MARITIME OCCUPATIONAL SAFETY AND HEALTH WITH HAZARD IDENTIFICATION

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Maritime Occupational Safety and Health with Hazard Identification

I.0 Introduction

I.1 Course overview

This course aims to provide knowledge and awareness to seafarers who will be designated as Shipboard Safety and Health Officer (SSHO) or to all officers and engineers on board as will be required by their respective companies, in compliance to the Department of Labor's Department Order 132 Series of 2013, in conjunction with the provisions of Maritime labor Convention 2006 (MLC 2006), Article IV, paragraph 1, Seafarers right to a safe and secure workplace that complies with safety standards; and paragraph 4, the right to health protection, medical care, welfare measures and other forms of social protection.

I.2 Competences to be achieved

Competencies required to be acquired by the trainees is the knowledge of duties and responsibilities of SSHO, safety procedures on board, accident prevention and selected provisions in the MLC 2006.

I.3 Maritime Accidents

Shipping is perceived to be a relatively dangerous industry. However, there is a lack of statistics in the area of Maritime Occupational Safety and Health (MOSH) due to the limited accessibility and reliability of reports of occupational accidents, incidents and diseases in flag States. This is mostly as a result of significant differences in data collection methodologies, poor recording, limited coverage, and limited statistics on the overall seafarer population.

However other information can be sourced from interested institution like the Protective and Indemnity (P & I) Clubs.

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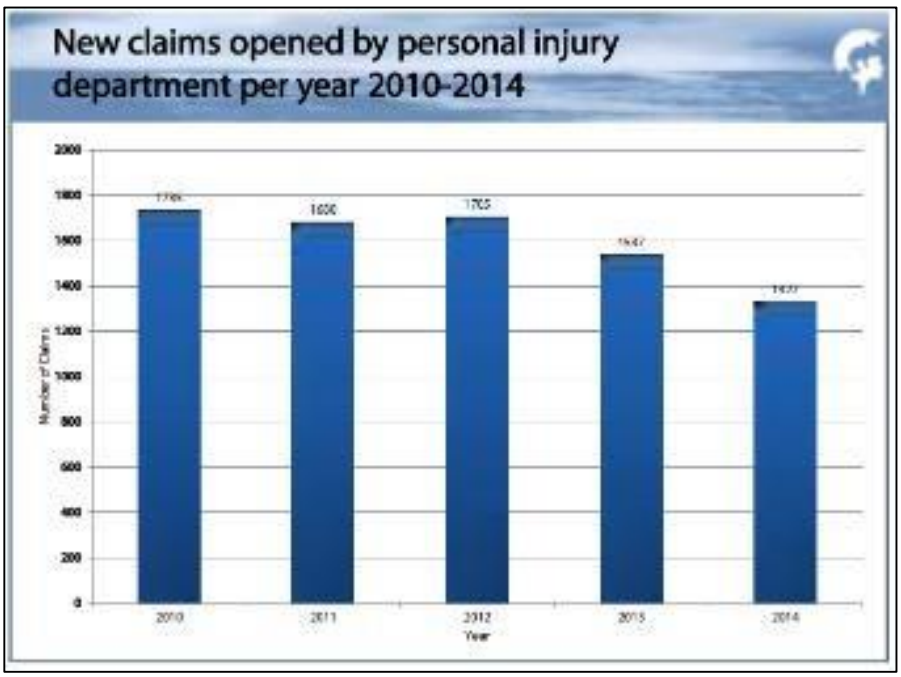
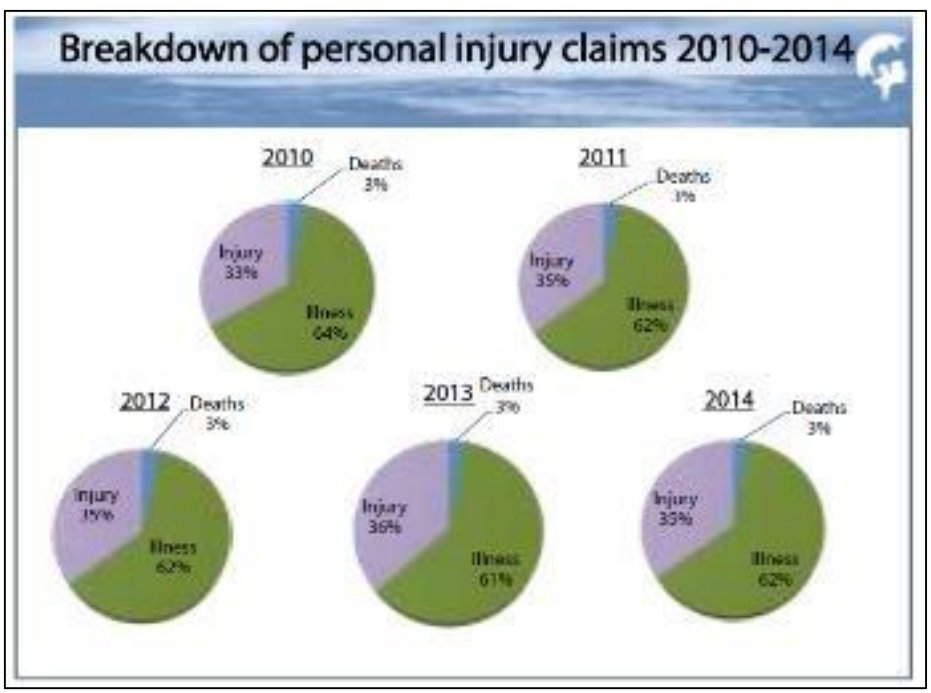
I.3 Maritime Accidents

Sample statistics are as follows:



Courtesy of Britannia P & I



Courtesy of Britannia P & I

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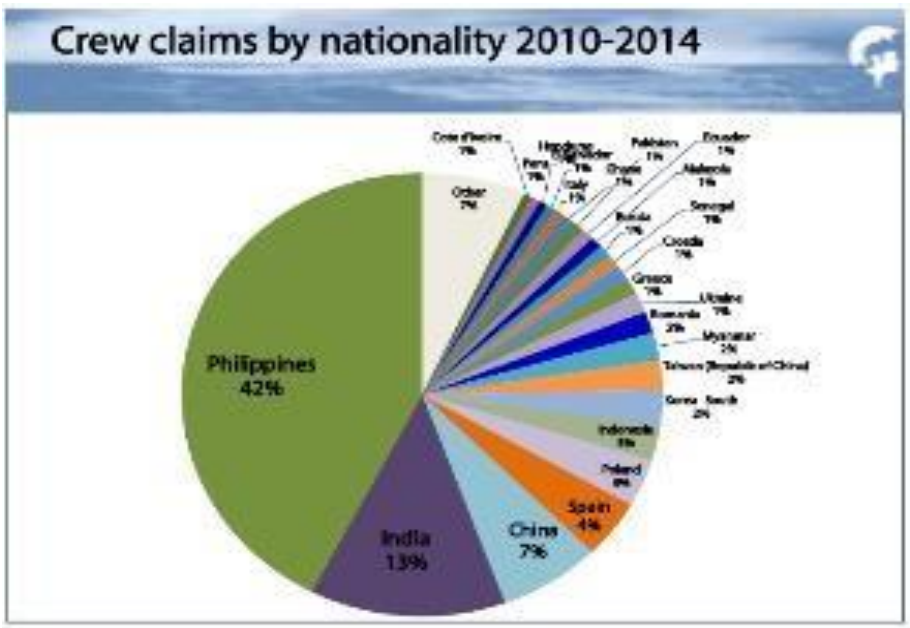
I.3 Maritime Accidents

Sample statistics are as follows:

Claim Type	Percentage of Claims	Average Amounts
Bruising/Fractures/Dislocations/ Cuts	30%	$27,202
Heart/Diabetes Related	10.5%	$46,463
Back Conditions	6%	$21,758
Kidney Problems	4.5%	$14,868
Appendicitis	4%	$20,057
Burns/Scalds	3%	$47,160
Malaria	1.5%	$24,175

Courtesy of Britannia P & I



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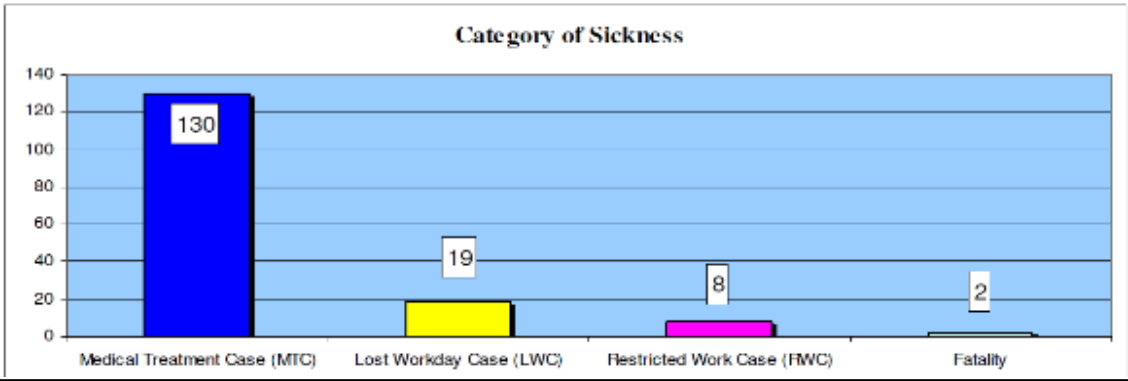
Others sources are from each company's data and analysis of accidents and incidents and the resulting impact on the health of the crew and the operation of the company.

Following are from a certain company for the first half of 2015:

Marine Sickness Data Statistics

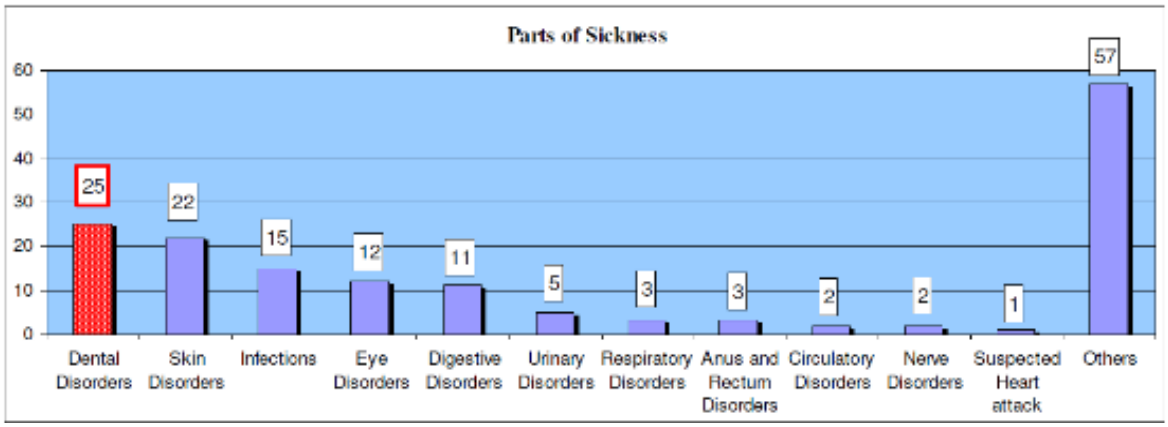
Category of Sickness

The number of sickness cases reported in first half of 2015 was 159. We have 82% of the cases of Medical treatment cases.



Parts of Sickness

The below table shows data segregated based on body parts of sickness. Especially, dental disorders count 25 cases, which is 16% of all reports and largest proportion. This trend is continued for several past years.



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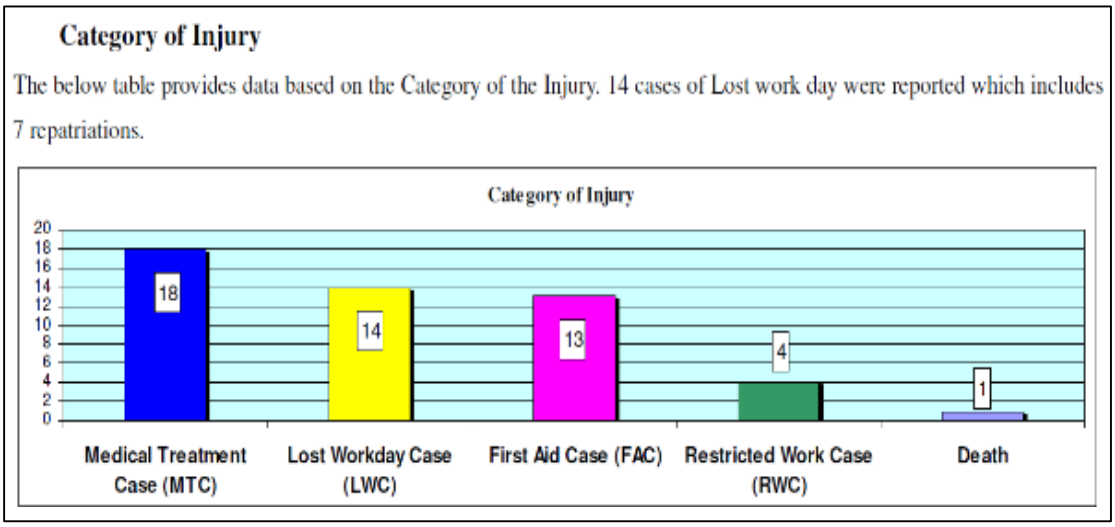

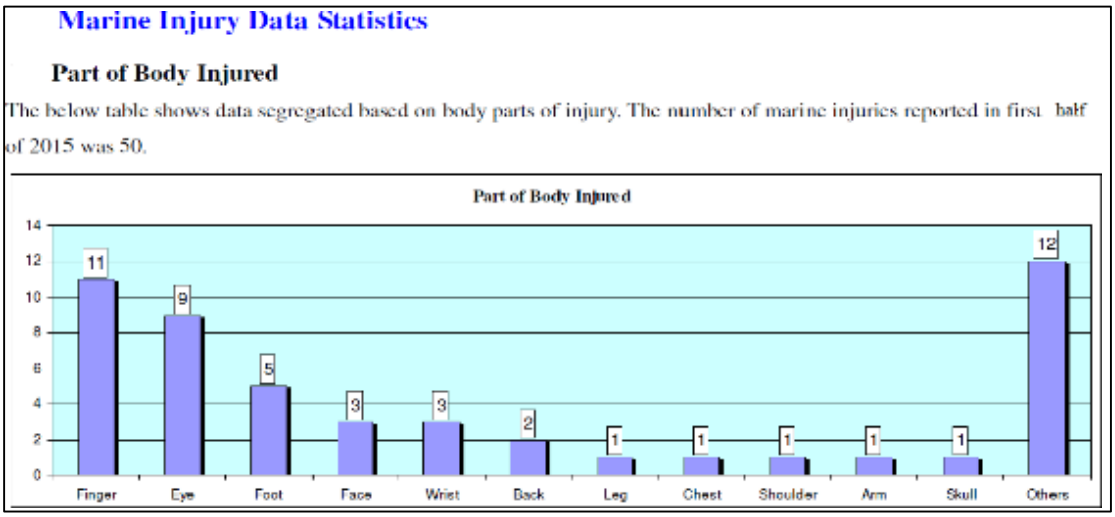

The graphs show illnesses and injuries suffered by crew during the period and the impact to the operation.

I.4 Legal Requirements

The legal requirements for a Ship Safety Officer onboard are set up in the following International Conventions and National Regulation:

1. Safety of Life at Sea (SOLAS), Chapter IX, Management for the Safe Operation of Ships
   - incorporated the ISM Code as part of SOLAS amendments to ensure implementation of the ISM Code by the Parties signatory to the Convention.

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2. Maritime Labor Convention 2006 (MLC 2006)

- outlines seafarers' rights to decent conditions of employment and fair competition for shipowners, it sets out:
- minimum requirements for seafarers to work on a ship; conditions of employment; accommodation, recreational facilities, food and catering; health protection, medical care, welfare and social security protection; compliance and enforcement

3. International Safety Management Code (ISM Code),

-objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment, and to property.

4. Occupational Health and Safety Management System (OHSAS 1801)

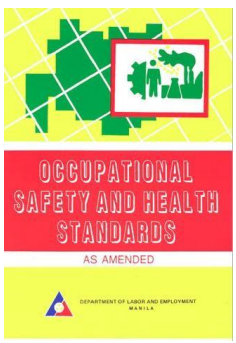
- is an internationally applied British Standard for occupational health and safety management systems. It helps all kinds of organizations to put in place demonstrably sound occupational health and safety performance.
- a widely recognized and popular occupational health and safety management system

5. Standards of Training, Certification and Watchkeeping for Seafarers, as amended.

-based on the guidelines given in the STCW Code 2010 Table A-II/2 & A-III/2

6. Occupational Safety and Health Standards

-formulated in 1978 in compliance with the constitutional mandate to safeguard the worker's social and economic well-being as well as his physical safety and health, on the authority of Department of Labor and Employment under Article 162 of the Labor Code of the Philippines



7. Department of Labor, Department Order 132, series of 2013

-requirements on the Maritime Occupational Safety and Health (MOSH) training for the designated safety and health officer

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

The MLC 2006 is the fourth pillar of International maritime laws under International Labor Organization (ILO) that deals with the protection of the rights of seafarers. Following are selected provisions in the MLC 2006:

I.4.1.1 Title 2, Regulation 2.3 - Hours of work and hours of rest

The purpose of this regulation is to ensure that seafarers have regulated hours of work or hours of rest

It is required to establish maximum hours of work or minimum hours of rest over given periods that are consistent with the provisions in the Code.

Definition of terms:

(a) hours of work - time during seafarers are required to do work on account of the ship;

(b) hours of rest- time outside hours of work; but does not include short breaks.

It is also required that either a **maximum number of hours of work** which shall not be exceeded in a given period of time,

or

a **minimum number of hours of rest** which shall be provided in a given period of time.

The normal working hours' standard for seafarers shall be based on an (8) eight-hour day with one day of rest per week and rest on public holidays.
However, this shall not prevent the Member from having procedures to authorize or register a collective agreement which determines seafarers' normal working hours on a basis no less favourable than this standard.

Should also take account of the danger posed by the fatigue of seafarers, especially those whose duties involve navigational safety and the safe and secure operation of the ship.

The limits on hours of work or rest shall be as follows:

(a) maximum hours of **work** shall not exceed:

(i) 14 hours in any 24-hour period; and

(ii) 72 hours in any seven-day period;

or

(b) minimum hours of **rest** shall not be less than:

(i) ten hours in any 24-hour period; and

(ii) 77 hours in any seven-day period.

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.1 Regulation 2.3 - Hours of work and hours of rest

Hours of rest may be divided into no more than two periods, one of which shall be at least six hours in length, and the interval between consecutive periods of rest shall not exceed 14 hours.

Musters, fire-fighting and lifeboat drills, and drills shall be conducted in a manner that minimizes the disturbance of rest periods and does not induce fatigue.

When a seafarer is on call, such as when a machinery space is unattended, the seafarer shall have an adequate compensatory rest period if the normal period of rest is disturbed by call-outs to work.

If no collective agreement or arbitration award exists or if the competent authority determines that the provisions in the agreement or award are inadequate, the competent authority shall determine such provisions to ensure the seafarers concerned have sufficient rest.

It shall be required the posting, in an easily accessible place, of a table with the shipboard working arrangements, which shall contain for every position at least:

(a) the schedule of service at sea and service in port; and
(b) the maximum hours of work or the minimum hours of rest required by national laws or regulations or applicable collective agreements.

The table shall be established in a standardized format in the working language or languages of the ship and in English.

It will be required that records of seafarers' daily hours of work or of their daily hours of rest be maintained to allow monitoring of compliance

The records shall be in a standardized format established by the competent authority taking into account any available guidelines of the International Labour Organization or shall be in any standard format prepared by the Organization. They shall be in the languages required by above provision.

The seafarers shall receive a copy of the records pertaining to them which shall be endorsed by the master, or a person authorized by the master, and by the seafarers.

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.1 Regulation 2.3 - Hours of work and hours of rest

Nothing in this Standard shall prevent a flag state from having national laws or regulations or a procedure to authorize or register collective agreements permitting exceptions to the limits set out. Such exceptions shall, as far as possible, follow the provisions of the Standard but may take account of more frequent or longer leave periods or the granting of compensatory leave for watchkeeping seafarers or seafarers working on board ships on short voyages.

Nothing in the Standard shall be deemed to impair the right of the master of a ship to require a seafarer to perform any hours of work necessary for the immediate safety of the ship, persons on board or cargo, or for the purpose of giving assistance to other ships or persons in distress at sea.

The master may suspend the schedule of hours of work or hours of rest and require a seafarer to perform any hours of work necessary until the normal situation has been restored. As soon as practicable after the normal situation has been restored, the master shall ensure that any seafarers who have performed work in a scheduled rest period are provided with an adequate period of rest.

(Maritime Labor Convention 2006, Title 2 Condition of Employment, Regulation 2.3 – Hours of work and hours of rest, page 30)

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.2 Regulation 3.1 - Accommodation and recreational facilities

This regulation ensures that seafarers have decent accommodation and recreational facilities on board.

This also requires flag states to ensure that ships that fly its flag provide and maintain decent accommodations and recreational facilities for seafarers working or living on board, or both, consistent with promoting the seafarers' health and well-being.

I.4.1.3 Standard A3.1 - Accommodation and recreational facilities (paragraph 4)

The competent authority for the flag states shall ensure in implementation of the requirements of this Convention relating to:

(a) the size of rooms and other accommodation spaces;
(b) heating and ventilation;
(c) noise and vibration and other ambient factors;
(d) sanitary facilities;
(e) lighting; and
(f) hospital accommodation.

With respect to general requirements for accommodation:

(a) there shall be adequate headroom in all seafarer accommodation; minimum headroom in all seafarer accommodation shall be not less than 203 centimetres; limited reduction in headroom maybe where it is satisfied that such reduction: (i) is reasonable; and (ii) will not result in discomfort to the seafarers;
(b) the accommodation shall be adequately insulated;
(c) in ships other than passenger ships, sleeping rooms shall be situated above the load line amidships or aft, except that in exceptional cases, where the size, type or intended service of the ship renders any other location impracticable, sleeping rooms may be located in the fore part of the ship, but in no case forward of the collision bulkhead;

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.3 Standard A3.1 - Accommodation and recreational facilities (paragraph 4)

(d) in passenger ships, and in special ships, the competent authority may, on condition that satisfactory arrangements are made for lighting and ventilation, permit the location of sleeping rooms below the load line, but in no case shall they be located immediately beneath working alleyways;

(e) there shall be no direct openings into sleeping rooms from cargo and machinery spaces or from galleys, storerooms, drying rooms or communal sanitary areas; that part of a bulkhead separating such places from sleeping rooms and external bulkheads shall be efficiently constructed of steel or other approved substance and be watertight and gas-tight;

(f) materials used to construct internal bulkheads, panelling and sheeting, floors and joinings shall be suitable for the purpose and conducive to ensuring a healthy environment;

(g) proper lighting and sufficient drainage shall be provided; and

(h) accommodation and recreational and catering facilities shall meet the requirements in Regulation 4.3, and the related provisions in the Code, on health and safety protection and accident prevention, with respect to preventing the risk of exposure to hazardous levels of noise and vibration and other ambient factors and chemicals on board ships, and to provide an acceptable occupational and on-board living environment for seafarers.

With respect to requirements for ventilation and heating:
(a) sleeping rooms and mess rooms shall be adequately ventilated;

(b) ships, except those regularly engaged in trade where temperate climatic conditions do not require this, shall be equipped with air conditioning for seafarer accommodation, for any separate radio room and for any centralized machinery control room;

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.3 Standard A3.1 - Accommodation and recreational facilities (paragraph 4)

(c) all sanitary spaces shall have ventilation to the open air, independently of any other part of the accommodation; and

(d) adequate heat through an appropriate heating system shall be provided, except in ships exclusively on voyages in tropical climates.

With respect to requirements for lighting, subject to such special arrangements as may be permitted in passenger ships, sleeping rooms and mess rooms shall be lit by natural light and provided with adequate artificial light.

With respect to requirements for mess rooms:

(a) mess rooms shall be located apart from the sleeping rooms and as close as practicable to the galley; ships of less than 3,000 gross tonnage may be exempted by the competent authority from this requirement after consultation with the shipowners' and seafarers' organizations concerned; and

(b) mess rooms shall be of adequate size and comfort and properly furnished and equipped (including ongoing facilities for refreshment), taking account of the number of seafarers likely to use them at any one time; provision shall be made for separate or common mess room facilities as appropriate.

With respect to requirements for sanitary facilities:

(a) all seafarers shall have convenient access on the ship to sanitary facilities meeting minimum standards of health and hygiene and reasonable standards of comfort, with separate sanitary facilities being provided for men and for women;

(b) there shall be sanitary facilities within easy access of the navigating bridge and the machinery space or near the engine room control centre;

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.3 Standard A3.1 - Accommodation and recreational facilities (paragraph 4)

(c) in all ships a minimum of one toilet, one wash basin and one tub or shower or both for every six persons or less who do not have personal facilities shall be provided at a convenient location;

(d) with the exception of passenger ships, each sleeping room shall be provided with a washbasin having hot and cold running fresh water, except where such a washbasin is situated in the private bathroom provided;

(e) in passenger ships normally engaged on voyages of not more than four hours' duration, consideration may be given by the competent authority to special arrangements or to a reduction in the number of facilities required; and

(f) hot and cold running fresh water shall be available in all wash places.

With respect to requirements for hospital accommodation, ships carrying 15 or more seafarers and engaged in a voyage of more than three days' duration shall provide separate hospital accommodation to be used exclusively for medical purposes;

Appropriately situated and furnished laundry facilities shall be available.

All ships shall be provided with separate offices or a common ship's office for use by deck and engine departments; ships of less than 3,000 gross tonnage may be exempted by the competent authority from this requirement after consultation with the shipowners' and seafarers' organizations concerned.

Ships regularly trading to mosquito-infested ports shall be fitted with appropriate devices as required by the competent authority.

Appropriate seafarers' recreational facilities, amenities and services, as adapted to meet the special needs of seafarers who must live and work on ships, shall be provided on board for the benefit of all seafarers,

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.4 Regulation 4.3 - Health and safety protection and accident prevention

Regulation 4.3 is about ensuring health and safety protection and accident prevention on the work environment on board ships and promotion of occupational safety and health

Seafarers should be provided with occupational health protection and live, work and train on board ship in a safe and hygienic environment.

Member (Flag States) shall develop and promulgate national guidelines for the management of occupational safety and health on board ships after consultation with representative shipowners' and seafarers' organizations and taking into account applicable codes, guidelines and standards recommended by international organizations, national administrations and maritime industry organizations.

Member (flag states) shall adopt laws and regulations and other measures addressing the matters specified in the Code, taking into account relevant international instruments, and set standards for occupational safety and health protection and accident prevention on ships

I.4.1.5 Standard A4.3 - Health and safety protection and accident prevention paragraphs 1, 2, 4, 6 and 7

Standard A4.3 – Paragraph 1
The laws and regulations and other measures to be adopted in accordance with this regulation, shall include the following subjects:

(a) adoption and effective implementation and promotion of occupational safety and health policies and programmes on ships, including risk evaluation as well as training and instruction of seafarers;

(b) reasonable precautions to prevent occupational accidents, injuries and diseases on board ship, including measures to reduce and prevent the risk of exposure to harmful levels of ambient factors and chemicals as well as the risk of injury or disease that may arise from the use of equipment and machinery on board ships;

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.5 Standard A4.3 - Health and safety protection and accident prevention paragraphs 1, 2, 4, 6 and 7

Standard A4.3 – Paragraph 1

> (c) on-board programmes for the prevention of occupational accidents, injuries and diseases and for continuous improvement in occupational safety and health protection, involving seafarers' representatives and all other persons concerned in their implementation, taking account of preventive measures, including engineering and design control, substitution of processes and procedures for collective and individual tasks, and the use of personal protective equipment; and
>
> (d) requirements for inspecting, reporting and correcting unsafe conditions and for investigating and reporting on-board occupational accidents.

Standard A4.3 – Paragraph 2
The provisions referred to in paragraph 1 of this Standard shall:

> (a) take account of relevant international instruments dealing with occupational safety and health protection in general and with specific risks, and address all matters relevant to the prevention of occupational accidents, injuries and diseases that may be applicable to the work of seafarers and particularly those which are specific to maritime employment;
>
> (b) clearly specify the obligation of shipowners, seafarers and others concerned to comply with the applicable standards and with the ship's occupational safety and health policy and programme with special attention being paid to the safety and health of seafarers under the age of 18;

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I.4.1 Maritime Labor Convention 2006 (MLC 2006)

I.4.1.5 Standard A4.3 - Health and safety protection and accident prevention paragraphs 1, 2, 4, 6 and 7

Standard A4.3 – Paragraph 2

(c) specify the duties of the master or a person designated by the master, or both, to take specific responsibility for the implementation of and compliance with the ship's occupational safety and health policy and programme; and

(d) specify the authority of the ship's seafarers appointed or elected as safety representatives to participate in meetings of the ship's safety committee. Such a committee shall be established on board a ship on which there are five or more seafarers.

Standard A4.3 – Paragraph 4

Compliance with the requirements of applicable international instruments on the acceptable levels of exposure to workplace hazards on board ships and on the development and implementation of ships' occupational safety and health policies and programmes shall be considered as meeting the requirements of the MLC 2006.

Standard A4.3 – Paragraph 6

Reporting and investigation of occupational safety and health matters shall be designed to ensure the protection of seafarers' personal data, and shall take account of the guidance provided by the International Labour Organization on this matter.

Standard A4.3 – Paragraph 7

The competent authority shall cooperate with shipowners' and seafarers' organizations to take measures to bring to the attention of all seafarers information concerning particular hazards on board ships, for instance, by posting official notices containing relevant instructions.

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I.4.2 Duties and Responsibilities (Under MEMOSH/2014/6 Guidelines for Implementing the Occupational Safety and Health Provisions of the Maritime Labour Convention

I.4.2.1 Shipowners' responsibilities and obligations

- ensure that masters have adequate support to carry out their responsibility for OSH management while on board effectively;
- establish a safety culture with high standards for OSH on board ship;
- consult with seafarers and, where appropriate, the representative seafarers' organizations, on the drafting and implementation of OSH policies;
- establish policies and programmes on OSH of seafarers which are consistent with international standards and national laws and regulations, and put in place systems for continuous improvement, taking into account the national guidelines for the management of occupational safety and health on board ships;
- establish safety committees;
- establish systems to conduct on-board investigations into occupational accidents, injuries and, where applicable, diseases, and provide reports to the competent authority;
- provide accommodation and recreational services, at no cost to the seafarer, in accordance with Regulation 3.1 and Standard A3.1, which are safe, promote the seafarers' health and well-being, and are inspected to ensure initial and ongoing compliance with minimum standards, including Regulation 4.3 and the associated provisions of the Code of the MLC, 2006

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I.4.2.2 Duties of the Master

- implement shipowner's OSH policy and programme on board ship and clearly communicate them to all crew;
- ensure positive safety culture exists on the ship, including reasonable precautions and continuous safety improvement to prevent occupational accidents, injuries and diseases on board ship;
- encourage seafarers to participate actively and express their views on safe and healthy working conditions and risk assessments, without fear of dismissal or other prejudicial measures;
- ensure work is planned, carried out and supervised so as to minimize the possibility of accidents, injuries or diseases;

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I.4.2.2 Duties of the Master

- ensure seafarers are assigned only to work to which they are suited by age, state of health and skills, and no seafarer under the age of 18 is assigned inappropriate duties;
- appropriate notices and instructions are issued in a clear and easily understood manner, in a language or languages verified to be understood by the entire crew;
- safety equipment, including all emergency and protective equipment, is maintained in good order and stowed properly;
- all statutory drills and musters are conducted realistically, effectively and conscientiously at the required intervals and comply with any applicable rules and regulations;
- practice and training is given in emergency procedures and special emergency equipment usage is demonstrated to the crew at regular intervals;
- operating manuals, vessel plans, national laws and regulations, safety procedures and so on are available to seafarers requiring such information to conduct their work safely;
- one or more safety representatives are appointed or elected, and regular meetings of the safety committee are held on board a ship on which there are five or more seafarers. If such a committee is not required, information on safety and health should be communicated in other ways;
- all seafarers on board as well as the shipowner are informed of the membership of the safety committee, and its members are competent to perform their duties;
- the safety committee is informed of notices issued by both the competent authority and the shipowner related to the safety and health of seafarers;
- all accidents or near accidents, injuries and diseases are investigated, recorded and reported in compliance with national laws and regulations and the shipowner's procedures;
- The master may designate a person to take specific responsibility for the implementation of, and compliance with, the ship's occupational safety and health policy and programme.

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I.4.2 Duties and Responsibilities (Under MEMOSH/2014/6 Guidelines for Implementing the Occupational Safety and Health Provisions of the Maritime Labour Convention

I.4.2.3 Duties of Shipboard Safety and Health Officer

Where appointed, the safety officers should:

- implement the ship's OSH policies and programmes;
- conduct or supervise regular risk assessments and the appropriate follow-up measures to ensure continuous improvement of the safety and health of the working environment;
- work closely with the safety representatives to promote a safety culture;
- improve the crew's awareness of OSH;
- encourage individual seafarers to behave responsibly to promote proactive safe and healthy working conditions on board, including mental well-being;
- ensure that those working on board handling chemicals are given adequate information on the intrinsic properties of the chemicals and the precautionary measures and to check that chemicals are used only in workspaces and by methods appropriate to the chemical in order to provide effective protection against accidents, injuries and diseases;
- check that machinery, protective equipment and other technical aids are designed and used appropriately to prevent or significantly reduce risk;
- identify and investigate any OSH problems;
- report investigations to the safety committee and to the individual involved, where necessary;
- investigate, together with the safety committee, accidents and incidents and make appropriate recommendations to prevent recurrence of such incidents;
- conduct OSH inspections;
- monitor and provide on-board OSH training of seafarers; and
- should be a member of the safety committee.

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I.4.2 Duties and Responsibilities (Under MEMOSH/2014/6 Guidelines for Implementing the Occupational Safety and Health Provisions of the Maritime Labour Convention

I.4.2.4 Powers of safety representatives

Shipowners should make appropriate arrangements to appoint or elect safety representatives. The ship's master should record the appointment of safety representatives in the ship's official logbook or in the minutes of the committee meeting. To ensure sufficient on-board experience, it is recommended that the safety representatives should have more than two years of sea service.

Safety representatives should:

- be elected by or appointed from their work groups or departments and should participate in meetings of the safety committee;
- be allowed sufficient time off from their main shipboard duties without loss of pay to be able to fulfil their functions or receive training required to fulfil their functions;
- not be subject to dismissal or other prejudicial measures for conducting functions assigned to the role;
- have access to all relevant information and documentation, including investigation reports, and all parts of the ship;
- take part in the planning of on-board tasks, including applying preventive measures and conducting risk assessments;
- participate in the investigation of accidents and incidents. A safety representative who has been involved in the accident or incident should not be a member of the investigation team;
- have the unrestricted right to communicate directly with the relevant competent authorities and seafarers' organizations;
- receive appropriate training and instructions.

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I.4.2 Duties and Responsibilities (Under MEMOSH/2014/6 Guidelines for Implementing the Occupational Safety and Health Provisions of the Maritime Labour Convention

I.4.2.5 Health and Safety Committee

MLC 2006 Standard A4.3, paragraph 2(d), requires the establishment of a safety committee and the appointment or election of safety representatives on board ships on which there are five or more seafarers.

Purpose and objective:

The purpose and objective of a safety committee is to ensure that the shipowner and seafarers at all levels and all departments on ships work together to develop and promote safety and health and to address problems related to the ship's working environment.

This collaborative effort between the shipowner and the seafarers should facilitate the implementation of the shipowner's OSH policy and programme.

The functions of the safety committee may include, but are not limited to:

- cooperating with the master and the shipowner in the implementation of the OSH policy and programme. The committee should provide seafarers with a forum to influence OSH matters;
- taking part in the planning, managing and coordinating safe and healthy working conditions on board. The committee should take all preventive measures important to OSH, including the mental well-being of seafarers, and provide advice to resolve safety and health problems;
- taking part in the investigation, identification and analysis of occupational accidents, injuries and diseases;

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- proposing and taking part in the implementation of measures to prevent any recurrence, in consultation with the master;
- keeping up to date on OSH provisions for the protection of seafarers;
- contributing to defining principles for appropriate and necessary training and instructions specific to on-board working conditions;
- continuously inspecting the observance of safety procedures;
- cooperating with any relevant occupational health service;
- making representations and recommendations on behalf of the crew through the master to the shipowner;
- discussing and taking appropriate action in respect of any OSH matter affecting the crew, and evaluating appropriate protective and safety equipment, including lifesaving equipment.

Composition and responsibilities;

The safety committee should include the master, and/or a person designated by the master, to take specific responsibility for the implementation of, and compliance with, the ship's occupational safety and health policy and programme, and safety representatives.

The number of safety representatives should reflect the number of seafarers on board and, where appropriate, the number of different departments or working groups.

The composition of the safety committee should, as far as possible, be such that the entire crew at all levels has effective representation. There are a number of ways in which a safety committee may be composed.

For ships with less than five crew members, the master should ensure that cooperative activities are actively promoted by seafarers, like information sharing, training and consultations in the area of occupational safety and health in the maritime sectors.

Maritime Occupational Safety and Health with Hazard Identification

Safety committee meetings:

Meetings should be held in compliance with the requirements of the competent authority. They should take place regularly, taking into account the pattern of operation of the ship and the arrangement for manning and with sufficient frequency to ensure continuous improvement.

The chairperson should also convene meetings when two or more committee members request a meeting to address a particular issue. Whenever possible, OSH issues should be dealt with at the shipboard level through the safety committee.

Meetings should also be convened after serious accidents or incidents as part of the regular investigation and reporting procedures.

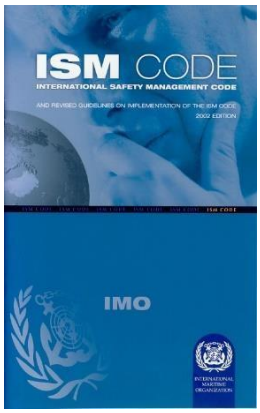
It is also recommended that hazardous situations should be treated as opportunities for safety improvement to prevent future accidents or incidents from harming seafarers or causing damage to the ship.

To avoid any delays between committee meetings, safety representatives should communicate regularly to identify potential or existing OSH issues and endeavour to resolve them. In so doing, they should cooperate with those responsible for tasks in the respective departments, including catering.

Minutes of the meetings should be distributed to the committee members, made available to those working on board and sent to the shipowner. The content of the minutes should be brought to the notice of the competent authority, upon request.

Maritime Occupational Safety and Health with Hazard Identification

I.4.3 ISM Code Safety Management System Procedures



http://www.mandibooks.com/ProductDetail.asp?PID=23262

The ISM Code requires each company to develop, document and implement their specific company Safety Management System (SMS).

There are duties and responsibilities of a Safety Officer that is embodied to the requirements in the ISM. To name a few:

I.4.3.1 Safety inspection

Onboard, the Master has the ultimate responsibility for the safety of the ship, crew, environment and cargo.

With the assistance of the Safety Officer, the Master is responsible for ensuring that the objectives of the SMS are achieved.

The safety officer shall inspect all areas of the vessel on a regular basis for safety compliance and to report to the Master any deficiencies noted.

The Regulations require the safety officer to carry out health and safety inspections of each accessible part of the ship at least once every three months, or more frequently if there have been substantial changes in the conditions of work.

Maritime Occupational Safety and Health with Hazard Identification

I.4.3 ISM Code Safety Management System Procedures

I.4.3.2 On Board Safety Training

The company should develop high quality safety training programs, seeking and acting upon crews' views and empowering them to become actively involved with onboard health and safety issues on a daily basis.

It is also important to understand the function, scope and characteristics of safety training. Areas that should be considered with regard to safety training include the selection and use of different training methods, monitoring and reinforcement of the training already held, i.e. ongoing communication through presentations, discussions and meetings to continuously check behaviour and raise awareness.

I.4.3.3 Understand the importance of reporting near misses and accidents.

A near miss is an unplanned event that did not result in injury, illness, or damage – but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, fatality or damage; in other words, a miss that was nonetheless very near (https://en.wikipedia.org/wiki/Near_miss_(safety)).

Recognizing and reporting near miss incidents can make a major difference to the safety of workers within organizations.

Maritime Occupational Safety and Health with Hazard Identification

II.0 Accidents, Hazard and Risk

The Safety committee must ensure it complies with the company's accident/incident investigation and reporting procedures. Generally, every accident/incident should be investigated and reported on with recommendations to prevent re-occurrence.

The committee should be able to assess and manage occupational risks through the application of preventive and protective measures.

In this context, the difference between a "hazard" and a "risk" should be clearly defined

II.1 Accident and Accident Investigation

An accident is the final event in an unplanned process that results in injury or illness to an employee and possibly property damage. It is the final effect of multiple causes.

An accident may be the result of many factors (simultaneous, interconnected, cross-linked events) that have interacted in some dynamic way.

Accident analysis is carried out in order to determine the cause or causes of an accident or series of accidents so as to prevent further incidents of a similar kind. It is also known as accident investigation (*https://en.wikipedia.org/wiki/Accident_analysis)*.

II.2 Accident reduction/prevention

The objective of accident analysis/investigation is to find out the root cause of the accident to be used as basis in formulating system or procedures to prevent the same accident from happening again. By identifying the hazards and managing the risk, accident can be prevented.

Maritime Occupational Safety and Health with Hazard Identification

II.3 Hazard Identification

A hazard is the inherent potential to cause injury, harm or damage to a seafarer's health. It can come from many sources, for example intrinsic properties, situations, potential energy, the environment or human factors.

II.4 Risk Assessment

A risk is the likelihood that a seafarer will be harmed or experience adverse health effects or that property will be damaged if exposed to a hazard.

The essential purpose of OSH is to prevent occupational accidents, injuries and diseases by managing occupational hazards and risks.

Procedures for hazard identification and risk assessment have to be conducted to identify what could cause harm to seafarers and property and the environment, especially the working environment, so that appropriate preventive and protective measures can be developed and implemented.

Gathering and analysing reliable data and statistics play a key role in conducting risk assessment effectively.

Maritime Occupational Safety and Health with Hazard Identification

III.0 Risk Involved on Board Ships

III.1 Overall Introduction

Any occupational health risk may lead to disability, temporary disability or to reduced work capability.

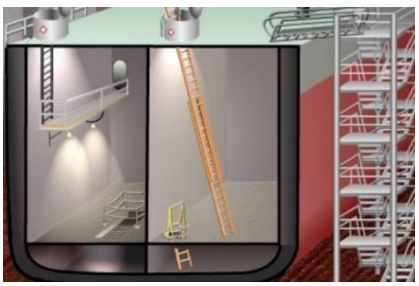
Occupational health risks to seafarers arise from exposure to hazards or harmful levels of ambient factors in the working environment. In cases where some risks are unavoidable, appropriate control measures should be implemented to minimize exposure to hazards that may cause injuries, diseases or death. Harmful exposure may have short-term and long-term adverse health effects

III.2 Safety and Direct Hazards

III.2.1 Work in enclosed spaces

The atmosphere in any enclosed space may be oxygen-deficient or oxygen-enriched and/or contain flammable and/or toxic gases or vapours.

Such unsafe atmospheres could also subsequently occur in a space previously found to be safe. Unsafe atmospheres may also be present in spaces adjacent to those spaces where a hazard is known to be present.



https://www.osha.gov/SLTC/etools/shipyard/standard/access/index_ac.html

III.2.2 Use of equipment and machinery

Specific equipment and machinery should only be operated by competent personnel.

http://www.turbosquid.com/3d-models/max-lathe-machine/540630

When operating and carrying out respective risk assessments, it is important that manufacturer's instructions are taken into consideration, including instructions related to equipment maintenance.

Maritime Occupational Safety and Health with Hazard Identification

III.2.3 Special safety measures on and below deck

Working on and below deck may pose additional hazards, especially in adverse weather conditions.

Work should not commence on open decks in conditions considered adverse by the master, unless it is considered necessary by the master for the safety of the vessel, its crew and cargo, the safety of life at sea and the protection of the marine environment.

III.2.4 Dangerous cargo and ballast

Relevant Conventions, codes and practices should be considered as they set out the requirements for the safe transport, stowage, segregation, loading, unloading and securing of cargoes, and regulations in relation to ballast water.

Should ensure that associated risks and hazards are identified and preventative measures are implemented.

III.2.5 Work at high places and over the sides

Work at High Places:
When having work done in a high place of 2 or more meters from the floor and in a place where there is a risk of falling, the following measures must be taken.

a) use a protective helmet and safety belt
b) If bosun's chair is used, must not be driven by a machine
c) If work is carried out near a funnel, whistle, radar, wireless communications antenna, etc. and there is a danger of harming the worker with the operation of the equipment in question, advise the time and nature of the work beforehand to the person handling the equipment

Maritime Occupational Safety and Health with Hazard Identification

d) Advise the Duty Officer/Engineer when the work starts and when it ends
e) Restrict passage under the work place
f) Station a lookout for the purpose of communicating with the worker on the job. Not necessary when conditions are such that, when an accident occurs, measures necessary for rescue can be promptly taken and there are two or more workers on the job at the same time
g) Have one of the workers or the lookout and the Duty Officer/Engineer carry transceivers so that communication between the two parties is ensured.

Work over Sides:

When having work done which has potential danger of dropping onto the sea, the following measures must be taken:

a) Use a safety belt and a work life jacket.
b) Use safe ladders.
c) When the work place can not be easily seen from deck, post a sign on the bulwark over the work place, or on the handrail, or near the suspended scaffolding, etc., that work is being done.
d) No discharge or throwing overboard of bilge, sewage, waste, etc.
e) Advise the Duty Officer/Engineer when the work starts and when it ends.
f) Station a lookout for the purpose of communicating with the worker on the job. Not necessary when conditions are such that, when an accident occurs, measures necessary for rescue can be promptly taken and there are two or more workers on the job at the same time.
g) Have one of the workers or the lookout and the Duty Officer/Engineer carry transceivers so that communication between the two parties is ensured.
h) Ready near the work place, life buoys, buoyant smoke signals, self-igniting lights and other lifesaving appliances that can be used immediately.

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III.2.6 Hot work

Hot Work means welding work, fusing and melting work, heating work using fire, chipping and scaling operations, use of mechanically powered tools, hand tools, grit blasting and other work that generate sparks and/or heat which could lead to fires or explosions.

III.2.7 Painting and paint scraping work

When having painting and paint scraping work done, the following measures must be taken:

a) No smoking and use of fire at the work place.
b) Do not use tools and equipment at the work place that let off sparks or become so hot as to be become a source of combustion.
c) Do not leave rags used for the work and paint pilled or scraped.
d) No persons other than those on the job approach the work place.
e) Ready near the work place an appropriate fire extinguisher.
f) Worker use a mask, protective gloves and other protective gear.

III.2.8 Descaling work and work using machine tools

When having de-scaling work or work using machine tools done, the worker must be made to wear goggles and other necessary protective gear.

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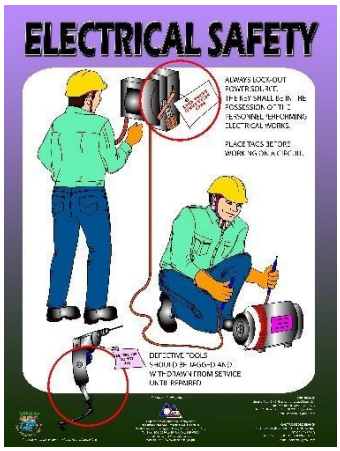
III.2.9 Working on electrical equipment

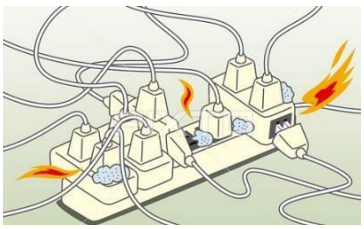
When carrying out jobs on Electrical Motors (220V or higher), GSP, Alternators, MSB, ESB, Power Distribution Transformers, Radars, Radio Communication Systems:



a) Prior to carrying out these jobs, ensure that circuit has been isolated and all personnel involved are aware of the emergency procedures and controls.
b) Persons should be properly attired for the job and area should be well marked.
c) Duty Engineer and duty Officer must be informed.
d) The area must be adequately illuminated.

Eliminate Octopus Connections:

a) Do not plug several power cords into one outlet
b) Pull the plug, not the cord
c) Do not disconnect power supply by pulling or jerking the cord from the outlet. Pulling the cord causes wear and may cause shock.



https://www.pixtastock.com/illustration/9747687

Effect of Current on Human Body:
Women – Let go current – if 6mA
Men- Let go current- if 9mA

Carrying out Cold Work:

When carrying out any job in a hazardous area which does not involve generation of high temperature conditions which in turn may cause ignition of combustible gases, vapours, or liquids within the area or an adjacent area for e.g. Connecting Disconnecting pipes etc.:

https://www.google.com.ph/search?q=connecting+pipes&biw+ON+TANKER+SHIPS

a) Ensure that the area is properly illuminated and adequate persons are available for the job.
b) The duty watch keepers must be informed and the area must be well marked.
c) Persons involved must be properly attired.
d) It may also be required to comply with enclosed space entry requirements.

Maritime Occupational Safety and Health with Hazard Identification

III.2.10 Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter.

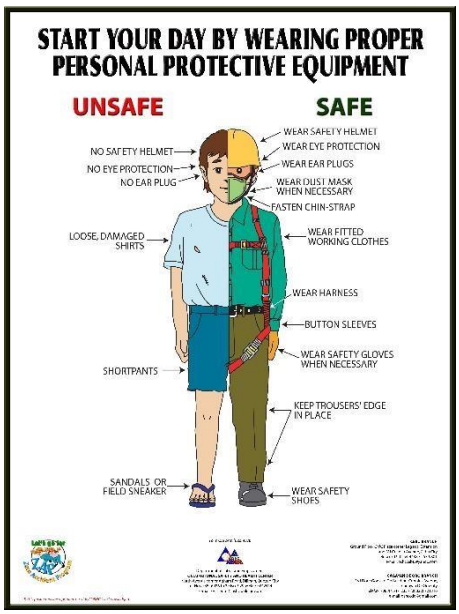
Any item of PPE imposes a barrier between the wearer/user and the working environment. This can create additional strains on the wearer; impair their ability to carry out their work and create significant levels of discomfort. Any of these can discourage wearers from using PPE correctly, therefore placing them at risk of injury, ill-health or, under extreme circumstances, death. Good ergonomic design can help to minimise these barriers and can therefore help to ensure safe and healthy working conditions through the correct use of PPE. *(https://en.wikipedia.org/wiki/Personal_protective_equipment)*

The PPE must be considered only after engineering and administrative controls have been found ineffective, not feasible or insufficient. It must be used only as a last resort or last line of defence. PPE must comply with existing OSH standards.

Seafarers who are required to wear personal protective equipment should be trained on how to do the following:

- Use protective equipment properly;
- Be aware of when personal protective equipment is necessary;
- Know what kind of protective equipment is necessary;
- Understand the limitations of personal protective equipment in protecting workers from injury
- Put on, adjust, wear, and take off personal protective equipment, and
- Maintain protective equipment properly.

(https://www.osha.gov/OshDoc/data_General_Facts/ppe-factsheet.pdf)



Maritime Occupational Safety and Health with Hazard Identification

III.3 Industrial Health

III.3.1 Noise

Working in areas with excessive noise may cause accidents, injuries and diseases, and may have short- and long-term adverse effects on health.

Excessive noise may also interfere with communication on board ship, which could increase the risk of accidents.

Allowable time a worker can stay in a work area without hearing protection:

8 hrs.(90db), 4 hrs.(95db), 2 hrs. (100db), 1 hr.(105db)

III.3.2 Vibrations

Vibrations are oscillating movements transmitted through solid material. They may affect the whole body due to the movement of the ship or when working near vibrating machinery, or may be focused on the hands and arms when using vibrating tools.

They may induce adverse health effects, either directly, or indirectly through the impact of reflex muscle activity on body structures.

III.3.3 Artificial lighting

Excessive or insufficient artificial lighting or the incorrect positioning of lighting may lead to inappropriate working conditions that could harm seafarers or damage property.

Adverse health effects associated with inadequate lighting include discomfort in the eyes, headaches, neck strains and temporary blurred vision or after-images (such as black spots caused by glare).

Such effects may, in turn, contribute to incidents involving injuries to personnel and damage to property.

Lighting should be well placed and sufficient for all working areas on board and the type of work conducted. Adequate lighting levels should be determined by the competent authority, after consultations with the shipowners' and seafarers' organizations concerned, taking into account national and international standards.

Maritime Occupational Safety and Health with Hazard Identification

III.3.4 Ultraviolet light

The major source of ultraviolet light (UV) affecting seafarers is the sun. The level of risk to harmful exposure to UV light depends upon the intensity of the light, the duration of the exposure, the use of protective clothing and the sensitivity of the seafarer.

Adverse health effects due to such an exposure may include premature ageing symptoms among seafarers under the age of 18, actinic keratosis and cancers such as carcinoma or melanoma.

III.3.5 Non-ionizing radiation

Seafarers may be exposed to non-ionizing radiation – a form of electromagnetic radiation that includes radio, microwave and infrared radiation – when working with various types of equipment, such as radar systems or welding equipment. The level of exposure varies depending on the strength of the fields generated from such equipment and the proximity of the work station.

Short-term exposure to high-intensity non-ionizing radiation causes tissue heating, in particular damage to the lens of the eye. Other possible health effects may include headaches, dizziness and sleep disturbance, which may lead to incidents. There is academic uncertainty about harmful effects of long-term exposure.

III.3.6 Extreme temperatures

Hyperthermia occurs when the human body fails to cool down by regulating its own temperature when exposed to high ambient temperatures and humidity for prolonged periods. Such conditions may also be present in engineering spaces on board ships.

It is important to note that seafarers suffering from secondary illnesses that involve dehydration are more susceptible to hyperthermia.

Adverse health effects from hyperthermia include profuse sweating, headaches, dizziness, fainting, lethargy, nausea, cramps in major muscles, rapid breathing and pulse, and high body temperatures. In extreme cases this condition may lead to death.

Maritime Occupational Safety and Health with Hazard Identification

Hypothermia occurs when the human body's core temperature falls below 35°C, the point at which normal body function is impaired.

Loss of life may occur when the deep body temperature falls below 30°C.

Seafarers may be exposed to cold water due to immersion in the sea or exposure to cold air while working on cold geographical trading routes.

Adverse health effects from hypothermia could include loss of muscle control leading to muscle incoordination; confusion and muddle-headedness; trouble following simple instructions; unconsciousness and, ultimately, death.

III.3.7 Structural features of the ship, means of access and asbestos- related risks

By nature of ships construction, jobs and work on board pose identified specific risk and hazards to the safety and health of seafarers which may result in fatalities or major injuries.

Special attention should be taken to identify and mitigate asbestos-related risks

Prolonged inhalation of asbestos fibers can cause serious and fatal illnesses including lung cancer, mesothelioma, and asbestosis (a type of pneumoconiosis).

Maritime Occupational Safety and Health with Hazard Identification

III.4 Occupational Health

III.4.1 Mental occupational health

Working at sea have a range of adverse effects on mental health. It is associated with stress, anxiety, depression, post-traumatic stress disorder (PTSD) and suicide.

In the short term, mental distress may have a negative effect on work performance, safety behaviour and well-being. In the longer term it may have a severe impact on a seafarer's life and on their ability to work.

Mental distress may be associated with factors beyond the workplace, such as concerns about events at home. At times a mix of work, non-work and personal issues may all combine and lead to distress. These interactions need to be recognized and competent support may need to be obtained to help with their resolution.

A range of work-related factors may contribute to mental distress. These can arise from the inherent physical constraints of living and working at sea; from the way in which a seafarer is treated by those with whom they work; from incidents that lead to mental trauma; or from a lack of personal fulfilment from work.

Seafarers should be provided with effective advice on measures to minimize the adverse effects of work-related factors on mental health.

May include steps to identify and reduce workplace stressors; increasing awareness of the signs of early mental distress to enable an early response; access to recreational and welfare facilities (MLC, 2006, Regulations 3.1 and 4.4), and organizational arrangements that enable seafarers to raise issues about mental stressors and to secure remedies for them.

Maritime Occupational Safety and Health with Hazard Identification

III.4.2 Violence in the workplace

Workplace violence - any action, conduct, threat or gesture of a person towards a seafarer in their workplace that is expected to cause harm, injury or illness to that seafarer.

Should develop a workplace violence prevention policy; identify factors that contribute to workplace violence; assess the potential for workplace violence; develop procedures to be followed in the event that threats of violence or aggression against a seafarer, and/or others working on board ship occur; review the effectiveness of the prevention measures; develop emergency notification procedures; and provide information and training on the factors that contribute to workplace violence.

III.4.3 Ergonomic hazards

Ergonomics is the study and design of workspaces (such as the workstation and ship bridge) and their components, work practices and procedures to benefit workers' productivity, health, comfort and safety.

Ship design and layout, including engineering, should provide a work environment that fosters effective procedures, safe work patterns and seafarers' health, and should minimize or prevent occupational accidents, injuries and diseases which may degrade human performance or increase potential for error.

A ship, as a workplace, comprises several specific types of workspaces.

On cargo ships, examples include the bridge, engine room, hatches, decks and accommodation.

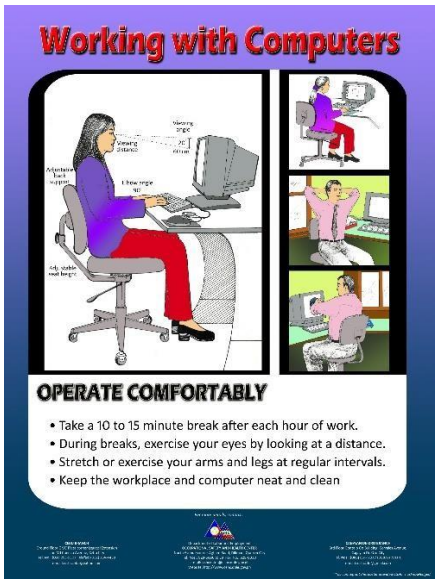
On passenger ships, in addition to the technical workspaces related to the ship's engine operations, there are also workspaces used for the on-board hotel and catering services.

Maritime Occupational Safety and Health with Hazard Identification

To ensure that work is carried out safely, certain basic ergonomic requirements should be adhered to in order to prevent seafarers from working for long periods in awkward positions such as on their knees, with arms and shoulders raised or with back and neck bent, or from repeating these postures and movements frequently.

Poor ergonomic layout, design and arrangement of the ship and its equipment may lead to both short- and long-term adverse health effects due to stressful working postures. These effects include, but are not limited to:

(a) musculoskeletal disorders;
(b) soreness, pain, stiffness and fatigue in muscles and joints;
(c) tingling in the fingers and changes in sensitivity altering the feeling in fingers, feet and legs;
(d) pain, soreness and swelling due to irritation around the tendons; and
(e) damage such as tennis elbow and inflammation of the tendons, which may last several weeks and may cause a recurrent chronic condition.



Maritime Occupational Safety and Health with Hazard Identification

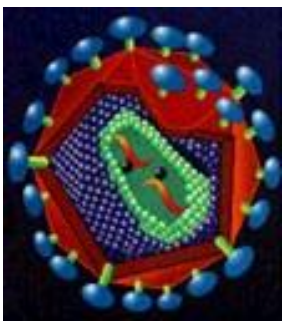
III.4.4 Biological Hazards

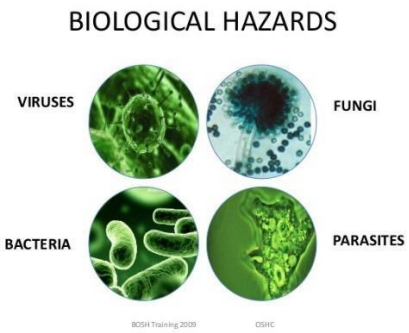
Work on board ships may lead to seafarers being exposed to biological agents. Biological agents could mean micro-organisms which may provoke an infection, allergy or toxicity.

For example, seafarers may be exposed to biological agents when cleaning and maintaining sewage tanks on board ships, or resulting from poor food hygiene, contaminated food or drinking water, dirty or wet linen, inappropriate personal hygiene, unhygienic treatment in the ship's hospital, and the spread of bacteria and viruses such as influenza.

The adverse health effects of exposure to biological agents include infectious diseases, allergies and toxicity, such as:

- Tuberculosis
- Hepatitis
- Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS)
- Sexually Transmitted Disease (STD)





Maritime Occupational Safety and Health with Hazard Identification

III.4.5 Chemical Hazards

Chemicals may refer to chemical substances – elements and their compounds – and chemical materials – compounds of two or more substances.

Chemicals may be in solid, liquid or gas/vapour form. They may be absorbed by the skin in liquid or vapour form or through inhalation of vapours from dust or aerosol sprays.

Chemicals are regarded as dangerous if they are classified and marked with a hazard symbol or statement, if they have a threshold limit value, or on the basis of their physical/chemical or toxicological properties or their use on board.

Work with chemicals should always be planned and carried out on the basis of an individual and an overall assessment of the short-term and long-term occupational health effects.

Harmful chemical exposure could occur during handling, storage, transportation, disposal, utilization and other work in close proximity with chemicals such as paints, cleaners or oils. There may also be exposure to chemicals transported either as packaged dangerous goods, or transported in bulk as a gas, liquid or solid (dust).

In addition, chemicals may also be developed during work processes, for example by fumes and particles in welding or from vehicle exhausts on roll-on/roll-off ships.

The short- and long-term adverse effects on health of exposure to chemicals may lead to acute chronic and delayed (remote) effects or consequences.

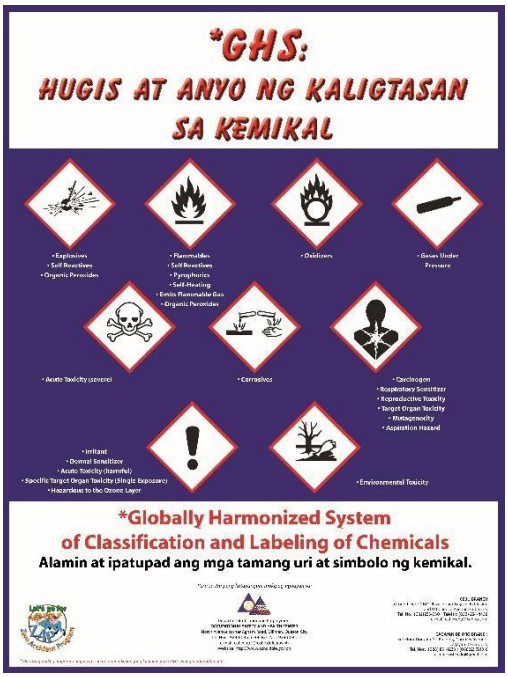
Maritime Occupational Safety and Health with Hazard Identification

Safety Data Sheets (SDS)

Summary of important health, safety and toxicological information on the chemical or the mixture ingredients. Should contain:

a) identification
b) hazard(s) identification
c) composition/information on ingredients
d) first aid measures
e) fire-fighting measures
f) accidental release measures
g) handling and storage
h) exposure control/personal protection
i) physical and chemical property
j) stability and reactivity
k) toxicological information
l) ecological information
m) disposal consideration
n) transport information
o) regulatory information
p) other information

SDS should conform to the Globally Harmonized System(GHS), an international standard for classifying chemicals and communicating its hazards.



https://www.ccohs.ca/oshanswers/chemicals/whmis_ghs/labels.html

Pictogram used for hazard communication

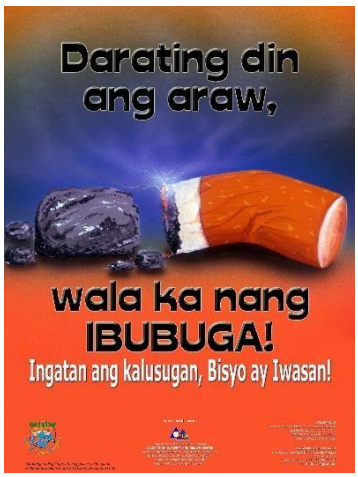
Maritime Occupational Safety and Health with Hazard Identification

III.3.6 Tobacco Smoking

The health dangers of smoking have been recognized for many years, and the link between passive smoking and other health disorders has been proven by numerous studies.

It should:

(a) reduce the risks to non-smokers from tobacco smoke on board ship;
(b) inform seafarers of the harmful effects of smoking;
(c) provide support and assistance to any seafarers who express a wish to stop smoking;
(d) designate non-smoking and smoking areas, with signs featuring the respective international symbols, which may be displayed at any entrance to the ship and in all common areas as appropriate.



III.4.7 Drug and Alcohol Abuse and Dependence

Abuse of and dependency on drugs and alcohol by seafarers while on board can affect work performance, lead to problems of discipline and supervision, and become dangerous to persons and the ship.

Alcohol may impair judgement and increase the risk of accidents. In the long term, alcohol abuse may lead to ill health and, in extreme cases, death.

Drug abuse by seafarers is extremely dangerous. Individuals who abuse drugs are likely to pose a serious hazard to themselves and other persons on board, and the ship.

Maritime Occupational Safety and Health with Hazard Identification

III.4.8 Fatigue

There is no universally accepted definition of fatigue. However, common to all the definitions is degradation of human performance.

The following definition is found in the IMO's MSC/Circ.813/MEPC/Circ.330, List of Human Element Common Terms:

"A reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities including: strength; speed; reaction time; coordination; decision-making; or balance."

The most common causes of fatigue known to seafarers are lack of sleep, poor quality of rest, stress and excessive workload.

Hours of work and/or rest are a key issue when considering the working environment. Lack of rest may have consequences for the overall safety and cooperation on board, as well as individuals' well-being, health and general quality of life.

Studies and research carried out by various organizations and administrations have shown the increasing human, financial and environmental impact of maritime accidents and frequently cite fatigue as a contributory cause due to lack of sleep.

Lack of sleep may lead to adverse health effects including but not limited to:

(a) poor concentration;
(b) increased risk of error and slower reaction times, which can mean that incidents are not averted in time;
(c) reduced ability to handle duties safely and to perform tasks optimally; and
(d) damaging health effects over a long period of time.

Maritime Occupational Safety and Health with Hazard Identification

IV.0 Emergency and accident response

Needs to develop Emergency and Accident Response Action Plans and to conduct the necessary training and drills for ships as part of overall safety and health policy within the occupational safety and health policies and programmes.

Emergency and accident response plans are an efficient and effective means of minimizing the risks to human life.

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WORKPLACE HAZARDS

SAFETY HAZARDS:

These are the most common and will be present in most workplaces at one time or another. They include unsafe conditions that can cause injury, illness and death. Machinery-related hazards (lockout/tagout, boiler safety, forklifts, etc.)

Reference:https://www.osha.gov/dte/grant_materials/fy10/sh-20839-10/circle_chart.pdf

Maritime Occupational Safety and Health with Hazard Identification

SAFETY HAZARDS: These are the most common and will be present in most workplaces at one time or another. They include unsafe conditions that can cause injury, illness and death.

Safety Hazards include:

- Spills on floors or tripping hazards, such as blocked aisles or cords running across the floor
- Working from heights, including ladders, scaffolds, roofs, or any raised work area
- Unguarded machinery and moving machinery parts; guards removed or moving parts that a worker can accidentally touch
- Electrical hazards like frayed cords, missing ground pins, improper wiring
- Confined spaces
- Machinery-related hazards (lockout/tagout, boiler safety, forklifts, etc.)

BIOLOGICAL HAZARDS: Associated with working with animals, people, or infectious plant materials. Work in schools, day care facilities, colleges and universities, hospitals, laboratories, emergency response, nursing homes, outdoor occupations, etc. may expose you to biological hazards.

Types of things you may be exposed to include:

- Blood and other body fluids
- Fungi/mold
- Bacteria and viruses
- Plants
- Insect bites
- Animal and bird droppings

PHYSICAL HAZARDS: Are factors within the environment that can harm the body without necessarily touching it.

Physical Hazards include:

- Radiation: including ionizing, non-ionizing (EMF's, microwaves, radiowaves, etc.)
- High exposure to sunlight/ultraviolet rays
- Temperature extremes – hot and cold
- Constant loud noise

ERGONOMIC HAZARDS: Occur when the type of work, body positions and working conditions put strain on your body. They are the hardest to spot since you don't always immediately notice the strain on your body or the harm that these hazards pose. Short-term exposure may result in "sore muscles" the next day or in the days following exposure, but long-term exposure can result in serious long-term illnesses.

Ergonomic Hazards include:

- Improperly adjusted workstations and chairs
- Frequent lifting
- Poor posture
- Awkward movements, especially if they are repetitive
- Repeating the same movements over and over
- Having to use too much force, especially if you have to do it frequently
- Vibration

CHEMICAL HAZARDS: Are present when a worker is exposed to any chemical preparation in the workplace in any form (solid, liquid or gas). Some are safer than others, but to some workers who are more sensitive to chemicals, even common solutions can cause illness, skin irritation, or breathing problems.

Beware of:

- Liquids like cleaning products, paints, acids, solvents – ESPECIALLY if chemicals are in an unlabeled container!
- Vapors and fumes that come from welding or exposure to solvents
- Gases like acetylene, propane, carbon monoxide and helium
- Flammable materials like gasoline, solvents, and explosive chemicals.
- Pesticides

WORK ORGANIZATION HAZARDS:
Hazards or stressors that cause stress (short-term effects) and strain (long-term effects). These are the hazards associated with workplace issues such as workload, lack of control and/or respect, etc.

Examples of work organization hazards include:

- Workload demands
- Workplace violence
- Intensity and/or pace
- Respect (or lack of)
- Flexibility
- Control or say about things
- Social support/relations
- Sexual harassment

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Near Miss:
Means any act, action and condition which could have led to an accident or incident, though it did not actually materialize, and includes both "action or condition which has resulted in a narrow escape before its developing into an "actual accident or incident" and "unsafe act / condition (trivial one which frequently occurs)".
Reference: NYKSM – SMS

Unsafe / Unhealthy Act:
Definition by The American National Standards Institute (ANSI)
"Any human action that violates a commonly accepted safe work procedure or standard operating procedure".
This is an act done by worker that does not conform or departs from an established standard, rules or policy.
These often happen when a worker has improper attitude, physical limitations, or lacks knowledge or skills.
Example: smoking in non-smoking area, using substandard or defective tools, working under the influence of liquor or drugs, improper storage of chemicals and or paints among others.

Unsafe / Unhealthy Condition;
ANSI Definition
Physical or chemical property of material, machine or the environment which could possibly cause injury to people, damage to property, disrupt operations in plant or office or other forms of losses.
These could be guarded or prevented.
Example:
Slippery and wet floors, dusty work area, octopus wiring, etc.

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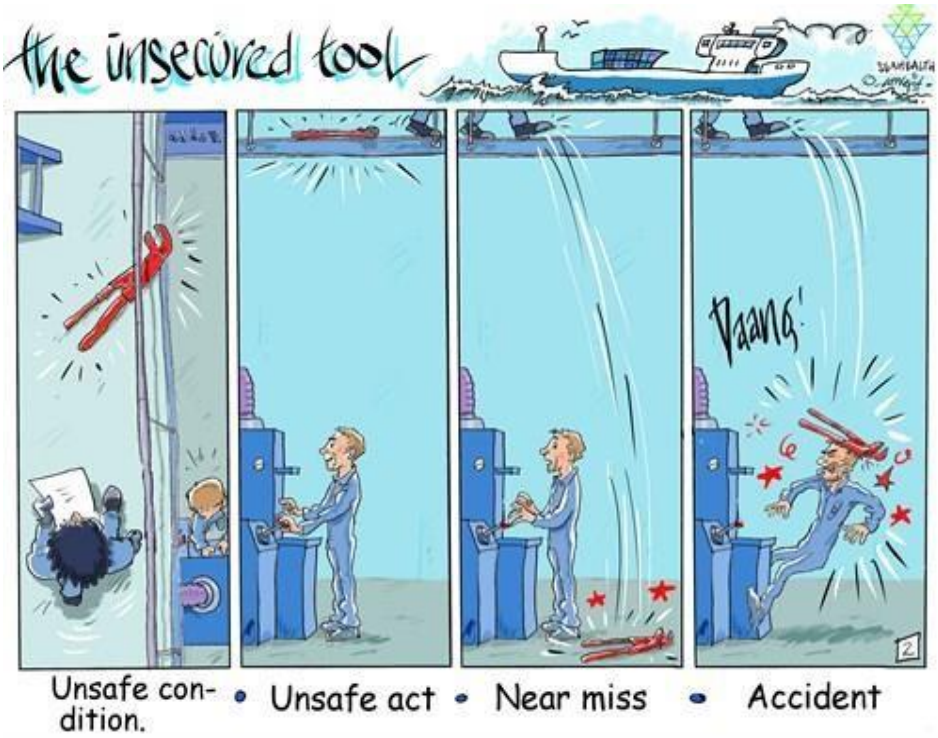
Poster reference: http://uk.nearmiss.dk/knowledge/what-is-what/



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Poor work practices create hazards – examples of unsafe work practices commonly found in the workplace include:

using machinery or tools without authority operating at unsafe speeds or in violation of safe work practices

- removing or disabling guards or other safety devices on machinery or equipment
- using defective tools or equipment or using tools or equipment in unsafe ways
- using hands or body instead of tools or push sticks
- overloading, crowding or failing to balance materials or handling materials in other unsafe ways, including improper lifting
- repairing or adjusting equipment that is in motion, under pressure, or electrically charged
- failing to use and/or maintain, or improperly using personal protective equipment or safety devices
- creating unsafe, unsanitary or unhealthy conditions by improper personal hygiene, poor workplace maintenance or by smoking in unauthorized areas. Learn how to avoid carrying hazardous substances home with you.
- standing or working under suspended loads, scaffolds, shafts, or open hatches

http://www.takeonestep.org/Pages/yoursafety/safenotsorry/workplacehazards.aspx

Maritime Occupational Safety and Health with Hazard Identification

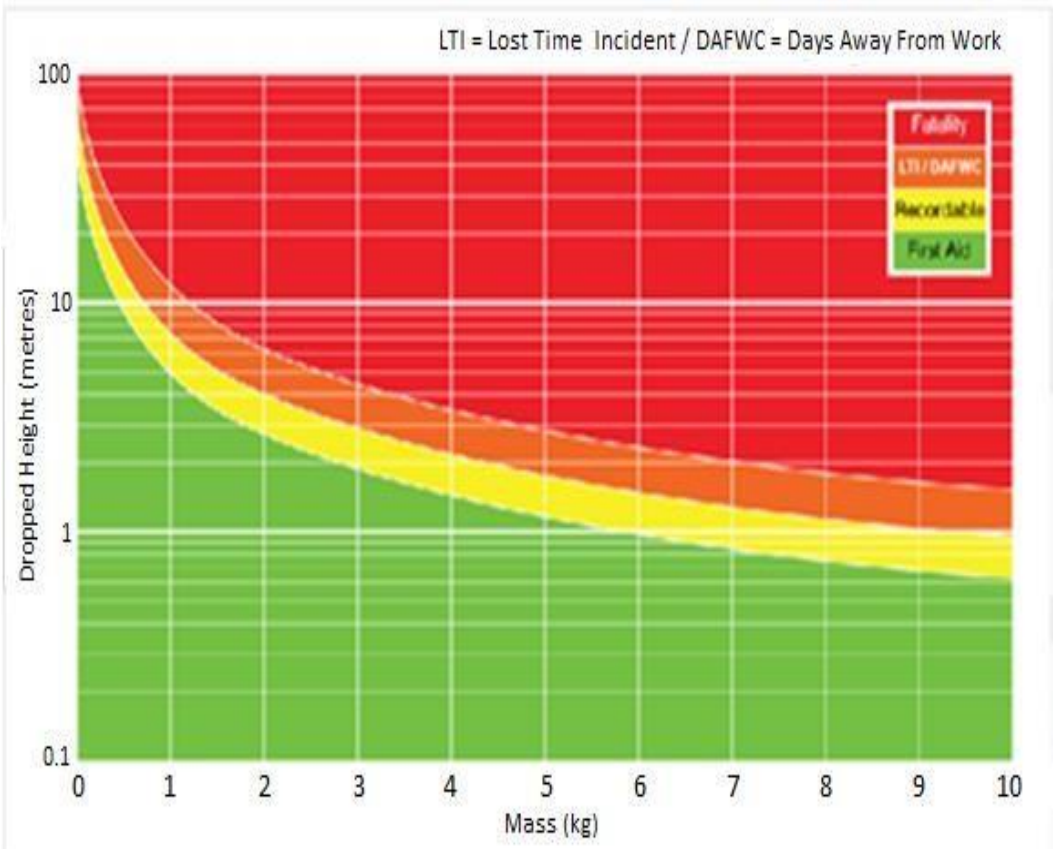
Dangers associated with falling and falling objects :

Falling object hazards

Falling objects on worksite exposes workers to minor injuries and even death.
Anytime work is being performed overhead where others may be working or walking below or any object (big or small) high above if left unsecured puts a worker on that site at risk of falling objects.

The higher the height of the fall the greater damage an object can create to the workers' body (head and other parts of the body).

EVEN SMALL OBJECT CAN KILL !!!



Reference: chart from the presentation of Leong Weng – DROPS Asia Chairman

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IMPACT FORCE OF A DROPPED OBJECT

MEASURED IN POUNDS PER SQUARE INCH

Weight of Dropped Object (pounds)

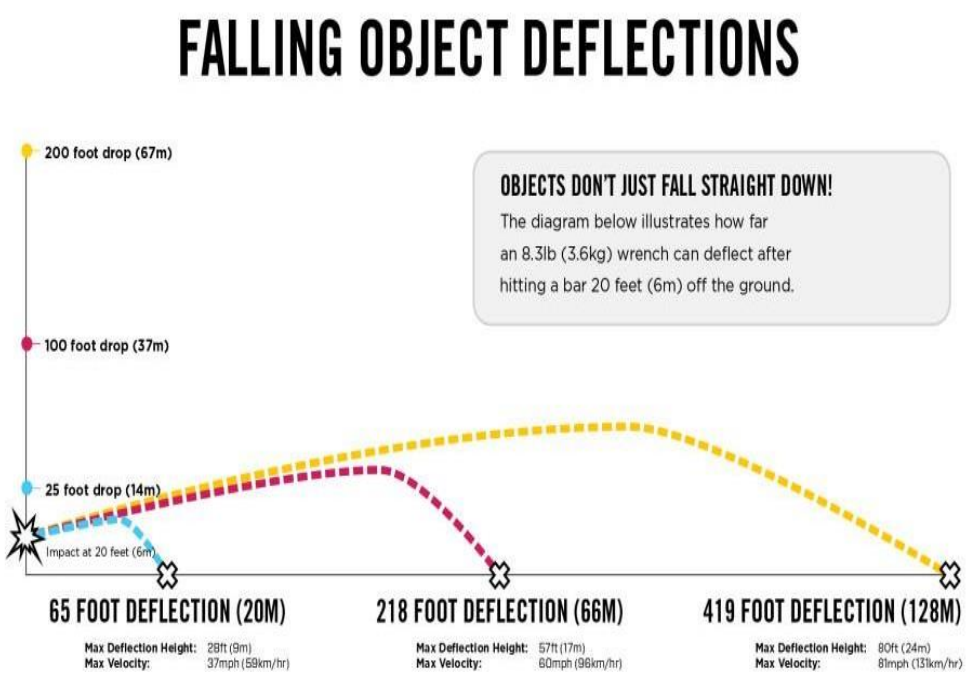
Drop Height (feet)	1	2	3	4	5	6	7	8	9	10
300	434	867	1,301	1,735	2,168	2,608	3,036	3,469	3,903	4,337
200	354	708	1,062	1,416	1,771	2,125	2,479	2,833	3,187	3,541
150	307	613	920	1,227	1,533	1,840	2,147	2,453	2,760	3,067
100	250	501	751	1,002	1,252	1,502	1,753	2,003	2,253	2,504
50	177	354	531	708	885	1,062	1,239	1,416	1,593	1,771
20	112	224	336	448	560	672	784	896	1,008	1,120
10	79	158	238	317	396	475	554	633	713	792
6	61	123	184	245	307	368	429	491	552	613

SERIOUS SEVERE FATAL

FALLING OBJECT DEFLECTIONS

"Dropped Object Deflection Study," Southern Polytechnic State University

DROPPED OBJECTS DON'T ALWAYS FALL STRAIGHT DOWN



Reference: http://blog.gallawayb2b.com/stop-the-drop/

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Falls

Falls is one of the leading causes of injury and or death in a worksite. But falls are easily preventable.

OSH requires workers to use fall protection system where they could fall at least 3 meters or where a fall from a lower height may result in serious injury. Fall prevention is required on scaffolds three (3) meters or higher.

The risk of falls can be lowered by implementing a fall prevention/protection plan in the company safety program. Good housekeeping also reduces the chance of slips, trips and falls.

The physical characteristics of various falls and associated calculations related to fall dynamics and force of impact (potential severity) illustrate the critical importance of fall prevention and the use of various fall protection control structures, devices, and activities.

VELOCITY UPON IMPACT (V)

$V = (V02 + 2\ gh)1/2$ or $V = V02 + 2\ gh = 2gh$

where:

V = velocity upon impact (ft/s or m/s)

Vo = initial velocity (ft/s or m/s)

g = acceleration due to gravity (32.2 ft/s2 or 9.81/s2)

h = distance of the fall (ft, m)

KE or Dynamic energy (E)

$E = ½\ mv2$ (Joules, ft-lb)

m= mass of the object (kg, slugs)

v= velocity of the object (m/s, ft/s)

Impact Force (EF)

EF = mgh / s

m = mass (kg, slugs)

s= slow down distance ; s = 1/2 m v2 / F

F=slow down force F = 1/2 m v2 / s

Ref: NELSON & ASSOCIATES; PHYSICS CALCULATIONS RELATED TO FALLING OBJECTS

By Gary S. Nelson and Timothy D. Snowden // www.engineering toolbox.com

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The severity of injury increases with the height of the fall, but also depends on body and surface features and the manner of body impacts on to the surface. The chance of surviving increases if landing on a surface of high deformity (a surface that bends, moves, or compresses), such as snow or water.

Reference: wikipedia

How long does it take to Fall?

Reference: Work Safe BC - worksafebc.com

An Introduction to Personal Fall Protection Equipment

Following table indicates how far a person can fall in just few seconds

Time (seconds)	Distance (metres)	Distance (feet)
0.5	1.2	4
1	5	16
1.5	11	36
2	20	64
2.5	31	100
3	44	144
4	78	256

Referring to the above table, one may not have the time to grab hold of something safe, but still tragedy can be prevented. Properly maintained and worn, safety belt or full body harness attached to a secure anchor could save life.

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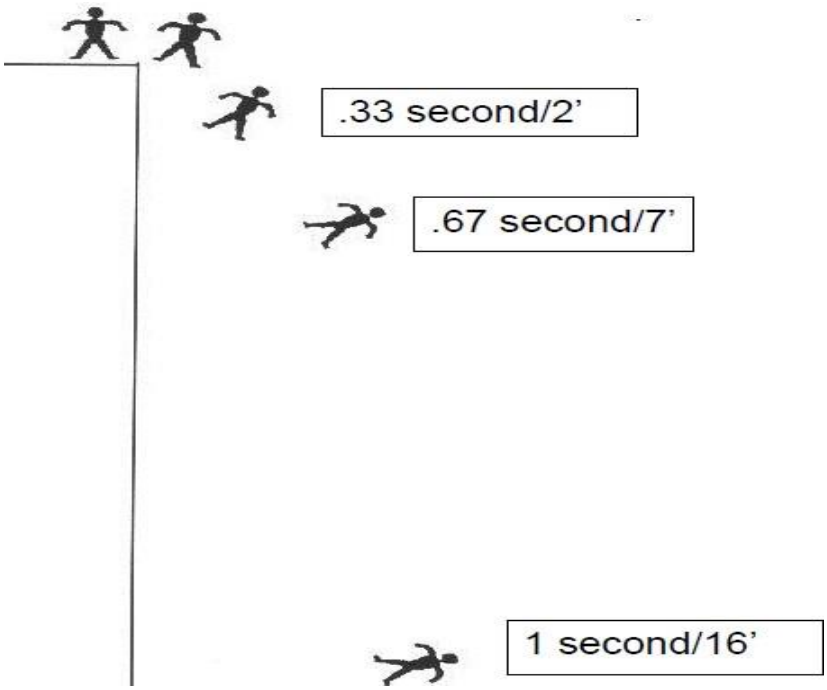
'it's not the fall that hurts but the sudden stop at the end'. Think of a fall as "…a sudden, unanticipated descent in space driven by gravity". Although this may not sound severe, the consequences are often disabling - or deadly. It takes most people about 1/3 of a second to become aware of a fall. It takes another 1/3 of a second for the body to react. A person can fall up to 7 feet in 2/3 of a second.

Reference: *https://www.osha.gov/dte/grant_materials/fy11/sh-22230-11/FallHazardManual.pdf*

Anatomy of Fall



Referring to the above mentioned formula:
(sample; 65 kilogram man, falling from a height of 5 meters)

Speed at impact: 9.90 m/s
Time until impact: 1.01 sec
Energy at impact: 3185.0 joules

In deciding to use a fall protection, first consider installing guardrails or barriers (engineering control). However, installing barriers or guardrails at a worksite may not always be practical and that is when a worker needs a personal fall protection equipment.

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Two types of fall protection:

a) Fall arrest:

Fall arrest system protects the workers body after by stopping the fall before he /she hits the surface below.

Equipment used:

a) Full body harness connected by lanyards or lifelines to secure anchors

b) Safety nets

Personal Fall Arrest Systems - The Fall

A free fall is defined as the act of falling before a personal fall arrest system begins to apply force to arrest the fall. When a fall is experienced using a PFAS, the fall is referred to as a free fall up until the system starts to arrest the fall to stop the fall.

OSHA regulations allow no more than a six foot free fall distance.

When the fall does come to a complete stop, the action is referred to as the fall arrest. Tremendous force is imposed on the body during the fall arrest. This force imposed during the arrest is known as the arrest force. Forces imposed in a fall greatly depend on the type of system you are using and the free fall distance.

For example: A 220 lb. worker:

- Free falling 2 ft. using a wire rope lanyard (without a deceleration device) = approx. 3917 lbs.
- Free falling 4 ft. using a nylon rope lanyard (without a deceleration device) = approx. 2140 lbs.
- Free falling 6 ft. using a synthetic web lanyard (with a deceleration device) = <900 lbs.

OSHA sets limits on the Maximum Arrest Force (MAF). The law prohibits the use of a safety belt for fall arrest and allows a maximum of 1800 lbs. when using a full body harness.

ARREST FORCE = the force imposed when the stop occurs.

Reference:https://www.osha.gov/dte/grant_materials/fy11/sh-22230-11/FallHazardManual.pdf

b) Fall Restraint

Fall restraint system prevents a worker from falling

a) Work-positioning systems includes using safety belts or full body harness that attach a worker to an anchor and leave both the workers hands free to work.

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b) Travel-restriction system of guardrails personal fall protection equipment used to prevent a worker from travelling to an edge from where a worker may fall.

INSPECTION OF FALL PROTECTION EQUIPMENT

Reference: ISEA // INTERNATIONAL SAFETY EQUIPMENTASSOCIATION
USE AND SELECTION GUIDE Personal Fall Protection Equipment

There are three vital components that make up a complete fall protection system.
These are the ABC's of fall protection:

- Anchorage.
- Body support.
- Means of Connection.

Each one must be in place and properly used to provide maximum worker protection.

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While each of these components is vital to worker safety, the connecting device is the critical link in assembling a safe fall protection system since it bears the greatest force during a fall. Careful consideration must be given to the selection, materials, construction and inspection/ maintenance of fall Protection equipment before, during and after a connecting device has been selected.

An anchorage, as defined by OSHA, is a secure point of attachment for lifelines, lanyards or deceleration devices. ANSI Z359 defines anchorage as a fixed structural component such as a beam, girder, column or floor that can support the forces exerted in arresting a fall, and introduces the term "anchorage connector" to refer to the component by which the connecting device is coupled to the anchorage. It may be a beam anchor, cross-arm strap, D-bolt, hook anchor, tripod, davit or other secure device that serves as a point of attachment for lifelines, lanyards or deceleration devices.

Anchorages and anchorage connectors must be independent and capable of supporting 5,000 lb per employee attached, or designed, installed and used under the supervision of a qualified person as part of a complete personal fall arrest system which maintains a safety factor of at least two. They must also be located high enough for a worker to avoid contact with a lower level should a fall occur.

A body support, or body wear, is the component that is worn on or around the torso.

Body belts and full body harnesses are the two most common body supports.

Body Belt

A body belt is a belt that circles the waist and is used for worker positioning and fall prevention.

A body belt may be supplied with D-rings on the hips and/or middle of the back. A body belt must NEVER be used for personal fall arrest.

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Full Body Harness

A full body harness is a body support device that distributes fall arrest forces across the shoulders, thighs and pelvis. Full body harnesses have a center back fall arrest attachment for connection to the fall arrest connecting device and may have other D-rings for use in worker positioning, fall prevention, suspension or ladder climbing.

The only form of body wear acceptable for fall arrest is the full-body harness.

Full body harnesses should be selected based on work to be performed and the work environment.

Side and front D-rings on full body harnesses are for positioning only.

Means of Connection

The connecting subsystem is the critical link which joins the body wear to the anchorage/anchorage connector. It can be an energy-absorbing lanyard, fall limiter, self-retracting lanyard, rope grab, or retrieval system. Connecting means will vary depending on whether the worker is equipped for personal fall arrest or work positioning and travel restriction

Connecting Means for Personal Fall Arrest

The connecting means for personal fall arrest is often a lanyard equipped with an energy-absorbing element to reduce the energy transmitted to the user's body in the event of a fall. Self-retracting lifelines or fall limiters reduce free-fall distance as well as reducing energy loads from a fall.

Connecting Means for Positioning and Travel Restriction

The connecting means for positioning and travel restriction is often a simple lanyard, constructed of rope, web or wire rope.

These may also include specialized positioning assemblies for rebar work, constructed of chain or web. All positioning devices are intended to reduce the potential for free fall to a distance of less than two feet. Restraint lanyards are specified in length to prevent the user from reaching a fall hazard zone.

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FREE FALL DISTANCE, TOTAL FALL DISTANCE, AND SYSTEM ELONGATION

Personal fall arrest systems must be selected and rigged to ensure that potential free fall distances will never exceed 6 ft (1.8 m) as required by OSHA. See manufacturer's instructions for connecting subsystems to determine the deceleration distance and elongation that must be taken into consideration.

Total fall distance is the sum of free fall distance and deceleration distance. Dynamic elongation of the system (temporary elastic stretch of connecting components and subsystems) and the worker's height must be added to total fall distance and the user must allow for clearance. It is prudent to allow for an additional safety factor of 3 ft (1 m) below the fallen worker's feet.
Potential fall distance must be calculated to determine how to rig the system, and selection of the appropriate type of connecting device.
For example, when using a 6-foot lanyard, the
illustration below shows a typical calculation of total estimated fall distance.
For the example shown:
When fall clearance is under 18.5 ft (5.6m), an alternative solution such as a shorter lanyard length, or a different connecting device such as a self-retracting lanyard or fall limiter, is needed to reduce the total fall distance.

When fall clearance is over 18.5 ft (5.6m) there is sufficient total fall distance available and the 6 ft lanyard is acceptable to use. Note that energy absorbing lanyards can expand up to 3.5 ft (1.1m). Consult manufacturer's instructions.

Note:

Never tie a knot in any lanyard to make it shorter, as it reduces the strength by more than 50%. Instead, purchase an adjustable lanyard and adjust it to proper working length.

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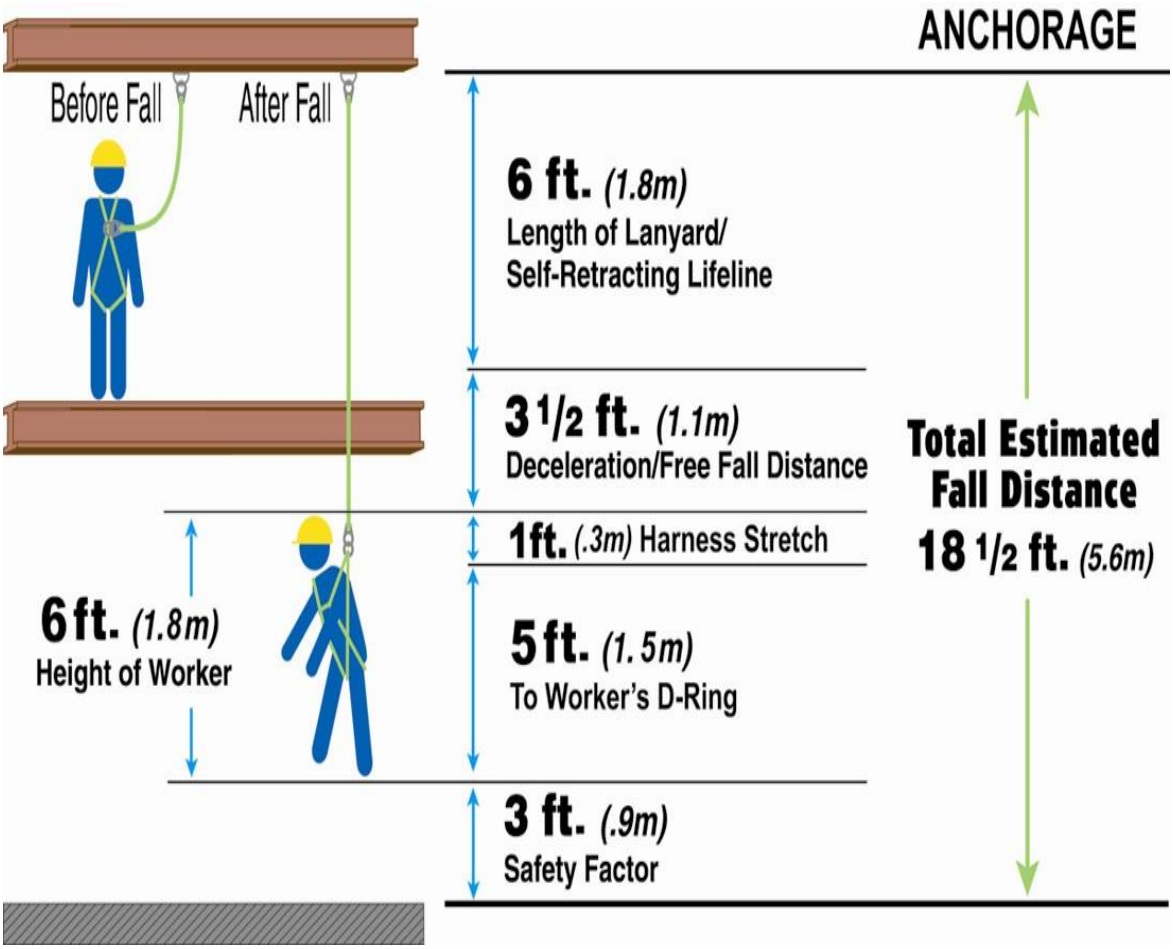

User movement

Identify all necessary movements of the user and the materials and equipment needed to perform the planned work. The plan should ensure there is no crossing or tangling of connecting subsystems of two or more workers. Make certain users do not clamp, knot or otherwise prevent the connecting subsystem from functioning properly. Establish controls to prevent these occurrences.

PENDULUM (SWING) FALLS

Swing falls can occur when the system is not anchored directly above the user. The force of striking an object in a pendular motion can cause serious injury. Always minimize swing falls by working as directly below the anchorage point as possible.

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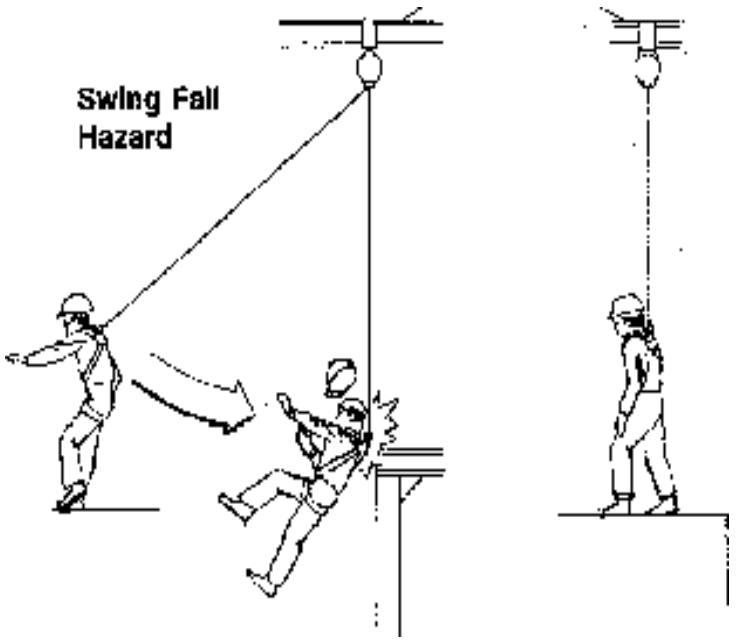

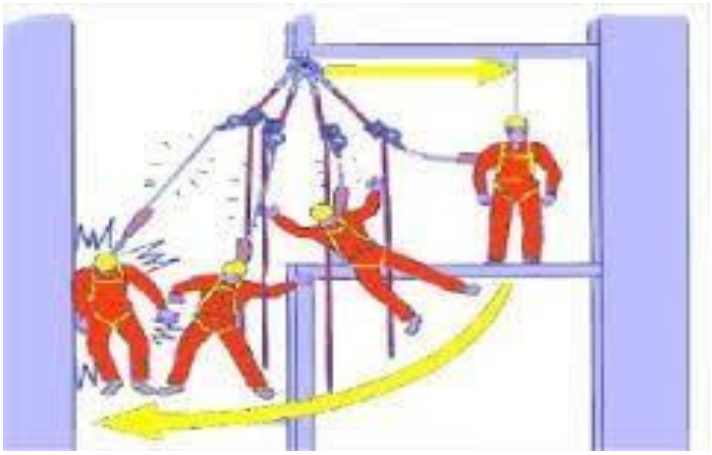

Clear Space in Fall Path

Make certain that enough clearance is available in all potential fall paths to prevent striking an object. The amount of clearance needed depends upon the type of connecting subsystem used, and the location of the anchorage. Consult the manufacturer's instructions for the particular connecting subsystem or component for clearance needed.

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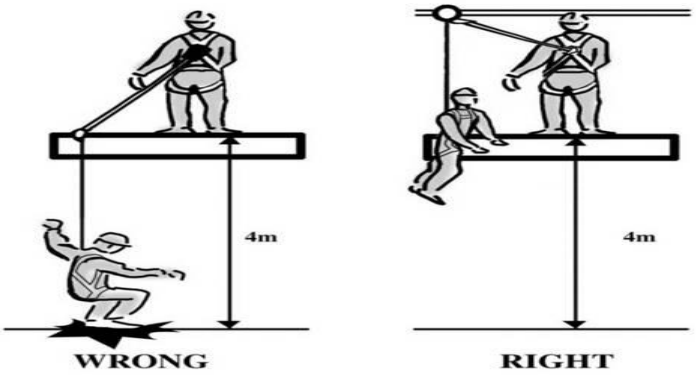

Spot the difference.

Inspection of Fall Protection Equipment

Fall protection equipment must be visually inspected before each use. Regular inspection by a competent person for wear on the equipment should be performed at least every 6 months. Severe service or wear will require more frequent inspections.

Inspection procedures should be written and each inspection should be documented. It is also important to follow any specific instructions that are provided with the equipment at the time of purchase. Instructions should be stored in a location where they are readily available to the users.

Inspect all equipment according to the manufacturer's instructions. If required by the manufacturer, return the equipment to the manufacturer for inspection, repair, or recertification.Remove equipment from service if a stress indicator or warning system has been activated.

Follow manufacturer's instructions for disposition of the equipment.

If a fall has been arrested, remove all components of the system from service and follow the manufacturer's instructions for disposal.

To inspect your harness or body belt, perform the following procedures.

Webbing – Grasp the webbing with your hands 6 in. (152mm) to 8 in. (203mm) apart. Bend the webbing in an inverted "U" as shown. The surface tension resulting makes damaged fibers or cuts easier to detect. Follow this procedure the entire

length of the webbing, inspecting both sides of each strap. Look for frayed edges, broken fibers, pulled stitches, cuts, burns and chemical damage

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D-Rings/Back Pads –
Check D-rings for distortion, cracks, breaks, and rough or sharp edges. It should pivot freely. D-ring back pads should also be inspected for damage.

Attachment of Buckles –
Inspect for any unusual wear, frayed or cut fibers, or broken stitching of the buckle or D-ring attachments.

Tongue/Grommets –
The tongue receives heavy wear from repeated buckling and unbuckling. Inspect for loose, distorted or broken grommets. Webbing should not have additional punched holes.

Tongue Buckles –
Buckle tongues should be free of distortion in shape and motion.
They should overlap the buckle frame and move freely back and forth in their socket. Roller should turn freely on frame. Check for distortion or sharp edges.

Friction and Mating Buckles –
Inspect the buckle for distortion. The outer bars and center bars must be straight. Pay special attention to corners and attachment points at the center bar.

Quick-Connect Buckles – Inspect the buckle for distortion. The outer bars and center bars must be straight. Make sure dual-tab release mechanism is free of debris and engages properly.

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When inspecting lanyards, begin at one end and work to the opposite end, slowly rotating the lanyard so that the entire circumference is checked. Additionally, follow the procedures below.

Hardware

Snaps - Inspect closely for hook and eye distortions, cracks, corrosion, or pitted surfaces. The keeper (latch) should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to
firmly close the keeper. Keeper locks must prevent the keeper from opening when the keeper closes.

Thimbles - The thimble must be firmly seated in the eye of the splice, and the splice should have no loose or cut strands. The edges of the thimble must be free of sharp edges, distortion, or cracks.

Lanyards

Wire Rope Lanyard – While rotating the wire rope lanyard, watch for cuts, frayed areas, or unusual wearing patterns on the wire. Broken strands will separate from the body of the lanyard.

Web Lanyard – While bending webbing over a pipe or mandrel, observe each side of the webbed lanyard. This will reveal any cuts or breaks. Swelling, discoloration, cracks and charring are obvious signs of chemical or heat damage. Observe closely for any breaks in stitching.

Energy-Absorbing lanyard - Examine as a web lanyard (described above). However, also look for the warning flag or signs of deployment. If the flag has been activated, remove this energy--absorbing lanyard from service.

Rope Lanyard – Rotate the rope lanyard while inspecting from end-to-end for any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change in original diameter. The rope diameter should be uniform throughout, following a short break-in period.

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Energy-Absorber Pack – The outer portion of the pack should be examined for burn holes and tears. Stitching on areas where the pack is sewn to D-rings, belts or lanyards should be examined for loose strands, rips and deterioration.
An energy-absorbing lanyard or self-retracting lifeline is composed of only one strength member (i.e., webbing, rope, steel cable). Substandard design, poor quality workmanship, excessive exposure to UV light or chemicals, physical damage, improper storage or inadequate inspection can lead to lanyard/lifeline failure.

To inspect your self-retracting lifeline, perform the following procedures.

Check Housing –
Before every use, inspect the unit's housing for loose fasteners anbent, cracked, distorted, worn, malfunctioning or damaged parts.

Retraction and Tension –
Test the lifeline retraction and tension by pulling out several feet of the lifeline and allow it to retract back into the unit. Always maintain a light tension on the lifeline as it retracts. The lifeline should pull out freely and retract all the way back into the unit. Do not use the unit if the lifeline does not retract.

Lifeline –
The lifeline must be checked regularly for signs of damage. Inspect for cuts, burns, corrosion, kinks, frays or worn areas. Inspect any sewing (web lifelines) for loose, broken or damaged stitching.

Braking Mechanism –
The braking mechanism must be tested by grasping the lifeline
above the impact indicator and applying a sharp steady pull downward which will engage the brakes. There should be no slippage of the lifeline while the brakes are engaged, once tension is released, the brakes will disengage and the unit will return to the retractable mode. Do not use the unit if the brakes do not engage.

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Check the hardware as directed under lanyard inspection (page 18). The snap hook load indicator is located in the swivel of the snap hook. The swivel eye will elongate and expose a red area when subjected to fall arresting forces. Do not use the unit if the load impact indicator has been activated.

Just as a chain is only as strong as its weakest link, the integrity of a fall protection system depends on proper connection of all its components.

The following are some examples of improper connections:

A. Do not attach two or more snap hooks or carabiners to a single D-ring.

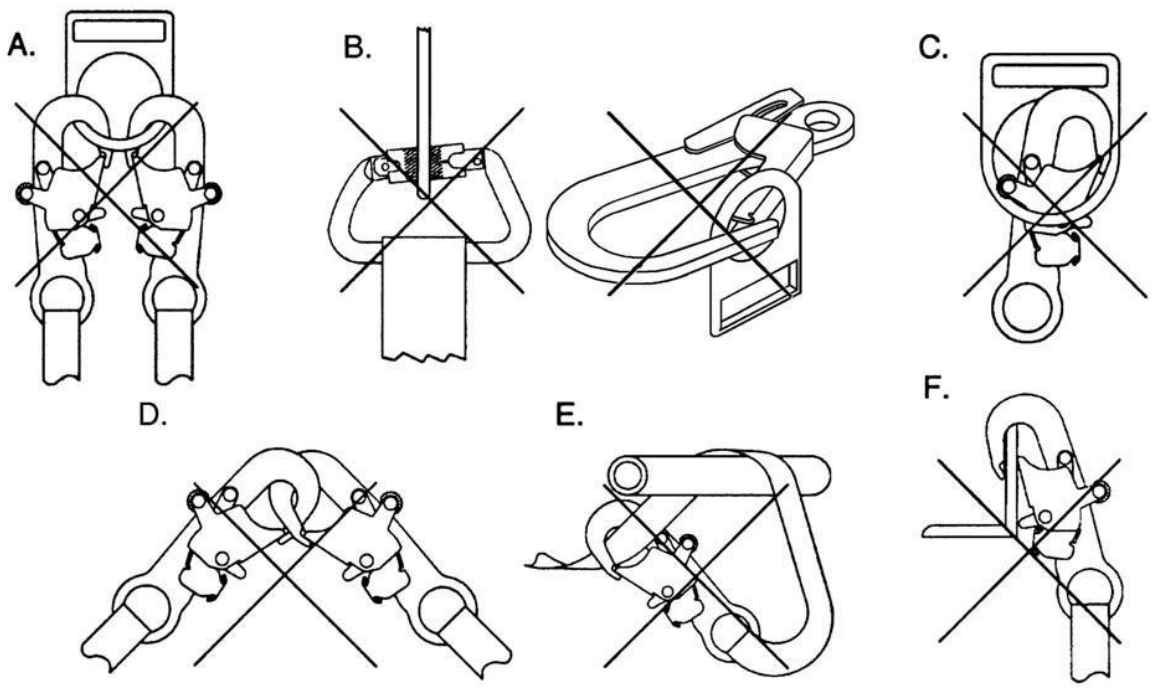
B. Do not load a carabiner or snap hook at the gate.

C. Ensure that connections are compatible and secure.

D. Do not attach two snap hooks or carabiners together.

E. Do not tie back on a lanyard unless specifically designed to do so by the manufacturer.

F. Ensure that the snap hook is closed and locked.



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Basic Care of Fall Protection Equipment
Basic care of your fall protection equipment will prolong the durable life of the unit and will contribute toward the performance of its vital safety function. Proper storage and maintenance after use are as important as cleansing the equipment of dirt, corrosives or contaminants.

Nylon or Polyester –
Remove all surface dirt with a sponge dampened in plain water. Squeeze the sponge dry. Dip the sponge in a mild solution of water and commercial soap or detergent. Work up a thick lather with a vigorous back and forth motion; then wipe with a clean cloth. Hang freely to dry, but away from excessive heat.

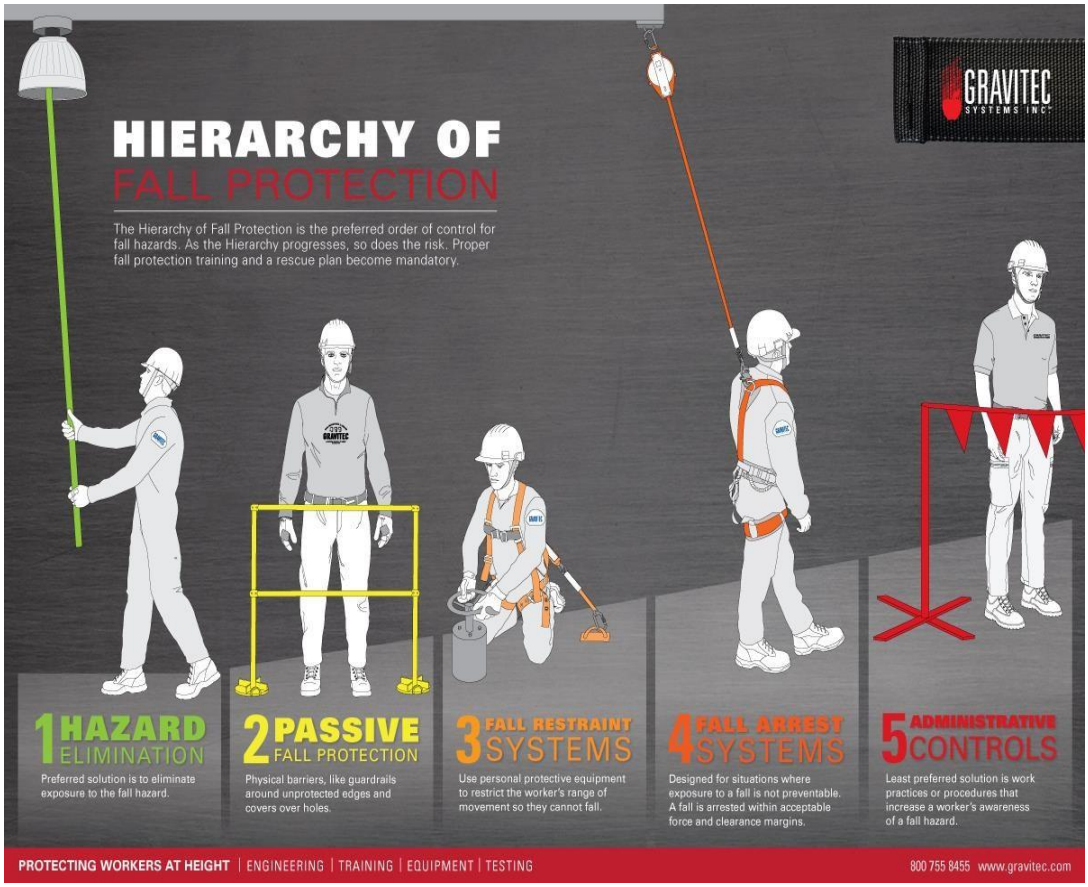
Housing –
Periodically clean the unit using a damp cloth and mild detergent. Towel dry.

Drying – Equipment should dry thoroughly without close exposure to heat, steam or long periods of sunlight.
When not in use, fall protection equipment should be stored in a cool, dry and clean place out of direct sunlight. Avoid areas where heat, moisture, light, oil, chemicals (or their vapors) or other degrading elements may be present.

Equipment that is damaged or in need of maintenance should NOT be stored in the same area as usable equipment. Heavily soiled, wet or otherwise contaminated equipment should be properly cleaned and dried prior to storage.

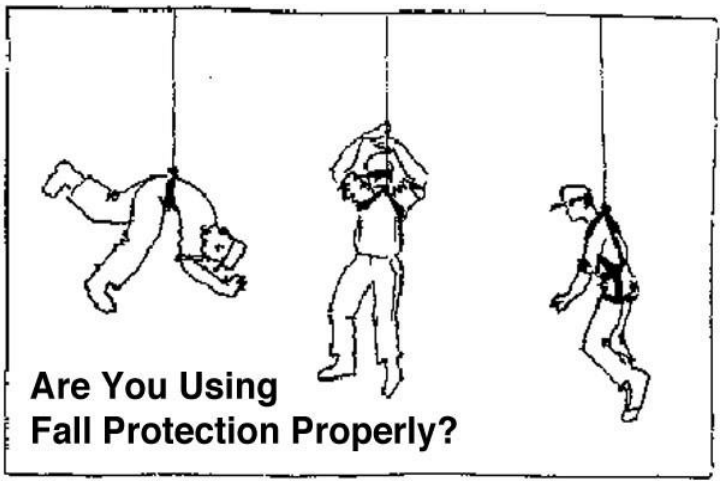
Prior to using equipment which has been stored for long periods of time, a formal inspection by a competent person should be performed.

Maritime Occupational Safety and Health with Hazard Identification



Reference: poster from Gravitec system

Maritime Occupational Safety and Health with Hazard Identification



Danger of Suspension: (after falling and suspended in mid-air)
Suspension trauma, also known as orthostatic intolerance or harness hang syndrome, can be a killer.
Suspension trauma is simply fainting in a harness. It will happen to anyone who is held in an upright position and with their legs immobile. One does not need to be ill ,injured or even in a harness to suffer the condition and if you don't stop its progress then you will lose consciousness and eventually die.
Reference:
http://www.healthandsafetyatwork.com/hsw/content/dangers-

When using a personal fall protection system, a prompt rescue is must in case of a fall. Proper training of personnel in rescue operation must be provided.

Maritime Occupational Safety and Health with Hazard Identification

Use of Helmet

Head protection against injury from Falling Object:

In many workplace such as in the engine room and on main deck onboard ship, the most serious risks are physical injuries, which can be as a result of the impact of a falling object or collision with fixed objects at the workplace.

Safety helmets are one of the most frequently used forms of PPE. Safety Helmets will protect the user's head against:

Reference:www.3M.com/occsafety

The main function and purpose for wearing a protective hard hat is to:

1. Help protect workers from head trauma due to small objects falling from above
2. Help prevent force from transmitting down the spine if an impact from above occurs
3. Help protect from low level electrical shock (Applies only to hard hats that meet ANSI/ISEA Z89.1-2009 Type I, Class G and E.)

Maritime Occupational Safety and Health with Hazard Identification

Test	Compliance to the ANSI/ISEA Z89.1 Standard means…
Force Transmission	Helmets shall not transmit a force to the test head form that exceeds 4450 N (1000 lbs). Maximum transmitted force of each individual test sample shall be averaged. The averaged values shall not exceed 3780 N (850 lbs).
Apex Penetration	The penetrator shall not make contact with the top of the head form.
Flammability	No flame shall be visible 5 seconds after removal of the test flame.
Class C	Class C helmets are not tested for electrical insulation.
Class G (Electrical)	Shall withstand 2200 volts (root mean square), AC, 60 Hertz, for 1 minute. Leakage shall not exceed 3 milliam-peres.
Class E (Electrical)	Must first pass the Force Transmission Test. Shall with-stand 20,000 volts (root mean square), AC, 60 Hertz, for 3 minutes. Leakage shall not exceed 9 milliamperes. At 30,000 volts, the test sample shall not burn through.

Hard Hat Inspection

A hard hat shell should be inspected prior to each use. Immediately replace the hard hat if any sign of wear appears or if there is any evi-dence of damage, abuse or plastic degradation as this may be a sign that protection is reduced. Any hard hat that shows signs of worn or damaged parts should be removed from service immediately and re-placed.

Workers in environments with higher levels of exposure to sunlight, heat, cold or chemicals should replace their hard hats more frequently than workers in other environments. If the hard hat shell becomes faded in color, exhibits a chalky appearance, or feels stiff and brittle, degradation of the shell may be occurring. A hard hat should be re-placed immediately at the first sign of any of these conditions.

Hard hat suspensions should also be inspected closely for cracks, frayed straps or other signs of wear. Any suspension that is damaged must be removed from service and replaced immediately.

It is recommended to replace the entire suspension system at least every 12 months.

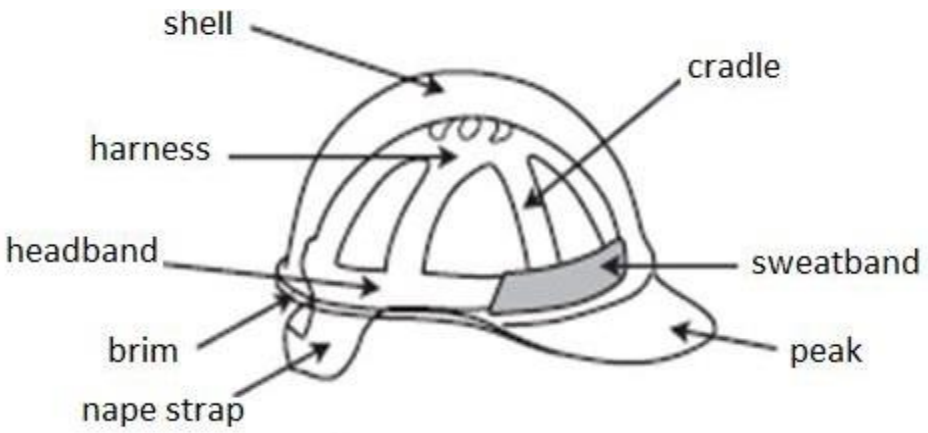
Maritime Occupational Safety and Health with Hazard Identification

Factors that can damage the hard hat

- Impact to the hard hat
- UV exposure
- Chemical exposure
- Abuse

Under any of the following circumstances, hard hat should not be used and be replaced

- Immediately if a blow to the hard hat occurs.



General design

Parts

The **shell** is a dome-shaped covering for the head and made of hard and durable materials.

The outer surface of the shell should be smoothly finished.
It may include:
a **brim** (a rim surrounding the shell which may include a rain gutter); or/ and a peak (a permanent extension of the shell above the eyes).

The **harness** is the assembly that provides a means of maintaining the helmet in position on the user's head and absorbing kinetic energy within the shell during an impact.

Maritime Occupational Safety and Health with Hazard Identification

It basically includes:

a **cradle** (the assembly of the parts of the harness in contact with the head to maintain the helmet in correct wearing position and with a suspension system to absorb shock in case of an impact);

a **headband** (the part of the harness surrounding the head of the user above the eyes); and

a nape strap (an adjustable strap normally integrated with the headband to fit behind the head).

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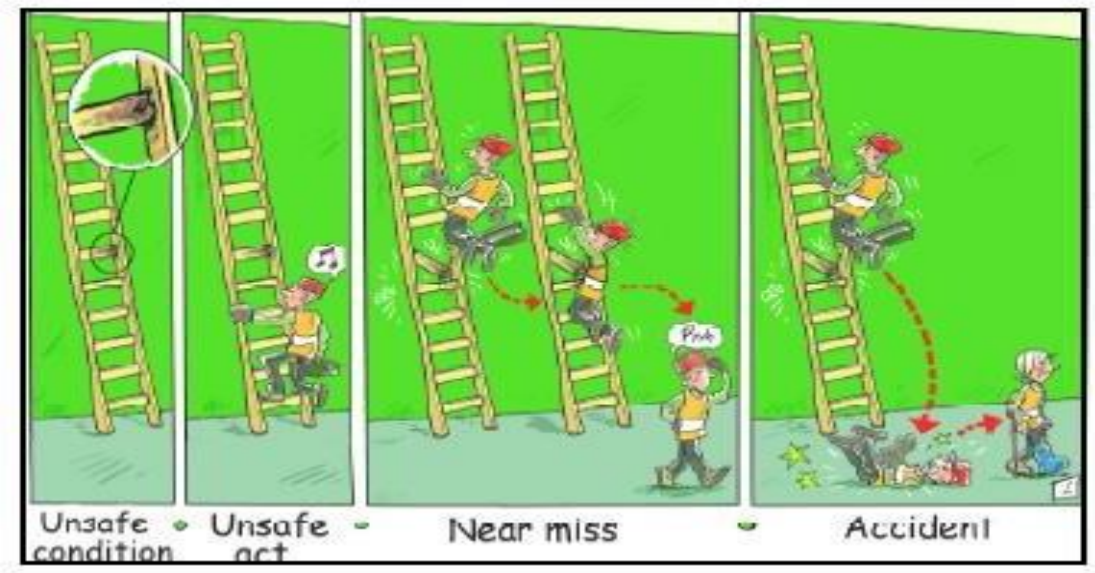
Dangers associated with using Ladders:



Causes of Occupationally - Related Deaths: Ladder mishaps result from several unsafe acts and conditions:

- Ladders placed on unstable surfaces.
- Workers on ladders reaching too far beyond the sides of the ladder. (Beyond the center of the body)
- Personnel standing too high on the ladder in order to maintain balance.

Maritime Occupational Safety and Health with Hazard Identification

 Defective or broken ladders (e.g., broken rails, rungs, missing hardware).
 Ladders that were not secured or braced. (Particularly extrusion ladders.)
 Personnel hand carrying loads while ascending or descending.
 Selecting the wrong ladder for the job.
 Improper positioning of the ladder.
 Strong winds or rain.
 Eighty percent of ladder fall victims fell or slipped and nearly half of these fell at least 8 feet.
 Fifty-seven percent of fall victims were holding object(s) with one or both hands.
 Sixty-six percent of fall victims were not trained in how to inspect ladders.
 Seventy-three percent of fall victims were not provided written instructions on the safe use of ladders.
 Thirty percent of fall victims had wet, greasy or oily shoes.

HAZARDS:

Most ladder mishaps result in falls which are sometimes fatal. Electrical shock can occur if the user is working with electrical equipment while standing on a conductive metal ladder. Portable metal ladders must always have warning labels affixed to the ladder.
Some of the various hazards are summarized below.

HAZARD	HELPFUL HINT
Personnel slipping	Remove grease, oil, and mud from shoes. Avoid overreaching. Do not climb past SAFE height. Watch your step.
Ladder movement	Secure base and top of ladder. Use nonskid feet. Set the ladder at the proper 4:1 angle. Avoid slippery surfaces.
Ladder breakup	Inspect all ladders before using.
Electrical shock	Use nonmetal ladders around electricity.
Environmental conditions	Use extra caution in climbing on windy days. Avoid climbing during storms.
Pinching (Body parts caught between moving parts in closing ladder.)	Use gloves where required. Use caution in closing ladder.

Maritime Occupational Safety and Health with Hazard Identification

Reference:
PORTABLE LADDER SAFETY IN ACCORDANCE WITH 29 CFR1910.25/.27

Portable Ladder Safety

Falls from portable ladders (step, straight, combination and extension) are one of the leading causes of occupational fatalities and injuries.

 Read and follow all labels/markings on the ladder.

 Avoid electrical hazards! – Look for overhead power lines before handling a ladder. Avoid using a metal ladder near power lines or exposed energized electrical equipment.

 Always inspect the ladder prior to using it. If the ladder is damaged, it must be removed from service and tagged until repaired or discarded.

 Always maintain a 3-point (two hands and a foot, or two feet and a hand) contact on the ladder when climbing. Keep your body near the middle of the step and always face the ladder while climbing (see diagram).

 Only use ladders and appropriate accessories (ladder levelers, jacks or hooks) for their designed purposes.

 Ladders must be free of any slippery material on the rungs, steps or feet.

 Do not use a self-supporting ladder (e.g., step ladder) as a single ladder or in a partially closed position.

 Do not use the top step/rung of a ladder as a step/rung unless it was designed for that purpose.

 Use a ladder only on a stable and level surface, unless it has been secured (top or bottom) to prevent displacement.

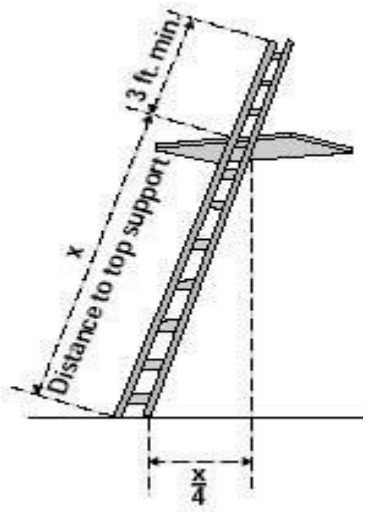
 Do not place a ladder on boxes, barrels or other unstable bases to obtain additional height

 Do not move or shift a ladder while a person or equipment is on the ladder.

 An extension or straight ladder used to access an elevated surface must extend at least 3 feet above the point of support (see diagram). Do not stand on the three top rungs of a straight, single or extension ladder.

Maritime Occupational Safety and Health with Hazard Identification

 The proper angle for setting up a ladder is to place its base a quarter of the working length of the ladder from the wall or other vertical surface (see diagram).



 A ladder placed in any location where it can be displaced by other work activities must be secured to prevent displacement or a barricade must be erected to keep traffic away from the ladder.
 Be sure that all locks on an extension ladder are properly engaged.
 Do not exceed the maximum load rating of a ladder. Be aware of the ladder's load rating and of the weight it is supporting, including the weight of any tools or equipment.
Reference: https://www.osha.gov/Publications/portable_ladder_qc.htm

Maritime Occupational Safety and Health with Hazard Identification

Dangers Associated with Manual Lifting:

Improper posture when lifting an object can result to back injury - Herniated disk

A herniated disk (side view and cross-section).

If the disk is very worn or injured, the jelly-like center may squeeze all the way through.

Once the nucleus breaks — or herniates — through the outer ring, pain in the lower back may improve. Sciatic leg pain, however, increases. This is because the jelly-like material inflames the spinal nerves. It may also put pressure on these sensitive spinal nerves, causing pain, numbness, or weakness in one or both legs.

Improper lifting. Using your back muscles to lift heavy objects, instead of your legs, can cause a herniated disk. Twisting while you lift can also make your back vulnerable. Lifting with your legs, not your back, may protect your spine.

Maritime Occupational Safety and Health with Hazard Identification

Good handling technique for lifting

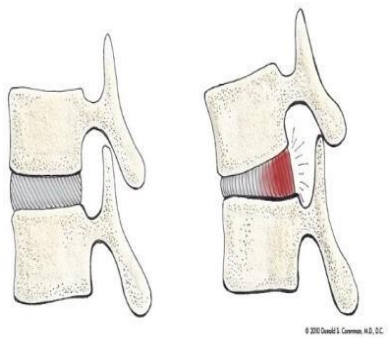
HSE Manual Handling – brief guide

Reference:http://www.hse.gov.uk/pubns/indg143.pdf

Lifting Technique

Reference: www.intersafety.co.ok/blog/wp-content/upload/2014/08/safe-lifting jpg

This following illustration demonstrates the stresses on the back wall of the disc with standing relaxed and with flexion (bending forward). With forward bending, the back wall of the disc is stretched. With any significant load (lifting), the fibers are tensioned and can tear



Reference: http:// www.synergy.com/blog/wp-content/upload/2015/07/strain2a-BB.jpg

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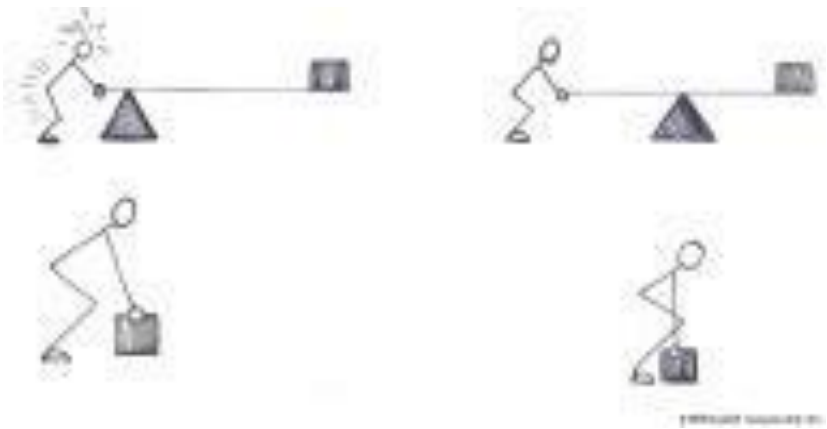
The further away the load is from your center of gravity, the greater the stress is on the back wall of the disc (remember high school physics- the laws of levers and fulcrums).



Dangers Associated with Electric welding:
Pneumoconiosis
a disease of the lungs caused by the habitual inhalation of irritants (as mineral or metallic particles) – Miriam Webster Dictionary

metallic particles are part of the welding fumes, adequate protection (face mask) as well as providing ventilation is necessary when doing welding works

Welding Fume
Reference:Job Knowledge 30 http://www.twi-global.com/technical-knowledge/job-knowledge/health-safety-and-accident-prevention-welding-fume-assessment-030/

Maritime Occupational Safety and Health with Hazard Identification

Fume/gases

Welding fume is a mixture of airborne fine particles. Toxic gases may also be generated during welding and cutting.

Fume

More than 90% of the fume arises from vaporisation of the consumable electrode, wire or rod as material is transferred across the arc or flame. The range of welding fume particle size is shown in relation to more familiar types of dust and fume. The respirable fraction of particles (especially less than 3μm) are potentially more harmful as they can penetrate to the innermost parts of the lung.

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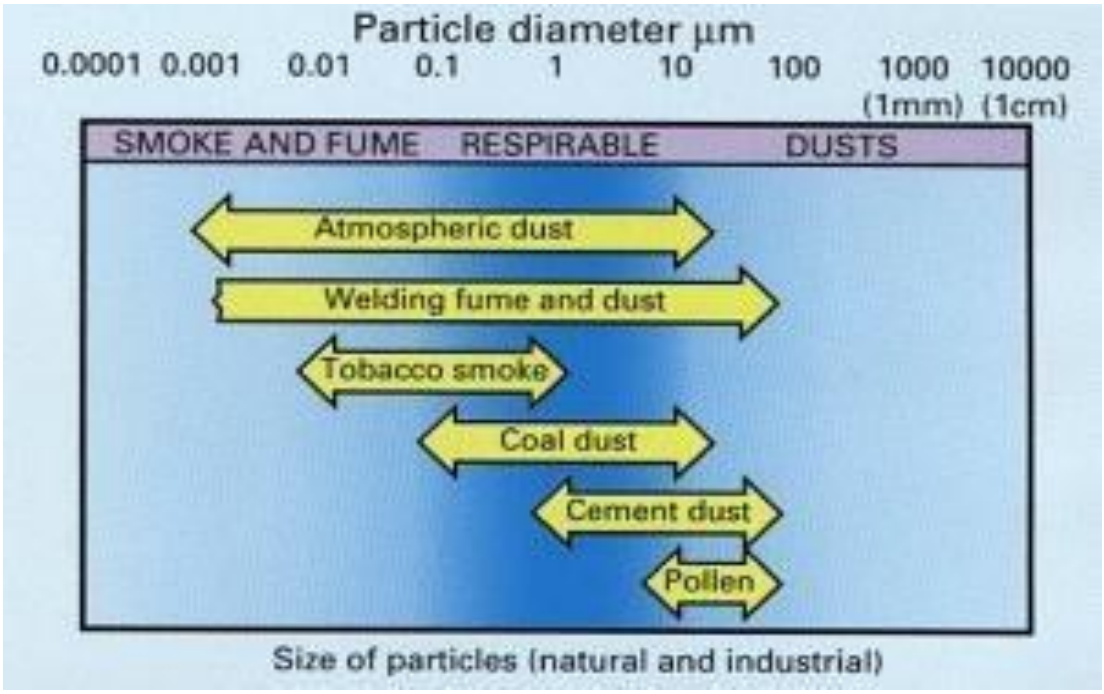


The range of welding fume particle size in relation to more familiar types of dust and fume

Gases

Gases encountered in welding may be:

- Fuel gases which, on combustion, form carbon dioxide and, if the flame is reducing, carbon monoxide
- Shielding gases such as argon, helium and carbon dioxide, either alone or in mixtures with oxygen or hydrogen
- Carbon dioxide and monoxide produced by the action of heat on the welding flux or slag
- Nitric oxide, nitrogen dioxide and ozone produced by the action of heat or ultraviolet radiation on the atmosphere surrounding the welding arc
- Gases from the degradation of solvent vapours or surface contaminants on the metal.

Maritime Occupational Safety and Health with Hazard Identification

The degree of risk to the welder's health from fume/gases will depend on:

- composition
- concentration
- the length of time the welder is exposed

Health hazards from particulate fume

The potential hazards from breathing in fume are:

Irritation of the respiratory tract

Fine particles can cause dryness of the throat, tickling, coughing and if the concentration is particularly high, tightness of the chest and difficulty in breathing.

Metal fume fever

Breathing in metal oxides such as zinc and copper can lead to an acute flu-like illness called 'metal fume fever'. It occurs most commonly when welding galvanised steel; symptoms usually begin several hours after exposure with athirst, cough, headache sweat, pain in the limbs and fever. Complete recovery usually occurs within 1 to 2 days of removal from the exposure, without any lasting effects.

Longer term effects

The continued inhalation of welding fume over long periods of time can lead to the deposition of iron particles in the lung, giving rise to a benign condition called siderosis.

There is evidence that welders have a slightly greater risk of developing lung cancer than the general population. In certain welding situations, there is potential for the fume to contain certain forms of chromium and/or nickel compounds - substances which have been associated with lung cancer in processes other than welding. As yet, no direct link has been clearly established. Nevertheless, as a sensible precaution and to minimise the risk, special attention should be paid to controlling fumes which may contain them.

Additional hazards

A number of other specific substances known to be hazardous to health can be found in welding fume such as barium and fluorides which do not originate from the metal. If the metal contains a surface coating, there will also be a potential risk from any toxic substances generated by thermal degradation of the coating.

Maritime Occupational Safety and Health with Hazard Identification

Health hazards from gases

The potential hazards from breathing in gases during welding are:

Irritation of the respiratory tract

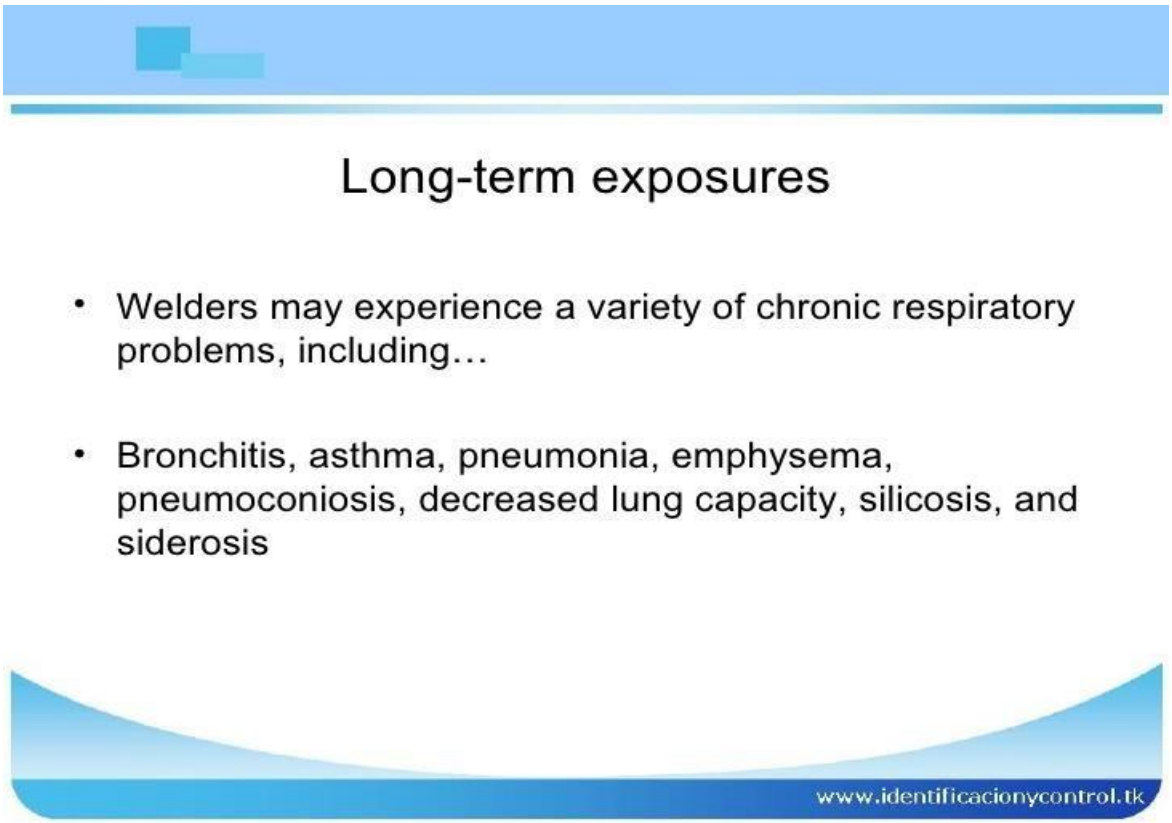
Ozone can cause delayed irritation of the respiratory tract which may progress to bronchitis and occasionally pneumonia.

Nitrogen oxides can cause a dry irritating cough and chest tightness. Symptoms usually occur after a delay of 4 to 8 hours. In severe cases, death can occur from pulmonary oedema (fluid on the lungs) or pneumonia.

Asphyxiation

Special precautions are needed when welding in confined spaces where there is the risk of asphyxiation due to the build up of inert shielding gases. Carbon monoxide, formed as a result of incomplete combustion of fuel gases, can also cause asphyxiation by replacing the oxygen in the blood.

Maritime Occupational Safety and Health with Hazard Identification



Establishing safe levels of fume in the workplace

Much of the regulatory framework applied to welding and allied processes is directed towards protecting the health of workers by maintaining their exposure to fume and gases within defined limits known as exposure limits. In the UK these limits are known as Workplace Exposure Limits (WELs). They are for use with the Control of Substances Hazardous to Health Regulation and are published annually in EH/40 from the Health and Safety Executive.

WELs are concentrations of hazardous substances in the air, averaged over a specified period of time referred to as a time weighted average.

Two time periods are used: long term (8 hours) and short term (15 minutes). Short term exposure limits (STELs) are set to prevent effects, such as eye irritation, which may occur following exposure for a few minutes.

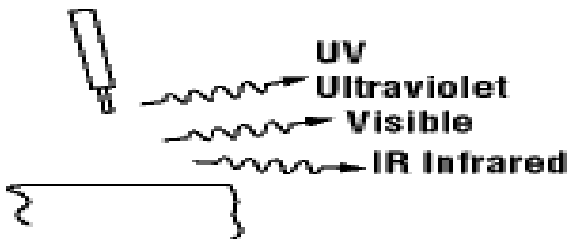
Maritime Occupational Safety and Health with Hazard Identification

Welding - Radiation and the Effects On Eyes and Skin

Reference: https://www.ccohs.ca/oshanswers/safety_haz/welding/eyes.html

radiation associated with welding

Welding arcs give off radiation over a broad range of wavelengths - from 200 nm (nanometres) to 1,400 nm (or 0.2 to 1.4 µm, micometres). This includes ultraviolet (UV) radiation (200 to 400 nm), visible light (400 to 700 nm), and infrared (IR) radiation (700 to 1,400 nm).



UV-radiation is divided into three ranges - UV-A (315 to 400 nm), UV-B (280 to 315 nm) and UV-C (100 to 280 nm). UV-C and almost all UV-B are absorbed in the cornea of the eye. UV-A passes through cornea and is absorbed in the lens of the eye.
Some UV radiation, visible light, and IR radiation can reach the retina.

Symptoms of "Arc Eye"

Certain types of UV radiation can produce an injury to the surface and mucous membrane (conjunctiva) of the eye called "arc eye," "welders' eye" or "arc flash." These names are common names for "conjunctivitis" - an inflammation of the mucous membrane of the front of the eye.

The symptoms include:

- pain - ranging from a mild feeling of pressure in the eyes to intense pain in severe instances
- tearing and reddening of the eye and membranes around the eye
- sensation of "sand in the eye" or abnormal sensitivity to light
- inability to look at light sources (photophobia)

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The amount of time required to cause these effects depends on several factors such as the intensity of the radiation, the distance from the welding arc, the angle at which the radiation enters the eye, and type of eye protection that the welder or bystander is using. However, exposure to just a few seconds of intense UV light can cause arc eye. These symptoms may not be felt until several hours after exposure.

Other possible effects to the eyes

Long-term exposure to UV light can produce cataracts in some persons.
Visible light from welding processes is very bright and can overwhelm the ability of the iris of the eye to close sufficiently and rapidly enough to limit the brightness of the light reaching the retina. The result is that the light is temporarily blinding and fatiguing to the eye.
A serious concern is the "blue light hazard" which is the temporary or permanent scarring of the retina due to its sensitivity to blue light, around 440 nm wavelength. Blindness may result.
Exposure to infrared light can heat the lens of the eye and produce cataracts over the long term.

Skin hazards associated with welding and radiation

Welding arcs and flames emit intense visible, ultraviolet, and infrared radiation.
UV radiation in a welding arc will burn unprotected skin just like UV radiation in sunlight. This is true for direct exposure to UV radiation as well as radiation that is reflected from metal surfaces, walls, and ceilings. Surface finishes and certain paint colours can reduce the amount of UV radiation that is reflected.

- Long-term exposure to UV radiation can cause skin cancer.
- Infrared radiation and visible light normally have very little effect on the skin.

Maritime Occupational Safety and Health with Hazard Identification

Dangers associated with hoisting heavy object using chain hoist (manual chain hoist / electric chain hoist)
Reference: www.ihsa.ca

Hoisting and Rigging Hazards
For safe rigging be sure to know the following:
- the weight of the load and rigging hardware
- the capacity of the hoisting device
- the working load limit of the hoisting rope, slings, and hardware.

When the weights and capacities are known, determine how to lift the load so that it is stable.
Identify hazards that can have an impact on a hoisting operation, elements that can affect hoisting safety, factors that reduce capacity, and safe practices in rigging, lifting, and landing loads.
Be familiar with the proper inspection and use of slings and other rigging hardware.
Most crane and rigging accidents can be prevented by field personnel following basic safe hoisting and rigging practices. When a crane operator is working with a rigger or a rigging crew, it is vital that the operator is aware of the all aspects of the lift and that a means of communication has been agreed upon, including what signals will be used.

Elements that can Affect Hoisting Safety
Working Load Limit (WLL) not known. Don't assume. Know the working load limits of the equipment being used. Never exceed these limits.

Defective components. Examine all hardware, tackle, and slings before use. Destroy defective components. Defective equipment that is merely discarded may be picked up and used by someone unaware of its defects.

Questionable equipment. Do not use equipment that is suspected to be unsafe or unsuitable, until its suitability has been verified by a competent person.

Maritime Occupational Safety and Health with Hazard Identification

Hazardous wind conditions. Never carry out a hoisting or rigging operation when winds create hazards for workers, the general public, or property. Assess load size and shape to determine whether wind conditions may cause problems. For example, even though the weight of the load may be within the capacity of the equipment, loads with large windcatching surfaces may swing or rotate out of control during the lift in high or gusting winds.
Swinging and rotating loads not only present a danger to riggers—there is the potential for the forces to overload the hoisting equipment.

Factors that Reduce Capacity
The working load limits of hoisting and rigging equipment are based on ideal conditions. Such ideal circumstances are seldom achieved in the field.

Swing. The swinging of suspended loads creates additional dynamic forces on the hoist in addition to the weight of the load. The additional dynamic forces (see point below) are difficult to quantify and account for, and could cause tip-over of the crane or failure of hoisting hardware. The force of the swinging action makes the load drift away from the machine, increasing the radius and side-loading on the equipment. The load should be kept directly below the boom point or upper load block. This is best accomplished by controlling the load's movement with slow motions.

Condition of equipment. The rated working load limits apply only to equipment and hardware in good condition. Any equipment damaged in service should be taken out of service and repaired or destroyed.

Dynamic forces. The working load limits of rigging and hoisting equipment are determined for static loads. The design safety factor is applied to account, in part, for the dynamic motions of the load and equipment. To ensure that the working load limit is not exceeded during operation, allow for wind loading and other dynamic forces created by the movements of the machine and its load.
Avoid sudden snatching, swinging, and stopping of suspended loads. Rapid acceleration and deceleration also increases these dynamic forces.

Maritime Occupational Safety and Health with Hazard Identification

Weight of tackle. The rated load of hoisting equipment does not account for the weight of hook blocks, hooks, slings, equalizer beams, and other parts of the lifting tackle. The combined weight of these items must be added to the total weight of the load, and the capacity of the hoisting equipment, including design safety factors, must be large enough to account for the extra load to be lifted.

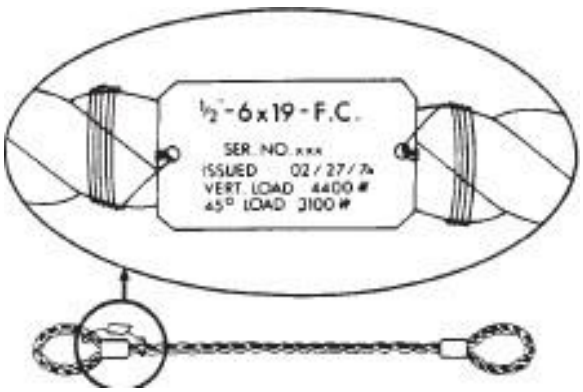
Slings

After the hoist rope, the sling is the most commonly used piece of rigging equipment.

Observe the following precautions with slings.

• Never use damaged slings. Inspect slings regularly to ensure their safety. Check wire rope slings for kinking, wear, abrasion, broken wires, worn or cracked fittings, loose seizings and splices, crushing, flattening, and rust or corrosion. Pay special attention to the areas around thimbles and other fittings.

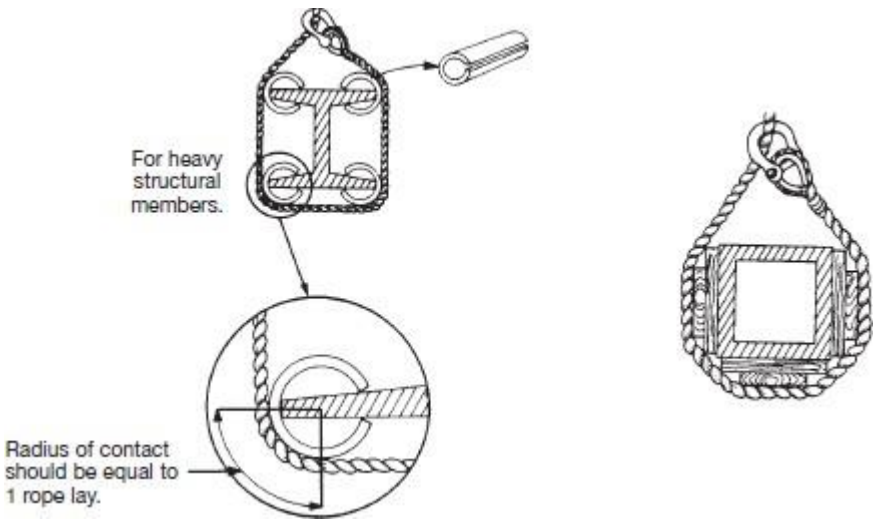
• Slings should be marked with an identification number and their maximum capacity on a flat ferrule or permanently attached ring. Mark the capacity of the sling for a vertical load or at an angle of 45°. Ensure that everyone is aware of how the rating system works.



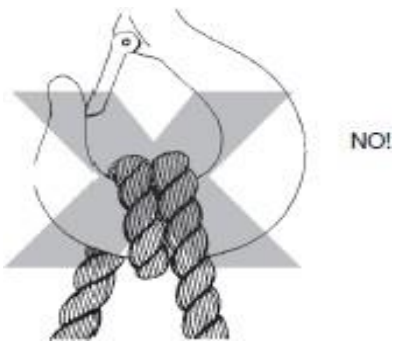
Maritime Occupational Safety and Health with Hazard Identification

• Avoid sharp bends, pinching, and crushing. Use loops and thimbles at all times. Corner path that prevent the sling from being sharply bent or cut can be made from split sections of large diameter pipe, corner saddles, padding, or blocking.

Ensure that Slings are Protected at All Sharp Corners on Heavy Items



• Never allow wire rope slings, or any wire rope, to lie on the ground for long periods of time or ondamp or wet surfaces, rusty steel, or near corrosive substances.
• Avoid dragging slings out from underneath loads.
• Keep wire rope slings away from flame cutting and electric welding.
• Never make slings from discarded hoist rope.
• Avoid using single-leg wire rope slings with hand-spliced eyes. The load can spin, causing the rope to unlay and the splice to pull out. Use slings with Flemish Spliced Eyes.

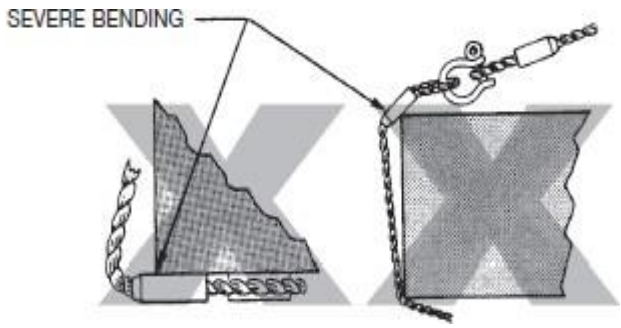


Maritime Occupational Safety and Health with Hazard Identification

Never Wrap a Sling Around a Hook

• Never wrap a wire sling completely around a hook. The sharp radius will damage the sling. Use the eye.

Do Not Permit Bending Near Any Splice or Attached Fitting



• Avoid bending the eye section of wire rope slings around corners. The bend will weaken the splice or swaging. There must be no bending near any attached fitting.

Field Calculation Formula (in the absence of manufacturers data)

The **field calculation formula** can be used to compute the working load limit of a wire rope in tons (2,000 pounds).

The formula applies to new wire rope of Improved Plow steel and a design factor of 5.

WLL = DIAMETER x DIAMETER x 8

(where DIAMETER = nominal rope diameter in inches)

OR

WLL = D2 x 8

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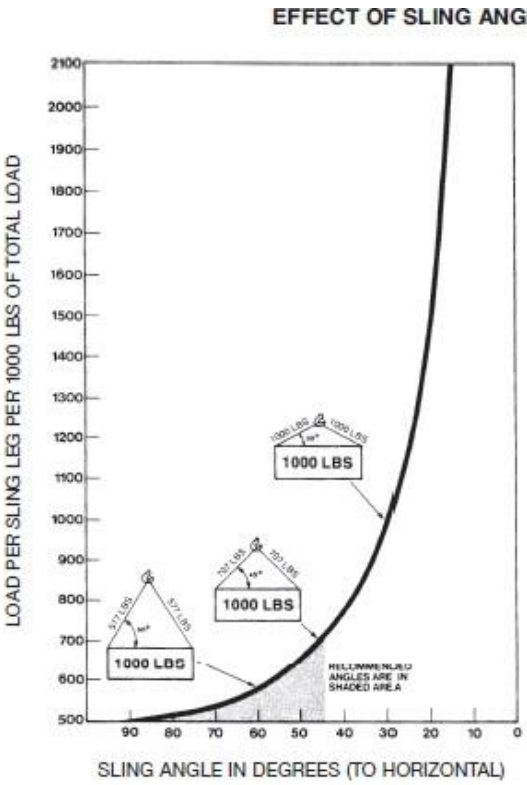
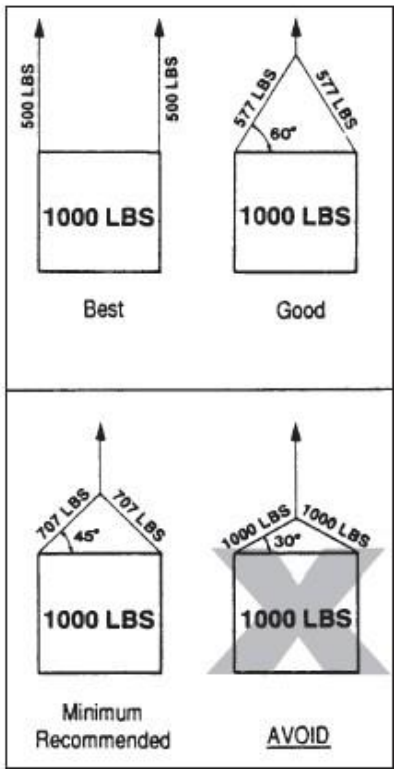


Figure 22a



For safe operation, always consult the manufacturer's data.
Below are sample of manufacturer's data

Reference: dunlapindustrial.com/wirecalculating.loads

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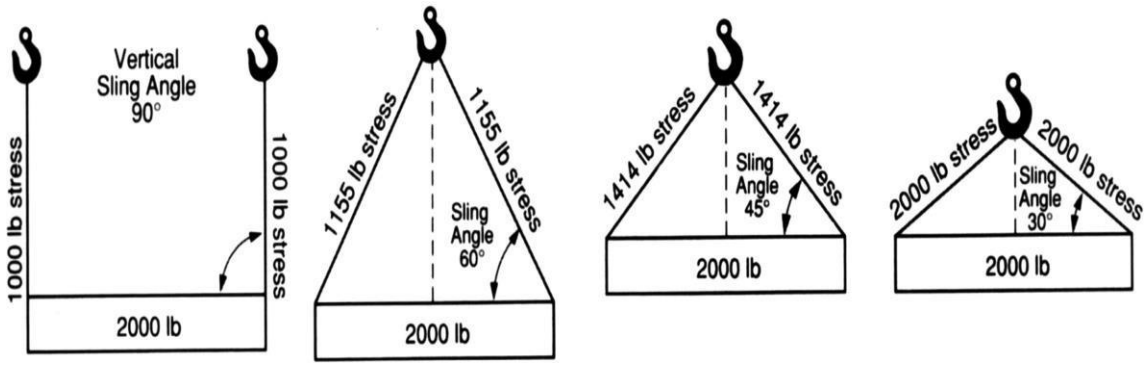

Reference: http://www.florida wire.com/load limits

WIRE ROPE

VERTICAL CHOKER BASKET SLING ANGLE

SINGLE LEG SLING MULTI-LEG SLING

	Rope Dia.	SINGLE LEG SLINGS CAPACITY - TONS			Approx. Loop Size	MULTIPLE LEG SLINGS - CAPACITY - TONS								
						2 Legs			3 Legs			4 Legs		
		Vertical	Choker	Basket		60°	45°	30°	60°	45°	30°	60°	45°	30°
6 x 19 XIP IWRC	1/4"	0.65	0.48	1.3	2 "x 4"	1.1	0.92	0.65	1.7	1.4	0.97	2.2	1.8	1.3
	3/8"	1.4	1.1	2.9	3" x 6"	2.5	2.0	1.4	3.7	3.0	2.2	5	4.1	2.9
	1/2"	2.5	1.9	5.1	4" x 8"	4.4	3.6	2.5	6.6	5.4	3.8	8.8	7.1	5.1
	5/8"	3.9	2.9	7.8	5" x 10"	6.8	5.5	3.9	10	8.3	5.9	14	11	7.8
	3/4"	5.6	4.1	11	6" x 12"	9.7	7.9	5.6	15	12	8.4	19	16	11
	7/8	7.6	5.6	15	7" x 14"	13	11	7.6	20	16	11	26	21	15
	1"	9.8	7.2	20	8" x 16"	17	14	9.8	26	21	15	34	28	20
	1-1/8"	12	9.1	24	9" x 18"	21	17	12	31	26	18	42	34	24
6 x 37 IWRC	1-1/4"	15	11	30	10" x 20"	26	21	15	38	31	22	51	42	30
	1-3/8"	18	13	36	11" x 22"	31	25	18	46	38	27	62	50	36
	1-1/2"	21	16	42	12" x 24"	36	30	21	55	45	32	73	60	42
	1-3/4"	28	21	57	14" x 28"	48	40	28	74	60	42	98	80	57
	2"	37	28	73	16" x 32"	64	52	37	95	78	56	127	104	73
	2-1/4"	44	35	88	18 "x 36"	76	62	44	114	93	66	n/a	n/a	n/a

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D/d Ratio

Reference: Basic rigging workbook, BrookHaven National Library

When a wire rope sling is used in a basket hitch, the diameterof the load where the sling contacts the load can reduce sling capacity. The method used to determine the loss of strength or efficiency is referred to as the D/d Ratio.

The "D" refers to the diameter of the object being lifted, while the "d" refers to the diameter of the wire rope sling, as shown in the figure 1.

For example, when a 1-inch wire rope sling is used to lift an object that measures 25 inches in diameter, the D/d Ratio is 25-to-1 (written 25/1).

Alternatively, the "D" can refer to the cross-sectional diameter of the eye, hook, or other object being used to hoist the load, as shown in the figure 2.

In both cases, the effective strength of the sling results. The table below (fig. 3) shows the D/d Ratio and corresponding efficiency percentage

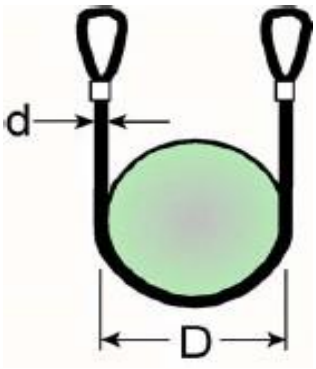

Fig. 1

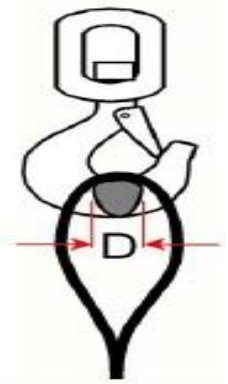

Fig. 2

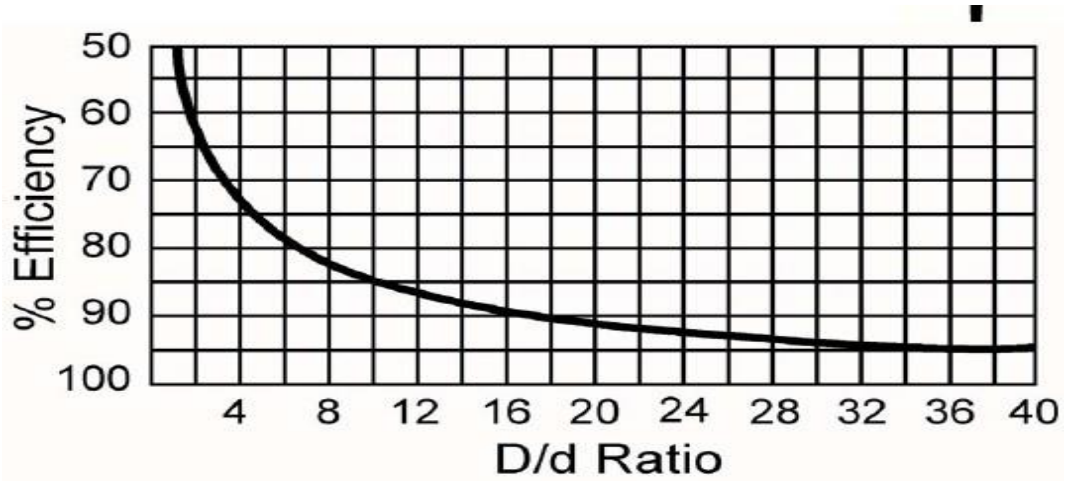

Fig. 3

Maritime Occupational Safety and Health with Hazard Identification

Dangers associated with electricity:

Hazards of electricity

- Electric shock
- Burns
- Fire

Defective and poorly maintained electrical / electric circuit device will generate electrical leak.
This leak passes all over the conductive material of the device / electrical circuit and if someone touches the device he will receive electric shock.

Common causes of electrical injuries / accidents

- Touching live parts
- Short circuit
- Inadequate guarding
- Overloading
- Breaking of connections

When the electric current has sufficient potential difference to overcome the body resistance, it results in shock burns or even death. Although potential difference determines whether the body's resistance will be overcome, the damaging factor in electrical shock is the current flow.

Factors affecting electric shock

a) Amount of current that flows through the human body. The amount of current that flows through to the body depends on:

- Voltage of the circuit; ohm's law states voltage is directly proportional to the current. A higher voltage means a higher current
- Insulating quality

b) The path the current takes through the body affects the degree of injury. A small current that passes from one hand to the other hand through the heart is capable of causing severe injury or death. However, there have been cases where larger current caused an arm or leg to burn off without going through vital organs of the body. In many such cases the person was not killed; had the same current passed through the vital organ, the person easily could have been killed.

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c) Duration of current flow; the longer the current flows through the body, the more devastating the result can be. That is the reason why immediate action should be taken to free co-workers when they shocked or burned by electricity.

Action to take:
Switch-off the electrical if the victim is still in contact with the energized circuit. While doing this, have someone else call for help. If you cannot quickly turn-off the current, pry the victim from the circuit with something that does not conduct electricity such as a dry wood broom stick.

d) Type of electric energy involved;
• Alternating current (AC) – the flow of electric charge whose magnitude and direction changes periodically. This can cause a person to maintain involuntary grip on the live metal or conductor and prolong current flow
• Direct current (DC) – the flow of electric charge that does not change direction
.
e) Body condition – Personal sensitivity to electric shock varies with age, sex, heart condition, etc.

An electrical current passing through the body can cause severe injury or death by:

• Contracting the chest muscles, resulting in breathing difficulty which would result to death due to asphyxiation.
• Affecting the central nervous system, resulting in malfunction of vital body function such as respiration.
• Interference with normal rhythm of the heart beat, resulting in ventricular fibrillation which is defined as "very rapid uncoordinated contractions of the ventricles of the heart resulting in loss synchronization between heartbeat and pulse beat" Once ventricular fibrillation occurs, it will continue and death will ensue within a few minutes.
• Electricity may also affect the heart muscle, resulting in sever heart muscle contraction and cessation of heart action.
• Heat generated when current overcomes tissue resistance may cause destruction of the body tissues
.

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The severity of an electric shock is the product of the current value and the time it flows through the human body.

Based on the research of Charles F. Dalziel, professor at the University of California, the effects of alternating current (60Hz) on the human body are generally as follows:

Current	**Effect**
0-1mA	No sensation, not felt
1 mA	Shock perceptible, reflex action to jump away, no direct Danger from shock but sudden motion may cause accident
>3mA	Painful shock
>6mA	Let go current for women
> 9mA	Let go current for men
> 10mA	Local muscle contractions, sufficient to cause "freezing" to the circuit for 2.5 % of the population
> 15mA	Local muscle contractions, sufficient to cause "freezing" to the circuit for 50% of the population
> 30mA	Breathing difficulty; can cause unconsciousness
> 50 - 100mA	Possible ventricular fibrillation of the heat
>100 - 200mA	Certain ventricular fibrillation of heart
>100 - 200mA	Sever burns and muscular contractions; heart more apt to stop than fibrillate
>1Ampere	Irreparable damage to tissue

Reference: Occupational and Environmental Safety Engineering and Management

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• Let go current

The maximum current that a person can tolerate when holding a conductor and can still free himself / herself by muscular stimulation.

• Ventricular fibrillation

Most death by electric shock are caused by ventricular fibrillation. It is a condition wherein the heart will not pulse regularly causing the heart to cease functioning. Once this occurs, the victim will be dead in a few minutes even if the electric source is interrupted.

• Even small amounts of current can cause minor shock sensations and result to secondary accidents.

Reference: http:// www.ccohs.ca/oshanswer/safety_haz/electrical.html

There are four main type of injuries caused by electric currents- electrocution (fatal), electric shocks, burns, and falls. These injuries can happen in various ways:

• Direct contact with the electrical energy.

• When the electricity arcs (jumps) through a gas (such as air) to a person who is grounded (that would provide an alternative route to the ground for the electricity).

• Thermal burns including flash burns from heat generated by an electric arc, and flame burns from material that catch fire from heating or ignition by electric currents. High voltage contact burns can burn internal tissues while leaving only very small injuries on the outside of the outside of the screen.

• Muscle contractions, or a startle reaction, can cause a person to fall from a ladder, scaffold or aerial bucket. The fall can cause serious injuries.

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Electric shock prevention

(a) Use of grounding system

Grounding or earthing is any means of absorbing any leakage current and making it flow directly to earth by using an electrical conductor. It is a process of connecting metal parts/casing of the electrical equipment to earth through grounding wires. The voltage exist on the metal casing and earth resistance. Grounding means safety. There are two types of grounding:

(1) System grounding – means grounding the neutral point iron terminal or electrical circuits on power transformer of electrical system;

(2) Equipment grounding – grounding of a non-charged metal part of electrical equipment.

(b) Use Double Insulating Materials

Insulating materials have extremely high resistance values, virtually to prevent flow of electric current through it. The principle of insulation is used when worked must to be carried out near un-insulated live parts. Work on un-insulated parts are carried out by using protective devices such as insulating stands, mats or screens, or rubber insulating gloves to protect workers from electric shock.

(c) Use Appropriate Disconnecting Means

(1) Fuse

A fuse is essentially a strip of metal that melts at a pre-determined value of current flow, and therefore cuts off the current to that circuit. In the event of abnormal condition such as faults or when excess current flows. The fuse would blow and protect the circuit or apparatus from further damage. In effective and safe operation, the fuse should be placed in a live conductor and never in the neutral conductor. Otherwise, even with the fuse blown or removed, parts of the circuits such as switches or terminal will be affected. Over-fusing means using a fuse rating higher than that of the circuit it is meant to protect. This is dangerous because in the event of a fault, a current may flow to earth without blowing the fuse, endangering workers and the circuit or equipment concerned. It could also result in over heating of the cable carrying the excessive current, with the risk of fire.

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(2) Circuit Breaker

A circuit breaker has several advantages for excess current circuit protection. The principle of the operation is that excess current flow is detected electromagnetically and mechanism of the breaker automatically trips and cuts off electric supply to the circuit it protects.

(3) Earth Leakage Circuit Breaker

Majority of electric shock injuries occur when the body act as conductor between line and earth. Protection against such shocks is provided by the inclusion of a current sensitive earth leakage circuit breaker (ELCB) in the supply line. ELCB may detect both over-current and earth leakage currents and thereby give very good circuit protection.

(d) Proper Maintenance of Portable Power Tools

The necessity to use flexible cables to supply electricity to the tools introduces hazards. Such cables are often misused and abused resulting in damage insulation and broken or exposed conductors. The tool itself could also become charged with electricity due to a fault. Constant care and adequate maintenance and storage are essential to safe use.

Causes of electrical fires

The more frequent causes of electrical fires may be listed under the general classes namely, arcs, sparks and overheating. An arc is produced when an electric circuit carrying a current is interrupted, either intentionally – by knife switch or accidentally – where a contact at a terminal becomes loose. The intensity of the arc depends, to a great extent, on the current and voltage of the circuit. The temperature of the electric arc is very high and any combustible materials in its vicinity may be ignited by the heat.

An electric arc may not only ignite combustible materials in its vicinity such as the insulating covering of the conductor, but it may also fuse the metal with the conductor. Hot sparks from burning combustible material and hot metal are thrown about, and may set fire to other combustible material.

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When an electric conductor carries a current, heat is generated in direct proportion to the resistance of the conductor and to the square of the current. The resistance of the conductors is used to convey current to the location where it is used, or to convey it through the windings of a piece of apparatus, except in resistance devices and heaters.

Sample checklist for basic electrical safety:

Inspect Cords and Plugs

• Check power chords and plugs daily. Discard if worn or damaged. Have any cord that feels more than comfortably warm checked by an electrician.

Eliminate Octopus Connections

• Do not plugs several power chords into one outlet.
• Pull the plug not the cord.
• Do not disconnect power supply by pulling or jerking the cord from the outlet. Pulling the cord causes wear and may cause a shock.

Never Break OFF the Third Prong on a Plug

• Replace broken 3-prong plugs and make sure the third prong is properly grounded.

Never Use Extension Cords as Permanent wiring

• Use extension cords only to temporarily supply power to an area that does not have a power outlet.
• Keep power chords away from heat, water and oil. They can damage the insulation and causes a shock.
• Do not allow vehicles to pass over unprotected power cords. Cords should be put in conduit or protected by placing planks alongside them.

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Electrical Incidents Photo Examples of Burns and Other Injuries
Reference:https://www.osha.gov/SLTC/etools/construction/electrical_incidents/burn_examples.html

Electrical Burns
Entrance Wound: High resistance of skin transforms electrical energy into heat, which produces burns around the entrance point (dark spot in center of wound). This man was lucky, the current narrowly missed his spinal cord.

Exit Wound: Current flows through the body from the entrance point, until finally exiting where the body is closest to the ground. This foot suffered massive internal injuries, which weren't readily visible, and had to be amputated a few days later.

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Arc or Flash Burns

This man was near a power box when an electrical explosion occurred. Though he did not touch the box, electricity arced through the air and entered his body. The current was drawn to his armpits because perspiration is very conductive.

Thermal Contact Burns

Current exited this man at his knees, catching his clothing on fire and burning his upper leg.

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Internal Injuries

This worker was shocked by a tool he was holding. The entrance wound and thermal burns from the overheated tool are apparent.

Same hand a few days later, when massive subcutaneous tissue damage had caused severe swelling (swelling usually peaks 24-72 hours after electrical shock). To relieve pressure which would have damaged nerves and blood vessels, the skin on the arm was cut open.

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Involuntary Muscle Contraction

This worker fell and grabbed a powerline to catch himself. The resulting electric shock mummified his first two fingers, which had to be removed. The acute angle of the wrist was caused by burning of the tendons, which contracted, drawing the hand with them.

Maritime Occupational Safety and Health with Hazard Identification

V.0 References

R1 *MEMOSH/2014/6 Guidelines for implementing the occupational safety and health provisions of the Maritime Labour Convention*

R2 *(Maritime labor Convention 2006, Title 2, Condition of Employment, Regulation 2.3- Hours of work and hours of rest, page 30*

R3 *(Maritime labor Convention 2006, Title 3, Accommodation, recreational facilities, food and catering, page 41*

R4 *(Maritime labor Convention 2006, Title 4, Health protection, medical care, welfare and social security protection, page 54*

R5 *https://en.wikipedia.org/wiki/Maritime_Labour_Convention*

R6 *https://www.osha.gov/OshDoc/data_General_Facts/ppe-factsheet.pdf*

R7 *http://rcontrols.com/safety_article/personal-protective-equipment*

R8 *https://en.wikipedia.org/wiki/OHSAS_18001*

R9 *https://en.wikipedia.org/wiki/Personal_protective_equipment*

R10 *https://en.wikipedia.org/wiki/Accident_analysis*

R11 *https://en.wikipedia.org/wiki/Near_miss_(safety)*