.
- Class and extent of all cargo involved.
- Possibility of explosion.
- Possibility of any vessel involved sinking/capsizing within a navigable channel.
- Hazard to the crew.
- Maneuverability of the vessel.
- Weather forecast.
- Risk of a serious pollution incident.

Step	Procedure
1	If a fire can be put out with no danger to the crew or the vessel, proceed.
2	If not, back off and maintain a safety zone so that no other vessel comes too close to the fire scene.
3	After completing the initial evaluation, reevaluate a fire scene/situation frequently. A small fire can rage out of control in minutes and threaten more property and cargo.
4	If a fire must be approached at any time, remember to always approach from windward. (See **Figure 18-10**)
5	If it becomes necessary to tie up alongside a burning vessel to fight a fire or to remove survivors, attach only one line to the vessel and keep a sharp knife accessible for a quick break away.

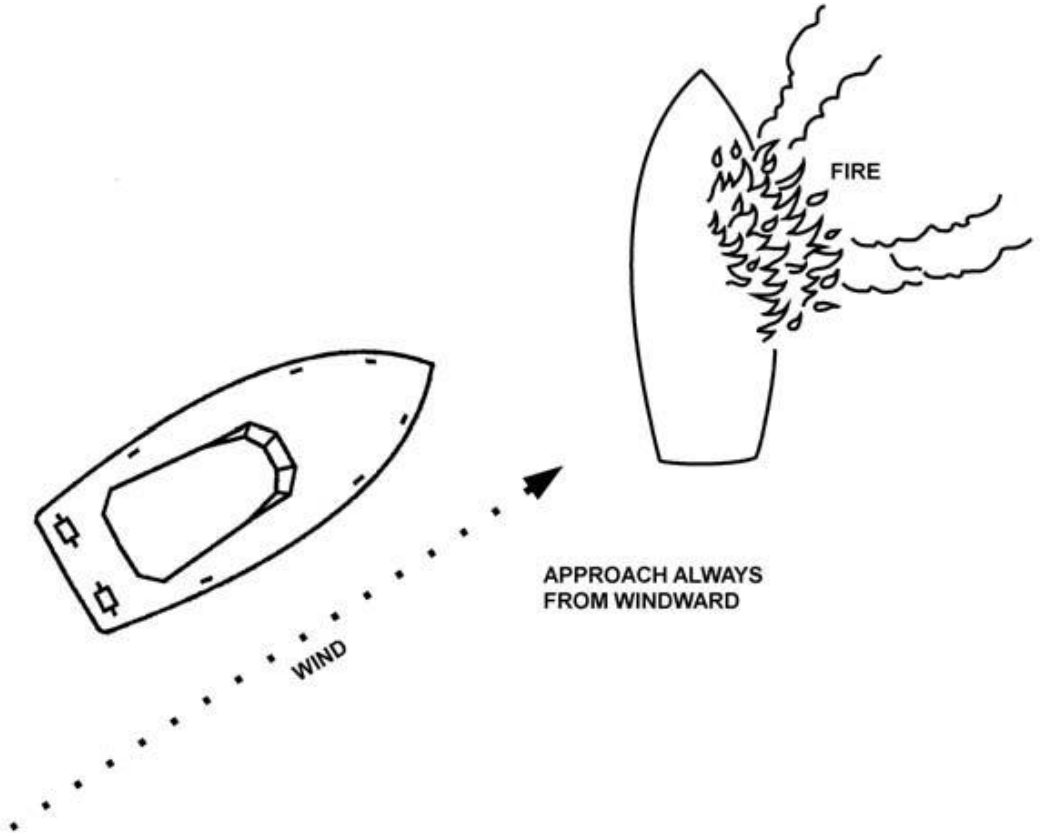

Figure 18-10
Approaching a Boat on Fire

E.4.d. Overhauling

Danger will still exist even after a fire is believed to be extinguished. The process of overhauling the fire is done to avoid fire re-flash as follows:

Step	Procedure
1	When a fire is out, check for hot spots and set a re-flash watch.
2	When danger of re-flash is no longer a concern, dewater the distressed vessel.

Section F. Extinguishing Fires

Introduction
A fire discovered early and quickly fought can usually be extinguished easily. Portable fire extinguishers are used for a fast attack that will knock down flames. However, they contain a limited supply of extinguishing agent. Crewmembers with limited training in using of these extinguishers often waste extinguishing agent by using them improperly. Periodic training, including practice with actual types of extinguishers carried onboard boats, will ensure proficient use of this equipment. Extinguishers that are due to be discharged and inspected should be used for training.

F.1. Safety Rules
The following safety rules should be observed when using portable fire extinguishers:

- Immediately upon discovering a fire, sound an alarm and summon help. Never try to fight a fire alone. Always call for help first.
- Never pass a fire to get an extinguisher.
- If it is necessary to enter a compartment to combat a fire, keep an escape path open.
- Never let a fire block a door, hatch, or scuttle. Stay low.
- If extinguishing a fire within a compartment with a portable fire extinguisher fails, get out. Then close the door, hatch, or scuttle to confine the fire.

F.2. Fire Combat
An attack should be started immediately to gain control and to prevent extension of a fire to other areas of a boat. An attack will be either direct or indirect, depending on the fire situation. Both methods are efficient when properly employed.

F.3. Direct Attack
In a direct attack, crewmembers advance to the immediate area of a fire and apply extinguishing agent directly on a fire, if a fire is small and has not gained headway. Once a fire has gained headway, an indirect attack should be used.

F.4. Indirect Attack
An indirect attack is best when it is impossible for crewmembers to reach a fire. Generally this is in the lower portions of a boat, such as the engine room and bilge areas. The success of an indirect attack depends on completely containing a fire. Every possible avenue a fire may travel must be cut off by closing doors, hatches, and scuttles and by securing al ventilation systems.

F.5. Fire Fighting Procedures on Division Vessels
Every fire will quickly spread to new sources of fuel or oxygen if they are available. However, the path through which a particular fire extends will depend on the location of a fire and the construction of surrounding spaces. These factors must be considered when fighting a fire. In addition, fuel and all products of its combustion will affect fire fighting operations. For these reasons, no fire can be fought routinely, and all fires must be fought systematically. The following procedures should be part of every fire fighting operation:

CAUTION! Never fight a fire, however small it may seem, until an alarm has been sounded. Once a fire gains intensity, it spreads swiftly.

Step	Procedure
1	Sound an alarm. Any crewmember who discovers a fire or any indication of fire must sound an alarm and give a location 9e.g., “FIRE, FIRE, FIRE IN THE BILGE”).
2	Evaluate a fire. • Determine the air supply to the fire. • Determine the class of fire (combustible material). • Determine the fuel source to the fire. • Select proper extinguishing agent. • Determine method for fighting a fire (direct or indirect). • Determine how to prevent spread of a fire. • Determine required equipment and crewmember assignments.
3	Determine the need to secure: • Electrical and electronic power panels. • Power to individual electrical and electronic equipment (alternator, radar). • Engine and fuel supply. • Air intakes (ventilation system, doors, hatches and scuttles).
4	Place all equipment necessary to combat a fire on an open deck area. This includes: • Portable fire extinguishers. • First Aid Kit.
5	Combat a fire with appropriate extinguishing agent(s)
6	Notify IC or park headquarters at the earliest opportunity. Keep them fully advised of the situation. • Give position. • Nature of fire. • Number of POB’s. • Your intentions. • Keep them advised of changing situation and status of personnel.
7	Overhauling a fire. • Once the fire has been extinguished, the spaces involved must be properly ventilated to remove any smoke, explosive or toxic gases. If there is any doubt as to whether the space might contain harmful fumes, do not enter that compartment. Return to the marina and have the space checked out by trained officials. Be careful when ventilating because the introduction of fresh air into a compartment might cause the fire to re-flash. • Once in the space, inspect all overhead spaces, decks, and bulkheads. • Check where wiring and piping penetrates through bulkheads and decks. • Expose areas that are charred, blistered, or discolored by heat until a clean area is found. • Pull apart and examine any materials that might have been involved with the fire for hidden fire and hot embers. Jettison (throw overboard) all such material if necessary. • Set a re-flash watch. One crewmember must be assigned to do nothing but check for re-ignition and to sound an alarm if it occurs.
8	Re-stow all firefighting equipment except those pieces that are being used by the re-flash

	watch. • Recharge or replace portable fire extinguishers, even if only partially used immediately upon arrival back at the unit.
9	Conduct a damage control check. Start any necessary dewatering operations. Depending on the severity of the damage, it might be best to tow the damanged vessel back to port where an in depth determination concerning damage to the vessel's systems can be conducted. Utilizing possibly damaged electrical or mechanical equipment might cause further damage or another fire.

F.5.a. Opening a Hatch

If someone must open a hatch to discharge a portable extinguisher, expect the possibility of burned hands and/or a singed faced can be expected. As the fresh air enters the compartment, it will feed the fire, and cause it to "blow up." The best method of opening a hatch is to stand to the hinged side of the hatch. Then while wearing gloves or using something other than bare hands, the hatch can be pulled open. If the boat has a closed engine compartment and no fixed system, it is a good idea to make a small hole with a pivoted cover into a space. A portable extinguisher may be discharged through this hole.

F.6. Fires Aboard Other Boats

Use the following procedures when battling a fire aboard other boats:

Step	Procedure
1	Brief crewmembers on appropriate procedures.
2	Assign each crewmember specific duties.
3	While en route to the scene, establish communication with the distressed vessel.
4	Approach the boat from upwind.
5	If no one is onboard, circle the boat (at a safe distance) searching for PIWs.
6	Advise all persons onboard the boat to move to a flame and smoke-free area, topside.
7	Attempt to determine the extent and source of the fire. If it is not obvious, ask the personnel aboard the distressed boat where the fire is located.
8	If the fire is beyond the crewmembers fire fighting capabilities, evacuate the persons from the distressed boat and call for assistance.
9	Check the physical condition of the survivors. If medical treatment is required, proceed to the nearest location where medical help can be administered.
10	If the fire is small and within the crewmember's capabilities, first ensure that the survivors are safe on the boat, another boat, or ashore before attempting to fight the fire.
11	After assessing the situation, fight the fire with the firefighting equipment available. Avoid placing the crew and transferred survivors in any danger.

F.7. Fire Under Control

Under the following circumstances, a fire may be considered to be under control:

- Extinguishing agent is being applied to a fire and has effectively begun to cool it down.
- The main body of a fire (base) has been darkened. At this point, a fire cannot generate enough heat to involve nearby combustible materials.
- All possible routes of fire extension have been examined and found safe or protected.

F.8. Fire Extinguished

Before a fire can be declared completely out, a VO must ensure the following actions have taken place:

- A thorough examination of the immediate fire area has been conducted
- A complete overhaul of all burned material has been accomplished.
- A re-flash watch has been set.
- All firefighting equipment has been re-stowed with the exception of what is being used for the re-flash watch.
- A damage control check has been performed.
- All crewmembers have been accounted for.

F.9. Abandoning a Boat

Crewmembers should not panic and hastily abandon a boat even when a fire is severe. Instead, they should stay calm while using equipment and training to combat the fire. Abandoning the boat should only be considered as a last resort once all available options for extinguishing the fire have been attempted. Aggressive and proficient fire fighting is normally a preferred alternative to abandoning a boat; however, crewmembers should not hesitate to abandon the boat if the following conditions exist:

- Becoming trapped by the flames.
- There is no longer the equipment to fight the fire.
- An explosion is likely (flames by the fuel tanks).
- Similar life threatening situations are apparent.

If able, the VO should inform IC or park headquarters of location and any other pertinent information. Make sure that:

- Distress call has been initiated.
- All personnel are wearing life jackets.
- Life raft or dingy is put over, if available.
- Extra signaling gear is taken.

Section G. Dewatering

Introduction

Dewatering a vessel is a consideration that is normally secondary to getting a fire put out. That is not to say, however, that dewatering is not important. Indeed, it may be possible to use dewatering equipment to keep the boat from capsizing. Know what equipment is available for dewatering and how to use it.

G.1. Action Before Dewatering

Action taken before beginning to dewater a disabled vessel varies depending upon the nature of flooding. Regardless, a VO should always brief crewmembers on what procedures to follow while emphasizing safety. If crewmembers have just put out a fire on a boat, someone must then board the vessel and check for flooding, but only when safety permits. A VO will direct crewmembers how to safely accomplish this inspection for flooding.

When responding to a distress call of a disabled vessel taking on water, the initial action on the scene will be as follows:

Step	Procedure
1	Search the immediate area for people in the water.
2	After all survivors are recovered and all persons onboard the sinking craft are accounted for and have been evacuated to a safe place, check the sinking craft for hull damage or other sources of flooding.
3	Before entering any flooded compartment/vessel, every attempt to secure electrical power should be made to reduce the chance of electrical shock.
4	Once a source of flooding is determined, crewmembers may perform procedures to reduce water flow into the boat. Safety of the crew is the first priority. The distressed vessel should not be boarded if it seems unstable and could possibly capsize or sink.
5	Once onboard, the crewmembers should wear PFDs and not go below decks if there is any threat of capsizing or sinking.
6	When flooding has been controlled, or at least reduced to a minimum, dewatering can begin. How a vessel is dewatered depends on the conditions that exist at the scene.

NOTE: This Manual does not cover technical information and use of commercial gasoline powered pumps, high capacity, manual, or electrical bailing p0umps. See and follow the manufacturing instructions for usage while dewatering.

G.2. Dewatering Using a Drop (Trash) Pump

Some Division facilities have trash pumps. Dewatering with a trash pump is done with the pump laced on the disabled boat. Trash pumps are very efficient means of dewatering a vessel in a short period of time.

Great Salt Lake State Marina has a large Trash Pump capable of a dewatering rate of 420 GPM. The pump is stored in the maintenance vessel but can be transferred aboard *Rescue One* to a vessel needing dewatering. When dewatering another vessel the pump should remain on *Rescue One* while the intake hose is placed onboard the vessel requiring dewatering. This should only be done in calm conditions while side-tied to the vessel.

CAUTION! Do not attempt to dewater another vessel with the trash pump in anything but calm conditions.

G.3. Dewatering Using a Portable Manual Bilge Pump

Many dewatering needs can be performed with the use of a high volume portable manual bilge pump. Many Division vessels are equipped with these pumps that can be passed to a vessel needing dewatering. (See Figure 18-11)

Figure 18-11
High Volume Portable Manual Bilge Pump

Rescue One and *Rescue Four* are both equipped with high volume portable manual bilge pumps that can be passed off to a vessel needing dewatering.

Section H. Righting Powerboats and Sailboats

CAUTION! Attempting to right a capsized vessel could cause extensive damage to that vessel. The crew of the disabled vessel is the primary responsibility. Remember, the Division is not in the salvage business.

Introduction
Any attempt to right a capsized vessel must be carefully thought through before beginning. Boat crews must make absolute certain that all crewmembers from a distressed vessel are accounted for before beginning any procedure to right the vessel. Survivors may be trapped inside the hull.

When an inboard boat capsizes, dewatering cannot begin until the craft has been righted. There are several methods for righting vessels of this type. The best one should be selected after evaluating the conditions on-scene. Regardless of the method used, an accurate count of the persons aboard the capsized boat is always essential. PFDs should be provided to them if necessary, and they should be brought aboard the boat before beginning the righting operation. A disabled craft should be approached cautiously. Watch for debris that may damage the boat or foul its propellers.

H.1 Righting Powerboats
The means selected for attaching lines determines the method of righting. Procedures for each method include:

- Righting by parbuckling.
- Righting using bow and transom eyebolt.
- Righting using towline fore and aft of boat's keel.
- Righting swamped boats astern using trailer eyebolt.

H.1.a. Righting by Parbuckling
Perform the following procedures when righting powerboats by parbuckling: (See **Figure 18-18**)

WARNING: Never have a swimmer attempt to rescue people trapped inside a capsized vessel. Attempt to keep the capsized vessel stable and call for assistance.

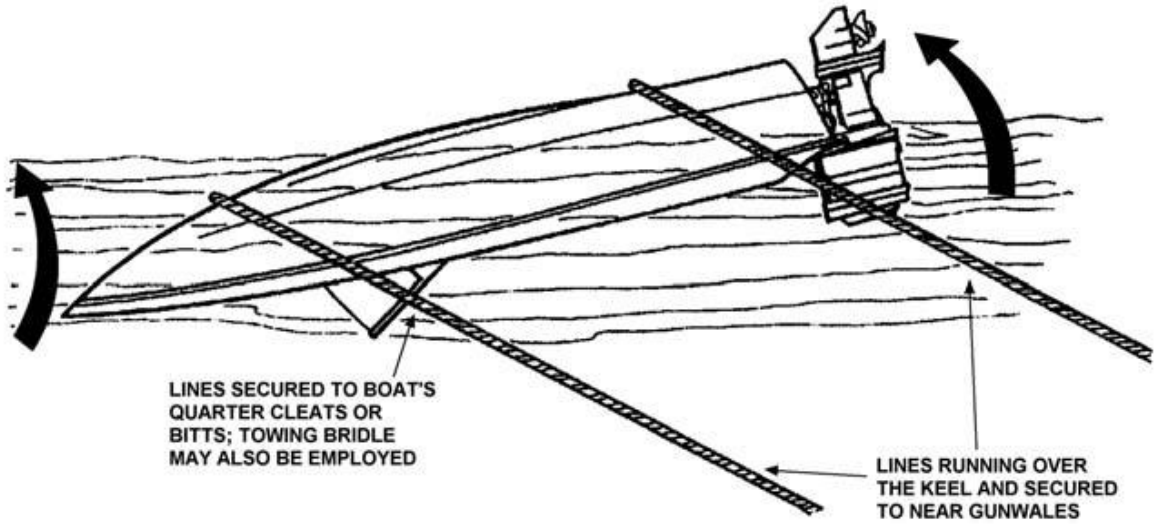

Figure 18-18
Righting Powerboats by Parbuckling

CAUTION! If the weather presents a danger to the person in the water or the boats involved, do not attempt righting.

Step	Procedure
1	Approach a capsized boat cautiously. Keep clear of all lines and debris in the water.
2	Account for all personnel from the capsized boat.
3	Recover all personnel from the water and provide PFDs to them as necessary.
4	Select a crewmember to be the tethered swimmer needed to enter the water to prepare the boat for righting
5	Direct a crewmember to secure towing bridle or mooring lines to the nearest gunwale of the capsized boat.
6	Then the person-in-the-water leads the bridle lines or mooring lines under the boat and back over the keel. Ensure that these lines are outboard or all handrails, lifelines, and stanchions. Ten run the bridle back to the towline, or run the mooring lines to the boat's rear quarter cleats or bitts.
7	Recover the tethered swimmer from the water.
8	Pay out enough on the towline or mooring lines to prevent the boat from hitting the stern during righting and towing. Then, secure the lines.
9	Gradually add power to the boat and increase speed the boat should right itself.
10	Reduce power so as not to continue to pull the boat over capsizing it again.
11	Bring the righted boat alongside the righting boat and dewater using the most appropriate method.

H.1.b. Righting Using Bow and Transom Eyebolt
Perform the following procedures for righting a vessel using the bow and transom eyebolt:

Step	Procedure
1	Approach a capsized boat cautiously-from downwind, down current, or both, keeping clear of all lines and debris in the water.
2	Account for all personnel from the capsized boat.
3	Recover all personnel from the water and provide them PFDs as necessary.
4	Bring the capsized boat alongside the working area of the boat.
5	Use a shackle to secure your towline to the trailer eyebolt of the capsized boat.
6	Secure a piece of scrap or mooring line to the capsized boat's outboard transom eyebolt (See **Figure 18-19**). It may be necessary to put a tethered swimmer into the water to accomplish this. The line should be strong enough to handle the strain of righting the vessel.
7	Pay out both towline and a scrap/mooring line and walk the capsized boat to a position astern of and athwartships to (from side to side) the boat.
8	Secure the scrap/mooring line to the boat's rear quarter cleat or bitt.
9	Pay out enough towline to permit the boat to remain clear of the stern when righting and towing commences. Secure the towline.
10	Gradually add power and increase speed. When the righting motion begins, cut or slip the scrap/mooring line. The boat should right itself. Tow the righted boat until water is being forced over the transom of the disabled boat.
11	When water ceases to flow over the towed boat's transom, reduce speed gradually ensuring that enough water has been forced out of the boat during towing to allow it to float on its own.
12	Bring the righted boat alongside the righting boat and dewater it using the most appropriate method.

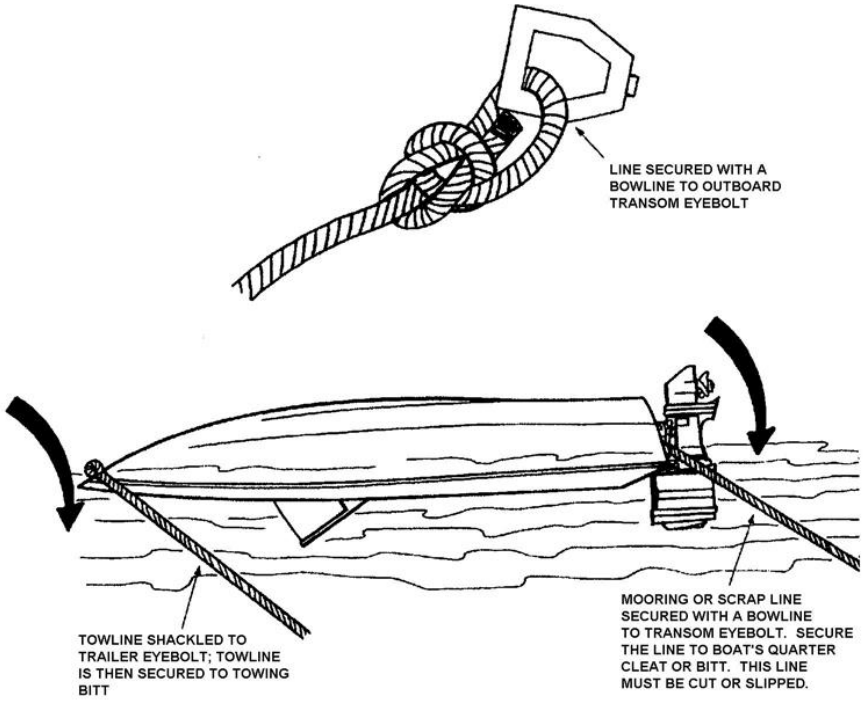

Figure 18-19
Righting Capsized Boats Using Bow and Transom Eyebolts

H.1.c. Righting Using Towline Fore and Aft of Boat's Keel

Perform the following procedures for righting a boat using a towline fore and aft of the boat's keel:

Step	Procedure
1	Approach the capsized boat cautiously, from downwind, down current, or both, keeping clear of all lines in debris in the water.
2	Account for all personnel from the capsized boat.
3	Recover all personnel from the water and provide PFDs to them as necessary.
4	Direct a crewmember to act as tethered swimmer and enter the water to prepare the boat for righting.
5	Direct the swimmer to run the towline fore and aft alongside the capsized boat's keel.
6	The swimmer will then secure the towline to the capsized boat's trailer eyebolt with a shackle.
7	Ensure the disabled boat is positioned fore and aft, directly astern of the righting vessel (capsized boat's stern toward the other boat's stern), and that the towline is running fore and aft along the capsized vessel's keel. (See **Figure 18-20**) Recover the swimmer.
8	Pay out enough slack in the towline to permit the boat to clear the stern when righting commences. Secure the towline.
9	Gradually add power and increase speed, pulling on the bow of the capsized boat. This pull will be countered by the aft portion of the disabled boat, which is the heaviest part of the craft. As a result of these two forces, the boat will be righted.
10	Tow the righted boat until water is being forced over the transom of the disabled boat.
11	When water ceases to flow over the towed boat's transom, reduce speed gradually, ensuring that enough water has been forced out of the boat during the towing to allow it to float on its own.
12	Bring the righted boat alongside the righting boat and dewater it using the most appropriate method.

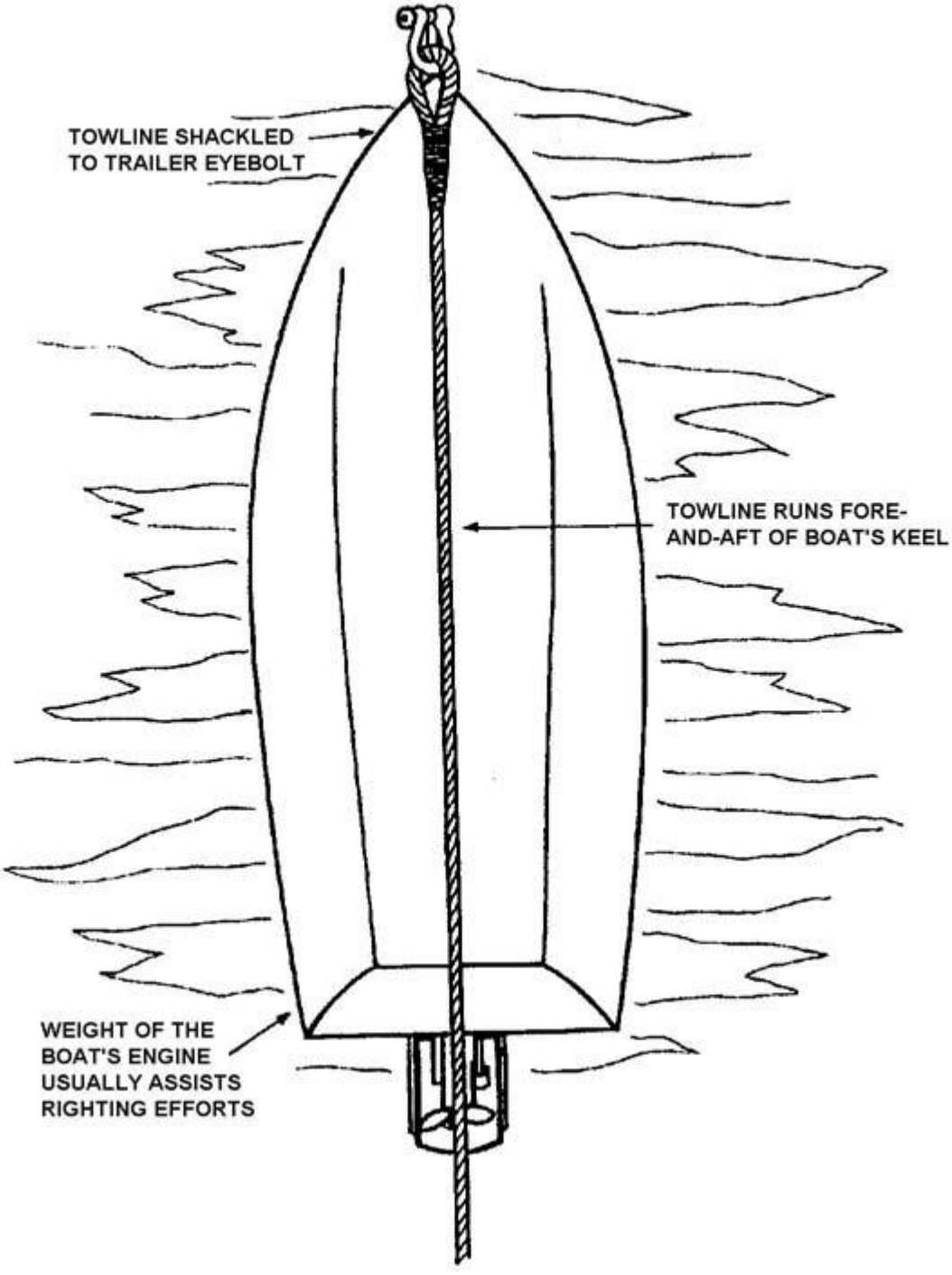

Figure 18-20
Righting Capsized Boats Using Towline Fore and Aft of Boat's Keel

H.1.d. Refloating Swamped Boats Astern Using Trailer Eyebolt

Perform the following procedures for righting a boat that has been swamped form astern: (See **Figure 18-21**)

Step	Procedure
1	Approach a swamped boat cautiously, form downwind, down current, or both, staying clear of all lines and debris in the water.
2	Account for all personnel form the swamped boat.
3	Recover all personnel from the water and provide them PFDs if necessary.
4	Bring the swamped boat alongside the working area of the boat.
5	Secure the towline to the trailer eyebolt of the swamped boat with a shackle.
6	Pay out the towline and walk the swamped boat directly astern of the boat.
7	Pay out enough towline to permit the swamped boat to remain clear of the stern when towing commences. Secure the towline.
8	Gradually add power to the boat and increase speed taking the swamped boat in tow. Tow the boat until water is observed being forced over the transom of the disabled boat.
9	When water ceases to flow over the towed boat's transom, reduce speed gradually, ensuring that enough water has been forced out of the boat during towing to allow it to float on its own.
10	Bring the righted boat alongside the righting boat and dewater it using the most appropriate method.

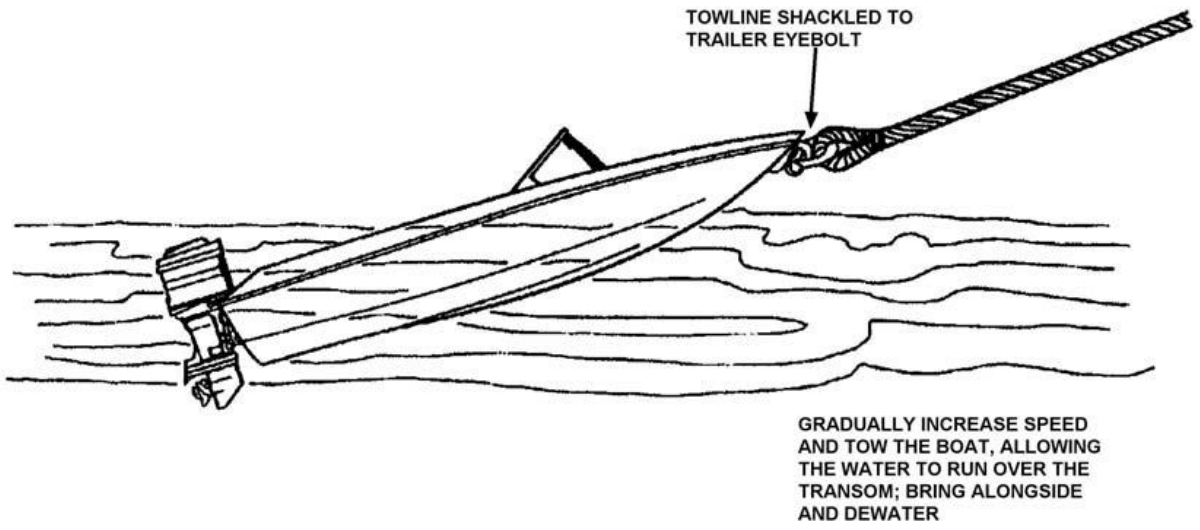

Figure 18-21
Refloating Boats Swamped Astern Using Trailer Eyebolt

H.2. Righting Small Sailboats

The VO should approach the capsized sailboat from upwind, up current, or both, remaining clear of lines and debris. All personnel from the sailboat should be accounted for and recovered as necessary. At least one person (tethered swimmer) will be needed in the water to help in righting the boat. Righting should not be attempted if the weather presents a hazard to the rescue boat or personnel.

NOTE: Quite often, sailboat crews are very familiar with righting their vessels should they capsize. If a member of the sailboat's crew wishes to remain in the water and attempt to right the vessel, recover the other people form the water and ensure the remaining crewmember is wearing a PFD before attempting to right the vessel.

Perform the following procedures for righting a small sailboat:

Step	Procedure
1	The person-in-the-water unships or removes he sails.
2	The sails, if removed, should be put aboard the rescue boat or secured to the disabled boat.
3	The person-in-the-water then stands on the keel or centerboard and leans back while holding onto the gunwale. The boat slowly begins to come back over.
4	Once the sailboat is righted, recover the swimmer and begin dewatering.

NOTE: Sails still hoisted create severe drag and force against righting attempts. They may even cause the boat to capsize again once it is successfully righted.

H.3. Righting Large Sailboats

A procedure called parbuckling may be used to right capsized powerboats or sailboats over 25 feet in length. Also, parbuckling should be used for righting small sailboats that cannot be righted by the method previously described.

A person from the overturned boat or a tethered swimmer from the rescue boat must enter the water to prepare the boat for righting.

WARNING: Do not secure any lines to the masts of sailboats. The force exerted during the righting may cause the mast to fracture.

Perform the following procedures for righting a small sailboat:

Step	Procedure
1	Unship or remove the sails.
2	Have the person-in-the-water run a bridle or towline to the capsized boat.
3	Ensure that the lines rigged for righting are outboard of all stays, shrouds, lifelines and stanchions.
4	Secure lines to available deck fittings using the same method as with powerboats.
5	Connect the other end of the bridle to the towline. Pay out enough line to prevent the distressed boat's mast (if so equipped) from striking the rescue boat should the distressed boat continue to roll in that direction.
6	Recover the person-in-the-water.
7	Commence righting by going ahead slowly on the engines.
8	Once a sailboat is righted, crewmembers should board it from the stern (because of the boat's instability) and secure all loose lines.
9	Secure the boom to stop it from swinging and possibly capsizing the boat again.
10	Begin dewatering.

H.4. Righting Sailing Catamarans

Catamarans are sailboats with two hulls and either a solid deck or trampoline between the hulls. The most popular catamaran is the Hobie Cat. Prindle and Nacra are two other fairly popular catamarans in Utah. These sailboats are very fast and stable but are definitely prone to tipping by either capsizing to their side or pitch-poling (burying the bow and tipping over forward. See **image 19-5**). Once they capsize they can be tougher to upright than day sailors. Catamarans can handle conditions on Great Salt Lake fairly well with an experience crew; even in wave conditions. But can be problematic for the inexperience in wind/wave conditions. Even the experienced crew may have trouble righting a capsized catamaran. Some catamarans, when they capsize, will want to go turtle fairly quickly.

Figure 18-22
Pitch-poling

Righting a catamaran that has gone turtle is fairly simple as long as the catamaran has righting lines rigged. If not the Division boat crewmembers will need to fashion righting lines from lines aboard the Division vessel. Have the catamaran crew follow these instructions to right a turtled catamaran:

- Tie the righting line to the front crossbar corner where it attaches to the hull.
- Have the catamaran crew stand in the diagonally opposite corner on the rear crossbeam, and use the righting line to hold yourself up. Lean back while pulling on the righting line. The natural forces will eventually weigh down the rear corner while lifting the opposite front corner. This leverage action will eventually turn and lift the catamaran, dragging the mast to the surface.
- If the catamaran crew cannot right the vessel from turtle it is possible to use the Division vessel to assist. Attach a tow line to the catamaran's righting line with the Division's stern facing the catamaran. Apply a little forward throttle. This should be enough to assist the catamaran crew to get the boat out of turtle.
- Once the sail or sails are on the surface, visually inspect the rigging for damage before proceeding further. If there is no damage it will now be necessary to make sure the sails are un-cleated so that water can spill from the sail as the catamaran is righted. If this is not done it may be impossible to right the catamaran.
- The catamaran crew now stands on the lower hull and, while holding the righting line tied to the hull in the air, lean backwards. Make sure the crew has checked the water to make sure no swimmers will be hit when the hull comes back down to the water surface. The further out the crew can lean the greater leverage to right the catamaran. Further leverage can be obtained by

positioning the boat so that the prevailing wind will fill the sail as it is being righted. See **Image 19-6.**

- The Division vessel can assist further righting the catamaran by stationing at the masthead, grabbing it with a boat hook and then raising it in the air.
- The leverage action will eventually lift the mast clear of the water. As the boat rises and comes back to the surface, the catamaran crew will position themselves under the catamaran in a safe position. To prevent the catamaran from sailing off or blowing over again, the crew should reach for the crossbeam as the catamaran surfaces. This will place the crew in a clear position to stop forward momentum and climb back on the catamaran.

Figure 18-23
Righting a Catamaran

If it is necessary to tow a catamaran do not do so from each hull with a bridle. This can put undue inward pressure on the hulls. It is even possible to break a hull doing this. It is much better to attach a single tow line or a bridle line to the forward crossbar. Catamarans also side-tow exceptionally well, even in waves as they will track with the Division vessel.

Section I. Flood Control

Introduction
Boats sometimes become damaged in groundings, in collisions, or from striking submerged objects. These mishaps may result in a holed, cracked, or weakened hull. If the hull has been damaged to the extent that water is entering the interior of the boat, it must be plugged or patched to keep the boat afloat.

NOTE: The primary purpose of the Division SAR, is to save lives. Conducting damage (flooding) control operations to save property alone should only be done after a complete risk assessment of the situation has been done to ensure the crew will not be subjected to undue risk. If available, the salvage should be considered before conducting this type of operation.

In This Section

This section contains the following information:

Plugging Holes

I.1. Plugs

The simplest method of stopping a small hole in wooden, metal or fiberglass hulls is to insert a plug or plugs. Plugs are usually made of a soft wood such as pine or fir. Plugs are used individually if they fit the hole, or in combination with other materials to make a better fit.

Both *Rescue One* and *Rescue Four* are equipped with wooden plugs (bungs) for patching holes.

I.2 Preparing Plug

Wrapping cloth around each plug before inserting them in the hole will keep the plug in place. It also fills the gaps between plugs.

I.3. Inserting Plugs

When plugging holes, it is usually easiest to insert the plugs form the inside. However, sometimes the rough edges protruding inward may make this method impossible. If it is necessary to insert the plugs form the outside, and safe to do so, the inboard end(s) of the plug(s) should be fitted with screw eyes. A line should be attached to each screw eye and fastened to a structure inside the boat. It will hold the plug in place (See **Figure 18-24**)

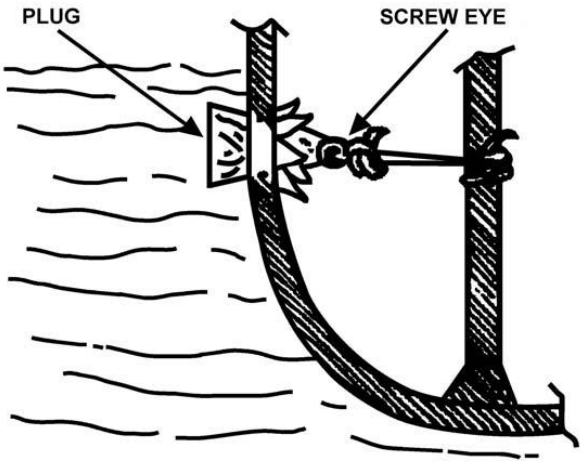

Figure 18-24
Screw Eye

I.4. Large Holes
Large Holes are generally too difficult to plug. A patch can be used to reduce the flow of water through a large hole, if an attempt is made.

I.5. Fiberglass Hulls
Fiberglass may be the most difficult hull material to plug. Wooden conical plugs driven into the hole may do nothing more than cause further splitting and cracking and add to an already difficult situation. The best method of plugging a hole in fiberglass is to shove some pliable type of material into it such as a rag, shirt, or piece of canvas. A PFD or blanket may also work well.

Patching Holes

I.6. Holes Below the Waterline
Patching holes below the waterline is usually a difficult task because of the pressure exerted by the water and the inaccessibility of the holed area. Small holes should be patched from the inside. Some type of material should be placed over the hole and hold it in place with another object. For example, if the boat were holed in the bottom, a PFD or seat cushion could be placed over the hole and held in place with a gas can, cooler, or toolbox.

I.7. Large Holes Below the Waterline
Large holes below the waterline are extremely difficult to patch. The pressure of the water flowing through the hole will not usually allow a patch to be installed from the inside.

I.7.a. Collision Mat
If a collision mat (a large piece of canvas or vinyl) is available, it can be used to patch a large hole. Perform the following procedures while placing the mat over the hole: (See **Figure 18-25**)

Step	Procedure
1	Tie four lines to the corners of the mat (Patch).
2	Position the mat by lowering it over the bow.
3	Have someone walk down each side of the boat, two of the lines for each person.
4	Slide the mat along the bottom of the boat.
5	Once the mat covers the hole, secure the four lines topside. The pressure of the water against the patch will also help to hold it in place.

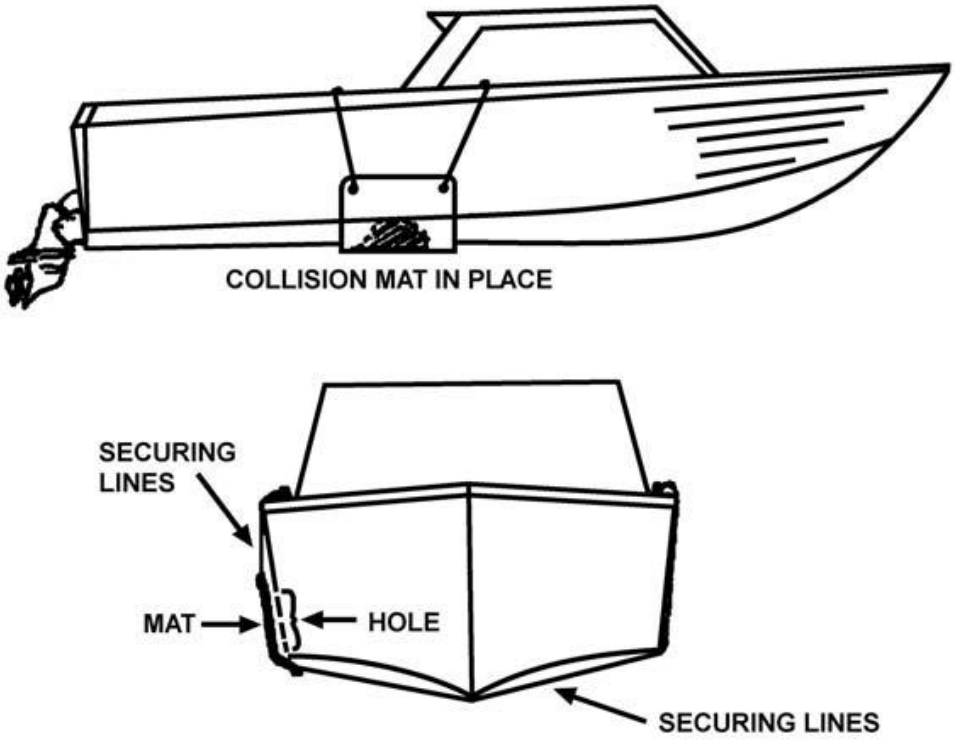

Figure 18-25
Collision Mat

I.7.b. Box Patch

Box patches are effective, even on holes that have jagged edges protruding inward. The box patch is usually a prefabricated box, which is held in place with screws, nails, or it may be wedged in place with anything available. A gasket (anything available) is placed between the box and the hull to make a good seal and to prevent the box from shifting. (See **Figure 18-26**)

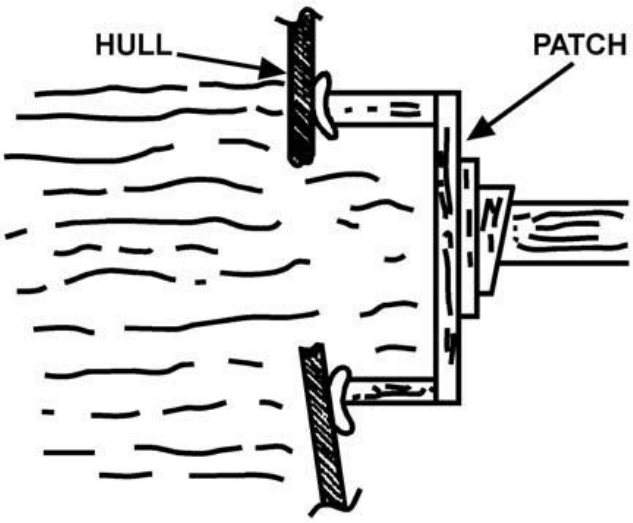

Figure 18-26

Box Patch

I.8. Holes Above the Waterline

Holes above the waterline may be more dangerous than they appear. As the boat rolls, they admit water into the boat above the center of gravity. This water reduces the stability of the boat. Plugs or patches on the inside or outside the hull should be used to cover these types of holes. The following procedures are an effective method for patching holes above the waterline:

Step	Procedure
1	Use a pillow or cushion that has a small hole punched in the center.
2	Place the cushion over the holed area from the outside and back it with a board of the same approximate size. The board should also have a small hole through the center.
3	Pass a line through the board and cushion and knot the end of the line outside the board.
4	Secure the entire patch by attaching the other end of the line to something firm inside the boat. (See **Figure 18-27**)

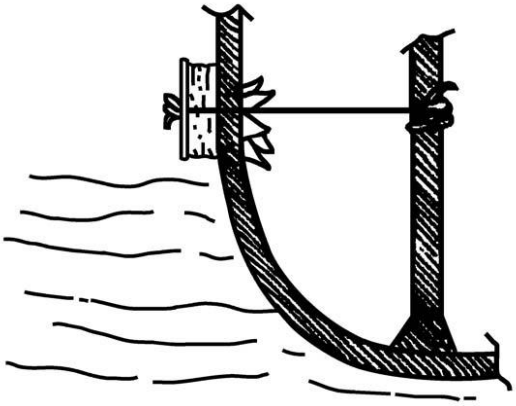

Figure 1827
Patching Hole Above Waterline

Patching Cracks

I.9. Cracks in Hulls

To patch a crack in the hull, use the following procedures:

Step	Procedure
1	Stuff the crack with something pliable such as a rag or line.
2	Place a piece of canvas or rubber over the crack to serve as a gasket.
3	Back the patch with a solid object such as a piece of plywood, panel door, or similar material.
4	To prevent the crack from traveling, especially in fiberglass, drill holes at each end of the crack. These holes will relieve the pressure at the ends of the crack, permitting the hull to flex without extending the crack.