

**Safety and Health in
Shipbuilding and Ship Repairing**



ILO Codes of Practice

**Safety and Health in
Shipbuilding and Ship Repairing**

International Labour Office Geneva

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Preface

At its 154th (March 1963) Session the Governing Body of the International Labour Office had adopted the proposals of the ILO Metal Trades Committee ¹ that a code of practice on occupational health and safety should be drawn up for the shipbuilding and ship repairing industry. The present code is published in accordance with that decision.

A preliminary draft was considered by two working parties—a medical one chaired by Dr. Grut (Denmark) and a technical one chaired by Mr. Netterstrom (United States)—formed in the course of an international symposium on occupational health and safety in shipbuilding and ship repairing which was held in Helsinki in August-September 1971 in conjunction with the ILO. On the basis of the observations of the working parties and the detailed comments of the International Metalworkers' Federation, a second draft was then prepared and submitted, in accordance with decisions taken by the Governing Body of the ILO at its 187th and 188th (June and November 1972) Sessions, to a meeting of experts on safety and health in shipbuilding and ship repairing that was held in Gothenburg from 4 to 8 December 1972 at the invitation of the Government of Sweden and the Swedish Work Environment Fund. The meeting was attended by the following experts:

Mr. Eduardo Dagnino McDonald (Chile), Legal adviser, Confederation of Production and Commerce and Central Chamber of Commerce.

Mr. Stanley Jensen (United States), District representative of the International Association of Machinists in San Francisco, Member of the Regional Health and Safety Council for the Shipbuilding Industry.

Mr. Takashi Kametani (Japan), Director, Safety Department,

¹ Conclusions No. 56 (Seventh Session, 1962).

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Japan Confederation of Shipbuilding and Engineering Workers' Unions.

Mr. Yukimasa Kamiya (Japan), Manager, Safety and Sanitation Office, Labour Relations Department, Ishikawajima Harima Heavy Industries Co. Ltd.

Mr. Ib Kjeldsteen (Denmark), Safety engineer, Aalborg Skibsværft.

Mr. Karl-Heinz Laubrecht (Federal Republic of Germany), Expert for health and safety, IG Metall Vorstand.

Mr. Dan McGarvey (United Kingdom), President, Amalgamated Society of Boilermakers, Shipwrights, Blacksmiths and Structural Workers.

Mr. K. N. G. Menon (India), Development Director, Shipping Corporation of India.

Mr. Ishimatsu Nohara (Japan), Chief Expert Officer in Industrial Safety, Industrial Safety and Health Department, Labour Standards Bureau, Ministry of Labour.

Mr. Ivar Nordén (Sweden), Director, AB Götaverken.

Mr. Wojciech Orszulok (Poland), Chief of division of the Higher Nautical School.

Mr. A. G. Robertson (United Kingdom), Joint Secretary, Shipbuilders and Repairers National Association.

Mr. Gerard F. Scannell (United States), Director of the Office of Standards of the Occupational Safety and Health Administration, United States Department of Labor.

Mr. L. P. Sharikov (USSR), Secretary, Central Committee, Trade Union of Workers of the Shipbuilding Industry.

Mr. Lars Skytøen (Norway), Vice-President, Norwegian Metalworkers' Federation.

Mr. R. A. Stockbridge (United Kingdom), Superintending Engineering Inspector, Directorate of Occupational Safety and Health, Department of Employment.

Mr. Arne Westlin (Sweden), Chief Engineer, National Occupational Safety and Health Board.

Mr. Westlin and Mr. Stockbridge were elected chairman and reporter respectively.

In adopting the code of practice, the experts recognised that its provisions could not be applied as they stood to all countries or regions, and that some of them would need to be adapted to local conditions; the code is not designed to supersede national laws and regulations or such general occupational safety and health rules as already exist in the industry, and the applicability of the code's provisions will be determined by local circumstances and technical possibilities.

The experts observed that the code was applicable to both new and old shipyards; they stressed in particular that no effort should be spared to improve safety and health conditions in older shipyards. As a rule, the code contains only a few detailed specifications regarding the materials and the construction of the machinery and equipment used in the industry. In fact many national or international standards already exist in these fields, for instance those relating to hoisting equipment, pressure vessels and electrical equipment. However, the code contains some general provisions in these respects. The experts recognised that it would not be possible to apply some of the recommendations to existing equipment, but only to new equipment. They considered it important that existing equipment not conforming to the relevant recommendations of the code should be disposed of as soon as possible.

The experts stressed that when it was intended to use new technology in shipbuilding and ship repairing, all the safety and health aspects of the new technology should be carefully studied and assessed prior to its introduction, and that appropriate rules, instructions or other measures should be prepared and applied; any experience subsequently gained should be immediately used to improve the occupational safety and health conditions. The experts considered that the code should remain valid for quite some time; it was based on the most advanced knowledge and techniques and was sufficiently flexible to allow for further technical developments.

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The experts stressed the hazards due to fire and explosion as well as intoxication and lack of oxygen, especially in confined spaces; special attention should be devoted to the prevention of these potential occupational hazards, as well as to the protection of the workers' sight and hearing.

In the opinion of the experts the code as a whole constitutes a body of advice which many countries should find valuable: government authorities, manufacturers of equipment used in the shipbuilding and ship repairing industries, professional organisations concerned with the prevention of occupational accidents and diseases, employers and workers and all other persons or bodies responsible for safety and health in those industries can obtain useful guidance from it. The text of the code was submitted to the Governing Body of the ILO, which agreed to its publication at its 190th (May-June 1973) Session.

1. General provisions

1.1. Definitions

1.1.1. In this code—

- (a) “adequate” means adequate to prevent dangers;
- (b) “breathing apparatus” means an apparatus that enables the wearer to breathe independently of the immediate atmosphere within specified limits;
- (c) “competent authority” means a minister, government department or other public authority having powers to issue regulations, orders or other instructions having the force of law;
- (d) “competent person” means a person who by training or experience, or both, is competent to perform the task or function, or assume the responsibility in question in a manner that will prevent danger as far as is practicable; for the purposes of Chapter 16 “competent person” means a person possessing at least the following qualifications:
 - (i) ability to understand certificates issued and instructions given by an analyst;
 - (ii) familiarity with the official regulations concerning the atmosphere of spaces in a vessel, with particular reference to flammable, explosive, toxic and other harmful substances;
 - (iii) familiarity with the structure and the spaces of the vessels with which he is concerned; and
 - (iv) ability to perform any atmospheric tests and inspections required to prevent danger, and to use gas-indicating instruments;
- (e) “danger” means danger of accident or injury to health;
- (f) “entry certificate” means a certificate issued by a competent person, to the effect that he has suitably tested the atmosphere in the oil tank or tanks or other confined space or spaces

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specified in the certificate, and found it safe for persons not wearing breathing apparatus;

- (g) "flameproof" (or "explosion-proof") denotes a method of construction whereby explosions occurring within a machine cannot be transmitted outside its enclosure;
- (h) "hot work" means riveting, welding, flame cutting, burning or any other work involving the use of heat or producing sparks;
- (i) "hot work certificate" means a certificate issued by a competent person, to the effect that he has suitably tested for the presence of flammable vapour the oil tank, compartment, or other space or part of the vessel specified in the certificate and found it to be safe for the use of naked lights, fires, lamps, heated rivets and other sources of heat;
- (j) "oil" means flammable oil of every kind and other combustible liquids, including combustible liquefied gas ¹;
- (k) "sound construction" means conforming to any relevant standards issued by a national standardising institution or other body recognised by the competent authority, or to generally accepted international engineering or other technical standards;
- (l) "sound material" means material of a quality conforming to any relevant standards issued by a national standardising institution or other body recognised by the competent authority, or to generally accepted international engineering or other technical standards;

¹ According to the flash point, oils are divided into two groups, namely—
(a) *volatile oils* and other liquids with a flash point not higher than 61° C (142° F) by the closed cup test (corresponding to 66° C (150° F) by the open cup test) or such other temperature as may be laid down by the competent authority; for example, benzine (petrol, gasoline), benzol (benzene), toluol (toluene), xylol (xylene), white spirit, petroleum (kerosene), crude oil, acetone, methanol and other alcohols and also flammable liquefied gas such as propane, butane and butadene; (b) *non volatile oils* and other liquids with a flash point higher than that for volatile oils, for example mineral oils such as diesel fuel oil, other fuel oil and lubricating oil, and also animal and vegetable oil such as whale oil, herring oil, groundnut oil, coconut oil and linseed oil.

- (m) “vessel” means any ship, boat other than a rowing boat, or floating construction such as a floating dock, a drilling platform or any similar floating structure; and
- (n) “confined space” means an enclosed space of such dimensions as to be dangerous in certain circumstances and for certain processes or types of work; in particular—
 - (i) when gas is used the expression means an enclosed space with a limited volume of air, little natural ventilation and no easy means of escape, where there may be danger from the excessive concentration of gases, such as oxygen, that favour combustion, from flammable or explosive air-gas mixtures, from gases dangerous to health, or from a combination of such gases, or from insufficient oxygen concentration; and
 - (ii) when electricity is used the expression means an enclosed space of which the walls, floor or ceiling are made wholly or partly of electrically conducting material and in which it is possible for a worker to touch the opposite walls, or impossible for him to stand upright, and where there may be danger of electrocution.¹

1.2. General duties of employers

1.2.1. (1) Employers should so provide and maintain buildings, plant, equipment and workplaces and should so organise work as to protect workers against risks of accidents and injuries to health.

(2) Employers should ensure regular safety inspections at suitable intervals of all buildings, equipment, workplaces and operations.

¹ This will be the case if any of the dimensions—length, width, height, or, for pipes, diameter—amount to less than 2 m (6 ft 6 in).

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(3) Employers should not permit buildings, equipment or workplaces in which a dangerous defect has been found to be used until the defect has been remedied.

1.2.2. Employers acquiring machines, appliances, vehicles or other equipment should ensure—

- (a) that such equipment conforms to any safety regulations applying to it; or
- (b) if there are no such regulations, that it is so designed or protected that it can be operated safely.

1.2.3. (1) Employers should provide such supervision as will ensure that workers perform their work in the conditions most conducive to safety and health.

(2) The erection, maintenance and dismantling of scaffolding, staging, stairs and ladders, as well as the fencing and covering of openings and hatches and other work of essential importance to safety, should be carried out by specialised workers under the direction of a sufficient number of qualified supervisors.

1.2.4. Work that is done jointly by a number of persons and requires mutual understanding for the avoidance of risks should be specially supervised by a competent person.

1.2.5. Employers should assign workers only to work for which they are suited by their age, physique, state of health and skill.

1.2.6. Employers, in consultation with the medical services, should not assign workers with diseases known to be apt to be aggravated by certain forms of work to employment on which such workers could endanger themselves or others.

1.2.7. Employers should satisfy themselves that workers are properly instructed in the hazards of their respective occupations and the precautions necessary to prevent accidents and injuries to health, and in particular that newly engaged, illiterate and foreign workers are properly instructed concerning hazards and precautions and are adequately supervised.

1.2.8. (1) Employers should provide the workers with, or post up in prominent positions at suitable places, up-to-date copies or summaries of, or extracts from, national or local regulations, and, whenever appropriate, instructions and notices relating to the protection of workers against accidents and injuries to health.

(2) The regulations, instructions and notices should as far as practicable be in the languages of the workers employed. Wherever possible, easily comprehensible symbols should be used.

(3) Texts should be displayed in a durable form and protected against damage from the weather.

1.2.9. If practicable, safety rules should be drawn up for each trade with members working on a vessel.

1.2.10. Employers should establish a reliable checking system by which it can be ascertained whether all the members of a shift, including operators of mobile equipment and workers employed by subcontractors, have left the confined spaces at the close of work.

1.2.11. Unless stipulated otherwise in national laws and regulations, responsibility for occupational safety and health should be clearly defined by means of agreements between the shipyard employer and the shipowners, the ships' captains, the harbour authorities and the subcontractors. Where subcontractors are used, they should be subject to the same safety regulations as others concerned.

1.3. General duties of workers

1.3.1. Within the limits of their responsibilities workers should do everything in their power to maintain their own health and safety and that of their workmates, and in particular to observe the safety regulations.

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1.3.2. Workers should constantly watch over the safety of their workplaces and the equipment that they use in the light of their personal knowledge and abilities. Any defects should be reported without delay to a competent supervisor.

1.3.3. (1) When a worker, through his job experience, has reason to believe that there would be a high risk to life or health if he carried out a task assigned to him, he should have the right to refuse to commence work, or to cease work. He should report his fears immediately to the management, the workers' safety delegate and the competent safety and health officer in the yard.

(2) A thorough investigation of the complaint should be promptly undertaken.

1.3.4. Workers should not rest in dangerous places such as those in the vicinity of fires, flammable substances, dangerous gases or running machines, or on scaffolds and railway tracks.

1.3.5. Workers should refrain from careless or reckless practices or actions that are likely to result in accidents or injuries to health to themselves or others.

1.3.6. Workers should always make proper use of all safeguards and safety devices and other appliances made available for their protection or the protection of others.

1.3.7. No worker, unless duly authorised, should interfere with, remove, alter or displace any safety device or other appliance made available for his protection or the protection of others, or interfere with any method or process adopted with a view to avoiding accidents and injuries to health.

1.3.8. Workers should not interfere with equipment such as structures, machines, valves, piping, electrical conductors and appliances that they have not been duly authorised to operate, maintain or use.

1.3.9. Workers should make themselves acquainted with and obey all safety and health instructions pertaining to their work.

1.3.10. Workers should wear clothing suited to their duties and to the weather.

1.4. Obligations of manufacturers and dealers

1.4.1. In order to prevent dangerous equipment from reaching users and to ensure that users take the necessary precautions, manufacturers and dealers should ensure that—

- (a) equipment such as machines, appliances and vehicles employed in the shipbuilding and ship-repairing industries complies with national or other official safety laws and regulations and standards applicable to its design and construction;
- (b) equipment not covered by national or other official laws and regulations or standards is so designed and constructed as to be as safe as practicable; and
- (c) equipment is accompanied by the necessary instructions for its proper use and maintenance that draw the attention of users to possible hazards.

1.4.2. Manufacturers and vendors of flammable liquids, explosives, toxic substances and other dangerous substances should furnish users with lists of ingredients entering into the composition of the substances, together with instructions for safe use.

1.5. General safety and health measures

1.5.1. (1) *Production requirements or urgency of work* should never take precedence over the safety and health of workers.

(2) *Work programming and plant facilities and utilisation* should be such as to—

- (a) necessitate a minimum of night work;
- (b) avoid manual handling and carrying of heavy loads as a routine procedure or the imposition of physical strain; and
- (c) prevent any risks in the unavoidable use of dangerous materials.

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(3) Special care should be taken to safeguard the safety and health of handicapped workers and older workers.

(4) National laws or regulations should be regarded as minimum standards.

1.5.2. The knowledge gained from experience and from scientific and technical progress should be used to promote the adaptation of the working environment to the workers' physical and mental capabilities, so as to create optimum conditions for ensuring safety and health.

1.5.3. It should be recognised that any occupational safety and health scheme should provide for reasonable hours of work, rest days at reasonable intervals, the necessary breaks during working hours (especially when the work is strenuous, dangerous or monotonous), and a tolerable workload.

1.5.4. (1) All buildings, plant, equipment and work materials (including technical appliances and personal protective equipment) should comply with the safety laws or regulations.

(2) If the safety laws or regulations are not applicable, employers should in all cases prepare and implement their own rules to ensure the appropriate level of protection against occupational accidents and diseases.

(3) When defects occur, measures should be taken immediately to eliminate all danger. If necessary, the buildings, plant, equipment and work materials affected should be put out of use until the defect has been remedied.

1.5.5. Employers should at all times provide workers with personal protective equipment and protective clothing adapted to their physique and to the prevailing climatic conditions, in accordance with the safety laws or regulations and the requirements of the work.

1.5.6. For employment such as scaffolding erection, crane-driving, fixing of loads and other dangerous work, employers should engage only workers with adequate training and at least three months' experience in a shipyard or similar enterprise.

1.5.7. The employer should ensure that supervisory staff and foremen are sufficiently aware of their responsibilities in relation to occupational safety and health, and should provide all of them with complete training in this field, so that they are capable of instructing workers thoroughly in the precautions to be taken in the performance of their jobs.

1.5.8. Employers should provide all workers with suitable training in safety measures to ensure that they are sufficiently safety-conscious to perform their jobs in accordance with accepted standards of safety and health. This training should, where relevant, extend to the use and maintenance of safety equipment.

1.5.9. Young workers and newly engaged workers should be given suitable training during working hours and without loss of earnings, to acquaint them with the occupational hazards to which they are exposed and with the measures needed to avoid them.

1.5.10. When new methods of work, materials, machines or equipment are introduced, all persons concerned with their use should be properly instructed by a suitable training course in the occupational safety and health requirements resulting from technical changes, modern methods of ship construction and new types of ships.

1.5.11. Training in occupational safety and health should take into account the workers' educational standard and any possible language problems in the case of foreign workers.

1.5.12. (1) Employers should in all cases make appropriate arrangements (if necessary by special agreement) with the persons in charge of the ship, to ensure that work on board is carried out without risk of accidents or disease.

(2) This should apply not only to work performed in the shipyard but also to work performed, for example, on a ship in the tideway.

1.5.13. Employers should allow unconditional access, at any time, to building and repair yards by official inspectors from the

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competent authority or other bodies responsible for supervision of shipyards.

1.6. Employment of young persons

1.6.1. No person under 15 years of age should be employed in the shipbuilding and ship-repairing industries.

1.6.2. (1) No person under 18 years of age should be employed on work that is particularly dangerous, or is apt to affect the safety or health of considerable numbers of workers, or requires mature judgement for its safe performance—for example operating power-driven machinery, driving tractors, handling flammable liquids in bulk, work with explosives, operating steam boilers, work with poisonous gas, harmful radiations, high temperatures, high pressures or corrosive or other harmful substances, and work in confined spaces.

(2) In particular—

- (a) young persons should not be employed on work exposing them to siliceous dust or asbestos dust, such as spraying or sawing asbestos, or to other harmful dust, such as scaling or cleaning boilers; and
- (b) young persons should not be employed on a stage, or in any part of a ship, from which they could fall more than 5 m (16 ft 6 in) or into water, unless they are under special guidance and supervision and are not left alone.

1.6.3. Young persons under the age of 16 should be in the charge of an experienced worker.

1.7. Employment of women

1.7.1. Women should be employed in accordance with national or other laws and regulations governing the employment of women.

2. Workplaces, their approaches and equipment

2.1. Means of access and egress

General

2.1.1. Adequate and safe means of access and egress should be provided for all workplaces.

2.1.2. Means of access and egress should be maintained in a safe condition.

2.1.3. Where special passageways or other safe means of access to or egress from workplaces are provided, workers should always use them for going to and from the workplaces.

Access to vessels

2.1.4. (1) Ways of escape in case of danger should be provided on ships under construction or repair.

(2) The ways of escape should be clearly marked, preferably with fluorescent paint.

(3) A plan showing the layout of the ways of escape should be posted at the accesses to the ship.

2.1.5. Means of access to vessels should be—

- (a) where practical, the ship's accommodation ladder, a gangway or a similar appliance complying with the relevant provisions of Chapter 4; or
- (b) in other cases, ladders, stairs, or, if necessary, rope step ladders or similar appliances complying with the relevant provisions of Chapter 4.

2.1.6. Means of access should be kept free from obstructions; if they pass under workplaces they should be protected against falling objects.

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2.1.7. Means of access should as far as practicable be so installed that no loads pass over them. In any event, loads should not be passed over the means of access while workers are on it.

2.1.8. (1) If the means of access to or egress from a vessel is a rope ladder or a gangway—

- (a) at least one adequate handhold should be provided at the place of boarding the vessel; and
- (b) a second gangway or a stairway complying with the relevant requirements of Chapter 4 should lead from the top of the bulwark to the deck as nearly as practicable opposite the rope ladder or gangway.

(2) Where a rope ladder gives immediate access to the vessel, the top step should be not more than 30 cm (1 ft) below the gunwale or top of the bulwark.

Access to dry docks

2.1.9. Means of access between floating dry docks and piers and bulkheads, and to the walls of dry docks from the floor, should be gangways, stairways or ladders complying with the relevant provisions of Chapter 4.

Access to holds, etc.

2.1.10. Hatches or any other means of access to holds, ships' decks or 'tween decks should be provided with safety barriers.

2.1.11. If it is not practicable to provide fixed hold ladders, portable metal ladders (or appropriate wooden ones) complying with the relevant requirements of Chapter 4 should be provided.

2.1.12. Rope ladders should be used only as supplementary means of access to holds.

2.1.13. Where practicable, access to holds should be by separate access hatches with a sloping ladder and handrail through each deck to the lower hold.

2.1.14. Where practicable, a fixed ladder should be provided at each end of the hatch.

2.1.15. (1) Separate openings such as man hatches giving access to hold ladders should be at least 60 cm (2 ft) by 60 cm clear for each ladder.

(2) If hinged covers are used to close the opening, the covers should be safeguarded against accidental closing.

2.1.16. Fixed hold ladders should—

- (a) extend to the underside of the hatch covers; or
- (b) be continued by and in line with arrangements for secure handhold and foothold on the coamings (e.g. steps or cups); and
- (c) not be recessed without a platform.

2.1.17. Steps and cups and similar arrangements should—

- (a) be so constructed and attached as to ensure safety;
- (b) have a clear width of at least 30 cm (1 ft) and provide foothold of a depth, including any space behind them, of at least 15 cm (6 in);
- (c) provide a firm handhold and be so constructed as to prevent the foot from slipping sideways;
- (d) be spaced at the same intervals as the rungs of the hold ladders; and
- (e) be continued to within at least 45 cm (1 ft 6 in) of the top of the coaming.

2.1.18. A safe handhold should be provided at the top of each ladder.

2.1.19. Handholds should be provided on the bulkhead above the level of the deck over escape manholes.

2.1.20. When ladders end at the top of deep tanks, or at weather deck flush hatches, temporary handholds should be provided on the deck away from the head of the ladder.

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2.1.21. There should be a fixed ladder at each side of permanent fore-and-aft bulkheads or shifting boards.

2.1.22. Tunnels in the vicinity of fixed hold ladders should be fitted on both sides with ladders or steps.

2.1.23. Coamings that are higher than 90 cm (3 ft) above the deck should be provided at suitable intervals on the outside with steps or cups or similar arrangements corresponding to the hold ladders.

2.2. Roadways, quays, yards, etc.

2.2.1. Roadways, quays, yards and other places where persons or vehicles move or are stationed should be so constructed and maintained as to be safe for the traffic that they have to carry.

2.2.2. In particular, such places should—

- (a) have a firm even surface;
- (b) be adequately drained and graded to prevent the accumulation of water, mud, and the like;
- (c) where necessary to prevent danger, be provided with pavements or special walkways for pedestrians;
- (d) have adequate fencing or covering round or over dangerous pits, openings, edges and other places where persons could fall; and
- (e) if sloping steeply towards the water, have the waterside edge protected as far as practicable.

2.2.3. Yards and other places that are surrounded by fencing should have separate gates for pedestrian and vehicular traffic.

2.2.4. Where walkways cross railway tracks or roads for motor traffic, bridges or underpasses should be provided if necessary to prevent danger.

2.2.5. (1) Walkways over bridges, caissons or dock gates, or on steep slopes at places where workers might be injured by traffic, should be provided with adequate railings or other barriers.

(2) The barrier should be continued at each end of such a walkway for a sufficient distance not exceeding 5 m (16 ft 6 in).

2.2.6. Dangerous crossings where transport of heavy objects is carried out should be protected by automatic signals or gates whenever possible, or be guarded by watchmen.

2.2.7. Measures should be taken for the safety of persons working on any snow or ice that may be surrounding the ship.

2.3. Heating, cooling, lighting and ventilation

Heating and cooling

2.3.1. Where necessary to prevent danger or preserve health and to provide adequate comfort, workplaces indoors and enclosed spaces on board should be—

- (a) adequately heated in cold weather; and
- (b) adequately cooled by ventilation in hot weather.

2.3.2. Heating installations should comply with the requirements of section 2.5.

Lighting

2.3.3. Where natural lighting is not adequate to prevent danger, adequate and suitable artificial lighting should be provided at all workplaces and their approaches.

2.3.4. Holds and other large spaces under the weather decks of vessels that are used extensively as workplaces or passageways by workers should be provided with two separate lighting installations, one of which should have its own source of power and be capable of providing emergency lighting.

2.3.5. If the lighting in a vessel is provided solely by sources outside the vessel, adequate emergency lighting should be available on board.

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2.3.6. Artificial lighting should not cause danger by producing glare or deep shadows.

2.3.7. Where necessary to prevent danger from electric shock, lamps should be protected by guards made of wire or plastic.

2.3.8. Matches and open-flame lamps should not be used for lighting on board vessels.

2.3.9. Portable lamps that burn liquid fuel should have a properly fitted screw lid or stopper, and be so constructed as to prevent leakage.

2.3.10. Liquid fuel for lamps should have a flash point over 38° C (100° F) as determined by the Abel closed test or the Pensky-Martens closed test.

2.3.11. Electric lighting should comply with the relevant requirements of Chapter 10.

2.3.12. All passageways from the weather deck to workplaces below should be adequately lighted so long as any worker is below.

2.3.13. Only persons authorised to do so should switch off, extinguish or displace lamps in the general lighting system.

2.3.14. Workers should not enter dark spaces without a portable light.

Ventilation

2.3.15. (1) Whenever natural ventilation does not ensure safe and healthy conditions as regards temperature and the composition of the atmosphere, artificial ventilation should be provided.

(2) In particular, local exhaust ventilation should be provided at places where dust, gas, vapour, steam or fumes are formed, if necessary to prevent danger.

2.3.16. If it is not practicable to ventilate workplaces sufficiently to ensure safe and healthy conditions, the workers should be provided with suitable respirators.

2.3.17. Ventilation for the prevention of fire and explosion risks should comply with the relevant requirements of Chapter 16.

2.3.18. Compressed air should not be used for ventilation unless it has been cleaned, warmed if necessary, and the pressure reduced.

2.3.19. Oxygen should never be used for ventilation.

2.3.20. Polluted or stale air should be so led off that it cannot cause any risk of fire, explosion or illness.

2.4. Housekeeping

2.4.1. Loose materials not required for immediate use should not be placed or left so as to dangerously obstruct workplaces and passageways.

2.4.2. No timber or other material with projecting nails should be used or allowed to remain at any workplace in such a way as to cause danger.

2.4.3. Tools, bolts, nuts and other objects should not be left lying about where they could cause a tripping hazard.

2.4.4. Scrap, waste, rubbish and dirt should not be allowed to accumulate at workplaces or in passageways.

2.4.5. Rubbish and dirt should not be thrown overboard but removed in a hygienic manner, for instance by being passed through a chute to a bin.

2.4.6. Workplaces and passageways on shore, on board or on floating equipment that are slippery owing to ice, snow, oil or other causes should be cleaned up or strewn with sand, sawdust, ash or the like.

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2.4.7. Piping, hose and electric cables should be laid at least 2 m (6 ft 6 in) above passageways, or else be protected by covers.

2.4.8. (1) Compressed air or oxygen should not be blown on clothes, or used to remove dust, snow or moisture.

(2) Oxygen should not be used for any other cleaning operations.

2.5. Fire and explosion protection

Fire extinguishing equipment

2.5.1. Places where workers are employed should, if necessary to prevent danger, be provided with—

- (a) suitable and sufficient fire extinguishing equipment; or
- (b) an adequate water supply at ample pressure for extinguishing fires in ordinary combustible materials.

2.5.2. All supervisors and a sufficient number of workers should be trained in the use of fire extinguishers.

2.5.3. Persons trained to use the fire extinguishing equipment should be readily available during all working periods.

2.5.4. Fire extinguishing equipment should be inspected at suitable intervals by a competent person and properly maintained.

2.5.5. Access to fire extinguishing equipment such as hydrants, portable extinguishers and connections for hoses should be kept clear at all times.

2.5.6. The necessary fire fighting equipment and at least one suitable fire extinguisher should be provided—

- (a) in every building or other place for the storage of combustible materials;
- (b) at a reasonable distance from places where welding, riveting and other hot work is carried on; and
- (c) in the immediate vicinity of switchgear and at main distribution points.

2.5.7. At least one suitable dry chemical extinguisher should be provided—

- (a) where flammable liquids are stored, handled or used; and
- (b) where oil or gas-fired heating equipment is used.

2.5.8. Fire extinguishing equipment should be adequately protected against mechanical damage.

2.5.9. In cold weather extinguishers should be protected against freezing.

2.5.10. Extinguishers containing methyl bromide, carbon dioxide, chlorinated hydrocarbons or carbon tetrachloride should be used only in the open air.

2.5.11. No work on oil tankers or floating tanks for mineral oils or their derivatives that puts the fixed fire extinguishing installation out of action, even temporarily, should be done without permission from the competent port authority.

Heating appliances

2.5.12. Fuel-fired heating appliances such as braziers should be used only in places where there is adequate general ventilation.

2.5.13. No fuel-fired heating appliance should be placed in means of egress.

2.5.14. A stove or brazier should not be placed on a wooden floor or any other combustible base, but on a non-combustible base extending a safe distance beyond the stove or brazier on all sides.

2.5.15. The combustion gases from stoves used below decks should be discharged in the open.

2.5.16. Stoves and braziers should be kept at a safe distance from combustible structures and material.

2.5.17. Tarpaulins, canvas sheets and the like in the vicinity of a brazier should be secured so that they cannot be blown onto it.

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2.5.18. Bituminous coal should not be used in braziers.

2.5.19. Heating systems for stores of flammable or combustible materials should not have any open flame or exposed incandescent part.

2.5.20. No part of heating systems for stores of flammable or combustible materials should be in dangerous proximity to such materials.

2.5.21. Fires should not be lit with flammable liquids such as oil and petrol (gasoline).

Highly combustible materials

2.5.22. Highly combustible materials and flammable liquids should be stored, transported, handled and used in conformity with the requirements of section 13.2.

Hot work

2.5.23. Hot work should be carried out in conformity with the relevant requirements of Chapter 14.

Tanks and spaces with galvanic protection

2.5.24. (1) If ballast tanks or other spaces are equipped with magnesium anodes for the prevention of corrosion, precautions should be taken to prevent explosions of hydrogen-air mixtures.

(2) In particular such tanks or spaces should—

(a) be filled as high as is practicable with water without allowing air pockets to form under the deck; or

(b) be completely emptied.

(3) The hatches or manholes of the tanks or spaces should be left open.

(4) The relevant requirements of Chapter 16 should be observed.

Inspection, supervision

2.5.25. Where there are fire or explosion risks, regular inspections should be carried out in particular places where there are heating appliances, electrical installations and conductors, stores of flammable liquids and combustible materials, welding operations and internal combustion engines.

2.5.26. When necessary to prevent danger, a fireman should be on duty at workplaces outside working hours.

Notices

2.5.27. Notices should be posted in conspicuous places indicating---

- (a) the location of the nearest fire alarm; and
- (b) the telephone number and address of the nearest fire brigade.

2.6. Protection against falls of objects

2.6.1. Where necessary and practicable to prevent danger, overhead screens should be provided or other precautions should be taken to prevent workers from being struck by falling objects.

2.6.2. Waste materials should not be thrown down from heights.

2.6.3. If material and objects cannot be safely lowered from heights, adequate precautions such as the provision of fencing, look-out men or barriers should be taken.

2.6.4. Workers employed at elevated workplaces should be provided with suitable containers for screws, bolts, nuts and the like.

2.6.5. Loose articles should not be left lying about in places where they could fall on persons underneath.

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2.6.6. Planks on stages outside a vessel should be so placed that no article likely to injure any person below can fall between them or between the stage and the side of the vessel.

Hatches and hatch covers

2.6.7. Hatches should not be opened or closed while workers are directly below them.

2.6.8. (1) A section of hatch through which material or equipment is being moved by a lifting appliance should be completely opened—provided that this need not apply to mechanically operated hatch covers, which need be opened only to the extent required to permit passage of the material without danger to workers working below or in the immediate vicinity of the said hatch cover section.

(2) Beams left in places adjacent to an opening should be effectively secured against displacement.

2.6.9. The hatch beams of a hatch in use should be either removed or secured to prevent their displacement.

2.7. Protection against falls of persons

Fencing and railings

2.7.1. (1) All fencing and railings used for floor openings, wall openings, gangways, elevated workplaces and other places to prevent falls of persons should—

- (a) be of sound material and good construction and possess adequate strength;
- (b) be at least 1 m (3 ft 3 in) high; and
- (c) consist of two rails or two taut ropes or chains, supporting stanchions, and, if necessary to prevent persons from slipping or objects from falling, a toe-board.

(2) Intermediate rails, ropes or chains should be at a height of about 50 cm (1 ft 8 in).

(3) Stanchions should be not more than 3 m (9 ft 9 in) apart, and should be secured so that they cannot be inadvertently displaced.

(4) Toe-boards should be at least 15 cm (6 in) high, and should be securely fastened.

2.7.2. Fencing and railings should be free from sharp edges.

2.7.3. Fencing and railings should be maintained in good repair.

Deck and floor openings and edges

2.7.4. When on a vessel under construction or repair workers have to go across or along uncovered deck beams or floors—

- (a) adequate footways or passages not less than 45 cm (1 ft 6 in) wide should be provided on the deck beams or floors to give safe access to workplaces; and
- (b) adequate portable ladders complying with the relevant requirements of Chapter 4 should be provided to give safe access from the ground or outer bottom plating to the top of the floor.

2.7.5. Small floor and deck openings through which persons could fall should be guarded by—

- (a) covers of adequate strength secured against displacement; or
- (b) fencing or railings on all exposed sides, complying with the requirements of paragraphs 2.7.1 to 2.7.3; or
- (c) other effective means.

2.7.6. Fencing or railings complying with the requirements of paragraphs 2.7.1 to 2.7.3 should be provided on—

- (a) the edges of dry docks, including the edges above flights of steps and chutes for materials; and
- (b) the unprotected sides or edges of openings in a deck or tank top of a vessel.

2.7.7. When workers are employed near open hatches not protected by coamings to a height of at least 75 cm (2 ft 6 in), or near other large openings in working surfaces, the edges of the

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openings should as far as practicable be protected by fencing or railings complying with the requirements of paragraphs 2.7.1 to 2.7.3.

2.7.8. Fencing or railings protecting edges of dry docks, or of openings in a deck or tank top, etc., should be kept in position except when removal is necessary for the passage of persons, materials or equipment, and if removed should be replaced as soon as practicable.

2.7.9. As far as practicable, sections of bilges that have no floorplates or gratings, or from which floor plates or gratings have been removed, should be protected—

- (a) by fencing or railings, complying with the requirements of paragraphs 2.7.1 to 2.7.3; and
- (b) if the open sections are in a passageway, by sufficient close-planked flooring.

2.7.10. Gratings, walkways, catwalks, etc., from which ladders or sections of flooring have been removed should be effectively fenced off.

Elevated workplaces

2.7.11. Workers employed at places from which they could fall more than 2 m (6 ft 6 in) should be provided with—

- (a) scaffolding or staging complying with the relevant requirements of Chapter 3;
- (b) ladders complying with the relevant requirements of Chapter 4;
- (c) catch platforms or nets; or
- (d) safety belts and lines complying with the relevant requirements of Chapter 23.

2.7.12. Elevated workplaces more than 2 m (6 ft 6 in) above the deck floor or the ground should be protected on all open sides by fencing or railings complying with the requirements of paragraphs 2.7.1 to 2.7.3.

2.7.13. Elevated workplaces should be provided with safe means of access and egress such as stairs, ramps or ladders complying with the relevant requirements of Chapter 4.

Protection against drowning and falls into water

2.7.14. (1) Where workers such as those employed on the outside of floating ships, or over water on ships on slipways, are in danger of falling into water and drowning, adequate rescue arrangements, such as the provision of a suitable manned boat, lifejackets, ring buoys and gaffs, should be made and constantly maintained for the duration of the danger.

(2) They should be protected by buoyant lifejackets or vests or belts, in accordance with the requirements of paragraphs 23.1.45 and 23.1.46.

2.7.15. (1) Workers should not be employed on a stowed or suspended lifeboat unless the boat is secured by means independent of the releasing gear so that it cannot fall if the releasing gear accidentally trips.

(2) Workers should not remain in a lifeboat while it is being lowered or hoisted for stowing.

(3) Workers should not be employed on the outboard side of a stowed lifeboat unless the boat is secured against swinging outwards.

2.7.16. If workers employed on the floor of a floating dry dock could fall into the water, the edge of the dock should be protected by railings complying with the requirements of paragraphs 2.7.1 to 2.7.3, or by other effective means.

2.8. Noise

2.8.1. (1) The noise of equipment and operations should be kept as low as possible and not exceed 90 dB(A) at any time during work.

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(2) The maximum permissible noise level should be kept under review in the light of current knowledge.

2.8.2. In acquiring and installing new machinery special attention should be given to noise prevention.

2.8.3. If noise cannot be reduced to a safe level, workers should be provided with ear protectors.

2.8.4. Workers continuously exposed to noise should undergo periodical medical examinations.

2.9. Protection against the weather

2.9.1. (1) In cold climates, during the cold season, as far as practicable—

- (a) exposed working places on board should be enclosed or screened against the wind¹; and
- (b) facilities for workers to warm themselves when working in exposed conditions should be provided.

(2) If the measures referred to in subparagraph (1) (a) cannot be implemented, suitable protective clothing should be provided and worn.

2.9.2. In hot climates, exposed working places on board should be sheltered against the sun.

¹ In particular the provision of inflatable tents might be considered.

3. Scaffolding and staging

3.1. General

3.1.1. Suitable and sufficient scaffolding or staging should be provided for workers for all work at a height that cannot safely be done from a ladder or by other means.

3.1.2. Scaffolding or staging should not be constructed, taken down or substantially altered except under the direction of a competent and responsible person, and by competent workers possessing adequate experience of that kind of work.

Materials

3.1.3. Sufficient material should be provided for and used in the construction of scaffolding or staging.

3.1.4. Timber used in the construction of scaffolding or staging should be spruce, fir, Oregon pine or equivalent timber, straight grained, sound, and free from large knots, dry rot, worm holes and other dangerous defects.

3.1.5. Where necessary, boards and planks used for scaffolding or staging should be protected against splitting.

3.1.6. Fastenings on scaffolding or staging should be steel bolts of adequate dimensions with washers and nuts, fibre rope lashings, or other means approved by the competent authority.

3.1.7. (1) Nails on scaffolding or staging should be of adequate length and thickness.

(2) Cast iron nails should not be used on scaffolding or staging.

3.1.8. Materials used in the construction of scaffolding or staging should be stored under good conditions and apart from any material unsuitable for scaffolding or staging.

3.1.9. (1) No rope that is defective should be used.

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(2) No rope that has been in contact with acids or other corrosive substances should be used unless it is composed of a suitable man-made fibre.

Construction

3.1.10. (1) Scaffolding or staging should be of adequate strength for the purpose for which it is used.

(2) It should be designed to carry the maximum load with a safety factor to be determined by the competent authority.

3.1.11. Scaffolding or staging should be provided with safe means of access such as stairs, ladders or ramps.

3.1.12. Scaffolding or staging should be sufficiently and properly braced.

3.1.13. Workers who are not specially authorised to do so should not make any alterations in or otherwise interfere with any scaffolding, staging, stairs or ladders whether inside or on the outside of a vessel.

3.1.14. If the scaffolding or staging is an independent structure, at least one-third of the putlogs should remain in position until the scaffolding or staging is finally dismantled, and remain securely fastened to the ledgers or the uprights as the case may be.

3.1.15. All structures and appliances used as supports for working platforms should be of sound construction, have a firm footing, and be suitably struted and braced to make them stable.

3.1.16. Loose bricks, drain pipes, ladder rungs or other unsuitable material should not be used for the construction or support of scaffolding or staging.

3.1.17. Whenever scaffolding or staging is dismantled—
(a) all components should be inspected by a competent person; and
(b) defective components should be repaired, reconditioned or removed.

3.1.18. When necessary to prevent danger from falling objects or other sources, scaffolding or staging should be provided with adequate screens.¹

3.1.19. Nails should be driven full length, and not driven part way and then bent over.

3.1.20. Unless it is made from a suitable man-made fibre, no fibre rope should be used on scaffolding or staging erected at any place where such rope would be apt to come into contact with acid or corrosive substances.

Inspection, maintenance

3.1.21. Before use, all scaffolding or staging should be examined by a competent person to ensure more particularly that—

- (a) it is stable;
- (b) the materials used in its construction are sound;
- (c) it is adequate for the purpose for which it is to be used; and
- (d) the required guards and safety devices are in position.

3.1.22. Scaffolding or staging should be inspected by a competent person after bad weather or strong earthquakes (of seismic intensity 4 and above); it should also be inspected by users before they use it.

3.1.23. Scaffolding or staging parts, including scaffolding machines and ropes and cables, should be inspected on each occasion before erection and should not be used on any occasion unless in every respect they possess the qualities required for their purpose.

3.1.24. (1) All scaffolding and staging should be maintained in good and proper condition, and every part should be kept fixed or secured so that no part can be displaced as a consequence of normal use.

¹ See also paragraph 2.6.1.

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(2) Unless it continues to be safe for use, no scaffolding or staging should be partly dismantled and left so that it is capable of being used.

Lifting appliances on scaffolds

3.1.25. When a lifting appliance is to be used on scaffolding or staging—

- (a) the parts of the scaffolding or staging should be carefully inspected and, if need be, adequately strengthened;
- (b) any movement of the putlogs should be prevented; and
- (c) if practicable the uprights should be rigidly connected to a solid part of the vessel, at the place where the lifting appliance is erected.

3.1.26. When the platform of the lifting appliance does not move in guides or when the load is apt to come into contact with the scaffolding or staging during hoisting or lowering, a vertical hoarding should be erected to the full height of the scaffolding or staging to prevent loads from being caught in it.

3.1.27. Jibs for hoisting materials should not be attached to standards or extension poles.

3.1.28. When no jib but only a rope pulley is used, the pulley should not be attached to a cross-beam unless the cross-beam—

- (a) has sufficient strength and is fixed to at least two standards or extensions in the way prescribed for ledgers; and
- (b) does not at the same time serve as a ledger for the scaffolding or staging.

3.1.29. If any upright forming part of scaffolding or staging is used as a fixing for a pulley block for hoisting material, the upright should be—

- (a) adequately housed in the ground or otherwise adequately secured against rising; and
- (b) effectively protected against damage by the action of the chain or wire or other means of securing the pulley block to the upright.

3.1.30. No upright forming part of scaffolding or staging should be used as an anchorage for a lead pulley block if it is apt to be displaced by such use.

3.1.31. If a hoisting appliance or any part of one moves along scaffolding or staging, adequate measures should be taken to prevent persons on the scaffolding or staging from being struck by the appliance or any part of it.

Prefabricated frames

3.1.32. Prefabricated frames for scaffolding or staging should have adequate arrangements on both faces for fixing bracing, as well as handrails if handrails are necessary to prevent danger.

3.1.33. Frames of different types should not be intermingled.

3.1.34. Frames should be sufficiently strong and rigid to avoid distortion during transport, handling, etc.

3.1.35. Where frames are superimposed vertically, adequate precautions should be taken to keep the legs in correct alignment.

3.1.36. In free-standing scaffolding or staging, adequate precautions should be taken to prevent vertical separation of frames.

Use of scaffolding or staging

3.1.37. (1) The practice of transferring heavy loads on or to scaffolding or staging should be discouraged. In any event, no sudden shock should be transmitted to the structure.

(2) When necessary to prevent danger, a hand rope (tag line) should be used to control loads being hoisted onto scaffolding or staging, so that they cannot strike against it.

3.1.38. The load on the scaffolding or staging should be evenly distributed as far as is practicable, and in any case should

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be so distributed as to avoid any dangerous disturbance of the equilibrium.

3.1.39. (1) During the use of scaffolding or staging, constant care should be taken to ensure that it is not overloaded.

(2) Scaffolding or staging should not be used for the storage of material that is not required for immediate use.

3.1.40. In adverse weather conditions such as a strong wind (more than 15 m per second or 3,000 ft per minute), snow, ice or heavy rain, workers should not be employed on scaffolding or staging unless specific protective measures are taken.

3.1.41. Scaffolding or staging materials and tools or other objects should not be thrown down but be properly lowered.

3.1.42. When air hoses, water hoses, electric cables or the like are used on scaffolding or staging they should be secured against displacement.

3.1.43. Workers should not be employed on scaffolding or staging erected on trestles or ladders.

3.2. Working platforms

3.2.1. No part of a working platform should be attached to or rest on loose bricks, drain pipes, ladder rungs or other loose or unsuitable supports.

3.2.2. No working platform should be used for working upon until its construction is completed and the necessary safeguards properly fixed.

3.2.3. For every working platform which is more than 2 m (6 ft 6 in) above the ground or floor, the clearance between flooring planks should be less than 3 cm (1¼ in).

3.2.4. (1) The width of the platform should be adequate having regard to the nature of the work and should be such that at every part there is not less than 60 cm (2 ft) clear passage free from fixed obstacles and deposited material.

(2) In no case should the width of a working platform be less than—

- (a) 40 cm (1 ft 4 in) if the platform is used as a footing only and not for the deposit of any material;
- (b) 80 cm (2 ft 8 in) if the platform is used for the deposit of material;
- (c) 110 cm (3 ft 8 in) if the platform is used for the support of any higher platform.

3.2.5. The maximum width of a platform supported on putlogs should as a rule not exceed 160 cm (5 ft 4 in).

3.2.6. As far as practicable, a clear headroom of at least 180 cm (6 ft) should be maintained on working platforms.

3.2.7. Every working platform should, if part of a pole scaffold, be at least 1 m (3 ft 3 in) below the top of the standards.

3.2.8. Boards or planks that form part of a working platform or are used as toe-boards should be—

- (a) of a thickness such as to afford adequate security having regard to the distance between the putlogs but in no case less than 3 cm (1 1/4 in); and
- (b) not less than 20 cm (8 in) wide.

3.2.9. (1) No board or plank that forms part of a working platform should project beyond its end support to a distance exceeding four times the thickness of the board or plank.

(2) Further specific safety rules for setting up such boards or planks should be observed in accordance with the requirements laid down by the competent authority.

3.2.10. Boards or planks should not overlap one another unless precautions such as bevelling or the provision of bevelled pieces are taken to reduce the risk of tripping to a minimum and to facilitate the movement of barrows.

3.2.11. Planks used for flooring should be of uniform thickness.

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3.2.12. Every board or plank that forms part of a working platform should rest on at least three supports, unless the distance between the putlogs and the thickness of the board or plank are such as to exclude all risk of tipping or undue sagging.

3.2.13. Platforms should be so constructed that the boards or planks cannot be displaced through normal use.

3.2.14. Every part of a working platform or working place from which a person is liable to fall a distance exceeding 2 m (6 ft 6 in) should be provided with fencing and railings complying with the requirements of paragraphs 2.7.1 to 2.7.3, provided that toe-boards should be fitted only when they are particularly necessary.

3.2.15. Fencing, railings, toe-boards and other safeguards used on a scaffolding or staging platform should be maintained in position, except that they may be removed for the time and to the extent required to allow the access of persons or the transport or shifting of materials.

3.2.16. Fencing, railings and toe-boards used on a scaffolding or staging platform should be placed on the inside of the uprights.

3.2.17. The platforms of suspended scaffolding or staging should be provided with fencing, railings and toe-boards on all sides; except that railings and toe-boards need not be provided on the side facing the vessel if the workers sit on the platform to work, but in such a case the platform should be provided with cables, ropes or chains affording the workers a firm handhold and capable of holding any worker who slips.

3.2.18. The space between the vessel and the platform should be as small as possible except where workers sit on the platform during their work, in which case it should not exceed 30 cm (1 ft).

Platforms attached to lifting appliance

3.2.19. If necessary to prevent danger when a working platform is attached to a lifting appliance, the lifting appliance should be provided with means of positively locking the supports so as to prevent inadvertent movement of the platform.

3.2.20. If necessary to prevent danger the lifting appliance operator should remain at the controls while the platform is in use.

3.2.21. If the platform is suspended—

- (a) adequate precautions should be taken against swinging and spinning; and
- (b) the movement of the platform should be governed by signals in conformity with the requirements of paragraphs 5.1.48 to 5.1.65.

3.2.22. Lifting bridles of working platforms suspended from cranes should—

- (a) have four legs such that the stability of the platform is ensured; and
- (b) be attached to the crane rope by safety hooks, shackles or other means that effectively prevent them from disengaging from the crane rope.

3.2.23. If the platform is rigidly attached to the lifting appliance, adequate precautions should be taken to prevent it from tilting during raising and lowering.

3.2.24. (1) While the platform is in use the lifting appliance should not be moved on any surface.

(2) The lifting appliance should be so installed and fixed that its position cannot be changed either by the load or by any other influence.

3.2.25. All lifting appliances used with working platforms should be fitted with over-hoisting limit switches.

3.3. Pole scaffolds

Uprights

3.3.1. Pole standards should be—

- (a) vertical or slightly inclined towards the vessel; and
- (b) fixed sufficiently close together to secure the stability of the scaffolding or staging.

3.3.2. The stability of the pole standards should be secured—

- (a) by letting the pole the necessary distance into the ground according to the nature of the soil;
- (b) by placing the pole on a suitable plank or other adequate sole plate in such a manner as to prevent slipping;
- (c) by diagonal bracing between the parallel poles, and cross-bracing between the inner and outer poles or from the outer poles to the ground; or
- (d) in any other sufficient way.

3.3.3. Where splices are necessary in round pole standards—

- (a) butt-joined double poles should be used instead of single poles;
- (b) the joints of the two poles should be adequately staggered; and
- (c) the poles should be adequately lashed together at the base and at each butt joint.

3.3.4. (1) No trucks or other moving equipment should be allowed to move near the base of pole standards.

(2) Where necessary, protective barriers should be erected not less than 1 m (3 ft 3 in) from the base of the pole.

3.3.5. Sawn timber standards should be butt-jointed with adequate timber pieces or fish plates secured on each side of the butt joint with bolts, washers and nuts.

Ledgers

3.3.6. (1) Ledgers should be practically level and securely fastened to the uprights by bolts, dogs, ropes or other efficient means.

(2) Except when special devices are used that ensure equivalent strength, the ends of two consecutive ledgers at the same level should be securely joined together at an upright.

3.3.7. Ledgers should extend over the whole length of the scaffold.

3.3.8. When necessary to prevent danger from heavy loading, ledgers should be adequately reinforced by bracing, cleats, or other effective means.

3.3.9. All ledgers should be left in place to brace the scaffolding or staging until it is dismantled.

3.3.10. Joints in ledgers should not be made—

- (a) in single-span ledgers,
- (b) near the end uprights;
- (c) in adjacent spans; or
- (d) in between uprights.

Putlogs

3.3.11. (1) Putlogs should be straight and securely fastened to the ledgers.

(2) If ledgers are not used, the putlogs should be fastened to the uprights and supported by securely fastened cleats.

(3) The dimensions of the putlogs should be appropriate to the load to be borne by them.

(4) The distance between two consecutive putlogs on which a platform rests should be fixed with due regard to the anticipated load and the nature of the platform flooring.

(5) As a general rule, the said distance should not exceed 1 m (3 ft 3 in) with planks less than 4 cm (1⁵/₈ in) thick, 1.5 m (5 ft)

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with planks less than 5 cm (2 in) thick, and 2 m (6 ft 6 in) with planks at least 5 cm thick.

3.3.12. If putlogs are removed from a scaffold before it is dismantled a sufficient number of adequate braces should be substituted.

3.3.13. Joints should not be made in putlogs.

3.4. Light suspended scaffolds with manually operated platforms

Outriggers, rings, etc.

3.4.1. Outriggers should be—

- (a) of adequate length, strength and cross-section to ensure the solidity and stability of the scaffolding or staging;
- (b) installed at right angles to the vessel's side; and
- (c) carefully spaced to suit the putlogs or deck irons.

3.4.2. Unless the workers sit to work, the overhand of the outriggers from the ship should be such that the platform is fixed to hand not more than 10 cm (4 in) from the vessel's side.

3.4.3. (1) The outriggers should be securely anchored to the vessel by counterweights, bolts or other equivalent means.

(2) When the outriggers are anchored by bags of ballast or other loose counterweights the bags or counterweights should be securely lashed to the outriggers.

3.4.4. The supporting hooks, shackles or rings should be forged from suitable steel or other suitable material.

3.4.5. Stop bolts should be placed at the end of each outrigger.

3.4.6. (1) Interior staging on board should be hung from sufficiently strong and firmly secured structures such as beams and floors by means of rings or shackles of tested bearing capacity.

(2) Interior staging should not be suspended from hooks.

Suspension ropes

3.4.7. (1) The suspension ropes should be made of high-grade manila fibre, man-made fibre or steel wire, and have a safety factor of at least 10 for fibre and 5 for metal.

(2) The choice of the suspension ropes should be determined by the potential hazards of the work; where hot work is being done and where any suspended working platform is used, steel wire ropes should be used.

3.4.8. The suspension ropes should pass through suitable pulley blocks so as to enable the platform to be raised and lowered safely.

3.4.9. Suspension ropes should be adequately protected against chafing against sharp edges or rough surfaces of any part of the vessel or other structure.

3.4.10. The pulley blocks should be fastened to the platforms by the hangers.

Platforms

3.4.11. The maximum length of the platforms of light suspended scaffolds should be 8 m (26 ft).

3.4.12. (1) Platforms should hang on at least three ropes which should be not more than 3 m (10 ft) apart.

(2) No intermediate rope should at any time be tauter than either of the end ropes.

3.4.13. Platforms of light suspended scaffolds should not exceed 60 cm (2 ft) in width.

3.4.14. The hangers supporting the working platform of a light suspended scaffold should be of steel bar or rod or equivalent material of adequate strength.

3.4.15. Hangers should pass under the platform planks and be secured to them.

Operation

3.4.16. Two or more light suspended scaffolds should not be combined by connecting them with planking or by other means.

3.4.17. When a light suspended scaffold is not in use it should be cleared of tools, other objects and rubbish and lashed to the vessel, or lowered to the ground.

3.4.18. Light suspended scaffolds should be examined for defects by its users before commencing work each day.

3.4.19. Not more than two workers should be employed on a light suspended scaffold at any one time.

3.4.20. Light suspended scaffolds should be prevented from swinging or knocking against the vessel by such means as ties and spacing bars.

3.4.21. Light suspended scaffolds on which the workers sit to work should be controlled or provided with devices to keep the platform at a distance of at least 30 cm (1 ft) from the side of the vessel and to prevent the workers from knocking their knees against the side if the scaffold swings.

3.4.22. When a light suspended scaffold is not being raised or lowered, the hauling part of the fall rope should be made fast with a self-locking hitch to the lower block.

3.4.23. No hot work should be done on scaffolds suspended by fibre rope.

3.4.24. When work is done on light suspended scaffolds, the workers should use a safety belt and line.

3.5. Heavy suspended scaffolds with machine-operated platforms

Outriggers

3.5.1. Outriggers of heavy suspended scaffolds should comply with the requirements of paragraphs 3.4.1. to 3.4.5.

3.5.2. (1) Outriggers should be securely anchored to the vessel by bolts or other equivalent means.

(2) No counterweight should be used as a means of securing the outriggers.

Suspension ropes

3.5.3. Only steel wire ropes should be used to suspend platforms of heavy suspended scaffolds.

3.5.4. The ropes used for suspension should—

- (a) have at all times a safety factor of at least 5 based on the maximum load that the ropes may have to support; and
- (b) be of such length that at the lowest position of the platform there are at least two turns of rope on each drum.

3.5.5. The shackles serving to fasten the ropes to the outriggers should be placed vertically above the drum centres of the winches on the movable platforms.

3.5.6. The upper ends of suspension ropes should terminate in a spliced loop or a loop made with a mechanical splice, provided with a steel ring or eye, and the bolt should pass through the outrigger shackle and the ring and be secured by a nut.

3.5.7. The lower ends of suspension ropes should be securely fastened to the hoisting machines by clips, babbitting or other effective means.

Scaffolding (hoisting) machines

3.5.8. Scaffolding machines or hoisting machines for working platforms should be so constructed and installed that their moving parts are adequately guarded and are readily accessible for inspection.

3.5.9. The frame of the hoisting machine should be securely fastened to the platform bearers by bolting or other effective means.

3.5.10. Winches on suspended scaffolding or staging should be—

- (a) of the self-braking type; or
- (b) provided with a ratchet and pawl and a positive locking device such that the platform can be securely held at any level and the pawl automatically engages when released from the hand control.

3.5.11. If the machine is power-driven, the release of the manual pressure on the starting switch or lever should stop the motor and automatically actuate the brake and securely hold the platform.¹

3.5.12. The moving parts of every scaffolding (hoisting) machine and associated suspension tackle should be inspected at least once in every two weeks.

3.5.13. When a scaffolding machine is moved from one place to another it should be inspected and overhauled before being used again.

Platforms

3.5.14. (1) Platforms should hang on at least three ropes which should be not more than 3 m (10 ft) apart.

(2) No intermediate rope should at any time be tauter than either of the end ropes.

(3) The load on the platform should be distributed as evenly as possible.

3.5.15. (1) Suitable putlogs, bearers or deck irons should be used to support the platforms and should be securely fastened so as to prevent displacement.

(2) Deck irons should be adequately jointed by fish plates.

3.5.16. The total width of the working platform of a heavy suspended scaffold should not exceed 1.5 m (5 ft).

¹ i.e. there should be a so-called "dead man's handle".

Operation

3.5.17. Operations with heavy suspended scaffolds should comply with the requirements of paragraphs 3.4.16, 3.4.17, 3.4.19 and 3.4.20.

3.5.18. (1) While persons are working on a heavy suspended scaffold, the suspension ropes should at all times be securely locked and the winch locked mechanically and electrically.

(2) The winch operator should be in full control of the winch during the whole operation.

(3) All necessary safety measures should be taken at the time of changing shifts.

3.6. Trestle scaffolds

3.6.1. No person should use any trestle scaffold which—

- (a) comprises more than two tiers;
- (b) exceeds a height of 3 m (10 ft) from the deck, ground or floor;
or
- (c) is erected on a suspended scaffold.

3.6.2. The width of a trestle scaffold erected on a platform should be such as to leave sufficient unobstructed space on the platform for the transport of materials or the passage of persons.

3.6.3. Trestles should be firmly fixed so as to prevent displacement.

3.6.4. Trestles used for trestle scaffolds should possess adequate strength and be adequately braced to ensure rigidity and resist lateral thrusts.

3.6.5. Extension pieces should not be nailed on the legs of trestles to increase height.

3.6.6. Trestle scaffolds should be set up on firm and level bases.

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3.6.7. Trestles for heavy duty scaffolds should not be more than 1.5 m (5 ft) apart.

3.7. Bracket scaffolds

3.7.1. Bracket scaffolds used in oil tanks, etc., should be supported by metal brackets welded or otherwise adequately secured to the hull, bulwark or other supporting structure.

3.7.2. As far as practicable attachments for the brackets should be welded to the hull plates or bulkheads before they are placed in position on board.

3.7.3. Bracket scaffolds should be used only by workers such as electric welders, carpenters, electricians and painters who do not need to have heavy equipment or materials on the scaffold.

3.7.4. The working platform of a bracket scaffold should not exceed 75 cm (2 ft 6 in) in width, but should not be less than 65 cm (2 ft 2 in).

3.7.5. Brackets should be designed to withstand safely a load of at least 175 kg (400 lb) at the extreme outer end.

3.7.6. Brackets should be securely assembled by mortises and bolts.

3.7.7. Brackets should be provided at intervals not exceeding 3 m (9 ft 9 in).

3.8. Tubular metal scaffolding or staging

General

3.8.1. Tubular metal scaffolding or staging should consist of steel tubing that is galvanised or otherwise protected against corrosion.

3.8.2. All vertical and horizontal members of tubular metal scaffolding or staging should be fastened together with an effective

coupler or locking device of drop-forged steel or equivalent material, with no loose parts.

3.8.3. Tubular metal scaffolding or staging should be adequately braced lengthwise and crosswise.

3.8.4. Scaffolding or staging should not be erected in dangerous proximity to any overhead electricity transmission line or electricity transmission equipment.

Uprights

3.8.5. Pipes for tubular scaffolding or staging should be straight and free from heavy rust, indentations, corrosion and other defects.

3.8.6. The ends of pipes should be squared to ensure even bearing over the whole area of the section at joints and other connections.

3.8.7. As a rule, every upright should rest on a firm level footing such as a metal plate.

3.8.8. Footings for uprights should be secured against displacement by recessing, staking or other effective means.

3.8.9. The tubular elements should be of adequate size and strength for the load they will have to carry and not less than 5 cm (2 in), or other close standardised figure, in outside diameter.

3.8.10. Uprights should be perfectly vertical.

3.8.11. Joints in uprights of tubular scaffolding or staging should be close to ledgers or other members capable of constraining them against lateral displacement.

Ledgers

3.8.12. If working platforms are removed, all ledgers should be left in place to preserve the rigidity of the scaffolding or staging.

Putlogs

3.8.13. On tubular scaffolding or staging one putlog should be placed on each side of each upright, except the end uprights where a putlog should be placed on one side.

3.8.14. The span of mild steel or aluminium alloy putlogs on tubular scaffolding or staging should not exceed 1.5 m (5 ft).

Guard rails and toe-boards

3.8.15. Toe-boards should be bolted to uprights or adequately secured to platform planks.

3.8.16. Guard rails should be secured to uprights by suitable connectors.

3.8.17. Diagonal bracing should not be used as guard rails unless it provides protection equivalent to that provided under section 2.7.

Fittings

3.8.18. Fittings for connecting members of tubular scaffolding or staging should accurately embrace, over the whole area of their bearing surfaces, the members on which they are used.

3.8.19. Where the efficiency of fittings depends on frictional grip, they should not be used to transmit primary tensile forces.

3.8.20. Fittings having screw threads in nuts should not be used if the amount of thread in the nut cannot be observed.

3.9. Mobile scaffolding or staging

3.9.1. (1) Scaffolding or staging supported on wheels should be adequately braced and stiffened to prevent dangerous distortion in use, and if necessary for stability be adequately weighted at the base.

(2) It should be secured in the raised position.

3.9.2. Mobile scaffolding or staging should be used only on a firm, level surface.

3.9.3. The height of mobile scaffolding or staging should not exceed four times the lesser base dimension.

3.9.4. Ladders giving access to mobile scaffolding or staging should be secured to the structure.

3.9.5. When mobile scaffolding or staging is in use the castors or wheels should be adequately blocked.

3.9.6. No person should ride on scaffolding or staging that is being moved.

3.10. Boatswain's chairs, skips, etc.

3.10.1. A skip, basket, boatswain's chair or similar equipment should be used as suspended scaffolding or staging only in exceptional circumstances, for work of short duration and under the supervision of a responsible person.

3.10.2. When such equipment is used as suspended scaffolding or staging—

- (a) it should be supported by ropes having a safety factor of at least 10 based on the total load including the dead weight; and
- (b) precautions should be taken to prevent the workers from falling out.

3.10.3. When a skip or basket is used as suspended scaffolding or staging—

- (a) it should be at least 1 m (3 ft 3 in) deep; and
- (b) it should be carried by two strong iron bands which should be properly fastened, continued round the sides and bottom and have eyes in the iron to receive the ropes; and
- (c) it should be provided with a rail fixed 10 cm (4 in) from the edge.

3.10.4. The total live loads on a boatswain's chair raised and lowered by hand should not exceed 110 kg (250 lb).

3.10.5. Boatswain's chairs that are used by persons in a sitting position should have a back rail or rope and a front rail, rope or post not less than 25 cm (10 in) above the seat.

3.10.6. (1) Boatswain's chairs that are used by persons in a standing position should be provided with a guard rail at least 75 cm (2 ft 6 in) in height on all sides.

(2) An intermediate horizontal rail, and a toe-board 15 cm (6 in) high, should also be provided on all sides.

3.10.7. The seat of a boatswain's chair should—

- (a) possess adequate strength and be firmly secured; and
- (b) measure at least 45 × 25 cm (18 × 10 in).

3.10.8. (1) The suspension rope of a boatswain's chair should be of steel wire or high-grade manila or man-made fibre.

(2) The suspension rope should be securely fastened to a firm overhead structure or passed through a pulley block similarly fastened and firmly secured to an easily accessible firm structure.

3.10.9. Fibre ropes should not be used on boatswain's chairs when workers in them are using a blow pipe or any open flame.

3.10.10. Workers using a boatswain's chair should wear a safety belt so fastened to the supporting tackle that they will be safely held if they fall out of the chair.

3.10.11. Before a boatswain's chair is used the overhead supports and the tackle should be inspected by a competent person.

4. Ladders, stairs, gangways and ramps

4.1. Ladders: general

4.1.1. (1) No ladder having any rung which depends for its support on nails, spikes or any other fixing should be used.

(2) No ladder having only one upright should be used.

4.1.2. Wooden ladders should be constructed with—

- (a) uprights of adequate strength made of wood free from visible defects and having the grain of the wood running lengthwise; and
- (b) rungs that are made of wood free from visible defects and are mortised or rabbeted into the uprights.

4.1.3. The intervals between rungs should—

- (a) be equal; and
- (b) not amount to less than 25 cm (10 in) or more than 35 cm (14 in).

4.1.4. If necessary to prevent danger, ladders should be provided with non-slip shoes, spikes or other devices to prevent slipping.

4.1.5. Ladders should, if necessary, be provided with a sufficient number of steel cross-ties to ensure rigidity.

4.1.6. Whenever possible, portable ladders should not exceed 6 m (20 ft) in length.

4.1.7. Every ladder or run of ladders rising to a height of 6 m (20 ft) or more should be provided with an intermediate landing or landings such that the interval between landings does not exceed 6 m (20 ft).

4.1.8. Landings should be—

- (a) of suitable size; and
- (b) protected by railings complying with the requirements of paragraphs 2.7.1 to 2.7.3.

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Inspection, maintenance

4.1.9. (1) Defective ladders should be immediately removed from the work area, and those that cannot be satisfactorily repaired should be destroyed.

(2) In particular, a ladder having a missing or defective rung should not be used.

4.1.10. Portable wooden ladders should be stored in a dry, well ventilated place.

4.1.11. Wooden ladders should not be painted, but oiled or covered with clear varnish or transparent preservatives.

Use

4.1.12. For every ladder used as a means of communication—

- (a) the ladder itself should rise at least 1 m (3 ft 3 in) above the highest point to be reached by any person using the ladder; or
- (b) one of the uprights should be continued to that height to serve as a handrail at the top.

4.1.13. Ladders should not stand on loose bricks or other loose packing but should have a level and firm footing.

4.1.14. Every ladder—

- (a) should be securely fixed so that it cannot move from its top or bottom points of rest; or
- (b) if it cannot be secured at the top, should be securely fastened at the base; or
- (c) if fastening at the base is also impracticable, should have a man stationed at the foot to prevent slipping.

4.1.15. Ladders should be properly lashed. Fibre rope, wire-cored fibre rope or wire rope without ferruled ends should not be used.

4.1.16. Undue sagging of ladders should be prevented.

4.1.17. Ladders should be equally and properly supported on each upright.

4.1.18. When a ladder is placed in position the distance between its foot and the base of the object against which the ladder rests should be about a quarter of the ladder's length.

4.1.19. Workers using ladders should—

- (a) leave both hands free for climbing up and down;
- (b) face the ladder;
- (c) avoid wearing slippery boots or shoes; and
- (d) avoid carrying heavy or bulky loads.

4.1.20. If objects have to be carried on ladders, belts or other suitable means should be provided and used for the purpose.

4.2. Portable metal ladders

4.2.1. Uprights of metal ladders should have a cross-section adequate to prevent dangerous deflection.

4.2.2. Rungs of metal ladders should be corrugated or treated to prevent slipping.

4.2.3. Rungs of metal ladders should be kept clean so as to prevent them from becoming slippery.

4.2.4. Metal ladders should be protected against corrosion by a coating of rust-proof paint or by other effective means.

4.2.5. Metal ladders should not be used in proximity to electrical equipment.

4.3. Portable step ladders

4.3.1. Step ladders should not exceed 5.5 m (18 ft) in length.

4.3.2. Back legs of step ladders should be adequately braced.

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4.3.3. Step ladders exceeding 1.5 m (5 ft) in length should be equipped with two or more cross-ties.

4.3.4. Ties should be made of steel or equivalent material.

4.3.5. The spread between the side rails and back legs should be restrained by means of high-grade fibre rope or by other effective means.

4.3.6. When step ladders are in the open position, their treads should be horizontal.

4.4. Portable trestle ladders

4.4.1. Trestle ladders should not exceed 5 m (16 ft 6 in) in height.

4.4.2. The spread between the pairs of side rails should be restrained by means of high-grade fibre rope or by other effective means.

4.4.3. The pairs of side rails should be joined at the top by bolted steel hinges of adequate dimensions or by other effective means.

4.4.4. Both pairs of side rails of trestle ladders should be equipped with a sufficient number of steel cross-ties.

4.4.5. On all trestle ladders exceeding 3 m (10 ft) in length provision should be made for the attachment of uprights and hand rails.

4.4.6. When in use, trestle ladders should have a firm footing and should, where necessary, be sufficiently and properly braced or strutted to prevent collapse and ensure stability.

4.5. Extension ladders

4.5.1. Extension ladders should not exceed 15 m (50 ft) in length.

4.5.2. Extension ladders should be equipped with guide brackets and an effective lock so that the ladders can be extended, retraced or locked in any position.

4.5.3. The rungs of overlapping sections should coincide so as to form double treads.

4.5.4. Extension ladders should be equipped with one or more extension ropes.

4.5.5. Extension ropes should be securely anchored and run over suitable pulleys.

4.5.6. (1) Extension ladders should be equipped with a sufficient number of cross-ties.

(2) Cross-ties should be made of steel or equivalent material.

4.5.7. Extension ladders should not have more than two sliding extensions.

4.6. Fixed ladders

4.6.1. Fixed ladders installed out of doors should be made of steel.

4.6.2. Fixed steel ladders should comply with the requirements of section 4.2.

4.6.3. Uprights of fixed steel ladders should be at least 40 cm (1 ft 4 in) apart.

4.6.4. As far as practicable fixed ladders should be set at an angle of 15° to the vertical.

4.6.5. The clearance at the back of the rungs should be at least 15 cm (6 in).

4.6.6. There should be no obstruction within 75 cm (2 ft 6 in) of the face of the ladder.

4.6.7. At the sides there should be at least 7.5 cm (3 in) clearance between the ladder and the nearest fixed object.

4.6.8. If the length of a ladder, or the total length of ladders that lie in line, exceeds 9 m (30 ft) the ladder or ladders should be provided with suitable landing platforms for every length of 9 m or fraction thereof.

4.6.9. When it is necessary for a ladder to pass closely through a hole in a platform, deck or floor, the edge of the hole should be padded so as to prevent injury to persons using the ladder.

4.6.10. Ladders should be firmly bolted or welded in position.

4.6.11. Runs of ladders from which a person could fall 6 m (20 ft) should be enclosed in a cage of heavy-gauge steel mesh.

4.7. Accommodation ladders

4.7.1. Ship's accommodation ladders should be—

- (a) at least 55 cm (1 ft 10 in) wide;
- (b) provided with platforms as necessary to prevent danger;
- (c) fitted on both sides throughout their length with fencing complying with the requirements of paragraphs 2.7.1 to 2.7.3, or on one side only, provided that the other side is properly protected by the ship's side; and
- (d) so made that they can be adequately supported and secured by hooks or other suitable fastenings against displacement.

4.7.2. Accommodation ladders should be so secured that when they are used in tidal ports the platform can be adjusted to the height of the wharf or other landing place according to the state of the tide.

4.7.3. If the space between the landing place and the ship is too great for safe passage from one to the other a gangway or other safe means of access should be placed between the ladder platform and the landing place.

4.7.4. If accommodation ladders have built-in steps and the slope is less than 30° to the horizontal, gangplanks provided with transverse treads at suitable stepping intervals and extending over the whole width of the steps should be laid over them.

4.8. Rope ladders

4.8.1. (1) The use of rope ladders should be strongly discouraged.

(2) Where no other means of access is available, rope ladders used as a means of access to vessels should—

- (a) be of adequate length and width;
- (b) be so made that they can be firmly secured to the vessel;
- (c) be so made and fitted that as far as practicable they are prevented from twisting and swaying fore and aft when in use;
- (d) have steps equally spaced at intervals of not less than 25 cm (10 in) or more than 35 cm (1 ft 2 in);
- (e) have steps that afford a foothold of at least 10 cm (4 in) over a width of at least 30 cm (1 ft) and allow a firm handhold; and
- (f) have steps so secured that they cannot twist, turn over or tilt.

4.8.2. Rope ladders more than 3 m (10 ft) long should have a sufficient number of effective spreaders that prevent them from turning on their axis.

4.8.3. Rope ladders should either hang fully extended or be pulled up completely so that they are not left with any slack.

4.8.4. When the upper end of a ladder or gangway rests on or is flush with the bulwark, firmly fixed steps or other appliances should—

- (a) lead from the top edge of the bulwark to the deck; and
- (b) be provided with a substantial handhold such as a rail or a stanchion.

4.9. Stairs

4.9.1. Stairs should be of adequate strength to withstand safely the loads that they will have to carry.

4.9.2. Stairs should have a clear width of at least 90 cm (3 ft).

4.9.3. Stairs made of perforated material should not have apertures exceeding 1.25 cm ($\frac{1}{2}$ in) in width.

4.9.4. No step of a stairway should depend for its support on nails, screws or any other similar fixing.

4.9.5. No stairway with missing or dangerously defective steps should be used.

4.9.6. Stairs with more than five steps should—

- (a) be provided on any open side with railings complying with the requirements of paragraphs 2.7.1 to 2.7.3;
- (b) if 1.2 m (4 ft) or more wide, be provided on both sides with an adequate handrail or, if this is not practicable, with an adequate hand rope; and
- (c) if not more than 1.2 m wide, be provided on one side with an adequate handrail or, if this is not practicable, with an adequate hand rope.

4.9.7. Every stairway that is at an angle of less than 30° from the vertical should be provided with a secure handhold at the top landing place, either by extending one upright for at least 1 m (3 ft 3 in) or by other effective means.

4.9.8. Movable and removable stairs should be adequately secured in the position of use.

4.9.9. No flight of temporary stairs should have an unbroken vertical rise of more than 3.5 m (12 ft).

4.10. Gangways, ramps and runways

4.10.1. All main gangways giving general access to a vessel in a shipyard, whether from the ground or from a wharf or quay, and all cross gangways leading from them to the vessel, should be —

- (a) sufficiently wide having regard to the number of persons employed on or at the vessel;
- (b) stable and if practicable of permanent construction; and
- (c) kept in position as long as required.

4.10.2. Every gangway, ramp and runway from which a person could fall more than 2m (6 ft 6 in) should be—

- (a) closely boarded or planked;
- (b) at least 50 cm (1 ft 8 in) wide; and
- (c) provided with railings complying with the requirements of paragraphs 2.7.1 to 2.7.3.

4.10.3. The slope of any gangway, ramp or runway should not exceed 1 : 4.

4.10.4. When a gangway, ramp or runway is used for the passage of materials there should be maintained a clear passage-way that is—

- (a) adequate in width for the transport of materials without the removal of railings and toe-boards; and
- (b) in any case of a width not less than 60 cm (2 ft).

4.10.5. All planks forming a gangway, ramp or runway should be so fixed and supported as to prevent undue or unequal sagging.

4.10.6. When the slope renders additional foothold necessary there should be proper stepping laths which should be—

- (a) placed at suitable intervals; and
- (b) of a width equal to the full width of the gangway, ramp or runway.

4.10.7. Ramps providing access for vehicles should—

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- (a) possess adequate strength and stability to withstand safely the maximum loads that they will have to carry;
- (b) have a gradient and a width that are safe for the vehicles; and
- (c) be provided with a substantial kerb on each side.

4.10.8. The minimum width inside the kerbs should be 60 cm (2 ft) more than the width of the widest vehicle using the ramp or runway if there is no passing, or 60 cm more than twice this width if there is passing.

4.10.9. Ramps and runways should be level transversely.

4.10.10. Where gangways at dry docks give access from an altar to a ship which is undergoing operations other than construction or reconstruction, and the edge of the altar is unfenced, adequate handholds should be provided for any length of altar that workers have to use when passing between the gangway and the nearest flight of steps leading to ground level.

4.10.11. Where a gangway leads onto a bulwark—

- (a) a platform should be provided at the inboard end of the gangway with safe means of access to the deck; or
- (b) if it is impracticable to provide a platform, a second gangway or a stairway should lead from the bulwark to the deck, and should either be attached to the first gangway or be connected to it by safe means of access.

5. Lifting appliances

5.1. General

5.1.1. All parts of lifting appliances should—

- (a) be of sound material, good construction and adequate strength;
- (b) conform to any national standards that may be applicable; and
- (c) be maintained in good repair and working order.

Maximum safe working load

5.1.2. The maximum safe working load should be marked upon—

- (a) every crab, jack, winch and pulley block used in the hoisting or lowering of any load;
- (b) every derrick pole or mast used in the hoisting or lowering of any load weighing 1,000 kg (2,250 lb) or more; and
- (c) every crane.

5.1.3. In the case of a crane fitted with a derricking jib, the safe working load at various radii of the jib should be marked upon it.

5.1.4. The maximum safe working load should be marked in a conspicuous place in a legible and durable manner, for example by incision or stamping.

Installation¹

5.1.5. Fixed lifting appliances should be installed—

- (a) by competent persons;
- (b) so that they cannot be displaced by the load, vibration or other influences;

¹ For installation on scaffolds see paragraphs 3.1.25 to 3.1.31.

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- (c) so that the operator is not exposed to danger from loads, ropes or drums;
- (d) so that the operator can either see over the zone of operations or communicate with all loading and unloading points by telephone, signals or other adequate means.

5.1.6. Adequate clearance should be provided between moving parts and loads of lifting appliances, on the one hand, and, on the other—

- (a) fixed objects such as walls and posts; and
- (b) electrical conductors.

5.1.7. Every lifting appliance should be adequately supported.

5.1.8. (1) Any crane to be used in an exposed position such that the effect of wind may be detrimental to the safety of that crane should have been designed to have the stability and structural strength required to stand up to the additional stresses involved in—

- (a) operating normally up to a predetermined wind velocity; and
- (b) withstanding the foreseeable wind velocity, including gusting, when not in operation.

(2) The crane should be fitted with a suitable wind speed indicator to indicate when the operation of the crane should be stopped owing to the wind velocity.

(3) In the case of a crane having a slewing jib and when the manufacturer so specifies, the jib should be left free to rotate according to the direction of the wind, like a weather vane, when the crane is not operating.

5.1.9. No structural alterations or repairs should be made without the permission of the competent authority on any part of a lifting appliance that affects the safety of the appliance.

Drums

5.1.10. (1) Rope drums should be of sufficient capacity to

accommodate as a minimum the length of rope required for the full range of the crane movement plus not fewer than two dead turns.

(2) Rope drums should also have enough additional width to accommodate the increase in length due to the permanent rope stretch that follows the fitting of a new rope.

(3) The rope may be layered on a drum which is suitably grooved and which is so designed that the rope cannot be damaged by the manner in which one layer winds onto another.

5.1.11. Rope anchorages should be readily accessible.

5.1.12. The angle between the rope and a plane perpendicular to the axis of the drum should not exceed 1 in 16 for lifting ropes and 1 in 12 for derricking ropes.

5.1.13. (1) The drum should be flanged at both ends.

(2) The flanges should project a distance not less than $2\frac{1}{2}$ rope diameters beyond the rope when the rope is fully wound on the drum.

Operator's cab or cabin

5.1.14. A lifting appliance in outdoor service should, as far as practicable, be provided with a cab or cabin of adequate size which should—

- (a) afford the operator adequate protection against the weather and, if necessary, the sun;
- (b) be heated in cold weather;
- (c) be properly ventilated;
- (d) afford the operator an adequate view of the area of operation;
- (e) afford the necessary access to working parts in the cab;
- (f) have a suitable seat and a foot rest; and
- (g) afford safe means of clearing the outside of any windows fitted on the cab.

Controls

5.1.15. (1) Controls of lifting appliances should be so arranged that—

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- (a) the operator at his stand or seat has ample room for operation, has an unrestricted view, and remains clear of the load and ropes; and
- (b) no load passes over the operator.

(2) Controls should be provided, where necessary, with suitable locking devices to prevent accidental movement or displacement.

5.1.16. Control handles should move in the direction of the resultant load movement.

5.1.17. (1) The stroke of hand levers should not exceed 60 cm (2 ft).

(2) The stroke of pedals should not exceed 25 cm (10 in).

(3) Pedals should have a non-slip surface.

5.1.18. Fixed lifting appliances should be equipped with devices that—

- (a) prevent over-hoisting;
- (b) prevent the load from moving if the power fails; and
- (c) where applicable, prevent the jib from being derricked-in too far and too high.

Brakes

5.1.19. (1) Lifting appliances should be equipped with brakes capable of effectively arresting and holding a load at least one-and-a-half times the maximum safe working load.

(2) If necessary to prevent danger, brakes should be provided with a locking device.

5.1.20. Brakes should act without shock or delay.

5.1.21. Brakes should be provided with simple and easily accessible means of adjustment.

5.1.22. (1) Brakes operated by hand should not require a force greater than 16 kg (35 lb) at the handle.

(2) Brakes operated by foot should not require a force greater than 32 kg (70 lb) on the pedal.

Inspection, maintenance

5.1.23. Before being placed in service, all new lifting appliances should be thoroughly inspected and tested by competent persons.

5.1.24. Lifting appliances should be thoroughly inspected at least once a year by a competent person, and tested after every substantial alteration or repair and at such other times as are deemed necessary by the competent person.

5.1.25. Every part of the structure, working gear and anchoring and fixing appliances of every crane, crab and winch and of all other hoisting appliances and tackle should, as far as the construction permits, be examined in position at least once in every month by the operator or some other competent person.

5.1.26. Means of communication such as telephone and signalling equipment should be tested before each spell of use.

Operation

5.1.27. Every crane driver or hoisting appliance operator should be properly qualified.

5.1.28. No person under 18 years of age should be in control of any lifting appliance including any scaffold winch, or give signals to the operator.

5.1.29. Slings should be properly trained in the safe use of loose lifting gear.

5.1.30. Adequate precautions should be taken to prevent lifting appliances from being set in motion by unauthorised persons.

5.1.31. The operation of lifting appliances should be governed by signals in conformity with the requirements of paragraphs 5.1.48 to 5.1.65.

5.1.32. The attention of the operator of a lifting appliance should not be distracted while he is working.

5.1.33. A crane, crab, winch or any other lifting appliance, or any part of such appliance, should not, except for testing purposes, be loaded beyond the safe working load.

5.1.34. During hoisting operations effective precautions should be taken to prevent any person from standing or passing under the load.

5.1.35. Operators should not leave lifting appliances unattended with power on or with a load suspended.

5.1.36. (1) No person should ride on a suspended load or on any lifting appliance not officially authorised for the conveyance of persons.

(2) Persons should be conveyed in work cradles by lifting appliances only—

(a) in special circumstances; and

(b) with approved work cradles conforming to the requirements of section 3.10.

5.1.37. Every part of a load in course of being hoisted or lowered should be adequately suspended and supported so as to prevent danger.

5.1.38. (1) Every receptacle used for hoisting piece goods should be so closed as to prevent the fall of any of the goods.

(2) If loose materials or loaded wheelbarrows are placed directly on a platform for raising or lowering, the platform should be closed in.

(3) Materials should not be raised, lowered or slewed in such a way as to cause sudden jerks.

5.1.39. No crane should be used to drag loads.

5.1.40. If necessary to prevent danger, ropes (tag lines) should be used to guide loads, particularly long objects such as planks or girders, so that they cannot swing while being raised or lowered.

5.1.41. At landings workers should not be obliged to lean out over the edge for loading and unloading.

5.1.42. (1) The hoisting of loads at points where there is a regular flow of traffic should be carried out in an enclosed space.

(2) If that is impracticable (e.g. in the case of bulky objects), measures should be taken to hold up or divert the traffic for the time being.

5.1.43. Adequate steps should be taken to prevent a load in course of being hoisted or lowered from coming into contact with any object in such a manner that part of the load or the object may become displaced.

5.1.44. (1) As far as practicable, plates and other ship's structural components should be attached to the suspension gear by means of shackles attached to eyes welded to the plates or components.

(2) The eyes should be of adequate strength and suitably positioned.

(3) If eyes cannot be provided, safety clamps should be used.

5.1.45. Skips should be raised or lowered by bridles with at least three ropes.

Safe load indicators

5.1.46. No power-driven jib crane should be used unless it is fitted with an automatic indicator which—

- (a) gives a clear visual indication to the driver or person operating the crane when the load being handled approaches the safe working load of the crane at any operating radius or inclination of the jib;
- (b) gives a clear audible warning to the driver or person operating the crane and any other person working in the vicinity of the crane when the load being handled exceeds the safe working load of the crane at any operating radius or inclination of the jib;

- (c) stops by a limit switch when the load being handled exceeds the safe working load of the crane at any operating radius or inclination of the jib¹; and
- (d) after limit switches have acted, allows travel in the opposite direction.

5.1.47. The maximum and minimum radii at which the jib may be worked should be clearly indicated on every derrick crane.

Signalling

5.1.48. Employers should establish a system of signalling for all operations in which signals are required to prevent danger.

5.1.49. The code of signals should be posted up at suitable places.

5.1.50. Employers should take adequate steps to ensure that workers are familiar with all signals that they may need to know in order to avoid danger.

5.1.51. There should be a distinctive signal for each operation.

5.1.52. Only competent and reliable persons duly authorised for the purpose should give signals; provided that anyone may give a "stop" signal to prevent danger.

5.1.53. No operation should be governed by more than one signaller.

5.1.54. (1) No operation for which a signal is provided in the code should be carried out until that signal has been given.

(2) No signal not provided for in the code should be given or obeyed.

¹ Operations (b) and (c) may be simultaneous. It is preferable for operating reasons for the limit switch to operate if the driver ignores the acoustic alarm and continues to hoist or slew out the load.

5.1.55. Hand signals should be given only when all persons for whom they are intended can easily see them.

5.1.56. Any signal that is not properly understood should be treated as a stop signal.

5.1.57. No signal for the movement of equipment should be given until the signaller has satisfied himself that no person in the area for which he is responsible will be endangered by the movement.

5.1.58. Acoustic warning signals should be clearly audible to all persons who might be endangered in consequence of them or whom they are intended to protect.

5.1.59. The signaller's workplace should be—

- (a) safe from moving equipment, falling objects and other hazards;
- (b) such that the signaller has an unobstructed view of the operation that he is directing; and
- (c) such that the persons concerned can easily hear or see the signals.

5.1.60. Signallers should have no other duties when signalling.

5.1.61. Signallers should be prepared to give the stop signal at any moment while signalling.

5.1.62. Signalling equipment should be efficient, properly installed, regularly tested and kept in good working order.

5.1.63. Only competent persons should repair, alter or adjust signalling devices.

5.1.64. Radio frequency signalling equipment should have the frequency conspicuously marked on both the transmitter and the receiver.

5.1.65. Radio frequency signalling equipment should not affect, or be affected by, any other signalling equipment in the neighbourhood.

5.2. Cranes and derricks: general

Construction

5.2.1. Stress-bearing structural members of cranes that are also subject to shock should be constructed of steel or other equally suitable material.

5.2.2. Cranes should be so designed and constructed that all parts can be safely lubricated, inspected and repaired.

5.2.3. Access to and egress from the operator's stand should be safe in any position of the crane.

5.2.4. Adequate precautions should be taken to prevent workers from being crushed between rotating parts of cranes and the carriages.

5.2.5. Access to the pulley at the end of the jib should be provided by a ladder protected by railings complying with the requirements of paragraphs 2.7.1 to 2.7.3.

5.2.6. (1) Every fixed crane should either be securely anchored or be adequately weighted by suitable ballast firmly secured to ensure stability.

(2) When a crane is weighted by ballast a diagram showing the position and size of the counterweights should be posted up in the operator's cab.

5.2.7. Loose material such as bricks and stones should not be used as ballast for jib cranes.

5.2.8. When change-speed gear is used for the hoisting motion, the maximum safe working load corresponding to each speed should be indicated.

5.2.9. When the jib of a jib crane is at the maximum radius there should not be less than two dead turns of rope on the derricking drum. Any further travel of the jib should be prevented by a stop.

5.2.10. Every crane having a derricking jib should be provided with an effective interlocking arrangement between the derricking clutch and the pawl sustaining the derricking drum, except where—

- (a) the hoisting drum and the derricking drum are independently driven; or
- (b) the mechanism driving the derricking drum is self-locking.

5.2.11. Electric cranes should be provided with a limit switch that prevents overwinding.

5.2.12. On electric cranes the floor of the operator's stand should be of wood or other insulating material.

5.2.13. As far as practicable electric cranes should be equipped with an overload prevention switch.

5.2.14. The erection of cranes should be supervised by a competent person.

5.2.15. Every crane should be fitted with a warning device which is clearly audible above the noise level in its operating area.

5.2.16. Every crane should be fitted with a flood-lighting device ensuring an illumination of at least 20 lux in any place the hoisting tackle can reach.

Inspection, testing

5.2.17. No crane or derrick should be used unless a person acting for the competent authority has—

- (a) inspected and tested it; and
- (b) furnished a certificate specifying—
 - (i) the maximum safe working load at the various radii at which the jib can be worked; and
 - (ii) in the case of a crane with a derricking jib the maximum and minimum radii at which the jib may be worked.

5.2.18. The examinations and tests required by paragraph 5.2.17 should be repeated—

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- (a) at such regular intervals as are prescribed by the competent authority;
- (b) after all substantial alterations or repairs to the crane;
- (c) after every removal and re-erection on a site; and
- (d) after every adjustment affecting anchoring or ballasting.

5.2.19. The safe working load at any radius specified in the most recent certificate should not be more than 80 per cent of the maximum load which the crane has withstood at the radius during the application of the test.

5.2.20. If a crane has been exposed to weather likely to have affected its stability, the anchorage and ballast should be examined and the crane found to be safe before it is used again.

5.2.21. Before being taken into use for the first time jib cranes with a variable radius should undergo tests—

- (a) of stability; and
- (b) of all movements such as travel, slewing, raising and lowering the load, braking the crane and braking the load.

5.2.22. Cranes should be tested for anchorage by the imposition on each anchorage of the maximum uplift or pull exerted either—

- (a) by a load of 25 per cent above the maximum load to be lifted by the crane as erected; or
- (b) by a lesser load arranged to exert an equivalent pull on the anchorage.

5.2.23. If the pull applied by the test to any anchorage is less than 25 per cent in excess of the pull which would be exerted by the maximum safe working load, a loading diagram appropriate to the crane anchorage should be affixed in a position where it can readily be seen by the crane operator.

Operation

5.2.24. A crane should not be used otherwise than for direct

lifting or lowering of a load unless its stability is not thereby endangered.

5.2.25. No crane should be used in weather likely to endanger its stability.

5.2.26. When a load is thought to approach the maximum safe working load a trial should be made by raising the load a short distance to ensure that the crane can carry it safely.

5.2.27. Overhead electric power lines should not be installed on piers, dry docks and building ways within reach of jib cranes.

5.2.28. While cranes are working no persons other than those engaged in the operations should be in the area.

5.2.29. Cranes should not be used to remove fixed objects.

5.2.30. Where more than one crane is required to lift or lower one load—

- (a) the machinery, plant and appliances used should be so arranged and fixed that no such crane will at any time be loaded beyond its safe working load or be rendered unstable in the hoisting or lowering of the load; and
- (b) a person should be specially appointed to co-ordinate the operation of the appliances working together.

5.2.31. (1) At the close of work, during longer breaks in operation and when the wind speed exceeds the safe limits, outdoor cranes should be secured against wind pressure.

(2) However, in the case of tower cranes the jib should be left free.

Floating cranes

5.2.32. Floating cranes should be equipped with shock-absorbing fenders.

5.2.33. Floating cranes should be moved, moored and anchored only under competent supervision.

5.3. Travelling cranes

Tracks

5.3.1. Tracks of travelling cranes should be of adequate section, properly laid, firm and level; they should be of adequate bearing capacity and have an even running surface.

5.3.2. All rails on which a travelling crane moves should, unless other adequate steps are taken to ensure the proper junction of the rails and to prevent any material alteration in their gauge—

- (a) be jointed by fish plates or double chairs; and
- (b) be securely fastened to sleepers.

5.3.3. The ends of tracks should be provided with adequate buffers.

5.3.4. Buffers should be protected against violent impact by a heap of sand, gravel or the like.

5.3.5. (1) On every stage, gantry or other place on which a crane moves there should in so far as practicable be maintained at every position of the crane an unobstructed passageway of a width of at least 60 cm (2 ft) between the moving parts of the crane and the fixed parts or edge of such stage, gantry or place.

(2) If at any time it is impracticable at any place or point to maintain a passageway of the width specified in the last subparagraph precautions should be taken to prevent the access of any person to such place or point at such time.

5.3.6. Between track-mounted cranes and other objects along the crane track, there should always be a sufficient clearance to prevent danger; this clearance should not be less than 60 cm (2 ft), or 90 cm (3 ft) when practicable.

5.3.7. The tracks should be kept clear of loose materials and equipment; the clearance may be marked by a painted line.

5.3.8. Where necessary to prevent danger from stacks of material or other causes, crane trolley wires should be guarded.

5.3.9. Rails should be electrically bonded.

Construction

5.3.10. Every travelling crane should be provided with a device for anchoring it to the rails of the crane track.

5.3.11. Every track-mounted crane should be provided with effective brakes for the travelling motion; alternatively, sprags, scotches or chocks should be kept available.

5.3.12. Track-mounted cranes should be provided with—

- (a) struts to prevent their collapse in the case of wheel breakage and so positioned that they can act as foot guards;
- (b) locking devices such as rail clamps that will prevent the cranes from being overturned by wind pressure; and
- (c) a device for removing obstacles, snow and ice from the rails.

5.4. Overhead travelling cranes

Tracks

5.4.1. Tracks of overhead travelling cranes should comply with the requirements of paragraphs 5.3.1 to 5.3.9.

5.4.2. Tracks of overhead travelling cranes should not be used as walkways.

5.4.3. (1) Alongside the track of overhead travelling cranes there should be a walkway complying with the requirements of section 4.10.

(2) If such a safe walkway cannot be provided, adequate recesses should be provided at suitable intervals.

5.4.4. (1) It should be possible to cut off the power from the crane track by means of a switch on the ground.

(2) It should be impossible to lock the switch open.

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(3) The switch should be accompanied by lamps or other devices showing whether the power is on or off.

5.4.5. In the cab there should be a switch by which the track can be made dead.

5.4.6. If necessary to prevent danger, adequate precautions should be taken to prevent contact between trolley wires and—

- (a) the operator as he goes to and from his cab; and
- (b) the hoisting rope.

Construction

5.4.7. (1) Overhead travelling cranes should comply with the requirements of paragraphs 5.3.10 to 5.3.12.

(2) Overhead travelling cranes should be provided with automatic switches limiting the travel of—

- (a) the crab on the bridge girder;
- (b) the hook, upwards and downwards; and
- (c) the crane on the track.

5.4.8. Limit switches should not prevent movement in the opposite direction.

5.4.9. On power-driven overhead travelling cranes, mechanical and electrical equipment that is not directly accessible from a track walkway or a bridge walkway should be accessible from working platforms.

5.4.10. Crane and crab drives should have power-operated brakes.

5.4.11. Adequate precautions should be taken to prevent the fall of gears, wheels and other parts.

5.4.12. The operator's cab should be of incombustible material.

5.4.13. Heating appliances should be so placed that operators will not have to come into contact with them when operating the controls.

5.4.14. A suitable fire extinguisher should be kept in the cab.

5.4.15. Access to operators' cabs should be by stairs or ladders complying with the relevant requirements of Chapter 4, or by other safe means.

5.4.16. Operators of overhead travelling cranes should be protected against harmful fumes, gases and other atmospheric contaminants, and also against harmful radiations.

5.4.17. Overhead travelling cranes should be provided with shock-absorbing bumpers such as hydraulic buffers.

Bridges

5.4.18. At least one of the bridge girders should be provided with a walkway complying with the requirements of section 4.10.

5.4.19. There should be convenient and safe means of access to and egress from bridge walkways.

5.4.20. Openings for access and egress should be so placed that users are not endangered by the crab.

Operation

5.4.21. In high winds overhead travelling cranes should be securely anchored.

5.5. Tower slewing cranes

General

5.5.1. Crane carriages over which rotating parts may move should be so constructed that no objects can be kept on them.

5.5.2. Tower slewing cranes on rails should comply with the relevant requirements of section 5.4.

5.5.3. Tower slewing cranes with a power-driven slewing mechanism should have a brake for the slewing motion.

5.5.4. If a crab operates on the jib of a tower slewing crane, the crab drive should be so constructed that a braked crab cannot slip even on an icy or greasy track.

5.5.5. Counterweight jibs that are loaded with ballast after erection should be provided with a walkway complying with the requirements of section 4.10.

5.5.6. Means of access to elevated operators' cabs should comply with the relevant requirements of Chapter 4.

5.5.7. Trailing cables should run over a drum that automatically winds and unwinds them.

Power control

5.5.8. It should be possible to lower a load or load handling equipment only with the motor switched on or so that the rated number of revolutions is not exceeded.

5.5.9. It should not be possible to lock the motor in a no-load position.

5.5.10. Tower slewing cranes should be equipped with at least one switch by which power for all movements can be cut off on all poles from the operator's stand.

5.5.11. It should be possible to switch on the power for the crane only when all controls are at zero.

5.5.12. The hoisting mechanism should automatically stop if even only one phase of the power fails.

5.5.13. (1) Tower slewing cranes should be equipped with overload protection that acts on—

- (a) the hoisting mechanism;
- (b) the mechanism for raising and lowering the jib; and
- (c) the jib crab if there is one.

(2) After the overload prevention device has acted it should be possible to lower the load and pull in the crab.

(3) It should be possible to render the jib-locking device inoperative by a switch, so that the jib can be pulled in.

5.5.14. (1) All power-operated cranes should be fitted with limit switches which, as appropriate—

- (a) automatically cut off the motive power of the hoisting mechanism when the hook (or other means of suspension of the load) reaches predetermined upper and lower limits;
- (b) automatically cut off the power actuating the derricking motion of the jib at predetermined outer and inner limits; and
- (c) automatically cut off the power actuating the horizontal motion of an overhead travelling crane and the motion of crabs on overhead travelling cranes and of trolleys of horizontal jib tower cranes at predetermined positions.

(2) Each limit switch should be so installed that after it has operated, the power is cut off for the normal motion controlled by the switch, but that the piece of machinery in question may none the less operate in the reverse direction.

(3) Crane operators should not use limit switches as a normal means of cutting off the power for the operations they control. When a limit switch is so positioned that it is accessible to the operator of the lifting appliance, it should be of such a design or so protected that the operator cannot interfere with it.

(4) Where a device is provided to enable a limit switch to be by-passed (for example, to allow the jib of a mobile crane to be lowered to the ground for such purposes as maintenance or a change of jib length), that device should normally be kept locked and should be operated only by a person authorised to operate it.

5.5.15. After limit switches have acted, travel in the opposite direction should be possible.

5.5.16. After the limit switch for the hook has acted it should not be possible to lower the jib.

Ballast, counterweights

5.5.17. Operating instructions should indicate the weight and position of the ballast.

5.5.18. The ballast or counterweight should be firmly secured in position.

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5.5.19. If loose material is used as ballast no reduction in quantity should be allowed to occur.

5.5.20. If the ballast and counterweight vary with the height of the tower and the radius of the jib, a table should be provided on the crane indicating the ballast and counterweight required for different tower heights and jib radii.

Operation

5.5.21. (1) Tower slewing cranes should be operated in accordance with the manufacturer's instructions.

(2) The manufacturer's instructions should be kept on the crane.

5.5.22. Tower slewing cranes should not be used to pull out fixed objects, lift with a slanting pull, drag objects or move vehicles.

5.5.23. Crabs and grabs should be used only for loose material.

5.5.24. The operation of tower slewing cranes should comply with the provisions of paragraph 5.2.31.

5.6. Derricks

5.6.1. Derricks should be erected on a firm base and adequately secured against displacement.

5.6.2. The mast of guy derricks should be supported by six top guys spaced approximately equally.

5.6.3. Where the guys of a guy derrick crane cannot be fixed at approximately equal intervals, such other measures should be taken as will ensure the safety of the crane.

5.6.4. No overhead electrical power lines should be in the operating area of derricks or in dangerous proximity to guy lines.

5.6.5. Gudgeon pins, sheave pins and foot bearings should be lubricated frequently.

5.6.6. When a derrick is not in use the boom should be lowered to prevent it from swinging.

5.6.7. Gears and pulleys for power-driven appliances should be provided with a guard cover.

5.6.8. The joining part of a derrick and a post should not allow the boom to dislocate from the supporter.

5.6.9. Truck-mounted derricks should not lift loads heavy enough to create a danger of overturning the truck.

5.7. Winches

General

5.7.1. All parts of the framework for winches should be of metal.

5.7.2. Frames of winches should be securely anchored to substantial foundations.

5.7.3. (1) There should be a fastening point for the rope at each end of a winch drum or barrel, and the rope should be secured at one of these fastening points.

(2) When the rope is let out, at least two turns of rope should remain on the drum.

5.7.4. When winch drums are grooved—

- (a) the radius of the grooves should be approximately the same as, but not less than, the radius of the rope; and
- (b) the pitch of the grooves should not be less than the diameter of the rope.

5.7.5. (1) To protect operators against breakage of ropes or flying objects, the winch operating stand should be properly guarded.

(2) Winches should be roofed for protection against the weather to meet the requirements of paragraph 5.1.14 (a).

(3) The means of protection should not obstruct the operator's view.

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5.7.6. (1) On every winch the control levers should be provided with suitable locking devices to prevent unauthorised use.

(2) Winches should be provided with rope guards.

Hand-operated winches

5.7.7. (1) As a general rule, hand-operated winches should be so constructed that the maximum effort to be applied by any one person at the handle or handles will not exceed 10 kg (22 lb) when the winch is lifting its maximum safe working load.

(2) In no case should this effort exceed 16 kg (35 lb).

5.7.8. Winches operated by hand should be provided with—

- (a) ratchet wheels on the drum shafts and locking pawls or self-locking worm gears, to prevent reversing while loads are being hoisted; and
- (b) effective braking devices for controlling the lowering of the loads.

5.7.9. Crank handles for hand-operated winches should be—

- (a) so constructed that they do not turn while the loads are being lowered by means of the brake; or
- (b) removed before the loads are lowered.

5.7.10. Detachable crank handles for hand-operated winches should be secured against accidental removal.

5.8. Poles supporting pulley blocks

5.8.1. (1) Poles supporting pulley blocks should—

- (a) be made of steel or of straight-grained timber free from knots;
- (b) be straight;
- (c) be adequately guyed and anchored;
- (d) be vertical or raked slightly towards the load; and
- (e) be of adequate strength for the loads that they will be required to move.

(2) They should be constructed and erected by competent persons.

5.8.2. Poles supporting pulley blocks should not be spliced.

5.8.3. Poles supporting pulley blocks should be adequately fastened at the foot to prevent displacement in operation.

5.8.4. When a special pole supporting a pulley block is used on scaffolding or staging, it should be secured by ropes in such a way that it cannot knock against the structure.

5.8.5. Poles supporting pulley blocks that are moved from place to place and re-erected should not be taken into use again before the pole, lifting ropes, guys, blocks and other parts have been inspected and the whole appliance has been tested under load.

5.8.6. When platforms are hoisted by gin poles, adequate precautions should be taken to prevent them from spinning at landings.

5.8.7. (1) Pulley blocks or wheels supported by a beam should be firmly secured to the beam.

(2) The supporting beam should be of adequate strength for the purpose for which it is being used.

(3) The supporting beam should be adequately secured against displacement by lashing, counterweights or other effective means.

5.9. Jacks

5.9.1. Jacks should be of such construction that the load—

- (a) will remain supported in any position;
- (b) cannot be lowered inadvertently; and
- (c) will not slip off the bearing surface.

5.9.2. Every jack should be accompanied by instructions for its safe use and proper maintenance.

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5.9.3. Every jack should have a stop or other effective means of preventing overtravel.

5.9.4. Electric jacks should be provided with automatic limit switches at the top and bottom limits of travel.

5.9.5. Hydraulic and pneumatic jacks should be provided with devices that prevent the load from falling if the cylinder containing the liquid or air is damaged or if the liquid or air supply pipe is fractured.

5.9.6. Screw and rack jacks should be provided with devices that prevent the screw or the rack from coming out of its seating.

5.9.7. When lifting objects with a jack, the jack should be—
(a) set on a solid footing;
(b) centred properly for the lift; and
(c) so placed that it can be operated without obstruction.

5.9.8. Jacks should not be released from under a raised load before it has been firmly secured or supported.

5.9.9. Jacks should be tested under load at suitable intervals.

5.10. Track-mounted crabs

General

5.10.1. Track-mounted crabs should have power-operated brakes.

5.10.2. Track-mounted crabs should be so installed that they cannot fall if the king bolt of the suspension gear breaks.

5.10.3. Track-mounted crabs exposed to high winds should be provided with protection against the wind, such as rail anchors.

5.10.4. Track-mounted crabs should be equipped with a loud warning device.

5.10.5. Loose parts such as brake weights and signal bells should be secured against falling.

5.10.6. Crabs on which workers can go should be protected by railings complying with the requirements of paragraphs 2.7.1 to 2.7.3.

Tracks

5.10.7. The ends of the crab track should be provided with securely anchored strong buffers.

5.10.8. Contact rails and protective conductors should be so laid or protected that accidental contact with them is not possible.

5.10.9. The tracks of track-mounted crabs should be protected against excessive contact voltages.

Power control

5.10.10. (1) The upward travel of the lifting device should be limited by a limit switch.

(2) Limit switches should allow travel in the opposite direction.

5.11. A-frames (sheer legs)

5.11.1. A-frames (sheer legs) should not be inclined at an angle exceeding 45°, and should be adequately guyed and anchored to prevent overturning or displacement. Consideration should also be given to fitting slip stoppers to the legs.

5.11.2. (1) Legs of A-frames should be of—
(a) steel or sound straight-grained timber; and
(b) adequate strength for the loads that they will be required to move.

(2) They should be constructed and installed by competent persons.

6. Ropes, chains and accessories

6.1. General

6.1.1. All ropes, chains and accessories should—

- (a) be of sound material, good construction and adequate strength;
- (b) before being placed in service, be thoroughly tested by competent persons;
- (c) conform to any national standards that may be applicable; and
- (d) be maintained in good working order.

6.1.2. Every chain, ring, hook, shackle and swivel used in hoisting or lowering, or as a means of suspension, and which has been lengthened, altered or repaired, should be adequately tested and examined before it is used again.

6.1.3. All cables or ropes used on hoisting appliances for raising or lowering materials should be long enough to leave at least two turns on the drum at every operating position of the appliance.

6.1.4. No rope should be used over a grooved drum or pulley if its diameter exceeds the pitch of the drum grooves or the width of the pulley groove.

6.1.5. Every hoisting or derricking rope or chain should be securely fastened to the barrel of the crane, crab or winch with which it is used.

6.1.6. All chains, ropes, slings and other gear used for hoisting or lowering or as a means of suspension should be periodically inspected by a competent person, and that person's findings should be entered on a certificate or in a special register.

6.1.7. (1) New chains and gear such as rings, hooks, shackles and swivels for lifting appliances should not be made of wrought iron.

(2) The use on lifting appliances of wrought iron chains, and of gear such as rings, books, shackles and swivels that is made of wrought iron, should be banned after a period to be fixed by the competent authority.

(3) Heat treatment should be permissible in the course of repairs only when it is carried out in accordance with the characteristics of the metal and by a competent person.

(4) If made of special steel, chains and gear such as rings, hooks, shackles and swivels on lifting appliances should not be subjected to any heat treatment.

6.1.8. When not in use, ropes, chains and accessories should be stored under cover in clean, dry, well ventilated places where they are protected against corrosion and not exposed to excessive heat.

6.1.9. As far as practicable, ropes, chains and accessories in storage should be arranged so that items with the same maximum safe working load are grouped together.

6.1.10. No gear used for attachment or as a means of suspension should be loaded beyond its safe working load, except for the purpose of making tests.

6.1.11. Tag lines should be provided on loads likely to swing or which need guidance.

6.2. Wire ropes

6.2.1. Wire ropes for lifting appliances should—

- (a) be made of sound steel wire;
- (b) have a safety factor suitable for the type of lifting appliance under the maximum safe working load and have an effective breaking strength of at least—
 - (i) in the case of appliances with a lifting capacity not exceeding 10 tons, five times the greatest anticipated stress in the rope; and

- (ii) in the case of heavy loading gear, four times the greatest anticipated stress in the rope;
- (c) consist of one length; and
- (d) be free from knots and kinks.

6.2.2. In order to prevent kinking, twisting or untwisting of new wire rope the rope should—

- (a) when received in coils, be uncoiled by rolling the coils like hoops on level surfaces, and straightened out before being put on sheaves; or
- (b) when received in reels, be unwound by—
 - (i) rolling the reels along the ground;
 - (ii) pulling the ends from reels mounted horizontally on spindles or vertically on turntables.

6.2.3. Ends of wire rope should be seized or otherwise secured to prevent the strands from coming loose.

6.2.4. Fastenings of wire rope should be carefully examined at regular intervals, and clips or clamps tightened if they show signs of loosening.

6.2.5. In order to keep wire ropes pliable and prevent rust, the ropes should, if practicable, be treated at regular intervals with suitable lubricants free from acids or alkalis.

6.2.6. Reverse bends in wire ropes should be avoided as far as practicable.

6.2.7. Wire rope should be renewed in the event of extensive wear, deformation, corrosion, kinking or 7 per cent decrease of nominal diameter, or if more than 10 per cent of the number of element wires are broken in one lay¹ of the rope.

6.2.8. (1) Wire ropes should be fastened to hooks and other accessories by fastenings of adequate strength.

(2) Eye splices and loops should be provided with thimbles.

¹ Length of eight diameters.

6.2.9. If wire ropes other than ropes for lifting and transport appliances are joined, long splices should be used.

6.2.10. Wire ropes should be cut with a suitable tool such as a soft hammer, and not with a hard hammer or an axe.

6.2.11. (1) When wire ropes are used, the pulleys or drums should be more than 20 times the nominal diameter of the running rope.

(2) The provision above should apply to new appliances.

6.3. Fibre ropes

6.3.1. (1) Fibre ropes and belts for lifting appliances should be of suitable man-made fibre or of good grade manila (abaca).

(2) They should have an effective breaking strength of at least—

(a) in the case of artificial fibre rope, eight times the greatest anticipated stress in the rope; and

(b) in the case of high grade manila (abaca) rope, ten times the greatest anticipated stress in the rope.

6.3.2. Before being put into use and while in use, at intervals to be determined according to the nature of the work but not to exceed three months, fibre ropes for lifting appliances should be examined for abrasions, broken fibres, cuts, fraying, displacement of yarns or strands, variation in size or roundness of strands, internal wear between strands, deterioration of fibre, discolouration and other defects.

6.3.3. Fibre ropes and belts should not be re-spliced.

6.3.4. Fibre ropes and belts should not be exposed to abrasion from rough surfaces, grit, sand, etc., or to corrosion by acids, alkalis, fumes, etc., or to great heat.

6.3.5. Fibre ropes should only be rove through blocks that—

(a) have no sharp or rough edges or undue projections; and

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(b) have sheaves with grooves at least as wide as the diameter of the rope and free from roughness.

6.3.6. Wet fibre ropes and belts should not be allowed to freeze.

6.3.7. Fibre ropes and belts should not be lubricated.

6.3.8. In storage fibre ropes and belts should—

(a) be hung on wooden pegs, galvanised hooks or the like, separately from metal gear; and

(b) be protected against rodents.

6.3.9. To prevent melting or fusing of synthetic ropes on capstan or drum under heavy load, the stress applied should be relieved.

6.4. Chains

6.4.1. Chains used for lifting and transport appliances should be withdrawn from use whenever—

(a) the chains have become unsafe from overloading or through faulty heat treatment; or

(b) the chains or individual links thereof have stretched more than 5 per cent of the length of the chains when manufactured; or

(c) any link has decreased more than 10 per cent of the diameter of the section of links when manufactured; or

(d) other external defects are evident.

6.4.2. Chains should be repaired only by properly qualified persons having suitable equipment for the purpose.

6.4.3. Chains that are wound on drums or pass over sheaves should be lubricated at frequent and regular intervals.

6.4.4. Chains should not be—

(a) hammered to straighten links or force them into position;

(b) crossed, twisted, kinked or knotted;

- (c) dragged from under loads;
- (d) dropped from a height;
- (e) used to roll loads over; or
- (f) subjected to shock loads.

6.4.5. Joining broken chains by wiring links together, by inserting bolts between links or by passing one link through another and inserting a bolt or a nail to hold it should be prohibited.

6.4.6. Chains should be examined at frequent intervals for stretch, wear, gouge marks, cracks and open welds.

6.4.7. When individual links of lifting or transport chains show excessive wear, or are bent, cut, gouged or cracked, they should be cut out and new ones substituted.

6.5. Slings

6.5.1. All slings should be made of chains, wire ropes or fibre ropes of adequate strength to withstand the stresses to which they will be subjected.

6.5.2. Rings, hooks, swivels and end links of hoisting chains should be made of the same material as the chains.

6.5.3. All new or reconditioned chain sling assemblies should be subjected to an appropriate tensile test before use.

6.5.4. The safe working load for chain or rope slings for an angle of 0° to 90° should be marked on the slings themselves.

6.5.5. Workers using slings should be familiar with the fact that stresses in slings vary with their angle.

6.5.6. Slings that show evidence of cuts, excessive wear, distortion or other dangerous defects should be withdrawn from use.

6.5.7. (1) Sharp edges of a load should not be in contact with ropes or chains.

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(2) Where necessary to prevent sharp bends in slings, corners of loads should be adequately padded.

6.5.8. When multiple slings are used the load should be distributed equally among the ropes as far as practicable.

6.5.9. Where double or multiple slings are used the upper ends of the slings should be connected by means of a shackle or ring and not be put separately into a lifting hook.

6.6. Pulley blocks

6.6.1. Pulley blocks should be made of mild steel or of other material of equivalent or better quality.

6.6.2. The diameter of the sheaves of pulley blocks measured at the bottom of the rope groove should be as follows:

- (a) for running wire rope, not less than 14 times the diameter of the rope;
- (b) for standing wire rope, not less than ten times the diameter of the rope;
- (c) for natural fibre rope, not less than six times the diameter of the rope; and
- (d) for man-made fibre rope, not less than five times the diameter of the rope.

6.6.3. Blocks should be provided with a suitable lubricating device.

6.6.4. The sheaves and housing of blocks should be so constructed that the rope cannot become caught between the sheave and the sides of the block.

6.6.5. (1) The grooves in the sheaves should be such that the rope cannot be damaged in the sheave.

(2) Blocks with badly corrugated grooves should be taken out of use.

6.6.6. Blocks designed for use with fibre rope should not be used with wire rope.

6.6.7. Pulleys within hand's reach of workers should be provided with guards that effectively prevent hands from being drawn in.

6.7. Hooks

6.7.1. (1) Hooks for lifting appliances should be of forged steel or of other material of equivalent or better quality.

(2) Wrought iron hooks in use should be banned after a period to be fixed by the competent authority.

6.7.2. Hooks should be provided with a catch or be so shaped as to prevent the load from accidentally slipping off.

6.7.3. (1) Hooks with deformation or cracks should not be used.

(2) Hooks should not be re-formed by cold bending.

6.7.4. Parts of hooks apt to come into contact with ropes or chains during hoisting operations should have no sharp edges.

6.7.5. Hooks should have a safety factor of 5 or more.

6.8. Shackles

6.8.1. Shackles should be marked with the safe working load.

6.8.2. Shackles should have a safety factor of 5 or more.

6.8.3. Shackles used for hanging blocks should—

(a) have a breaking strength at least twice that of the pulling lines; and

(b) have the pins secured by locked nuts.

6.8.4. No shackles should be built up by welding.

6.8.5. Shackle pins should be adequately secured.

7. Internal combustion engines

7.1.1. Starting cranks of internal combustion engines should automatically disconnect when the engine starts and be effectively secured against kicking back.

7.1.2. Internal combustion engines should not be started up with oxygen or other oxidising gases.

7.1.3. Exhaust gases from internal combustion engines should be so led off that the attendant and other persons in the vicinity are not exposed to them.

7.1.4. Internal combustion engines should not run in enclosed places unless adequate mechanical ventilation is provided.

7.1.5. When fixed internal combustion engines are used below deck the exhaust should be led into the open air clear of ventilation intakes and other deck openings.

7.1.6. Exhaust lines, mufflers, joints and connections should be tight, and inspected for tightness as soon as the engine is started.

7.1.7. When internal combustion engines are being fuelled—

- (a) suitable equipment such as pumps, hoses and nozzles should be used;
- (b) the engine ignition should be shut off;
- (c) care should be taken to avoid spilling fuel;
- (d) no person should smoke or have an open light in the vicinity; and
- (e) a fire extinguisher should be kept readily available.

7.1.8. No internal combustion engine should be taken on board a vessel for repair work unless the vessel's officers have been notified.

7.1.9. When the exhaust gases of internal combustion engines of mobile equipment such as fork-lift trucks, cranes and loaders are discharged into the atmosphere below deck—

- (a) a competent person should test the atmosphere at suitable intervals for carbon monoxide;
- (b) if the carbon monoxide content of the atmosphere of the space in question exceeds 50 parts per million the workers should be withdrawn from the space; and
- (c) the workers should not re-enter the space until it has been re-tested and certified safe by a competent person.

7.1.10. Internal combustion engines should not be used in confined spaces below deck where any explosive, or any flammable liquid or gas, or any similar dangerous substance is present.

7.1.11. Operators of internal combustion engines in confined spaces should not work alone.

7.1.12. Diesel engines used aboard ships should be equipped with a means of closing the air intake to stop the engine if a flammable atmosphere should develop.

8. Metalworking machines

8.1. Abrasive wheels

Construction

8.1.1. Floor stands for abrasive wheels should be—

- (a) rigidly constructed;
- (b) sufficiently heavy for the wheels, discs, etc., used; and
- (c) securely mounted on substantial foundations so as to withstand vibration.

8.1.2. Abrasive wheels, except wheels used for internal grinding and wheels less than 5 cm (2 in) in diameter, should be equipped with protection hoods or other suitable devices to prevent injury to persons if the wheel breaks.

8.1.3. (1) Protection hoods should—

- (a) so far as is reasonably practicable be of such a design and so constructed as to contain every part of the abrasive wheel in the event of any fracture of the abrasive wheel or any part thereof occurring while the wheel is in motion;
- (b) be properly maintained and so secured as to prevent their displacement in the event of any such fracture as aforesaid; and
- (c) enclose the whole of the abrasive wheel except such part thereof as is necessarily exposed for the purpose of any work being done.

(2) Every hood for an abrasive wheel used for grinding on the periphery and mounted on a fixed machine should be kept adjusted to the decreasing diameter of the wheel.

8.1.4. Stationary abrasive wheels, and portable abrasive wheels whenever practicable, should be equipped with exhaust systems that will effectively remove the dust and dirt particles produced in grinding.

8.1.5. Work rests on abrasive wheels should be—

- (a) substantially constructed;
- (b) shaped to fit the contour of the wheel; and
- (c) securely fixed in position as close as practicable to the wheel.

Operation

8.1.6. Workers employed on abrasive wheels should be provided with protection for the head and eyes against flying particles or splashes.

8.1.7. Abrasive wheels should be inspected before they are mounted to ascertain whether they are cracked or otherwise damaged.

8.1.8. Every abrasive wheel should be properly mounted.

8.1.9. Work rests should not be adjusted while wheels are in motion.

8.1.10. There should be affixed to every grinding machine a notice specifying—

- (a) the maximum working speed of the spindle;
- (b) in the case of any machine for which there are provided arrangements for operating the spindle at more than one working speed, each speed; and
- (c) in the case of any machine for which there are provided arrangements for operating the spindle at an infinite number of working speeds within a specified range, the maximum and minimum working speeds of the spindle.

8.1.11. Every governor or other device used for controlling the speed of any air-driven grinding machine should be properly maintained.

8.1.12. The maximum safe speed of operation should be marked on every abrasive wheel.

8.1.13. Abrasive wheels should not be run at a speed exceeding the maximum safe speed indicated on them.

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8.1.14. Work should not be forced against cold abrasive wheels but applied gradually.

8.1.15. Abrasive wheels should be run at the maximum safe speed for at least one minute before any work is applied and while all workers are in a place that is safe if the wheel bursts.

8.1.16. Abrasive wheels should be tested for balance at least once a week and trued if necessary.

8.1.17. Abrasive wheels used in wet grinding should not be left standing in water.

8.1.18. Dry grinding or brushing should not be done on surfaces coated with harmful paint unless local exhaust ventilation is provided or respiratory protective equipment is used.

9. Hand tools, portable power-driven tools

9.1. Hand tools

9.1.1. In order to reduce the hazards from sparking, adequate precautions should be taken when hand tools are used—

- (a) on vessels that carry oil, liquefied combustible gases or other flammable liquids;
- (b) near flammable or explosive material; and
- (c) in the presence of explosive dusts or vapours.

9.2. Pneumatic tools

Construction

9.2.1. Operating triggers on portable pneumatic tools should be—

- (a) so placed as to minimise the risk of accidental starting of the machine; and
- (b) arranged to close the air inlet valve automatically when the pressure of the operator's hand is removed.

9.2.2. Hose and hose connections for the supply of compressed air to portable pneumatic tools should be—

- (a) designed for the pressure and service for which they are intended;
- (b) fastened securely to the permanent pipe outlet and to the tool; and
- (c) designed so that they cannot be released while the hose is under pressure.

9.2.3. Pneumatic shock tools should be equipped with safety clips or retainers to prevent dies and tools from being accidentally expelled from the barrel.

Use

9.2.4. Tools should not be shot out of pneumatic hammers, but be removed by hand.

9.2.5. When cutting rivets with pneumatic cutters—

- (a) the tools should be provided with a cage guard or other suitable device to catch the rivet heads; or
- (b) the workers should be provided with suitable head and eye protection.

9.2.6. Pneumatic tools should be disconnected from the source of power and the pressure in the hose lines released before any adjustments or repairs are made.

9.2.7. (1) Air supply lines should be adequately protected from damage by traffic or other movement.

(2) Over such surfaces as those of ladders, steps, scaffolds and walkways, hose should not be laid in such a manner as to create a tripping hazard.

9.2.8. Portable pneumatic tools should not be hoisted or lowered by the air line.

9.2.9. Reciprocating pneumatic equipment should have the plungers, dies and tools removed when they are not in use.

9.2.10. Compressed air should not be used for cleaning clothing or parts of the body, or be directed to the body.

9.2.11. Hose should be inspected visually before each use and removed if damaged.

9.3. Powder-actuated tools

Construction

9.3.1. Powder-actuated tools should have—

- (a) a guard or protective shield that cannot be removed without rendering the tool inoperative;

- (b) a device that prevents the tool from firing inadvertently, as for example if it is dropped or while it is being loaded;
- (c) a device that prevents the tool from firing if it is not approximately perpendicular to the working surface; and
- (d) a device that prevents the tool from firing if the muzzle is not pressed against the working surface.

Inspection, maintenance

9.3.2. (1) Every time it is used, a powder-actuated tool should be inspected beforehand to ensure that it is safe to use.

(2) In particular action should be taken to ensure that—

- (a) the safety devices are in proper working order;
- (b) the tool is clean;
- (c) all moving parts work easily; and
- (d) the barrel is unobstructed.

9.3.3. Powder-actuated tools should be repaired only by the manufacturer or by competent persons.

9.3.4. Powder-actuated tools should be kept clean.

Use

9.3.5. Powder-actuated tools should be accompanied by instructions for their maintenance and use.

9.3.6. Only well trained and competent persons at least 18 years of age should use powder-actuated tools.

9.3.7. Operators of powder-actuated tools should wear safety goggles, and be protected by safety helmets and face screens or shields if necessary to prevent danger.

9.3.8. Powder-actuated tools should not be loaded until they are to be used.

9.3.9. Powder-actuated tools should never be pointed at any person, even when they are unloaded.

9.3.10. Powder-actuated tools should not be stored or used in an explosive or inflammable atmosphere.

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9.3.11. Powder-actuated tools should not be fired—

- (a) into concrete or masonry near the edge;
- (b) into existing holes; or
- (c) into objects or structures through which the projectile could pass if that would cause danger.

9.3.12. Powder-actuated tools should not be used on hard or brittle materials such as cast iron, hardened steel, glazed tiles, glass blocks or hard rock unless they are specially designed for such use.

9.3.13. When it is being fired a powder-actuated tool should—

- (a) be held perpendicular to the working surface; and
- (b) have the muzzle pressed firmly against the working surface.

9.3.14. An obstructed bore should not be cleared by firing another stud or cartridge into it.

9.3.15. Powder-actuated tools and cartridges should not be left unattended.

9.3.16. Powder-actuated tools should not be transported loaded, or left loaded when not in use.

9.3.17. When not required for use, inspection or other purpose, powder-actuated tools should be kept in a suitable container.

9.3.18. Only cartridges conforming to the maker's specifications should be fired in a powder-actuated tool.

9.3.19. Cartridges should be kept in a metal container that—

- (a) is clearly marked to indicate its contents;
- (b) is kept locked when not in use; and
- (c) contains nothing except cartridges.

9.3.20. If a powder-actuated tool misfires—

- (a) it should be left in the operating position against the material for at least 15 seconds; and

(b) the cartridge should be removed before lifting the guard from the surface.

9.3.21. Misfired cartridges should be safely destroyed by competent persons.

9.3.22. If necessary to prevent danger, areas in which powder-actuated tools are being used should be fenced off or indicated by warning signs or notices.

9.4. Electrical tools

9.4.1. Portable electrical tools should comply with the requirements of section 10.4.

10. Electricity

10.1. General

10.1.1. All parts of the electrical installation in a shipyard should—

- (a) be of a standard of construction not lower from the safety point of view than national or international standard specifications approved or accepted by the competent authority;
- (b) be so constructed, installed and maintained as to prevent fire, external explosions and electric shock;
- (c) not be apt to be damaged by water, dust or electrical, thermal or chemical action to which they may be subjected; and
- (d) be efficiently insulated or have all bare live parts enclosed or otherwise protected.

10.1.2. (1) All electrical appliances and conductors should be clearly marked to indicate their purpose and voltage.

(2) When the layout of an installation cannot be clearly distinguished, the circuits and appliances should be identified by labels or other effective means.

(3) Circuits and appliances carrying different voltages in the same installation should be clearly distinguished by coloured markings or other conspicuous means.

10.1.3. Adequate precautions should be taken to prevent installations from receiving current at a higher voltage from other installations.

10.1.4. Where necessary to prevent danger, installations should be protected against lightning.

10.1.5. Lines of signalling and telecommunication systems should not be laid on the same supports as lines carrying current of medium or high voltage.

10.1.6. Electric welding installations should comply with the relevant requirements of this chapter and the requirements of section 14.3.

10.1.7. If a vessel's own electrical system is supplied with electricity from outside—

- (a) all the circuits to be energised should be equipped with suitable over-current protection;
- (b) all the circuits to be energised should have been inspected and found to be in a safe condition; and
- (c) if the vessel is in a dry dock, the system should be properly earthed.

10.1.8. When an installation ceases to be used—

- (a) it should be disconnected from the source of current by removing the fuses, by disconnecting the conductors or by other effective means; and
- (b) if it is not supervised and maintained it should be dismantled.

10.1.9. Personal protective equipment such as rubber gloves and rubber boots should not be considered as providing adequate protection against the risk of electric shock.

Protection against excessive contact voltage

10.1.10. Protection against excessive contact voltage should be provided in all installations where the operating voltage exceeds 50 V AC to earth (rms).

10.1.11. Protection against excessive contact voltage should be afforded by one or more of the following:

- (a) placing live parts out of reach;
- (b) protective barriers;
- (c) enclosure;
- (d) insulation;
- (e) earthing of neutral;
- (f) automatic circuit breakers;
- (g) reduction to safety extra-low voltage; or
- (h) earthing of non-current-carrying metal parts.

Shipbuilding and ship repairing

10.1.12. (1) No bare conductors or other bare current-carrying parts of equipment should be allowed within 3 m (9 ft 9 in) of the ground or of any place where any person may work or pass unless they are effectively fenced or screened.

(2) In places where long metal objects or high vehicles are used, or where material is stacked, greater clearance should be required, unless the bare conductors are effectively fenced or screened.

10.1.13. (1) Covers, protective mesh and housing should be made of incombustible material, possess adequate mechanical strength and be reliably secured.

(2) The size of the openings of protective mesh or wire netting should be determined in relation to the distance to the nearest live parts, and the apparatus should be capable of successfully passing tests using approved test fingers or probes.

10.1.14. If enclosures can be removed—

- (a) removal of the enclosure should switch off the current; and
- (b) it should be impossible to remove the enclosure without a special tool or key kept by a competent person.

10.1.15. If an installation has an earthed neutral it should be equipped with an appliance that automatically cuts off the current from the defective part of the installation.

Circuit controls

10.1.16. At the beginning of every installation there should be a device that cuts off the current from all conductors.

10.1.17. In all circuits supplying consuming appliances it should be possible to cut off the current from all active conductors by means of a readily accessible device.

Dangerous environments

10.1.18. At places where electrical installations are exposed to damp, conducting liquids, corrosive fumes or similar harmful

agents, the conductors and equipment used should be specially protected against such agents.

10.1.19. (1) In confined spaces with conductive elements or where conditions are otherwise dangerous, portable electrical appliances should be supplied only with safety extra-low voltage.

(2) Sources of supply at a higher voltage should be outside the confined spaces.

10.1.20. Only flameproof equipment and suitably protected conductors should be installed or used—

- (a) on vessels that carry oil, liquefied combustible gases or other flammable liquids;
- (b) at storeplaces for explosives or flammable liquids; and
- (c) in other flammable or explosive atmospheres.

10.1.21. In highly combustible environments—

- (a) precautions should be taken to prevent heating of highly combustible substances;
- (b) electrical conductors and equipment should be prevented from coming into contact with highly combustible substances;
- (c) no bare conductors or live parts of electrical equipment should be allowed;
- (d) the sheathing of conductors should be fire-retardant; and
- (e) an appliance should automatically cut off the current if the insulation of a conductor is damaged.

Earthing

10.1.22. In installations where the voltage exceeds 50 V AC (or 65 V for telephone) the following should be earthed:

- (a) armouring and metallic coverings of cables;
- (b) external metallic parts of electrical equipment that are not normally live; and
- (c) metallic parts in the immediate vicinity of live conductors.

10.1.23. Earthing systems should be so installed that no dangerous voltage can arise between earthed parts and the earth.

10.1.24. Earthing should be ensured by one or more of the following:

- (a) conductive sheaths or armourings of cables;
- (b) special conductors forming part of cables; or
- (c) visible outside conductors.

10.1.25. All parts of earthing systems should—

- (a) have perfect electrical continuity;
- (b) be efficiently connected to earth by means of suitable earth electrodes or by other equivalent means;
- (c) have adequate mechanical strength; and
- (d) be properly maintained and periodically examined.

10.1.26. (1) The metal parts of electrical installations that require to be earthed should be provided with clearly visible earthing terminals that permit reliable connection with the earthing conductor.

(2) Whenever equipment is provided with more than one earthing terminal perfect electrical continuity should be ensured between these terminals.

10.1.27. Earthing conductors, particularly their attachments and connections to earthing terminals, should be protected against corrosion where necessary.

10.1.28. Except for testing purposes no switch, fuse, circuit breaker or other circuit-opening device should be placed in any earthing conductor.

10.1.29. Earthing conductors should have a total conductance equal to at least half that of the largest current-carrying conductor in the circuit.

10.1.30. All connections in earthing conductors should be carefully made by efficient methods.

10.1.31. Water pipes, air pipes and track rails, except the track rails of electric cranes that are used as return conductors, should not be used as earthing conductors, but should be earthed if there is risk of their becoming live.

10.1.32. (1) Earth electrodes should be so constructed and installed as to obtain the lowest practicable resistance to earth.

(2) The settings of the protective apparatus of the associated system should be co-ordinated with the earth resistance value so as to ensure effective disconnection of the system on the occurrence of earth faults.

10.1.33. Earth electrodes of installations should be separate and at a safe distance from the earth electrodes of lightning rods.

Protection against overloads and short circuits

10.1.34. Devices providing protection against overloads and short circuits should be installed at the origin of supply conductors.

10.1.35. In case of short circuit in any circuit whatsoever the supply of electricity should be cut off automatically by means of automatic circuit breakers or fuses of sufficient breaking capacity.

10.1.36. Automatic overload protection devices should be designed to follow as far as practicable the thermal variation of the parts to be protected closely enough to ensure that the supply of electricity is cut off before the parts reach a dangerous temperature.

Electrical equipment rooms

10.1.37. (1) Large electrical equipment rooms serving exclusively for the generation, transformation or distribution of electricity, such as main distribution stations, should have at least two separate and easily accessible ways of escape.

(2) The doors, if any, of these rooms should—

(a) open outward;

(b) be easy to open at all times from the inside; and

(c) be opened from the outside only with a special key.

(3) If the electrical equipment housed in these rooms contains considerable quantities of combustible oil, the rooms should be so laid out that in the event of fire, smoke cannot escape so as to cause danger.

Shipbuilding and ship repairing

10.1.38. (1) In electrical equipment rooms, bare live parts should be either out of reach or protected by screens, lattice work, gratings or the like.

(2) Passageways of adequate width should be provided between screens, between lattice work on gratings facing each other or between them and walls of the rooms.

10.1.39. Only electricians or persons accompanied by electricians should be allowed in electrical equipment rooms.

Notices

10.1.40. The following notices should be kept exhibited at suitable places:

- (a) a notice prohibiting unauthorised persons from entering electrical equipment rooms;
- (b) a notice prohibiting unauthorised persons from handling or interfering with electrical apparatus;
- (c) a notice containing directions concerning procedure in case of fire;
- (d) a notice containing directions concerning the rescue of persons in contact with live conductors and the restoration of persons suffering from electric shock; and
- (e) a notice specifying the person to be notified in case of an electrical accident or some other dangerous occurrence, and indicating how to communicate with that person.

10.1.41. At all places where contact with or proximity to electric equipment can cause danger, suitable warnings should be placed.

10.2. Conductors

General

10.2.1. All wiring should be supported on proper insulators, and not looped over nails, brackets, etc.

10.2.2. Neutral, compensating and protective conductors should be clearly distinguishable from other conductors.

10.2.3. Overhead lines should be carried on supports of adequate strength and at a height that prevents contact with persons, animals or equipment passing underneath.

10.2.4. Overhead power lines should have a vertical clearance of at least 7.5 m (25 ft) at places where they cross roads and other traffic areas.

10.2.5. Power lines crossing over railways or roads should have safety nets underneath them at the crossings.

10.2.6. Poles carrying electrical conductors or equipment should be securely anchored in the ground or in some other base.

10.2.7. While conductors are being removed from poles, the poles should be adequately guyed, so as to oppose one-sided pulls.

10.2.8. Outdoor conductors should be disconnectable by means of switches, fuses or plug and socket connections.

10.2.9. Temporary conductors should not cross power lines, telephone lines or radio aerials.

10.2.10. Armoured cables and other heavy duty conductors should be protected against damage, in particular from vehicles, mechanical equipment, rough handling, etc.

10.2.11. Conductors should not be handled with the bare hands, but with rubber gloves or insulated appliances designed for the voltage applied.

10.2.12. Only heavy duty conductors should be laid on the ground.

10.2.13. Cables buried in the ground should—

- (a) be protected against ground pressure, chemical action, impact of tools and other sources of mechanical damage;
- (b) be laid at a safe distance from other metal conduits or pipes; and
- (c) have their position marked by indicators on the surface or at an adequate distance above them.

10.2.14. Conductors passing through bulkheads, walls, etc. should be enclosed in protective coverings.

10.2.15. Conductors passing through door frames, hatches, manholes or the like should be protected so that the insulation is not damaged by the closing of doors, covers or lids.

Flexible cables

10.2.16. Flexible cables for hand-held or portable apparatus where the voltage exceeds 50 V and where all circuits are not intrinsically safe should—

- (a) contain an earthing conductor with a conductance of at least half that of the largest current-carrying conductor, unless the cable is supplying portable apparatus of an approved double-insulation or all-insulated type;
- (b) unless otherwise specified by the competent authority, be protected by at least one continuous metal screen that will ensure that the supply of electricity is cut off automatically if serious damage occurs to the cable;
- (c) be coiled preferably in a figure-of-eight;
- (d) be protected against kinking by a rubber tube or other suitable device at the motor end; and
- (e) be relieved from mechanical strain at connections to terminals.

10.2.17. Hand-held apparatus and, where practicable, portable apparatus, should be supplied by a single flexible cable.

10.2.18. All flexible cables where the voltage exceeds 50 V, other than those forming part of intrinsically safe circuits, should have external sheathing that is highly resistant to fire and mechanical damage.

10.2.19. Automatic devices should be provided for the purpose of making or maintaining dead any hand-held or portable apparatus supplied by a flexible cable in the event of a break in the earthing conductor included in the cable.

10.2.20. The flexible cable should not be used to lift a portable tool.

10.2.21. Flexible cables should not be laid on surfaces that are oily or wet with corrosive liquids.

10.2.22. Flexible cables should be kept clear of loads, running gear and moving equipment.

10.2.23. Heavy rubber-insulated flexible cords should be used for extension lights for boilers, tanks and other places where conductors may be subjected to rough handling or moisture.

10.3. Equipment: general provisions

General provisions

10.3.1. Unless they are flameproof, control appliances such as switches, fuses and circuit breakers should not be installed at places where there are explosives, flammable liquids or flammable gases.

10.3.2. Motors, distribution apparatus and switchgear should be protected against dripping and splashing water, particularly in pump rooms.

Transformers

10.3.3. Outdoor oil-filled transformers placed on the ground should be—

- (a) installed at a place free from combustible materials; and
- (b) so sunk below ground level or enclosed that escaping oil cannot spread.

10.3.4. As far as practicable transformers on poles should be at least 4.5 m (15ft) above the ground.

10.3.5. Transformers on poles less than 4.5 m (15 ft) above the ground should be adequately enclosed by fencing or other effective means.

Switchgear

10.3.6. As far as practicable, metal-enclosed or metal-clad switchgear should be used.

10.3.7. If open-type outdoor switchgear has to be used—

- (a) all live parts should be adequately protected against accidental contact by guards or by elevation;
- (b) adequate working space should be provided around live parts; and
- (c) the switchgear and associated transformers and other apparatus should be adequately enclosed in earthed metal fencing.

10.3.8. For control, instrument and protective relay circuits not associated with power circuits, dead-front switchboards should be used.

Circuit breakers

10.3.9. Circuit breakers should—

- (a) be of adequate breaking and making capacities to perform their normal function; and
- (b) have their essential characteristics clearly marked on them.

10.3.10. In circuits where the voltage exceeds 50 V the isolating device should act on all poles.

10.3.11. It should not be possible for circuit breakers to be opened or closed inadvertently by gravity or by mechanical impact.

Fuses

10.3.12. Fuses should bear clear markings indicating their rated current, whether they are of the fast or slow breaking type and, as far as practicable, their rated breaking capacity.

10.3.13. (1) It should not be possible to remove or insert fuses in a circuit (other than an intrinsically safe circuit) where the voltage exceeds 50 V unless the circuit has been made dead by means of an isolating device on the incoming side.

(2) The fuses of such a circuit should be accessible only to authorised persons.

10.3.14. Effective protective measures should be taken to ensure that persons removing or inserting fuses will not be endangered, in particular by any adjacent live parts.

Switches

10.3.15. All switches should be of the enclosed safety type, unless installed in places accessible only authorised persons.

10.3.16. Switches should be so installed and earthed as to prevent danger in their operation.

10.3.17. Switches should be so constructed that they cannot inadvertently close by gravity.

Motors

10.3.18. All motors supplied by a voltage exceeding 50 V should be equipped with a switch.

10.3.19. There should be only one control device for starting a motor.

10.3.20. When a motor can be switched off from more than one place, a stopping device should be provided in the immediate vicinity of the motor, unless this is impracticable.

10.3.21. Motors should be so installed as to ensure that they can be adequately cooled.

10.3.22. Each motor should be effectively protected against over-current.

10.3.23. Non-flameproof fan motors should be in the open air or in a place free from explosion risk.

Connections

10.3.24. At points where cables and conductors are joined, branched or led into apparatus, they should be—

- (a) mechanically protected; and
- (b) properly and durably insulated.

10.3.25. (1) Conductors and cables should be joined, branched or led into apparatus through junction boxes, sleeves, bushings, glands or equivalent connecting devices.

(2) Whenever practicable, cables should be joined by junction boxes or plug-and-socket couplings.

(3) When parts of cables or conductors are joined together, or cables or conductors are joined to one another or to apparatus, the attachment should be made by screwing, clamping, soldering, riveting, brazing, crimping or equivalent means.

10.3.26. Junction boxes and connectors should be protected as far as possible against traffic, falls of ground, water and other sources of damage.

10.3.27. Whenever armoured cables are joined the junction boxes should be bridged by a suitable conductive bond between the armouring of the cables.

Lighting and heating installations

10.3.28. Temporary lighting installations should have heavy duty cables.

10.3.29. Temporary lights should not be suspended by the cables unless the latter are designed for the purpose.

10.3.30. An infra-red electric lamp for heating should be enclosed in guards that as far as practicable prevent accidental contact with the lamp.

10.4. Mobile and portable equipment

General provisions

10.4.1. The frames of portable electric tools and appliances, except double-insulated tools, should be properly connected to earth.

10.4.2. Mobile appliances should not be transported while they are connected to the source of power.

Portable apparatus

10.4.3. The supply of electricity to portable tools and appliances should be at a voltage not exceeding 220 V.

10.4.4. Portable machines should be equipped with a built-in switch.

10.4.5. Hand-held electrical tools should be provided with a built-in switch that will break the circuit automatically when the tool is released by the hands.

10.4.6. Portable electric tools and appliances should not be used in flammable or explosive atmospheres unless the requirements of paragraph 16.1.35 (2) (h) are observed.

Hand lamps and portable lamp holders

10.4.7. The use of hand lamps and portable lamp holders exceeding 130 V should not be permitted. The voltage should be reduced to safety extra-low voltage with the use of isolating transformers if necessary in particularly conductive locations.

10.4.8. Hand lamps should be—

- (a) equipped with a strong cover of glass or other transparent material;
- (b) proof against dust and water; and
- (c) equipped with a strong guard over the cover.

10.4.9. Portable lamp holders should in addition to the requirements of paragraph 10.4.8 have—

- (a) all current-carrying parts enclosed; and
- (b) an insulated handle.

10.5. Inspection and maintenance

10.5.1. All electrical equipment should be inspected before use to ensure that it is suitable for the use proposed.

10.5.2. Earthing circuits in all installations should be tested before being put into use and periodically thereafter.

10.5.3. At the beginning of every shift every person using electrical equipment should make a careful external examination of the equipment and conductors for which he is responsible, especially flexible cables.

10.5.4. Electrical conductors and equipment should be repaired only by electricians.

10.5.5. As far as practicable no work should be done on live conductors or equipment.

10.5.6. Before any work is begun on conductors and equipment that does not have to remain live—

- (a) the current should be switched off;
- (b) adequate precautions (such as padlocking and tagging) should be taken to prevent the current from being switched on again;
- (c) the conductors and equipment should be tested for current;
- (d) the conductors and equipment should be earthed and short-circuited; and
- (e) neighbouring live parts should be adequately protected against accidental contact.

10.5.7. After work has been done on conductors and equipment, the current should be switched on again only on the orders of a competent person.

10.5.8. Electricians should be supplied with sufficient adequate tools, and personal protective equipment such as rubber gloves, mats and blankets.

10.5.9. All conductors and equipment should be considered to be live unless there is certain proof of the contrary.

10.6. Work in the vicinity of electrical installations

10.6.1. When work is to be done in the neighbourhood of electrical conductors or installations, before it begins the employer should ascertain the voltage carried so that persons and equipment can be kept at a safe distance from the conductors or installations.

10.6.2. No work should be done in dangerous proximity to a conductor or an installation until it has been made dead.

10.6.3. Before the current is restored the employer should ensure that no worker remains in a dangerous position.

10.6.4. If a conductor or an installation in the neighbourhood of which work is to be done cannot be made dead, special precautions should be taken and special instructions given to the workers so as to prevent danger.

10.6.5. As far as practicable, the precautions referred to in paragraph 10.6.4 should include adequately enclosing or fencing live conductors and installations.

10.6.6. If mobile equipment has to be employed in the neighbourhood of conductors or installations that cannot be made dead, its movements should be so controlled as to keep it at a safe distance from them.

11. Pressure plant

11.1. Steam boilers

General

11.1.1. Steam boilers should comply with national or other official regulations as regards materials, design, construction, inspection and testing.

11.1.2. Only competent persons should operate boilers.

11.1.3. Boiler-feed water should be kept free of soap, oil and other foreign substances with the exception of suitable water additives.

11.1.4. Steam should not be allowed to leak from the water column or its connections.

11.1.5. Boiler installations, especially gauges, should be well lighted.

11.1.6. The space around a boiler should be kept clear of obstructions and rubbish.

11.1.7. Water should not be fed into a hot empty boiler.

11.1.8. If the water level is low the fire should be damped down, the ash door closed and the fire doors left open.

11.1.9. If persistent foaming occurs the boilers should be shut down.

11.1.10. Safety valves should operate freely at all times.

11.1.11. (1) Water gauge glasses and water columns should be blown out at frequent intervals during each shift to make sure that all connections are clear.

(2) Blow-off cocks should be opened and closed slowly so as to avoid water hammer.

11.1.12. Boilers should be blown off into a sump or pit, or

other effective precautions should be taken to avoid scalding persons.

11.1.13. Scale should not be allowed to accumulate in boilers.

11.1.14. Boilers in operation should not be left unattended unless they are fitted with automatic safety devices.

11.1.15. All working parts of steam boilers such as valves, cocks, injectors and pumps should be frequently inspected by the operator.

11.1.16. Boilers should be repaired only by competent persons, after all pressure has been removed.

11.2. Steam piping

General

11.2.1. (1) If a steam hose from a steam source outside the vessel is connected to the vessel's steam piping, a suitable pressure gauge and a suitable relief valve should be installed at the junction between the hose and the piping.

(2) The relief valve should be set for a pressure not exceeding the safe working pressure of the vessel's steam piping.

(3) It should not be possible to isolate the relief valve from the system that it protects.

(4) The pressure gauge and the relief valve should be visible and readily accessible.

11.2.2. Steam hose and fittings should have a safety factor of at least 5.

11.2.3. Steam hose and piping should be shielded or insulated if necessary to prevent accidental contact with workers.

11.2.4. If steam hose is hung up—

- (a) the weight should be suitably relieved; and
- (b) the hose should be protected against chafing.

11.3. Compressors

Construction

11.3.1. (1) Compressors should comply with national or other official regulations as regards materials, design, construction, inspection and testing.

(2) As regards matters not dealt with in the above-mentioned regulations, compressors should comply with the relevant requirements of the *Model Code of Safety Regulations for Industrial Establishments*, issued by the International Labour Office.

Operation

11.3.2. Compressors should be operated only by competent persons.

11.3.3. On or near compressors, instructions for their operation should be displayed.

11.3.4. Air supplied to compressors should be clean and free from any explosive, flammable or toxic contaminant.

11.3.5. All working parts, including speed governors, safety valves and oil separators, should be inspected and if necessary cleaned at suitable intervals.

11.3.6. Only a cleaning agent specified by the manufacturer should be introduced into compressor cylinders and connected piping.

11.3.7. Leaky valves should be promptly repaired or replaced.

11.3.8. Pipes should not be connected or disconnected while there is any pressure in them.

11.3.9. Care should be taken to prevent any spread of lubricating oil to coolers, receivers and other parts of the system where it might cause danger.

11.3.10. Dangerous gases escaping from safety and other valves should be led off safely.

11.4. Air receivers

11.4.1. (1) Air receivers should comply with national or other official regulations as regards materials, design, construction, inspection and testing.

(2) As regards matters not dealt with in such regulations, air receivers should comply with the relevant requirements of the *Model Code of Safety Regulations for Industrial Establishments*, issued by the International Labour Office.

11.4.2. Air receivers should be cleaned of oil, carbon and other foreign substances at suitable intervals.

11.4.3. Before use, air receivers should be inspected, internally and externally, by qualified inspectors authorised by the competent authorities—

- (a) after installation; and
- (b) after reconstruction or repairs.

11.5. Gas cylinders

General

11.5.1. Cylinders for compressed, dissolved and liquefied gases should comply with national or other official regulations concerning their material, design, construction and markings.

11.5.2. No gas cylinder should be used unless it is fitted with—

- (a) a high-pressure gauge;
- (b) a reducing valve with pressure regulator and safety relief device; and
- (c) a low-pressure gauge.

11.5.3. Gas cylinders should be inspected and tested by a competent person or a competent authority—

- (a) before being used for the first time;
- (b) before being used after repairs; and

(c) at suitable intervals.

11.5.4. (1) No person other than the gas supplier should attempt to mix gases in a cylinder.

(2) No one except the supplier of the cylinder or a person authorised by him should refill a cylinder.

11.5.5. Cylinders should be adequately protected against excessive heat and excessive variations of temperature, direct rays of the sun, accumulation of snow and continuous dampness.

11.5.6. (1) Cylinders should not be knocked, dropped or rolled in handling, or otherwise subjected to violent shocks, especially at low temperatures.

(2) Cylinders should be moved by tilting and rolling them on their bottom edges.

(3) The devices for holding the cylinders should be such that the cylinders can be rapidly removed in case of fire.

11.5.7. When in use cylinders should be held in place by a truck, chain or other effective means.

11.5.8. Cylinders should be kept at a safe distance from—
(a) electrical conductors such as third rails, trolley wires and earthing conductors;

(b) all operations which produce flames, sparks or molten metal or cause excessive heating of the cylinders.

11.5.9. Valve protection caps should always be in place when cylinders are not in use or not connected for use.

11.5.10. If cylinders charged with liquefied gases are heated this should not be done with an open flame.

11.5.11. (1) The valves of cylinders should be closed immediately after emptying.

(2) Empty gas cylinders should be marked to show that they are empty.

11.5.12. No tools or other objects should be placed on the top of a gas cylinder.

11.5.13. Leaky cylinders should be taken into the open air at a safe distance from any open flame or sparks.

11.5.14. Acetylene cylinders should be opened slowly with a special tool which should be left on the stem so that the valve can be closed quickly in an emergency.

11.5.15. Oxygen cylinders should not be allowed to come into contact with oil or grease.

11.5.16. Oxygen under pressure should not be allowed to come into contact with oily or greasy surfaces such as clothes or containers.

11.5.17. The valves of oxygen cylinders should not be opened by hammering, or other violent means, and should always be opened slowly.

Storage

11.5.18. Except when in use, cylinders containing combustible gases should not be kept in spaces where welding or cutting work is being done, and oxygen cylinders should be kept separated from all other cylinders.

11.5.19. No cylinder that contains or has contained any oxygen or other flammable gas should be taken below a completed deck unless it is put in a place that is adequately ventilated to prevent any dangerous concentration of gas or fumes.

11.5.20. When gas cylinders are stored in enclosed spaces—
(a) the number of cylinders should be as small as practicable;
(b) the cylinders should be stored in rooms with fire-resisting walls;
(c) the cylinders should be kept at a safe distance from flammable substances, radiators and other sources of heat; and
(d) the cylinders should be secured against falling and rolling.

11.5.21. Storerooms containing charged cylinders should be conspicuously marked on the outside with suitable danger signs.

Shipbuilding and ship repairing

11.5.22. Storerooms should be adequately ventilated.

11.5.23. No person should smoke in a cylinder storeroom.

11.5.24. If necessary to prevent danger there should be a fire-resistant partition between cylinders of oxygen and cylinders of acetylene or fuel gas.

11.5.25. Cylinders should be segregated for storage by type of gas.

11.5.26. Empty cylinders should be kept apart from charged cylinders.

11.5.27. Cylinders charged with acetylene or liquefied fuel gas should be stored with the valve end up and not laid on their sides.

Transport

11.5.28. Suitably designed equipment should be used for transporting gas cylinders in shipyards.

11.5.29. When cylinders are moved by a hoisting mechanism, a properly designed cradle or the like should be used.

11.5.30. Cylinders should not be hoisted by slings, hooks or magnets.

11.6. Acetylene generators

General

11.6.1. (1) Acetylene generators should comply—

- (a) with the requirements of national or other official regulations as regards materials, design, construction, inspection and testing; or
- (b) as regards matters not dealt with in such regulations, with the relevant requirements of the *Model Code of Safety Regulations for Industrial Establishments*, issued by the International Labour Office.

(2) Every acetylene generator should be fitted with—

- (a) a pressure-limiting device;
- (b) a pressure-indicating device; and
- (c) a safety device to protect the generator from gas feedback or flashback.

11.6.2. (1) Every acetylene generator should be accompanied by the manufacturer's instructions for its use.

(2) The instructions should be displayed conspicuously and in the immediate proximity of the generator.

11.6.3. Acetylene should contain not more than 0.05 per cent by volume of phosphoretted hydrogen and not more than 0.15 per cent of sulphuretted hydrogen.

Calcium carbide

11.6.4. Calcium carbide should be kept in containers that—

- (a) are made of metal of adequate strength to prevent breakage in handling;
- (b) are air-tight and water-tight with an air-tight lid or stopper;
- (c) are conspicuously marked with the words "Calcium carbide" and a suitable warning such as "Keep dry".

11.6.5. Carbide containers should be opened only with non-sparking tools.

11.6.6. Calcium carbide should be stored—

- (a) on shore only;
- (b) in dry, well ventilated, closed premises protected against static electricity.

11.6.7. Not more than one day's supply of carbide should be taken on board.

11.6.8. No unauthorised person should be allowed in a store-place for calcium carbide.

11.6.9. Calcium carbide waste should be destroyed by being immersed in a large quantity of water in the open air at a safe distance from any open flame.

Shipbuilding and ship repairing

Operation of generators

11.6.10. As far as practicable acetylene generators should be installed in the open air.

11.6.11. No acetylene generator should be taken below a completed deck unless it is put in a place that is adequately ventilated to prevent any dangerous concentration of gas or fumes.

11.6.12. No acetylene generator containing any carbide should be placed in dangerous proximity to any source of heat or combustible material.

11.6.13. No person should smoke or take a naked light or flame—

(a) into any acetylene generator house or shed; or

(b) into dangerous proximity to any acetylene generator in the open or on board a vessel.

11.6.14. Acetylene generators should not be allowed to freeze.

11.6.15. Only competent persons should operate acetylene generators.

11.6.16. No alterations should be made to an acetylene generator without the permission of the competent authority.

11.6.17. The pressure in acetylene generators and their gas-holders should at no time exceed 1.5 kg/cm^2 (22 lb/sq in).

11.6.18. Partially spent charges of carbide should not be re-placed in the generator.

11.6.19. When charged acetylene generators are being moved, precautions should be taken to prevent them from falling, overturning or tilting.

11.6.20. Hydraulic seals should be—

(a) kept filled to the proper level; and

(b) inspected daily by the person using the burner or blowpipe.

Maintenance and repair of generators

11.6.21. Before any part of an acetylene generator is repaired it should be—

- (a) thoroughly cleaned;
- (b) cleared of carbide, residue and sludge;
- (c) thoroughly flushed; and
- (d) completely filled with water, steam or inert gas.

11.6.22. Portable acetylene generators should be charged, cleaned and blown off—

- (a) in the open air; and
- (b) in daylight.

11.6.23. A conspicuous notice prohibiting smoking, naked lights and flames should be displayed on or near every acetylene generator while it is charged, being charged or being cleaned.

12. Hull construction

12.1. General

12.1.1. (1) As far as practicable, structural steel erectors should be protected by safe means of access and working, such as—

- (a) ladders;
- (b) gangways;
- (c) fixed platforms;
- (d) platforms, buckets, boatswains' chairs, etc., suspended from lifting appliances;
- (e) safety belts and life lines; and
- (f) catch nets or catch platforms.

(2) The means of protection provided should comply with the relevant provisions of this Code.

12.1.2. All staging, keel blocks, props, stays, fish plates, guy ropes, tensioning ropes, erection frames and other similar equipment on the slipway, vessel, blocks or sections should be firmly secured.

12.1.3. (1) Hulls under construction should be so fixed as to be incapable of overturning. The safety factor against tipping should be at least 1.5. Measures to ensure stability should include—

- (a) a supporting base of adequate strength;
- (b) underlying structures of sufficient strength and stability;
- (c) supports for the hull;
- (d) stays on the outside of the hull; and
- (e) anchoring.

(2) If there is any danger that the stability of the hull will be affected as work proceeds, stability should be ensured at each stage by suitable measures.

(3) No structures supporting the vessel on the slipway, and no

part of the hull, should be dismantled or removed without the permission of the management.

(4) Supports, stays and anchors should be properly secured against sliding, overturning, falling down and buckling.

12.1.4. When sternposts, propeller shaft brackets, rudders and similar structures are being placed in position, use should be made of props, stays, cages, keel blocks, guy ropes, ropes with stretching screws or special rigging.

12.1.5. When fore and aft and thwartship bulkheads are being installed they should be secured against falling by means such as ropes with stretching screws.

12.1.6. When fittings are being placed in position under decks and secured with bolts, the work should be done from a safely secured floor footing and not from any suspended part.

12.1.7. When floors of double bottoms, decks, platforms, compartments, bridges and the infrastructure of engine and boiler rooms, corridors and similar spaces are being installed, at the end of the day or shifts no extraneous, abandoned or unsecured objects should be left behind.

12.1.8. Before holes are drilled in floors, decks or bulkheads, the workers on the other side of such structures should be informed of the risk from the drill.

12.1.9. Before temporary partitions are installed or adjusted in holds all other work over the hatches of such holds should be stopped.

12.1.10. Steel girders that are being erected should be adequately shored or braced until they are permanently secured in position.

12.1.11. No load-bearing structural member should be dangerously weakened by cutting, holing or other means.

12.1.12. If harmful substances have to be removed from steel surfaces, the work should comply with the relevant requirements of section 13.6.

Prefabricated sections

12.1.13. (1) Sections should be assembled only at places intended for the purpose in the building plans.

(2) Assembly work should not be carried on in passageways.

12.1.14. (1) For the storage of finished sections, spaces or places of adequate dimensions should be provided, and equipped with transport and lifting appliances that ensure the easy and safe installation, storage and removal of the sections.

(2) Sections taken into storage should be placed securely in position.

12.1.15. Whenever possible, welding, assembly work, fitting or other work should not be done on sections in storage.

12.1.16. Before being taken on board, prefabricated sections should be—

- (a) complete, completely finished and ready for placing in position;
- (b) provided with adequately dimensioned and placed attachments such as fixed eyes or U-bolts to facilitate lifting them, placing them and securing them to supports; any welding attachment should be done by competent welders and subjected when necessary to non-destructive testing by a competent person; and
- (c) provided with the necessary indications for placing them in position on the hull.

12.1.17. (1) Fitting work for the equipment of sections should be done in places specially provided for the purpose.

(2) Fitting work should not be done on sections placed on platforms for transport.

12.1.18. (1) Sections should be tilted with the help of special mechanical equipment and structures.

(2) The tilting equipment should have a locking device that ensures secure control at any angle of tilt.

(3) The operations of placing sections in the tilting equipment, tilting them and removing them should be carried out under competent supervision.

12.1.19. (1) No welding, assembly or other work should be done on sections until they are placed in position and firmly secured.

(2) No work should be done on sections secured by suspension from cranes.

Flooring

12.1.20. Working floors from which structural iron or steel units are being erected should be close-planked.

12.1.21. Workers employed below riveting gangs should be protected by a close-planked floor above them.

12.1.22. If steel is stored on temporary flooring, the flooring should be strong enough to support it safely and be adequately secured in position, and the load should be safely distributed.

Hoisting

12.1.23. While structural members are being moved into place the load should not be released from the hoisting rope until the members are securely fastened in place.

12.1.24. Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.

12.1.25. Open-web steel girders that are hoisted singly should be directly placed in position and secured against dislodgement.

12.1.26. Bundles of girders should be secured against dislodgement after being hoisted.

12.1.27. No load should be placed on open-web steel girders until they have been placed in position and secured.

Riveting

12.1.28. Rivet holes should be cleared of paint by reaming or other effective method.

12.1.29. Rivets, bolts, nuts, wrenches and other loose articles should be kept in boxes or otherwise prevented from falling from a height.

12.1.30. When a vessel is being fitted out or repaired afloat it should be prohibited to cut rivets or drill holes in the shell within 1 m (3 ft 3 in) of the waterline unless the holes are stopped up the same day before the end of the shift.

12.1.31. When the heads of defective rivets are being cut off or their shanks are being knocked out of the hole, screens should be used to protect against flying pieces that have fallen or been knocked out.

12.1.32. Precautions to prevent fires caused by rivet heating equipment should be taken in conformity with the requirements of paragraph 2.5.6 and section 14.4.

12.1.33. (1) Riveting in confined spaces should comply with the relevant requirements of Chapter 15.

(2) Bolts used for the temporary holding together of plates for riveting should not be re-shaped by jumping up or forging.

13. Work with dangerous and irritating substances and radiations

13.1. General

13.1.1. (1) Every effort should be made to remove the hazards due to dangerous substances by the substitution of less dangerous substances.

(2) Dangerous substances should be used only if the workers in charge are aware of the risks of fire, toxicity or other dangers which may occur in the transporting or use of such substances and their prevention.

13.1.2. Containers and packages in which there are dangerous substances, including radioactive substances, should—

- (a) be plainly marked to indicate the contents by chemical name and their dangerous nature, and labelled with the relevant danger symbol; and
- (b) carry or be accompanied by instructions for safely handling and using the contents.

13.1.3. Approaches to working areas where danger from toxic or irritant gases may exist should be provided with notices or signs—

- (a) naming the gas involved; and
- (b) indicating the prevention measures to be taken.

13.1.4. (1) The preparation and mixing of dangerous substances should be carried out in special preparation premises, separated from other workplaces and well ventilated.

(2) An air-flow pressure switch should be installed in the ventilating airstream and be interlocked with the power supply of the working equipment.

(3) Processes involved in the preparation of minium, bases and white lead, and the decanting, sifting, mixing and grinding of dry lead pigments, should be completely mechanised and carried on in closed equipment.

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13.1.5. (1) All operations connected with any handling of dangerous substances, whether liquid or solid, such as transfer from one container to another, should be carried out only on premises fitted with exhaust ventilation and with the help of tools and appliances that prevent spillage of such substances.

(2) Toxic pigments should not be delivered in a dry powder form.

13.1.6. Painting materials, solvents and cleaners should not be kept together with dry pigments and chemicals.

13.1.7. In spaces on board in which work is done with paints, adhesives, resins and similar preparations containing volatile, flammable or otherwise harmful substances—

- (a) adequate ventilation, whether general or local, should be provided;
- (b) no hot work should be done;
- (c) if necessary to prevent danger, precautions should be taken against fire and the workers should wear respiratory protective equipment operating independently of the surrounding atmosphere;
- (d) the ventilation should be such as to keep the concentration of flammable vapours below 5 per cent of their lower explosive limit; frequent tests should be made by a competent person to ascertain the concentration; and
- (e) when paint is being applied in parts of the interior of a vessel, no other work should be done in such parts either during that time or for a certain time afterwards, until it is safe.

13.1.8. The transfer of paint, lacquer, adhesive, resin and the like from one container to another and to the painters' pots should be carried out over metal dishes with rims at least 5 cm (2 in) high.

13.1.9. Paint and other coating materials accidentally spilled on the floor should be immediately cleaned up and taken away.

13.1.10. (1) Painted articles should not be dried without local exhaust ventilation.

(2) Artificial drying of painted objects should be carried out in specially equipped chambers with reliable thermal insulation and ventilation that prevent the formation of explosive concentrations of solvent vapour.

13.1.11. (1) Used wiping materials and rags should be kept in metal containers with self-closing lids.

(2) At the end of the shift, used wiping materials should be removed from the workplace and put away in a safe place.

13.1.12. When not in use, packages containing paints, varnishes, lacquers and other combustible or volatile substances should be—

(a) kept tightly closed; and

(b) kept away from sparks, flames, sources of heat and the sun's rays.

13.1.13. At the close of work—

(a) the remains of adhesives, lacquers, solvents, thinners and insulating materials should be kept in closed containers; and

(b) brushes, spray-guns, hose and other equipment should be cleaned of residues of paint, lacquer and adhesive outside the ship and be kept in a cupboard in tightly closed containers.

13.1.14. (1) Empty containers for painting and other coating materials should be taken to a special storeplace equipped with exhaust ventilation or to a special place set aside for the purpose at a distance of at least 25 m (80 ft) from the preparation shop of the vessel.

(2) Empty containers should not be kept at workplaces.

13.1.15. (1) Creosote, tar mixtures or solutions containing phenol should not be allowed to come into contact with the skin or eyes.

(2) Creosote burns should be washed immediately and receive medical attention straight away.

13.1.16. Dangerous liquid substances should be safely

drawn from containers, e.g. with siphons, tipping appliances or other suitable devices. Workers should never put their mouth to the siphons.

13.1.17. For heating untreated thermoplastic paints up to 130-180°C and applying them, workers should be provided with personal equipment for protection against burns.

13.1.18. In confined spaces or dangerous atmospheres, dangerous substances should be handled and used in conformity with the requirements of Chapter 15.

13.1.19. Workers exposed to toxic or irritating substances should promptly report any physical complaints to the medical services, first-aid post or a supervisor.

Personnel

13.1.20. (1) Workers on painting jobs and workers taking part in insulating work with asbestos-containing materials, scouring and cleaning work or work involving the use of organic solvents, pitch, coal tar resins, polyurethane and epoxy resins and adhesives should undergo a medical examination before starting work and subsequent periodical medical examinations.

(2) Persons who have not passed a medical examination, or in respect of whom work with lacquers, paints, solvents, adhesives and insulating materials containing asbestos is contra-indicated for health reasons, should not be employed on such work.

13.1.21. As long as the use of dangerous substances cannot be avoided, every effort should be made, by effective control through training, good housekeeping¹ and ventilation, to prevent any risk for young workers and trainees handling such substances.

13.1.22. Persons with open wounds should not handle toxic or corrosive substances without the permission of a physician.

¹ Properly managed, tidy and supervised workplaces, segregation.

13.1.23. Workers exposed to toxic or irritant substances should be informed of the fact and of the symptoms of exposure and should promptly report such symptoms to the medical service, first-aid post or a supervisor.

13.1.24. Workers exposed to toxic or irritant substances should be provided with protective clothing and equipment necessary to prevent danger, in addition to the ordinary working clothes.

13.1.25. Workers exposed to toxic or irritating substances should be given adequate instructions in the precautions to be taken.

Restrictions on use of certain substances

13.1.26. Benzene and substances containing benzene should not be used as solvent or thinner except where the process is carried out in an enclosed system or there are equally safe methods of work.

13.1.27. Dichlorethane, methanol and carbon tetrachloride should not be used as solvents.

13.1.28. Hot surfaces should not be painted with coal tar, ethinol, perchlorinated lacquers and nitrolacquers, or paints prepared from such lacquers.

13.1.29. Pigments containing lead should be mixed or further processed with other lead paints or with substances not containing lead only if the pigments have previously been mixed with oil or varnish.

13.1.30. Red lead in the raw or dry state should be used only for preparing, stopping or filling material.

13.1.31. White lead¹ should not be used or manipulated in the preparation of painters' stopping material except under an

¹ Sulphate of lead.

effective exhaust draught that removes the dust produced at or near its source.

13.1.32. Where national laws or regulations permit the use of organic arsenic or organic mercury in paints, special precautions should be taken in their use, particularly in repair work.

Personal hygiene

13.1.33. (1) Workers should be instructed of the importance of keeping the skin clean to protect it from irritants.

(2) When necessary to protect the skin, workers exposed to toxic or irritating substances should use barrier creams, or should wear gloves or gauntlets.

13.1.34. Adequate washing facilities complying with the requirements of section 24.4. should be provided for persons employed in the painting of vessels and apt to come into contact with toxic substances.

13.1.35. All workers exposed to toxic substances should remove working clothes and thoroughly wash the hands and face before partaking of any food or leaving the work site.

13.1.36. Solvents should not be used for cleaning the skin.

13.1.37. Precautions should be taken to prevent the contamination of street clothes used during working hours.

13.2. General precautions with highly combustible materials

13.2.1. Highly combustible solids and flammable liquids should be stored only in locked store places ashore that are not occupied by persons.

13.2.2. Fire protection measures should be taken at store places for combustible and flammable materials in conformity with the requirements of section 2.5.

13.2.3. Buildings or structures for the storage of flammable liquids in bulk should be—

- (a) enclosed by a watertight wall sufficient to retain all the liquid stored if it accidentally escapes; or
- (b) so constructed that no liquid could escape as the result of a fire or other occurrence.

13.2.4. When not stored in bulk, flammable liquids should be kept at an adequate temperature in containers that are—

- (a) tightly closed;
- (b) fireproof and unbreakable;
- (c) kept away from sparks, flames, sources of heat and the sun's rays; and
- (d) labelled with the relevant danger symbol.

13.2.5. The issue of flammable and highly combustible substances and materials and the filling of containers with them should take place outside the vessel or the dock in places on shore specially appointed for the purpose and equipped in accordance with the requirements of fire protection; this rule is not applicable, however, for small quantities of such materials.

13.2.6. Flammable and highly combustible substances and materials should be issued to workers only in properly closed containers and in quantities not exceeding the requirements of one shift.

13.2.7. (1) Fuel for a temporary heating device should be stored in safe containers.

(2) No such fuel in excess of one day's supply should be stored below deck unless in a fire-resistant compartment.

(3) No fuel should be stored in paths of exit.

13.2.8. There should be no smoking, and no open flame or incandescent material, in dangerous proximity to highly combustible material.

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13.2.9. (1) Out of working hours, containers and appliances containing combustible substances such as cleaning, greasing and lacquering substances and liquid fuel should not be left on berths, staging or vessels.

(2) Any such containers and appliances left at workplaces at mealtime breaks should be supervised by an attendant.

13.2.10. While fuel is being taken on or off vessels, the dangerous area in the proximity of the fuel should be clearly indicated and no hot work should be allowed in that area.

13.2.11. Highly combustible, flammable or volatile materials should not be heated except in a water jacket or the like at a moderate temperature.

13.2.12. When flammable liquids are transferred from one metallic container to another, the two containers should be electrically bonded and earthed so as to prevent danger from static electricity, except for quantities or under conditions which do not involve a hazard.

13.2.13. As soon as containers for flammable liquids are empty they should be cleaned out by steam, hot soapy water or other effective means.

13.2.14. Before piping that has carried flammable liquids is dismantled it should be blown with steam. In certain situations, when dealing with non-volatile oil, inert gas may be used.

13.2.15. (1) Whenever possible no butane or propane should be used inside a vessel.

(2) Butane and propane cylinders and equipment should not be left unattended below deck.

13.2.16. Oily clothes should not be left in confined spaces.

13.2.17. (1) Petrol (gasoline) should not be used for removing grease or other substances from equipment, materials or the body.

(2) Flammable waste materials such as sawdust, greasy rags

and scrap wood should not be allowed to accumulate at workplaces but should be kept in metal containers with self-closing lids.

13.2.18. For discharging static electricity and preventing friction sparks, rubber hose used for washing parts with solvents should have ends made of non-ferrous metal and be earthed by metal tape or other reliable means.

13.3. Spray painting

13.3.1. Spray painting should not be done with any toxic material such as lead, carbon bisulphide, carbon tetrachloride, mercury, antimony, arsenic, arsenic compounds or methanol, or with a mixture containing more than 1 per cent of benzene, unless the workers wear adequate air-line breathing apparatus.

13.3.2. Spray painting of internal surfaces such as those of cisterns, tanks and compartments should be allowed only when—

- (a) air-line breathing apparatus is supplied and used, the air to be pre-warmed if necessary;
- (b) the workers are provided with personal protective equipment; and
- (c) no other work is carried out in the area.

13.3.3. (1) Any place in which spray painting is being done should be ventilated by either natural or mechanical means.

(2) The workers should be so protected by adequate air-line breathing apparatus that the solvent concentration they inhale is kept within safe limits.

13.3.4. A sufficient number of fire extinguishers of the foam or other suitable type should be maintained at the place where any material having a nitro-cellulose or other flammable content is being used.

13.3.5. Workers employed in spray painting should be provided with—

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- (a) overalls, head coverings and gloves; and
- (b) a sufficient quantity of material capable of removing the paint or the spraying mixture from the hands and face.

13.3.6. No person should smoke, or have any fire, naked flame or other source of ignition in any place in which spray painting is being done, or in its vicinity.

13.3.7. (1) All metal parts of equipment and appliances used for spray painting (spraying booths, paint pumps, spray guns, carriages, tables, brackets, solvent drums, etc.) and also metal articles to be spray-painted should be electrically bonded and earthed.

(2) The proper condition of the earthing system, conductors, earthing connections, equipment and appliances should be verified at least once a month.

13.3.8. (1) Painting appliances working under pressure such as oil separators and oil-pump tanks should be equipped with the necessary fittings: valve for reducing the pressure of the air entering the appliance and a tested and sealed pressure gauge.

(2) On the gauge dial should be a red line indicating the maximum permissible working pressure.

(3) Connections in the air hose should be firmly secured so as to prevent them from being impaired by the pressure of the compressed air.

13.3.9. Spray-gun operators should—

- (a) adjust the atomisation pressure of the gun so as not to create excessive mist;
- (b) use the gun so that neither they themselves nor any other workers remain between the gun and any ventilation fan; and
- (c) not test the gun by spraying it indiscriminately about any place.

13.3.10. When the outside of vessels is being spray-painted, including the underwater part, regard should be paid to the direction of the wind (painting downwind).

13.4. Work with unsaturated polyesters

13.4.1. (1) Containers with over 25 litres of organic peroxides should be kept in a special building or room, not containing any other material.

(2) Quantities up to 25 litres should be kept in a closet ventilated by outside air.

(3) The building, room or cupboard should be of fire-resisting construction.

(4) The roof should be of light construction so as to serve as an explosion vent.

(5) The building or room should be kept cool.

13.4.2. (1) Storeplaces for organic peroxides should not be used for any other purpose.

(2) The store and the area round it should be kept clean and free from combustible matter.

(3) Persons should not smoke in the store and in its vicinity, nor in any other place where peroxides are handled or used.

13.4.3. Before beginning work, workers handling polyesters should rub a barrier cream on their hands.

13.4.4. Resins and hardeners (setters) should be prevented from getting into gloves.

13.4.5. Only qualified persons should draw off, measure or weigh organic peroxides or add them to unsaturated polyesters.

13.4.6. Organic peroxides should not be added to hot bases or be drawn off in hot appliances.

13.4.7. Containers and appliances in which organic peroxides are measured should be clean.

13.4.8. Used containers and brushes should be cleaned with warm water and soap, and not with flammable solvents.

13.4.9. Organic peroxides should not be mixed directly with

accelerators; the accelerator should be carefully mixed with the resin before the peroxide is added.

13.4.10. Containers of organic peroxides should be kept closed and protected against dirt.

13.4.11. (1) Containers of organic peroxides should bear a distinctive identification mark or colour.

(2) Unused peroxides should not be returned to a partially full container.

13.4.12. (1) Organic peroxides and polyesters should be stored and mixed only in quantities not exceeding one day's requirements and in buildings or rooms separate from other work-places and built of fire-resisting materials.

(2) In addition—

- (a) only the minimum quantity of peroxides required should be brought from the store into a working area;
- (b) any full or partially used containers should be returned to the store when not in use; and
- (c) empty containers should be removed from the working area and not used as waste receptacles.

13.4.13. (1) Peroxides and polyesters should, as far as practicable, not be spilled on work tables or floors; these should be provided with coverings of paper or the like, which should be changed daily if soiled.

(2) Work tables should be covered with easily washable material such as metal or glass.

13.4.14. Any spilled liquid peroxide should be cleaned up immediately with marl, sand, diatomaceous earth or vermiculite or other incombustible absorbent material, but not with a cloth.

13.4.15. (1) Adequate means of extinguishing fires should be provided.

(2) Water should be used with solid peroxides and sand or powder with liquid peroxides.

13.4.16. (1) Unsaturated polyesters and lacquers based on them should be sprayed only in special booths in which no other material is sprayed.

(2) Effective exhaust ventilation should be applied to the booth so as to produce an inward air velocity of not less than 0.5 m/s (100 ft per minute) at any point of the booth face. Only centrifugal fans should be used to ventilate the booths.

(3) Residues from the booths should be burnt in the open air or kept in closed metal containers.

13.4.17. Waste peroxide absorbed in suitable material should be mixed with suitable combustible material and be burned in small quantities in the open air well away from any building or fire hazard. Alternatively, the charged absorbent should be mixed with sufficient dilute sodium hydroxide solution in a non-combustible container in the open.

13.4.18. Persons drawing off, measuring, weighing or transporting peroxides or adding them to polyesters should wear goggles or face screens.

13.4.19. Water and suitable equipment for rinsing the eyes in case of injury should be kept readily available in a conspicuous place.

13.4.20. Polyester resins should be mixed with peroxides, fillers, pigments, etc., in a place specially set aside for the purpose.

13.4.21. If harmful pigments and fillers such as quartz, asbestos or aluminium powder are used, local exhaust ventilation should be provided.

13.4.22. Escaping styrene vapour should be exhausted as it arises; if necessary, workers should be provided with air-line respirators.

13.4.23. When working with synthetic resins, workers should protect their hands as far as practicable, for instance by wearing rubber gloves outside cotton gloves.

13.4.24. Tools should be cleaned daily by workers wearing

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gloves of rubber or synthetic material as protection against solvents, etc.

13.4.25. Places where polyesters are used should be cleaned daily after the close of work.

13.4.26. Any polyester spilled on the skin should be immediately wiped off with crêpe or tissue paper, but not rags.

13.5. Work with adhesives

13.5.1. Persons working with adhesives containing toxic solvents should—

- (a) have been medically examined; and
- (b) undergo a medical examination periodically.

Personal protection

13.5.2. Workers preparing, issuing or applying adhesives, washing containers and appliances, or scouring adhesive-coated surfaces, should be provided with—

- (a) protective clothing, including a head covering and rubber gloves,
- (b) facilities for washing and taking showers in hot water: and
- (c) if necessary to prevent danger, respiratory protective equipment.

Preparation of adhesives

13.5.3. (1) Adhesives should be prepared in special premises ashore set aside for the purpose and equipped with chambers connected to effective exhaust ventilation.

(2) The preparation process should be mechanical.

13.5.4. (1) Floors of premises for preparing adhesives should—

- (a) be covered with ceramic tiles with the joints sealed;
 - (b) slope; and
 - (c) be provided with drain pipes for carrying off water.
- (2) The walls up to a height of 1.5 m (5 ft) or 2 m (6 ft 6 in) should be faced with tiles or coated with oil paint.

13.5.5. (1) In premises for the preparation of adhesives, flammable volatile solvents should be stored in quantities not exceeding one day's requirements in tightly closed containers kept in metal cupboards or chests.

(2) Resin and oil additives should be kept in hermetically sealed containers stored in chemical cupboards.

13.5.6. Prepared adhesive should be issued to workers only in special pots with lids.

Application of insulation and adhesives

13.5.7. Work in which adhesives are applied should be done in places provided with general ventilation or effective local exhaust ventilation for removing dust, gases and vapours directly from their source.

13.5.8. Insulating material containing asbestos should not be cut with power tools except on special tables equipped with effective local exhaust ventilation.

13.5.9. While insulation is being glued on, or the surface of insulating material is being glued, and afterwards, the place should be thoroughly ventilated to remove airborne toxic and flammable substances.

13.5.10. Processes using phenol-formaldehyde, epoxy resins, polyurethane and other toxic adhesives should include adequate measures for preventing the deposit of adhesive on the exposed parts of the body, workers' clothing, equipment and the floor.

13.5.11. (1) For applying adhesives to large surfaces, special appliances should be used.

(2) When adhesives are applied by hand, brushes with protective washers (discs) placed at the bottom of the sleeve should be used.

13.5.12. Containers and brushes for adhesives should be washed in premises ashore for preparing adhesives, in special cupboards equipped with exhaust ventilation.

13.5.13. In work involving the application of insulation and adhesives, cleaning up should be carried out at regular intervals by using a vacuum cleaning system.

13.6. Removing insulation, paint and other coatings

13.6.1. (1) When insulation, paint or any other coating is removed by harmful substances such as volatile solvents, the workers should wear adequate respiratory protective equipment.

(2) Insulation and paint should not be removed by burning inside the ship.

13.6.2. When old insulation is removed by mechanical or chemical means inside a vessel—

- (a) the insulation should first be vetted;
- (b) there should be effective ventilation; and
- (c) the resulting waste should be disposed of in non-flammable bags whenever appropriate.

13.6.3. When using paint and rust removers containing strong acids or alkalis, suitable protection should be provided for the hands, and against any noxious gas which may be produced.

13.6.4. When steam guns are used on paint—

- (a) workers within range of the blast should be protected by suitable face shields; and
- (b) metal parts of the gun should be insulated to protect the operator against burns.

13.6.5. (1) No lead-painted surface other than that of iron-work or steelwork should be rubbed down or scraped by a dry process.

(2) No lead-painted surface of ironwork or steelwork should be rubbed down or scraped by a dry sandpapering process.

(3) All debris produced by rubbing down or scraping any lead-painted surface should be removed before it becomes dry.

13.6.6. (1) When paint is being sanded by machine, the sandpaper should be wet or the machine should be equipped with an adequate dust collector.

(2) If required the workers should wear adequate respiratory protective equipment.

13.6.7. Workers removing paints, preservatives, rusts or other coatings with power-driven tools, as well as workers in the vicinity, should be protected against eye injury by suitable goggles or face shields or other effective means.

13.6.8. Workers removing hardened preservative coatings in the open air, as well as any other workers exposed to the fumes or dust from the operation, should be protected by adequate respiratory protective equipment.

13.6.9. No flame or heat should be used to remove soft or greasy preservative coatings.

13.6.10. Wooden objects coated with adhesives should be scoured only on premises provided with general ventilation and with local exhaust ventilation at the workplaces.

13.6.11. Dust that has formed when wooden objects coated with preservative have been scoured should not be removed by blowing with compressed air, which would disperse it.

13.6.12. Dust from tables and floors at workplaces where adhesive has been removed by scouring should be cleaned up with vacuum appliances.

13.7. Work with asbestos

13.7.1. (1) Asbestos should not be used when a suitable substitute material is available.

(2) When material containing asbestos is used—

- (a) the material should be kept wet; or
- (b) the process should be carried on under an exhaust draught or in some other equally safe manner designed to ensure that the concentration of airborne asbestos dust entering the work-place is not above the established permissible level; or
- (c) when (a) and (b) are not practicable, approved forms of respirator (fine dust masks) and protective clothing should be provided.

13.7.2. Exhaust equipment is to be inspected once in every seven days, and examined by a competent person once in every 14 months.

13.7.3. When asbestos must be sprayed in vessels—

- (a) machines for shredding and spraying asbestos should be equipped with means of keeping the asbestos wet;
- (b) valves for the water and asbestos supplies should be so interlocked in spraying equipment that the water must be turned on first and the asbestos turned off first;
- (c) the workers should wear positive pressure breathing apparatus;
- (d) all operatives should be given formal training to the standards prescribed by the manufacturer in respect of the spraying technique and dust control procedures; and
- (e) no workers not employed on spraying should be allowed in the vicinity unless they are adequately protected.

13.7.4. No person who has not attained the age of 18 years should be employed in connection with the spraying of asbestos or the stripping of asbestos-based coatings.

13.7.5. Asbestos dust deposited on the floor, ledges, etc., should be kept wet and removed as soon as practicable. Vacuum cleaning equipment or other dustless methods such as wetting before and during sweeping should be used for the purpose, and

where that is impracticable personnel undertaking the cleaning and any other persons in the close vicinity must be provided with protective equipment.

13.7.6. Vacuum cleaning equipment should be regularly maintained and cleaned.

13.7.7. When automatic removal and collection is impracticable, suitable receptacles should be provided. Attention should be given to the following requirements:

- (a) receptacles must be capable of being closed so as to prevent the escape of dust;
- (b) if dust arises from the mouth of the receptacle during use, a dust extraction hood should be provided to prevent the uncontrolled escape of dust into the workplace;
- (c) the supply of receptacles should be sufficient to prevent overfilling and be conveniently available to the workplace; and
- (d) the regular removal of full receptacles and the substitution of empty ones should be arranged.

13.7.8. (1) Before being removed, overalls, caps and shoes should be cleaned by a vacuum cleaner or by other appropriate means.

(2) Blowing clean is not an appropriate means of complying with the requirements of subparagraph (1).

(3) After removal, the articles referred to in subparagraph (1) should be stored in a dust-tight container such as a tape-sealed plastic bag.

13.7.9. (1) The employer is responsible for the maintenance and laundering of protective clothing.

(2) For laundering the clothing should be packed in plastic bags marked "Asbestos-contaminated clothing" in bold letters.

13.7.10. (1) Outdoor clothing should be stored in a clean room where asbestos dust cannot penetrate.

(2) Facilities should be provided to enable the workers to wash.

13.8. Work with man-made mineral fibres

13.8.1. Workers engaged on insulation work with man-made mineral fibres that include glass wool, rock wool and slag wool but do not include asbestos should be provided with the appropriate protective equipment such as appropriate gloves, working clothing, goggles and simple dust respirators.

13.8.2. As far as practicable insulation work with mats and slabs of man-made mineral fibre should be done—

- (a) on sections before they are bound up; and
- (b) at a distance from other work.

13.8.3. Mats of man-made mineral fibre used for insulating places on board should be wrapped in impervious material when being transported to workplaces.

13.8.4. Proper facilities for changing to or from and regular cleaning of working clothing should be provided by the employer.

13.9. Radio and radar radiations

13.9.1. On, inside or around equipment and masts, the area in which a radiation intensity constituting a health hazard may occur should be specially marked at the appropriate places.

13.9.2. (1) The areas mentioned in paragraph 13.9.1 should not be entered during operation of the radar equipment.

(2) However, in case of need or for urgent reasons connected with the operation of the equipment such areas may be entered provided that—

- (a) the work is supervised by a specially trained person and carried out by experienced workers;
- (b) the workers are constantly instructed concerning the possible dangers and the protective and precautionary measures to be applied;

- (c) the necessary protective clothing is placed at the disposal of the workers; and
- (d) the transmitter power is constantly checked during the work.

13.9.3. On leaving areas in which they have been accidentally exposed to radar radiation that constitutes a health hazard, workers should immediately undergo a medical examination.

13.9.4. Radar equipment should be tested only when no work is being carried out on the masts and all persons are at a safe distance, having regard to the nature and power of the radar equipment.

13.9.5. For ionising radiations that may be emitted in radar installations from high-voltage and high-power tubes or from radioactive materials in special tubes, the requirements of paragraphs 13.10.1 to 13.10.3 should apply.

13.10. Ionising radiations

13.10.1. (1) No equipment emitting ionising radiations should be used unless a special licence has been obtained from the competent authority.

(2) The equipment should be checked by competent persons at regular intervals.

(3) The form of licensing and the intervals between these regular checks should comply with the national laws and regulations.

13.10.2. No equipment emitting ionising radiations should be operated unless—

- (a) the use of the equipment is supervised by a person specially trained in radiation protection; and
- (b) the workers have been instructed, before starting work, on the working methods, the possible dangers and the protective and precautionary measures to be applied; the instruction should be repeated at regular intervals.

13.10.3. All radiation protection measures such as those relating to maximum permissible radiation levels, monitoring, surveillance, medical examination and minimum age should comply with the relevant requirements of the national laws and regulations and, in so far as the latter do not apply, with the relevant provisions of the Radiation Protection Convention, 1960, and the Radiation Protection Recommendation, 1960, adopted by the International Labour Organisation, as well as the relevant provisions of the *Model code of safety regulations (ionising radiations)*¹ published by the International Labour Office.

¹ ILO: *Manual of industrial radiation protection*, Part II: *Model code of safety regulations (ionising radiations)* (Geneva, 1959).

14. Welding, flame cutting and other hot work

14.1. General

14.1.1. No welding should be done on board a vessel except on the orders of a competent supervisor.

14.1.2. Before any local heating, welding or flame cutting or other hot work is begun at a place it should be ascertained that the place and the surfaces (inside and outside) to be treated are free from flammable substances, including gases, coatings and materials.

14.1.3. No welding should be done on surfaces covered with greasy, oily or other flammable or combustible substances.

14.1.4. (1) If necessary to prevent danger when hot work is being done, a fire watchman should be appointed at the workplace.

(2) Fire watchmen should remain at the workplace for the entire duration of the work and, if necessary, for a certain period thereafter.

14.1.5. Where reasonably practicable, the paint should be removed over a width of at least 20 cm (8 in), i.e. 10 cm (4 in) on each side of the cut or the seam to be made.

14.1.6. If necessary to prevent danger from the opposite side of surfaces that are being heated, a watch should be kept to prevent anyone with highly combustible substances from approaching.

14.1.7. (1) Heating of surfaces with charcoal or gas in isolated or congested spaces should be allowed only if an exhaust ventilation system is provided that will maintain the atmospheric concentration of toxic gases or other toxic substances generated by the process at a level below the relevant permissible limits and that will carry the dangerous airborne substances to the outside air.

(2) Where that is not practicable, the operator should be equipped with an adequate air-line breathing apparatus.

14.1.8. (1) When welding, cutting or heating is being done on materials containing lead, cadmium, beryllium, copper or other toxic or harmful substances, precautions should be taken to protect workers from the fumes by—

- (a) providing effective local exhaust ventilation; or
- (b) by providing the workers with air-line respirators.

(2) In addition—

- (a) the fume concentration of the working environment should be assessed; and
- (b) the workers should undergo special medical examinations.

14.1.9. At places where welding machines are operated by internal combustion engines, adequate ventilation should be provided.

14.1.10. Adequate precautions should be taken to protect persons working or passing near welding operations from dangerous sparks and radiation.

14.1.11. A suitable fire extinguisher should be kept ready for immediate use at a reasonable distance from any place where hot work is done.

14.1.12. Forges should not be placed in peak tanks, fuel tanks, chain lockers, or cargo spaces between decks, or under raised decks.

14.1.13. Floors of places at which welding is being done should be kept free from pools of water.

14.1.14. In no circumstances should oxygen be used to ventilate, cool or blow dust off clothing.

14.1.15. Welders should wear suitable protective clothing and equipment such as fire-resistant gauntlets and aprons, helmets and goggles with suitable filter lenses.

14.1.16. Welders should wear clothing that is free from grease, oil and other flammable material.

14.1.17. Workers engaged in the removal of excess metal or slag or in other similar operations should—

- (a) wear gloves and goggles or a face screen;
- (b) chip away from the body; and
- (c) ensure that other persons are not struck by chips.

Welding at places with fire risks

14.1.18. (1) As far as practicable, objects to be welded, cut by flame or heated should be taken to a place free from fire risks.

(2) If the object cannot be taken to a safe place, all combustible cargo, combustible waste and other combustible material should be moved to a safe distance.

(3) If the measures referred to in (1) and (2) cannot be taken, precautions should be taken to prevent the dispersion of slag, sparks and heat and to protect combustible material in the vicinity by effective means.

(4) The work should be authorised by a competent person.

14.1.19. When welding, flame cutting or heating is done on tank shells, decks, overheads or bulkheads, the precautions referred to in paragraph 14.1.18 (2) and (3) should also be taken on the other side of the structure in question.

14.1.20. Before any welding, cutting or heating is done on any surface covered with a preservative coating of unknown flammability, the flammability should be tested by a competent person.

14.1.21. While surfaces that have been covered by highly flammable preservative coatings are being heated, suitable fire-extinguishing equipment such as a hose should be kept ready for use at the workplace.

Heating in confined spaces

14.1.22. Welding, cutting and heating operations in confined spaces should comply with the relevant requirements of Chapter 15.

Welding on containers for explosives or flammable substances

14.1.23. Welding or cutting operations on containers in which there are explosive or flammable substances should not be allowed.

14.1.24. (1) Welding or cutting operations on any container that has held explosive or flammable substances, or in which flammable gases may have been generated, should be undertaken only after—

(a) the container has been—

(i) thoroughly cleansed by steam or other effective means; and

(ii) found by air tests to be completely free from combustible gases and vapours; or

(b) an inert gas has been substituted for the air in the container.

(2) If an inert gas is used for this purpose, after the container has been filled the gas should be allowed to continue to flow slowly into it throughout the welding or cutting operation.

14.1.25. Before starting any welding operations on, or otherwise applying heat to, closed or jacketed containers or other hollow parts, such containers or parts should be adequately vented in a suitable manner, to ensure the release of any pressure built up during the application of heat.

14.1.26. Before any welding, cutting or heating is done on hollow structures such as skegs, bilge keels, fairwaters, masts, booms, stanchions or railings, a competent person should inspect the structure, and if necessary test it, for flammable liquids and vapours, and certify it as safe for the work to be done.

14.2. Gas welding and cutting

General

14.2.1. The oxygen pressure for welding should always be high enough to prevent acetylene from flowing back into the oxygen line.

14.2.2. Acetylene should not be used for welding at a pressure exceeding 1 atm. gauge.

14.2.3. At the close of work for the day and before any lengthier interruption of work on board—

- (a) supply valves of cylinders, acetylene generators and gas mains should be securely closed; and
- (b) blowpipes and movable pipes or hoses for flammable or oxidising gas should be taken to the topmost completed deck or to another safe place that is adequately ventilated and supervised to prevent any dangerous concentration of gas or fumes, unless adequate testing for explosive concentrations of gas or oxygen is made by a competent person before torches are re-lighted.

Acetylene generators

14.2.4. Acetylene generators should comply with the requirements of section 11.6.

Gas cylinders

14.2.5. Loaded and empty gas cylinders should be kept in separate places.

14.2.6. Empty gas cylinders should be marked to show that they are empty.

14.2.7. Inside buildings oxygen cylinders should not be stored near acetylene cylinders or near cylinders filled with other fuel gases.

14.2.8. Welders should not tamper with or attempt to repair safety devices and valves on gas cylinders.

14.2.9. When acetylene cylinders are coupled, flash arrestors should be inserted between the cylinder and the coupler block, or between the coupler block and the regulator.

14.2.10. Only acetylene cylinders of approximately equal pressure should be coupled.

14.2.11. Gas should not be taken from a cylinder unless a pressure-reducing regulator has been attached to the valve.

14.2.12. Only the right pressure-reducing regulator should be used for the gas in the cylinder.

14.2.13. Cylinder valves, pressure-reducing valves and torches should be kept free from grease, oil dust and dirt.

14.2.14. Cylinders found to have leaks that cannot be stopped by closing the valve should be taken into the open away from any source of heat and slowly drained of gas.

14.2.15. Cylinders should not be lifted by magnets.

Manifolds

14.2.16. Manifolds should be clearly marked to show the substance that they contain.

14.2.17. Manifolds should be placed only in safe and accessible positions in the open air.

14.2.18. (1) Manifold hose connections, including inlet and outlet connections, should be such that the hose cannot be interchanged between fuel gases and oxygen manifolds and headers.

(2) Adaptors should not be used to permit the interchange of hose.

(3) Connections should be kept free from grease and oil.

14.2.19. Nothing should be placed on a manifold that might damage it or impede quick closing of the valves.

Hose

14.2.20. Only hose specially designed for welding and cutting operations should be used to connect an oxy-acetylene torch to gas outlets.

14.2.21. An efficient back pressure valve and flame arrestor should be provided in the acetylene supply line between each burner or blowpipe and the source of supply as near as practicable to the burner or blowpipe.

14.2.22. Hose lines for oxygen and for acetylene should be of different colours, or otherwise equally clearly and appropriately identified.

14.2.23. Hose connections should be sufficiently tight to withstand without leakage a pressure twice the maximum delivery pressure of the pressure regulators in the system.

14.2.24. (1) Care should be taken that hoses are always laid in good order so as not to become kinked or tangled or be stepped on, run over or otherwise damaged.

(2) Hoses laid in passageways should be completely protected with covers.

(3) Hangers should be provided on board the vessel to hang the hoses.

14.2.25. Any length of hose in which a flashback has occurred should be discarded, unless found acceptable according to national standards after testing.

14.2.26. No hose with more than one gas passage should be used.

14.2.27. Only soapy water should be used for testing hose for leaks.

14.2.28. Compressed air should not be used to clean any hose that may contain oil residues from the compressor.¹

14.2.29. (1) Open-end fuel-gas and oxygen hoses should be removed from confined spaces as soon as they are disconnected from the torch.

(2) The connections between hose and torch and between hoses should be securely fixed with metal fittings such as hose bands.

(3) Valves or cocks at the gas and oxygen inlet of hoses should have identification numbers of users.

¹ An inert gas may be used for this purpose.

(4) All hoses should be inspected at least every four months by competent persons.

(5) Any repairs should be done by a competent person.

Blowpipes (torches)

14.2.30. (1) Blowpipes should be inspected at the beginning of each shift for leaking shut-off valves, hose couplings and tip connections.

(2) Defective blowpipes should not be used.

14.2.31. Clogged blowpipe-tip openings should be cleaned with suitable appliances designed for the purpose.

14.2.32. When blowpipes are being changed the gases should be shut off at the pressure-reducing regulators and not by crimping hose.

14.2.33. (1) Blowpipes should be lit with friction lighters, stationary pilot flames or by other safe means.

(2) Blowpipes should not be lit with matches.

14.2.34. The operating valves of blowpipes should be so constructed or protected that they cannot be opened accidentally.

14.2.35. (1) All blowpipes should be inspected at least every four months by competent persons.

(2) Any repairs should be done by a competent person.

14.3. Electric arc welding

Equipment

14.3.1. (1) A welding machine should be controlled by a switch mounted on or near the machine framework.

(2) When opened, the switch should immediately cut off the power from all conductors supplying the machine.

14.3.2. Welding circuits should be supplied only through

generating or converting equipment or a double-wound transformer.

14.3.3. The maximum open-circuit no-load voltage should be in accordance with national or international codes or standards.

14.3.4. Return conductors should be taken directly to the work and securely connected mechanically and electrically to it or to the work bench, floor, etc., and to an adjacent metallic object.

14.3.5. Cables should be supported so as not to create dangerous obstructions.

14.3.6. In arc welding or cutting machines the motor generators, rectifiers, transformers and all current-carrying parts should be protected against accidental contact with uninsulated live parts.

14.3.7. Ventilating slots in transformer enclosures should be so designed that no live part is accessible through any slot.

14.3.8. Metal frames of arc-welding machines should be effectively earthed.

14.3.9. Only heavy-duty cable with unbroken insulation should be used.

14.3.10. Circuit connections should be waterproof.

14.3.11. When lengths of cable have to be joined, only insulated connectors should be used, on both the earth line and the electrode holder line.

14.3.12. Connections to welding terminals should be made at distribution boxes, socket outlets, etc., by bolted joints.

14.3.13. Welding terminals should be adequately protected against accidental contact by enclosures, covers or other effective means.

14.3.14. Electrode holders should—

- (a) have adequate current capacity; and
- (b) be adequately insulated to prevent shock, short-circuiting or flashovers.

Protective clothing and equipment

14.3.15. (1) Welders should be supplied with and wear garments of leather or equivalent material, and should avoid wearing highly flammable clothing such as untreated cotton or greasy garments.

(2) Protective clothing should cover as much of the skin as practicable.

14.3.16. When welding, welders should be protected by a helmet, a head shield or a hand shield made of heat-resisting and electrically insulating material and fitted with a window that will filter infra-red and ultra-violet radiation, as well as visible radiations.

14.3.17. (1) Where persons other than the welders are likely to be exposed to harmful radiations or sparks from electric arc welding, they should be protected by screens or other effective means.

(2) Workers such as crane drivers who cannot be protected from radiations by screens should wear suitable tinted goggles.

14.3.18. Walls and screens of both permanent and temporary protective enclosures should be so painted or otherwise treated as to absorb harmful radiations from the welding equipment and prevent reflection.

14.3.19. Welders should be protected by gloves, sleeves, aprons, leggings and spats against burns from metal splashes and electrode stubs.

14.3.20. When sheathed electrodes are used, the welders should be protected by goggles against eye injuries from flying fragments of sheaths, and should also have ear protectors at their disposal.

14.3.21. Workers using pneumatic hammers or chisels to remove slag from welds should wear suitable goggles.

Operations

14.3.22. When arc welding is done in damp or otherwise conductive confined spaces—

- (a) the electrode holders should be completely insulated; and
- (b) the welding machine should be either—
 - (i) outside the confined space; or
 - (ii) equipped with a voltage-reducing device in the case of arc welding with alternating current.

14.3.23. Adequate precautions should be taken to prevent—

- (a) damage to fibre ropes from heat, sparks, slag or hot metal;
- (b) fires started by sparks, slag or hot metal; and
- (c) flammable vapours and substances from entering the working area.

14.3.24. Electric arc welders should not stand on wet ground or have wet hands or gloves.

14.3.25. Welders should take adequate precautions to prevent—

- (a) any part of their body from completing an electric circuit;
- (b) any part of their body from coming into contact with the exposed part of the electrode or electrode holder when they are in contact with metal; and
- (c) wet or damaged clothing, gloves and boots from touching any live part.

14.3.26. Welding circuits should have identification numbers of users when in use and should be switched off when not in use.

14.3.27. Electrodes should be inserted in the holder only with a means of insulation such as insulating gloves.

14.3.28. Electrode and return leads should be adequately protected against damage.

14.3.29. Live parts of electrode holders should be inaccessible when they are not in use.

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14.3.30. Live parts of electrode holders should not be allowed to come into contact with metallic objects when not in use.

14.3.31. Whenever necessary, electrode stubs should be deposited in a fire-resistant container.

14.3.32. Electric arc welding equipment should not be left unattended with the current switched on.

14.3.33. When chlorinated solvents are used—

- (a) they should be kept at a safe distance from the electric arc; and
- (b) surfaces treated with them should be steamed or thoroughly dried or otherwise freed from them before any welding is done on the surfaces.

14.4. Forges, rivets and riveting

14.4.1. As far as practicable, forges and rivet fires should be placed in the open air.

14.4.2. For work on slipways portable fires should not be placed in closed compartments.

14.4.3. Portable fires placed on wooden floors, decks or scaffolding should stand on a metal base and be protected against the wind.

14.4.4. When forges and rivet fires are used on board—

- (a) pails of water or other suitable means of extinguishing fires should be provided by them;
- (b) the fires should be extinguished at the close of work; and
- (c) the place should be inspected after the close of work by a competent person.

14.4.5. In closed spaces on board the use of open forge and rivet fires should as a rule not be allowed.

14.4.6. If forges and rivet fires are used below the weather deck precautions should be taken to evacuate the smoke to a safe place in the open air.

14.4.7. In closed spaces, hot rivets should be taken to the workplace from hand to hand if the work is all done on the same level, or through a metal chute or tube having at the delivery end a box or bucket attached or placed underneath and a funnel at the dispatching end.

14.4.8. (1) Unused or unusable rivets should be passed from hand to hand in pincers and collected in portable metal boxes.

(2) Throwing rivets from the workplace to the heater or throwing them away should be prohibited.

15. Work in confined spaces and dangerous atmospheres

15.1. General

15.1.1. Harmful atmospheric contaminants such as dusts, fibres, fumes, gases and mists should as far as practicable be rendered harmless at or near their point of origin by removal, suppression or other effective means.

15.1.2. When harmful atmospheric contaminants cannot be rendered harmless, workers exposed to them should be provided with respiratory protective equipment complying with the relevant requirements of Chapter 24.

15.1.3. Where necessary to prevent danger the atmosphere of workplaces should be tested for harmful contaminants at suitable intervals by a competent person.

15.1.4. A record should be kept of all atmospheric tests and inspections, showing—

- (a) the date, time, nature and results; and
- (b) any instructions given by the inspecting person after the inspection or test.

15.1.5. Only persons who have undergone a suitable medical examination may be employed in confined spaces.

15.1.6. When any person is to be employed on board in a confined space that may become dangerous—

- (a) two sets of suitable breathing apparatus should be kept on the vessel;
- (b) two additional sets of suitable breathing apparatus should be kept readily available off the vessel;
- (c) a flameproof lamp or torch should be kept with each set of breathing apparatus;
- (d) two safety belts and life lines should be kept readily available; and

(e) a competent person should continuously supervise the work.

15.1.7. (1) No person should enter confined spaces in which toxic, inert, asphyxiating, flammable or other dangerous gases may accumulate, or oxygen may be deficient, such as—

- (a) cargo spaces or other spaces containing or having last contained combustible or flammable liquids or gases in bulk;
- (b) cargo spaces or other spaces containing or having last contained bulk liquid or gas cargoes of a poisonous, corrosive or irritant nature;
- (c) spaces in tankers immediately above or adjacent to the spaces referred to in (a) and (b) above; and
- (d) spaces that have been fumigated.

(2) In exceptional cases, a person may enter these spaces provided that—

- (a) (i) the atmosphere has been tested and found safe by a competent person; and
(ii) an entry certificate has been issued by the competent person; or
- (b) (i) the person entering is wearing suitable respiratory protective equipment such as self-contained breathing apparatus or an air-line breathing apparatus; and
(ii) a competent person continuously supervises the work.

15.1.8. Before any work is done in a tank or other confined space—

- (a) all piping entering the tank or space should be disconnected or blanked off;
- (b) any moving machine parts should be stopped and prevented from starting up;
- (c) all manhole lids and other covers should be removed; and
- (d) if necessary to prevent danger, ladders, staging or platforms should be provided.

15.1.9. Before anyone enters cofferdams, peaks, water

tanks, coal bunkers, and oil or other tanks or spaces where there may be a deficiency of oxygen—

- (a) the spaces should have been well ventilated either by having fresh air blown through or by being filled with water and then emptied; and
- (b) if necessary they should be tested to ascertain whether the oxygen content is adequate so that persons may remain in them without risk.

15.1.10. The following precautions should be taken in enclosed spaces—

- (a) where flammable gases or vapours can cause danger of fire or explosion:
 - (i) there should be no lighting or other electrical equipment that is not flameproof;
 - (ii) there should be no equipment or footwear or other articles that are apt to produce sparks;
 - (iii) there should be no open fire or flame;
 - (iv) there should be adequate ventilation; and
 - (v) no person should smoke or carry matches; and
- (b) where dust can cause an explosion:
 - (i) there should be no lighting or other electrical apparatus that is not dust-tight;
 - (ii) in addition to adequate general ventilation, suitable local exhaust ventilation should be provided so far as is practicable to minimise the escape of dust produced by the process;
 - (iii) the associated dust collector (filter boxes) should be situated in the open and be provided with explosion relief arrangements as necessary;
 - (iv) to avoid the risk of a secondary explosion, dust should not be allowed to accumulate within the enclosed space;
 - (v) there should be no equipment or footwear or other articles that are apt to produce sparks;

- (vi) there should be no open fire or flame; and
- (vii) no person should be allowed to smoke or carry matches.

15.1.11. Tanks, spaces and piping should be cooled to a reasonable working temperature before gas tests are made.

15.1.12. If a vessel has been laid up after an entry or a hot work certificate has been issued, no one should go into a tank or a space or use open fire in, on or near a tank, space or piping before a new certificate has been issued.

15.1.13. When cleaning work is being carried on in a tank or space that has contained corrosive liquids, or is being cleaned with such liquids, or contains sludge or deposits from petrol with lead additives, workers should wear suitable protective clothing.

15.1.14. Air cleaning equipment should be so placed that—

- (a) collected contaminants can be removed from it without causing danger; and
- (b) it can be serviced and repaired without causing danger by recontamination of the atmosphere.

15.1.15. Atmospheric contaminants removed by exhaust systems should not be discharged so that they can recontaminate the atmosphere of workplaces.

15.1.16. Compressed oxygen should in no circumstances be used to ventilate any confined space in a vessel.

15.1.17. Gas cylinders should not be brought into confined spaces.

15.1.18. For working in or inspecting spaces such as double bottoms and closed peaks—

- (a) at least two persons should be appointed to work together;
- (b) an attendant should be stationed at the manhole or other entrance;
- (c) portable electric lamps at a voltage not exceeding safety extra-low voltage should be used; and

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(d) if necessary to prevent danger, respiratory protective equipment should be worn.

15.1.19. In spaces where harmful lacquers or paints have been applied, or where lacquers or paints have been removed with harmful or flammable solvents, no subsequent work should be allowed until the space has been thoroughly ventilated and the air tested and found to be safe.

15.1.20. Work in narrow and congested spaces should be so organised that workers of different trades are not employed together, except in cases when different types of work must be co-ordinated.

15.1.21. Before testing compartments of the vessel or isolated structures by flushing with water or oil or blowing air, the management should make sure that no workers are in the compartments or structures, and the manholes should then be closed.

15.1.22. Before testing fuel compartments with warm oil, precautions against fire should be taken.

15.1.23. At the first signs of poisoning, workers in confined spaces should immediately inform a supervisor and report to the first-aid or medical service.

15.1.24. The checking system referred to in paragraph 1.2.10 should be applied as appropriate.

15.1.25. Manholes should measure not less than 40 × 35 cm (16 × 14 in) if elliptical and 40 cm (1 ft 4 in) across if circular.

Work without respiratory protective equipment

15.1.26. Work being done in confined spaces should be done without respiratory protective equipment only if—

- (a) adequate ventilation is provided;
- (b) the atmosphere is tested at suitable intervals;
- (c) adequate arrangements are made to ensure the prompt and

safe evacuation of persons who are taken ill or lose consciousness;

- (d) large spaces have two separate means of access and egress;
- (e) all lids and other closing devices of manhole and other openings of the confined space have been removed;
- (f) the ventilation equipment is supervised so that it cannot be switched off or interfered with by persons not specially authorised to do so; and
- (g) so long as any worker is in the confined space, a competent person exercises general supervision over the operation and in particular maintains communication with the worker and ensures that the ventilation is adequate and that rest pauses are taken.

Painting, coating, etc.

15.1.27. If freshly painted confined spaces are left open, notices should be posted at the entrances prohibiting workers from entering unless authorised by a competent person.

15.1.28. No paint dissolved in highly flammable solvents should be used in any confined spaces unless—

- (a) all electrical equipment, including lighting and ventilating equipment, is flameproof;
- (b) measures have been taken to draw off static electricity; and
- (c) the vapours or gases are discharged outside the space at a safe distance from any source of ignition or deck opening.

15.1.29. In closed and congested spaces the use of coal tar lacquers and of lead-based and other painting materials containing harmful or volatile toxic substances should be allowed only if—

- (a) brushes or rollers are used;
- (b) spray painting is done in conformity with the requirements of section 13.3;
- (c) there is effective ventilation ensuring that the concentration of harmful substances in the atmosphere will be kept below the maximum permissible levels; and

- (d) the workers are equipped with respiratory protective equipment whenever it is impracticable to ensure the observance of those levels.

Hot work

15.1.30. (1) In enclosed spaces all toxic preservative coatings should be removed from surfaces on which hot work is to be done.

(2) If the toxic coatings cannot be removed the worker should wear air-line breathing apparatus complying with the relevant requirements of Chapter 23.

15.1.31. When gas welding or cutting is done in confined spaces—

- (a) the gases should be supplied from a safe place outside the space;
- (b) it should be possible to cut off the supply of gases from a point outside the space;
- (c) no blowpipe should be left unattended inside the tank or vessel or other confined space during meals or other interruptions of the work; blowpipes and gas hoses should be removed from the space at the end of the day's work;
- (d) the workers should take all necessary precautions to prevent unburned combustible gas or oxygen from escaping inside the tank or vessel or other confined space;
- (e) when necessary, an attendant should watch the welder or welders from outside; and
- (f) fire-proof protective clothing should be worn.

15.1.32. (1) Before any hot work is done in enclosed spaces on metals that have been covered by soft and greasy preservative coatings—

- (a) a hot work certificate should be obtained; and
- (b) (i) the preservative coatings should have been removed over a sufficient area to prevent overheating of the surface; or

(ii) the surface should be cooled.

(2) While the work is in progress, a competent person should make frequent tests for flammable vapours.

(3) If flammable vapours are found by the tests the work should stop and not be resumed until a fresh hot work certificate has been obtained.

15.1.33. When hot riveting of structural steel is to be done in a confined space—

- (a) the steel surfaces in the area of operations should be free of any compound containing lead or any other substance that could liberate toxic fumes when heated; and
- (b) adequate ventilation should be provided to prevent the accumulation of fumes.

Ships' oil tanks

15.1.34. Work on, or affecting the safety of, vessels' oil tanks should comply with the requirements of Chapter 16.

16. Work on or affecting vessels' oil tanks

16.1. General

16.1.1. (1) As far as practicable, tanks that are to be cleaned or repaired should be degassed at a safe place before the vessel arrives at the berth for such cleaning or repairs.

(2) Vessels that are entering docks for cleaning or other work on oil tanks should comply with the relevant requirements of section 19.2.

16.1.2. Oil tanks of vessels should be cleaned only when the vessel is at a place where oil residues can be safely disposed of.

16.1.3. Oil tanks of vessels should be cleaned and repaired only under the direct supervision of a suitably qualified person such as an engineer, a supervisor or a ship's officer.

16.1.4. (1) The precautions to be taken in cleaning and repairing oil tanks should be known to all persons employed in those operations and to the vessel's crew.

(2) The vessel's officers should ensure that the crew observe the precautions laid down.

16.1.5. As far as practicable, vessels should be earthed in a reliable manner before work on oil tanks begins.

16.1.6. Gas cylinders should not be taken into oil tanks.

16.1.7. There should be no smoking on board during work on vessels with oil cargo tanks, except at the appointed places on the vessels.

16.1.8. (1) Covers of tanks should be opened carefully so as to avoid any sparking.

(2) If covers have to be struck to move, only non-sparking tools should be used.

16.1.9. A concentration of flammable gas should be considered dangerous if it is above 5 per cent of the concentration constituting the lower explosive or ignition limit.

Cleaning

16.1.10. (1) Before an oil tank on board a vessel is tested for the purpose of issuing a hot work certificate it should be cleaned and ventilated.

(2) The oil tank should be cleaned in such a way that—

(a) all volatile oil is vaporised; and

(b) all residual oil, sludge and other deposit is removed.

(3) After the oil tank has been cleaned—

(a) all covers should be removed from manholes and other openings;

(b) the tank should be so ventilated as to remove all oil vapour; and

(c) any remaining deposit should be washed or scraped off the interior surfaces.

16.1.11. As far as practicable oil tanks should not be cleaned manually but by spraying with hot water or chemical solutions, using washing machines, steam, or other effective methods.

16.1.12. (1) Volatile oils should not be used for cleaning tanks, spaces or piping.

(2) If the temperature in a tank is under 15°C (59°F), petroleum and similar substances with a flash point over 40°C (105°F) may be used, provided that their residue is thoroughly dried and that the tank is thoroughly ventilated afterwards.

(3) If toxic cleaning materials such as trichlorethylene are used—

(a) steps should be taken to ensure that the residue is completely removed even in recesses and deposits; and

(b) sufficient ventilation should be provided to prevent the accumulation of harmful concentrations of vapours.

16.1.13. Valves, pumps, filters and other fittings connected to piping, as well as heating coils in tanks or other enclosed spaces, should be steamed out, washed out with water or cleaned in some other effective manner.

16.1.14. Tanks and other enclosed spaces and piping that have contained benzene should, if the temperature is below the liquid's freezing point (about 6°C), be thoroughly cleared of frozen benzene by steaming or washing out with hot water, or with diesel oil or a similar non-volatile oil.

16.1.15. Tank washing equipment should—

- (a) not allow steam to pass into the tank;
- (b) not cause sparks;
- (c) have hose and connections electrically bonded together and to the vessel; and
- (d) not include any portable electrical appliances or conductors that are not flameproof.

16.1.16. No unauthorised persons should be allowed on board a vessel while the tanks are being cleaned.

16.1.17. While tanks are being cleaned no other work should be done on adjoining tanks, on deck or between cofferdams.

16.1.18. Other vessels should not approach a vessel whose tanks are being cleaned unless authorised to do so by the competent authority.

Certification

16.1.19. A hot work certificate should be obtained from a competent person before—

- (i) any naked light or flame or heated rivet or other incandescent object;
- (ii) any lamp other than a flameproof lamp;
- (iii) any electrical equipment or conductors other than flameproof equipment or conductors;
- (iv) any spark-producing equipment (such as belts and shafts) or material (including footwear);
- (v) any equipment or material producing static electricity (for instance, synthetic textile clothing and silk); or

(vi) any other source of heat

—is taken into any of the following spaces, or any hot work is done in them:

I. On tankers—

- (a) within cargo tanks that have carried combustible or flammable liquids or gases in bulk, or within spaces adjacent to such tanks and surrounding areas;
- (b) within fuel tanks or surrounding areas;
- (c) on pipelines, heating coils, pumps, fittings and other equipment connected with the cargo and fuel tanks referred to in (a) and (b) above; and
- (d) any other part of the tanker specified by the competent person.

II. On dry-cargo, miscellaneous and passenger vessels—

- (a) within cargo tanks that have carried combustible or flammable liquids or gases in bulk or in surrounding areas;
- (b) in enclosed spaces adjacent to cargo tanks that have carried flammable gases or volatile liquids if the workplace is not more than 7.5 m (25 ft) from the cargo tanks;
- (c) within fuel tanks or in surrounding areas; and
- (d) on pipelines, heating coils, pumps, fittings and other equipment connected to the cargo or fuel tanks referred to in (a), (b) and (c) above.

16.1.20. If after a hot work certificate has been issued doubt arises concerning the extent to which a tank, an enclosed space or a length of piping is free from gas, work should not begin or continue before it has been authorised by the issue of a new certificate.

Entry without certificate

16.1.21. If in exceptional circumstances it is necessary to go into a tank or other enclosed space before a hot work certificate has been issued, the following special precautions should be taken without fail:

- (a) the workers concerned should wear an air-line or self-contained breathing apparatus and a safety belt with a lifeline;
- (b) workers should not wear boots shod with iron or the like that could produce sparks, or clothing apt to produce electrostatic sparks;
- (c) only flameproof lamps should be used for lighting;
- (d) at the entrance of the tank or space there should be an attendant who watches the work; and
- (e) if necessary to prevent danger, there should also be firemen with suitable fire-extinguishing equipment on the spot and a stretcher readily available in the vicinity.

Hot work

16.1.22. When hot work is being done in cargo tanks—

- (a) a sufficient number of suitable fire extinguishers should be kept in readiness;
- (b) at least one of the workers should be familiar with the operation of the extinguishers;
- (c) there should be means of easy access to and egress from the workplaces; and
- (d) the means of access and egress should be kept as clear as practicable;
- (e) an emergency lighting system should be provided;
- (f) in the case of forced ventilation the fresh air inlet should be at a safe distance from the gas outlet from the tank;
- (g) in the case of exhaust ventilation the air discharge outlet should be at a safe distance from the fresh air inlet;
- (h) on the fan motor leads, near the motors, there should be manual means of cutting off the current quickly in the event of a fire; and
- (i) the workers should carry self-contained breathing apparatus for immediate use in emergencies.

16.1.23. In dry-cargo holds for which a hot work certificate is not required under paragraph 16.1.19, no hot work should be

done until a competent person has examined them and found them to be free from flammable liquids, gases and vapours.

16.1.24. Before any hot work is done in engine room and boiler room spaces of any vessel for which a hot work certificate is not required under paragraph 16.1.19 above, or in fuel-tank and engine compartments of boats, the bilges should be inspected and tested by a competent person and found to be free of flammable liquids, gases and vapours.

16.1.25. While any hot work is being done in a confined space—

- (a) pipelines that could carry dangerous substances into the space should be disconnected or blanked off, or other precautions should be taken to prevent any discharge of dangerous substances in the space;
- (b) manhole covers and other closing devices that have been closed should be kept closed; and
- (c) if manhole covers or other closing devices have to be opened or any valves are manipulated so as to cause a potential danger, all workers should be withdrawn from the space and should not return until it has been re-tested and a new hot work certificate has been issued.

16.1.26. (1) In engine and boiler rooms, open fires should not be used outside the fixed fireplaces unless such use is authorised for every separate job by the hot work certificate.

(2) All work involving the use of open fires should be stopped if, and so long as, tanks, spaces and piping opening into or leading to the engine or boiler room are ventilated through that room, and no work should be resumed before the issue of a new hot work certificate.

16.1.27. (1) Before any hot work is done on a weather deck over spaces that are not either free of gas or filled with an inert gas, all valves, closing devices and vents (except those venting up masts) connected to tanks and compartments below that are not gas-free should be closed for the duration of the work.

(2) A hot work certificate should be issued in the case of volatile liquids.

16.1.28. (1) During hot work there should at all times be firemen with suitable fire-extinguishing equipment stationed at the workplace on board and a stretcher readily available in the vicinity.

(2) Access to the place where hot work is being done should as far as practicable be kept free so that if necessary the place can be quickly evacuated.

16.1.29. If a workplace becomes unsafe because of a fire risk—

- (a) all workers should be withdrawn from it;
- (b) a conspicuous notice should be displayed at the workplace indicating the risk of fire; and
- (c) until the place has been made safe the notice should remain and the workers should not return.

16.1.30. Before any hot work is done on any metal covered with a preservative coating, the relevant requirements of section 14.1 should be complied with.

16.1.31. When a vessel or any tank, compartment or other space within it has been certified unsafe for all work or for hot work, the vessel or the spaces in question should be conspicuously signposted accordingly.

16.1.32. If during the course of work in or on the outer surface of any tanker or aircraft carrier—

- (a) any pipe or tank joint is opened or broken; or
- (b) any other risk arises that oil vapour may enter or form in the part of the tanker or aircraft carrier in question

—the work should be suspended and existing entry certificates and hot work certificates in respect of the part in question should be regarded as no longer in force.

16.1.33. If on a vessel other than a tanker or an aircraft

carrier, in the course of work in any oil tank or in any compartment or space adjacent to an oil tank, any pipe or tank joint is opened or broken; or any other risk arises that oil vapour may enter or form in the oil tank or any compartment or other space adjacent to it—

- (a) the work should be suspended; and
- (b) existing entry certificates and hot work certificates in respect of the tanks, compartments and other spaces in question should be regarded as no longer in force.

16.1.34. (1) In any part of a vessel in which oil present is likely to cause fire or an explosion, repairs involving the use of a naked light or flame, a lamp other than a flameproof lamp, or a heated rivet should not be carried on until a hot work certificate has been issued in respect of that part.

(2) When the hot work has been completed, the workplace and its surrounding area, where necessary, should immediately be inspected for possible hidden seats of fire.

Work during the loading, unloading and degasification of oil tanks in ports

16.1.35. (1) While oil tanks are being loaded, unloaded or degassed, precautions should be taken to prevent a fire or an explosion.

(2) In particular—

- (a) all other vessels and floating equipment capable of emitting flames or sparks should be kept at a safe distance;
- (b) all flame arresters should be in place and in working order;
- (c) no hot work should be done and no naked flames or sparks should be produced on board by equipment or tools or otherwise;
- (d) persons on board should not carry matches or lighters or wear nailed footwear;
- (e) no unauthorised persons should be allowed on board;
- (f) all doors, portholes and openings through which there is any

possibility that gas may enter should be closed; in no case should doors be locked;

- (g) there should be no insulation defects in electrical equipment;
- (h) the use of portable electric equipment should be prohibited unless—
 - (i) the compartment over which or within which the equipment is to be used is gas-free, the adjacent compartments are also gas-free, and all openings of tanks or other compartments are closed if not gas-free;
 - (ii) it is intrinsically safe;
 - (iii) it is wholly within a flameproof enclosure or a pressurised container or is a safety torch;
- (i) pumps and fire hoses should be in working order and ready for immediate use;
- (j) the cargo hoses should be adequately protected against damage, leaks and kinks;
- (k) all tank openings except gas-venting outlets should be closed;
- (l) all adequate measures should be taken to prevent the generation and accumulation of static electricity on hoses, in the body or on the surface of oils, and in empty steam-filled tanks;
- (m) all spaces in which gas might accumulate should be adequately ventilated but not by electric fans;
- (n) foam or other suitable fire-extinguishing equipment should be kept in readiness near pipe couplings, deck openings and other places where oil leakages could easily be detected;
- (o) where ships' inert-gas fixed fire-extinguishing systems are allowed by the competent authority, special precautions should be taken to prevent accidents due to oxygen deficiency;
- (p) watchmen should be posted on the quay—
 - (i) to take the necessary action if a leakage occurs; and
 - (ii) to report any leakage to the competent port authority.

16.1.36. If oil leaks from piping used for loading or unloading—

- (a) the loading or unloading operations should be stopped; and
- (b) the necessary repairs should be made with the precautions required for work in flammable or explosive atmospheres.

16.1.37. Upon the completion of unloading, oil residues in the piping should be pumped out with water.

16.1.38. Oil residues from tanks and double bottoms should not be allowed to accumulate on board or in the vicinity of vessels.

16.1.39. As soon as they have discharged their cargo oil tankers should move out of the port to a safe distance.

17. Work on boilers, engines and machinery of vessels

17.1. Boilers

17.1.1. (1) Before the boiler erection framework is installed, the management should inspect the site and verify the solidity of the erection stand and its foundation, and also the proper condition of the entire framework.

(2) Parts of the framework such as uprights and brackets should be free from cracks and fractures, and fastenings such as bolts and screws should be free from worn threads.

17.1.2. The erection framework should be calculated for the load to be imposed on it, firmly and reliably installed on its foundation and tested with a spirit level.

17.1.3. No objects should be placed on stands at erection sites.

17.1.4. The delivery of parts on the stand should keep pace with the progress of erection and should not exceed the requirements of the shift.

17.1.5. When the collector is being installed on the framework no work should be done on portable ladders.

17.1.6. Pipe fitters and other workers whose work involves lying or kneeling on metal should use mats and knee pads of heat-insulating material, and electrically insulating material if they are working with electric machines or appliances.

17.1.7. (1) Pipe fitters expanding pipes should not press with the body against universal joints or pneumatic tools.

(2) Workers employed on the outside of the boiler with a machine with a universal joint should obey the orders of fitters working inside the collector.

17.1.8. (1) While the boiler is being filled with water in preparation for testing, the air valve should remain open.

(2) A cold boiler should only be filled slowly with hot water.

17.1.9. Before a hydraulic test is carried out on a boiler, staging and erection framework should be cleared of all extraneous objects such as boxes, fastenings and tools.

17.1.10. Defects discovered during a hydraulic test should not be remedied while the boiler is under pressure.

17.1.11. (1) On the platform supporting the boiler there should be stops to prevent the boiler from shifting in a longitudinal or a transverse direction.

(2) When installed on the platform, the boiler should be firmly secured.

17.1.12. Before the boiler is placed on the deck, the deck should be cleared of all extraneous objects and put into a safe condition for the operation.

17.1.13. Boiler rooms and foundations should be prepared for the admission of the boiler and cleared of all extraneous objects and materials.

17.1.14. Until the boiler rests on its foundation, all persons should be kept out of the boiler room.

17.1.15. Boilers should not be placed in heavy rain, snow-storms or high winds.

17.1.16. Before the boiler is tested it should be examined inside and outside, and its proper condition and readiness for testing should be verified.

17.1.17. Electric cleaning rods with flexible cables should have a signal cord for switching off the motor from the workplace.

17.1.18. (1) The firebox should be cleared of soot, dirt and oil residues with the dampers closed and the temperature inside the boiler not exceeding 30°C (86°F).

(2) Soot, dirt and oil residues accumulating in the operation of the boiler should be collected and removed to a place specially set aside for the purpose.

17.1.19. Persons working inside boilers should use portable lamps at a safety extra-low voltage for lighting.

17.1.20. (1) Alkaline solutions for lixiviating boilers should be prepared with care.

(2) While the scum is being treated with alkali the boiler room should be suitably ventilated by mechanical means.

(3) Persons lixiviating boilers should wear suitable gloves and other suitable protective equipment.

17.1.21. Before any work is begun in the fire, steam or water spaces of boilers in use—

- (a) the spaces should have cooled sufficiently to make work safe for the workers employed;
- (b) the isolation and shut-off valves connecting the dead boilers with any live boilers on system should be closed, blanked and tagged to indicate that workers are employed inside; where valves are welded instead of bolted, at least two isolation and shut-off valves connecting the dead boiler with the live system should be closed, locked and tagged;
- (c) drain connections to the atmosphere on all the dead inter-connecting systems should be opened; and
- (d) a notice warning that workers are in the boilers should be conspicuously displayed at suitable places.

17.1.22. While work is being carried on in a boiler, firebox floors should be close-planked if they are dangerous because of exposed tubing or gaps in the refractory lining.

17.1.23. Before any work is begun on a valve, fitting or section of piping that has carried steam or hot liquids or gases—

- (a) the isolating and shut-off valves connecting the dead system with any live system should be closed, blanked and tagged to indicate that workers are employed on the dead system; where valves are welded instead of bolted, at least two isolation and shut-off valves connecting the dead system with the live system or systems should be closed, locked and tagged; and
- (b) drain connections to the atmosphere on all the dead inter-connecting systems should be opened.

17.2. Engines and machinery

17.2.1. Before tests at rest and in operation are carried out, the management should check the state of engines, machinery, fittings and piping, and also the corresponding compartments, and satisfy themselves that all the fencing planned for engines and machinery in the compartments in question is in place.

17.2.2. Before any maintenance or repair work is done on a vessel's main engine, reduction gear or connecting accessories—

- (a) the jacking gear should be engaged to prevent the main engine from turning over;
- (b) a notice should be displayed at the throttle to indicate that the jacking gear is engaged;
- (c) if the jacking gear is steam-driven, the stop valves to the gear should be closed, locked and tagged to indicate that workers are employed on the main engine;
- (d) if the jacking gear is electrically driven, the circuit controlling it should be de-energised by tripping the circuit breaker and opening the switch or removing the fuse; the circuit breaker, switch or fuse should be tagged to indicate that workers are employed on the main engine.

17.2.3. Before the jacking engine is operated, it should be ensured that all workers, equipment and tools are clear of the engine, reduction gear and connecting accessories, and of the propeller.

17.2.4. Before any work is done on or in the immediate vicinity of the propeller, a notice warning that workers are employed there should be conspicuously displayed in the engine room.

17.2.5. Before the main engine is turned over, when warming up or testing, for example, it should be ensured that all workers, equipment and tools are clear of the propeller.

17.2.6. (1) Before the shafts and main engines begin to revolve, a thorough examination should be made of the casing,

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bearings, toothed wheels, frame foundations and other structures, and it should be verified that no persons and extraneous objects are in the immediate vicinity of such parts.

(2) Before shafts and main engines begin to revolve, all workers should be warned, and workers should not work in scows or rafts near the propellers without a permit.

17.2.7. Before any work is done on the anchor windlass or any of its attached accessories—

- (a) the devil's claws should be made fast to the anchor chains; and
- (b) the riding pawls should be in the engaged position; or
- (c) in the absence of devil's claws and riding pawls, the anchor chains should be secured to a suitable fixed structure on the vessel.

17.2.8. Warning tags and notices used when workers are employed in boilers or on piping should not be removed until the work is complete, all workers are in a safe place, and permission for removal has been given by a competent person.

17.2.9. Engine and boiler rooms and all other spaces related to the control and operation of ships' engines should be cleared of dirt, rubbish and surplus objects, and persons not taking part in the work should be kept away.

17.2.10. In the cold season workplaces on the floor below the stern should be protected against the wind and weather by tarpaulins or screens.

17.2.11. For hauling the head and blade of the rudder and also the shafts under the stern, inclined staging should be erected.

17.2.12. For securing the bolts fastening the rudder head to the rudder, special flooring with fencing should be provided.

17.2.13. For installation work of short duration on vessels afloat, use may be made of cradles and boatswains' chairs operated by blocks and tackle.

17.2.14. For installation work on the side of a vessel afloat, use may be made of rafts of suitable lifting capacity.

17.2.15. Workplaces and foundations should be prepared to take engines and their accessories and other equipment, and be cleared of extraneous objects, rubbish and dirt.

17.2.16. Before engines, machinery and structures are transported, all fittings and appliances that might fall or hamper the work should be removed from them.

17.2.17. Workers near radar scanners or sirens or blow-off valves should be protected by a permit-to-work system when testing is to be undertaken.

18. Abrasive blasting

18.1. Abrasives

General

18.1.1. No sand or other substance containing free silica should be used for abrasive blasting on board ships.

18.1.2. Used abrasive should not be used again except in closed systems.

18.1.3. (1) Where the blasting process may give rise to flammable dusts such as those of aluminium or zinc, deposits should not be allowed to accumulate to such an extent that they give rise to the risk of secondary dust explosion.

(2) Additionally, all dust separation and collection equipment should be in the open air and where necessary fitted with explosion relief.

Young persons

18.1.4. No person under 18 years of age should be employed—

(a) on abrasive blasting; or

(b) on the cleaning, maintenance or repair of blasting enclosures or appliances, or of ventilating equipment for enclosures.

Clothing and protective equipment

18.1.5. (1) Workers employed on abrasive blasting should be provided with suitable protective clothing, including overalls and gauntlets, and suitable respiratory protective equipment.

(2) When abrasive blasting is done in the open air the foregoing requirements shall apply only if dangerous siliceous material is used.

18.1.6. When abrasive blasting is done in confined spaces the operators should be protected by—

- (a) hoods and air-line breathing apparatus; or
- (b) positive pressure air helmets complying with the relevant requirements of Chapter 23.

18.1.7. Workers employed at places where the atmosphere contains dangerous concentrations of abrasive material should be provided with suitable eye and respiratory protective equipment.

18.1.8. When abrasive blasting is done at places where the operator could fall 2 m (6 ft 6 in) or more he should wear a safety belt and line complying with the relevant requirements of Chapter 23.

Enclosures

18.1.9. Abrasive blasting should, if possible, be done in a blasting enclosure such as a chamber or cabinet.

18.1.10. Abrasive blasting enclosures should be equipped with exhaust ventilation adequate to remove and safely discharge the dust produced in blasting.

18.1.11. Dust extraction equipment should not allow dust to escape into places where workers are employed or pass.

18.1.12. Blasting enclosures should be kept completely closed while blasting is in progress.

18.1.13. The exhaust ventilation should be in operation—

- (a) whenever the blasting enclosure is in use; and
- (b) whenever any worker is in the enclosure for the purpose of maintenance, repair, and similar operations.

18.1.14. Every blasting enclosure should be inspected and tested at suitable intervals, not exceeding one week in the case of inspections and one month in the case of tests.

18.1.15. As far as practicable, vacuum apparatus should be used for cleaning blasting enclosures.

Hoses

18.1.16. Hoses for abrasive blasting should allow static electricity to be safely discharged.

18.1.17. (1) Nozzles should be attached to hoses in such a way that they cannot become detached when in use.

(2) Nozzles should be equipped with means by which—

(a) the operator can control the flow; and

(b) the flow will be automatically cut off if the operator loses control of the hose.

Medical examination

18.1.18. Persons employed on abrasive blasting should undergo a periodic medical examination including a chest radiographic examination.

19. Docks and docking operations

19.1. Docks

General

19.1.1. Wet, dry and floating docks should be provided at approximate places with life-saving equipment such as buoys.

Floating docks

19.1.2. (1) Access to and egress from floating workplaces (vessels) which are lying in or near docks should be so arranged that the means of access and egress cross crane tracks only if there is no danger of their being destroyed.

(2) Access to and egress from floating docks should be possible even when the dock is in the lowest position.

(3) The edges of both floating and dry docks should be provided with railings as required under paragraph 2.7.1.

(4) The steps and passages leading to the docks should be provided on their open sides with railings that meet the requirements of paragraphs 2.7.1 to 2.7.3.

(5) The floors of floating docks should be provided on every side with railings that meet the requirements of paragraphs 2.7.1 to 2.7.3.

19.2. Admission of vessels

19.2.1. (1) When a vessel is entering or leaving a dock, only the persons required for the docking or undocking operation should be on board.

(2) During the docking or undocking operation, the workers should remain on the open deck. The only exceptions to this rule should be the persons required to operate the vessel.

(3) During docking and undocking operations, the dock should be securely closed so that persons not engaged in the operation are not exposed to danger.

(4) Cranes in floating docks should always be secured against any inadvertent movement during docking or undocking operations.

(5) Before docking and undocking of the ship, the stability of the operation should be checked by the dock manager in co-operation with the competent ship's officer.

(6) Before floating the dock, an inspection of the valves and draining openings in the bottom and side of the ship should be carried out to ensure that the openings are closed and properly secured.

Tankers

19.2.2. Tankers that are carrying or have carried volatile liquids as cargo should not enter a dock unless—

- (a) their cargo tanks, spaces and piping have been emptied, cleaned, ventilated, and tested for gas, and
- (b) the master has obtained a certificate from the competent authority or its authorised representative that there is no fire or explosion hazard connected with the vessel.

19.2.3. Tankers that are carrying or have carried non-volatile liquids as cargo should not enter a dock unless—

- (a) they have been tested for gas;
- (b) the master has obtained a certificate in accordance with paragraph 19.2.2 (b);
- (c) the tanks are kept closed.

19.2.4. If because of damage or other special circumstances a full test of the tanker is not practicable before it enters the dock, the precautions to be taken should be determined by the dock or port authorities.

19.2.5. Copies of the certificate referred to in paragraph 19.2.2 (b) should be conspicuously posted on all means of access to the tanker when it has been docked.

19.2.6. Bunker tanks do not need to be emptied for a tanker to enter a dock.

19.3. Work on vessels in dock

19.3.1. Before work begins on a vessel in dock—

- (a) it should be cleared of silt, dirt or ice, and be cleaned;
- (b) the hull should be earthed;
- (c) all engines and machinery should stop working, with the exception of those necessary for operating the essential services of the ship;
- (d) the propellers and the rudder should be blocked;
- (e) the radar, radiotelephone and radiotelegraph installations should be prevented from working; and
- (f) the fire-extinguishing system should be connected to the dock water mains.

19.3.2. (1) Temporary piping, hose or electric cables laid from the shore to the vessel should be supported on ladders, gangways or the like.

(2) Piping, hose and cables should be kept clear of the passageway on gangways.

19.3.3. Goods that are unloaded while the vessel is in dock should not cause any obstructions on the dock.

19.3.4. As far as practicable for protection against the weather, workers on the dock bottom should be provided with—

- (a) in cold weather, removable sheds or the like with portable fires; and
- (b) in rain or snow, coverings on staging.

19.3.5. No fires should be lit, heating appliances installed or hot work done in a dock without the authorisation of the dock management.

19.3.6. Cranes should not operate in a floating dock if there is—

- (a) a list or trim difference; or
- (b) high wind.

19.3.7. When not in use, cranes in floating docks should be taken to the centre line of the dock and firmly secured.

20. Transport of workers by water

20.1. Boats

20.1.1. (1) Boats used to transport workers by water should comply with the requirement of the competent authority.

(2) In particular—

- (a) the boats should be manned by an adequate and experienced crew;
- (b) the maximum number of persons transported should not be greater than safety allows, and this number should be displayed in a conspicuous place;
- (c) suitable and adequate life-saving appliances should be provided and properly placed and maintained; and
- (d) boats carrying more than 12 persons should have a valid certificate issued by the competent authority.

20.1.2. On mechanically propelled ships and boats workers should be adequately protected against falling overboard by bulwarks at least 60 cm (2 ft) or railings at least 75 cm (2 ft 6 in) high.

20.1.3. Motor boats should carry fire extinguishers.

20.1.4. Rowing boats should carry a spare set of oars.

20.2. Landing places

20.2.1. Workers should be embarked and disembarked only at suitable and safe landing places.

20.2.2. Pontoons and landing places should be provided with sufficiently strong and well secured bollards or cleats to which boats can be made fast.

20.2.3. Bridges or gangways leading to pontoons or landing places should be provided with railings complying with the relevant requirements of paragraphs 2.7.1 to 2.7.3.

20.2.4. Steps leading down to pontoons or landing places should, on the land side, be provided with a fixed railing, and on the water side, with a chain railing at least 90 cm (3 ft) high and an intermediate chain that can be unhooked according to the height of the tide.

20.2.5. Pontoons and landing places should be provided with sufficient suitable life-saving appliances.

20.2.6. Pontoons, landing places, bridges, gangways and water steps should be adequately lighted.

20.2.7. Pontoons and landing places that stand high above the water should be provided with suitable ladders.

20.2.8. At conspicuous places there should be notices giving instructions for the resuscitation of drowning persons.

20.3. Rafts

20.3.1. Rafts for work on water should—

- (a) be sufficiently stable, strong and adapted for their purpose; their capacity and buoyancy should be displayed;
- (b) have firm, close-planked floors;
- (c) have railings complying with the requirements of paragraphs 2.7.1 to 2.7.3;
- (d) be securely moored or anchored;
- (e) have appliances for mooring or anchoring;
- (f) have suitable life-saving equipment; and
- (g) not be overloaded.

20.3.2. If trestle scaffolds are used on rafts, adequate precautions should be taken to prevent the overturn of scaffolds or rafts.

21. Moving and launching vessels on slipways

21.1. Lowering and raising vessels

21.1.1. Vessels should be raised and lowered on slipways only in daylight or under adequate artificial lighting.

21.1.2. In a high wind vessels should be raised or lowered only in emergencies and in conditions approved by the management and ensuring safe performance of the work.

21.1.3. Vessels should not be raised in a sheath of ice.

21.1.4. Rail tracks for raising and lowering should be tested for gauge and correctly aligned.

21.1.5. Rail tracks and workplaces in their vicinity should be cleared of dirt, rubbish and extraneous objects.

21.1.6. (1) Before it is raised the vessel should be cleared of cargo, ballast, fuel and explosive and flammable substances.

(2) Compartments and other spaces on board in which there is kerosene, benzene and similar materials should be cleaned, steamed out, ventilated and tested for atmospheric contaminants.

21.1.7. At the beginning of raising and lowering operations, there should be sufficient clearance between the vessel's hull and the staging to ensure free and safe movement of the ship.

21.1.8. Staging, keel blocks, stops, stays and other structures supporting the vessel during raising and lowering operations on the slipway should be removed under competent direction and supervision.

21.1.9. (1) Bolsters on stops such as brackets and channel irons under the hull should be secured to the top of the stops or to the outside edge of the vessel.

(2) Before the stops are driven in, their attachments should be verified.

(3) When stops are being driven into the slipway all unnecessary persons should be kept away.

21.1.10. Before bringing carriages up to the vessel and while they are under the vessel, the reliability of their resistance to lateral displacement and the reliability of the attachment of blocks to the carriages should be tested with winches.

21.1.11. Persons employed in raising and lowering operations should be warned before the carriages begin to move.

21.1.12. When the vessel is being hauled on to the slipway, the extent of the lift of the front and back balancing beams should be controlled.

21.1.13. When electro-hydraulic systems of raising are employed, a manometric relay should be installed.

21.1.14. When the carriages have been positioned, the hydraulic pressure should not be cut off until a special signal has been given and the valve of the oil chamber of the plunger has been opened.

21.1.15. Carriages should only be connected up after all keel blocks, stops and other structures supporting the ship have been collected.

21.1.16. Before the operation begins, winches for lateral movement and all rollers of carriages for lateral movement should be aligned in the direction of the pull.

21.2. Launching

21.2.1. Vessels should be launched only in daylight or under adequate artificial lighting.

21.2.2. (1) If the slipway has to be dried suitable precautions should be taken and a fireman should be posted near by.

(2) Appliances for drying the slipway should have been previously tested and filled with fuel.

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(3) It should be prohibited to use highly flammable liquids such as benzine, or to fill or light appliances near the slipway.

21.2.3. Before the vessel is launched—

- (a) the weather deck should be cleared of rubbish, dirt and extraneous objects;
- (b) there should be a clear and safe passageway along the sides from the bow to the stern and around the mooring bollards and the launching anchor; and
- (c) protective railings should be installed around the deck.

21.2.4. Staging, keel blocks, stops, stays and other structures supporting the vessel on the slipway should be removed only under competent direction and supervision after all trades have finished working.

21.2.5. (1) In the area where staging and other structures supporting the vessel on the slipway are being removed, no other work should be done and no unnecessary persons should be present.

(2) The area should be fenced off or guarded.

21.2.6. The material, staging and other structures dismantled should be removed and stacked.

21.2.7. Keel blocks on the slipway should be so placed that parts of launching equipment cannot catch in them when the vessel moves.

21.2.8. The area around chain stoppers on shore should be fenced off and guarded.

21.2.9. Before the vessel is launched, the management should verify the proper condition of temporary piping and electric cables, staging, slipway, launching equipment and the adjoining area of water, as well as the drag slings and anchor chains.

21.2.10. During launching operations, no authorised persons should be allowed on board.

21.2.11. (1) Between the vessel's hull and the staging there

should be sufficient clearance to ensure free and safe movement of the vessel.

(2) The whole length of the slipway, as well as places in the vicinity, should be cleared of people and extraneous objects.

21.2.12. (1) The administration responsible for the area of water near the slipway should be warned in good time of the launching time and of the establishment of signalling stations.

(2) The area should be protected by signalling equipment and signallers, and be cleared of unnecessary vessels before the launch.

21.2.13. Workboats should be manned only if there is no risk from the launching operations and the associated movement of water.

22. Other work

22.1. Work in mould lofts

22.1.1. As far as practicable mould lofts should—

- (a) have inside walls of a light colour;
- (b) have adequate general lighting free from glare;
- (c) be kept at a comfortable temperature;
- (d) be protected against excessive noise and vibration; and
- (e) if necessary to prevent danger, be equipped with exhaust ventilation.

22.1.2. Suitable lifting and transport appliances should be provided for moving heavy models, frames, blocks, etc.

22.1.3. Models, frames, templates, etc., should have no projecting nails or screws.

22.1.4. Storage racks should be at least 2 m (6 ft 6 in) above floor level.

22.1.5. If adhesives are heated the relevant requirements of section 13.1 should be complied with.

22.1.6. Marking out tables, stands and storage racks should bear a clear indication of the maximum load that they can carry.

22.1.7. Adequate precautions should be taken to prevent heavy material from slipping or falling.

22.1.8. (1) Projection apparatus for photographic methods of marking out should be placed in a closed cabin with incombustible walls and ceiling.

(2) The apparatus should be at such a distance from the walls that safe movement on all sides is possible.

(3) When not in use the cabin should be kept locked.

(4) Precautions should be taken to prevent eye injuries from the arc lamp.

22.2. Installing piping

22.2.1. (1) Pipes should be taken on board in slings on lifting appliances.

(2) They should be properly secured in the slings.

22.2.2. Piping being installed should immediately be secured.

22.2.3. Piping should not be provisionally secured by rope, wire blocks or other makeshift means.

22.2.4. Frozen pipes should be thawed not with blow lamps or open flames but with heated sandbags or by similar safe means.

22.2.5. Valves should not be opened or closed with the help of extraneous appliances not provided for in their design.

22.2.6. No objects should be laid on or hung from pipes.

22.2.7. Only on the orders of the management and under the supervision of a competent person should water, steam and compressed air be admitted to piping for testing purposes.

22.3. Installing lifting appliances

22.3.1. When a crane is being moved or installed with the use of shore or floating cranes, no work should be done on the crane being moved or installed until it has been firmly secured to the deck.

22.3.2. No lifting operations should be carried out with derricks or cranes installed on board unless they have undergone the prescribed tests.

22.3.3. (1) Lifting appliances should be tested in daylight when the visibility is good.

(2) Lifting appliances should not be tested if the vessel has a list.

(3) Measures should be taken to ensure that the vessel is on even keel (no initial list) before any test is carried out on a lifting appliance on board.

22.4. Work with anchors and anchor chains

22.4.1. For hauling and stacking anchor chains, the workers should be provided with suitable hooks.

22.4.2. When anchor chains are being stacked, the anchor locker should be lit with electric light.

22.4.3. (1) All workers should leave the anchor locker before anchor chains are stacked in it.

(2) The entrance to the locker should be closed or guarded and no person should be allowed to enter it when anchor chains are being raised or lowered.

22.4.4. Before persons are sent into the anchor locker the anchor chain should be secured to a stopper on deck.

22.4.5. (1) If the anchor is joined to the anchor chain at the ship's side a raft should be used for the purpose.

(2) Workers should not go under the suspended anchor.

(3) The anchor should be secured by lashing to a firm part of the ship.

22.4.6. Before the testing of main and stern anchors is begun, a responsible supervisor should ascertain that—

(a) there are no workers in the chain locker and that it is closed;

(b) at the side of the place where the anchor is to be dropped there are no persons or extraneous objects;

(c) the windlasses and capstans are in proper working order and will be operated by qualified workers; and

(d) the chain stoppers are in working order.

22.5. Charging batteries of submarines

22.5.1. When batteries are being installed on submarines or when the battery deck is up, no other work should be carried on until the battery deck is in place.

22.5.2. No battery should be charged on board unless—

- (a) the battery ventilating system is in operation and discharging to the open air; or
- (b) the battery compartment is ventilated by a forcing fan on deck so that the gas-laden air is discharged in the open air.

22.5.3. While batteries are being charged—

- (a) the exhaust ventilation system should be tested at suitable intervals for hydrogen;
- (b) if necessary, precautions should be taken to keep the hydrogen concentration in the exhaust system below 3 per cent; and
- (c) sufficient carbon dioxide fire extinguishers should be in each battery compartment.

22.5.4. (1) While batteries are being charged and for a suitable time afterwards—

- (a) the ventilation should be in operation at full power; and
- (b) no open lights or flames or smoking should be allowed in the battery compartment.

(2) The above rules should be conspicuously posted.

22.5.5. No cell should be unsealed unless the ventilation system is in operation.

23. Working clothes and personal protective equipment

23.1. General

23.1.1. When workers cannot be adequately protected against occupational hazards of accident or ill health by other means, they should be provided with protective clothing and other personal protective equipment as conditions may require.

23.1.2. Personal protective equipment should conform at least to national standards that may be applicable.

23.1.3. Employers should ensure that personal protective equipment provided by them is used when necessary to prevent danger.

23.1.4. Workers should be instructed in the use of the personal protective equipment that is provided.

23.1.5. Workers should make proper use and take proper care of the personal protective equipment provided.

23.1.6. (1) Protective equipment should be properly maintained, cleaned and, if necessary for health reasons, disinfected or sterilised at suitable intervals.

(2) In particular, where necessary, protective clothing should be suitably impregnated or made flame-resistant after cleaning.

23.1.7. All workers should wear close-fitting working clothes and safety boots.

23.1.8. On board ship, workers should wear well fitting footwear without exposed metal in the soles.

23.1.9. All personal protective equipment should be kept fit for immediate use.

23.1.10. Protective clothing and equipment should be stored in clean and sanitary conditions and not taken away from the worksite by the user.

23.1.11. Protective clothing and equipment should be cleaned before being transferred from one worker to another, and sterilised unless that is obviously not necessary.

23.1.12. Defective or dirty protective clothing and equipment should not be used.

23.1.13. Working clothes and outer clothing should be removed before the wearer partakes of any food.

Waterproof clothing

23.1.14. Workers required to work in the rain or in similar wetting conditions should be provided with waterproof clothing and head covering.

23.1.15. Oilskin clothing should be kept in a well ventilated place away from stoves, radiators and other sources of heat, and not be rolled or put in lockers or other confined spaces.

Head protection

23.1.16. Workers employed at any place where they might be exposed to head injury by—

- (a) falling from heights;
- (b) falling or flying objects; or
- (c) striking against objects or structures

—should wear a safety helmet complying with the requirements of the competent authority.

23.1.17. Where necessary to prevent danger from electricity, safety helmets should be made of non-conducting material.

23.1.18. In working places exposed to the sun in hot weather—

- (a) workers should wear suitable head coverings; or
- (b) sun nets, etc., should be used.

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23.1.19. In cold weather, workers should be provided with appropriate head protection for warmth.

Eye protection

23.1.20. Eye protection measures should be applied in accordance with the requirements of the competent authority in regard to shipbuilding and ship repairing.

Hand and arm protection

23.1.21. Suitable gloves or gauntlets should be worn by workers such as those employed on gas welding or cutting, machine caulking, machine riveting, transporting or stacking plates, or handling plates at machines, at places where they might be exposed to hand or arm injuries from—

- (a) hot, toxic or corrosive substances; or
- (b) sharp or rough points, edges or surfaces of objects.

Foot protection

23.1.22. Workers employed at places where they might be exposed to foot injury from—

- (a) falling objects or crushing;
- (b) hot, corrosive or poisonous substances;
- (c) sharp-edged tools such as axes; and
- (d) abnormal humidity

—should wear footwear designed for protection against such injury.

Safety belts and lifelines

23.1.23. Workers who cannot be protected against falls from heights by other means should be protected by safety belts and lifelines.

23.1.24. The lifelines to which safety belts are attached should be of—

- (a) man-made fibre; or
- (b) special flexible wire rope if there is a danger that the line may be severed.

23.1.25. Only safety belts, safety straps and lifelines that comply with the requirements of the competent authority should be issued to workers.

23.1.26. All metal parts of safety belts, safety straps and lifelines should be made of forged steel.

23.1.27. Safety belts, safety straps, lifelines, permanent anchors and connections should both separately and when assembled have a breaking strength of at least 1,300 kg (2,850 lb).

23.1.28. Safety belts, safety straps and lifelines should be of man-made fibres or of other material having equivalent or greater strength.

23.1.29. If hooks are used for attaching safety belts to fixed anchors, they should be safety hooks.

23.1.30. Safety straps should be so fastened to safety belts that they cannot pass through the belt fitting if either end comes loose from its anchorage.

23.1.31. Metal thimbles should be used for connecting ropes or straps to eyes, rings and snaps.

23.1.32. Safety belts, safety straps and lifelines should be so fitted as to limit the free fall of the wearer to 1.5 m (5 ft).

23.1.33. Not more than one worker should be attached to any lifeline.

23.1.34. Not more than one lifeline should be attached to any anchor.

23.1.35. Safety belts, safety straps and lifelines should be inspected before each occasion of use.

23.1.36. When a worker's safety depends on a safety belt he should not work in isolation.

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23.1.37. Precautions should be taken to ensure that lifelines are not cut, pinched or led over sharp edges.

23.1.38. Lifelines should be kept clear of sources of heat, acids and caustic substances.

23.1.39. When a worker wearing a safety belt changes his workplace the lifeline should be adjusted to keep the slack to a minimum.

Catch nets

23.1.40. Where workers cannot be protected against falls from heights by other means they should be protected by catch nets.

23.1.41. Catch nets should be of man-made fibre cordage, wire or woven fabric or equivalent material.

23.1.42. The perimeter of catch nets should be reinforced with cloth-covered wire rope, manila rope or equivalent material.

23.1.43. Catch nets should be provided with adequate means of attachment to anchorages.

Protection against moving vehicles

23.1.44. Workers who are regularly exposed to danger from moving vehicles should wear—

- (a) conspicuous clothing; or
- (b) devices of conspicuous material.

Protection against drowning

23.1.45. Life jackets, vests or belts complying with the requirements of the competent authority should be worn by workers employed—

- (a) on floating pontoons, rafts, stages and the like;
- (b) on open-deck floating plant not equipped with bulwarks, railings or other adequate protection;

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- (c) on structures or stages extending over or adjacent to water and not equipped with railings or other adequate protection;
- (d) alone at night at places where they might drown; and
- (e) in skiffs, small boats and launches if not in the cabin or other enclosed space.

23.1.46. Life jackets, vests or belts should be inspected before each occasion of use.

23.1.47. (1) A sufficient number of lifebuoys should be provided and suitably placed on vessels under construction or repair, floating staging, floating cranes, floating docks and motor boats.

(2) At least 30 m (100 ft) of rope should be attached to each lifebuoy.

Protection against slipping

23.1.48. (1) When necessary to prevent danger from slipping, workers should be provided with boots with spiked soles or other non-slip soles.

(2) Workers employed on vessels or staging should wear securely fastened footwear.

Respiratory protective equipment

23.1.49. (1) Self-contained or air-line breathing apparatus of an approved type should be made available where efficient protection against airborne dust, fumes, vapours and gases cannot be ensured by other means, as in the case of workers such as those employed on—

- (i) the application of asbestos by spraying;
- (ii) breaking down asbestos lagging for removal;
- (iii) cleaning of rooms, floors, sacks or other containers that have held asbestos;
- (iv) working on material containing asbestos with portable power-driven tools;

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- (v) scaling, electric arc welding, gas welding, air gouging, blasting, buffing, scurfing or cleaning boilers, combustion chambers or smoke boxes if harmful or offensive dust or fumes are produced.

(2) A person using such apparatus should have a lifeline attached unless this requirement is itself hazardous or impracticable.

(3) Where possible such workers should be under the surveillance of a person situated in uncontaminated air to whom a suitable respiratory protective device is immediately available and who is instructed in methods of resuscitation and in the administration of oxygen.

(4) Means of summoning assistance in an emergency should be available.

23.1.50. (1) If in case of emergency it is necessary for workers to be employed at places where they might be exposed to injury from oxygen deficiency they should wear self-contained or air-line breathing apparatus and should have a lifeline attached, unless this itself presents a hazard or is impracticable.

(2) Where possible such workers should be under the surveillance of a person in uncontaminated air to whom a suitable respiratory protective device is immediately available and who is instructed in methods of resuscitation and the administration of oxygen.

(3) Means of summoning assistance in an emergency should be available.

23.1.51. All persons required to use respiratory protective equipment should be adequately instructed in its care and use.

23.1.52. Arrangements should be made for regular inspection and maintenance of respiratory protective equipment by a competent person.

23.1.53. Respiratory protective equipment used by one person should not be used by another before it has been cleaned and sterilised.

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23.1.54. When not in use respiratory protective equipment should be kept in closed containers.

23.1.55. (1) Air supplies to breathing apparatus should be free from harmful contaminants and obnoxious odours. The air should be at comfortable breathing temperature, i.e. within the range of 15-25°C (59-77°F) with a recommended maximum relative humidity of 85 per cent.

(2) The user of any breathing apparatus should be warned whenever there is a danger of failure of the air supply.

23.1.56. When compressed air is used to supply air-line breathing apparatus—

- (a) the compressor should be so placed as to avoid contamination of the air supply; and
- (b) there should be an effective regulator and an effective filter in the supply line.

23.1.57. (1) When air-line breathing apparatus is used the capacity of the air service should be calculated on the basis of a minimum requirement of 120 litres (4.2 cu ft) per minute per person.

(2) The pressure of air admitted to the kink-resistant tubing connected to personal protective apparatus should be within the safe working pressure of the tubing, and the pressure should never be less than 0.35 kg/cm² (5 lb/sq in).

23.1.58. In the supply line from a compressor or from a cylinder of compressed air there should be—

- (a) a pressure-reducing valve;
- (b) a relief valve pre-set to function at a pressure slightly above the setting of the reducing valve if the latter fails; and
- (c) a filter that effectively removes pipe scale, oil, water and harmful vapours.

24. Medical services and supervision, safety and health organisation, hygiene and welfare

24.1. Occupational health services

24.1.1. (1) The employer should establish in every shipyard an occupational health service.

(2) Depending on the circumstances, the occupational health service—

(a) should either be organised by the undertaking itself or be attached to an outside body; and

(b) should be organised—

(i) as a separate service within a single undertaking; or

(ii) as a service common to a number of undertakings.

24.1.2. The organisation, functions, staffing and equipment of occupational health services should conform to the requirements laid down in the Occupational Health Services Recommendation, 1959 (No. 112), adopted by the International Labour Organisation.

24.1.3. The occupational health service should be placed under the direction of a physician specialised in occupational health.

24.1.4. The physicians in occupational health services should enjoy full professional and moral independence from both the employers and the workers. In order to safeguard this independence, the conditions of employment of the physicians, especially the conditions concerning their appointment and the termination of their employment, should be laid down by—

(a) national laws or regulations;

(b) agreement between the parties concerned; or

(c) agreement between the employers' association and the trade unions.

24.1.5. The functions of the occupational health service are to advise and assist management and workers on matters relating to occupational health and safety, and in particular—

- (a) to advise management and other bodies or persons responsible for occupational health and the prevention of accidents, especially on—
 - (i) the planning and construction of workplaces and of social and sanitary facilities;
 - (ii) work processes, the acquisition of working equipment and the introduction of work processes;
 - (iii) the selection of personal protective equipment;
 - (iv) all ergonomic and hygienic aspects of work; and
 - (v) questions of job re-assignment, the rehabilitation of handicapped workers and their adaptation to the work process;
- (b) to examine workers as far as this is necessary to protect their health during work;
- (c) to exercise surveillance of occupational health and the prevention of accidents, and in that connection—
 - (i) to visit the workplaces as necessary and to report any deficiencies to the employer or to other persons responsible for occupational health and prevention of accidents, and to propose measures for remedying such deficiencies; and
 - (ii) to investigate and evaluate the causes of sickness due to work and to propose to the employer measures for avoiding such sickness;
- (d) to assist the workers to regulate their conduct in accordance with the requirements of occupational health and safety, and especially to instruct them in the risks to which they are exposed at work and measures for preventing them; and
- (e) to work in close collaboration with members of the safety committees and trade union safety stewards.

24.1.6. (1) The premises occupied by the occupational health service should—

- (a) be conveniently accessible from all workplaces;
- (b) be so designed as to allow stretcher cases to be handled easily; and
- (c) as far as practicable not be exposed to excessive noise and dust.

(2) The premises should comprise at least a waiting room, a consulting room and a treatment room, and also, if necessary, suitable accommodation for nurses and laboratory workers.

(3) Rooms for waiting, consultation and treatment should—

- (a) be sufficiently spacious, suitably lighted and ventilated and, where necessary, heated; and
- (b) have washable walls, floor and fixtures.

24.1.7. (1) The occupational health service should be provided with appropriate medical and examination equipment and supplies and such documentation as may be required for its work.

(2) The occupational health service should keep such records of its activities as will provide adequate information on—

- (a) the workers' state of health;
- (b) the nature, circumstances and outcome of occupational injuries; and
- (c) to the extent that such information is not provided by other agencies, the hygienic condition of workplaces, sanitary installations, etc.

24.1.8. The occupational health service should collaborate with labour inspection (especially medical inspection) services concerned with treatment, job placement, accident prevention and welfare.

24.2. Medical supervision and first aid

Medical examinations

24.2.1. If practicable, all workers should undergo a medical examination—

- (a) before or, if that cannot be achieved, shortly after entering employment for the first time (examination on employment); and
- (b) periodically at such intervals as may be considered necessary by the competent authority or the responsible medical service in view of the risks inherent in the work and the conditions under which it is performed (periodical re-examination).

24.2.2. (1) Workers exposed to toxic substances such as lead, mercury, chromium, arsenic and aromatic hydrocarbons, or to ionising radiations and other dangerous environmental agents, should undergo pre-employment and periodical medical examinations.

(2) The period of re-examination should be laid down by the competent authority in the light of current knowledge of the health hazards associated with such substances.

24.2.3. All medical examinations should—

- (a) be comprehensive, and whenever indicated by the type of work should include X-rays, lung function tests, audiometric tests and laboratory examinations; and
- (b) be cost-free to the workers.

24.2.4. (1) Workers under 21 years of age should receive special medical supervision, including chest X-ray examination whenever medically required.

(2) Workers over 40 years of age should receive special medical supervision.

24.2.5. The data obtained by medical examinations should be suitably recorded by the medical services entrusted with carrying them out and kept by these services for reference.

24.2.6. When the work presents a special risk to the health of a worker he should be employed on other work.

24.2.7. (1) When a worker is found at the medical examination to constitute a risk of infection or a risk to the safety of other workers, he should not be allowed to work while the risk remains.

(2) Every effort should be made to find for such a worker alternative work to which such risks do not attach.

24.2.8. (1) Workers who have been severely injured should not return to work without permission from a physician.

(2) In the case of workers returning after a severe injury or a long-term sickness absence, the physician should advise on the type of work to be undertaken.

First aid

24.2.9. Except in emergencies, first aid in case of accident or sudden illness should be rendered only by a physician, a registered nurse or a person trained in first aid and possessing a first-aid certificate acceptable to the competent authority.

24.2.10. Adequate means and personnel for rendering first aid should be readily available during working hours at places where work is carried on.

24.2.11. It should be possible to summon medical aid by telephone or radio.

24.2.12. (1) If not immediately available, medical aid should be promptly summoned when a worker is severely injured.

(2) Severely injured persons should not be moved before the arrival of a doctor or other qualified person, except for the purpose of removing them from a dangerous place.

24.2.13. (1) All injuries, however slight, should be reported as soon as practicable to the nearest first-aid man or room.

(2) Injured workers should obey the instructions of first-aid and medical personnel.

First-aid kits and boxes

24.2.14. One or more first-aid kits or boxes should be provided at suitable places near workplaces and on motor vehicles,

locomotives and floating plant, and be protected against damage and contamination by such agencies as dust, moisture and the weather.

24.2.15. (1) First-aid kits and boxes should contain sufficient and adequate material for rendering first aid to workers.

(2) The contents of first-aid kits and boxes should comply with the relevant provisions of national regulations or standards.

(3) First-aid kits and boxes should not contain anything besides material for first aid.

24.2.16. First-aid kits and boxes should contain simple and clear instructions to be followed in emergencies.

24.2.17. First-aid boxes should be replenished after each occasion of use.

24.2.18. (1) First-aid boxes and their contents should be in the charge of a responsible person who is qualified to render first aid.

(2) The contents and condition of every first-aid box should be inspected at least once a week by the person in charge of it.

Stretchers

24.2.19. In every shipyard there should be provided and kept readily available—

- (a) a sufficient number of suitable sling stretchers or similar appliances for raising injured persons;
- (b) a sufficient number of carrying or wheel stretchers; and
- (c) two clean blankets for each stretcher.

Rescue and resuscitation equipment

24.2.20. At every shipyard there should be sufficient suitable rescue and resuscitation equipment, including automatic oxygen breathing apparatus.

24.2.21. A sufficient number of persons trained to use resus-

citation apparatus should be constantly available during working hours.

24.2.22. Resuscitation apparatus should be used only by persons trained in its use.

First-aid rooms

24.2.23. In every shipyard in which the number of persons employed normally exceeds 50, a suitable first-aid room should be provided.

24.2.24. First-aid rooms should not be used for purposes other than rest and treatment of patients.

24.2.25. First-aid rooms should be in the charge of a competent person who should be readily available during working hours.

24.2.26. First-aid rooms should be furnished with adequate and suitable equipment, including—

- (a) a smooth sink with hot and cold water;
- (b) means for sterilising instruments;
- (c) suitable dressings, bandages and splints;
- (d) a couch;
- (e) a stretcher;
- (f) blankets and hot water thermos bottles; and
- (g) a foot bath.

24.2.27. First-aid rooms should be under the supervision of a physician.

Transport of sick and injured workers

24.2.28. (1) Arrangements should be made to ensure the prompt transport of sick or injured workers to a hospital or other equivalent treatment centre.

(2) Where practicable, such arrangements should include facilities for promptly obtaining an ambulance from some place situated within a reasonable distance of the working area.

(3) If an ambulance is not available the alternative means of transport should be reasonably comfortable.

24.2.29. If work is carried out on a vessel that is not in direct communication with the shore during working hours, there should be on the vessel or in its vicinity a suitable boat ready for use for landing sick and injured persons.

Notices

24.2.30. Notices should be conspicuously exhibited at suitable places stating—

- (a) the location of the nearest first-aid box, first-aid room, ambulance and stretcher and the place where the person in charge can be found;
- (b) the location of the nearest telephone for calling the ambulance and the telephone number and name of the person or centre to be called; and
- (c) the name, address and telephone number of the physician, hospital and rescue station to be called in an emergency.

First-aid personnel

24.2.31. All supervisors should be proficient in first-aid emergency procedures.

24.2.32. Workers should be encouraged to become proficient in first aid.

24.2.33. In every shipyard there should always be readily available during working hours a sufficient number of persons competent to administer first aid and responsible for summoning an ambulance or other means of transport if needed in cases of accident or illness.

24.2.34. If more than ten workers are employed on a ship not lying moored to the shore at least one first-aid man should be accessible on board.

24.2.35. First-aid personnel should be adequately trained in manual resuscitation procedures.

Register

24.2.36. (1) A first-aid register should be kept in each first-aid room for recording the names of persons to whom first aid has been rendered and the particulars of injuries and treatment.

(2) The register should be accessible only to authorised persons.

24.3. Safety and health organisation

24.3.1. In every shipyard the employer should appoint a safety officer to be in charge of all matters relating to safety and hygiene on the project.

24.3.2. At all shipyards at which 200 or more workers are regularly employed, the safety officer should be employed full time on safety and health activities.

24.3.3. Safety officers should assist management in the prevention of occupational accidents and diseases, and should in particular—

- (a) advise management and other persons responsible for occupational safety and health, especially on—
 - (i) the planning and installation of plant, and of welfare and sanitary facilities;
 - (ii) the acquisition of working equipment and the introduction of work processes;
 - (iii) the selection of personal protective equipment; and
 - (iv) the organisation of workshops, the methods of work and the working environment;
- (b) make appropriate safety inspections of working installations and technical devices, especially before they are put into service, and of processes, especially before they are brought into operation;
- (c) exercise surveillance of occupational safety and health measures, and for that purpose—

- (i) visit workplaces at regular intervals and report any deficiencies to the employer or to other persons responsible for occupational safety and health, and propose measures for remedying such deficiencies;
 - (ii) observe whether personal protective equipment is being used;
 - (iii) investigate the causes of accidents and compile reports on the causes and circumstances of every lost-time accident, minor accident and dangerous occurrence, the statistics produced to be such as to ensure their comparability with those of other shipyards;
 - (iv) compile and evaluate the results of investigations and propose to management measures to prevent the occurrence and recurrence of accidents;
 - (v) exercise surveillance over the execution of specific accident prevention measures; and
 - (vi) ensure that official regulations, instructions and other standards relating to safety and hygiene are complied with;
- (d) assist workers to behave in accordance with the requirements of occupational safety and health, and especially instruct them in the occupational hazards to which they are exposed and in the equipment and measures for preventing these hazards, and co-operate and participate in the periodic training of first-aid workers;
- (e) if necessary to prevent danger, report to the official occupational safety and health services any unsatisfactory conditions as regards safety and health that the employer fails to remedy within a reasonable time; and
- (f) work in close collaboration with the members of the safety committee and workers' safety delegates, and inform them of all important occurrences and all proposals made.

24.3.4. (1) At all shipyards at which 25 or more workers are regularly employed there should be a safety committee.

(2) In larger shipyards there should be additional safety committees for individual worksites.

24.3.5. Safety committees should include—

- (a) the employer himself or his representative in order to facilitate the immediate implementation of the committee's conclusions;
- (b) effective representation of the workers; and
- (c) the safety officer(s), the physician in charge of the medical service and any other persons professionally concerned with safety and health.

24.3.6. The workers' delegates on safety committees should be elected by all the workers in such a manner that all suitable qualified workers are enabled to serve on a committee in turn.

24.3.7. Safety committees should—

- (a) consider circumstances and causes of all accidents occurring on a project;
- (b) make recommendations to the employer for preventing the occurrence or recurrence of accidents;
- (c) make periodical inspections of the worksite and all its equipment in the interests of safety and hygiene;
- (d) watch over the execution of particular measures taken for the prevention of accidents;
- (e) watch over compliance with official regulations, instructions and other standards relating to safety and hygiene;
- (f) endeavour to secure the co-operation of all workers in the promotion of safety and hygiene;
- (g) participate in the drawing up of the undertaking's safety rules;
- (h) study the statistics of accidents, injuries and diseases occurring on the project;
- (i) see that all new workers, and workers transferred to new jobs, receive adequate safety training, instruction and guidance;
- (j) if necessary to prevent a persistent occupational hazard, report to the competent official inspector any unsatisfactory

conditions as regards safety and health that the employer fails to remedy within a reasonable time;

- (k) advise on projects which affect the safety and health of workers; and
- (l) take all practicable steps to implement their own recommendations.

24.3.8. Safety committees should meet at suitable intervals and keep adequate records of all meetings.

24.3.9. Employers should—

- (a) give safety committees all reasonable encouragement and facilities in the performance of their duties;
- (b) consult safety committees in all matters relating to safety and health on the project;
- (c) take all practicable steps to give effect to recommendations of safety committees; and
- (d) in cases where they do not adopt a safety committee's recommendation, inform the committee of the reasons within a reasonable time.

24.3.10. The safety committees should carry out their duties independently of, but in collaboration with, the safety officers and the medical service of the shipyard.

24.3.11. (1) At all shipyards records should be kept of all lost time, accidents, minor accidents and dangerous occurrences.

(2) The records should include statistics that will show—

- (a) the accident record of each operation, occupation and individual; and
- (b) the distribution of accidents by causes.

24.3.12. Accident statistics should be compiled by methods approved by the competent authority so as to ensure their comparability with those for other shipyards.

24.3.13. Where appropriate, employers should make arrangements whereby workers can submit suggestions relating to safety and health at the shipyard.

24.3.14. Where two or more employers are engaged at a shipyard they should co-ordinate their safety activities by—

- (a) the appointment of a joint safety officer;
- (b) the appointment of a joint safety committee; or
- (c) other effective means.

24.3.15. In every shipyard regularly employing fewer than 25 workers, the workers should be entitled to appoint at least one of their number to be a safety delegate (safety steward).

24.3.16. Workers' safety delegates should be entitled to represent the workers in all matters bearing on safety in the shipyard.

24.3.17. Workers' safety delegates should be recognised by management and the competent authority, and their rights to effective representation of the workers' interest in occupational safety and health matters should be guaranteed.

24.3.18. Workers' safety delegates should receive adequate periodic training in all occupational safety and health aspects of the work during paid working hours.

24.4. Hygiene and welfare

24.4.1. Shelters, toilet facilities, washing facilities, meal rooms, cloak rooms and rest rooms should—

- (a) be adequately lighted and ventilated;
- (b) if necessary for reasons of health or welfare, be heated or cooled; and
- (c) be maintained in a clean and sanitary condition.

24.4.2. No food should be taken into working places on board. Items of clothing should not be kept in working places on board.

Drinking water

24.4.3. (1) An adequate supply of cool and wholesome drinking water should be provided for and be readily accessible to all workers.

(2) All drinking water should be from a source approved by the competent health authority.

(3) Where such water is not available, the competent health authority should ensure that the necessary steps are taken to make any water to be used for drinking fit for human consumption.

24.4.4. The use of common drinking cups should be prohibited.

24.4.5. Drinking water for common use should not be contained in barrels, pails, tanks or other containers from which the water must be dipped, whether they are fitted with a cover or not.

24.4.6. Where practicable, hygienic drinking fountains should be provided.

24.4.7. Supplies of water that are not fit to drink should be conspicuously indicated by notices prohibiting workers from drinking it.

24.4.8. There should be no means of connecting a supply of drinking water with a supply of water that is unfit to drink.

24.4.9. Drinking water should not be warmer than 24°C (75°F) or cooler than 10°C (50°F) at the point of use.

24.4.10. If necessary for health reasons, salt drinks or tablets should be supplied to the workers in a hot environment.

24.4.11. If a treatment and purification system is installed to provide drinking water, the system should be approved by the competent health authority before it is used.

Shelters

24.4.12. Suitable shelters should be provided for the workers to afford protection in bad weather.

24.4.13. Unless they are provided elsewhere, shelters should provide suitable facilities for—

(a) drying and storing clothing;

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- (b) taking meals; and
- (c) washing.

Toilet facilities

24.4.14. Adequate toilet facilities should be provided for the workers at easily accessible places. Toilets should be provided at the rate of one for 20 persons.

24.4.15. There should be separate toilet facilities for each sex.

24.4.16. When practicable, flush toilets connected to public sewage systems should be provided.

24.4.17. No toilet other than a water flush should be installed in any building containing sleeping, eating or other living accommodation.

24.4.18. If a public sewage system is not available, a temporary sewage system should be provided in accordance with the requirements of the competent public health authority.

24.4.19. Toilets should be so constructed as to screen the occupants from view and afford protection against the weather and falling objects.

24.4.20. Toilets, including privies, should have a smooth and impervious floor.

24.4.21. For personal cleansing, toilets should be provided with an ample supply of toilet paper.

24.4.22. Plumbing and other toilet fixtures should comply with the requirements of the competent health authority.

24.4.23. (1) Adequate washing facilities should be provided as near as practicable to toilet facilities.

(2) Such facilities should comply with the provisions of paragraph 24.4.28.

24.4.24. On the weather deck of vessels under construction afloat, enclosed urinals should be provided.

Washing facilities

24.4.25. Adequate washing facilities should be provided for all workers.

24.4.26. Washing facilities should not be used for any other purpose.

24.4.27. There should be at least one washing facility for every six workers who have rest and meal breaks at the same time.

24.4.28. In washing places—

- (a) there should be a sufficient flow of clean cold and hot water;
- (b) there should be adequate means of removing waste water;
- (c) suitable non-irritating soap should be supplied in sufficient quantity;
- (d) the use of common towels should be prohibited; and
- (e) sufficient hygienic hand-drying facilities should be provided.

24.4.29. Where workers are exposed to skin contamination by poisonous, infectious or irritating substances, or oil, grease or dust, at least one shower bath supplied with hot and cold water should be provided for every six workers regularly exposed to such contamination who cease work at the same time.

24.4.30. (1) Shower-bath equipment should be thoroughly cleaned at least once in every day of use and effectively disinfected.

(2) The use of wooden duck boards in shower rooms should be avoided.

24.4.31. There should be separate washing facilities for each sex.

Meal rooms and canteens

24.4.32. If at least 20 workers are employed at a worksite, a suitable room should be provided in which they can take their own meals, unless they can spend mealtimes in their own homes or in another suitable place.

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24.4.33. (1) Meal rooms should not be located near toilets and rubbish dumps.

(2) Meal rooms should be provided with—

- (a) a sufficient number of tables and chairs or benches;
- (b) drinking water;
- (c) adequate facilities for washing, unless such facilities are available elsewhere in the vicinity;
- (d) adequate facilities for cleaning utensils, tableware and other articles connected with the preparation and eating of meals;
- (e) adequate facilities for heating food and boiling water; and
- (f) covered receptacles for the disposal of waste food and litter.

24.4.34. Receptacles for waste should be emptied after each meal and thoroughly cleaned, and if necessary disinfected.

24.4.35. Meal rooms should be available to workers employed on floating equipment.

24.4.36. Meals rooms should not be used for any other purpose.

24.4.37. The floor of meal rooms should be easily washable.

24.4.38. Meal rooms should be cleaned daily.

24.4.39. (1) Dining tables should be covered with suitable non-absorbent washable material.

(2) Tables should be cleaned after each meal.

24.4.40. Where necessary for reasons of health or welfare a canteen should be provided where workers can obtain hot meals.

24.4.41. Separate toilet and washing facilities should be provided for the canteen staff.

Cloakrooms

24.4.42. Cloakrooms should be provided for the workers at easily accessible places. They should be large enough to allow the

workers of a single shift to change their clothing without causing congestion.

24.4.43. Cloakrooms should not be used for any other purpose.

24.4.44. Cloakrooms should be provided with—

- (a) suitable facilities for drying wet clothes;
- (b) individual metal lockers, of adequate size, provided with locks and with adequate ventilation and a division built in for the separation of working and other clothes; and
- (c) benches or other suitable seats.

24.4.45. There should be separate cloakrooms for each sex.

24.4.46. Suitable arrangements should be made for disinfecting cloakrooms and lockers in conformity with the requirements of the competent health authority.

Waste disposal

24.4.47. A sufficient number of receptacles should be provided at suitable places for the disposal of garbage and other waste.

24.4.48. Receptacles for waste should be covered, non-corrodable, fly-tight and easy to clean.

24.4.49. Waste receptacles should be kept closed, and emptied at suitable intervals.

24.4.50. Waste receptacles should be cleaned at suitable intervals, and disinfected if that is necessary to prevent danger.

24.4.51. The contents of waste receptacles should be incinerated or otherwise harmlessly disposed of at suitable intervals.

24.4.52. Garbage should not be left or kept elsewhere than in the containers provided.

25. Miscellaneous

25.1. Reporting and investigation of occupational accidents and diseases

25.1.1. All accidents causing loss of life or serious injury to workers should be reported forthwith to the competent authority.

25.1.2. Other injuries and occupational diseases causing incapacity for work for periods of time laid down in national or other official regulations should be reported to the competent authority within such time and in such form as may be specified in national or other official regulations.

25.1.3. Dangerous occurrences such as explosions, collapse of cranes or derricks and serious fires, as may be specified in national or other official regulations, should be reported forthwith to the competent authority, irrespective of whether any personal injury has been caused or not.

25.1.4. Provided the danger has been isolated, when a fatal accident has occurred, the scene of the accident should be left undisturbed until it has been visited by a representative of the competent authority.

25.1.5. Provided the danger has been isolated, plant or gear on which a dangerous failure has occurred should be kept available for inspection by the competent authority.

25.2. Other safety and health rules and standards applicable to shipbuilding and ship repairing

25.2.1. Maintenance and repair shops and other workshops should comply—

(a) with national laws and regulations concerning occupational safety and health in industrial establishments; or

(b) as regards matters not dealt with in such laws and regulations, with the *Model Code of Safety Regulations for Industrial Establishments* published by the International Labour Office.¹

25.2.2. Tractors, tractor operations and motor transport should comply with the relevant requirements of the national laws or regulations and, in so far as the latter do not apply, with the relevant provisions of the code of practice relating to safety and health in building and civil engineering work, published by the International Labour Office.²

25.2.3. Shipyard railways should comply with the relevant requirements of the national laws or regulations and, in so far as the latter do not apply, with the relevant provisions of the code of practice relating to safety and health in dock work, published by the International Labour Office.³

25.2.4. Diving operations should comply with the relevant requirements of the national laws or regulations and, in so far as the latter do not apply, with the relevant provisions of the code of practice relating to safety and health in building and civil engineering work, published by the International Labour Office.²

25.3. Other matters

Unauthorised persons

25.3.1. Unauthorised persons should not be allowed in shipyards, on vessels or in docks unless accompanied by a responsible person.

¹ *Model Code of Safety Regulations for Industrial Establishments, for the guidance of governments and industry* (Geneva, 1958).

² *Safety and health in building and civil engineering work* (Geneva, 1972).

³ *Safety and health in dock work* (Geneva, 1958).

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Solitary workers

25.3.2. (1) Places where a worker is working alone and out of contact with other workers should be inspected at suitable intervals in each shift.

(2) This provision applies also to overtime working.

Intoxicants

25.3.3. (1) Workers should not consume alcoholic beverages if by so doing they are likely to endanger themselves or others.

(2) Persons who because of their consumption of alcohol are likely to endanger themselves or others should not be on the job.

New techniques

25.3.4. New techniques, such as the use of mobile units carrying platforms and scaffolding, should be introduced only if appropriate training in their safe use has been given and if they will not result in a lowering of accepted standards of safety and health.

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