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PROJECT SITE SAFETY REQUIREMENTS

Addis Ababa, Ethiopia
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1. Introduction

This document addresses specific safety requirements in project sites for the overall wellbeing of each stakeholder of the project. It has been derived from the standards and specifications, statutory requirements and leading standards of state-of-the-art industries. All collaborators, associated persons, employees and visitors must abide with the requirements stated in this document as their assigned duties and responsibilities.

Every contributor of a project under the supervision of AMEMWs ought to submit measures to assure compliance to these requirements which are to be approved by AMEMWs technical team. The details of this document apply to all projects. Additional directions might be introduced to specific projects as per the need.

The safety requirements are classified into 13 major elements making up the thirteen golden safety rules of AMEMWs. A general summary is provided at the end of the document.



Figure 1. AMEMWs' golden safety rules.

2. Personal Protective Equipment (PPE)

In the hierarchy of control for any level of risk management, the use of PPE (Personal Protective Equipment) is the final step. PPE shall be used next to other counter measures. In this respect, the respective PPE usage is mandatory on AMEMWs project sites.

The PPE type required depends on the specific activity to be performed as specified in the Permit to Work. PPE must comply with an internationally recognized standard (examples: ANSI, CE) and maintained in good condition.

The following PPE are mandatory in all project sites. Additional PPE is required depending on the nature of work assignment.

- a) Suitable Safety Helmets – no Bump Caps;
- b) Highly Visible, Reflective Clothing / Vests;
- c) Safety Shoes or Boots including Rain Boots (Wellingtons / Gumboots);
- d) Safety Glasses;
- e) Ear Plugs or similar - carry on person;
- f) Harness Lanyard;
- g) Gloves as per job function (material handling, chemical, electrical, etc.);
- h) All other PPE are required at specific work areas as per instruction of Permit to Work. Examples include: welding mask & apron, face shield (grinding, concrete pouring with hose, etc.), respiratory protection, personal fall arrest systems and other PPE.

All AMEMWs employees and contractors will be required to wear, maintain and properly store the appropriate Personal Protective Equipment. All personnel on site shall be trained, to enable them to effectively use the provided PPE and to protect them against workplace hazards. The extent of the training depends on the complexity of the equipment. A register of all PPE issued to employees will be kept and updated as necessary by each contractor. Damaged or defective PPE items will be replenished as and when required.



Figure 2. Project site Personal Protective Equipment.

3. Mobile Equipment and Vehicle Safety

It is a common practice to drive with various vehicles and work with mobile equipment during the construction phase of most project works. These machines pose a constant risk of serious

or fatal injuries to those who work in and around them. Operators are not always able to see workers on the ground; therefore, they must actively practice safe work procedures.

All contractors are required to keep an updated Vehicle and Equipment Register.

3.1. Multiple Vehicles and Equipment On site

Commonly used equipment in operation on project sites are

- ✓ Personnel being transported to the site on public roads;
- ✓ Telescopic fork lifts transporting material on site;
- ✓ Roller compactors;
- ✓ Rotating equipment such as concrete mixer trucks.

Major Risks associated with vehicles and mobile equipment

- ✓ Road transportation accidents;
- ✓ Crushed if vehicle overturns;
- ✓ Run over by a backing vehicle;
- ✓ Crushed if caught between a wall or other vehicle or structure;
- ✓ Electrocution if equipment makes contact with an overhead power line.

Common Hazards associated with vehicles and mobile equipment:

- ✓ Congestion caused by traffic and equipment around active work areas;
- ✓ Inexperienced or unqualified drivers and operators;
- ✓ Driving over rough areas or poor ground;
- ✓ Speeding of vehicles and equipment on site;
- ✓ Plant in poor condition;
- ✓ Inexperienced operators;
- ✓ Inhalation of dust and fumes;
- ✓ Drivers of equipment not seeing the flagman or other pedestrians when reversing;

- ✓ Work procedures not available or updated;
- ✓ Task not clearly defined in the procedures.

3.2. General Precautions

Vehicle and equipment condition – Proper working condition of vehicles and equipment minimize the probability of breakdowns and incidents. The following are required to keep site equipment in an acceptable condition:

- a) Initial Inspection
- b) Daily Inspection
- c) Maintenance of vehicles and equipment

Licensed and certified drivers and operators – All drivers and operators shall have a valid license or certification from an approved party when operating a vehicle or equipment.

Communication – Operators shall always be in constant communication with the people working around them. Communication with operators should be included regularly at toolbox talks and reinforced by the supervisor on site.

Segregation – Where possible, all mobile equipment operations close to workers shall require a safety zone, which must strictly be controlled.

Trained Flagmen is required when physical segregation of workers and equipment is not feasible and should be present when:

- a) Working in congested zones next to other workers;
- b) Visibility of the work area is not very clear;
- c) High volumes of traffic are present;
- d) Working on or next to a main site road;
- e) Driving on Brewery Roads.

Speed Limits – Respect the site speed limit at all times, which is 20 Km/hr on main roads. When the situation demands reduce to an even lower acceptable speed.

Blind Spots – Operators have to be sure that nobody is behind the equipment or in their blind spots when moving, even if this involves getting out of the machine and checking. High-visibility vests are mandatory on site.

Seatbelts –All transportation including personnel transported to site on public roads and mobile equipment on site will have qualified seatbelts available. Vehicles or mobile equipment without seatbelts will not be permitted.

Mounting & Dismounting – Stepping on and off equipment are some of the biggest causes of injury on construction sites. This includes entering and exiting the cab of a machine. A good rule of thumb is to always maintain three points of contact when getting on or off the equipment. The three-point rule requires three of four points of contact to be maintained with the vehicle at all times - two hands and one foot, or both feet and one hand. If handholds or steps are damaged, replace them; it could prevent a major injury down the line.

Unloading Equipment from trailers – Always ensure that equipment is on level ground when loading or unloading. It greatly reduces the risk of rollovers or sliding off the low-bed ramps.

Load Limits – Be aware of the load limits of varying equipment when operating different machines. Depending on the equipment set-up and size the load limits can change drastically. As with all equipment operations, confirm all workers are at a safe distance when moving loads.

Pedestrians and ground workers – People on the ground are responsible for their own safety on site and should always be aware of the immediate surroundings, safe walkways and barricaded zones.

Pedestrians should:

- a) Maintain eye contact with the operator. If the pedestrian can't see operator, then the operator can't see pedestrian;
- b) Signal the operator when entering a danger zone, do not act until an operator acknowledges the signal;
- c) Do not take 'shortcuts' across areas where mobile equipment is working;
- d) Avoid swing zones, pinches and blind spots;
- e) Do not ride on mobile equipment;
- f) Stay out of the road or work path of machinery.

Mobile Equipment and Vehicle Safety tips for drivers	
Do's	Don'ts
Watch for pedestrians	Give rides to unauthorized people
Operate at a speed that suits load and road conditions	Ride with blocked view (for example: high forks)
Look in the direction of travel	Ignore signs and markers
know the vehicle's capacity and load center	Park on a sloppy space

Table 1. Safety tips for mobile equipment drivers.

4. Hand & Power Tools

Employees who use hand and power tools are exposed to various risks during site work. Impact injuries, chemical fumes exposure and electrical shock are just a few. Proper tools, maintenance and operational methods are required.

Hand Tools:

Hand tools, manually powered tools, include anything from hammers and axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance and tools falling from height.

Safe Practices:

- ✓ No handmade tools are allowed without approval from AMEMWs' technical team;

- ✓ Tools shall be inspected regularly and replaced when required;
- ✓ Tools shall be stored in a dry and suitable location;
- ✓ When working at height, tools shall be secured to prevent it from falling downwards;
- ✓ Employees using saw blades, knives, or other tools, should direct the tools away from themselves and other employees;
- ✓ Cracked and damaged tools must be removed from service;
- ✓ Impact tools such as hammers, wedges, and chisels must be kept free of mushroomed heads. The wooden handles of tools must not be splintered;
- ✓ Iron or steel hand tools may produce sparks that can be an ignition source around flammable substance. Where this hazard exists, spark-resistant tools made of non-ferrous materials should be used where flammable gases, highly volatile liquids, and other explosive substances are stored or used;
- ✓ Always wear suitable gloves and other PPE as required.



Figure 3. Hand tools safety summary.

Power Tools:

Power Tools are powered by an additional energy source and mechanism other than the solely manual labor used with hand tools. The most common types of power tools are Electric Tools, Pneumatic Tools, Powder-Actuated Tools and Liquid Fuel Tools.

Appropriate personal protective equipment such as safety glasses or safety shields and gloves must be worn to help protect against hazards that may be encountered while using power tools and must be fitted with guards and safety switches. Common incidents associated with power tools include abrasions, cuts, lacerations, amputations, burns, electrocution, and broken bones and are often caused by the following:

- a) Making contact with the cutting, drilling or grinding components;
- b) Getting caught in moving parts;
- c) Suffering electrical shock due to improper grounding, equipment defects, or operator misuse;
- d) Being struck by particles that are ejected by force;
- e) Touching hot tools or work pieces;
- f) Being struck by falling tools.

Follow these guidelines for working with power tools:

- ✓ Use the correct tool for the job. Do not use a tool or attachment for something it was not designed to do;
- ✓ Never disable or tamper with safety releases or other automatic switches;
- ✓ Examine each tool for damage before use;
- ✓ Competent operators to use tools according to the manufacturers' instructions;
- ✓ Provide correct PPE;
- ✓ Select the correct bit, blade, cutter, or grinder wheel for the material at hand. This precaution will reduce the chance for an accident and improve the quality of work;

- ✓ Keep all guards in place. Cover exposed belts, pulleys, gears, and shafts that could cause injury;
- ✓ Trailing cables must not be in the path of other workers, and should be inspected regularly for damage by the user or other appointed person;
- ✓ Power sockets must be durable and fit for purpose. Domestic sockets will be removed from industrial and construction areas;
- ✓ Never carry a tool by the cord or hose;
- ✓ Keep cords and hoses away from heat, oil, and sharp edges;
- ✓ Tools will be either grounded or double insulated;
- ✓ Always operate tools at the correct speed for the job at hand;
- ✓ Do not rely on strength to perform an operation. The correct tool, blade, and method should not require excessive strength;
- ✓ Before clearing jams or blockages on power tools, disconnect from power source;
- ✓ Never reach over equipment while it is running;
- ✓ Keep a firm grip on portable power tools;
- ✓ Keep bystanders away from moving machinery;
- ✓ Do not operate power tools when sick, fatigued, or taking strong medication;
- ✓ When possible, secure work pieces with a clamp or vice to free the hands and minimize the chance of injury;
- ✓ Keep all tools in good condition with regular maintenance. A system shall be active for regular planned and recorded maintenance.

Power Tool Guards – The exposed moving parts of power tools need to be safeguarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded. Many serious incidents and accidents happen as a result of contact with rotating and moving parts.

Portable Abrasive Grinders – Portable abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments and cause serious cutting and burning injuries.

Before an abrasive wheel is mounted, it must be inspected closely for damage. Take care to ensure that the spindle speed of the machine will not exceed the maximum operating speed marked on the disc. An abrasive wheel may disintegrate or explode. Allow the tool to come up to operating speed prior to grinding or cutting. The employee should never stand in the plane of rotation of the wheel as it accelerates to full operating speed. Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of wheel breakage.

When using a powered grinder:

- a) Always use eye or face protection;
- b) Turn off the power when not in use;
- c) Always have a proper grip with both hands on the machine;
- d) Never clamp a hand-held grinder in a vice;
- e) Strictly follow the manufacturer's instructions.

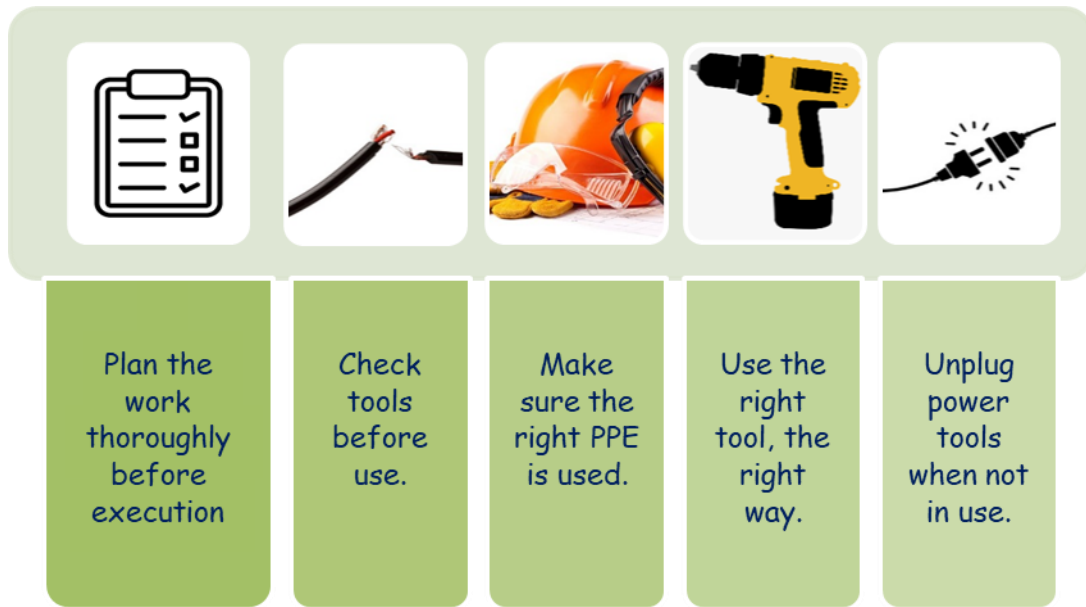


Figure 4. Power tools safety summary.

5. Safety Signs and Barricading

Signs and barricading will be visible at all times where a hazard exists on site.

Open shafts; work at height activities, equipment in operation in close proximity to other workers and obstructions on site will be sufficiently barricaded and highlighted with signs. Barricades, signs and any other protection installed shall be properly maintained and cleaned. Defective or broken signs and barricading will be removed and replaced.

- ✓ Overhead and underground Hazards such as pipe racks, structures, power lines and low clearance points should be identified and flagged;
- ✓ Only personnel directly involved in the work area barricaded may cross the barricade tape. All other personnel must obtain permission from the work responsible person to enter;
- ✓ A person crossing the barricaded area without permission from the responsible person is subject to disciplinary actions;

- ✓ Barricading must be safe and not create additional hazards. Re-bars or other protruding edges used for barricading, shall be made safe by using qualified rebar caps, or bending the sharp edges over;
- ✓ Signs, signals and barricades will only be removed when the hazard no longer exists.

Examples of activities requiring barricading:

- a) Overhead work / overhead hazards;
- b) Open edges or platforms;
- c) Corrective chiseling;
- d) Crane and load lifting;
- e) Pressure testing;
- f) Radiographic work;
- g) Pressure testing activities with a potential of energy release;
- h) Incident scene (for example: spill of hazardous material).

Tape / Soft Barricading:

Soft barricading is used where temporary hazard communication is required to prevent employees from entering a specific area. It is not a long-term solution and shall not be permitted to be used as such.

- ✓ Avoid installing barricade tape across access and egress ways unless hazardous activities are performed and the area needs to be protected;
- ✓ When installing barricade tape for overhead hazards, all areas posing a hazard of falling objects shall be barricaded. The barricade shall be installed to restrict access to the entire area potentially affected by falling object;

- ✓ When using barricade tape for crane and lifting works, the accessible area within the swing radius of the crane shall be barricaded to prevent personnel access. The rotating parts of the crane shall also be barricaded;
- ✓ When using barricade tape for pressure testing, the barricaded area must encompass the entire potentially affected area of the leaks.

Hard Barricades

Hard barricades shall be constructed in all places where there is a danger to fall to a lower level.

- ✓ If the (shaft) opening is deeper than 1 meter, in congested construction areas or close to an access or egress path, then a hard or rigid barricade must be used sufficient to resist a force as determined by the Risk Assessment. Usually, a resistance force of 90 Kg will be required;
- ✓ Floor, roof and other openings must immediately be secured with rigid hard barricading.

When installing hard barricade, ensure it is installed at least 1 meter from the edge of the opening. Hard barricades must be highly visible.



Figure 5. Site safety signs and safety barricades.

6. Hot Work

Hot Work is operations where heat is used or generated or work which generate sparks and open flames.

Requirements to assist in preventing hazards associated with Hot Work:

- ✓ Hot Work activities must be visibly identified with barricades and warning signs;
- ✓ All combustible material is to be removed from open flame sources. Combustible materials that are not removable must be covered with material suitable to prevent combustion;
- ✓ Electrical Cables or Gas Hoses in good condition, arranged in a safe manner, protected from sparks;
- ✓ Leads, grounding devices, clamps welding machines, hoses, gauges, torches and cylinders shall be inspected before each use;
- ✓ Firefighting equipment suitable for the hot work activity must be placed strategically close to the work;
- ✓ Extinguishers shall be serviced and in good condition. All extinguishers must be registered;
- ✓ Fire resistant protection measures are required where other workers or pedestrians are present next to Hot-Work activities or not;
- ✓ A competent Fire Watcher and Fire Fighter is available at the Hot Work area;
- ✓ Gas Bottles transported upright in suitable cradles & stored securely to prevent toppling at work or storage locations;
- ✓ Qualified Flash-back Arrestors fitted to gas hoses, pressure regulators and protective caps fitted to gas bottles.

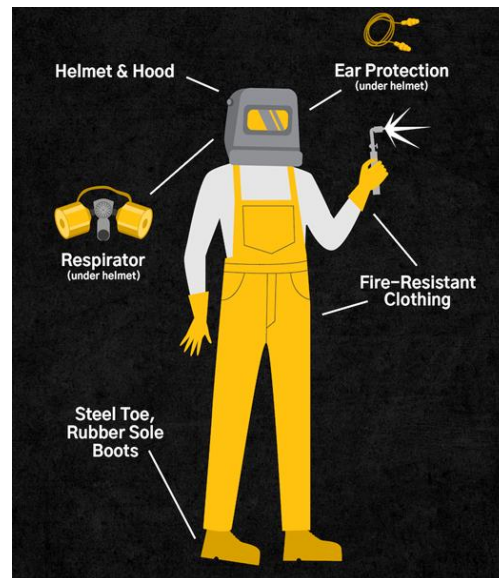


Figure 6. Hot work PPE.

7. Working at Height (WAH)

Working at Height is accessing a location where there is potential for a person to sustain injury by falling. In addition to working above ground level, this includes working over excavations, working on roofs or near skylights or any unprotected edge.

The following are considered Working at Heights:

- a) Working on Ladders;
- b) Working on Scaffolding;
- c) Working on Mobile Elevating Working Platforms (MEWP's);
- d) Working on roofs or open platforms or edges;
- e) Working on any open structure that may lead to injury by falling;

Control measures as specified in the hierarchy of control and used to assist in eliminating or controlling hazards:

- ✓ Elimination - For example, performing work at ground level instead of at height;
- ✓ Substitution - For example, using a MEWP instead of a ladder;

- ✓ Engineering controls - fall prevention must be used in place of personal fall protection systems when possible - for example, installing stairs instead of using vertical ladders or safety railings;
- ✓ Administrative policies and procedures - For example, delivering refresher training to the employees who work at height to improve their knowledge;
- ✓ Personal protective equipment (PPE) - For example, providing fall-arrest systems.

Factors to be evaluated prior to WAH:

- ✓ The physical capabilities of the employees intended to WAH. All workers should be competent, physical capable and have undergone Work at Height Training;
- ✓ Potential fall path, taking into account obstacles (rebar, structures, etc.) below;
- ✓ Work environment (weather conditions, lighting, space, etc.);
- ✓ Access to WAH points;
- ✓ Condition and stability of the existing work surfaces;
- ✓ Proximity to overhead power lines, gas lines or hot steam pipes;
- ✓ Load-bearing capacity of fragile surfaces;
- ✓ Possible objects falling from height onto employees or assets underneath;
- ✓ Equipment to be used (for example: scaffolds, ladders or mobile elevated work platforms (MEWPs)) and the associated hazards;
- ✓ Certification, inspection records and condition of work-at-height equipment;
- ✓ Emergency procedure(s) required in the event of an incident. This must include rapid response to prevent any worker hanging in a harness for a long period, suffering suspension trauma.

Requirements to assist in preventing hazards associated with Working at Height:

- ✓ The use of qualified and inspected PPE and other equipment;
- ✓ Personal Fall Arrest Systems (PFAS) operators with approved specific training.

Portable ladders

The use of portable ladders for working at height is only allowed for short duration of work. In all other cases, alternative means must be provided (e.g., scaffold, MEWPs) instead of using portable ladders.

- ✓ Height of work < 6 meter;
- ✓ Total time on the ladder < 4 hours;
- ✓ The load carried < 10 kg;
- ✓ At least 3 points of contact with the ladder at all time;
- ✓ Work is at less than an arm length from the ladder;
- ✓ Clear and stable weather (no rain, wind below 5 m/s);
- ✓ Ladder maintained and in good condition;
- ✓ Ladder labelled;
- ✓ Ladder inspected before work;
- ✓ Enough room to place the ladder;
- ✓ The ladder is placed that the horizontal distance between the feet and the top support is 1/4 of the working length of the ladder at an angle of 75 degrees.

Scaffolding

Scaffolding is a temporary structure for construction or repair work, which shall be removed when work is complete.

All scaffolds shall display relevant information in the form of a scaffold tag. Scaffold tags shall be located at all scaffold access points. The general purpose of the tag is to tell the intended scaffold user about the status of each scaffold and to document regular inspections. The following scaffold tag designations shall be used:

- ✓ Red scaffold tag, DO NOT USE SCAFFOLD: All scaffolds that are unfit for use, due to condition, busy erecting or being dismantled;

- ✓ Yellow scaffold tag, SAFETY HARNESSSES REQUIRED: This tag shall be used only for scaffolds that are no longer under the process of construction and have been inspected by an Authorized Scaffold Inspector. The required fall prevention measures are not provided (as an example some fixed structure is preventing the ability to install complete hand rails around the perimeter of the scaffold). Any works conducted on a yellow tagged scaffold require the use of PFAS and 100% tie-off at all times;
- ✓ Green scaffold tag, SCAFFOLD SAFE FOR USE: This tag shall be used only for scaffolds that have been inspected by the Authorized Scaffold Inspector and do not require the use of fall protection unless otherwise indicated.

Risks and requirements associated with the use of Scaffolding include:

- ✓ Overloading, collapsing or toppling. The load capacity of scaffolding is determined by a height to base ratio of 4:1, meaning the scaffold can be up to four times the minimal base width. For example, a scaffolding structure with a base width of 3 meters can have a height of up to 12 meters; $3 \times 4 = 12$ meters (Based on the ratio of 4:1). Scaffolding exceeding this ratio need to be certified by a qualified engineer. Manufacturer's specifications shall always be followed.
- ✓ Falls from height, this is the most common scaffolding hazard. A personal fall arrest system or a guardrail system must be utilized at all time during construction and as per scaffold tag specifications;
- ✓ Bad planking, another cause of scaffold-related incidents is unsecured planking. When planks are uncleaned or not secured enough, they might slip off and cause the worker to fall or trip over;

- ✓ Falling tools or materials, scaffolding-related injuries involve being struck with falling debris. Toe-boards and guardrails are an important component of scaffold construction, not only to protect the worker from falling but also to prevent any material from falling off a scaffold and hitting people below.

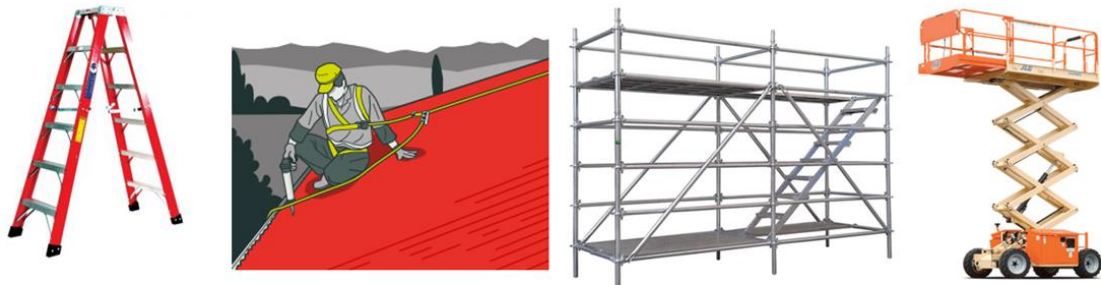


Figure 7. Working from height examples.

Personal Fall Arrest Systems (PFAS):

A Personal Fall Arrest System consist of qualified anchor points, a full body harness with double lanyards with shock absorber connected to a horizontal / vertical lifeline or self-retractable lanyard or self-retractable fall arrestor.

For each work activity where Personal Fall Arrest Systems are applied, the following shall be considered:

- ✓ Proof that PFAS are designed, installed and used by a competent person/s or service provider/s (must be certified by an Authorized Inspection and / or Certification Body);
- ✓ The PFAS shall be designed and installed to achieve the lowest possible Fall Factor, starting from 0 not exceeding 2.0 see fall factor chart;
- ✓ The PFAS shall be designed and installed taking into account maximum intended and allowable load;

- ✓ The PFAS shall be designed and used to ensure the distance is short enough to prevent the user from coming into contact with lower obstacles or ground level or other potential hazards in the event of a fall.
- ✓ 100% Tie-Off must be achieved by the user at all times when using PFAS;
- ✓ Stand-by person assigned for quick response and notification of Emergency Response;
- ✓ Competent person inspection to ensure that the worker is using the system correctly;
- ✓ Working at height activities with the use of PFAS shall not proceed when the wind speed is greater than or equal to 6 Beaufort.
- ✓ Manufacturer specifications and a user manual covering equipment storage, safe operation and inspection requirements shall be available and registered.
- ✓ Emergency arrangements shall be available, taking into account safe rescue methods to reach and secure the suspended worker/s within the time limit before suspension trauma sets-in (depending on situation but usually, 10-20 minutes).

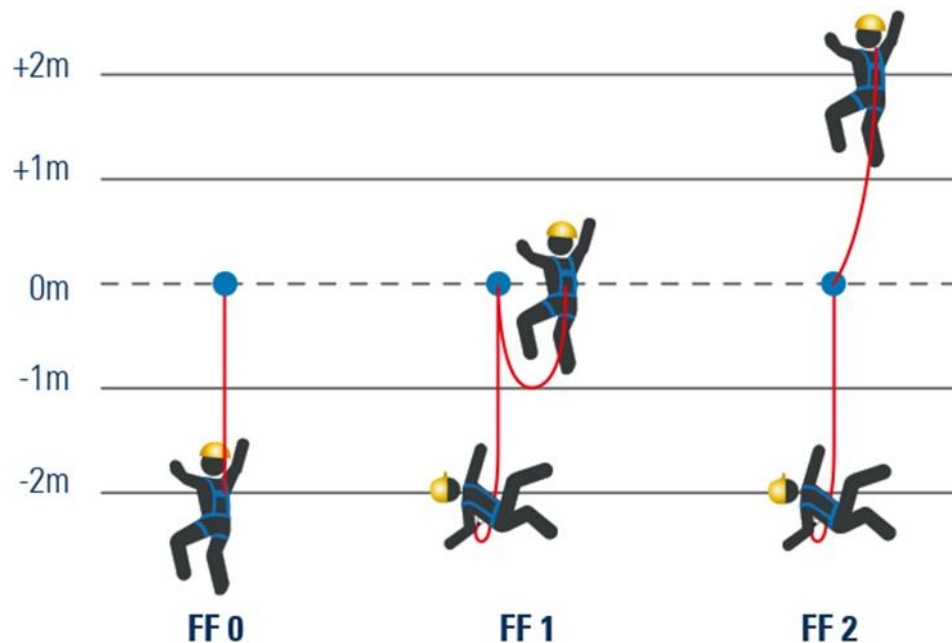


Figure 8. Fall factor chart.

Priority must be given to achieve the lowest FF, starting from 0. No FF > 2 will be allowed.

Anchor Point Selection:

The selection of the type and position of anchor points will depend on the nature and location of the task and the construction of the structure.

Anchor points may consist of an additional scaffold rail, a horizontal lifeline, or any equivalent anchor point that allows authorized Workers to perform their tasks in full compliance with 100% tie-off requirements. Anchor points shall be tested in accordance with a recognized standard or approved by a competent person to ensure that the points are secure and can hold the required load.

Fixed anchor points used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting the required static load in the event of suspension.

Mobile Elevating Work Platforms (MEWPs):

Mobile elevating work platforms are designed to provide a temporary safe platform, which is mobile to easily move from one location to another.

Only a competent person shall be designated to operate the work platform, scissor lift, cherry picker or man-lift. MEWPs shall be used, maintained and inspected in accordance with regulations and per manufacturer's instructions.

Risks associated with the use of MEWPs include:

- ✓ Overturning or collapse of the MEWP;
- ✓ Personnel falling or being thrown from the MEWPs;
- ✓ Workers in the MEWPs trapped against structures;
- ✓ Workers coming in contact with electricity;
- ✓ Mechanical failure;

- ✓ Strong wind;
- ✓ Uneven, unstable ground conditions;
- ✓ Faulty outriggers or outriggers used incorrectly;
- ✓ Personnel or material overloading the carrier;
- ✓ Sudden movement of the carrier or basket caused by an impact (e.g., from a vehicle, from a suspended load);
- ✓ Overreaching from the workers;
- ✓ Climbing into or out of an elevated carrier.

Emergency Rescue

Working at Height activities requires emergency measures to be ready for any event. Considerations as part of permit to work requirements have to be prepared at all times. Suspension rescues of personnel at height shall be considered prior to all WAH activities.

8. Confined Space

A Confined Space is a place, which is substantially enclosed, but not always entirely. Fatalities or serious injury or illness can occur from hazardous substances or conditions within or nearby the space (for instance: a lack of oxygen).

Examples of activities requiring the Confined Space:

- ✓ Electric cuts during elevator installation
- ✓ All enclosed areas such as tanks, manholes, concrete mixer drums, etc.;
- ✓ Limited openings for entry or exit;
- ✓ Not designed for continuous worker occupancy;
- ✓ Certain deep pits may also be classified as a confined space;
- ✓ Any area where workers are present where they cannot readily exit or escape without certain controls ready.

Typical Risks include:

- ✓ Asphyxiation;
- ✓ Fire and explosion risks;
- ✓ Mechanical risks (moving parts);
- ✓ Electrical contact risks;
- ✓ Thermal risks;
- ✓ Engulfment risk;
- ✓ Inward converging walls or downward sloping floors;
- ✓ Quicksand risks (for instance: with grain or barley).

Requirements to assist in preventing hazards associated with Confined Space:

- ✓ An approved Method Statement, Risk Assessment, permission to work in Confined Space;
- ✓ The use of qualified and inspected equipment;
- ✓ PPE as required by the nature of work;
- ✓ Purge the Confined Space should any substance be present before the entry of workers to ensure that no sludge or other deposits will give off hazardous gas, vapor, dust or fume during the course of work;
- ✓ Mechanical ventilation may be necessary to ensure an adequate supply of fresh air;



Figure 9. Confined space safety sign.

9. Lifting and Rigging

Since AMEMWs has experience with lifting and rigging activities, the caution to accidents related to such activities is high.

Planning requirements associated with Lifting Safety:

- a) An approved Lifting Permit including a specific Lifting Plan and Risk Assessment is mandatory for loads above 10 tons, loads above 75% of the safe working limit of the lifting equipment and for all tandem lifts. For all other lifting activities, the General Permit to Work is required with the Lifting Checklist completed on site;
- b) Qualified equipment: All lifting and rigging equipment including shackles, slings, hooks, ropes, chain blocks, etc. shall be certified by a qualified inspection authority and placed on a registered examination program. Equipment owners are responsible for obtaining annual inspections of their lifting and rigging equipment.
- c) Modifications or alterations that may affect the capacity or safe operation of the equipment shall not be made without written approval from the manufacturer;
- d) Defective components shall be quarantined and removed from AMEMWs property. Equipment that is merely discarded may be picked up and used by someone unaware of its defects.
- e) Equipment that is suspected to be unsafe or unsuitable or that does not have a valid inspection certificate shall not be used on AMEMWs premises or any premises related to the project.
- f) Operator Competence: No one shall be permitted to operate any lifting equipment or give instruction to do so, unless they are trained and qualified by a qualified inspection / certification authority in the use and operation of the equipment. Documentation of lifting and rigging operator qualifications must be provided;

- g) Safe Working Limit and Lifting load: A safe rigging and lifting operation requires the accurate information on the weight of the load and rigging hardware, the capacity of the hoisting device, the working load limits of the hoisting rope, slings, and hardware. These factors shall be determined prior to any lifting activity;
- h) Load movement: Establish the pick-up and lay-down areas that are within the crane's load lifting radius prior to starting the lift. Ensure the load path from the beginning of the lift to the lay-down area is clear of obstructions and no other personnel is under the load;
- i) Hazardous wind conditions: Never carry out hoisting or rigging operation when winds create hazards for workers. Assess load size and shape to determine whether wind conditions may cause problems. All lifting activities will cease at conditions above 5 m/s unless specifically approved by AMEMWs technical team.
- j) Calibrated anemometer shall be available;
- k) Electrical contact: One of the most frequent fatal incidents is electrocution. An electrical path can be created when a part of the hoist, load line, or load comes into close proximity to an energized overhead power line;
- l) Ground conditions: Prior to the use of a mobile crane or other approved lifting equipment, the ground condition must be known and suitable for the intended lifting operation;
- m) Barricades and signage shall be established around lifting operations to prevent unauthorized entry;
- n) Two or more separately rigged loads shall not be hoisted in one lift, even if the combined loads are within the rated capacity.

Requirements during the Lifting & Rigging operations:

- a) Taglines shall be used for all lifting operations with competent operators involved;

- b) Suitable gloves must be worn at all times when handling and using a tagline or other lifting equipment;
- c) Workers shall never climb on or ride on a load being hoisted;
- d) Personnel shall not stand or pass under a suspended load;
- e) No other person is allowed to direct the load other than the appointed Rigger;
- f) Hand signals used as communication between the Operator and the Rigger;
- g) When initiating the lift, the load shall be lifted 20 - 30 cm above the ground to visually verify the rigging is correct;
- h) Load charts shall be specific to the particular rigging configuration of each crane, load charts shall be visible and securely positioned.

Sling Angles:

- a) The bearing capacity of any sling is influenced by the rigging configuration and the angles formed. The bearing capacity reduces as the angle increases;
- b) Keep the sling angles at 45° or greater or as determined by the lifting plan when required. Never use a sling at a sling angle not recommended by the sling manufacturer;
- c) Always determine the sling angle as part of the ultimate safe working load;

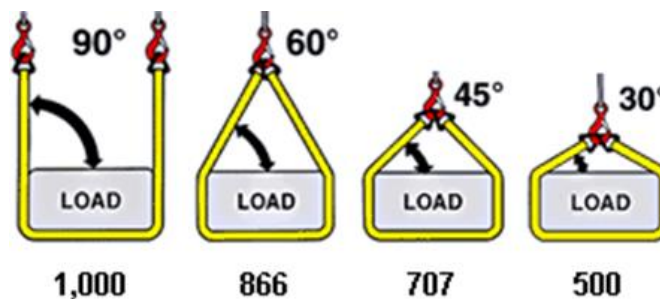


Figure 10. Sling angles for different loads in Kg.

Angles in Degree	Factor	Angles in Degree	Factor
90	1.000	60	0.866
85	0.996	55	0.819
80	0.985	50	0.766
75	0.966	45	0.707
70	0.940	40	0.643
65	0.906	35	0.574

Table 2. Sling Angle and Bearing Capacity Table.

Sling inspection and practices:

- a) Slings shall be visually inspected by the person using the sling each day of their use;
- b) Know the safe working load of the sling and the load;
- c) Never use web slings with a knot;
- d) Never tie two web slings together with the eyes;
- e) Whenever web slings are rigged with angles (including when used as a choke sling), ensure that the appropriate limitations for load are assessed as indicated above;
- f) Protect the webbing from sharp edges that could damage fibers during use and possibly result in a dropped load;
- g) Do not use slings to pull or drag loads;
- h) Make sure that the slings are located correctly on the load;
- i) Be sure to be aware of wire ropes in acid type environments. Such an environment can have a rapid corrosive effect on the wire rope;
- j) The following should be looked for in a pre-use wire rope inspection: Broken wires, severe localized abrasion or scraping or corrosion, kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure. Also look for end attachments that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected;

- k) Check overall length of chain slings to see if it matches up with the length on the tag. If a sling is shorter or longer (considering allowable tolerances) than the length on the tag. The sling must be taken out of service;
- l) When not in use, slings shall be returned to a suitable storage location and not be placed on the ground;
- m) Do not trap slings between load and floor. Place the load on skids or other suitable packing.

Chain/ Lever blocks:

The use of any chain and lever block is regarded as lifting activities which presents risk of personal injury or property damage. That risk is greatly increased if proper instructions and warnings are not adhered too.

- ✓ No person is allowed to operate the chain or lever block without being fully trained, physically fit and authorized to do so;
- ✓ The block must be fitted with various safety devices: load brakes, hook latch, limit switch, emergency stop and shock protection. Prior to using the block, ensure that operators identify and are familiar with these devices;
- ✓ Chain or Lever Blocks attachment points shall be suitably qualified and sufficient for the intended load.
- ✓ Chain and lever blocks are not designed for, and should not be used for, lifting, supporting or transporting personnel;
- ✓ No modification, re-rating or alteration of hoisting equipment is allowed;
- ✓ No person shall stand under a raised load;
- ✓ All loads shall be securely identified and the safe work zone protected below. Barricading or other suitable warning is required;
- ✓ Lifting must always be personally attended, never leave a raised load unattended;

- ✓ Over capacity load lifting is very hazardous and shall never be undertaken. Loads must be verified before lifting;
- ✓ Always inspect the chain or lever block prior to use (this includes registered documented inspections and visual inspections prior to work). Check daily the chain for wear, twists and kinks and that it feeds through block smoothly. Check daily the hook for width increase, safety latch, bolts and nuts). Check quarterly; components, gears, shafts, bearings and brakes.
- ✓ Never operate the chain or lever block if the chain is kinked, twisted or damaged;
- ✓ Never pull the bottom hook into the block housing;
- ✓ Do not expose block to rain or excessive humidity;
- ✓ Chain and lever blocks are designed for manual lifting. Do not use a motor or other mechanical device to lift the load.

10. Working with Electricity

Electricity can easily be fatal or severely injure people and cause damage to property from the effects of fires and explosions. Most electrical incidents occur because:

- ✓ Personnel are working on or near equipment that is thought to be dead but which is live;
- ✓ Personnel are working on equipment known to be live but those involved do not have adequate training or appropriate equipment to prevent injury;
- ✓ Personnel involved have not taken adequate precautions.

All electrical work requires to be covered by a Permit to Work. For medium and high voltage work (>1000 Volts) the Special Electrical Permit to Work is mandatory.

Low voltage electrical work (<1000 Volts) shall be covered by the General Permit to Work.

Common Electrical Hazards:



- ✓ Underground power cables

Underground power cables can be very hazardous during construction of a brewery. They are hidden from view and workers may not know about them until it's too late. It's also impossible to tell by sight whether these cables are live when they are uncovered. Care needs to be taken when carrying out digging tasks on the construction site, particularly if working near buildings. An Excavation Permit to Work is required for all digging activities.

- ✓ Overhead power lines

Overhead power lines or temporary site cables is a serious hazard when machinery or vehicles get into contact with it or is close enough for an arc to conduct electricity. Electricity may be conducted through the equipment as well as through anyone using or touching the equipment at the time.

Contact is usually due to a lack of awareness. The severity depends on the amount of current present.

Extreme care needs to be taken when working close to these cables:

- a) Toolbox communication is required to inform workers of the electrical cables in and around their work areas;
- b) Barricading is required to ensure that the cables are in a protected zone;
- c) Proper cable management shall apply on site, placing cables strategically out of the way. This includes taking into account water deposits due to rain.

- ✓ Electrical systems tools and equipment

Electrical systems and equipment are present on site and it is a serious hazard if not managed correctly.

- a) Only trained and competent operators shall work with these installations and equipment;

- b) Regular documented inspections are required, visual inspections needed before usage, never use electrical equipment that is showing signs of damage;
- c) The use of residual current devices for all electrical tools are mandatory;
- d) No unauthorized connections are allowed from the power distribution panels;
- e) Only authorized personnel may perform installations and connections on site;
- f) Ensure that isolation devices work correctly;
- g) Only use electrical material fit for purpose, for example rather than using domestic sockets use industrial sockets only;
- h) Reduce the supply voltage where possible by using battery operated hand tools;
- i) Always switch off the equipment when not in use.

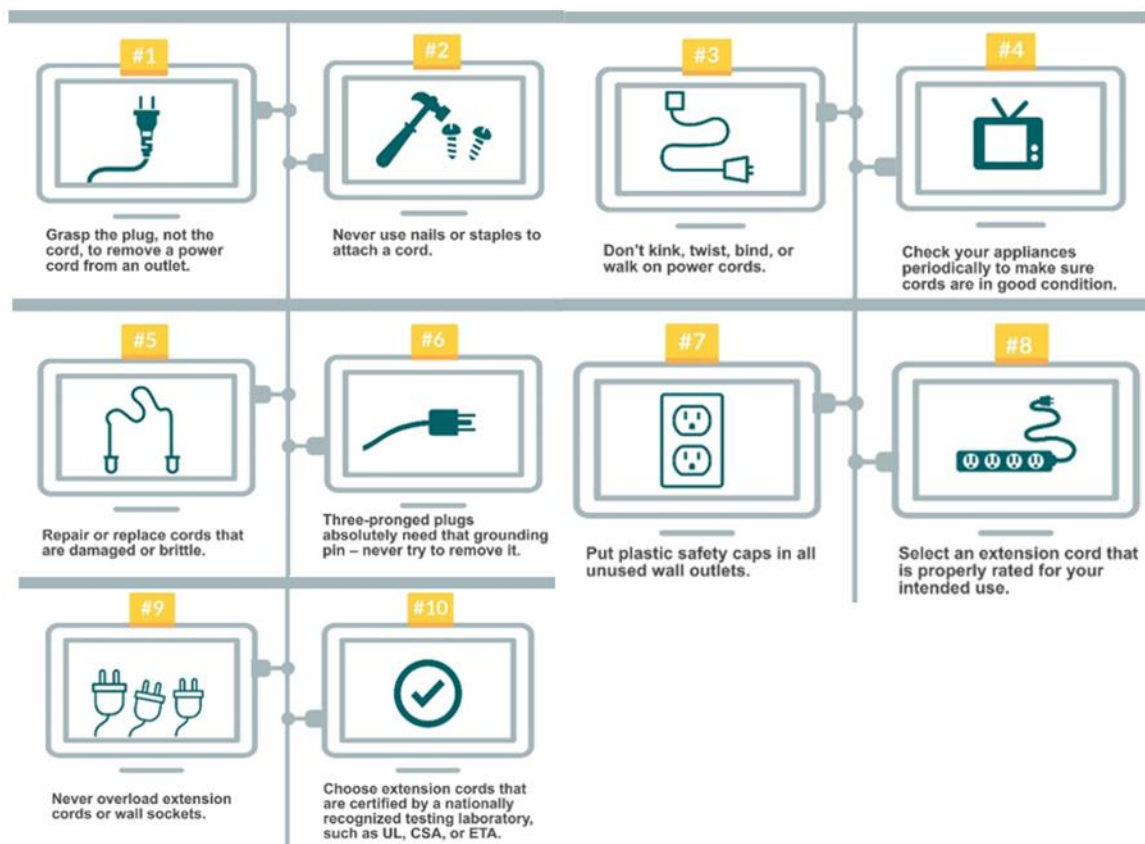


Figure 11. Summary of safety procedures for working with electricity.

11. Lock Out Tag Out (LOTO)

During machine installation, commissioning and maintenance procedures, personnel get into locations with high risks. Employees working with these machines or equipment may be exposed to fatal or serious injuries if hazardous energy is not properly controlled. A sudden release of energy can lead to serious accidents and incidents including:

- ✓ Being hit/captured by the equipment that has been automatically or accidentally restarted;
- ✓ Being hit by parts of the equipment having potential energy stored that is accidentally released (for example: pallet table falling down);
- ✓ Contact with energized electrical conductors;
- ✓ Contact with steam, chemicals or other dangerous materials.

Lock out-Tag out Procedures allow workers to safely complete the work, preventing unauthorized sudden energizing.

Lock Out is:

- ✓ Preventing a de-energized area to be re-energized;
- ✓ Prevent unintended energy release;
- ✓ Prevent unintended start-up of the machine;

Tag out is done to show why and where a lockout is placed and who can remove the lock.

LOTO Steps as required by the Permit to Work:

- a) Review all Hazards and Controls and perform employee briefing;
- b) Notifying effected personnel, verify that it is safe to shut down the effected systems;
- c) Shut down required energy sources;
- d) Isolate the energy source taking note of stored energy that could be released;

- e) Secure energy sources with lock devices and attach the information tags;
- f) Attempt to restart the energy source to ensure the Lock Out is effective;
- g) Work on the Locked-Out systems can proceed;
- h) Verify the work is finished, notify effected personnel and ensure it is safe to restart;
- i) Remove locking devices and tags at energy source;
- j) Remove the isolation at the energy source safely;
- k) Restore energy to the effected systems.

12. Manual Handling

Manual Handling is the transporting or supporting of a load (including the lifting, putting down, pushing, pulling, carrying or moving thereof) by hand or by bodily force.

In effect, any activity that requires an individual to lift, move or support a load, will be classified as a manual handling task. It covers a wide variety of activities including lifting, lowering, pushing, pulling and carrying. If any of these tasks are not carried out appropriately there is a risk of injury.

To help prevent manual handling injuries in the workplace, workers should avoid such tasks as far as possible. However, where it is not possible to avoid handling a load, practical measures should be adopted to avoid injury.

For any lifting activity always take into account:

- a) Individual capability;
- b) The nature of the load;
- c) Environmental conditions;
- d) Training;
- e) Work organization.

Requirements to assist in preventing injuries associated with Manual Handling:

- ✓ Avoid lifting from floor level or above shoulder height, especially heavy loads;
- ✓ Adjust storage areas to minimize the need to carry out such movements;
- ✓ Assess the weight to be carried and whether the worker can move the load safely or needs any help – maybe the load can be broken down to smaller, lighter components
- ✓ Consider to use a lifting aid, such as a forklift truck, electric or hand-powered hoist;
- ✓ Think about storage as part of the delivery process – maybe heavy items could be delivered directly, or closer, to the storage area;
- ✓ For a long lift, plan to rest the load midway on a table or bench to change grip. Keep the load close to the waist. The load should be kept close to the body for as long as possible while lifting;
- ✓ Adopt a stable position and make sure your feet are apart, with one leg slightly forward to maintain balance.

13. Housekeeping

Effective housekeeping can eliminate some workplace hazards and help get a job done safely and properly. Poor housekeeping can frequently contribute to accidents by hiding hazards that cause injuries.

Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly, maintaining walkways and work areas free of slip and trip hazards and removing of waste materials e.g., wood, nails, concrete, cardboard and other hazards from work areas. It also requires paying attention to important details such as the layout of the workplace, the adequacy of storage facilities and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

Good Housekeeping Practices involve:

- ✓ Ensuring work areas are kept clean and tidy and access and egress points are kept clear;
- ✓ On completion of any work or when leaving a worksite, ensure the area is left in a safe and secure manner, with appropriate warning signs displayed;
- ✓ Tools and materials to be kept in designated storage areas after use;
- ✓ Material stored on site needs to be identified and visibly barricaded;
- ✓ Keep access to stairs, emergency exits and firefighting equipment clear and accessible at all times;
- ✓ Prevent falling objects that may hit workers or equipment by installing toe boards and placing tools and materials away from edges.

14. Non-Destructive Testing (NDT)

All governmental laws, standards and requirements pertaining to the use, storage or handling of a radiation source must be complied with.

All NDT and Radiation work shall be pre-approved by the project Manager and a dedicated Kick-Off meeting will be requested prior to work.

Requirements for NDT:

- ✓ NDT must always be performed under controlled conditions, following an approved Method Statement, Risk Assessment and General Permit to Work indicating all safety requirements pertaining to the NDT conditions;
- ✓ Qualified and inspected PPE and other equipment;
- ✓ Trained and certified operators with up-to-date dosimeter registers;
- ✓ Minimum safety distances will be determined as per source strength and other conditions and indicated in the Permit to Work

15. Site Safety Rules Summary

- ✓ Always wear the required PPE as instructed by the Permit to Work. At a minimum, reflective vest, safety helmet and boots. All workers shall carry a pair of safety glasses and earplugs with them;
- ✓ Approved Permit to Work required for all work activities;
- ✓ Follow Safety Sign instructions;
- ✓ Site speed limit will be strictly adhered to – 20 Km/Hr on access roads;
- ✓ ZERO Tolerance towards Alcohol and Drugs – Random tests will be performed prior and during work activities and may also be done after incidents;
- ✓ Eating and drinking within the project site is not allowed in order to avoid vermin, rats and dogs;
- ✓ No sleeping on site;
- ✓ The number of vehicles on the construction site shall be kept to an absolute minimum. Employees are requested to park at designated areas and walk rather than drive to site;
- ✓ Keep all roads, access doors and fire hydrants clear. Notify the Installation Representative before blocking any roadway;
- ✓ No Smoking on site, only in designated smoking shelters or zones;
- ✓ All mobile equipment is required to have with audible reversing alarms and flashing beacons;
- ✓ Passengers not permitted to ride on mobile equipment;
- ✓ All equipment will be provided with fire extinguishers;
- ✓ Hoses, pipes and cables will be kept clear of traffic and out of pedestrian routes;
- ✓ Keep the site clean, do proper housekeeping;

- ✓ Keep vigilant all the time and watch out for moving cranes or other mobile equipment;
- ✓ Before using any electrical installation or tool, check the condition of its electric cables;



