Code of Construction Safety Practice

OUR VISION

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INDEX

CHAPTER ONE

PRELIMINARY

The current Construction Safety Code is set out to regulate the working conditions in construction projects for all employees who work with contractors or sub-contractors companies.

Each employer shall protect his employees by complying with the following:

1. Provision of Local Oder no. 61/1991 on Environmental Protection Systems in the Emirate of Dubai.
2. Provision of Local Order no. (3) of 1999 on Construction Activities Regulations in the Emirate of Dubai.
3. Provision of Local Order no. (11) of 2003 on Public Health and community Safety in the Emirate of Dubai.
4. Administrative Decision no. (125) of 2001 on Endorsement of Construction Regulations, Conditions and Specifications.
5. Administrative Order no. (211) of 1991 on Issuance of the Executive Regulations of the Local Order no. (61) of 1991 concerning Environmental Protection Systems in the Emirate of Dubai.
6. Explanatory Note of the Local Order no. (61) of 1991 on Environmental Protection Systems in the Emirate of Dubai.

1.1. Application:

This code includes a set of rules which regulate construction projects carried out in the Emirate of Dubai. Technical guidelines appended thereto are part and parcel of this code.

All rules and appended technical guidelines stipulated herein shall be applied to all building operations and engineering construction projects undertaken by way of trade or for the purpose of residential, commercial or industrial by or on behalf of the private or the public sector which includes the government or any other public authority.

1. Construction works include erection, alteration, repair, dismantling, demolition, structural maintenance, painting, land cleaning, earth moving, grading, excavation, trenching, digging, boring, drilling, tunneling blasting, or concreting or any work or undertaking in relation to a construction project.

2. Project means any public or private construction project and includes the following:
    - 2.1. The construction of a building, bridge, structure, industrial establishment, mining plant, shaft, caisson tunnel, excavation, highway, street, runway, parking lot, cofferdam, channel, conduit, sewer, storm water drainage, water main, service connection, telecommunication or electrical cable, or pipeline, etc.
    - 2.2. Development of mines, quarries, crushing and screening.
    - 23. Any work, project, land, or appurtenances used in connection with construction works.

Definitions:

Unless the context otherwise requires, the following meanings and terms shall be deemed to mean the definitions hereby assigned to them.

State:	The United Arab Emirates
Emirate:	The Emirate of Dubai (ED)
Municipality:	Dubai Municipality (DM)
Director General:	Director General of Dubai Municipality
Competent Department:	Building Department in Dubai Municipality
Department Concerned:	The Department which, based on a request by the Competent Department, provides technical consultations on certain matters
Concerned Authority:	Means any Ministry, Division, Authority of Local or Federal Governmental Institution in the Emirate in connection with the application of this code.
Person:	Means a natural or juridical public or private person
Owner:	Means a natural or juridical public or private person whose land or building is registered under his name whether in his competency as an owner, possessor or leaser.
Engineer:	Means a natural or juridical person delegated to implement de signs or supervise construction works or both. He is the person who is authorized to perform engineering consultations in the Emirate in accordance with the valid legislations.
Contractor:	Means a natural or juridical person assigned to implement the construction works and who is authorized to perform construction contracting activities in the Emirate in accordance with the valid legislations.
Inspector:	Means an engineer or supervisor appointed by the Competent Department.
Location:	Means the land
Land:	Means any piece or size of land determined by length of its margins, its specified number and location, and designated to building hereby planning or distribution project or any other way legally approved to be used or constructed or building on it as one unit.
Occupant:	Means a person who exercises full operational control over the place (land, building, or any part of it) whether an owner, lessee, possessor or any other entity that permits him to oc cupy the place.
Building:	Means any construction building that established or built on a fixed location on ground whether this establishment is from stone, cement, iron, wood, clay or any other material used in establishing buildings. It includes the foundation, walls, ceilings, projections, fences, etc.
Temporary building:	Means any building which shall be removed from its place after the end of a limited time of the activity or usage which it was built for.

Construction works:	Means works with construction of buildings demolition alterations, repair, additions, or maintenance and it may include the digging and demolition operations.
Approved:	Means approved by the Department Concerned in Dubai Municipality
Sub-contractor:	Means a natural or juridical person assigned to perform sub-construction or temporary works and who is authorized to per form those works in accordance with the enforced legislations in the Emirate.
Regulations:	Means the Occupational Health and Safety Regulations speci fied in the Local Order no. 61/1991
Workplace/Worksite:	Means any place where construction operations or works or engineering construction works or both are being carried out on and any temporary storage or workshop area associated with the works.
Hoist:	Means the lifting machine whether operated by power or not with a carriage, platform, or cage.
Lifting Appliance:	Means a grab, winch, pulley block, gin wheel used for raising or lowering and a hoist, crane, excavator, dragline.
Lifting Gear:	Means a chain sling, rope sling, or similar gear and a ring, link, hook, shackle, swivel or eye bolt.
Scaffolds and False Work:	Means any temporarily provided structure on or from which persons perform work in connection with operations or works to which these rules apply, and any temporarily provided struc ture which enables persons to obtain access to or which en ables materials to be taken to any place at which such work is performed. This includes any working platform, gangway, run, ladder or step ladder together with guardrail, toe-board, or other safe guards and all fixings.
False Work:	Means any temporary structure used to support a permanent structure during its construction and until it becomes self supporting.
Slopping Roof:	Means a roof with a pitch more than 10 degrees.
Working platforms:	Includes a working stage.
Slung Scaffold:	Means a scaffold suspended by means of lifting gear, rope, chains or rigid members and not provided with means of raising or lowering by a lifting appliance or similar device.
Suspended scaffold:	Means a scaffold (not being a slung scaffold) includes a sky hoist suspended by means of ropes or chains and capable of being raised or lowered.
Trestle Scaffold:	Trestle scaffold includes a scaffold in which the supports for the platform are any of the following which are self-supporting that is to say, split heads, folding step-ladders, tripods or mov able contrivances similar to any of the foregoing.
Occupational Disease:	The disease which results from exposure to any physical, chemical, biological or radiant material in the workplace to an extent that affects the operation of the body organs and health of employees and it includes the industrial disease.

Supervisor:	the person who is responsible for the workplace and has the authority of supervision and direction of the work team
Occupational Health and Safety Representative:	Means a professional qualified technical person who is able to anticipate, recognize, evaluate and control hazards in connection to work. He is selected to supervise the application of the Occupational Health and Safety Regulations in worksites.
Health Hazard:	Means any activity or operation which adversely affects public health and the safety of humans and environment.
Accident:	It is defined as unexpected, unplanned and undesired event which results in injuries, deaths, damages of equipment or machine and property loses.

CHAPTER 2

GENERAL SAFETY AND HEALTH PROVISIONS

INTRODUCTION:

This chapter of the Construction Safety Manual sets forth the general safety and health provisions and the duties of an employer, engineer, contractor and sub-contractor regarding safety matters and the minimum necessary requirements and arrangements that shall be followed during all construction and building stages including designing, supervision and execution of works for the protection and safety of employees.

2.1. COMMITMENTS AND RESPONSIBILITIES:

2.1.1. The engineer and contractor shall act the same responsibility for the execution and safety of construction works during and after the execution period in accordance with the Laws in force and the Local Orders issued in this regard. Their responsibilities extend to include adjacent buildings in the workplace and any public facility that may adversely be affected by the execution of those works.

2.1.2. The engineer and contractor shall act the same responsibility for the safety of all employees and attendees in or near the worksite. They shall jointly comply with the application of the safety rules and procedures set forth in the Code and the appended technical guidelines thereof.

2.1.3. The engineer and contractor shall be jointly responsible for providing all necessary technical, occupational, organizational and operational methods and requirements for the work progress in the construction worksites.

2.1.4. The employer shall be responsible for compliance with all legislations and regulations re quirements on buildings and constructions issued by Dubai Municipality.

2.1.5. In all cases, the Municipality or its employees shall not bear any sort of responsibility, before, during or after construction operations, since they perform checking of drawings, construction calculations and carry out land and worksite inspections.

2.2. DUTIES OF THE ENGINEER:

2.2.1. The engineer who prepares the specifications and conditions of a project shall provide an individual chapter for all applicable safety procedures in this project in reference to the articles and items specified in this manual.

2.2.2. The engineer shall obtain no objection certificates from the authorities concerned and shall compare it with the actual situation at site.

2.2.3. The engineer shall refer to any relevant plans and drawings of water, electricity, telephone and sewage lines and topographical maps of the worksite, and explore the permanent and seasonal watercourses and their maximum and minimum levels, and the location of water springs and wells, soak up cavities and underground water to determine the precautionary procedures that shall be followed to avoid any potential hazards may result from any of these hazards.

2.2.4. When designing or supervising the execution of any construction project, the engineer shall consider sources of hazards and risks, which might face employees during construction or maintenance operations, to avoid any potential health and safety hazards with all possible and practicable means.

2.2.5. The engineer shall prioritize the protection of employees against different hazards in the workplace, as well as the protection of all people, who may be adversely affected by those works, also protection of the adjacent properties and services.

2.2.6. The engineer shall review the “Safety Plan” submitted by the contractor and approve it before its execution.

2.2.7. The engineer shall appoint safety staff for each different construction contract to carry out

the occupational health and safety duties and responsibilities in accordance with the regulations in item 2.8 herein specified.

2.2.8. The engineer shall conduct periodical meetings with the contractor on occupational health and safety matters at least every fifteen days during the different execution stages of the project, and they shall be documented and available in the worksite.

2.2.9. The engineer shall ensure the commitment of the contractor to apply all occupational health and safety procedures which shall not be less than the minimum standards stipulated in this manual and the appended technical guidelines, and any other additional standards that might be included in the contract specifications or agreed upon in the periodical meetings in the worksite.

2.3. DUTIES OF THE CONTRACTOR:

2.3.1. It shall be the duty of every contractor/subcontractor to comply with the safety regulations and guidelines set forth in this manual and the Occupational Health and Safety Regulations and Rules in force in the Dubai Emirate and provide a safe and healthy work environment for all his employees.

2.3.2. The contractor shall develop a “Safety Plan” which shall be carried out during the execution of the project. This plan shall include all actions, arrangements and precautions that are necessary for accomplishing the work such as: plan target, responsible persons for its application, healthy procedures in the work environment, provision of medical care, occu pational health and safety awareness and training procedures, applicable procedures for safety and protection of the workplace against different hazards, necessary personal protec tive equipment to be available in the workplace in view of potential hazards, risk assessment of major potential hazards accompanying each execution stage of the project and their protective measures, and explanation of the procedures that shall be followed in case of occurrence of different accidents. The contractor shall submit a copy of the safety plan to the engineer to be Approvel. Enough flexibility in the safety plan shall be provided to ensure well treatment of all emergency cases on condition that it shall be continuously updated in accordance with stages and changes of the work.

2.3.3. The contractor shall permanently maintain a copy of the safety plan in the workplace and provide the workplace with tools, equipment and materials necessary for the application of safety procedures to be available for checking by the Specialized Department.

2.3.4. The contractor and all subcontractors in the worksite shall be fully committed to and respon sible for the application of all occupational health and safety regulations and requirements provided that they are not less than the minimum standard set forth in this manual and any other standards in line with the rules specified therein which are included in the contract specifications or agreed upon in the worksite.

2.3.5. A safety staff shall be appointed (Senior Safety Officer, Safety Officer, and Safety Inspector) according to item 2.8. herein specifying the minimum required numbers, qualifications and experiences of applicants. In addition, it specifies the required procedures for obtaining the approval of the Specialized Department on their employment.

2.3.6. The contractor shall provide 24 hour security guards in the worksite to ensure no admittance of unauthorized persons to the worksite.

2.3.7. An approved statement on the necessary risk assessment procedures to be applied during the execution of all work items in the worksite shall be submitted to and approved by the en gineer. (Reference is made to technical guideline # 34 concerning Risk Assessment Procedures).

2.3.8. Occupational health and safety training programs shall be conducted in accordance with clause 2-5 herein specified.

2.4. ACCIDENTS AND INJURIES IN CONSTRUCTION WORKSITES:

2.4.1. Accident Definition:

An accident is defined as an unexpected, unplanned and undesired event which results in injuries, deaths, and/or damages of machinery, equipment, and property losses.

2.4.2. Serious Accident:

A serious accident is defined as:

1. An accident leads to the death of one employee or more in the worksite.
2. An accident results in a serious injury of a person or more persons.
3. An accident results in lost-time injuries of more than one person as a result of the same accident.
4. Fire, collapse, explosion or leakage of hazardous materials accidents accompanying with financial losses which lead to work suspension for a period more than one shift in one section of the worksite.

2.4.3. Work Accidents Injuries:

Work accidents injuries result from an accident which took place during or because of the execution of work. There are three types of work accidents injuries:

2.4.3.1. Serious (Major) Injury:

An injury arising out of, or in connection with work which results in any of the following:

1. Death of any person
2. Fracture of the skull, spine, pelvis or any bone in the wrist, arm, leg or ankle.
3. Amputation of a hand, arm, foot, finger, thumb or any body organ.
4. Absorption of any substance that might cause health danger if inhaled, swallowed or through the skin.
5. Unconsciousness resulting from electric shock, heat stroke, lack of oxygen, etc.
6. Second or third degree burns because of any reason.
7. Any other injury which results in the admission of an injured employee to hospital for more than 24 hours for medical treatment.

2.4.3.2 Lost-Time Injury:

An injury arising out of, or in connection with work which leads to an employee absence from work for more than three days in addition to the day of injury.

2.4.3.3 Minor Injury:

An injury arising out of or in connection with work which does not fit with any of the above categories (i.e. first aid injuries).

2.4.4. Responsibilities of Protection from Accidents:

1. The contractor shall conduct frequent and regular inspection of the worksites, materials and equipment to be made by competent persons qualified in this field.
2. The use of any machinery, tool, material or equipment which is not in compliance with any applicable requirement of this manual is prohibited. Such machinery, tools, materials or equipment shall be marked and tagged as “Not Safe for Work” and all operational switches shall be locked to render them inoperable.
3. The contractor shall adequately instruct each employee in the recognition and avoidance of unsafe conditions in the worksite and the regulations applicable to his work

environment to control or eliminate any hazards or other exposure to illness or injury.

4. Employees required handling or use poisons, caustics and other harmful substances shall be instructed of the safe handling and usage procedures of these materials. They shall be made aware of the potential hazards, personal hygiene and the necessary personal protective equipment required.
5. Material Safety Data Sheets of all chemicals and any other harmful materials in use at site shall be made available.
6. In jobsite areas where harmful plants or animals are present, employees shall be instructed regarding the potential hazards, and how to avoid injury and the first aid procedures to be used in the event of injury.
7. Employees required handling or use flammable liquids, gases or toxic materials shall be instructed in the safe handling and use of these materials.
8. The contractor shall not permit any employee other than qualified competent personnel to erect, dismantle or inspect scaffolds.
9. Every contractor, at his expense, shall provide his employees with all necessary personal protective equipment appropriate to their work nature (Refer to Chapter 4 on Personal Protective Equipment). The contractor shall ensure and supervise the appropriate and effective use of these equipment.
10. The contractor shall not permit any person to operate cranes unless he is qualified person and authorized by the Specialized Department, to do so.
11. The contactor shall develop, implement and instruct all employees to comply with a Safe Work Permit System and to issue appropriate permits according to each work type (welding – excavation – lockout/tagout – radiography – confined space entry– etc.). Necessary procedures shall be set forth and all employees shall be trained so that no type of these works shall be performed unless an appropriate permit has been obtained from qualified competent person designated by the contractor. All safety procedures specified in the safe work permit shall be applied.

2.4.5. Accident Reporting:

1. In case of any accident occurrence, the contractor shall immediately inform the authorities concerned, the engineer and the Specialized Department, then a written report on the accident shall be sent to the Specialized Department as follows:
    i. Inform the Police on telephone 999 in case of serious accident and lost-time injuries which necessitate transfer of injured persons to a hospital and receiving of medical treatment.
    ii. Inform the Civil Defense Department on telephone 997 and the Police on telephone 999 in case of a fire, explosion, collapse of a structure or scaffold, or breakdown of a crane or any other machinery that may endanger the employees.
    iii. Inform Dubai Municipality on the emergency telephone 800900 in case of any of the abovementioned cases.
2. The contractor and subcontractors shall submit a report on the accident within 72 hours of its occurrence using the form approved by the Specialized Department in Dubai Municipality and coordinate with this Department in case of any more studies required.
3. The contractor shall inform the Specialized Department in Dubai Municipality about the technical data of the causes of these accidents and final evaluations of human and physical losses immediately after released by other authorities concerned: the criminal laboratory, the technical committees, the Police, and the Civil Defense Department.
4. The contractor shall maintain an accident record in the worksite in line with the approved

form by the Specialized Department in Dubai Municipality, this record shall be kept for five years after the date of accident occurrence.

5. Each contractor shall conduct safety levels measurements in worksites through analyzing, assessing and classifying the statistics of work accidents, occupational diseases, and fatali ties which occur in any construction work section and come up with indications to guide in improving service performance relevant to the safety and health of employees. (Reference is made to technical guidelines # (36) concerning accidents analysis and statistics.

2.4.6. Accident Investigation and Writing Reports:

1. The contactor and the engineer shall conduct a full investigation in the worksite to determine the causes led to the occurrence of an accident and they shall submit a comprehensive report to the Specialized Department, using the approved and specified forms (Refer to forms in appendix A)
2. The contractor shall not alter (change) with the accident scene until the investigation ends, unless it is necessary to prevent aggravation of any danger. All procedures carried out shall be reported in a detailed and comprehensive report includes the preparation time and date and the investigation results. See also accident investigation guideline # (37).

2.4.7. For more information, refer to technical guidlines no. (35,36 & 37)

2.5. GUIDELINES AND TRAINING

1. The contractor shall notify employees of the hazards they might be exposed to in different worksites and instruct them as to the most appropriate ways for their safety particularly when entering confined or enclosed spaces or dangerous atmospheres. He shall instruct them on how to use the necessary personal protective equipment and appliances such as masks and respiratory apparatus.
2. Employees required to handle toxic or harmful materials shall be provided with the necessary information on safe handling and use of these materials prior to work initiation provided that they shall be supplied with all protective and necessary appliances and equipment.
3. All personnel who are responsible for rescue of others' life shall be instructed in the appropriate procedures for this work and they shall be fully aware of the locations of rescue equipment and appliances and how to use them appropriately.
4. Employees who are responsible for receiving and sending communication signals shall be instructed in the simplest and most successful recognized system to enable them to use it efficiently.
5. Employees shall be instructed in the safe and appropriate handling of flammable liquids and gases and other relevant protection requirements.
6. Employees shall be instructed in the most appropriate ways and methods to protect themselves when working in harsh conditions such as: severe coldness and hotness or where harmful animals and insects exist. In addition, they shall be trained in first aid procedures to enable them providing first aid in the event of any employee injury.
7. The contractor shall provide the workplace with necessary firefighting equipment and instruct employees in how to use them to protect lives and properties available in the workplace from hazards resulting from his work in accordance with the requirements specified in this manual. Employees responsible for firefighting shall be capable of carrying out this work and fully aware of the locations of all necessary firefighting agents and equipment.

8. All employees in the worksite shall be instructed and trained in how to use their personal protective equipment and appliances in case of any emergency occurrence in the project.
9. No employee shall be permitted to use or operate any machinery or heavy equipment unless he is qualified, not younger than 18 years old, healthy fit and possess a valid deriving license issued in the United Arab Emirates. In addition he shall have a certificate from a inspection body approved by Dubai Municipality qualifying him to do so.
10. No employee shall be permitted to use fixed machinery and equipment such as tower cranes and temporary material and personal hoists unless he is trained and has a certificate issued by a company approved and accredited by Dubai Municipality.
11. No employee shall be permitted to perform any work unless he is qualified and adequately trained in performing this work safely in accordance with the occupational health and safety regulations specified in this manual. It is mandatory that all new employees shall be instructed and trained in the safety regulations and guidelines (Safety Induction) prior to starting their work.
12. Safety training shall be conducted by safety consultant's organization approved and accredited by Dubai Municipality, in addition to the internal training conducted by safety representative according to the nature and activities of the project and the hazard associated with each activity.

2.6 WORK ENVIRONMENT PROTECTION

2.6.1 The contractor shall provide occupational health and safety measures and safeguard the work environment in construction workplaces to ensure the protection against the following hazards:

1. Physical hazards resulting from performing of works such as:
    a. Severe hotness and coldness
    b. Noise and vibrations
    c. Illumination
    d. Dangerous and harmful radiations
    e. Static and dynamic electricity
    f. Explosion Hazards

2. Mechanical hazards resulting from employee's body struck against or by a solid object such as:
    a. Every hazard results from work machinery and tools such as appliances, machinery, raising and pulling tools, and transportation, handling and mechanical power transmission.
    b. Every hazard results from construction, building, excavation, demolition, and hazards of collapse and fall.

3. Chemical hazards resulting from handling solid, liquid and gas materials pertaining to the following:
    a. Chemical hazards include: inhalation, skin and eye contact, ingestion and accidental injection of hazardous chemical substances, which may be in the form of solids, liquids or gases.
    b. Among health hazards of chemical substances that i\they may cause poisoning, allergy, buns, eye injury and the possibility of causing cancer and death.

c. Not to exceed the permissible maximum concentration of chemical materials to which employees are exposed (in accordance with the tables in the technical guideline no. (12) on occupational health and industrial hygiene).
d. Providing the necessary precautions to protect the construction site and employees in case of transfer, storage, handling and use of hazardous chemical materials and their waste disposal.
e. Maintaining a record of hazardous chemical materials handled at site, which includes a data relevant to every chemical material, and a record of work environment observations and employees' exposure to chemical hazards in the workplace.
f. Providing the Material Safety Data Sheets (MSDS) of all chemical materials in the workplace which include their scientific and commercial names, chemical components, hazardous limits, safety precautions and relevant emergency procedures.
g. Instructing and training employees in handling hazardous chemicals, their hazards and safe and protective means from these hazards.

2.6.2 The contractor shall provide rescue, first aid, and housekeeping means in worksites to minimize the aggravation of results of any accident.

2.6.3 The contractor shall take necessary precautions for fire protection in accordance with the requirements specified in this manual.

2.6.4 The contractor shall conduct a risk assessment and an analysis of hazards and emergencies in the workplace and develop an appropriate emergency plan to control these hazards or emergencies in case of occurrence. He shall instruct and train employees in implementing this plan in emergency cases provided that the plan shall be tested by periodical and practical drills to ensure its effectiveness.

2.7 SUPERVISION OF SAFE WORK PERFORMANCE:

Every Contractor/Engineer who carries out supervise construction works (building, demolition, maintenance …etc) shall appoint qualified technical staff to supervise the application of the occupational health and safety requirements in the worksite in accordance with the minimum specified numbers in table (1,2,3 & 4) and in line with the work/project nature and size. Every contractor shall provide the technical staff with adequate occupational health and safety training and necessary authorization to be able to perform the assigned tasks, including the suspension of any work which causes hazards to employees and properties in the workplace.

2.8 SAFETY STAFF

A safety staff consists of the following positions:

1. Senior Safety Officer
2. Safety Officer
3. Safety Inspector

2.9 SAFETY STAFF MAIN TASKS:

The main duty and responsibility of the safety staff is to provide the project manager and engineering staff with the technical and consultant support in addition to all or some of the following:

1. Supervision of the application of the occupational health and safety requirements in con

struction sites in accordance with the technical standards and rules specified in this manual and the appended technical guidelines thereto.
2. Preparation of plans and timetable programs for periodical and regular checking of the occupational health and safety requirements including cranes, equipment, machinery, scaffolds, firefighting systems, workshops, electrical installations, temporary structures, workplace organization requirements, etc.
3. Supervision of proper and correct application of the Safety Plan items relevant to the worksite.
4. Training of employees on methods of safe work practices and providing necessary technical guidance for accident protection.
5. Training, qualifying and enabling employees before permitting them to perform work activities assigned to them in accordance with the safety regulations and requirements relevant to the worksite.
6. Dealing with construction accidents in accordance with the emergency plan which includes reporting to the authorities concerned, providing first aid to injured persons, keeping the accident stage without change, implementing necessary procedures to reduce the aggravation of accidents' results, and protecting lives and properties.
7. Keeping records of accidents and work injuries.

2.10 SENIOR SAFETY OFFICER QUALIFICATIONS

Minimum qualifications and experience:

1. A university degree in engineering (in safety, civil, architect … etc) or according to the nature of the project and specialization from an university accredited by the Ministry of Higher Education in UAE.
2. Not less than 5 years specialization experience in construction worksites.
3. Obtaining a qualification certificate (accreditation) issued by qualifying (accreditation) safety consultant organization for safety staff in construction worksites approved by the Municipality.
4. Any other requirements specified by the Specialized Department.

2.11 SAFETY OFFICER QUALIFICATIONS

Minimum qualifications and experience:

1. A diploma degree in engineering (in safety, civil or architect) or according to the nature of the project and specialization from an university accredited by the Ministry of Higher Education in UAE.
2. Not less than 3 years technical experience in construction worksites.
3. Obtaining a qualification certificate issued by qualifying company for safety staff in construction worksites approved by the Municipality.
4. Any other requirements specified by the Specialized Department.

2.12 SAFETY INSPECTOR QUALIFICATIONS:

Minimum qualifications and experience:

1. A secondary school or industrial technical certificate.
2. Not less than 2 years technical experience in construction worksites.
3. Obtaining a qualification certificate issued by qualifying company for safety staff in construction worksites approved by the Municipality.
4. Any other requirements specified by the Specialized Department.

2.13 REQUIRED NUMBERS OF SAFETY STAFF:

2.13.2 Minimum required numbers for a consultant engineer to obtain a construction license:

The number of safety staff specified in table (1) shall be appointed by a consultant engineer during the license procedure stage. (As a minimum):

Table No. 1

Company Classification	Required Safety Staff	
	Safety Officer	Senior Safety Officer
Ground + 4 Stories Ground + 12 Stories	1	---
Unlimited Stories	----	1

2.13.3 Minimum required numbers for a consultant engineer in the worksite:

The number of safety staff specified in table (2) shall be appointed by a consultant engineer in the construction worksite. (As a minimum):

Table No. 2

Number of Employees in Every Shift	Required Safety Staff		Remarks
	Safety Officer	Senior Safety Officer	
From 1 to 150 employees	1 (part-time)	---	Any engineer in the workplace may be assigned to undertake the required tasks of the safety staff according to the conditions and qualifications stipulated in item (10.2) & (11.2)
More than 150 up to 500 employees	1	--	
More than 500 up to 1000 employees	---	1	
More than 1000 up to 2000 employees	1	1	
The number of the safety staff shall be increased by one Safety Officer for every 1000 employees more than 2000 employees			

2.13.4 Minimum required Safety Staff for a Contractor to obtain a construction license:

The number of safety staff specified in table (3) shall be appointed by a contractor in the license procedure stage: (As a minimum):

Table No. 3

Company Classification	Required Safety Staff		
	Safety Inspector	Safety Officer	Senior Safety Officer
Ground + 1 Story or less	1	--	--
Ground + 4 Stories	--	1	--
Ground + 12 Stories	--	--	1
Unlimited Stories	--	1	1

2.13.5 Minimum required Safety Staff for a Contractor in the worksite:

The number of safety staff specified in table (4) shall be appointed by a contractor in the construction worksite (As a minimum):

Table No. 4

Number of Employees in Every Shift	Required Safety Staff		
	Safety Inspector	Safety Officer	Senior Safety Officer
Less than 50 employees	1(partial attendance)	--	--
From 50 up to 150 employees	1	--	--
More than 150 up to 500 employees	1	1	--
More than 500 up to 1000 employees	1	1	1
More than 1000 up to 1250 employees	2	1	1
More than 1250 up to 1500 employees	2	2	1
More than 1500 up to 2000 employees	2	2	2
The number of the safety staff shall be increased with one Safety Inspector for every 1000 employees more than 2000 employees			

2.14 SIGNS, SIGNALS AND BARRICADES

Every contractor/subcontractor shall provide every worksite with the necessary signs, signals and barricades to warn employees against hazards and to prevent accidents. (Refer to Chapter 6 on Signs, Signals and Barricades)

2.15 INSPECTION AND PERMITS:

1. Every contractor shall ensure that machinery, equipment and tools available in the workplace are in good operating condition and if used, employees shall not be adversely affected if they comply with their operational instructions.
2. Every crane and lifting equipment (i.e. tower cranes, mobile cranes, construction hoists and forklifts) shall be fully inspected one time every 12 months by an inspection bodies (company) approved and accredited by Dubai Municipality and a safety certificate shall be obtained. The contractor shall conduct a regular and

periodical maintenance to ensure that it is safe and to compare this with the issued safety certificate and recording the inspection results in a special log.

3. The contractor shall inspect rigging tools (such as alloy chains, wire ropes, shackles, and eye bolts) every 6 months.
4. Earth moving, compacting and leveling equipment and crawlers (Such as excavators, bulldozers, trucks, crawlers and graders shall inspected one time every 12 months and obtain a certificate from accredited inspection company.
5. The contractor shall conduct periodical inspection every 6 months to all personal and material hoist equipment, this inspection shall be conducted by an inspection authority (company) accredited by Dubai Municipality and shall obtain a safety certificate from this company. The inspection body shall conduct a regular and periodical inspection every 3 months to ensure
   that all these machinery and equipment are safe and to compare this with the issued safety certificate and recording the inspection results in the log.
6. Contractor shall inspect all types of scaffolds on site (Supported scaffolds, suspended scaffolds and cradles once every 6 months by an inspection authority (company) and obtains the relevant safety certificates, the test will be repeated in case of any alteration, increasing the height level of the scaffold and moving it to another place.
7. All operators of all machinery and equipment mentioned above shall be tested every 12 months by an approved and accredited inspection authority (third party inspection body) and issuing a qualifying certificate to each operator.
8. All air receivers, compressors, pressure vessels shall be inspected once every 12 months by an approved and accredited inspection authority (Third party inspection body) and the relevant certificates shall be issued.
9. In case of carrying out any changes or alteration to the lifting machinery or equipment by the contractor or occurrence of any environment conditions which may affect the safety of these equipment, the previous certificate shall be considered cancelled and a new inspection must be carried out by an approved and accredited inspection authority (Third party inspection body) and a new certificate shall be issued.
10. The contractor shall conduct periodical maintenance for all machinery, equipment and lifting equipment (slings) in the worksite in accordance with the manufacturers' recommendations to ensure their safe operation and record all inspection details.

" Appendix A "

Form No. 1: Work Accidents

Name of injury:	**Occupation:**	**Date of Employment:**
Department:	**Imm. Supervisor:**	**Tel. No.:**
Date of Acc.:	**Time of Acc.:**	**Location:**

Status of the injured employee at the time of accident:	**Yes**	**No**	**N/A**
Was the accident occurred during official working hours?	( )	( )	( )
Was the injured employee authorized to carry out this job?	( )	( )	( )
Was the injured employee trained on doing this job?	( )	( )	( )
Was the injured employee being supervised at the time of accident?	( )	( )	( )
Was the correct equipment, tool(s)/material used?	( )	( )	( )
Was the injured employee using the proper PPE?	( )	( )	( )
Was machine guarded? Was guard in place at the time of accident?	( )	( )	( )
Was the energy source (electricity, compressed air, etc.) on machinery,			
Which the employee was servicing, isolated at the time of accident?	( )	( )	( )
Was the injured employee working on a scaffold, platform, stairs, roof?	( )	( )	( )
Was the height of the scaffold, platform, stairs, roof more than 2 m.(6 feet)?	( )	( )	( )

What was the procedure taken during the occurrence of the accident?		**Accident Type:**	
First aided at the location	□	Accident	□
Transferred to a hospital	□	Fatality	□
Transferred to home	□	Near Miss	□
Returned to work	□	Lost-time injury	□
Moved to perform another work	□	Serious injury	□
Others (specify)	□	Others	□

Environmental Conditions:

Atmosphere: wet □ dry □ hot □ cold □ storm □ rain □ mist □

Lighting in accident location: good □ weak □ natural □ artificial □

Land surface: leveled □ unleveled □

Land is dirtied with water □ dye □ construction material □ others □

Names of Witnesses:

S.N.	Name	Occupation	Department
1			
2			

Describe the accident in details (Use additional sheets if needed)

Accident causes:

Unsafe practice by the injured employee:

Unsafe working conditions:

Recommended corrective actions to prevent occurrence of similar accidents:

Form No. 2: Annual Record of Work Accidents

Project:	Project No:	Year:
Location:		
Contractor Name:		
Consultant Name:		
Health and Safety Employee Name:	Project Manager Name:	

Accidents/Injuries	Total No. from 1/1/... To 31/12/ ...	Lost Days
Total Reported Accidents		
Total Reported Fatalities		
Total Reported Near Misses		
Total Reported Lost-Time Injuries		
Total Reported Serious Injuries		
Number of employees working in the project		
Total annual working hours per employee from 1/1/... to 31/12/....		
Total annual working hours of all employees in the project		
Frequency of Accidents		
Severity of Injuries:		

Health and Safety Officer: **Project Manager:**

Frequency of Accidents = $\frac{\text{No. of injuries per year x 1000000}}{\text{Actual total working hours per year}}$

Severity of Injury = $\frac{\text{Lost days because of injuries per year x 1000000}}{\text{Actual total working hours per year}}$

CHAPTER THREE

Occupational Health and Environmental Control

Introduction:

This chapter discusses the procedures and conditions which shall be taken into consideration to protect the working environment. It includes matters such as occupational health, medical services, and medical facilities. Workplace's cleanness and waste collection and disposal from workplace and providing it with necessary health facilities and drinking water. Minimum levels of illumination in work areas and noise exposure are determined, and the procedures that shall be taken into consideration when there is an exposure to gases, radiations, insects, harmful creatures, heat stroke, or any work accident.

3.1. Medical Services:

3.1.1. Medical Examination:

1. The contractor shall carry out all necessary medical examinations for all employees who will be assigned to special works which necessitate such medical examinations to ensure that those employees are medically fit and free of diseases which might be caused by such work.
2. The contractor shall ensure the capability of the employees to withstand the surrounding circumstances of the work which they will perform.

3.1.2. First Aid

3.1.2.1. General

1. First-aiders shall be adequately aware of the appropriate first aid for the treatment of injured persons. They shall have the ability to detect the place and type of injury, how they render temporary first aid for injured persons and how to transfer them to the nearest physician, medical center or hospital without causing any extra complications. The injured persons shall not be cared of or transferred except by qualified and accredited personnel by the authorities concerned.
2. The contractor shall ensure the availability of medical personnel prior to commencement of the project for prompt medical attention in case of accidents or serious injury. First Aiders names shall be posted on notice boards in all workplace offices (according to table no. 1)

Table (1)

Required number of first aiders
First aid Staff

No. of employees in each workplace	Part-time first-aider (performing other jobs and permanently available in the workplace	Full time first aider
Less than 50 employees	1	----------
50 to 250 employees	1	1
More than 250 to 500 employees	2	2
More than 500 to 1000 employees	3	3

* A part time and a full time first aider shall be added for each extra 1000 or numerical fraction of 1000 thereof.

3. The part-time first aider shall be permanently available in the workplace to provide the necessary first aid in case of accidents or serious injuries in the worksite. The first aider shall have experience, adequate training in first aid and accredited by the authorities concerned and shall have the knowledge of how to act in case of emergencies. He shall know the places where first aid equipment are available in the worksite.
4. Full-time first aider shall be scientifically qualified not less than obtaining secondary school certifi cate (G12 pre-university degree). He shall obtain adequate training in first aid and accredited by the authorities concerned (Medical Department – Medical Services – Dubai) or by any other spe cialized companies accredited by Dubai municipality. He shall be responsible for all first aid equipment in the worksite.
5. First aid boxes contain sufficient quantity of suitable first aid materials shall be provided and shall be placed in a clearly identified and readily accessible locations. These boxes shall be protected against weather conditions, dust or rain, and shall be inspected on weekly basis and before sending them out of the worksite to ensure the replacement of the consumed materials. (according to table no. 2)
6. A tag shall be fixed on all telephone sets with telephone numbers of responsible parties to call them in case of emergencies (ambulance, hospitals, fire brigade, police, municipality emergency…) also in well known places for all personnel in the workplace. Communication facilities on site shall be inspected to ensure their validity for work. A map shall be prepared to identify the best way leads to the nearest medical facility to the workplace. This map shall be displayed on safety announcement and advertisement board.
7. When there are 250 or more persons at work on site, a suitable staffed and equipped first aid room shall be provided and maintained. This room shall be provided with suitable illumination in case of emergencies. (according to table no. 3)
8. Employees who are responsible for first aid or medical assistance procedures shall obtain appropriate training on blood borne pathogens and shall be provided with personal protective

equipment and apparatuses and shall use and preserve them (the protective tube used in CPR procedure, protective clothing, gloves, masks and eye protective apparatuses) to prevent contact with blood or any other contaminated materials that might transfer infection. In case any similar case detected, it shall be immediately referred to the medical authorities concerned.

9. They shall have an exposure control plan identifies all steps that shall be followed for protection against such diseases hazards.
10. In workplaces where the employees may be exposed to eye hazards by corrosives or any othesubstances, eye wash stations shall be provided in an easy accessible unobstructed places, travel distance to reach such facilities shall not exceed 30 m. (See fig. # 1).

Fig. 1

11. First aid facilities shall be in accordance with the specified requirements in the technical guideline no (26) issued by the Specialized Department.

3.1.2.2. First aid equipment and first-aid Staff:

1. First aid equipment, first-aider number and their designated area shall be adequate and appropriate to the project size, location, number of employees and the execution period provided that the supplied and stored first aid materials in the workplace shall not be less than the minimum level specified in tables no 1, 2 & 3.
2. The contractor shall provide first aid boxes in workplace. Those boxes shall contain medicines, bandages; disinfection materials specified in table no (2). A first aid box shall be provided for every 150 additional employees.
3. In addition to the above item (no. 2), first aid boxes shall be provided every 300 meters for the horizontally extended buildings and every 10 floors for the vertically multistory buildings.

Table (2)

Items	No. of Employees				
	1 – 10	11 – 25	26 – 50	51 – 100	101 – 150
Form (Guidance Card)	1	1	1	1	1
Plastic Band aids	40	75	150	300	450
Adhesive Plaster 5 inches X 10 yards	1	1	1	2	3
Adhesive Plaster 1 inch X 10 yards	1	1	1	2	3
Absorbent Cotton (Bundle)	1	1	1	1	2
Gauze Bandage 1 inch	1	1	2	4	6
Gauze Bandage 2 inch	1	2	4	8	10
Gauze Bandage 3 inch	1	2	4	8	10
Gauze Bandage 3 X 3 inch	1	2	5	10	15
Sterilized oval eye pads	1	3	3	6	9
Triangular Bandages	1	2	2	4	6
Ammonia Inhalant (bottle)	1	1	1	2	2
Eye wash	2 Oz.	4 Oz.	4 Oz.	4 Oz.	4 Oz.
First Aid Cream	1	1	1	1	2
Calamine Lotion	1 Oz.	2 Oz.	2 Oz.	4 Oz.	6 Oz.
Cotton Tipped Applicator – 6 inches	25	50	100	200	300
Rescue Breather	-	1	1	1	1
Surgical Scissors	1	1	1	1	1
Anti-septic Solution	250 ml.	500 ml.	500 ml.	500 ml.	1000 ml.

Table (3)

S.N	Contents	No. of Employees		
		250-1000	1001-3000	3001-5000
1	Stretcher	1	2	3
2	Wheelchair	1	2	3
3	A Sink with Cold and Hot Running Water	1	2	3
4	Drinking Water	1	2	3
5	Paper Towels, Soap and Nail Brushes	1	2	3
6	Smooth Topped Impermeable Work Surfaces	1	2	3

7	Clean Garments for Use by First Aiders	1	2	3
8	Clinical Thermometer	1	2	3
9	One Wash Bottle	1	2	3
10	A Cough with Pillow and Blankets Frequently Cleaned	1	2	3
11	Dressing Trolley (two shelves with caster wheels)	1	2	3
12	Kidney Tray (medium size (2) number).	1	2	3
13	Different Size Splints	1	2	3
14	Full Content Mobile First Aid box	1	2	3

4. A first aid room shall be provided per every 5000 additional employee or its fraction and it shall include the similar contents specified in table no. 3.
5. An adequate area not less than 20 square meters shall be provided for the first aid room to encompass all the above specified contents and enable unconstrained performance of first aiders.
6. In addition to the required number of first aiders specified in table no. (1), the contractor shall train a number of employees in the workplace on first aid procedures according to the size and nature of the work project in order to assist the competent employees in this field.
7. First aid box contents and first aid rooms shall be inspected regularly to ensure the validity and efficiency of their content materials and equipment.

3.1.2.3. Treatment:

1. The injured person shall immediately be transferred to the nearest clinic or medical center after receiving necessary first aid. Persons transferring the injured person shall be fully aware of the best and safe transferring method that should be followed according to the injured person condition.
2. A helicopter deck shall be provided in accordance with the conditions specified by the authorities concerned provided that the workplace shall have adequate area, for the immediate evacuation of urgent and serious cases (flight ambulance) such as the following:
    a. More than 1000 employees are in the workplace.
    b. Workplace is far from hospitals.

3.1.2.4. Records:

1. The contractor shall keep files including employees' medical reports for a period not less than (5) five years to present them on request by specialized parties.

3.2. Housekeeping:

3.2.1. Housekeeping works:

1. Workplace shall regularly be kept clean and all construction wastes such as cement bags, wood and aluminum rubbish, etc. shall be removed taking into consideration the following:

a. Flammable and combustible liquids shall never be spilled on grounds or walls and shall be cleaned up immediately.
b. Metal containers with covers shall be provided to collect rags wetted with combustible substances or other highly hazardous wastes and shall be daily removed outside the workplace.

3.2.2. Eating Facilities:

1. A suitable dining area shall be provided in accordance with sound general hygienic conditions. It shall be protected against sun rays, dust and rains with solid and cleanable floors. The area shall be provided with potable water, enough number of tables, seats, plastic garbage bags and metal garbage containers for plastic garbage bags, smoking shall be prohibited in these areas.
2. All joint and shared dining areas shall be provided, operated and maintained in accordance with the legislations of the authority concerned in Dubai.
3. All food services in the workplace shall be complying with the requirements of the authority concerned and sufficient number of tables and seats shall be provided.
4. All occupational health and housekeeping rules shall be followed for food services in the workplace.
5. Containers of rotten or hazardous wastes shall be manufactured in a way that prevent leakage and enable full and comprehensive hygienic cleaning and maintenance. These containers shall be provided with solid and tight sealed covers.
6. Solid and liquid wastes shall be removed promptly to keep a healthy environment.

3.3. Sanitation Facilities:

1. All Sanitary piping and installations shall be in accordance with the technical standards and specifications of sanitation facilities approved by the Specialized Department in Dubai Municipality.
2. Adequate sanitation facilities, sanitary sewage and water source shall be provided in the workplace in accordance with the following table:

No. of Employees	Minimum number of Sanitary facilities
20 or less	1 toilet seat + urinal + lavatory
From 21 to 200	(1 toilet seat + urinal + lavatory) per 40 employees sequance
More than 200	(1 toilet seat + urinal + lavatory) per 50 employees sequance

3. Every sanitation facility and its openings shall be covered as appropriately as to prevent exposure to different weather conditions and falling materials. Toilets shall be separated with partitions and lockable doors for privacy purposes.
4. Sanitation facilities shall be made accessible in all time in near proximity to the worksite and shall be equipped with suitable cleansing agents.
5. Urinal facilities shall be provided in appropriate enclosed places so that it cannot be seen from any other places inside or outside the location.
6. Sanitation facilities shall be maintained and kept permanently clean. The sanitation and washing facilities shall be daily cleaned up by water and soap and sterilized twice a week at least.
7. Sanitation facilities shall be provided with adequate lighting and ventilation.
8. In case lead components, permanent poisoned or colored materials are used, the

workplace shall be provided with special sink for hand wash for every five employees in addition to soap and a brush for nails wash and any other washing means with an adequate water source to remove these materials.

9. Adequate size holding tank shall be provided and regularly cleaned as required. Soak away or analyzing tanks shall not be permitted in the workplace.
10. In case of modern toilets, they shall be provided with toilet seat and cover. All sanitary supplies shall be provided with adequate toilet cleaning tissues.
11. In case temporary toilets are required for employees in high floors of the building, the sanitary sewage system shall be made in accordance with the engineering specifications and rules.

3.4. Potable Water:

1. A supply of potable water shall be provided in accordance with the quality standards applied by Dubai Emirates and which is approved for drinking purposes by the local authority having jurisdiction (the authority concerned). Cold potable water shall be provided in hot weather.
2. An adequate supply of potable water shall be provided in all places of employment and shall be distributed in such a manner as to prevent contamination between water consumer and the supply source.
3. Drinking water shall be dispensed by water-pipelines installed in accessible locations for usage and maintenance purposes and equipped with taps. There shall be 2 meters separate distance at least between a pipe-system furnishing potable water and a pipe-system furnishing non-potable water.
4. The common drinking cup (one cup to be used for many) shall be prohibited and where disposable cups (to be used once) are used, a waste receptacle for disposing of the used cups shall be provided.
5. Potable water tanks shall be fabricated of anti-corrosion materials, which shall not affect the physical or chemical properties of potable water. Also these materials shall not cause any alteration of the color, taste or odor of the potable water, and shall not be affected by heat or humidity, opaque (not transparent) and has no any bad health effect, and in accordance with the regulations of the concerned department.
6. Potable water tanks shall be clearly marked as containing «Safe drinking water».
7. When designing potable water tanks, consideration shall be given to avoid sharp angles between tank walls which will allow the accumulation of dirt and germs and restrict cleaning operations.
8. Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.
9. Uncovered containers shall not be used and potable water shall not be stored in any other containers not designed for storing potable water.

3.5.Non-potable water:

1. Outlets for non-potable water shall be conspicuously posted, “Danger, Water Unfit for Drinking, Washing or Cooking” in Arabic Language, English Language and the most common language used in the work place.
2. There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing non-potable water.

3.6. Washing facilities:

1. All toilets shall be provided with adequate and sufficient number of washing facilities (lavatory) in accordance with item 3.3.2 of this chapter.
2. Each washing facility shall be kept in good sanitary condition and provided with hot and cold running water, body soap and individual cloth towels.
3. Whenever bathing is required by a particular standard, showers shall be provided in accordance with the following standards:
    - 3.1. One shower shall be provided for each 10 employees of each sex, who are re quired to shower during the same shift.
    - 3.2. Body soap or other appropriate cleansing agents convenient to the showers shall be provided.
    - 3.3. Showers shall be provided with hot and cold running water.
    - 3.4. Employees who use showers shall be provided with individual clean towels.
4. Whenever employees are required by a particular standard to wear protective clothing, change rooms equipped with storage facilities for street clothes and separate storage facilities for the protective clothing shall be provided.
5. Adequate washing facilities shall be provided for employees engaged in the application of paints, coating, insecticides, or herbicides, or in other operations where contaminants may be present. Such facilities shall be in near proximity to the worksite and shall be so equipped as to enable employees to remove such harmful substances.

3.7. (Vermin Control):

1. Enclosed workplace shall be so constructed and maintained so as to prevent the entrance or harborage of insects, snakes and other vermin.
2. Appropriate shoes, helmets, gloves or any other personal protective equipment shall be used.
3. An effective extermination control program shall be followed where the presence of such insects, snakes is detected. Insecticides, pesticides, and snake repellents shall be used in coordination with the Department Concerned.

3.8. Temporary residence locations

1. No temporary residences shall be erected in worksites unless after obtaining approval from the Specialized Department in Dubai Municipality.
2. When temporary residences for employees are permitted, they shall be adequately heated, air-conditioned, ventilated, and lighted and shall be provided with a good sewage system
3. Open areas and lands surrounding temporary residences shall be kept free of accumulation of garbage, trash, paper rubbish, dirt and other wastes.
4. Temporary residences shall provide protection against weather conditions. Every sleeping room shall be at least 4 square meters (40 square feet) floor area for everyone in accordance with the conditions and specifications specified by the Specialized Department in Dubai Municipality and Concerned Authorities.
5. Areas for rest and protection against bad weather conditions shall be provided for employees.

3.9. Illumination:

1. Adequate and appropriate illumination in Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be provided.

2. Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in the following table

Area	Illumination intensity (Lux)
General construction area lighting	50
Excavation and waste areas and loading platforms.	35
Tunnels and underground work areas. Warehouses, carpenter shops, living quarters, locker or dressing	100
rooms and indoor toilets.	100
First aid stations and offices.	400
Engineering drawing locations	600

3. In addition to items (1) and (2), illumination shall be installed to ensure the following requirements:
    - Lighting shall be comfortable and shall not expose employees or surroundings for disturbing glare.
    - The illumination glare shall be as minimum as possible.
    - Every part of any area shall receive light from at least two directions to avoid dense shadows.
    - All vertical and horizontal surfaces shall be properly illuminated.
    - Light fixtures shall be suitable for the area they are installed in.
    - Illumination shall be adequate for cleaning and maintenance operations.
4. Emergency Illumination (connected to other power source) shall be provided with a minimum illumination intensity of 50 Lux in all routes leading to emergency exits and near exists, tunnels, and dark places and where necessary when electrical power is is cut off.
5. The technical guideline number (12) shall be refered to in this regard.

3.10. Ventilation

1. The contractor shall provide adequate and appropriate ventilation in confined or enclosed spaces such as vaults, basements and water tanks to discharge dusts, fumes, mists, vapors, or gases produced in the course of construction work to the outside atmosphere.
2. Whenever hazardous substances such as dusts, fumes, vapors, or gases exist, the contractor shall provide adequate ventilation systems which include local ventilation to exhaust those hazardous materials from the workplace.
3. When ventilation systems in the workplace are unavailable, inadequate or out of order, the contractor shall provide adequate protective equipment for employees in accordance with the technical guidelines no. (7) issued by the Competant Department in Dubai Municipality.

3.11. Noise:

Noise is the undesirable high sound which exceeds the allowable limits. Rules of chapter seven (7) on noise protection of the Local Order no. 61/1999 shall be applied on noise resulting from construction, building and demolition works. Noise is divided into two types:

1. Noise affecting public and neighbors:
   Continuous allowable noise levels resulting from workplaces during the period from 7 am to 8 pm and in the period from 8 pm to 7 am shall not exceed the following levels:

Allowable Limits for Noise Level in Different Areas

Area	Allowable Limits for Noise Level (dBA)*	
	Day (7 a.m. - 8 p.m.)	Night (8 p.m. - 7 a.m.)
Residential Areas With Light Traffic	40 - 50	30 - 40
Residential Areas in Downtown	45 - 55	35 - 45
Resedential Areas with include some Workshops & Commercial Business or Residentail Areas near the Highways	50 - 60	40 - 50
Commercial Areas & Downtown	55 - 65	45 - 55
INdustrial Areas (Heavy Industry)	60 - 70	50 - 60

*dBA means decibels adjusted. dBA is used for determining the sound exposure to humans

2. Noise affecting employees in workplace (occupational noise)
3. The contractor shall not expose the employees in the workplace to noise levels higher than levels specified in table (5)

Table (5)

Sound level dBA	Duration per day, hours
85	8 hours
87	6 hours
90	4 hours
92	3 hours
95	2 hours
97	One hour and half
100	One hour
102	45 minutes
105	30 minutes
107	22.5 minutes
110	15 minutes
115	7.5 minutes

4. When employees in workplace are exposed to sound levels exceeding those listed in above table (5), feasible administrative or engineering controls shall be utilized. Some examples of engineering controls include installation of noise reducing baffles or installation of vibration absorbers for machinery which produce noise. Administrative

controls include, for example, the reduction of noise exposure time to employees, posting of appropriate warning signs and appropriate training for employees. If such controls fail to reduce sound levels within the levels of the table, appropriate personal protective equipment, shall be provided and used to reduce sound levels within the levels of the table (reference is made to technical guidelines no.(11).

5. In all cases where the sound levels exceed the values shown, a continuing effective hearing conservation program shall be administered for.
6. In case equipment which operate with diesel and produce high noise such as dewatering pumps, alternative electrical pumps may be used or isolating it in such a way to reduce the noise levels to the allowable levels.
7. When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the following formula:

Fe = (T1 / L1) + (T2 / L2) + ... + (Tn / Ln)

where:
Fe = The equivalent noise exposure factor.
T1 = The first period of noise exposure at the essentially constant level.
T2 = The second period of noise exposure at the essentially constant level.
Tn = The last period of noise exposure at the essentially constant level.
L1= The duration of the permissible noise exposure at the constant level (in the first period).
L2= The duration of the permissible noise exposure at the constant level (in the second period).
Ln= The duration of the permissible noise exposure at the constant level (in the last period).
(If the value of (Fe) does not exceed unity (1) the noise exposure does not exceed the per missible levels (85 dBA).

Example:
An employee is exposed at the following levels for the following periods:
105 dBA ¼ hour.
95 dBA ½ hour.
85 dBA 1 ½ hours.

Fe = (¼ divided by ½) + (½ divided by 2) + (1½ divided by 8)
Fe = (0.5 + 0.25 + 0.188) = 0.938 which is less than 1, the exposure is within \ permissible limits.
Since the value of Fe does not exceed unity, the exposure is within permissible limits (85 dBA).

8. In all cases where noise levels exceeding those listed in table (5), appropriate hearing conservation guidelines shall be posted in known places to all employees.
9. Exposure to impulsive or impact noise resulting from heavy gavels shall not exceed 140 dBA peak sound pressure level, where the variations in noise level involve maxima at intervals of 1 second or more as shown in table (6). If the intervals are less than one second, it shall be considered continuous within the values shown in table (5).

Table (6)

Sound Level dBA	Permitted number of impacts per work shift (8 hours)
140 dBA	100 Impacts
130 dBA	1000 Impacts
140 dBA	10000 Impacts

10. The contractor shall obtain a night work permit from the Specialized Department in Dubai Municipality before the initiation of any work which produce noise in neighborhood areas during the night time period from 8 pm to 6 am, in compliance with all the conditions specified in the work permit and provision of the following conditions:
    - Informing neighborhoods about the time, duration and type of the works that shall be performed and emergency telephone numbers of the technical supervision personnel.
    - Compliance with the limited noise levels.
    - Provision of all occupational health and safety conditions for night works
        1. Adequate illumination intensity
        2. No employee to work alone
        3. Compliance with permitted work items
        4. Posting of appropriate traffic and warning signs.
    - Complete the obtaining of Non Objection certificates from the authorities concerned.
    - Scheduling of work which produces noise to reduce its effect on residential areas to the minimum level possible and providing sound control methods of the machinery or any other sources of noise as practical as possible by using the technical, engineering and administrative controls.

Fig. 2

3.12. Atmospheric Contaminants:

1. The contractor shall arrange to remove gases and vapors from places in the workplace where employees perform their jobs to prevent hazards and injuries which may affect respiratory system or any other parts of the body.
2. Harmful types of gases and vapors:
    - Suffocating gases: (carbon dioxide, nitrogen)
    - Corrosive gases: (Ammonia, Chlorine)

- Poisonous gases and vapors (Lead)
- Anesthetic gases and vapors (Chloroform)

3. The contractor shall provide appropriate procedures for protection against atmospheric contaminants (gases, vapors, dusts) and prevent the exposure of employees in different worksites to harmful concentrations higher than permissible levels specified in technical guidelines no (31) on occupational health.
4. To reduce exposure to less than harmful levels specified in tables therein, the contractor shall apply the appropriate engineering and administrative controls for example: Use tools equipped with wetting method (water suppression of dust) or exhaust system to exhaust dusts, when such controls are not feasible to achieve full compliance, proper personal protective equipment shall be used.
5. The contractor shall take all necessary precautions (for example adequate ventilation, proper storage of hazardous materials) to limit the release of dust, mist, fumes and volatile liquids by applying the following:
    5-1. Wet the dust and the worksite with water when exposed to dust storms.
    5-2. covering the entrances and locations of cars movement with appropriate materi als or continuously wet it with water to prevent release of dust.
    5-3. Garbage chutes shall be used for disposal of debris or mechanical equipment or any other appropriate method, in all cases debris shall be prohibited to be thrown directly from higher floors.
    5-4. Taking all necessary precautions during transportation and unloading of construction materials.
6. The contractor shall take all adequate and necessary measures to eliminate gas and fume emission from equipment and machinery used in different worksites through continuous maintenance of these equipment and machinery and providing them with special filters to prevent the emission of fumes and gases.
7. The contractor shall not dispose debris by burning them inside or outside the workplace. They shall be transferred to the dumping areas approved by the authorities concerned.
8. All workplace fronts shall be covered with tarpaulin or any other appropriate materials to prevent the spread of mist, volatile liquids or paint materials.
9. Safe aisles with adequate protective canopies shall be provided to protect passengers against exposure to volatile liquids, construction wastes or falling objects.

3.13. Radiation (ionizing – non-ionizing)

Radiation includes two main types as follows:

- Ionizing radiation includes rays such as X-rays, Gamma-rays, cosmic rays, and particles such as Alpha and Beta particles. These rays, especially X-rays and Gamma-rays, are used on testing welding efficiency in steel structures and pipelines.
- Non-Ionizing radiation includes electromagnetic rays such as radio, television, radar, microwaves, infrared, ultraviolet, laser and normal light waves. Laser beams are used in some apparatuses. Welding operations, especially arc welding, produce ultraviolet and infrared rays.
- Ionizing radiation is more dangerous than non-ionizing radiation on human health.

3.13.1. Ionizing radiation:

1. Reference shall be made to Regulations on Hazardous Goods Management/Control of 1997 specified in Chapter Four issued by Dubai Municipality.
2. Appliances which constitute hazardous radiation source on employees shall not be used

without appropriate permissions from the authorities concerned.

3. Employees shall not be permitted to be exposed to radiation doses exceeding the permissible limits specified by the authorities concerned in accordance with age and gender.
4. When determining the radiation doses, all internal and external radiation sources shall be considered weather the effect is immediately (one exposure) or accumulated effects.
5. Technical guidelines (20) on radiation types and safety precautionary measures and procedures shall be applied.
6. Necessary medical examinations shall be conducted to all employees to determine the exposed doses, and the result of these examinations shall be recorded in special log kept on site to be inspected by authorities concerned and take the necessary measures accordingly.
7. Any activity which involves the use of radioactive materials or x-rays shall be performed only under the supervision of a competent person specially trained and has an approved certificate from the authorities concerned authorizes him to perform such activities.
8. All areas where radioactive materials and tools are used shall be temporary or permanently barricaded, and proper warning signs in Arabic, English and the most common language used in the worksite shall be posted (fig. # 3).
9. Primary (basic), periodical and final medical examinations shall be conducted and provided to all employees working in this field in accordance with the guidelines and regulations of the authorities concerned.

Fig. 3

3.14. Vibrations

1.Employees shall not be exposed to vibrations resulting from electrical or compressed air equipment more than the allowable limit (2.8 M/S2) during 8 hours per day. (See fig. # 4).

Fig. 4

2. The contractor shall select equipment with vibration levels less than those allowable limits and in case that is not feasible, vibration hazards can be minimized by using anti – vibration gloves and any other alternative method.
3. Ref. is made to technical guideline # 10 concerning vibration hazards.
4. All the recommendations and guidelines of the manufacturing company regarding use, maintenance and safety rules shall be followed.

3.15. Heat Exposure

The two main heat-related illnesses are called Heat Exhaustion and Heat Stroke. They are quite different and must be recognized since the treatment of the two conditions differs..

For example, a person with heat stroke has a very high skin temperature and the body becomes dry and unable to control its temperature, in this case this person needs cold shower and continuous ventilation until his body temperature is reduced.

The person who has heat exhaustion is heavily sweating losing water and salt, in this case this person needs to drink big amount of salty water to compensate the amount lost by sweating.

Heat illnesses Prevention and Protection

1. All employees working in locations where they are exposed to high heat, shall be instructed on heat hazards, different heat-related illnesses, accompanying symptoms for each type and case and methods of prevention and treatment.
2. Proper warning signs shall be posted.
3. Make available cold water and request employees to drink adequate quantities of cold water to compensate losses of water by sweating. This may be from 5 liter to 10 liters per day for each worker during summer months.
4. Eat sparingly during the day.
5. Avoid overexposure to the direct rays of the sun, and stop all activities carried out in direct sun during hot period of the day in summer months (July and August) as per the instructions and regulations of the authority concerned.
6. Provide shade over the task area if possible.
7. Wear light, loose clothing, a hat and sunglasses.

8. Provide adequate ventilation in closed and confined workplaces.
9. Carry out heavy jobs in the coolest part of the day.
10. Reference is made to technical guideline # 9 issued by the Specialized Department at Dubai Municipality.

3.16. Asbestos:

1. The contractor shall be committed to and comply with all items specified in the Council of Ministers decree no. (39) of 2006 on banning importation, exportation, production and utilization of asbestos sheets and the technical guidelines no. (13) on safety procedures regarding working in demolition worksites where there is an exposure to asbestos fibers.
2. The contractor shall be responsible for the health of his employees who perform works on asbestos-containing materials or asbestos fiber-releasing materials in demolition worksites. He shall be responsible for the protection of any of his employees who might be exposed to asbestos dust. All precautions shall be taken to prevent the spread of asbestos dust and fibers within the working environment. (demolition worksites)
3. The contractor shall take adequate precautions/controls to prevent emissions of asbestos dust or fiber into the environment or workplace by preventing abrading operations or using of abrasive wheel disks for cutting asbestos materials.
4. All employees shall be provided with the appropriate personal protective equipment and clothing and shall ensure they wear them. (protective clothing, safety shoes, protective glasses, gloves, proper respirators for asbestos fibers).
5. Asbestos dust and fibers on grounds shall be cleaned up by vacuum cleaning machines.
6. Asbestos fibers shall be kept in dust-tight double plastic bags.
7. All asbestos bags shall be labeled with approved printed warning signs (information cards) that identify asbestos health hazards.
8. All asbestos wastes shall be collected, wetted and kept in dust-tight non-preamble bags.
9. Asbestos wastes shall be disposed of in accordance with the regulations of the authorities concerned in Dubai.
10. If any employee is exposed to airborne asbestos dust resulted from cutting and drilling asbestos products shall be immediately reported to the concerned medical authorities and necessary medical examination shall be conducted to him by a specialized doctor.

3.17. Waste Collection and Disposal from the Worksite:

1. Employee who carry out waste collection shall be provided with necessary and appropriate personal protective equipment.
2. Plastic bags shall be provided for waste collection and dust-tight metal containers shall be provided for keeping the plastic bags until disposed of.
3. Construction material wastes shall be disposed of regularly and frequently to prevent accumulation in roads and passageways. They shall be removed to the specified areas designated by authorities concerned.
4. Containers of solid or liquid rotten wastes shall be tightly sealed to prevent leakage. They shall be fully cleaned up, kept healthy and provided with suitable covers. They shall be emptied in coordination with the authorities concerned.
5. Construction wastes such as wood, aluminum, etc. shall be accumulated in piles or packages to facilitate removal from workplace.
6. Debris shall be removed by means of garbage chutes, mechanical equipment or any other appropriate means. In all cases, they shall never be thrown directly to ground from high floors.

CHAPTER FOUR

Personal Protective Equipment

4.1. General Requirements:

1. The contractor shall provide at his expense, personal protective equipment (PPE) required for different operations and shall take all necessary measures to ensure that PPE are effectively worn by employees.
2. The contractor shall assess the workplace hazards to determine the PPE as required for the job being performed. The contractor shall provide PPE for employees at his expenses.
3. Personal protective equipment approved by the concerned parties and comply with the requirements of this manual shall be used.
4. Personal protective equipment shall be properly fitting for each employee and adequate for the work he performs.
5. Employees shall be physically able and medically determined qualified (medical examination) to use respiratory protection equipment that may be required in their job duties. This medical examination shall be repeated yearly.
6. Contractor shall ensure that users of personal protective equipment are trained by their direct supervisors to know how to use them correctly.
7. When personal protective equipment are not in use, they shall be kept in plastic bags and maintained in such a sanitary and hygienic way to prevent contamination.

4.2. Personal Protective Equipment:

4.2.1. Head Protection:

1. Employees working in areas where there is possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by safety helmets. This includes all construction and demolition sites. As shown in figures 1 & 2.

Fig. 1

Fig. 2

2. Safety helmets shall meet the specifications contained in the technical guidelines no. (1) issued by the Specialized Department and in accordance with the international standards.
3. Before using a safety helmet, it shall be inspected to ensure their safe reliable working condition, it is free from cracks or sings of impact and that the straps and internal shock-absorbing lining are in sound condition.
4. All points of entry to a hard-hat areas shall have a sign warning of the requirement to wear hard hats.
5. The contractor shall prevent any worker, visitor or supervisor from entering to the worksite unless suitable safety helmet is worn and keep wearing it while in worksite.

4.2.2. Eye and Face Protection:

1. Employees shall be provided with eye and face protection equipment when machines or operations present potential eye or face injury from physical or chemical agents.
2. Eye and face protection equipment shall meet the requirements specified in the technical guidelines no (2) issued by the Specialized Department.
3. Employees whose vision requires the use of medical spectacles shall be protected by one of the following types:
    - Eye Glasses with protective lenses providing optical correction;
    - Goggles that can be worn over corrective lenses without disturbing the adjustment of the spectacles;
    - Goggles that incorporate corrective lenses mounted behind the protective lenses.
4. Face and eye protection equipment shall be kept clean and in good repair. The use of eye and face protective equipment with structural or optical defects shall be prohibited.
5. Table (4 – 1) shall be used as a guide for the selection of the proper shade numbers of filter lenses or plates used in welding. Shades more dense than those listed in the table may be used to suit the individual's needs. (Figure 3)

Table (4 – 1)

Filter Lens Shade Numbers for Protection against Radiant Energy

Welding Operating	Shade Number
Shielded etal-arc welding 1/16, 3/32, 1/8, 6/32 - inch diameter electrodes	10
Gas- shielded arc welding (nonferrous) 1/16, 3/32, 1/8, 5/32 - inch diameter electrodes	11
Gas- shielded arc welding (ferrous) 1/16, 3/32, 1/8, 5/32 - inch diameter electrodes	12
Shielded metal - arc welding (ferrous) 3/16, 7/32, 1/8, 1/4 - inch diameter electrodes	12
5/16, 3/8 - ich diameter electordes	14
Atomic hydrogen welding	10 - 14
Carbon - arc welding	14
Soldering	2
Torch brazing	3 or 4
Light cutting, up to 1inch	3 or 4
Medium cutting, 1 ot 6 inches	4 or 5
Heavy cutting, more than 6 inches	5 or 6
Gas welding (light), up o 1/8 inch	4 or 5
Gas welding (Medium), up o 1/8 to 1/2 inch	5 or 6
Gas welding (heavy), more than 1/2 inch	6 or 8

Fig. 3

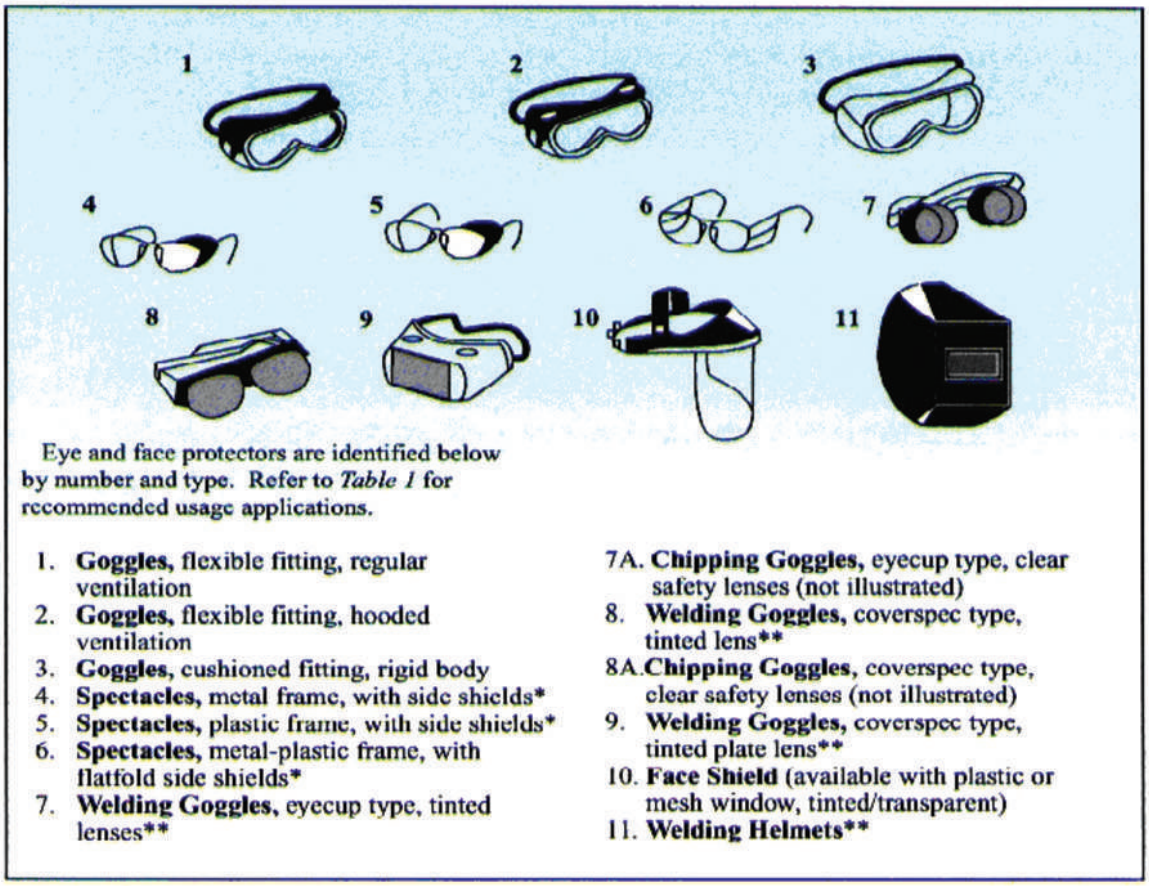
6. Table 4-2 shall be used as a guide in the selection of face and eye protection for the haz ards and hazardous operations noted.

Table (4-2)

Eye and Face Protector Selection Guide

Applications		
Operation	**Hazards**	**Recommended Protectors**
Acetylene-Burning, Acetylene-Cutting, Acetylene-Welding	Sparks, harmful rays, molten metal, flying particles	Welding Goggles, Eyecup Type, Clear Safety Lenses, Filter Lens Shade Numbers Welding Goggles, Cover spec Type, Clear Safety Lenses (see Table 4-1) Welding Goggles, Cover spec Type, Clear Safety Lenses
Chemical Handling	Splash, acid burns, fumes	Goggles with flexible fitting and regular ventilation Face shield with Plastic or Mesh Window. For severe exposure add Face shield over Goggles
Chipping	Flying particles	1, 3, 4, 5, 6, 7A, 8A
Electric (arc) Welding	Sparks, intense rays, molten metal	9, 11 (11 in combination with 4, 5, 6, in tinted lenses advisable)
Furnace Operations	Glare, heat, molten metal	7, 8, 9 (for severe exposureadd 10)
Grinding	Flying particles	1, 3, 4, 5, 6, 10 1, 3, 7A, 8A (for severe exposure add 10)
Laboratory	Chemical splash, glass breakage	2 (10 when in combination with 4, 5, 6)
Machining	Flying particles	1, 3, 4, 5, 6, 10

Figure 1. Recommended Eye and Face Protectors



Eye and face protectors are identified below by number and type. Refer to *Table 1* for recommended usage applications.

1. **Goggles,** flexible fitting, regular ventilation
2. **Goggles,** flexible fitting, hooded ventilation
3. **Goggles,** cushioned fitting, rigid body
4. **Spectacles,** metal frame, with side shields*
5. **Spectacles,** plastic frame, with side shields*
6. **Spectacles,** metal-plastic frame, with flatfold side shields*
7. **Welding Goggles,** eyecup type, tinted lenses**

7A. **Chipping Goggles,** eyecup type, clear safety lenses (not illustrated)

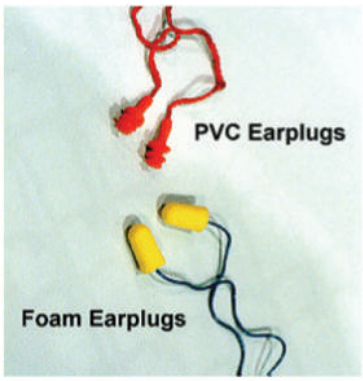
8. **Welding Goggles,** coverspec type, tinted lens**

8A. **Chipping Goggles,** coverspec type, clear safety lenses (not illustrated)

9. **Welding Goggles,** coverspec type, tinted plate lens**
10. **Face Shield** (available with plastic or mesh window, tinted/transparent)
11. **Welding Helmets****

4.2.3. Hearing protection:

Ear Canal



1. Where it is not possible to reduce the noise levels in the workplace to the permissible noise exposure levels specified in Table (4 – 3), by using different engineering controls, the contractor shall provide the employees with ear protective devices. Employees shall be trained on correct fit, use, and maintenance of PPE and on how to keep them in a sanitary and reliable condition. The selection of protectors shall be comfortably used in accordance with the technical guideline no (4) issued by the Specialized Department.

Table (4-3)

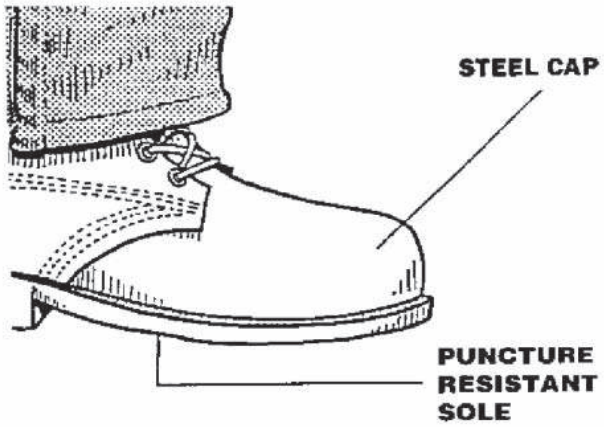
Sound Level dBA	Duration per day, hours
85	8 hours
87	6 hours
90	4 hours
92	3 hours
95	2 hours
97	One hour and half
100	One hour
102	45 minutes
105	30 minutes
107	22.5 minutes
110	15 minutes
115	7.5 minutes

2. Ear protective devices inserted in the ear or earmuffs shall conform to the international standards (British, European and American standards).
3. Plain cotton is prohibited as an acceptable protective device against noise hazards.

4.2.4. Foot Protection:

1. The contractor shall provide safety shoes for all employees in construction or demolition workplaces to protect their feet from any potential injury.

2. Selection of safety shoes shall be determined in consideration of the hazards or potential hazards in the workplace and they shall comply with the requirements and specifications in the technical guideline no (8) issued by the Specialized Department.
3. Safety shoes lined with steel toe cap covering top and steel sole shall be used in worksite.



4. For wet and muddy conditions, rubber boots shall be used.
5. Where live electrical current is the hazard (during working in electrical installation), non-conductive safety footwear with adequate insulation according to the nature of work shall be used.

4.2.5. Respiratory Protection:

1. The contractor shall implement adequate engineering and administrative controls to prevent employees' exposure to harmful atmospheric contaminants (gases, fumes, vapors, mists, sprays, bad smells, etc.)
2. The contractor shall provide appropriate respiratory protection equipment, which shall be used in compliance with the details in the technical guideline (7) issued by the Specialized Department.
3. Respiratory equipment shall be of the appropriate types and suitable for the contaminants to which the employees are exposed.
4. The contractor shall prepare a written program plan for respiratory protection which specifies the standard operating procedures controlling the selection and usage of respirators.
5. No employee shall be permitted to enter or work in any workplace where the percentage of oxygen is less than 19.5 % unless he is provided with a source of air with high purification quality.
6. No employee shall be permitted to enter to septic tanks or non – ventilated basements unless these places have been ventilated and ensured that adequate oxygen levels is available and free of explosive gases after being tested using oxygen and gas detectors.
7. Confined spaces located under ground level shall be provided with the following types of devices which shall be used according to the nature of work:
    - Special masks to purify air from harmful gases such as carbon monoxide.
    - Air purifying respiratory protection devices.
    - Closed Circuit Compressed Oxygen SCBA.
    - Special apparatus to detect gases and oxygen.
8. Table 4-4 shall be used as a guide in the selection of respiratory protection devices for the hazards and hazardous operations noted.

Table (4-4)

Selection of Respiratory Protection Devices

Hazard	Respirator
Oxygen deficiency	Self contained breathing apparatus. Hose mask with blower. Combination air-line respirator with auxiliary self-contained air supply or an air storage receiver with alarm.
Gas or vapor contaminants immediately dangerous to life and health	Self-contained breathing apparatus. Hose mask with blower. Air purifying, full face-piece respirator with chemical canister (gas mask)
Gas or vapor contaminants not immediately dangerous to life and health	Air-line respirator. Hose mask without blower. Air purifying half mask or mouthpiece respirator with chemical cartridge.
Particulate contaminants immediately dangerous to life and health	Self contained breathing apparatus. Hose mask with blower. Air-purifying, full face-piece respirator with appropriate filter. Self rescue mouth piece respirator (for escape only).Combination air-line respirator with auxiliary self contained air supply or an air storage receiver.
Particulate contaminants not immediately dangerous to life and health	Air-pumping, half mask or mouthpiece respirator with filter pad and cartridge. Air line respirator Air line abrasive/ grill blasting respirator. Hose mask without blower.
Combination gas, vapor and particulate contaminants immediately dangerous to life	Self contained breathing apparatus. Hose mask with blower. Air purifying, full face-piece respirator and health with chemical canister and appropriate filter (gas mask with filter). Combination air-line respirator with auxiliary self contained air supply or an air-storage receiver with alarm.
Combination gas, vapor and particulate contaminants not immediately dangerous to life and health	Air-line respirator. Hose mask without blower. Air-purifying, half mask, or mouthpiece respirator with chemical cartridge and appropriate filter.

9. Compressed breathing air in respiratory protection equipment must meet at least the requirements specified in table number (4 – 5) and it may be guided by the specification for breathing air Type 1 - Grade D described in ANSI/CGA G-7.1-1989.

Table (4-5)

Description	Limits
Oxygen Content % volume	19.5 % - 23.5 %
Condensed hydrocarbon oil mist mg/m3 maximum	0.5 mg/m3
Carbon Dioxide ppm maximum	500 ppm (900 mg/m3)
Carbon Monoxide ppm maximum	5 ppm (5.5 mg/m3)
Noticeable odor	Lack of noticeable odor
Inert nuisance particulates mg/m3 maximum	0.5 mg/m3
Water (present as a liquid)	Nil

4.2.6 Hand Protection:

1. Any contractor shall provide adequate and suitable hand protection for any person han dling rough, abrasive, sharp or excessively coarse material such as reinforcement rods, pre-cast concrete, etc. or toxic and corrosive materials, electricity, hot materials.
2. The material of the protective equipment shall be suitable for the operation ensuring proper protection against the hazard, as detailed in technical guideline # (3) issued by the specialized department.
3. Employees working in construction activities shall be provided by the suitable gloves according to the type of work as follows:
    - 3-1 Chrome leather gloves to be used when handling sand blasting and for most activities and handling different materials. (Fig. # 4-1).
    - 3-2 Gloves made of cotton or other fabrics are used for handling materials (Fig. # 4-2).
    - 3-3 Insulated rubber gloves are used when working in electrical installation (Fig. 4-3).
    - 3-4 Gloves made of rubber (latex, nitrite, or butyl), plastic, or synthetic rubber-like material such as neoprene protect workers from burns, irritation, and dermatitis caused by contact with oils, greases, solvents, and other chemicals. (Fig. 4-4).
    - 3-5 Anti-Vibration gloves to be used to reduce the effect of vibration. (Fig. 4-5).
4. Any damaged gloves shall be disposed of and replaced with new gloves.

Fig. 4-1

Fig. 4-2

Fig. 4-3

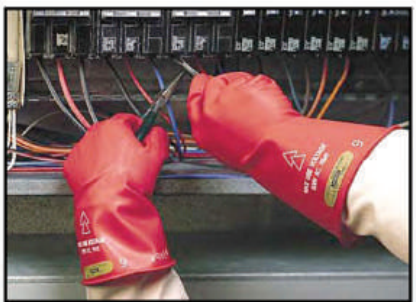


Fig. 4-4

Fig. 4-5

4-2-7 Protective Clothing:

1. Every contractor shall provide adequate and suitable protective clothing for all employees to protect them from hazards such as chemical liquid and vapors, heat and cold, electricity, impacts, ionizing radiation and also general weather conditions.
2. Reference shall be made to the technical guideline # 6 issued by the specialized department regarding selection and use of protective clothing for different activities.

4-2-8 Safety Belts, Lifelines and Lanyards:

1. Each employee working at a level which is 2 m (6 feet) or more above lower level shall be provided with safety harness and shock absorbing lanyard to protect them from falls hazards. (Fig. # 6).
2. Anchorage points for safety harness should be sited above the worker head, the height of the anchorage point should not be less than 5 m (18.5 feet) from the ground level, and this point shall be strong enough to withstand a force of not less than 2275 kg (5000 pounds) (Fig. # 9).
3. Safety belt lanyard shall be minimum of 1 cm thickness of nylon or equivalent with maximum length to provide for a fall (Free Fall) not greater than 2m (6 feet), Snap hooks attached to the lanyard must be fitted with a double locking device whish shall be opened only by pressing on two places on the hook at the same time to prevent accidental opening. (Fig. # 6).
4. Safety harness and lanyard must bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 1.07 meters (3.5 feet) after the free fall distance of 2 meters (6 feet) by using a shock absorber, To decrease this height, the lanyard may be shortened but not less than 90 cm (3 feet) (Fig. # 7 & 8).
5. Safety belt shall not be used for fall protection.
6. Safety belts shall be used only as a part of an worker positioning system (Restricted employee from reaching to the edges) and shall no longer be used for fall protection. (Fig. # 5).

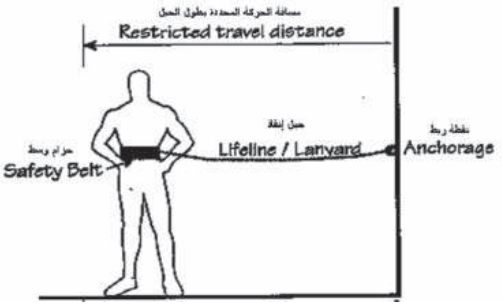


Fig.5

7. The requirements and specifications shall conform to technical guideline # (5) issued by the specialized department.

Fig. 6

Fig. 7

Fig.8

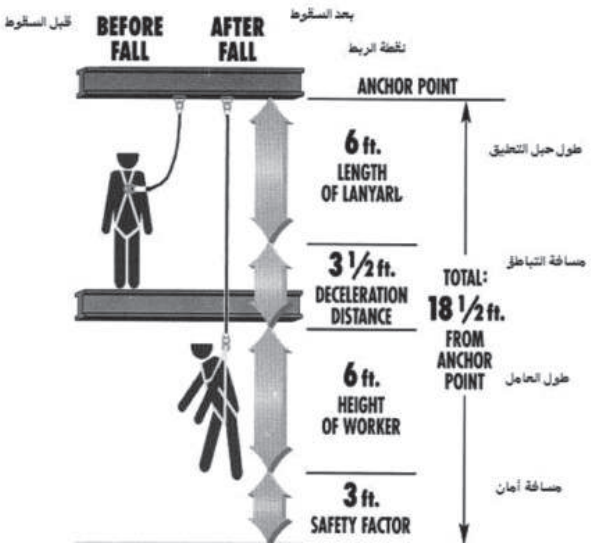


Fig. 9

4-2-9 Safety Nets:

Safety nets are used to protect employees from fall hazards, and there is another type of safety nets used to protect employees against falling objects.

Safety Nets for Catching Employees After the Fall (Fig. # 10):
The mesh size of safety nets designed for protecting persons against fall hazards shall not exceed 15 cm x 15 cm (6 inches x 6 inches). This type of nets shall be tied to a strong structure or frame by ropes, which shall be strong enough to support a forth of not less than 2275 kg (5000 pounds).

Safety Nets for Falling Objects (Fig. # 11):
The mesh size of safety nets designed for the protection from falling objects shall not exceed 12 – 19 mm.

Fig. 10

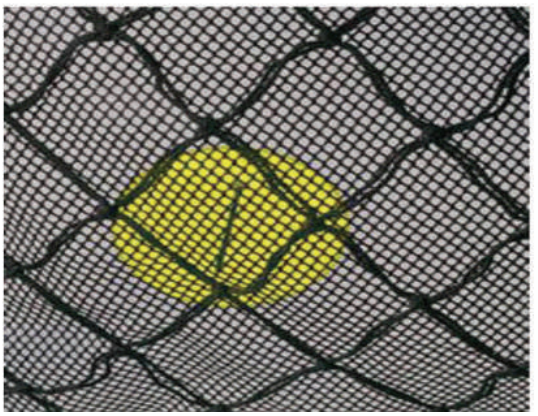


Fig. 11

General Requirements:

1. Safety nets shall be provided when working places are more than 8 meters above the ground or water surface or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines or safety harnesses is impracticable.
2. Where safety net protection is required, operations shall not be undertaken until the net is in place and has been tested without failure.
3. The requirements and specifications shall conform to the technical guideline # (19) issued by the specialized department.
4. Safety net shall extend not less than 2.5 meters (8 feet) horizontal distance beyond the edge of the work surface and this distance shall be increased whenever the distance between the work surface and the net is increased.
5. Safety nets shall be installed in locations where employees are exposed to falling objects.
6. Safety net shall be installed as close under the work surface as practicable but in no case more than 8 meters (25 feet) below such work surface.
7. Nets shall be hung with sufficient clearance to prevent user's contact with surfaces or structures below.
8. The maximum size of each safety net mesh opening shall not exceed 15 cm x 15 cm.
9. Safety nets shall be inspected at least once a week for wear, damage, and other dete

rioration. Safety nets shall be capable of absorbing an impact force of drop test consisting of a 180 kilogram (400-pound) bag of sand 76 cm (30 inches) in diameter dropped from the highest walking/working surface at which workers are exposed, but not less than 1.1 meters (42 inches) above the level.

10. Forged steel safety hooks or shackles shall be used to fasten the not to its support. (Fig. # 12).

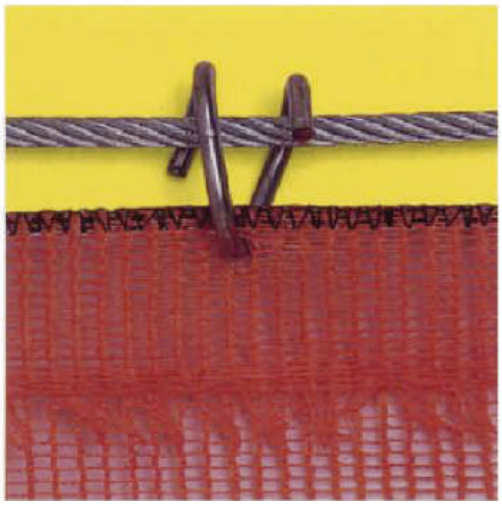


Fig. 12

11. Any material, scrap, tools or equipment that falls into the net must be removed as soon as possible but no later than the end of the work shift.

4- 3 Working Over or Near Water

Any workplace over or near water is considered a dangerous work place, where employees working in such workplaces are exposed to the hazard of slipping, or falling into the water.
Considerable efforts must be made to prevent persons from tripping, falling or being swept into the water, and if it happens, means of rescue and rescue equipment must be provided.

4-3-1 General Regulations:

1. The local weather forecasts and sea conditions should be obtained and publicized at the beginning of each work day or shift.
2. All platforms near water shall be adequately illuminated.
3. Adequate protective clothing and equipment, suitable for the work involved shall be provided and worn.
4. Adequate number of rescuer according to the nature of work performed shall be provided.
5. A first Aider, trained in Cardiac Pulmonary Resuscitation (CPR) and familiar with both rescue and treatment of drowning must be readily available at all workplaces adjacent to or on water.
6. A minimum of two persons shall carry out the job, to ensure that always there are someone who can activate the alarm (distress flares).
7. Due to severe, and high humid weather conditions when working near water, adequate

maintenance activities should be increased to find out and treat any corrosion or excessive wear at all cranes, machinery and equipment unless they are designed to work in such atmospheres.

4-3-2 Scaffolds, Platforms. Gangways, and Fall Prevention:

1. Platforms and gangways must be a minimum of 80 cm wide complete with guard rails and toe-boards. (Fig. # 13).

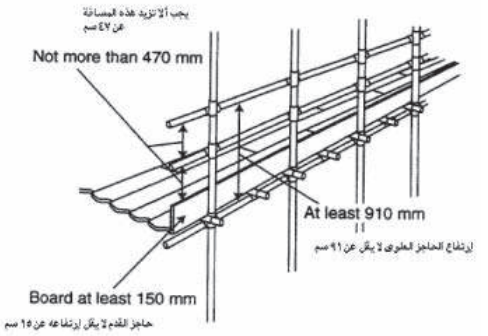


Fig. 13

2. At all edges from which a person might fall into the water, secure barriers or fences are required.
3. Warning notices must be erected at all edges and boundaries near water and set so that they are easily seen by operators approaching the danger point.
4. Access points to and from platforms shall be of adequate strength and secured properly to prevent tripping and falls.
5. Safety nets shall be erected between the platforms and the water surface to save lives and prevent injury. The net shall be inspected frequently for damage and to ensure that it is securely attached to its support.
6. Employees working on platforms or scaffolds must use personal protective equipment to protect them from fall hazards such as safety harnesses and other.

4-3-3 Rescue Equipment and Procedures:

1. Employees working over or near water where the danger of drowning exists shall be provided with approved life jacket or buoyant work vest.
2. Buoyancy aids which is manually inflated shall be able to support even an unconscious person face upwards within 5 seconds (ten seconds if automatically inflated). The person's head will be supported with the mouth and nose well clear of the water.

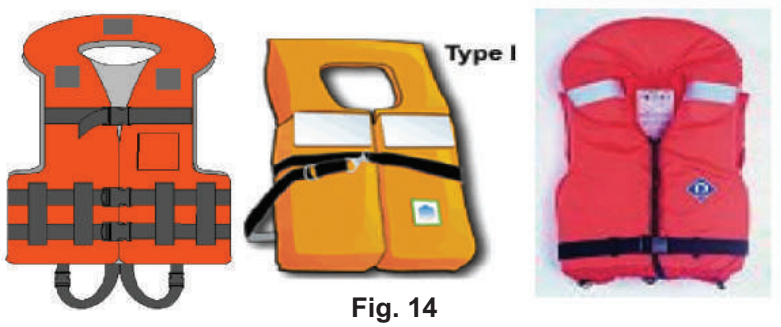


Fig. 14

3. Life jackets and buoyancy aids shall be inspected for defects that would alter its strength or buoyancy. Defective devices shall be removed from service.
4. Lifebuoys (life rings) with rope or cord lifeline (not less than 27 meter length – (100 feet) and according to the height of the work platform above water) attached and the rope should have a knot every three meters for easy holding should be placed in conspicuous positions near the water's edge for use in emergency cases.
5. Lightweight throwing lines of adequate lengths attached to a floating capsule or floating canvas bag shall be provided for rescue operation.
6. Self illuminated lights shall be used when working at night.
7. Employees working over or near water shall be trained on the proper rescue procedures, how to act in case of emergency and how to use the available rescue equipment.
8. The distance between ring buoys shall not exceed 60 meters (200 feet).
9. All rescue equipment shall be inspected on daily basis to ensure that it is in its place, and functioning properly.

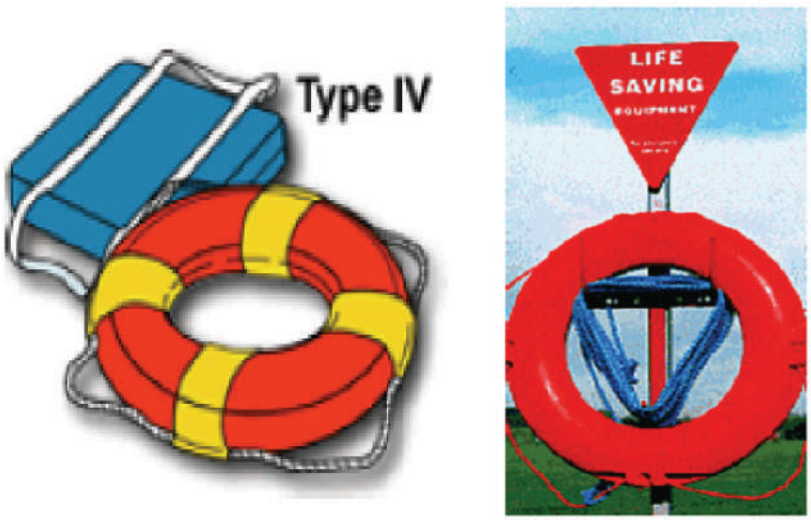


Fig. 15

Fig. 16

4-3-4 Rescue/safety Boats:

1. At least one life-saving skift (boat) shall be immediately available at locations where employees are working over or adjacent to water (Fig. # 17).

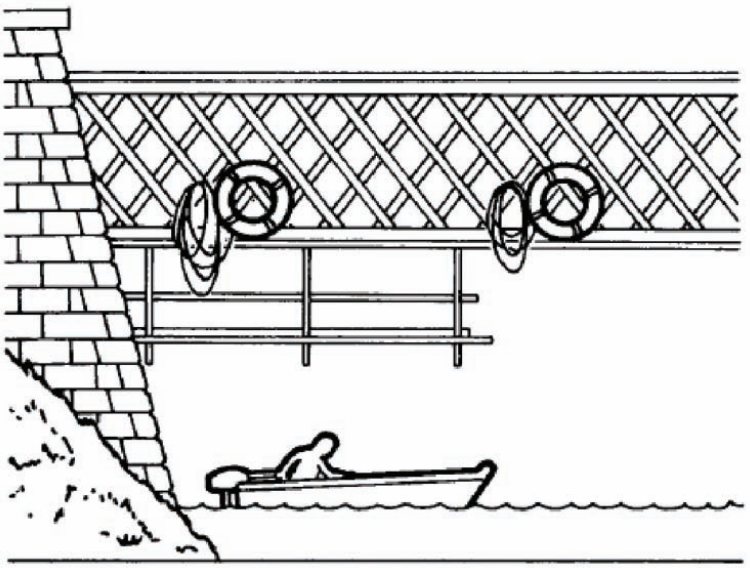


Fig. 17

4-3-5 Rescue Procedures:

1. The number of persons at work shall be periodically checked to ensure that no one is missing.
2. Operative works in pairs so that there is always one to raise the alarm.
3. Each person is trained in what to do in the event of emergency.

CHAPTER FIVE

Fire Protection and Prevention

5.1. Definition of a Fire:

Fire is a chemical reaction which involves rapid oxidation of combustible materials. Three elements must be present to produce a fire; they are fuel or combustible material, oxygen and heat or an ignition source. These elements are representing by the fire triangle as shown in Figure (1). Each face represents one of the elements (fuel, oxygen and heat) while the fourth face represents the fire which is a chemical chain reaction.

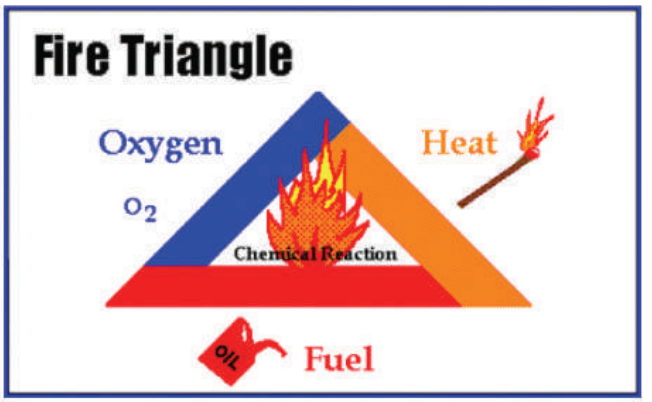


Fig.1

5.2. Classes of Fire:

Fires are classified by the fuel they burn. There are six fire classes according to the European system as follows:

1. Ordinary combustible material fires (Class A)
   These are fires involving solid materials such as wood, paper, cloth, rubber and some plastics. The most effective extinguishing agent is water and dry chemical extinguishers rated for (ABC)

2. Flammable and combustible liquid fires (Class B)
   These are fires involving flammable and combustible liquids such as: motor gasoline, kerosene, solvents and alcohols. The most effective extinguishing agents are foams, Carbon Dioxide and dry chemical. Water is not recommended to extinguish this class of fire as it spreads the fire.

3. Flammable compressed gas fires (Class C)
   These are fires involving liquefied compressed gases such as liquefied petroleum gas (LP-Gas) and acetylene. The best extinguishing agent is dry chemical and carbon dioxide.

4. Combustible metal fires (Class D)
   These are fires involving metals such as sodium, potassium and magnesium. A special dry powder agent is used for this class.

5. Electrical equipment fires (Class E)
   These are fires involving electrical wiring and equipment. The most effective extinguishing agent is dry chemical and carbon dioxide.

6. Cooking oils and Fats fires (Class F)
   This is a new class of fires added to other fire classes. It involves combustible vegetable oil in cooking appliances. A new wet chemical agent is used for this class.

5.3. Fire Extinguisher Types:

The most common and usable fire extinguishers are (Figure 2):

1. Water Fire Extinguishers
2. Carbon Dioxide Extinguishers
3. Dry Chemical Fire Extinguishers
4. Foam Fire Extinguishers

Fig.2

5.4. General Requirements:

1. The contractor shall submit a map showing all firefighting equipment locations, rescue entries, emergency exists, means of egress, assembly points, access to all required firefighting equipment and apparatuses and fire hydrants in the workplace. This map shall be reviewed and approved by the engineer.
2. The contractor shall develop a fire protection and prevention plan throughout all phases of the construction and demolition works. The contractor shall ensure the availability of all required fire protection and suppression equipment as specified in this manual.
3. The fire protection plan shall include all applied procedures in emergency cases, fire accidents in the worksite, and building or worksite evacuation steps. All employees shall be trained on applying those procedures. Regular fire evacuation drills shall be conducted to ensure the effectiveness of those procedures and the name and telephone numbers of the person(s) responsible(s) of the fire protection plan.

4. Manual or automatic alarm systems shall be provided in the workplace to be used in case of fire accidents or any other emergency cases to warn the employees to evacuate the location or the building.
5. A qualified employee in the worksite shall be assigned to regular inspection of all firefighting equipment and ensure their reliable working conditions and shall be provided with appropriate training to perform this inspection.
6. Access to all firefighting equipment shall be kept free from any obstruction and maintained at all times. All construction sites shall be accessible (fire lane shall be provided) to permit approaching of Civil Defense vehicles/equipment through a not less than a 6-meter-(20 feet)-wide unobstructed access way capable of withstanding firefighting equipment loads.
7. All exit routs in construction sites shall be properly protected and free of any debris, fall of hazardous materials or any other obstacles in all times. In case any of these exits is closed, an alternative exit shall be provided.
8. All cars shall park 6 meter (20 feet) away from the new buildings or buildings under construction.
9. Firefighting equipment shall be located in designated places, visible and easily accessible in all times for all employees in the location. Civil Defense personnel shall be able to access all connections/ facilities and guiding valves and all outside fire protection system components in all times. Guiding signs shall be fixed to clearly identify the location of those components when it is difficult to see them.
10. A regular inspection shall be conducted for all fighting equipment and maintaining them in good working condition. Damaged or defective equipment shall be replaced immediately.
11. The contractor shall provide the employees with adequate training on fire fighting procedures.
12. An adequate means of escape shall be maintained. Gangways, doors and stairs shall be kept free of any obstructions at all times In view of the changing nature of the construction operations, escape routes shall be frequently surveyed. Illumination shall be provided in emergency cases in each floor such that illumination intensity shall not be less than 50 lux especially near emergency exits.
13. Adequate emergency exits shall be provided in every building under construction ac cording to the number of employees in the building, and by any means they shall not be less than two emergency exits in each floor above the ground floor.
14. Adequate signs shall be provided in the location or the building to direct to escape routes of the location or the building which shall be used by all employees in emergency cases to reach to the assembly points. (Fig. # 3).

Fig. 3

15. Smoking is prohibited in any place within or on the roofs of the under construction new buildings or even in the buildings under maintenance and enough «No Smoking» signs shall be provided in the location.
16. Any hot works (welding, cutting, heating and burning) shall not be performed without obtaining appropriate hot work permits.
17. Reference is made to the specifications on fire protection and preventions mentioned in the guideline no. (24) issued by the specialized department.
18. Building floors shall be numbered from inside and outside the building to facilitate their recognition in case of emergencies.
19. In demolition operations which include flammable materials, hydrants with fire hoses and water tankers equipped with pumps shall be provided.
20. All emergency exits shall be provided with self-closing, and 60 min. fire resistant doors to prevent the spread of flames and smoke into these exits or to other floors.

5.5.Firefighting Equipment and Systems in Projects under Construction:

5.5.1. Portable equipment:

1. A program shall be prepared to ensure that portable fire extinguishers are fully charged, maintained in a good operating condition and exist in the designated locations at all times.
2. Fire extinguishers shall be located in visible locations, in normal path of travel and shall be easily and readily accessible.
3. Fire extinguishers locations shall be identified with an appropriate size red square fixed above each extinguisher and the wall behind the fire extinguisher shall be painted with red paint if possible.
4. In places where extinguisher cannot be visible as a result of the existence of partitions that prevent its visibility, the extinguisher's place shall be designated by a distinct sign fixed on an appropriate height which refers to the extinguisher's location (figure 4).

Fig. 4

5. All extinguishers shall have clear class-identifying signs for easy selection of appropriate extinguisher class in case of fires (as shown in figure 2)
6. All portable extinguishers shall be fixed on holders, special boxes or on shelves except for wheeled extinguishers.
7. All portable extinguishers shall be mounted on walls on heights not more than the following: (figure 5)

a. 1.5 meters (5 feet) high of the ground for extinguishers which their gross weight are 18 kgs. (40 bounds) or less.
b. 1 meter (3.5 feet) height of the ground for extinguishers exceeds 18 kgs. (40 bounds) weight.

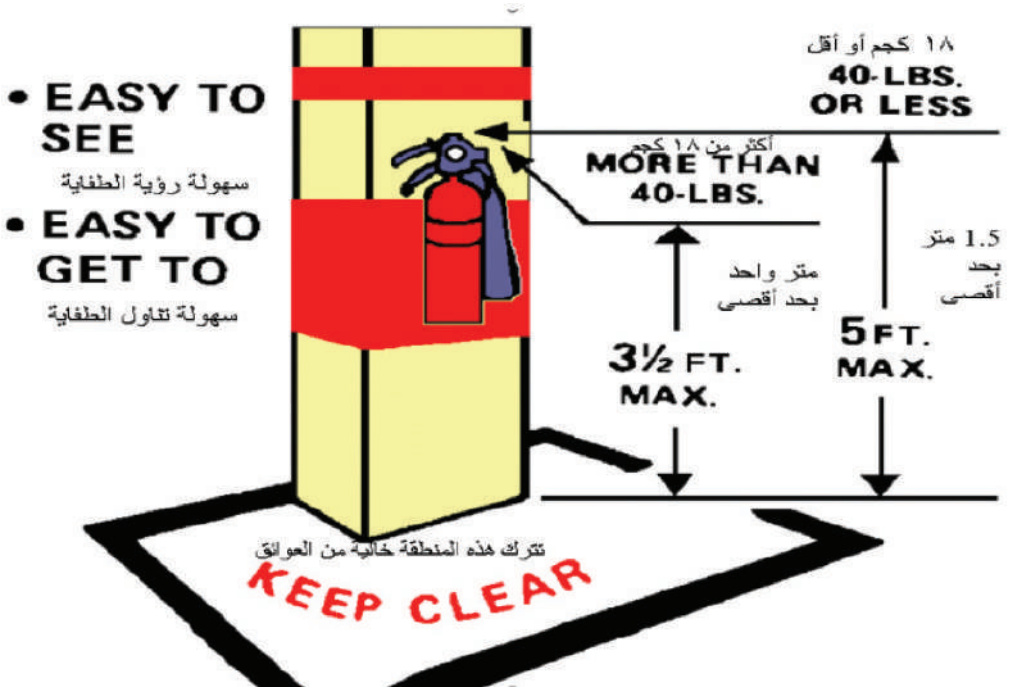


Fig. 5

8. Extinguishers shall be mounted on walls, so that the operating instructions must face outwards.
9. Different types, capacity, and classes of fire extinguishers shall be provided to protect buildings, according to the type of flammable and combustible materials in the building.
10. Fire extinguishers shall be distributed in easily accessible locations and the maximum travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 15 meters (50 feet).
11. At least one portable fire extinguisher according to the class and capacity specified by the concerned authority shall be located in no less than 8 meter and no more than 15 meter away from any storage area of flammable liquids outside the location.
12. Fire extinguishers shall be provided in each floor of the multi-story buildings in accordance with the above specified requirement in addition to one fire extinguisher at least shall be located adjacent to stairways.
13. Wheeled and portable fire extinguishers located in open areas shall be protected against direct sun rays or surrounding atmospheric conditions by using proper covers.
14. In case of using any fire extinguisher, it shall be refilled and returned immediately to its designated place.
15. All portable fire extinguishers shall be inspected at least monthly to ensure their existence in their locations and that their safety seals are not broken and there are no damages or defects.

16. All fire extinguishers shall be annually maintained by inspecting of the mechanical parts and the amount of the charged agent, repelling means of the contents and repairing any defects or replacing them with a good condition extinguisher.
17. A sticker or card shall be fixed on each extinguisher including date of recharging and maintenance with the name and signature of the individual who made the inspection and maintenance.
18. Additional number of spare extinguishers shall be provided to replace any extinguisher needs maintenance.

5.2.2. Fixed Systems:

The contractor shall provide fixed firefighting systems in the multi-story buildings and towers in accordance with the requirements and specifications of the Civil Defense and to give the priority to the early installation for the permenant devices in accordance with the following articles:

1. Dry risers mains shall be provided and installed at each level of of the buildings under construction when the height of the same exceeds 18 meters to 30 meters height, and shall be equipped with controllable outlets on each level to be used by connecting fire hoses or hose reels. These risers shall be equipped with proper inlet at the ground level for water supply by fire brigade from outside the building.
2. Wet risers mains shall be installed in the building when exceeds 30 meters height and supplying it with enough water through tanks and movable pumps installed in different floor levels in accordance with its design by a competent organization authorized by the Civil Defense Administration taking into consideration the building area, required number of risers, flammable and combustible material types, the appropriate water amount to extinguish the fires, type and water tanks size.
3. In case of using some floors for the storage of flammable and combustible materials, additional firefighting systems shall be provided in these places such as automatic water sprinklers or water mist units or any other system, that these systems shall be appropriate and adequate for firefighting according to the storage amounts and types of stored materials.
4. All the specifications and requirements for all firefighting systems and equipment used in the location, shall comply with the specification and requirements prescribed by the Civil Defense.
5. The required water supply for adequate operation of the equipment and firefighting systems in the location shall be made available.
6. The contractor and the consultant shall periodically and continuously ensure that all firefighting systems are properly operating, and the proper maintenance shall be provided.
7. Existing buildings in which construction works are performed (maintenance, décor, partial demolition, additions, etc.) and in which works require disconnect of a part or all fixed firefighting systems, all these systems shall be kept ready for use if the maintenance is not of these systems themselves as they shall be re-operated at the end of each working day, providing that they shall be inspected by a qualified competent person to ensure their return to operation, and in all cases adequate temporary alternative systems shall be provided when they stop working.

Fig.6

5.2.2.1 Fire hoses:

1. Hose cars shall be provided with their special keys and nozzles and other necessary equipment and tools. These equipment and tools shall be kept in a box fixed on these cars or shall be appropriately fixed on hoses' cars (figure 7).
2. Fixed firewater pumps shall be operated for few minutes at least every seven days.
3. Water fire systems shall be empted from water and inspected at least monthly.
4. All fire hoses shall be inspected to ensure they are free of any rottenness at least monthly.
5. Manual equipment, ladders and other additional tools shall be inspected at least every six months to ensure their existence in their locations and that they are in good working conditions.
6. Each hose shall be individually inspected (hydrostatically) on the highest pressure of the pump at least for 3 minutes annually.
7. Hoses shall be carefully dried after each inspection or use and return them to their designated locations (some hoses manufactured from synthetic materials may not need drying)
8. All fire fighting equipment and tools shall be only used for fire extinguishing purposes or training and shall not be used for any other purposes (for example cleaning works)

Fig.7

5.5.3. Automatic sprinkler systems:

In cases when automatic sprinkler systems are required in new buildings priority shall be given to the installation of the systems and prepare them for operation. Hydrostatic testing shall be conducted for the systems once they are installed in each floor and after obtaining the approval of the Civil Defense, they shall be connected with the supplying pipe and shall be operated. An outside alarm shall be installed to produce signs of activation of the system and connecting it with the water pump to connect it with the alarm system.

5.5.4 Telephone Service:

A telephone line shall be provided in the location to inform the Civil Defense in case of emergencies and the location address shall be fixed next to the telephone to facilitate informing.

5.6. Fire Prevention:

5.6.1. Ignition Hazards:

1. Electrical wiring and electrical equipment used for light or power purposes shall be installed in compliance with the requirements of electrical rules of the concerned authority and the requirements specified in chapter (16) of this manual.
2. Internal combustion engine powered equipment shall be so located that the exhausts are well away from combustible materials. When the exhausts are piped to outside the building under construction, a clearance of at least 15 cm shall be maintained between such piping and combustible materials.
3. Smoking shall be prohibited in all construction sites except for the areas previously designated and provided with special procedures for fire prevention.
4. No smoking signs shall be conspicuously posted at all locations except for areas permitted for smoking. (figure 8)

Fig.8

5. Any hot works including welding, cutting, heating and burning shall not be performed without issuing a hot work permit by the contractor after taking all adequate safety precautions and procedures to safeguard the welding operation.

6. Portable battery powered lighting equipment used in connection with the storage, handling or use of flammable gases or liquids shall be of an intrinsically safe design.
7. The nozzles of air, inert gas, and steam lines or hoses when used in cleaning or venti lation of tanks or containers including hazardous concentrations of flammable gases or vapors, appropriate procedures shall be taken to dissipate (discharge) any static electrical charge may be generated to the ground.

5.6.2. Temporary buildings:

1. No temporary building shall be erected where it will adversely affect safe means of entrance to and exit from the workplace.
2. Temporary building, when located within another building or structure, shall be of either noncombustible materials or of combustible materials having a fire resistance of not less than one hour.
3. Temporary buildings shall be located at a distance of not less than 3 meters from any other adjacent buildings or structures. When it is not possible to keep this distance, a special permit shall be obtained from the competent department.
4. The temporary buildings, divided into rooms, shall be provided with doors to help contain the spread of fire.

5.6.3. Open yard storage:

1. Combustible materials shall be stacked with due regard to the stability of stacks and in no case higher than 3 meters if stacked manually and not higher than 4.5 meters if mechanically stacked.
2. Driveways between and around combustible material storage area shall be at least 4 meters wide and maintained free from accumulation of rubbish, equipment or any other articles.
3. The entire storage site shall be kept free from accumulation of unnecessary combustible materials. Weeds and grass shall be kept down and a regular procedure provided for the periodic cleanup of the entire area.
4. Method of pilling shall be solid wherever possible and in orderly and regular piles. No combustible material shall be stored outdoors within 3 meters of a building or adjacent structure.
5. Portable fire extinguishers, suitable for the fire hazard involved, shall be provided at convenient, conspicuously accessible locations in the yard area. The portable fire extinguishers shall be placed so that maximum travel distance to the nearest unit shall not exceed 15 meters.

5.6.4. Indoor storage:

1. Storage shall not obstruct, or adversely affect, means of exit. Materials shall not be stored within one meter of a fire door opening.
2. All materials shall be stored, handled, and pilled with due regard of their fire characteristics.
3. In-compatible materials, which may create a fire hazard, shall be segregated by a barrier having a fire resistance of at least one hour.
4. Materials shall be stored to minimize the spread of fire internally and to permit convenient access for firefighting.
5. Clearance shall be maintained around lights and heating surfaces to prevent ignition of combustible materials.

6. All aisles leading to firefighting equipment shall be kept free from any obstruction at all times. All construction sites shall be accessible to permit the entrance of Civil Defense vehicles/equipment through not less than a 6-meter-(20 feet)-wide unobstructed access way capable of withstanding firefighting equipment loads.

5.7 Flammable and Combustible Liquids:

5.7.1. General requirements:

1. Only containers and portable tanks made of material suitable for storage and handling of flammable and combustible liquids shall be used.
2. Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.
3. No more than 10 gallons of paints and flammable and combustible liquids shall be stored at night in or within 15 meters (50 feet) of the building unless it is stored in an approved flammable liquid storage cabinet in a designated area specified by the project administration.
4. Flammable liquids shall be kept in appropriate safe closed containers (Safety Cans) and stored in a well ventilated storage room either located in a safe area or constructed of fire-resistant concrete, masonry or metal structure.
5. Wherever flammable liquids are stored, all reasonably practicable steps shall be taken to ensure that any flammable liquid which leaks, split or otherwise escape shall be contained or immediately drained off to a suitable container or to a safe place or otherwise treated to make it safe.
6. Outdoor portable tanks shall not be nearer than 3 meters from any building. Each tank shall be surrounded by a dike walls with at least 110 % volume of the total gross capacity of the tank in a manner to contain any leakage and prevent accumulation of spilled flammable liquids to prevent fire. Every two or more portable tanks shall be separated by at least 1.5-meter-clear area.
7. Containers and tanks shall be labeled with the product/material name and «Keep away – Flammable». Containers, in excess of 60 gallons, shall be labeled with «Keep 15 meters clearance of the building».
8. Within 60 meters of each portable tank, there shall be a 5-meter-wide clear access way to permit approach of fire control apparatus.
9. Storage areas shall be kept free of weeds, debris, and other combustible material not necessary to the storage.
10. At least one portable fire extinguisher of the type & capacity as specified by the Civil De fense Department (The concerned authority) shall be located outside of, but not more than 3 meters from, the door opening into any room used for storage of flammable or combustible liquids.
11. At least one portable fire extinguisher, of the type & capacity prescribed by the concerned authority shall be located not less than 8 meters, nor more than 15 meters, from any flammable liquid storage area.
12. Appropriate warning signs shall be posted near flammable liquids storage areas. reference to technical guideline # (40)

5.8. Liquefied Petroleum Gases (LP-Gas)

5.8.1. When LPG cylinders are stored in construction sites, the following provisions shall be applied:

1. They shall be kept on ground level and readily accessible.

2. They shall be kept in open air, protected from unauthorized access by a fence not less than 2 meters high.
3. They shall be stored in an upright position and tightly tied to prevent fall hazards.
4. They shall be adequately sheltered to be protected against sunrays.
5. They shall be kept away from all flammable or combustible materials.
6. They shall be tagged with «LPG – Highly Flammable» and «No Smoking or Naked Flame»
7. LPG cylinders' regulators shall be examined and appropriately designed to capable of withstanding an operational pressure more than 250 PSIG. Cylinder hoses shall be examined to withstand operational pressure not less than 350 PSIG, the hose length shall not exceed 2 meters.
8. A safe separated distance not less than 6 meters (20 feet) shall be maintained between LPG cylinders and other gas cylinders such as oxygen, chlorine and ammonia. If this space cannot be provided because of limited space area, a partition of not less than 1.5 meters (5 feet) high shall be erected and resist fire for not less than 30 minutes.
9. LPG storage locations shall be provided with appropriate firefighting extinguishers as specified by the concerned authority.
10. All installations and maintenance shall be performed by trained LPG fitters. All LPG pipelines and hoses shall be tested for safe working/leak conditions.

5.9. Other Combustible Materials:

5.9.1. Combustible Materials Storage:

Construction combustible materials shall be stored at a distance not less than 6 meters (20 feet) from the building under-construction or under-maintenance except for the following:

1. Construction materials under installation in any floor.
2. Materials can be stored in car parking areas if these areas are equipped with automatic fire sprinklers and vertical protected openings.

5.9.2. Combustible wastes and debris:

Wood, cartoon and packaging and other similar materials shall not be accumulated inside the buildings and shall be daily disposed of.

5.10. Special Equipment:

5.10.1. Engine Equipment:

1. Equipment operated by electricity is preferable to be used inside buildings, rather than equipment operated with fuel.
2. Equipment and machinery shall be allowed to cool down to the surrounding temperature before re-fueled. These equipment shall not re-fueled while running.
3. Equipment and machinery shall be placed in such a way that the direction of its exhaust pipes is directed toward an opposite direction to the location where combustible materials are present. The exhaust pipe is preferred to be directed outside the building.

5.10.2. Temporary Heating Devices:

1. Temporary heating devices powered with liquefied petroleum gas shall be listed and shall be installed, used and maintained in accordance with the specifications of the manufacturer.
2. Heating devices shall be installed away from combustible materials. They shall be refilled with fuel in accordance with the approved provisions.

3. Heaters shall not be used in areas painted with flammable materials. Propane or Kerosene heaters are prohibited to be used inside buildings. Heaters shall not be kept unattended while working.
4. Heating devices shall be located at least 90 cm. (3 feet) away from flammable materials in a safe place protected from fall hazards.

5.10.3 Asphalt and Butch men Heaters:

1. Bitumen and tar heaters shall be placed not less than 6 meters (20 feet) away from any combustible materials or combustible floors or building openings.
2. Except heaters fitted with thermostat, a watch person shall be attended at a distance of 30 meters (100 feet) to supervise the heater during its operation.
3. No obstacles shall be allowed between the watch man and the heater. The heater shall be provided with secure covers.
4. One dry powder 9 kg (20 pounds) fire extinguisher shall be placed at a distance of 10 meters (30 feet) away from any heater during operation.
5. At least one dry powder 9 kg (20 pounds) fire extinguisher shall be placed on roof during the application of butch men.
6. Cleaning rags saturated with asphalts and butch men shall be kept away from combustible materials and structure to prevent fires caused by spontaneous ignition of these rags.

5.10.4 Removal of Wastes and Debris:

1. All wastes and debris accumulated in the building shall be removed on daily basis, and on close intervals as necessary to keep the place clean and tidy.
2. Waste baskets shall be provided inside and outside the building, wastes and debris shall be removed daily.

5.11 Drums:

1. Drums which contains a flamable liquids shall be stored in a vertical position on pallets to minimize puncturing due to forklifts vehicles handling drums by their side walls.

5.12 General Fire Prevention Measures:

1. Procedures to be followed when fire occurs, shall be written in Arabic language, English language and other most common language on site, and shall be displayed at entrances and exits, and near telephone sets. These procedures include important telephone numbers, how to evacuate the building correctly.
2. Number of workers shall be designated and trained on what they shall do in case of a fire on site.
3. Regular training on basic measures on fire fighting shall be provided to all employees on site to ensure that they are able to operate and use fire fighting equipment correctly.
4. All employees shall be trained on steps to be taken should an emergency occur, how to safely evacuate the building and the location of the assembly points.
5. Smoking is prohibited at all or in vicinity of locations where flammable and combustible materials are stored. Areas shall be conspicuously posted: “NO SMOKING”.
6. Smoking and using of open flames are prohibited at enclosed facilities.
7. Non-compatible materials, which may create a fire hazards, shall be segregated by a barrier having a fire resistance of at least 1 hour.
8. A distance of not less than 6 meters (20 feet) shall be maintained between buildings and

structures and sheets and other combustible materials used in construction activities.

9. All routes and passageways leading to the areas where combustible materials are present shall be maintained free of any obstacles.
10. When a fire occurred at any site or building under construction, the contractor/consultant engineer in coordination with the specialized department shall carry out a comprehensive assessment, and testing to the building to ensure it is safe and how bad it is affected by fire, and determine the suitable engineering solutions and approve it from the specialized department.

CHAPTER SIX

Signs, Signals and Barricades

Introduction:

Hazards exist in every construction workplaces, which require adequate identification and explanation to warn employees against risks arising from such hazards.

Distinctive guiding colors and signs are the best means to be used to warn and inform employees of different hazards and any special precautions that may be required. Distinctive colors identify different hazard types, thus help employees to recognize degree of risk and consequently minimizing potential injuries.

Sings, signals and barricades conform to a unified international system. When other warning sign systems rather than those specified in this manual are used, they shall be approved by the Department concerned in Dubai Municipality.

6.1. Definitions:

6.1.1. Signs:

Are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazard exists.

6.1.2. Signals:

Are moving hand signs or warning flashing devices moved as required provided to workers, such as flagmen, to warn of possible or existing hazards.

6.1.3. Tags:

Are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

6.1.4. Barricade:

It means a temporary obstruction made of wooden boards, metal plates or any other appropriate material equipped with retro-reflection banners. The banners shall be in white and red or yellow and black colors inclined by a 45 degree from the horizontal in the direction of travel. (fig. # 1).

Fig. 1

6.2. General Requirements:

1. Every contractor or subcontractor shall provide appropriate signs, signals and barricades to warn the employees of hazards to prevent accidents in each work site.

2. Signs, signals and barricades required in the worksite shall be visible at all times when work is being performed. The colors and symbols used shall conform to international standards.

3. Wording (text) on the warning signs shall be in Arabic, English and other language known to majority of persons in the workplace.

4. Guiding and warning signs shall include a symbol/pictorial panel in addition to the text.

5. All employees shall be informed as to the meaning of the various signs, tags, and barricades used in the workplace and what special precautions are required.

6. All signs, signals and barricades shall be free from sharp edges and shall be furnished with rounded corners to prevent injuries to employees.

7. Exit signs affixed to emergency exits shall be of a type which store energy, and shall emit light (stored energy) when the power shuts off and when it is invisible to provide some light to assist employees to find the location of emergency exits during emergency.

8. Exit signs shall be lettered in legible red letters not less than 15 cm (6 inches) high.

9. Signs shall be posted in visible locations and the wording on any sign should be concise and easy to read for intended viewing distance. The size of lettering must be as large as possible for intended viewing distance and shall not be less than the limits specified below in table (1). Safety officers on site shall determine the appropriate locations of signs and barricades.

Table (1)

The relationship between sign viewing distance and letter size

Viewing Distance (meter)	Minimum letter size (cm)
60 – 75 meter	12.5 cm (5 inches)
45 – 60 meter	11.5 cm (4.5 inches)
36 – 45 meter	10 cm (4 inches)
32 – 36 meter	9 cm (3.5 inches)
27 – 32 meter	7.6 cm (3 inches)
23 – 27 meter	6.35 cm (2.5 inches)
18 – 23 meter	5 cm (2 inches)
12 – 18 meter	3.8 cm (1.5 inches)
9 – 12 meter	2.5 cm (1 inch)
6 – 9 meter	1.9 cm (0.75 inch)
3 – 6 meter	1.25 cm (0.5 inch)
3 or less meter	0.635 cm (0.25 inch)

6.3. Warning Signs (Fig. # 2):

6-3-1 Colors shall be used to indicate the purpose of the warning sings as follows:

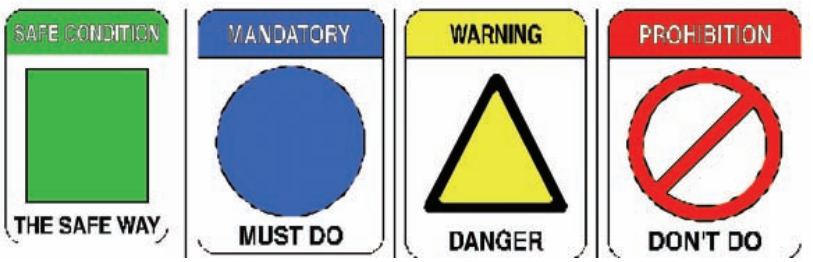


Fig.2

6-3-2 Red color shall indicate the different firefighting equipment such as fire extinguishers and others (fig. # 3).

Fig.3

6.4. Safety signs:

6-4-1 The sign types, colors, and shapes surrounding the symbol shall be as shown in table (2):

6-4-2 Safety signs shall be in rectangular shape. They shall have an upper panel indicating intent symbol surrounded with a circle, triangle or rectangular and the lower panel for symbol wording in Arabic, English and other language known to majority of persons in the workplace.

Table (2)

Colors and Shapes Used in Safety Signs

Sign Type	Background Color	Symbol Color	Surrounding Shape
Prohibition	White	Black	Red circle crossed with a line
Waning / Caution	Yellow	Black	Black Triangle
Informational	Green	White	Rectangular
Mandatory	Blue	White	Circle
Miscellaneous	As approved by the authority concerned		
Traffic	As approved by the authority concerned		

6.4.3. The signs are classified according to their purposes as follows:

6.4.3.1. Prohibition Signs:

These signs shall indicate imminently hazardous situation. The symbol on the sign shall indicate prohibition of any work such as “No Smoking” “No Use of Near Open Flame» «No Admittance» and other similar signs as shown in figure 4.

No Aperate No Admittance No Smoking Do Not Operate

Fig.4

6.4.3.2. Warning/Caution Signs:

These signs shall be used to warn employees against potential hazards and unsafe practices. They shall include existing hazards such as toxic gases, hazardous chemicals and similar warnings (figure 5).

Radiation Hazard Flammable Material Beware Electricity

Fig.5

6.4.3.3. Safe Condition Signs:

These signs shall be used to communicate necessary information to all persons concerned for their safety during their presence in the workplace (figure 6).

Emergency Eyewash Emergency Shower Assembly Point

Fig.6

6.4.3.4. Firefighting Signs (figure 7):

These signs shall be used to guide employees to locations of firefighting equipment in the work-place.

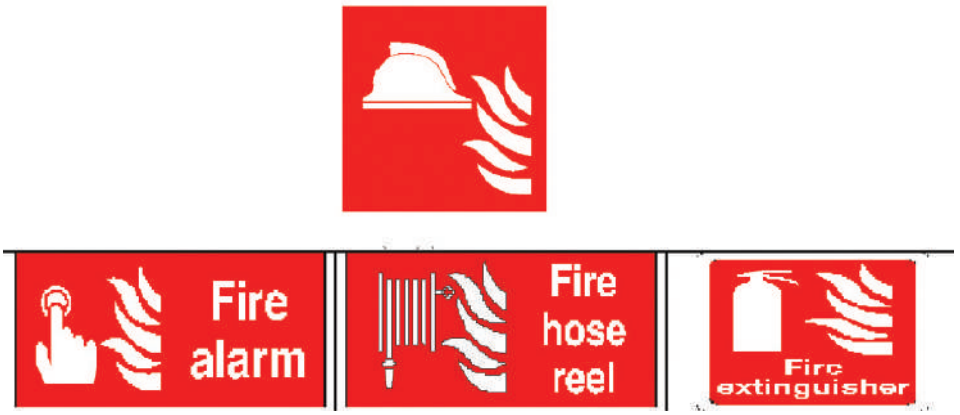


Fig.7

6.4.3.5. Mandatory Signs (Figure 8):

Mandatory signs shall be used in worksites which require particular precautions such as welding, painting, scaffolding, confined spaces and similar locations. Persons in such worksites shall be obliged to use any of the personal protective equipment specified in Chapter 4 of this manual. Wher-ever these signs are posted or exist shall be mandatory (figure 8).

Fig.8

6.4.3.6. Miscellaneous:

Any type of signs which are not previously mentioned such as:

1. Traffic signs (figure 9):

Construction areas shall be posted with legible traffic signs at points of hazards. They shall conform to standards set by the authorities concerned.

Fig.9

2. Directional arrow signs (Fig # 10):

Directional arrow signs shall be used to indicate the direction to accesses or exits of a location, fire exits, firefighting equipment, or first-aid locations.

Fig.10

6.5. Signals:

6.5.1. Vehicle traffic control

1. A flagman or other appropriate traffic control shall be provided for traffic controls within and outside the worksite (figures 11& 12).

Fig. 11

Fig.12

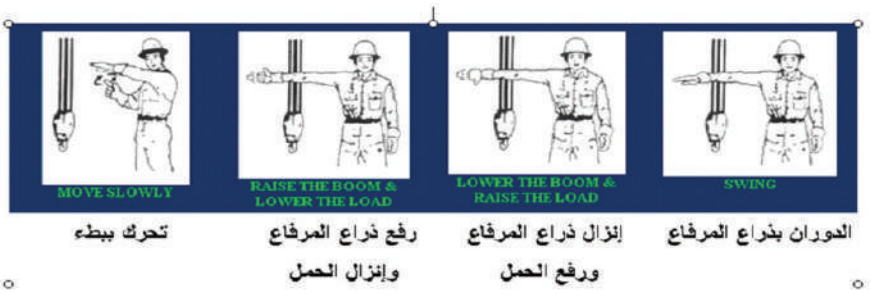
2. flagmen shall use red flags not less than (300 mm X 200 mm) or hand signaling with a diameter not less than (250 millimeters) and in periods of darkness, red lights shall be used.
3. Flagmen shall be provided with and shall wear a red or orange warning garment while flagging. Warning garments worn at night shall be of a suitable reflecting material or straps (figure 13).

Fig.13

6.5.2. Crane and Hoist Signals (figure 13):

Hand signal system shall be used by a qualified person (Banks man) for directing crane operator, no other person is allowed to give this signals to the crane operator, except for emergency stop signals, which can be given by any person.

Crane Signals



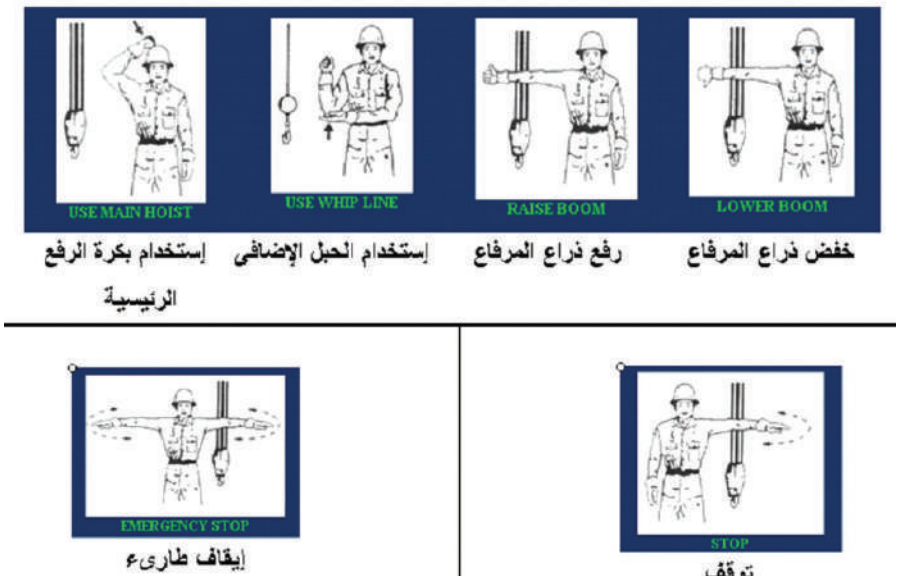


Fig. 14

6.6. Accident Prevention tags:

1. Accident prevention tags shall be used as a temporary means of warning employees of existing hazards, such as defective tools and equipment etc. They shall not be used in place of or as a substitute for accident prevention method.
2. Colors used in accident prevention tags shall conform to those used in warning signs. Dimensions of accident prevention tags shall conform to the local or international specifications approved by the authority concerned (14 cm X 7 cm) (figure 15).

S.N.	Keyword/Phrase	Keyword/ Phrase Print Color	Background Color	Tag Color
1	“DO NOT OPERATE”	White	Red	White
2	“DANGER”	White in red oval	Black	White
3	“CAUTION”	Yellow	Black	Yellow
4	“OUT OF ORDER” “DO NOT USE”	White	Black	White

Figure 15

6.7. Barricades (figures 16):

Fig.16

1. Barricades in the form of railing for protection of employees against any fall into different levels, opening or warning against any dangers nearby.
2. Barricades for protection of employees and public relating to street and highway traffic diversions, excavation trenches and pits.
3. Barricades for protection of public against material falling from building under

construction, building material interfering with the pedestrian and vehicular movement in public streets/highways or public areas shall be provided by the contractor before the start of work as advised by the Specialized Department in Dubai Municipality.

4. The contractor shall arrange for perimeter fencing/sheeting to protect the public from hazards.
5. Flashing amber lights shall be used to warn at night.
6. Plastic or concrete traffic barricades may also be used.
7. The contractor shall obtain approval for all works in the road corridor from the authorities concerned.

6.8. Some warning signs of chemical hazards (figure 22):

Fig. 17

6.9. Low Flying warning lights

All buildings, tower cranes, hoists, high installations, structures shall be provided with warning lights for low flying in accordance with the regulations of Dubai Civil Aviation Authority in Dubai.

CHAPTER 7

Material Handling and Storage

Introduction:

Cement, masonry, reinforcing steel, timber and other materials are important and necessary for construction works. They should be protected against damages resulting from bad storage and/or adverse effect of various atmospheric conditions in the work environment.

This chapter addresses safe methods of storage, appropriate storage sites and waste disposal methods of construction materials with regard to each material's nature. In addition, it sets forth the applied methods of material handling and transfer whether manually or by power-operated handling equipment and machinery.

7.1. General Requirements:

1. The contractor shall prepare a sketch of the construction site identifying material storage areas and entrances and exits thereof.
2. The storage area shall have safe conditions such as provision of necessary safety equipment, fire extinguishers, illumination ... etc.
3. Guidelines identifying types, hazards, handling and the maximum safe load limits of materials stored in this area shall be conspicuously posted in the storage entrance.
4. All materials stored shall be stacked or racked to prevent sliding, falling or collapse.
5. Loads stored on floors, scaffolds, platforms or any temporary structures shall not exceed the designed allowable floor loads. Maximum safe load limits of each floor shall be conspicuously posted in all storage areas and shall not be exceeded (figure 1).

Fig. 1

6. Storage areas shall be adequate to provide safe and free movement of employees, equipment and machinery.
7. Aisles and passageways shall be kept clear to provide free and safe movement of employees and material handling equipment. Such areas shall be kept in good repair, appropriately and periodically maintained. They shall be of such suitable width for stored material nature and method of material handling.
8. All material in bags or stored in tiers, unless racked, shall be stacked, blocked, interlocked and limited in height so that it is stable and secured against sliding or overturning. Material more than 10 bags high shall be stacked by stepping back the layers and in no case higher than 4 meters.

9. Unauthorized persons shall be prohibited from entering storage areas.
10. Combustible liquids, gases and greases shall be stored in areas designed for this purpose. A clearance of not less than 15 meters shall be maintained between a storage area and any ignition source. A clearance of not less than 4 meters shall be maintained between the combustible materials and any electrical source. Smoking shall be prohibited in such areas and signs, tags and additional barricades shall be provided when necessary.
11. No material shall be stored behind exit doors and emergency exits in particular. A clearance of not less than (1) meter shall be maintained behind these doors, and kept clear and free from obstructs. Runways leading to emergency exits shall not be obstructed or used for any other purpose.
12. When a difference in road or working levels exit, means such as ramps, blocking, or grading shall be used to ensure the safe movement of vehicles between the two levels.
13. Material stored inside buildings under construction shall not be placed within (2) meters of any hoist way or inside floor openings, and not within (3) meters of an exterior wall which does not extend above the top of the material stored.
14. When materials stored adjacent to a wall, the wall shall be ensured not to be endangered by falling or collapse of stored materials or load side-effects of storage.
15. Employees required to work on stored material in silos, tanks and similar storage areas and exposed to a fall hazard of a distance more than 2 meters shall be equipped with suitable lifelines and safety belts (figure 2).

Fig.2

16. Incompatible materials shall be segregated in storage.
17. Bagged materials shall be stacked or layered by taking adequate precaution to prevent collapse of the piles.
18. Reinforcing steel, pipe, bar stock and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent spreading or tilting.
19. Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion or pest harborage.
20. Materials shall not be stored on scaffolds or runways in excess of supplies needed for immediate operations or in excess of safe load limits of these floors.
21. Storage of materials shall be done so as to ensure the best usage and handling of any stored material with regard to the stability and order of other stored materials.

7.2. Storage of Materials:

7.2.1. Masonry

1. Bricks shall be stacked on an even, solid surface.
2. Brick stacks shall not be more than 2 meters in height.
3. When masonry blocks are stacked higher than 2 meters, the stack shall be tapered back one half block per tier above the 2 meters level.
4. The stacked blocks shall not be more than 4 meters high in all cases.
5. Adequate clearance distance shall be maintained between masonry blocks for free movement and handling.

7.2.2. Lumber:

1. Used lumber shall have all nails withdrawn before stacking (figure 3).

Fig. 3

2. Lumber shall be stacked on level and solidly supported sills.
3. Lumber shall be so stacked as to be stable and self supporting.
4. Lumber members shall be stacked level and stable and partitions, if used, shall be erected orthogonally with lumber members.
5. Lumber piles shall not be stacked beyond a safe height of 3 meters if lumber to be handled manually and 4.5 meters if handled by mechanical equipment (figure 4).

Figure (4)

7.2.3. Cement and Lime:

1. Bags of cement and lime shall be stacked 10 cm (4 inches) above land on a dry and level surface. The bags shall not be stacked and interlocked more than 10 bags high. Worn bags shall be removed to prevent spreading of their contents and covered to be protected from atmospheric conditions.

2. The top of the cement bags stack shall be maintained level and stable at all times particularly during un-stacking and unloading (figure 5).

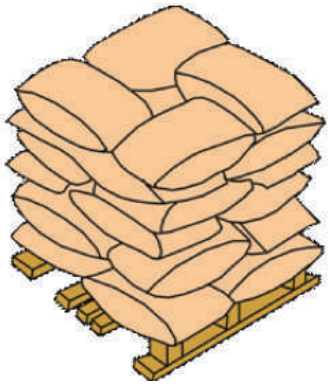


Fig.5

3. The storage area shall be adequate for orderly cement stacking with due regard to the best usage of stored bags.
4. Clearance of at least 60 cm shall be maintained between the cement stacks and the storage walls.

7.2.4. Precast Concrete:

1. During handling of precast concrete members, employees shall be kept clear from the handling area.
2. Precast concrete members shall be adequately supported to prevent collapse during loading and stacking and ensured not to be placed on each other.
3. Precast concrete members shall be stacked on solid, level surfaces.

7.2.5. Reinforcing and Structural Steel:

1. Reinforcing and structural steel shall be piled according to their measurements in separated bundles away from roadways.
2. Structural steel shall be securely piled to prevent members sliding off or the pile toppling over.
3. Reinforcing steel shall be stored on floors above land with partitions to permit convenient raising and lowering process.

7.2.6. Stone Blocks:

1. Materials shall be separated by concrete walls or steel bridges designed so as to withstand the material loaded thereon provided that stored materials shall not exceed the wall's height.
2. When stone blocks are stacked, the stack shall not be kept in vertical position or tapered back.

7.2.7. Cylindrical Material (figure 6):

1. Cylindrical materials, unless racked on shelves with tilting-preventive edges, shall be stacked in bundles where each two adjacent cylinders or pipes are tied together so as to prevent spreading or tilting.

2. Cylindrical materials shall be piled according to their type and size on a solid and level surface.
3. Stacked pipes shall not be higher than 1.5 meter and adequately secured so as to be stable.
4. Either a pyramid or wedged stack shall be used.
5. Where a wedged stack is used, the outside pile or pole shall be securely chocked. Wedged stacks shall be tapered back at least one pile or pole in each tier.
6. Before cutting the tie wires, cylindrical stacks shall be maintained stable and no person shall be on the unloading side of the carrier.

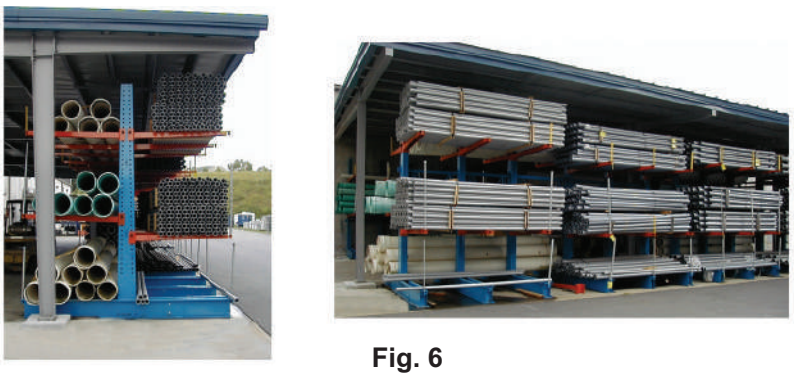


Fig. 6

7.2.8. Dust-Producing Material:

1. Dust-producing materials such as loose cement shall be stored in silos or tanks or similar containers. All necessary precautions shall be taken, during storage and transportation of dust-producing materials, to prevent spreading of dust and to provide employees with necessary personal protective equipment.
2. Obtaining of necessary licenses from the competent Department and «No Objection» certificate from other authorities concerned shall be required for the establishment of mellow cement plants within the construction sites provided that the plant shall conform to the environment protection and safety guidelines issued by the competent Department.

7.3. Disposal of Waste Materials:

1. Debris shall not be thrown from upper stories, but be removed either by machinery or enclosed tilted passage/enclosed chutes. Waste material shall be kept in special containers to ensure safe disposal. In case no containers exist, accumulated debris shall be surrounded by railing or wall of such strength as to withstand the impact of different loads (figure 7).

Fig. 7

2. All scrap lumber, waste material and rubbish shall be removed from the immediate work area as the work progresses.
3. Disposal of waste material or debris shall be as per the Dubai Municipality Regulations.
4. Garbage chute shall have such appropriate opening diameters suitable for the type of debris and constructed of such strong materials capable of withstanding the impact of materials loaded therein and securely and adequately attached to the building.
5. The contractor shall periodically inspect garbage chutes to ensure their efficiency and stability.
6. All solvent waste, oily rags and flammable liquids shall be kept in fire resistant/metal containers with lid until removed from worksite.
7. Debris of maintenance or décor works in structured and inhabited buildings shall be accumulated in metal containers for safe disposal.

7.4. Material Handling:

7.4.1. Manual Lifting:

1. No employee shall be asked to carry loads above his capacity and in any case no load shall exceed 32 kgs. as specified in Table (1) (figure 8).
2. Where possible, mechanical lifting equipment shall be used (figure 9).

Table (1)

Lifting or lowering of loads by unspecialized employees in material loading and lowering in repetitive short intervals.

WHO and Unified Arabic Codes for Building Execution and Design (UACBED)

General Safety Code on Construction Projects

Employee Age (Years)	Allowable Load Limits for Manual Lifting (Kgs.)
16-18	24
18-20	30
20-35	32
35-50	26
More than 50	20

Fig. 8

Fig. 9

3. Materials in the worksite shall be moved by hand trucks, forklifts, dump bodies, mechanical pulled trucks or any other mechanical equipment.
4. Appropriate aisles for material movement by mechanical devices shall be prepared and marked with suitable signs for safe movement. These aisles shall be kept clear from any obstructs and pedestrians shall not be permitted to use them.
5. Forklifts, dump bodies and other mechanical handling equipment shall not be operated otherwise than by personnel designated by authorities concerned and a responsible company approved by Dubai Municipality. They shall be professional in operating and directing such equipment.
6. All materials subject to dismantling, gliding or rolling shall be piled for transfer and handling.
7. Whenever material is to be moved by hands, the material size shall not be above the size which the employee can easily move and bulky materials which restrict visibility shall not be moved.

7.4.2. Mechanical Handling Equipment and Appliances:

7.4.2.1. Forklift Trucks (figure 10):

Fig. 10

1. The forklift truck shall be:
    a. of sound construction, adequate strength and free from patent defect.
    b. Properly and periodically maintained.
    c. Provided with overhead protection for the driver.
    d. Provided with an alarm and a buzzer.
    e. Provided with a reverse alarm horn.
    f. Thoroughly examined by an approved inspection body every 12 months and obtained a safety certificate.
2. No person other than the authorized person who is trained on forklift driving with a valid driving license issued by UAE and training and qualifying certificate approved by Dubai Municipality shall operate forklift trucks.
3. No attachment shall be incorporated on the forklift unless approved by the manufacturer (importer).
4. All persons, drivers and assistant drivers shall be thoroughly conversant with the factors which affect the stability of the forklift in operation.
5. Forklift driver shall lift the load for a distance of at least 20 cm above land to ensure the stability and balance of the load before continuing lifting and moving.
6. The driver or any part of his body shall be prohibited to be out of the driving cabin during lifting processes.
7. Maximum allowable loads specified in the metal placards affixed on forklifts shall not be exceeded.
8. Reference shall be made to the technical guideline no. (33) on forklifts.

7.4.2.2. Excavators

1. Equipment license and safety certificate issued by the authority concerned shall be valid and the equipment is in a safe operating condition.
2. The contractor shall periodically maintain the equipment in accordance with the recommendations and requirements of the manufacturer.
3. No person shall be allowed to work or stand near the operating boom or the tail-swing lifting point.
4. When the excavator is being adopted for use as a crane, slings shall be secured to a correctly designed and manufactured lifting point by a competent authority.
5. No person shall stand under the load when using an excavator as a crane.

7.4.2.3. Conveyors:

1. Means of stopping the motor or engine shall be provided at the operator's station. Conveyors systems shall be equipped with audible warning signal to be sounded immediately before starting up the conveyor.
2. If the operator station is at a remote point, similar provision for stopping the motor or engine shall be provided at the motor or engine location.
3. Belt conveyors shall be fitted with emergency trip wires or stop buttons, which must be fully operative at all times.
4. Emergency stop switches shall be arranged so that the conveyor cannot be started again until the actuating stop switch has been reset to running or «on» position.
5. Screw conveyors shall be guarded to prevent employee contact with turning screws.
6. Where a conveyor passes over work areas, aisles or thorough fares, suitable guards shall be provided to protect employees required to work below the conveyors.
7. All crossovers, aisles, passageways shall be conspicuously marked by suitable signs.

8. Conveyors shall be locked out or otherwise rendered inoperable and tagged out with a «Do not operate» tag during repair and when operation is hazardous to employees performing maintenance work. All precautions for a conveyor's lockout and tag-out procedures shall be taken.
9. No person shall be allowed to ride on a conveyor.
10. Guards shall be provided at all pulleys and belt nips and at all idlers and other places where the risk of trapping exists.
11. All moving parts of the conveyor shall be covered and guarded to protect employees against their hazards.

7.4.2.4. Operating procedures of material handling equipment and plant:

1. All the earthmoving and mechanical handling equipment shall be operated as per the manufacturer's instruction taking adequate precautions at all stages of its operation.
2. These equipment shall be thoroughly examined by a responsible inspection body approved by the Municipality every 12 months and obtained a safety certificate.

7.5. Tires installation and maintenance:

1. A safety tire rack or protective cage shall be provided and used when inflating, mounting and dismounting of tiers.

Fig.11

2. Heavy machinery, equipment, or parts thereof, which are suspended or held aloft by use of slings, hoists or jacks, shall be substantially blocked to prevent falling or shifting before employees are permitted to work under or between them. Bulldozer and scraper blades, end loader buckets, dump bodies, and similar equipment, shall be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position with the motors or engines stopped and brakes set.
3. Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and parking brake set (figure 12).

Fig. 12

4. Battery charging:

The use, care and charging of all batteries shall be followed:

- Suitable ventilation shall be provided to ensure diffusion of the gases fr om the battery to prevent the accumulation of an explosive mixture (figure 13).

Fig. 13

- Racks and trays shall be of acid resistant construction.
- Floors shall be of acid resistant construction with suitable slope and appropriate discharge system for the protection against acid accumulation.
- Face shields, aprons and rubber gloves shall be provided for employees to protect them against acid hazards (figure 14).

Fig. 14

- Facilities shall be provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage.
- Material safety data sheets shall be provided.

5. Access roadways and grades:

- The contractor shall ensure that the prepared or allocated access roadways for the move of construction equipment or vehicles shall be so constructed and maintained as to generally withstand the movement of the equipment and vehicles involved.
- No contractor shall move or cause to be moved construction equipment or vehicles upon any access roadway or grade unless the access roadway or grade is constructed and maintained to accommodate safely the movement of the equipment and vehicles involved

7.6. Rollover Protective Structures (ROPS):

1. Material handling equipment such as rubber-tired, self propelled scrapers, rubber-tired front end loader, dozers, wheel type tractors, loaders, wheel type tractors, crawler tractors and motor graders used in the construction sites in the Emirate of Dubai, shall be equipped with rollover protective structures to minimize the possibility of the opera tor/driver being crushed as result of a rollover or upset in case of a complete overturn of an equipment.
2. ROPS removed for any reason shall be remounted with equal quality, bolts or welding as required for the original mounting.
3. Each ROPS shall have the following information affixed to the structure:
    - Manufacturer or fabricator's name and address;
    - ROPS model number, if any;
    - Machine make, model, or series number that the structure is designed to fit.
4. ROPS shall be so designed and constructed so as to withstand at least two times the

weight of the equipment when overturned.

5. Safety belt shall be provided and the contractor shall ensure that all heavy equipment operators use the safety belt during deriving and operating the equipment.
6. Any person other than the driver shall be prohibited to ride the equipment during driving and operation of the equipment in different construction worksites.
7. No person other than the trained operator shall operate the heavy equipment.
8. All machines such s rollers, compactors, front-end loaders, excavators, bulldozers and similar equipment shall be equipped with a horn, distinguishable from the surrounding noise level with a flashing light to be used when the equipment derived in reverse.

Chapter 8

Scaffolding Safety

Introduction:

A scaffold is an elevated temporary working platform used to support workers, materials and tools during construction work.

It is being used when it is not possible to perform works with other safe means.

There are various types of scaffolds being used at construction sites , including supported scaffolds, such as: Frame Scaffolds, Tube and Clamps Scaffolds, System Scaffolds, Suspended Scaffolds, and Mobile Tower Scaffolds.

Employees working on scaffolds are exposed to many hazards such as falls, complete collapse of scaffolds.

This section of the safety manual covers the general safety guidelines for scaffolds higher than 2 m from the ground adjacent to the location where the scaffold is erected, also this section determines specific requirements for different types of scaffolds. (For more information refer to technical guideline # (38).

8 - 1 General Requirements:

1. Scaffolds must be provided for employees engaged in work that cannot be done safely from the ground or from solid construction.
2. All scaffolds must be erected, moved, dismantled or altered, only under the supervision of a competent persons and by skilled and experienced workers.
3. Each scaffold and scaffold component shall be capable of supporting, without failure, its own weight and at least 4 times the maximum intended load applied or transmitted to it.
4. The contractor shall prepare the construction designs, drawings, and design loads for all scaffolds used on site including forms concrete ceiling supports, platforms used for storage of materials and others, and same must be approved by the consultant engineer, prior to erection of scaffolds. All these information must be kept on site for inspection purposes.
5. Scaffolds cannot be erected, used, closer than 3 m (10 feet) near energized power lines to avoid any contact between the scaffold components and these power lines.
6. Supported scaffolds with a height to base width ratio of more than four to one (4:1) shall be tied to the building structure vertically and horizontally. The first bottom tie must be placed no higher than four (4) times the minimum base width and vertical ties shall be repeated at intervals not greater than 8 m (26 feet). Horizontal ties shall be placed at each end and at intervals not greater than 9 m (30 feet).
7. Supported and suspended scaffolds shall be inspected by a third party inspection body approved by Dubai Municipality and a proper certificate shall be issued by this company, the inspection will be repeated in case of any change on the location of erection or suspension.

8 - 2 Scaffolds Foundations:

1. Scaffolds must have base plates, even when setting on a concrete floor.
2. When setting the scaffold on soft soil, the soil shall be compacted to avoid the presence of any holes and to enhance its ability to support the intended loads. Scaffold legs must be set on base plates and adequate mudsills with not less than 5 cm thick and not less than 25 cm wide to distribute the load on bigger area. (See fig. # 1).

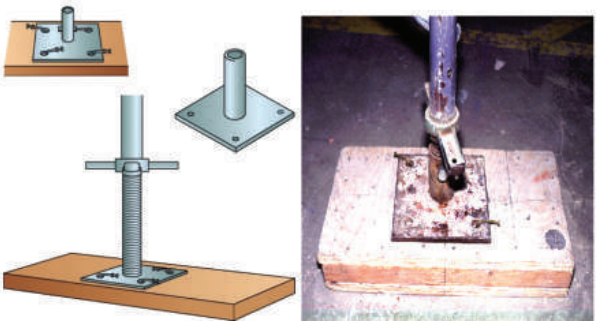


Fig. 1

8 - 3 Scaffold Platform:

1. The front edge of all platforms shall not be more than 35 cm (14 inches) from the face of the work, unless guardrail systems are erected along the front edge and/or personnel fall arrest systems are used.
2. The width of the platform of a scaffold shall be determined according to the purpose of use and height from the ground to provide adequate area to work safely, but the width of each platform shall not be less than:
    1. be not less than 60 cm wide (3 boards) when used for persons only and not for materials.
    2. Be not less than 80 cm wide (4 boards) when used for persons and materials.
    3. Be not less than 150 cm wide (7 boards) when used for the support of any higher platform or used to dress roughly shaped stones.
    4. Be not less than 43 cm when used as wooden passages.
3. The open side edges of platforms higher than 2 m shall be provided with standard guard rail not less than 95 cm and not more than 115 cm high and consists of top rail and mid rail and toe-board not less than 15 cm high above the platform, taking into consideration that the distance between the top rail and the mid rail or between the mid rail and the toe-board should not be more than 47 cm. (see fig. # 2).

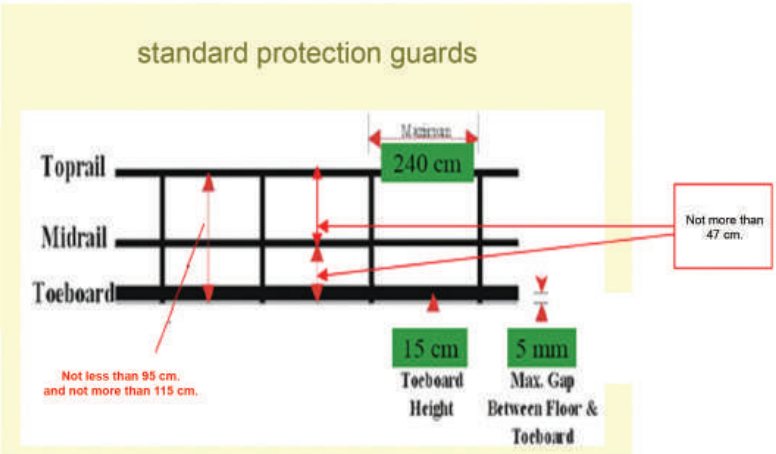


Fig. 2

4 When the provision of providing scaffolds and platforms with guard rails is not possible or not practical, all employees working on scaffolds shall use safety harnesses which will be anchored at the building or strong structure or a safety line at the nearest point on top of the worker head. If it is not possible to do so, the worker shall be tied to the strong components of the scaffold or provide adequate alternative methods to protect from fall hazards such as safety nets, etc.

5 Wood scaffold planks should be nominal 5 cm x 25 cm. Gaps between adjacent planks or toe-boards should not exceed 2.5 cm. Planking should extend a minimum of 15 cm over the center of each support (unless cleated to prevent the plank from sliding) and a maximum of 30 cm. the ends of wooden planks shall be encased in metal sleeves or jackets to protect them from damage,

6 Where persons are required to work or pass under the scaffolds. Scaffolds shall be provided with a screen between the toe-board and the guardrail, extending along the entire opening. (see fig. # 3).

Fig. 3

7 Faces of scaffolds shall be covered with tarpaulin sheeting covers (Containment Sheeting) to protect against scattering of dust and debris on people and cars in the street. (in this case, wind loads shall be considered). (see fig. # 4).

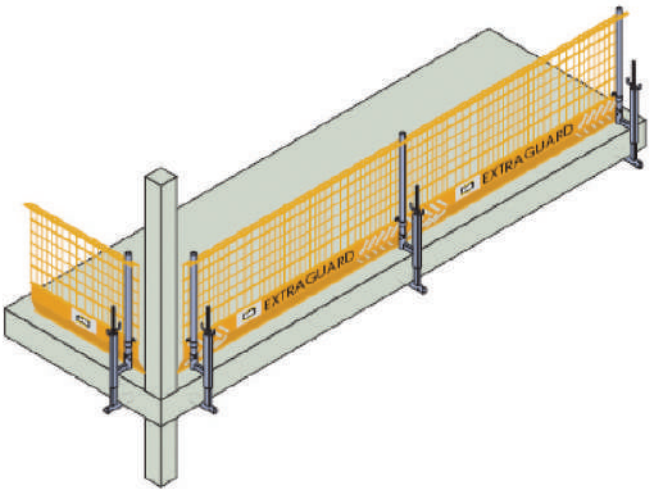


Fig. 4

8- 4 Safe Access to Scaffolds:

1. A safe way access, secured adequately for entrance and exit to or from any place where one person works at any time shall be provided.
2. It is preferable to provide a ladder inside the scaffold to reach to the work platform. (See fig. # 6).
3. Portable single ladders when used as access means to the scaffold platform, shall not have a slope more than 4 (vertical) : 1 (Horizontal) i.e. one meter out for every 4 meters of height, and extend at least 1 m above platform level to provide adequate handhold at all stepping-off points. (See fig. # 5).

Fig. 5

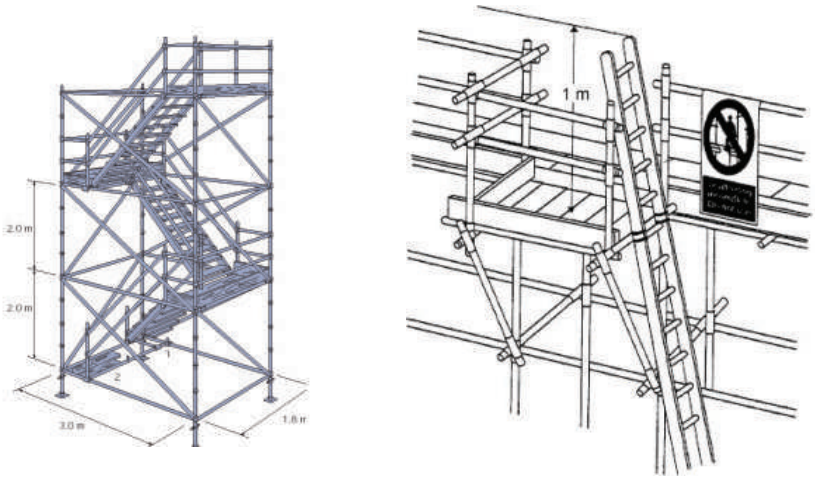


Fig. 6

4. When the length of the ladder exceeds 9 m, it shall be provided with intermediate landing, which shall not be used as a working platform or for storage of materials. These landing shall be provided with a standard guard rail system to protect against fall hazards.

5. In case of using a vertical ladder more than 6 m height, a fall protection system must be provided to protect employees from fall hazards, such system may be a cage or a ladder safety device.
6. Ladders shall be securely tied from upper and bottom to prevent slipping and shall be fixed on stable and level surfaces using their slip-resistant feet.

8- 5 Capacity:

Working Loads of Scaffolds:

Working load is the total load of all persons, equipment, tools, materials, transmitted loads, and other loads reasonably anticipated to be applied to a scaffold or scaffold component at any one time. There are three different types of scaffolds according to load (Light Duty Scaffolds, Medium Duty Scaffolds, and Heavy Duty Scaffolds). As follows:

1. Light Duty Scaffolds: Designed and constructed to carry a working load of 1.2 Kilo Newton per square meter (25 pounds per square foot).
2. Medium Duty Scaffolds: Designed and constructed to carry a working load of 2.4 Kilo Newton per square meter (50 pounds per square foot).
3. Heavy Duty Scaffolds: Designed and constructed to carry a working load of 3.6 Kilo Newton per square meter (75 pounds per square foot).

1. Each scaffold shall be designed to be capable of supporting, without failure, its own weight and at least 4 times the maximum working load applied or transmitted to it.
2. Each suspension rope, used on non-adjustable suspension scaffolds shall be capable of supporting, without failure, at least 6 times the maximum intended load applied or transmitted to that rope.
3. Scaffolds shall not be loaded in excess of the working load they are intended, and this load shall be evenly distributed on the scaffold platform.
4. Materials or loads shall be moved or deposited without imposing any violent shock.
5. Material shall not be kept upon a scaffold unless needed for work within a reasonable time. These loads shall not exceed the designed load limit of the scaffold.

8- 6 Maximum Heights of Scaffolds & Maximum Number of Working Levels: (Tube and Clamp Scaffolds)

1. Each contractor shall prepare a design for scaffolds systems according to the nature of work, and the expected intended loads, and the methods of fixing the scaffolds, the consultant engineer shall approve such designs.
2. The maximum height of scaffold shall not exceed 38 m (125 feet), and in case the need for higher scaffolds, the contractor shall submit a design prepared by specialized third party company and shall obtain the approval of the consultant engineer on that design before starting the erection of the scaffold, this approved design shall be kept on site for inspection by the concerned department personnel.
3. The maximum number of working levels at the same time and the maximum number of additional planked levels shall be determined by referring to table # 1 below:

Table (1)

Maximum Number of Plankd Levels

	Maximum Number of Additional Planked Levels			Maximum Hight of Scaffold (in feet)
	Light duty	**Medium Duty**	**Heavy Dudy**	
Number of Working Levels				
1	16	11	6	125
2	11	1	0	125
3	6	0	0	125
4	1	0	0	125

8 -7 Scaffolds Materials:

1. Metal parts used for scaffolds shall be of suitable quality and be in good condition and free from corrosion or other patent defect likely to affect their strength materially.
2. Nails or bolts used in the construction of scaffolds shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the scaffolds. Fiber rope lashing, nails, clamps and any other means shall be used according to the manufacturing recommendations.
3. All lumber used in construction of scaffolds shall be free of large knots, split, wraps, decay, twist, dry rot or any other defects, and shall have straight-grained, and shall not be painted or treated by any means so that to hide defects.
4. It is strictly prohibited to use any ropes that have been affected by acids or bases (alkalis) or damaged ropes for scaffolds.
5. Fiber ropes shall not be used for scaffolds in places that might cause the rope to be damaged.
6. All necessary precautions shall be taken to avoid the split of planks.
7. All material used for erection of scaffolds shall be stored properly and away from any other materials that might affect it. (Refer to Section 7 – Storage and Handling of Materials).

8- 8 Erection of Scaffolds:

1. Scaffolds shall be erected or dismantled by a skilled workers, trained and qualified to perform such work, under the supervision of a competent person.
2. Scaffolds shall not be extended beyond its highest fixing point to the extend that will affect its stability.
3. Worker erecting and dismantling scaffolds shall be provided with proper fall protection measures and shall be provided with the suitable personal protective equipment to protect them from fall hazard.
4. Where materials of the scaffolds are handled manually during erection or dismantling, no workers shall exist under these materials.
5. All scaffold materials used for the support of the working platform shall be sound rigid and of adequate strength and firm footing and well strutted and braced.

6. Loose bricks and drain pipes or any other unsuitable materials shall not be used for erection or supporting scaffolds.
7. Proper protection from the hazard of falling objects shall be provided to the top of scaffold if this hazard exists.
8. All faces of the scaffold shall be braced diagonally, both internally and externally to adequately support the scaffold.
9. Partially erected or dismantled scaffolds shall not be used, and a prominent warning notice indicating that the scaffold is incomplete and not safe to be used (Red Scaffold Tag) shall be posted. The access to the scaffold shall physically be blocked.
10. Scaffolds and scaffold components shall be thoroughly inspected by a competent persons who is authorized by the contractor to ensure that the scaffold is stable, and ca pable of supporting the intended loads and then he shall post the green scaffold tag after signing it which indicate that the scaffold is complete and safe to use.

8 -9 Scaffolds Ties:

1. When the height of scaffolds exceeds 4 times its width, the scaffold shall be tied to the fixed building structure, vertically and horizontally. The first bottom tie must be placed no higher than four (4) times the minimum base width and vertical ties shall be repeated at intervals not greater than 8 m (26 feet). Horizontal ties shall be placed at each end and at intervals not greater than 9 m (30 feet).
2. At least 50 % of all ties shall be positive (+ ve) ties, that is, they do not get their strength from friction as in the case with the reveal ties.
3. There are 5 various types of ties as follows:
   - 3-1 Through Ties (+ Ve)
   - 3-2 Reveal Ties (Not Positive)
   - 3-3 Box Ties (+ Ve)
   - 3-4 Anchor Bolt Ties (+ Ve).
   - 3-5 Other Methods of Tying

3-1 Through Ties: (See fig. # 7)

3-1-1 A tube is taken through any convenient opening, such as a window, and coupled to another parallel horizontal tube.

3-1-2 Another two tubes will be connected vertically to the horizontal tubes using proper right angle clamps.

3-1-3 These vertical tubes shall be fixed to the scaffold using right angle clamps.

3-1-4 This type of ties is a positive tie.

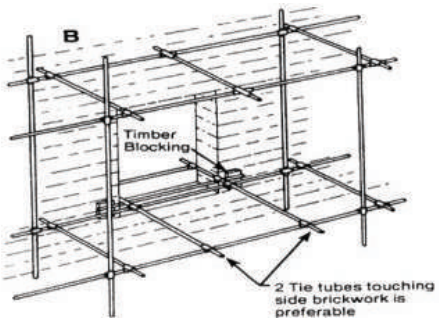


Fig. 7

3-2 Reveal Ties: (See fig. # 8):

3-2-1 A tube is wedged into an opening in the wall by means of 'Reveal Pin'.

3-2-2 A second tube is then fixed between this tube and the scaffold to form the tie. The reveal pin normally consists of a piece of tube with a base plate at one end and a screw jack at the other.

3-2-3 This type of ties is considered not positive type of ties.

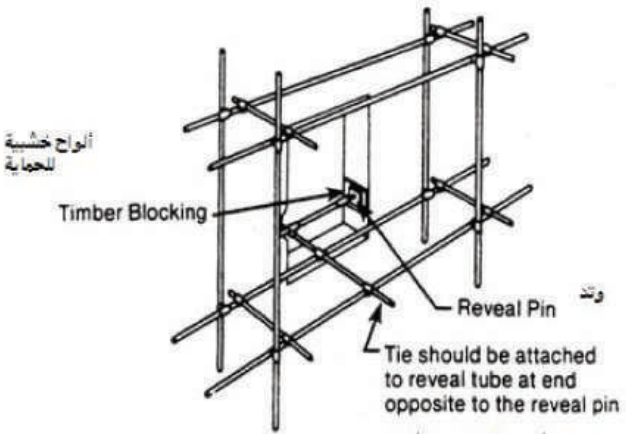


Fig. 8

3-3 Box Ties: (See fig. # 9)

3-3-1 This tie can be used if there is a column close to the scaffold.

3-3-2 Tie tubes run both sides of the column, with cross tubes tied back and front to both tie tubes.

3-3-3 This type of ties is considered a positive tie.

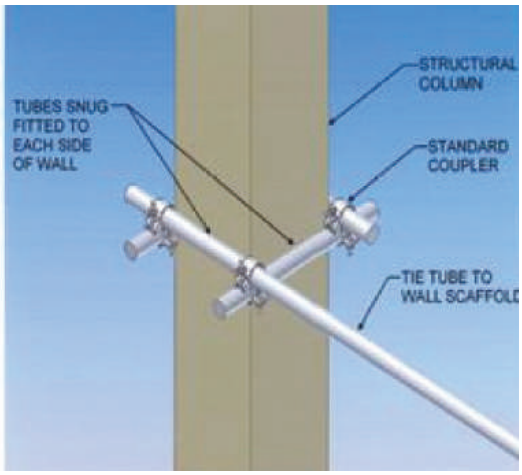


Fig. 9

3-4 Anchor Bolt Ties: (See fig. # 10)

3-4-1 There are many types of anchors available. They do however, vary in pull out strength and they leave a hole behind which has to be repaired. A pull out force of at least 800 lbs, 1200 lbs, and 1600 lbs, is necessary for light, medium and heavy duty scaffolds respectively. Therefore the proper type of anchor bolt should be selected according to the type of scaffold.

3-4-2 An anchor bolt shall be fixed to the wall through a drilled opening in steel plate.
3-4-3 A proper tube is welded to the steel plate (which is fixed to the wall by the anchor bolt).
3-4-4 This tube shall be tied to the scaffold using the proper right angle clamps.
3-4-5 This type of ties is considered a positive tie.

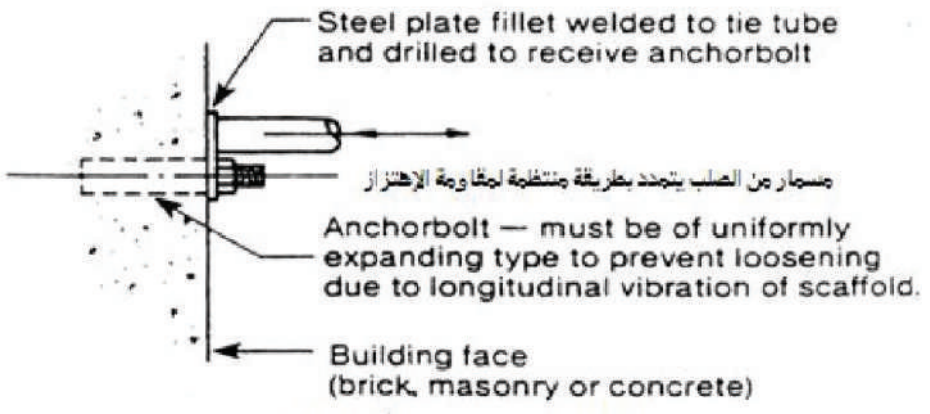


Fig. 10

3-5 Other Methods of ties:

3-5-1 Tower scaffolds my be tied using guy rope which will be tied to the scaffold (only at joints) and to a point on the ground using anchor bolt with an optimum angle of 45 degree. (See fig. # 11).
3-5-2 More than one guy rope per tower may be required on tall structures.
3-5-3 Also an elevated tube with an angle of 45 degree with the horizontal may be used to tie the scaffold. (Raker Ties) (See fig. # 12)
3-5-4 The raker tube shall be tied to the scaffold using proper clamps and the other end will be fixed on base plate and mud sill.

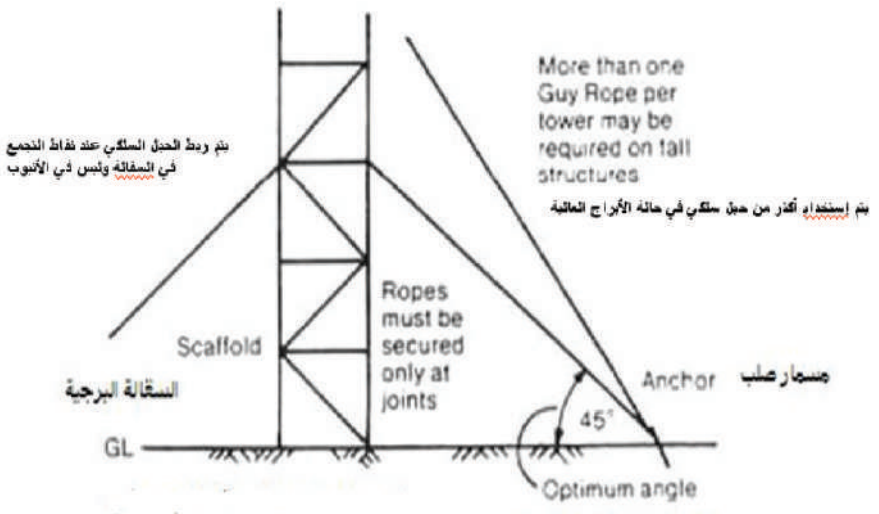
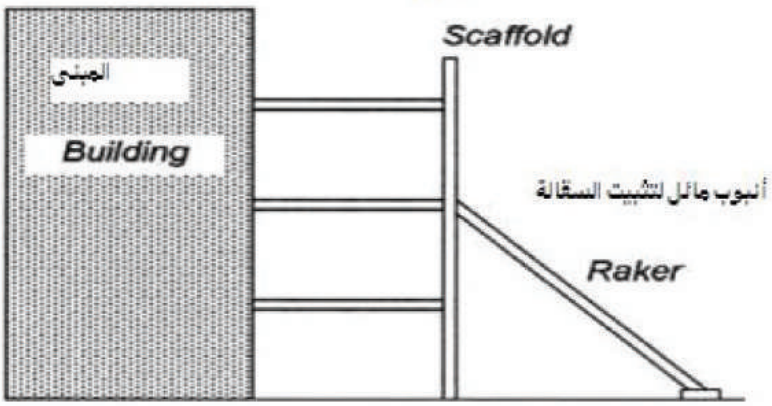


Fig. 11



Side Elevation View of the use of Rakers

Fig. 12

In case the scaffold cannot be tied using any one of the above methods, the contractor shall arrange to prepare a special design for the said scaffold and obtain the approval of the consultant engineer on that design, and must keep a copy of this design at site for inspection by the concerned department at Dubai Municipality.

8 -10 Inspection and Maintenance:

1. Scaffolds shall be inspected by a competent person who has been provided with the necessary and adequate training to qualify him to supervise the erection, dismantling and inspection of scaffolds. This person(s) must obtain a training certificate as a scaffold competent person issued from a company approved by Dubai Municipality.
2. Scaffolds shall be inspected before use by a competent person to ensure of the following:
    - The scaffold is adequately secured and stable (safe foundations and methods of ties).
    - Of sound material, free from patent defects.
    - It is suitable to the purpose of work to be done.
    - The necessary required protection measures are provided.
3. All the scaffolds shall be inspected by a competent person as follows:
    - On daily basis before each use.
    - After bad weathers or when the scaffold is not in use for long period.

• In case any alteration is made to the scaffold or its components.

4. All material for any scaffold shall be inspected before being taken into use to ensure that they are in good and safe conditions.
5. Every scaffold shall be properly maintained and every part shall be kept so fixed, secured or placed in position as to prevent so far as is practicable accidental displacement.
6. No scaffold or part of a scaffold shall be partly dismantled and remain in such a condition that it is capable of being used unless, that part is safe to be used according to the regulations mentioned in this section after being inspected by a competent person and declared that it is safe to be used.
7. No excavation operations shall be carried out near the foundations of any scaffold, and

when it is necessary to do so, safe alternative methods shall be provided to secure scaffold foundations in such a way to guarantee its safety and stability.

Types of Scaffolds

8 -11 Supported Scaffolds:

8-11-1 Metal Scaffolds:

Supported scaffolds such as Frame Scaffolds, Tube and Clamps Scaffolds, Systems Scaffolds, and Mobile Tower Scaffolds and others.

8-11-1-1 General Requirements:

1. All scaffolds shall be erected according to the manufacturer's recommendations. Intermixing of different types of metal is not allowed when erecting the same scaffold unless, it has been approved by a competent person who has enough knowledge about the effect of such intermix on the integrity and strength of the scaffold.
2. Metal parts used for scaffolds shall be straight and of suitable quality and in good condition and free from bent, cracks, corrosion, and all other defects. All metal parts used for scaffolds must be inspected by a competent person before use.
3. Metal parts used for scaffolds shall be securely connected together by adequate and strong method.
4. Scaffolds shall be provided with proper ladders or stairways to be used for access to the scaffold and shall be attached to the structure of the scaffold.
5. Scaffolds components materials shall be stored in well protected stores to protect them from being affected by different weather conditions.
6. Paints covering metal pipes shall be kept and maintained to protect it from being damaged the matter which may cause alteration of the metal pipes specifications and consequently affect its designed support and stability.
7. Metal pipes coated by special paints to protect them from rust and corrosion shall be used in places with high humidity when the possibility of exposure to rust and corrosion is very high.
8. All clamps shall be inspected regularly and maintained properly and inspect them before each use, and grease moveable parts to ensure that the threaded parts are in good operational condition.

8-11-1-2 Tube & Clamp Scaffolds:

This type of scaffolds consists of vertical pipes (Posts) and horizontal Longitudinal pipes running parallel to the structure (Runners) and pipes supporting the platform (Bearers) and diagonal pipes (Bracing) all of these components are joined together by means of special clamps of two different types. Right angle clamps and swivel joint clamps (See fig. 13 & 14).

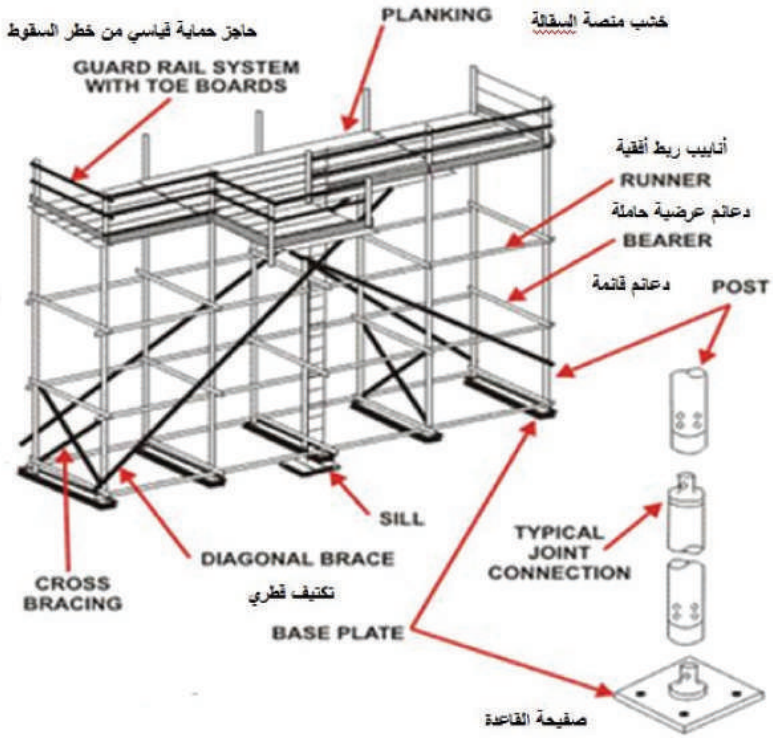


Fig. 13

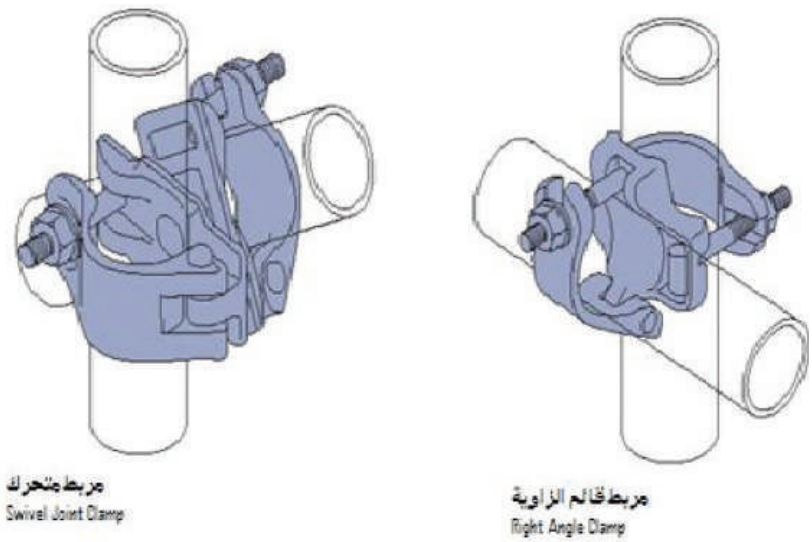


Fig. 14

8-11-1-3 Frame Scaffolds:

This type of scaffolds consists of Steel fabricated frame and cross bracing. Frame scaffolding is relatively simple and fast to erect, provided that the surface is level, and the access is not restricted. It considered easy to be erected and does not need great experience since every part is being con-

nected at the predetermined place.
The scaffold shall be erected on base plates with adjustable leveling screw and proper mud sill on a well compacted soil. (See fig. # 15).

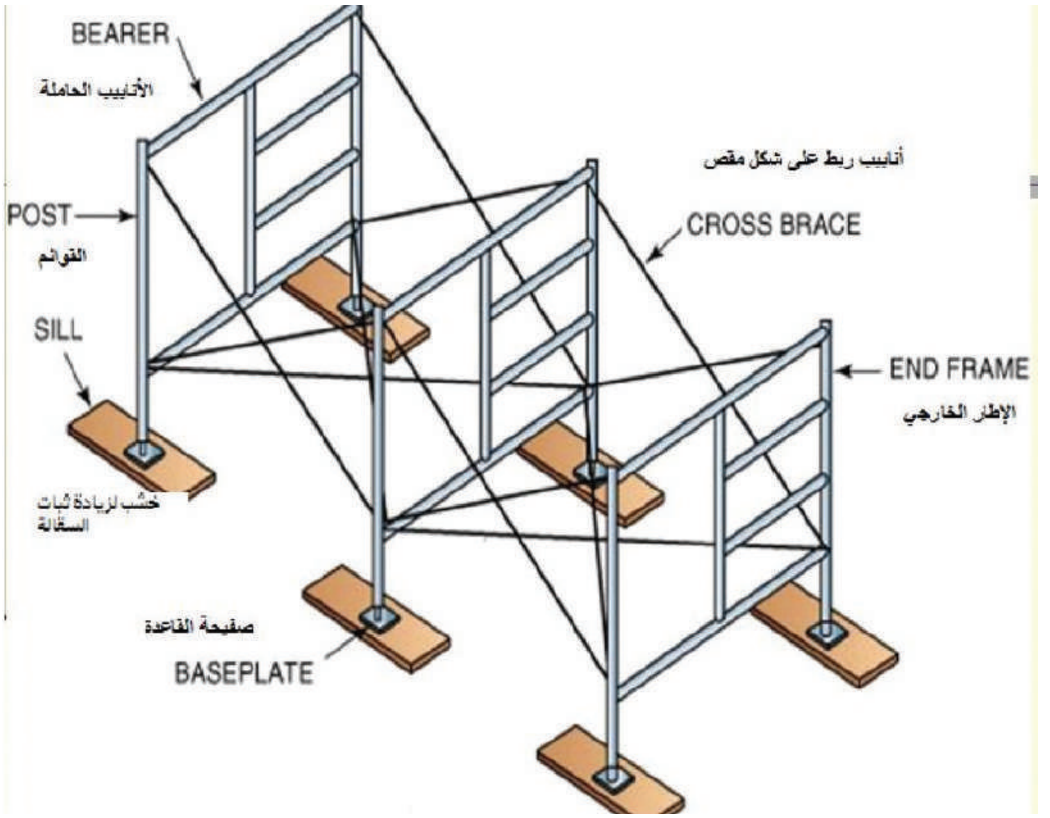
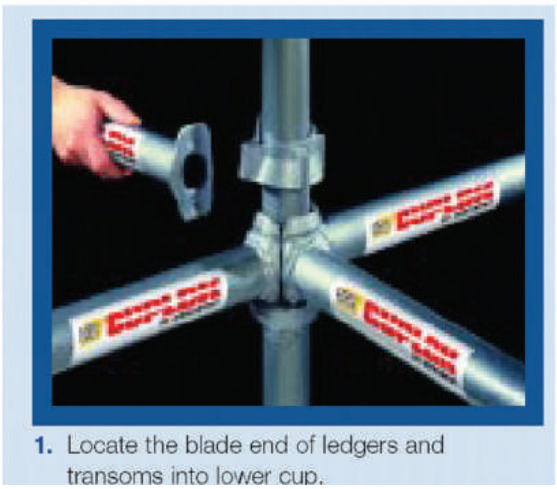


Fig. 15

8-11-1-4 System Scaffolds:

- There are various types of this scaffold, and it consists of vertical pipes with different lengths (posts), and the runners and bearers are connected to fixed locations.\
- The most popular one is the cup-lock system scaffold, where all the blades of the pipes are located into lower cup, and the upper cup is lowered down and tightened with a hammer blow.
- The advantage that modular systems have is that they do not require a high degree of expertise to erect them since the location of the connections are fixed. (See fig. # 16).

2. Lower the upper cup down the standard and rotate.



1. Locate the blade end of ledgers and transoms into lower cup.

3. Tighten with a hammer blow.

Fig. 16

8-11-2 Mobile Tower Scaffolds:

It is a scaffold mounted on wheels and may be made of normal tube and fittings and has only one platform. The platform shall not extend outward beyond the base support of the tower and shall have standard guard rails and toe-boards (See fig. # 17).

Means of access (an access ladder) shall be provided from inside the tower or fixed outside the tower according to the safety requirements of ladders.

Mobile tower scaffolds are equipped with casters at the bottom and positive locking brakes to prevent the tower from movement during use. These casters shall be capable of supporting the safe working load of the scaffold.

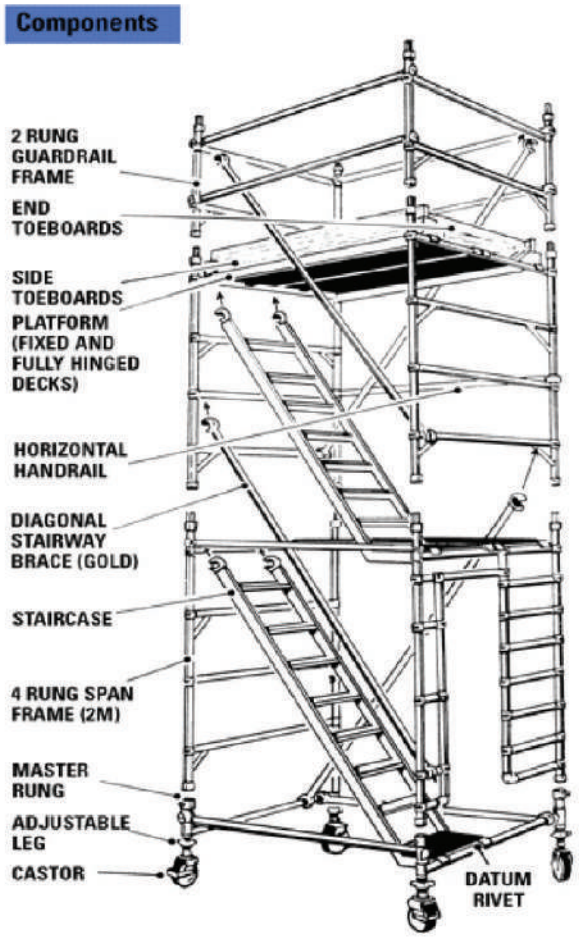
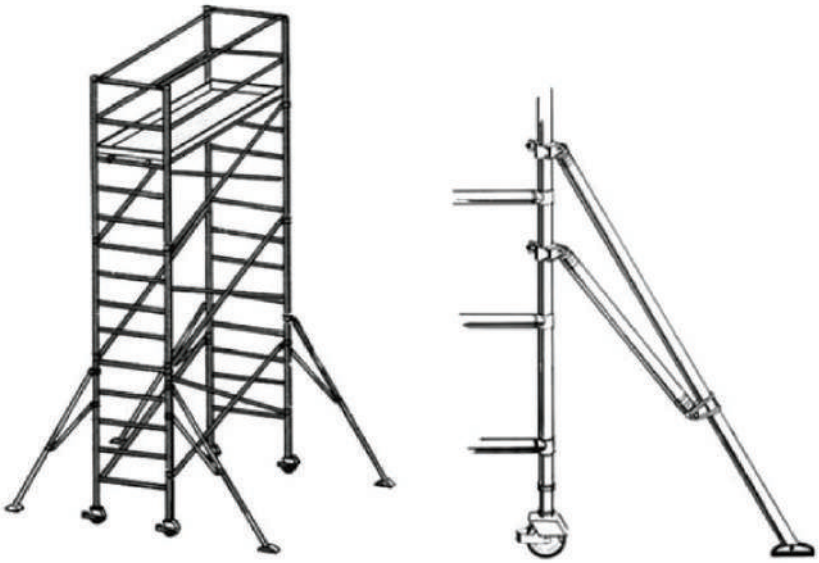


Fig. 17

General Requirements:

1. The height of the mobile tower shall not exceed 4 times the smallest base width of the scaffold, in case the height is exceeding 4 times the width of the scaffold, special out riggers shall be used to increase the width of the scaffold, and consequently increasing the permissible height.
2. Rolling scaffolds shall be used only on firm, level, clean surfaces.
3. Rolling scaffolds shall be moved on leveled surfaces only by pushing or pulling or both. Manual force used to move the scaffold shall be applied as close to the base as practicable, but no more than 1.5 m (5 feet) above the supporting surface. No persons, equipment or materials are allowed to be on the platform during moving it. Scaffold casters and wheels shall be locked with positive wheel locks after the ending of moving the tower and before any one is allowed to work on the platform.
4. It is recommended to use a ladder (internal staircase) to access to and from the platform (see fig. # 17), in case of using a vertical ladder higher than 6 m, it shall be protected by a cage or provide workers with proper fall protection equipment.

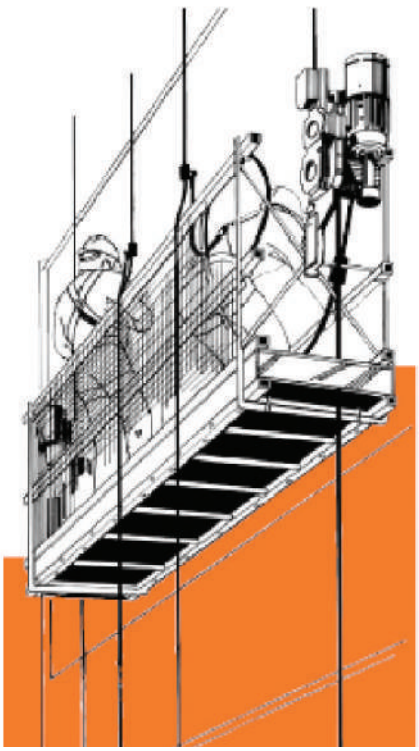


Rolling scaffold with outrigger stabilizers

Adjustable outrigger stabilizers

Fig. 18

8-11-3 Suspended Scaffolds:



Suspended scaffolds consist of platforms suspended by proper wire ropes fixed to outriggers which are installed horizontally on the roofs of buildings where the suspended scaffold shall be used. Proper counter weights shall be attached to the other ends of the outriggers to support the scaffold. Scaffold shall be provided with adequate and suitable means of lowering and raising the scaffold (hoists).
There are many types of suspended scaffolds such as: suspended platforms, cradle scaffolds and boatswain's chairs.

General Requirements:

1. Every suspended scaffold shall be provided with adequate and suitable chains or ropes and winches or other lifting appliances or similar devices and shall be suspended from suitable outrigger beams, joists, runways, rail tracks or other equally safe anchorage.
2. The winches or other lifting appliances or similar devices of a suspended scaffold shall be:
    - Provided with a brake or similar devices which comes into operations when the operating handle or lever is released.
    - Adequately protected against the effects of weather, dust or material likely to cause damage.
3. The outrigger beams for a suspended scaffold shall be:
    - Of adequate length and strength and properly installed and supported.
    - Installed horizontally and provided with adequate stoppers at their outer ends.
    - Properly spaced having regard to the construction of the scaffold and of the runway, joist or rail track on which the scaffold is carried.
4. When counterweights are used with outriggers, this counterweights shall be securely fastened to the outriggers and shall not be less than four times the total weight of the scaffold (its weight + capacity) (refer to technical guideline # 39).
5. To avoid using large amounts of counterweights (counterbalance) the part of the outrigger installed on the roof of the building shall be much longer than hang over part of the outrigger where the wire ropes carrying the scaffold will be attached.
6. All workers using such types of scaffolds shall be provided with appropriate fall protection system consisting of a full body harness, lanyard, shock absorber, rope grabbing device and lifeline (See fig. # 19).
7. The points of suspension of every suspended scaffold shall be an adequate horizontal distance from the face of the building or other structure.
8. Every runway joist and rail track supporting a suspended scaffold shall be:
    - Of suitable and sound material;
    - Of adequate strength for the purpose for which it is used.
    - Free from patent defect.
    - Provided with adequate stoppers at each end; and
    - Properly secured to the building.
9. The suspension ropes or chains of a suspended scaffold shall be:
    - Securely attached to the outriggers or other supports and to the platform framework or to any lifting appliance or other device attached thereto, as the case may be; and
    - Kept in tension.
10. Where winches are used with suspended scaffolds the suspension ropes shall be of such a length that the lowest position at which the scaffold is intended to be used, there are not less than two turns of rope remaining on each winch drum and the length of

each rope shall be clearly marked on its winch.

11. Every part of a suspended scaffold, and all plant and equipment used for that purpose shall be: of good construction, suitable and sound material, and properly maintained, and where constructed of metal, free from corrosion.
12. No wire other than wire rope shall be used for the raising, lowering and suspension of a suspended scaffold. on suspended scaffolds.
13. The platform of every suspended scaffold shall be:
    - Clearly boarded, planked or plated;
    - Be at least 60 cm wide if used as footing only and not for the deposit of any material.
    - Be at least 80 cm wide if used for the workers and deposit of material.
    - Be acceptable to 43 cm wide if it is used as wooden passage.
14. The space between the face of the building or structure and the platform shall not be more than 30 cm.
15. All suspended scaffolds shall be inspected by a third party company approved by Dubai Municipality and shall issue a testing certificate, inspection shall be repeated in case there is any alteration to the location of the scaffold, and a new testing certificate shall be issued.

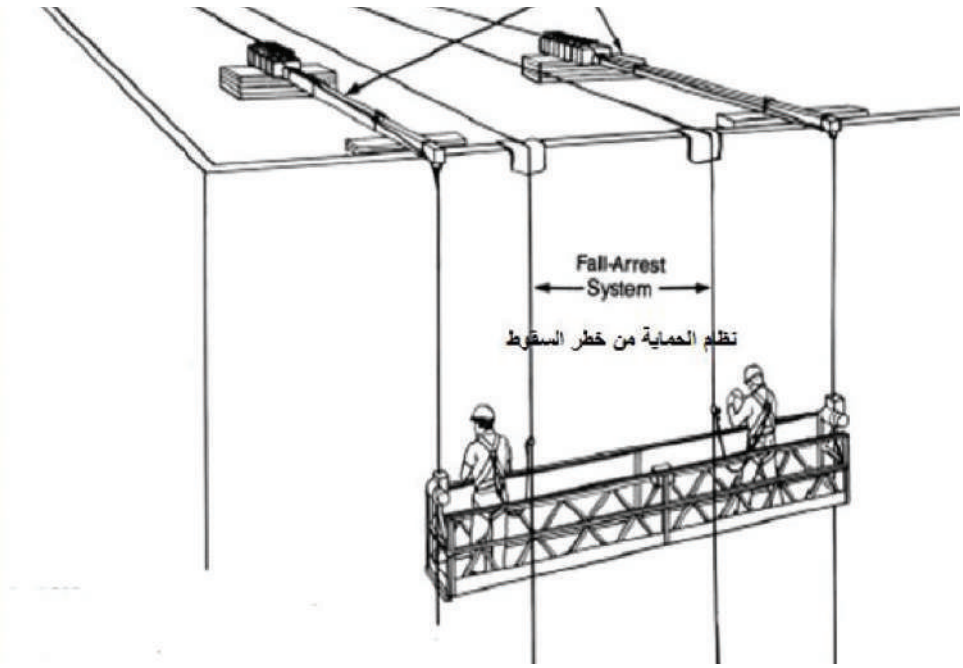


Fig. 19

8-11-4 Cradle Scaffolds:

This type of scaffolds has only one working platform suspended by means of extended outrigger beams fixed on the roof of the building. Cradles may be (traveling) i.e. able to be raised or lowered and traversed horizontally or (fixed) i.e. able only to be raised or lowered.

This type of scaffolds for painting and windows and stone cleaning and other similar activities. (See fig. # 20).

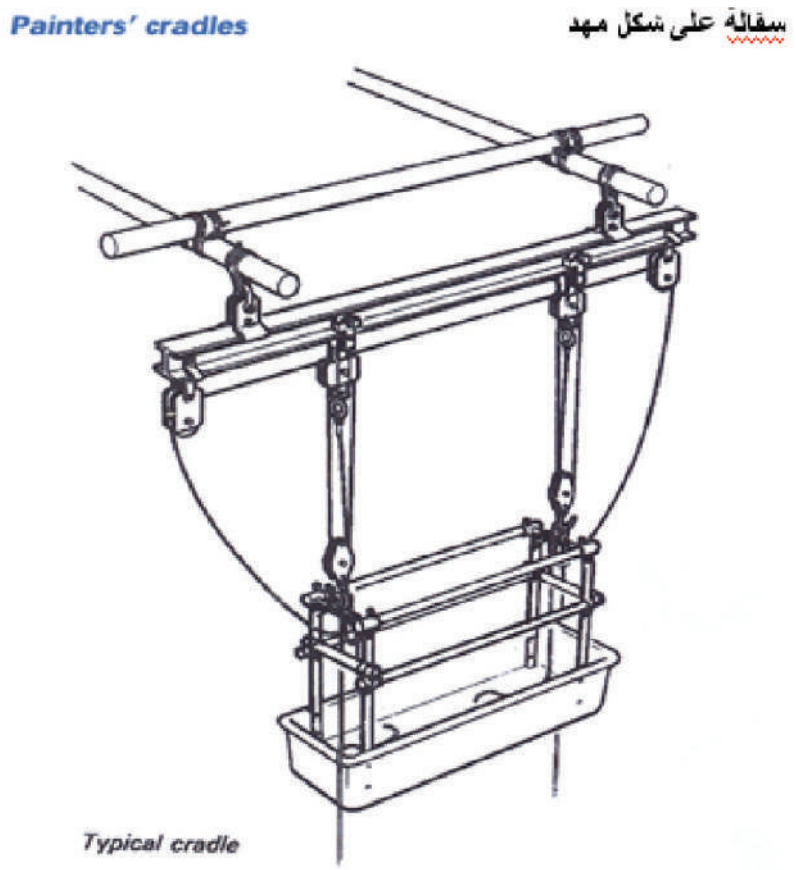


Fig. 20

8-11-5 Boatswain's Chairs, Cages, Skips etc. (Not Power Operated) :

1. No boatswain's chair, cage, skip or similar plant or equipment, not power driven appliance, shall be used unless :
   - It is of good construction, suitable and sound material, and adequate strength, free from patent defect and properly and adequately maintained.
   - The outriggers or other supports are of adequate strength and properly installed and supported.
   - Chairs, ropes and lifting gear are firmly secured to the outriggers and to the chair, skip, etc.
   - Suitable means are provided to prevent any occupant falling out.
   - It is free of materials or articles liable to interfere with the occupant's handhold or foothold or otherwise endanger him.
   - Suitable measures are taken to prevent spinning or tipping in a manner dangerous to any occupant.
   - In the case of any skip or other receptacle it is at least 0.9 x 1.15 m deep.
   - Its installation has been, and its use is, supervised by a competent person.
2. Boatswain's chair, cage, skip or similar plant or equipment not power operated, shall be used as a working place only when the work would not take long enough to make use of a suspended scaffold reasonably practicable.

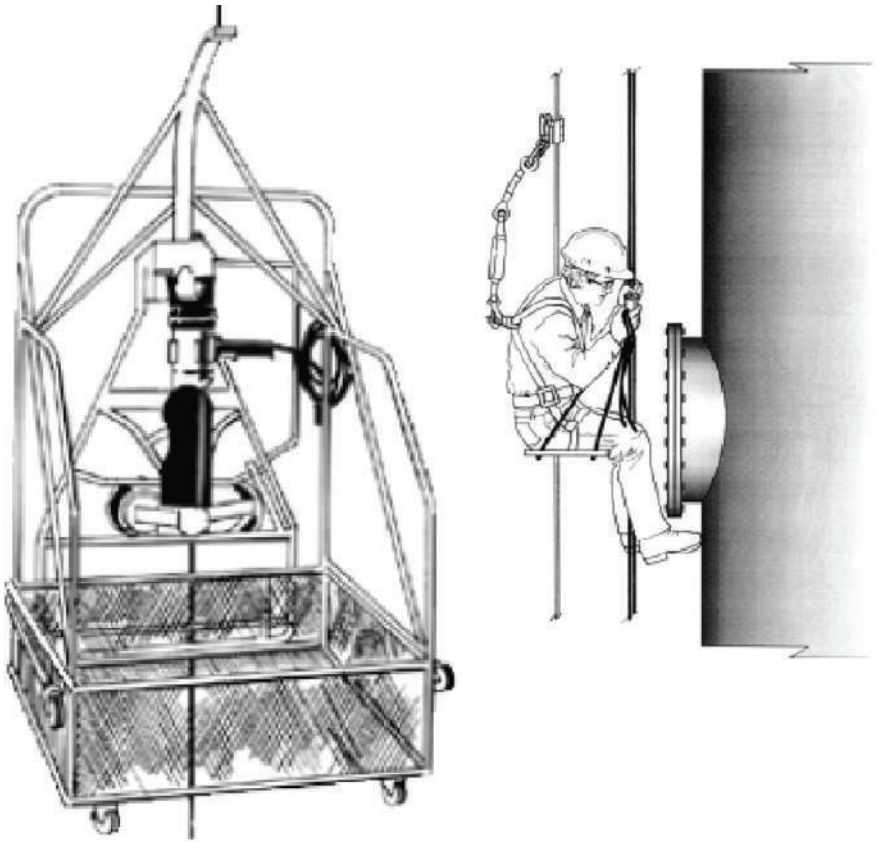


Fig.21

8-11-6 Rope Access:

All the workers involved in the works of Rope access must be competent, qualified and well trained by competent training body and cirtified to work with same activity. The regulations of the British Health & Safety Executive (HSE) and Working at Height Safety Society regulations shall be followed in regards to using rope access systems.

CHAPTER NINE

Excavations

Introduction:

Excavations are the most hazardous activities in construction workplaces. Most construction work involves some forms of excavation for foundations, drains, sewers, etc. Workers involved in excavation activities are exposed to various potential hazards.

Thus, Dubai Municipality stresses that the contractor shall be responsible for providing all necessary precautions and applying all necessary protective procedures to protect employees against potential hazards to which they might be exposed during excavations, such as cave-ins.

9.1. General Requirements:

1. Excavations greater than 1.25 meters deep shall not be permitted unless a shoring system is provided in accordance with a specific design by a professional organization or by using an open excavation that is approved by the Specialized Department.
2. In open excavations, the angle of repose shall not be more than 40º measured from the horizontal unless the stability of an excavation sides at a higher slopes is determined by a professional organization and approved by the Specialized Department.
3. Prior to opening an excavation, no objection certificates (NOC) shall be obtained from all concerned authorities having jurisdiction of excavation. Permits shall be in compliance with the actual conditions and in case that there are any differences; the concerned authorities shall be consulted before the start of the excavation.
4. When any changes occur during excavation in the location and/or in the adjacent services which may expose workers to hazardous situations, work shall be stopped and the Specialized Department shall be consulted.
5. All adequate and appropriate personal protective equipment shall be provided to protect head, eyes, respiratory, hands, feet and other body parts as specified in chapter 4 in this manual and the attached technical guidelines thereto.
6. A check in/check out system of all employees entering or exiting from excavations shall be established to clearly identify the identity of each employee working underground.
7. Timbering sheeting or other support for any part of an excavation, shaft or tunnel shall be:
    - Made of good quality materials.
    - Thoroughly inspected before use.
    - Constructed and properly maintained.
8. In case there are different layers of different types of soil, the slope shall be made on the basis of the angle of repose of the weakest type of soil.
9. Diversion ditches or other suitable means shall be used to prevent surface water from entering the excavation. When reaching groundwater level, excavations shall be stopped until dewatering the area using groundwater removal pumps by a specialized company in compliance with the provisions and approvals of the concerned authorities after determining that the groundwater is free from hazardous contaminants.
10. Excavation below the level of the base of footing of any foundation of any other building shall not be permitted unless a support system such as underpinning and other precautions measures are provided by a professional engineer to ensure the stability of the adjacent walls and to protect employees involved in the excavation activities or in the vicinity thereof. If the stability of adjoining buildings or walls is endangered by excavations, shoring, bracing or underpinning designed by a qualified person and approved by the Specialized Department in Dubai Municipality shall be provided to ensure the stability of the structure and to protect employees.

11. Excavated materials/spoils shall be placed at least 60 cm (2 feet) away from the edge of an excavation (figures 1 & 2) and shall not be accumulated higher than 1.5 times of this distance.
12. Excavated materials/spoils shall not be kept next to existed structure or walls, and the height level of the excavated materials/spoils shall not be higher than the height of these walls.

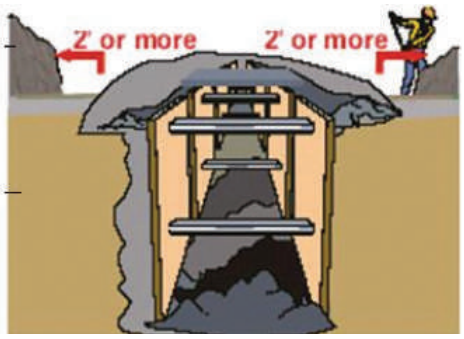


Fig. 1

Fig. 2

13. Protective barricades and flashing warning signs shall be placed in all excavations near sidewalks, pavements and streets. Warning signs shall be illuminated from dusk to dawn and when weather conditions reduce visibility. All wells, calyx, holes, pits and shafts shall be covered or barricaded and backfilled upon completion of the work. (figure 3).

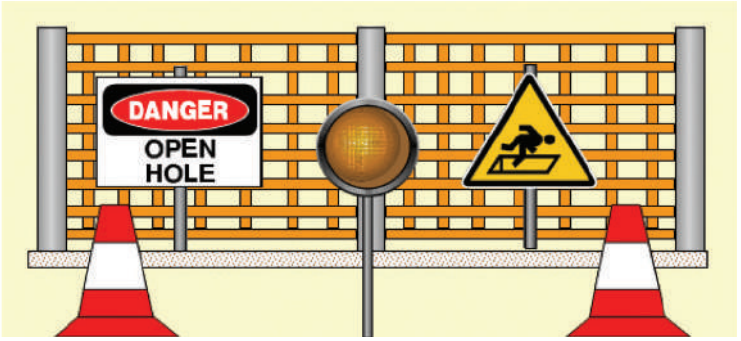


Fig. 3

14. Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guard-rails shall be provided.
15. Dimensions of the members of shoring, shielding and bracing systems shall be appropriately and adequately determined.
16. When a soil is adversely affected by weather, coverage and adequate support systems shall be installed to prevent cave-ins.
17. The worksite shall be adequately and properly illuminated especially in access and egress points and during hoisting operations.
18. Excavations greater than 1.2 m. in depth shall be provided with stairs, ladders or ramps. Ladders used as access ways shall extend from the bottom of the excavation to not less than 90 cm (3 feet) above the surface. At least two stairs, ladders or ramps, one on each side of excavation shall be provided with maximum of 15 meters travel distance to facilitate access and egress of employees from excavation (figure 4).

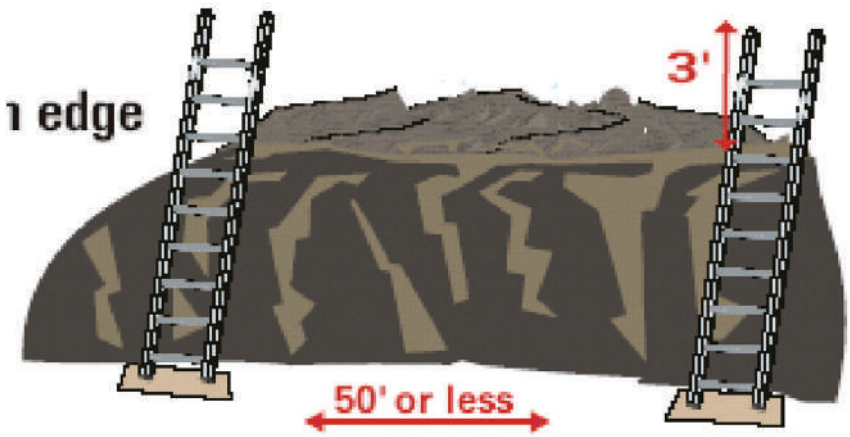


Fig. 4

19. Protective systems shall be inspected daily, regularly and after rain falls or occurrence of other hazardous conditions by a competent person. All necessary precautions measures shall be taken to prevent cave-ins, displacement or any other hazards. Where there is an evidence of a possible hazard, all excavation works shall be halted until the necessary precautions have been taken to ensure the safety of employees, properties and adjacent services.
20. Ramps used solely for personnel access shall be a minimum width of 1.25 meters (4 feet) and provided with standard guardrail to protect employees against fall hazards. Ramps used for equipment access shall be a minimum width of 3.75 meters (12 feet) and provided with curbs or equivalent protection in accordance with the soil classification type.
21. Where any vehicle is used for tipping material into any excavation or over the edge of any embankment or earth work, well anchored stop blocks shall be used to prevent the vehicles overrunning the edge Fig. # 5. A parking area capable of withstanding imposed loads shall be provided for loading/unloading equipment and vehicles.

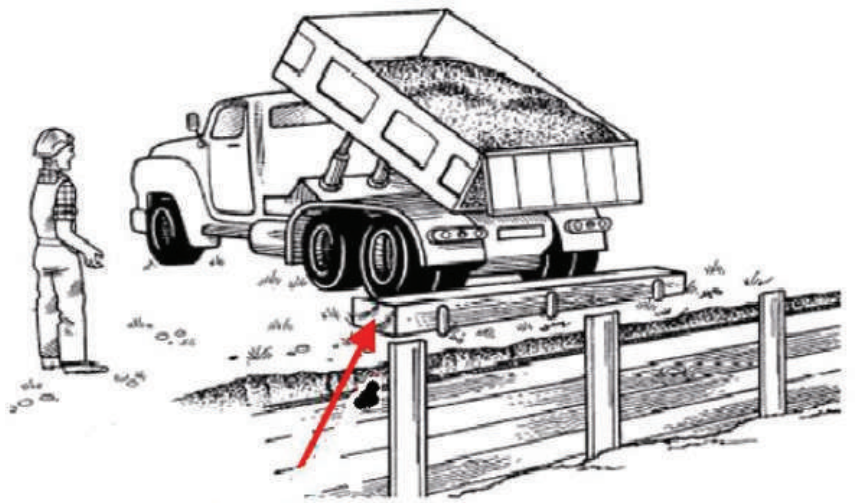


Fig. 5

22. When excavation equipment used in hoisting materials and loads, all employees shall be cleared from the working area and necessary precautions shall be taken to protect them.

9.2. Support Systems:

9.2.1. Deep Excavation:

Various systems are used to provide support to the sides of deep excavations such as:

1. Soldier System (Single Type).
2. Soldier System (Double Type).
3. Contiguous Piles.
4. Secant Piles.
5. Diaphragm Wall.
6. Open Excavation.

1-1 Soldier System (Single Type):

1-2 Single steel piles shall be used as supports/pillars with dimensions and separated distances in compliance with the design. Reinforced concrete panels or timber lagging shall be gradually inserted in between those steel piles during excavation. Excavations greater than 40 cm in depth shall not be permitted unless reinforced concrete panels or timbers lagging are inserted in between the steel piles.

1-3 This system shall only be used in case of the existence of one basement and no adjacent buildings to the excavation (figure 6).

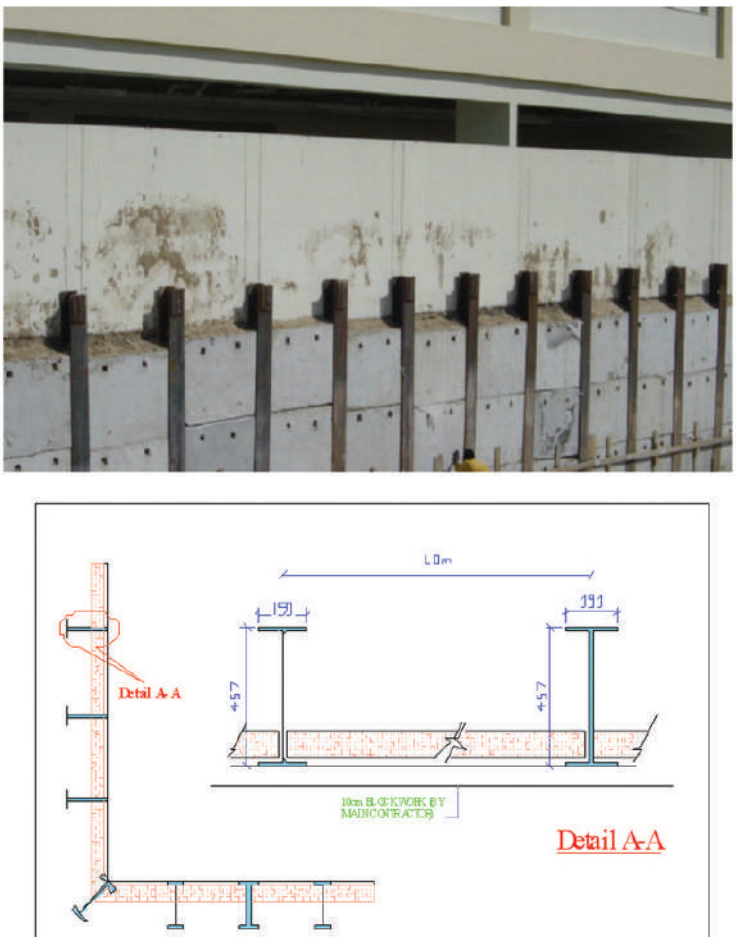


Fig. 6

2. Soldier System (Double Type):

2-1 Double steel piles shall be used as pillars with dimensions and separated distances as specified in the structural design. They shall be provided with anchors to be attached to the strong layer of the soil from behind to provide a sufficient length for its attachment in order to be capable of withstanding the tension forces resulting from soil pushing.

2-2 This system shall only be used in case of the existence of two basements with no adjacent buildings to the excavation (figure 7).

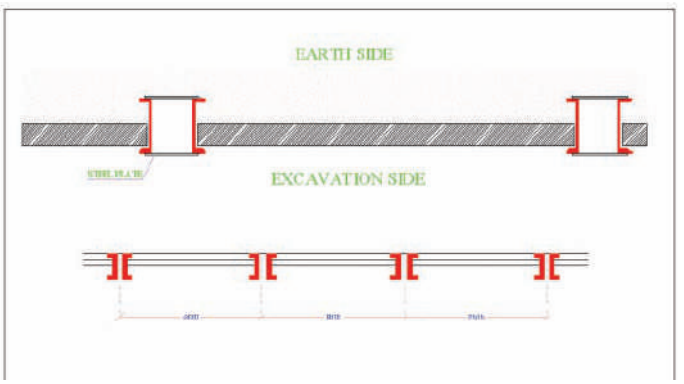


Fig. 7

3. Contiguous Piles:

1. Contiguous piles shall be used without anchors or by using anchors properly attached to the strong layer of the soil to provide the required tension force.
2. This system shall be used in case of excavation of two basements provided that there are no adjacent buildings to the excavation. In case of the existence of adjacent buildings based on extended piles under the excavation level, loads shall be transferred to those piles by end bearing system (figure 8).

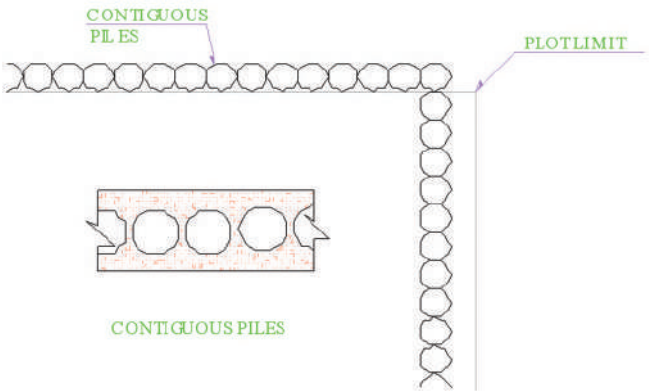


Fig. 8

4. Secant Piles:

1. Secant pile walls are formed by constructing intersecting reinforced concrete piles provided with anchors to be attached to the back side of soil.
2. This system shall be used in case of the existence of two or three basements and adjacent buildings provided that it is supplied with anchors on different levels in accordance with the structural design (figure 9).

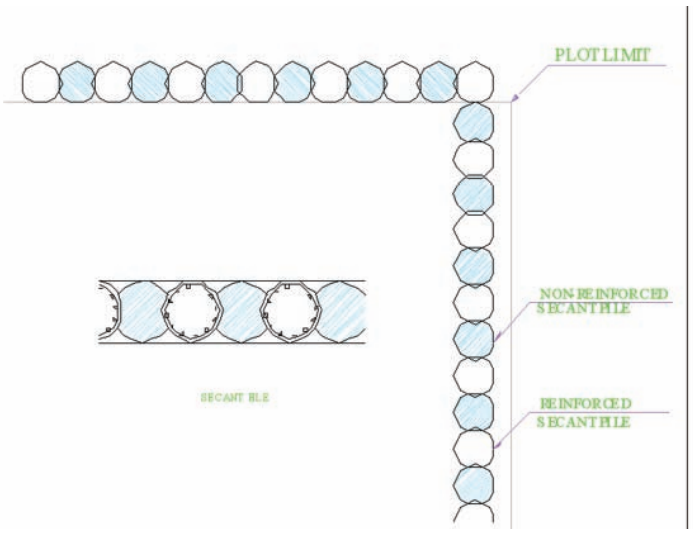


Fig. 9

5. Diaphragm Wall:

1. Diaphragm wall system shall be used with anchors to attach them to the back soil body in the strong layer.
2. This system shall be used in case of the existence of more than three basements and adjacent buildings providing the anchors are provided at different levels in accordance with the structural design (figure 10).

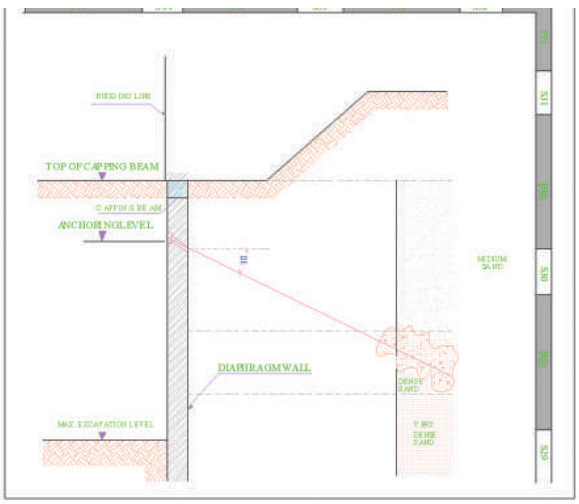


Fig.10

6. Open Excavation:

1. In case there are no space on the excavation edges and upon obtaining the approval of the concerned authorities, open excavation shall be used as a means of protection from cave-ins.
2. in open excavations, the angle of repose shall not be greater than 40º measured from the horizontal unless a study has been made by a specialized organization ensures that the use of slopes with greater angles is safe, and this study shall be approved by the specialized department.

9.3. Trenches:

1. Sides of trenches 1.25 meters or more in depth shall be shored, sloped or otherwise supported by means of sufficient strength, and these means shall be approved by the consultant engineer before work begins.
2. Installation of support systems shall be carried out along (in sequence) with excavations of trenches.
3. Cross support systems shall be made by connecting both ends of the support systems by trench jacks to prevent slipping or falling of sides.
4. Backfilling shall progress together with the removal of support systems from the excavation, beginning at the bottom of the excavation. In unstable soils, ropes or any other method shall be used to pull out the support members from above after all personnel have cleared the trench.
5. Ladders used as access ways shall extend from the bottom of the trench to not less than (900 millimeter) above the surface of the ground. Ladders shall be provided to require no more than 8 meters of lateral travel.
6. Hydraulic system materials shall be used in a manner consistent with the recommendations of the manufacturer.

9.3.1. Trench Support Systems:

9.3.1.1. Sloping and Benching Systems:

1. Excavations shall be slopped at an angle not greater than 40º measured from the horizontal unless a report of a soil testing lab which determines the stability of the soil in an angles more than 40º measured from the horizontal have been submitted and approved by the Specialized Department in Dubai Municipality (figure 11).

Fig.11

9.3.1.2. Shoring System:

1. Timber or Aluminum shoring structure shall be installed to support the sides of an excavation as a method of protection against cave-ins. This system shall be used when using of the slopping or benching systems is impractical.
2. The members of the shoring system shall be vertically and horizontally erected and both ends are connected by trench jacks to prevent slippage or falling of the sides (figure 12).

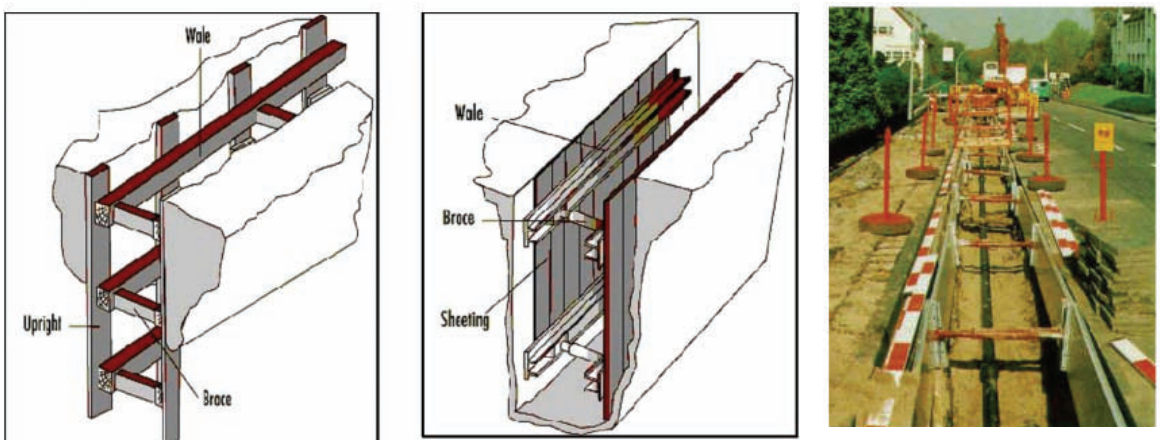


Fig. 12

9.3.1.3. Trench Shields:

1. Trench shield system is the best support system to protect against cave-ins. Shields shall be designed or pre-manufactured so as to fit in the excavation parameters and thereby protect employees within the structure (figure 13).

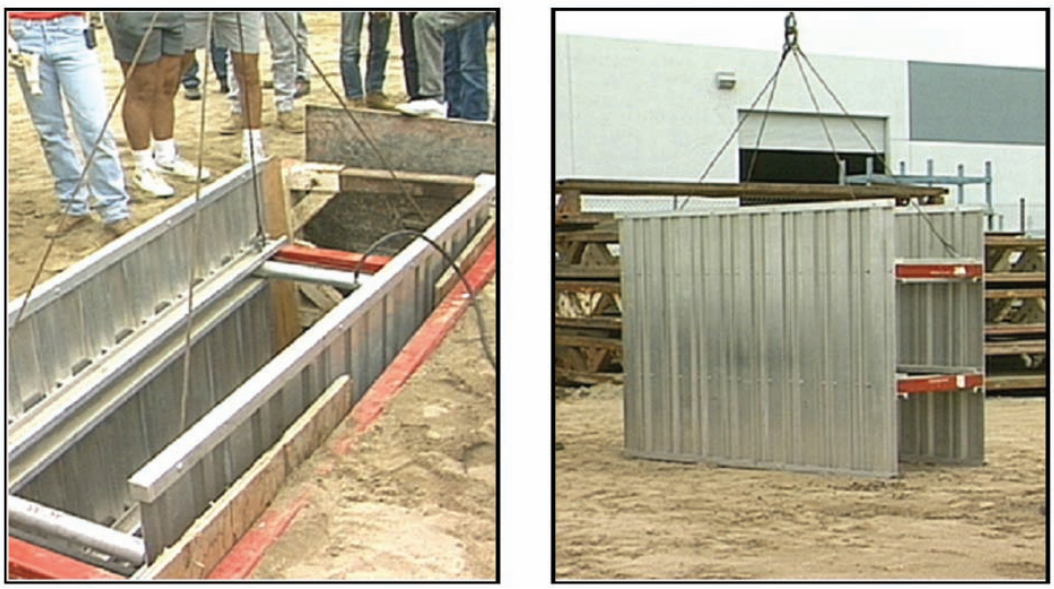


Fig. 13

CHAPTER TEN

Concrete and Masonry

Introduction:

Concrete and masonry is considered one of the dangerous activities in the construction industry. It includes concrete pouring, masonry activities, formwork and shoring systems for ceilings and other structures, also it is considered one of the activities which badly affect the environment.

This chapter of the safety manual covers safety precautions and requirements to be followed when performing any concrete and masonry work.

101- General Requirements:

10-1-1 Handling Material:

Employees working with cement and concrete shall wear necessary personal protective equipment such as: Goggles, protective helmets, gloves, rubber boots, and suitable clothing which cover the body completely and prevent the exposure of the skin to cement, concrete, and any other chemicals used in manufacturing as practically as possible. Suitable masks shall be used when working with bulk cement.

10-1-2 Formworks and Shoring:

1. All formworks shall be erected according to the sizes and dimensions specified in the approved drawings, and shall be adequately supported to ensure that it will safely sustain all loads that might be applied. It is necessary to obtain the approval of the consultant engineer before starting concrete pouring.
2. When dismantling the formwork after being used, all nails shall be removed, and the formwork shall be cleaned and stored neatly.
3. Formworks for ceilings and other structures shall be erected by qualified well trained competent persons chapter 8 of this manual concerning scaffolds safety shall be referred to.
4. when Employees working more than 2 meters (6 feet) above any adjacent working surfaces, standard railing system shall be erected around the work area or safety harnesses or any other means to protect from fall hazards shall be provided to employees to protect them from fall hazards in compliance with the technical guideline # concerning fall protection equipment.

10-1-3 Concrete Discharge Pipes (Chutes):

1. Concrete inclined chutes (skips) shall be erected by persons who has adequate experience in such type of work, and shall be inspected and maintained on daily basis to ensure that it is in a good operating condition.
2. These chutes shall be adequately fixed and supported to prevent vibration and displacement.
3. The area under these chutes shall be barricaded to protect employees from the hazard of falling concrete.
4. When transporting concrete to higher levels using pipes the following shall be considered:
    - Determine the route of pipes to ensure the minimum changing of the route to avoid sharp bending or kinking.
    - Carrying out periodical inspection to pipes and metal clamps to ensure they are free of wears due to friction caused by concrete pouring and to ensure that no leak from joints.

10-1-4 Concrete Buckets :

1. Riding on concrete buckets shall be prohibited Also it shall not be used to transport employees to the different levels in the building.
2. Concrete buckets shall be attached to the crane hooks which has a safety latch.
3. Concrete buckets shall be free of any extensions that could allow the accumulation of concrete and thus falling down,
4. Concrete movement shall be supervised by a competent person.
5. All concrete buckets, pipes, and mixers shall be thoroughly cleaned at a designated locations provided with recycling facilities for concrete and water according to the regulations of the concerned authorities.
6. Water resulted from the cleaning operations of concrete wastes shall not be drained to the public sewage or drainage systems or to the storm water drainage pipes unless they are properly treated according to the regulations of the concerned authorities.

10-1-5 Concrete Buggies :

1. Concrete buggies shall be kept clean and free from any accumulated materials, proper stoppers shall be used to control the movement of such buggies and stop it at all location for off loading concrete and material.
2. Concrete buggies shall be equipped with special handles to protect hands and fingers from friction.
3. Handles of concrete buggies shall not extend beyond the wheels on either side of the buggy. (Fig. # 1).

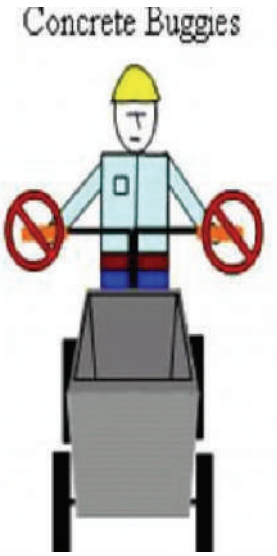


Fig.1

10-1-6 Concrete Runways :

1. All concrete runways shall be of adequate strength and adequately supported, and is wide enough to accommodate concrete buggies, sand, material etc.
2. No more than 5% slope shall be permitted in such runways, and timber runways shall be provided with proper stopper to slow down the buggies speed and protect it from overturning.
3. Runways shall be free of slippery material such as greases and silts.

10-1-7 Concrete Mixers:

1. Exposed gears, chains and rollers of mixers shall be properly guarded.
2. Barricades shall be provided at the area where the box will be lowered to prevent employees from approaching or walking under the box.
3. No residual concrete material shall be allowed around concrete mixers.
4. Wires and pulleys of the concrete handling shall be inspected on daily basis to ensure safe operation.
5. Bulk storage bins, containers, or silos shall have conical or tapered bottoms with mechanical or pneumatic means of starting the flow of material.
6. Concrete mixers equipped with 90 cm or larger loading skips shall be equipped with a mechanical device to clear the skip of material and shall have guardrails installed on each side of the skip. (Fig. # 2).

Fig.2

7. Concrete buckets equipped with hydraulic or pneumatically operated gates shall have positive safety latches or similar safety devices installed to prevent premature or accidental dumping. The buckets shall be designed to prevent material from accumulating on the top and sides of the bucket.
8. Elevated concrete buckets shall be routed, to the extent practical, to minimise the exposure of workers to hazards associated with falling buckets or concrete. The crews shall be kept away from under concrete buckets by a adequate distance. (Fig. # 3).
9. Riding on concrete buckets during lowering or raising it shall be prohibited. (Fig. # 3).

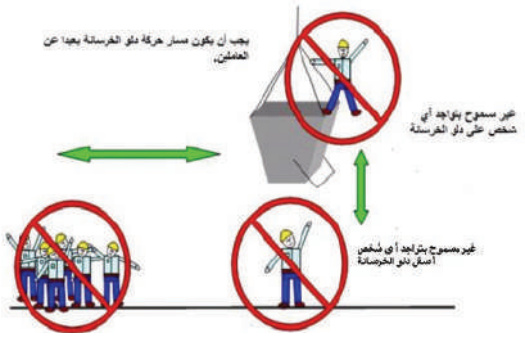


Fig.3

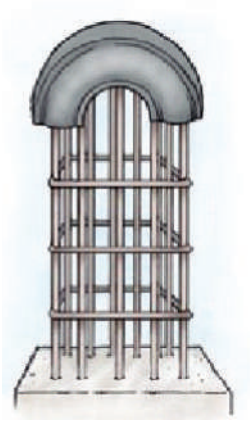
10. Discharge pipes shall be inspected periodically and according to the guidelines of the manufacturer. All damaged parts shall be replaced and shall be adequately and safely attached.
11. Concrete shall not be poured in the form of free fall.

10-1-8 Concrete Transit Mixers:

1. An employee who has a good knowledge of giving the correct signals to warn employees on site when concrete transit mixers are moving reverse and the direction of the discharge box, also to guide the truck operator.
2. The routes designated for the reverse movement of the concrete trucks shall be free of any equipment, debris and workers.
3. It is recommended to let the routes designated for the reverse movement of the trucks in one direction, and in a circular way to reduce the collision hazards,
4. All trucks shall be equipped with reverse alarm and flash light which will work when trucks move backward,
5. Contractor shall take all the necessary means to remove periodically and continuously all concrete wastes from site and dispose of in the designated places.
6. The contractor shall provide means of cleaning of trucks tyres, concrete transit and mixers before leaving from the building location to the street.
7. Contractor shall arrange to clean the area surrounding the site from sands, dust and any other material which might affect the street cleanness, and pavement.
8. Ready made concrete companies shall take all the necessary measures and means to ensure that concrete or water shall not be leaked by treating the nozzles of the pumps and mixers by strong stoppers or using mechanical means to prevent leakage, all measures shall be taking to prevent the leakage of oil from the concrete trucks and mixers during transporting or discharging of concrete.

10-1-9 General Construction:

1. The contractor shall develop and prepare a method statement for structure construction includes all the necessary steps to carry out works and the precautions to be taken to ensure the safety of employees during all the stages of work.
2. The removal of the supporting systems from the structure elements shall be made at the pre-determined times according to the nature and specification of the project and after obtaining the permission of the consultant engineer on that to ensure safety of the building and to avoid collapse or any damage during the period of weakness or un-stability.
3. Construction loads shall not be placed on a concrete structure unless the consultant engineer determines in writing that the structure is capable of supporting the loads.
4. Employees shall not be permitted to work above or in positions exposed to protruding reinforcing steel or other impalement hazards unless provisions have been made to cover them and adequately protect them to avoid employees injury in case falling on them Fig. (4).



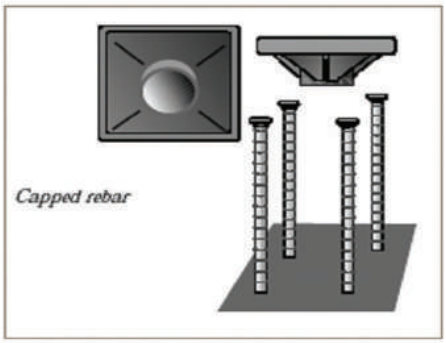


Fig.4

5. The contractor shall take all the necessary precautions to ensure the stability of reinforced steel during the different stages of work and during pouring of concrete.
6. When working with formworks or reinforced steel on sloped surfaces, the contractor shall take the necessary measures to ensure the stability of the formworks and the reinforced steel during the different stages of work and it is preferable always to work from bottom up.
7. When pouring concrete for structure elements, provisions shall be made to avoid the accumulation of big quantities of concrete exceeding the capacity of the formworks to support such quantities.

8. Post Tensioning Concrete: (Fig. # 5 & 6)

Fig.5

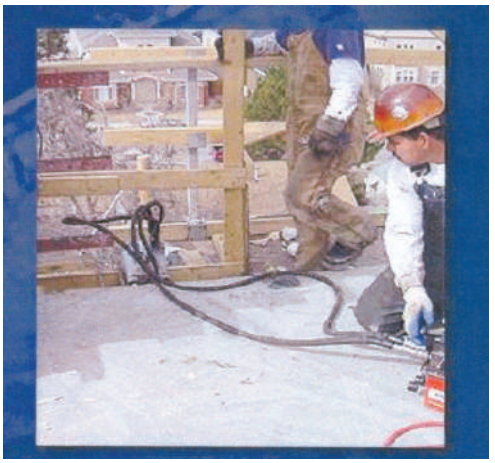


Fig.6

- A job hazard analysis shall be made to the operation of post tensioning before performing it to determine all the potential hazards associated with this operation and to determine the necessary precautionary measures.
- No employees (Except those essential to the post-tensioning operations) shall be permitted to be present in the area.
- Signs and barriers shall be erected to limit employee access to the post-tensioning area during tensioning operations.
- The contractor shall ensure that all the equipment and devices used for post-tensioning operations are safe and a safety certificate must be issued by a inspection body approved by the municipality stating that the equipment, devices and compressors are safe.

9. The structural steel and the reinforced steel used for walls, piers and columns or any vertical structures operations shall be supported and/or guyed to prevent them from overturning or collapse. The support of different reinforced steel shall be designed by specialized engineer and approved by the consultant engineer.

10. All practical precautions such as using support systems whenever necessary shall be followed to prevent exposure of any employee or the public due to the collapse of any part of a building or other structure during the stage of weakness or un-stability.
11. Measures shall be taken to prevent unrolled wire mesh from recoiling.

102- Roof Support Systems:

10-2-1 Support (Shoring) Works: (Fig. # 7 & 8)

Fig.7

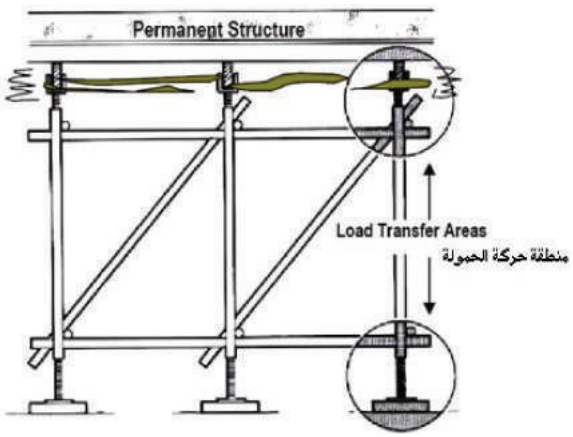


Fig. 8

1. Support systems shall be designed by a specialized organization and shall be approved by the consultant engineer.
2. All formwork, shoring, and bracing shall be designed, fabricated, erected, supported, braced, and maintained so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by the structure, and then the temporary supports systems shall be removed.
3. When the roof support systems are erected on concrete roof, the consultant engineer and the contractor shall ensure that these roofs are capable of supporting the imposed loads and to determine if additional supports (Back propping) is needed and designed according to the project specifications and approved by the consultant engineer.

10-2-2 Planning and Design:

1. Roof support systems shall be designed and fabricated and erected as per the specifications specified by the manufacturer.
2. The specifications of the design and fabrication and the execution of the support systems shall be kept on site during the stage of planning and execution to be reviewed by the specialized department.

10-2-3 Erection of Roof Support (Shoring) Systems:

1. Supporting ground or completed construction upon which formwork and shoring is to be placed shall be of adequate strength to carry the vertical and lateral loads to be imposed.
2. When shoring systems shall be erected on sand soil, the type of sand shall be adequately inspected and mud sills shall be placed under the vertical posts.
3. Formworks for shoring shall be sound, rigid and capable of carrying the maximum intended load.
4. Shore heads, extension devices, or adjustment screws shall be firm contact with the (posts) footing sill and form material.
5. Diagonal bracing shall be provided in vertical and horizontal planes to provide stiffness and to prevent buckling of individual members (reference shall be made to Chapter 8 on Scaffolding and the technical guideline no. (38) relevant thereto).
6. Whenever connections in vertical posts are needed due to height of the ceilings, a diagonal and vertical bracing shall be adequately provided in accordance with an approved design by the consultant to ensure stability of the shoring when loaded.

10.2.4. Inspection:

1. The contractor and the consultant shall inspect all shoring equipment prior to erection to determine that they meet the requirements specified in the shoring design. Any equipment found to be damaged shall not be used.
2. Erected shoring equipment shall be inspected during and immediately after the placement of concrete. Any shoring equipment that is found to be damaged, displaced, or weakened shall be immediately reinforced or re-shored.

10.3. Pre-cast Concrete:

1. Pre-cast concrete wall units shall be adequately and temporary supported to prevent overturning and to prevent collapse until permanent connections are completed.
2. No employee shall be permitted under pre-cast concrete members being lifted or tilted into position except those employees required for the erection of those members after taking all precautions to protect them against potential hazards.

10.4. Masonry:

1. A limited access zone shall be established whenever a masonry wall is being constructed. The limited access zone shall conform to the following:
    - The limited access zone shall be established prior to the start of construction of the wall.
    - The limited access zone shall be equal to the height of the wall to be reconstructed plus 1.25 m. (4 feet) as specified in the technical requirements, and shall run the entire length of the wall (figure 9).

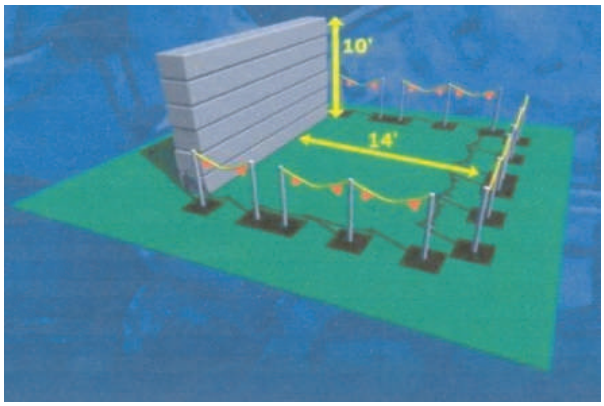


Fig. 9

- The limited access zone shall be established on the side of the wall which will be un-scaffolded.
- The limited access zone shall be restricted to entry by employees actively engaged in constructing the wall. No other employees shall be permitted to enter the zone.
- The limited access zone shall remain in place until the wall is adequately supported to prevent overturning and to prevent collapse. The wall shall be braced to prevent overturning or collapse.

2. Masonry walls shall not be used to support any lateral loads or as supporting walls unless a special design has been made and approved by the consultant engineer.
3. All masonry walls shall be adequately braced to prevent overturning and to prevent collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place.
4. Scaffolds used by construction employees shall not be used to provide temporary lateral support for masonry walls.
5. Employees working on more than 2 meters (6 feet) height shall be provided with fall protection equipment (safety belt) (Reference shall be made to the technical guideline no. (19) on Fall Protection).
6. Excavation under the foundation level of any masonry wall shall not be permitted unless adequate shoring has been made.

10.5. Cast-in-place Concrete Labs:

1. In case cast-in-place concrete lab shall be established in the site, environmental effects resulting from the lab shall be studied and necessary licenses shall be issued from the authority concerned.
2. The contractor shall take all necessary precautions to prevent environment contamination through controlling dust emissions of concrete preparations by applying the following precautions:
   - To ensure un-leaking of connections used for loading and unloading of concrete silos.
   - To provide concrete silos with necessary filters in accordance with the manufacturer's requirements.
   - To provide concrete silos with a luminous and acoustic alarm device equipped

with pinch valve which will be activated when concrete permissible limit is attained.

- To store sand and stone in enclosed areas provided with exhaust fans equipped with dust filters.
- To provide concrete grounds for all lab area.
- To continuously wet the lab area with water.

3. Conveyor belts shall be fully guarded with exhaust hood equipped with filters at the front and rear ends of the conveyors and in changing direction points.
4. Concrete mix chambers shall be fully closed with enclosed contact pipes through which concrete components shall be mixed.
5. Concrete mix chambers shall be provided with automatic cleaning devices. Manual cleaning shall not be permitted to prevent entrance of employees to the chambers.
6. Appropriate PPE and respirators shall be provided to employees.
7. An operating control switch for the lab which automatically opens the door of the concrete mix chambers shall be used to prevent double action of operation and maintenance.

CHAPTER ELEVEN

Steel Erection

Introduction:

Construction workplaces are always associated with steel erection activities used in the construction of single and multi-story buildings and bridges.

This chapter sets forth the safety procedures and rules to be applied to protect employees engaged in steel erection from potential hazards associated with these activities.

Steel Erection Activities:

11- 1 General Requirements:

1. Prior to beginning the erection of any steel structure, the contractor shall develop a detailed steel erection plan, includes, risk assessment, temporary supports, and erection equipment used, and the sequence of erecting of these structures, and this plan shall be submitted to the Consultant Engineer for approval.
2. A steel erection contractor shall not start steel erection unless ensuring that concrete has attained and has sufficient strength to support the loads imposed during steel erection, and obtains the approval of the consultant engineer according to the project specifications.
3. The contractor shall provide his employees with all necessary personal protective equipment and shall ensure their effective use.
4. Steel erection materials shall be stored and transferred in accordance with their erection order and sequence.
5. Hand tools shall be protected from falling while steel erection activity is performed.
6. Adequate precautions shall be taken during hoisting and rigging activities of steel structure to prevent their potential slipping out or fall. A structure engineer shall design the location of load anchoring points, load balance and hoisting with reference to chapter 21 on lifting tools and equipment.
7. Load carrying capacity of the crane shall be determined to ensure that it is able to lift the load. Hoisting processes shall be controlled so as not to allow swinging of joists or any other structural members.
8. Adequate precautions shall be taken when working on suspended scaffolds. If platforms are installed over those scaffolds they shall be free from bolts, nuts and debris in accordance with chapter 8 on scaffolds and the technical guidelines no. (38).
9. When working on suspended scaffolds, employees shall be provided with harness belts anchored to a stable and permanent structure. When guardrail or safety belt systems are impracticable, a safety net shall be installed directly below the working area.
10. Work on open web steel joists shall not be permitted during strong winds or heavy rains which endanger the safety of employees. Work shall be completely stopped when wind speed is 38 km/h or more.
11. Each steel member shall be correctly erected in its place and adequately anchored before removing the temporary supports or released from the hoisting line.
12. Trusses shall be adequately anchored or temporarily supported until completion of permanent anchorage.

11.2. Material Hoisting and Rigging:

1. During hoisting operation, cranes and derricks shall be kept at a distance not less than 3 meters from electrical power lines.
2. Cranes used in steel erection activities shall be regularly inspected to ensure their safe working condition.

3. Routes of suspended loads shall be pre-planned to ensure that no employee is required to work directly below a suspended load, unless there is a protective shields above them. The area below the hoisting equipment shall be cleared (figure 1).

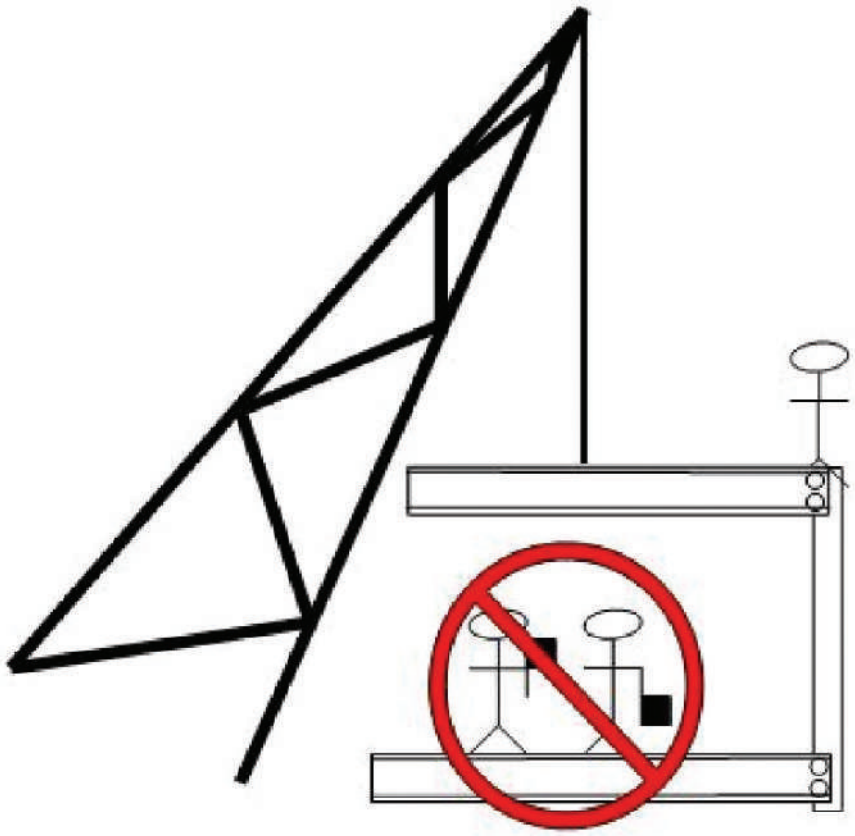


Fig. 1

4. Hoisting of different size steel bundles shall be avoided unless they are all tied in one bundle to prevent slipping out.
5. Hooks with self-closing latches shall only be used in material hoisting activities.
6. Tag lines shall be used to control the movement of the suspended loads during hoisting operations. Tag lines shall be properly attached to the load to prevent slippage and displacement. (Fig. # 2).

Fig. 2

7. Tightly closed boxes or basket nets shall be used to hoist small pieces, sheets and small bundles.

11.3. Fastening with bolts and welding:

1. All bolts, nuts, tools and any other objects which might be scattered shall be kept in boxes to avoid displacement resulting form work vibrations.
2. Welding machines' cables, air lines and hoses shall be laid in a way to avoid tripping hazards, and to protect them against damage. They shall not permitted to be laid in aisles or corridors.
3. Welding cylinders shall be fixed in stable up-right position. Empty cylinders shall be immediately removed from the worksite. Reference is made to chapter 15 on welding.

11.4. Temporary Platforms:

1. In multi-story steel web structural buildings, a temporary platform of metal sheets with appropriate and adequate thickness and strength shall be installed. They shall be capable of withstanding the imposed loads (figure 3) on the beams and girders until permanent platforms have been installed. Temporary platforms shall be properly anchored so as to prevent their movement, slippage or overturning when exposed to loads. All fall protection systems shall be provided for employees.
2. Upon completion of joist installations, temporary platforms shall be installed over the whole area except for the necessary openings for work purposes.

Fig. 3

11.5. Column Anchorage:

1. Each structural column shall be anchored by a minimum of four anchor rods (anchor bolts) provided that they are not less than what specified in the approved plans, designs and execution methods. Employees shall not be permitted to climb those columns (figure 4).

Fig. 4

11.6. Beams and Columns erection:

1. During placing steel web structural members, the load shall not be released from the hoisting line until the members are secured with at least two bolts per connection provided that they are bolted in different sides of the bridge drawn up wrench-tight or the equivalent as specified in the project structural design (figure 5).

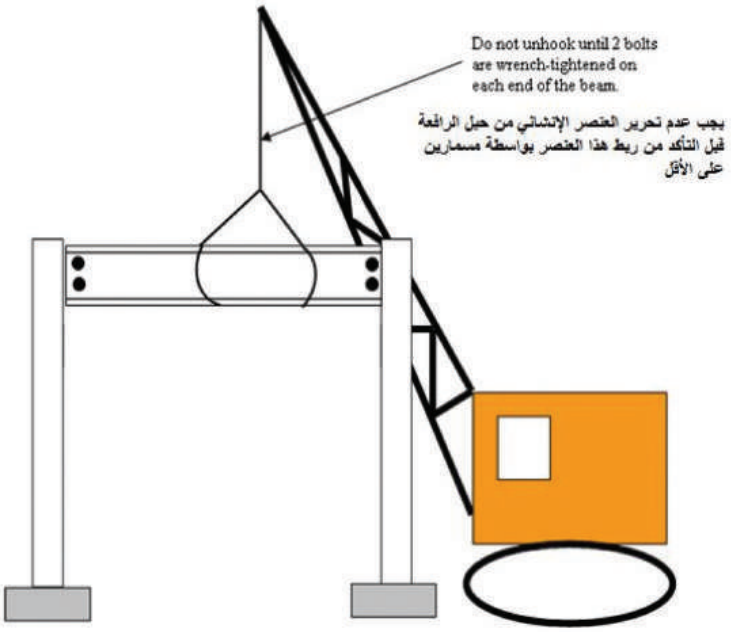


Fig.5

2. Any structural member of the steel joists shall be permanently anchored in accordance with the approved designs and specifications before the installation of other completing members.
3. Columns shall be supported in compliance with the technical requirements to ensure protection against overturning until permanently anchored.

11.7. Fall Protection:

1. Each employee engaged in a steel erection activity who is on a walking/working surface with an unprotected side or edge more than 2 meters (6 feet) above a lower level shall be protected from fall hazards by one of the following systems: (in line with the technical guidelines no (19) on fall protection)
    a. Guardrail Systems and Platforms
    b. Lifelines & Safety Harness (figure 7,8 & 9)
    c. Positioning Device System (figure 10)
    d. Warning Line System (figure 11)
    e. Safety Net System (figure 12 & 13)

The distance between the top rail and the mid rail or between the mid rail and the toe-board shall not exceed 47 cm.

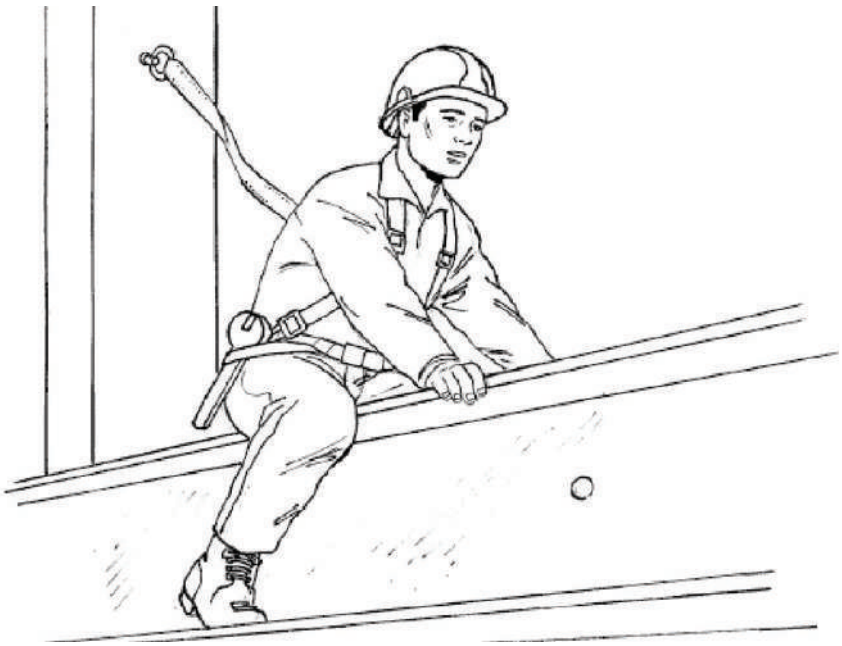


Fig.6

Fig.

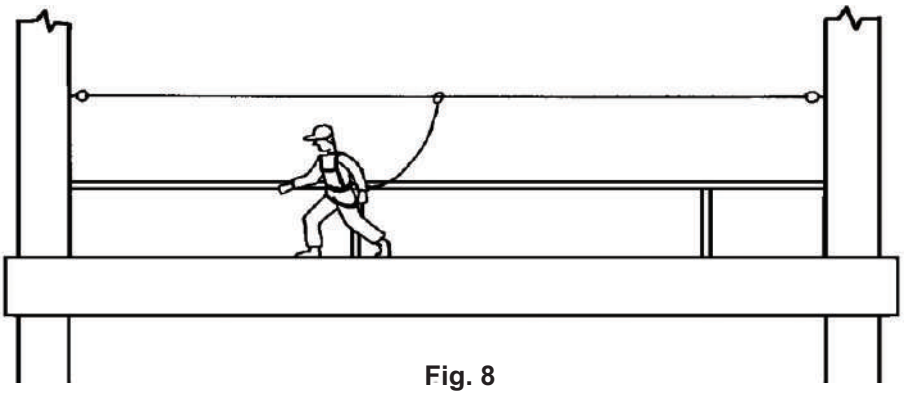


Fig. 8

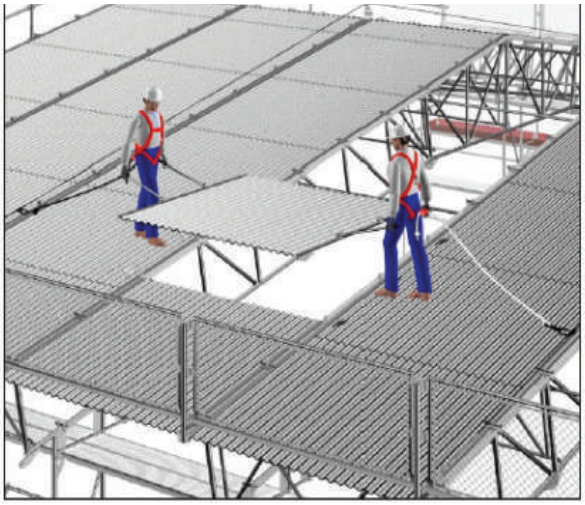


Fig.9

Fig.10

Fig.11

Fig.12

CHAPTER TWELVE

Underground Construction, tunnels, Shafts, Cofferdams, Caisson

Introduction:

Employees working in underground construction such as tunnels, shafts, wells, caissons, mines entrances, and cofferdams are exposed to many hazards such as: collapses, insufficient illumination, limited entrance and exits, exposure to toxic gases and fire and explosions.

This chapter of the safety manual covers the safety measures to be followed when working in underground construction activities, also it provides safety guidelines and requirements when working in such locations.

12 -1 General Requirements:

1. Contractor shall develop and prepare an action plan (method statement) which shall be applied during the whole period of the execution of the work, methods of execution, details of the specifications of the equipment and materials used, rescue teams and equipment, inspection methods and inspection tools etc.
2. Contractor shall carry out a risk assessment of the potential hazards, and shall develop and prepare a written plan includes safety measures that shall be followed according to the results of the risk assessment, also the suitable system of work permits shall be followed.
3. All employees working in tunnels or underground construction activities shall be physically and mentally fit to the job and shall not be less than 18 years of age.
4. Contractor shall ensure that workers are instructed and trained on the recognition and avoidance of hazards associated with underground construction.
5. Adequate and suitable personal protective equipment and clothing shall be provided to the employees working in underground construction and shall be worn.
6. Oncoming shifts shall be informed of any hazardous occurrences or conditions that have affected or might affect employee safety, including liberation of gas, equipment failures, earth or rock slides, cave-ins, flooding, fire or explosions, and shall be recorded in a special log book kept on site.
7. The contractor shall provide and maintain safe means of access and egress to all work stations, these means shall be maintained clean, and free of any debris, wastes, and any other hazardous obstacles.
8. Employees shall be provided with suitable means to protect them from exposure noise, reference shall be made to what have been specified in chapter 3 and chapter 4 of this manual in this regard.
9. Employees working in wet underground areas shall be provided with rubber boots.
10. Lighting circuits shall be installed on one side of the tunnel near the spring line and shall be mounted on insulators at each point of suspension.
11. Oil-fitted transformers shall not be used underground unless they are located in a fire-resistant enclosure and surrounded by a dike to contain the contents of the transformers in the event of a rupture.
12. Evacuating employees from underground construction shall be made easily in case of fire, suffocation or any bodily or respiratory inconveniences. All employees shall be made aware of all these hazards.
13. Vertical shafts of small diameter which is entered by employees shall covered by a steel lining or concrete pipe, wood or any other material with adequate strength to support the adjacent soil and prevent its collapse.
14. This lining shall cover the whole depth of the shaft and shall extend a minimum of 30 cm (1 foot) above ground level.

15. All shafts or vertical access ways with depth more than 1.2 meters (4 feet) shall be supported by using wooden sheets or lining.
16. The roof, walls and sides of the working area shall be inspected at the beginning of each shift and regularly thereafter.
17. When any signs of the presence of historical statues are noticed in the working area, concerned authorities shall be notified immediately.

12- 2 Access and Egress:

1. Access to any underground openings shall be controlled to prevent unauthorized entry.
2. Unused access ways or other openings shall be tightly covered or fenced off and shall be posted with warning signs indicating “KEEP OUT” or similar language.
3. Every location of underground construction shall have a check-in/check-out system that will ensure that above-ground personnel can determine the identification of all underground personnel.
4. A qualified competent person shall be available at all access ways to the underground construction for communication and emergency cases purposes.

12- 3 Communications:

1. The contractor shall ensure that a qualified competent person is present above ground near the access ways at any time employees are working underground. This person shall control all entry and egress operations, communication with employees underground, and he shall be responsible of summoning emergency teams when required.
2. In situation where unassisted voice communication is inadequate, power-assisted means shall be used to provide communication among workers and support personnel.
3. At least two effective means of communication (at least one of which shall be voice communication) shall be provided in all shafts that are being developed or used either for personnel access or for hoisting.
4. A communication system shall be tested by qualified, trained, competent person upon initial entry of each shift to the underground and as often as necessary thereafter to ensure proper operation.
5. Any employee working alone underground, (who is both out of range of natural unassisted voice communication and not under observation by other person) shall be provided with effective means to communicate the need for and to obtain emergency assistance. Employees working alone shall be required to check in with their supervisor at least once an hour.

12- 4 Emergency Rescue Plans and equipment:

1. Contractor shall develop and prepare plans for rescuing personnel who might become injured or incapacitating while underground or in a shaft or caisson.
2. Plans shall be periodically reviewed with all affected personnel so that they maintain a working knowledge of emergency responsibilities and procedures.
3. Emergency plans shall be drilled on a periodic basis to ensure their efficiency.
4. Emergency equipment specified in the emergency plan shall be provided within 15 minutes of each portal or shaft entry. Inspections and workability tests of the equipment shall be made and documented periodically.
5. When a shaft is used as a means of egress, arrangements shall be made for power-assisted hoisting capability to be readily available in an emergency, unless the regular

hoisting means can continue to function during a power failure.

6. All employees working underground shall be provided with self rescuing/emergency respirators (ref. is made to technical guideline # 7) to protect them where they may be trapped by smoke or gas.
7. Each worker underground shall have an acceptable portable hand lamp or cap lamp in his work area for emergency use, unless natural light or an emergency lighting system provides adequate illumination for escape. (Fig. # 1).

Fig.1

12 -5 Rescue Teams:

1. On job sites where less than 25 persons are underground at one time, provisions shall be made for at least one five-person rescue team to be either on the job site or within 30-minutes maximum travel time from the underground entry point. (Fig. # 2).

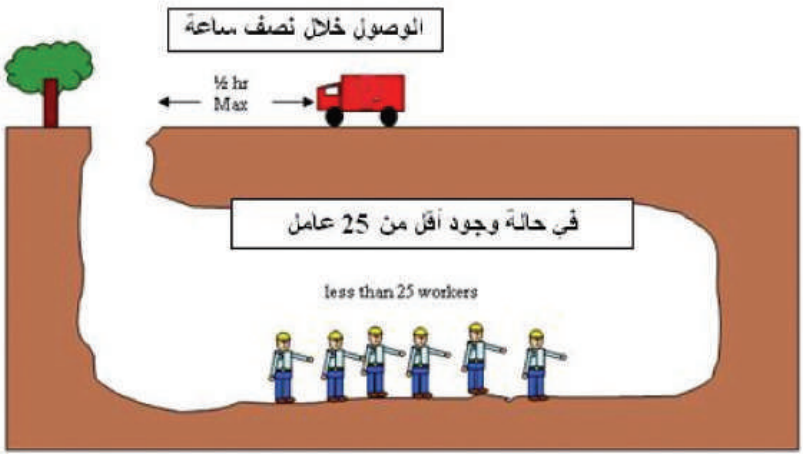


Fig. 2

2. On job sites where 25 or more persons are underground at one time, provisions shall be made for at least two five-person rescue teams. One rescue team shall be on the job site or be within 30-minutes travel time from the underground entry point, and the other rescue team shall be within 2-hours travel time. (On call) (Fig. # 3).

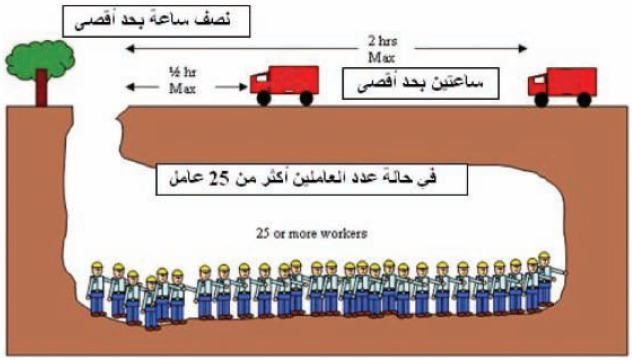


Fig. 3

3. Rescue team members shall be qualified in rescue procedures, the use and limitations of breathing apparatus, and the use of firefighting equipment. Rescue teams shall be kept informed of conditions at the job site which may impact their response.
4. On job sites where flammable or noxious gases are encountered or anticipated in hazardous quantities, rescue team members shall practice donning and using Self Contained Breathing Apparatus (SCBA).

12- 6 Hazardous Atmospheres:

Underground construction operations shall be classified as potentially gassy (hazardous) operations if air monitoring discloses 10% or more of the lower explosive limit for methane or other flammable gases (Lower Explosive Limits –LEL- FOR METHANE 5%, while Upper Explosive Limits –UEL- is 15%).

12-6-1 Protective Measures for Hazardous Atmospheres:

1. Only equipment approved for the hazardous location and maintained in suitable condition shall be used in hazardous atmospheres.
2. Mobile diesel-powered equipment used in hazardous atmospheres operations shall be approved from the concerned authority, and shall be operated in accordance with these requirements and the manufacturer's instructions.
3. Smoking shall be prohibited in all hazardous atmosphere operations and the contractor shall be responsible for collecting all personal sources of ignition, such as matches and lighters, from all persons entering this hazardous atmosphere areas.

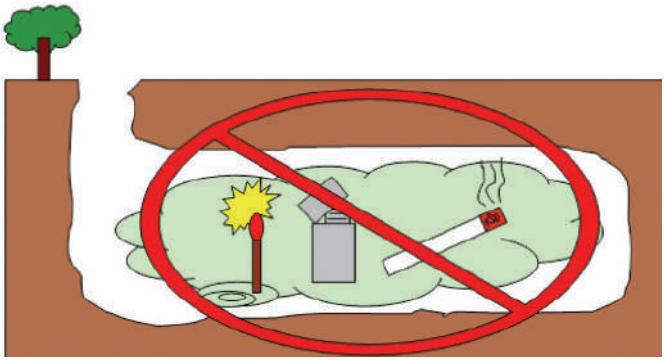


Fig. 4

12- 7 Air Quality Standards and Air Monitoring:

1. The contractor shall assign a qualified trained and specialized competent person to conduct air monitoring in the underground areas.
2. Air monitoring devices shall be approved by the concerned authorities, calibrated before and after use, and used in accordance with the manufacturer's instructions.
3. When air monitoring is required, the competent person shall determine which substances to monitor and how frequently to monitor. Such determination shall be based on:
    - The location of the job site and proximity of fuel tanks;
    - The geology of the job site, particularly the soil types and their permeability.
    - Any history of air quality contaminants in nearby job sites or any changes in air quality monitored during a previous shift
    - Work practices and job site conditions (Use of diesel engines, explosives, or fuel gas, ventilation characteristics, visible atmospheric conditions, welding or cutting etc.).
4. A record (including location, date, time, substance, monitoring results, and name of person conducting the test) of all air quality tests shall be maintained at the job site.
5. The atmosphere in all underground work areas shall be tested as often as necessary to assure that the atmosphere contains at least 19.5% oxygen and no more than 22% oxygen. (Fig. # 5).

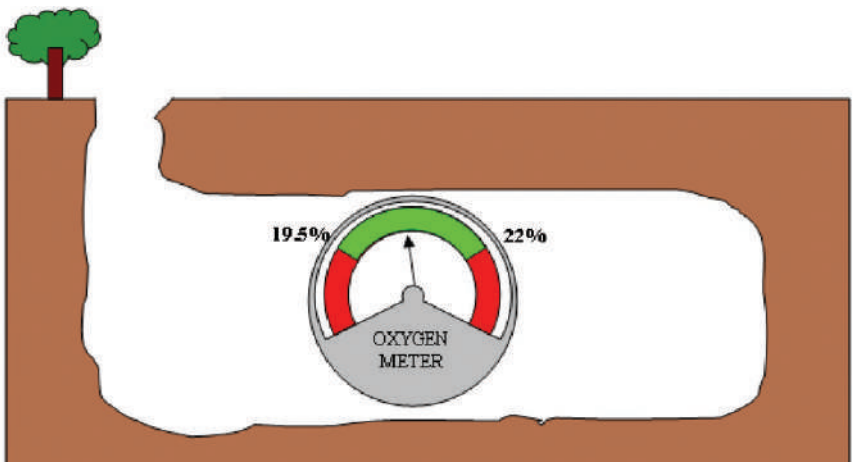


Fig. 5

6. Testing for oxygen in underground work areas shall be conducted first and before any other test is conducted.
7. The atmosphere in all underground work areas shall be tested quantitatively for Carbon Monoxide, Nitrogen Dioxide, Hydrogen Sulfide, and other toxic gases, dusts, vapors, mists, and fumes as often as necessary to ensure that the Permissible Exposure Limits (PEL) are not exceeded.
8. The continuous sampling and indicating Hydrogen Sulfide monitor shall be designed, installed, and maintained to provide a visual and aural alarm when the concentration of Hydrogen Sulfide reaches 10 ppm (10 parts per million) in this case all employees shall be evacuated until additional measures are taken to reduce the concentration level

to lower than this level.

9. The atmosphere in all underground work areas shall be tested quantitatively for methane and other flammable gases as often as necessary to determine whether it is necessary to take the following precautions:
    - Whenever 5% or more of the lower explosive limit for methane or other flammable gases is detected in any underground work area or in the air return, steps shall be taken to increase ventilation air volume to reduce the concentration to lower than this level.
    - Whenever 10% or more of the lower explosive limit for methane or other flammable gases is detected in the vicinity of welding, cutting, or other hot work, such work shall be suspended until the concentration of such flammable gas is reduced to less than 10% of the lower explosive limits.
    - Whenever 15% or more of the lower explosive limit for methane or other flammable gases is detected in any underground work area or in the return:
        - All employees, except those necessary to eliminate the hazard, shall be immediately withdrawn to a safe location above ground; and
        - Electrical power, except for acceptable pumping and ventilation equipment, shall be cut off to the area endangered by the flammable gas until the concentration of such gas is reduced to less than 15% of the lower explosive limit.
10. If diesel-engine or gasoline-engine driven ventilating fans or compressors are used, an initial test shall be made of the inlet air of the fan or compressor, with the engine operating, to ensure that the air supply is not contaminated by engine exhaust.
11. When rapid excavation machines are used, a continuous flammable gas monitor shall be operated at the face with the sensor placed as high and close to the front of the machine's cutter head as possible.
12. When ventilation has been reduced to the extend that hazardous levels of methane or other flammable gases may have accumulated , all affected areas shall be tested after ventilation has been restored and before any power, other than for acceptable equipment, is restored.
13. Whenever the ventilation system has been shut down with all employees out of the underground work areas, only competent persons authorized to test for air contaminants shall be allowed underground until the ventilation has been restored and all affected areas have been tested for air contaminants and declared safe.
14. Operations that meet the criteria for potentially gassy or gassy operations (hazardous operations) shall be subjected to the following monitoring:
    - Tests for oxygen content shall be conducted in all affected work areas and work areas immediately adjacent to such areas at least at the beginning and midpoint of each shift;
    - When using rapid excavation machines, continuous automatic flammable gas monitoring equipment shall be used to monitor the air at the heading, on the rib, and in the return air duct. The continuous monitor shall signal the heading and shut down electric power in the affected underground work area, except for acceptable pumping and ventilation equipment, when 20% or more of the lower explosive limit for methane or other flammable gases is encountered.
    - A manual flammable gas monitor shall be used as needed, but at least at the beginning and midpoint of each shift, to ensure that the permitted limits are not exceeded, in addition, a manual electrical shut down control shall be provided near the heading.

- Local gas tests shall be made prior to and continuously during any welding, cutting, or other hot work.

12 -8 Ventilation:

1. Fresh air shall be supplied to all underground work areas in sufficient quantities to prevent dangerous accumulation of dusts, fumes, mists, gases, vapors.
2. Mechanical ventilation shall be provided in all underground work areas except where it is demonstrated that natural ventilation provides the necessary air quality through sufficient air volume and air flow.
3. Ventilation and exhaust systems for tunnel excavation shall be of sufficient capacity to maintain an adequate supply of uncontaminated air at all points in the tunnel.
4. The supply of fresh air shall not be less than 95 liter/second (200 cubic feet per minute - cfm) for each employee underground plus that necessary to operate the equipment.
5. The direction of mechanical airflow shall be reversible (with controls for reversing the airflow of ventilation systems).
6. Following blasting, ventilation systems shall exhaust smoke and fumes to the outside atmosphere before work is resumed in affected areas.
7. Gassy operations shall have ventilation systems installed which are constructed of fire-resistant materials and have acceptable electrical systems, including fan motors.

12 -9 Illumination:

1. Illumination intensity shall be sufficient to light the underground work areas in particular near to machinery.
2. Only lighting equipment that approved for the hazardous location shall be used (ex-proof).
3. Illumination intensity during general operations in tunnels shall not be less than 55 LUX (5 foot candle), and shall not be less than 105 LUX (10 foot candle) near shafts.
4. At least two different sources of illumination shall be provided at each area inside confined spaces to avoid shadows.

12- 10 Fire Prevention and Protection:

1. For every underground construction project, a fire prevention and protection plan shall be developed and implemented. The plan shall detail:
    - The specific work practices to be implemented for preventing fires;
    - Response measures to be taken in case of fire to control and extinguish the fire;
    - Equipment required for fire prevention and protection;
    - Personnel requirements and responsibilities for fire prevention and protection; and
    - Requirements for daily and weekly fire prevention and protection inspections.
2. Fire prevention and protection plans shall be reviewed with all affected personnel as often as is necessary for them to maintain a working knowledge of emergency responsibilities and procedures.
3. Plans shall be drilled as often as is necessary to ensure their efficiency
4. Open flames and fires are prohibited in all underground construction operations except as permitted for welding, cutting, and other hot work operations.
5. Smoking shall be strictly prohibited in all underground work areas, and readily visible signs prohibiting smoking shall be posted.
6. Adequate and suitable fire extinguishers shall be provided and maintained at each

portal and shaft entry, and at locations containing combustible materials.

7. A suitable fire extinguisher shall be provided at the head pulley and tail pulley of underground belt conveyors.
8. A fire extinguisher suitable for the expected fires shall be provided, and the maximum travel distance to reach to the extinguisher shall not be more than 8 meters.
9. No more than the amount of diesel necessary for work during the next 24-hour period shall be permitted underground.
10. The piping of diesel fuel from the surface to an underground location is permitted only if:
    - Diesel fuel is contained at the surface in a tank whose maximum capacity is no more than the amount required to supply the equipment serviced by the underground fueling station for a 24-hour period;
    - The surface tank is connected to the underground fueling station by an acceptable pipe or hose system controlled at the surface by a valve, and at the shaft bottom by a hose nozzle ;
    - The pipe is empty at all times except when transferring diesel fuel from the surface tank to a piece of equipment in use underground; and
    - Hoisting operations in the shaft are suspended during refueling operations if the supply piping in the shaft is not protected from damage.
11. Motor gasoline shall not be taken, stored, or used underground.
12. Acetylene and LP-Gas may be used underground only for welding, cutting, and other hot work. All safety requirements specified in chapter 15 of this manual concerning welding and cutting and technical guideline number (21).
13. Oil, grease, and diesel fuel stored underground shall be kept in tightly sealed containers in fire-resistant areas at least 90 meters (300 feet) from underground explosive magazines and at least 30 meters (100 feet) from shaft stations and steeply inclined passageways.
14. Diesel containers shall be contained within retaining walls strong enough to withstand any pressure applied on it as a result of spillage of all the diesel container contents, and shall contain such spillage; the volume of the retaining walls shall not be less than 110% of the volume of the diesel container.
15. Flammable or combustible materials shall not be stored above ground within 30 meters (100 feet) of any access opening to any underground operation.
16. Only fire-resistant hydraulic fluids approved by the concerned authority shall be used in hydraulically actuated underground machinery and equipment.
17. Electrical installations in underground areas where oil, grease, or diesel fuel are stored shall be used only for lighting fixtures.
18. Lighting fixtures in storage areas or within 7.5 meters (25 feet) of underground areas where oil, grease, and diesel fuel are stored shall be approved for such hazardous areas.
19. Any structure located underground or within 30 meters (100 feet) of an opening to the underground shall be constructed of material having a fire-resistance rating of at least 1 hour.

11- 12 Ground Support:

1. All wells or shafts over 1.2 meters (4 feet) in depth that employees must enter shall be supported by lagging, pilling or casting of sufficient strength to withstand shifting of the surrounding earth. Except where the shaft penetrates into solid rock.
2. After blasting operations in shafts, a competent person shall inspect the walls, ladders,

and timbers to determine if they have loosened or its strength and stability is affected by the explosion.

3. No employee shall be permitted to enter an unsupported auger-type excavation in unstable material for any purpose.
4. There shall be two safe means of access in shafts at all times, this may include the ladder and hoist.

12- 12 Tunnel Gates:

1. Areas beside tunnel gates and areas on top of these gates shall be maintained free of loose or sharp material.
2. All loose material shall be fixed by using suitable means, and these means shall be designed by qualified engineer.
3. Anchored chain-link fabric shall be provided on rock faces subject to scatter.
4. Where tunnels are excavated thorough earth or shale, any excavation above or adjacent to portal areas shall be sloped to the angle of repose or held in place by ground supports. When undercutting occurs on these slopes, whether due to erosion or other causes, the overhanging material shall be promptly removed.
5. A protective shelter shall be provided at each underground portal to protect persons and equipment from the hazards of falling rock or other material. The protective shelter shall project at least 4.5 meters (15 feet) out from the portal.
6. Contractor shall ensure that a comprehensive design for all casting and bracing systems for ceilings, sides, and walls of tunnels is made by qualified engineer and approved by the consultant engineer.
7. Support sets shall be installed so that the bottoms have sufficient anchorage to prevent ground pressures from dislodging the support base of the sets. Lateral bracing shall be provided between immediately adjacent sets to provide added stability.
8. Damaged or dislodged ground supports shall be repaired or replaced. Whenever possible, new supports shall be installed before removing the damaged supports.
9. All services and utilities enter the tunnel shall be protected against any damage which might occur as result of entering and exiting of machinery and equipment.
10. An outside drainage lines shall be installed to drain rain waters and other water accumulated near the portals of the tunnels to prevent these water from entering into the tunnel. In case the natural slope is not feasible, special mechanical means shall be used to remove such water.

12 -13 Haulage:

1. Haulage equipment used inside tunnels shall be of the type not consuming oxygen, and not contaminate the air in the tunnel.
2. Haulage equipment of rubber tires shall be equipped with two headlights at both ends, a backup light, and an automatic backup alarm.
3. All vehicles and mobile equipment required to move in and out underground construction areas shall have a revolving, flashing amber light, mounted so as to be visible in all directions. The flashing light shall be on whenever a vehicle or mobile equipment is in operation.
4. Where narrow-gage railroads are used for haulage, the tracks shall be properly secured to prevent shifting.

12- 14 Hoisting Operations:

1. Materials, equipment and tools that are being raised or lowered shall be adequately secured or stacked putting them in a cage or any other means to prevent them from shifting, snagging or falling into the shaft.
2. A proper audible and visible warning system shall be used at the bottom of the shaft to warn employees during hoisting operations.
3. Proper warning signs shall be posted at the bottom of the shaft to warn employees during hoisting operations.
4. Hoisting pulleys shall be equipped with limit switch to stop the hoisting operation at a certain level before contact the boom tip.

12- 15 Drilling:

1. Drilling Jumbo decks and stair treads shall be designed to be slip-resistant and secured to prevent accidental displacement. On jumbo decks over 2 meters (6 feet) in height, guardrails shall be erected (according to the technical guideline # 19 concerning fall protections). Safe access shall be provided to all working levels of drill jumbos.
2. Suitable barriers shall be provided around powered mechanical loading equipment to prevent access.
3. All connections between the hose supplying the drill with air shall be properly fixed to prevent kick back when disconnected or when the drill stops working.

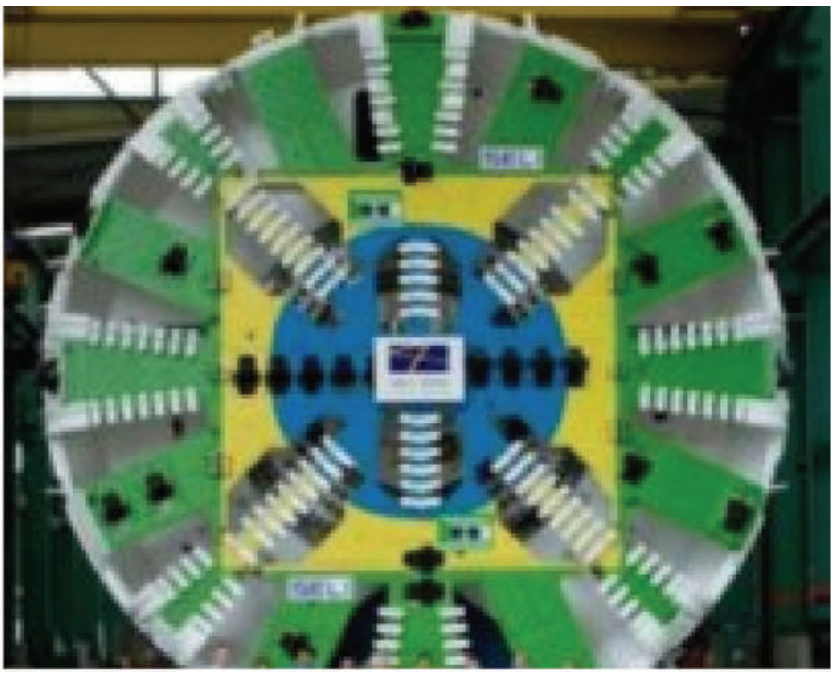


Fig.6

4. Necessary tests to the roof and walls at the work area shall be carried out at the beginning and end of each shift and periodically thereafter.
5. Drilling machines shall be inspected by a competent person and all defects shall be repaired before use.

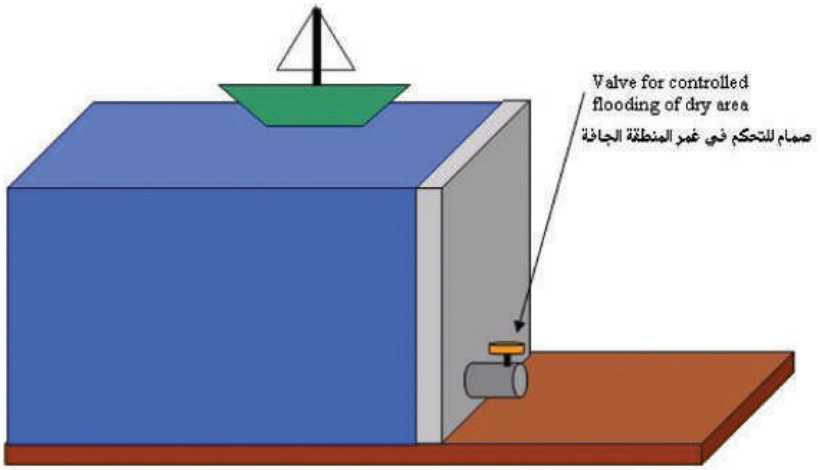
6. No person is allowed to remain on the jumbo drills except the operator and his assistance.
7. When moving the jumbo drill from an area to another area, the steel drill and its attachment shall be securely fixed.
8. The location where drilling shall take place shall be examined to ensure that there is no hazards before work begins.
9. No person is allowed to remain on the drilling tower during the rotation of drilling bits.

12- 16 Tunneling in Soil:

1. Where tunnels are excavated by conventional methods, the excavation shall not be extended more than 60 cm (24 inches) ahead of ground supports.
2. Under no circumstances shall persons be permitted to work in unsupported sections of the tunnels.
3. All voids in back of ground supports shall be filled blocked braced, or treated to prevent further cave-ins.
4. Where liner plate is not used for tunnel support, 5 cm (2 inches) wire mesh or chain-link fabric shall be installed over the crown section, extending down to the spring line on each side of the tunnel and secured in place.

12- 17 Cofferdams and Caissons:

1. When designing cofferdams or caissons that there is a possibility that water may rise, also necessary provisions should be followed to control flooding at the work area.
2. When it is necessary to use slopes, bridges, and walkways during working in cofferdams, proper protection such as standard railing shall be provided.
3. The minimum number of ladders, passageways, or slopes shall not be less than 2, or the area shall be provided with other means helps to evacuate workers and tools in case of emergency.
4. Instructions and regulations concerning emergency evacuation of employees and tools shall be clearly posted.
5. Every cofferdam or caissons and very part thereof shall be:
    - Of good construction
    - Of sound material and free from patent defect
    - Properly maintained.
6. In any cofferdam or caissons, there shall be adequate means (isolated room) for persons to reach places of safety in the event of an in-rush of water.
7. No cofferdam or caisson shall be constructed or placed in position or altered or dismantled except under the immediate supervision of a competent person.
8. All material for the construction or fixing of a cofferdam or caisson shall be inspected by competent person. Unsuitable or defective material shall not be used.
9. No person shall be employed in cofferdam or caisson unless it has been inspected by a competent person at least once on the same or preceding day.
10. Thorough examination shall be carried out whenever explosive charges have been fired or any damaged has occurred.



12- 18 Explosives:

1. Explosives shall not be permitted or used except by or under the immediate control of a competent person with adequate knowledge of the dangers connected with their use and after obtaining the necessary permissions from the concerned authorities.
2. Adequate warning shall be given to ensure that the employees are not exposed to risk of injury from the explosion or from flying material.

Chapter 13

Demolition

Introduction:

Demolition is considered one of the most dangerous operations in the Building/Construction industry. Demolition operations varies between different types such as using explosives, mechanical demolition as well as manual demolition.

This chapter covers the measures and safe methods to be taken prior to any demolition operation to carry out such operations safely and to protect workers from all potential hazards.

There are many demolition techniques such as:

- Manual Demolition.
- Demolition using equipment (Mechanical Demolition).
- Overturning/Wire Rope Pulling
- Demolition using Explosives.

13 -1 Demolition Hazards:

13-1-1 Health Hazards:

13-1-1-1 Exposure to Lead:

Lead as a toxic dust or fumes arises from cutting and burning steelwork covered with lead based paint, therefore it is essential before carrying out any demolition operations to identify the presence of any lead based paint or lead-containing materials and in case it is available and it is possible that the workers could be exposed to high concentration of lead exceeding the permissible exposure limits (50 µg/m3), the contractor must provide his workers with the suitable personal protective equipment (Respiratory Protection equipment). (fig. 1)

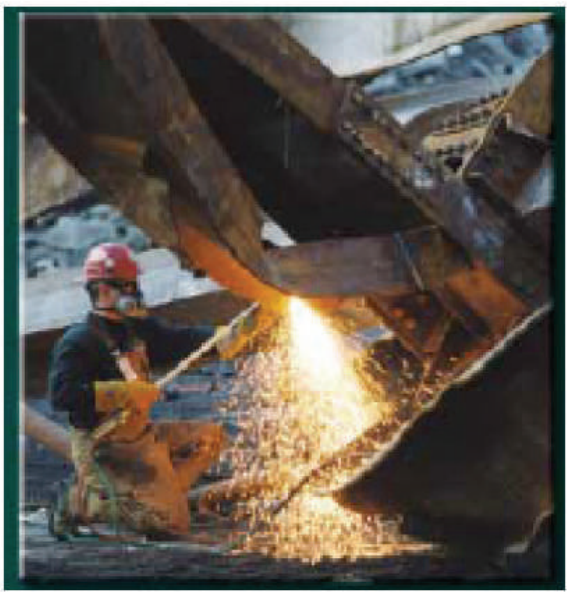


Fig. 1

13-1-1-2 Exposure to Asbestos:

Asbestos dust and fibres will be generated whenever demolition involves work on asbestos in sprayed coatings, thermal and acoustic insulation materials, fire resistance walls and partitions, or asbestos cement sheets.

Asbestos insulation or coating must be removed by specialist contractors only and before any demolition work is started, also all precaution safety measures should be followed including the use of suitable and adequate respiratory protection equipment.(Masks with high efficiency particulate air filters – HEPA Filters).

Reference is made to Technical Guideline # 13 .

13-1-1-3 Exposure to Silica dusts:

Employees work at demolition sites who might be exposed to dust which contains silica particles could lead to severe health effects (Silicosis). Therefore it is necessary that such employees use adequate and suitable personal protective equipment (such as respiratory protection equipment … etc.) while working at demolition sites.

13-1-1-4 Exposure to Poly Chlorinated Biphenyl (PCB):

PCB's (Polychlorinated Biphenyls) are toxic substances which were used as dielectric filler fluids in electrical transformers and capacitors and are still used in some refrigeration and heating equipment. This substance enters human body by inhalation and skin absorption and can cause severe health effects.

It is important to identify equipment PCB's before carrying out any demolition work, and take all precautionary measures to get rid of it and use adequate personal protective equipment before starting demolition work.

13-1-2 Entry into Confined Spaces:

Tanks and other vessels may contain toxic gases and vapours or explosive gases, also low concentrations of oxygen levels inside such confined spaces the matter which presents a great danger to employees life in case they enter such places, it is essential, therefore, that any confined space is ventilated and the atmospheres tested, before it is entered or any demolition work is permitted.
(It is necessary to issue the proper Entry Permit and take all the necessary precautionary measures and suitable rescue measures) – for more details refer to section #: (19).

13-1-3 Noise Hazards:

Using of demolition equipment such as compressors and concrete breakers frequently create noise levels in excess of the daily time weighted average permitted levels (85 dBA). Therefore it is necessary to identify jobs that expose employees to noise levels higher than the permitted levels and provide them with the necessary hearing protective equipment which will reduce noise levels to less than the permitted levels. Also the proper signs shall be fixed to warn employees against the hazards of noise and to indicate the necessity of using personal protective equipment.

Each contractor shall prepare a study about the effect of noise resulting from demolition works on the adjacent buildings particularly hospitals, schools, ….etc. and determine the best methods and techniques he will follow to reduce the exposure noise levels at such buildings, taking into consideration the possibility of scheduling the work in coordination with the adjacent sites.
(Refer to section # 2 regarding noise hazards).

13-1-4 Vibration Hazards:

Pneumatic equipment such as drills and breakers are likely to give rise to high vibration levels exceeds the permissible levels which is 2,8 m/s2 during 8 hours a day the matter which could lead to

the white fingers disease. These hazards can be reduced by using anti-vibration gloves, and selecting tools and equipment which produce less vibration levels as well as scheduling work so that exposure to vibration hazards is reduced.

13-1-5 Nature of Work Hazards:

1- Fall Hazards:

During demolition works, employees are exposed to the hazard of falls, therefore the contractor must provide the necessary fall protection measures to his employees.

2- Collapse Hazards:

Employees are exposed to the hazard of collapse of buildings or part of the buildings during demolition works the matter which might lead to death or serious injuries, therefore each contractor shall ensure that all structures are properly supported to protect his employees from the hazard of collapse of such buildings in particular at the buildings which was exposed to fire or partially supported buildings.

3- The Hazard of Using Heavy Equipment:

Each contractor must take all the necessary measures to protect his employees against the hazards of using heavy equipment.

4- The Effect on Utilities and Services:

The location of all utilities and services shall be determined and isolated prior to the commencement of any demolition work.

5- Effect on Adjacent Buildings:

Demolition works may affect the adjacent buildings and services.

13 -2 General requirements:

1. No demolition work shall be commenced unless a demolition permit is issued from the concerned department at Dubai Municipality according to the rules and regulations followed in this regard.
2. Demolition work shall not be started unless all safety and security measured are provided at the demolition site and in the equipment which will be used during the demolition work.
3. Any contractor before undertaking a demolition work shall obtain a no objection certificates (NOC's) from the appropriate authorities (electricity, water, roads, sewer, traffic,etc.) and he shall ensure that the drawings and actual utilities are identical, and he shall stop working immediately and refers to the concerned party in case there is a deference.
4. Before starting any demolition work, the contractor shall conduct an engineering survey (by a registered professional engineer) of the structure to determine the structure layout, the condition of the framing, floors, walls, the possibility of unplanned collapse of any portion of the structure and the existence of other potential or real demolition hazards. Also surveying the adjacent structures including historical buildings and accordingly plan his demolition method, equipment to be used, and all necessary precautionary measures.
5. Prior to the commencement of any demolition job, the contractor shall conduct a survey for asbestos, to determine the presence, quantity, and condition of substances

contain asbestos in the old buildings or buildings which is known or suspected to contain materials contain asbestos, and this survey must include all the components of the building including locations which could be reached and locations which could not be reached (confined). It is necessary to take all safety measures to control the hazards of asbestos and to protect employees against exposure to asbestos. (ref. is made to section # 3 Occupational Health and to the technical guidance # 13 concerning asbestos.

6. Prior to the commencement of any demolition operations, the contractor shall conduct a survey for lead using the proper scientific methods which should be approved by the concerned department, to determine the presence of lead in buildings, and shall take all the necessary safety measures to protect employees working in demolition from the hazards of exposure to lead and its associates according to the direction of the concerned party.
7. A survey for PCB's shall be carried out by contractor to identify equipment containing PCB's such as fluorescent lights and the presence of mercury in fluorescent lights in buildings to be demolished, and it shall be disposed of as a hazardous waste according to visual checking and the results of tests if it is necessary. Transformers in fluorescent light without labels reading "Free of PCB's" will be considered as it contains such substance.
8. The concerned department at Dubai Municipality shall be provided with a written evidence that the required surveys have been performed as well as the results of the tests conducted.
9. It shall be determined if any hazardous building materials, hazardous chemicals, gases, explosives, flammable materials, or dangerous substances have been used in any building construction, pipes, tanks, or other equipment on the property. When such hazards are identified, testing shall be conducted to determine the type and concentration of the hazardous substance and test results shall be provided to the concerned department, and all the necessary precaution shall be taken to control or eliminate before demolition is started.
10. The contractor shall prepare a demolition plan by a registered professional engineer and based on the engineering and lead and asbestos surveys – for the safe dismantling and removal of all building components and debris, and the methods of demolition and the sequence of demolition operations, and safety measures to be followed.
11. All demolition and removal of debris shall be carried out by approved and registered contractor who has the permission from the concerned department at Dubai Municipality to carry out such type of work and classified according to the jobs he will perform.
12. The registered demolition contractor shall obtain a no objection certificate from the concerned department at Dubai Municipality and shall submit a detailed suggested method of operation for each case separately and obtain the necessary approval of such methods from the concerned department – Dubai Municipality. The approved method shall not be modified unless the concerned department has been notified to approve the modified method, also the method to be followed to isolate the adjacent buildings during demolition operations hall be determined.
13. In case the approved demolition permit or the insurance certificate has been expired, the demolition operation shall not be continued and the contractor must renew them before the expiry date.
14. Demolition operations shall be conducted under the supervision of consultant office in the following cases:

- Buildings with height more than (ground + 7 floors).
- Buildings which were erected using post tensioning techniques.
- Buildings which have more than one basement.
- Buildings which will be demolished using explosives.
- Any other demolition cases which considered by the concerned department to be conducted under the supervision of a consultant office such as buildings which have been damaged by fire, or due to collapse and others, and the consultant shall hold responsible for the following:
  - Carrying out all the required surveys according to the nature of the building which shall be demolished and its components.
  - Carrying out a risk assessment of all hazards associated with the demolition operation.
  - Determines the safe demolition method including the detailed drawings.
  - Determines all precautions and conditions to be provided by the contractor to ensure safe demolition operations.
  - Actual supervision of all demolition operations and ensures that all demolition operations have been carried out according to the approved methods and required conditions.
  - Ensures that the contractor has taken all requirements of safety and security, and proper engineering methods during all phases of operations.

15. In case that explosives will be used in the demolition operations, s specialised party shall perform the job after obtaining the approval of the concerned department at Dubai Municipality and other concerned authorities and determining the suggested time of execution with this authorities.

13- 3 Site Preparatory Operations:

1. The contractor shall assign a registered professional civil engineer who is approved by Dubai Municipality to safely supervise all demolition operations according to the approved methods and the permission conditions and that from the starting of ratory operations until the end of the demolition operations.
2. All employees engaged in demolition activities shall be instructed in the demolition plan so that they may conduct their work activities in a safe manner, and they must be provided with the necessary personal protective equipment (Safety shoes, helmets, suitable gloves, ear protectors, eye protection ..etc. according to the nature of work and the associated hazards.
3. All electric, gas, water, steam, sewer, and other service lines shall be shut off, capped, or otherwise controlled outside the building line before demolition is started. The contractor shall obtain in advance all the needed No Objection Certificates (NOC's) from the concerned authorities and shall ensure that it is identical with the actual locations of the existing utilities, and in case of any differences he has to inform the concerned authorities and coordinate with them to modify this situation.

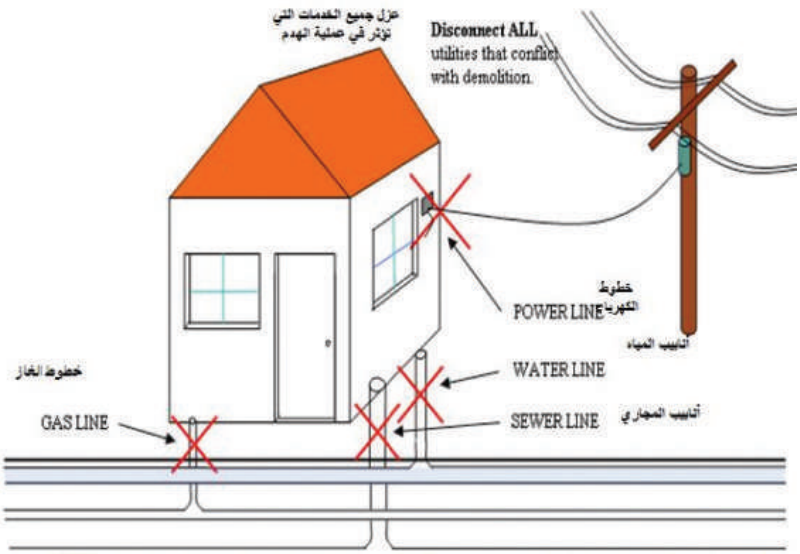


Fig. 2

4. If it is necessary to maintain any power, water, or other utilities during demolition, such lines shall be temporarily relocated and protected in case it will be affected by the demolition activities, and that in coordination with the concerned authorities.
5. When demolition activities are to be carried out in heavily populated areas, the contractor shall apply the highest standard of site protection, safe systems of work, and effective supervision during demolition operations.
6. The contractor shall not be permitted to start demolition works, unless the proper warning and guidance signs have been provided at the demolition site.
7. A fence, at least 2 m (6 feet) high shall be erected to enclose all demolition operations, and shall be maintained during all the demolition operations and removal of debris.

Fig. 3

8. The contractor shall provide a protection barrier not less than the building to be demolished high to the adjacent buildings, and he has to consider the safety of pedestrians and adjacent building and includes that in the demolition methods.
9. The contractor shall follow adequate safe systems of work, and he must inform the concerned department in case there are any obstacles to report this case before the commencement of demolition operations.
10. When employees are required to work within a structure to be demolished, adequate shoring or bracing shall be used to prevent accidental collapse of building. This is essential for structures damaged by fire, explosion or other cause.
11. The contractor shall close the demolition site at the end of working hours to ensure that unauthorised persons are not entered or damage the machinery and equipment.
12. The contractor shall provide security services at the demolition site 24 hours a day.

13- 4 The Execution of Demolition:

1. The demolition operations must be executed in accordance with the approved method, and the terms of the licence and under the direct supervision of the specialised engineer. In case of any deviations, the concerned department shall be informed to obtain their permission.
2. All demolition operations shall be carried out under the direct supervision of the contractor's registered engineer.
3. The contractor shall comply with the scheduled permitted working hours, and in case the need to work during night, he has to obtain the necessary permission from the concerned department and also must obtain the necessary other permissions from the concerned authorities, and he has to follow all the regulations concerning working at night.

4- An adequate safe area shall be determined as restricted area around the demolition site from all directions according to the nature and height of the building and the method of demolition and all of that shall be included in the demolition plan submitted to the concerned department at Dubai Municipality, and in case that this safe area can not be provided, the contractor shall suggest alternative protection method and include such method in the demolition plan and must obtain the approval on it from the concerned department.

5. Horizontal demolition shall not be permitted on buildings which is higher than (ground + first floor), for buildings higher than that a mechanical demolition shall be used, and in all cases demolition will be from top to down and from outside to inside, unless an other demolition method has been approved by the concerned department.
6. Before the starting of demolition operations, any part of the building which is attached directly to any adjacent building shall be isolated manually to a distance not less than 3 m (10 feet). The mechanical demolition ball is not permitted to isolate any parts of the building which is directly attached to adjacent buildings to protect those buildings from the effect of vibration resulting from the use of such mechanical equipment.
7. Hazards to anyone from the fragmentation of glass shall be controlled. All glass parts or any fragile structures which are capable of being broken and scattered shall be dismantled manually before the starting of the demolition operations to protect employees from the hazards of flying scattering glass particles.

Fig. 4

8. At the end of working hours, the demolition work shall be stopped at a stage with a safe and stable structure to avoid the fall of any structure.
9. Employees entrances to multi-story structure being demolished shall be completely protected by side-walk sheds or canopies or both. Protection shall be provided from the face of the building for a minimum of 2.4 m (8 feet).
10. All such canopies shall be at least 0.6 m (2 feet) wider than the building entrances or openings and shall be capable of sustaining any loads or materials which might fall on it.
11. Masonry walls or other sections of masonry shall not be permitted to fall upon the floors of the multi-story buildings in such masses as to exceed the safe carrying capacities of the floor.
12. Mechanical equipment shall not be used on floors or working surfaces unless such floors or surfaces are of sufficient strength to support the imposed load.
13. Except for cutting holes in floors for chutes, holes through which to drop materials, preparation of storage space, and similar preparatory work, the demolition of floors and exterior walls shall begin at the top of the structure and proceed downward.
14. Only those stairways, passageways, and ladders designated as means of access to the structure shall be used during the demolition operations as follows:
    - 14-1 The designated means of access shall be indicated on the demolition plan, other access ways shall be indicated as not safe for access and closed at all times.
    - 14-2 The stairwell shall be covered at a point no less than two floors below the floor on which work is being performed.
    - 14-3 Access to a floor where work is in progress shall be through a separate lighted, protected passageway.
15. The contractor shall coordinate with historical buildings department to provide additional protection measures to protect such historical buildings from any damages

in case of performing a demolition work in buildings adjacent to those buildings.

16. The demolition permission does not allow the contractor to carry out any excavation works at the worksite for the purpose of building. In case of removal of foundations, the contractor shall re-fall the excavation to the ground levels.
17. Employees shall not be permitted to approach to the locations which will expose them to any hazard during the execution of demolition operations, and the contractor shall prevent any one from entering such dangerous locations.
18. It is not permitted to leave big quantities of debris at site; the contractor must remove them promptly to the designated areas determined by concerned authorities.
19. The contractor is fully responsible for the worksite and he has to comply with the method of demolition approved by the concerned department according to the conditions of the demolition permission, and he shall be subject to legal obligations and penalties in case of violations or damage to the public properties.
20. When tall structures are being felled, a distance of not less than one and half times the total height should be allowed along the proposed line of fall to protect from the hazards of falling materials during falls.
21. In case of partially demolition operations to any building, the following conditions shall be followed in addition to the previous conditions:
    - 21-1 Isolate and remove utilities from the part to be demolished to outside the demolition area.
    - 21-2 To ensure that the demolition of that part will not affect the stability of the remaining structures.
    - 21-3 To determine the demolition lines at safe structural areas.
    - 21-4 Shoring and supporting the remaining parts.
    - 21-5 In case of partially demolition on buildings which are connected to other buildings, the connected parts shall be isolated to a distance not less than 3 m (10 feet) using hand held tools before allowing the use of mechanical equipment.

13 -5 Debris Removal:

1. Any chute opening into which debris is dumped shall be protected by a guardrail 1.05 m (42 inches) above the floor or other surface on which personnel stand to dump the material. ny space between the chute and the edge of openings in the floors through which it passes shall be covered. (See fig. # 5).

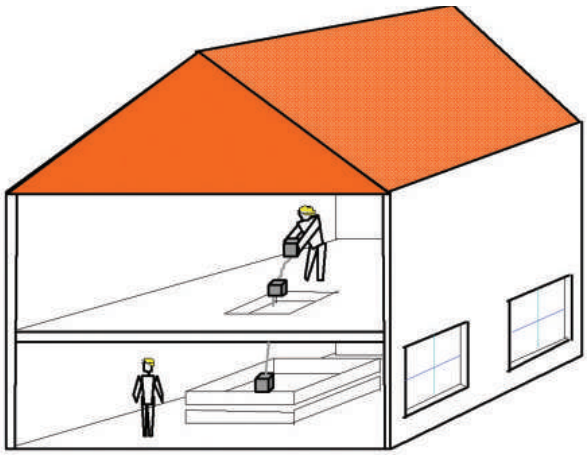


Fig. 5

2. When debris is dropped through openings in the floors without chutes, the openings and the area onto which the material is dropped shall be enclosed with barricades not less than 1.05 m (42 inches) in high and not less than 1.8 m (6 feet) back from the projected edge of the opening above.
3. Any openings cut in a floor for the disposal of materials shall be not longer in size than 25% of the aggregate of the total floor area to avoid the effect on the stability of the whole floor.
4. Signs warning of the hazard of falling materials shall be posted at each side of the debris opening at each floor.
5. Debris removal shall not be permitted in lower areas until debris handling ceases on the floors above.
6. The storage of waste and debris on any floor shall not exceed the allowable floor loads.
7. All openings at all floors below the top floor when not in use, shall be kept closed.
8. A substantial gate shall be installed in each chute at or near the discharge end. A competent employee shall be assigned to control operation of the gate and the backing and loading of trucks.

Fig.6

9. Chutes shall be designed and constructed of such strength as to eliminate failure due to impact of materials or debris loaded therein.
10. Where materials is dumped from mechanical equipment or wheelbarrows, a toe board or bumper, not less than 10 cm (4 inches) thick and 15 cm (6 inches) high, shall be attached at each chute opening.

13 -6 Wall Removal:

1. Masonry walls, or sections of masonry, shall not be permitted to fall upon the floors of the building in such masses as to exceed the safe carrying capacities of the floors.
2. All wall sections must be supported until all the adjacent waste materials which are restricting its demolition have been removed.
3. Structural or load-supporting members on any floor shall not be cut or removed until all stories above such a floor have been demolished and removed.
4. Employees shall not be permitted to work on the top of a wall when weather (winds, rains, .etc.) constitutes a hazard.
5. Walls that serves as retaining walls to support earth or adjoining structures shall not be demolished until such earth has been braced or adjoining structures have been underpinned.
6. Walls shall not be used to retain debris unless capable of safely supporting the imposed load.
7. Floor openings within 3 m (10 feet) of any wall being completely demolished shall be planked using thick wooden boards. (See fig. # 7).

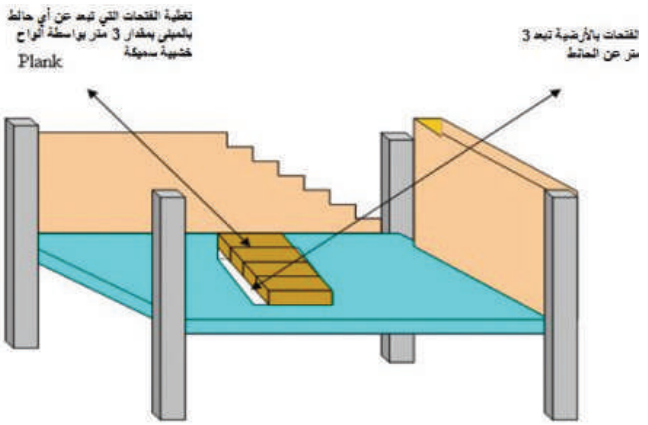


Fig. 7

13 -7 Floor Removal:

1. Openings cut in a floor shall extend the full span of the arch between supports.
2. Before demolishing any floor arch, debris and other material shall be removed from such arch and other adjacent floor area.
3. Planks not less than 5 cm x 25 cm (2 in x 10 in) in cross section, full sized undressed shall be provided for and shall be used by employees to stand on while breaking down floor arches between beams. Such planks shall be so located as to provide a safe support for personnel should the arch between the beams collapse, taking into consideration that the straddle space between planks shall not exceed 40 cm (16 in).
4. Safe walkways, not less than 45 cm (18 in) wide, formed of wood planks not less 5 cm

(2 in) thick or of equivalent strength, shall be provided and used by personnel when necessary to enable them to reach any point without walking upon exposed beams.
5. Planks shall be laid together over solid bearings with the ends overlapped at least 30 cm (1 foot).
6. When floor arches are being removed, employees shall not be allowed in the area directly underneath. The area shall be barricaded to prevent access and signed to warn of the hazard.
7. Opposite Removal: in case of suspended ceilings, they shall be removed from bottom to top and all the precautionary measures mentioned in this section must be considered.

13- 18 Steel Removal:

1. When floor arches have been removed, planking shall be provided for the workers razing the steel framing.
2. Steel construction shall be dismantled column-by-column and tier-by-tier (columns may be in two-story lengths). The design of the structural members shall be considered when safely removing them to ensure the removal of the loaded members before the load bearing members.
3. Any structural member being dismantled shall not be overstressed to avoid any sudden collapse.

13 -9 Demolition Tools and Equipment:

1. The contractor shall ensure that all tools and equipment working at the demolition site are in good operational condition, and shall ensure that the necessary maintenance operations to those demolition equipment are carried out.
2. Only authorized employees are allowed to enter to the restricted areas which might be affected by demolition hazards, and the contractor must take all the necessary precautionary measures to protect those employees and must inform them about all the potential hazards during working at such areas.
3. When not in use all equipment must be secured against tampering.
4. only one equipment shall be allowed to work at the same location at the same time to prevent interaction which might lead to damages and accident. (refer to chapter 22 abd cgaoter 21 of this code)

13 -10 Demolition Techniques:

13-10-1 Hand Held Tools Demolition
13-10-2 Mechanical Equipment Demolition
13-10-3 Overturning/Wire Rope Pulling
13-10-4 Demolition Using Explosives

13-10-1 Hand Held Tools Demolition:

1. Only hand-held tools are used in this demolition technique, and lifting appliances may be used to hold larger structural members during cutting and for lowering severed members and other debris.
2. A safe place of work must be provided for hand demolition, where scaffolds are used to provide a working platform, it should normally be dismantled progressively as the building is demolished. When scaffolding is tied to a building, additional ties may need to be provided at a lower level before the upper ties are removed as the demolition proceeds.

3. Before starting the demolition operations, it shall be well planed and this will be in the re verse order to the erection of the building and the sequence of demolition will start from the upper floor then the other below floors and so on.
4. Where demolition operations are carried out at upper open floors, the proper protection to the open sided edges shall be provided (proper guardrails) or employees shall use proper harness to protect them from fall hazards.
5. Each main structural member, shall be supported by a crane or temporary props whilst the ends are unbolted or cut. Structural members and trusses shall be carefully lowered to ground level.
6. The free fall of debris on the ground inside or outside the building is permitted only when the horizontal distance between the point where the debris will fall and the main road is more than 6 m, or more than half the drop height (whichever is the greater). In other cases the debris will be removed using the normal means such as chutes.
7. Steel structural members shall be demolished and lowered gradually to the ground or being cut to a suitable lengths of suitable size and weight before lowering it. Cranes shall be used to support joists and beams during cutting and lowering them to the ground. Same methods shall be used to untie joints during the demolition of pre-cast structural buildings or steel buildings.
8. When it is needed to demolish a part of a building, the demolition line shall be determined to be at a safe structural areas.

13-10-2 Demolition by Mechanical Equipment:

1. Only the crane operator and his assistant are allowed within the restricted area of 6 m or 20 feet from the part of the building being demolished. The cabs of the crane should be strong enough to protect the operator against the fall of debris, and the crane cab should be provided with roll over protection system (ROP), also the front window glass of the crane shall be of shutter-proof materials and protected by a steel screen mesh. (see fig. # 8 & 9).

Fig. 8

Fig. 9

2. Demolition Using the Steel Ball: (See fig. # 10 & 11)

2-1 The weight of the demolition ball shall not exceed 50% of the crane's rated load, based on the length of the boom and the maximum angle of operation at which the demolition ball will be used, or it shall not exceed 25% of the nominal breaking strength of the line by which it is suspended, whichever is less.

2-2 The crane boom and load line shall be as short as possible.

2-3 The ball shall be attached to the load line with a swivel connection to prevent twisting of the load line and shall be attached by positive means so that the weight cannot accidentally disconnect.

Fig. 10

Fig. 11

13-10-3 Overturning / Wire Rope Pulling:

1. Deliberate controlled collapse may be induced by the application of a horizontal force at high level. The structure is pulled with wire ropes attached to winches or vehicles, demolition being achieved by impact on overturning.
2. Ropes shall be attached to the structure before pre weakening is carried out. The diameter of wire ropes used should not be less than 38 mm.
3. When pulling over walls or portions of walls, all steel members affected shall have been cut free.
4. All roof cornices or other ornamental stonework shall be removed prior to pulling walls over.

13-10-4 Demolition Using Explosives:

1. Any demolition operations by using explosives shall be performed in coordination of the concerned authorities and under their direct supervision.
2. Demolition by using explosives shall be performed by specialized companies who have qualified and trained personnel in this field after obtaining the necessary permission from the concerned authorities which allow such companies to obtain the necessary explosive materials to be used in such operations.
3. The contractor shall consult specialized personnel in the field of demolition before taking the decision to use explosives in such kind of operations, who shall take into their consideration the type of building, its location and the adjacent buildings.
4. A comprehensive survey to the adjacent buildings, private and public utilities and historical buildings shall be conducted by a specialized company in the field of demolition using explosives.

5. When there is a possibility of occurrence of severe vibrations due to the explosion operations, seismic testing should be performed to study the effect of the vibration on the adjacent buildings and to determine the proper safety measures to be followed to protect such adjacent buildings.
6. The contractor shall take into his account the utilities at the demolition sites, weather underground or above ground utilities, and he must consult the concerned authorities and obtains their permission before starting demolition operations using explosives.
7. Demolition of buildings using explosives may require the removal of some of the building components such as columns, beams. The contractor shall assign a specialised and registered construction engineer to supervise such operations and secure it after taking all the adequate precautions to avoid the weakening of the building or its collapse during performing the removal of those components.
8. All different explosive operations must be performed under the supervision of a highly qualified technical expert who is approved by the concerned authorities.
9. The technical expert who is specialized in the explosive operations shall determine the quantities of explosive substances, type, the locations where these explosives will be loaded, and the method of firing. The area shall be evacuated completely from all personnel during the process of loading the explosive materials and during firing of it.
10. After blast have been fired, safety precautions should be taken during the removal of debris, in case there is a misfired charges, the area shall be evacuated immediately and prevent any one from entering to the demolition area until the blast expert deals with this charge and secure it.
11. The specialised companies in the field of demolition using explosives must inform the concerned authorities before performing any demolition operations in order to take the necessary precautions to protects lives and properties. They should refer to BS 5607 or equivalent from Arabic or International Standards approved in UAE in this regards.
12. No one is permitted to return back to the blasting area, unless the blasting experts advices that the operation is completed after he is ensured that all explosives have been fired.

13- 11 Demolition of Pre-Tensioned Members:

1. Simple pre-tensioned beams and slabs of spans up to about 7 m (23 feet) can be demolished in a manner similar to ordinary reinforced concrete, they may be lifted and lowered to the ground as complete units after the removal of composite concrete covering to tops and ends of he units.
2. When lifting such members from the structure, should generally be done from points near the ends of the units or from lifting point positions. Reuse of lifting eyes, if in good conditions, is recommended whenever possible.
3. When units are too large to be removed, consideration should be given to temporary supporting arrangements.

CHAPTER 14

HAND AND POWER-OPERATED TOOLS

Introduction:

Tools are divided into hand tools and power-operated tools. Tools are essential in our practical life. Any workplace would hardly be free from these tools which assist in many work activities. They are used daily in construction sites. Tools mishaps can cause many hazards which endanger the safety of employees who use them and result in different accidents. Thus, the safety regulations on hand and power-operated tools emphasize the necessity of instructing employees, who use these tools in their daily work, in the proper and safe use of these tools.

14.1. General Requirements:

1. All hand and power-operated tools shall be maintained in safe operating condition and shall be used only for the purpose for which they are designed.
2. Every person who supplies, lease or maintain any industrial machinery, equipment or tools shall ensure that such machines/equipment are of safe and good condition and that there is no danger to persons operating them if they comply with their operating instructions.
3. Defective tools or otherwise rendered unsafe by defects that impair their strength shall be removed from service.
4. When tools used on platforms or aloft and subject to falling or displacement, all adequate precautions shall be taken for being appropriately secured or tied (figure 1).

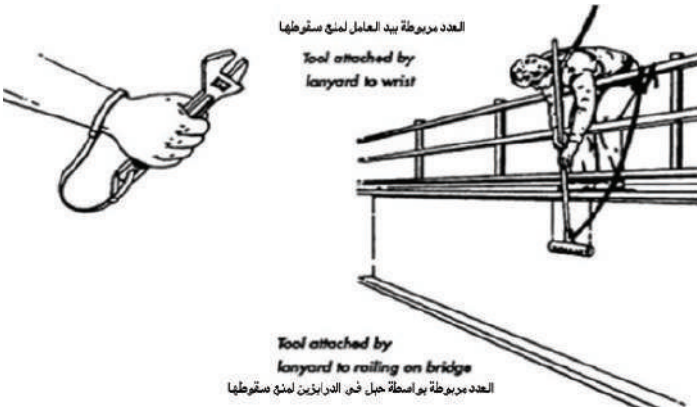


Fig. 1

5. Employees using hand and power-operated tools and exposed to the hazard of falling, flying, abrasive and splashing objects, or exposed to dusts, vapors, mists and gases shall be provided with the appropriate personal protective equipment necessary to protect them from the hazards.
6. Handling of tools by throwing from one location to another, or from one user to another or from one level to another shall not be allowed.
7. No spark-producing tools or equipment shall be used in areas containing combustible or explosive materials.
8. Tools requiring heat treating and redressing shall be tempered, grooved, dressed and sharpened only by experienced employees of demonstrated skill in this kind of work.
9. Powered-operated tools shall be inspected and determined to be in safe operating condition before use and periodic maintenance shall be made in accordance with the manufacturer's instructions.
10. Any power-operated tools shall be operated and maintained only by qualified and trained personnel authorized by the contractor.
11. Reciprocating and rotating hand-held powered tools shall be equipped with a constant pressure switch that will automatically shut off the power when the pressure is released (figure 2).

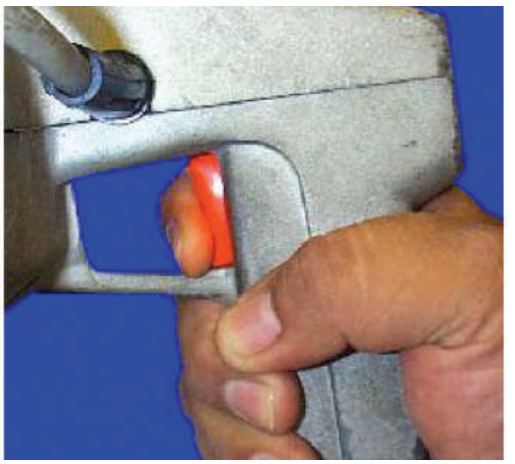


Fig.2

12. The cranks on hoists or hand-powered winches shall be provided with positive self-locking dogs provided that hand wheels shall be free from exposed spokes, projecting pins or knobs.
13. Pneumatically driven nail staplers shall be of the type which prevents the tool from ejecting fasteners unless the muzzle is in contact with the work surface with force more than 25 Newton of the tool's weight and the trigger is pulled/pressed.
14. The manufacturer's safe operating pressure for hoses, valves, pipes, filters, and fittings shall not be exceeded.
15. Hydraulic or compressed air tools shall have non-conductive hoses.
16. When fuel-powered tools are used in enclosed spaces, all employees using these tools shall be provided with appropriate respirators.
17. Loose clothing shall not be worn while working with power tools as set forth in chapter 4 of this manual on personal protective equipment.
18. Employees shall be instructed in the safe and proper use, handling and maintenance

of all hand and power-operated tools necessary for the project to avoid accidents.

19. All power-operated tools shall be supplied with instructions of proper use in Arabic, English and other language known to majority of employees. Employees shall adequately be instructed in the proper use of new unfamiliar equipment which have been recently brought and not previously used in the worksite.

14. 2. Hand Tools:

14.2.1. Materials:

1. Hand tools shall be constructed of sound and good quality materials that are appropriate to works for which they are designed.
2. The wooden handles of hand tools shall be of solid straight fiber wood and kept soft, free of cracks and splinters. They shall be kept tight in the tool. Wooden wedges shall be used as necessary to prevent slippage of the tool from the handle.
3. Handles shall be designed so as to fit hand-held equipment and tools to which they are attached and kept permanently tight in the tool.
4. Handles of cutting tools shall be provided with protrude parts (protection exposed) to prevent the sliding of hands to the blades.

14.2.2. Maintenance:

1. Hand-held tools or equipment shall be kept clean and protected against corrosion, decay. Moving parts shall be oiled and greased and cleaned with non-flammable liquids.
2. The cutting edges shall be kept sharp by using special devices and cooling the equipment to keep the cutting edge cold during the abrasive process.
3. Heads of chisels, wedges and other impact tools shall be properly pointed and tempered when cracked or mushroomed.
4. Tool defects shall be repaired the soonest possible by a qualified person in the worksite or sent to the specialized workshop. They shall be totally removed when can not be repaired.

14.2.3. Transportation:

1. The cutters of every hand-held tool shall be so covered as to prevent its hazards while being moved.
2. Hand tools shall be carried in an appropriate box to avoid any hazards.
3. Tools with sharp edges shall not be put in clothes' pockets.
4. Saw teeth edges and portable equipment shall be in other side of the body
5. Axe shall be carried by holding it near the blade, with the hand extended downward, and the axe blade parallel to the foot.

14.2.4. Storage:

1. Sharp tools shall be placed in its holders when not in use.
2. Sharp tools and its attachments shall be stored away from the places where the workers sit and stand, to minimize the hazard of falling of such tools on workers.

14.2.5. Handling and Use of Hand Tools:

1. Hand tools shall be used only in the jobs they have been designed for.
2. The following is not permitted:
    - Throwing tools from one user to another
    - Using tools at a close distances from any other worker or machine, which may

expose the worker himself or the other worker or the machine to dangerous hazards.

• Use it as a support

3. It is not allowed to leave tools and their attachments where other workers do their works or where they move, or leave it on scaffolds or on high places the matter which expose those workers to falling objects hazards.
4. Insulated hand tools shall be used when working on electrical installations.
5. Adjustable wrenches when used, they shall be fixed on nuts so that the permanent jaws of the wrench shall be facing the direction of pull. (Fig. # 3).

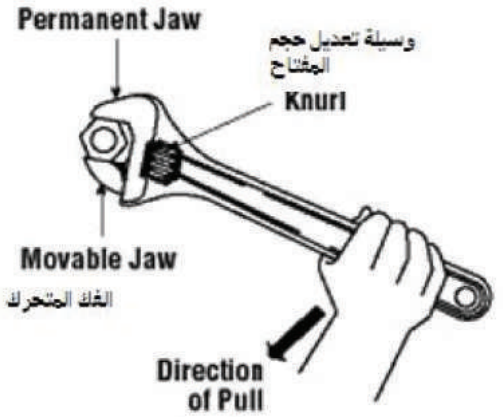


Fig. 3

6. When unscrew nuts and bolts using box or socket wrenches, the handle shall be pulled not pressed.
7. It is not permitted to increase the torque by increasing the length of the wrench handle using a pipe or cheater bar.
8. It is not permitted to insert any materials to secure box wrenches on the bolt head or nuts.
9. It is not permitted to use wrenches on moving parts of any machine. Wrenches is not permitted to be used as hammer unless it is designed for that.
10. When hammering chisels, it shall be held by chisel holder and not by hand unless it is fitted with sponge rubber. (Fig. # 4).

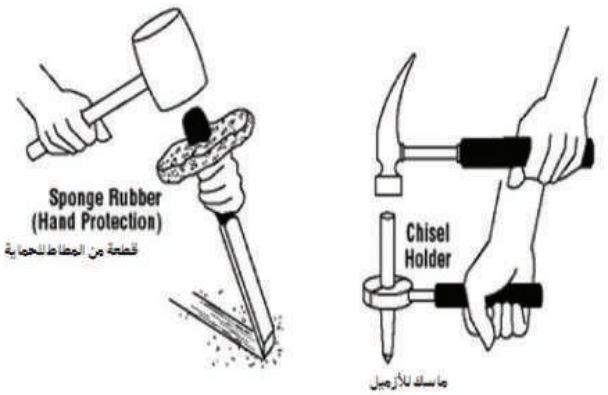


Fig.4

11. The suitable tools for fixing or un-tying bolts or nuts according to the type and hardness of metal.
12. Special torque wrench shall be used when it is needed to fix the nuts or bolts to a certain torque.

14.3. Power-Operated Tools:

14.3.1. Air Compressors:

Construction:

1. The trigger of tools powered by compressed air shall be fixed to achieve the following:
   - Preventing accidental operation of tools
   - When finger is released from the trigger, inlet valve of the compressed air will shut down.
2. The following specifications shall b provided on hoses an connections used to connect tools with the compressor:
   - Designed to support pressure and conditions of work
   - Securely fixed to the pipe of the compressor and equipped with special securing chain connected to the pipe end or of the type which shut down automatically if disconnected from the compressor. (Fig. # 5).

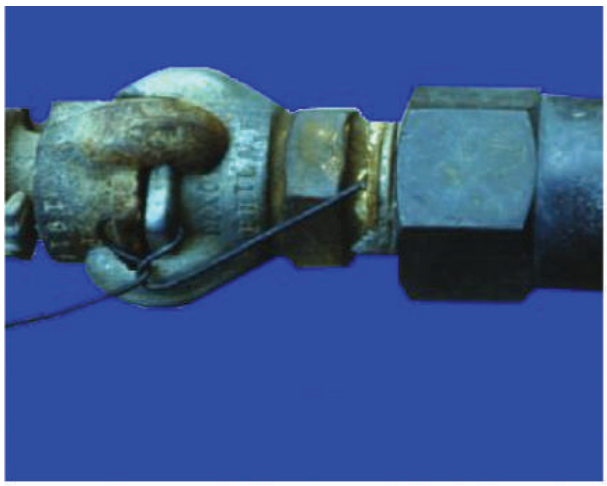


Fig. 5

3. Hammering or drilling machines operated with compressed air shall be equipped with clamps or fasteners which prevent the accidental disconnection of the bits from the cylinders.
4. Employees working with compressed air equipment shall not wear loose clothing or dangling jewelry and loose long hair shall be covered.
5. Bits fixed on tools shall be removed manually when not in use, and it is not permitted to remove it using compressed air, or according to the manufacturer's instructions.
6. When cutting rivets using cutters working with compressed air, the following shall be considered:
   - The cutters provided with safety cage or any other means to collect the rivet heads.
   - Employees using such cutters shall use face shields and helmets.

7. Hoses shall be emptied of compressed air before calibration, repair or disconnect it from compressor.
8. Hoses shall be kept away from places where vehicles move and when this is impractical, adequate protection shall be provided.
9. Hose shall not be laid over ladders, steps, scaffolds, or walkways to prevent a tripping hazard.
10. The use of compressed air for blowing dirt from clothing or any part of the employee's body shall be prohibited.
11. When hoses are cut or cracked or leaked, the defective part shall be cut and then the hose shall be connected using metal connection specially designed to this purpose.
12. Hoses shall be protected from heat, chemical or mechanical impact or any thing might damage it.
13. Compressors shall be appropriately located so as to minimize hazards of noise and fume gases resulting from ignition.

14.3.2. Portable Electrical Tools:

1. All portable electrical tools shall be properly grounded or of the type of double insulation, the sign specifying that shall be posted on the tool body Fig. (6).

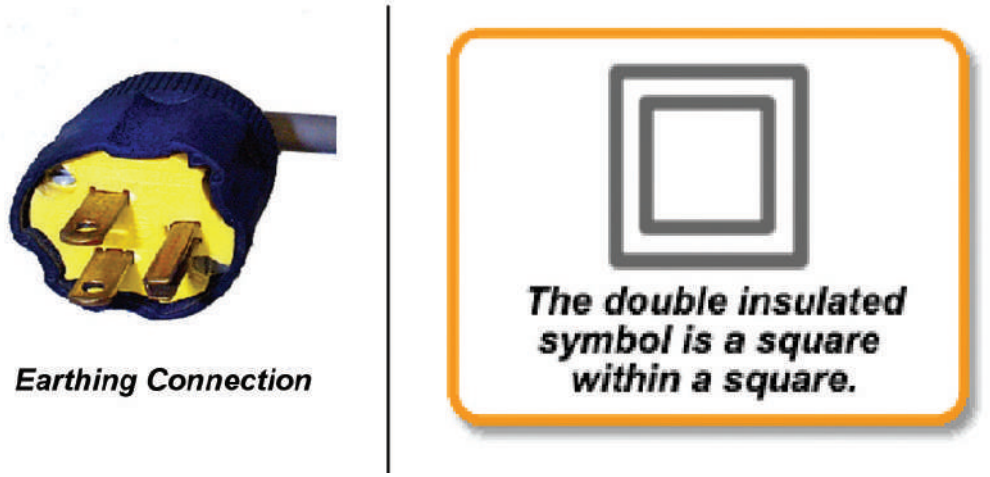


Fig. 6

2. All electrical wires shall be inspected to find out any damage in the insulated cover.
3. Electrical power shall be de-energized, locked out, and tagged out by qualified persons before performing any repairs or modifications.
4. Electrical equipment used in wet atmospheres shall be suitable to such atmosphere (Water Proof).
5. The operating switch shall be fixed on the mobile machine so that it will disconnect the power automatically when releasing the pressure from it.
6. Special tools designed for hazardous locations where flammable and combustible materials are handled and stored (Ex – Proof).
7. Branched electrical panels shall be capable of connecting several electrical tools according to the need, taking into consideration providing protection against humidity,

tampering, and supply power lines shall be designed to support the expected loads.
8. Electrical tools shall be kept in special place and only authorized persons can reach it.
9. Electrical tools shall be periodically inspected by qualified competent person to ensure it is working properly, also before use and at the beginning of each shift and during work.
10. Defective tools shall be disconnected and tagged “Do Not Operate”
11. It is completely prohibited to connect electrical tools to electrical sockets unless inspected and proved safe.

14.3.3. Wood Working Tools:

14.3.3.1. General Requirements:

1. All machinery shall be operated, maintained and inspected only by adequately qualified and trained personnel.
2. Every machine shall be stopped at the end of the work day.
3. Cleaning or adjustment of machinery while in motion shall be prohibited.
4. When using different installations with different diameters, sizes in one machine, this machine must be equipped a switch which can change the speed of the machine according to the size of the installations.
5. When a speed governor is installed on a machine, the following shall be considered:
    a. Designed so that the primary operational speed is the lowest speed.
    b. Provided with an auxiliary control operational speed register.
6. Work pieces shall be tightly mounted or tied to feeders and free moving edges of the material shall be supported by extending the saw table beyond the leading edge of the saw blade or by using trestles. A push-stick or other safe means shall be used when small or short work pieces under cut are pushed or directed (figure 7).

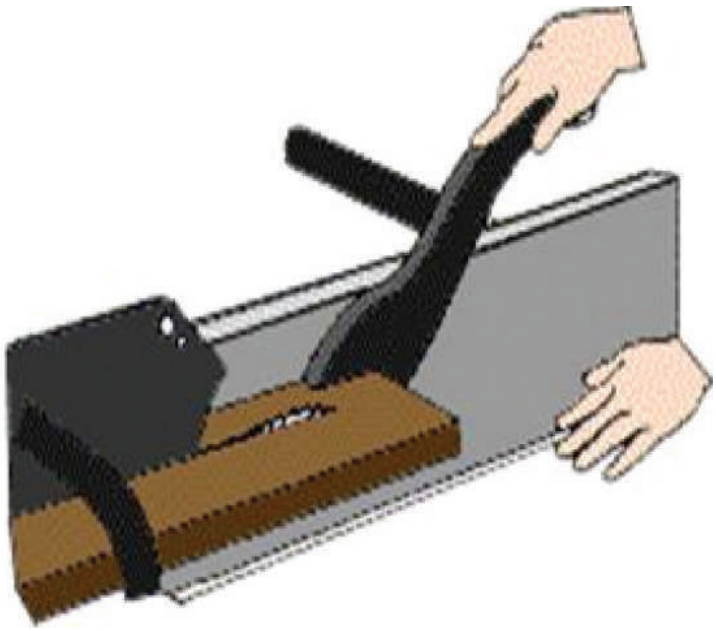


Fig. 7

7. An appropriate exhaust system shall be used to protect employees form flying sawdust or splinters (figure 8).

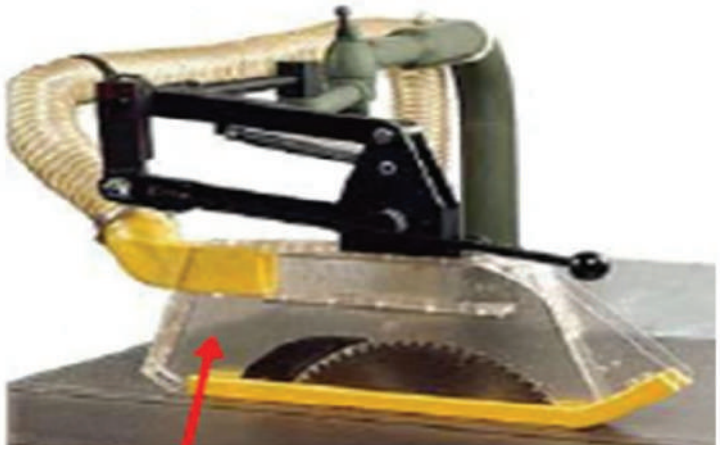


Fig. 8

8. Sawdust and flammable materials shall not be accumulated in the site and the workshop shall be cleaned periodically.
9. Appropriate and adequate personal protective equipment shall be used while using power woodworking machines
10. oods shall be free of nails, or any other metal materials which might interfere with the blade movement. The speed of feeding shall be suitable to the cross sectional area of the wood and its type, so that the blade shall not be exposed to increased pressure and temperature.

14.3.3.2. Circular Saws:

1. Circular saws shall be provided with protecting guards (figure 9).

Fig. 9

2. Protection guards shall be so designed as to:
    - Fully cover the part of the saw blade that protrudes above the top of the table and as close as possible to the lower portion of the blade beneath the table.
    - Protect the saw operator against accidental contact with saw blade, danger from flying splinters or broken saw teeth while the saw is in operation.
3. Circular saws shall be of cutting edges equipped with rips to facilitate work and protect against stretching
4. The opening in the table for the saw blade shall be kept as small and slightly more than the thickness of the blade as practical.
5. Feeding devices and moveable tables shall be so adequately mounted as to prevent any side thrust out of their places during operation.
6. Portable circular saws shall be so constructed as to ensure automatic self-adjustable guard of the blade wheel while rotating.
7. Portable saw blade guard shall be so constructed as to have firm and secure bearing to prevent removal while the saw is in motion.
8. Circular saws shall be inspected at the start of every work shift and periodically by qualified personnel to be altered whenever defected or removed for repair and to maintain sharpness of the cutting edge.
9. The manufacturer's recommended safe operating speed shall not be exceeded.
10. Adjustments of saw blade wheels while in motion shall be prohibited.
11. Pressing the saw wheel to prevent the forward travel of the blade after shutting off the machine shall be prohibited.
12. When cutting circular shape wood or wood column or the like, these materials must be secured using mechanical means to prevent twisting or overturning.
13. Appropriate precautions shall be taken to prevent kicking back of pieces to be cut.
14. Areas where saws are used shall be equipped with vacuuming devices to collect and exhaust sawdust, chips and splinters.
15. Open-flame or spark-producing devices such as welding machines, etc., shall not be used in or near carpenter workshops.
16. Accumulated saw shavings (waste) shall be prohibited in worksites.

14.3.3.3. Band Saws (figure 10):

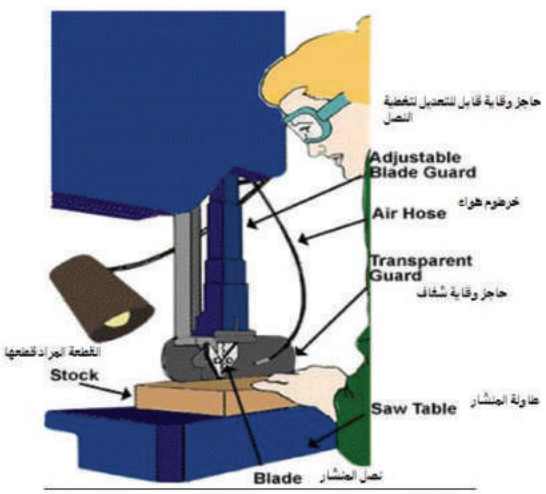


Fig. 10

1. Band saw blades shall be fully enclosed except at the point of operation.
2. The pulleys on which the saw blade is fitted shall be completely enclosed by solid sheets of metal or other material of an equivalent strength and firmness.
3. The top pulley guard shall extend beyond and above the bottom wheel rim at least 10 cm. away from the rim in all sides of the pulley.
4. Guards of the bottom pulleys shall:
    - Enclose all moving parts under the table.
    - Allow the removal of sawdust from the area under the table while movement of the saw blade remains free.
5. An automatic feeding device shall be installed on band saws.
6. Band saws shall be periodically inspected by qualified personnel to be altered whenever defected or removed for repair.
7. The manufacturer's recommended safe operating speed shall not be exceeded.
8. Adjustments of saw blade wheels while in motion shall be prohibited.
9. Pressing the saw wheel to be forced to stop after shutting off the machine shall be prohibited.
10. The connection places on the band saw blade shall not be more than one connection, according to the manufacturer's instructions.

14.3.3.4. Planning Machine:

1. Blades of planers and surfers shall have cylindrical heads in all cases.
2. Every planning machine shall be provided with a bridge guard capable of covering the full length and breadth of the cutting slot in the table, and adjustable in vertical and horizontal direction in accordance with the nature of the work being performed.
3. Slots in the table shall be kept as small as possible.
4. All moving parts under the table shall be fully guarded.
5. Feed rollers fitted in thicknessing machines shall be provided with adequate guards.
6. Thicknessing machines shall be provided with kick-back preventers. This guard shall be as freely moveable as possible.
7. When short pieces are planned, appropriate tools shall be used to control the material.
8. When grooving is carried out on wood, appropriate pressing tool shall be used.
9. Each power-driven woodworking machine shall be provided with a disconnect emergency (stop) switch that can be locked in emergencies.

14.3.4. Grinding Machines:

Fig.11

1. Every grinding machine shall be properly mounted on the work table.
2. Employees who use grinding machines shall be provided with safety goggles to protect their eyes against the flying solid cutters resulting from grinding operations.
3. Tongue guards on power grinders shall be adjustable to be within 6 mm. (1/4 inches) of the constantly decreasing diameter of the wheel at the upper opening (figure 12).

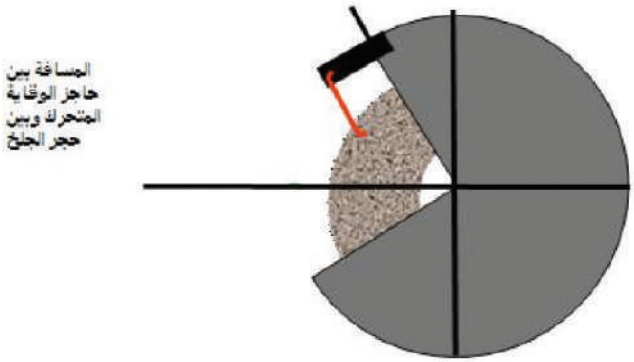


Fig.12

4. The distance between tool-rests on power grinders and the abrasive wheel shall not be more than 3 mm. (1/8 inches) and shall be so adjustable as to the decreasing diameter of the wheel (figure 13).

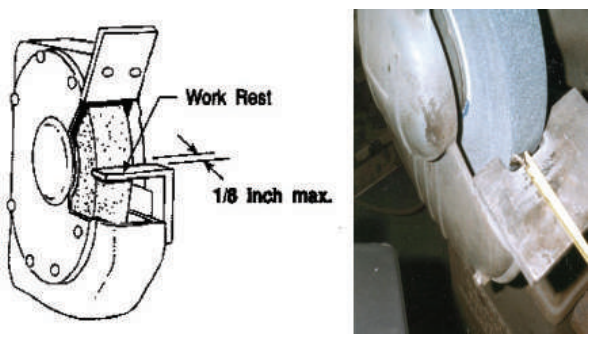


Fig.13

5. Abrasive wheels shall be so selected as to withstand and maintain the spindle speed at safe levels (figure 14).

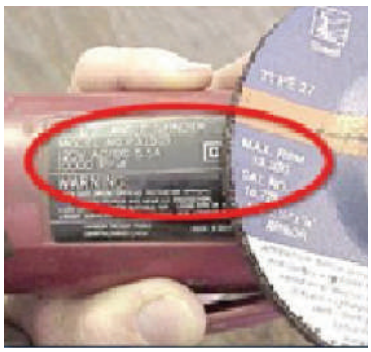


Fig.14

6. All abrasive wheels shall be closely and thoroughly inspected and ring-tested before mounting. Cracked or damaged grinding wheels shall be removed to prevent flying cutters or break which cause injury to employees.
7. Warning placards indicating necessary and adequate PPE, such as safety goggles, etc., shall be affixed near to grinding machines.

14.3.5. Powder-Actuated (Explosive-Actuated) Tools:

Fig.15

14/3/5/1 General Requirements:

1. Only qualified and adequately trained operators who have been trained by an authorized company approved by the competent Department.
2. Each part of such tools shall be provided with the following:
   - An affixed metal placard conspicuously indicates that such tool is a (powder-actu ated) explosive-actuated tool and the lockable container shall be kept under lock and key to prevent accidental automatic operation.
   - Operator's instruction and service manual.
   - Maximum operative load of the tool
   - Tool technical inspection record
   - Service tools and accessories necessary for the maintenance, operation and repair of the tool.
3. Inspection and testing:
   - Explosive-actuated tools shall be periodically inspected, thoroughly cleaned and tested in accordance with the manufacturer's recommendation to ensure its safe operating condition before use.
   - Explosive-actuated tools and the charges shall be secured at all times to prevent unauthorized possession or use.
   - These tools shall be stored and monitored in special areas and shall not be used expect by authorized personnel.
   - Explosive-actuated tools and equipment shall not be loaded until just before the intended firing time. Neither loaded nor empty tools are to be pointed at any employees. Hands shall be kept clear of the open barrel end.
   - The use of explosive-actuated tools shall be prohibited in flammable atmospheres.
   - Adequate personal protective equipment (such as goggles, face and eye shield,

ear protectors … etc.) shall be provided to operators of such tool.

- Appropriate type of powder shall be selected with regard to the nature of work being performed so as to prevent penetration through to the other side. The area where powder-actuated tool is operating shall be cleared and prevented from any person's access (figure 16).

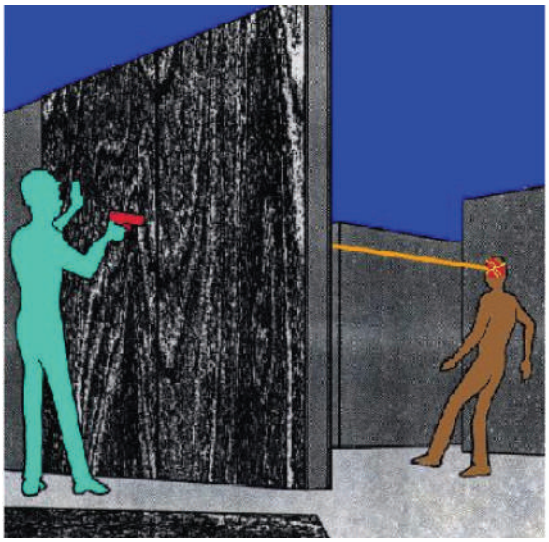


Fig.16

14.3.6. Abrasive and Grit Blasting:

1. Blasting operation shall be performed by trained and experienced personnel in these operations and they shall be provided with appropriate personal protective equipment (appropriate respirators, ear protectors, body protective suits, etc…) (figure 17).

Fig.17

2. All connections and hose nozzles shall be designed to prevent disengagement and shall be equipped with safety lashings.
3. Hoses and hose connections shall be so designed as to prevent build up of static electricity. Hose nozzles shall be grounded and no adjustment shall be attempted to cancel this characteristic.
4. Nozzle attachments shall be of metal and fit on the hose. A safety device shall be provided at the sand blasting nozzle to cut off the flow of the compressed air from the nozzle in accidental disengagement when the operator loses control of hose. A stand/ support shall be provided on which the nozzle may be mounted when it is not in use.
5. In shot blasting machines, every door, aperture and joint of the blasting enclosure shall be kept closed and air tight while blasting is being done. Proper dust collection system shall be provided and cleaned periodically.
6. Blasting area shall be cleared and appropriately barricaded to provide protection to other employees or machinery. Unauthorized employees shall not be allowed to approach the area.

14.3.7. High Pressure Water Jetting:

1. Only qualified personnel designated by the contractor shall operate, maintain and repair high pressure water jetting equipment.
2. The work pieces to be jetted shall be moved to isolated areas. Where it is impracticable, area limits shall be defined with barriers and warning sings erected restricting access.
3. When carrying out the jetting operation with chemical additive, extra precautions shall be taken.
4. No adjustments to the equipment shall be attempted when it is under pressure.
5. Accesses, exits, safe working platforms and adequate personal protective equipment appropriate to the nature of the work being performed shall be provided when working at heights.

14.3.8. Air Compressors:

Fig. 18

Air compressors used for performing operations such as cleaning, drilling, hoisting, chipping etc., in construction sites shall be:

1. Supported with sufficient clearance area to permit a complete external inspection and to avoid corrosion of external surfaces. Under no circumstances shall an air receiver be buried underground or located in an inaccessible place.
2. A drain pipe and valve shall be installed at the lowest point of every air receiver to provide for the removal of accumulated oil and water. Adequate automatic traps may be installed in addition to drain valves.
3. The drain valve on the air receiver shall be opened and the receiver completely drained frequently and at such intervals as to prevent the accumulation of excessive amounts of liquid in the receiver.
4. Every air receiver shall be equipped with a pressure gauge and safety valve. The safety valve shall be tested frequently and at regular intervals to determine whether they are in good operating condition.
5. Every pressure vessel shall be examined by a inspection body approved by Dubai Municipality once in 12 months by visual examination and hydrostatic or pneumatic test and a certificate shall be issued.

CHAPTER FIFTEEN

WELDING AND CUTTING

INTRODUCTION:

Welding is used to join metals. When welded, two pieces of similar metals are heated, melted and fused together. Once completed, the welded joint is as strong as or stronger than the pieces from which the joint is formed.

Hazards associated with welding include: smoke, toxic fumes, flying solid particles, high temperature, light radiation, fires and explosions.

15.1. General Requirements:

1. The contractor shall not permit employees to carry out any hot work operations (welding, cutting, open flames, etc.) except after obtaining the appropriate written «Hot Work Permit» from the authorized person.
2. Hot work operations may be carried out (welding, cutting, open flames, etc.) without obtaining «Hot Work Permit» only in pre-designated and specified areas by the contractor as workshops and far from the areas which contain flammable liquids or materials.
3. Welders, cutters and their supervisor shall be trained in the safe operation of their equipment, safe welding and cutting practices and welding and cutting respiratory protection and fire protection.
4. All welding equipment shall be inspected daily. Defective equipment shall be removed from service, replaced or repaired and re-inspected by qualified competent persons before again being placed in service.

15.2. Fire Prevention and Protection:

1. The contractor shall ensure that welding areas are free of combustible and flammable materials by conducting proper measurements using safety apparatuses to detect the

percentage of flammable and combustible material in air. The lower flammable limit (LFL) reading must not exceed 10 % before starting the welding operation.

2. If the object to be welded cannot be moved, all moveable fire hazards in the vicinity shall be taken to a safe place at least 11 meter (35 feet) away from the welding area.
3. If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards. The floor shall be covered with damp sand or wetted to extinguish flying sparks, also if possible, the work area shall be enclosed with portable fire-resistant screens. (Fig. # 1).

Fig. 1

4. Suitable and adequate fire extinguishing equipment (fire extinguishers, fire hose reel, etc.) shall be immediately available in the work area and shall be maintained in a state of readiness for instant use in case of fire (Fig. # 2).

Fig.2

5. A person who is well-trained on firefighting shall be assigned as a firewatcher to maintain a watch for flying sparks resulting from the welding operation within 11 meters (35 feet) area. A fire watch shall be maintained for at least a half hour after completion of welding operation.

6. No welding or cutting operations shall be performed on used barrels or any other containers of flammable or combustible materials until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable or combustible materials present (Fig. # 3).

Fig. 3

7. Noncombustible supports shall be used under metal workings while welding operation is performed.
8. A fire – resistant cover shall be used to cover all openings or cracks on walls adjacent to the welding area to prevent passage of sparks or heat transfer through those openings or cracks to adjacent areas.
9. If welding or cutting is to be performed on a metal wall, partition, ceilings or roofs, adequate precautions shall be taken to prevent ignition of combustibles on the other side, due to heat transfer by conduction or radiation.
10. No welding or cutting shall be performed in areas where flammable paints or other flammable or combustible materials are present.
11. When welding or cutting is performed near fire fighting sprinkler heads, a wet cloth shall cover those sprinkler heads to prevent their activation as a result of welding produced heat. When welding or cutting operations complete, the cloth shall be removed. Necessary precautions shall be taken when performing welding and cutting operations in areas safeguarded with fire alarm system to prevent fire alarm activation.

15.3. Protection of Personnel:

1. Employees performing any type of welding or cutting and other personnel present in the welding area shall be protected against radiation, flying sparks, glare, melting materials and welding slag by wearing proper and adequate personal protective equipment and clothing in accordance with the requirements specified in Chapter Four in this manual.
2. Suitable eye and face protective wear (safety glasses, goggles, and face shields) with appropriate filter lenses to the nature and size of welding electrode shall be used.

3. Protective flame-resistant gauntlet gloves and cotton suits with full sleeves and without pockets shall be used. The trousers shall have no cuffs and shall extend well down to the shoes. Appropriate safety shoes shall be used and durable flame-resistant aprons made of leather may be used as an additional protection over the protective clothing.

Fig. 4

15.4. Health Protection and Ventilation:

1. Prior to the start of any welding or cutting operation, metal components, anti-rusting coatings, welding electrodes and welding electrode coatings (if any) shall be identified.

2. After identifying the above information, potential health hazards, types and kinds of appropriate personal protective equipment and adequate protective ventilation shall be determined.
3. Proper ventilation shall be provided in welding area either naturally or mechanically.
4. Natural ventilation is considered adequate within a welding area space of 284 square meters (10000 square feet) with a ceiling height of not less than 5 meters (16 feet).
5. If above listed conditions are not provided for adequate natural ventilation, mechanical ventilation shall be required. Mechanical ventilation shall be at a minimum rate of 56 cubic meter per minute (2000 cubic feet per minute) per each welding equipment. It is preferable that local exhaust ventilation to be used as near as practicable to the work being welded and provided with a rate of air-flow sufficient to maintain a velocity in the direction of the hood of 30 meter per minute (100 linear feet per minute) which shall extract the welding fumes into a special filter in (HEPA Filter – High Efficiency Particulate Air filter). Exhaust systems shall also be efficient means to provide a rate of airflow of at least 20 air change per hour to keep the concentration of fumes within safe allowable concentration limits. (Fig. # 5).

Fig. 5

6. When performing welding and cutting operations in confined spaces, adequate ventilation shall be provided and local exhausting ventilation systems shall be provided to extract welding and cutting harmful fumes outside the confined space.
7. Before welding, cutting, or heating is commenced on any metal surfaces covered by preservative or anti-rust coatings, all surfaces shall be thoroughly stripped of such coatings for a surrounding distance of 10 cm. (4 inches) from the area of heat application.
8. When welding, cutting, or heating materials including the toxic substances specified in table # (1) is undertaken the following precautions shall be taken:
    a. Mechanical ventilation and respiratory devices shall be provided in any confined spaces or limited spaces.
    b. Except for Beryllium, when substances specified in table (1) exist in confined spaces or indoors, adequate mechanical ventilation, preferably local exhaust ventilation, shall be used. With Beryllium, appropriate respirators shall be used.

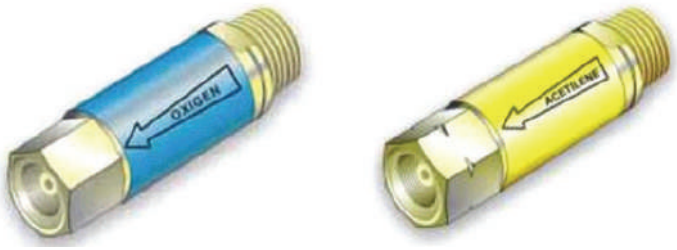
Table (1)

Substance	Uses	Hazards
Beryllium	Strengthening Copper and Aluminum alloys	Metal fume fever (flu-like symptoms) and suspected to cause cancer
Cadmium	Metal rust preventive coating	Respiratory diseases (Pulmonary Edema) and suspected to cause cancer
Chromium	Iron alloys specially stainless steel	Eye and skin allergy, nasal irritation and some kinds cause cancer
Nickel	Iron alloys specially stainless steel	Skin diseases and causes cancer
Zinc	Galvanized steel	Metal fume fever (flu-like symptoms)
Vanadium	Manufacturing of Filler wire	Eye and respiratory allergy and may cause Asthma
Fluoride	Welding electrodes coatings when melted cover the welding area to prevent the reaction of oxygen with the melted metal which may damage welding	Eye, nose and throat irritation. Excessive exposure may cause fluid in the lungs and bone damages Respiratory diseases
Silica	Welding electrodes coatings when melted cover the welding area to prevent the reaction of oxygen with the melted metal which may damage welding	specially Silicoses

9. Arc and gas cutting, Oxygen cutting using either an iron powder or chemical flux, gas-shielded arc cutting, and plasma cutting shall employ local mechanical exhaust ventilation or other means adequate to remove the fumes generated.
10. Other persons exposed to the same atmospheres as welders or cutters shall be protected in the same manner as welders and cutters, according to the technical guidelines # (21).

15.5. Gas Welding:

1. Torch valves and gas source valves shall be turned off when welding is temporarily stopped and they shall be removed from the welding area to a designated safe storage place at the end of each working shift.
2. Torches and hoses shall be removed from confined spaces when the work is suspended.
3. Non-return valves shall be installed to gas cylinders on each hose directly close to the torch for oxyacetylene welding, cutting and heating equipment which mix oxygen and acetylene or other fuel gases. (Fig. # 6).



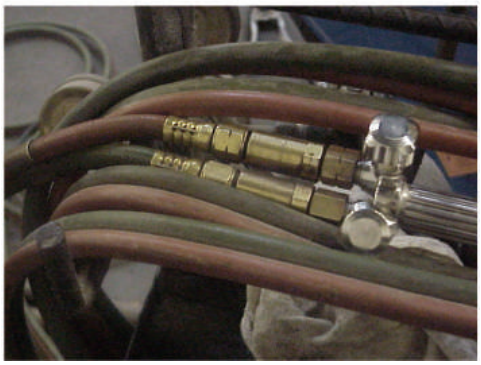


Fig. 6

4. Flash-back arrestor valve shall be installed on the regulators of oxygen and acetylene cylinders to prevent very fast flame back as a result of clogged torch tip. If oxygen and acetylene mixed in one of the hoses, it shall cause gas explosion or flashback. (Fig. # 7).

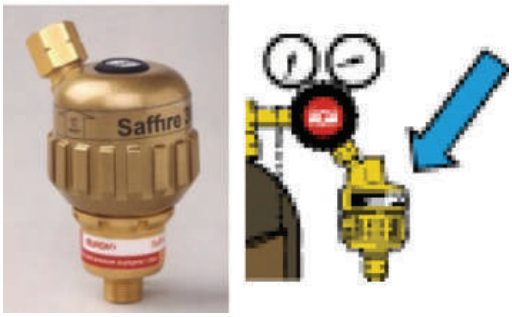


Fig.7

5. Hoses shall be stored in boxes with holes to provide ventilation for the contents.
6. Acetylene gas (C2H2)pressure regulators shall be adjusted in order not to release gas pressure more than 15 psi (bounds per square inch) in any condition. Acetylene under pressure
   more than 15 psi will be unstable and may decompose and cause a violent explosion.
7. Clogged torch tip openings shall be cleaned with suitable cleaning wires, drills or other suitable devices designed for such purposes and recommended by the manufacturing company.
8. Torches shall be lighted by friction lighters or other approved devices, and not by matches or other hot work activity.
9. Oxygen cylinders and fittings shall be kept away from oil or grease, and shall not be handled with oily hands or gloves to prevent fire accidents.
10. Compressed gas cylinders (oxygen and acetylene) shall never be taken into confined spaces.
11. All hoses used in gas welding and cutting shall be examined thoroughly to ensure they are very tightly attached and there are no gas leaks (by using soapy water, a flame shall never be used for this purpose).
12. Torches in use shall be inspected by a qualified and trained person at the beginning of each working shift for leaking shutoff valves, torch connections, hose couplings, and tip connections. Any defective valves, torch connections, hoses or tip connections shall be removed from work immediately.
13. Oxygen cylinders in storage shall be separated from flammable gas cylinders or combustible materials, a minimum distance of 6 meters (20 feet) or by a noncombustible barrier at least 1.5 meters (5 feet) high having a fire-resistance rating of at least half hour. (30 minutes).
14. Copper connections or regulators shall not be used with acetylene gas cylinders. Acetylene reacts with copper and produces hazardous compounds. Brass connections and regulators shall be used.

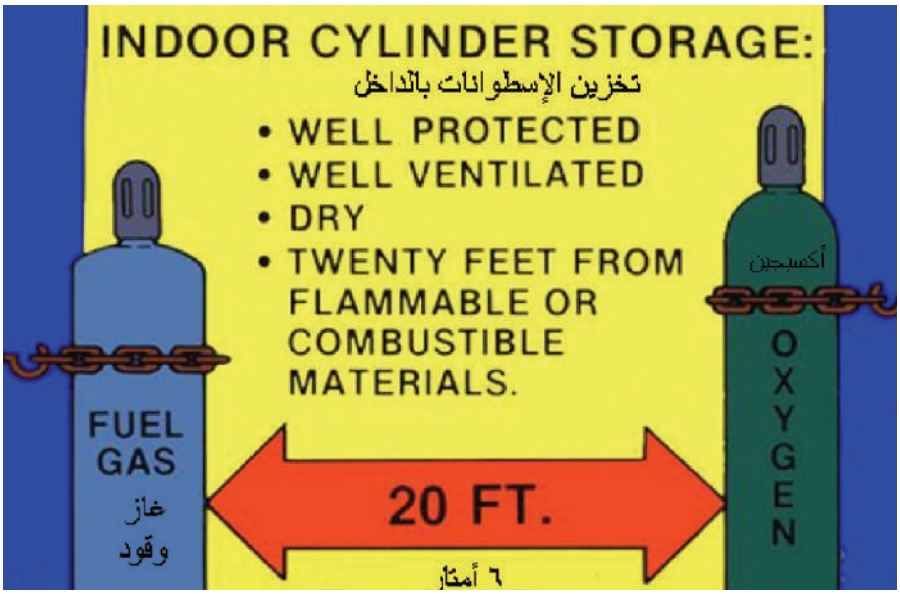


Fig.8

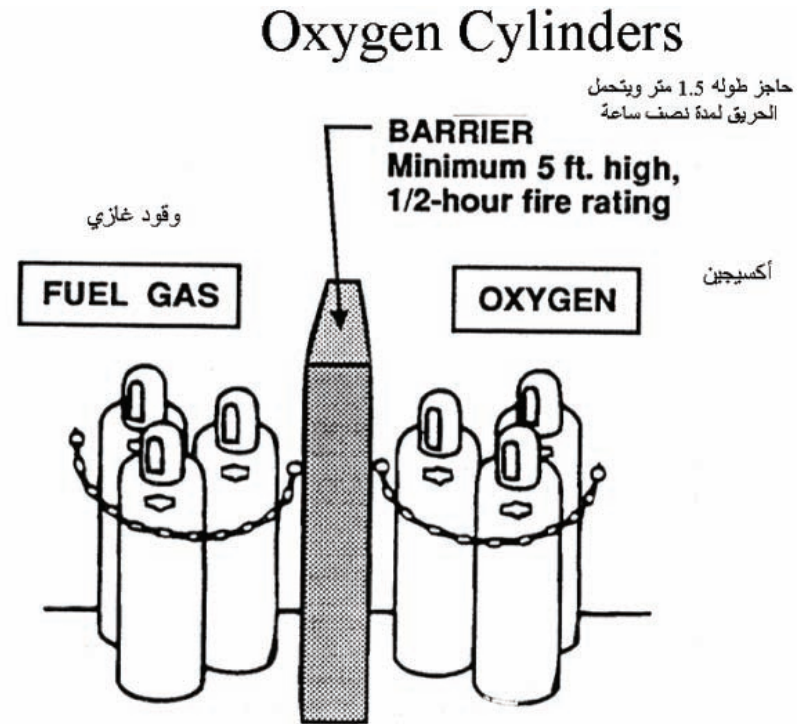


Fig.9

15.6 ARC Welding and Cutting:

1. Electrode holders shall be of a capacity capable of safely handling the maximum rated current for the electrical circuit and fully insulated to prevent electrical shocks; disconnect of the electrical circuit or sparks when wires connected to handles.
2. A disconnecting switch shall be fixed on the welding machine or near to it to ensure immediate disconnection of all electrical power when machine is switched off.
3. Adequate personal protective equipment shall be used, especially eye shields with filters suitable to the size of the welding electrode and kind of welding.
4. Welding supply cables shall not be placed near power supply cables or other high-tension wires.
5. Personnel shall be protected against the harmful gases resulted from gas arc welding of stainless steel by providing adequate local ventilation.
6. Wires or power connections' length shall not exceed the appropriate length to execute the work. They shall be to the nearest point to the working area.
7. Work lead to complete circuit shall be attached to the work piece or the work-table to be to the nearest point to the working area.
8. Employees performing electrical welding and cutting shall be protected against the accidental contact with motor generators, rectifiers, transformers, and all live electrical parts.
9. Welding operations shall be performed in dry areas away from moist or rain falls.
10. Arc welding machines shall be effectively grounded.
11. Cables and connectors of arc welding machines shall be appropriately insulated for normal or heavy works.

12. External surface of manually operated electrode holders and the clamp shall be adequately insulated to protect from heat or electrical chock hazards.
13. All welding installations shall be water proof.
14. Insulated connections shall be used when attaching wires together for grounding cable and the power cable connecting the power source with the welding electrode.
15. Electrical wires used in arc welding operations, shall be free of repairs or splices.
16. Pipelines containing gases or flammable liquids or conduits containing electrical circuits, shall not be used as ground return.
17. All arc welding and cutting operations shall be shielded by non-combustible or flame proof screens which will protect employees and other persons working in the vicinity from the direct rays of the arc. (Fig. # 1).
18. When arc welding is used with inert gases (Argon), the resulting ultra violet (UV) radiations are 5 – 30 % more than metal arc welding. Thus, any chlorinated organic solvents shall be kept 60 meters (200 feet) away from welding area to prevent the decomposition of these chlorinated organic solvent and the formation of phosgene gas, unless shielded.

CHAPTER SEXTEEN

Electrical Hazards

Introduction:

Electricity is an essential source of power. It is essential for modern life and the power energy in different industries.

Use of electricity is not free from hazards to human beings and properties. Electrical hazards are certain in use, maintenance and connections of electrical apparatuses.

Control of most electrical hazards is not difficult or expensive. However, negligence of application of electrical protection procedures causes many injuries to persons and properties.

16.1. Electrical Hazards:

1. Electrical Shock
2. Burns
3. Arc-Blasts
4. Fires and Explosions
5. Falls

16.2. General Instructions:

1. All electrical wiring and installations shall conform to the provisions and requirements of Dubai Electricity and Water Authority (DEWA).
2. All electrical works shall be performed by qualified persons who shall be provided with adequate and necessary personal protective equipment.
3. Prior to maintenance operations on any electrical equipment or appliances, the electrical current shall be disconnected, (lockout and tag out) with a lock or any other adequate means and tagged out to ensure the prevention of reenergizing of the equipment by any person during work.
4. Employees working near electrical circuits shall not wear trinkets, rings, watches and jewelry.
5. Approved explosion proof electrical lighting shall be the only means used for artificial illumination in areas where flammable liquids or gases are present and creating a potential explosion hazards.
6. Employees working in electricity shall be instructed in using the proper fire extinguishers in electrical fires such as Dry Chemical and CO2 extinguishers. Water or extinguishers containing water shall not be used in extinguishing electrical fires which occur in electrical equipment or conductors as water is a good conductor which causes electrical shocks for the person using the extinguisher.
7. Metal ladders or non-insulated hand tools shall not be used while working in electrical installations. (Handles of all hand tools used shall be insulated and wooden or fiberglass-coated ladders shall be used) (figure 1).

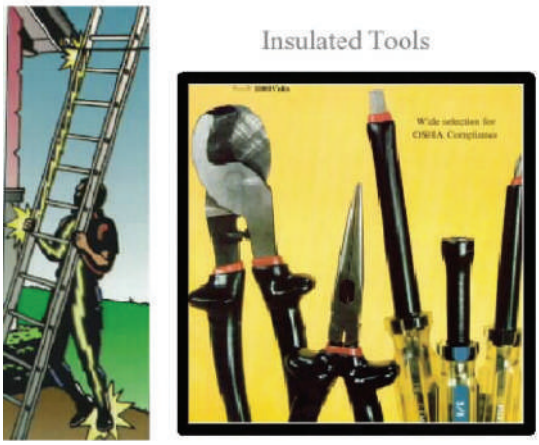


Fig. 1

8. Fixed and mobile electrical appliances and equipment shall be grounded by means of non-current carrying wire. When a short circuit occurs and a live wire permits a high fault-current flow to the frame or cover of an equipment or machine, the circuit breaker or fuse shall be tripped to interrupt the current and disconnect the electrical circuit or ground wire carries the current to ground and prevent the current traveling through human body to the ground. The ground conductor shall be continuously checked by using Ohm Meter.
9. When the fuse or circuit breaker disconnect the electrical circuit, electrical current shall not be re-connected before inspecting the cause of the fault and repair it and thus replace the fuse with other fuse of the same rating or the circuit breaker shall be returned to its first position by a qualified employee.
10. Electrical circuit shall not be overloaded to prevent occurrence of fires.
11. Electrical wires shall not be passed through doors or windows and shall be kept away from heating sources such as heaters and shall not be hung from nails to prevent the damage or wearing of the insulating material.
12. Defective or corroded electrical wires shall not be used and shall immediately replaced.
13. In case a person receives an electrical shock, this person shall not be touched, first, disconnect the power and remove the injured person away using a piece of wood or any other insulated material, and then, first aid shall be provided to the injured person such as Cardiac Pulmonary Resuscitation (CPR). The doctor shall be informed immediately or the injured person shall be taken to the nearest hospital.
14. When recharging batteries, employees shall be instructed not touch the battery liquids, and shall be provided with adequate and suitable personal protective equipment when doing that (Face shield, rubber gloves, aprons) and when refilling batteries by acid, acid shall be added to water (and not water to acid), in case any burns by the effects of acids occurred, immediately flush the burn with big amount of water.

16.3. Electricity at Site:

1. Before any operations or works at site commences and during work progresses, the contractor shall take all practicable steps to prevent danger to persons employed from any live electric cable or apparatus.

2. The design and installation of all electrical power systems for the construction site shall be done by qualified competent electricians as per the regulations and requirements issued by the authority concerned.
3. Necessary protective devices such as earth leakage circuit breakers (ELCB) shall be provided in the electrical circuit to avoid risks of electrical shocks (figure 3).

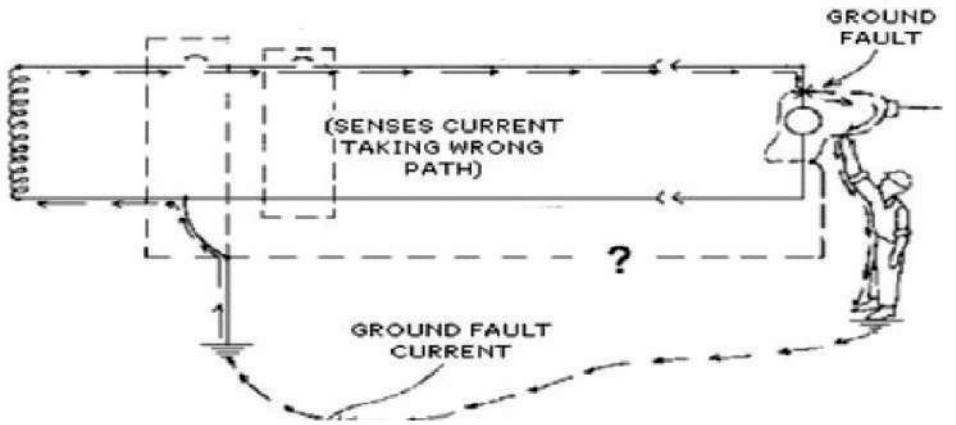


Fig. 3

4. All persons working with electrical equipment or installations in construction sites shall wear the necessary suitable personal protective equipment to protect them from electrical shock or burns (figure 4). PPE shall be selected by a qualified person in accordance with the nature of the assigned work.

Fig. 4

5. Electrical equipment and apparatuses shall be so installed as to make nameplates and markings affixed on them can be examined without removing the installed equipment from a hard wire position.
6. All fuses and circuit breakers in the electrical panel shall be clearly marked and labeled in lieu to their connected apparatuses as to facilitate recognizing each

equipment's fuses or circuit breakers.

16.4. Personal Protective Equipment during Working with Electricity

1. Non-conductive helmets shall be used, and aluminum helmets shall not be used while working near electricity.
2. Eye and face protection shall be used when working in electricity where flying sparks or electrical arcs may occur.
3. Long boots made of non-conductive material shall be used.
4. All hand tools used during working in electrical apparatuses shall be insulated. Power-operated hand tools shall be grounded or of the double insulated type equipment (figure 5).

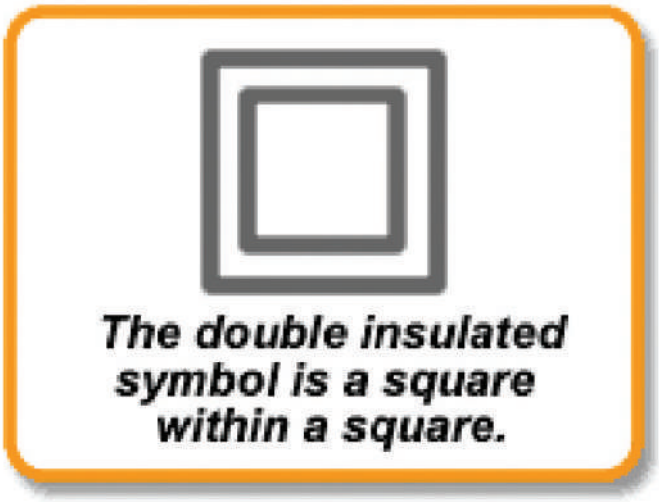


Fig.5

16.5. Temporary Electrical Extensions:

1. All temporary electric wiring shall be installed and protected so that the wiring cannot be damaged by traffic movement.
2. Electrical wires which do not resist atmospheric conditions or of limited electrical information shall not be used.
3. All wires shall be insulated to prevent contacts with its supports.
4. All pipes and conduits which contain electrical wires shall be provided with appropriate boxes and covers at their ends.
5. All electrical wires, installations, tools and appliances shall be of the types which comply with the requirements of the authority concerned.
6. Electrical apparatuses shall be appropriate to the atmospheric conditions where they shall be used. They shall be explosion proof while operated in wet, flammable or explosive locations.
7. Switches located in or near the entrances of confined spaces shall be distinctive for immediate electricity disconnection in emergencies.
8. Exposed empty lamp sockets and broken electrical bulbs shall not be permitted.
9. Mobile electrical lamps shall be provided with electrical cables capable of withstanding the severest operating conditions to which they may be exposed. Electrical lamps shall not be mounted by its wires.
10. Non-spark-producing lamps of 12 volts shall be used in wet, flammable and

explosive locations.

11. Portable electrical tools without double insulation shall comply with the specified requirements of the authority concerned and shall be grounded.
12. Electrical installations in the worksite shall be protected against damages as a result of over passing persons or equipment. They shall also be protected from sharp edges or suitably raised from ground. Automatic circuit breakers shall be used in the electrical circuits exposed to heavy equipment passage or hammering by metal machines.
13. Appropriate clearance distance shall be maintained between electrical cabinets doors and electrical installations. Equipment doors and hinged panels must have at least a 90 degree opening provided in the workplace.
14. Persons who are engaged in electrical installations shall wear insulated gloves and other insulated tools or hot line tools used for live lines when it is necessary to work with energized circuits.
15. Clearance distance specified by the authority concerned shall be maintained between employees and any exposed live installations.
16. Electrical equipment and machines shall be grounded and shall not be connected to electricity before ensuring safe electrical circuit status and enclosed and exposed live installations are appropriately insulated to prevent contact.
17. If work nature in the worksite requires a temporary electrical transformer, all procedures specified by the authority concerned on required protection shall be applied provided that the installations shall be in compliance with the electrical volt used.
18. All requirements of electrical installation and safety regarding machines, equipment and electrical apparatuses when used in the site shall be applied provided that those requirements shall include the procedures of protection against overloading, earth leakage current and short circuit current.

16 -6 In case of erection or maintenance of main electrical stations or electrical substations projects, or high voltage cables installations projects, the contractor shall develop and prepare a risk assessment study and detailed action plan before commencing any work, and shall obtain the necessary approvals and no objection certificates from the concerned authorities.

CHAPTER SEVENTEEN

Control of Hazardous Energy (Lockout/ Tag out)

Introduction:

Every workplace including different construction worksites has the need for on-going maintenance, repair, and installation of machines. Serious injury can be caused by the sudden and unexpected startup of the machinery or equipment.

These guidelines pertain to the application of safe working procedures to isolate energy sources and movable parts from equipment and machinery prior to any maintenance or installation works being performed in order to prevent any unauthorized person to operate the machinery by mistake and expose workers to great danger.

Definitions:

A. Lockout – Tag out:

The placement of a device to isolate energy sources of equipment being controlled and the placement of tags on energy-isolating device to indicate that the equipment is out of service for maintenance work thereby preventing reenergizing the equipment except after the maintenance work is completed and only by personnel who lockout it. References in technical guideline # (15)

B. Energy Isolation Devices: (figure 1):

Mechanical devices that physically prevents the transmission or release of energy such as:

1. Manually operated electrical circuit breakers
2. Blind flanges
3. Chains and locks to secure valves locked.
4. Disconnect switches
5. Padlocks (used to lockout some types of electrical panels)

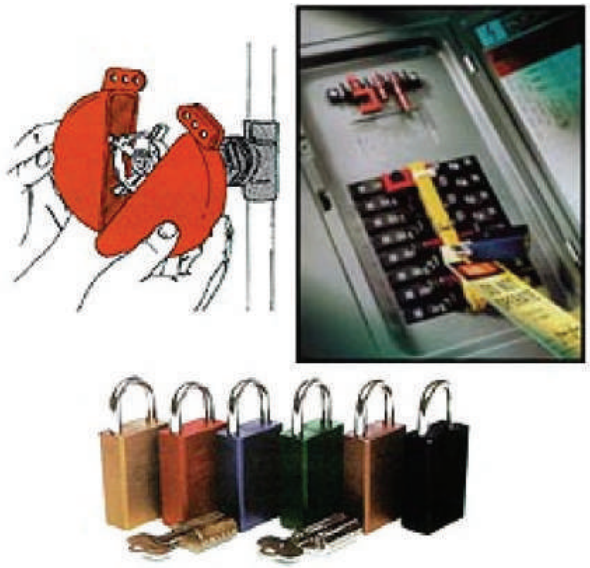


Fig. 1

C. Energy Resources: (figure 2)

1. Electrical energy
2. Mechanical energy
3. Hydraulic energy
4. Pneumatic energy
5. Chemical energy
6. Thermal energy
7. Gases
8. Others

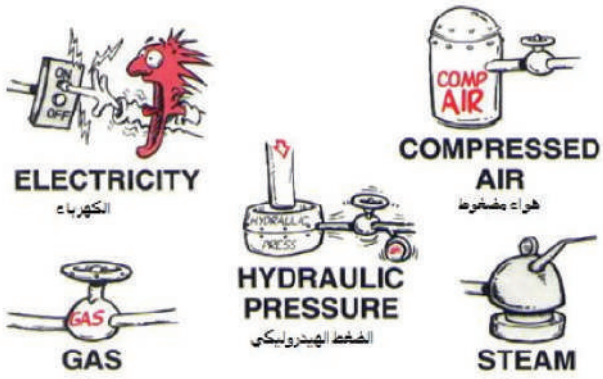


Fig.2

D. Affected Employees: (figure 3)

Affected employees are the employees whose job requires them to operate and use machinery and equipment which are energized by different energy sources or any other existing persons near those equipment or machinery.

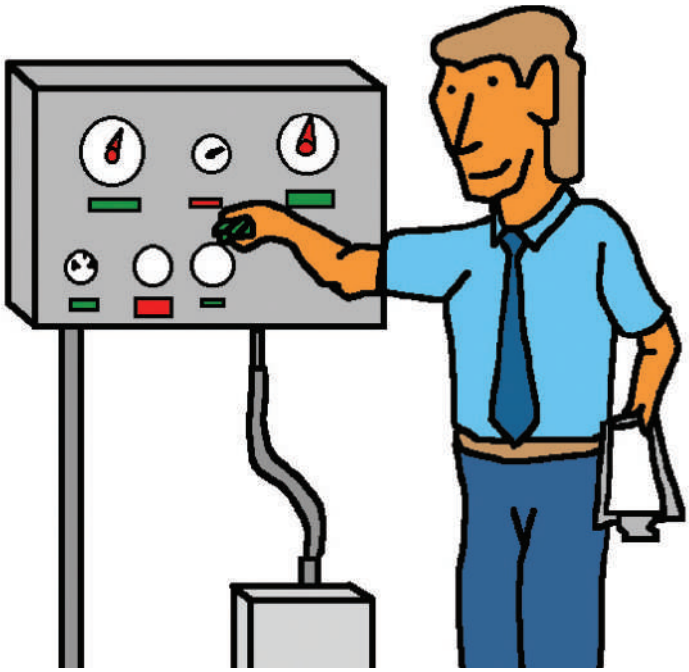


Fig. 3

E. Authorized Employee: (figure 4)

Authorized employee is the employee who locks out and tags out machines or equipment prior to the initiation of different works (such as maintenance or repair) and removed them after work is completed.

Fig.4

F. Safety Padlock: (figure 5)
It is a lock with only one key used as a lockout device to hold the energy isolating device of equipment and appliances in the safe position which prevent the energizing of equipment or appliances except by the responsible employee who applied the device and has the lock key.

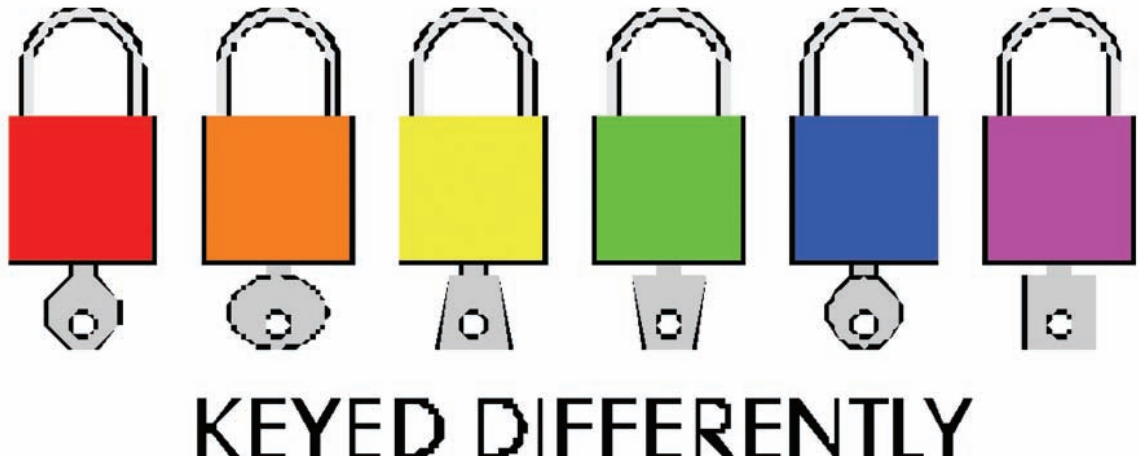


Fig.5

G. Disconnection:
It is the disconnection of the equipment energy source by valves, electrical switches or mechanical devices to ensure that the equipment being controlled cannot be operated.

H. Residual energy:
It is the remaining energy in a machine or equipment connections after activation of the disconnection, including but not limited to (the air pressure in pipelines after locking the valves or the accumulated electrical energy in electrical condensers).

17.2. General Requirements:

1. Prior to the initiation of maintenance, repair or installation works of a machine or equipment operated by different energy sources, energy-isolating device of this machine/ equipment shall be appropriately locked out and tagged out to ensure the prevention of accidental reenergizing of the equipment by any person or unexpected activation of the machine/equipment which could endanger employees.
2. Tags shall be written in Arabic, English and any other most common language in the workplace to ensure that they are understandable by all employees concerned.
3. placing of lockout and tag out devices to energy isolating devices of different machines/ equipment prior to maintenance and repair operations shall be implemented by well experienced and qualified competent person listed by the contractor.
4. All procedures of all maintenance and repair works which shall take place in the project shall be coordinated between the contractor and the consultant.
5. Prior to starting maintenance or repair on machines or equipment, all authorized employees shall be notified.
6. The contractor shall develop a written plan which clearly identifies work scope, purpose,

responsibilities, permits, rules and procedures, periodic inspection of lockout devices and adequate training of authorized employees to ensure hazardous energy control.

17.3. Training:

1. Adequate training to all employees responsible of applying lockout and tag out system shall be provided to ensure the correct application of this system.
2. The training shall include the recognition of different hazardous energy sources, the type of the energy available in the workplace and the methods and means necessary for energy isolation and control.
3. Retraining must be provided on lock out / tag out measures in the following cases:
    - 3-1 Whenever there is a change in hob assignments or a change in energy isolation procedures.
    - 3-2 Whenever a periodic inspection reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedure.
4. Trained or retrained employees' data shall be fully documented such as trainee's name, date of training, the location and type of devices on which they have be trained and the trainer's name.

17.4. Periodic Inspection:

1. Periodic inspection shall be conducted in all operations applying lockout and tag out systems to ensure safe operational procedures and employees' compliance with all procedures and requirements.
2. Inspection of energy isolation and control results shall be documented in special records.

17.5. Requirements for Lockout/Tagout Devices:

Lockout and Tag out devices shall have the following conditions:

1. Tags must clearly identify the employee who applies them.
2. Lockout and tag-out devices must withstand the environment to which they are exposed for the maximum duration of the expected exposure. Tag-out devices must be constructed and printed so that they do not deteriorate or become illegible,
3. Lockout and tagout devices shall be standardized in color, shape and size. Tagout devices shall clearly indicate their purpose and shall include a legend such as (Do Not Operate, Do Not Energize, etc).
4. Lockout and tagout devices shall be sustainable enough to prevent forceful or accidental removal.

17.6. Energy Isolation and Control Procedures:

The procedures for the application of energy control (Lockout/Tagout Procedures) shall be implemented in the following sequence:

1. Before servicing or installing equipment, different types of energy source on the equipment and stored energy must be identified, , identify persons to be notified that the equipment will be shut down for service, and affected employees shall be notified..
2. The person in charge on site shall shut down the equipment using the normal procedure for shutting down the equipment by pressing the stop button. (Fig. # 6).

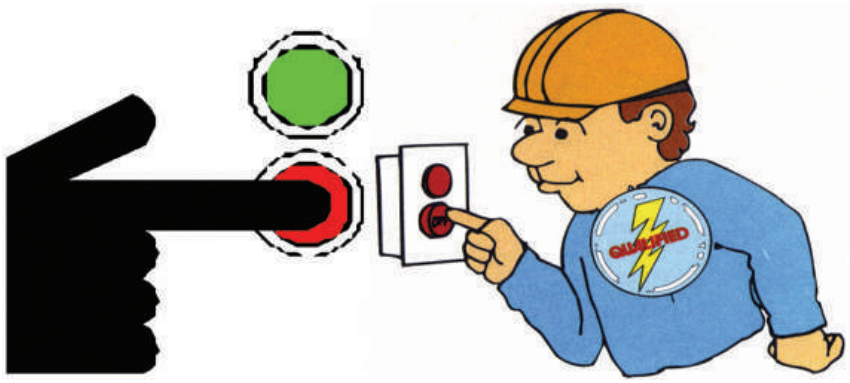


Fig. 6

3. The person in charge on site shall shut off the power supply, - close gas valves - close compressed air and steam valves of equipment which will be maintained. (According to the type of energy). The authorized employee who performs maintenance is responsible for locking out the energy sources of the equipment by the control devices (figure 7).

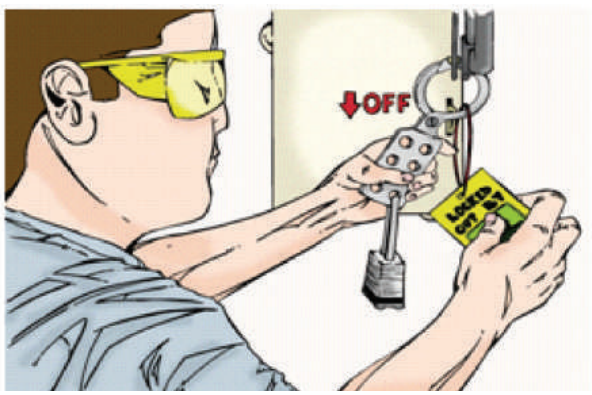


Fig.7

4. Tagout devices shall be attached to energy isolating devices or valves to indicates that these switches and valves of the equipment have been locked out for maintenance purposes and that, the operation of equipment is prohibited except by the authorized employees (figure 8).

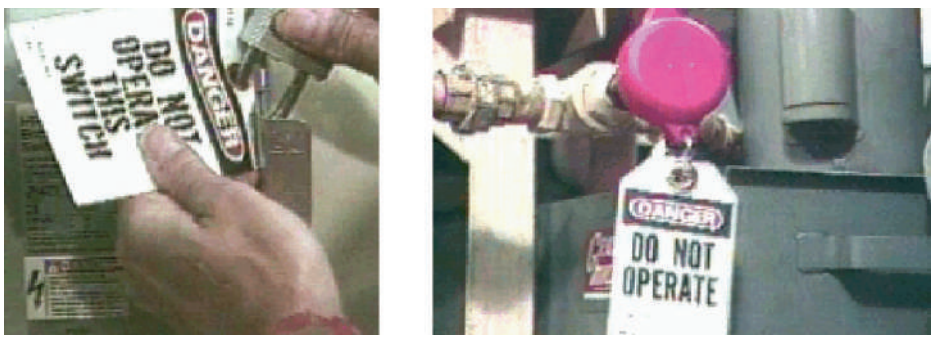


Fig. 8

5. Stored or residual energy accumulated in the pipes such as compressed air, steam, compressed gases or residual electrical energy in the condensers shall be released (figure 9).

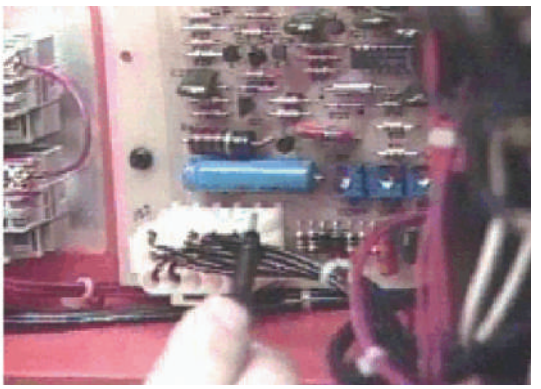


Fig. 9

6. Test Equipment to Verify that All energy Has Been Released or Controlled by putting switches to the ON position, and hence return the switch to the OFF position Fig. (10).

Fig. 10

7. Authorized employees who are responsible for maintenance operations shall start work on the equipment.
8. Whenever works on equipment will extend beyond one shift, employees of the new shift shall place their locks on the lockout devices before removing the locks of the previous shift employees.
9. On-site occupational health and safety responsible employee shall conduct daily safety inspection tours to ensure the application of the abovementioned steps on equipment under maintenance and repair.

10. Once maintenance works are completed, person in charge on site, in coordination with the authorized employee who performs maintenance and repair of the equipment shall carry out the following:

i. Remove all used tools.
ii. Ensure that all safety guards of the equipment are in place.
iii. After ensuring clearance of all personnel from vicinity of the equipment, remove lockout devices (if they were applied), reconnect electricity by switching the keys in the electrical panels to «On» position, open gas, air and steam valves and remove tags.
iv. Operate the equipment by its operating switches in the presence of the person in charge and the maintenance employee.

17.7. Exception:

In case energy isolating control devices (lockout and tagout devices) cannot be used for any reason, the following procedures shall be applied:

- Switching the electrical operating switch of the equipment to «Off» position from the electrical control panel.
- Closing air, compressed gases and steam valves.
- Attaching tags on the equipment that indicate the energy isolation for maintenance and repair works.
- Assigning an employee to monitor the electrical control panel and closed valves to prevent accidental re-operation by any person.

CHAPTER EIGHTEEN

Chemical Materials Hazard and Labling

Introduction:

Statistics indicate that 650, 000 chemical materials have been discovered and more hundreds are being introduced annually, the matter which endangers life and health of employees in case that appropriate safety protective measures are not applied.

Exposure to different chemicals may seriously affect the body organs such as respiratory, heart, liver and kidneys. To prevent injuries and diseases resulting from exposure to hazardous chemicals, the provisions of this chapter are to ensure that information about hazards of chemicals produced and handled in the workplace shall be transmitted to employers and employees to ensure their knowledge of the hazards and protective measures of those chemicals.

The main purpose of this chapter is to assess the hazards of all chemicals used in different workplaces and to communicate to employers and employees the information concerning hazards, appropriate protective measures and safe handling of those chemicals to which they are exposed.

18.1. General Requirements:

18.1.1 The contractor shall prepare an inventory list of all available amounts of chemicals used in the workplace.

18.1.2 The contractor shall ensure that all hazardous chemical containers used in the workplace are labeled and tagged with appropriate warning signs. Labels and tags shall be conspicuously written in Arabic, English and the most common language in the workplace.

18.1.3 If chemical materials are transferred from their labeled primary containers into other secondary small containers, the contractor shall ensure that similar labels and tags of the primary containers are affixed to the secondary small containers.

18.1.4 The contractor shall ensure that material safety data sheet for each hazardous chemical in the list is obtained. Copies of the MSDS for hazardous chemicals in a given work site are to be readily accessible to employees in that area to obtain information on hazardous chemicals in their work area.

18.1.5 Material safety data sheets shall be updated and available in Arabic, English and the most common language in the workplace.

18.1.6 All employees handling chemicals in the workplace shall be provided with appropriate and effective training on the safe handling measures of these chemicals.

18.1.7 In case subcontractors are working on-site, they shall be informed with the hazards of the chemicals used in the workplace. If subcontractors import chemicals which are not listed in the inventory of hazardous chemicals used in the workplace, the main contractor shall ensure that the containers of those chemicals are appropriately labeled, tagged or marked and that each chemical's material safety data sheet is available.(MSDS)

18.2. Chemical Hazard Identifing Program:

18.2.1 The contractor shall develop a chemical hazard communication program which specifies hazards of the chemicals used in the workplace and inform the employees who are exposed to those chemicals about their hazards and safe means of handling and storage.

18.2.2 Technical guidelines no. (16) on chemical hazard communication shall be consulted.

18.2.3 The program shall include the following items (figure 1):

- A list of all hazardous chemicals which are used in the workplace and their hazards.
- Means to ensure that there is a Material Safety Data Sheet (MSDS) for each chemical in the list, and to be readily accessible to all employees handling such chemicals.
- System for ensuring that chemical containers are labeled
- Appropriate training of all employees exposed to hazardous chemicals.

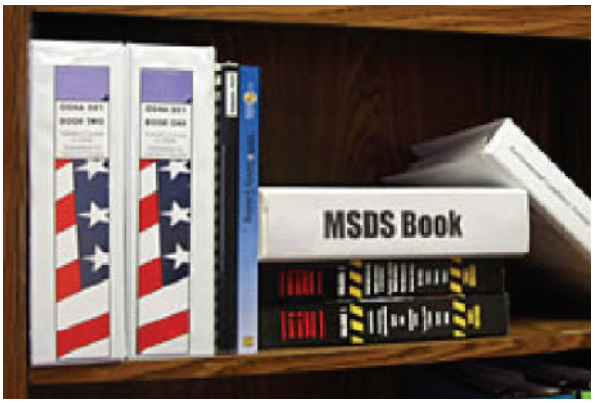
Fig. 1

18.2.3.1. A list of All Hazardous Chemicals:

All hazardous chemicals used in different worksites shall be identified and listed. Chemical material is considered hazardous if it:

1. Has physical hazards (combustible, flammable, or explosive materials – compressed gases)
2. It has health hazards (toxic, irritant, corrosive, and carcinogen materials)
3. Listed as hazardous in the List of Hazardous Materials specified in the Local Order no 61 of 1991 or it is assigned a Threshold Limit Value (TLV) by the American Conference of Governmental Industrial Hygienists (ACGIH).

18.2.3.2. Material Safety Data Sheets (MSDS):



The Material Safety Data Sheet (MSDS) is the key to Hazard Communication Program. It shall contain all important information regarding the chemical substance.

The contractor shall ensure that material safety data sheets for all chemicals in the workplace are available. They shall be provided to all employees who are exposed to hazardous chemicals to enable them to know all information on hazardous chemicals they handle.

International warning labels and tags affixed to hazardous chemical containers shall be used to indicate the most hazardous items. Warning labels and tags are the first step towards identifying the hazards of the material in the container.

There are different types of labels such as:

1. National Fire Protection Association (NFPA) Labels.
2. Hazardous Material Identification System (HMIS) Labels.
3. Right To Know (RTK) Labels.

1. Labels of the National Fire Protection Association (NFPA) and HMIS, classifying chemical hazards into four different rating colored categories ranking the hazards of each chemical. Chemicals are assigned a numerical rating system from 0 to 4. The label also identifies the proper personal protective equipment that shall be used when handling the chemical. (NFPA warning labels are in diamond shape, while HMIS are in rectangular shape (figure 2). The blue part of the label is reserved for the identification of health hazards, the red is for flammability hazards, the yellow is for reactivity hazards, and white is for special hazards in NFPA labels while it is reserved for personal protective equipment identification in HMIS labels.

The chemical substances are assigned a numerical system from 0 to 4 rating the effects of these hazards into five degrees as follows:

Hazard Rating	Type
Degree (0)	No or Minimal hazard
Degree (1)	Slight
Degree (2)	Moderate
Degree (3)	Serious
Degree (4)	Extreme

2. HMIS label system has been updated to include an additional box next to Health Hazard box for (*) indicating a Chronic Hazard. Physical hazard is a new category to replace and update Reactivity Hazards (figure 3). English letters are used to indicate the necessary personal protective equipment where each letter is keyed to specific personal protective equipment (figure 4).

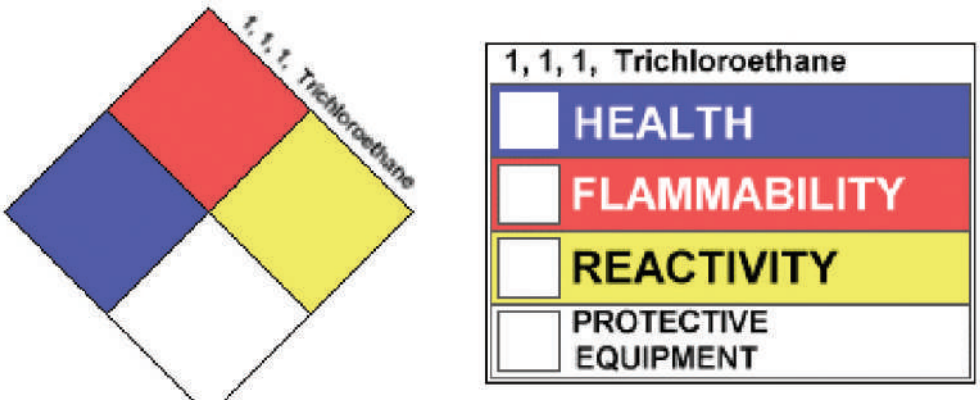


Fig.2

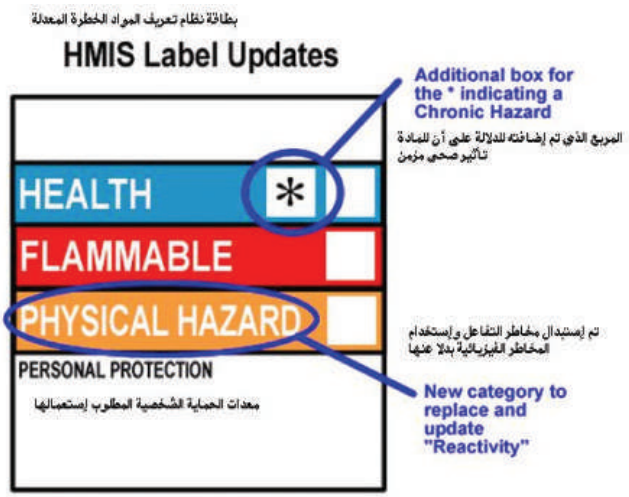


Fig. 3

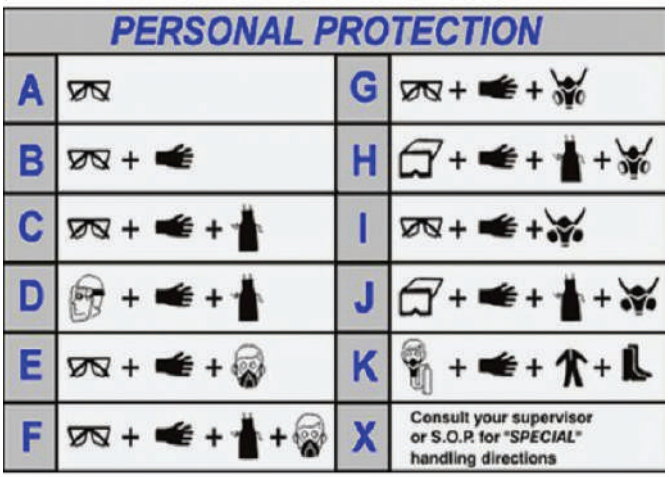


Fig. 4

3. Special Hazard in NFPA Labels:

Special hazard identification part is only used in NFPA label system. Special acronyms re place numbers in other hazards and they indicate the special hazards of the chemical in the white part of the label as follows (figure 5):

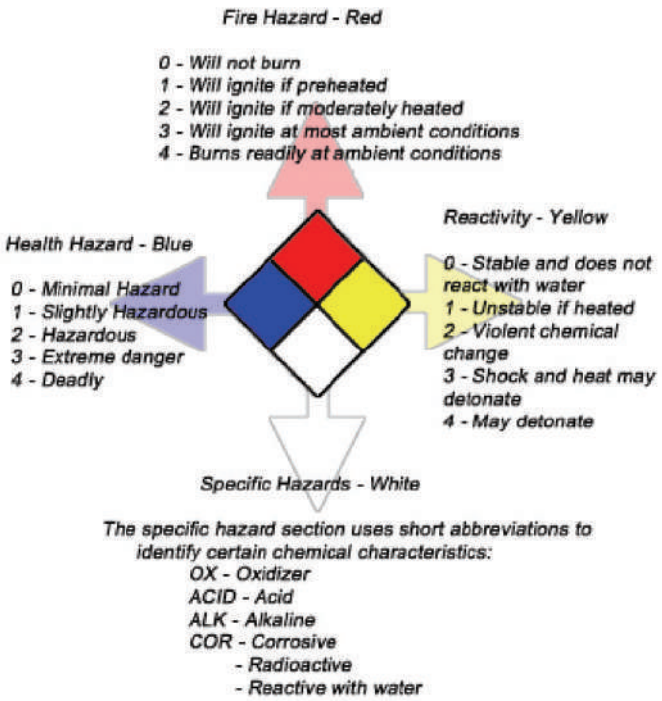


Fig.5

4. RTK Labels: (Right to know)

RTK is a comprehensive label system which contains information of chemical hazards, nec essary personal protective equipment, target organ effects, firefighting procedures, neces sary first aid, spillage control. It also includes a minimized NFPA label (figure 6).

Fig. 6

5. Some Warning Labels for chemical hazards:

Read Warning Labels
Then Read MSDS (figures 7 & 8)


مادة متفجرة
EXPLOSIVE MATERIAL
مادة سامة
TOXIC MATERIAL
مادة مهيجة
IRRITANT
مادة ضارة بالبيئة
ENVIRONMENTAL HAZARD
مادة مؤكسدة
OXIDIZING MATERIAL
مادة حارقة
CORROSIVE MATERIAL

Fig. 7

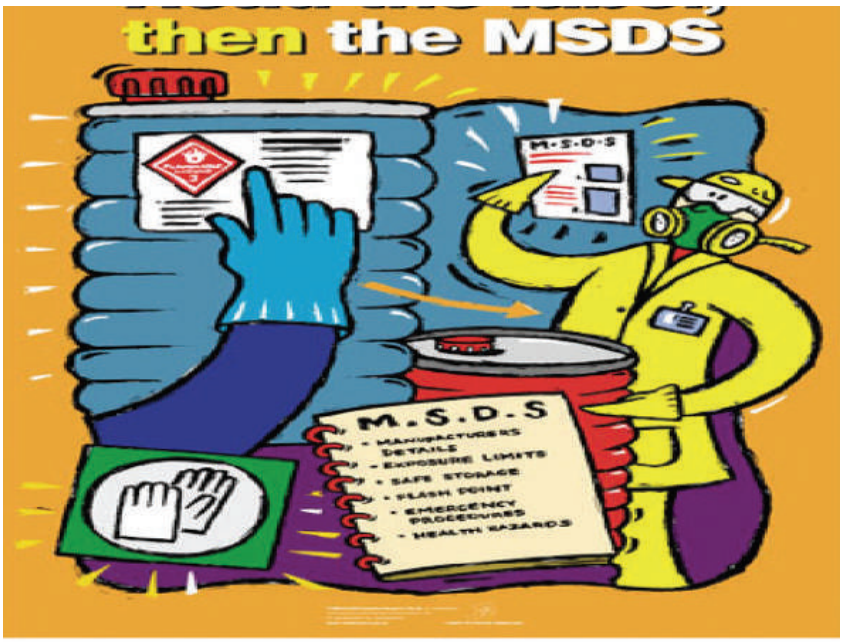

then the MSDS
M.S.D.S
M.S.D.S
- MANUFACTURERS DETAILS
- EXPOSURE LIMITS
- SAFE STORAGE
- FLASH POINT
- EMERGENCY PROCEDURES
- HEALTH HAZARDS

Fig.8

18.2.3.3. Employee Training:

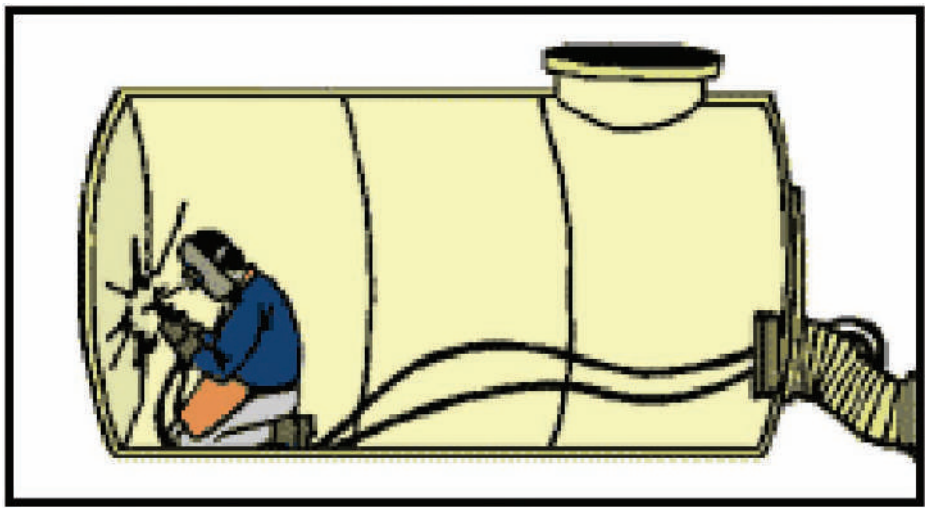
Employee training is a key element in a hazard communication program. The training shall include the following:

- Information about different hazardous chemicals.
- Explanation of the hazards of all chemicals in the workplace.
- How to read and interpret information in the MSDS of each chemical.
- Knowledge of the necessary personal protective equipment needed when handling the chemical and how to immediately recognize them from the warning labels.
- Subcontractors who might be working on-site shall be informed of the hazard communication program.

18.3 Hazard Material Transportation Manual issued by Dubai Municipality shall be consulted for hazard material transportation purposes.

CHAPTER 19

CONFINED SPACES



Introduction:

In many cases, employees in different construction sites are required to perform some necessary works in confined spaces in the worksite. Work in confined space may expose employees to many risks such as death or serious injuries.

In this regard, Dubai Municipality stresses the importance of the application of all necessary safety procedures before permitting any employee to enter or work in any of these confined spaces.

19.1. General Requirements:

19.1.1. The contractor shall identify all confined spaces in the construction site and prepare a list of these spaces.

19.1.2. The list of confined spaces shall be updated as new confined spaces are discovered in the worksite.

19.1.3. Appropriate warning signs shall be posted on all confined spaces in the construction worksite to warn all employees of the danger of such spaces and that these spaces are permit-required (figure 1).

Figure (1)

19.1.4. All employees who are required to enter and perform a work inside confined spaces shall be notified of the hazards of the spaces that may be faced during entry. Necessary periodic training shall be provided to those employees on safe working procedures while in confined spaces.

19.1.5. The contractor shall develop a written safety plan of the confined spaces and the safe working procedures in these spaces. An appropriate safety permit form shall be developed so as not to permit any personnel to work in confined spaces except after taking all necessary precautions and obtaining the required permit from the qualified competent person designated by the contractor.

19.1.6. No person shall be required or allowed to enter any chamber, tank, vat, pit, pipe, flue or other confined space in any construction site in which any gas, fume, vapor, dust or oxygen deficiency atmosphere is likely to be present as to involve risk to persons, unless:

- Certified by competent person based on test carried out by himself that the space is free from dangerous gas, vapors, fumes, dust or oxygen deficient atmosphere.
- Such person is wearing suitable breathing apparatus and safety belt securely attached to a rope where its free end is held by another person and anchored outside the confined space.
- A control system is established incorporating the safety precautions, testing of atmosphere testing, safety equipment and required supervision for the job.

19.2. Confined Space Entry Procedures:

19.2.1. Before a confined space entry or work begins, potential hazard evaluation shall be conducted and a work permit shall be issued and signed by a competent person designated by the contractor to authorize entry.

19.2.2. Identification of Confined Space Hazards:

Before entry begins, it is crucial that the surrounding atmosphere in the confined space shall be tested in order as follows:

- Test oxygen concentration and ensure that it is not less than 19.5 % and not more than 23.5%.
- Test combustible material concentration and ensure that it is less than 10% and when welding operations shall be performed in the confined space, the concentration shall be 0%.
- Test toxic gases concentration and ensure it is less than the permissible exposure limits. Reference shall be made to the technical guideline no. (12) to identify permissible exposure limits of toxic gas concentrations.
- Testing shall be conducted in the bottom, middle and top of the confined space as some toxic gases are heavier than air thus deposited to the bottom, others are of the same density of air thus remain in the middle and others are lighter than air thus accumulate on the top of the tank (figure 2).

Fig.2

19.2.3. Ventilation of confined spaces:

19.2.3.1. Mechanical ventilation shall provided in a confined space by using proper air blowers. Those blowers shall be operated by compressed air to permit not less than 20 times air change of the space per hour Fig. (3).

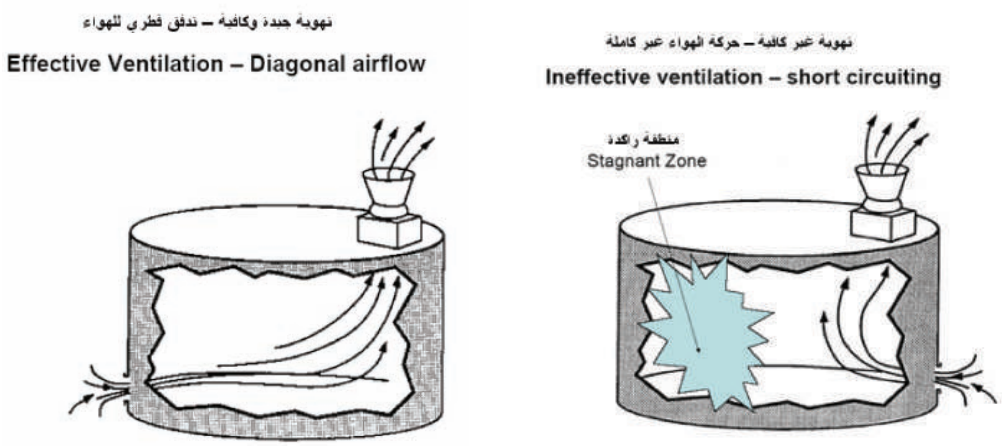


Fig.3

19.2.3.2. In case of performing any welding operations within a confined space, mechanical ventilation shall be provided near the welding point. Appropriate PPE and hot work permit shall be provided to prevent any health hazards resulted from the welding fumes. (figure 4).

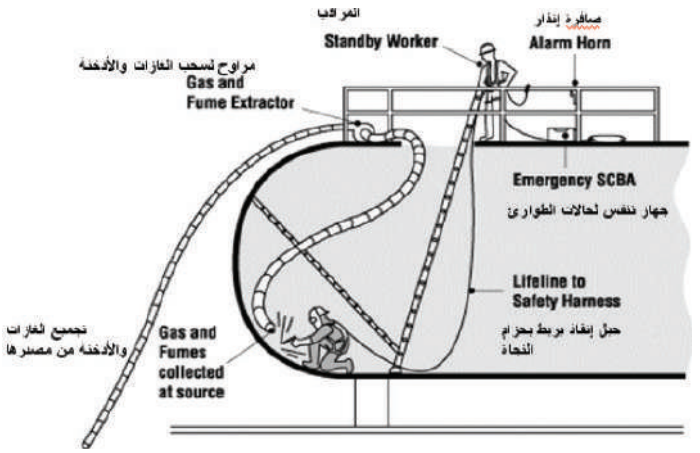
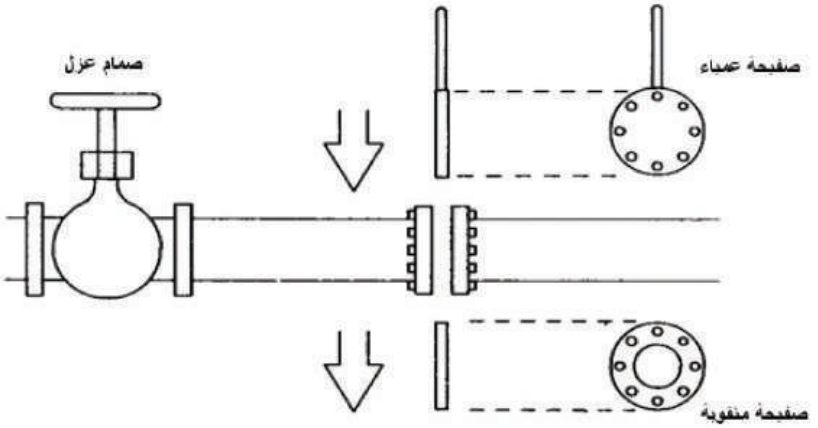


Fig. 4

19.2.4. Before starting work in a confined space, all its contents shall Be removed. All electrical and mechanical equipment, power sources, valves and lines shall be appropriately locked out and tagged. Blind flanges shall also be fixed on lines to ensure positive isolation and prevent hazardous materials from entering into the confined space which may cause hazards to employees therein (figure 5).



Method of Blanking Hydraulic/Pneumatic Lines
طرق عزل وإغلاق خطوط الأنابيب الهيدروليكية / الهواء المضغوط

Fig. 5

19.2.5. After verifying that the confined space is safe, well ventilated and the interior atmospheric conditions are suitable for work, all employees who will perform the job (entrants) shall be notified of all safe procedures followed, and responsibilities and tasks of each entrant, equipment and necessary PPE to be used, then entrant will enter to the space to perform work. Oxygen, toxic gases and flammable material testing instruments shall be kept working to continuously monitor the atmosphere while entrants are working in the confined space. These instruments are so designed as to activate an alarm siren when measurements exceed the permissible exposure limits, in case the alarm is activated the employees shall be required to evacuate the confined space immediately.

19.2.6. A trained person (attendant) shall permanently exist in the confined space entrance to monitor activities of the entrants and to notice any hazards that may appear in the confined space. Under any circumstance, the attendant is not authorized to enter the confined space and if any entrant in the confined space is injured, the attendant shall:

19.2.6.1. Perform a non-entry rescues by using the available methods such as lifeline or other rescue methods such as retrieval methods.

19.2.6.2. In case performing non-entry rescue is not feasible, immediately he must summon rescue team which is equipped with respirators, and other rescue devices appropriate to enter a confined space and rescue the injured person.

19.2.7. A qualified responsible person designated by the contractor as entry supervisor shall supervise all confined space procedures and activities.

19.2.8. All rescue team members shall be ready on call and equipped with all PPE necessary for making rescues to any entrant injured or exposed to other hazardous conditions.

19.3. Training:

19.3.1. The contractor shall instruct all employees in different construction sites not to enter any confined space without obtaining the proper entry permit.

19.3.2. All employees who are required to enter confined spaces or act as entry supervisors or attendants, and rescue members shall be trained to acquire the skills and procedures necessary for safe performance of their responsibilities while working in the confined space.

19.3.3. All rescue team members in the site shall be instructed in the proper use of PPE necessary for rescue processes and these PPE shall be tested periodically and regularly.

Confined Space Entry Permit

Company:

Date of permit:

Work shift: First Second Third

Time issued:

Job site/ Space (place and site):

Work to be performed:

Authorized and Trained Employees:

1. Entry Supervisor
2. Entry Attendant:
3. Authorized Entrants:
4. Authorized Entrants:

Contact Information in Case of Emergency:

Emergency Receiver: Telephone No.:

Contact Person: Time of Contact:

Pre-Entry Requirements:

Requirements	Yes	No	Not Applicable	Requirements	Yes	No	Not Applicable
Electrical de-energizing/ lockout/tag out				Hot work permit			
Lines (Broken/ Capped/ Blanked)				Safety Harness, Lifeline, Tripod hoisting equipment			
Purge/Flush/Vent				PPE			
Ventilation (Natural /Mechanical)				Helmet			
Secure Area				Gloves			
Safe Lighting				Goggles			
Non Spark tools				Other PPE			
Communication Means				Other PPE			
Contractor>s				Other PPE			

Work Monitoring Results: **Testing**

Monitoring at least every 4 hours	Permissible limits for entry	Test 1 Time/ Signature	Test 2 Time/ Signature	Test 3 Time/ Signature	
Percent of Oxygen	19.5% to 23.5%				
Flammable gas limits	Under 10%				
Other toxic gases					
Other toxic gases					
Other toxic gases					
Potential Atmospheric Hazards	**Yes**	**No**	**Not Applicable**		
Oxygen deficiency					
Flammable gases					
Flammable vapors					
Flammable dusts					
Toxic gases or vapors					

Non-potential atmospheric hazards	Yes	No	Not Applicable	
Noise				
Chemical contact				
Electrical hazards				
Exposure to Mechanical hazards				
Temperature extreme				
Engulfment hazards				
Entrapment hazards				
Other non-atmospheric hazards				

Pre-Entry List of Inspection

Do not enter this permit confined space until the following conditions corrected:

	Completed	Needs Actions
Before entering the permit space the supervisor or assigned person shall inform the rescue team. IDLH conditions require at least one rescue team member located outside the space.		
Two persons at least shall be assigned to work in the confined space. One employee at least shall remain standby monitoring outside the space in all times		
The area around the confined space shall be inspected to ensure that it is free from hazards such as vapors resulting from tanks, sewers, and car fumes		
Ensure that employees assigned to monitor gas limits are well trained		
Ensure that measurement tests to monitor gases and practical testing (pure air measurement) of gas monitoring has been done during this shift and who performed it?		
Continue monitoring the atmospheric conditions while employees are in the confined space if this is a part of entry procedures		

This permit has been concluded for the following reason:

Work completed: Work canceled: Time Remarks:

Supervisor Signature: Time Date

Please return the completed permit form to: Please review the permit and Keep it in file for a year …

A sample entry permit

Entry permit

Permit date: / / **Work shift:** 1st☐ 2nd☐ 3rd☐ **Expires:** / /

Time started: _____

Permit space to be entered (name and location of space): _____

Purpose of entry: _____

Names of trained, authorized individuals

- Entry supervisor: _____
- Entry attendant: _____
- Authorized entrants: _____
- Authorized entrants: _____

Emergency contact information

Emergency responder: _____ Phone number: _____

Contact person: _____ Time: _____

Pre-entry requirements

Requirements	Yes	No	N/A	Requirements	Yes	No	N/A
Lockout - tagout/de-energize	☐	☐	☐	Hot work permit	☐	☐	☐
Pipe(s) broken or capped or blanked	☐	☐	☐	Fall arrest harness/lifeline/tripod	☐	☐	☐
Purge or flush or drain	☐	☐	☐	Personal protective equipment	☐	☐	☐
Ventilation (natural or mechanical)	☐	☐	☐	*Hardhat*	☐	☐	☐
Secure area	☐	☐	☐	*Gloves*	☐	☐	☐
Safe lighting	☐	☐	☐	*Safety glasses*	☐	☐	☐
Non-sparking tools	☐	☐	☐	*Respirator, type*	☐	☐	☐
Communication method	☐	☐	☐	*Other PPE:*	☐	☐	☐
Contractor employees involved	☐	☐	☐	*Other PPE:*	☐	☐	☐

Space-monitoring results		Test 1	Test 2	Test 3	Test 4
Monitor at least every four hours	**Permissible entry levels**	Time: Initial:	Time: Initial:	Time: Initial:	Time: Initial:
Percent oxygen	19.5% to 23.5%				
Combustible gas	Less than 10% LEL				
Other toxic gas					
Other toxic gas					
Other toxic gas					

440-2864b (9/04/COMWEB)

Page 1 of 2
Entry permit

Entry permit (continued)

Possible atmospheric hazards	Yes	No	N/A
Lack of oxygen	☐	☐	☐
Combustible gases	☐	☐	☐
Combustible vapors	☐	☐	☐
Combustible dusts	☐	☐	☐
Toxic gases/vapors	☐	☐	☐
Possible non-atmospheric hazards			
Noise	☐	☐	☐
Chemical contact	☐	☐	☐
Electrical hazard	☐	☐	☐
Mechanical exposure	☐	☐	☐
Temperature extreme	☐	☐	☐
Engulfment	☐	☐	☐
Entrapment	☐	☐	☐
Other non-atmospheric hazard	☐	☐	☐

Pre-entry checklist

Do not enter this permit space until the following "needs action" conditions are corrected.

OK	Needs action	
☐	☐	Before entering the permit space, the supervisor or designee must notify the rescue team. IDLH conditions require at least one rescue team member located outside the space.
☐	☐	A minimum of two employees must be assigned to work involving permit space entry. One employee must remain outside the permit space at all times.
☐	☐	The surrounding area must be surveyed to show that it is free of hazards such as drifting vapors from tanks, piping, sewers, or vehicle exhaust.
☐	☐	Those responsible for operation of the gas monitor have been trained.
☐	☐	Gas monitor calibration tests and functional test (fresh air calibration) have been performed this shift on the gas monitor. If so, by whom? _____
☐	☐	The atmosphere will be continuously monitored while the space is occupied, if required by entry procedure.

This permit has been terminated for the following reason:

☐ Work completed ☐ Canceled Time: Note:

Supervisor's signature Time: Date: / /

Return this completed permit to _____. Review, then file for one year.

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Page 2 of 2
Entry permit

Chapter 20 – Miscellaneous

Road Works/Site Planning/Site Transport

Introduction:

This chapter covers all aspects related to safe working near or on the high ways in addition to constructing new roads, or re-construct or re-pavement of the existing roads.

Also this chapter covers all the safety measures concerning site planning, and covers vehicles used on site and safety measures related to them.

20- 1 Road Works:

20-1-1: General Requirements:

1- All works within the boundary of work site shall require the issuing of a NOC (Non Objection Certificate) from the concerned party and other parties as may be required for the execution of the work. All such NOC shall be obtained prior to the commencement of any work on the site and shall be compared with utilities and services on site and in case of any differences a new NOC shall be issued from the concerned parties according to the exact situation on site.

2- Any contractor who undertakes road work shall conform with the Construction Safety Rules and shall ensure the protection of his employees as well as the public.

3- Road works are considered among dangerous and hazardous works, therefore the contractor must carry out adequate Risk Assessment and determine the safe work procedure to protect his employees, users of the road, and the public against these hazards.

4- All works implemented on roads shall be supervised by a competent person who has been adequately trained, and this person must be permanently available on site.

5- All workers working at road works projects shall be provided by necessary and adequate personal protective equipment.

6- Where any work will be performed within the links of the road or part of the road, the contractor must obtain the necessary prior permission from the concerned parties, and must comply with the procedures and requirements of these parties.

7- All construction workers engaged in highway works shall take all precautions against the traffic hazards.

8- The provision of a complete system of advanced warning signs on high way works shall be maintained by the contractor and this system shall be approved by the concerned party at Dubai Municipality.

9- All areas within site where the work will be performed during night shall be adequately illuminated and all workers shall wear light reflected suites.

10- All workers handling bituminous material or concrete and all other workers on roadwork sites shall at all times wear protective clothing, safety boots, gloves, safety helmets and eye protection.

11- All holes, excavations, open manholes, wet concrete, and spoil heaps on road work sites shall be provided with suitable and adequate barriers (with suitable light flashers) to protect pedestrians, workers, plant or vehicles from falling over or into such places.

12- Where works within the boundary of working site are considered by the concerned department staff at Dubai Municipality to constitute a danger or hazard to the public, then warnings and suspensions may be issued and these shall be strictly adhered to. Failure to immediately comply with the warnings or suspensions shall result in further actions being taken by the concerned department staff at Dubai Municipality, which may include closing down of site.

13- It is not permitted to install bituminous mixing and preparation plants on under construction sites unless the necessary permissions are issued from the concerned department.

20-1-2 Traffic Control Near Road Works Sites:

1- All vehicles and equipment on site shall be provided with high lights fixed on back of the vehicle which will work automatically when the truck or vehicle moves backward, also all vehicles and mobile equipment shall be provided with reverse alarm system to warn workers during the movement of such vehicles and equipment backward. In addition to that, the contractor must assign a trained person to guide these heavy equipment during reverse movements. This person shall be seen all the times by the drivers of such vehicles.

2- The contractor must assign a Traffic Control Person (TCP) for the protection of other workers on site against moving cars and for the protection of moving cars against the hazards of the construction sites.

3- The person who will be responsible of Traffic Control on site shall be medically fit, with good vision and hearing ability.

4- The contractor shall provide the Traffic Control Persons (TCP) with the necessary training to enable them to carry their work safely and protect themselves against all the hazards they might face, also the contractor must train such persons on the proper signs which they are going to use during their work , and how to request car's drivers to slow down when approaching road works sites.

5- Traffic control person shall not perform any other work while directing vehicular traffic near road works sites.

6- Traffic Control Persons (TCP) shall be positioned in safe positions not exposed to any hazards from the cars moving near the road works site.

7- Traffic Control Persons (TCP) shall be provided with the following equipment:
- Suitable Hard Hat
- Suitable Safety Shoes
- A Vest covering the upper part of the body, and has an orange colour fluorescent retro-reflective strips fixed on front and back of the vest.

8- The contractor shall provide a separate routes for pedestrian and separate routes for vehicles in particular at entry and exit gates.

9- Traffic Control Persons (TCP) shall be provided with the following traffic signs:
- Octagonal Shape Sign, 450 mm wide, and mounted on a pole 1.2 m long.
- These signs shall be made of material which resist all weather conditions.
- These signs shall be painted with High-intensity retro-reflective red on one side with the word "STOP" printed in high-intensity retro-reflective white and the length of each letter shall be not less than 150 mm.
- The other side of the sign shall be painted with black colour and a high-intensity retro-reflective yellow diamond shall be within this side with the word "SLOW" printed in black colour and the length of each letter shall be not less than 120 mm. (as per fig. # 1).

Fig. 1

10- The maximum speed limit inside the road works site shall not exceed 25 Km/Hour, and the necessary signs and humps shall be provided on site to slow down the speed inside the site and near entrance. all the necessary permissions shall be obtained from the concerned parties before fixing these signs and humps outside the boundary of the site.

20-1-3 Traffic Detour:

1. Contractor must obtain all the necessary approvals from the concerned parties before carrying out any traffic detour or when using part of the road during carrying out different activities.
2. Contractor shall take all the necessary measures to ensure the protection of his employees as well as the public against all the possible hazards during road works or during traffic detour.
3. The necessary traffic warning signs shall be fixed at an adequate distance from the road works site to warn car drivers against the hazard of such road works, the size and location of those signs shall depend upon the nature of roads and the speed limits in such roads and shall be according to the requirements of the concerned parties.

Samples of Traffic Signs used inside road works sites:

Fig. 2

20-1-4 Locations of Traffic Control Persons (TCP) Inside Sites:

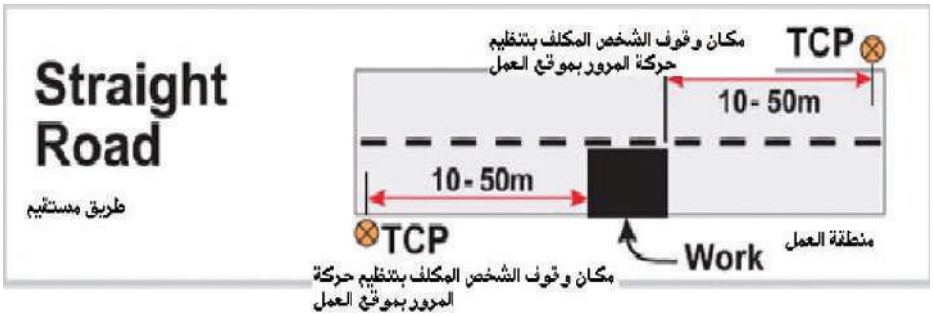
1. Traffic Control Persons (TCP) must be located at safe distance from the work site, and they must always face the coming traffic.
2. Traffic Control Persons (TCP) must be located at places where they can see and be seen by the approaching traffic for at least 150 meters (500 feet) from the work site.
3. Traffic Control Persons (TCP) must be located at a distance of 10 – 50 meters from the work zone, this distance depends on the speed limits and volume of traffic at each road and according to table # (1) and Fig. # 3 & 4

Table # (1)

Posted Speed	60 Km/Hour or less		70 Km/Hour to 90 Km/Hour	
Traffic Volume	Low	High	Low	High
Distance of TCP from Work Zone	10 – 15 m	20 – 30 m	30 – 40 m	40 – 50 m

Fig. 3

Fig. 4



4. In case of hills and curves, three Traffic Control Persons (TCP) shall be assigned to control traffic and each one of them shall be located in the place shown in fig. # 5 & 6 providing that the person located in the middle must be able to see both the other two persons.

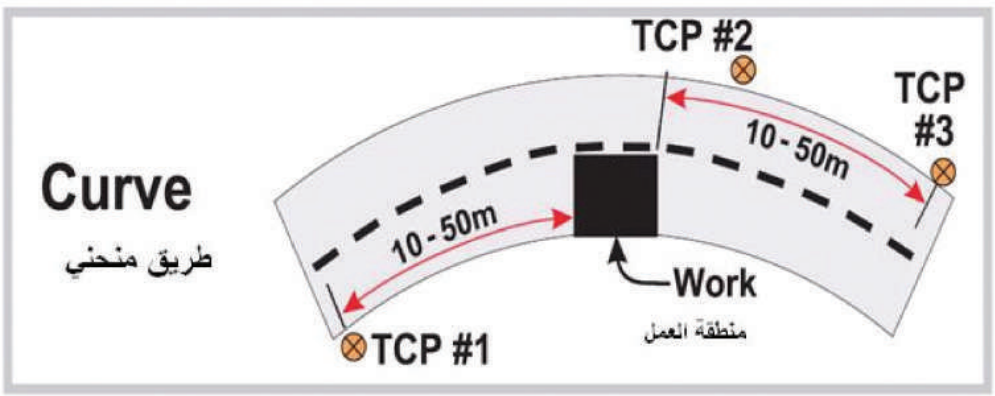


Fig. 5

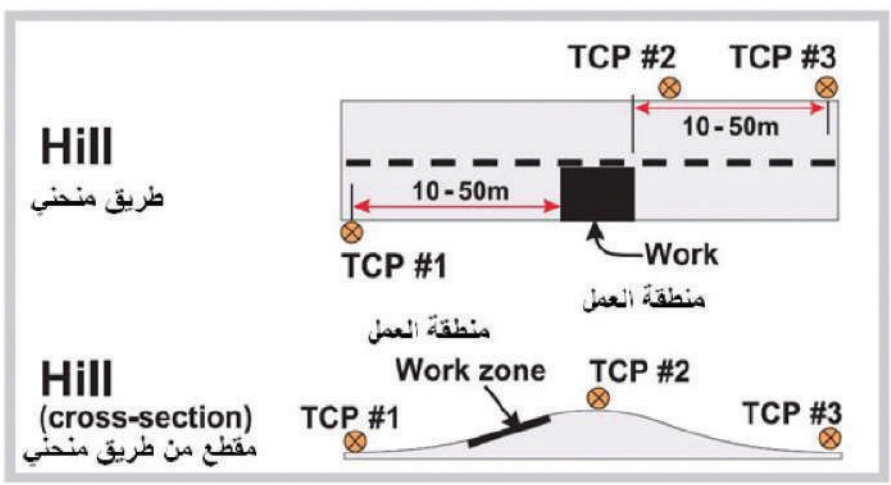


Fig. 6

20- 2:Site Layout:

Introduction:

In order to ensure the ease of work flow process the site layout must be planned and organized considering the order of carrying out the works and the proper complying with the Safety & Health Plan.

20-2-1 General Requirements:

Each contractor shall make a site layout and shall obtain the approval from the consultant engineer on such site layout, also he shall get a new approval in case of carrying out any change or alteration to the site layout, which shall incorporate the following:

1. Perimeter fencing shall be installed around the whole site with a minimum height of 2 m to protect the public from the site hazards. (As per Fig. # 7).

Fig. 7

2. Adequate warning of entrances and exits.
3. Material storage area – mixer location, aggregate and cement storage.
4. Material off-loading area.
5. Positions of hoist equipment and cranes.
6. Offices, workshops, connection to the services.
7. Electrical incoming, and connections inside the site.
8. Temporary structures, scaffolds, light towers, etc.
9. Rubbish dump areas and rubbish clearance areas, facilities.
10. Storage, transport and use of flammable materials.
11. Access roads and plant movement areas.
12. Car parking areas.
13. Assembly points in case of emergency.

14. Locations of fire fighting equipment.
15. Locations of First Aid Stations.
16. Project information Main Sign.
17. Warning signs.
18. Any other information requested by the concerned Department.

20 -3 Site Transport:

Introduction:

Transport accidents continue to contribute to occurrence of many serious personal injuries, this part explains the rules and regulations related to the safe use of vehicles at works sites.

20-3-1: General Requirements:

1. Each contractor shall ensure that person authorized to drive a vehicles in construction site holds a valid driving licence issued from UAE according to the type of vehicle. The contractor must not permit any person to drive or operate such vehicles unless he holds the proper licence.
2. The driver shall be instructed on the potential hazards such as overhead lines, structures, excavations, steeply sloping ground, movement of people, overloading, speed, cranes, and other plant in operation.
3. The maximum speed limit inside the construction site shall not exceed 20 Km/Hour, the contractor shall ensure that all drivers are complying with this speed limit and the necessary traffic signs indicating the speed limits shall be provided on site.
4. The contractor shall ensure that all vehicles on site are equipped with reverse alarm and flasher light which will work when any vehicle moves backward.
5. At the commencement of each day/shift the driver shall carry out a thoroughly check to his vehicle to ensure that it is in good a safe condition before operating and driving it.
6. The contractor shall provide all vehicle drivers and operators with the necessary training to ensure the safe use of such vehicles.
7. Vehicles must not be manoeuvred too close to excavation sites (Reference is made to section # 9 – Excavation and Trenching Safety Regulations) and guidline No. 39
8. It is highly recommended to have the entrance to the site from one direction and the exit from other direction, so that all vehicles on site to be directed toward the exit to facilitate the evacuation of the site during emergency cases.
9. Security personnel shall inspect all vehicles before entering the site to ensure that tires are in good working conditions to avoid any accidents and stoppage of work.
10. The driver shall not leave his vehicle unattended with the engine is running.

CHAPTER TWENTY ONE

SLINGS & RIGGING EQUIPMENT




Introduction:

The operation of lifting materials and equipment is considered on of the essential operations at different construction site, also it is a very dangerous operation which might lead to serious accidents. Therefore and in order to avoid such serious accidents it is necessary to select the right and suitable type of slings and make sure it is safe and inspected and well maintained.

21- 1 General Requirements:

1. No chain, rope or lifting gear shall be used in raising or lowering or as a means of suspension unless:
    a) It is of good construction, sound material, adequate strength, suitable quality and free from patent defects.
    b) It has been tested by a competent person of a third party company approved by Dubai Municipality every six months and obtain a certificate from this company (signed by the competent person) specifying the safe working load (SWL). All the testing records shall be kept in site to be presented to the municipality's inspectors upon request.
2. Rigging equipment for material handling shall be inspected prior to se on each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed from service.
3. All wire ropes and ropes used in lifting operations shall be of adequate length. No less than two full wraps shall be remained on drum with boom point at ground level (See fig. # 1).

Fig.1

4. All wire ropes, chains and their attachments when not in use shall be stored on racks at clean, dry and well ventilated places, and by hanging them vertically; each sling will be classified in the store according to its safe working load (SWL).
5. Rigging and lifting equipment shall be clearly marked with its safe working load and identification number. Rigging equipment shall not be loaded in excess of its safe working load recommended by the manufacturer or according to the test certificate.
6. In case using a sling of multi sling legs, the safe working loads at different angles of the leg shall not be exceeded.
7. The upper ends of sling legs shall be connected by means of a shackle ring or link of adequate strength. (See fig. # 2).

Fig. 2

8. Rigging equipment, when not in use, should be removed from the immediate work area so as not to present a hazard to employees.
9. Slings shall not be shortened with knots or bolts or other makeshift devices.
10. Every sling used for raising or lowering on lifting appliance shall be securely attached to the appliance, and the method of attachment shall not be a method likely to result in damage to any part of the sling or to any lifting gear supporting it so as to present a hazard to employees.
11. Hands and fingers shall not be placed between the ling and its load while the sling is being tightened around the load.
12. All lifting gears, chains, ropes and appliances except a fiber rope or fiber rope sling (Which shall be destroyed), which have been lengthened, altered, or repaired by welding or otherwise shall, before being used again, be adequately re-tested and re-examined by a competent person of a company approved by Dubai Municipality and a testing certificate signed by this person shall be obtained.
13. Shock loading is prohibited.
14. A sling shall not be pulled from under a load when the load is resting on the sling.

21- 2 Alloy Steel Chain Slings:

1. Alloy steel chain slings shall have permanently affixed identification stating size, grade, rated capacity and sling manufacturer. (See fig. # 3).

Fig. 3

2. Hooks, rings, welded or mechanical coupling links and other attachments when used with alloy steel chains shall have a rated capacity at least equal to that of chain. When using more than one leg (multi sling legs) this equipment shall have a rated capacity at least equal to that of chain at that position.
3. Only original components of shackles shall be used to avoid the occurrence of accidents. (See fig. # 4).

Fig. 4

4. Whenever wear at any point of any chain link exceeds 10 per cent reduction in diameter the chain shall be removed from service immediately.

21 -3 Wire Rope Slings:

1. The safe working load recommended by the manufacturer for various sizes and classes of wire ropes shall not be exceeded.
2. Wire ropes shall not be secured by knots.
3. When using U-shape clips to form eyes, the u-bolt of all wire rope clips must be applied on dead end of the rope, also rope thimbles of proper sizes shall be fitted in the eye to protect it from friction Fig.(5).
4. The recommended number of clips and spaces of wire clips, as well as the tightening torque is illustrated in table # 1. The first clip shall be fixed as close to the thimble as possible.

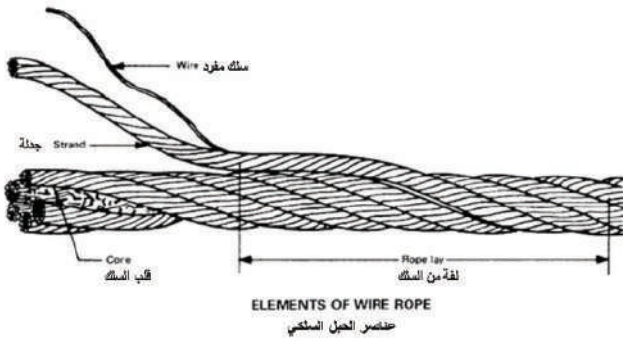
Fig.5

Table # (1)

Rope Diameter (mm)	Number of Clips	Min. Spacing mm	Tightening Torque Newton / Meter
5 mm	3	30 mm	2
6.5 mm	3	39 mm	3.5
8 mm	4	48 mm	6
10 mm	4	60 mm	9
13 mm	4	78 mm	33
16 mm	4	96 mm	49
19 mm	4	114 mm	68
22 mm	5	132 mm	107
26 mm	5	156 mm	147
30 mm	6	180 mm	212
34 mm	6	204 mm	296
40 mm	6	240 mm	363

5. Wire ropes shall be lubricated with suitable lubricants recommended by the manufacturer and free of acids and alkalis.
6. All wire ropes must be inspected before being used. Any rope showing excessive wear, corrosion, rust or any defect shall be taken out of service.
7. Wire ropes used for rigging operations shall have a safety factor of Five times its safe working load.
8. Each wire rope used in hoisting or, lowering or in pulling loads shall consist of one continuous piece without knot or splice. (See fig. # 6).

9. Wire rope shall not be used and shall be immediately removed from service if any of the following conditions are present:
   - 9-1 The total number of visible broken wires is 3 in any strand or 6 in any lay. (See fig. # 7).
   - 9-2 Kinking (See fig. # 8).
   - 9-3 Bird Caging (See fig. # 9).
   - 9-4 Wear equal to 10 % of the original outside diameter of the wire. (See fig. # 10).



ELEMENTS OF WIRE ROPE
عناصر الحبل السلكي

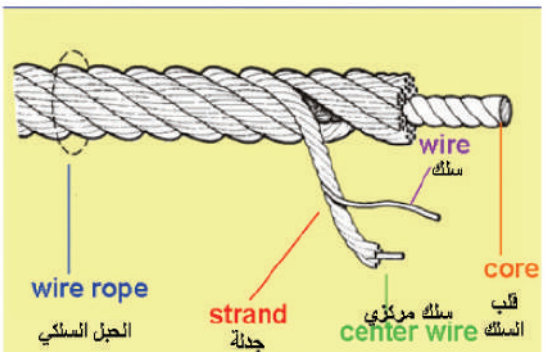


Fig.6

Fig.7

Fig.8

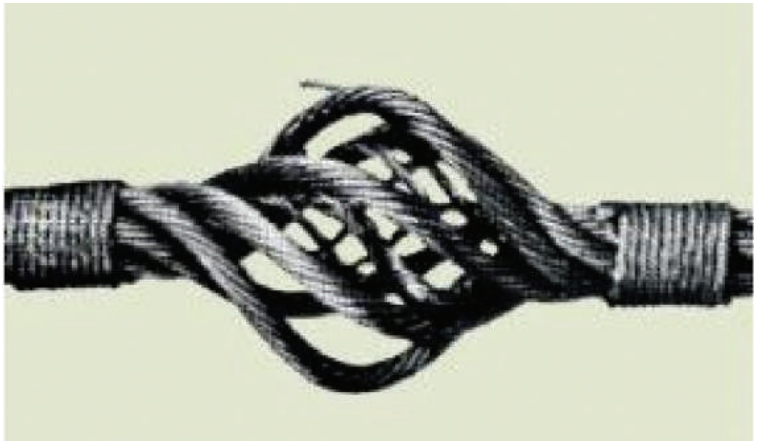


Fig. 9

Fig. 10

21 -4 Natural Rope and Synthetic Fiber:

1. All splices in rope slings shall be made in accordance with manufacturer's recommendation.
2. Spliced fiber rope slings shall not be used unless they have been spliced as per the manufacturer's recommendation.
3. Knots shall not be used in lieu of splices.
4. Natural and synthetic fiber rope slings shall be immediately removed from service if any of the following conditions are present:
   - 4-1 Abnormal wear.
   - 4-2 Powdered fiber between strands.
   - 4-3 Broken or cut fibers.
   - 4-4 Variations in the size or roundness of strands.
   - 4-5 Discoloration or rotting.
   - 4-6 Distortion of hardware in the sling.
5. Synthetic Webbing (Nylon, Polyester and Poly Propylene).
   - 5-1 Synthetic webbing shall be of uniform thickness and width and selvage edges shall not be split from the webbing width.

5- 2 Fittings Shall be:

5-2-1 of minimum breaking strength equal to that of the sling; and
5-2-2 Free of all sharp edges that could in way damage the webbing.

5 -3 attachment of end fittings to webbing and formation of eyes:

Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an eyes pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling Fig. (11)

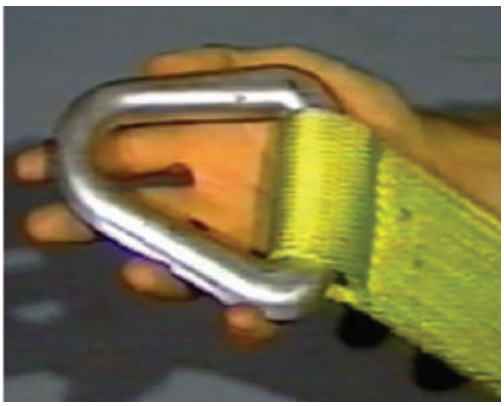


Fig. 11

5- 4 Environmental Conditions:

When synthetic web slings are used, the following precautions shall be taken:
5-4-1 Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquid of acids or phenolics are present.
5-4-2 Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

5-5 Removal from Service:
Synthetic web slings shall be immediately removed from service if any of the following conditions are present:

5-5-1 Acid or caustic burns

5-5-2 Melting or charring of any part of the sling surface (See fig. # 12).

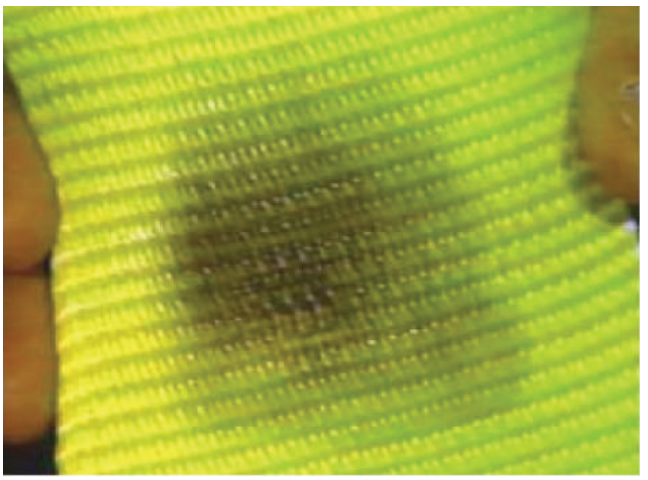


Fig. 12

5-5-3 Snags, punctures, tears or cuts. (See fig. # 13).

Fig. 13

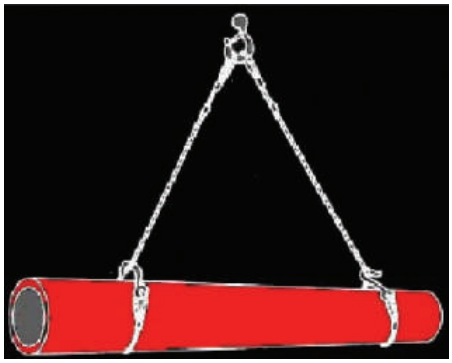
5-5-4 Broken or worn stitches.
5-5-5 Distortion of fittings.

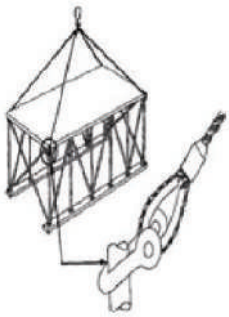
21- 5 Slings Configuration: (See fig. # 14)

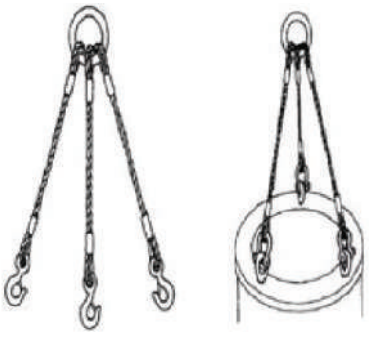
Single Leg Sling: normally used on loads with single point of attachment with the sling in a vertical plane.

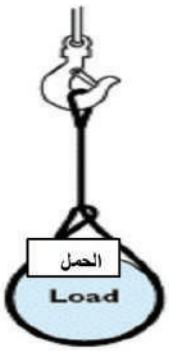
Two Legs Sling: Used when two lifting points are required. The angle between the legs of the sling should not exceed 90 degree. (The best angle is 60 degree, and then the 45 degree angle.

Three Legs & four legs Slings are used when 3 or 4 lifting points are attached with the load.









Vertical Chocker Basket

Fig.14

All employees working in rigging operations shall be aware of the safe working loads and the different angles between the sling's legs and the load.

21- 6 Slings Selection:

1. The load to be lifted shall be determined, this can be determined by the manufacturer, supplier, shipping tickets, or by calculations. Where weight of loads can not be determined, they must be estimated by a person of experience in such matters. The sizes, diameters of slings suitable to the load weight according to this load.
2. The size and shape of the load must be considered together with any lifting points which may be available. An assessment of the center of gravity of the load must also be made to ensure the load is balanced during raising.
3. Some loads may have to be placed at a certain angle. It is necessary to ensure that the crane hook is placed above the center of gravity of the load to ensure the load shall not swing.
4. When using a sling of multi legs, the angle between the sling legs and the load shall not be less than 45 degree.

21- 7 Attachments:

Pulley Blocks (See fig. # 15):

1. Pulley blocks shall be made of anti-impact metal.
2. Sheaves shall be made of suitable metal and shall be compatible with the size and diameter of the rope used.
3. Pulley blocks must be greased, lubricated and maintained frequently.
4. Pulleys shall be designed so that the rope will not be stuck between the grooves and sides of the pulleys.
5. The grooves must be free from surface defect which could cause rope damage.
6. The load line shall be matched properly with the sheaves groove size to avoid the rope to be jumping of a sheave.

Hooks:

Every hook used for raising or lowering or as a means of suspension shall be:

1. Provided with a safety latch to prevent the displacement of the sling or the load from

the hook. (See fig. # 15).

2. Hooks used in lifting operations shall be made of steel formed or equivalent.
3. Provided with a tag line controlled manually with adequate length to allow workers working in rigging operations to keep away in such cases which require that.

Shackles:

1. Shackles shall be 1.5 times as strong as the strength of the ropes attached to it.
2. Shackles used for suspended loads, shall be provided with threaded pins to tightly connect it or with any other suitable and adequate method.

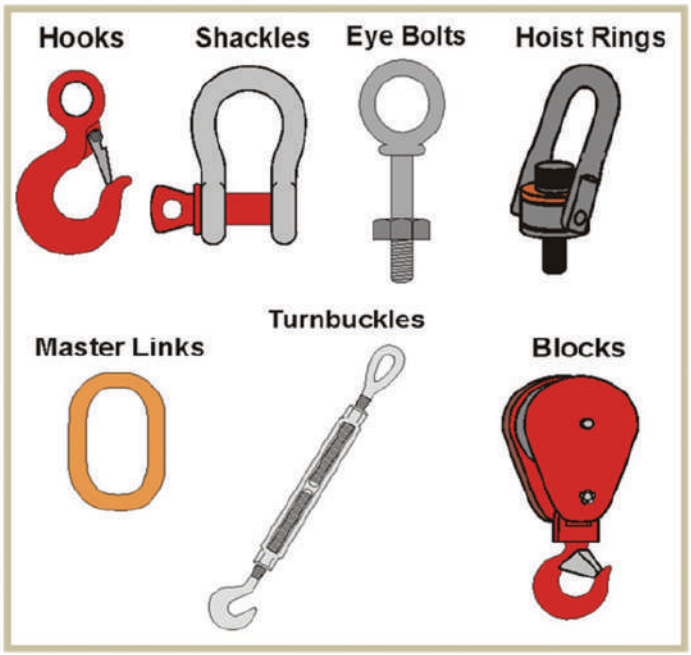


Fig. 15

CHAPTER TWENTY TWO

CRANES

Tower Crane

Mobile Crane

Introduction:

Cranes with different types and sizes are used extensively on construction sites, almost on daily basis due o their role on facilitating handling and lifting material and equipment. The use of different types of cranes involves a specific risk to the health and safety of employees and to other equipment on site.

Many types of cranes are used on construction sites such as: tower cranes, mobile cranes and personal & material hoists.
This section of the safety manual stresses on the necessity of training all employees associated with these operations on the proper and safe use of these equipment to protect themselves, other employees and other equipment on site from these risks.

21 -1 General Requirements:

1. Before any lift is carried out, a risk assessment is required to be undertaken for major and special lifting operations for each type of cranes separately, and all the adequate precautionary measures shall be taken accordingly.
2. All lifting appliances or machines and every part thereof including all working gear and all other plant or equipment used for anchoring or fixing such appliances or machines shall be of good mechanical construction, sound material, adequate strength and free from patent defect, and shall be properly and adequately maintained.
3. Every part of the framework of cranes and all its components shall be made of metal.
4. All crane's attachments of lifting appliances and machine shall be of good construction and adequate strength.
5. Loads shall be attached to the crane by using a safe and adequate method (Refer to section # 21 of this manual).
6. Every drum or pulley round which the chain or wire rope of any lifting appliance is carried shall be of suitable diameter and construction for the chain or rope used. At least two full wraps shall remain on the drum when the boom point at ground level.
7. All crane operators shall be qualified and have adequate knowledge and experience

about their job and with all aspects of safe crane operation, and they have been properly trained in this regard and have been approved by the concerned department – Dubai Municipality.

8. When more than one employee is involved in the rigging operation, only one person shall be appointed to give the proper signals to the crane operator, and this person has been thoroughly trained to do this job and has been approved by the concerned department – Dubai Municipality. (See fig. # 1).

Fig.1

9. All cranes must be fitted with brakes capable of holding and controlling the maximum load.
10. All moving parts in cranes (Belts, gears and pulleys) must be guarded from employee contact.
11. Each crane on site shall be thoroughly examined every 12 months by a competent person of a third party company approved by Dubai Municipality and testing certificate shall be obtained from this company. Each crane on site shall be re-tested and thoroughly examined following any repairs or alterations or any weather conditions which may affect the strength or stability of the crane.

12. Every crane shall have the following documents in the cab:
    - 12-1 A copy of the operating manual developed by the manufacturer.
    - 12-2 A copy of the load-rating chart for the crane, which shall include the crane make and model, the year of manufacturing, and serial number, and load ratings for all crane operating configurations.
    - 12-3 Crane operating speeds.
    - 12-4 Operating limits in windy or cold weather conditions.
13. Maintenance including preventive maintenance and repairs shall be conducted in accordance with the manufacturer's recommendations and shall be recorded in special logs and keep it on site upon request by the concerned department – Dubai Municipality. These records shall be maintained for at least two years.
14. Accessible areas within the swing radius of the Crane swing radius area shall be barricaded, to prevent an employee from being struck or crushed by the crane. Also no equipment shall be allowed in this barricaded area. (See fig. # 2).

Fig.2

15. It is strictly prohibited to use any crane exceeded 25 years of service unless a safety and quality certificate is issued from the manufacturing company & Non Destructive Test for all structure.
16. An unobstructed passageway not less than 600 mm wide shall be maintained between moving and rotating structures of the crane and any guard-rails, fencing or other nearby fixture to protect the rigger from being injured. Provided that if at any time it is impracticable to maintain such a passageway at any or point, all reasonable steps shall be taken to prevent the access of any person to such place or point at such time Fig. (3).

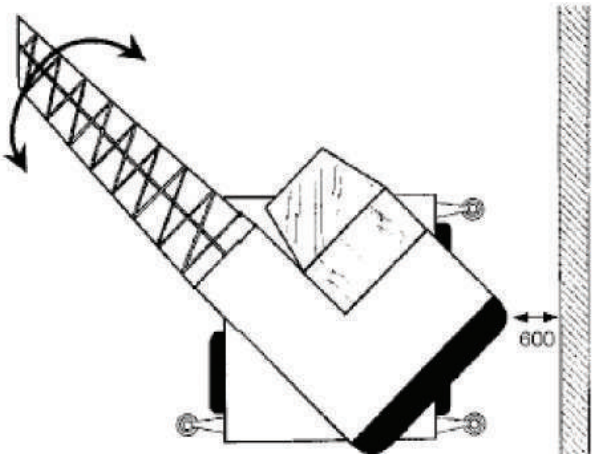


Fig. 3

17. When working near excavation works (trenches) a safe distance of one and half the depth of the trench shall be maintained between the crane and the edge of the trench to make sure that lateral pressure shall not occur on the trench walls, The cranes shall be placed on stable soil. (See fig. # 4).

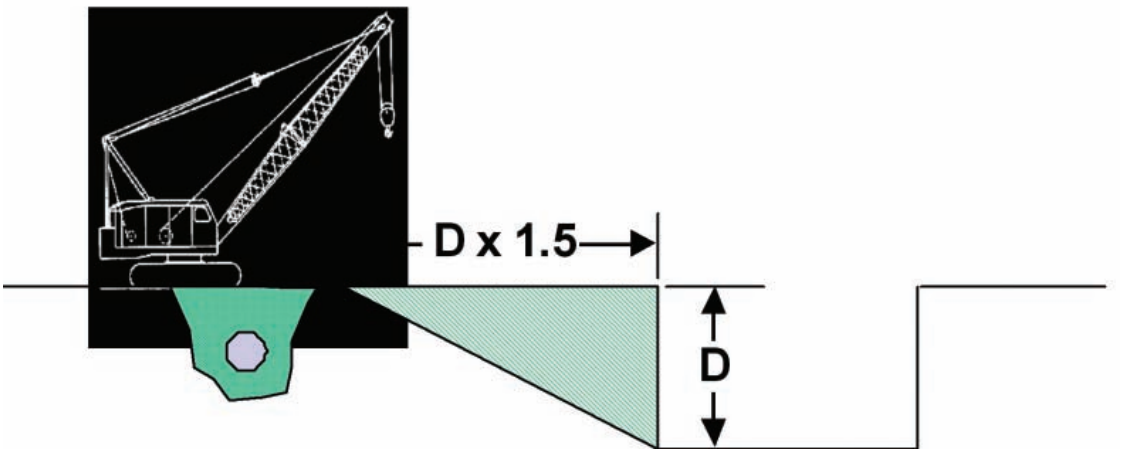


Fig. 4

18. Control handles, levers, switches shall be designed so that they cannot be operated accidentally and shall be marked to show what they are for and how they should be operated.
19. All cranes shall be provided with an automatic safe load indicator with a visual warning to the crane operator and an audible warning to those in the vicinity.
20. A crane must have a stable and level base. If the ground is soft or not level, all the precautionary measured shall be taken to ensure the stability of the crane, and that, may be achieved by using adequate timber mats under each out rigger of the crane according to the type of soil. (See fig. # 5).

Fig. 5

21. All cranes must stay clear of the power lines by at least 3 m (10 feet) (See fig. # 6).

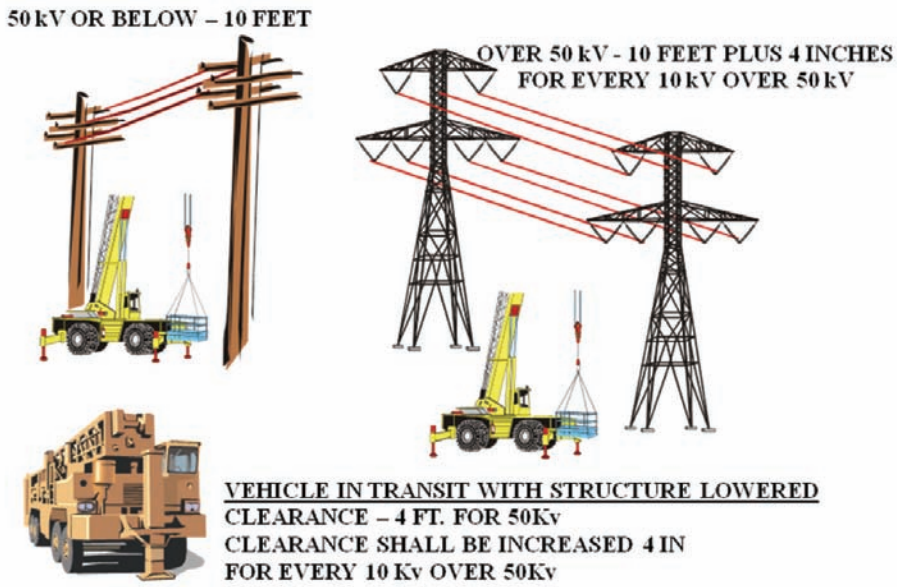


Fig. 6

22. When tower crane is used, the foundation where the crane will be fixed shall be designed so that it can support the maximum determined height and load, this design shall be approved by the consultant engineer before executing this foundation and before fixing the crane structure on it.
23. When handling long or large loads, a tag line shall be used to direct the load into position and prevent it spinning Fig. (7).

Fig.7

24. No crane which has any timber structural member shall be used.
25. When two cranes are used to lift one load at the same time, each crane shall work within its safe working load and remain stable throughout the lifting operation. One designated trained competent person shall be responsible for the operation, and all communication and signaling systems to both operators shall be performed by one person.
26. All tower cranes more than 30 meters high and mobile cranes with boom length more than 30 meters high shall be provided with warning lights to warn aircrafts and in particular helicopters in accordance with the regulation of Dubai Civil Aviation Authority.
27. No employee shall be allowed to stand under any suspended load, not even to pass under that load Fig. (8).

Fig. 8

28. The hoisting mechanism of a crane shall not be used for any purpose other than raising or lowering a load vertically.
29. Crane boom or jibs shall not be worked at a radius greater than specified on the test certificate.
30. Test certificates for cranes shall include a special item concerning the crane foundation, specifying that it has been erected according to the recommendation of the manufacturing company, and shall be approved by the consultant at the worksite, a proper written declaration about that shall be issued by the contractor and the consultant.
31. Cranes shall be erected on site by specialized company has commercial permission issued from Dubai Emirate permitting them to erect cranes.
32. The contractor shall comply with the recommendations of the manufacturing company regarding crane erection method.
33. Contractor shall take all precautionary measures to protect his employees, properties, adjacent buildings and utilities during the erection or increasing the height or dismantling of cranes.
34. Contractor shall provide LIghting Protection System for all type of cranes used at site and ensure the maintenance of the same

22 -2 Crane Signals:

1. Only qualified, trained and licensed persons shall operate cranes. Training on crane operations shall not be permitted during working hours and training shall be carried out under the supervision of a qualified competent person, providing that such training shall not affect safety of employees, adjacent buildings, and properties and shall not be affected by ongoing activities.
2. An assistant (signalperson) shall be appointed to give the necessary signals to the crane operator, this person shall be trained and licensed to do so.
3. Signals may be given by hand (hand signals) or by using wireless radio devices (two way radio).
4. When wireless devices are used, the contractor shall ensure that these devices are in good working condition and the work shall stop in case any malfunction occurs to these devices.
5. When wireless devices are used, the contractor shall ensure that both the operator and the signal person understand each other.
6. When normal means of communication (hand signals and wireless devices) is not feasible, a closed control television cameras may be used, and all the necessary precautions shall be taken to keep them in good order and shall be safeguarded against accidental operations.
7. Every signal given for the movement or stopping of a lifting appliance shall be clear and distinct and such that the person to whom it is given is able to hear or see it easily.
8. Signals shown in fig. # 9 is a guidance only and any other alternative means of signaling may be used by workers on construction sites providing that it will fulfill the same purpose, and ensuring that the crane operator and the signal person understand the purpose of this alternative method.

Fig.9

22- 3 Crane Operators and their Assistants:

22-3-1 Crane Operators:

Crane operators shall meet the following requirements:

1. Must be at least 18 years of age.
2. Possess a valid UAE driving license for cranes according to the recommendations of the Authority Concerned.
3. Be medically fit for the purpose, with particular emphasis on eyesight, hearing and speaking.
4. Be trained and physically capable of operating the crane controls.

5. Adequately trained in hand signaling system.
6. Holds a qualifying and training certificate issued by recognized organization approved by Dubai municipality.

22-3-2 Crane Operator Assistant (Signaler/Slinger):

Crane Operator Assistant (Signaler/Slinger) shall meet the following requirements:

1. Must be at least 18 years of age.
2. Be medically fit for the purpose, with particular emphasis on eyesight, hearing and speaking.
3. Has an aptitude for judging distances and heights.
4. Be capable of selecting lifting gear slings suitable for the loads to be lifted.
5. Be capable of directing the safe movement of the crane and its load to maintain the safety of all personnel.
6. Be thoroughly trained in a hand-signaling system and be capable where necessary, of giving clear and distinct instructions over radio or similar signaling systems.
7. Holds a qualifying and training certificate issued by recognized organization approved by Dubai municipality.
8. Be capable of determining the safe areas for storage and avoiding storage in unstable locations.

22 -4 Tower Cranes:

22-4-1 Tower Cranes on Fixed Base:

1. When any tower crane is selected for use on the construction sites, the following items shall be taken into consideration:

1-1 Suitable location with the minimum hazards.
1-2 Other cranes nearby (avoiding collision with other tower cranes on site).
1-3 The presence of overhead power lines.
1-4 Proximity of other structures, buildings, public access areas like highways, streets, etc.
1-5 Away from excavation sites.
1-6 Adverse weather conditions.

2. Regarding the base of the crane, the following conditions shall be met:
   2-1 Dimensions and reinforcement of the base shall be in accordance with the specifications of the manufacturing company.
   2-2 The contractor shall carry out all the necessary soil tests to ensure that it is capable of supporting all the loads resulting from the base, the crane components, and the maximum loads of the crane, also all the environment effect and obtains the approval of the consultant engineer on that.
   2-3 The erection of the base of the crane shall be carried out according to the drawings approved by the consultant engineer and under his supervision. All of that shall be recorded and documented and shall be kept on site for inspection purposes by the specialized department at Dubai Municipality.
3. Tower cranes with height exceeding 30 meters shall be provided with warning lights to warn low flying aircrafts/Helicopters. A white color warning light shall be fitted at the highest point of the crane and another white color lights shall be fitted on the crane jib one at each end of the jib and then every 4 meters along the jib length.
4. Tower crane shall not be used as part of any scaffold or support for any access, storage or transfer feature or as a means of access by employees.
5. Tower cranes on sites shall be provided with lightening protection systems.
6. Tower cranes cabin for operator shall have its windows free of broken or cracked glass or any other means of obstructions for clear vision. Window glass shall be of Shutter – proof type and shall be kept clean. (Fig. # 10).

Fig.10

7. When the height of tower cranes exceed the free standing heights determined by the manufacturing company, the crane shall be fixed and anchored to nearby solid structures or buildings in accordance with the regulations of the manufacturing company. At any time the height of the tower crane is adjusted a new safety certificate must be issued from a company approved and accredit by Dubai Municipality. (Fig. # 11).

Fig.11

8. The safe working load (SWL) shall be marked at various radii and an indicator shall be fitted which shows the safe working load at each operating radius.
9. A safe means of access to the crane cabin shall be provided by using a permanent steel ladder fitted with proper cage for fall protection with rest platform fitted with proper guard rails shall be provided at every 9 meters vertical intervals.
10. Jib inspection may be afforded by the provision of an expanding metal walkway inside the jib with life lines fitted to permit the fixing of safety harnesses during the inspection operations.
11. Each crane on site shall be re-tested and thoroughly examined following any repairs or major alterations or any weather conditions which may affect the strength or stability of the crane, and a new safety certificate must be issued.
12. No employee is permitted to pass or stand under hoisted and suspended loads during rigging operations.
13. Gears of the slewing ring shall be protected and fitted in such a way to prevent the interference of other element like wire ropes and hoisting ropes and the likes with these gears.
14. The correct amount of ballast and counter-weight must be properly fitted to the crane base as per the specification of the manufacturer during and after completion of fitting.
15. Operating instructions issued by the manufacturer shall be posted inside the crane cabin or on the crane structure for easily seen and viewed.
16. When the tower crane is not in use, the brake shall be activated to prevent the

movement of the crane jib by the effect of wind or any other means. Once a building or structure is completed, a tower crane has to be dismantled, this factor should always be taken into account when deciding the initial positio n.

22-4-2 Tower Cranes Mounted on Rail Track:

1. In addition to what is specified in item # 2 regarding the base of the tower crane, the contractor shall ensure providing the following requirements and conditions related to cranes mounted on a rail track:
    - 1-1 The rails shall be adequately supported on a surface sufficiently firm to prevent undue movement or displacement of the rails.
    - 1-2 be laid in straight lines or in radii curves suitable for the free movement of the crane.
    - 1-3 be provided with adequate stops or buffers at each end of the track.
2. The cranes shall be provided with effective brakes on traveling motion.
3. Rail mounted tower cranes should be fitted with an audible and visible travel alarm to warn workers on site.
4. Every travelling crane on rails shall be provided with guards to remove from the rails any loose material likely to cause danger.

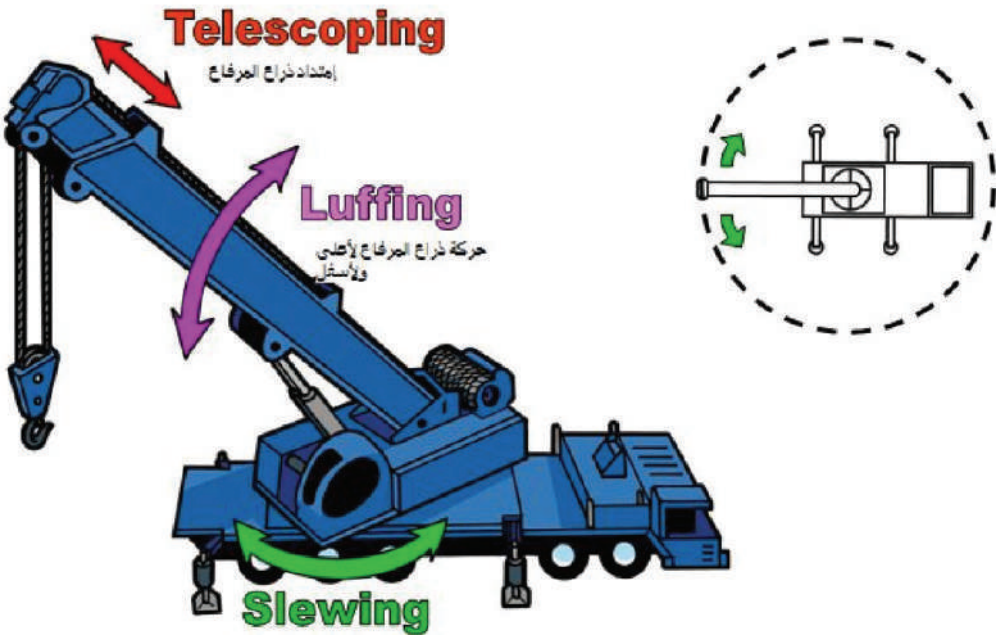
22-4-3 Tower Cranes Supported by the building structure

In this case the loads of the crane will be transfered to different slab levels through the structure of the building wich required to be sufficient and strong enough to transfere that load

- 1- The crane should be connected to 3 slabs at least.
- 2- The slabs will considers ready only after reaching its 28 days strengthing.
- 3- For any exceptions from above mentioned notices, the contractor will get the written approval of the engineer.
- 4- for post tension slabs, the cranes will connected to those slab complete 28 days strengthing and after getting the engineer written aaproval.
- 5- The contractor will meet the manufacturars recomentations for errictions, inspections and maintenance procedures.
- 6- For other requirements refer to this chapter 22 of the code.

22- 5 Mobile Cranes:

1. The safe working loads shall be clearly marked on each crane and other lifting appliances.
2. No load greater than safe working load shall be lifted by the crane except for the purpose of testing.
3. Derricking cranes shall be marked with the maximum operating radius of the jib.
4. All mobile cranes shall be provided with boom angle indicator and boom length indicator.
5. All mobile cranes shall be provided with proper limit switch (Anti-Two Block Switch) to prevent any contact between the hoisting block and the tip of the boom by automatically stop the lifting operation at an adequate distance (1 m) between the hoist block and the boom tip. (Fig. # 12).


Telescoping
إمتداد ذراع المرفاع
Luffing
حركة ذراع المرفاع لأعلى ولأسفل
Slewing

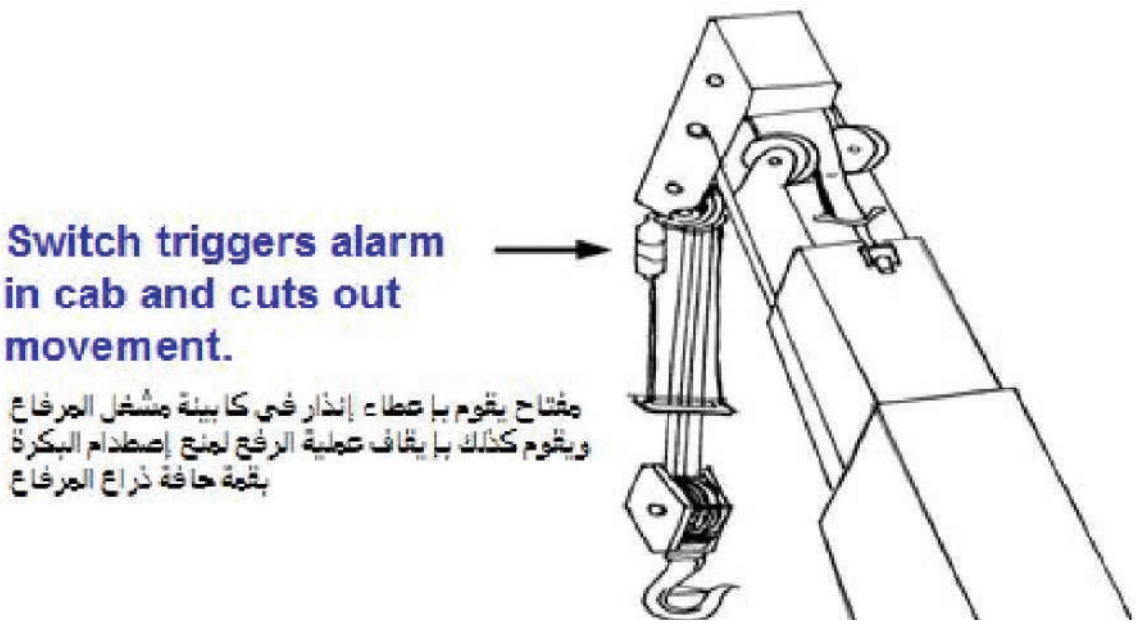

Switch triggers alarm in cab and cuts out movement.
مفتاح يقوم بإعطاء إنذار في كابينة مشغل المرفاع ويقوم كذلك بإيقاف عملية الرفع لمنع إصطدام البكرة بقمة حافة ذراع المرفاع

Fig.12

6. The contractor shall ensure that any mobile crane enters the site has a valid safety certificate before permitting to enter. All the details of the crane and the operator shall be recorded and kept on site.

22- 6 Personal & Material (Construction) Hoists:

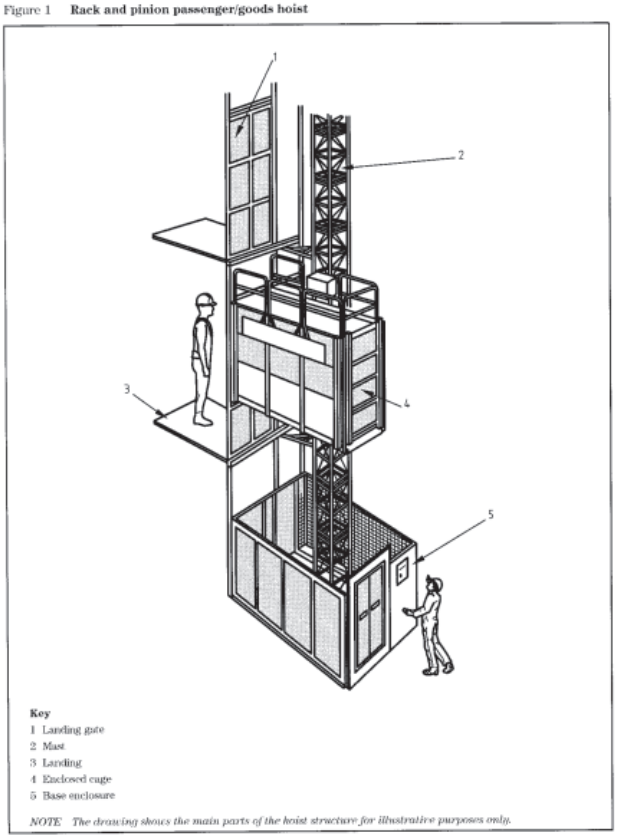
22-6-1 Personal Hoists:

1. Personal hoists shall be thoroughly examined after erection and before being put in to service by a competent person working with a third party company approved and accredit by Dubai Municipality to ensure that they have been properly erected on fixed and suitable foundation and safe to operate and a safety certificate shall be issued by this company.
2. Passenger hoists shall be inspected every six months by a competent person working with a third party company approved and accredit by Dubai Municipality, and a safety certificate shall be issued from this company. A copy of the safety certificate shall be posted inside the cabinet.
3. Each personal hoist on site shall be re-tested and thoroughly examined following any repairs or major alterations or any weather conditions which may affect the strength or stability of the hoist, and a new safety certificate must be issued. The personal Hoist shall not be used unless the new safety certificate is issued.
4. Personal hoists shall be operated by qualified competent persons.
5. The contractor shall ensure that all the requirements and instructions of the manufacturer have been followed in regard to tying to the building, and operation and maintenance measures.
6. Gates shall be fitted in the enclosure at all landing places and shall normally be at least 2 meter high, covered with proper mesh for clear viewing and these gates shall be opened only by the hoist operator from outside.
7. A warning notice should be posted on the hoist gates requesting that these gates to remain closed. No persons shall be carried by the hoist unless it is provided with a cage with the following conditions:
    - 7-1 Constructed with cage gate with interlocking arrangements to prevent the occupants falling out or from being trapped between any part of the cage and the fixed structure or moving part, the ceiling of the cage shall be constructed from materials prevent being struck by articles or materials falling down the hoist way.
    - 7-2 Every hoist enclosure shall be fitted with interlocking gates at landing places.
    - 7-3 Every hoist used for carrying persons shall be provided with an over-run device (limit switch) at the bottom and top of the hoist way, which automatically stops the hoist if it exceeds the pre-determined travel limits.
8. Gage gates shall be provided with electrical or mechanical locking devices, so that the gates cannot be opened except when the cage is at the landing stage, and so that the hoist cannot be operated unless that gate is closed and the lock is in the shut position.
9. Hoists must be fitted with a emergency brake to stop the fully loaded platform or cage in the event of failure of the hoist rope or driving gear. The hoist must be stopped completely within a fall distance not exceeding 3 meter or according to the manufacturer recommendations.
10. Hoists shall only be operated from one position from inside the cage, if for any reason the cage stops between landing stages, it should be isolated electrically from outside

to prevent any possibility of further movement and remove trapped persons from the cage safely.

11. All hoists shall be provided with stoppers from top and bottom to prevent the cage from exceeding the pre-set top position or the pre-set bottom position by more than 100 – 200 mm.
12. Adequate illumination shall be provided inside the cage, outside the cage and at all entrances and exits at all levels.
13. An adequate space shall be maintained from the upper side of the cage when at its highest position to provide a free travel path if the cage over-runs the upper landing level, also an adequate space shall be maintained from the underside of the cage for the same purpose.
14. Overhead protective covering shall be provided above the overhead work of all hoists to prevent objects falling down the shaft way.
15. Proper shock absorber (springs) shall be erected at the bottom of the hoist shaft to absorb any sudden move in case the hoist fell down.
16. Personal hoists shall not be used to carry materials.
17. In case the personal hoist is used to carry materials the following conditions shall be met:
    - 17-1 No passengers shall be allowed to ride the cage with the material except the operator.
    - 17-2 Hazardous or Flammable materials shall not be allowed in the presence of the operator, in this case these materials shall be carried by the material hoist.
    - 17-3 Not to exceed the safe working load of the hoist.
    - 17-4 The loads shall be distributed uniformly and materials shall not be stacked to the extend that it will collapse.
18. The speed limit of the hoist of single speed shall not exceed 0.5 m/second in the under construction buildings. Hoists with two speeds the lower speed shall not exceed 0.25 m/second, in case it is needed to increase the speed more than these limits, special approval must be obtained from the specialized department.
19. Hoist main control panel shall be protected against dust, water and tampering by any person.
20. Hoist shall be operated manually when descending and ascending.
21. Hoist cage shall be provided with a fire extinguisher to be fixed near the door.
22. When selecting the location of the hoist, if possible, it shall be located away from the garbage chutes areas also away from the location of tower cranes and any other circumstances that may present hazards to the hoist users.
23. The control panel shall be electrically isolated in such a way to prevent the occurrence of any electrical faults or short circuits in the cage or the hoist structure.
24. Personal hoists shall be inspected regularly to ensure that all safety devices available are in good working condition.
25. Hoists shall be erected at easy reached places, the entrance and exits shall be free of any obstruction. A temporary barricade shall be provided at the lowest level of the hoist for the safety of employees on site.
26. Signs of conspicuous and easily read style (in Arabic, English and the most common language on site) giving instructions for the use of the hoist shall be posted at well known location to all employees.
27. Personal hoist cages shall be provided with proper means of communication to be used in case of emergency or in case the hoist stops for any reason.
28. The hoist shall not reverse its direction unless completely stopped.

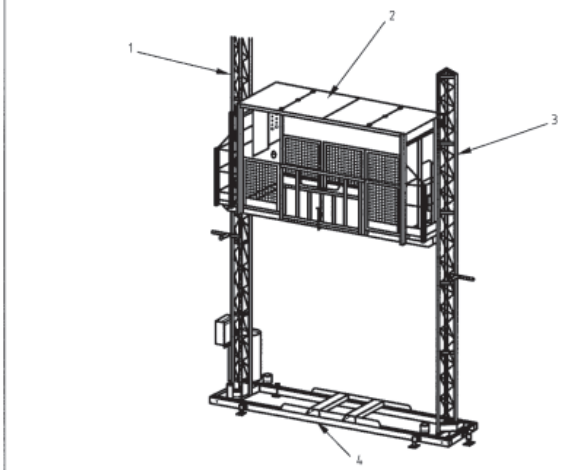
Figure 1 **Rack and pinion passenger/goods hoist**



Key
1 Landing gate
2 Mast
3 Landing
4 Enclosed cage
5 Base enclosure

NOTE The drawing shows the main parts of the hoist structure for illustrative purposes only.

Figure 6 **Transport platform**



Key
1 Mast
2 Cage with roof
3 Mast
4 Base frame

NOTE 1 The drawing shows the main parts of the hoist structure for illustrative purposes only.
NOTE 2 Base enclosure not shown for clarity.

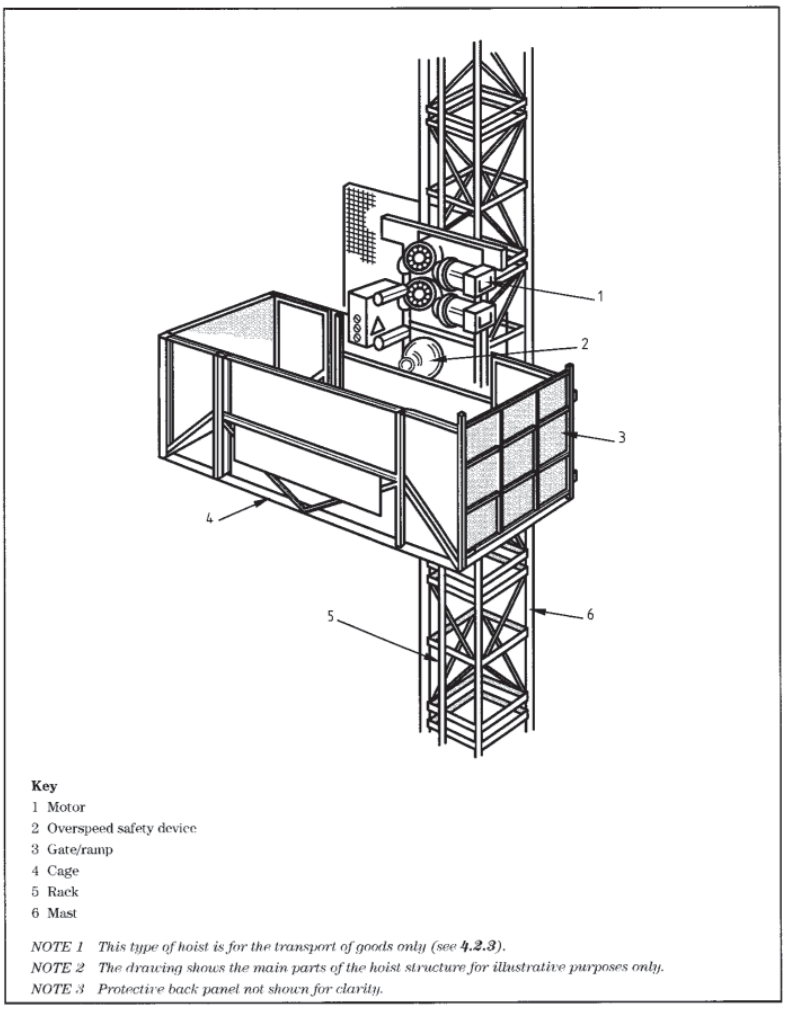
Fig. 13

22-6-2 Material Hoists:

In addition to all the previous regulations concerning the personal hoists, the following regulations shall be followed:

1. It is strictly prohibited to use material hoists to carry persons.
2. The entrance of the hoist at the lowest level shall be barricaded.
3. Rated load capacities of the hoist recommended by the manufacturer shall not be exceeded, and the lifting engines must be of adequate strength to be able to lift these loads.
4. When loaded with materials, these materials shall be distributed in a uniform manner on the platform and stacked in such a way to prevent its collapse.
5. The hoist shall be provided with proper over-run devices from top and bottom.
6. Hoists shall be provided with suitable emergency brakes to stop it in case of emergency.
7. Signs including the statement “No Riders Allowed” shall be posted at each material hoist entrance.

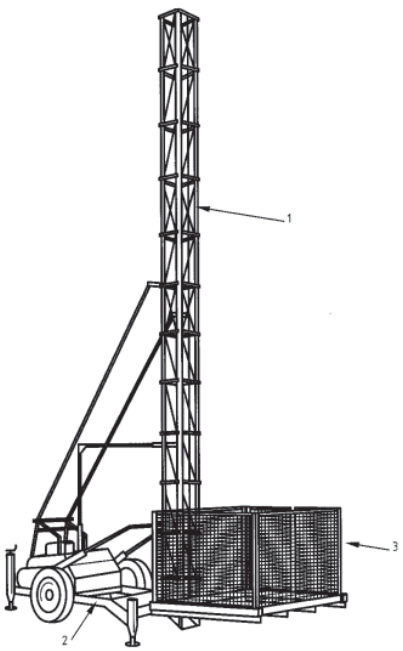
Figure 2 **Rack and pinion goods hoist**



Key
1 Motor
2 Overspeed safety device
3 Gate/ramp
4 Cage
5 Rack
6 Mast

NOTE 1 *This type of hoist is for the transport of goods only (see* ***4.2.3****).*
NOTE 2 *The drawing shows the main parts of the hoist structure for illustrative purposes only.*
NOTE 3 *Protective back panel not shown for clarity.*

Figure 3 **Rope driven goods hoist**

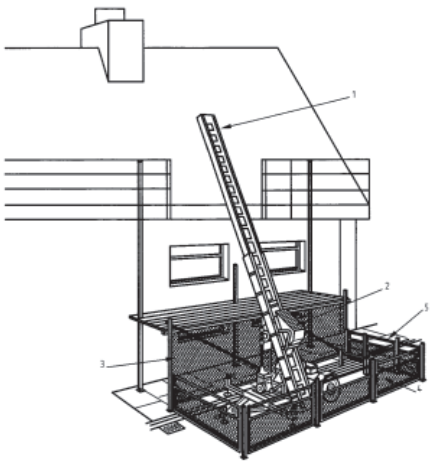


Key
1 Mast
2 Base frame
3 Cage

NOTE 1 The drawing shows the main parts of the hoist structure for illustrative purposes only.
NOTE 2 Base enclosure not shown for clarity.

BS 7212:2006

Figure 4 **Inclined goods hoist**



Key
1 Mast
2 Carrier
3 Pedestrian protection
4 Base enclosure
5 Gate

NOTE 1 The drawing shows the main parts of the hoist structure for illustrative purposes only.
NOTE 2 This example shows a ladder hoist.

Fig. 14

22- 7 Personal Platform:

22-7-1 General Requirements:

Due to the great hazards associated with the use of crane – suspended work platforms, the following conditions must be followed:

A- Crane Conditions:

1. The crane shall be fixed on a firm footing ground.
2. Uniformly level within 1 % .
3. Crane brakes is engaged and all other safety devices shall be used to ensure that the crane shall not move during the lifting operation.
4. The total weight of the loaded personnel platform and related rigging shall not exceed 50 percent of the rated capacity for the radius and configuration of the crane.
5. The crane operator shall remain at the controls at all times when the crane engine is running and the platform is occupied.

B- Crane Components:

1. Cranes shall be equipped with boom angle indicator, readily visible to the operator.
2. Cranes shall be equipped with a device to indicate clearly to the operator, at all times, the boom's extended length or an accurate determination of the load radius to be used during the lift shall be made prior to hoisting personnel.
3. A positive acting device shall be used which prevents contact between the load block or overhaul ball and the boom tip (anti-two-blocking device).

C- Personnel Platforms:

Each personnel platform and suspension system shall be designed by qualified engineer or a qualified person competent in structural design taking into consideration the following points:

1. The personnel platform itself, shall be capable of supporting, without failure its own weight and at least five times the maximum intended load.
2. Each personnel platform shall be equipped with a standard guardrail system and shall be enclosed at least from the toe-board to mid-rail with either solid construction or expanded metal having openings no greater than 13 mm (½ inch) to prevent falling of tools and material from the platform.
3. A hand grab rail shall be installed inside the entire perimeter of the personnel platform.
4. The personnel platform shall be conspicuously posted with a plate or other permanent marking which indicates the weight of the platform, and its rated load capacity or maximum intended load.
5. Access gate shall be installed, and shall not swing outward during hoisting, and shall be equipped with a restraining device to prevent accidental opening.

D- Inspection and Testing:

Personal platform shall be inspected before employees use it as follows:

1. The personal platform is lifted from the ground or to the same level where employees will enter to the platform and move the platform to all places the platform is expected to reach.
2. All control and safety devices at the crane and the platform shall be inspected to ensure that they are working properly.
3. The crane lifting the personal platform will be down graded to 50 percent of its actual capacity to ensure safe lifting operation.
4. All wire ropes shall be inspected to ensure that they are free of any damage or defects and they are wrapped in their correct place around the drum.
5. Visual inspection to the crane and the platform shall be carried out by a competent person.
6. The platform and rigging shall be proof tested to 125 percent of the platform's rated capacity in the following cases:
    - 6-1 When the platform is used for the first time.
    - 6-2 After carrying out any repairs or modifications.
    - 6-3 Before use it to lift personnel.

The test is carried out by loading the platform uniformly by 125 % of its capacity and raise it about one meter from the ground and holding it in a suspension position for 5 minutes with the test load evenly distributed on the platform. (Fig. # 15).

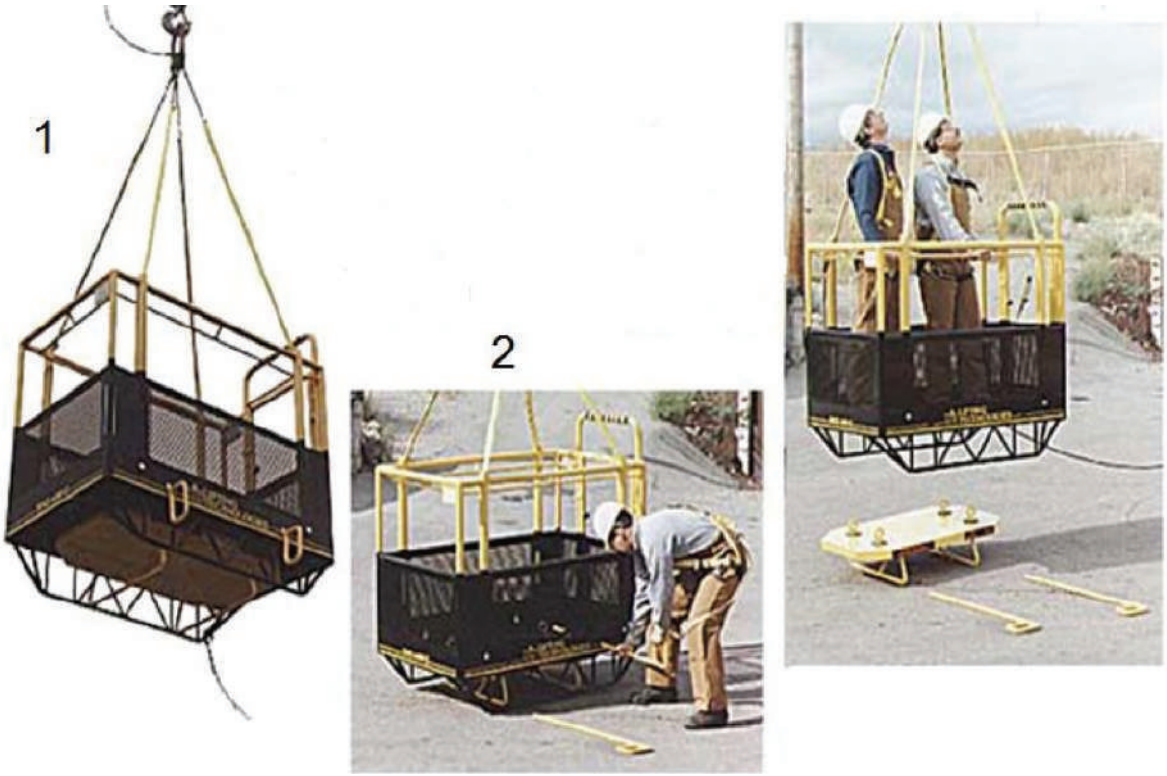


Fig.15

E- Required Safety Regulations:

1. Tag lines shall be used unless their use creates an unsafe condition.
2. Employees using the personal platform shall be provided with proper fall protection measures (Lanyard + harness) and tied off to basket. (Fig. # 16).

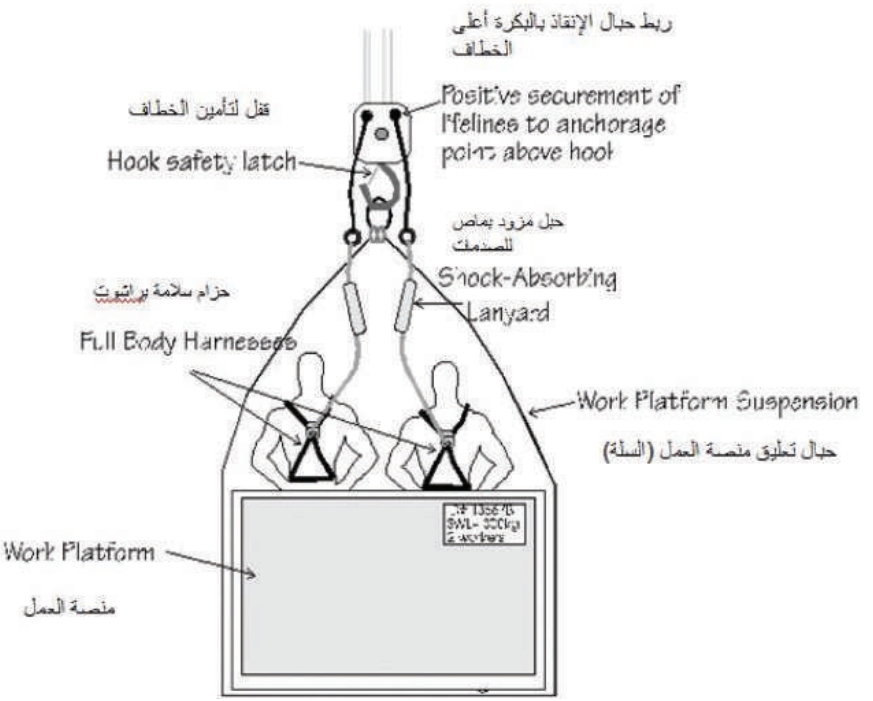


Fig. 16

22- 8 Helicopter Cranes:

22-8-1 General Regulations:

1. Helicopter cranes when used shall comply with the regulations of Dubai Civil Aviation Authority and after obtaining the necessary permits.
2. All loading and lifting operations by using Helicopter cranes shall be conducted under the supervision of qualified, trained competent person, who shall plan, assess all hazards and supervises such operations.
3. Tag lines shall be of a length that will not permit their being drawn up into rotors Fig. (16).

Fig.16

4. All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation.
5. All cargo hooks shall be equipped with an emergency mechanical control for releasing the load to avoid presenting any hazard to the plane.
6. The hooks shall be tested prior to each day's operation.
7. Personal Protective Equipment for employees receiving the load shall consist of eye pro tection, hard hats secured by chinstraps and hearing protection devices.
8. Loose-fitting clothing likely to flap in the downwash, and thus be snagged on hoist line, shall not be worn.
9. Every practical precaution shall be taken to provide for the protection of the employees from flying objects in the rotor downwash. All loose gear within 30 m (100 feet) of the place of lifting or depositing the load shall be secured or removed.
10. The helicopter pilot shall be responsible for the size, weight, and manner in which loads are connected to the helicopter, if, for any reason, the helicopter pilot believes the lift cannot be made safely, the lift shall not be made.
11. When employees are required to work under hovering craft, safe access shall b provided for employees to reach the hoist line hook and engage or disengage cargo slings. Employees shall not work under hovering craft except to hook, unhook, or position loads.
12. Static charges on the suspended load shall be dissipated with a grounding device before ground personnel touch the suspended load, or protective rubber gloves shall be worn by all ground personnel touching the suspended load.
13. No unauthorized person shall be allowed to approach within 15 m (50 feet) of the helicopter when the rotor blades are turning. (Fig. # 17).

Fig. 17

14. Whenever approaching or leaving a helicopter with blades rotating, all employees shall remain in full view of the pilot and keep in a crouched position. Employees shall avoid the area from the cockpit or cabin rearward unless authorized by the helicopter pilot to work there.
15. There shall be constant reliable communication between the pilot and a designated employee f the ground crew who acts as a signal person during loading and unloading. This signal person shall be distinctly recognizable from other round personnel. (Fig. # 18).
16. Good housekeeping shall be maintained in all helicopter loading and unloading areas.

Fig.18

Chapter Twenty Three

References

1- OSHA Construction Safety & Health Standards OSHA 29 CFR 1926
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