

SHIPBUILDING AND SHIP-REPAIRING
SAFETY GUIDE

(SUPERVISORS)

MARINE DEPARTMENT
HONG KONG GOVERNMENT

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PREFACE

The contents of this booklet have been extracted from the "Shipbuilding and Ship-Repairing Safety Guide". The instructions cover merely the basic requirements. Since the immediate responsibility for controlling activities rests with Supervisors, they should fully understand the various problems and comprehend the general principles attending the recommendations. For this it is essential that they are conversant with the entire Guide, copies of which may be obtained from the Marine Department, Reception Counter or the Government Publications Centre, Star Ferry Concourse.

I—Fires and Explosions

1. *RESPONSIBILITY*

In the prevention of accidents on ships under repair or construction the foreman or the supervisor is the keyman. The degree of a supervisor's enthusiasm and drive will to a measure determine the safety standards secured. His duties should include:-

- (a) instructing the workmen in safe working methods,
- (b) supervising the observance of such methods, and
- (c) initiating any steps necessary to overcome potentially dangerous situations.

2. *SMOKING AND NAKED LIGHTS*

Total prohibition of smoking on board ship is unrealistic and unenforceable and gives rise to surreptitious smoking, which is the danger. Smoking may be controlled by allocating certain safe areas in the accommodation as 'smoke rooms'. In their selection it should be ensured that the areas will remain free of flammable vapours and due account must be taken of the prevailing wind conditions.

In places where smoking is authorised, suitable containers should be made available for extinguishing cigarettes and disposing of matches.

Smoking and any type of naked flame should be prohibited in all hazardous areas. This restriction should also apply on the jockey or other craft alongside.

Conspicuous warning notices should be displayed in every part of the ship where smoking is forbidden. Particular attention should be paid to such areas as certain machinery spaces, score rooms, holds, battery rooms, pump rooms, lamp rooms, paint rooms, tanks, cofferdams, etc. and also deck areas near open hatches when hazardous cargo is being carried.

Fires are often caused by the indiscriminate discarding of burning cigarettes thrown overside which may be blown back on board.

The risk involved in carrying matches and, more particularly, lighters when working on the ship should be impressed on all personnel. No one having on his person matches or lighters should be permitted to enter a prohibited space.

3. *SPONTANEOUS COMBUSTION*

Spontaneous combustion can occur in damp or oil soaked rags or cotton waste. Steel receptacles fitted with close fitting covers should be provided for the storage of oil soaked rags or cotton waste, prior

to removal from the ship for disposal ashore. Cleaning materials should not be stored adjacent to hot surfaces.

4. *HOT WORK*

- (i) No hot work should be commenced until a responsible person has thoroughly checked the vicinity of the job to ensure that there is no flammable material beneath, behind or within the object under repair. Steps should be taken to prevent sparks cropping down open hatchways or ventilators.
- (ii) Before commencing burning or welding always check what is on the other side of the plating and equally important, check again on completion of the work.
- (iii) Whenever possible, station a watcher on the opposite side.
- (iv) Fire patrols should be alerted to the fact that materials may smoulder for a long time after work has ceased.
- (v) Fire extinguishers and buckets filled with water or sand should be readily available when welding operations are being carried out.
- (vi) No hot work should be carried out on locations where all sides in way of the job cannot be inspected beforehand, e.g. tanks, cabins or spaces where access to interiors is impeded by closed manholes, tank lids, locked doors, etc.
- (vii) Hot work should not be started before all combustible materials such as dunnage, sacking, waste paper, paints, oil etc. have been cleared from and around the area.
- (viii) Hot work should not be carried out in or near refrigerated spaces before they have been gas-freed, the insulation stripped, all combustibles removed and the atmosphere freed of any flammable dust.
- (ix) Hot work should not be done on smokeboxes, uptakes, fan trunks, ventilators, samson posts, pipes etc. before a thorough examination has been undertaken to eliminate any risk of fire,
- (x) Hot work should not be started on insulated bulkheads or panels before all combustible materials in way of the working area have been stripped clear.
- (xi) Hot work should not be done in or on tanks containing oil.
- (xii) In a tank which has previously contained oil, it should be ensured that no oil-impregnated scale likely to give off gas remains. There should also be no flammable material which might catch fire in adjacent spaces by transmission of heat through bulkheads, etc.
- (xiii) To prevent the possibility of formation of petroleum vapors when hot work is in progress in or around a tank which has

previously contained oil, a small quantity of water for quenching may be provided.

- (xiv) Hot work should not be carried out within or in the vicinity of any oil compartment, cofferdam or pump room (in oil tankers), rudders or similar enclosed spaces unless a gas-free certificate allowing such work has been obtained. A supervisor should not allow hot work to commence in any compartment until he has *personally* seen an appropriate gas-free certificate.
- (xv) Pipelines and heating coils may contain flammable materials even though the ship may have been declared gas-free.
- (xvi) If the presence of prophetic iron sulphide is known—and it should be suspected after the carriage of sour crudes—any impregnated scale should be first damped down and then scraped off before hot work is allowed, whether inside or outside the tank.
- (xvii) It is emphasized that a gas-free certificate is not a guarantee that there is no danger of fire or explosion in the space.

5. OXY-ACETYLENE EQUIPMENT

- (i) Under no circumstances should oil or grease be introduced to the spindles of valves or regulators of oxygen bottles.
- (ii) Care must be taken to protect hoses conveying the gases from cylinders against damage or crimping.
- (iii) Naked flames should not be introduced to the vicinity of oxygen or acetylene cylinders.
- (iv) Cylinders which contain or have contained oxygen or any fuel gas under pressure should not be installed or placed within fifteen feet of any substantial source of heat other than the blow-pipe in use.
- (v) No oxygen or acetylene cylinder should be taken below the topmost deck unless it is installed or placed in a part of the vessel which is adequately ventilated to prevent any dangerous concentration of gas or fumes.
- (vi) No acetylene generating plant should be installed on board a ship under repair.
- (vii) Hoses for the supply of oxygen or any fuel gas should be of sound construction and be properly maintained at all times. All pipes or hoses should be securely attached to the apparatus and other connections by means of suitable clips or equally effective devices

- (viii) Efficient regulating valves should be provided on cylinders containing oxygen or fuel gas under pressure and maintained in good working order.
- (ix) The control valves of blow-pipes through which oxygen or fuel gas is supplied should be so constructed, or the operating mechanisms so protected, that they cannot be opened accidentally.
- (x) When the use of the equipment on board a vessel ceases for the day, the supply valves should be securely closed and the movable pipes or hoses disconnected from the cylinders.
- (xi) When it is necessary to undertake hoc work in a confined space, adequate ventilation should be provided and maintained as a precaution against asphyxiation, injurious fumes or explosions.
- (xii) Additional precautions will be necessary where there is a toxic risk produced by the cutting, welding or heating of certain metals.
- (xiii) The storage of oxygen cylinders and fuel gas cylinders on board a vessel should be separate from each other and their quantities kept to a minimum.
- (xiv) Smouldering ropes should not be used to light blow-pipes. Spark lighters, such as ones employing flint on steel, are suitable.

6. *ELECTRICAL INSTALLATION*

- (i) Only approved portable tools should be provided for use by workers. Strict prohibition of the use of defective electrical tools, cables, plugs and sockets should be enforced.
- (ii) A competent electrician should be employed to instal any temporary power supply and to ensure that such installations and equipment are properly used and maintained.
- (iii) It should always be ascertained that the ship's wiring is of sufficient capacity to carry the load of any temporary wiring installation.
- (iv) Workmen should be prohibited from tampering with electrical fittings on board ship. Electrical apparatus should not be connected to the supply without the approval and supervision of a responsible person.
- (v) Clothing or similar articles should never be placed over electric heaters, nor so close to electric heaters or electric light bulbs as to restrict the flow of air and thus lead to overheating and fire.
- (vi) Portable electric apparatus and tools should be tested before use.

- (vii) Electric tools should be effectively earthed. Portable electrical tools should be plugged only to the boards provided for them and should be disconnected when not in use.
- (viii) After work ceases, ships undergoing major repairs and others constituting large fire risk should be made dead electrically to the utmost extent possible. The only electric circuits retained should be those needed to provide emergency lighting, and for fire watchers to effect their patrols.
- (ix) Electric cables should not be allowed to lie in pools of water or where they may be cut or chafed. Preferably, they should pass overhead. Frayed cable is a serious fire hazard.
- (x) Temporary wiring should be restricted to a minimum and removed immediately after use.
- (xi) Faulty fittings or wiring should be reported immediately to the person responsible.
- (xii) All circuits (main and subsidiary) should be correctly fused to avoid overloading.
- (xiii) Electric leads should be fitted with suitable plugs. The ends of bared wires should not be inserted into sockets.
- (xiv) Hard wearing cable should be used for portable lamps and tools.
- (xv) Temporary supply leads interfering with the activities of a worker should only be moved by an authorized electrician.
- (xvi) Only self-contained battery operated hand lamps or torches of an approved type should be used in hazardous areas and these should be well maintained.
- (xvii) No portable electrical lamps or equipment should be used in hazardous areas nor should wandering leads pass through such areas.
- (xviii) In hazardous areas, electrical equipment should be flameproof to the requisite standard, or, in some applications, intrinsically safe.
- (xix) When handling volatile petroleum or engaged in gas-freeing operation, flammable vapours should be prevented from entering accommodation, machinery and boiler rooms, because much of the electrical equipment in these spaces is not approved for use in the presence of flammable vapours. Air-conditioning or forced ventilation should be shut down. If the hazard persists, oil handling or gas-freeing operations may be suspended.

7. *AEROSOLS*

Aerosol spray may ignite on contact: with a naked flame, heated surface or even a lighted cigarette. They should be stored in a cool place and out of the sun's rays. Ensure that the manufacturer's warning notices printed on the containers are obeyed.

8. *STOWAGE*

Close stowage retards fire spread. Always keep cotton waste, combustible stores, etc. stowed compactly in securely closed lockers.

9. *COMPARTMENTATION*

The compartmentation of working areas aboard a vessel should be maintained at all times so that fire is confined to a limited space or compartment. This will usually conform to the designed compartmentation of the vessel. No obstructions which would prevent the operation of fire doors, etc. between compartments or spaces should be tolerated.

10. *DOORS*

As far as is possible, doors should be kept shut even if they are constructed of combustible material. If a fire starts the boundary sealing thus provided will keep the fire in check. Any malfunction of fire doors etc. should be immediately attended to and wherever practicable doors, skylights etc should be closed when work is finished for the day.

11. *MEANS OF ESCAPE*

- (i) Adequate and safe means of escape from any part of the vessel (e.g. ship's holds, enclosed spaces should be maintained at all times. Rope and vertical ladders are not satisfactory where emergency evacuation is required.
- (ii) Exits should provide unobstructed and safe means of escape and be clearly marked and suitably lighted. Where work is done at night an emergency lighting system is suggested.
- (iii) Emergency evacuation should form a part of regular fire drills.
- (iv) The evacuation alarm system should not be used for any other purpose.

12. *LIFTING EQUIPMENT*

In areas likely to contain flammable gas, temporary protection may be provided by preventing striking of metal parts and so ensuring against the risk of sparking.

13. *HOT SCOT*

Incandescent carton from, the main or galley funnel, or from the funnels of other craft alongside may ignite -flammable vapours or other combustibles. Once started, such sparking is not easy to stop. When it occurs, tank cleaning or other hazardous operations should cease immediately.

14. *PORTABLE OIL ENGINES*

Unless a vessel is wholly gas-free and frequent gas tests are made, the use of portable oil engines should be prohibited in the vicinity of spaces likely to contain flammable gas.

15. *HANDLING OF PETROLEUM, BUNKERING ETC.*

Personnel concerned should make themselves familiar with the nature and characteristics of the petroleum and of the conditions of the tanks, pipelines and venting systems so as to plan the safe handling of the fuel or cargo.

16. *OPENING AND CLOSING OF OIL TANKS*

- (i) During handling of petroleum and ballasting of tanks, all openings should be closed and secured.
- (ii) Any opening required to be opened for sounding or sampling should be covered with sandbags or other suitable device.
- (iii) Before opening any oil tank fitting, any pressure in the tanks should be relieved.

17. *WEATHER PRECAUTIONS*

In the event of still air conditions or thunderstorms gas-freeing, tank cleaning, ballasting or handling of oil should be stopped.

18. *CRAFT AND TUGS ALONGSIDE*

- (i) No unauthorized craft should be allowed to secure alongside a vessel when in the process of handling oil and also when cleaning, ballasting or gas-freeing oil tanks.
- (ii) When tugs are alongside or assisting a tanker, all cargo tank openings must be closed, unless all tanks are gas-free.

19. *PAINTING*

- (i) The solvents used in paints may give rise to flammable vapours which may also be toxic.

- (ii) Interiors of enclosed spaces should be well ventilated both while painting is in progress and until the paint has dried.
- (iii) There should be no smoking or use of naked lights in such spaces during painting nor before the paint has dried.

20. ACTIVITIES

- (i) Incompatible activities must not be allowed to take place simultaneously e.g. painting or working with combustible materials in the same area where hot work is being carried out.
- (ii) In pursuing their various occupations workmen should not obstruct means of escape with materials and/or tools.
- (iii) Flammable liquids and other combustible materials or dangerous goods should not be stored on board the vessel in excess of their daily or immediate requirements. Dangerous goods not in immediate use should be kept in suitable non-combustible receptacles or safe storage areas.

21. REMOVAL OF WASTE AND OTHER COMBUSTIBLES

- (i) Arrange for the regular removal of empty gas cylinders, empty containers which have held paint thinners and accumulated waste, rubbish and scrap. Remove all combustible materials to safe storage areas when not in use, especially when work has finished for the day.
- (ii) Rags and other waste contaminated with flammable liquids should be placed in metal bins fitted with lids and removed at the end of each day.
- (iii) Waste liquid should be collected, kept in a closed container and removed from the ship daily, or more frequently where necessary.

22. WORKING AREAS

Ensure working areas are safe prior to and during work. After completion of work all naked flames and smouldering rope ends should be extinguished and the area rendered safe.

23. FIRE PROTECTION EQUIPMENT

The fixed and portable fire protection equipment installed on a vessel should be fully operative at all times. If any part of the equipment is removed or rendered inoperative, the particular item should be replaced. Failing this, alternative fire fighting provision should be made. Whenever necessary, to cover a particular risk, additional fire fighting equipment should be supplied.

24. FIRE HAZARDS IN MACHINERY SPACES

The seriousness of fire in machinery spaces cannot be overstressed. All personnel should be fully aware of the precautions necessary for its prevention and of the immediate action to be taken should fire break out.

- (i) It should be ensured that fire-fighting appliances are kept free of obstruction and ready for use at all times.
- (ii) Smoking should be prohibited if there is any possibility of flammable vapour being present.
- (iii) Cleanliness is the best precaution against fire. Suitable metal containers should be provided for the disposal of used cotton waste, cleaning rags or similar materials. Such containers should be emptied at frequent intervals and the contents safely disposed of.
- (iv) If a hot bearing has been observed in a closed crankcase, the crankcase must not be opened until the bearing has cooled down, otherwise the entry of air could create an explosion.
- (v) All oil spills should be wiped up as soon as possible.
- (vi) Oil should not be allowed to accumulate in boiler registers, tank tops, bilges and near hot pipes or other heated surfaces.
- (vii) Scavengers and drip trays should be kept free from oil and any leakage should be given immediate attention.
- (viii) Any oil found in bilges should be disposed of and the bilges washed at the earliest opportunity, ensuring that the relevant regulations in this regard are observed. The source of leakage to the bilge should be located and repaired.
- (ix) Engine room bilges should at all times be kept clear of rubbish and other substances so that strums are not blocked and bilges may be readily and easily pumped.
- (x) When handling oil or gas-freeing, vapour should be prevented from entering machinery spaces, as much of the equipment there is neither explosion proof nor intrinsically safe. Burners in the boilers are potential sources of ignition.
- (xi) Extreme caution is required when filling any settling or other oil tank to prevent it overflowing, especially in engine rooms where the exhaust pipe or other hot surfaces are directly below. Particular care should be taken when filling tanks which have their sounding pipes in the machinery spaces. In no case should a weighted cock on a sounding pipe of a fuel or lubricating oil tank be secured in the open position.

25. COOKING STOVES

- (a) The use of a cooking stove should not be permitted when an undue hazard exists, e.g. when cleaning, gas-freeing, filling, emptying or ballasting any tank. However, equipment which is safe for use with petroleum vapour, e.g. appliances using black-heat, immersed elements or steam coils, may be allowed.
- (b) Precautions to be observed, if L.P.G. is used for cooking:—
 - (i) The gas should contain an additive which will give a distinctive odour.
 - (ii) The gas bottles should have their fittings thoroughly checked. The equipment should be expertly installed to avoid leakage and be regularly serviced and maintained.
 - (iii) L.P.G. is heavier than air. Apart from the hazard of fire and explosion there is also a risk of asphyxiation in the event of gas leakage in an enclosed space, and should ventilation be deficient, from carbon monoxide poisoning when the appliance is in use. The equipment should be installed in a well ventilated area.
 - (iv) A warning notice should be displayed adjacent to each appliance (See Section I).
- (c) At least one fire extinguisher and a sand bucket should be provided near every cooking stove.
- (d) No oil rags or deposits of fat should be allowed to accumulate in the vicinity of cooking stoves.

26. PACKED FLAUMBLE PRODUCTS

- (a) The handling of flammable liquids and gases in cylinders or containers should be carefully supervised, ensuring that:—
 - (i) each package is inspected for leakage or damage;
 - (ii) drums or gas cylinders are stowed on wooden platforms and not dragged across the deck or rolled;
 - (iii) empty containers unless gas-free, are treated as filled containers, and
 - (iv) temporary protection is provided to prevent hoists, slings etc. striking against bulwarks or coamings and so risking sparks.
- (b) Any hold which has been used for packed cargo should be thoroughly ventilated and the atmosphere tested before entry.
- (c) Any oil drums employed for emptying tank contents should be removed from the ship with the least delay.

- (d) Should oil reception facilities be available, these should be used in preference to emptying contents into drums. Alternatively, consideration may be given to pumping directly into a barge suitable for the purpose.

27. USE OF TOOLS

- (a) Care should be taken to avoid smears or flakes of aluminum adhering to surfaces. To avoid the risk of ignition of flammable mixtures, tools which have been used on aluminium structures or fittings should be cleaned after use. Portable equipment made of aluminium or light alloy should be used with great care in oil tanks or adjacent confined spaces.
- (b) Tools should not be carried by personnel into oil tanks but lowered in a canvas bag or plastic bucket to avoid their being dropped.
- (c) Only plastic or wooden hand tools should be used for removing paint or scale and sludge in tanks that have contained flammable liquids.
- (d) In tanks which have previously held flammable liquids all steel tools should be used with the minimum impact force necessary.
- (e) Before any hammering or chipping is undertaken, or any power tools used, it should be ensured that there is no flammable gas in the vicinity.

28. ANODES

Anodes when fitted in cargo tanks are likely to become insecure due to corrosion. Owing to the risk of incentive sparking if one should fall, they should be inspected and replaced or removed if necessary.

29. STATIC ELECTRICITY

- (a) Static electricity can cause sparks that can ignite flammable gas. Broadly, all petroleum distillates are prone to electrostatic generation and should be handled accordingly if a gassy atmosphere is suspected.
- (b) Precautions to prevent ignition are:—
 - (i) Metallic or metal reinforced hoses should be thoroughly bonded.
 - (ii) Water in suspension in petroleum is a potent static producing medium. Before any clean or white oil is pumped, it should be checked that oil lines and tank bottoms are as free as possible of water. A low loading rate (1 metre/sec)

will reduce the possibility of static electricity. After the bottom oil inlet and floors have been covered, the filling rate may be somewhat increased.

- (iii) During filling or transfer of clean oils no conducting material of any description should be allowed inside the tank being filled. Conducting materials include, manual steel ullage tapes, sampling cans and metal sounding rods. Non-conducting materials may however be used.

30. GAS-FREEING

Tank cleaning is a safe operation but if due precautions are not observed, the consequences can be disastrous.

(a) Precautions

Before gas-freeing, ensure that:—

- (i) ships personnel have been notified;
- (ii) warning signals and notices are displayed as required;
- (iii) all fire appliances are ready for use and correctly positioned;
- (iv) adequate safe lighting as required is available;
- (v) no naked lights are being used;
- (vi) no hot or unauthorized work is being carried out;
- (vii) there is no smoking on board, except in authorized places;
- (viii) there is no cooking on board, except in areas considered safe;
- (ix) all doors and openings leading from the main deck to accommodation or machinery spaces are, as far as is practicable, closed (particularly Important on tankers):
- (x) all ventilators are suitably trimmed and any mechanical ventilation stopped;
- (xi) all tank openings, except those required to be used, are closed;
- (xii) all pipes containing oil or any combustible fluid are drained and isolated and control valves closed;
- (xiii) all oil lines, valves, etc. required for use are properly set;
- (xiv) the valves in the venting system are open (tankers):
- (xv) no unauthorized craft is alongside, and
- (xvi) there are no naked lights in use and no smoking in the vicinity of the ship.

(b) Procedure

The following procedure is recommended:—

- (i) after stripping, wash through the whole pipeline system;
- (ii) wash through all oil pumps with water;
- (iii) close gas valves, if any, of tanks whose vent systems are commor to those being cleaned (tankers);
- (iv) blow through heating coils, if fitted;
- (v) open tank covers as necessary;
- (vi) operate mechanical fans, gas ejectors or other safe means (e.g. wind sails), as long as necessary:
(Note: Do not use ordinary electric fans).
- (vii) test for gas with a combustible gas indicator;
- (viii) if atmosphere still contains flammable gas, give additional ventilation;
- (ix) again test for gas:
- (x) when gas-free, mop up tank bottoms, keeping ventilating devices operating;
- (xi) remove all sludge, sediment and scale;
- (xii) clear all gas lines:
- (xiii) the covers of all tank openings should be kept closed unless required for gas-freeing;
- (xiv) do not employ oxygen for ventilating;
- (xv) in tankers, gas from tanks under the centrecastle should be vented outside the centrecastle;
- (xvi) if tank washing is required, the tank atmosphere should be in non-fammable condition, preferably below 15% of the Lower Explosive Limit, and
- (xvii) if steaming a tank containing white oil is essential, precautions seated under "Static Electricity" should be observed.

Note: If in the course of work in any oil-tank or in any compartment or space adjacent thereto, any pipe or tank joint is opened or broken or any other event occurs so that there is a risk of oil vapour contaminating the space, work should be suspended forthwith and thereafter any certificate for 'entry' or 'hot work' previously issued in respect of the tank space, or compartment should no longer be regarded as valid (See Appendices 2 and 3).

31. PUMPROOMS AND COFFERDAMS

The precautions recommended for gas-freeing tanks apply to pump-rooms and cofferdams.

32. WARNINGS OF EXPLOSIONS

- (a) If flame from tank openings is yellow-orange in colour and is accompanied by black smoke, It indicates a 'too-rich' condition in the tank. The flame will not pass back into the tank and an explosion is not immediately likely.
- (b) If flame from a tank opening burns with a bluish-red flame, and is nearly smokeless, it indicates a flammable condition in the tank. The flame is likely to pass back into the tank and an explosion is imminent. The deck must be evacuated immediately.
- (c) Provided all tank openings are closed, oil tanks are unlikely to explode during fires on deck.

33. EXTINGUISHING AGENTS

- (a)
 - (i) Water is suitable for fire involving solid materials, but it is dangerous to use water on deep seated burning oils and fat. Water fog, however, can be used against small oil fires or for making a screen between the fire fighters and the fire. The hose-reel is the most effective first-aid hand appliance available. Unless a ship fire occurs in a dry dock, fullest use should be made of water in its extinction, provided adequate drainage and bilge pumping facilities are fitted and are in efficient working condition, so that stability is maintained. It is important to start pumping out the water as soon as hoses are brought into play.
 - (ii) Water should not be used on electrical fires. Fires involving low flash point fuels cannot be effectively extinguished by water. If the flash point is lower than the water temperature it is quite useless to even attempt cooling.
- (b) Foam is suitable for petroleum fires, but must not be used for electrical fires.
- (c) CO₂ is suitable for most fires. CO₂ is asphyxiating and ineffective against liquefied gas fires.
- (d) Dry powder is suitable for all small fires, particularly liquefied gas fires. The use of dry powder is not recommended for delicate electrical equipment such as telephone switchboards or other equipment containing relays because the dry chemical is likely to coat the contacts and make them inoperative.

Note: On tanks or vats of flammable liquids dry powder is likely to have inadequate lasting blanketing effect, making it necessary to take steps to overcome re-ignition hazards from heated surfaces of the tanks or vats. Dry powder has no cooling or wetting effect and will not extinguish deep-seated fires in ordinary combustibles and should be followed up with foam or Water, as the case requires, in order to ensure that the fuel is completely cooled. However, avoid the use of powder with foam, unless both substances are compatible.

- (e) Bromochlorodifluoromethane (B.C.F.) is a vaporising liquid, it is slightly toxic, has flame inhibiting effect and is suitable for electrical fires.

34. USE OF FIRE EXTINGUISHERS

All personnel should be made familiar with the right type of extinguisher for dealing with a particular fire and the correct method of operating the particular extinguisher provided. An extinguisher will not operate unless the correct method is used.

35. METHODS OF DEALING WITH DIFFERENT TYPES OF FIRE

(a) *Oil Spillage on Deck*

Use a dry chemical extinguisher and follow up with foam (if compatible) or water fog spray. Cool surrounding areas with water spray.

(b) *Electrical Fires*

Switch off and electrically isolate; use CO₂, vaporizing liquid or dry chemical extinguisher.

(c) *Ship's galley*

Use CO₂, dry chemical or vaporizing liquid for a small fire or use foam if oil fire.

(d) *Accommodation Involving Combustible Materials*

Use water spray, close all doors and ports of affected and adjacent accommodation. Continue water spray to prevent re-ignition. Breathing apparatus may be required.

(e) *Oil Cargo Tanks*

Use foam or steam smothering if fitted and in the case of heavy oils use water fog or spray.

(f) *Major Fire In Engine room or Pumproom*

Close down engine-room or pump room. Stop ventilation. Shut off all oil sections and oil pumps. Ship's fixed equipment is to be used, that is, foam, steam, water, fog or scored inert gas under pressure. Water sprays should be used to cool decks and structures in vicinity.

(g) *L.P.G. and L.N.G. fires*

Such fires should not be extinguished until the source of vapour is under control. When such a fire is ready for extinguishing, dry chemical is the most effective medium. Cover affected area with large quantities of water spray to cool and control the effect of radiant heat. Water jets should not be used directly into a L.P.G. or L.N.G. fire.

II—Entry into Confined Spaces

1. Before any person is allowed to enter any enclosed space where there is a possibility of a hazardous atmosphere, the following precautions should be ensured:—
 - (i) that the atmosphere in the compartment is free from toxic concentrations of the vapour (i.e. below T.L.V.);
 - (ii) that the atmosphere has enough oxygen (not less than 18%). In the absence of a suitable detector, the space should be thoroughly ventilated, so that an ample supply of oxygen is assured;
 - (iii) that a man is positioned outside the compartment to keep watch and summon aid if required;
 - (iv) that effective ventilation is maintained whilst the men are inside, and
 - (v) that a breathing apparatus, harness, life-line and safety lamp are ready for use at the entrance to the compartment and a person trained in their use is standing by. The wearer and the persons outside must understand the accepted system of signals.
2. In case of spaces not adjoining oil tanks, or not connected to the pumping system, or when the petroleum involved is non-volatile the above precautions may be relaxed and adequate ventilation should provide sufficient safeguard. This would not apply if sour crude is handled.
3. A gas-free tank may become hazardous:—
 - (i) if there occurs a change in temperature causing vapour to be given off from scale, sludge or residue;
 - (ii) upon dismantling or testing of fittings including heating coils which may contain volatile oil or vapour;
 - (iii) upon disturbing scale or sludge, and
 - (iv) upon opening valves or accidental removal of blanks leading to the tank permitting ingress of volatile oil, vapours, inert gas etc.
4. **RESCUE**

The person positioned outside the enclosed compartment must keep a careful and constant watch on the men inside. If showing signs of being affected, he should raise the alarm, but must NOT enter the space to give help. No rescue must be attempted without wearing

a breathing apparatus and a life-line. Every moment is vital. Any physical injury sustained by the casualty is of secondary importance. The victim must be brought out with the least delay and then attended.

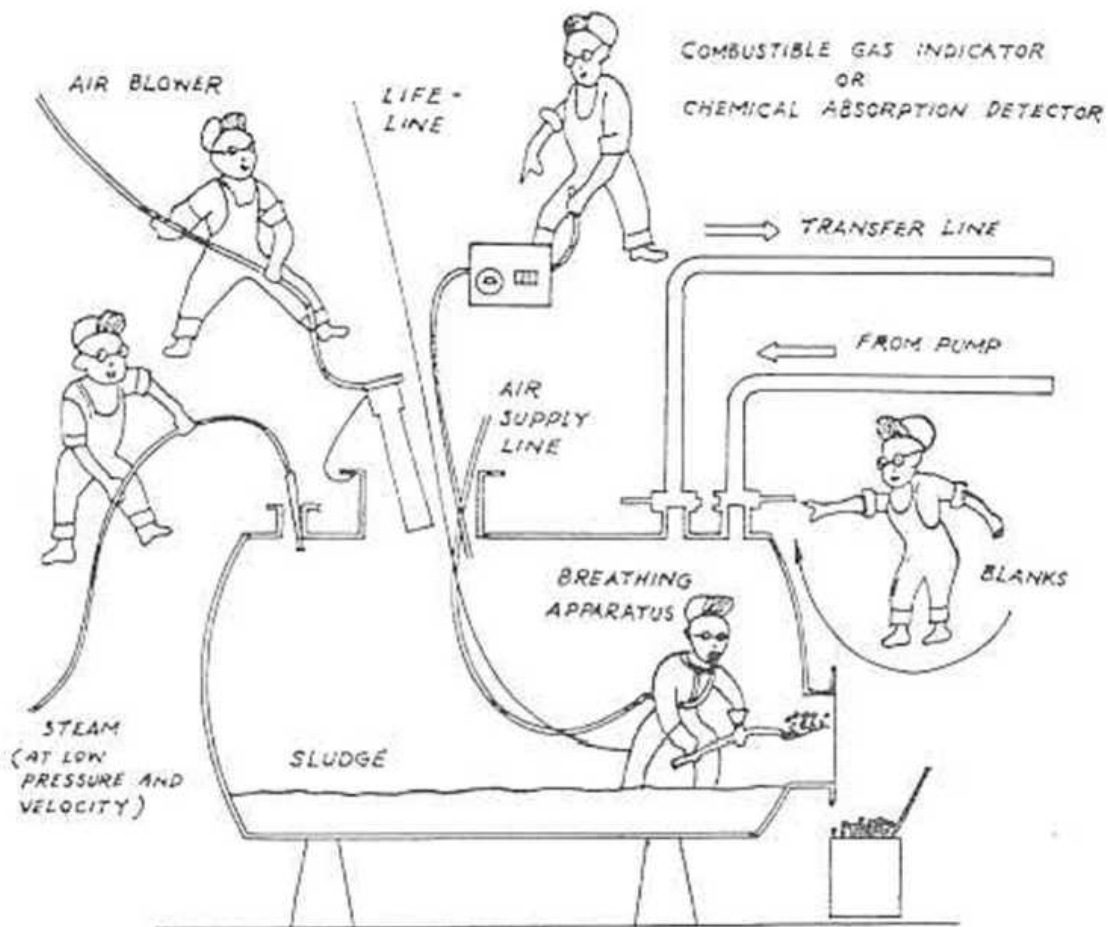
5. *SKIN EFFECT PRECAUTIONS*

- (i) As far as practicable contact with petroleums, corrosives and other harmful chemicals should be avoided. Protective clothing, goggles, and gloves should be used, as required.
- (ii) In case of contact, the substance should be removed as soon as possible using clean cloth, soft soap and water.
- (iii) Personnel should not wear oil soaked clothes.
- (iv) In case of any skin disease prompt medical advice should be sought.

6. *GENERAL PRECAUTIONS*

- (i) Breathing apparatus should be kept in good working order and adjusted to fit the user.
- (ii) Any resuscitation equipment (e.g. Minuteman, Epac, etc.) should be maintained in good working order and be readily available to revive any person overcome by fumes.
- (iii) A sufficient number of employees trained in methods of artificial respiration and in the use of resuscitation apparatus should be readily available.
- (iv) Filter cannisters are intended for specific gases and are effective only in atmospheres containing sufficient oxygen. Such apparatus must not therefore be used for rescue work. It will however be helpful for specific purposes, e.g. painting in a confined space.
- (v) Any worker in a confined space should be allowed to leave the space for rest spells in the open air appropriate to the duration and type of work on which he is engaged.
- (vi) In a confined space in which work is proceeding constant ventilation must be maintained to dispel vapour or fumes evolved and to keep the atmosphere fresh.
- (vii) The assistant outside the compartment should have immediately to hand a suitable fire extinguisher and a supply of water.
- (viii) Warning notices should be posted at the entrances of confined spaces.
- (ix) Enclosed spaces should be well ventilated both while painting is in progress and until the paint, has dried, particularly as the evaporating paint solvents may be toxic.

- (x) Paints containing lead or mercury should not be used in confined spaces.
- (xi) Toxic and explosive gases may be generated in compartments such as bilge wells by the decomposition of organic matter in water.
- (xii) A combustible gas indicator does not indicate oxygen deficiency or reliably indicate the presence of hydrogen. Even when a reading of zero is obtained, it does not follow that the tank is safe to enter therefore due caution should still be exercised.



PREPARATION OF TANK: ESTABLISH SOUND PROCEDURES
AND MAKE SURE THAT THEY ARE ALWAYS FOLLOWED.

III—Safe Means of Access and Places of Work

1. GENERAL

- (a) Access to ships must be provided by an accommodation ladder or gangway and only when it is impossible to rig either should portable ladders be used.
- (b) Where appropriate, at the point of access on board the vessel a lifebuoy with an attached line should be kept ready for immediate use.
- (c) During the hours of darkness all means of access should be adequately illuminated.
- (d) Every bridle, chain, wire, shackle, block, tackle, rope or any other means of attachment used should be subject to frequent inspections.
- (e) Wooden gangways and other means of access should not be painted nor be treated in such a way that any cracks or defects are concealed. They may, however, be treated with a transparent preservative.
- (f) The general means of access to the ship should be placed in such a position that cargo is not worked over it. Where this is not practicable, a man should be situated near to the gangway to warn persons coming on board or leaving the vessel that cargo is being worked.
- (g) In the event of a means of access being unsafe for any reason physical barriers should be erected and warning notices prohibiting its use posted at every approach.
- (h) The means of access should be kept in position as long as required, and where practicable be of permanent construction.
- (i) Any oil or other slippery substance falling on the floor should be removed as quickly as possible. As a temporary measure, sand or some other suitable substance may be applied, until the spillage is properly cleaned.
- (j) All places of work and means of access should be kept free of rubbish, obstructions, projecting stacked material, nails, bits of wood etc.
- (k) Dependent on the number of persons on board, a suitable number of means of general access to the ship should be provided.
- (l) Every avenue of escape should be kept clear at all times. At least two satisfactory means of escape must always be available for use in an emergency.

- (m) If a ship is lying alongside another ship and workers are required to pass from one to the other, a safe means of access should be provided.
- (n) Where it is necessary to erect outside staging for a ship in a floating dock, there should be provided sufficient ladders giving direct access to the stages. The number of ladders will depend on the extent of the staging and the work to be done.
- (o) Every means of access should be of sound construction, of adequate strength for the purpose for which it is intended and properly maintained.

2. *GUARD RAILS AND FENCING*

- (a) All fencing required to be provided for hatchways, gangways, accommodation ladders, etc. should be of sound material and good construction and possess adequate strength and be at least 900 mm high. It should consist of two rails or taut ropes or chains, supporting stanchions and, if necessary, to prevent persons slipping or objects falling, a toe-board.
- (b) Intermediate rails, ropes or chains should be about 500 mm high.
- (c) Stanchions should not be more than 2 meters apart and be secured against inadvertent displacement.
- (d) Toe-boards should be at least 150 mm high and be securely fastened.
- (e) Railings should be free from sharp edges.
- (f) All guard rails and fencing should be maintained in good repair.
- (g) Temporary fencing of hatchways, elevated platforms, etc., should, as far as reasonably practicable, extend to a height of at least 900 mm and consist of either two taut ropes or chains with stanchions or a properly rigged and securely fastened net.

3. *GANGWAYS*

- (a) When the upper end of a gangway rests on, or is flush with the top of a bulwark, suitable and substantial steps properly secured to the deck and equipped with a substantial handrail at least 900 mm high should be provided between the top of the bulwark or rail and the deck. Where such a platform is not practicable, a second gangway or stairway leading from the bulwark onto the deck should either be attached to the end of the first gangway or be placed contiguous to it. In that case a means of access, securely protected by fencing, should be provided from one to the other.

- (b) Where practicable, an accommodation ladder should be used instead of a gangway, if the latter would assume a dangerous angle.
- (c) The practice of rigging gangways on ships' rails is dangerous and should never be adopted unless the rail is specially reinforced.

4. ACCOMMODATION LADDERS

- (a) When accommodation ladders have fixed steps and the angle is such that personnel are required to walk on the edges of the steps, suitable cleated duckboards should be laid over and secured to the ladder.
- (b) If the foot of a suspended accommodation ladder is more than 300 mm from the edge of the quay, the space between the bottom step or platform and the quay should be bridged by a firm walkway fitted with rails, taut ropes or chains, on both sides to a height of at least 900 mm.
- (c) The fencing between the accommodation ladder and the walkway should be fitted in such a way that there are no gaps.

5. PORTABLE LADDERS

- (a) Where it is not possible to make use of a gangway or accommodation ladder because of tides or other reasons, a portable ladder may be used provided that when in use there is a safe clearance behind the rungs.
- (b) Portable ladders should extend at least 1 metre above the upper landing place unless there are other suitable handholds extending to a height of at least 1 metre above the landing. When these ladders have their upper end resting on bulwarks or rails suitable safe access to the deck must be provided.
- (c) Portable ladders should generally be secured as near as possible to their upper resting place in such a manner as to prevent displacement.
- (d) Portable ladders should be placed at a slope of four vertical to one horizontal.
- (e) Portable ladders should stand on a firm base and be securely lashed in position. If fixing is impracticable, a person should be stationed at the base of the ladder when in use to prevent it from slipping.
- (f) Portable ladders should not be painted.

6. ROPE LADDERS

- (a) As far as possible, rope ladders should not be used as a means of access.
- (b) Rope ladders should be checked before use to make sure that they are in a good and safe condition and that there are no broken or faulty seeps.
- (c) The ladder should never be secured to rails unless the rails are able to take the weight of men and ladder with an ample margin of safety.

7. SAFETY NETS

Those parts of a gangway, accommodation ladder or portable ladder that overhang the water should have a net spread below them in such a manner that a person slipping is prevented from falling into the water. Safety nets should also be used when there is a danger of any one dropping from a height, e.g. a hold or deep tank.

8. STAGES AND STAGING

- (a) Prior to being used, all staging material should be thoroughly examined by a competent person for any possible defects, which should be of adequate strength, suitable quality and in good condition.
- (b) Dunnage wood should not be used in the construction of staging.
- (c) Planks should never be supported on the rungs of portable ladders. Planks supported on the rungs of fixed ladders should not be used to support stages.
- (d) All stages other than suspended stages should be secured in position to prevent movement. Suspended stages should be prevented from twisting and their planks secured against slipping.
- (e) Stages from which a man is liable to fall more than 2 metres or into water should, wherever practicable,
 - (i) be at least 430 mm wide;
 - (ii) if it is a side not immediately adjacent to the vessel, be fitted with guard rails or stanchions and taut ropes to a height of at least 900 mm above the stage; and
 - (iii) be closely planked or plated.
- (f) Men working on stages which do not comply with the requirement in (e) above should wear safety harness or life-line which should be suitably anchored. Failing this, such other precautions as are reasonable in the circumstances, should be taken.

- (g) Blocks or ether devices through which ropes are led should not be secured to portable rails or stanchions.
- (h) All stagings should be thoroughly examined by a competent person before being taken into use and it frequent intervals thereafter, when in use.
- (i) To safeguard persons below, personnel working on stages should be provided with and use suitable tool containers. All articles should be lowered by means of a rope.
- (j) Except in case of an emergency, work on stages should not take place in the vicinity of cargo working.
- (k) A sufficient supply of suitable planks and other materials and appliances should be available for the construction of stages and stagings.
- (l) The use of fibre ropes or ropes made with strands consisting of wire cores should not be allowed. Fibre ropes may be used where the suspension ropes are reered through blocks.
- (m) Means to be provided for securing and suspending staging should be prevented from coming into contact with moving parts of machinery, sharp edges, sources of heat or corrosive material.
- (n) All staging should be erected, altered and dismantled by gangs specially, chough not exclusively, employed for that purpose.
- (o) No unauthorised person should erect, alter or dismantle staging of any type.

9. *BOSUN'S CHAIR*

- (a) Hooks should not be used to support a bosun's chair unless they are of a type which, because of their special construction, cannot be accidentally dislodged.
- (b) Suitable measures should be taken to prevent the chair from spinning or tipping and the occupant from falling there from.
- (c) On each occasion that a bosun's chair is rigged for use and at least daily when ic is in use, the chair and the rigging should be thoroughly examinee.
- (d) When a workman in a bosun's chair is required to be hauled aloft, this should be done by hand power only.

10. *WORKING ALOFT*

- (a) Boys and inexperienced men should not work aloft unless accom-panied by an experienced worker or adequately supervised.

- (b) Before work is commenced in the immediate vicinity of the ship's whistle, the power should be shut off and suitable warning notices posted, both on the bridge and in the machinery spaces.
- (c) Before work is done on masts or other places in close proximity to radio aerials or the radar scanner, the officer-in-charge should be informed.
- (d) Before chairs or stages are rigged or other duties undertaken on top of the funnel, arrangements should be made to prevent steam safety valves being lifted or boiler tubes blown, until the work is completed.
- (e) A safety harness, which is to be suitably anchored while in use, should be worn when working aloft.

11. *WORK ON HATCHES AND IN HOLDS*

- (a) Every space exceeding 2 metres in depth which is served by hatchways (including access and trimming hatchways) that are not protected with coamings to a clear height of 760 mm should, when not in use, be fenced to a height of 900 mm or securely covered.
- (b) No person should be allowed on a hatchway, unless it has been ensured that the hatchway is completely covered and it is safe to do so.
- (c) Men required to work on partly covered hatchways should be protected against the danger of falling by spreading a net below them or by other suitable means.
- (d) Safety nets should not be secured to the hatch covers.
- (e) Measures should be taken to prevent stacks of cargo from falling on men working below.
- (f) If suitable fixed ladders or stairs are not provided, portable rigid ladders may be used, provided that they are properly secured and have a safe clearance behind the rungs.
- (g) Rope ladders should not be used for access to holds.
- (h) When an access ladder, handgrip or ladder cleat is found to be unsafe, the access should be blocked off, and other suitable means of access provided until repairs have been carried out.
- (i) Hatch covers and beams should not be removed or replaced while work is going on below them.
- (j) Hatch covers should not be thrown or handled in a manner liable to cause damage.

- (k) Hatch covers, beams, pontoons and tarpaulins which have been removed should be stacked and secured, or placed in such a manner that they cannot fall down a hold or otherwise cause danger.
- (l) Where mechanical hatch covers are fitted, the manufacturer's instructions should be strictly followed in their operation and men warned especially of any potential dangers accompanying the operation.
- (m) When the lids of deep tanks are opened, openings should be adequately fenced. In addition, a suitable net adequately secured should be spread across the opening or other equally effective means adopted to prevent men falling into the tank.
- (n) Where it is necessary to lay hatch boards, forward or aft or athwart ship across or along uncovered beams, sufficient hatchboards should be used to provide a walkway of at least 430 mm wide, and where required, suitable and sufficient ladders should be put in use.

IV—Gas and Electric Welding

1. *RESPONSIBILITY*

To ensure personal protection and avoid damage to equipment safe working practices must be followed. The fire and explosion risks inherent in these operations have been adequately covered before. All Supervisors should be fully conversant with the recommended precautions.

2. *CARE AND STORAGE OF CYLINDERS*

- (a) Where cylinders are used in the open they should be protected from rain and direct sunlight. Oxygen and acetylene cylinders should not be stored together. Also cylinders which are full should be stored separately from those empty.
- (b) Oxygen cylinders may be stacked horizontally with suitable wedges at each side of the stack to prevent their displacement, but acetylene cylinders should always be stored and used in an upright position, and properly secured against falling. Cylinders should never be carried in chain slings; proper rope slings or cradles should be used.
- (c) Cylinders should not be dropped from one level to another, nor used as work supports or rollers.
- (d) Cylinders should not be allowed to come into contact with electrical apparatus or live wires.

3. *CARE IN THE USE OF CYLINDERS*

- (a) Cylinders should not be transported with regulators and hoses attached unless a proper trolley or carrier is used. Before transporting a cylinder, its valves should be properly shut.
- (b) When a cylinder is empty of gas, its valve should be shut. No attempt should be made to fill one cylinder from another.
- (c) In the case of an acetylene cylinder becoming hot or catching fire, the cylinder and its fittings should be handled as little as possible. Either opening or closing the valve could cause an explosion. Cooling the cylinder body from a safe position is recommended. Alternatively, the cylinder may be thrown overboard into the sea. In the event of such an occurrence, the Fire Services Department and the suppliers should be advised immediately.

- (d) Only standard keys should be used for operating cylinder valves. Long leverage spanners or regulation keys fitted with extension pieces should not be allowed, if a cylinder valve spindle is found damaged the supplier should be informed. When closing cylinder valves excessive force should not be used.

4. CARE IN THE USE OF OXY-ACETYLENE EQUIPMENT

- (a) Before attaching a regulator to the cylinder it is advisable to "snift" the valve in order to rid the connection of dirt, oil or foreign particles. The regulator chosen should be correct for the gas contained in the cylinder.
- (b) Gauges for oxygen should be marked "oxygen" and never tested with oil.
- (c) Welding or cutting apparatus should not be used unless automatic pressure regulators are fitted to the oxygen and acetylene gas cylinders.
- (d) Before fitting a regulator to a full cylinder, the adjusting screw for regulating the output pressure should be released. Otherwise there is a risk of damage to the regulator.
- (e) It should be ensured that the threads on the regulators and other fittings correspond with those on cylinder valve outlets.
- (f) All equipment should be kept clean and in good condition so that it is safe to use.
- (g) Frequent accidents occur due to leakages or to the supply hoses becoming loose or being blown off. Hoses should be firmly attached to blowpipes and regulators by suitable means. Hoses and other connections should be frequently examined and leakage tests using soapy water carried out. Faulty or leaky equipment should be changed without delay.
- (h) There are two types of blowpipes in common use, low pressure and high pressure. A low pressure blowpipe may be used on a high pressure system, but under no circumstances, should a high pressure blowpipe be used on a low pressure system.
- (i) Rubber hoses should be inspected periodically to see that they are free from cuts, cracks, burns and wear. The hoses should be kept clear of sharp edges or corners, falling objects, sparks or blowpipe flame.

- (j) It should be ensured that red hoses are used for acetylene and other fuel gases and black hoses for oxygen.
- (k) Only hoses of equal length should be used. Surplus lengths should not be coiled around regulators or cylinders.
- (l) The use of odd bits of tubing should not be permitted.
- (m) The maker's instructions for use of blowpipes should be observed.
- (n) Pressures in excess of those recommended should not be permitted.
- (o) Standard hose connectors should be used to join individual lengths of tubing. Leaks in tubing should not be repaired with wire or insulating tape.
- (p) All nozzle tips should be kept clean, otherwise distortion of flame and back-fire may result. Nozzle orifices should not be poked with steel wires.
- (q) Only good quality hoses should be used. Inferior hose may crack or leak and fire internally when oxygen passes through it.

5. *ELECTRIC ARC WELDING*

- (a) Arc welding and cutting equipment may be divided into two groups: (i) equipment connected to an electrical supply, and (ii) engine driven equipment.
- (b) In the case of stationary transformers or motor generator sets, a suitable switch and fuse should be provided adjacent to the equipment, in order that it may be isolated from the main supply, if necessary.
- (c) It should be ensured that all equipment is properly earthed, and that the cables are of the correct type and capacity and fitted with appropriate connectors on the output side. Particular care should be taken to ensure that the work piece is connected to the "work" terminal of the transformer. In addition, the work-piece should be earthed independently.
- (d) A periodic inspection will be required to ensure that: (i) all connections are clean and tight, (ii) they are correctly made, (iii) the correct types and sizes of cables, earthing clamps, electrode holders, cable connectors, etc. are used, and (iv) the earthing arrangements are satisfactory in all respects.
- (e) Before engine driven equipment is put into use, a check should be made to ensure that the exhaust outlet is sufficiently removed so that there is no danger of exhaust gases being inhaled.

- (f) Care should be taken to ensure that the plane is level and the wheels chocked to prevent accidental movement.
- (g) Careful watch should be kept for fuel leaks and avoidance of spillage when filling fuel tanks.

6. *ELECTRIC SHOCK*

- (a) The open-circuit voltage of arc welding equipment will not usually exceed 100 volts which is generally safe under normal working conditions, but the risk of shock is present.
- (b) In cramped spaces such as boilers and small tanks, which may also be warm and damp, or in an insecure position where an electric shock may lead to a serious fall, special care should be exercised.
- (c) In the event of a worker sustaining an electric shock artificial respiration should be started at once and continued until a doctor arrives at the scene.

7. *PROTECTIVE CLOTHING AND EQUIPMENT*

- (a) Goggles fitted with suitable filter lenses should be used for gas welding.
- (b) For electric welding, face shields or helmets fitted with suitable filter lenses should be used.
- (c) Use of sun glasses should not be permitted.
- (d) Gloves should be worn by all workers engaged in welding operations.
- (e) The wearing of plimsolls and such like footwear should be discouraged.

8. *WELDING IN CONFINED SPACES*

- (a) Where an operator is required to weld in a confined space, such as inside a boiler drum, air receiver, tank, etc.
 - (i). a fully insulated electrode holder should be used,
 - (ii). adequate ventilation should be provided,
 - (iii). an assistant should keep the operator under constant observation,
 - (iv). suitable means should be provided to enable the assistant to cut off the power immediately, if required,

- (v). provision should be made for the withdrawal of the operator in the case of shock or other injury, and
 - (vi). it is recommended that mats, dry boards or other non-conducting materials and rubber boots be used to assist in the prevention of electric shock.
- (b) The flux coating of an electrode should not be regarded as sufficient protection against electric shock. Consequently the insertion of an electrode into a holder should be done only when wearing insulated gloves. Electrodes should be removed from the holders when not in use.

V—Raising and Lowering

1. *GENERAL*

- (a) The importance of correct use of the various items of lifting appliances and gear cannot be emphasised enough.
- (b) The supervisor or other competent person, appointed In-charge, should be present when raising and lowering operations are in progress.
- (c) Before commencing operations, it should be ensured that the gear selected is suitable for the job and that it is in good condition.
- (d) The weights of the load to be lifted and the lifting gear should be ascertained so that the lifting appliance will not be overloaded.
- (e) Loads should be raised and lowered smoothly, avoiding any sudden jerks, dragging, snatching or tipping. Steps should be taken to prevent chains or ropes coming into contact with sharp edges during the operations.
- (f) If the load is large or of awkward proportions, or is to be manoeuvred in a confined space, special care should be taken. Any contact with the surrounding structure may cause excessive strain on a part or the whole of the lifting arrangement. In such a situation the gear selected should have a higher SWL than that required for normal working.
- (g) A load should never be left suspended unless there is a suitable person in-charge of the lifting appliance while the load is so left. Loads being raised or lowered should not pass or remain suspended over any person.
- (h) Where necessary guide ropes should be attached to the load so that it may be safely maneuvered.
- (i) Loads should be securely suspended or supported whilst being raised or lowered and all reasonable precautions should be taken to prevent their slipping or displacement.
- (j) Every lifting appliance or gear should be adequately and suitably supported or suspended having regard to the purpose for which it is used.
- (k) Only persons who have been adequately trained should be permitted to work as riggers, slingers, operators and signallers.

2. *SIGNALLING*

- (a) The task of signalling should, as far as practicable, be assigned to a single person who can be readily identified.

- (b) A well understood and uniform code of signals, with a distinctive signal for each operation, should be used.
- (c) Where the circumstances require more than one signaller, their actions should so co-ordinate as to obviate confusion.
- (d) The signaller should stand where he can see the load and be seen himself by the operator.

3. *NATURAL FIBRE ROPES*

- (a) The most commonly used ropes for lifting are of Manilla, Sisal and Hemp. Coir rope should not be used for this purpose.
- (b) Ropes should not be left lying on wet or damp surfaces since this sets up rot. Wet ropes should be dried naturally as excessive heat will cause the fibres to become brittle in a matter of hours.
- (c) When not in use ropes or slings should be laid on wooden racks or hung on galvanised steel pegs.
- (d) Ropes should be frequently inspected. Mildew, rot, chemical action as well as physical damage, all act adversely upon the strength of a rope. The strands should be opened up slightly and it ensured that the individual fibres are healthy and strong. If powdery, discoloured or weak the rope should be condemned and destroyed. Any excessively stretched rope should be scrapped.
- (e) It is not usual for fibre ropes to be supplied with certificates of SWL. The guaranteed breaking strength figure should therefore be used to assess the SWL. A factor of safety of eight is recommended.

4. *SYNTHETIC FIBRE ROPES*

- (a) Synthetic ropes should not be exposed to direct sunlight for any length of time and should be kept clear of all sources of heat.
- (b) Ropes should be kept clear of contamination by chemicals. Polypropylene ropes however resist both alkalis and acids.
- (c) Synthetic ropes should be inspected frequently. Excessive wear may be indicated by powdering between the strands, and improper use by fusing of the strands. The manufacturer's leaflet should be consulted for other signs of wear or overloading, and the recommended method of splicing.
- (d) Personnel handling synthetic ropes should be made aware of the

proper procedures and how these may differ from those adopted in the handling of natural fibre ropes.

5. *WIRE ROPES*

- (a) Wire ropes should be lubricated frequently in order to protect against internal abrasion and external corrosion.
- (b) When not in use, wire ropes should be stored under cover in a dry atmosphere
- (c) Wire ropes should be inspected frequently for faults, e.g. broken wires, unlaying of strands, corrosion, evidence of crushing or bending. Any wire which is flattened, opened, knotted or kinked should not be used. If in any length of ten diameters the total number of visible broken wires exceeds 5%, or if the rope shows signs of excessive wear or corrosion, the wire should be condemned.
- (d) Wire splices should consist of at least three tucks with a whole strand of the rope followed by two tucks with one half of each strand, all tucks being against the lay. Any other splices used should have an equivalent efficiency.
- (e) Where wire ropes are secured by metal ferrules or bulldog grips care should be taken that they are fitted correctly and an adequate number used. (See Fig. III). The grips should be spaced about 6 diameters apart and all fitted the same way, i.e. with the saddle in contact with the part of the wire in tension. Wires should only be secured with grips when splicing is impractical. Wire ropes made up by using bulldog grips should not be used as slings. When correctly made up the connection should have 85 to 90% strength of the wire rope.

6. *CHAINS*

- (a) Chains should be examined frequently for damage. Chains that have been twisted, distorted, corroded, cracked or scored and whose strength is impaired thereby, should be condemned.
- (b) No chain should be used when there is a knot tied in any part of it.
- (c) No chain should be shortened or joined to another chain by means of bores and nuts.

7. *HOOKS. SHACKLES, EYEBOLTS ETC.*

- (a) Every item of such gear should be examined frequently for cracks, distortion, corrosion, indentation and excessive wear. If damaged, the particular item should be condemned.
- (b) Pins for shackles etc. should be free and fit correctly.

- (c) Care should be taken to ensure that the load is applied in line with the shank of a 'dynamo' eyebolt and in the case of a shackle, along its arms and not across. (See Fig. IV)
- (d) A 'collar' eyebolt should be used for inclined loading. (See Fig. V)
- (e) The threads of eyebolts, pins, holes in parts to be lifted, etc., should be examined before use so as to ensure that they are not worn or broken.
- (f) Eyebolts should be screwed fully home until the shoulder is in contact with the face of the tapped hole. If unavoidable, no more than one washer may be used as a distance piece.
- (g) Particular attention should be given to the junction of the shank and the collar as cracks leading to failure are liable to develop here, specially if the radius is small. Eyebolts bent at the root of the shank should not be repaired.
- (h) It should be ensured that no hook has opened out more than one fifth of its designed measurement.
- (i) In the case of swivel hooks, they should turn freely.

8. *SLINGING*

- (a) The slinging of a load should be done under strict supervision. Where the load is of a cumbersome size or is unusually heavy, slings should be attached to suitable fittings if provided, rather than passed round the load.
- (b) Where slings are passed round a load they should be protected from sharp corners or other protrusions by adequate packing. Packing should be provided to prevent the slings slipping on the load. (See Fig. I) In all such cases the slings should be pulled tight and secured before lifting is commenced.
- (c) Chain or rope slings should never be dragged along a hard floor. In order to avoid pulling slings from beneath a load in contact with the floor, battens should always be available and positioned before a load is landed. (See Fig. VI)
- (d) When reeving a sling round a load, it is very important to ensure that loops do not form in the rope, since tension applied in these circumstances will tend to produce a kink.
- (e) The minimum radius round which a sling may be bent is three times the diameter of the rope.

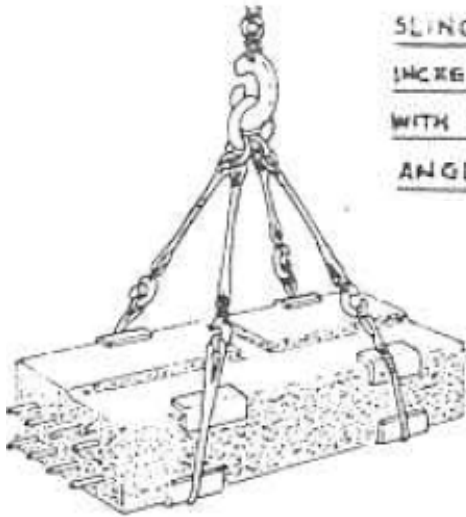


FIG. I. PROTECTING AGAINST ABRASION.

SLING LEG TENSION
INCREASES RAPIDLY
WITH CHANGE OF LEG
ANGLE.

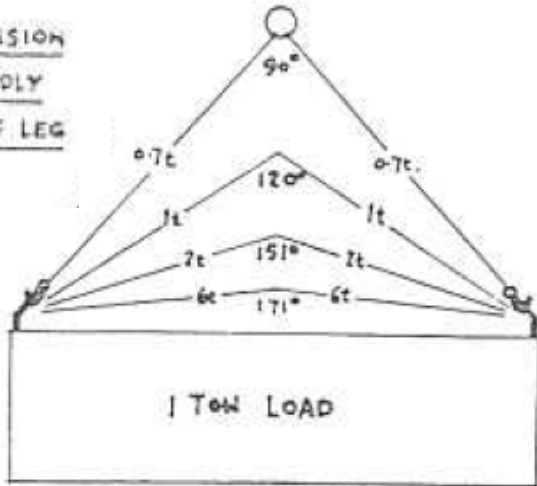


FIG. II SLING LEG TENSION
AT DIFFERENT ANGLES.

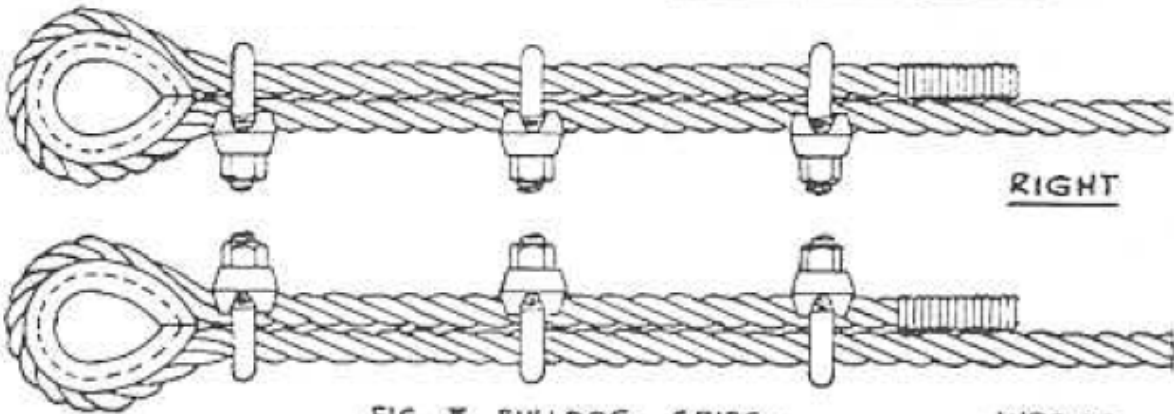


FIG. III BULLDOG GRIPS.

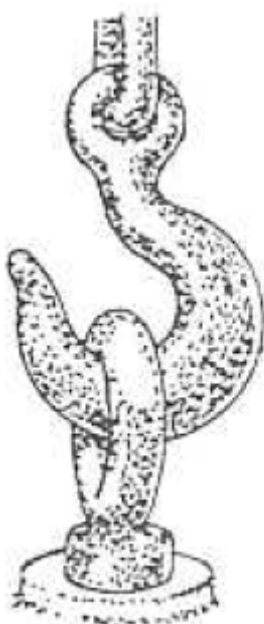


FIG. IV DYNAMO EYEBOLT



FIG. V COLLAR EYEBOLT.

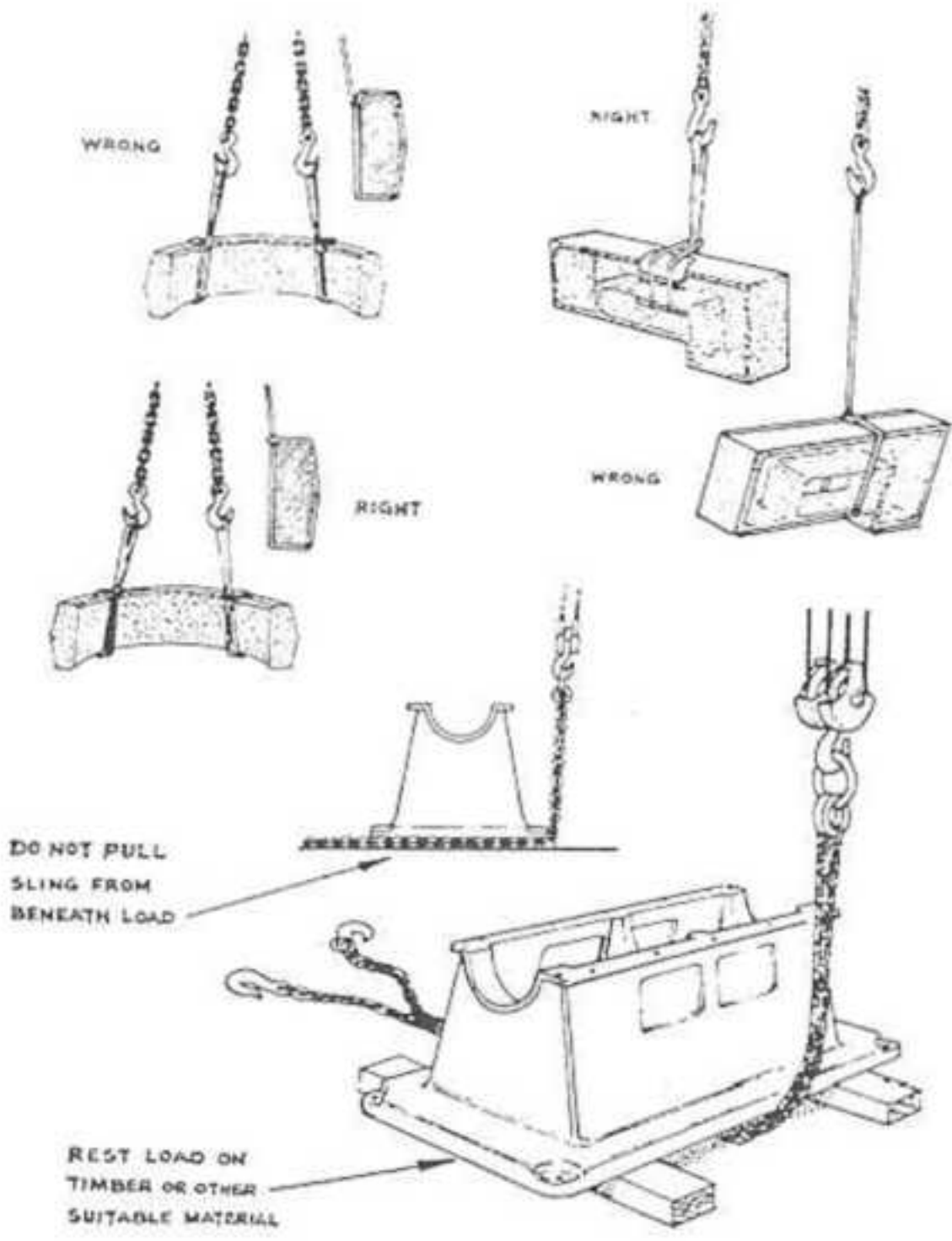


FIG. VI USE OF SLINGS

VI—Machinery Hazards

1. *OVERHAULING MACHINERY*

- (a) When machinery is being overhauled measures should be taken to prevent its turning or inadvertent starting.
- (b) Before work is commenced, notices should be posted at or near the controls giving warning that the machinery is not to be used.
 - (i) Steam-operated machinery should have the steam valves and exhaust valves, if any, securely closed. The lines should be drained and drain valves left open.
 - (ii) Diesel driven machinery should have the valves in the air starting system securely closed.
 - (iii) In the case of electrically operated machinery and electric generators the fuses should be removed and circuit breakers taken out at the main switchboard. Where practicable, the circuit breakers should be locked in the isolated position.
- (c) Before any personnel are allowed to enter the main engine crankcase or gear case, the turning gear should be engaged and a warning notice posted at the starting position. Lubricating oil should be wiped up in the immediate working area and suitable staging, adequately secured, should be used to provide a safe working place.
- (d) Before turning gear is used for turning the main engine, it should be ascertained that all personnel are clear of the crankcase and any moving parts of the main engine, and that the engine will not foul any disconnected parts or tools. A warning notice indicating whether the position of the turning gear is in or out should be attached to the controls.
- (e) When guards or other safety devices are removed from machinery to facilitate overhaul, it is important that they are replaced immediately the overhaul is completed and before the machine or equipment is tested.
- (f) Every dangerous part of working machinery, unless otherwise safe by its position and construction, should be securely fenced. When a particular part is not so protected, temporary fencing should be provided.
- (g) When working on upper platforms or stagings it should be ensured that no heavy objects such as tools or parts of machinery can drop on a person working below. A bucket or box should be used for tools and small parts of machinery. Larger pieces should be lashed up.

- (h) If it is necessary to work on steering gear when the vessel is in the stream suitable steps should be taken to immobilize the rudder.

2. REFRIGERATION MACHINERY

- (a) When repairs are being carried out and there is any doubt as to the adequacy of the ventilation, a portable fan or other suitable means should be used to assist in the removal of toxic gases from the vicinity of the machine.
- (b) Personnel charging or repairing refrigerator plants should fully understand the precautions to be observed when handling the refrigerant.
- (c) Cylinders should always be transported with the steel cap fitted over the valve to prevent damage. They should be handled with care and never jolted violently, dropped or thrown about.
- (d) When charging refrigeration plants through a charging connection in the compressor suction line, it is sometimes the practice to heat the cylinder to evaporate the last of the liquid refrigerant. This should be done only by placing the cylinder in hot water or some similar indirect method and never by *heating the cylinder directly with a blowlamp or other flame*.
- (e) Should it be known or suspected that the refrigerant has leaked into any compartment, no attempt must be made to enter the compartment unless approved breaching apparatus is worn, and someone is in attendance outside.
- (f) When repair or maintenance necessitate the application of heat to vessels containing refrigerant, which form component parts of the refrigeration system, it should be ensured that appropriate valves are opened to prevent any build-up of pressure within the vessels.

3. STEAM PIPES

Before joints in steam lines or steam fittings are broken or cylinder covers of steam auxiliaries are removed, it is important that valves on the steam and exhaust lines are closed, that the lines are completely drained and any drain valves are left open. It should be remembered that steam valves often leak slightly when closed and can thus build up pressure in the pipe line or cylinder, and suddenly eject steam and water which may have collected in a dip in the line.

4. BOILERS

- (a) Setting of boiler safety valves should be entrusted only to skilled and experienced personnel under close supervision of the ship's Chief Engineer.

- (b) No person should enter any boiler, boiler furnace or boiler uptake until it has been cooled sufficiently to make work in such places safe.
- (c) Before any person enters a boiler which is one of a range of two or more boilers, and also for the whole time during which that person remains in the boiler, the following should be complied with:
 - (i) All inlets through which steam or water might enter the boiler from any other part of the range should be disconnected from that part, drained and left open to atmosphere; or
 - (ii) Where this is not practicable, all valves or cocks, including blow down valves controlling entry of steam or water, should be closed and securely locked; warning notices should be put up to the effect that no person should open such valves because there are men working in the boiler.
- (d) Every boiler, boiler furnace or boiler uptake, should be adequately ventilated before any one enters and while persons remain inside. An attendant should always be standing by outside while persons remain inside the boiler.
- (e) In the fitting of manhole or handhole doors, it should be ensured that their joints are tight and that the clearance between the door and the aperture is the minimum practicable (about 1.5 mm).
- (f) Where personnel are required to work in the immediate vicinity of a gauge glass under pressure, covers should always be in place.

5. FLOOR PLATES

- (a) Whenever floor plates, gratings, handrails or ladders are removed, the openings should be effectively fenced or guarded.
- (b) Any oil spillage on the floor plates should be removed as quickly as possible.

6. PORTABLE POWER TOOLS

- (a) Power-operated portable hand tools should be regularly inspected. Unless properly used, handled and maintained, they can be dangerous. Electric tools should be adequately earthed, unless doubly insulated. The supply cables and plugs should be of adequate capacity.
- (b) It is important that the operative is familiar with the portable tool. No power tool which is wet or faulty, or has its guard or safety device missing should be used.

- (c) Care should be taken to prevent 'kick back' from impact wrenches and portable drills, it should be ensured that any release or stop safety device is effective.
- (d) Leads and hose lines should be protected from wear, sharp bends and damage.
- (e) Air powered tools should not be connected to an air supply where the pressure is in excess of the makers specification.
- (f) Grinding wheels should be equipped with a guard enclosing all of the wheel that the work permits.
- (g) Abrasive wheels should be correctly fitted, using flanges of the correct size and soft washers.
- (h) Oversize abrasive wheels should not be fitted to any grinding machine.
- (i) Abrasive wheels should not be used above their maximum recommended speed.
- (j) If an abrasive wheel has been dropped it should be carefully inspected before further use.

7. *HAND TOOLS*

- (a) Hand tools should be maintained in good condition, inspected periodically and defective tools taken out of use.
- (b) It should be ensured that the handles are secure, jaws of spanners and wrenches are not worn, and that hammers, cold chisels and other percussive tools do not have barbs or jagged edges.
- (c) It should be ensured that the tools used for the job are correct.

8. *WORKING CLOTHES AND PERSONAL PROTECTIVE EQUIPMENT*

- (a) Loose or torn clothing and long hair are a hazard when working near moving machinery. Wearing of neck ties, sweat rags round the neck and finger rings while working in the machinery spaces should be discouraged.
- (b) Suitable eye protection and dust masks should be worn by men handcleaning tubes, scaling boilers and cleaning backends.
- (c) Goggles should be worn when operating a power tool such as a grinder or scaling machine. If there is any risk of eye injury people nearby should also wear goggles.

VII—Personal Protective Equipment

1. *RESPONSIBILITY*

Where the need to wear personal protective equipment arises the Supervisor should ensure that this is complied with.

2. *CARE AND MAINTENANCE OF EQUIPMENT*

All equipment should be properly cared for, efficiently maintained and thoroughly inspected at regular intervals.

3. *SAFETY HEAD-GEAR*

Inspections should be carried out at least once a month, as follows:—

- (i) A thorough cleaning and disinfection of the shell should be done after first removing the sweat-band.
- (ii) The shell should be examined for deterioration and re-painted, if required.
- (iii) If re-painting is required, another helmet on temporary loan should be issued.

4. *GOGGLES AND FACE SHIELDS*

- (i) This type of equipment is best issued on a permanent personal loan basis.
- (ii) It should be ensured that the user knows how to clean and maintain the equipment.
- (iii) Only substances which can have no adverse effect should be used for cleaning the lenses and head-bands.
- (iv) Where goggles or face shields are issued on temporary loan, they should be taken apart and thoroughly washed and disinfected before being re-issued.
- (v) If a lens becomes chipped, pitted or partly opaque it should be scrapped.
- (vi) The head-band and its adjusting device should be in an efficient condition.
- (vii) After cleaning, all eye protective devices should be placed in individual polythene bags and stored in a dry and dust-proof cupboard.

5. RESPIRATORY PROTECTIVE EQUIPMENT

In the selection of the correct equipment, amongst the factors to be taken into account are the location, the nature of the substance or substances against which protection is required, their likely concentrations in air, the possible duration of exposure and the kind of work to be performed. (See Respiratory Protective Equipment Chart). Self-contained breathing apparatus and the canister and cartridge type respirators provide protection to different degrees for relatively short periods of time, whereas the air hose type breathing apparatus provides protection for as long as the face-piece is supplied with breathable air. Dust respirators provide protection for long periods at low airborne dust concentrations. Canister, cartridge and dust respirators interfere little with the wearer's mobility. But at high work rates the inhalation and exhalation resistance results in discomfort which can limit the period of time for which these may be worn, as also will adverse environmental conditions of temperature and humidity. The compressed air type breathing apparatus however obviates these objections.

(a) *Dust Respirators*

- (i) Before cleaning, the respirator should be taken apart and the rubber, plastic or PVC components carefully examined for signs of deterioration.
- (ii) Stretching and lightly folding rubber or PVC will reveal any fine cracks. Damaged or worn parts should be discarded.
- (iii) For respirators used by painters, the parts should first be soaked in a solution of suitable alkaline cleanser to get rid of foreign matter, and then removed and dried.
- (iv) Head harnesses should be washed in warm soapy water, thoroughly dried and inspected again.
- (v) It is recommended that head harnesses be disinfected before re-issue.
- (vi) New filters should be fitted and where mutton cloth surrounds are used for the part of the mask which comes into contact with the face, a clean surround should be provided.
- (vii) The respirator should be placed in a clean polythene bag until required for use.

(b) *Cartridge, Canister and Full Face Respirators*

- (i) These respirators should be taken apart, cleaned, inspected and tested as in the case of dust respirators.
- (ii) Lenses should be examined for any signs of damage and replaced if necessary.

- (iii) It should be ensured that the head harness straps are properly fitted.
 - (iv) Leakage tests should be carried out paying special attention to the corrugated tubes and the areas around eye-pieces or frames around wide-vision masks, if the latter type is used.
 - (v) The valves should be checked and the respirators disinfected. If necessary, the cartridge or canister should be changed making sure that the storage life has not been reached or exceeded.
 - (vi) The respirator should be repacked and it ensured that the proper card to record periods of use is furnished.
 - (vii) The respirator should be stored until required for use in a place which is dry and free from contamination.
- (c) *Air Line Respirators*
- (i) Air line respirators should have their face masks inspected, tested, cleaned and disinfected as for canister mask face-pieces.
 - (ii) Filters attached to the belts should be taken apart, cleaned, disinfected, dried and re-assembled.
 - (iii) Filter agents should be renewed as necessary.
 - (iv) Any unusual accumulation of oil, dirt or foreign matter in filters should be investigated.
 - (v) The pressure regulator should be checked.
 - (vi) The entire length of air hose should be examined to ensure that it is in good condition.
 - (vii) The harness provided with this equipment should be checked.
- (d) *Self-Contained Breathing Apparatus*
- (i) Personnel required to wear this equipment should be trained and instructed in its use.
 - (ii) All parts of this apparatus should be inspected, cleaned, tested and disinfected at regular intervals.
 - (iii) The cylinders should always be kept in a fully charged condition.
 - (iv) Record cards should be provided for each set of equipment.
 - (v) The equipment should be maintained in accordance with the makers recommendations.

6. *HAND PROTECTION*

A regular inspection should be made to ensure that the gloves are in a good condition and can afford the protection for which they are intended.

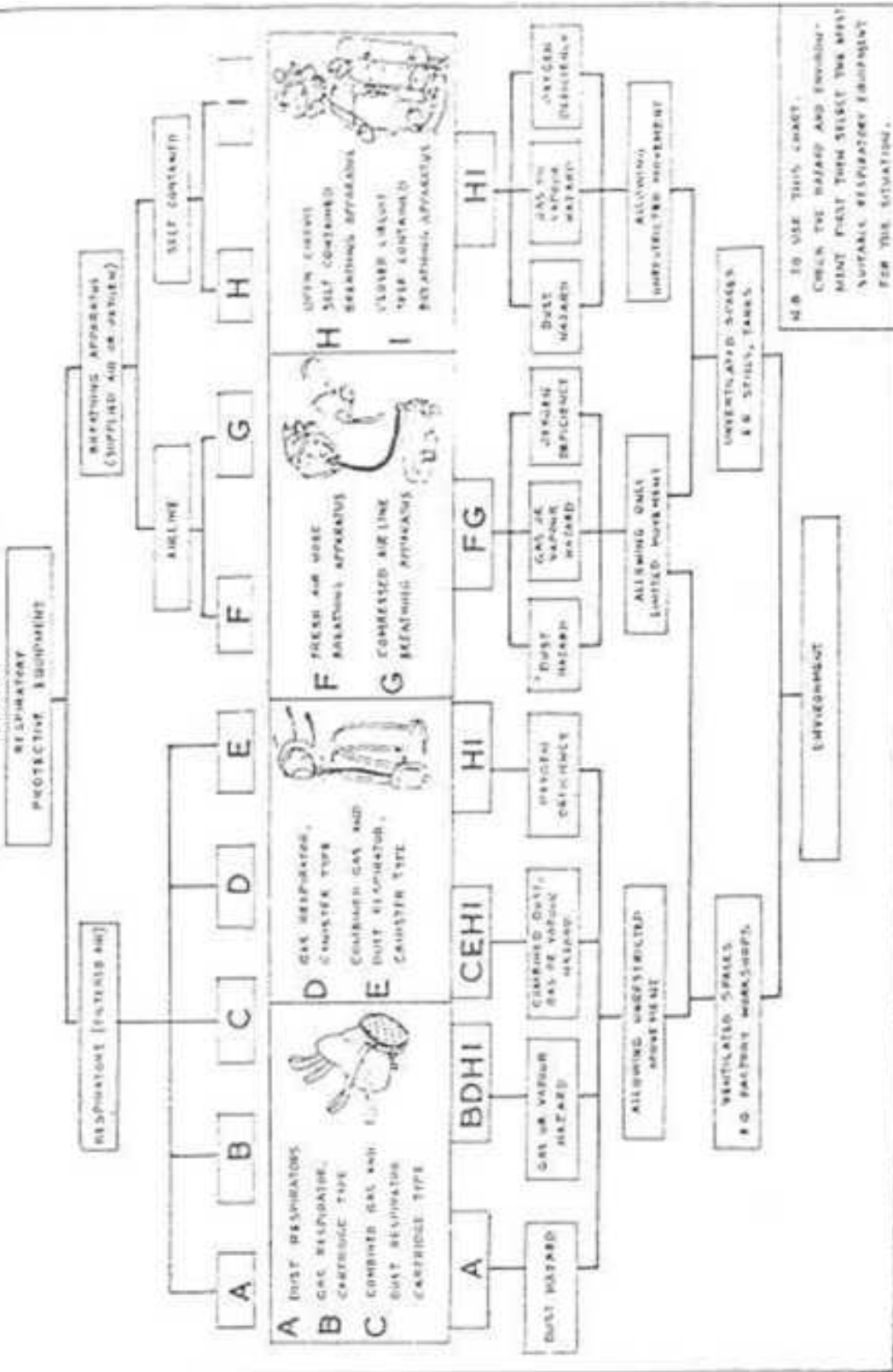
7. *SAFETY BELTS*

- (i) The type of safety belt should be correct for the task to be performed.
- (ii) With all types of safety belt, it should be ensured that in the event of the wearer falling, the maximum drop of two metres will not be exceeded.
- (iii) Safety belts should be secured to a safe anchorage.
- (iv) Where work is to be done in a confined space an attendant should be on the outside tending the free end of the safety line.

8. *SAFETY FOOTWEAR*

- (i) Personnel should be encouraged to wear safety footwear with oil, heat and slip resistant soles, and steel toe-cap inserts.
- (ii) When handling heavy objects safety boots should always be worn.

RESPIRATORY PROTECTIVE EQUIPMENT CHART



VIII—Chemical and Dust Hazards

1. It is essential that Supervisors know precisely the hazards associated with the chemicals used and the measures to be taken, and have the necessary equipment available to cope with any foreseeable situation.
2. Clear instructions on the precautions to be taken should be given to all personnel who are likely to be exposed to hazardous chemicals.
3. It should be ensured that all containers of chemicals are correctly labelled in English and Chinese.
4. Chemicals should be stored in a safe place. Only the minimum amount of chemicals required for immediate use should be issued.
5. Any hazardous chemical spillage should be instantly removed.
6. Workers should be encouraged to observe a high standard of personal hygiene at all times. Hands and face should be washed prior to eating or drinking and immediately after finishing work.
7. Eating or smoking should not be allowed in areas undergoing surface preparation or preservation.
8. It should be ensured that the ventilation is sufficient to keep the concentration of toxic vapour or dust to the minimum. When using solvents or paints in a confined space, any mechanical ventilation should be continued until the space is gas free.
9. Lead paint should not be applied in the form of a spray in interiors unless the worker is wearing suitable breathing apparatus.
10. Before work is allowed to be undertaken in or around any space containing dangerous goods, suitable precautions should be taken to eliminate all risks.

IX—First Aid

1. All workers should be informed of the exact location where First Aid equipment is kept and where First Aid treatment can be obtained.
2. It should be ensured that a First Aid box with adequate contents is furnished to each vessel on which work is done, unless the place where First Aid equipment is kept is in close vicinity and immediate access is available.
3. The contents of the First Aid box should be checked before being issued, and at least once weekly thereafter to ensure that any shortages are replenished.
4. There should be at least one qualified first aider readily available during working hours who should be in-charge of the First Aid equipment.
5. There should always be readily available on board during working hours a responsible person whose duty is to summon an ambulance or other means of transport if needed in cases of accident or illness.
6. A record should be kept of all cases of accident or sickness for which First Aid treatment is given.
7. Any serious injury sustained by personnel should at once be reported to the Management.

X—Safety Education, Training and Promotion

1. The Supervisor or Foreman is the most important link in the chain from boardroom to the work place. He explains, instructs, interprets and enforces top management's orders and directives.
2. From the workers' point of view the Supervisor's word is authoritative. Being closely associated with the people in his charge, his influence, example and authority, should provide him with a degree of control that is of utmost importance for accident prevention. Being in control of the local situation he is in the best position to notice and correct unsafe physical conditions and acts. The Supervisor is the key man not only from the production point of view but also accident prevention.
3. All supervisory staff should receive adequate training in accident prevention techniques and discuss at regular intervals matters relating to accident prevention with the workers under their control.

