

Training for Occupational Safety and Health

A Course for "Occupational Safety Card for the Construction Industry"



Safety

Health



勞工事務局

Training for Occupational Safety and Health

A Course for “Occupational Safety Card for the Construction Industry”



勞工事務局
Labour Affairs Bureau

Training for Occupational Safety and Health

A Course for “Occupational Safety Card for the Construction Industry”

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1. H.K. Construction Industry Training Authority: "Construction Industry Safety Card Course"
2. H.K. Occupational Safety and Health Council: "Construction Industry Safety Card Course"
3. "A Training Textbook for Supervisors of Occupational Safety and Health" published by Wanli Press

Part I Theoretical Study

Chapter 1 Preface

During the recent years, Macao's Construction industry has been rapidly developing with Macao's economic growth, transforming the city into a more modern one. On the other hand, as more and more brand-new and complicated construction projects appear, and as the requirement of construction speed becomes more rigorous, the risks for occupational safety and health on the construction sites increase steadily. Therefore, occupational safety and health for the building workers should not be neglected.

Section 1 Trend of Development of Macao's Construction Industry

Before 1989 there was no law in Macao to provide supervision over the Construction industry. According to the statistics at that time, there were more industrial accidents in the Construction industry than in other industries. And those accidents were usually more serious. When the Macao Portuguese government realized this, "The Regulations for Safety and Hygiene in the Construction Industry" were worked out and implemented in 1991. After a period of trial implementation, the Regulations were put into full implementation in order to maintain the safety and health of the builders.

With the construction projects becoming increasingly complicated, with the working environment on the construction sites changing from time to time, and with high mobility of the building workers, the risks of the builders' safety and health have increased greatly. Since the handover of Macao to the People's Republic of China in 1999, Macao Special Administrative Region has made greater strides in its development. More and more big construction projects are under way. Greater attention has been paid to the protection of the builders' lives and health. Effective popularization and education of occupational safety and health has become a must. Therefore, in April, 2002, the Government of Macao Special Administrative Region took the initiative in jointly sponsoring a course of "Occupational Safety Card for the Construction Industry" with Macao's five organizations in the Construction industry (the trade unions and chambers of commerce). The aim of this course is that through popularization and education as well as the compulsory training, the people who work in the Construction industry, either the employers or employees, are taught to effectively prevent industrial accidents and occupational diseases.

The Government of Macao Special Administrative Region also started to revise the regulations concerned, and made the course of "Occupational Safety Card for the Construction Industry" a compulsory training program. Its purpose is, through the joint efforts of the government, the main contractors, and the workers, to effectively promote and maintain the occupational safety and health of the building workers.

Section 2 The Aim and the Implementation of “The Regulations for the Safety and Hygiene of the Construction Industry”

- “The Regulations for the Safety and Hygiene of the Construction Industry “ approved by No. 44/91/M Decree were passed on July 6, 1991, and promulgated and implemented on July 19,1991. The first year was a year of trial implementation. The Regulations went into effect from the first day of the next month after its promulgation, namely, from August 1st of the same year.

- The Regulations are applicable to, within the Construction industry,
 - all types of work;
 - all the sites and places;
 - the machines, tools, appliances, and materials for construction.

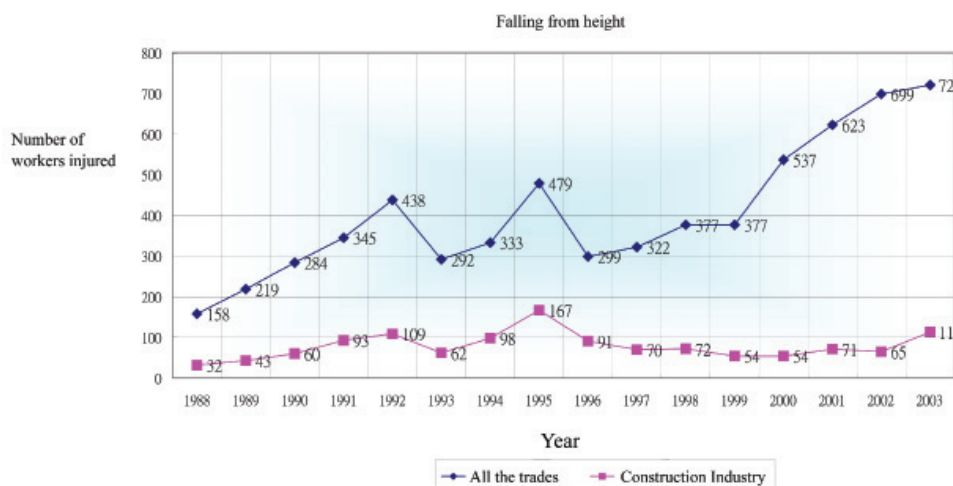
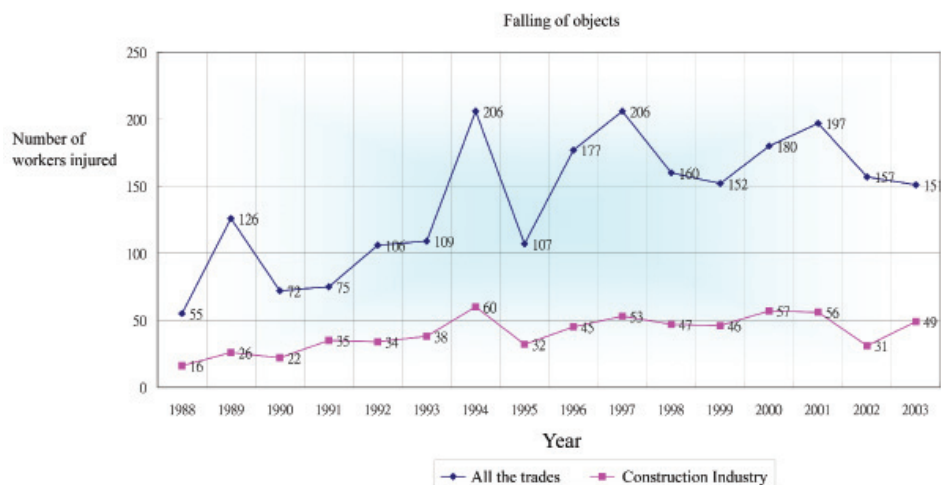
- The aim of the Regulations is:
 - to maintain the safety and health of all the workers in the Construction industry;
 - to reduce the loss of lives and property caused by industrial accidents;
 - to further promote the safety in construction by enforcing the decree.

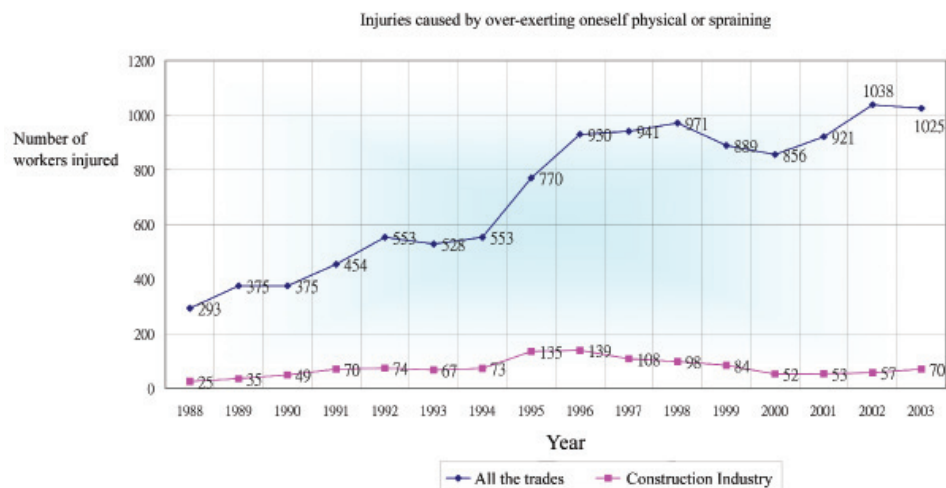
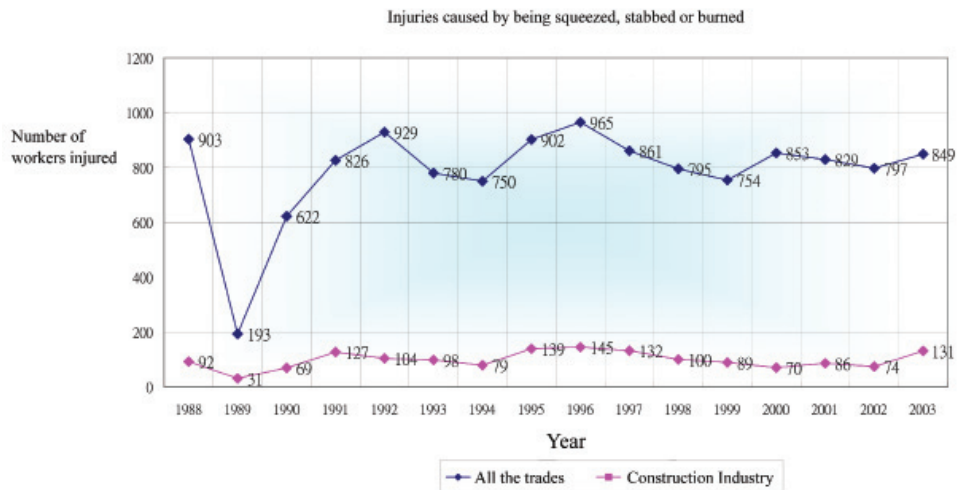
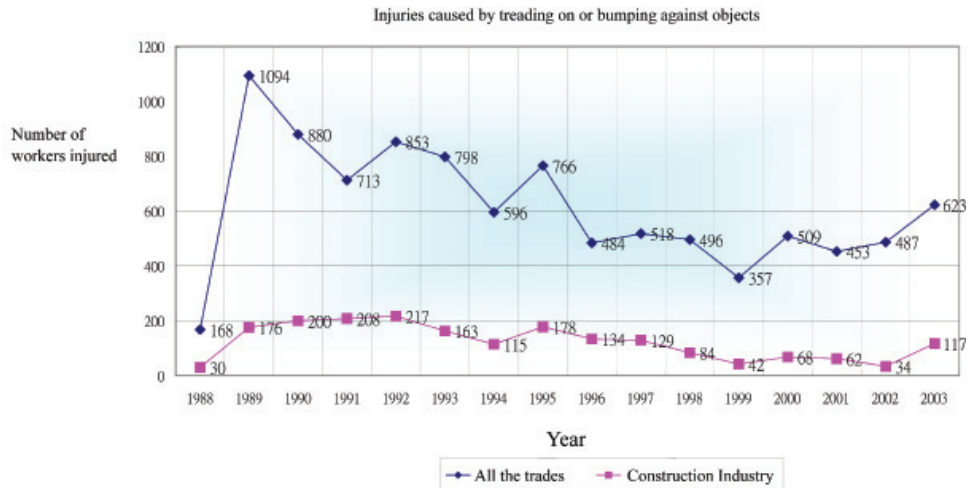
- The targets of the Regulations include:
 - all the people working on the construction sites;
 - the contractors;
 - all the frequent and occasional workers on the construction sites.

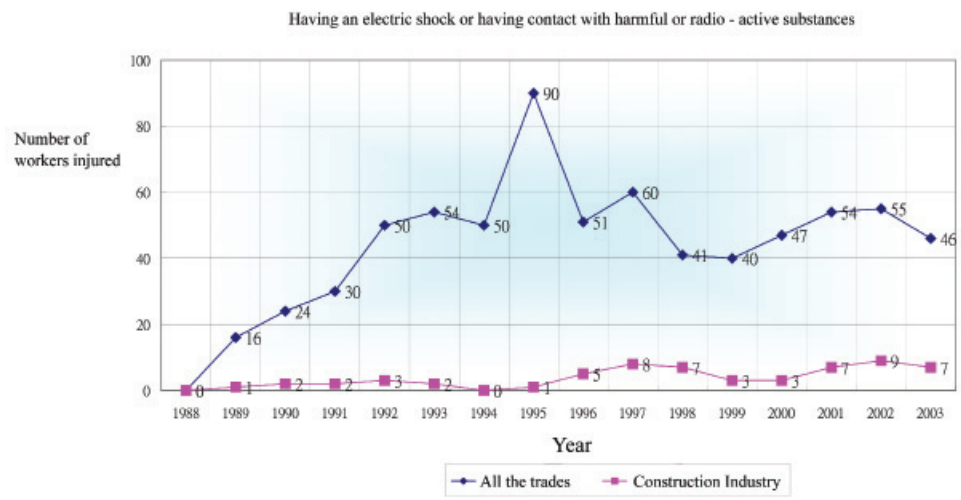
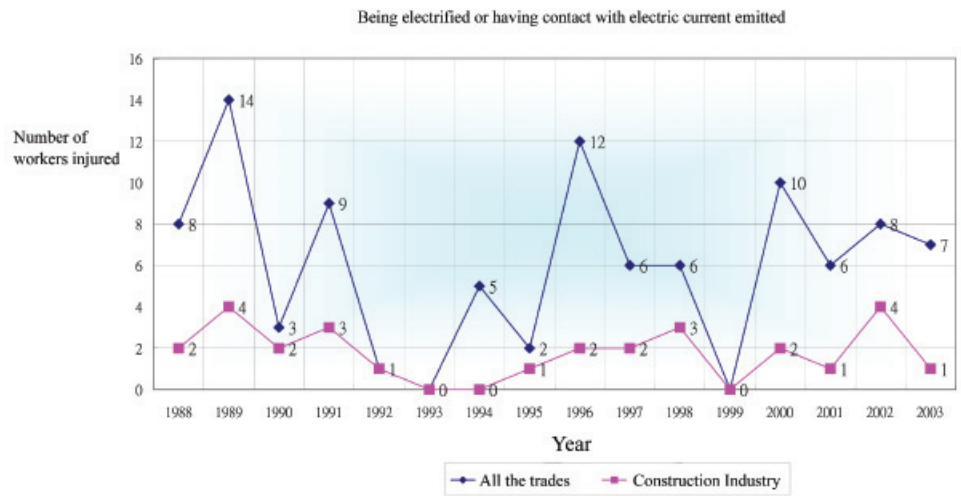
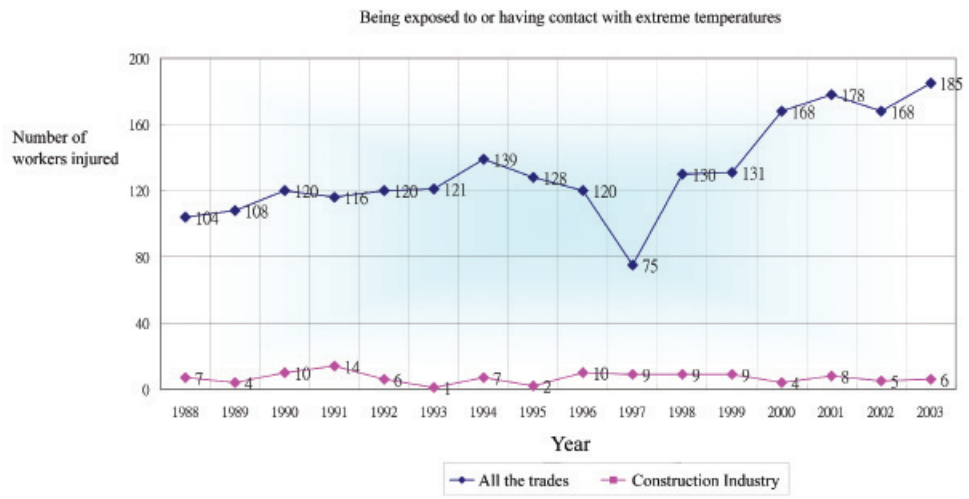
Section 3 The Basic Safety Rules at Work

- Abide by and fully implement the regulations for work safety laid down by the contractor or the company.
- Work according to the instructions of the employer or the safety supervisors designated by the employer.
- Actively participate in the construction-site discussion or the training program for work safety organized by the contractor.
- Use the safety facilities and personal protection equipment provided by the contractor.
- Upon discovering unsafe working environment on the construction site, stop work at once and immediately report to the superior.
- Avoid unsafe act at work, such as violating the safety regulations for the sake of convenience, trick playing, etc.

Section 4 The Statistics of Industrial Accidents in Macao







Chapter 2: Decrees Concerning Construction Site

Section 1 No. 44 / 91 / M Decree (The Regulations for Safety and Hygiene in the Construction Industry; July 19)

Article One: General Principles

Article Two: General Measures for Prevention

Chapter 1: Force resistance and stability

Chapter 2: The operation and maintenance of vehicles and mechanical equipment

Article Three: Lifting Machines

Chapter 1: General principles

Chapter 2: Suspension lifting and methods of fastening it

Chapter 3: Lifting equipment

Article Four: Excavation

Chapter 1: General principles

Chapter 2: Support

Chapter 3: Working rules

Article Five: Underground Work

Article Six: Capping Works

Article Seven: Demolition Works

Article Eight: Working Platform

Chapter 1:

Chapter 2:

A) General principles

B) Metal and mixed scaffolding

C) Bamboo scaffolding

Chapter 3: Suspended working platform

Chapter 4: Bridge board, inclined bridge board, and fixed ladder

Chapter 5: Movable ladder

Article Nine: Work in the Vicinity of the Electric Cable, Piping, or Electrical Equipment

Article Ten: Personal Protective Equipment

Article Eleven: Overall Site Protective Equipment

Article Twelve: Hygiene and First-aid on the Construction Site

Article Thirteen: The Last Rule

Section 2 The Employer's and Employee's Obligations Stipulated in the Decree

➤ The responsibilities of the contractor:

- Abide by “The Regulations for the Safety and Hygiene of the Construction Industry” and follow the instructions about the safety and hygiene of the Construction industry given by the authority concerned.
- Take necessary measures to ensure that machines, appliances, tools, and other appliances are kept in safe condition.
- Take necessary and appropriate measures to effectively prevent the risks to the lives, bodies and health of the workers.
- Explain to the workers the possible risks they may confront with and how to avoid them, especially to the new-comers.
- Provide the workers with free personal protection equipment and make sure that the equipment is kept hygienic and taken good care of, and is always ready for use.
- The washrooms are maintained in hygienic and good condition.
- The training and knowledge of the safety and hygiene of the Construction industry should often be offered to all the workers.
- Encourage the workers to cooperate with each other in order to avoid the risks in their job so that they can keep their well being.
- For the construction site with over a hundred workers every day, the contractor in charge should designate a qualified safety supervisor to do monitoring work on site.
- Workers without valid “Occupational Safety Card for the Construction Industry” should not be hired.
- While at work, workers should have a valid “Occupational Safety Card for the Construction Industry” and take it along with them.
- When industrial accidents occur on site or during the working hours, the contractor should inform the Labour Affairs Bureau within 24 hours.
- Before the construction works starts, the contractor should fill in Form 1, and then hand it in to the Labour Affairs Bureau within seven days after the construction works starts.

➤ The Obligations of the employee:

- In order to prevent the risks at work, the present regulations must be observed; the same with the orders and instructions from the superiors in charge of the project or from the local license-issuing authority and supervisory authority.
- The safety equipment should be kept in good condition and used correctly and appropriately.
- The knowledge of safety and first-aid at work provided by the contractor or the authority concerned should be learned earnestly.
- Any negligence that may cause accidents with the loss of human life or property should be immediately reported to the contractor or its representative.
- Suitable preventive measures should be adopted to ensure the safety and health of himself and others; dangerous activity should be prohibited, especially such activities as altering, demolition, damaging, or destroying safety equipment and facilities for the personal or the overall site protection.
- Fellow workers should be taken care of and respected; all the information, knowledge, and coordination for safety should be offered to them.
- It is required that all the workers should have a valid “Occupational Safety Card for the Construction Industry” and take it along with them while at work.

Section 3 The Training Course for Occupational Safety and Health

- Before entering the construction site to work, the workers in the Construction industry should take the training course for occupational safety and health, which is generally referred to as the course for the “Occupational Safety Card for the Construction Industry.”
- Whether you take this course for the whole day or for two evenings, it requires a total of six hours, including three hours for the theoretical study, two hours for practice, and one hour for a simple exam.
- A brief introduction to the course:
Object: This course is intended for all the people working on the construction site in Macao (including interior decoration projects).

The theoretical content includes:

- laws, decrees, and regulations concerning the safety on the construction site,
- the basic safety concepts of the work on the site,
- prevention of the industrial accidents and safety work items,
- knowledge of personal protective equipment and practicing to use it.

The practical content includes:

- learning how to use earplugs,
- learning how to use dust respirators,
- learning how to use safety harness.



- The course fee: free of charge
- Qualification for the attendance: No requirement for schooling.
- Procedure for applying: the applicant’s original ID or its duplicate, two black or color photos of one and a half inches, and filling in the application form.
- Certificate: After completing the course required hours, with the practice and passing the exam, the trainee will receive “The Occupational Safety Card for the Construction Industry” issued by the Labour Affairs Bureau.

Chapter 3 Safety for Construction Work



Section 1 The Basic Safety Concepts for Working on Construction Site

Focus 1): Common Construction Projects and Their Potential Risks in the Construction Industry

Item : foudation of the site and excavation work (including excavating tunnels and the road).
 Potential hazard : fall of persons, workers injured by falling objects, machines turning over or collapsing.

Item : working at height and using working platform.
 Potential hazard : fall of person and objects, and collapse of working platforms.

Item : lifting up heavy materials.
Potential hazard : falling of objects or collapse of hoisting machines, the heavy materials being hoisted or cantilever touching an electric cable.

Item : demolition works.
Potential hazard : collapse of the Construction, harmful objects, and dust.

Item : using lifting equipment.
Potential hazard : traffic accidents, machines turning over.

Item : welding and cutting.
Potential hazard : electric shock, explosion of gas cylinders, radiation, inhaling harmful gases.

Item : working in confined space.
Potential hazard : poisoning, lack of oxygen.

Item : piling.
Potential hazard : earing loss.

Focus 2): Recognizing Dangerous Working Procedures and Corresponding Preventive Measures to Be Taken

- It is required that all the workers who have to deal with dangerous working procedure must obtain the following beforehand:
- the information concerning the project,
 - recognizing the working method and procedure,
 - special training for safety,
 - certificate for completing the required training.

Focus 3): Causes of Industrial Accidents and Methods for Their Prevention

➤ Industrial accidents / incidents:

Industrial accidents refer to a chain of unplanned events which cause domino effect and lead to the deaths, injuries, or occupational diseases of the workers, or the damage and destruction of the equipment, or the loss of property at the work place, thus affecting the environment.

➤ Causes of industrial accidents / incidents:

- unsafe acts,
- unsafe conditions,
- unsafe acts and conditions.

➤ An example of unsafe acts



➤ An example of unsafe conditions



➤ Prevention of industrial accidents / incidents:

With the sincere cooperation of the three-sides: workers, contractors, and the government, many accidents can be avoided:

- The contractor or the employer should provide safe working conditions to the workers, including personal protective equipment which the workers need when necessary.
- The workers should be cooperative, and use the personal protective equipment according to the instructions of the contractor or the employer.

- The government stipulates the laws and decrees, to help the employer provide and publicize the safety education at work, supervise that work at the construction site is safe, and when necessary, put under control those who violate safety regulations to ensure the safety of all the other workers.

The consequences of the industrial accidents may be very serious; they may bring about inestimable losses to the workers, the contractor or employer, and even to the society:

- To the injured worker: He may lose his ability to work, thus causing economic difficulty, becoming physically injured and mentally affected, even losing his life.
- To the family members of the injured worker: they will lose their economic support; they must look after the injured person.
- To the employer: He will suffer losses of time, money, reputation, and a skilled worker; he may be responsible, to some extent, for the violation of “The Regulations for Safety and Hygiene of the Construction Industry”.
- To the society: The economic losses will be difficult to estimate, while productivity will be affected, and total competitiveness will be weakened.

Focus 4): Emergency Procedure and Elementary Knowledge of First Aid

- When accidents or emergencies occur at work on the construction site, workers should start the procedure of dealing with emergencies and take necessary measures of first aid.
- As a rule, all the workers should receive safety training and drill, and they should also know the information and procedures concerned.
- The workers should know and recognize the following in advance:
 - The location of the first-aid station or clinic;
 - The way to contact the safety supervisor, such as his telephone number;
 - The way to contact the qualified first-aid personnel on the construction site, such as his telephone number;
 - When an accident occurs, they should know who to inform, and how to report to the police (or the procedure of reporting to the police);
 - The fire alarm system and how to sound the fire alarm on the construction site, the emergency exits on different floors of the building, measures of fire prevention, and how to use portable fire extinguisher;
 - In case of inclement weather, such as typhoon, necessary safety measures and procedure.

- Hygiene in the place of work: On all of the constructions sites, there should be hand-wash basins, toilets, and shower equipment, and all of the equipment should be kept clean and tidy.
- First-aid kit:
 - On all the construction sites, there should be a first-aid kit for every fifty people, and it should be put in a place easy to approach and easily visible;
 - In the center of the surface of the first-aid kit there should be a sign of a red cross.
- Stretcher: Whenever the daily average number of workers is over fifty, there should be a stretcher ready beside the first-aid kit.
- First-aid personnel: Whenever the number of workers is over thirty on the construction site, there should be at least one certified first aider in charge of first-aid.

Focus 5): Reporting Industrial Accidents

- “The Regulations for Safety and Hygiene of the Construction Industry” stipulates that within the twenty-four hours after an industrial accident occurs on the construction site or within the working hours, the contractor must inform the Labour Affairs Bureau the accident in the following ways:
 - Hand in the written report in person (together with the duplicate of the injured worker’s ID).
 - Fax the written report (together with the duplicate of the injured worker’s ID).

Section 2 Effective Prevention of Industrial Accidents in the Construction Projects

Focus 1): The Overall Layout and Preparation of the Site Before Construction

- Types of dangerous work with potential risks:
 - Operating lifting equipment for hoisting;
 - Using a bulldozer or an excavator, or other types of lifting equipment;
 - Working at a place where there is a danger of falling / working at height;
 - Working on a platform or a ladder;
 - Excavating a tunnel or caisson;
 - Coming into contact with temporary electric installations or working at a place near high-voltage electric installations;
 - Traffic accidents caused by heavy-duty vehicles on the construction site.

- In order to reduce unexpected dangers and risks, suitable safety measures should be taken:
 - Hoisting should be done by qualified people with proper training, and assisted by the signalman.
 - Lifting equipment should be operated by people with suitable training, and assisted by the signalman.
 - Suitable measures should be adopted to prevent people falling from height.
 - Suitable measures should be adopted to prevent workers from accidentally damaging the underground installations such as high-voltage electric cable when they are excavating, and suitable facilities should be provided to prevent the displacement of earth.
 - Electric tools with earthing or ground wire should be used, and safety rules concerned should be strictly observed.
 - The traffic on the construction site should be directed by the person in command.

- In addition to ensuring that the construction site is safe and fairly tidy, effective protection measures for the overall site should be taken:
 - Building materials should be piled neatly;
 - Mould plates, which have just been demolished, should be dealt with in time; projected nails on timber should be denailed or flattened out.
 - Passages should be kept unblocked and sufficiently lighted.
 - Handle with great care such chemicals as thinner, nitric acid, hydrochloric acid; people should close or store the container properly after using in order to prevent any accident.
 - Clean the greasy dirt and puddles swiftly.

Focus 2): Safety Measures for Lifting Equipment and Hoisting Operation

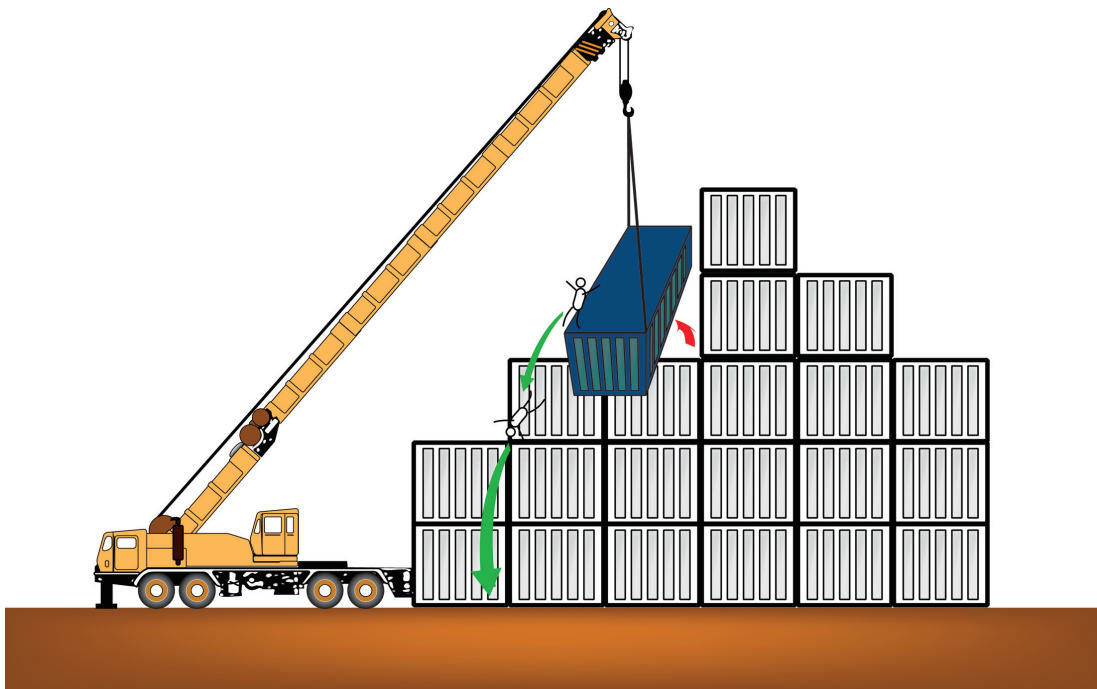
➤ Lifting equipment

Machinery:

Common lifting equipment includes lifting elevator, crawler crane, tower crane, grab crane, lifting pulley, winch, hoister, pulley block, chain block, platform crane, excavators, pile driver, dragline excavator, conveyer, cable car, cableway, overhead rail, etc.

Accessories:

Common lifting accessories include chain sling, rope sling, ring, link, shackle, hook, swivels, eyebolt, plate clamp, etc.



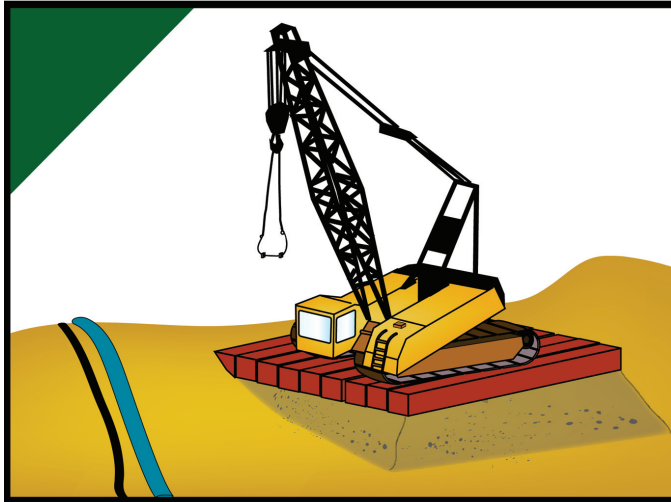
➤ Safety measures for hoisting

Common accidents:

The turnover or collapse of the crane, breaking of crane arm and suspended rope, falling of persons and materials, crane contacting overhead electric cable, struck by crane or swinging cargo, falling objects hitting persons.

Safety Measures:

- Lifting equipment appropriate to the procedure should be chosen.
- Lifting equipment should be securely rested on a solid basis.



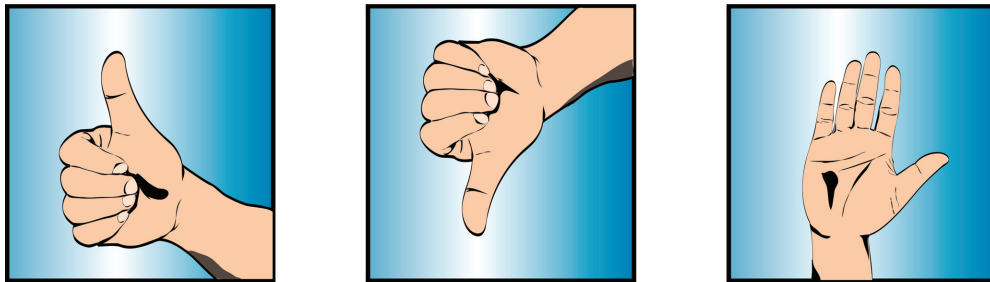
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- Except for the cargo lift, all the other lifting equipment must be inspected at least every 14 months by a competent person, and the result of the inspection should be recorded in Form 6.
- Every time after the maintenance or the replacement of a part of the lifting equipment, it should be inspected by a competent person again, and the result of the inspection should be up to the standard required in Forms 4 and 5.
- Every time after the maintenance or replacement of a part of the lifting equipment, it may affect, to some extent, the operation of the equipment; therefore it is necessary for a competent person to inspect and test it and then the result of the inspection and testing should be recorded in Form 3.
- Before hoisting the cargo, the worker should know the weight of the cargo so as to make sure that it will not exceed the maximum load of the equipment.

- People working with the lifting equipment and installing the sling as well as the signalman should receive the necessary training in this field.



- The safe load indicator of the lifting equipment should be constantly checked to make sure that it is working properly.
- It should be avoided that the winch rope and the hoisting rope are too far away from the capstan.
- The suspended rope should be correctly fastened to the cargo (such as a long or pointed object) to prevent the cargo from falling.
- When hoisting or transporting bricks or loose materials, a container with a fence should be used so as to prevent the cargo from falling.
- The cargo is not allowed to stop and stay high above the ground, and when transporting the cargo on the construction site with people walking below, the distance between the bottom of the cargo and the ground should not be less than two meters (2 m).
- When lifting the cargo, dragging along on the ground is not allowed; cargo should be hoisted vertically.
- When operating a mobile crane, necessary measures must be taken to make sure that the distance between the swinging arm of the crane and other movable parts in operation on the one hand, and the nearest obstacle on the other hand must be at least 60 centimeters (60 cm) away from each other.
- If that obstacle is an aerial cable, then the safety distance should not be less than three meters (3 m).
- When damaged or faulty lifting accessories are found, they must be replaced at once.
- The sling should be constantly examined; if the cable rope is found broken, holey, twisted, etc, or if more than one-third of the string is worn out, or the diameter of the sling cable is changed, it should not be used any more.
- When several cranes are being operated at the same time, a qualified person should be in command so as to avoid collision.
- In inclement weather, all hoisting and transportation should stop.
- When typhoon comes, the hoisting arm of the tower crane must be loosened and turned leeward, so that it can turn freely.
- Before a cargo lift is to be operated, a competent person should give it a safety inspection and record everything in detail.
- All cargo lifts must not be used for passengers.
- At the entrance and exit of a cargo lift on every floor, there should be a door not lower than 0.9 meters (90 cm) high and a fence on the other three sides which is 1.8 meters high.

Focus 3): Safety Measures for Excavation

- ◆ The potential risks in excavation
 - The fall of persons;
 - The falling of objects;
 - The collapse of mud walls or slopes;
 - Damaging the underground public utilities (such as high-voltage electric cable, and water pipe);
 - Toxic, harmful, flammable, or suffocative gases may be released while digging;
 - Flooding by water or mud.

- ◆ Preventive measures
 - Before digging, the exact position of the nearby public utilities must be known so as to avoid damaging them by mistake.
 - Before digging, tests must be conducted in the tunnel, including tests of oxygen content, and flammable, suffocative or toxic gases; the results of the tests should be recorded in Form 12.
 - When the depth of the digging is over 1.2 meters (1.2 m), suitable shoring should be used to prevent the collapse of rubble to bury the workers alive.
 - When the depth of the digging is over 5 meters (5 m), metal shoring should be used.
 - At the edge of the excavation, 15-centimeter (15 cm) high kick plates should be installed, and nothing should be put on those boards, such as miscellaneous objects, tools, or rubble.
 - When the excavation is over two meters deep, a solid ladder should be fixed firmly, every 20 meters, for people to come down or go up.
 - At the edge and the surroundings of the excavation, there should be a 90-centimeter (90 cm) high barrier and suitable railing.
 - When using a shovel or a pick-axe, the workers should keep a distance of at least 1.5 meters (1.5 m) from each other.
 - The rubble dug from the excavation should not be piled up within 0.5 meters (0.5 m) from the tunnel's edge.
 - The people who are excavating must wear safety helmets.
 - On the site of excavation, there should be pumping equipment so that the water and silt can be removed instantly.
 - Competent persons should make regular inspections.

Focus 4): Safety Measures for Underground Construction and Entering a Confined space

➤ Confined space
Manholes, caissons, tunnels, or any work place with a narrow entrance and exit, and poor ventilation.

➤ Safety measures for entering a confined space

Common dangers:

- ◆ lack of oxygen, which leads to asphyxiation;
- ◆ poisoning caused by the accumulation of toxic gases (such as carbon monoxide);
- ◆ fire or explosion caused by the accumulation of explosive gases (such as biogas);
- ◆ slipping and falling from height, and falling of objects;
- ◆ manual handling operations;
- ◆ drowning;
- ◆ electric shock (e.g. when doing electric welding);
- ◆ inhaling siliceous dust;
- ◆ loss of hearing (e.g. using the jackhammer without ear protection);
- ◆ handling chemicals improperly;
- ◆ biological hazard;
- ◆ radioactive hazard;
- ◆ traffic hazard;

Preventive measures:

- ◆ Workers and managers should receive training in advance and thus be aware of the possible dangers that may occur while working underground, the correct procedure of entering a confined space, the safety equipment needed, and the correct emergency procedure.
- ◆ The risk assessment of the work place should be made in advance and the corresponding safety measures should be worked out accordingly.
- ◆ Before entering the confined space, air testing must be conducted (including oxygen, toxic and explosive gases).
- ◆ If the oxygen content is less than 21%, the confined space must be ventilated first.
- ◆ The entrance of the manhole and the caisson should be furnished with solid fences and kick plates.
- ◆ Two sets of emergency escape equipment should be ready for use;

- ◆ Electric tools should have ground connection or double insulation, and whenever possible, low-voltage electric equipment should be used.
- ◆ Suitable personal protective equipment should be worn or protection tools should be carried when entering confined space.

When entering the confined space the following safety installations and personnel must be provided:

- ◆ gas testing instrument;
- ◆ respirator;
- ◆ separate life line and safety belt;
- ◆ respiration resuscitator;
- ◆ alarm equipment (e.g. alarm bell);
- ◆ rescuers who have been trained to do their job;
- ◆ qualified first-aid personnel;
- ◆ first-aid equipment and stretcher.

Emergency procedure:

- ◆ Call 999 to report the accident to the police.
- ◆ Rescuers on the scene should rescue without delay.
- ◆ If it is already known that the injured have become unconscious, anyone who wants to go into the confined space of the accident must have a suitable respirator;
- ◆ To move the injured people out of the confined space as soon as possible so that the first-aid personnel can give them first aid.
- ◆ Take the injured people to the hospital as soon as possible.

Focus 5): Safety Measures for Capping Works, Using Working Platform and Ladder

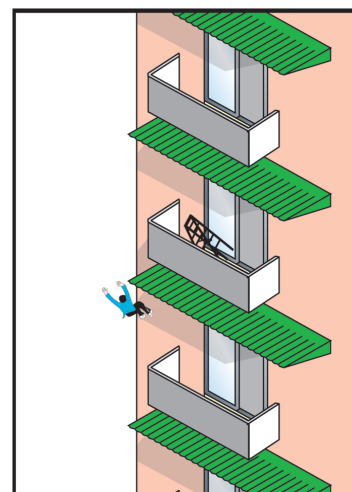
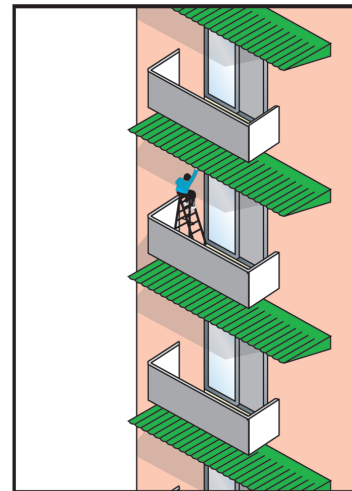
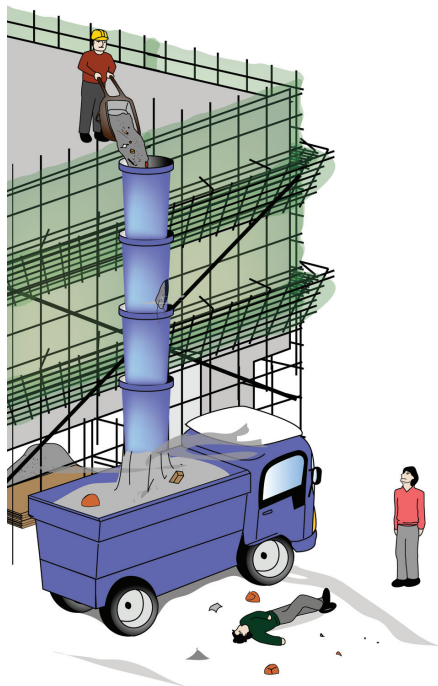
➤ Capping works

When working at the roof top and other dangerous work of the capping, special safety measures must be taken in accordance with the slope, the surface and its character as well as the weather condition. Therefore, the railing, working platform, roof floor ladder, and proper kick plates should be built up.

➤ Safety measures for using working platform and ladder

Common accidents:

- ◆ The collapse of scaffolding that leads to people falling;
- ◆ The falling from height: workers fall off from the edge, lift shaft, and opening of the floor, and from working platform;
- ◆ The falling objects;
- ◆ Injuries to the public.



Safety Measures:

- ◆ All the working platforms, roof floor ladders, and planks should be wide enough for people to work on; their width should not be less than 40 centimeters (40 cm).
- ◆ If the working platform cannot be used at the place of work, workers must be equipped with safety belts.
- ◆ Only competent person can be employed to build, repair and demolish the scaffolding, which should be checked every 30 days and the result of the inspection should be recorded in Form 13.
- ◆ After a typhoon, a thunder storm, or 15 days in a row without using the scaffolding, an inspection is needed before using it again and the result of the inspection must be recorded in Form 13 again.
- ◆ When the platform of the scaffolding is used only for people to pass, its width should not be less than 40 cm; if the platform, besides being used for people to pass, is also used for people to transport objects and building materials, then its width should not be less than 65 cm.
- ◆ On the scaffolding, a fence must be built, and it should be strong enough and should be 90 cm high; in addition, around the working platform there should be kick plates which should not be less than 15 cm high.
- ◆ The catch fan is to hold up the falling objects and building materials; the vertical distance between the first inclined shield of scaffolding and the ground floor level should not be more than 10 meters (10 m) while the vertical distance between every two inclined shields of scaffolding should not be more than 20 meters (20 m).
- ◆ The width of the catch fan must not be less than 2 meters.
- ◆ The scaffold should have the facilities like ladder for people to climb up and come down safely.
- ◆ If the working environment does not allow us to put up scaffold or working platform, then suitable safety net or safety belt should be used, and they should be fastened to a fixed point above the worker's shoulder or a separate lifeline.
- ◆ All the ladders used at the work place should not be stained with greasy dirt, and before using the ladder the workers' shoes should be checked to make sure that they are not stained with greasy dirt either.
- ◆ When there's a risk of electric shock, metallic ladders shouldn't be used.
- ◆ Before using a ladder, an inspection must be made to find out if it has been damaged.
- ◆ The ladder should be placed at an angle of about 75° (namely, the height-base ratio is 4 to 1).
- ◆ The top of the ladder should not be less than one meter above the platform so that that part of the ladder can be used as handrail.
- ◆ When climbing up the ladder, the worker should face the ladder and should not carry anything in his hands; furthermore, there should always be 3 contact points with the ladder divided by hands and feet.
- ◆ When working on the ladder, it is not allowed, for the sake of safety, to lean backwards.
- ◆ If it is necessary to stay on the ladder to work for a long time, suitable safety measures should be taken or someone else should stay at the base of the ladder to supervise.
- ◆ When the suspended working platform is used, the barrier cannot be less than 90 cm high.
- ◆ The height of the platform should be in a correct proportion to the area of the platform.
- ◆ It is not allowed to throw hand tools to each other on the platform.
- ◆ The platform should not be overloaded.
- ◆ The people working on the suspended working platform should use safety belt, which should be fastened to a separate lifeline.
- ◆ The weight and height for manual handling cannot exceed 50 kg and 9 m while working on any platform.

Focus 6): Safety Measures for Demolition Works

➤ Demolition works

When demolishing, suitable measures should be adopted to prevent objects and building materials from falling down and burying alive people working at a lower level; demolition works should be done from the top floor to the lowest floor, level by level, from the propped to the prop; if the building is to be demolished as a whole, approval from the government department concerned must be obtained.

➤ Safety measures for demolition

Common Accidents:

- ◆ Collapse of the building, which leads to burying people alive or falling from height;
- ◆ Falling of objects.

Safety measures:

- ◆ A competent person must be in command of the project of demolition.
- ◆ People without experience in demolition are not permitted to take part in the work of demolition.
- ◆ If the person in charge of the project of demolition is not sure that the supply of water, gas, and electricity have been completely cut off, no demolition works should be done at all.
- ◆ No outsiders should be allowed to participate in part of the demolition works.
- ◆ At the surrounding area of the demolition project, a suitable and solid protection fence should be built to ensure the safety of the public.
- ◆ Before the demolition works begins, make sure whether there are harmful substances on the spot such as asbestos or its products, and objects with a fragile structure must be demolished first.
- ◆ The enclosing wall and everything that sticks out on the walls of the building must be demolished first, especially something that sticks out more than two meters from the wall.
- ◆ In the process of demolition works, try to sprinkle water at the work place so as to prevent a huge cloud of dust.
- ◆ Personal protective equipment must be used, such as gloves, dust respirators, eye protectors, and safety shoes.
- ◆ If pressure or a ram is used to demolish a certain part of the building, suitable measures should be adopted to prevent the building from collapsing toward the workers.
- ◆ If the metal cable, ropes and other pulling force methods are used to demolish the building, precaution must be taken to control the area of the collapsed building.
- ◆ It is strictly forbidden to throw down objects of demolition works from height; the garbage collector and elevators should be used to carefully transport these objects down to the restricted zone in order to avoid hurting people.
- ◆ During the period of demolition works, make sure that enough first-aid equipment is provided and maintained.

Focus 7): Safety Measures for Using Electricity and Working Near Electric Installations

➤ Safety for using electricity

Common dangers:

- ◆ Electric shock and burns;
- ◆ fire and explosion.

➤ Preventive measures

Common causes for accidents:

- ◆ Leakage of electricity and damage to the insulation.
- ◆ No earthing has been used or the electric wire has been wrongly connected.
- ◆ Using electric appliances in the humid / wet environment.
- ◆ Putting the electric wire directly into the socket without using a plug.
- ◆ Plugging several electric appliances into multi-adaptors, resulting in overload and overheat.

Safety measures:

- ◆ Never pull the electric wire to take out the plug.
- ◆ Avoid using poorly insulated electric appliances or wires.
- ◆ Install suitable devices to prevent the leakage of electricity and use earthing.
- ◆ Use electric appliances with the sign of “double insulation” (■).
- ◆ When working at height, wooden ladder and rubber pad should be used as much as possible.
- ◆ Electricians should wear electricity-proof gloves and shoes.
- ◆ Use standard plugs to connect to the socket, and never connect a electric wire directly into the socket.
- ◆ Do not connect several extension cords in a row with the last one connected to several electric appliances.
- ◆ Before doing maintenance work on a highly dangerous and large-scale electric installation, first of all turn off the main switch, and then lock it up, and put up a sign of “Do not turn on the switch!”
- ◆ If the work place is in the outdoor or humid / wet working environment, the switch box should be installed with a proper earthing connection or an earth leakage circuit breaker.
- ◆ Never use electric installations in the rain.
- ◆ A competent electrician should perform a regular check and maintenance of all the electric installations and facilities; they should perform a check and a re-inspection on the temporary power supply system on the construction site every 60 days, and they should make a technical report about it.

- ◆ Measures should be taken to prevent workers from going near the aerial cable, underground cable, and power installations.
- ◆ When working near the power installations, the tools and machines which workers use should keep the following safety distance:
 - When it is under 60,000 volts, the safety distance is 3 meters;
 - When it is above 60,000 volts, the safety distance is 5 meters.
- ◆ When for some reason it's not possible to cut the power to the underground cable, the constructor must contact the power supply company, so that the cable can be removed to a safe distance of at least 1.5 meters, providing protection to the workers:
 - Install safety warnings, showing the power cable position;
 - Install suitable barriers in order to prevent that any worker will get closer than 1.5 meters from the power cable;

Points of attention when using electric hand tools:

Electric hand tools refer to electric drill, electric grinder, electric saw, etc. When they are used, the following are necessary:

- The tools must be in good condition without any damage; if people have discovered some problem with the tool, the workers should stop using it, and the sign that "It is forbidden to use this tool!" should be put up on the tool and they should immediately report it to their superior.
- The tools must be connected with earthing cable.
- The tools must have double insulation installation.
- The tools must have plugs and sockets, which are up to standard for connecting with the mains.
- Before using the tools the workers must be trained so that they know the functions of the tools and the methods of using them.
- Only after turning off the power can the plug be pulled out; nobody should ever pull the cable to take out the plug.
- The workers should always keep their bodies dry, and make sure that their working environment is not wet, so as to avoid getting an electric shock.
- Electric wire should be placed at a high place; it should never be carelessly put on the passages.
- Do not use power in an overloaded way.
- Regular checks and maintenance must be done.

Focus 8): Colective Protection Measures**1. Safe Stacking on the Construction Site****Railing and kick plates**

- ◆ If the work place is over two meters high and there is a danger of people falling down, a railing of 90 cm high and kick plates of 15 cm high must be put up at that level.
- ◆ If an opening is made on the wall which is less than 90 cm from the floor or the work platform, a proper fence should be put up there for the protection of the workers, and if necessary, kick plates of no less than 15 cm high should be installed.

Safe stacking on the construction site

- ◆ All the objects, building materials, tools, and equipment that are not in current use should be dealt with properly and put away at safe places so as to avoid endangering the security of people.
- ◆ All the nails and protrusive objects on the timber and bamboo should be removed before storing, or the nails and protrusive objects on the timber and bamboo should be covered properly when storing them.
- ◆ When dismantling the scaffolding, all the objects, tools, utensils, and other objects and building materials should be handled carefully; it is forbidden to throw them down from a higher place, which might hurt people nearby.
- ◆ When there is a rainstorm, which may hurt workers, security measures should be taken immediately, and in particular, the objects and building materials, which may be blown away by the storm, should be moved to a safe place.

Boarding

- ◆ All the projects under construction near the streets, especially those of demolition, building, rebuilding, or the maintenance of the roof top and the shop front must have boarding or other protective facilities for the whole range of construction so as to ensure the security of the public.

2. Signs of the tunnel and at the entrance and exit of the motor vehicles**The warning system of the construction**

- ◆ If the place of construction is not easy for people to see so that people may enter the construction site by mistake or have the danger of collision, a warning system of the construction must be set up for a long time to ensure the security of the public.
- ◆ If the warning system of the construction is set on a public road, lighting installation is necessary at night or on foggy days.
- ◆ If the construction is near the street, signs must be put up at the entrance and exit of vehicles, and at the same time there must be a signalman to direct the incoming and outgoing vehicles to avoid dangers to the pedestrians and drivers.
- ◆ For the construction near the street, warning lamps and reflectors must be put along the railing.

3. Mechanical operation

Mechanical guard shields

- ◆ Fixed guard shield;
- ◆ Interlocking guard shield;
- ◆ Automatic guard shield;
- ◆ Tactile guard shield;
- ◆ Facilities controlled by both hands.

Types of mechanical injuries

- ◆ Stabbing and cutting wounds;
- ◆ Splashing wounds;
- ◆ Pinch wounds;
- ◆ Clipping wounds;
- ◆ Pressing wounds;
- ◆ Spraining muscles.

Causes of accidents

- ◆ The revolving part of the machine catches the body;
- ◆ The worker is struck and wounded by the moving part of the machine;
- ◆ The worker has direct body contact with the point, grinding, or hot part of the machine, or has an electric shock, and is thus injured;
- ◆ The worker's clothes, hair, necklace or other objects are caught by the revolving part of the machine and thus accidents occur;
- ◆ The scraps shot out from the machine in operation hit the worker.

The parts of the machine that may inflict injuries upon people

- ◆ Points of operation;
- ◆ Moving and revolving parts;
- ◆ Power transmission parts: transmission gear, gear wheel, chain, belt, connecting rod, etc.

Example: Circular saw

- ◆ The circular saw must have:
 - a movable upper guard shield which can be opened and closed, and which is as high as the timber to be sawed;
 - a lower guard shield;
 - an edged saw;
 - a vertically cutting guide.
- ◆ When the timber must be pushed by hand, a wooden stick should be used instead.
- ◆ The band saw must have a guard shield along the saw blade with an opening only at the entrance of the timber.
- ◆ The flywheels of the band saw should have a net guard shield; when it is sawing the timber, a push rod, or a teeter board should be used instead.

4. Welding (gas welding and arc welding)

Safety measures for arc welding

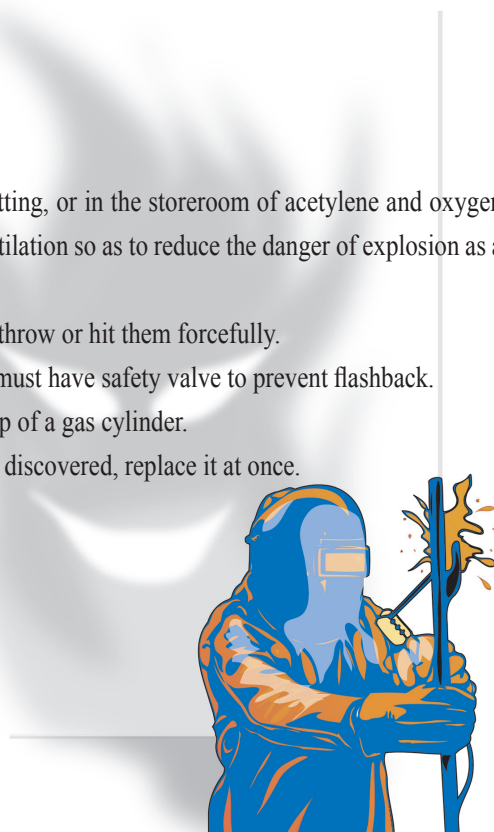
- ◆ When arc welding is being done, the welded metal will be fused by arc light, and then the new metal will be fused and welded.
- ◆ The arc light is produced because of the reaction between the welded metal and the electrode of the deposited metal.
- ◆ When welding, the worker should have a special handle to hold the electrode, for the electrode and the handle will be charged and become hot; if the worker accidentally touches them, he will have an electric shock or be burned.
- ◆ Arc light will give out infrared radiation (heat) and ultraviolet radiation.
- ◆ Smoke comes from the metals and solder.
- ◆ Common accidents:
 - The sparks and hot metals burn the worker.
 - Injuries to eyes by radiation and foreign particles.
 - The ultraviolet ray produced during the welding may cause “arc eye.”
 - The infrared ray produced during the welding and the fusion of metals may lead to “cataract”.
 - The ultraviolet ray may cause skin inflammation.

- Having an electric shock.
- The eye is burned by arc radiation.
- Inhaling toxic fumes or gases.
- Fire or explosion.
- ◆ Preventive measures:
 - Welding should not be done in a waterlogged or wet environment.
 - All the tools must have effective earthing connection.
 - Tools must be well maintained.
 - Proper safety helmets, welding face guards (eye protectors), flameproof gloves, safety shoes and aprons must be used.
 - There should be a screen around the place of welding to keep the arc light from going out.
 - There should be good ventilation.
 - Proper fire-fighting equipment should be provided such as carbon dioxide or powder fire extinguishers.
 - When welding is done at a high level, workers must have a working platform to work on and wear safety belts.
 - Screens must be used to prevent sparks from flying out to hurt people or set fire on other objects.
 - After the welding is done, make sure that there is no tinder left and that power supply is switched off, in order to prevent fire.

Safety measures for gas welding

- ◆ The equipment for gas welding and cutting includes the following: oxygen cylinder, acetylene cylinder, decompressor with oxygen meter or gas meter, welding torch (welding blow lamp), cutting torch, flashback arrestor, gas pipe (wind pipe: with three colors of blue, green, and black; gas pipe: with only red color), ignition gun, flameproof gloves, glasses, and work clothes.
- ◆ In order to increase the acetylene capacity of the steel cylinder and prevent explosion, a special porous material has been installed inside the steel cylinder. This material must be strong, porous, light, non-sedimentary in the steel cylinder, and non-destructible at a high temperature.
- ◆ When the steel cylinder is being used, the pressure must be lowered to the safety level, and the steel cylinder must be put vertically upright, and must never be put horizontally.
- ◆ Oxygen: Oxygen is a colorless, tasteless, and odorless gas, which is not spontaneously flammable, but oxidizing; in gas cutting, oxygen is oxidizing and as a result will produce a high temperature, which will smelt steel so that cutting can be done.
- ◆ Oxygen has a very reactive chemical property; it can oxidize with most elements, and the drastic oxidization is combustion.

- ◆ Oxidization heightens with the increase of pressure and temperature.
- ◆ When high-pressure oxygen is being used, it is strictly forbidden to have any contact with oil or flammables, for the heat produced from the rubbing of air currents, from the collision of solid metal particles, and the electrostatic sparks among high-speed air currents are all the preliminary elements of ignition, which may lead to the burning of flammables and even to explosion.
- ◆ Acetylene: Acetylene is also called calcium carbide gas, which is generally used as a flammable gas in gas cutting or gas welding. The temperature of the flame of acetylene may reach as high as 3100°C to 3200°C . Therefore it is commonly used in cutting or welding. It is a colorless gas, but mixed with hydrogen sulphide, hydrogen phosphoreted, sulphides, and other impurities, it gives off pungently stinking smell. When the concentration of acetylene in the air has reached 2.5%, it will immediately burn once it has met with tinder.
- ◆ Acetylene is a most unstable chemical, which is easy to explode.
- ◆ After having contact with copper or silver for a long time, acetylene can easily turn itself into compounds such as copper acetylides and silver acetylides. These compounds will easily explode if they are collided or under high temperature or pressure.
- ◆ The parts that are used with acetylene should not be made with pure copper; if it is made of alloy, the copper content should not exceed 67%.
- ◆ Common accidents:
 - Explosion of the gas cylinder;
 - Fire;
 - Inhaling toxic fumes or gas;
 - Eyes getting hurt.
- ◆ Safety measures:
 - In the workshop of welding or gas cutting, or in the storeroom of acetylene and oxygen cylinder, attention must be paid to ventilation so as to reduce the danger of explosion as a result of the leakage of acetylene.
 - Handle gas cylinders carefully; never throw or hit them forcefully.
 - Both oxygen and acetylene cylinders must have safety valve to prevent flashback.
 - Never put miscellaneous objects on top of a gas cylinder.
 - Check the tube regularly; if leakage is discovered, replace it at once.
 - Gas cylinder should be put vertically.
 - Be well ventilated.



5. Fire prevention

Measures for fire prevention

- ◆ Causes that lead to fire
 - Combustion needs three necessary conditions:
 - Fuel -- such as paper, timber, thinner, acetylene, etc.;
 - Heat -- such as the heat produced by flame, sparks from welding, and use of electricity in an overloaded way;
 - Oxygen -- Oxygen in the air (approximately 21%) makes flame continue to burn.

- ◆ Common causes for fire alarm on the construction site:
 - Short circuit of electric wire or overloaded connection with electricity;
 - Placing the wire directly into the socket outlet without a plug;
 - Using damaged electric equipment and circuit;
 - Lack of maintenance which leads to the overheating of electric tools;
 - Storing too many flammables;
 - Pile-up of too much garbage and flammable waste;
 - Smoking or flame at the work place.

- ◆ Methods to put out fire:
 - To separate the fuel;
 - To stop the supply of oxygen;
 - To cool down.

- ◆ Types of portable fire extinguisher used on the construction site:

Types of fire	Types of portable fire extinguisher			
	Water	Foam	Carbon dioxide	Powder
Class A Paper, timber, and cotton material	✓	✓	✗	✓
Class B Solvents, fuel, grease	✗	✓	✓	✓
Class C All electrical appliances	✗	✗	✓	✓

- ◆ The users should pay attention to the methods of use, the restrictions, and the dates of expiration of various types of fire extinguisher.



- ◆ Points of attention that the workers must know and the regulations they must abide by:
 - The position of emergency exits in case of fire.
 - Fire doors must always be kept shut, but not locked.
 - Make sure that the place where fire extinguishers are placed should not be locked with obstacles.
 - Follow the advice of the sign “No smoking.”
 - Properly discard the flammable objects and materials.
 - Do not fill up a lidless container with flammable objects and materials.
 - Flammables should be kept far away from the tinder.
 - Before doing welding or gas cutting, an inspection must be made first.
 - When electric appliances are not in use, turn off the main switch of power supply.

6. Collapse and flooding

- ◆ When construction is going on on the site where there is a danger of collapse and flooding, there must be first-air tools and equipment; at the same time, all the prevention measures should be taken to make sure that once an accident occurred, all the workers would be rescued, and there must be lighted signs of emergency exits for people to leave the place as soon as possible.

7. Identifying chemicals and learning to use their labels

Specifications of Labels

Risk Symbol	Name of Substance
	Turpentine Particular Risks -Flammable -Harmful by inhalation, in contact with skin and if ingested Safety Precautions -Keep away from sources of ignition -No Smoking
	Benzene Particular Risks -Highly flammable -Toxic by inhalation and in contact with skin -Dangers of very serious irreversible effects -May cause cancer Safety Precautions -Keep container tightly closed and in a well ventilated place -Keep away from food, drinks and animal food -Keep away from sources of ignition -No Smoking -Avoid contact with skin -Do not empty into drains or sewers

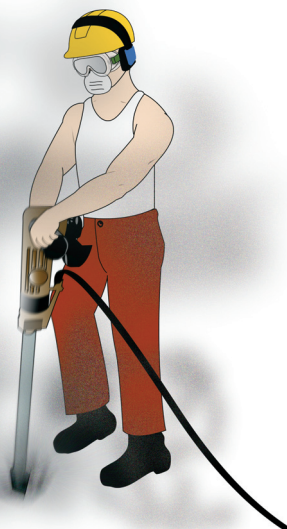


When using the chemical, the worker must follow the safety measures listed on the label

Symbol	Risk Properties
	<p>Very dangerous A substance which may explode under the effect of flame. When violently shaken or rubbed, it may have reaction which may lead to explosion.</p>
	<p>Extremely flammable A liquid whose flash point is below 0° C while its boiling point is 35° C or under.</p> <p>Highly flammable A substance or a compound that becomes hot after being exposed to the air and then starts burning without any energy resources; Any solid that begins to burn after a brief contact with a source of ignition and will continue to burn even after it is moved away from the source of fire; Any liquid whose flash point is below 21° C; A gas which will easily burn in the air under normal atmospheric pressure; A gas which will gradually produce enough amount of dangerously highly flammable gas after its contact with water or damp air;</p> <p>Flammable liquids whose flash point is between 21° C and 55° C.</p>
	<p>A substance which gives rise to highly exothermic reaction when in contact with other substances, particularly with flammable substances</p>
	<p>A substance, which, if it is ingested, inhaled, or absorbed by skin, may lead to acute or chronic harm; if the case is serious, it may even cause death; If a poisonous substance enters the human body, it may cause damage to some organs.</p>
	<p>A substance, which, if it is ingested, inhaled, or absorbed by skin, may affect that person's health. It is less serious than a toxic substance.</p>
	<p>Most of them are strong acids or alkali. A substances which may on contact with living tissues cause severe damage to them. If there is a corrosive gas, it will damage the respiratory tract.</p>
	<p>Irritant substances are non-corrosive substances. If any part of human body has direct and repeated contact with this type of substance for a long time, it will cause inflammation or allergy.</p>

8. Occupational noise (D.L. 34/93/M)

- ◆ Unpleasant sounds and other sounds whose loudness will damage human hearing are regarded as noise.
- ◆ Common sources of noise on the construction sites:
 - Pile driving;
 - Well drilling;
 - Running jackhammers;
 - Metallic works.



- ◆ The hazard of noise to human beings:
 - Temporary loss of hearing;
 - Permanent loss of hearing.

- ◆ Assessment of noise: It should be done by a competent person with a suitable sound level meter.

- ◆ The decree - Law 34/93/M states that:
 - When the daily equivalent sound level is between 85 dB (A) and 90 dB (A), it is warning sound level, and ear muffs and earplugs should be worn.
 - When the daily equivalent sound level is equal to or higher than 90 dB (A), or the peak sound level reaches 140 dB, it is the limit sound level exposed, and it is compulsory to wear ear muffs and earplugs.
 - When people work in an environment where the noise is between 85 dB (A) and 90 dB (A), the work place should have a yellow sign; people should have a hearing check-up before starting to work in this environment, and should have another hearing check-up every three years.
 - When people work in an environment where the noise is 90 dB (A) or the peak sound level reaches 140 dB, the work place should have a blue sign; people should have a hearing check-up before starting to work in this environment, and should have another hearing check-up every year.



必須採用聽覺保護器
" USO OBRIGATÓRIO DE PROTECTORES AUDITIVOS "

9. Use of hand tools

- ◆ Hand tools include: hammer, chisel, spanner, pincers, file, saw, screwdriver, etc.

- ◆ Types of tools:
 - electric tools;
 - tools driven by gasoline engines;
 - tools driven by percussion cap.

- ◆ Common dangers:
 - wounded by the cutting edge of a tool;
 - stabbed and wounded by the sharp point of a tool;
 - pinched and wounded by a tool;
 - having an electric shock when using an electric hand tool;
 - wounded by touching the revolving part of a tool;
 - the hand is hurt when hammering;
 - hearing is damaged by noise;
 - inhaling powder and dust;
 - hit and wounded by the scraps;
 - fire or explosion caused by the use of a hand-held electric tool.

- ◆ Safety measures:
 - Choose the hand tools correctly according to the requirement of the work.
 - Before using the hand tool, first check if it is damaged.
 - Keep the tool clean, especially the part held by the hand.
 - Use the hand tool with a correct posture and hold it in a correct way.
 - When using the tool with a cutting edge, make sure that the cutting edge is not directed toward people.
 - When the tool with a cutting edge is not being used, make sure that the cutting edge is properly covered and protected in order to avoid hurting people.
 - The tools should be maintained regularly.

10 Manual Handling Operations

Safety measures for manual handling operations

- ◆ Injuries caused to the workers by the incorrect ways of transportation:
 - Hernia.
 - Torn back muscles, especially with the slipped disc of the circular cartilage between the vertebrae.
 - Cuts, bruises, crash injuries and sometimes laceration to fingers, and hands.
 - The foot is pressed, and kicked, and wounded.
 - The toes are struck by a heavy object.
 - The muscles of the leg are overstrained.
 - Death by crushing from heavy object.

- ◆ The basic safety principles and steps of manual handling operations:
 - Firmly grasp the object to be transported.
 - Keep your back in a straight and upright position.
 - Bend your knees and squat down with your two feet apart.
 - Both arms should be as near to the body as possible.
 - Grasp the object firmly and then breathe deeply.
 - Raise the heavy object with the strength of your feet, never forget to turn round with your feet, and never sprain your waist.
 - Carry the heavy object to the destination.

- ◆ Preparations before manual handling operation:
 - Try to make as much use of the lifting machines as possible.
 - Try to use the handcart as much as possible;
 - Check the shape, the size, and the weight of the object to be transported, and then decide how to transport it.
 - Check carefully whether it has got grease spots or a sharp edge.
 - The worker's hands should not be stained with grease dirt.
 - Along the route of transportation there should not be any obstacles which may trip the worker and make him fall.
 - Before transporting, the worker should know the destination clearly.
 - Wear proper protection gloves and safety shoes.

Chapter 4 Knowledge and Prevention of Occupational Diseases

Section 1 Silicosis

Silicosis

- ◆ Silicosis, or lime lungs are caused by inhaling, over a long period of time, excessive fine particles of dust which contain free silica. After fine dust penetrates deep into the lungs, it leads to the damage of lung tissues and deterioration of lung functions.
- ◆ Generally silicosis can be dormant for between 15 and 20 years.
- ◆ Tuberculosis accelerates the development of silicosis and silicosis patients are more likely to develop Tuberculosis.
- ◆ Smoking can aggravate lung condition.
- ◆ Symptoms:
 - Short breath after work in early stages of the disease;
 - Breathing difficulty, coughing and worsening of lung functions occur when patients' conditions become severe.

- ◆ Persons liable to silicosis:
 - Workers who drill, break or dig rocks on construction sites or in quarries;
 - Workers who cut or chisel metals or jade stones;
 - Workers who carve, chisel or grind monuments;
 - Workers who process glass or soft ceramic materials;

- ◆ Preventive measures:
 - Avoid using materials containing silica if possible.
 - Tightly close off the processing space to prevent silica dust from polluting the workshops.
 - Control the silica dust produced, keep the working area well ventilated, and use proper ventilation equipment to draw out the dust.
 - Use sprinkling water or wet-grinding device against the production of silica dust.
 - Wear dust respirators to stop silica dust from getting into the respiratory system and inhaling of large amount of dust.
 - Regular medical check-ups.

Section 2 Asbestosis

Asbestosis

- ◆ Asbestosis, or asbestic lungs are caused by the inhaling of asbestos fibers in the process of handling or processing asbestic raw materials, which leads to the damage of lung tissues
- ◆ Asbestos may also cause:
 - Mesothelioma;
 - Mesothelial spots ;
 - Lung cancer.
- ◆ Symptoms:
 - Breathing difficulty, coughing, sputum, feeling weak and feeble.
- ◆ Persons Liable to Asbestosis:
 - Workers who demolish or use asbestos or its products;
 - Ship industry workers;
 - Workers who use asbestos to insulate heat or sound;
 - Automobile maintenance workers.
- ◆ Preventive measures:
 - Avoid using things or materials made of asbestos wherever possible.
 - Separate the processing work involving asbestosis from other work.
 - Properly dispose asbestic wastes by using air-proof, double-ply bags to wrap up asbestic wastes and labeling the bags to prevent them from contaminating air.
 - Work in tightly confined space to prevent asbestos from contaminating the workshops.
 - Keep the workshops clean and prevent asbestic dust from accumulating by using vacuum or wet-mopping.
 - Wear effective prevention covers like dust respirators, working suits, helmets, etc.
 - Take showers and change clothes immediately after work so that asbestic dust won't be carried away from working sites.
 - Quit smoking.
 - Regular medical check-ups.

Section 3 Electric Arc Eye

Electric Arc Eye

- ◆ Electric arc eye is caused by ultra-violet rays that come from:
 - natural light source (ultra-violet of the sun);
 - artificial light source (electric arc welding);
 - thermal sources of high heat in work (electric arc welding and gas welding used in cutting metals);
 - using or repairing ultra-violet lamps;
 - ultra-violet disinfectant lamps;
 - mercury lamps.

- ◆ The disease dormancy period stretches from 6 to 8 hours with the minimum of half an hour and the maximum of 24 hours.

- ◆ Symptoms:
 - Mild eye discomfort in early stages;
 - Dry or burning eyes, eye swelling, feeling of foreign matter in the eyes;
 - More serious symptoms include severe pain of the eyes, fear of light, tearfull eyes, and spasms of eyelids.

- ◆ Persons liable to electric arc eye:
 - Workers using electric arc and gas to weld and cut materials.

- ◆ Preventive measures:
 - Suspending the work;
 - Avoiding exposure to strong lights;
 - Wearing eye protectors or protective face masks;
 - Applying anti-biotic eye-drops or eye-ointment

Section 4 Occupational Loss of Hearing

Occupational Loss of Hearing

- ◆ Occupational loss of hearing is caused by long exposure to high noises that are produced by mechanical clashes, revolves and sudden changes of air pressure in the working or a frictional environment.

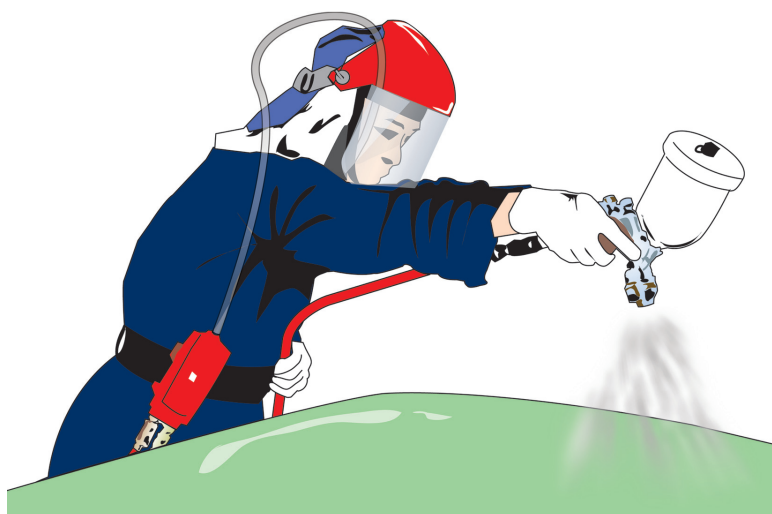
- ◆ Symptoms:
 - Impaired inner-ear hair cells;
 - Hearing test curve clearly reveals V-shaped falls in the positions of 3000Hz, 4000Hz or 6000Hz;
 - Weakened sense of hearing in the early stage but the temporary weakening of hearing can be restored within 24 hours;
 - The slow recovery of temporary change of hearing threshold may take 48 hours;
 - Occupational loss of hearing, also known as permanent change of hearing threshold, cannot be restored to the original level even after half a year in most cases.

- ◆ Persons Liable to Occupational Loss of Hearing:
 - Construction workers, especially those who are involved in driving piles or running jackhammers;
 - Workers whose jobs producing big noises.

- ◆ Methods of Prevention
 - Reduce working hours in great noises (work by shifts).
 - Improve processing techniques to decrease sound levels.
 - Replace old machines or replace them with new types of production.
 - Isolate the areas where big noises are produced.
 - Define noisy areas.
 - Check on workers' hearing regularly according to relevant decrees.
 - Wear suitable ear protectors.

Part II Practice

Chapter 5 Personal Protective Equipment (P.P.E)



Section 1 Basic Concepts in Personal Protective Equipment

Personal Protection Equipment

- ◆ Personal protection equipment is used only when collective protection measures can't be used.
- ◆ Personal protection equipment is used only when it is suitable for the nature of the job.
- ◆ Personal protection equipment should be properly used.
- ◆ Personal protection equipment should be cleaned and well kept after it is used.
- ◆ Personal protection equipment should be made in appropriate designs and of appropriate materials that are able to protect workers against predictable dangers.

Section 2 Introduction to Personal Protection Equipment

1. Head Protection

- ◆ It is specified in the regulations that all the workers on the construction site must wear suitable safety helmets.
- ◆ People on the construction site must avoid the risk of being hit by falling objects.
- ◆ All safety helmets must be replaced every two years.
- ◆ Safety helmets that have been violently hit must be replaced immediately.
- ◆ No drilling, painting or spilling of organic solvents over the safety helmets is allowed.
- ◆ When working outdoors, neck strap of the helmet must be put on.



2. Eye Protection

- ◆ When workers are doing jobs like running flint abrasion wheel, using gas or electric welding, or using concrete drill, suitable eye protection must be selected and worn in order to protect their eyes.
- ◆ Eye protection includes:
 - eye protectors;
 - safety spectacles;
 - glare-proof eye protectors used in gas welding;
 - head cover and face shield used in electric welding.



3. Protection of Respiratory System

- ◆ Breathing apparatus is used to protect respiratory system against inhaling of dust, fog or toxic gases.
- ◆ Disposable or durable respirators can be used accordingly.
- ◆ Dust respirators are used in work areas where large amount of dust is produced.
- ◆ Filtering respirators are used in the work areas where air is full of pollutants.
- ◆ Air-line breathing apparatus must be used in the working environment where oxygen is insufficient or toxic gases are found existent.
- ◆ Self-contained breathing apparatus can also be used in the working environment where oxygen is insufficient or toxic gases are found existent.
- ◆ Durable respirators should be cleaned with water after use and be kept in good condition.
- ◆ In case of finding breathing difficult, change the filters of the respirators.



4. Hearing Protection

- ◆ Excessive exposure to intensive noises leads to the permanent damage of hearing and that may not be restored in any way.
- ◆ Short-term exposure to intensive noises can also lead to the temporary loss of hearing.
- ◆ Frequent exposure to very noisy working environment without any protection of hearing can also result in permanent loss of hearing.
- ◆ Wearing suitable hearing protective devices can prevent hearing from being impaired.
- ◆ Hearing protective devices should be checked and cleaned regularly with water to ensure that they do not get aged and must be kept in good condition.
- ◆ Common types of hearing protective devices include:
 - Ear plugs;
 - Ear muffs.



5. Hand Protection

- ◆ Wearing suitable gloves can protect hands from any possible harm in work.
- ◆ Hand gloves are usually made of following materials:
 - Cotton for general uses,
 - Leather anti-abrasion,
 - Rubber / PVC against impairment from chemicals or for electricity resistance,
 - Steel anti-abrasion and cutting injuries.
- ◆ Workers should not wear gloves when operating drilling machines, punching machines, iron-bending machines and others that have revolving or moving parts.



6. Foot Protection

- ◆ Wearing suitable safety shoes can protect feet against any impairment.
- ◆ Safety shoes function in the following ways:
 - Steel-caps shoes can protect toes against any injuries caused by kicking on any objects or against squashing injuries by falling-off objects.
 - Steel soles can prevent any piercing of sharp-pointed things.
 - Anti-slippery.
 - Waterproof.
 - Some of the safety shoes are designed for special purposes such as for insulation or heat-resistance.



7. Protection of Body: Work Suits

◆ Protective work suits include:

- suits for general purposes;
- aprons;
- heat-resisting work suits;
- low-temperature thermal work clothes;
- static-proof work suits;
- anti-chemical work suits;
- life jackets;
- light-reflecting work suits;
- cut-resisting work suits.



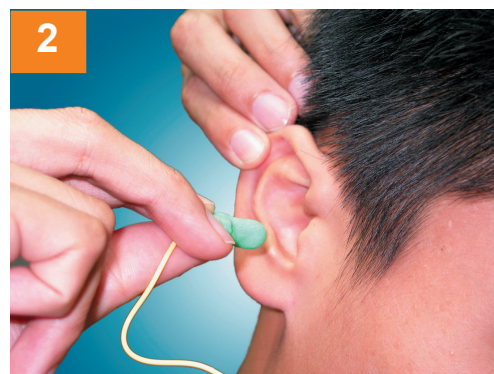
8. Protection of Body: Safety Belt and Its Accessories

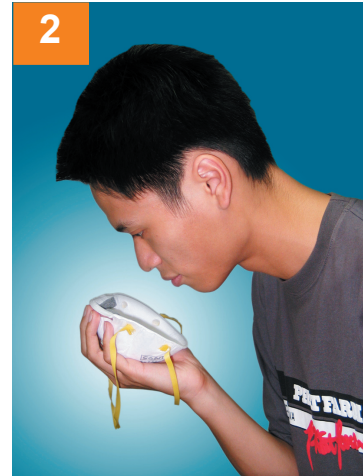
- ◆ Fall of persons: When working high above the ground, if there is no suitable equipment like work platform, railing, or safety net available to prevent workers from falling off, they must wear suitable safety belts that should be fastened to suitable anchorage points to prevent accidents.
- ◆ Some cautions in using safety belts:
 - The fall arresting device on the safety belts must be buckled up on an independent lifeline.
 - The hanger hook of the safety belt must also be buckled up on suitable anchorage points.
 - The hanger hook of the safety belt should be buckled up high above the user to ensure that in case of falling the dropping distance and force can be reduced to the minimum (with the hanger high and the user low).



Chapter 6 Practical Application

Section 1 Demonstrations and Wearing Practice of Anti-Noise Ear Plugs and Dust Respirators





Section 2 Demonstrations of Application of Safety Belts and Fall Arresting Devices





Organizer:

Labour Affairs Bureau

Co-organizer:

Macao Association of Building Contractors and Developers Predial de Macau

Macao Federation of Trade Unions

Macao Construction Industry General Union

Macao Construction Association

Macao Engineering Superintendent Association

Macao Construction Machinery Engineering Association

