ELEMENTARY FIRST AID
I.M.O. MODEL COURSE 1.13

I. GENERAL PRINCIPLES OF FIRST AID

A. FIRST AID – it is an immediate care given to a person who has been injured or suddenly taken ill. It includes self-help and home care when medical assistance is delayed or not yet available.

All crew members should be prepared to administer first aid. They should have sufficient knowledge of first to be able to apply thru true emergency measure and decides when treatment can be safely delayed until a medical professional arrives. Those not properly trained should recognize their limitations. Procedures and techniques beyond rescuer's ability should not be attempted for more harm may result from their actions.

1. OBJECTIVES OF FIRST AID

- To alleviate suffering
- To prevent added / further injury or danger
- To prolong life

2. ROLES AND RESPONSIBILITIES OF A FIRST AIDER

- Acts as the bridge that fills the gap between the victim and the physician
- Does not compete with nor take the place of the physician
- It ends when the services of the physician begins
- Ensures safety of own self and that of bystander and victim
- Requests advanced medical care as needed and assists advanced personnel

B. GUIDELINES IN GIVING EMERGENCY CARE

- Getting started phase:
  - Planning of action
  - Gathering of needed materials
  - Remembering the initial response:
    - A – Ask for help

- I – Intervene
- D – Do no further harm

- Give instruction to helper(s)

II. THE UNCONSCIOUS CASUALTY

A. EMERGENCY ACTION PRINCIPLE – the guiding rules to be utilized by the first aider on the scene of emergency which acts as the framework on which to base future actions.

1. SURVEY THE SCENE - Always look for your own safety and do not become the next casualty. Scene safety is an assessment focused on ensuring the wellbeing of the first aider. You are no help to the victim if you enter the scene without protecting yourself first for you cannot help your victim if you yourself is a victim. Also, the secondary concern in the scene safety is the safety of the victim and the bystanders.

2. ACTIVATE MEDICAL ASSISTANCE - In some emergencies, you will have enough time to call for specific medical advice before administering first aid. But in some situations, you will need to attend to the victim first.

Both trained and untrained bystanders should be instructed to Activate Medical Assistance as soon as they have determined that an adult victim requires emergency care, "CALL FIRST".

Information to be remembered in Activating Medical Assistance:

- Identify yourself
- Exact location
- Number of persons injured
- What happened

B. PRIMARY SURVEY – A procedure performed to identify the life threatening condition of the victim. It includes airway obstruction, respiratory arrest, cardiac arrest, and severe bleeding. Any problems identified should be given appropriate treatment before assessing for other possible injuries.

C. SECONDARY SURVEY – A procedure performed to identify other injuries of the victim. The rapid physical assessment should be done on both responsive and unresponsive victims. A conscious victim can be a good source for information regarding his condition.

1. S.A.M.P.L.E. HISTORY – A type of interview where its main purpose is to gather information about the possible history of the present condition of the victim.

- *Signs and Symptoms* – Warning signs that the victim manifests during the onset of incident. A sign is something that you can see or perceive such as bleeding. A symptom is something that the patient is experiencing or feeling that is not obvious to another person such as chest pain.

- *Allergies* – Identifying existence of patient's allergy to medication, food, and other substance and recognizing the reaction the patient exhibited. If there are no allergies, just note it as N.K.A. or No Known Allergies.

- *Medications* – If the victim has prescribed medications, note the name of the drug and what it is for, the dosage, and frequency of intake.

- *Pertinent Past History* – This covers the medical history of the victim taking into consideration any surgical procedures, trauma, illness, or any feelings of abnormalities before the incident occurred.

- *Last Oral Intake* – What did the victim last eat, drink, and drugs, how much was consumed, and when was it taken.

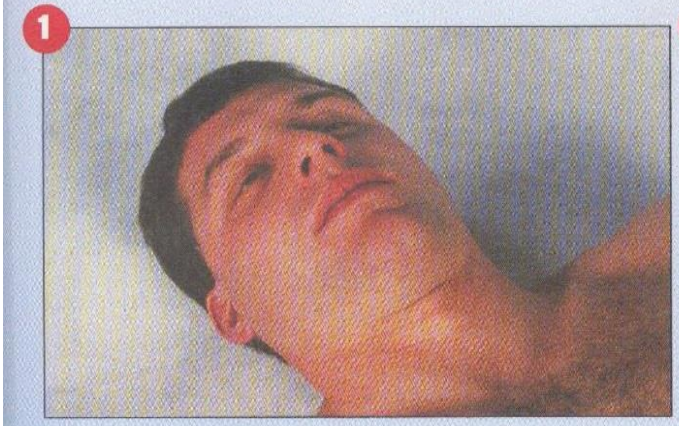
- *Events Leading To Injury Or Illness* - What was your patient doing immediately prior to the emergency? How did they find themselves in that situation? Three sample questions would be "What happened?", "How did it happen?", "What were you doing when this happened?"

2. VITAL SIGNS - These are the key signs that are used to evaluate the patient's general condition. The first set of vital signs that you obtain is called the baseline vital signs.

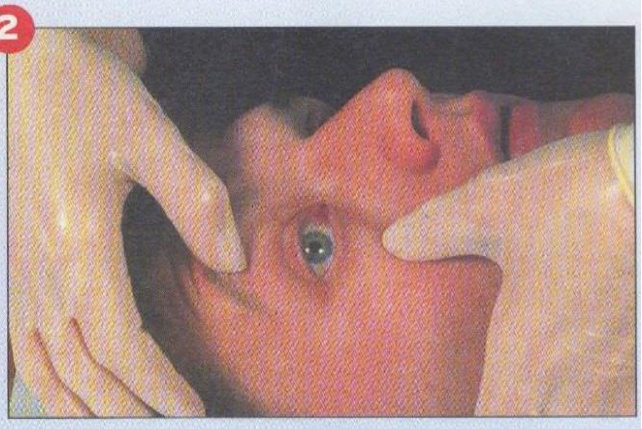
- Blood Pressure – $\frac{90-130}{60-80}\ mmHg$
- Respiratory Rate – 12 – 20 cycles per minute
- Pulse Rate – 60 – 100 beats per minute
- Temperature – 36.5 – 37.5 ˚C

3. HEAD-TO-TOE EXAMINATION – A rapid medical assessment to quickly identify existing or potentially life threatening conditions. Evaluating each region, visualize and palpate to identify signs of injury using the mnemonics D.C.A.P.B.T.L.S.

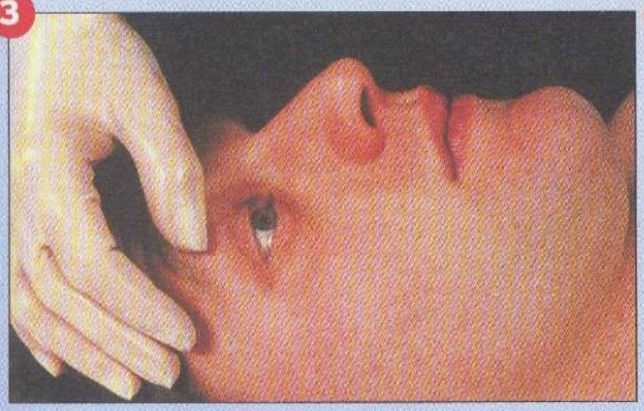
- D – Deformity
- C – Contusion
- A – Abrasion
- P – Puncture
- B – Burns / Bleeding
- T – Tenderness
- L – Laceration
- S – Swelling



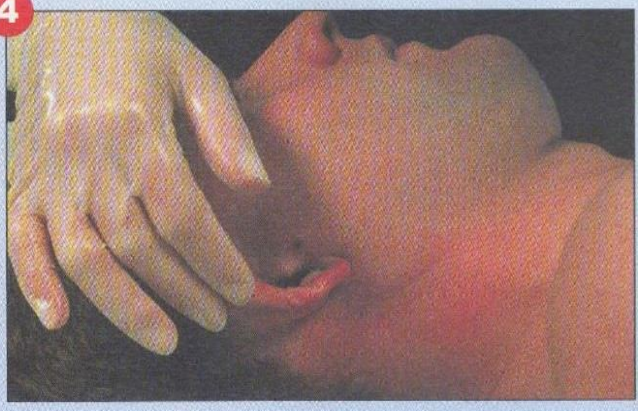
Look at the face for obvious lacerations, bruises, or deformities.



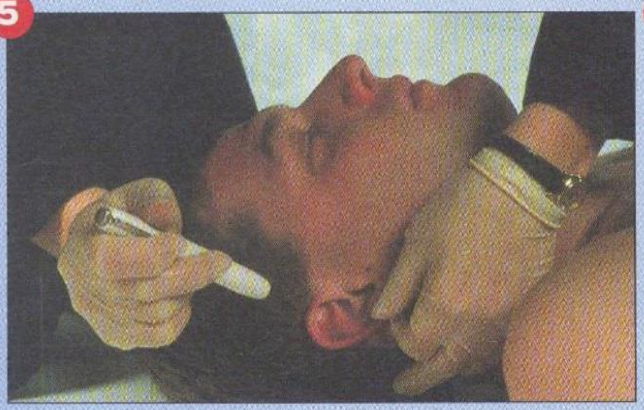
Inspect the area around the eyes and eyelids.



Examine the eyes for redness and for contact lenses. Assess the pupils using a penlight.

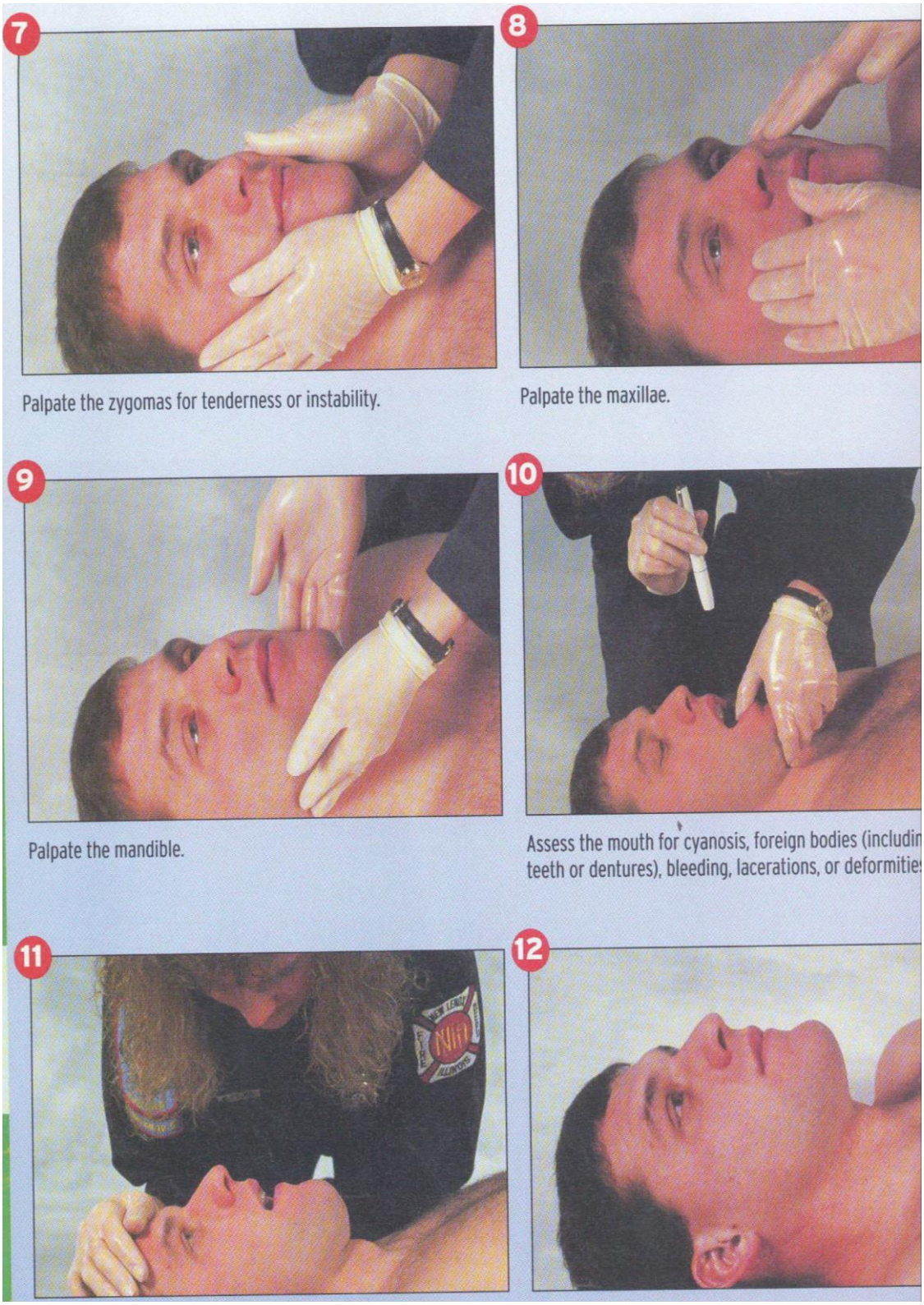


Pull the patient's ear forward to assess for bruising (Battle's sign).



Use the penlight to look for drainage or blood in the ears.

Look for bruising and lacerations about the head. Palpate for tenderness, depressions of the skull, and deformities.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Palpate the zygomas for tenderness or instability.
8
Palpate the maxillae.
9
Palpate the mandible.
10
Assess the mouth for cyanosis, foreign bodies (includin
teeth or dentures), bleeding, lacerations, or deformitie
11
12

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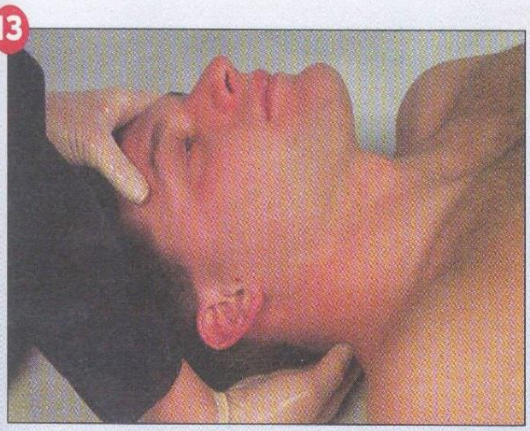

Palpate the front and the back of the neck for tenderness and deformity.

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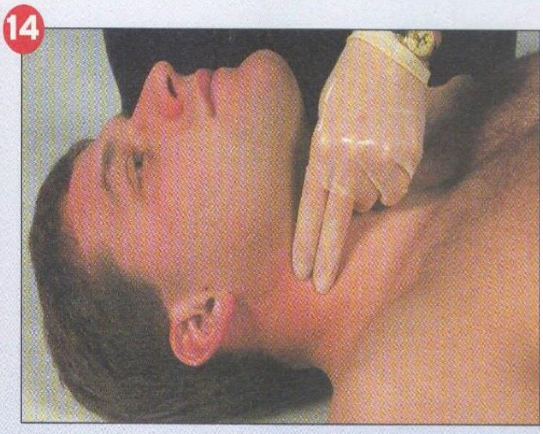

Look for distended jugular veins. Note that distended neck veins are not necessarily significant in a patient who is lying down.

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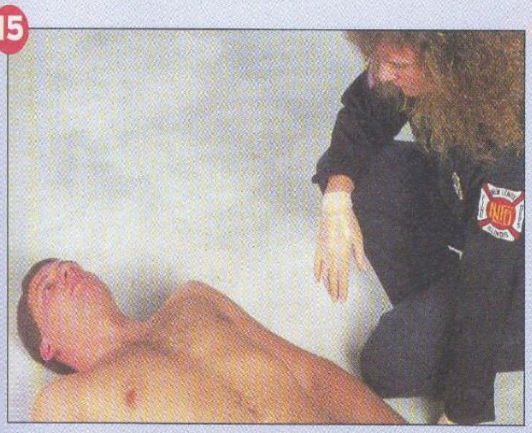

Look at the chest for obvious signs of injury before you begin palpation. Be sure to watch for movement of the chest with respirations.

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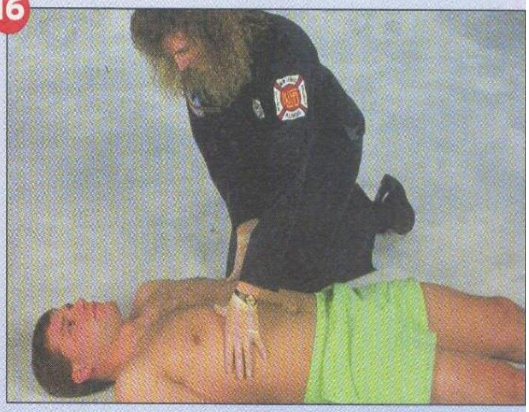

Gently palpate over the ribs to elicit tenderness. Avoid pressing over obvious bruises or fractures.

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Listen for breath sounds over the midaxillary and midclavicular lines.

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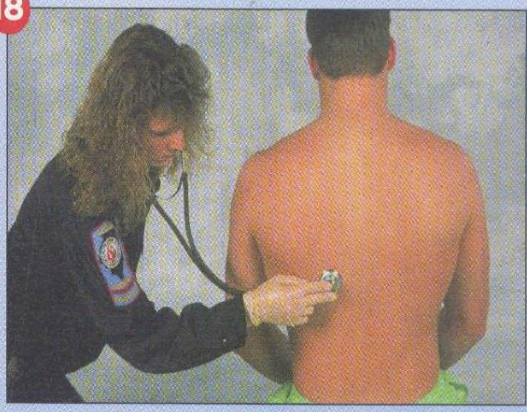
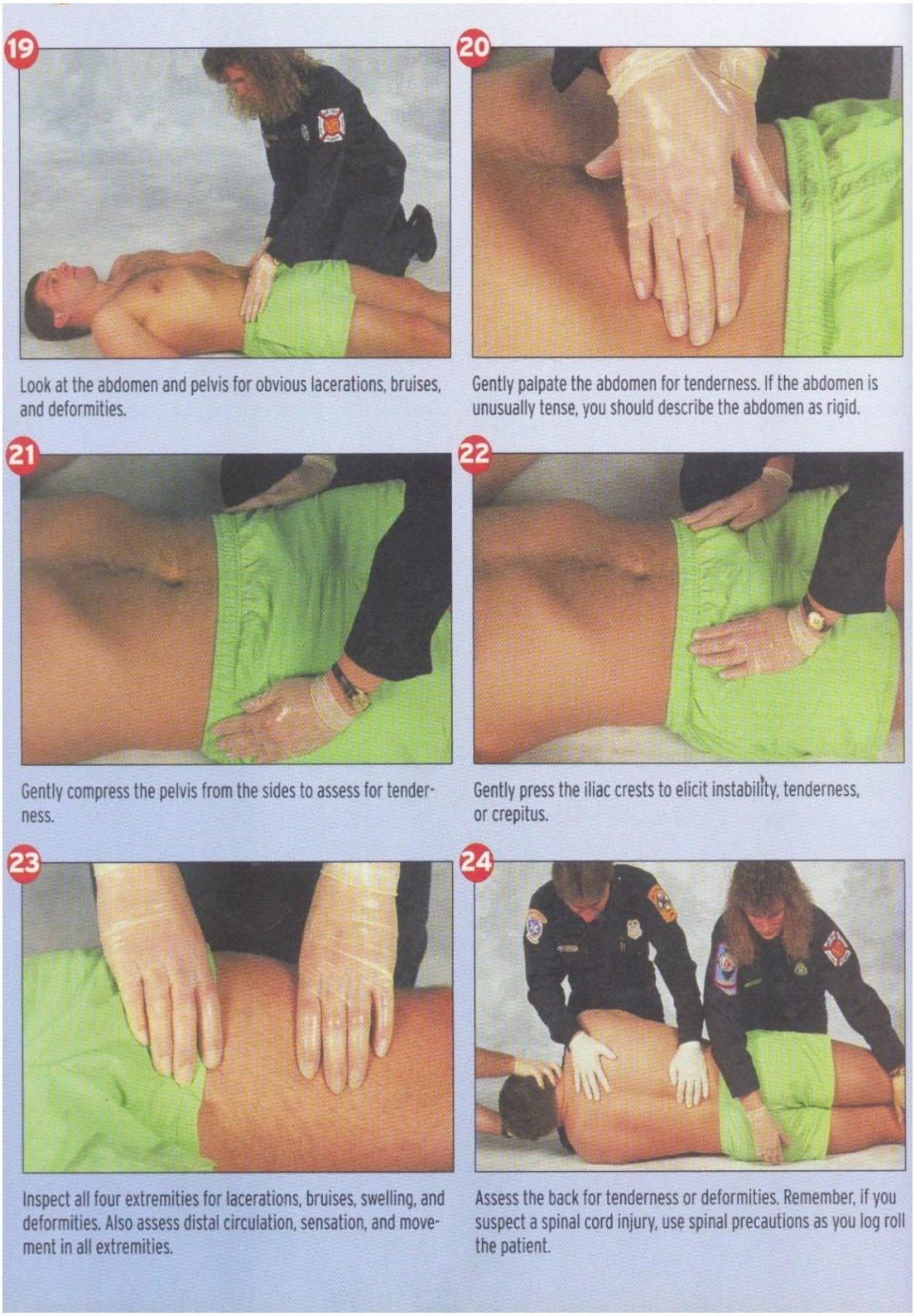


Listen also at the bases and apices of the lungs.



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Look at the abdomen and pelvis for obvious lacerations, bruises, and deformities.

20

Gently palpate the abdomen for tenderness. If the abdomen is unusually tense, you should describe the abdomen as rigid.

21

Gently compress the pelvis from the sides to assess for tenderness.

22

Gently press the iliac crests to elicit instability, tenderness, or crepitus.

23

Inspect all four extremities for lacerations, bruises, swelling, and deformities. Also assess distal circulation, sensation, and movement in all extremities.

24

Assess the back for tenderness or deformities. Remember, if you suspect a spinal cord injury, use spinal precautions as you log roll the patient.

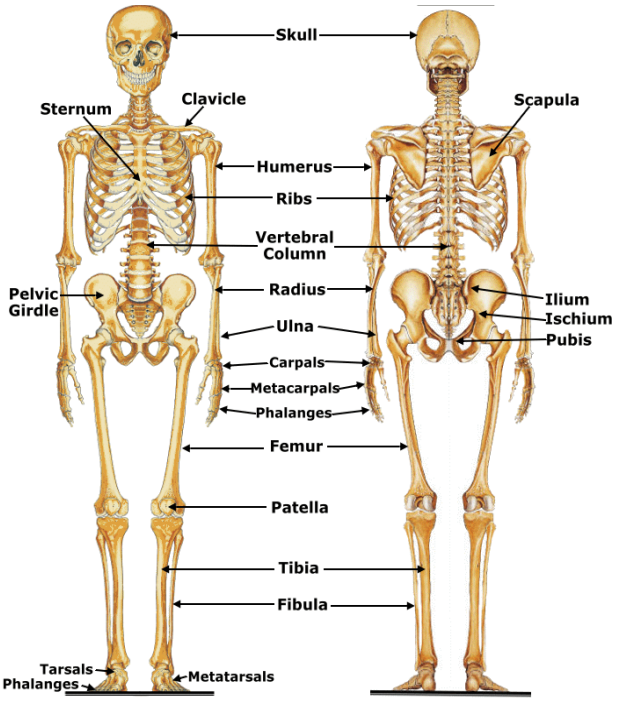
III. BODY STRUCTURES AND FUNCTIONS

The study of the human body involves anatomy and physiology. The human body can show anatomical non-pathological anomalies which need to be able to be recognized.

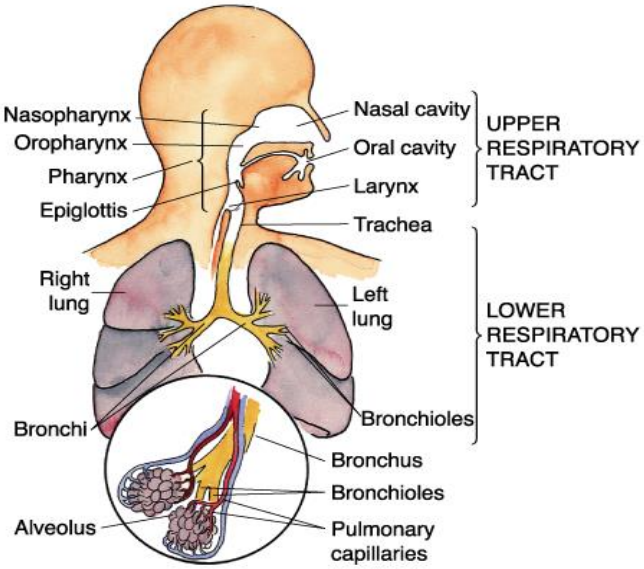
Physiology focuses on the systems and their organs of the human body and their functions. Many systems and mechanisms interact in order to maintain homeostasis.

A. SKELETAL SYSTEM

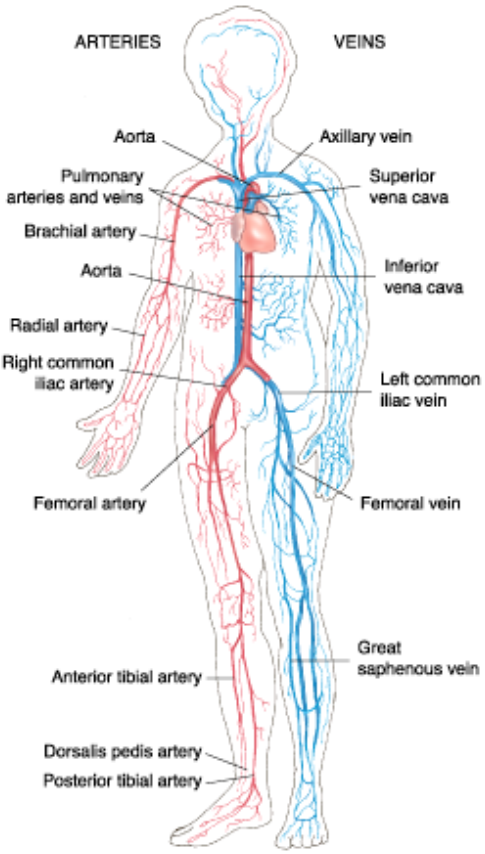
– The framework of the body, consisting of bones and other connective tissues, which protects and supports the body tissues and internal organs. The human skeleton contains 206 bones, six of which are the tine bones on the middle ear (three in each ear) that function in hearing. The largest bone in the body is the thigh bone, or femur.



B. RESPIRATORY SYSTEM – The specialized organs, collectively, concerned with external respiration or the process of breathing. It includes the nasal passages, larynx, trachea, bronchi, bronchioles, lungs, and diaphragm. The integrated system of organs involved in the intake and exchange of oxygen and carbon dioxide between the body and the environment.



C. CIRCULATORY SYSTEM – The system in the body by which blood and lymph are circulated. The parts of the circulatory system include the heart, along with all the arteries, veins, and capillaries. Nutrients, oxygen, and other vital substances are carried throughout the body by the blood, which is pumped by rhythmic contractions of the heart. Blood is pumped from the heart to the arteries, which branch into smaller and smaller vessels as they move away from the heart. The blood passes oxygen and nutrients to the cells and picks up waste in the capillaries, then returns to the heart through the veins.



1. THE BLOOD

- *Red blood cells* – Carries oxygen from the lungs to the body's tissues and take carbon dioxide back to the lungs to be exhaled

- *White blood cells* – Cells of the immune system that are involved in defending the body against both infectious diseases and foreign materials.

- *Plasma* – A fluid composed of about 92% water, 7% vital proteins such as albumin, and 1% mineral salts, sugars, fats, hormones, and vitamins

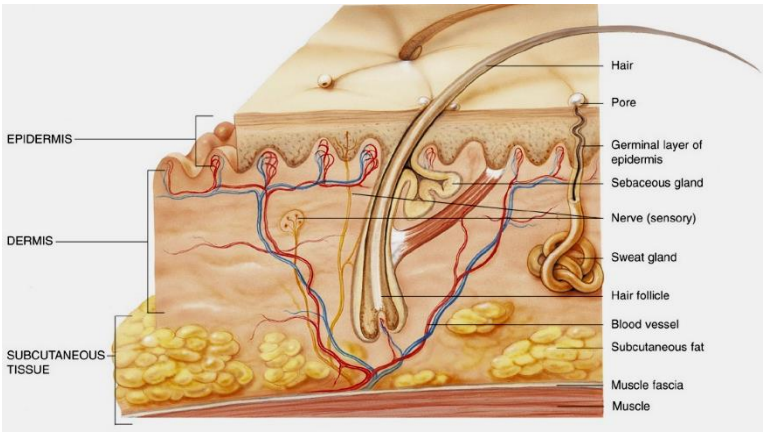
- *Platelets* – Small, colorless cell fragments in the blood whose main function is to interact with clotting proteins to stop or prevent bleeding.

2. THE BLOOD VESSELS

- *Arteries* - Carry the blood from the heart to all the parts of the body tissues

- *Veins* – Carries the un-oxygenated blood back to the heart. This blood vessel have much thinner walls than arteries and are generally larger in diameter

- *Capillaries* – Small blood vessels at the end of the arteries. The have fine end division of the arterial system which allows contact between cells of the body tissue and the plasma and red blood cells.



D. INTEGUMENTARY SYSTEM – The organ system that protects the body from various kinds of damage, such as loss of water or abrasion from outside. The system comprises the skin and its appendages (including hair, scales, feathers, and nails). The integumentary system has a variety of functions; it may cushion and protect the deeper tissues, regulate body temperature, and is the attachment site for sensory receptors to detect pain, sensation, pressure, and temperature.

IV. BLEEDING AND INJURIES

A. WOUND – A type of injury in which skin is torn, cut, or punctured (open wound), or where a blunt force trauma causes a contusion (closed wound).

1. CLOSED WOUND – injury involving underlying tissues without breaking the skin or mucus membrane.

a) CAUSES

- Blunt objects resulting to bruises
- Application of external forces
- Contusion – Simple bruising. In this type of injury, the capillaries in the epidermis and dermis are damaged, without breaking in the skin. Blood oozes out of these vessels into the spaces between cells or interstitial space, causing swelling and discoloration. Blood loss is generally limited, and not of serious consequence. It may however act as a signpost, pointing to more serious injuries.

b) TYPES
- Open wound (external wound)
- Closed wound (internal wound)

c) SIGNS AND SYMPTOMS
- Pain and tenderness
- Swelling
- Discoloration
- Hematoma
- Symptoms of shock
- Passage of blood in the urine or feces
- Sign of blood along mouth, nose, and ear canal

d) FIRST AID MANAGEMENT FOR CLOSED WOUND
- I – Immobilization
- C – Cold compress
- E – Elevation

2. OPEN WOUND – injury where there is presence of break in the continuity of the skin

a) CAUSES
- Falls
- Sharp objects or tools
- Car accidents

b) TYPES
- *Puncture* – Sharp object penetrates the tissue, and travels internally, but does not move laterally in any direction from the point of entry. Such wounds can be misleading, as they may appear quite small on surface examination, but extend quite deeply into the body; even damaging nerves, blood vessels, or internal organs. They may cause substantial internal bleeding or secondary injuries, such as a collapsed lung, which may not be readily evident during primary assessment. Occasionally, the object causing the injury will remain in the wound as an impaled object. A

stab wound from a knife or other sharp object, or a bullet wound would be examples of this type of injury. This is usually referred to as penetrating trauma.

- *Abrasion* – a scraping or scratching. Generally quite superficial, and affecting only the surface layers of the epidermis. No internal organs, nerves, or blood vessels other than capillaries, are affected. This may be the result of a fall, or of sliding (friction) against rough surfaces. The road rash often suffered by falling motorcyclists is an example of this type of wound.

- *Laceration* – jagged edges to the wound margins, more closely resembling a tear than a slice. The wounded tissue is random rather than a straight direction and may have multiple branches. Most often caused by an object with a broken or serrated edge, such as a piece of broken glass or metal, but may also be caused by a blow from a blunt object to tissue with bone immediately behind it.

- *Avulsion* – A full thickness laceration-type wound, often semi-circular in shape. This creates a flap which, when lifted, exposes the deeper tissues to view, or extrudes them from the wound itself. Avulsions often occur in mechanical accidents involving fingers, and on a more serious note, may affect the orbit of the eye or the abdominal cavity, exposing the internal viscera. Avulsions are difficult to repair, and no avulsion should ever be considered a minor injury.

- *Incision* – straight edges to the wound margins, as if sliced with a knife. These can vary in size, and may be caused by a variety of objects, including a scalpel, a knife, any piece of straight, sharp metal, or a piece of glass. Tissue is rarely missing from the wound site, and the margins of the wound may be easily matched from one side of the wound to the other for the purposes of closure.

B. BLEEDING

1. TYPES

- *Arterial bleeding* – The blood is typically bright red to yellowish in color, due to high degree of oxygenation. Blood typically exits the wound in spurts, rather than a steady flow. The amount of blood loss can be copious, and can occur very rapidly.

- *Venous bleeding* – This blood is flowing from a damaged vein. As a result, it will be blackish in color due to the lack of oxygen transported and will flow in a steady manner. Caution is still indicated; while the blood loss may not be arterial, it can still be quite substantial, and can occur with surprising speed without intervention.

- *Capillary bleeding* – Usually occurs in superficial wounds such as abrasions. The color of the blood may vary somewhat and will generally ooze in small amounts, as opposed to flowing or spurting.

2. DANGERS OF BLEEDING

- Hemorrhage
- Infection
- Shock

3. FIRST AID MANAGEMENT FOR MINOR BLEEDING

- Wash with soap and water
- Apply with mild antiseptic
- Cover the wound with sterile dressing and/or bandages

4. FIRST AID MANAGEMENT FOR SEVERE BLEEDING

- Control bleeding
    - Apply direct pressure on the wound
    - Elevate the injured part
    - Apply direct pressure on the artery / pressure point
    - Tourniquet
- Cover the wound with sterile dressing

- Care for shock
- Consult or refer to physician

V. SHOCK

A depressed condition of the many body functions due to the failure of enough blood to circulate throughout the body following a serious injury.

A. BASIC CAUSES OF SHOCK

1. PUMP FAILURE - The heart's pumping power is weaker than normal. With heart failure, blood moves through the heart and body at a slower rate, and pressure in the heart increases.

2. HYPOVOLEMIA (FLUID VOLUME LOSS) - Hypovolemic shock is an emergency condition in which severe blood and fluid loss make the heart unable to pump enough blood to the body. This type of shock can cause many organs to stop working.

- **Blood loss can be due to:**
  - **Bleeding from cuts**
  - **Bleeding from other injuries**
  - **Internal bleeding, such as in the gastrointestinal tract**
  - **The amount of circulating blood in your body may drop when you lose too many other body fluids, which can happen with:**
  - **Burns**
  - **Diarrhea**
  - **Excessive perspiration**
  - **Vomiting**

3. DILATION OF BLOOD VESSELS – excessive dilation of blood vessels (vasodilation) increases the capacity of blood vessels, so that blood meets with less resistance as it flows through them. Blood pressure in the dilated vessels is lower, so the cells fed by those vessels get less blood. Blood vessels may be excessively dilated because of a serious allergic reaction (anaphylactic shock), a severe bacterial infection (septic shock), and overdose of drugs or poisons that dilate blood vessels.

B. FACTORS THAT CONTRIBUTE TO SHOCK

- Pain
- Rough handling

- Improper transfer
- Continuous bleeding
- Exposure to extreme cold or excessive heat
- Fatigue

C. DANGERS OF SHOCK

- Leads to death
- Makes body susceptible to infection
- Leads to loss of body parts

D. SIGNS AND SYMPTOMS OF SHOCK

1. EARLY STAGE (COMPENSATORY STAGE)

- Pale or cyanotic face
- Cold and clammy skin
- Irregular breathing
- Rapid and weak pulse
- Nausea and vomiting
- Weakness and thirst

2. LATE STAGE

- Apathetic or relatively unresponsive
- Sunken eyes with vacant expression
- Dilated pupils
- Mottled skin
- Low blood pressure
- Hypothermia
- Unconsciousness

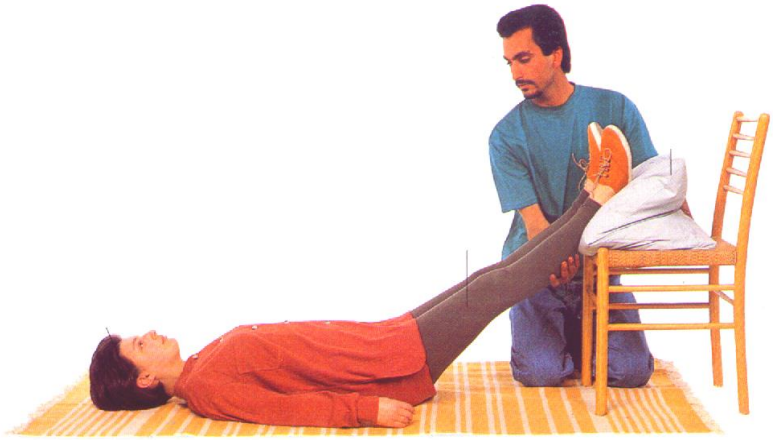
E. FIRST AID AND PREVENTIVE MANAGEMENT

- Objectives:
  - Improve blood circulation
  - Ensure adequate supply of oxygen
  - Maintain normal body temperature

- Methods:
  - Proper positioning
  - Proper body heat
  - Proper medical advice and transfer

PROPER POSITIONING

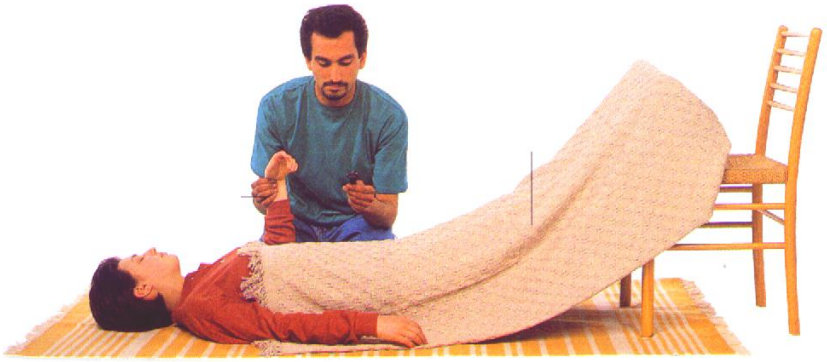
1. SIDE LYING POSITION – position choice for unconscious victim; also known as recovery position.



2. TRENDELENBURG POSITION – keep the victim on lying position with legs elevated 12 – 18 inches high; also known as leg elevation

3. LONG SITTING OR FOWLER'S POSITION – position of choice for victim with difficulty of breathing

PROPER BODY HEAT – maintain body heat blanket (must not be perspiring) and keep the patient warm but not hot. Too much heat raises the surface, temperature of the body and diverts the blood supply away from the vital organs to the skin.



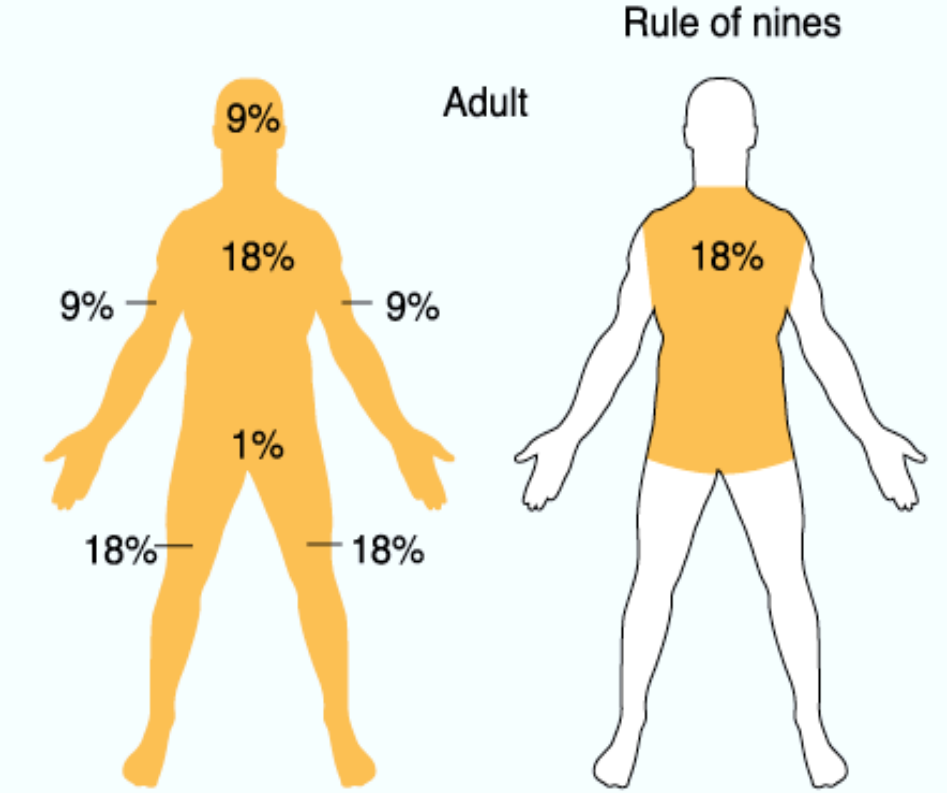
VI. BURN INJURIES

An injury involving the skin including muscles, bones, nerves and blood vessels. This result from heat, chemical or radiation and may vary from depth, size and severity and caused damage to cell in the affected area.

A. FACTORS TO DETERMINE THE SEVERITY OF BURNS

1. **Depth –** The deeper the burn, the more severe it is
2. **Extent –** estimation of how much body surface area is affected by the burn
3. **Location –** burns on the face, hands, feet, and genitals are more severe than on other body parts
4. **Age and medical condition –** determine if other injuries or pre-existing medical problems exist or if the victim is elderly or young

B. RULE OF NINE



C. TYPES OF BURN INJURIES

1. **Thermal Burn** – Occur when hot metals, scalding liquids, steam, or flames come in contact with your skin. These are frequently the result of fires, automobile accidents, playing with matches, improperly stored gasoline, space heaters, and electrical malfunctions. Other causes include unsafe handling of firecrackers and kitchen accidents (such as a child climbing on top of a stove or grabbing a hot iron).

2. **Chemical Burn** – Occurs when living tissue is exposed to a corrosive substance such as a strong acid or base. Chemical burns follow standard burn classification and may cause extensive tissue damage. The main types of irritant and/or corrosive products are: acids, bases, oxidizers, solvents, reducing agents and alkylants. Additionally, chemical burns can be caused by some types of chemical weapons e.g. vesicants such as mustard gas and lewisite, or urticants such as phosgene oxime.

3. **Electrical Burn** - May appear minor or not show on the skin at all, but the damage can extend deep into the tissues beneath your skin. If a strong electrical current passes through your body, internal damage, such as a heart rhythm disturbance or cardiac arrest, can occur. Sometimes the jolt associated with the electrical burn can cause you to be thrown or to fall, resulting in fractures or other associated injuries.

D. FIRST AID MANAGEMENT FOR BURNS

1. FIRST AID MANAGEMENT FOR THERMAL BURNS

- *Stop the burning process* - remove hot or burned clothing or stop contact with the hot steam, liquid, or a hot object and cool the injured area with water (not ice) within 30 seconds. This may limit the extent and severity of the burn. Run your burned hand or finger immediately under cool tap water for several minutes. Gentle cleansing may be performed as necessary.

- *Control the pain* – apply a cool wet compress for pain relief but do not use ice for it may worsen the injury to the skin. One may use acetaminophen or ibuprofen for pain but never use butter or mayonnaise as it may increase chance of infection.
- *Begin healing process* – use an antibiotic ointment to aid in healing and limit the chance of infection. Remember to never remove blisters especially those on the palms of the hands or the soles of the feet.

2. FIRST AID MANAGEMENT FOR CHEMICAL BURNS

- *Remove the cause of the burn* – brush any remaining dry chemical and then rinsing the chemical off the skin surface with cool, low pressure water for 20 minutes or more.
- *Remove clothing or jewelry* – remove all articles worn especially those in contact with the agent
- *Wrap the burned area loosely* – use a dry, sterile dressing or a clean cloth
- *Rewash the burned area* – if the person experiences increased burning after the initial washing, rewash for 10 – 20 more minutes in free flowing water
- *Take an over-the-counter pain reliever* – if needed for pain, aspirin, ibuprofen, naproxen, or acetaminophen may be taken.
- *Get a tetanus shot* – all burns are susceptible for tetanus.

3. FIRST AID MANAGEMENT FOR ELECTRICAL BURNS

- *Look first, do not touch* – The person may still be in contact with the electrical source. Touching the person may pass the current through you.
- *Turn off the source of electricity if possible*. If not, move the source away from both you and the injured person using a dry, non-conducting object made of cardboard, plastic or wood.
- *Check for signs of circulation* (breathing, coughing, or movement). If absent, begin CPR immediately
- *Prevent shock.* Lay the person down with the head slightly lower than the trunk, if possible, and the legs elevated

- *Cover the affected areas*. If the person is breathing, cover any burned areas with a sterile gauze bandage, if available, or a clean cloth. Don't use a blanket or towel, because loose fibers can stick to the burns.

E. CLASSIFICATION OF BURNS

1. FIRST DEGREE BURN

- *Cool burn* – hold burned skin under cool (not cold) running water or immerse in cool water until pain subsides
- *Protect burn* – cover with sterile, non-adhesive bandage or clean cloth and do not apply butter or ointments for they may cause infections
- *Treat pain* – give over-the-counter pain reliever such as ibuprofen, acetaminophen, or naproxen
- *Seek medical* help if:
    - You see signs of infection (increased pain, redness, swelling, fever, or oozing)
    - The person needs a booster shot, depending on date of last injection. Tetanus booster shots should be given every 10 years.
    - Redness and pain last more than a few hours
    - Pain worsens
- *Follow up* – the doctor will examine the burn and may prescribe antibiotics and pain medication

2. SECOND DEGREE BURN

- *Cool burn*
    - Immerse in cool water for 10 – 15 minutes
    - Use compresses if running water isn't available
    - Don't apply ice (it can lower body temperature and cause further damage)
    - Don't break the blisters or apply butter or ointments for it may cause infection
- *Protect burn* – cover loosely with sterile, non-stick bandage and secure in place with gauze or tape
- *Prevent shock* – unless the person has a head, neck, or leg injury, or it would cause discomfort:
    - Lay the person flat

- Elevate lower extremities about 12 inches
- Elevate burn area above heart level if possible
- Cover the person with coat or blanket

- *See a doctor* – the doctor can test burn severity, prescribe antibiotics and pain medications, and administer a tetanus shot if needed

3. THIRD DEGREE BURN

- *Call the emergency number*
- *Protect burn area*
  - Cover loosely with sterile, nonstick bandage or, for large areas, a sheet or other material that would not leave lint in wound
  - Separate burned toes and fingers with dry, sterile dressings
  - Do not soak burn in water or apply ointments or butter for it may cause infection
- *Prevent shock* – unless the person has a head, neck, or leg injury, or it would cause discomfort:
  - Lay the person flat
  - Elevate lower extremities about 12 inches
  - Elevate burn area above heart level if possible
  - Cover the person with coat or blanket
  - For an airway burn, do not place pillow under the person's head when the person is lying down. This can close the airway
  - Have a person with facial burn sit up
  - Check pulse and breathing to monitor shock until emergency help arrives
- *See a doctor* – doctors will give oxygen and fluid, if needed, and treat the burn

VII. RESCUE AND TRANSFER OF CASUALTY

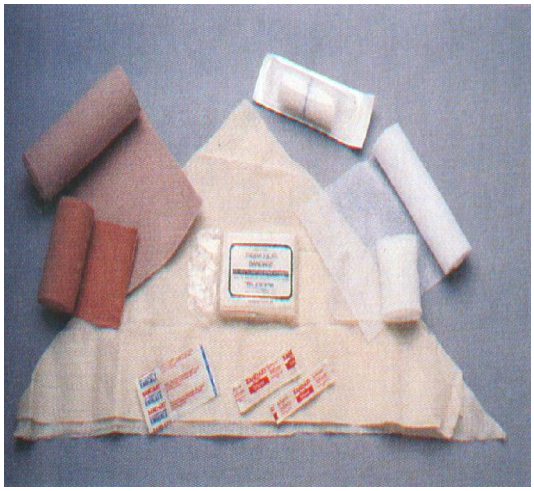
A. BANDAGE - a clean cloth material used to hold the dressing in place. It also serves as the support for immobilization. It uses a sterile clean cloth material to cover the wound which is called a dressing.

1. GUIDELINES IN BANDAGING

- Use a dressing large enough to extend at least 1 inch beyond the edges of the wound
- Use a non-stick dressing if body tissues or organs are exposed
- If the dressing is over a joint, splint and make a bulky dressing so the joint remains immobilized
- Bandaging techniques depends upon:
    - Size and location of the wound
    - First aid skill
    - Materials on hand

2. TYPES OF BANDAGES

- *Gauze bandage* - The most common type of bandage is the gauze bandage, a simple woven strip of material, or a woven strip of material with a Telfa absorbent barrier to prevent adhering to wounds. A gauze bandage can come in any number of widths and lengths, and can be used for almost any bandage application, including holding a dressing in place.



- *Elastic bandage* - a "stretchable bandage used to create localized pressure" Elastic bandages are commonly used to treat muscle sprains and strains by reducing the flow of blood to a particular by the application of even stable pressure which can restrict swelling at the place of injury. Elastic bandages are also used to treat bone fractures.

- *Triangular bandage* - Also known as a cravat bandage, a triangular bandage is a piece of cloth put into a right-angled triangle, and often provided with safety pins to secure it in place. It can be used fully unrolled as a sling, folded as a

normal bandage, or for specialized applications, as on the head. One advantage of this type of bandage is that it can be makeshift and made from a fabric scrap or a piece of clothing. The Boy Scouts popularized use of this bandage in many of their first aid lessons, as a part of the uniform is a "neckerchief" that can easily be folded to form a cravat.

3. TECHNIQUES IN BANDAGING

a) CRAVAT PHASE FOR TRIANGULAR BANDAGE

- Cravat of head / ear

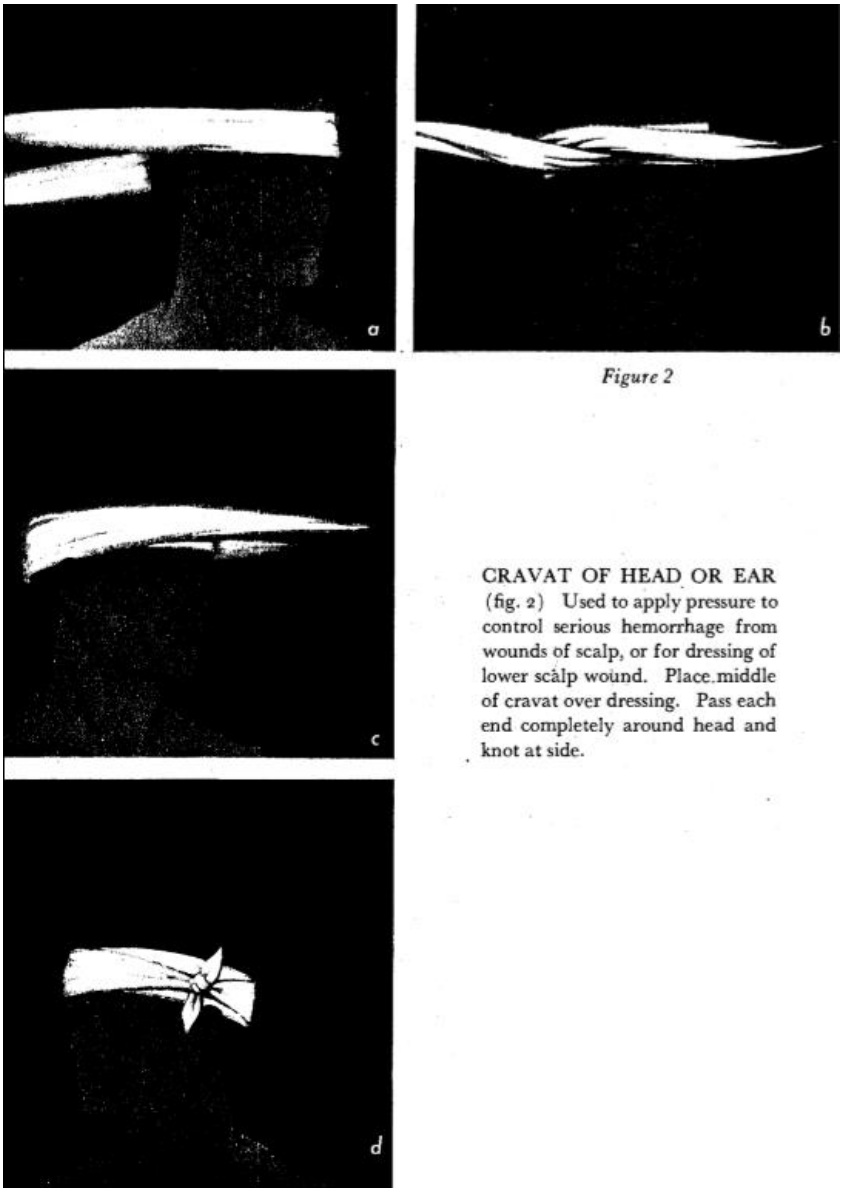


Figure 2

CRAVAT OF HEAD OR EAR
(fig. 2) Used to apply pressure to control serious hemorrhage from wounds of scalp, or for dressing of lower scalp wound. Place middle of cravat over dressing. Pass each end completely around head and knot at side.

- Cravat of jaw

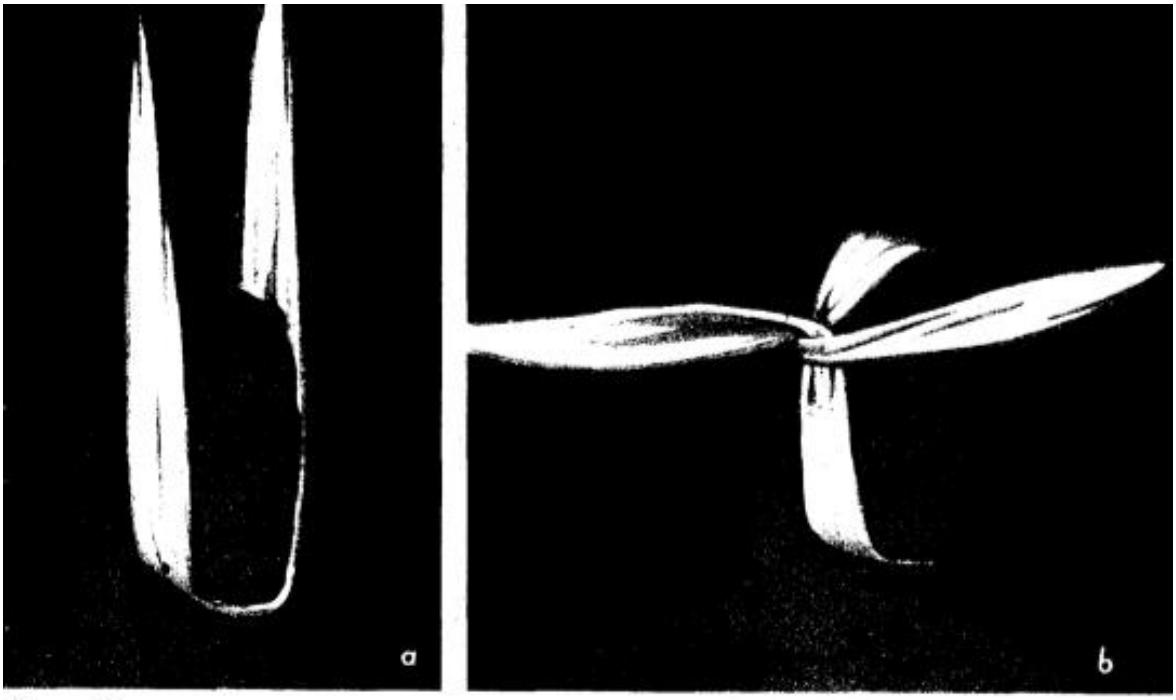


Figure 3

CRAVAT OF JAW (Mento-vertico-occipital cravat) (fig. 3) Used to retain dressings on the chin, cheeks, and scalp, and as a temporary dressing to secure fixation of the parts in a fracture or dislocation of the jaw.

(*a*) After making triangle into cravat of proper width, place under chin so that one end is longer than other. Carry ends upward in front of ears.

(*b*) Bring longer end over top of skull. Cross both ends on side of head. Ends should now be of equal length.

(*c*) and (*d*) Pass ends around head in opposite directions and tie with square knot in front of other ear, and on primary turn of cravat.

- Triangular arm sling

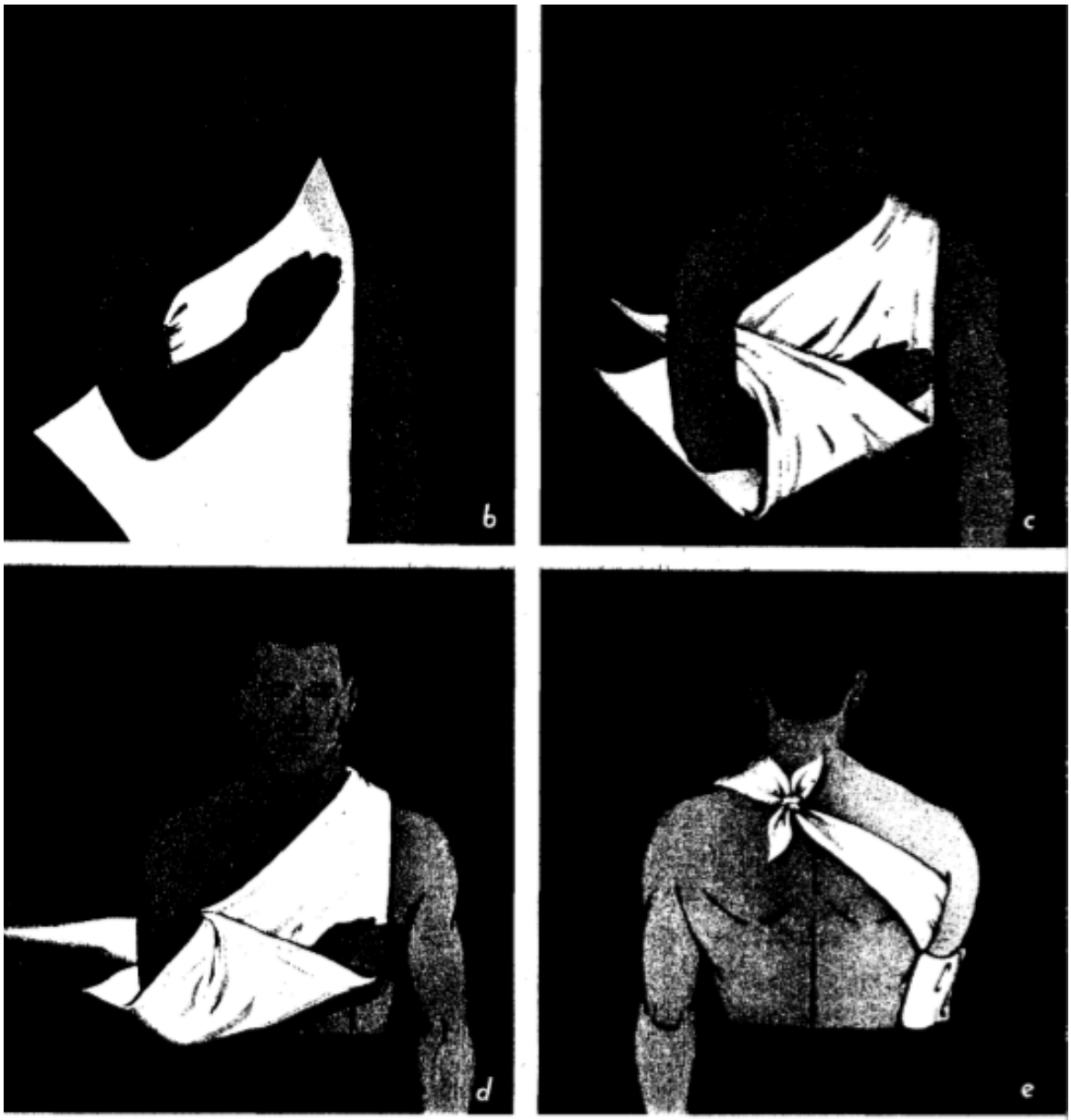


Figure 6

version of this sling is frequently used where it is desirable to support the forearm, without pressure on the collarbone or shoulder of the injured side.

(*b*) Start as in (*a*).

(*c*) and (*d*) Pass lower end of bandage *under* injured shoulder. Ends of fingers should extend slightly beyond base of triangle.

(*e*) Tie ends. Secure apex to sling at elbow by tucking in or with safety pin.

- Triangle of forehead or scalp

Figure 5

TRIANGLE OF FOREHEAD OR SCALP (fronto-occipital) (fig. 5) Used to retain dressings on the forehead or scalp.

(*a*) Place middle of base of triangle so that edge is just above eyebrows and bring apex backward, allowing it to drop over back of head (occiput).

(*b*) Bring ends of triangle around to back of head, above ears, and cross them over apex at occiput.

(*c*) Carry ends around to forehead and tie them in square knot.

(*d*) Turn up apex of bandage toward top of head. Pin with safety pin or tuck in behind crossed part of bandage.

- Shoulder – armpit cravat / Triangle of chest or back

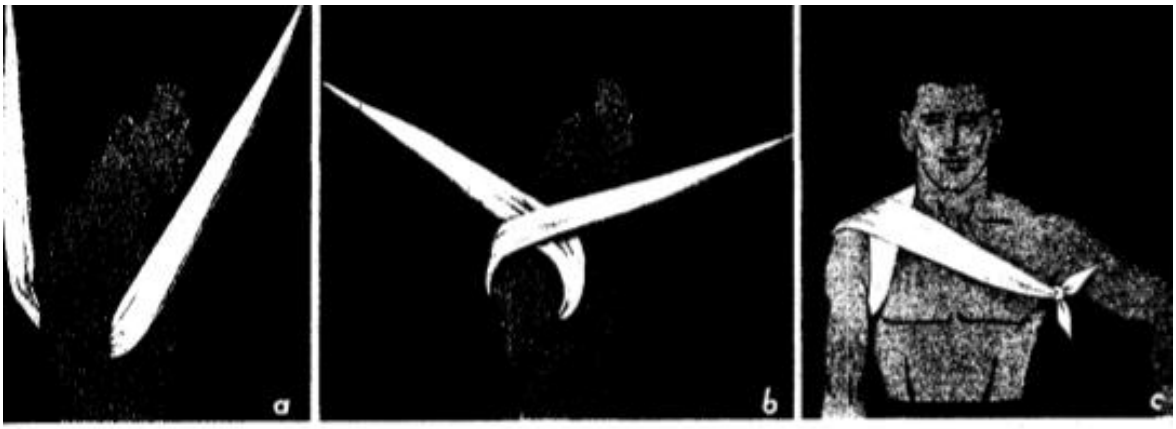


Figure 7

SHOULDER-ARMPIT CRAVAT (bis-axillary) (fig. 7) Used to hold dressings in the armpit (axilla) or on the shoulder.

(*a*) Place middle of cravat in armpit over dressing.

(*b*) Carry ends upward and over top of shoulder.

(*c*) Cross ends and bring them across back and chest respectively to opposite armpit where they are tied.

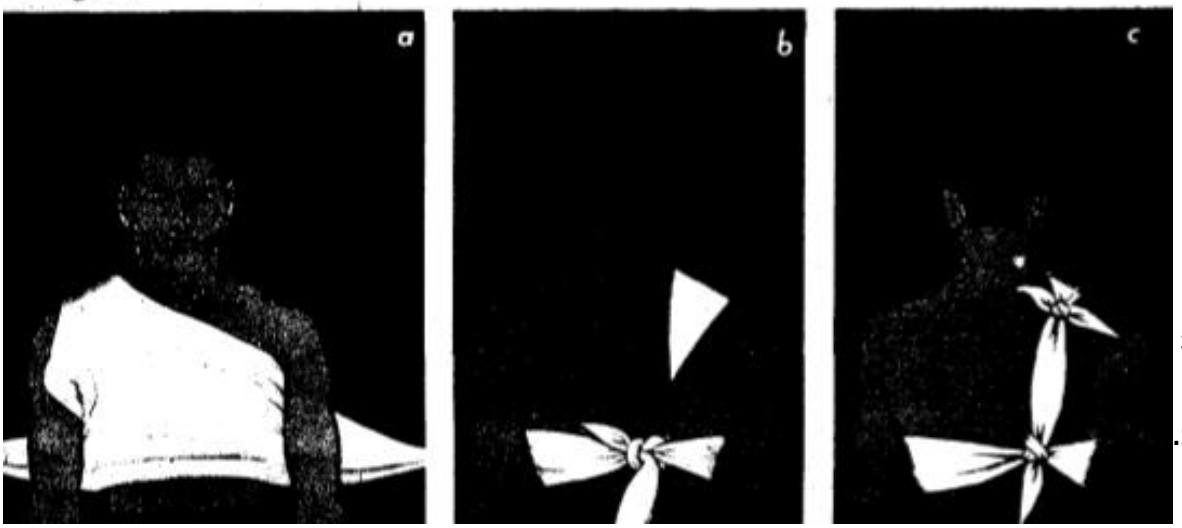
TRIANGLE OF CHEST OR BACK (fig. 8) Used to retain dressings on burns or wounds.

(*a*) Drop apex of triangle over shoulder on injured side. Bring bandage down over chest (or back) to cover dressing and so that middle of base of bandage is directly below injury. Turn up a cuff at base.

(*b*) Carry ends around body and tie in square knot.

(*c*) Bring apex down and tie to one of ends of first knot.

Figure 8



- Triangle of shoulder

Figure 6

TRIANGULAR ARM SLING (brachio-cervical triangle) (fig. 6) Used for fractures or injuries of hand, wrist, and forearm.

(*a*) Arm to be put in sling should first be bent at elbow so that little finger is about a hand's breadth above level of elbow. Drop one end of triangle over shoulder on injured side and let bandage hang down over chest with base toward hand and apex toward elbow. Slip bandage between body and arm. Carry lower end up over shoulder on injured side. Tie the two ends, by square knot, at back of neck. Knot should be on either side of neck, *not* in middle, where it could cause discomfort when patient is lying on back. Draw apex of bandage toward elbow until snug, bring it around elbow to front, and fasten with safety pin or adhesive tape. An alternative is to secure apex with a knot as shown in center figure above. Another

- Cravat of elbow or knee

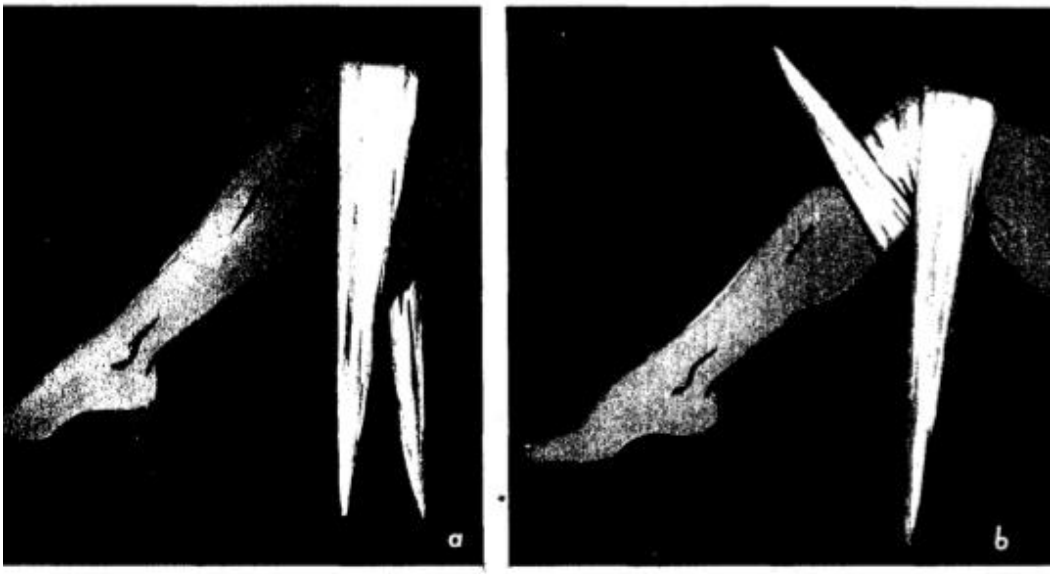


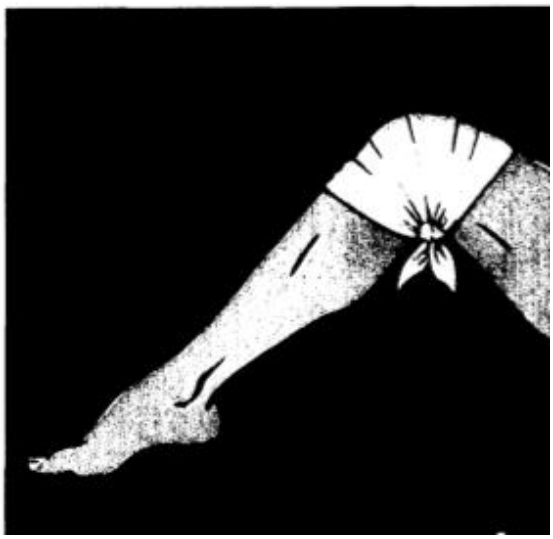
Figure 12

CRAVAT OF KNEE (fig. 12) Used to retain dressings around knee.

(*a*) Place center of cravat over center of knee.

(*b*) Bring ends down each side of knee and cross underneath, with descending turns down calf, and ascending turns up thigh.

(*c*) Bring ends together, and tie on cravat.



- Cravat of arm or leg

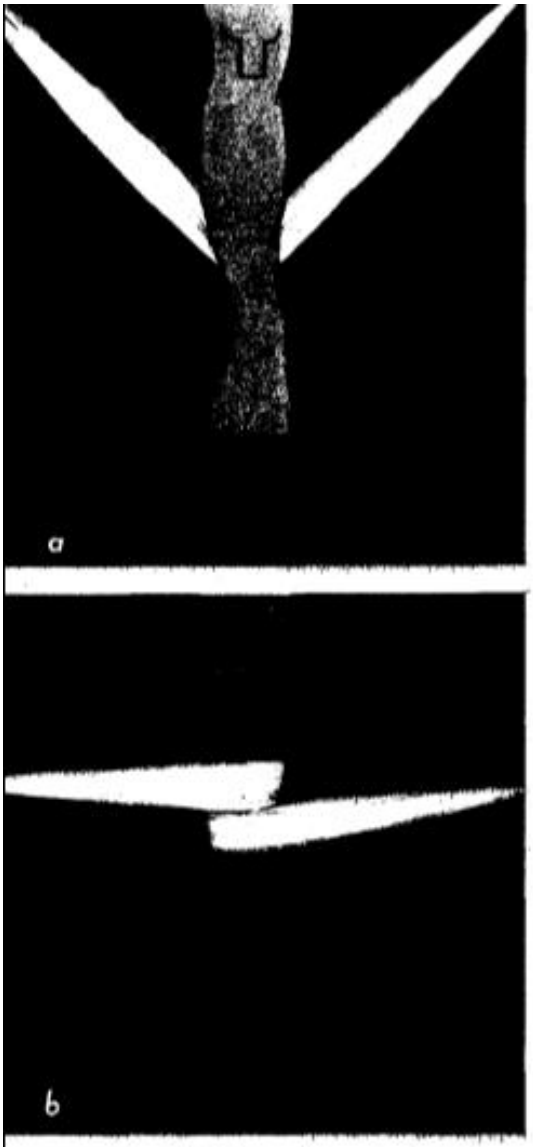
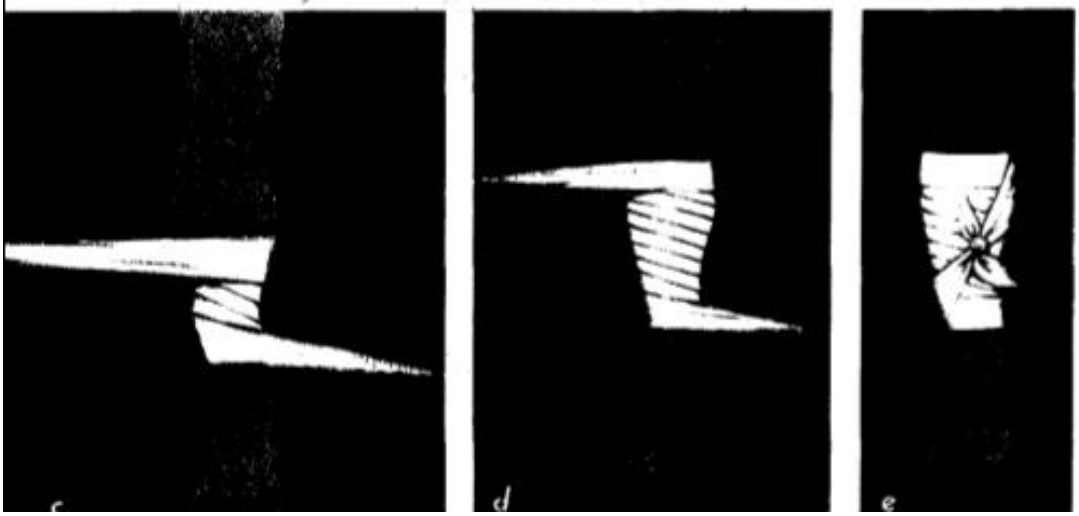


Figure 13

CRAVAT OF LEG (fig. 13)
Used to retain dressings on leg.
(*a*) Place center of cravat at center of calf, with ends forward and up, assuming wound is at about middle of leg.
(*b*) Cross ends in front, and commense ascending turns with upper end, and descending turns with lower end.
(*c*) and (*d*) Each turn covers two-thirds of preceding turn, until dressing is covered.
(*e*) Terminate by tying both ends over cravat.

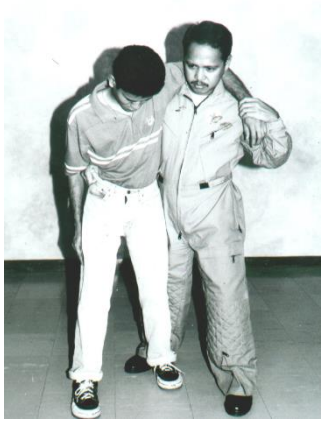


b) USE OF ROLLER BANDAGE
- Spiral (open, closed, and spiral reverse)
- Figure of eight
- Recurrent with spiral turns

B. EMERGENCY TRANSFER – moving a victim from one place to another after giving first aid by use of emergency rescue

1. POINTERS TO OBSERVE DURING TRANSFER
- Victim's airway must be maintained open
- Hemorrhage is controlled
- Victim is safely maintained in correct position
- Supporting bandages and dressing remain effectively applied
- The method of transfer is safe, comfortable, and as speedy as circumstances permit

2. METHODS OF TRANSFER



- One man assist and carry

Assist to walk
Fireman's carry

Cradle carry
Pack strap – carry

- Two man assist and carry

Four hand sit

Carry by extremities

- Three man carry

Hammock Carry

Bearer's along side

VIII. BASIC LIFE SUPPORT – an emergency procedure that consists of recognizing cardiac arrest and the proper application of cardiopulmonary resuscitation to maintain life until a victim recovers or advanced life support is available.

A. TYPES OF DEATH

1. **Clinical death** - when breathing and circulation stops
   - 0 – 4 minutes – brain damage is likely
   - 4 – 6 minutes – brain damage is probable

2. **Biological death – when the brain has been deprived of oxygenated blood**
   - 6 – 10 minutes – irreversible brain damage is probable
   - 10 minutes or more – irreversible brain damage is certain

B. THE CHAIN OF SURVIVAL – a metaphor for the elements of the emergency cardiovascular care systems concept. The 5 links in the chain of survival are:

1. Immediate recognition of cardiac arrest and activation of the emergency response system
2. Early cardiopulmonary resuscitation with an emphasis on chest compressions
3. Rapid defibrillation
4. Effective advanced life support
5. Integrated post-cardiac arrest care

C. C – A – B SEQUENCE – the CAB sequence allows rescuers to start chest compressions sooner, and the delay in giving breaths should be minimal.

- C – Compressions – push hard and fast on the center of the victim's chest
- A – Airway – tilt the victim's head back and lift the chin to open the airway
- B – Breathing – give mouth-to-mouth rescue breaths

D. AIRWAY OBSTRUCTION – A life threatening condition or emergency that requires prompt diagnosis and treatment where there is blockage of the upper airway which can be in the trachea, voice box, or throat area.

1. CAUSES OF AIRWAY OBSTRUCTION

- Allergic reactions
- Improper chewing of food
- Infection of epiglottis
- Throat cancer
- Trauma
- Loose upper and lower dentures

2. TYPES OF AIRWAY OBSTRUCTION

- Anatomical obstruction -can be caused by allergic reactions, infections, anatomical abnormalities, and trauma
- Mechanical obstruction – can be caused by presence of foreign matter

3. CLASSIFICATIONS OF OBSTRUCTION

- *Mild airway obstruction* – partial obstruction and that the victim can still cough and answer the question, “Are you choking?”
- *Severe airway obstruction* – also referred to as complete obstruction; there is poor air exchange and increased breathing difficulty, a silent cough, cyanosis, or inability to speak or breath and if patient become unconscious due to an obstruction

E. CHOKING - occurs when a foreign object becomes lodged in the throat or windpipe, blocking the flow of air. In adults, a piece of food often is the culprit. Young children often swallow small objects. Because choking cuts off oxygen to the brain, administer first aid as quickly as possible.

1. MANIFESTATIONS OF CHOKING

- Inability to talk
- Difficulty breathing or noisy breathing

- Inability to cough forcefully
- Skin, lips, and nails turn blue or dusky
- Loss of consciousness

Universal Choking Sign

RELIEF OF CHOKING

- *Heimlich maneuver* – The Heimlich maneuver is an emergency technique for preventing suffocation when a person's airway (windpipe) becomes blocked by a piece of food or other object.
- *Back blow* – designed to use percussion to create pressure behind the blockage, assisting the patient in dislodging the article.
- *Chest thrust* - A modified version of the Heimlich maneuver technique which is sometimes taught for use with pregnant and/or obese patients.

2. MANEUVERS TO OPEN AIRWAY

- *Head tilt – chin lift* – an emergency rescue maneuver which maximizes the diameter of the airway for rescue breathing

- *Jaw thrust maneuver* - Airway management is the medical process of ensuring there is an open pathway between a patient's lungs and the outside world, as well as reducing the risk of aspiration. Airway management is a primary consideration in cardiopulmonary

resuscitation, anesthesia, emergency medicine, intensive care medicine and first aid.

3. FOREIGN BODY AIRWAY OBSTRUCTION MANAGEMENT

a) CONSCIOUS ADULT

1. Check the scene and the victim
2. If the victim cannot cough, speak or breathe (inform the bridge immediately)
3. Perform Heimlich maneuver
4. Continue Heimlich maneuver until the object is forced out or the victim becomes unconscious

b) UNCONSCIOUS ADULT

1. Place him on the floor on a supine position (lying down face up)
2. Look for any blocking object by opening the airway. If there is an obstruction which can be removed, do a finger sweep.
3. Once the object is removed, do head tilt – chin lift and look, listen, and feel for adequate breathing.
4. Perform CPR if there is no pulse and absent breathing after assessment for circulation and respiration.

F. RESPIRATORY ARREST – a condition in which the breathing stops or is inadequate and circulation continues for quite some time.

1. WAYS TO VENTILATE THE LUNGS

- Mouth to mouth
- Mouth to nose
- Mouth to mouth and nose
- Mouth to stoma
- Mouth to face shield
- Mouth to mask
- Bag mask device

2. MOUTH-TO-MOUTH BREATHING – A quick and effective way to provide oxygen to the victim. The rescuer's exhaled air contains approximately 16% oxygen and 4% carbon dioxide. This is enough to meet the victim's needs.

- Actions:
  - Maintain a head tilt-chin lift to keep the airway open
  - Pinch the victim's nose tightly with thumb and forefinger
  - Make a mouth-to-mouth seal
  - Provide 2 mouth-to-mouth breaths. Make sure the chest rises with each breath
  - If the chest does not rise, repeat the head tilt-chin lift to reopen the airway

3. **FIRST AID MANAGEMENT: RESCUE BREATHING** – a technique of breathing air onto a person's lungs to supply him or her with the oxygen needed to survive

- Give each breath in 1 second
- Each breath should result in visible chest rise
- Check the pulse every 2 minutes
- Rescue breathing sequence:
  - Blow
  - 1 1002 1003 100**1** blow
  - 1 1002 1003 100**2** blow
  - 1 1002 1003 100**3** blow
  - 1 1002 1003 100**4** blow
  - 1 1002 1003 100**5** blow

- 1 1002 1003 100**6** blow
- 1 1002 1003 100**7** blow
- 1 1002 1003 100**8** blow
- 1 1002 1003 100**9** blow
- 1 1002 1003 10**10** blow

G. CARDIAC ARREST – cessation of functional circulation of the blood due to failure of the heart to contract effectively.

HIGH QUALITY CPR improves a victims chances of survival. The critical characteristics of high quality CPR include:

- Start compressions within 10 seconds of recognition of cardiac arrest
- Push hard, push fast: Compress at a rate of at least 100/min with a depth of at least 2 inches (5cm) for adults, approximately 2 inches (5cm) for children, and approximately 1 ½ inches (4cm) for infants
- Allow complete chest recoil after each compression
- Minimize interruptions in compressions (try to limit interruptions to <10 seconds)
- Give effective breaths that will make the chest rise
- Avoid excessive ventilation

1. THE CHAIN OF SURVIVAL – provides a useful metaphor for the elements of the emergency cardiovascular care (ECC) systems concept. The 5 links of survival are:

- Immediate recognition of cardiac arrest and activation of the emergency response system
- Early cardiopulmonary resuscitation (CPR) with an emphasis on chest compressions
- Rapid defibrillation
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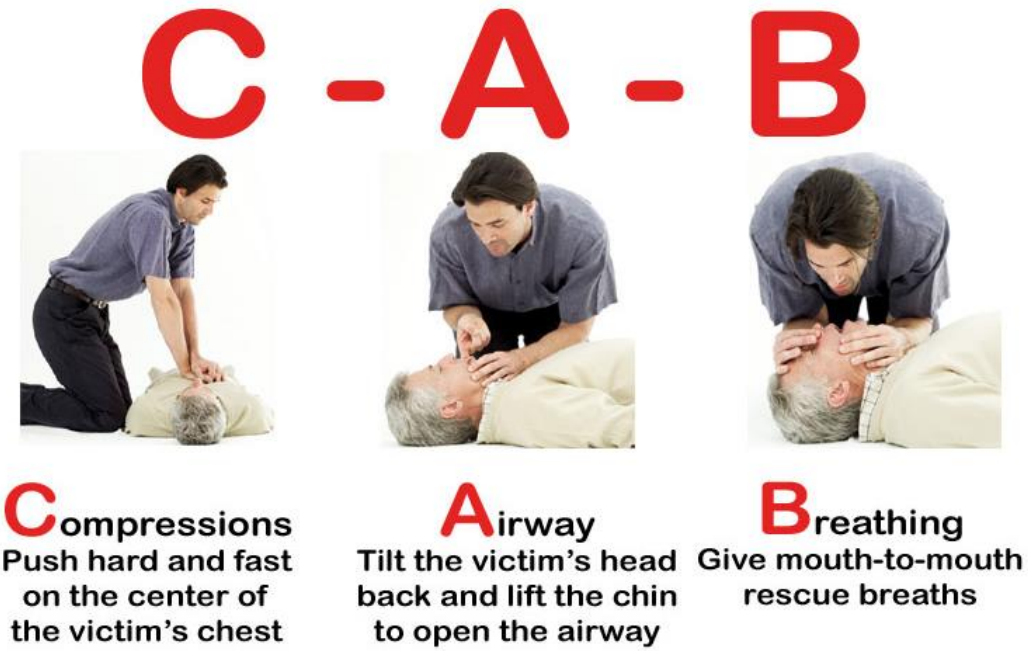


2. CRITERIA FOR NOT STARTING CPR

- The victim has a valid DNAR/DNR order
- The patient has signs of irreversible death
  - Rigor mortis
  - Decapitation
  - Dependent lividity

3. WHEN TO S.T.O.P. CPR

- S – spontaneous signs of circulation
- T – turnover to professional provider
- O – Operator is exhausted
- P – Physician assumes responsibility
- S – Scene becomes unsafe

4. FIRST AID MANAGEMENT: CARDIOPULMONARY RESUSCITATION - **It is the combination of external chest compressions and rescue breathing.**

- CPR sequence:
  - 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 1 2 3 4 5 6 7 8 9 and **1** blow blow

- 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
  1 2 3 4 5 6 7 8 9 and **2** blow blow
- 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
  1 2 3 4 5 6 7 8 9 and **3** blow blow
- 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
  1 2 3 4 5 6 7 8 9 and **4** blow blow
- 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
  1 2 3 4 5 6 7 8 9 and **5** blow blow

PERSONAL SURVIVAL TECHNIQUES (PST)

1.1 INTRODUCTION, SAFETY AND PRINCIPLES

1.1.1 Safety Guidance

Survival at sea is an essential factor that every seafarer, or passenger must have adequate knowledge of. No one can tell when an accident or an emergency will occur. It is only always best to know "What to do."

Proper training and familiarization will give a person the foundation of survival that will amplify his/her chances to remain alive during and after the occurrence of an accident or emergency on board.

Survival – is the ability of a seafarer to stay alive when life is threatened in a shipping casualty. It is an action, ability or effort exerted by a person or group of persons in order to continue to live in the midst of disastrous situation. It is a struggle for existence.

Survival Actions

The following paragraphs elaborate on the meaning of each letter of the word "SURVIVAL." This will show you guidelines of actions that are needed to be done in case someday seafarers find themselves on the brink of survival at sea.

S – Size up The Situation

Am I okay? Is there any sign of immediate danger around me? What emergency first aid measures must I take? What is my around me that I can use to increase my chances of survival? Where are the other survivors? Are they injured?

U – Use All Your Senses, Undue Haste Makes Waste

You may make a wrong move when you react quickly without planning. Do not make hasty movements without purpose, and remember energy is also an important factor in your success to surviving at sea. Consider all aspects of your situation (size up the situation) before you make an action. In your haste, you may lose equipment or become disoriented.

R – Remember Where You Are

It is important that you are aware, or have an idea at least, of where you are. Most probably you will be drifted away from your ship, you have to note your surroundings so as you do not lose your sense of direction. Always try to determine how your location relates to the following:

- Location of lifesaving equipment
- Location of survivors
- Location that may present dangers that you need to stay away from

V – Vanquish Fear and Panic

The largest obstacle in survival at sea is fear and panic. These may cause you to react to your emotions rather than to the situation. If uncontrolled, it will destroy your ability to make wise decisions and will greatly reduce your chances of survival.

I – Improvise

No matter where you may find yourself in, there will always be something within your immediate location that could aid you in your strive for survival. The more creative and inventive you are, churns out more chances for you to survive.

V – Value Living

While the urge to survive is basic to humans, extreme conditions could severely test their will to survive. Once you lose your will, all knowledge and training in survival techniques would be useless.

A – Act Wisely and with Certainty

Your actions will be the key to your survival and unwise decisions, unnecessary taking risks would make you miss out other alternatives that could perk up the odds of your survival and chances of being rescued.

L – Learn Basic Skills

Without proper training and knowledge in basic skills for surviving, your chances of staying alive at sea are slim.

This is the main purpose of the STCW courses. By understanding the instructions and involving yourself enthusiastically in practical training and drills on board, will reduce your fear and give you self-confidence and, thus, equip you for survival.

Psychology of Survival

It takes much more than the knowledge and skills to build shelters, get food, make fires, and sail without the aid of standard navigational devices to live successfully through a survival situation. Some people with little or no survival training have managed to survive life-threatening circumstances. Some people with survival training have not used their skills and died. A key ingredient in any survival situation is the mental attitude of the individual(s) involved. Having survival skills is important; having the will to survive is essential. Without a desk to survive, acquired skills serve little purpose and invaluable knowledge goes to waste.

There is a psychology to survival. The seafarer in a survival environment faces many stresses that ultimately impact on his mind. These stresses can produce thoughts and emotions that, if poorly understood, can transform a confident, well-trained seafarer into an indecisive, ineffective individual with questionable ability to survive. Thus, every seafarer must be aware of and be able to recognize those stresses commonly associated with survival. Additionally, it is imperative that seafarers be aware of their reactions to the wide variety of stresses associated with survival.

Essentials for Survival at Sea

- Have a strong will to survive.
- Have survival knowledge and techniques: (a) Proper use of life-saving appliances and equipment (b) Actions to be taken when abandoning a ship (c) Survival knowledge and techniques required when drifting (d) Cautions required by a person being pick-up

- Have excellent lifesaving appliances which are always maintained in good condition.

1.1.2 Principles of Survival at Sea

The principles of survival at sea include the following:

- Initial on-board familiarization
- Regular training and drills
- Preparedness for any emergency
- Knowledge of actions to be taken when these happen:
  - called to survival craft stations
  - required to abandon ship
  - required to jump in the water
  - in the water
  - aboard a survival craft
  - knowledge of the main dangers to survivors

On Shore Training

The main purpose of conducting trainings and drills on board ship is to prepare a trained and organized response team to emergency situations which may unexpectedly cause loss of life, damage to ship and property, and pollution of the environment.

Proper preparation and training is vital prior to embarkation or boarding a vessel. Going to sea without knowledge about the operation of life-saving equipment, actions to be taken in case of emergencies is like going to a war blind-folded. It's suicide.

Training is not only a part of preparation but could also give a person confidence and state of mind under survival conditions. Many lives have been lost unnecessarily due to lack of training and misuse of lifesaving equipment.

An accident or emergency, such as fire, will be quickly resolved if the correct thing is done in the initial response. However, if an emergency is not dealt with immediately or in the wrong way, it may and it will develop into a life-threatening and potential ship-loss situation.

Onboard Familiarization

It is required to every ship that all crew, especially the newly-joined ones, to be familiarized with the general layout of the ship:

- Accommodation
- Machinery spaces, including main and auxiliary pump rooms
- Storerooms, paying attention where paint and combustible materials are stored
- Location of fire alarms
- Locations of muster stations during emergency and emergency equipment
- Locations of fire hoses, fire hydrants, and firefighting equipment
- Location and operation of fixed firefighting systems
- Emergency escape routes

Most important, he must be completely familiar with the emergency signals and the expected response, including the duties and responsibilities in such emergency.

SOLAS Training Manual

Trainings specific to the ship is documented in the ship's SOLAS Training Manual

Ship must have a SOLAS Training Manual which explained in details the following:

- Appropriate donning of lifejackets and immersion suits.
- Muster at the assign station.
- Boarding, Launching and Clearing the survival craft and rescue boats.
- Method of Launching from within the survival craft.
- Released from launching areas.
- Method and use of devices for protection and launching areas where appropriate.
- Illumination in launching areas.
- Use of all survival equipment.
- Use of all detection equipment.
- Use of radio life-saving appliances.
- Use of drogues
- Use of engines and accessories.
- Recovery of survival craft and rescue boats including stowage and securing.
- Hazard of exposure and the need of warm clothing.
- Best use of survival craft.

- Method of retrieval, including use of helicopter rescue gear (sling, basket, stretchers), breeches buoyant shore life saving apparatus and ship's line throwing apparatus.
- All other functions contained in the muster list and emergency instructions.
- Instruction for emergency repair of the lifesaving appliances.

Instruction for on-board maintenance of life-saving appliances shall include the following:

- A check list for use when carrying out the inspection require by this regulations.
- Maintenance and repair instruction.
- Schedule of periodic maintenance.
- Diagram of lubrication points with the recommended lubricants.
- List of replaceable parts.
- List of source of spare parts.
- Log of records of inspection and maintenance.

1.1.3 Definitions, Survival Craft and Appliances

- Survival craft – a vessel that is totally enclosed, suitably propelled, and designed and constructed so as to permit the safe carrying of its full complement of persons through conditions of fire on water for a distance of at least one nautical mile in a radial direction from the offshore installation from which the vessel is launched.
- Rescue boat – is a boat designed to rescue persons in distress at sea.
- Float-free launching – method of launching a survival craft whereby the craft is automatically released from a sinking ship and is ready for use. Float-free arrangements may either be an HRU or some other means.
- Free-fall launching – method of launching a survival craft whereby the craft with its complement of persons and equipment on board is released and allowed to fall into the sea without any restraining apparatus.
- Immersion suit – is a protective suit which reduces the body heat loss of a person wearing it in a cold weather.
- Inflatable appliance – an appliance that depends on non-rigid, gas-filled chambers for buoyancy which can be inflated for use in emergency situations.
- Thermal protective aid – is a bag or suit made of waterproof material with low thermal conductance.
- Launching appliance – means of transferring a survival craft or rescue boat from its stowed position safely to the water.

1.2 EMERGENCY SITUATIONS

1.2.1 Types of Emergencies

1. Fire – one of the most serious risks for property and persons, as well as for the surrounding environment.
2. Flooding – unwanted ingress of the sea water in large quantities can result from a variety of reasons. It can also result from bursting of any pipeline carrying sea water.
3. Collision – results from a ship crashing into a still or floating object. Ship collision cases can be a ship to ship, ship to floating object, ship to submarine or ship to still structure collisions.
4. Grounding – involves the impact of a ship on the seabed, resulting in damage of the submerged part of her hull and particularly the bottom structure, potentially leading to water ingress and compromise of the ship's structural integrity and stability.
5. Man Overboard (MOB) – is a situation in which a person has fallen off a boat or ship into the water and is in need of rescue.
6. Abandonship – to leave a ship that is in danger of sinking.
7. Adverse reaction of dangerous goods or hazardous bulk materials – any negative reaction of cargo substances which is capable of causing harm to people, animals, property or the environment.
8. Shifting of cargo – in the transportation of goods the cargo sometimes shifts in such a way as to endanger not only the cargo but also the means of transport.

1.2.2 Precautions

As soon as possible after joining a ship, the personnel must acquire some knowledge of the following:

- The meaning of emergency signals
- Instructions on the muster list and their duties
- The location and use of lifesaving equipment
- The location and use of firefighting equipment

- Escape routes and equipment
- Emergencies involving the sinking of the ship
- The means provided for survival on ship and survival craft

Things to Remember

1. Know your duties in an emergency.
2. Be prepared - an emergency can arise anytime.
3. Knowledge and training gives you the best chances to cope with an emergency.

1.2.3 Fire provisions

The International Convention for the Safety of Life at Sea (SOLAS), 1974, requires flag States to ensure that their ships comply with minimum safety standards in construction, equipment and operation.

Chapter II-2: Construction – Fire protection, detection, extinction:

Regulation 2: Fire safety objectives and functional requirements

Fire safety objectives

- Prevent the occurrence of fire and explosion
- Reduce the risk to life caused by fire
- Reduce the risk of damage caused by fire to the ship, its cargo and the environment;
- Contain, control and suppress fire and explosion in the compartment of origin and
- Provide adequate and readily accessible means of escape for passengers and crew.

Functional requirements

In order to achieve the fire safety objectives set out in paragraph 1, the following functional requirements are embodied in the regulations of this chapter as appropriate:

- Division of the ship into main vertical and horizontal zones by thermal and structural boundaries;
- Separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;
- Restricted use of combustible materials;
- Detection of any fire in the zone of origin;
- Containment and extinction of any fire in the space of origin;
- Protection of means of escape and access for firefighting;
- Ready availability of fire-extinguishing appliances; and
- Minimization of possibility of ignition of flammable cargo vapour.

1.2.4 Foundering

Abandoning Ship

The order to abandon ship is never given until the master judges it necessary. The ship is the safest survival craft, but if the ship's condition will put people's lives in great danger, abandoning it will be the best option.

1.2.5 Crew Expertise

The effectiveness of the means provided during such emergency depends on the expertise of the personnel.

1.2.6 Muster List and Emergency Signals

Muster list must be located in places where it can be easily seen. Muster list tells you the following:

- WHO YOU ARE - Identifies all crews by name, number, rank, or a combination of both number and rank.
- WHERE YOU GO - Identifies the muster stations (assembly stations) which are the designated places on the ship that personnel should go upon hearing the general emergency alarm signal.

- WHAT TO DO - Either specific duties are assigned, such as preparations of boats, stairway guides etc., or crew will carry out duties as required - dependent on the nature of emergency.

Personal Muster Card - contains information which is useful to crew members in an emergency situation.
The following are information in the muster card:

1. Crew number, etc.
2. General Emergency Alarm signal
3. Fire alarm signal
4. Abandon ship signal
5. Muster (assembly) station
6. Emergency duties

Alarm Signals

General Alarm - consist of seven (7) or more short blast followed by one (1) long blast on the ship's whistle. (Instruction: Get ready)

Boat Alarm - at least (7) short blast followed by one (1) long blast repeated on the ship's whistle. (Instruction: All to attend their station wearing life jacket)

Fire Alarm - continuous blast of the whistle for a period of not less than 10 seconds followed by a continuous ringing of the general alarm. (Instruction: All to attend their stations bringing along their assigned firefighting equipment)

Man Over Board Alarm - the letter "O" sounded at least four times on the ship's whistle followed by the same signal sounded on the fire bells. (Instruction: rescue boat crew to muster station immediately carrying the immersion suit)

Actions to be taken on hearing emergency alarm signals and discovering potential emergencies:

- Raise the alarm
- Attire yourself adequately and properly
- Go to your muster station
- Find out nature of the emergency
- Take action as per muster list or duty list

1.2.7 Crew and Emergency Instructions

As soon as possible after joining a ship, personnel should acquire knowledge of:

- The meaning of emergency signals
- Instructions on the muster list and their duties
- The location and use of life-saving equipment
- The location and use of fire-fighting equipment
- Escape routes and equipment
- Emergencies involving the sinking of the ship
- The means provided for survival on ship and survival craft

1.2.8 Extra Equipment and Survival

If time permits, any extra equipment you can collect and take aboard the survival craft may enhance your chance for survival in an abandonship situation. The following is a list of extra equipment that is to be taken to the survival craft if time permits:

- Warm clothes
- Hand-held VHF radio
- EPIRB (Emergency Position Indicating Radio Beacon)
- SART (Search and Rescue Transponder)
- Extra water and food
- Blankets
- Anything that floats
- Sextant, chronometer, charts, navigation tables

1.2.9 Abandoning ship – complications

The complications in abandoning ship are caused by the following:

- Some of the survival craft not capable of being launched
- Absence of lighting
- Absence of personnel assigned to certain duties

1.3 EVACUATION

1.3.1 Abandoning ship – the last resort

The ship usually offers the best chance of survival and that abandoning ship should only be undertaken if all other measures fail.

1.3.2 Personal preparation for abandoning ship

- Put as many layers of warm clothes as possible, including foot protection, making sure to cover head, neck, hands, and feet.
- If an immersion suit is available, put it on over the warm clothing.
- Put your life jacket and make sure to secure it correctly.
- Take plenty of water – it may be your last for a long time.
- Take anti-seasickness medication – seasickness will interfere with you survival chances as vomiting removes important body fluids. Seasickness makes you more prone to hypothermia and impairs your will to survive.
- Take any additional items if time permits – extra food, water, blankets and spare radio.

1.3.3 Need to prevent panic

Panic is a sudden fear which dominates or replaces thinking and often affects groups of people. Panics typically occur in disaster situations, or violent situations which may endanger the overall health of the affected group.

Fear can be terrible but panic is unforgivable at sea. Panic leads to pushing, shoving, and trampling, which can lead to other injuries, like broken bones or concussion. Panic prevention is a crucial goal of emergency management, because panic is highly contagious and highly destructive.

1.3.4 Crew duties to Passengers

In passenger ships, passengers will look to the crew for help in an emergency. It is the crew's duty to assist the passengers. Passengers' safety is the crew's number one priority.

Crew duties with respect to passengers

- Ensure safety of the passengers
- Prevent panic

- Assist passengers to don their lifejackets properly
- Ensure passengers are suitably dressed
- Direct passengers to their muster stations
- Keep passengers away from emergency area
- Keep passengers informed

1.3.5 Crew duties – launching survival craft

Before a survival craft drill is held, the person in charge of a survival craft and his or her second-in-command shall each have a list of the survival craft crew members, and the person in charge shall ensure that the crew members know what their duties are.

During a survival craft drill, the master of a vessel shall ensure that the crew members perform the duties assigned to them in connection with the survival craft drill, including:

a. Mustering the crew or passengers;
b. Locating and rescuing crew and passengers who are trapped or who are otherwise unaccounted for;
c. Preparing for the launching of the survival craft and ensuring that the equipment and supplies, including a supply of blankets, that are required to be carried in the survival craft are in place and properly stowed;
d. Inspecting and, if practicable, testing the radio lifesaving equipment that is required to be carried in the survival craft;
e. Operating the davits used for launching life rafts;
f. If the vessel carries motor lifeboats, starting and operating the lifeboat motors and verifying that the fuel tanks are filled to capacity;
g. If the vessel carries survival craft other than lifeboats, participating in instruction in the operation and deployment of those survival craft;
h. If the vessel is fitted with a marine evacuation system, carrying out the procedures required for the deployment of the system up to the point immediately preceding its actual deployment;
i. Testing the emergency lighting for the mustering of passengers and crew and for the abandonment of the vessel; and
j. Inspecting and testing the lifesaving appliances that are fitted or carried on the vessel, other than those referred to in paragraph (*e*) or (*j*).

1.3.6 Master's orders to abandon ship

The order to abandon ship comes from the master.

1.3.7 Means of Survival

Essential for survival after the ship has been abandoned

- A means of keeping afloat
- A means of keeping warm
- Drinking water and food
- A means of communicating with ships or rescue services

1.4 SURVIVAL CRAFT AND RESCUE BOATS

1.4.1 Lifeboats

A small watercraft carried on a ship to provide a means of emergency evacuation in the event of a disaster aboard the ship.

Different types of lifeboats:

- Open
- Partially enclosed
- Self-righting partially enclosed
- Totally enclosed
- Totally enclosed with a self-contained air support system
- Fire protected

Passenger ships capacity of lifeboats:

For passenger ships the capacity of the lifeboats is generally sufficient for every person on board.

SOLAS Regulation 21

1 Survival craft

1.1 Passenger ships engaged on international voyages which are not short international voyages shall carry:

Partially or totally enclosed lifeboats complying with the requirements of section 4.5 or 4.6 of the Code on each side of such aggregate capacity as will accommodate not less than 50% of the total number of persons on board. The Administration may permit the substitution of lifeboats by liferafts of equivalent total capacity provided that there shall never be less than sufficient lifeboats on each side of the ship to accommodate 37.5% of the total number of persons on board. The inflatable or rigid liferafts shall comply with the requirements of section 4.2 or 4.3 of the Code and shall be served by launching appliances equally distributed on each side of the ship.

Cargo ships capacity of lifeboats:

For cargo ships the capacity of the lifeboats is generally twice the number of persons on board.

SOLAS Regulation 31

1 Survival craft

1.1 Cargo ships shall carry:

One or more totally enclosed lifeboats complying with the requirements of section 4.6 of the Code of such aggregate capacity on each side of the ship as will accommodate the total number of persons on board.

Description of different types of lifeboats:

- Open - the most elementary lifeboat which is nothing but a hand-propelled boat with oars and sometimes has a small outboard engine fitted. This type has no permanent covering or shelter and it provides little protection from the environment.
- Partially enclosed – shall be provided with permanently attached rigid covers extending over not less than 20% of the length of the lifeboat from the stem and not less than 20% of the lifeboat from the aftermost part of the lifeboat
- Self-righting partially enclosed - complies with the same regulations as the partially enclosed lifeboat, however, a safety belt shall be fitted at each indicated seating position. These are designed to hold a person in place when the lifeboat is in a capsized position. The lifeboat stability shall be such

that it is inherently or automatically self-righting when fully loaded with its full or partial load.

- Totally enclosed – shall be provided with a rigid watertight enclosure which completely encloses the lifeboat.
- Totally enclosed with a self-contained air support system – shall be installed on chemical tanker and gas carriers carrying cargoes emitting toxic vapours or gases, shall carry lifeboats with self-contained air support system.
- Fire protected – shall be installed on oil tankers, chemical tankers and gas carriers carrying cargoes having a flashpoint not exceeding 60°C shall carry fire-protected lifeboats.

Launching of lifeboats:

Lifeboats are launched in the following method:

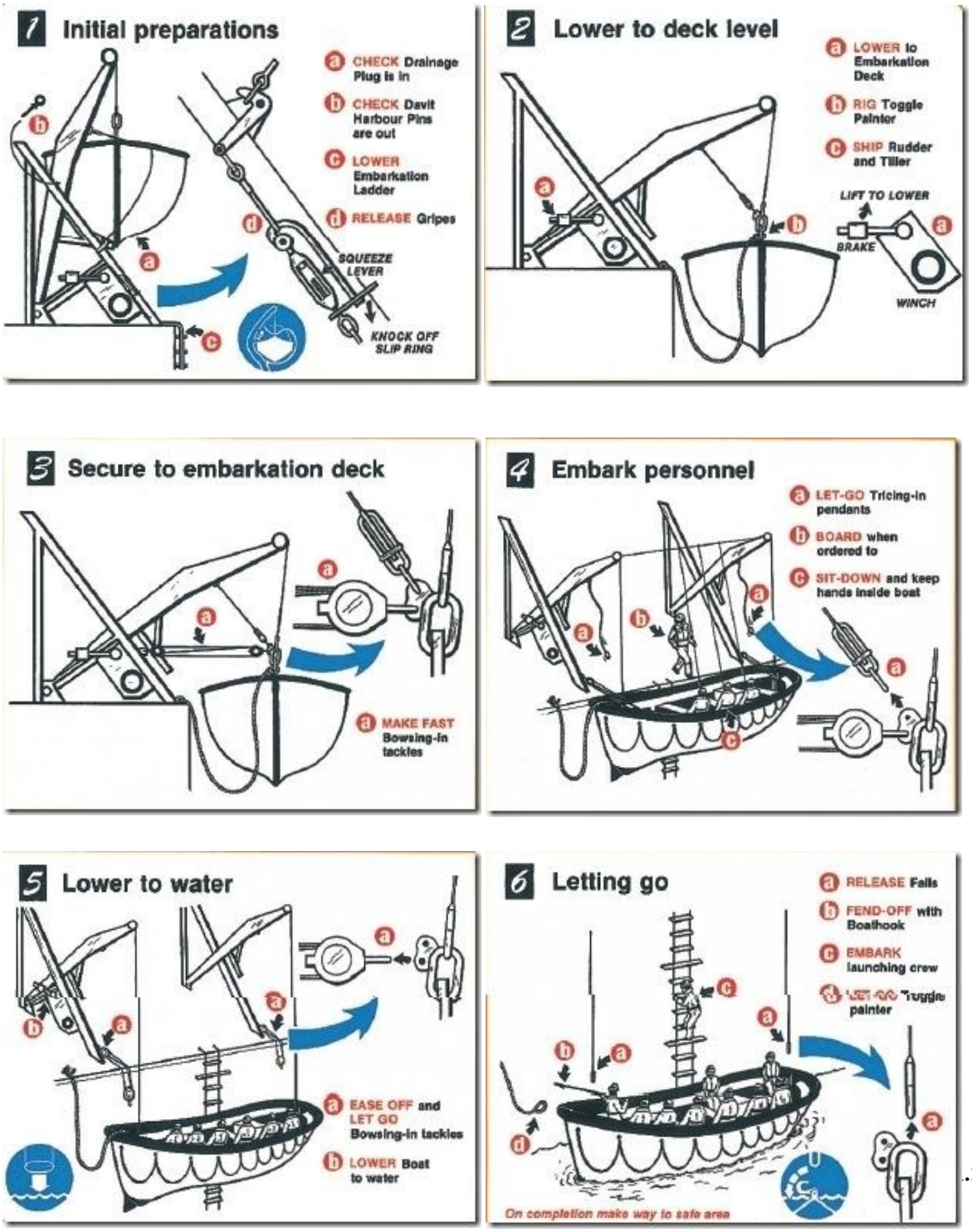
- Davit launched
- Free fall method

Precautions in lifeboat launching:

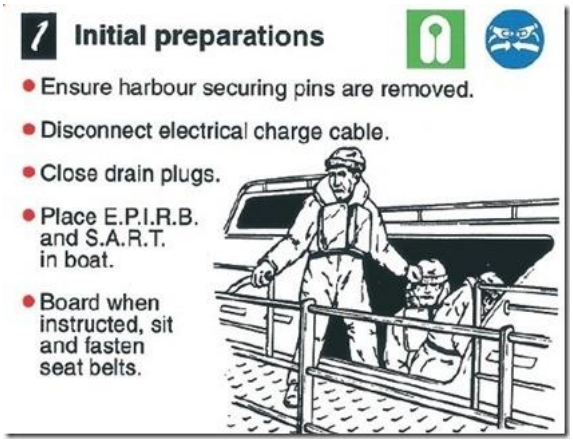
Life Boats and Life rafts are provided in ships as a means of life saving in case of emergency.

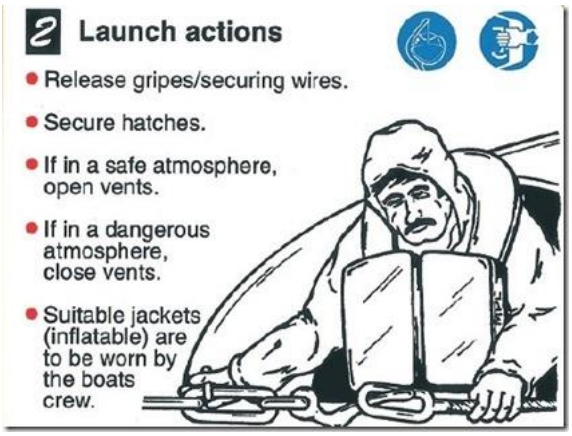
- The number of lifeboats and life rafts provided is calculated on the basis of carrying capacity of these lifesaving appliances and the number of ship's crew.
- The life-saving appliances are to be surveyed periodically as per the regulations to ensure seaworthiness.
- Safety awareness posters on procedures to launch life boats and liferafts are prominently displayed in ships.
- Easy access/approach to these appliances is necessary to use these lifesaving appliances without any time delay.
- Drills on using lifesaving appliances are to be conducted periodically to ensure that the ships' crew members are confident to use these appliances in case of emergency.

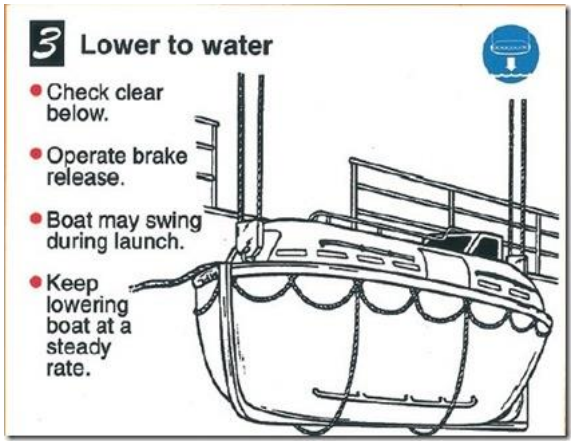
How to Launch an Open Lifeboat

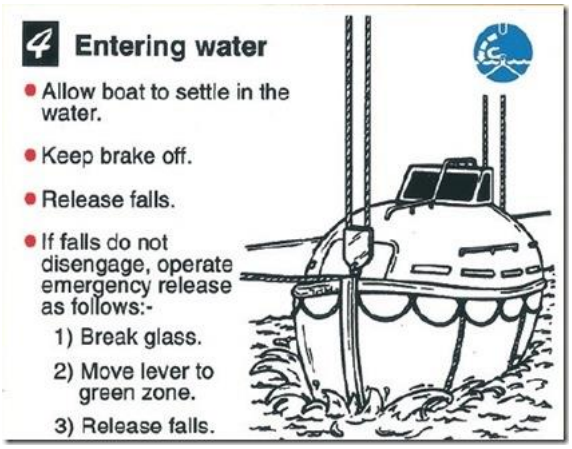


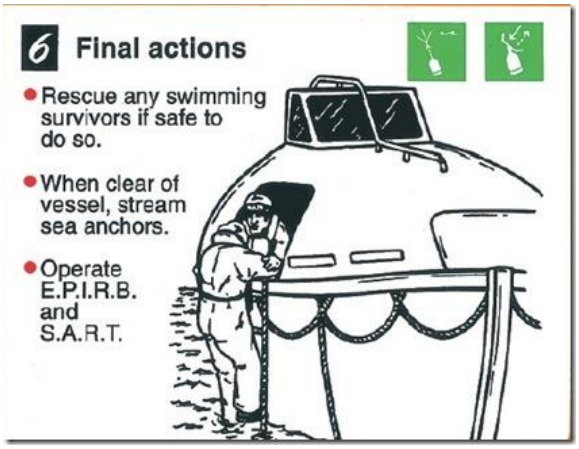
Steps to launch an enclosed life boat:











1.4.1.7 Lifeboats means of embarkation:

- Lifeboats and life rafts for which approved launching appliances are required shall be stowed as close to accommodation and service spaces as possible.
- Muster stations shall be provided close to the embarkation stations. Each muster station shall have sufficient clear deck space to accommodate all persons assigned to muster at that station, but at least 0.35 m^2 per person.
- Muster and embarkation stations shall be readily accessible from accommodation and work areas.
- Muster and embarkation stations shall be adequately illuminated.
- Alleyways, stairways and exits giving access to the muster and embarkation stations shall be lighted.
- Davit-launched and free-fall launched survival craft muster and embarkation stations shall be so arranged as to enable stretcher cases to be placed in survival craft.
- An embarkation ladder complying with the requirements.
- Shall be provided for bringing the davit-launched survival craft against the ship's side and holding them alongside so that persons can be safely embarked.

1.4.2 Life Rafts

A raft usually made of inflatable material and used in an emergency on large bodies of water.

Types of life raft:

- **Inflatable life raft**
- **Rigid life raft**

Type description:

Inflatable Liferafts

The inflatable liferaft is the most common type of liferaft and forms the secondary appliance in the majority of ships. In some classes of vessels, liferafts are the main form of life-saving equipment. International regulations lay down the requirements for the design and manufacture of inflatable liferafts and the emergency equipment carried in them.

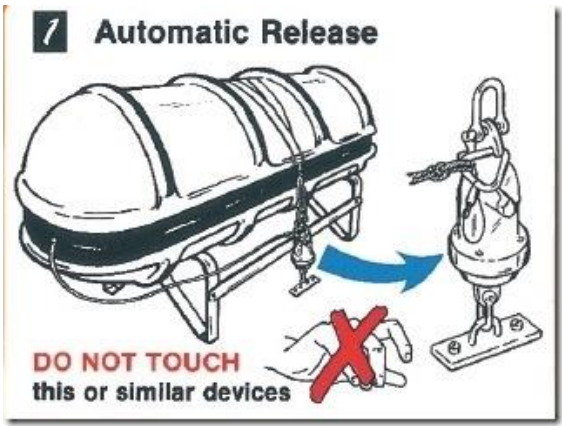
Liferafts complying with the 1974 SOLAS Convention are made of different sizes from 6 persons to 25 persons capable of being launched by standard throw overboard procedures or by davits. For small crafts, those used for pleasure purposes, liferafts for four persons are produced to meet national regulations.

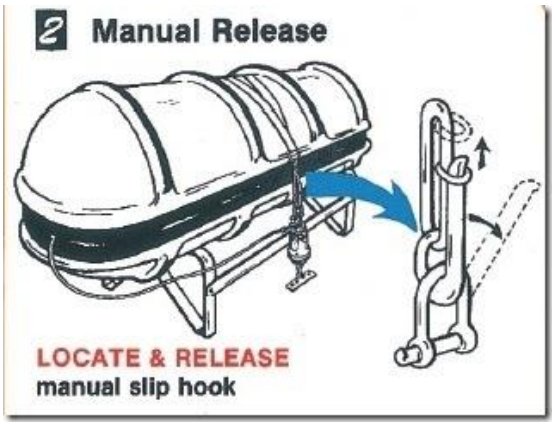
Larger liferafts of 35, 45, and 50 person capacities are found on large, high-density passenger and ferry vessels.

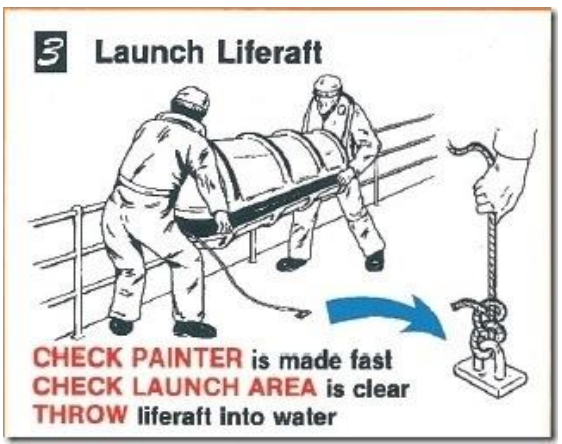
Rigid Liferafts

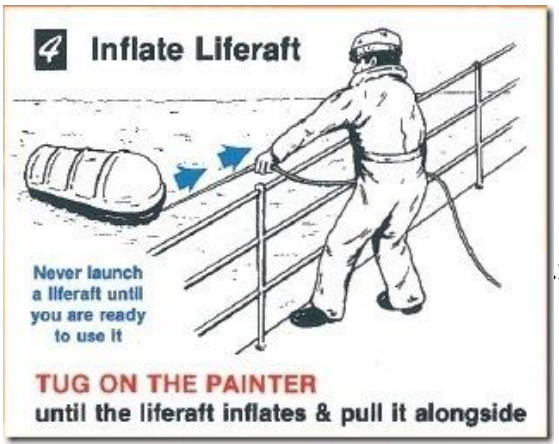
Liferafts are also made of rigid cork type material. They usually have a mesh net attached and lifelines. Capacity will be marked clearly. These are more common on small commercial vessels.

Steps to launch a liferaft:



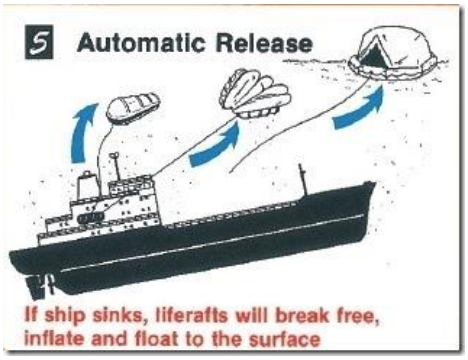






Float-free arrangement for life rafts:

Life rafts shall be installed with a hydrostatic release unit (HRU), whereby the craft is automatically release in case the ship sinks and the raft is ready for use.



1.4.3 Rescue boats

A boat designed to rescue persons in distress at sea.

Passenger ships requirements

- Passenger ships of 500 gross tonnage and over shall carry at least one rescue boat on each side
- Passenger ships of less than 500 gross tonnage shall carry at least one rescue boat

Cargo ships requirements

Cargo ships shall carry at least one rescue boat. A lifeboat may be accepted with the requirements for a rescue boat.

In addition to the lifeboats, all cargo ships constructed before 1 July 1986 shall carry the following:

- One or more life rafts capable of being launched on either side if the ship and will accommodate the total number of persons on board
- In addition to the life rafts, a life raft stowed as far forward or aft, or one as far forward and or aft, is reasonable and practicable.
- May be securely fastened so as to permit manual release.

Requirement for a lifeboat to be classed as rescue boat:

- A lifeboat may be accepted as a rescue boat provided it also complies with the requirements for a rescue boat.

1.5 PERSONAL LIFE-SAVING APPLIANCES

Life-saving appliances will significantly increase your chances of survival when a shipwreck or other emergency occurs. You must know the locations of such and be familiar of its operation in a situation at sea.

Personal Flotation Device

- Lifebuoy
- Lifejacket
- Lifeboat
- Immersion Suit
- Thermal Protective Aid

1.5.1 Lifebuoys or life rings

Flotation devices tossed to a person who has fallen overboard. The lifebuoys are placed in such a way that they are easily accessible on both sides of the ship. The lifebuoys must be ready from being rapidly cast off. They must not be permanently fastened.

A certain number of lifebuoys must be carried on every ship. The number is dependent on the length and purpose of the ship (cargo or passenger).

The name and port of registry of the ship shall be marked on each lifebuoy in legible block letters. The lifebuoys will greatly help his chances for survival and assist the ship in finding him.

Be aware of the locations of lifebuoys and the various attachments and how they work. If a person falls overboard, the lifebuoy will greatly help his chances for survival and assist the ship in finding him.

At least one lifebuoy on each side of the ship shall be fitted with a buoyant lifeline complying with the requirements of paragraph 2.1.4 of the Code equal in length to not less than twice the height at which it is stowed above the waterline in the lightest seagoing condition, or 30m, whichever is greater.

Not less than one half of the total number of lifebuoys shall be provided with self-igniting lights complying with the requirements; not less than two of these shall also be provided lifebuoy self-activating smoke signals and be capable of quick release from the navigational bridge.

1.5.2 Lifejackets

Life jacket is a sleeveless jacket made up of buoyant or inflatable material used to keep human body afloat in water.

Lifejacket carrying requirements

- Passenger ships
  - There must be a life jacket for every person on board ship.
  - Lifejacket for each child or 10% of the total number of passenger whichever is greater.
- Cargo ships
  - There must be a lifejacket for all crew and their families, if on board.
  - Infant lifejackets must be provided in cargo ships.
  - The number of lifejackets must be carried in excess as in case of damage to any, it can be replaced with spare one.

Life jacket buoyancy

Life buoyancy may be achieved by packing with buoyant material and can also be inflated.

- **Non inflatable life jacket**: These jackets are fitted with buoyant materials and they don't need to inflate.

- **Inflatable life jacket**: This jacket needs inflation for buoyancy and is automatically inflated when immersed in water. It normally consists of two different buoyancy compartments.

Lifejacket equipment

- Each life jacket shall be fitted with a whistle firmly secured by a lanyard.
- Life jacket lights and whistles shall be selected and secured to the lifejacket in such a way that their performance in combination is not degraded.
- Each life jacket shall be provided with a releasable buoyant line or other means to secure it to a lifejacket worn by another person in the water.

- Each life jacket shall be provided with a suitable means to allow a rescuer to lift the wearer from the water into a survival craft or rescue boat.
- Jacket must not sustain burning or melting when exposed to fire for a period of 2 seconds.
- It is clearly capable of being worn in only one way or, as far as is practicable, cannot be donned incorrectly.
- When jumped from a height of at least 4.5 m into the water no injury and dislodging or damaging the lifejacket.
- Should have buoyancy which is not reduced by more than 5% after 24 hour submersion in fresh water

1.5.3 Immersion Suits

Immersion Suits

An immersion suit is a protective suit that reduces the body heat loss of a person in cold water. IMO requires that suits, when functioning and worn properly, prevent the reduction of body heat loss to the extent that the body temperature of a person staying in 0°C. Cold water does not fall to less than 35 degree after 6 hours.

A body temperature of 35°C is dangerous because the person gets apathetic. As a consequence of this, an immersion suit is a piece of personal equipment that should always be available for crew. Not only in northern waters but also in relatively warm waters. After all, there are not many places where the sea temperature is above 35 degree C.

Immersion suits carrying requirements

An immersion suit of an appropriate size, shall be provided for every person assigned to crew the rescue boat or assigned to the marine evacuation system.

Passenger and cargo ship with non-enclosed lifeboats requirements

All passenger and cargo ships with non-enclosed lifeboats shall carry at least three immersion suits for each lifeboat.

1.5.4 Thermal Protective Aids

Thermal protective aids are fully waterproof garments designed to increase the survival time of an individual in cold water.

Purpose of Thermal Protective Aids

Thermal protective aids are designed to keep you warm and preserve body heat in emergency or in a life raft. It does not provide flotation and are usually only worn once. (You don your lifejacket after putting on the suit). Thermal protective aids are part of the survival craft equipment and can also be used to warm a hypothermic victim or to help keep in the survival craft.

Thermal protective aids are provided for 2 persons or 10% of the persons a lifeboat is certified to accommodate and at least one in a life raft. Any injured persons should be protected against the cold with thermal protective aid.

Requirement for passenger and cargo ships without immersion suit

All passenger and cargo ships with non-enclosed lifeboats a thermal protective aid must be provided for persons not provided with an immersion suit.

1.6 PERSONAL LIFE-SAVING APPLIANCES (DEMONSTRATIONS)

1.7 SURVIVAL AT SEA

1.7.1 Dangers to survivors

The most obvious mistake made by many persons after evacuation from ship is to assume that when they have found the relative security of a survival craft, their troubles are over. Depending on undetected circumstances, they could be, in fact, just the beginning. It should always be remembered that no one is a survivor until he/she has been rescued and brought to land. Every successful rescue will have to pass through three phases:

- The abandonment phase
- The survival phase
- The rescue phase

Description of dangers

In each separate period, there will always be dangers to survivors, both in the water and in the survival craft. These dangers can be the following:

- Immersion and drowning
- Exposure to cold and hypothermia
- Exposure as heat stroke and heat exhaustion

- Seasickness
- Drinking sea water
- Fire and oil in the water
- Failure to maintain body fluids correctly
- Hunger and Thirst
- Marine Predators/Sharks

1.7.2 Best use of survival craft facilities

How to clear from ship

- Obey every command.
- Wear your lifejacket and fasten it securely.
- If possible, lower yourself by ladder or lines. If you jump, jump feet first, protecting your face with your hand.
- Avoid debris in the water.
- If possible, jump to windward from the lowest part of the ship or from an overhang structure.
- If propellers are still turning, leave by the bow.
- If the water is covered with burning oil, discard your life jacket and swim under water, swim windward.
- To protect yourself from underwater explosion, swim away from the ship for at least one hundred (100) yards or swim aboard a boat raft or wreckage. If none of this are available; swim or lie flat on your back.

Heat stroke, sun stroke, exposure and hypothermia

Exposure

Exposure to the elements is your next biggest concern to surviving after abandoning ship. Heat stroke, sunstroke, dehydration, exposure to cold and hypothermia are caused by fall or rise of your body temperature with the environment.

Hypothermia - is a condition in which core temperature drops below that required for normal metabolism and body functions which is defined as 35.0 °C (95.0 °F). Body temperature is usually maintained near a constant level of 36.5–37.5 °C (98–100 °F) through biologic homeostasis or

thermoregulation. If exposed to cold and the internal mechanisms are unable to replenish the heat that is being lost a drop in core temperature occurs. As body temperature decreases characteristic symptoms occur such as shivering and mental confusion.

Hyperthermia - is an elevated body temperature due to failed thermoregulation. Hyperthermia occurs when the body produces or absorbs more heat than it can dissipate. When the elevated body temperatures are sufficiently high, hyperthermia is a medical emergency and requires immediate treatment to prevent disability and death.

The most common causes are heat exhaustion and heat stroke. Heat stroke is an acute condition of hyperthermia that is caused by prolonged exposure to excessive heat and/or humidity. The heat-regulating mechanisms of the body eventually become overwhelmed and unable to effectively deal with the heat, causing the body temperature to climb uncontrollably.

This requires immediate treatment to reduce the body temperature in order to prevent brain damage or death. The most effective treatment is a liquid-cooling bath.

Expected Survival Time in Cold Water

Water Temperature	Exhaustion or Unconsciousness in	Expected Survival Time
70–80° F (21–27° C)	3–12 hours	3 hours – indefinitely
60–70° F (16–21° C)	2–7 hours	2–40 hours
50–60° F (10–16° C)	1–2 hours	1–6 hours
40–50° F (4–10° C)	30–60 minutes	1–3 hours
32.5–40° F (0–4° C)	15–30 minutes	30–90 minutes
<32° F (<0° C)	Under 15 minutes	Under 15–45 minutes

Seasickness

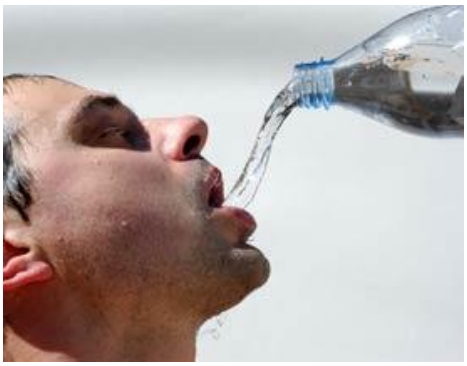
As soon as practical, anti-seasickness pills should be issued to all persons. Anti-seasickness medication is part of all survival craft equipment. Even the most hardened and experienced seaman is prone to seasickness in a survival craft and should take the medication. The consequential loss of moisture and distress caused by vomiting will reduce motivation, vitality, and the will to survive.

In the survival environment, seasickness can be extremely dangerous if vomiting occurs, vital body fluids will be lost. If water rations are low, it may mean the difference between surviving and death from dehydration.

Resting in a reclined position with the eyes closed can aid a seasick victim. If possible, give small amounts of dry foods, crackers, bread, or the like. The nature of the absorbing qualities of these foods may help alleviate seasickness.

Prudent use of fresh water and food and the need to avoid dehydration

Dehydration



Another serious threat to the survivor is dehydration, which is the loss of body fluids. This occurs with either a limited or nonexistent water supply. This can occur in either cold or hot environments. The process is seriously accelerated by exposure to tropical heat and the effect of high temperature on the body's metabolic process. The dehydration process is triggered, as fluid is lost in the body through excessive sweating when the body tries to cool itself down.

If dehydration process continues without fluid intake, it will result in acute dehydration and eventually death. Excessive sweating can also create a critical low salt level in the body. This sweating alters the consistency of the blood causing cramps in the limbs and abdomen.

NEVER, under any circumstances, drink urine or straight sea water. Urine and seawater have an extremely heavy salt content. This will considerably speed up the dehydration process.

Hunger and Thirst

A person may die within a few days if he does not get water but can survive weeks without food. In the survival situation, people should not be forced to eat if they do not feel like it.

Foodstuffs with high sugar content are best. As sugar is metabolized in the body, it yields some water helping the survivor to maintain a better water balance.

Survival craft rations consist of non-thirst provoking foods. It is good to eat the food ration along with the water ration.

Survival in case of fire or oil on the water

If you are in the area where surface oil is burning you should do the following:

- Discard your shoes and buoyant life preservers. (If you have an uninflated life preserver, keep it.)
- Cover your nose, mouth, and eyes and quickly go underwater.
- Swim underwater as far as possible before surfacing to breathe.
- Before surfacing to breathe and while still underwater, use your hands to push burning fluid away from the area where you wish to surface. Once an area is clear of burning liquid, you can surface and take a few breaths. Try to face downwind while inhaling.
- Submerge feet first and continue as above until clear of the flames.

If you are in oil-covered water that is free of fire, hold your head high to keep the oil out of your eyes. Attach your life preserver to your wrist and then use it as a raft.

Survival in shark-infested areas

Castaways in survival craft commonly report the presence of sharks. However, they are often reported as more of a nuisance than an actual hazard due to their tendency to bump against the underside of a lifeboat or a life raft.

The majority of shark attacks occur in tropical water, but this may be simply because more people swim in warm waters than cold water. While it is not known what actually motivates shark attacks, a desire for food and defense of territory seem to be the strongest favors.

Here are some preventive measures in shark-infested waters:

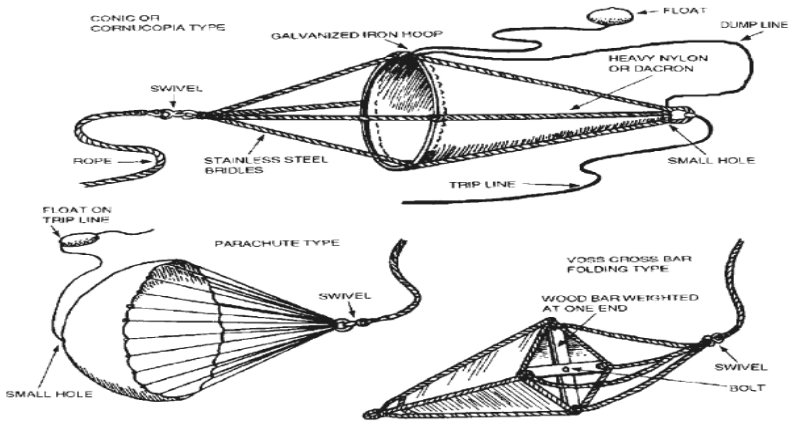
- Avoid erratic movements that produce sound waves underwater
- Stay out of the area where fish, animal blood, offal (wastes, dumped products) – these odors attract sharks
- Avoid trailing any part of your body in the water such as dangling arms or legs from life raft.
- Discourage a shark that threatens to attack or damage the life raft by jabbing at its snout or gills with an oar

If you are in the water, kick and splash to chase the shark away. If you are in group, keep together and kick and splash. Sharks prefer easy food.

Sea anchor

The sea anchor (or drogue) is a conical bag made of canvas. A small hole in the bottom of the bag permits water to get out and thus prevents the bag from collapsing. A tripping line is provided to ease hauling in the bag.

One of principal functions of a sea anchor is to provide stability in a rough sea. By trailing a sea anchor, you can minimize the possibility of capsizing in strong winds, or heavy seas. Because a raft floats on the water rather than in the water, it is susceptible to strong winds. Another important function of the sea anchor is its ability to slow down the drift of the raft (or lifeboat). This is important if you sent distress message with a position and you want to remain close to that area. Searchers will stay to look for wreckage and survivors at the last determined or confirmed position.



The principle involved in using a sea anchor is to create a "drag" effect that will do the following:

- Slow down the drift
- Give you direction and control
- Stabilize the raft
- Minimize capsizing

Duties of lookout

Lookout on the survival craft is called a bowman and its responsibilities and duties are the following:

- Handles the bow line and fenders when coming alongside or getting underway
- Responsible for the cleanliness of the boat
- He should be qualified to relieved the coxswain if necessary
- Collects water from humidity and rain
- He must always be ready with hand flares, parachute signals and torches for immediate use.

Facilitating detection

If you have succeeded in boarding the raft and there are people staying in the water, you must use the quoit line fixed to the raft floor to rescue other persons. Don't maneuver the craft going to the person for it will be difficult even in calm weather. If the person in the water is unconscious, one of the persons in the ramp should jump into the sea to save him with the quoit in his arms. During night time and you know that there are still persons in the water, light or fire a hand flare as soon as you are on the raft.

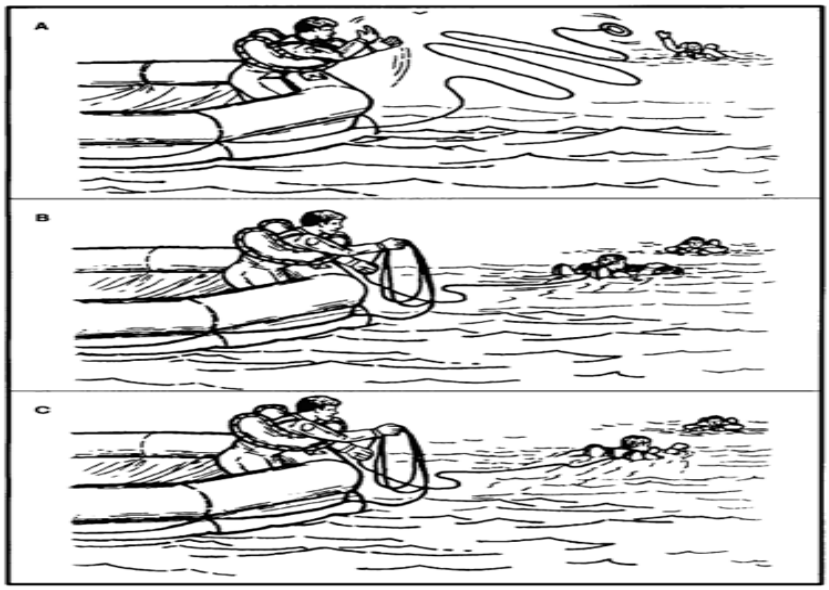


Figure 16-1. Rescue from water.

Maintaining morale

In maintaining the morale of the survivors, keeping the survivors active is important. An assignment to various task-nursing care, supply tally, rescue watch, among other activities will divert and occupy the mind and may help to keep hopes high. Lone survivor should make every effort to conserve energy and resources. They may imagine that they hear voices or see things that are not really there. Keeping the mind active with mental exercises may help to prevent this development.
Anxiety is the most contagious and can destroy chances of survival on the open sea. The best treatment for anxiety is to reassure patients and other people in the lifeboat and assign small task to keep them occupied. Acute agitation should be treated promptly, as situation demands. For some victims forcible restrain may need to be applied.

Use and working of shark repellents

Whether you are in the water or in a boat or raft, you may see many types of sea life around you. Some may be more dangerous than others. Generally, sharks are the greatest danger to you. Other animals such as whales, porpoises, and stingrays may look dangerous, but really pose little threat in the open sea.

Some of the measures that you can take to protect yourself against sharks when you are in the water are:

- Stay with other swimmers. A group can maintain a 360-degree watch. A group can either frighten or fight off sharks better than one man.
- Always watch for sharks. Keep all your clothing on, to include your shoes. Historically, sharks have attacked the unclothed men in groups first, mainly in the feet. Clothing also protects against abrasions should the shark brush against you.
- Avoid urinating. If you must, only do so in small amounts. Let it dissipate between discharges. If you must defecate, do so in small amounts and throw it as far away from you as possible. Do the same if you must vomit.

If a shark attack is imminent while you are in the water, splash and yell just enough to keep the shark at bay. Sometimes yelling underwater or slapping the water repeatedly will scare the shark away. Conserve your strength for fighting in case the shark attacks.

If attacked, kick and strike the shark. Hit the shark on the gills or eyes if possible. If you hit the shark on the nose, you may injure your hand if it glances off and hits its teeth.

When you are in a raft and see sharks--

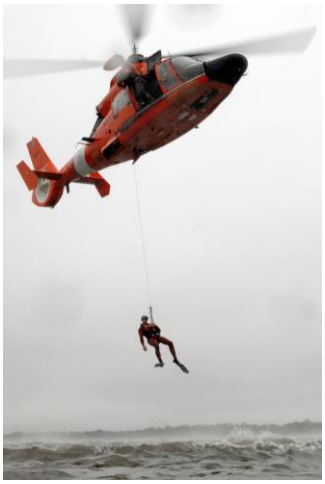
- Do not fish. If you have hooked a fish, let it go. Do not clean fish in the water.
- Do not throw garbage overboard.
- Do not let your arms, legs, or equipment hang in the water.
- Keep quiet and do not move around.
- Bury all dead as soon as possible. If there are many sharks in the area, conduct the burial at night.

When you are in a raft and a shark attack is imminent, hit the shark with anything you have, except your hands. You will do more damage to your hands than the shark. If you strike with an oar, be careful not to lose or break it.

Survival in water

- Do not try to swim if raft or net is available. Save your strength.
- Keep kicking your legs and moving all parts of your body to prevent numbness which will strike in 30 seconds of inactivity in cold water.
- Beware of drowsiness, which often comes on between 15 to 45 minutes after you enter the water.
- Shivering saps strength quickly. Deep rapid breathing and moving the arms and legs will usually stop it.
- Non-swimmers are most likely to lose their heads. Encourage them and keep talking to them calmly and quietly.
- Stay calm.

1.8 HELICOPTER ASSISTANCE



Rescue by helicopter is used both when rescuing badly-injured persons and when rescuing whole crews from the ship or survival craft.

During any kind of helicopter rescue, relating to inflatable life rafts, however, the arch tube should be emptied of air so that the canopy may be laid down in the raft. Otherwise, it will work as a sail and make the operation more complicated. On lifeboats, all construction should be laid down.

Under good weather conditions, the helicopter may be able to land on the water and the rescuing can be made from here.

In all cases, remember that the pilot of the helicopter decides how the operation has to be carried out.

1.8.1 Communicating with the Helicopter

The success of any helicopter / ship operation depends on establishing and maintaining good communications. This applies not only to the communications between the helicopter and the ship, but also to messages passed between the ship operator, the ship's agent and the helicopter operator.

Communications during the operation itself must be directly between the helicopter and the ship not relayed through any third party. The international language of shipping and aviation is English. To avoid any misunderstandings, especially if the language being used is foreign to any party involved, a standard message format. Before the operation can be agreed, it is essential that information on the facilities which the ship can provide for landing or for winching is exchanged and acknowledged between the ships can provide for landing or for winching is exchanged and acknowledge between the ship and the helicopter operation.

Hand and arm signals

If portable VHF radio sets are brought to survival crafts, communication may be easy. Hand signals may also be used.

DO NOT HOIST – arms extended horizontally, fingers, clench, and thumbs down

HOIST – arms raised above the horizontal, thumbs up

> **Note:** If the survivor has to give the hoisting signal himself, he should raise only one arm to prevent slipping out of the sling.

Communication with the use of shore station

Asking for a helicopter rescue should only be in a serious situation and should never be in a case of trivial illness or for your own convenience. Apart from the expense of helicopter evacuation, the pilot and crew often risk their lives to render assistance to ships at sea and their services should be used only in an emergency. After the call to the shore and evacuation is desirable; the coastguard will make the necessary arrangements and will keep in touch with the ship.

1.8.2 Evacuation from ship and survival craft

Rescue by helicopter of survivors at sea is a job that requires both courage and skill, especially in either fog or gale lashed seas. Horizons can disappear and the pilot may have great difficulty in estimating his height above the water. Winds under cliff face changes direction and force in a most haphazard manner. Yet the air-sea rescue crews will cheerfully brave all this and in spite of the elements achieve the rescue of survivors against all odds, often when it appears to the helicopter crews themselves to be humanly impossible.

Evacuation from Ships

Group all survival craft together to make a bigger target for the rescue services.

Should an aircraft or ship be sighted, ensure that survival routines are maintained right up until the moment of rescue. The rescue craft may have higher priorities.

Signal the ship or aircraft and continue this until the rescue unit has clearly indicated that the signals have been received. Take a roll-call of all persons, with notes of injuries sustained and treatment given.

If aerial or masts have been rigged, these should be taken down, particularly if helicopter are operating.

Evacuation from lifeboat and life rafts

Owing to the danger to the rotors, a helicopter requires a space on the ship to be clear of mast and other obstructions. Preferably, a raft, dinghy or boat drifted astern of the vessel, with survivors on board. The usual approach is for the helicopter to lower a member of its crew on a length of steel wire. He will have with him a helicopter strop, which is slipped over the survivor's shoulders and under his armpits. Held by the crewman, the survivor is then hoisted up to the helicopter. On occasion the helicopter may lower the wire, which will be weighted, without the crew member but with the helicopter strop attached. The survivor should slip the strop over his shoulders and under his armpits, signal crew to hoist and hold on.

1.8.3 Helicopter Pick Up

A helicopter might use a single-lift, double-lift, basket-lift or stretcher-lift for picking up survivors.

Methods of Helicopter Pick Up

1. Rescue sling or strop
2. Rescue seat or double lift
3. Rescue Basket
4. Stretcher-lift

Single-lift is a typical sling or harness. Approach the sling in a way so that it is always between you and the hoist. The sling is to be put under the armpits and the straps or clamp tightened. Keep your arms down along your body or grip the clamp while being pulled up so you don't slip out.

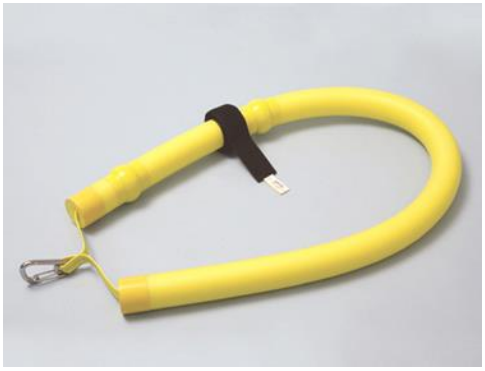


Figure: Rescue Sling

When using a **double-lift**, the helicopter sends a rescue a rescuer down to put the sling around the person to be rescued.

Figure: Double Lift

When using a **basket lift**, the person has to sit down, with arms and legs inside the basket. The head should be bent towards the knees and the hands around the knees. Keep still until the basket lift is on board the helicopter.

Figure: Basket Lift

A stretcher lift is used when rescuing badly-injured persons. A tiller or guiding rope is often used (also used with basket lifts) to help keep the stretcher clear of obstacles. Never make the tiller rope fast to the ship.

When a rescue is happening from a large ship, injured persons most often can be rescued from the deck. On smaller ships, a raft may be put aft to transfer the patient.

In the majority of cases where helicopter assistance is being given, a member of the air view will instruct and assist in the correct method of transfer. In the event of an aircraft being engaged and when the strop only is lowered without a frogman or winch man, the following list of precautionary measures are advised:

a. Do not touch the strop, winch wire or any part of the lifting hoist until the static electricity has been removed from the wire. The pilot will first earth the wire by allowing it to enter the sea or touch the deck of the ship, to remove static electricity.
b. Keep the lifejacket on and place the strop over the upper part of the body, around the back and over the lifejacket. Draw down the toggle of the web straps and ensure a tight fir around your person.
c. Once secured inside the strop and ready to be hoisted, give a "thumbs up" signal to the winch man or observer of the helicopter.
d. Place your arms at the side (when engaged in the United Kingdom) or follow instructions of the landing officer.
e. When level with the helicopter access, wait until instructions are received from the helicopter crew.

Hand and arm signal used for safe lifting

Hand signals should be preplanned and practiced before the operation. It is important that the hand signals not impair the crew's ability to fly the aircraft. When using hand signals, the PC and hoist operator should be positioned on opposite.

Examples of hand signals used during hoist operations:

- Movement of the helicopter can be indicated by moving the open hand in the desired direction with the palm facing in that direction.
- Hold in present position is indicated by a clenched fist.

- Movement of the hoist is indicated by extending the thumb either up or down from clenched fist.
- Fingers are used to indicate number of feet.

Helicopter crew assistance

A member of the helicopter crew assists in the rescue operations especially if the persons to be rescued are not familiar in helicopter hoist or if there are people who are injured. They can use double lift in lifting. When using a double-lift, the helicopter sends a rescue a rescuer down to put the sling around the person to be rescued.

General Precautions for Seafarers When Working with Helicopters

a. Do not secure any lines passed down from the helicopter.
b. Do not touch the winch man, stretcher, or hook wire until wire is earthed.
c. Do not fire rockers or rocket line throwing apparatus in the vicinity of the aircraft.
d. Do not transmit on radio while winch procedure is ongoing.
e. Do not direct strong lights into the helicopter's direction when working operations at night.

Unless otherwise instructed by the pilot, or if exceptional circumstances dictate, the surface vessel should steer with the wind 30 degrees or follow this procedure/s:

a. The port bow if rescue is aft.
b. The starboard bow if the rescue is midships.
c. The starboard quarter if the rescue area is forward.
    - In addition, the vessel should be prepared for these reasons:
    - The rescue area is clear of all loose objects and all aerials are removed.
    - A wind indicator is could be flying a windsock, flag, or smoke. If smoke is used, it should not interfere with the aircraft's vision. When operating at night, the wind indicator should also be illuminated.
    - Always wear rubber gloves when handling winch wire.
    - Illuminate the operational area when engaged in night operations.

1.9 EMERGENCY RADIO EQUIPMENT

1.9.1 Search and Rescue Transponder (SART)

A Search and Rescue Transponder (SART) is an electronic unit which reacts to the emissions of X-band radars. It has a receiver which scans for VHF signals between 9.2GHz – the frequencies on which X-band radar transmits its signal.

With the implementation of Global Maritime Distress Safety System (GMDSS), all compulsory of X-band vessels up to 500 tons must carry at least one SART. Above 500 tons, they must carry at least two. Non-compulsory vessels are strongly advised to carry at least one to aid in any possible rescue.

1.9.2 How does SART works?

- As soon as the SART detects a signal, it immediately transmits its own signal on the same frequency. This signal consists of a series of twelve pulses, and these are displayed on the screen of the radar as a series of twelve echoes with a gap of 0.6 miles between each of them.
- The first dot is at the position of the SART, with the remainder radiating in a straight line towards the edge of the screen.
- As the rescue vessel approaches the SART, the twelve dots each become short arcs. These arcs increase in size as the vessel gets closer, until the signal from the SART is permanently activated by the weakest side-lobes from the radar transmission. The signal from the SART becomes twelve concentric circles on the radar screen and this tells the would-be rescuers that they have more or less arrived.
- When a SART is switched on, it will show a light to indicate that it is working. An approved SART should have sufficient power to operate in this stand-by mode for at least 96 hours. When it receives a signal from the X-band radar, and transmits its own signal, it will either flash this indicating light or in some cases, a second light or even a buzzer. This will serve to let the distressed persons know that approaching radar is activating the SART. If the survivors have handheld VHF with them, then this would be a good time to use it to try calling the approaching ship.

1.9.3 Mounting of SART

To ensure best performance the AIS SART should be mounted as high as possible on the liferaft and at least one meter above sea level. The whole body of the AIS SART should be clear of any metallic obstruction and should have a clear view of the sky. Deployment inside the canopy of an inflatable liferaft is acceptable. The AIS SART should be activated before deploying on either the telescopic pole or lanyard.

Deploying outside the liferaft canopy

- Remove the lanyard spool from the top of the telescopic pole and tie the free end of the lanyard to a fixing point within the liferaft.
- Extend the telescopic mounting pole as indicated in Figure 8.
- Push the larger end of the telescopic mounting pole into the socket on the base of the AIS SART as indicated in Figure 9.
- Deploy the AIS SART through the SART opening in the liferaft.
- Place the lower end of the pole in the pocket provided in the liferaft.

1.9.2 Portable VHF transceiver

Number of VHF transceiver onboard

A two-way VHF radiotelephone apparatus is a light-weight, compact, water-proof, and handy emergency radio equipment capable of use in both lifeboats and life rafts. It is so simple and easy to use that even unskilled person can use it an emergency.

At least three two-way VHF radiotelephone apparatus shall be provided on every passenger ship and on every cargo ship of 500 gross tonnage and upwards. At least two two-way VHF radio-telephone apparatus shall be provided on every cargo ship of 300 gross tonnage and upwards but less than 500 gross tonnage. Such apparatus shall conform to performance standards not inferior to those adopted by the organization. If a fixed two-way VHF radiotelephone apparatus is

fitted in a survival craft, it shall conform to performance standards not inferior to those adopted by the Organization.

An approval two-way VHF radio-telephone apparatus for survival crafts shall be stowed in a protected and easily-accessible position ready to be removed to any survival craft in case of abandon ship. It shall be portable, watertight, capable of floating in sea water, and capable of being dropped into the sea without damage.

Battery requirement for VHF transceiver

The battery pack in all cases must have sufficient capacity to ensure a minimum of 8 hours of operation at the highest SCT RF power output. The batteries are based on a duty cycle of 1:9 for the non-chargeable type as well as the rechargeable type. Batteries are marked with month and year of manufacture. These batteries must be replaced on or before the expiration date, there is no grace period. The IMO has set up some specifications that we should be aware and give minimum requirements for these units. The SCT must be capable of radiating a minimum Radio Frequency (RF) power of 250 mw (milliwatts) or 1/4 watt.

Usage of portable VHF transceiver

The controls on a two-way VHF radio-telephone apparatus are very simple. The basic controls consist of a volume control which often incorporates the on/off switch, a control for selecting the channel, and a squelch control. The squelch control is used to suppress noise interference.

Recharging batteries

The primary battery unit is a 7.2V / 5000mAh lithium cell. This unit is specially designed for GMDSS emergency use to preserve a long shelf- and operating-life.

Battery change procedure:

1) Hold down the two push-buttons on each side, and pull the battery pack out of the housing.

2) Check the gasket inside the housing for no damage. If it is broken, replace it with a new (stock no. X-93024). Remove dirt when replacing the gasket.

3) Replace the expired battery. The label on the battery is marked with date of replacement. The primary battery is equipped with a seal to prevent inadvertent

use. Break this seal before use. Breaking this seal indicates that the shelf life has expired.
4) Push the new battery unit into the housing until you hear the two pushbuttons are clicking into right position. Tron VHF will not be waterproof unless the pushbuttons are in correct position.

1.9.3 Emergency position-indicating radio beacons (EPIRBs)

The Emergency Position Indicating Radio Beacon (EPIRB) is one of the most important lifesaving equipment on board ship. As its name implies, it is used for transmitting a distress alert and for guiding the rescuers to the position it indicates. An operating EPIRB means that somebody is in distress and an immediate assistance is needed.

The early development of EPIRB was more for aircraft than for ships. The earliest EIPIRB transmitted on the aircraft frequencies of 121.5MHz and/or 243MHz. They simply transmit a signal usually alternating tones to be received on the emergency frequency on a normal aircraft radio – 121.5MHz being the civil emergency frequency and 243MHz for military equivalent.

With the dawning of the space age, it was later realized that an EPIRB could be used to raise the alarm in a distress situation. An additional higher frequency of 406MHz was later assigned for specialized EPIRB. This higher frequency could be made more stable which makes fixing position from the satellite much easier. The signal on this frequency incorporates a coded message to provide identification of the vessel to which the EPIRB is licensed.

The best EPIRB would be one that could transmit on both frequencies: 406MHz to give the satellite the best chance of getting a good fix on the EPIRB position and 121.5MHz for any searching aircraft to home on. A 406MHz MHz EPIRB transmits a short-coded message every 50 seconds when activated. Each half-second burst indicates the identity of the vessel to which the EPIRB is registered.

Another type of EPIRB is the INMARSAT EPIRB. It operates in one of the normal INMARSAT frequencies of 1.6GHz. It must either be programmed with its position or more normally, it contains an integrated GPS receiver.

Four types of EPIRBs

Inmarsat E EPIRB

Inmarsat E EPIRBs transmit a distress signal to Inmarsat geostationary satellites which includes a registered identity similar to that of the 406 MHz EPIRB and a location derived from a GPS navigational satellite receiver inside the EPIRB. Inmarsat EPIRBs may be detected anywhere in the world between 70 degrees North latitude and 70 degrees South latitude. Since geostationary satellites are used, alerts are transmitted nearly instantly to a rescue coordination center associated with the Inmarsat coast earth station receiving the alert. Alerts received over the Inmarsat Atlantic Ocean Regions are routed to the Coast Guard Atlantic Area command center in New York, and alerts received over the Inmarsat Pacific Ocean Region are routed to the Coast Guard Pacific Area command center in San Francisco.

COSPAS SARSAT

COSPAS-SARSAT is an international, humanitarian satellite-based search and rescue system that has helped save over 20,000 lives worldwide since its inception in 1982 (total as of June 2005). SARSAT is an acronym for Search and Rescue Satellite-Aided Tracking. COSPAS is an acronym for the Russian words "Cosmicheskaya Sistyema Poiska Avariynich Sudov," which mean "Space System for the Search of Vessels in Distress," indicative of the maritime origins of this distress alerting system.

VHF EPIRBs (121.5 Mhz)

121.5 MHz Emergency Position Indicating Radio Beacon or EPIRB (marine type) beacons can no longer be manufactured or sold in the U.S. By 2005 certain categories of aircraft, depending on circumstances and use, have been required to carry a 406 MHz Emergency Locator Transmitter (ELT). And as of January 1st, 2007, it is illegal to carry or use a 121.5 MHz EPIRB aboard any vessel in American waters. Please note: 121.5 MHz Man Overboard Devices will still be legal for use beyond 2009.

How EPIRB is used

If an EPIRB is accidentally activated in the transmit mode, it should be turned off at once by removing the battery. Cancel the false alarm by calling the nearest Coast

Station and also make a safety call on the VHF radio for the benefit of vessels in the vicinity. Failure to cancel the false alarm may cause fine or additional expenses to your vessel as payment for any rescue preparation and/or RCC's operational expenses.

How an EPIRB saves lives:

- If the vessel sinks, the EPIRB will be automatically released from its bracket when subjected to water pressure at 2-4 meter depth, and then float up to the surface. It will be automatically activated and start to transmit vessel identity and positioning signals to the COSPAS/SARSAT satellites.
- The satellite forwards the signal to a ground receiving station or local user terminal (LUT) where the position will be calculated and transferred to a Mission Control Center (MCC).
- The necessary command will be sent to the nearest Rescue Control Center (RCC) which coordinates the rescue operation. Finally, the search and rescue forces (SAR) bring the distress to a satisfactory conclusion.
- An approved EPIRB has 48 hours of continuous operation.

PERSONAL SAFETY AND SOCIAL RESPONSIBILITY (PSSR)

INTRODUCTION

This course is designed to train all seafarers in complying with emergency procedures, preventing pollution of the marine environment, observing safe work practices, fostering clear and effective communication on board, maintaining good human and working relationships and take necessary actions to control fatigue.

It shall cover mandatory training requirements for the trainee under Section A-VI/1 Paragraph 2.1.4 and columns 1 and 2 of Table A-VI/1-4 of the STCW Code, 2010.

I. COMPLYING WITH EMERGENCY PROCEDURES

EMERGENCY – a situation that poses an immediate risk to health, life, property, or environment.

Whenever some incident of a serious or harmful nature happens, we classify it as an emergency. One of the most important factors in dealing with an emergency situation is the presence of a solid action plan apart from a sharp mind and lack of fear.

Nevertheless, the situation on a ship is more critical since normally ships are isolated floating objects moving in the vast and deep seas. It is therefore necessary to know about the emergency essentials since there are so many types of emergencies which might arise when a ship is sailing or even at port.

Some of the most common emergencies on board are caused by the following:

1. Carelessness
2. Deliberate disregard of safety rules and notices
3. Lack of knowledge (i.e. ignorance) of the person's duties and responsibilities
4. Lack of awareness of existing hazards of the profession.

Types of Emergencies On Board

1. Fire – one of the most serious risks for property and persons, as well as for the surrounding environment.
2. Flooding – unwanted ingress of the sea water in large quantities can occur for a variety of reasons. It can be due to the bursting of any pipeline carrying sea water.
3. Collision – results from a ship crashing into a still or floating object. Ship collision cases can be a ship to ship, ship to floating object, ship to submarine or ship to still structure collisions.
4. Grounding – involves the impact of a ship on the seabed, resulting in damage of the submerged part of her hull and particularly the bottom structure, potentially leading to water ingress and compromise of the ship's structural integrity and stability.

5. Man Overboard (MOB) – is a situation in which a person has fallen off a boat or ship into the water and is in need of rescue.

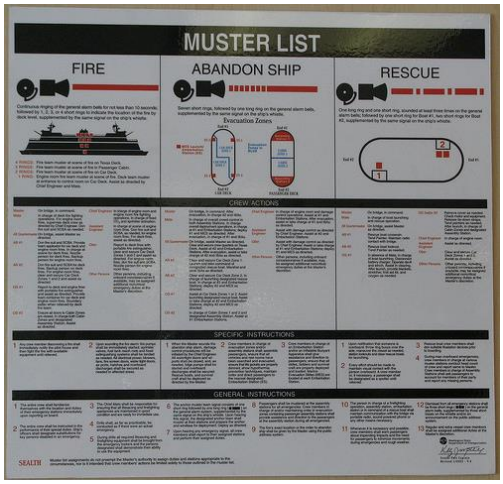
6. Abandonship – to leave a ship that is in danger of sinking.

Emergency signals:

- General Alarm - consists of seven (7) or more short blast followed by one (1) long blast on the ship's whistle. *(Instruction: Get ready)*
- Boat Alarm - at least (7) short blast followed by one (1) long blast repeated on the ship's whistle. *(Instruction: All to attend their station wearing life jacket)*
- Fire Alarm - continuous blast of the whistle for a period of not less than 10 seconds followed by continuous ringing of the general alarm. *(Instruction: All to attend their stations bringing along their assigned fire fighting equipment)*
- Man Over Board Alarm - the letter "O" sounded at least four times on the ship's whistle followed by the same signal sounded on the fire bells. *(Instruction: rescue boat crew to muster station immediately carrying the immersion suit)*

Important Things to Remember in case of Emergency

1. Know your duties, items to bring, etc. in case of emergency.
2. Be prepared always as emergencies could happen any time.
3. Knowledge and training (including drills) can give you the best chances to survive/cope with an emergency



Drills and Muster

Muster list – is a plan of action prepared to be followed in case of an emergency. It is composed of specific duties allocated to crew members, division of crew in various squads and teams, muster stations, emergency headquarters, etc.

SOLAS Chap3, Reg 53

- The muster list shall specify details of emergency alarm and action to be taken by each individual when this alarm is sounded.
- Shall specify the exact means by which an "abandon ship" order will be issued.
- The muster list shall specify which officers are assigned to ensure that the life saving and fire appliances are maintained in good condition and ready for emergency use.
- Muster list shall identify substitutes for 'key persons'.
- Shall specify the duties assigned to crew in relation to passengers in case of an emergency.
- Shall contain means of intra-ship communications in an emergency.
- Shall define the "emergency muster point'.

Actions to be taken on hearing emergency alarm signals and discovering potential emergencies:

- Raise the alarm
- Attire yourself adequately and properly
- Go to your muster station
- Find out nature of the emergency
- Take action as per muster list or duty list

Contingency Planning

Under the ISM Code, every company is required to identify the various contingencies that could occur on board and draw up drills and procedures to deal with such contingencies.

Chapter III, Regulation 53 of SOLAS stipulates guidelines for the drawing up of such muster lists and contingency plans.

IMO stipulates, as part of ISM, that every company must have a contingency plan for all perceived ship or environment threatening incident. Such plan includes all aspects like training, organization, communications and reporting systems.

Contingency plan gives the broad outline, while the "Muster List" delegates the duties to individuals.

Value and Need of Drills and Training

- Regulatory or legislative needs, i.e. requirements of SOLASS, MARPOL, STCW, ISM, etc.
- Operational need - to ensure correct and effective action, can only be achieved by regular and realistic drills
- State of mind, e.g., on exposure to an emergency, all persons are affected and there is general dip or reduction in performance. This dip in performance can only be compensated for by regular and realistic drills

Importance of Musters and Drills

1. It prepares a trained and organized response to situations of great difficulty, which may unexpectedly threaten loss of life at sea.
2. It is important that they should be carried out realistically, as closely as possible to emergency situations.
3. The muster list should be conspicuously posted before the ships sail and, on international voyages and in ships of Classes II A and III, should be supplemented by emergency instructions for each crewmember.

Internal Communication

Internal communications in use on board ships for emergency

situations:
- Telephone
- Emergency powered or sound-operated phone
- Public address systems
- Lifeboat VHF
- Walkie-talkies
- Emergency alarms, etc.

Manning, Musters and Drills

1. Every emergency station should be under the command of a qualified person designated in advance with a deputy. He should check that everyone is present at muster stations and make sure that they know their respective duties.
2. At least three experienced lifeboat men should be placed on each boat.
3. Musters to the emergency station should take place at least once every 7 days. The drills should be performed without any prior notice.
4. When the signal for muster is given, all persons on the installation should be wearing lifejackets, then proceed to their respective emergency stations.
5. Each muster should be followed by a drill, as realistically performed as possible. The drill should comprise the following:
    a. The use, handling and correct operation of all life-saving appliances.
    b. Starting of the engine in the man-over-board boat and lowering it to the surface of the water surface and launching trials when conditions so permit.
    c. Summoning of standby vessels.
6. After the drill has been completed, all equipment should be examined and brought up to standard by regulations.
7. The carrying of musters and drills should be entered in a special journal.
8. The Maritime Directorate and the Ship Control may at any time require musters and drills to be carried out.

Importance of Knowledge in the Emergency Procedures

Emergency procedures are necessary to counter accidents and other unplanned events that threaten the lives of the crew, passenger, and valuable property. Often an accident or emergency such as fire will be quickly resolved, if the correct thing is done in the very first few minutes. However, if a small emergency is not dealt with immediately, it can develop into a life-threatening and potential ship loss situation. Therefore, emergency procedures are set to overcome these potential problems. It is essential that crewmembers know what the emergency procedures are for a

particular emergency and have the discipline and training to effectively counter that emergency.

Emergency Teams

A. Roles of Team Leaders
   1. Must be capable of carrying out any tasks that may be assigned to members of their teams.
   2. Must ensure that his team members are efficiently trained and ready for any emergency.
   3. Must never allow himself to be too involved in any one activity that he is doing.

B. Team Formation

1. Bridge Team
   - Responsible for command and control of the situation
   - Ensures that an efficient muster of personnel is carried out
   - Institutes a controlled search for unaccounted personnel if required
   - Ensures a smooth and well-coordinated rescue or safety controlled program or plan.
2. Engine Room Team
   - Advise the bridge of the state of readiness of the engine room
   - Indicate status of plan and emergency system
   - Determines if an emergency has an adverse effect on plant operation
   - Plans whatever actions are needed to be taken to remedy any deficiencies to the engine room and emergency system
   - Maintains or puts in place essential emergency services
3. Emergency Teams No. 1 and No. 2
   - They first muster and report readiness to the Bridge
   - Prepares emergency equipment to take action as directed by the Master or designated officer in charge
4. Support Team
   - Advises readiness to the Bridge and provides supports logistics to the emergency teams in the following forms:
     a. Hospital and first aid facilities
     b. Prepare lifeboats and life rafts
     c. Provides breathing apparatus to emergency teams
     d. Provides additional firefighting equipment
     e. Maintains security patrol
     f. Makes available whatever appropriate life-saving equipment and protective apparatus

5. Reserve Team
   - Provides additional personnel to the different teams as deemed prudent

II. MARINE POLLUTION PREVENTION

Marine Pollution

Marine pollution is the release of by-products of human activity that cause harm to natural marine ecosystems. The pollutants may be sewage, toxic chemicals, oil spills, marine litter, overfishing or inert materials that may smother, choke, or strangle living organisms.

GESAMP – The Group of Experts on Scientific Aspects of Marine Environmental Protection is an advisory body, established in 1969, that advises the United Nations (UN) system on the scientific aspects of marine environmental protection.

GESAMP defines marine pollution as: "Introduction of man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazard to human health, hindrance to marine activities including fishing, impairment of quality for use of sea-water, and reduction of amenities."

Causes of Marine Pollution

A. Intentional Pollution

- Discharge into the sea of ballast water from fuel oil tanks
- Discharge into the sea of ballast water from cargo tanks
- Discharge into the sea of slops from tank cleaning
- Discharge into the sea of oily water from machinery bilges
- Throwing overboard of trash and garbage within restricted zones
- Throwing overboard dunnage
- Discharge into the sea of raw sewage

B. Unintentional Pollution

- Overfilling of tanks
- Wrong handling of valves
- Faulty or non-functional equipment
- Blowing overboard trash or garbage
- Marine accidents like: grounding, collision, explosion, etc.

Effects of Marine Pollution

- Oil spilling is hazardous for the marine life. It seriously affects the life cycle of coral reefs thriving in the ocean.

  The oil spilled in the ocean could clog up the gills of fishes, hence preventing their respiration. It affects the process of photosynthesis of marine plants, since it blocks the sunlight.

- Toxic wastes have direct effect on marine life and affect the human beings indirectly. When the harmful toxic wastes are dumped into the ocean, the fishes could consume the poisonous chemicals. When the fish is eaten by humans, this could lead to food poisoning.

- Dumping of garbage into ocean can deplete the oxygen dissolved in water. As a result, the health of marine life is affected seriously. Due to lack of oxygen, the sea animals including whales, seals, herrings, dolphins, penguins, and sharks could perish.

- Carbon dioxide is hazardous for marine life including coral reefs and free-swimming algae.

- Plastics dumped into ocean can affect the marine life seriously. Plastic items such as bottles and bags could choke and suffocate the sea animals, as they eat them thinking that they are food. Plastics are known to be a major cause for the death of turtles, as they swallow the floating bags, mistaking them for jelly fish.

- Dumping of industrial wastes such as pesticides, especially DDT, can accumulate in the fatty tissue of animals. This could lead to the failure in the reproductive system of mammals and birds.

Events and Conventions on the Prevention of Marine Pollution

*Conference of 1929 – International Conference in Washington DC, USA in an apparent attempt to control discharge to the sea but was unsuccessful in adapting any Convention paper. It was disrupted by the staging of Second World War.

*OILPOL Convention - The 1954 Convention, which was amended in 1962, 1969 and 1971, primarily addressed pollution resulting from routine tanker operations and from the discharge of oily wastes from machinery spaces - regarded as the major causes of oil pollution from ships.

The 1954 OILPOL Convention, which entered into force on 26 July 1958, attempted to tackle the problem of pollution of the seas by oil - defined as crude oil, fuel oil, heavy diesel oil, and lubricating oil in two main ways:

- it established "prohibited zones" extending at least 50 miles from the nearest land in which the discharge of oil or of mixtures containing more than 100 parts of oil per million was forbidden; and

- it required Contracting Parties to take all appropriate steps to promote the provision of facilities for the reception of oily water and residues.

*In 1962, IMO adopted amendments to the Convention which extended its application to ships of a lower tonnage and also extended the "prohibited zones." Amendments adopted in 1969 contained regulations to further restrict operational discharge of oil from oil tankers and from machinery spaces of all ships.

*Torrey Canyon – In 1967, the tanker Torrey Canyon ran aground while entering the English Channel and spilled her entire cargo of 120,000 tons of crude oil into the sea. This resulted in the biggest oil pollution incident ever recorded up to that time. The incident raised questions about measures then in place to prevent oil pollution from ships and also exposed deficiencies in the existing system for providing compensation following accidents at sea.

*1973 Convention – Finally, an international Conference in 1973 adopted the International Convention for the Prevention of Pollution from Ships. While it was

recognized that accidental pollution was spectacular, the Conference considered that operational pollution was still the bigger threat. As a result, the 1973 Convention incorporated much of OILPOL 1954 and its amendments into Annex I, covering oil.

*1978 Conference – In 1978, in response to a spate of tanker accidents in 1976-1977, IMO held a Conference on Tanker Safety and Pollution Prevention on February 1978. The conference adopted measures affecting tanker design and operation, which were incorporated into both the Protocol of 1978 relating to the 1974 Convention on the Safety of Life at Sea (1978 SOLAS Protocol) and the Protocol of 1978 relating to the 1973 International Convention for the Prevention of Pollution from Ships (1978 MARPOL Protocol) - adopted on 17 February 1978.

As the 1973 Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument - the International Convention for the Prevention of Marine Pollution from Ships, 1973 as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) - finally entered into force on 2 October 1983 (for Annexes I and II).

Annex V, covering garbage, achieved sufficient ratifications to enter into force on 31 December 1988, while Annex III, covering harmful substances carried in packaged form, entered into force on 1 July 1992. Annex IV, covering sewage, enters into force on 27 September 2003. Annex VI, covering air pollution, was adopted in September 1997 and enters into force on 19 May 2005.

*****MARPOL Convention – is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and updated by amendments through the years.

The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes:

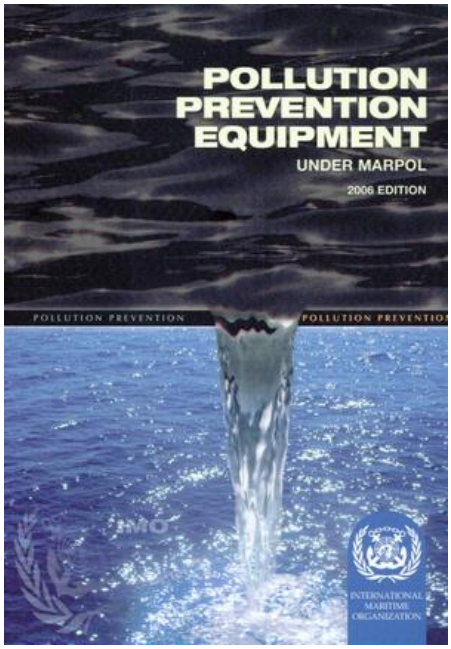
Annex I	**Regulations for the Prevention of Pollution by Oil**
Annex II	**Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk**
Annex III	**Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form**
Annex IV	**Prevention of Pollution by Sewage from Ships**
Annex V	**Prevention of Pollution by Garbage from Ships**
Annex VI	**Prevention of Air Pollution from Ships** (entry into force 19 May 2005)

Major Oil Spills

Year	Location	Description
1990	USA	The tanker, American Trader, leaked 300,000 gallons of crude from a gash in the hull causing an oil slick 14 miles long polluting Bosa Chica, one of southern California's biggest nature preserves.
1989	Morocco	After explosions and a fire Iranian tanker Kharg-5 was abandoned spilling 70,000 tonnes of crude oil, endangering the coast and oyster beds at Oualidia.
1989	USA	Exxon Valdez grounded and spilled 10 million gallons (38,800 tons) of crude oil into Prince William Sound in Alaska.
1988	700 nautical miles (1,300 km) off Nova Scotia, Canada	Odyssey
1983	South Africa	Fire broke out on the Spanish tanker Castillo de

		Bellver and 175.6m gallons of light crude burnt off the coast at Cape Town. Fire broke out on the the Castillo de Bellver and its cargo of 252,000 tonnes of oil burnt.
1983	Persian Gulf	Nowruz oil field
1983	Saldanha Bay, South Africa	Castillo de Bellver
1979	Trinidad	160,000 tons of crude oil spilled after a collision off Tobago between the Atlantic Empress and the Aegean Captain.
1978	France	Wrecked tanker Amoco Cadiz spilled 220,000 tons gallons off the Brittany coast.
1978	France	About 67.2m gallons of crude spilled after the Amoco Cadiz ran aground near Portsall in France's worst ever tanker accident. The resulting slick eventually covered 125 miles of Breton coast.
1977	Northern Pacific	Liberian-registered Hawaiian Patriot caught fire in the Northern Pacific spilling 30.4m gallons.
1976	USA	The Argo Merchant ran aground off Nantucket spilling 7.7m gallons of oil and causing a slick 100 miles long and 60 miles wide.
1976	A Coruña, Spain	Urquiola
1972	Oman	After a collision with Brazilian tanker Horta Barbosa the South Korean tanker Sea Star spilled

		about 35.3m gallons of crude into the Gulf of Oman.
1970	Sweden	At least 15.3m gallons (Imperial) of oil spilled in a collision involving the Othello in Tralhavet Bay.
1970	Sweden	15.3m gallons of oil spilled in a collision involving the Othello in Tralhavet Bay.
1967	UK	The Torrey Canyon spilled 119,000 tons of crude off the Scilly Islands (Cornwall) in the UK.



Pollution Prevention

Prevention is the most effective way to stop marine pollution. Basic environmental protection procedures can prevent operational pollution. Following the pollution discharge restrictions will go a long way towards preventing marine pollution. Taking simple precautions such as putting "drip pans" under oil valves and other oil connections. Accidental pollution can be prevented through the use of checklists, to ensure adherence to proper procedures.

To avoid pollution:

- Use and follow checklists
- Use containment devices
- Recycle as much as possible
- Observe discharge restrictions

SOPEP – Regulation 37 of MARPOL Annex 1 states that each tanker over 150 GRT and vessels other than tankers over 400 GRT must have on board a Shipboard Oil Pollution Emergency Plan (SOPEP) approved by the Flag Administration or Classification in fact on behalf of the flag admin.

The purpose of the Plan is to provide guidance to the Master and officers on board the ship with respect to the steps to be taken when an oil pollution incident has occurred or is likely to occur. SOPEP in itself is a guide line for the response of the vessel's crew in case of oil pollution and how to report, who will be reporting and what should be reported.

Oil Record Book (ORB) – An Oil Record Book Part I shall be carried on board every oil tanker of 150 gross tons and above and every other ship of 400 gross tons and above to record relevant machinery space operations. In addition, Oil Tankers of 150 gross tons and above shall carry an Oil Record Part II to record cargo and ballast operations.

The Oil Record Book contains many references to oil quantity. The limited accuracy of tank measurement devices, temperature variations, and clingage will affect the accuracy of these readings. The entries in the Oil Record Book should be considered accordingly.

III. OBSERVANCE OF SAFE WORKING PRACTICES

Working on ships is a hazardous occupation to which we are exposed as soon as seafarers step on board. The necessity of understanding the hazards, equipment and procedures is a must to avoid the risk of accidents that can lead to injury or the loss of life.

This unit involves the skills and knowledge required to implement regulatory requirements for occupational health and safety on board ships, including following and applying established maritime safe working practices and procedures and hazard control strategies.

These are the proper safety procedures to be considered having:

- Protective clothing (PPE) and equipment
- Fire precautions and firefighting
- Proper lifting/carrying
- Movement about the ship access to the ship

- Entering close and confined spaces
- Tool safety, welding, and flame cutting operations
- Painting
- Working aloft and outboard
- Dangerous cargoes
- Falling and moving objects
- Mooring
- Hatches
- Lifting and mechanical appliances
- Working with machinery
- Work in the galley
- Occupational and Personal Health

Such are the most likely hazards on board ships:

- Gangway and safety net
- Main deck
- Holds and hatches
- Forecastle and poop deck
- Engine room
- Windlass, anchors and winches
- Cranes or derricks
- Accommodation
- Bridge
- Manifold and deck pipelines
- Galley

Safety– This is the state of being free from danger or . It is the exemption from hurt, injury, or loss.

Safety on board ships has come a long way, but there is still a lot of scope to improve. Most of the accidents at sea are due to Human Error. Human error can be reduced by proper training and motivation. Accidents mainly happen due to lack of management, taking shortcuts, complacency, attitudes, etc.

Reasons why Safety Should be Given Importance On Board

- Powerful machinery
- High pressure gases and liquids
- High electrical voltages

- Unpredictable forces of nature
- High-speed equipment
- Volatile fuels
- Heavy lifts

Personal Responsibility to Ensure Safety On Board

- Observance of safety precautions, signs, notices, etc.
- Wearing of appropriate personal protective equipment (PPE)
- Observance of appropriate safety procedures at all times

Nature of Shipboard Hazards

Various shipboard hazards include the following:

• Slips, trips and falls due to slippery surfaces (oil, grease, garbage, water, ice, etc.) or obstructions (pipelines, welding cables, lashing eyes, wires, ropes, etc.)
• Head injuries due to low doorway entrances, overhead loads, falling equipment or material, etc.
• Falls through open manholes, unfenced tween-decks, loose or missing gratings, etc.
• Clothing, fingers, etc. getting caught in moving machinery such as grinding wheels, winch drums, gears, flywheels, etc.

- Burns from steam pipes, hot machinery, welding sparks, etc.
- Eye injuries through chipping, welding, chemicals, etc.
- Injuries and sliding/fall of unsecured equipment due to ship movements in rough weather
- Hazards of extreme weather
- Lack of oxygen in confined spaces
- Presence of hydrocarbon gas and toxic gases
- Hazards of chemicals used on board
- Fire
- Collision/grounding/flooding/ sinking
- Pirates and stowaways

Equipment provided on board to counter hazards:

Personal protective equipment:

- Helmet
- Goggles
- Gloves
- Safety shoes
- Dust masks and respirators
- Protective clothing
- Self-contained breathing apparatus

Life-saving appliances:

- Lifejackets
- Lifebuoys
- Life rafts
- Lifeboats
- Line-throwing apparatus
- EPIRBs and SARTs
- TPAs and immersion suits

Firefighting appliances:

- Fire hoses, nozzles, hydrants, and fire main
- Portable fire extinguishers
- Fire axe
- Fire-detecting system
- Fixed extinguishing system

Medical equipment:

- Resuscitator
- Stretcher
- Medicines
- Medical equipment

Oil spill equipment:

- Absorbent rolls
- Chemical dispersant
- Sawdust, brooms, dust pans, shovels and barrels

Use and Demonstration of PPE (Personal Protective Equipment)

Head Protection

Gloves

Eye protection

Ear protection

Respiratory protection

Safety footwear

Safety Harness

Hazardous Operations to Personnel or Ship

- Loading/unloading of cargoes
- Mooring
- Working aloft
- Handling of chemicals
- Engine-room watch keeping and maintenance
- Lifting loads (manually and mechanically)
- Entry into enclosed spaces
- Hot work
- Anti-piracy and stowaway operations

Manual Lifting, Carrying and Mechanical Appliances

Many people have sustained serious back and other injuries during manual lifting or carrying operations as a result of accidents, poor organization, or unsatisfactory working methods. Employers should always aim to find safer practicable alternatives to such operations on board ship.

In manual lifting and carrying, the proper procedure to be followed as a matter of habit is to size up the load to be lifted, look for sharp edges, protruding nails or splinters for greasy or other surfaces which may affect grip and for any other features, which may prove awkward or dangerous. (e.g., sacks of bulk commodities may be difficult to get off the deck.)

For mechanical lifting appliances, a qualified person should regularly inspect, examine and test all appliances and gear used for lifting, lowering and handling loads on a ship. Records including particulars of such checks should always be kept up to date.

Never use any appliance or gear which has not been checked, or is in any way defective. If you notice any defect during use, stop the operation and report the problem immediately. Do not exceed the safe working loads marked on appliances or gear, and follow the directions shown on controls.

Loading and unloading of cargoes

In general, cargo vessels, bulk carriers, and container ships cargo is lifted on and off the vessel by cranes or derricks. Bulk cargo is poured into the ship's hold by conveyor belts. The hazards on these vessels, in the holds and on the jetty alongside are mainly from overhead loads, lifting gear and cargo handling equipment such as trucks and forklifts.

Ro-ro ships and car carriers have several decks connected by ramps. Cargo is driven on and off the vessel and up to the various decks via the ramps.

In tankers, chemical carriers and gas carriers cargo is in the liquid state and is pumped into and out from the ship through pipelines. The main hazard is from gas, which could be flammable, toxic, or could cause a lack of oxygen.

Personnel working on these types of vessels must have special knowledge of the hazards involved in their working procedures, which is covered in the tanker familiarization training course.

Passenger ships also may carry cars or other cargo, and includes ferries. In addition to deck and engine-room staff, there may be a large number of cooks, waiters, housekeeping staff, shop and other service assistants, entertainment, medical, and religious attendants, etc. and that personnel working on these ships must have a knowledge of crowd control, especially in emergency situations.

Dangerous cargoes

Dangerous cargoes and goods are hazardous in different ways. Never be careless with any of them. Tanker crews will find useful information in booklets "Safety in Oil Tankers" and "Safety in Chemical Tankers" produced by the International Chamber of Shipping. Self-unloader crews will find more information in "Safe Working Practices for Self-unloaders." When dangerous goods are carried with the general cargo, they should be labeled and segregated in accordance with the requirements of "Emergency Procedures for Ships Carrying Dangerous Goods." Keep an eye open for spills, leaks, and damage to containers. Report these at once and keep clear until the appropriate action can be taken.

Falling & moving objects

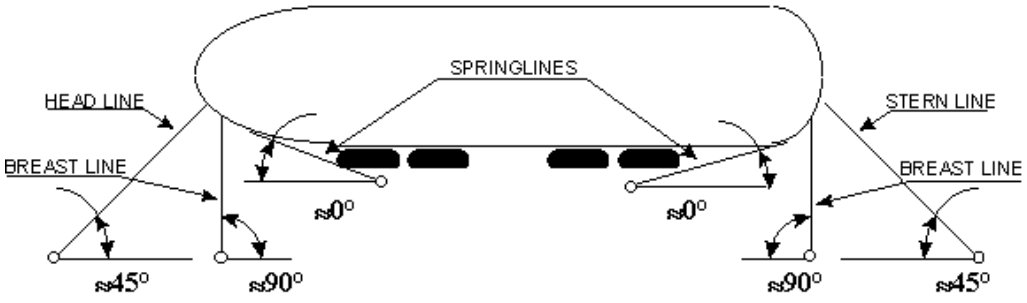
Falling and moving objects are common causes of serious injury on board. The general rule, not always easy to follow, is to be aware of such possibilities wherever you are working, and find the safest place you can.
You should lash or stow securely anything on board liable to shift or move. Do not leave doors free to swing. Secure hatches open when in use (Code, Chapter 1&18). When working cargo, beware of swinging loads and hooks and cargo falling from sets. As much as possible, keep clear, and don't work or pass under swinging or suspended loads. When acting as signaler, make sure that the load is secure and that all other persons are clear before giving the signal to hoist.

Mooring and unmooring

Mooring - the tying up of a ship to a jetty, berth or pier.

The lines used to tie up the ship are known as mooring lines or mooring wires.

Mooring lines are extremely heavy synthetic lines around 100 mm diameter or more and wires too are heavy around 50 mm diameter, depending on the size of the ship.



All mooring equipment—ropes, wires, heaving lines, stoppers, shackles, winches and windlass, etc.—must be checked to be in good order and condition before the operation.

These ropes and wires are risky to handle and can be extremely dangerous to those in the vicinity, especially when under stress. When the ropes or wires part under stress, they can cause a whiplash that can kill or dismember a person. This operation is more risky during strong winds, heavy seas or swell or rain, or by the need for speed.

Persons should never stand in the bight of a rope or wire.

Mooring lines must be constantly checked and always maintained taut. Special attention must be paid when loading or unloading at a high rate. There is a large tidal range in the port or strong currents. There are strong winds or at berths exposed to sea.

Enclosed Spaces

Enclosed Space – is defined as one with restricted access that is not subject to continuous ventilation, and in which the atmosphere may be hazardous due to the presence of hydrocarbon, toxic or inert gas, or oxygen deficiency.

Possible enclosed spaces include the following: forepeak tanks, chain lockers, cofferdams, topside tanks, cargo tanks, ballast tanks, duct keel, after peak tank, bunker tanks, etc.

Careless entry into such spaces has resulted into accidents, sometimes fatal, when the person is overcome by a lack of breathable atmosphere or is injured and not rescued in time.

Kinds of enclosed space hazards:

- Atmospheric hazards
- Physical hazards

A. Atmospheric hazards could result from the presence of hydrocarbon gas, presence of toxic gas or deficiency in oxygen. Due to the presence of hydrocarbon gas, a toxicity and flammability hazard arises.

Hydrocarbon vapours can be present due to petroleum leakage, retention in tank structure, retention in pipeline, disturbance of sludge/scale.

Other gases, such as NO, N02 S02, CO, benzene, H2S, etc., can be a toxic hazard. These gases can evolve from cargo, ship's stores or ship operations. Toxic hazards are harmful or poisonous to the body. These toxic gases should not be present in concentrations more than their TLVs.

Threshold Limit Value– The average concentration of toxic gas to which the normal person can be exposed without injury for 8 hours per day and 5 days per week.
It is a level to which it is believed a worker can be exposed day after day for a working lifetime without adverse health consequences.

The atmosphere may be rendered deficient in oxygen due to the causes listed below:

- Ingress of inert gas (in inerted tank or leakage across from inerted tank into adjoining enclosed space)
- Rusting
- Paint drying
- Hydrogen
- Electrical cleaning fluids
- Solvents/emulsifiers
- Refrigerants
- Burning
- Flooding with C02 to fight a fire
- Welding and gas cutting without proper ventilation
- Running an internal combustion engine in a confined space
- Decay of organic matter, e.g. vegetables, grain, fruits, etc.

Deficiency in oxygen can result in **anoxia**.

The symptoms commence with giddiness, breathlessness and unconsciousness, and progress onto brain damage causing memory loss, mental instability, paralysis, coma, or death.

B. Physical hazards could cause a person to be physically or even fatally injured.

Physical hazards could include:
- Darkness
- Unsecured ladders
- Slippery surfaces
- Obstructions
- Unguarded openings
- Unsecured objects left from previous visit
- Flooding
- Getting trapped in accidentally

The following precautions are to be followed prior to entry into enclosed spaces:
- An enclosed space entry permit system must be strictly followed
- The space is to be thoroughly ventilated and confirmed by testing of the atmosphere
- There must be sufficient oxygen to support life (21 % O2)
- Insufficient flammable gas for the purpose and
- Toxic gas must be less than the TLV

Proper protective equipment- overalls, hard hat, safety shoes, etc., and approved torchlights, non-sparking tools, etc. must be used. Vigilance and alertness must be exercised. The atmosphere must be monitored and all precautions observed while the job is underway.

An **Enclosed Space Entry Permit** is a document issued by a responsible person permitting entry to a space or compartment during a specific time interval. A permit should be completed only for a single space or compartment, and should include the checks and

information contained in the sample form in Appendix 1 of ISGOTT (International Safety Guide for Oil Tankers and Terminals)

Entering enclosed & confined spaces

Many deaths have occurred in recent years when crew members have entered spaces where the air could not support life. Such spaces are likely to be short of oxygen; some may contain asphyxiating or toxic gases. This does not apply only to pump rooms or to tanks that have contained petroleum or chemicals.

Some casualties have occurred recently in cargo spaces containing, or that have contained, seemingly harmless cargoes such as steel cuttings, wood chips, tallow, and even vegetables. Any confined space may be deficient in oxygen. So don't take a chance. Never enter an enclosed or confined space without the permission of the Master or a responsible officer. These persons must ensure that the designated routes space is safe to enter by testing and ventilating before entry, and by having spare breathing apparatus, safety lines, and another safety persons standing by.

If, when inside a space, you feel dizzy or have difficulty breathing, get out at once. If you are on standby outside and the person inside collapses, raise the alarm immediately, but do not rush in without thinking. Speed in rescue is vital, but putting a second life at risk will just add to the problem. Rescuers must wear breathing apparatus.
Lives have been lost when precautions were not taken despite obvious danger.

IV. ONBOARD COMMUNICATION

Communication On Board Ship

Communication is an essential part of human interaction. The benefits of effective communication are many and obvious, as they enhance all aspects of our personal and professional lives. Ineffective or misunderstood communications may give rise to problems or embarrassment or even cause graver outcomes. In the world of international shipping, with seafarers from many countries sailing on ships trading to all parts of the world, effective communication between those on board and between the ship and the shore is highly important.

Communication – is the exchange and flow of information and ideas from one person to another; it involves a sender transmitting an idea, information, or feeling to a receiver.

Effective communication occurs only if the receiver understands the exact information or idea that the sender intends to transmit. Many of the problems that occur in an organization or ship are either the direct result of people failing to communicate and/or processes, which leads to confusion and can cause good plans to fail.

Methods of Communication

Verbal – is when a person puts across a message by speaking. The message can be sent to an individual, a team or a group.

Non-verbal – includes facial expressions, eye contact, tone of voice, body posture and motions, and positioning within groups.

Direct – within the same area can have direct feedback. (The most effective means is person to person)

Indirect – using channels of communications, e.g., radios, phone, fax, etc.

Communication Barriers

Most of us desire to communicate effectively, but do not have a keen appreciation of the communication barriers to be faced. Because of these barriers, there is ample opportunity for something to go wrong in any communication.

Examples of Communication Barriers:

- Physical barriers – often due to the nature of the environment (noise, poor lighting or an environment which is too hot or cold).
- System design faults – refer to problems with the structures or systems in place in an organization (inappropriate information systems, a lack of supervision or training, and a lack of clarity in roles and responsibilities).
- Attitudinal barriers – come about as a result of problems with crew in a ship (poor management, lack of consultation with employees, personality conflicts, and the personal attitudes of individual employees which may be due to lack of motivation or dissatisfaction at work).

- Psychological factors – people's state of mind (worries about their health or marriage, personal problems).
- Different languages and cultures – represent a national barrier which is particularly important for organizations involved in overseas business.
- Physiological barriers – may result from the individual's personal discomfort, caused, for example, by ill health, poor eye sight or hearing difficulties.

Overcoming the Language Barrier

- Limit your vocabulary to common words and phrases
- Avoid slang and acronyms
- Speak slowly and clearly
- Use standard terminology
- Use translator if necessary
- Use written material if necessary

These are the four primary components of communication:

- Sender – is an individual, group, or organization who initiates the communication. This source is initially responsible for the success of the message.
- Message – the information that the sender wants to communicate to the receiver (words or signs).
- Receiver – the individual or individuals to whom the message is directed.
- Feedback – the final link in the chain of the communication process. Without feedback, the sender cannot confirm that the receiver has interpreted the message correctly.

The Three Basic Listening Modes

1. Competitive or Combative Listening – happens when listener is more interested in promoting his own point of view than in understanding or exploring someone else's view.

2. Passive or Attentive Listening – the listener is genuinely interested in hearing and understanding the other person's point of view.

3. Active or Reflective Listening – the single most useful and important listening skill. In active listening one is genuinely interested in understanding what the other person is thinking, feeling, wanting or what the message means, and he is active in checking out his understanding before responding with the new

message. This verification or feedback process is what distinguishes active listening and makes it effective.

Effective Listening Skills

1. Repeat what is said to you. When someone is giving information that is important, repeat what they have said verbally or in your mind.

2. Write it down. One of the most effective ways to listen is to write down what one is saying.

3. Maintain eye contact and provide non-verbal cues. One of the keys to listening is to pay attention to the speaker. Maintain eye contact and acknowledge what they are saying as they are saying it.

4. Avoid outside distractions. If someone wants to talk with you, whether business or personal in nature, ignore or turn off distracting devices and make sure you are both comfortable.

5. Ask clarifying questions. If in listening to someone speak, there are points which are not clear, ask questions.

Effective communications are an essential ingredient to safe and efficient ship operations. Communication can be achieved in many ways, but the prime method for operational communications is through speech. And when in an operational situation such as berthing a ship or fighting a fire, it is vitally important that those involved can communicate effectively.

The international community has chosen the **English language** as the medium for that communication, and IMO has developed a standard vocabulary and the training tools for performing such.

V. SOCIAL RESPONSIBILITY

Social responsibility – is the obligation of organization management to make decision and take actions that will enhance the welfare and interests of society as well as the organization.

The need to avoid conflict between employer and employee should have the highest priority, and to this end, there should be a properly negotiated agreement

which is clearly and explicitly documented on all matters connected with the social and work environment. Seafarers work within the conditions stipulated in their Maritime Articles of agreement.

Employees:

- Have the obligation and dedication to help in the improvement and advancement of the company.
- Promoter of the company wherever he goes. He is to guard the image of the company that is not destroyed.

Employers:

- Concerned not only on the profit, but also of other activities beneficial to the employees and to the society as a whole.

Rights and Obligations of Seafarers

Each crew member has a social responsibility to his ship, himself, his colleagues, to the company, and to the environment.

Sources of Seafarers' Rights:

- Flag State Law

  A ship has the nationality of the flag that it flies. Also, under international law, the laws of a flag State apply to a ship regardless of the location of the ship. Therefore, seafarers are entitled to the protection of, and are governed by, the laws of the flag State wherever the ship is and regardless of their nationality.

- Port State Law

  When your ship enters a port, that port State can exercise certain powers over the ship while it is in port. Generally, a port State does not intervene in the internal affairs of a ship unless there is a dispute which concerns the peace and good order of the port (for example if a crime is committed on board).

- Home State

  Seafarers will be able to rely on rights contained in your Home State Law if that law governs your contract of employment. Otherwise, if you are in trouble

when abroad, your home country should provide support and assistance through its consular offices. Therefore ask for the assistance of consular officers.

- Contract of Employment

  Your individual contract of employment will set out what your rights are as between you and your employer. Your contract may be (1) a private contract and/or (2) a collective bargaining agreement produced by a trade union or an employers' association and/or (3) a form of contract in which the government has taken an active role (such as the POEA Contract: Standard Terms and Conditions governing the employment of Filipino Seafarers on board Oceangoing Ships). Your contract may be directly with the shipowner, or it may be with a manning agent, or it may be with some other agent for the ship owner.

- International Laws
  International laws are laws made at the highest level among states. Since it was founded in 1919, the International Labour Organisation (ILO) has set international labour standards for all workers, and specifically has set standards for seafarers in more than 65 Conventions and Recommendations.

Duties of the Employer/Agency/Master:

1. To faithfully comply with the stipulated terms and conditions of this contract, particularly the prompt payment of wages, remittance of allotment and the expeditious settlement of valid claims of the seafarer.

2. To ensure that the vessel's grievance machinery provided in the contract works and to ensure its free access at all times by the seafarers. To provide a seaworthy vessel for the seafarer and take all reasonable precautions to prevent accident and injury to the crew including provision of safety equipment, fire prevention, safe and proper navigation of the vessel and such other precautions necessary to avoid accident, injury or sickness to the seafarer.

3. To observe the Code of Ethics for Seafarers and conduct himself in the traditional decorum of a master.

Duties of the Seafarers

1. To faithfully comply with and observe the terms and conditions of this contract, violation of which shall be subject to disciplinary action pursuant to section 33 of this contract;

2. To abide by the Code of Discipline as provided in the POEA rules and regulations governing overseas contract workers;

3. To be obedient to the lawful commands of the Master or any person who shall lawfully succeed him and to comply with company policy including safety policies and procedures and any instructions given in connection therewith.

4. To be diligent in his duties relating to the vessel, its stores and cargo, whether on board, on boats or ashore; and

5. To conduct himself in an orderly and respectful manner towards passengers and shipper stevedores, port authorities, and other persons on official business with the ship.

Shipping is a commercial entity and therefore profit making is part of the operation. The employee must discharge his duties sincerely to the fullest of his capabilities. He should be responsible towards the three elements of the shipping operation, namely, company, government, and individual.

There is dignity in labour, and there are responsibilities towards others:

- Obedience, respect, discipline, and following orders of his superiors
- Abiding by company's policies as laid down in the safety manuals and rules and regulations governing flag State requirements and other mandatory legislation
- Adhering to the safety and environment protection policy at all times and to assist fellow seamen in distress, search and rescue operations, and oil pollution mitigation operations

Employment Conditions

Describes the employment conditions include:

- Employment contracts
- Seafarers' rights
- National and international requirements

Drugs and Alcohol

There are international and national regulations against the use, carrying or distributing of any illegal drugs or alcohol. The punishment for these could be very, very severe.

Shipping companies should have a clearly written policy on drug and alcohol abuse that is easily understood by seafarers as well as shore-based staff. In order to enforce their policy, companies should have rules of conduct with the objective that no seafarer will navigate a ship or operate any equipment while impaired by drugs or alcohol. It is recommended that seafarers be subject to testing and screening for drugs and alcohol abuse by means of unannounced testing and routine medical examination.

***Alcohol** – is a clear drink that is made from corn, barley, grain, rye, or a beverage containing ethyl. Once the alcohol is absorbed into the tissue, it affects your mind and body.

Alcohol is a depressant. After consumption, alcohol causes the body's systems to slow down. Feelings of drunkenness are associated with elation and happiness but feelings of anger or depression can arise. Balance, judgment, and coordination are also negatively affected. One of the most significant side effects of alcohol is reduced inhibition.

***Alcohol dependence** (also called "alcoholism") – is a chronic and potentially fatal disease in which a person is addicted to alcohol. It cannot be cured, but it can be successfully controlled.

***Drugs** – chemical substances used in the treatment, cure, prevention, or diagnosis of disease or used to otherwise enhance physical or mental well-being.

The misuse of legitimate drugs, or the use, possession, distribution or sale of illicit or unprescribed controlled drugs on board cannot be condoned and should be prohibited. In addition, any use of a prescribed controlled drug which causes, or contributes to unacceptable job performance or unusual job behaviour should require the seafarer to be excused from duty until such times as he is repatriated, or treatment and its after-effects cease.

***Drug abuse** – a condition that exists when a person overuses drugs or other substances.

Company Drug and Alcohol Policy

1. General

1.1 All the crew and master shall abide strictly by the instructions provided by company on drugs and alcohol.
If the country of the port of call or the local region has a different policy on alcohol consumption from the ship's company, the stricter policy shall be followed.
1.2 Shipboard personnel, third party service providers, and shore management visiting vessel must not be impaired by alcohol at any time.

2. Alcohol Policy of Company

2.1 The distribution and consumption of any form of Hard Liquor (Whisky, Rum, Vodka, and Gin, etc.) is prohibited on board vessels.
2.2 No Ship's personnel are allowed to carry or bring any form of liquor on board the vessel.
2.3 Only Beer or Wine, as distributed by Master, could be consumed by ship's crew, which must be less than 03 units per day.
2.4 At any time, the alcohol concentration of ship's personnel must be less than 40mg/100ml blood or 54mg/100ml urine or 18µg/100ml breath
2.5 No alcohol shall be consumed by shipboard personnel 4 hours prior to watch or other designated duties until the completion of such job.
2.6 To demonstrate company policy, Senior Officers on board and the Shore-Management visiting vessels, shall lead by example.

3. Control and Implementation of Alcohol Policy

3.1 General Guidelines

3.1.1 The Master, regardless of the above, may totally prohibit consumption of alcohol on board when he deems it necessary.

3.1.2 The crewmembers returning to vessel in port after shore leave could be checked to confirm compliance with company Alcohol Policy.

3.1.3 If at any time, alcohol concentration of any crew member is tested exceeding the allowable limits or is observed to breach the company alcohol policy, the company shall be informed, and an appropriate log book entry shall be made.

3.1.4 A disciplinary action against the person, breaching company alcohol policy, will be initiated by the company, which may include even dismissal from the service.

3.1.5 The Master shall effectively control and monitor the distribution of alcohol to support the Company Policy on alcohol. This shall be periodically verified by Shore-Management during ship visits.

3.2 Work Restrictions

The Master, when he judges that a member of the crew is clearly under the influence of alcohol, or the result of an alcohol test shows that his blood alcohol content (BAC) exceeds 0.04%, must not allow the crew member in question to engage in any work. In such a case, the Master must record the facts and report the matter to the company.

3.3 Alcohol Test

At least once a month and at other times when deemed necessary, the Master must carry out unannounced alcohol tests on all persons engaged in watch duties.

The chief officer shall carry out and witness the test for Master.

The result of this test shall be recorded in the "Alcohol Testing Record (S-031000-04FRM)'' and retained on board.

3.4 Alcohol Unit Conversion:

It takes one hour for the body to rid itself of one unit of alcohol.

It is brought to attention of all persons on board that 2 units of alcohol consumed within the hour will result in BAC 0.04% by weight.

3. Drugs

3.1 The all crew members must not possess, use or buy, and sell drugs other than those of a doctor's prescription or the ship's medical supplies permitted by the Master. Also, even though the drugs may be recognized by law, their wrongful use is forbidden.

The following drugs must not be possessed by crew members regardless of the extent of their content and amount:

a) Marijuana
b) Cocaine
c) Opium
d) Phencyclidine (PCP)
e) Amphetamine

3.2 The Master, during the monthly inspection of the living quarters, must check whether the crew members possess any drugs, record the results in the "Inspection Record for Crew Living Quarters (S-031000-05FRM)" and retain the record on board the ship.

Health and Hygiene on Board

It is the responsibility of all crew on board to observe hygiene and promote good health. Cleanliness and good housekeeping is fundamental to good health.

<u>Health</u>
Keeping fit and staying healthy are as important on a ship as elsewhere. Illness may reduce your ability to concentrate on a job and increase the risk of accident.

Good health depends on a balance of work, rest and recreation, regular, nutritious meals, adequate sleep, and moderate use of alcohol and tobacco. Misuse of alcohol or drugs not only affects your general fitness, but also increases your likelihood to suffer accidents. Never drink alcohol while undergoing treatment with drugs, even common remedies such as aspirin or seasickness tablets may be dangerous when taken with alcohol.

Many serious infectious diseases can be prevented by inoculations and vaccinations, and you should ensure that these are kept up to date. Precautions should be taken against the risk of contracting malaria when visiting certain countries.

Personal cleanliness is also essential, particularly in jobs where prolonged exposure to mineral oils can cause problems such as dermatitis. You should wash frequently to get rid of the oil. Synthetic detergents, solvents and degreasers, such as turpentine, take the natural oils out of your skin, leaving your hands cracked and vulnerable to damage by other substances. Use a protective cream or wear rubber or plastic gloves. Other chemicals such as scale and rust removers have the same effect but can be corrosive; thus, when using these, avoid getting splashes on your face and arms. To prevent infection, clean all cuts and abrasions; treat them without delay, and protect the areas until they are healed.

HUMAN RELATIONSHIPS ON BOARD

Owners and managers of profit and nonprofit organizations define **human relations** as fitting people into work situations so as to motivate them to work together harmoniously. The process of fitting together should achieve higher levels of productivity for the organization, while also bringing employees economic, psychological, and social satisfaction.

Human relations covers all types of interactions among people—their conflicts, cooperative efforts, and group relationships. It is the study of why our beliefs, attitudes, and behaviors sometimes cause interpersonal conflict in our personal lives and in work-related situations.

Shipping management differs from the management of an industry based ashore in a number of ways:

- The shipping company comprises a number of small mobile industrial units (the ship) which may, at any particular moment, be distributed over large distances

throughout the world, in contrast with a shore industry which operates in a fixed location
- When making a voyage, the ship can undergo considerable climatic change, which operates can adversely affect personnel
- The ship is operating in a hostile environment and has to cope with extreme conditions of weather
- The personnel operating the ship will be subject to other hazards consequent upon the concentration of machinery and equipment in confined spaces

Interpersonal Relationship

Interpersonal relationships are social associations, connections, or affiliations between two or more people. Good relationships make the life of all seafarers more comfortable, healthy, and less prone to accidents.

Elements which could help in better relationships:
- Policies of company
- Function of shipboard management
- Clarity of responsibilities with reference to shipboard functions, structure, and flow of authority
- Importance of understanding individual, ship, company, and social needs.

How to Develop Good Human Relationships

1. Respect persons for who they are
2. Help others if they are in need
3. Don't take undue credits
4. Practice courtesy at all times
5. Don't behave in a manner that is destructive to good interpersonal relationships
6. Respect good standard and expectations
7. Give recognition and emotional support
8. Avoid unholy alliances and coalition
9. Express interest in your colleagues
10. Focus on the positive side

Team Work and Team Building

The shipboard operation in team work and the effectiveness of it depends on the effectiveness of its team members. Good teamwork could help in better decision making.

For the team to function effectively, members must know the following:

- Team's goals, aims or objectives
- Role of individual members
- Need for cohesiveness

These are factors that deter team operation:

- Distortion of aims
- Hidden agenda
- Inflexible behavior of members
- Communication problems
- Groupies
- Physical environmental problems
- Status or ego problems
- Handling of grievances / counseling

Teamwork - to succeed at the task in hand, the seafarers involved need to combine their efforts. If everyone does his job well, then it increases what the team can accomplish. This teamwork has to be recognized by everyone. Great things can happen if individuals master the fundamentals and work together as one unit. Everyone has his own unique role, but each person's individual role must be recognized and appreciated.

VI. ACTIONS TO CONTROL FATIGUE

Fatigue - is a subjective feeling of tiredness which is distinct from weakness, and has a gradual onset. Unlike weakness, fatigue can be alleviated by periods of rest.

Medically, fatigue is a non-specific symptom, which means that it has many possible causes. Fatigue is considered a symptom, rather than a sign because it is a subjective feeling reported by the patient, rather than an objective one that can be observed by others. Fatigue and 'feelings of fatigue' are often confused.

Types of Fatigue

1. **Physical Fatigue** - is the transient inability of a muscle to maintain optimal physical performance.

2. **Mental Fatigue** - is a transient decrease in maximal cognitive performance resulting from prolonged periods of cognitive activity.

Causes of Fatigue

- Shortage of sleep / poor quality sleep – restlessness, disturbed sleep, inability to relax fully, rough weather, restricting sleep
- Negative environmental factors - noise and vibration
- High job demands / high stress - taking on other jobs outside normal duties such as paperwork
- Frequent port turnarounds – which interrupt standard working patterns
- Adverse weather conditions – fighting against the elements both the cold and wet or intense heat
- Consistently working more than 12 hours a day – there is a demonstrable link between both the number of hours we work and sleep deprivation

Importance of obtaining necessary rest

Getting enough rest is imperative to living a healthy lifestyle and when you do not relax and get enough sleep you are putting yourself at risk for illness as well as other side effects. Body needs enough rest to function properly.

Effects of sleep schedules, and the circadian rhythm on fatigue

Circadian Rhythm - are physical, mental and behavioral changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism's environment.

Circadian Rhythm Disorder - are disruptions in a person's circadian rhythm -- a name given to the "internal body clock" that regulates the (approximately) 24-hour cycle of biological processes in animals and plants.

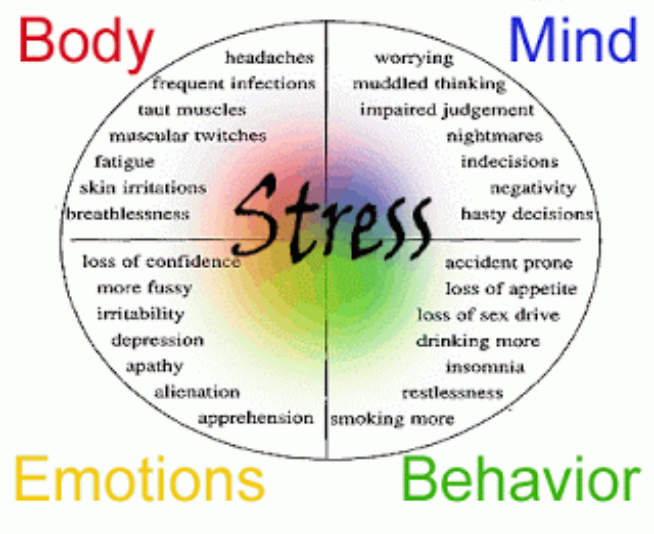
Factors that affects the Circadian Rhythm

- Shift work
- Time zone changes
- Changes in routine
- Medications

Stress - is a person's response to a stressor such as an environmental condition or a stimulus. Stress is a body's method of reacting to a challenge. According to the stressful event, the body's way to respond to stress is by sympathetic nervous system activation which results in the fight-or-flight response. Stress typically describes a negative condition or a positive condition that can have an impact on a person's mental and physical well-being.

Types of stressors on seafarers

- Physical stress
- Environmental stress



Physical Stressors

- Excessive or not enough exercise
- Physical exertion
- Lack of rest and sleep
- Smoking
- Excessive drinking
- Pollution
- Radioactive substances
- Excessive cold, heat or humidity
- Excessive noise

Environmental Stressors

- Noise
- Air pollution
- Crowding

- Traffic congestion
- Terrorism and piracy
- Adverse weather

Effects of schedule changes and seafarers fatigue

- Less alertness and shows sleepiness
- Untoward mood
- Reduced safety
- Increase the risk of accidents that may lead to loss of life, environmental damage and huge economic lost

Necessary actions to control fatigue

- Keep the schedule of duties under review to ensure that the hours of work continue to be realistic and workable.
- Provide compensatory rest if it is necessary to exceed normal hours of work.
- Work with the seafarers to identify and reduce exposure to fatigue inducing risk factors.
- Be proactive in identifying hazards and reducing exposure, review safety procedures and re-enforce safety training.
- Encourage discussion of individual and group concerns about fatigue and take action based on their conclusions.
- Consider introducing a fatigue management program – which is auditable and where its success can be measured.
- Consider using tools and techniques to assess and manage factors contributing to fatigue.

FIRE PREVENTION AND FIRE FIGHTING

2.1 INTRODUCTION, SAFETY AND PRINCIPLES

Annex 1 of resolution A.437(XI)

All seafarers should be instructed in the dangers for fire in ships and the ways in which fires are caused.

Training them, preferably before they take up employment on sea-going ship, in the prevention and extinguishing of fires.

Master, officers and as far as practicable other key personnel who may also have to control fire-fighting operations should have advanced training in techniques for fighting fire with particular emphasis on organization, tactics and command.

Concept and Chemistry of Fire

Fire – is a chemical reaction known as combustion. It is frequently defined as the rapid oxidation of combustible materials accompanied by a release of energy in the form of heat and light.

Oxidation – is a chemical process in which a substance combines with oxygen. During this process, energy is given of, usually in the form of heat.

Fire or combustion is rapid oxidation; three burning substance combines with oxygen at a very high rate. Energy is given off in the form of heat and flames. All matter exists in one of the following states:

- Solid State – closely packed molecules
- Liquid State – molecules loosely packed
- Gas or Vapor State – molecules are not packed at all and are free to move.

All matter consists of molecules. In order for a substance to oxidize, its molecules must be well surrounded by oxygen molecules. The molecules of a vapor are not packed together at all; they are free to move about. Thus, only vapors can burn. However, when a solid or liquid is heated, its molecules move about rapidly. If enough heat is applied, some of the molecules break away from the surface to form a vapor just above the surface. This vapor can now mix with oxygen. If there is enough heat to raise the vapor to its ignition temperature and I there is enough oxygen present, the vapor will oxidize rapidly and it will start to burn.

Burning

What we call burning is the rapid oxidation of millions of vapor molecules. The molecules oxidize by breaking apart and recombining into new molecules. During this process, energy is released radiating heat and light. The heat that is released is radiant heat, which radiates in all directions. Thus, part of it moves back to the burning solid or liquid matter (the fuel). The heat that is radiated back to the fuel is called radiation feedback.

Part of this heat releases more vapor, and part of it releases the vapor to the ignition temperature. At the same time air is drawn into the air where the flames and vapor meet. The result is a CHAIN REACTION. The burning vapor produces heat, which releases and ignites more vapors. The additional vapor burns producing more heat, which releases and ignites more vapor.

After a time, the amount of vapor released reaches a maximum rate and begins to level off producing a steady rate of burning. This usually continues until most of the fuel has been consumed. After this stage the process begins o break down.

Principles of Survival in Relation to Fire

- Regular training and drills
- Preparedness for any fire emergency
- Knowledge of actions to be taken when called to fire stations
- Knowledge of escape routes
- Knowledge of dangers of smoke and toxic fumes

2.2 THEORY OF FIRE

Conditions for fire to occur

- The presence of material which acts as fuel
- A source of ignition, e.g. chemical, biological and physical
- The presence of oxygen

The fire triangle

A **fire triangle** is used as a model for conveying the components of a fire. The fire triangle's three sides illustrate the three elements of fire, which are heat, fuel, and oxidization. The three elements must be combined in the right proportions for a fire to occur. If any of the three elements are removed, the fire is extinguished.

For a fire to thrive and spread it requires three things:

- Fuel for the fire to burn
- Air for the fire to breathe
- Heat for the fire to continue burning

Removal of any one of the sides of this Fire Triangle will extinguish the fire.

Fuel – If fuel is removed, the fire will starve and be extinguished. With bushfires this can be done through a number of preemptive methods, including prescribed burning or physical removal of the fuel.

The removal of fuel can also be done through the lighting of small controlled fires to remove the fuel ahead of the fire. These fires, called burn-out fires, are lit from control lines and must only be done by experienced firefighters and well-supervised crews.

Air – If air is removed, the fire will suffocate—because of a lack of oxygen—and go out. The removal of air from a bushfire is quite difficult as fires are normally quite big and encompass considerable area.

Water-based foam sprayed on to the fire will act as a blanket between the fire and the air. Similarly, a layer of dirt shoveled onto the fire will act as a blanket.

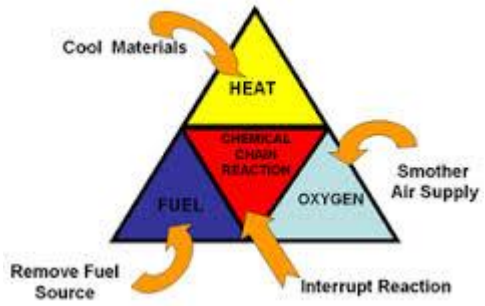
Heat – The removal of heat or the cooling of a fire is the most common form of suppression.

In most cases water is used to essentially soak up the heat generated by the fire. This heat turns the water in to steam, thereby robbing the fire of the heat used.

Without energy in the form of heat the fire cannot heat unburnt fuels to ignition temperature and the fire will eventually go out. In addition, the water can act to smother the flames and suffocate the fire.

The fire tetrahedron

The fire tetrahedron is a four-sided geometric representation of the four factors necessary for fire: fuel (any substance that can undergo combustion), heat (heat energy sufficient to release vapor from the fuel and cause ignition), oxidizing agent (air containing oxygen), and uninhibited chemical chain reaction (sufficient exothermic reaction energy to produce ignition). The fuel/air ratio must within flammable limits, which describes the amount of vapor in air necessary to propagate flame. Removing any of these four factors will prevent, suppress, or control the fire.



<u>Properties for flammable materials</u>

- **Flammability -** Flammability is how easily something will burn or ignite, causing fire or combustion. The degree of difficulty required to cause the combustion of a substance is quantified through fire testing.]
- **Ignition point -** The minimum temperature at which a substance will continue to burn without additional application of external heat.
- **Burning temperature -** The lowest temperature at which a substance will burn without continued application of an ignition source.

- **Burning speed –** The burning speed or rate will depend on the substance configuration. Solid fuels in the form of dust or shavings will burn faster than bulky materials.

- **Thermal value -** Heat produced by combustion, usually expressed in calories per gram or British thermal units per pound.

- **Lower flammable limit (LFL) -** The minimum concentration of a particular combustible gas or vapor necessary to support its combustion in air.

- **Upper flammable limit (UFL) -** The point at which, due to insufficient oxygen present, the concentration of a gas in air becomes too great to sustain a flame upon ignition.

- **Flammable range -** The range of flammable vapor or gas-air mixture between the upper and lower flammable limits is known as the 'flammable range', also often referred to as the 'explosive range'.

- **Flashpoint -** The lowest temperature at which vapors above a volatile combustible substance ignite in air when exposed to flame.

- **Auto-ignition -** Ignition temperature refers to the minimum temperature at which a substance that is flammable such air or gas, must be heated before it begins burning without the source of the heat. This temperature is a major determinant in setting the safety standards for low volatile products such as lubricating oil, diesel oil and fuel oil.

Occurrence of static electricity

Static electricity is an imbalance of electric charges within or on the surface of a material. The charge remains until it is able to move away by means of an electric current or electrical discharge.

Static electricity is generated when two things made of different materials rub together. It may not seem an obvious source of ignition, but it does present a hazard.

Reactivity

Reactivity is the tendency of a substance to undergo chemical reaction, either by itself or with other materials, and to release energy.

Ignition Sources

Ignition source is any process or event capable of causing a fire or explosion.

- Open flames
- Sparks
- Static electricity
- Hot surfaces

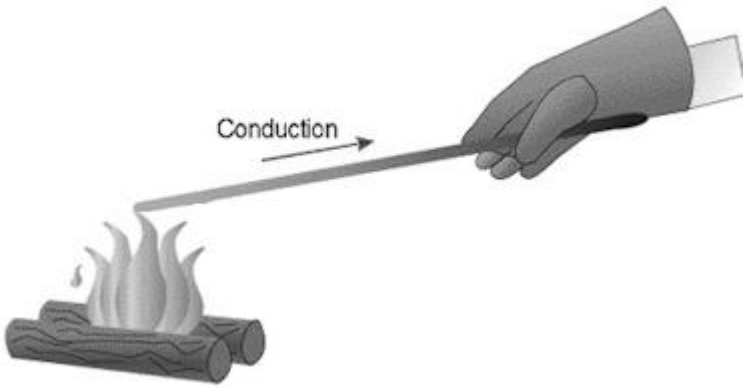
Fire hazard and spread of fire

Conduction - This kind of heat transfer can only take place in solids and is considered as the slowest form of heat transfer.

Conduction is the process of heat transfer by 'collision of molecules' in a substance. As temperature increases, molecules move faster and strike other molecules harder and more often. An example of this is when an iron bar is held at one end with the other end in a fire, the molecular motion at the hot end increases and the heat gradually travels along the bar by the increase in the motion and collision of molecules, until it can be felt by the hand.

Some factors which affect the rate of heat transfer by conduction are the following:

- The Thickness of the Material.
- The Temperature Difference between the two sides of the solid being heated (length of heat path).
- The Conductivity of the Material.
- The Surface Area.

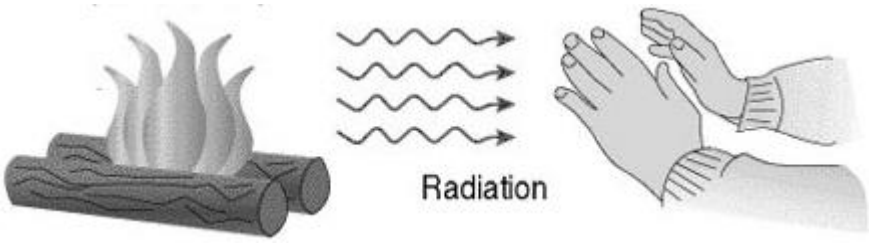


Radiation - Radiated heat is illustrated by the heat of the sun which reaches earth as 'rays' of heat energy which are invisible but similar to rays of light. A further example is heat from an open fire - when you are standing in front of the fire, the side facing the fire becomes warm while the other side remains cool.

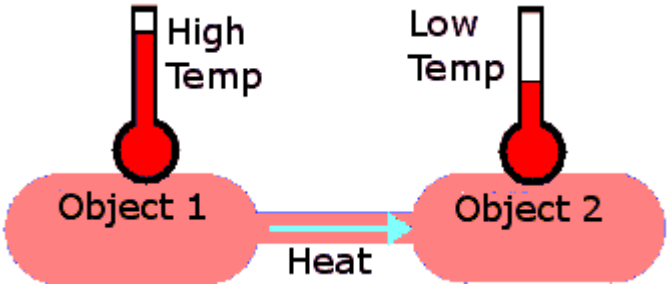
Radiated heat needs no material for its transfer and can travel through vacuum (as from the sun). Substances in the path of radiated heat will increase in temperature.

Heat transfer by radiation depends on these three conditions:

- The temperature of the radiating surface.
- The type of receiving surface—i.e., color and texture—Black, rough surfaces will absorb more heat than light, smooth ones.
- The area of the receiving surface—greater area, greater heat reception.

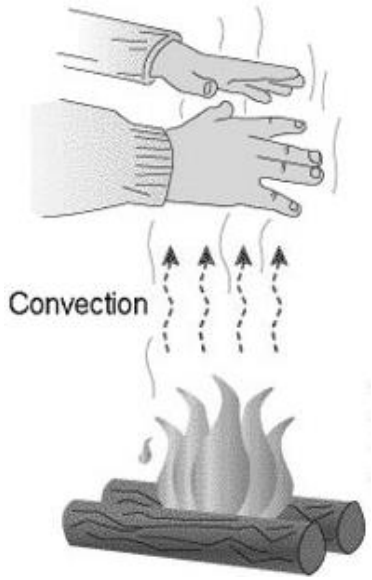


Heat-flow - When you bring two objects of different temperature together, energy will always be transferred from the hotter to the cooler object. The objects will exchange thermal energy, until thermal equilibrium is reached, i.e. until their temperatures are equal. We say that heat flows from the hotter to the cooler object. Heat is energy on the move.



Convection currents – Usually takes place in fluids. As a fluid is heated, the molecules increase in motion and the fluid begins to expand, molecules move further apart. This gives a decrease in density which causes the hotter fluid to rise and the cool fluid to fall, setting up a circulation within the fluid. The heat energy is gradually increased throughout the fluid.

This method of heat transfer is seen in the use of space heating and in heat distribution in a furnace. Convection can take place by the natural currents set up by the application of heat or increased heat transfer by mechanical means (forced convection) as when a fan or pump is used.



Method of propagation

Spread of fire occurs as a result of equalization in temperature between fire and surroundings via conduction, radiation, and convection currents.

Fire hazards in engine room

- Combustible liquids – fuel and lubricating oils
- Oil leaks and oil soaked insulation
- Hot surfaces, e.g. exhaust pipes, engine parts overheating
- Defects in lagging
- Hot work, e.g. exhaust pipes, engine parts overheating
- Defects in lagging
- Hot work, e.g. welding, cutting by oxyacetylene torch
- Auto-ignition, e.g. oil dripping on hot surface

Fire hazards in galley

- Combustible liquids, e.g. cooking oil, hot fat
- Hot surfaces, e.g. ovens, frying pans, flues
- Defective electrical connections

Fire hazards in accommodation

- Combustible materials, e.g. furnishings, personal effects
- Matches and cigarette smoking
- Defective electrical connections

Fire hazards from cargoes, including self-heating cargo and spontaneous combustion

- Oxidizing cargoes and organic peroxides
- Compressed flammable gas
- Pyrophoric cargoes
- Explosives

Fire hazards from smokers and cigarettes

- Temperature of a burning cigarette, which is 500°C
- Carelessness with cigarettes and matches, setting fire to bedclothes
- Waste-paper-bin contents and furnishings

Four phases of fire development

- Ignition (Incipient) - The phase of fire development where the fire is limited to the point of origin.

- Developing (Surface fire) - The phase of fire development where the fire has moved from the point of origin and has begun to involve other fuels. Thermal layering takes place (cooler air is pushed downward, while the hotter air rises).

- Absolute fire (Fire in depth in solids) - The phase of fire development where the fire is free-burning and consuming large amounts of fuel.

- Burning out - The phase of fire development where the fire has consumed the available fuel or oxygen, and is shrinking in size.

Classification of fires and appropriate extinguishing agents

Classification letter and appropriate extinguishing agents for fires

- **CLASS A**: Fires involve solid materials usually of an organic nature. Examples: wood, paper, cloth, plastics,

  Extinguishing agents: Water, Foam and Powder are also used.

- **CLASS B**: Fires involve liquids, flammable gases, paint, solvent, cooking fats, diesel.

Extinguishing agents: Foam or powder. CO2 may also be used. Never use water on CLASS B fire!

- **CLASS C**: Fires involving electrical fires or caused by electricity.
  Extinguishing agents: Dry powder or CO2.

- **CLASS D**: Fires involving combustible materials such as sodium, aluminum, titanium, and potassium i.e. fire involving metals.

  Extinguishing agents: Dry powder, and plentiful amount of water or sand.

- **CLASS K (F)** : Fires involves cooking oil, Fats, (vegetable oil, animal oil)

  Extinguishing agents: wet chemical fire extinguisher.

2.3 FIRE PREVENTION

Fire prevention principles

Concepts to prevent and extinguish fire by use of fire triangle and fire tetrahedron

Extinguishing the fire by the following methods will break the "fire triangle" and "fire tetrahedron" and prevent the spread or continuation of the fire.

Starvation – the fire will not sustain combustion if the source of the fuel is removed. Eliminate any inflammable materials from the fire area; turn the valves off.

Smothering – reduce the oxygen around the fire boundaries. The extinguishing agent used here is CO2, foam, sand, steam, or fire blankets.

Cooling – the fire must be cooled down to a temperature below the ignition point. The most common agent here is water fog and foam is also used for this purpose.

Chain Breaking – using dry powder can interrupt the chain reaction.

Ship construction arrangements

Basic principles

The following basic principles having regard to the type of ships and the potential hazards involved:

- Division of ship into main vertical zones by thermal and structural boundaries;
- Separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;
- Restricted use of combustible materials;
- Detection of any fire in the zone of origin;
- Containment and extinction of any fire in the space of origin;
- Protection of means of escape or access for firefighting;
- Ready availability of fire-extinguishing appliances;
- Minimization of possibility of ignition of inflammable cargo vapors.

How escape routes are protected

Emergency escape routes are well marked showing arrows and symbols. They are provided also with an emergency lighting system.

Class A, B, and C divisions

Class A division - shall be composed of steel or equivalent metal construction, suitably stiffened and made intact with the main structure of the vessel, such as shell, structural bulkheads, and decks. They shall be so constructed that, if subjected to the standard fire test, they would be capable of preventing the passage of smoke and flame for 1 hour. In addition, they shall be so insulated with approved structural insulation, bulkhead panels, or deck covering that the average temperatures on the unexposed side would not rise more than 250 °F. above the original temperature, nor would the temperature at any one point, including any joint, rise more than 325 °F. above the original temperature, within the time listed below:

Class A-60	60 minutes.
Class A-30	30 minutes.
Class A-15	15 minutes.
Class A-0	0 minutes (i.e., no insulation requirements).

Class B division - shall be constructed with approved incombustible materials and made intact from deck to deck (or to ceiling as provided in paragraph (h) of this section) and to shell or other boundaries. They shall be so constructed that, if subjected to the standard fire test, they would be capable of preventing the passage of flame for 1/2 hour. In addition, their insulation value shall be such that

the average temperature of the unexposed side would not rise more than 250 °F. above the original temperature, nor would the temperature at any one point, including any joint, rise more than 405 °F. above the original temperature within the time listed below:

Class B-15	15 minutes.
Class B-0	0 minutes (i.e., no insulation requirements).

Class C division - shall be constructed of approved incombustible materials, but need meet no requirements relative to the passage of flame nor the limiting of temperature rise.

Means for gas freeing tanks

- Portable ventilation
- Natural ventilation

Purpose and means of inerting cargo tanks

The purpose of inerting cargo tanks is to minimize the percentage of oxygen content and to prevent explosion and fires occurring onboard ships carrying crude oil, hydrocarbon gases or refined oil products.

Fire –prevention arrangements required in cargo tanks

Cargo spaces of ships 1,000 gross tons and upwards are protected either by affixed gas fire extinguishing system or by foam fire extinguishing system.

Cargo spaces of ships of 2,000 gross tons and upwards are exempted from the above provision if they are provided with steel hatch covers and effective means of closing all ventilators and other openings leading to the hold or tank.

Safe practices

General safety procedures

- No smoking in hazardous areas
- Ability to raise fire alarm quickly
- Ability to extinguish fire by using portable extinguishers and other methods
- Ability to recognize fire hazards and to take necessary steps to prevent fire

Measures to prevent fire hazard in engine room

- Ensuring insulation and lagging are kept in good condition
- Eliminating oil leaks and preventing accumulation of oil
- Taking proper fire precautions when welding or burning is being carried out
- Checking that caps and cocks for sounding pipes to oil tanks are closed
- Maintaining a clean engine room, removing oil soaked rags

Measures for reducing fire hazard in the galley

- Keeping extraction-fan flues clean
- Ensuring cooking oils do not spill on top of the stove or overheat in electrical cooking pans
- Keeping electrical installations well maintained

Measures for reducing fire hazards in accommodation areas

- No smoking in bed
- No unauthorized electrical fittings
- No emptying of ashtrays into waste-paper bins without ensuring all cigarette ends are extinguish

Measures for reducing fire hazards in cargo spaces

- Ensuring hatches are correctly cleaned
- Ensuring cargo is stowed and ventilated in accordance with the rules
- Prohibition of smoking during cargo-working periods
- Securing of cargo
- Inerting the atmosphere in cargo compartments when required

2.4 FIRE DETECTION

Fire and smoke detection system

Construction of an automatic fire-detection system

Fire detectors initiate a signal in response to heat, smoke, flame, or some other indication of fire. Not all types of detectors are used aboard ship – some are not applicable and some are not necessary.

Types of automatic fire detectors

- Smoke detector
- Flame detector
- Heat detector

Components of fire detectors

1. Normal Power Supply
   The normal power supply may be supplied either by a separate branch circuit from the ship's switchboard or by storage batteries. When the power supplied by storage batteries, they must be used only for the fire alarm and fire detection systems.

2. Emergency Power Supply
   Emergency power may be supplied by a separate branch circuit taken from the temporary emergency lighting and power system switchboard or by storage batteries. If duplicate storage batteries supply the normal power, the battery being charged may serve as the emergency power source.

3. Fire Detection Control Unit
   The fire detection control unit consists of a drip-proof enclosed panel containing the fire alarm signaling, trouble-alarm and power failure alarm devices. These devises must register both a visual an audible signal. The visible signals are lights:

   A red light indicates fire of smoke
   A blue light indicates trouble in the system
   A white light indicates that the power is on in the system

The control unit also contains a power supply transfer switch to engage the emergency power supply if the normal power supply fails.

Alarms or actions which may activate a detector

Detectors may activate by the following:

- Smoke detectors
- Heat detectors
- Flame/Fire detectors
- Water flow sensors

Benefit of an automatic sprinkler system to fire detection in passenger and crew accommodation

Automatic alarm systems are both fire detection and fire extinguishing systems. The system piping is usually charged with water to the sprinkler heads. The water is held back by a fixed temperature seal in each head. The seal is either a piece of fusible metal or a liquid-expansion bulb. Either one will allow water to flow through the sprinkler head when the temperature reaches a preset value.

Aboard ship, automatic sprinkler systems are arranged so that the release of water from a sprinkler head automatically activates visible and audible alarms in the bridge or fire control station.

Detection systems

- Cargo spaces – patrol system
- Engine room and other machinery spaces – smoke, heat, flame detectors
- Accommodation – smoke, heat, flame detectors
- Bridge and other control rooms - smoke, heat, flame detectors

Automatic fire alarm

Operation of an automatic fire alarm

1.) Smoke Detector – All fire emits smoke and gases, often long before open flames are visible. The smoke can therefore be activated before the actual outbreak of a fire.
2.) Flame detector – is activated when it is "hit" by varying infrared or ultraviolet rays from the flames. These types of detectors are consequently suitable for installation in places where there is risk of fire with rapid development of flames.
3.) Heat detector – is the name indicates, affected by heat. The alarm is usually when the room temperature rise to about 700°C. Such detectors are also available for activation at other temperatures.

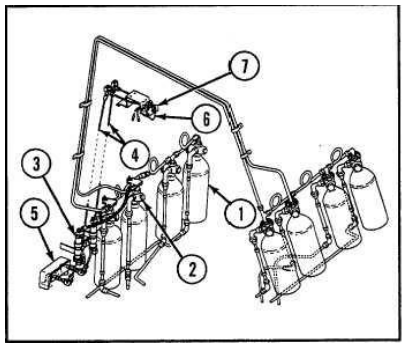
Fire zone systems and its location of installation in a ship

The system is divided into sections called fire zones. These display a light on the central fire-alarm panel pin-pointing the fire location. Consequently, aboard cargo ships, the alarm will go off automatically as soon as a fire is detected. On passenger ships, the officer on duty on the bridge will first pull a fire alarm in the crew quarters.

Benefits of a zoned system

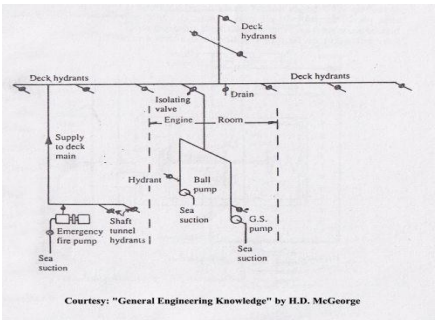
The benefit of a zone system is to easily identify which section the alarm has been activated and thus make necessary actions for fire prevention.

2.5 FIXED FIRE EXTINGUISHING SYSTEMS



Ships, unlike barges, have built-in fixed fire systems to extinguish shipboard fires. Experience has encouraged ship designers to improve these systems to a high degree of efficiency. Crews generally are trained to use these systems. However, the number of trained crew members aboard during a fire emergency and the initial damage done by the fire to the equipment or access to the fire system may render the condition of the system suspect. The system may or may not be operating properly. It may or may not have been used properly by the ship's crew and may be partially or fully expended.

1. Firemain Systems



Courtesy: "General Engineering Knowledge" by H.D. McGeorge

The primary intent in the design and construction of a fire main system is to provide the crew with protection for their ship. As such, they are designed for use by non-trained firefighters (Similar to the design intent of Class II standpipe systems). These systems are composed of the following:

- Firemains - Firemains are configured either as loops, or as "dead-end" (riser) mains. The loop is obviously preferred because a break between the pump and the fire can be valved off and water pumped to the fire from an alternate route.
- Branch Lines - Branch lines run from the fire main to the fire station.
- Fire Stations - Fire stations usually consist of a hydrant with required hose and nozzles. Stations may be located so all portions of a ship can be reached by streams from two separate fire stations.
- Fire Pumps - Fire pumps aboard ships vary greatly in capacity but they usually are designed to provide much less water than their land-based counterparts. For this reason, augmenting or bypassing the ship's fire pump must be carefully considered. Over pressurization may cause rupture of the piping or result in the relief valve operating. Relief valves may be set as low as 25 psi. Some relief valves dump water into the engine room compartment presenting a flooding problem.
- International Shore Connection - The international shore connection is a

device that has the ship's coupling on one end and an adjustable flange on the other end. Shoreside fire departments must have the opposite connector, which consists of an adjustable flange on one end and a fire department's coupling on the other.

2. Water Sprinkler Systems

The most common use of the sprinkler system is for the protection of living quarters and lockers, public spaces and adjacent passageways, or vehicular decks on Roll-on/Roll-off vessels, and ferries. Their primary function is to protect the vessel's structure and limit fire spread while providing escape routes.

3. Spray Systems

Spray systems are similar to manual sprinkler systems except that heads or spray nozzles are installed so that their stream is directed at the area to be protected/cooled.

4. Foam Systems

Foam systems usually are designed to protect engine rooms and/or cargo storage areas only. The duration of foam discharge is limited, and water usually continues to flow after the foam concentrate supply is exhausted.

5. Carbon Dioxide (CO2)

Carbon dioxide systems are designed to protect enclosed spaces or portions thereof. They are used to protect cargo spaces, switchboard rooms pump rooms, generator rooms, and engine rooms. Some smaller systems are used to protect areas such as paint lockers, galley ranges, and duct systems.

General requirements for a fixed system

- The medium used must not produce toxic gases
- The quantity of the medium must be adequate for the spaces which are to be protected
- The piping system must have control valves
- The release of a gas medium must not be automatic
- The order to release the medium must be given by the captain or a senior officer

Typical fixed systems

- Carbon dioxide
- Sprinkler (wet and dry risers)
- Foam (low expansion)
- Foam (high expansion)
- Fire mains, hydrants
- International shore connection
- Emergency generators, fire and bilge pumps
- Pressure water spray in special category spaces
- Chemical powder applicants

Smothering effect systems: Carbon dioxide and foams

How CO_2 smothers a fire

CO_2 is heavier than air, when a CO_2 extinguisher is aimed at the base of a fire; it displaces the air (actually the oxygen) and removes 1 leg of the fire triangle causing the fire to go out. The CO_2 smothers the fire by preventing the oxygen from reaching the fuel.

Dangers of CO_2

Carbon dioxide is a toxic gas which is odorless and colorless. Rising levels of carbon dioxide affect the human body.

An effect of CO2 discharge on human includes:

- Risk of asphyxiation
- Eye and ear injury
- Loss of balance due to impingement of high velocity discharging gas
- Frostbite to exposed skin

Actions to be taken when CO_2 alarm sounds

- Evacuate all persons from the compartment
- Make a roll call
- Survey the area in which the alarm sounded

Spaces provided with CO_2

Carbon dioxide systems are designed to protect enclosed spaces or portions thereof. They are used to protect cargo spaces, switchboard rooms, pump rooms, generator rooms, and engine rooms. Some smaller systems are used to protect areas such as paint lockers, galley ranges, and duct systems.

Action of foam on a fire

Foam fire extinguishers work by covering a burning flammable liquid with a blanket of foam, cutting off the fire's air supply and preventing the release of flammable vapors.

Foam systems usually are designed to protect engine rooms and/or cargo storage areas only. The duration of foam discharge is limited, and water usually continues to flow after the foam concentrate supply is exhausted.

Actions to be taken before CO_2 and foam is released

- The command shall decide, on the basis of the on-scene leader, when to release CO2 or used the foam system, taking into consideration the situation of the fire, the elapsed time from its detection, the remaining air cylinders, etc.
- Evacuate all persons from the compartment in case of CO2 release and close all openings.
- Make a roll call to make sure no one is left in the compartment.

- Station proper number of personnel and resume boundary cooling by spraying water around the fire zone.

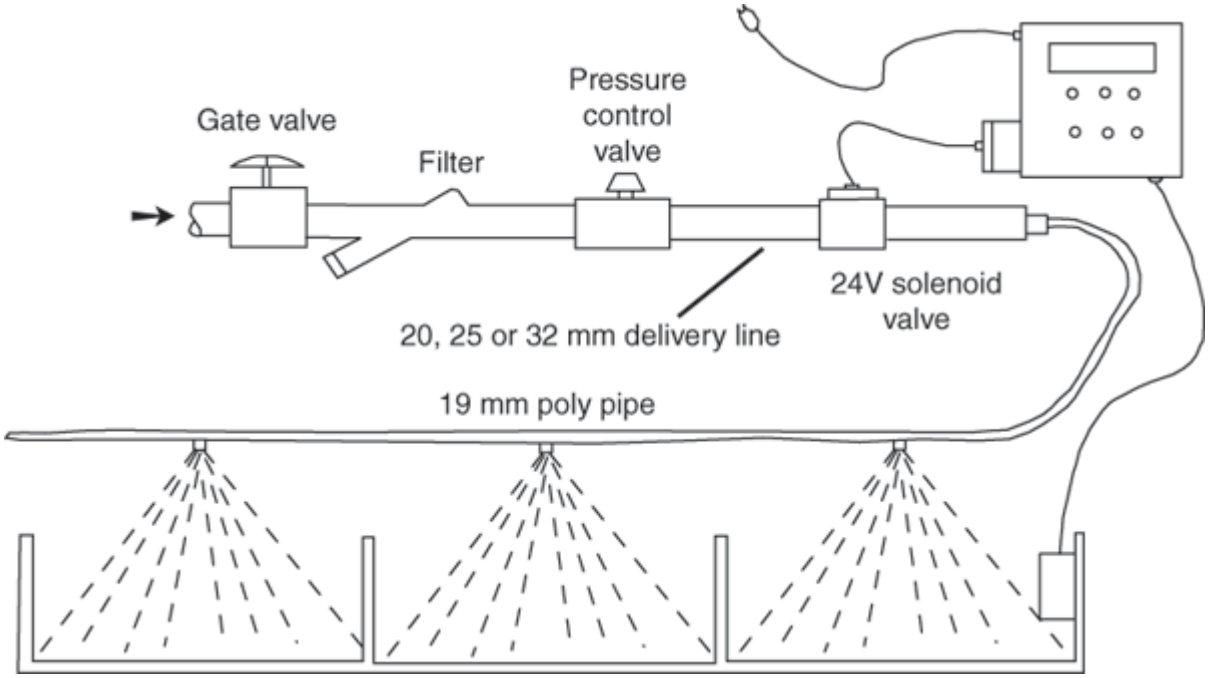
Types of foam

- Low expansion foam
- High expansion foam

<u>Cooling effect systems: sprinklers, pressure spray</u>

How sprinkler system works

A fire sprinkler system is an active fire protection measure, consisting of a water supply system, providing adequate pressure and flowrate to a water distribution piping system, onto which fire sprinklers are connected.



Spaces were sprinkler system is used

- Paint locker
- Accommodation spaces on some ships
- Living quarters on some ships

Special category spaces for manually operated pressure water spray systems

Manually operated waters pray systems consist of an array of open sprayers arranged to provide a uniform coverage of water spray in the protected area. Each system is required to cover all the protected areas with a uniformly distributed

water spray of at least 10l/ m2/min for horizontal projected surfaces and 4l/m2/min for vertical surfaces.

Water spray systems can be used to protect areas such as accommodation front bulkheads, forward domes, aft domes, (Port and Starboard) manifold drip trays (Port and Starboard) and general equipment and machinery spaces.

Requirements for the number and positioning of hydrants

a. The number and position of hydrants shall be such that at least two jets of water not emanating from the same hydrant, one of which shall be from a single length of hose, may reach any part of the ship normally accessible to the passengers or crew while the ship is being navigated and any part of any cargo space when empty, any ro-ro space or any vehicle space, in which latter case the two jets shall reach any part of the space, each from a single length of hose. Furthermore, such hydrants shall be positioned near the accesses to the protected spaces. At least two hydrants are to be provided in machinery spaces of category A.

b. In addition to the requirements in item a) above, passenger ships shall comply with the following:

    1. In the accommodation, service and machinery spaces, the number and position of hydrants shall be such that the requirements of item a) above may be complied with when all watertight doors and all doors in main vertical zone bulkheads are closed, and

    2. Where access is provided to a machinery space of category A at a low level from an adjacent shaft tunnel, two hydrants shall be provided external to, but near the entrance to, that machinery space. Where such access is provided from other spaces, in one of those spaces two hydrants shall be provided near the entrance to the machinery space of category A. Such provision need not be made where the tunnel or adjacent spaces are not part of the escape route.

Reason for fitting a shut-off valve to serve each hose

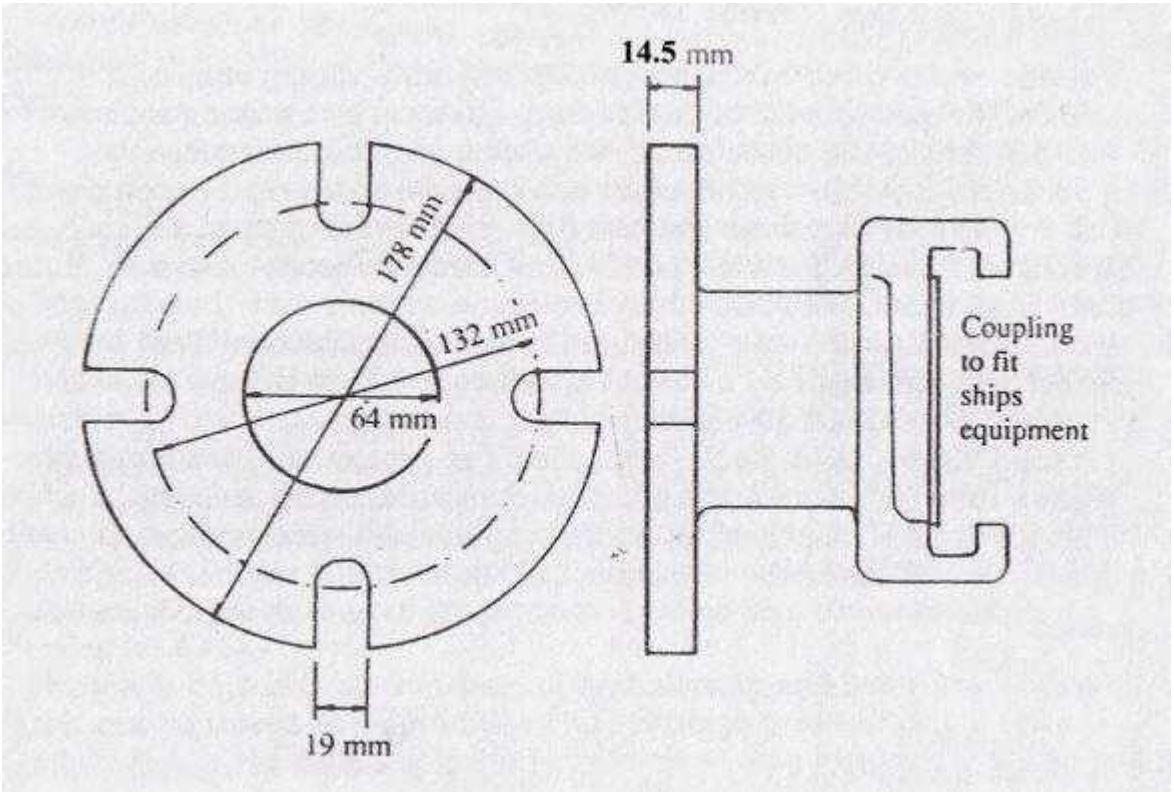
The shut off valve's primary purpose is to control the flow of water from a fire hose. The design of the valve also adds fire fighters safety.

Reason for fitting isolating valves on the fire main

An isolating valve is fitted so that if part of the fire main is damaged it can be isolated from the supply. That way the rest of the main is still usable and can be used for firefighting.

International hose connection, dimensions and purpose

The international shore connection is a universal hose connection that is to be provided on all ships as per the SOLAS requirement. The purpose of the International Shore Connection is to keep a standby hose attachment to get a connection from shore or from other ships in case there is a total failure of pumps onboard.



How an international shore connection is connected

The connection should be made up of steel or other suitable material and shall be designed for 1.0 N/mm2 services. The flange should have flat surface on one side and other side should be permanently connected or attached to a coupling which can be easily fitted to ships hydrant and hose connection. Simply place two identical flanges together and secure with four bolts.

The connection should be kept onboard with a ready gasket of material which can handle a pressure of 1.0 N/mm2 together with four 16mm bolts, 50 mm in length and eight washers so that the connection can be readily used in case of an emergency situation.

Carrying requirements for international shore connection

The international shore connection is required by international treaty to be carried onboard all passenger and cargo vessels of 500 gross tons or more, regardless of fire main size, engaged in international voyages, and is recommended for all vessels that would be expected to render assistance. It is also intended to be provided at shore facilities that would be used to supply water to a ship's fire main system.

2.5.4 Emergency fire pump (Cargo ships)

MSC.1/ Circ.1388 gives the unified interpretation of FSS Code Chapter 12, paragraph 2.2.1.3 for the suction head requirements for the emergency fire pumps in cargo ships, which should be applied to ships constructed on or after 1 January 2012.

FSS Code, Chapter 12, paragraph 2.2.1.3 Suction heads

The total suction head and the net positive suction head of the pump shall be determined having due regard to the requirements of the Convention and this chapter on the pump capacity and on the hydrant pressure under all conditions of list, trim, roll and pitch likely to be encountered in service. The ballast condition of a ship on entering or leaving a dry dock need not be considered a service condition.

Emergency fire pump capacity

Where a fixed water-based fire extinguishing system installed for the protection of the machinery space in accordance with SOLAS regulation II-2/Reg.10.4.1.1, is supplied by the emergency fire pump, the emergency fire pump capacity shall be adequate to supply the fixed fire extinguishing system at the required pressure plus two jets of water. The capacity of the two jets shall in any case be calculated by that emanating from the biggest nozzle size available onboard from, but shall not be less than 25 m3/h.

Requirements for the location of fire pumps

The space containing the fire pump shall not be contiguous to the boundaries of machinery spaces of category A or those spaces containing main fire pumps. Where this is not practicable, the common bulkhead between the two spaces shall be insulated to a standard of structural fire protection equivalent to that required for a control station.

2.5.5 Chemical powder applicants

Typical fixed powder apparatus

The system should be capable of manual release. A manual release station should be located adjacent to each hand hose line storage area and each monitor. A back-up release station should be provided at the fixed dry chemical powder unit. The operation of any manual release station should initiate the pressurization of the fixed dry chemical powder unit and begin the discharge of dry chemical powder to all connected hand hose lines and monitors.

Application of a typical fixed powder

Total Flooding System

A total flooding system means a supply of dry chemical permanently connected to fixed piping, with fixed nozzles arranged to discharge dry chemical into an enclosed space or enclosure about the hazard.
This type of system shall be used only where there is a permanent enclosure about the hazard that is adequate to enable the required concentration to be built up. The leakage of dry chemical from the protected space shall be minimized since the effectiveness of the flooding system depends upon obtaining an extinguishing concentration of dry chemical.
In total flooding system, the rate of application shall be such that the design concentration in all parts of the enclosure shall be obtained within 30 seconds.

Local Application System

Local application system shall be used for the extinguishment of fires in flammable or combustible liquids, gases, and shallow solids such as paint deposits, where the hazard is not enclosed or where the enclosure does not conform to the requirements for total flooding. Application of dry chemical shall be from nozzles mounted on the tank side or overhead.

Area Method

Applicable to superficial fire and the amount of extinguishing agent depends upon the hazardous are.

Volume Method

Applicable to cubical fire, and the amount of extinguishing agent depends upon the volume of the object in danger.

The hazard shall include all areas that are or may become coated by combustible or flammable liquids or shallow solid coatings, such as areas subject to spillage, leakage, dripping, splashing, or condensation, and all associated materials or equipment such as freshly coated stock, drain boards, hoods, ducts, etc., that might extend fire outside or lead fire into the protected area.

2.6 MISCELLANEOUS FIRE FIGHTING EQUIPMENT

2.6.1 Fire hoses and nozzles

Fire hoses and nozzles

Fire hoses shall be of non-perishable material approved by the Administration and shall be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Each hose shall be provided with a nozzle and the necessary couplings. Hoses specified in this chapter as ''fire hoses'' shall, together with any necessary fittings and tools, be kept ready for use in conspicuous positions near the water service hydrants or connections. Additionally, in interior locations in passenger ships carrying more than 36 passengers, fire hoses shall be connected to the hydrants at all times. Fire hoses shall have a length of at least 10 m, but not more than:

- 15 m in machinery spaces;
- 20 m in other spaces and open decks; and
- 25 m for open decks on ships with a maximum breadth in excess of 30 m.

Unless one hose and nozzle is provided for each hydrant in the ship, there shall be complete interchangeability of hose couplings and nozzles.

Number and Diameter of fire hoses

Ships shall be provided with fire hoses, the number and diameter of which shall be to the satisfaction of the Administration.

In passenger ships, there shall be at least one fire hose for each of the hydrants required by and these hoses shall be used only for the purposes of extinguishing fires or testing the fire-extinguishing apparatus at fire drills and surveys.

In cargo ships:

- Of 1,000 gross tonnage and upwards, the number of fire hoses to be provided shall be one for each 30 m length of the ship and one spare, but in no case less than five in all. This number does not include any hoses required in any engine-room or boiler room. The Administration may increase the

number of hoses required so as to ensure that hoses in sufficient number are available and accessible at all times, having regard to the type of ship and the nature of trade in which the ship is employed. Ships carrying dangerous goods in accordance with regulation 19 shall be provided with three hoses and nozzles, in addition to those required above; and

- Of less than 1,000 gross tonnage, the number of fire hoses to be provided shall be calculated in accordance with the provisions of paragraph 2.3.2.3.1. However, the number of hoses shall in no case be less than three.

Size and type of nozzles

For the purposes of this chapter, standard nozzle sizes shall be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Administration.

For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.

For machinery spaces and exterior locations, the nozzle size shall be such as to obtain the maximum discharge possible from two jets at the pressure mentioned in paragraph 2.1.6 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

Nozzles shall be of an approved dual-purpose type (i.e. spray/jet type) incorporating a shutoff.

Fire Hoses

A single length of hose of the required size, type and length: 63.5mm diameter hose is used at weather deck locations; 38.1mm diameter hose is used in enclosed areas. Unlined hose may not be used in machinery spaces. The hose coupling must be of brass, bronze or a similar metal and be threaded with National Standard fire-hose coupling thread.

The hose must be 15m in length, except on the weather decks of tankers. There the hose must be long enough to permit a single length to be goosenecked over the side of the tank ship. Goose necking is directing a stream of want over the vessel's side, perpendicular to water surface.

The fire hose must be connected to the hydrant at all times, with the appropriate nozzle attached. However, when a hose is exposed to heavy weather on an open deck, it may be temporarily removed from the hydrant and stowed in a nearby accessible location. Fire hose may also be temporarily removed when it might be damaged by the handling of cargo.

Nozzle

A nozzle, preferably of combination type, so that water flow may be controlled must be connected to the hose at all times. The following regulations apply to vessels contracted of built after May 1965: Tank must be equipped with combination nozzles throughout. Cargo and miscellaneous vessels must be equipped with combination nozzle in machinery spaces and may be use smooth-bore solid-stream nozzles in other spaces.

The combination nozzle must be fitted with a control that permits the stream to be shut off and to be adjusted for solid stream of high velocity fog. On a 63.5mm combination nozzle, the solid stream orifice must be at least 22.2mm in diameter; on a 38.1mm nozzle, the opening must be at least 15.8mm in diameter.

Correct maintenance and storage for hoses and nozzles

Most shipboard racks for the stowage of hose at fire station require that the hose be faked. The procedure should include the following steps:

1. Check the hose to make sure it is completely drained. Wet hose should not be racked.
2. Check the female coupling for its gasket.
3. Hook the female coupling to the male outlet of the hydrant. (The hose should always be connected to the hydrant.)
4. Fake the hose so that the nozzle end can be run out to the fire.
5. Attached the nozzle to the male end of the hose, making sure a gasket is in place.
6. Place the nozzle in its holder or lay it on the hose, so that it will not come adrift.

There are several different types of hose rack. One type consists of a half round plate, over which the hose is faked. A horizontal bar swings into position, holding the hose snug. Reels are used in engine rooms. They are also used for rubber hose, such as that found on semiportable CO_2 extinguisher.

Rolling Hose – After spare hose is used, it should be rolled and replaced in stowage. The hose must first be drained and dried. Then it should be placed flat on the deck with female coupling against the deck. The hose is next folded back on itself, so the male coupling is brought up to about 1.2m from the female couplings. The exposed thread of the male coupling should be layered between the hose when the roll is completed. The roll should be tied with small stuff to keep it from losing its shape.

2.6.2 Mobile apparatus

Types of mobile apparatus

- Carbon dioxide cylinders
- Powder containers with propellant gas
- Foam-making equipment

2.6.3 Portable fire extinguishers

A fire extinguisher is an active fire protection device used to extinguish or control small fires, often in emergency situations. Typically, a fire extinguisher consists of a hand-held cylindrical pressure vessel containing an agent which can be discharged to extinguish a fire.

Main types of fire extinguishers:

1. Stored pressure type – In stored pressure units, the expellant is stored in the same chamber as the firefighting agent itself. Depending on the agent used, different propellants are utilized. With dry chemical extinguishers, nitrogen is typically used; water and foam extinguishers typically use air. Stored pressure fire extinguishers are the most common type.

2. Cartridge-operated type – contain the expellant gas in a separate cartridge that is punctured prior to discharge, exposing the propellant to the extinguishing agent. Unlike stored pressure types, these extinguishers utilize compressed carbon dioxide instead of nitrogen.

Parts of Portable Fire Extinguisher

- The cylinder: The body of the stored pressure extinguisher holds some combination of extinguishing agent and expellant gas.
- The handle: The handle is nothing more than a grip for carrying and for holding the extinguisher when you use it.
- The trigger: This is usually a short lever mounted above the handle at the top of the extinguisher, although some models may differ. Squeezing the trigger releases

the extinguishing agent through the nozzle.

- The nozzle or horn: Depending on the type and model, the extinguishing agent is expelled from the top of the extinguisher through a fixed nozzle, or a nozzle or cone attaches to the extinguisher by a short hose.
- The pressure gauge or pressure indicator: Stored-pressure extinguishers are designed with a built-in pressure gauge or pressure indicator so you can check the extinguisher's operating pressure. (A pressure check should be done at least once a month.)
- The locking mechanism or pin: To prevent accidental discharge, all portable extinguishers come with some sort of locking mechanism that must be removed or released before the extinguisher will work.

How to Operate a Portable Fire Extinguisher:

There are four basic steps to operating a portable fire extinguisher. An easy way to remember the procedure is to think of the word "PASS."

Pull the Pin: Holding the extinguisher with the nozzle pointing away from you, release the locking mechanism. In most cases, this means pulling out the pin located below the trigger.

Aim low: Standing 6 to 8 feet away from the fire, point the extinguisher nozzle at the base of the fire – the lowest point of the fire nearest you. Extinguishers are designed to be operated in an upright position. Always hold the extinguisher vertically. Never cradle it horizontally or at an angle in your arms.

Squeeze the trigger: Squeeze the trigger slowly and evenly. This will release the extinguishing agent and expel it through the nozzle.

Sweep side to side: As the extinguishing agent is expelled, sweep the nozzle from side to side. As the fire closest to you goes out, you may move closer to the fire and continue the sweeping motion until the fire is extinguished.

Types of Fire Extinguishers

It is essential that the type of extinguisher you use is appropriate for the type of fire you are fighting. If, for example, you spray water on a grease fire, the water will cause the grease to splatter and the fire may spread. Similarly, If you dowse live electrical equipment with water, you are putting yourself in danger of electrical shock.

There are many types of portable fire extinguishers on board ships. Depending on their intended use, fire extinguishers use a variety of "fire extinguishing agents"– the water or the chemicals(s) that put out the fire.

- Water extinguishers – contain water and compressed gas and should only be used on Class A (ordinary combustibles) fires.
- Carbon Dioxide (CO2) extinguishers – are most effective on Class B and C (liquids and electrical) fires. Since the gas disperses quickly, these extinguishers are only effective from 3 to 8 feet. The carbon dioxide is stored as a compressed liquid in the extinguisher; as it expands, it cools the surrounding air. The cooling will often cause ice to form around the "horn" where the gas is expelled from the extinguisher. Since the fire could re-ignite, continue to apply the agent even after the fire appears to be out.
- Dry Chemical extinguishers – are usually rated for multiple purpose use. They contain an extinguishing agent and use a compressed, non-flammable gas as a propellant.
- Halon extinguishers – contain a gas that interrupts the chemical reaction that takes place when fuels burn. These types of extinguishers are often used to protect valuable electrical equipment since they leave no residue to clean up. Halon extinguishers have a limited range, usually 4 to 6 feet. The application of Halon should be made at the base of the fire, even after the flames have been extinguished.
- Foam Fire Extinguisher – when sprayed onto a fire, foam extinguishes and smothers the flames, then seals in any harmful vapors under the outer film of foam. The foam also penetrates absorbent materials, and cools the fire as the water in the foam evaporates. Foam is extremely effective on Class A fires and Class B (flammable liquids such as petrol, spirits, and diesel).

2.6.4 Fireman's outfit

Lists the constituents of a fireman's outfit in three sections as the following:

- Personal equipment
- Breathing apparatus
- Fireproof lifeline with snap hook and harness

The constituents of personal equipment are these items:

- Fire suit
- Gloves and shoes (non-conducting)
- Hard helmet
- Safety lamp
- Fire axe

2.6.5 Breathing apparatus

A self-contained breathing apparatus, or SCBA, sometimes referred to as a Compressed Air Breathing Apparatus (CABA), air pack, or simply Breathing Apparatus (BA) is a device worn by rescue workers, firefighters, and others to provide breathable air in an immediate danger to life and health atmosphere.

Adequate respiratory protection is essential for your safety. The products of combustion from shipboard fires are so toxic that a few breaths can cause death. Most fire deaths are caused by smoke inhalations rather than burns.

Types of Breathing Apparatus

- Closed-circuit type – filters, supplements, and recirculates exhaled gas. It is used when a longer-duration supply of breathing gas is needed.

- Open-circuit type – are filled with filtered, compressed air, rather than pure oxygen. Typical open-circuit systems have two regulators; a first stage to reduce the pressure of air to allow it to be carried to the mask, and a second stage regulator to reduce it even further to a level just above standard atmospheric pressure. This air is then fed to the mask via either a demand valve (activating only on inhalation) or a continuous positive pressure valve (providing constant airflow to the mask).

Parts of the Breathing Apparatus

The Breathing Apparatus consists of four main parts:

1. The Backpack and Harness – the backpack provides the frame for mounting the other working parts of the BA. It is usually constructed of a lightweight metal

or composite material. The harness consists of straps and fasteners used to attach the BA to the fire fighter.

2. Air Cylinder Assembly – a compressed air cylinder holds the breathing air for the B. A. This removable cylinder is attached to the backpack harness and can be changed quickly in the field.
3. Regulator Assembly – the regulator controls the flow of air to the user. It may be mounted on the waist belt or shoulder strap of the harness or attached directly to the face piece. Inhaling decreases the air pressure in the face piece. This opens the regulator which releases air from the cylinder into the face piece. When inhalation stops, the regulator shuts off the air supply.
4. Face Piece Assembly – delivers breathing air to the firefighter. The face piece also protects the face from smoke and high temperature. The face piece is composed of a face mask with a clear lens and an exhalation valve.

Limitations on the Use of B. A.

Because the B. A. carries its own supply of air in a pressurized cylinder, its use is limited by the amount of air in the cylinder. B. A. for structural firefighting must carry enough air for a minimum of 30 minutes.

2.6.6 Resuscitation apparatus

Resuscitation apparatus

Oropharyngeal Airways

Oropharyngeal Airways are curved breathing tubes. They are inserted in the patient's mouth to hold the base of the tongue forward so it does not block the air passage. The rescuer cannot depend completely upon this type of device, however; the head must be tilted backward to provide maximum opening.

There are two basic guidelines that determine whether or not an airway should be used:

1. If the patient is conscious and breathing normally, an airway should not be inserted because it will cause him to vomit.
2. If the patient is unconscious with breathing obstructed, an airway should be inserted if breathing remains obstructed after head tilt and artificial ventilation are attempted.

If the patient reacts by swallowing, retching or coughing after an artificial airway is in place, the airway must be removed quickly. Otherwise, it may make him vomit, increasing the likelihood of airway obstruction. Artificial airway should be employed only when the rescuer is trained in their use.

Demonstrate how it is used to revive a person affected by smoke

If the patient is not breathing, 2 ventilations are given via the provider's mouth or a bag-valve-mask (BVM). If available, a barrier device (pocket mask or face shield) should be used.

To perform the BVM or invasive airway technique, the provider does the following:

- Ensure a tight seal between the mask and the patient's face
- Squeeze the bag with one hand for approximately 1 second, forcing at least 500 mL of air into the patient's lungs

To perform the mouth-to-mouth technique, the provider does the following:

- Pinch the patient's nostrils closed to assist with an airtight seal
- Put the mouth completely over the patient's mouth
- After 30 chest compression, give 2 breaths (the 30:2 cycle of CPR)
- Give each breath for approximately 1 second with enough force to make the patient's chest rise
- Failure to observe chest rise indicates an inadequate mouth seal or airway occlusion
- After giving the 2 breaths, resume the CPR cycle

How the use of this equipment may reduce the CABA wearer's endurance time in a smoke-filled space

While many emergency care units carry mechanical pressure-cylinder resuscitators as part of their equipment, the use of these devices is not recommended. Effective artificial ventilation depends on the volume of air introduced into the lungs, not the pressure that delivers it. Because the lungs are very elastic, the back pressure increases as they fill with air, and more and more pressure is required to deliver the proper amount of air. Moreover, if there is a partial obstruction of airway, or if the patient's lungs have lost some of their elasticity, even more pressure is require to inflate them properly.

The problem with pressure-cycled resuscitators is that they inflate the lungs to a certain set pressure and then allow exhalation. But the machines have no way of knowing whether or not the proper amount of oxygen has been delivered. That is, they cycle from inflation to exhalation when they sense a certain back pressure,

regardless of the amount of oxygen deliver an insufficient amount of oxygen, which is of little value to the patient.

Some mechanical resuscitator mechanical resuscitators are equipped with override valves that deliver a constant flow of oxygen as long as a special valve is held open. The flow of oxygen bypasses the pressure-sensing device in the regulator. The operator is able to continue inflating the patient's lungs until the rising chest indicates that the proper amount of oxygen has been delivered.

Demonstrate knowledge of other resuscitation methods

Mouth-to-mouth Resuscitation

This technique has been proved both experimentally and clinically to be the most effective means of artificial ventilating a non-breathing patient.

Mouth-to-nose Resuscitation

This alternative method may be used if the patient has a serious injury to the lower jaw, or if he has severely receding chin due to lack of natural teeth or dentures. The mouth-to-nose resuscitation technique is essentially the same as the mouth-to-mouth technique. Clamp the patient's jaw shut with your fingers and cover his nose with your mouth. Blow full breath into his nose. After each breath, allow the patient's mouth to open, to provide quick and effective exhalation.

Mouth-to-Airway Ventilation

The mouth-to-airway unit (commonly called the S tube) and various similar devices have been introduced to overcome objections to direct mouth-to-mouth contact. These tools should be employed only if the rescuer is trained in their use, and only if they are immediately available.

Bag-Mask Resuscitator

Another valuable tool for artificial ventilation is the bag-mask resuscitator. This device consists of a facepiece fitted to a self-inflating bag. A special valve arrangement allows the bag to refill and the patient to exhale without removal of the unit from his face. A common problem with this device is failure of the operator to hold the facepiece firmly enough against the patient's face. The result is then a poor seal.

2.6.7 Fire blankets

Fire blanket

A fire blanket is a safety device designed to extinguish small fires. It consists of a sheet of fire retardant material which is placed over a fire in order to smother it.

How to use a Fire blanket

A fire blanket either completely surrounds a burning object or is placed over a burning object and sealed closely to a solid surface around the fire. Whether the blanket is placed on top, or surrounding it, the job of the blanket is to cut off the oxygen supply to the fire, thereby putting it out.

Fire Blankets usually have two pull down tails visible from outside the packaging. The user should place one hand on each tag and pull down simultaneously removing the blanket from the bag.

The tails are located near the top of the fire blanket which allows the top lip of the fire blanket to fold back over the user's hands protecting it from radiated heat or direct contact burns.

Location of fire blankets

Fire blankets on board ships are located on the galley.

2.7 SHIP FIRE-FIGHTING ORGANIZATION

2.7.1 General emergency alarm

The signal consists of seven or more short blasts followed by one long blast on the ship's whistle and bells or klaxons or equivalent sounding elsewhere in the ship.

There are other special alarms operated from the navigating bridge to summon the crew to fire stations.

Other possible fire alarms:

- C02
- Pump room
- Manually operated alarm system
- UMS fire-detection system

All the above alarms sound like a siren. When the CO2 alarm in the galley sounds, leave the room quickly closing the doors behind you. Make sure all crew members are out of the area. CO2 are also known as carbon dioxide, it is non-toxic however on the discharge of CO2 in fire extinguishing concentration, serious hazards such as suffocation and reduced visibility can occur.

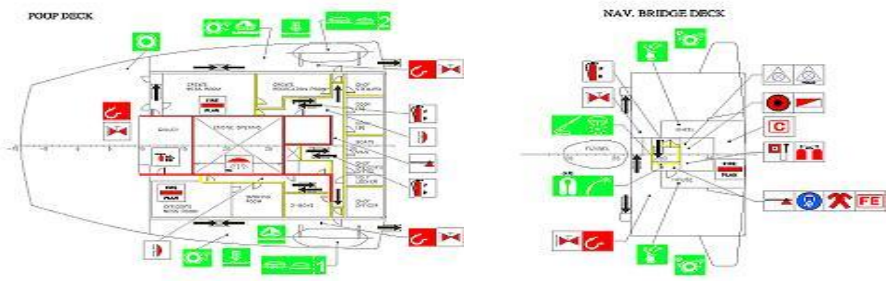
Purpose of the special alarm operated from the navigating bridge to summon the crew to fire stations

Other possible fire alarms

- CO_2
- Pump-room
- Manually operated
- UMS fire-detection system

2.7.2 Fire control plans and muster list

Fire control plan and its location



A Fire Control and Safety Plan shows all safety facilities and equipment on board. It also indicates fire precaution and extinction aboard ship.

The fire control plan is posted on board in distinct locations accessible to everyone. For the effective use of all fire technical facilities it is necessary to have knowledge of the different fire systems and how these can be used in various situations.

Information on the Fire Control Plan

The following information is mostly given by means of symbols. The meaning of each symbol is shown on the plan. Everybody boarding a vessel should study the plan in order to become familiar with the installation on board of the vessel, e.g., find out how to leave the several spaces, find out where in case of different equipment, etc. This is because you have to act quickly and accurately in case of emergency.

1. Position of water-tight door (as applicable)
   In case of fire or fire drills must be close. This is of utmost importance, because a fire always needs oxygen, which can each via the accesses.
2. Exits
3. Emergency - exits
4. Emergency stops of the ventilation (engine room, accommodation, pump rooms)
   For the same reason, the ventilation has always to be stopped. After stopping the ventilation, the flaps must be closed too of course. The ventilation fans should have a possibility to be stopped.
   a. Near the fan
   b. At a place marked on the fire control plan
5. Fire pumps
6. Emergency Fire Pumps
   Fire pumps are normally located in the engine room. The number and capacity of the pumps must be as prescribe in the regulations. Emergency fire pumps must always be located far from the fire pumps.
7. Connection for fire hoses
   Number, size and length of the hoses are prescribed in the regulations. Fire hoses on the open deck have at least of 2". In the accommodation smaller hoses are permitted.
8. Positions and types of fire extinguisher
9. Position of International Shore Connection
10. Location of alarm apparatus
11. Location of the release arrangements for the fixed extinguishing installations
12. Location of fireman's outfit

Muster list

Muster List is a plan of action before an emergency situation would arise. It also contains certain information such as when alarm signals are used and how they sound. Its main purpose is to give instruction to teach crewmembers on what to do in case of emergency.

2.7.3 Communications

Methods of communication

The methods of communication used during a fire emergency are the following:

- Messengers
- Telephones
- Walkie-talkies
- Ship-shore VHF
- Public address system

2.7.4 Personnel safety procedures

1. Know the firefighting Team Organization
2. Fire zone shall not be entered unless the person-in-charge has given orders to do so.
3. Familiarity with the area of the fire zone and with escape routes
4. Firefighters properly equipped when entering fie zone, especially if the light have failed and the space is filled of smoke.
   a. Fireman's suit
   b. Breathing apparatus

c. Torch/flashlight
d. Axe
e. Fire proof lifeline with fittings

O one pull	-	Okay
A two pull	-	Advance
T three pull	-	Take slack
H Four pull	-	Help

2.7.5 Periodic shipboard drills

Simulated fire drills are conducted on board ship to test and exchange capability of crew to extinguish fire. It gives them the opportunity to familiarize with the different firefighting equipment and appliance as well as strategies and techniques. Maintenance ensures that all equipment are in good order and condition.

Fire drills include proper operation and use of equipment and techniques of survival in firefighting.

- Emergency generator
- Emergency fire pump
- Emergency Bilge pump
- Emergency shut – off controls
- Finding the way in smoke
- Finding and removing casualties
- Use of SCBA
- Simulated fires

Typical exercise for use during fire drills

- Extinguishing a fire in a deep fryer
- Entering a closed room on fire
- Extinguishing a major deck fire
- Rescuing an unconscious person from a smoke-filled space

2.7.6 Patrol systems

Patrol system

On ships having more than 36 passengers, an efficient patrol system must be maintained so that an outbreak of fire would be promptly detected. Each member of the fire patrol should be trained to be familiar with the arrangements of the ship as well as the location and operation of any equipment he may be called upon to use.

The fire patrol system is also advisable on other types of ships.

Duties of the patrol

Patrolmen and watchmen should be given specific instructions concerning their duties. They must be made aware that their primary duty is to transmit an alarm on discovering fire, or even on seeing or smelling smoke. Their first action should be use the nearest manual fire alarm box. Valuable time may be lost is the patrolman or watchman suspects that an alarm is unnecessary and instead goes to the bridge and report his findings.

After transmitting the alarm, the patrolman or watchman should take such action as is necessary; awaken passenger and crew in the area, use a fire extinguisher or simply report to the officer in charge of the emergency squad.
The patrolman, watchman or other crewmember that first discovers a fire is very important to the investigation of the cause of the fire. He should be encourage to write down what he knows about the fire as soon as possible while the facts are fresh in his mind. Important items should include:

- Time of discovery
- Exact location where smoke or fire was seen
- What doors were open or closed
- Who, if anyone, was in the area prior to discovery
- The condition of any fire extinguisher he used
- Any other condition or circumstances that might have a bearing on fire.

2.8 FIRE-FIGHTING METHODS

2.8.1 Knowledge of fire safety arrangements

Location and use of:

- Fire alarms – Manual fire alarm systems consist of normal and emergency power supplies, a fire control unit to revive the alarm and the necessary fire alarm boxes. The fire control unit is similar to the automatic fire detection control unit; it must contain means for receiving alarm signals into audible and visible alarms. It must also have provision for registering trouble signals. And, as with automatic systems, vibrating bells are required for engine room notification.

- Emergency controls – It is where we remotely detect the location of the fire. We can also silence the alarm from here if we already locate where the fire

is happening. The panel board is separated in each space or area around the ship where fire detectors are situated.

Necessity of knowing how fire-fighting works

Aboard the ship as well as ashore, fire can be either a friend or an enemy. Harnessed and controlled, fire is so much a part of our daily lives that we take it and its uses for granted. But uncontrolled fire brings disaster – loss of lives and millions of dollars in property damage. Some cases, fires that followed collision have done so much more damage than the collision themselves.

Vessels are subject to all fire hazards of land installations, and more, Passenger vessels may be likened to moving hotels, with spaces for sleeping, recreation, cooking and dining; these spaces and their occupants present as much of a potential fire problem at sea as they do on land. Tankers are mobile storage facilities for petroleum products and other hazardous fluids.

The problem of fire prevention and firefighting become even more acute once vessel leaves port. Then, rough seas and navigation difficulties may also increase the hazard. Assistance is far away, and the crew and vessel must provide their own fire protection. This lack of assistance makes shipboard fire prevention extremely important, a matter that must be of great concern to officers and crew alike.

Necessity of being aware of potential hazards

The major causes of shipboard fire are discussed in this chapter, along with actions that crew members can take to reduce the possibility of fire. These causes a fire, these situation and actions are common to all vessel and are the responsibility of all crew.

Some fires may be purely accidental, and others may be caused by circumstances beyond control. But many fires have resulted from the acts or omission of crew members. Carelessness and irresponsible or ill-advised actions have caused disastrous fire. And omission not taking the proper preventive measures when hazardous situation are discovered have allowed many fires "just happen".

No matter how a shipboard fire starts, it could result in the loss of lives. It is therefore extremely important that crew members be constantly alert for situations that could cause fire aboard ship.

2.8.2 Fire alarms and first actions

Actions on discovering a fire

- Activate the alarm
- If possible, eliminate the cause of fire
- If possible, restrict ventilation

2.8.3 Fire-fighting

Factors to be considered in deciding on fire-fighting methods

- Accessibility of the location of the fire
- Personnel present at the location of the fire
- Reactions with the cargo
- Equipment and fire-fighting agents appropriate to the fire

Reasons for a re-flash watch

The objective of the examination is to find and extinguish hidden fire and hot embers and to determine whether the fire has extended to other parts of the ship. This is an important aspect of firefighting that should be conducted as seriously as the attack on the fire. Overhaul personnel should make use of four senses – hearing, sight, touch and smell. They should trace the length of all duct systems, look into them, and touch and smell them to determine the extent the line has traveled. They should inspect all overhead spaces, decks and bulkhead in the same manner. They must be thorough and especially watchful where wiring or piping penetrates through bulkheads or decks; fire can travel through the smallest crevice.

Any materials that might have been involved with fire, including mattresses, bales, crates and boxes should be pulled apart and examined. Materials that might reignite especially bedding, baled cotton and bolts of fabric, should be removed from the fire area, they should be placed on a weather deck with a charge hose line manned and ready to extinguish any new fire.

2.9 FIRE-FIGHTING DRILLS

A fire or other emergency drill shall as far as practicable be conducted as if it were an actual emergency.

A fire or other emergency drill should be held simultaneously with the first stage of the abandon ship drill.

For the purpose of a fire drill an outbreak of fire should be assumed to have occurred in some part of the ship and fire control measures simulated as appropriate. The complete co-operation of the personnel of all departments is essential in firefighting. The type and position of the supposed fire should be varied from time to time and can include:

(1) Cargo fires in holds or other spaces;
(2) Fires involving oil, gas or chemical cargoes as appropriate;
(3) Fires in engine, pump or boiler rooms;
(4) Fires in crew or passenger accommodation; and
(5) Fires in galleys due to burning oil or cooking fats.

The engine room staff should ensure that the fire pumps in the machinery spaces are prepared for operation, started, and that full water pressure is on the fire mains. Where there is an emergency fire pump situated outside the machinery space, this pump should be started up as indicated below. The fire party or parties at the scene of the assumed fire should lay out hoses and where practicable water should be played through them, the water being supplied first from the machinery space pump and then from the emergency pump only, with the machinery space isolating valve closed. A number of portable fire extinguishers should be available and members of the fire party should be instructed in the use of the type of fire extinguisher for a particular type of fire.