

INDUSTRIAL SAFETY

Safety:-

Safety means saving from injury. In industrial context, it is the completion of work without **accident**.

Accident:-

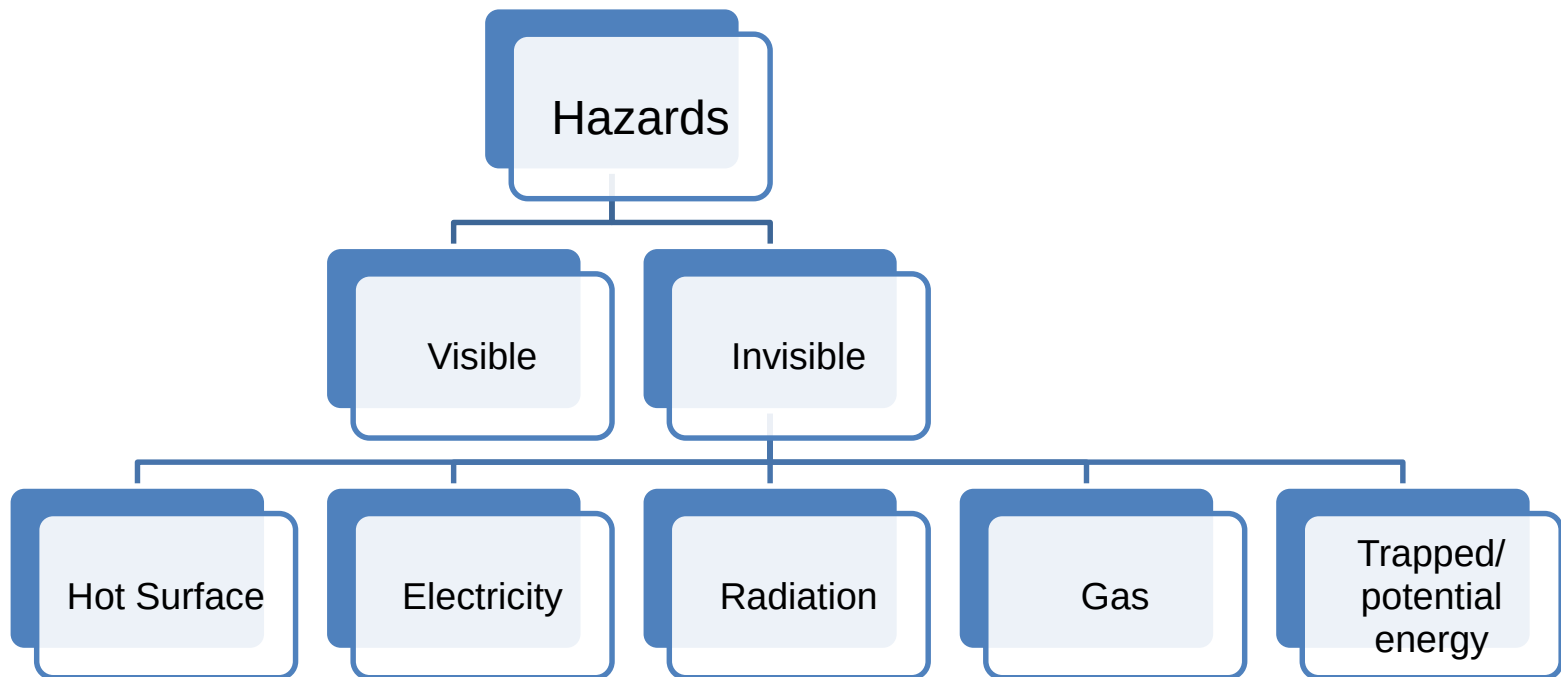
Accident is an undesired event. It brings harm to the body and loss of property.

Accident could cause -

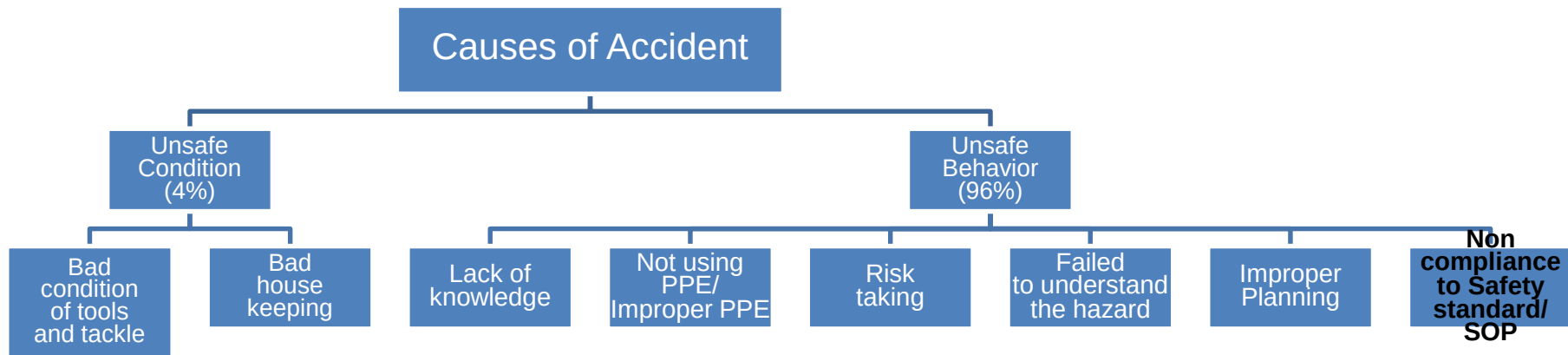
- i. Physical injury to the workmen
- ii. Damage to property
- iii. Wastage of raw-materials

Hazard:-

Hazard means the object or condition which causes accident or have potential to cause accident.

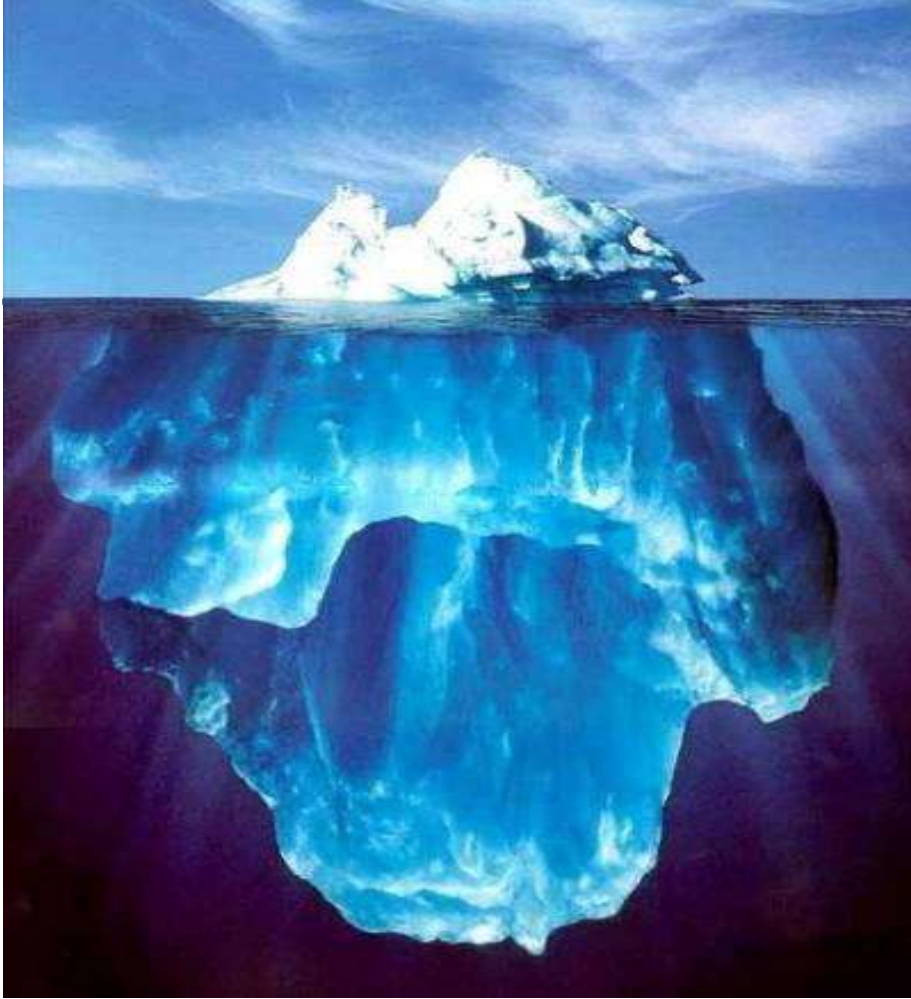


Information on **invisible hazards** must be obtained for prevention of accidents.



Accident is **never desired** but 96% of accidents are caused due to **Human Errors**.

Iceberg Analogy



Fatality

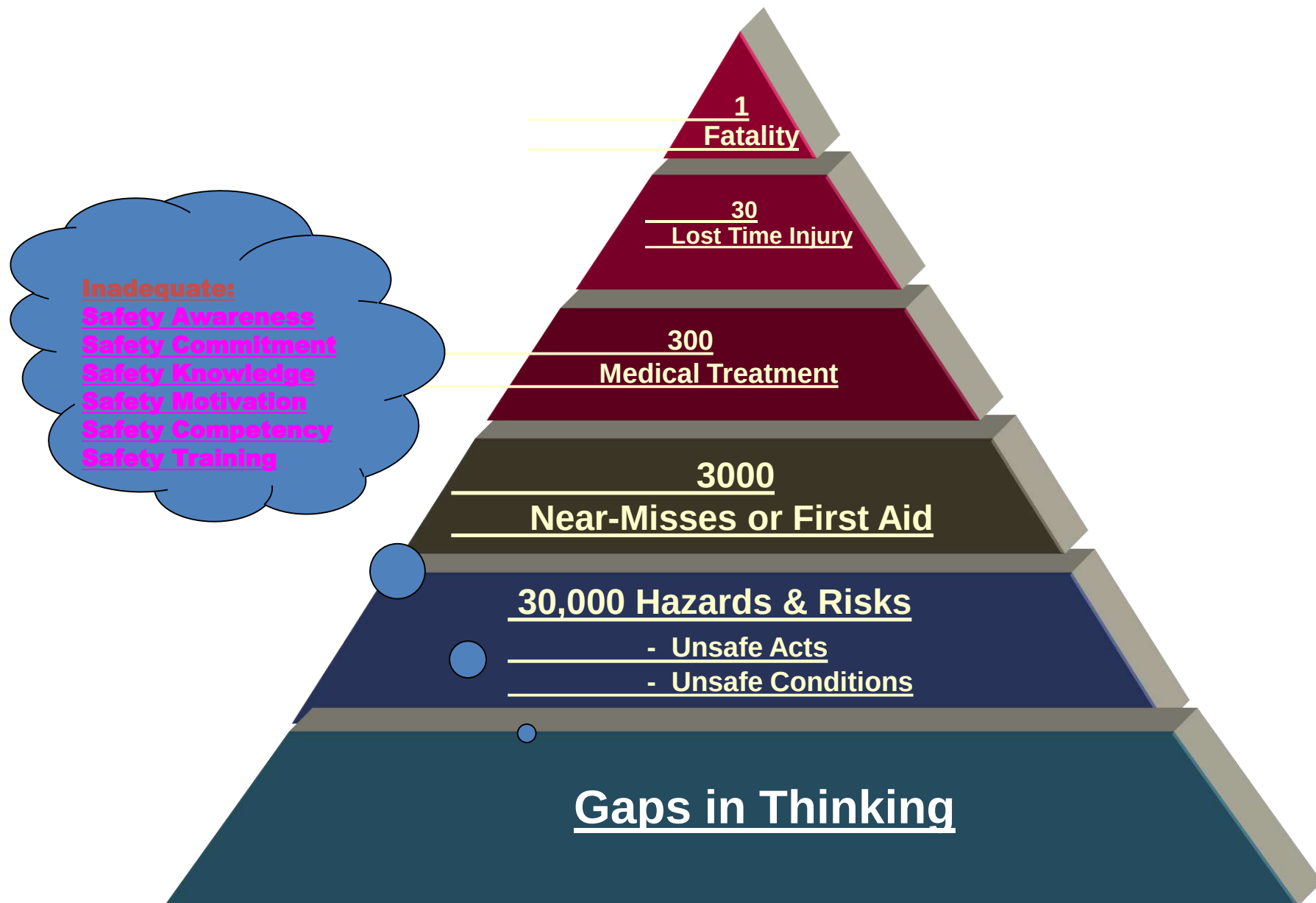
Lost Time Injuries

Medical cases

First Aid cases

Unsafe Acts

Unsafe Conditions



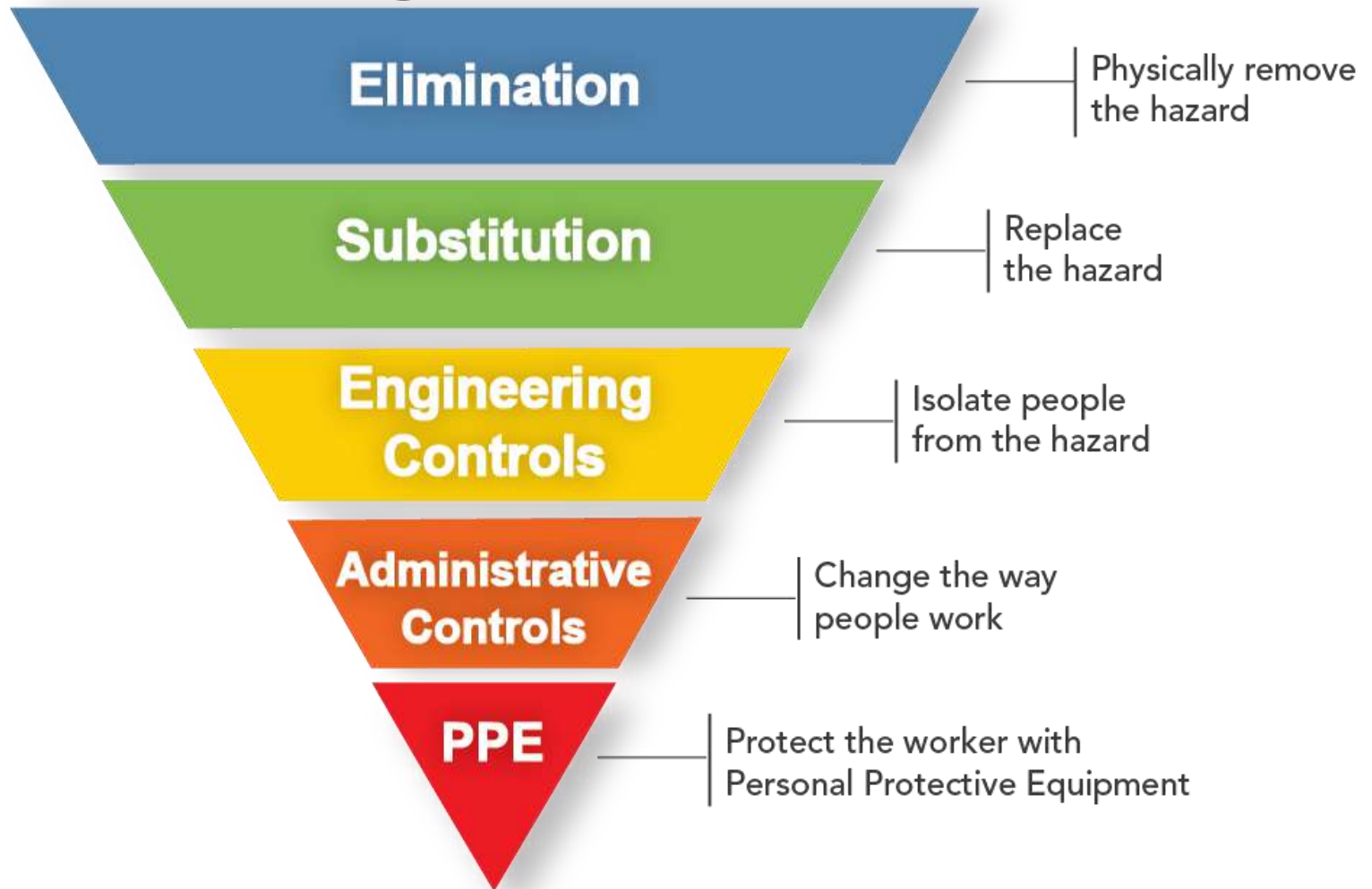
Control of Hazards

Hierarchy of Controls

Most
effective



Least
effective



General Safety Introduction

- Hazard Communication
- Respirators
- Personal Protective Equipment
- Hearing Conservation
- Fall Protection
- Lockout Tagout
- Confined Space
- Fire / Fire Extinguishers
- Basic First Aid (not certified training)
- Blood Borne Pathogens
- Heat/Cold Stress
- Good Safety Practices

Hazard Communication

- “The Right To Know”
- Chemical Hazards
- Written Program
- Training
- Container Labels
- Material Safety Data Sheets (MSDS)
- Inventory List



Chemical Hazards

- Flammable/Explosion
 - Flash point
 - LEL
- Toxic/Poison
 - Acute / Chronic
 - Local / Systemic
 - Routes of entry
- Reactive
- Corrosive



Container Labels

- Shipping Labels
- Manufacturer's Warnings
- NFPA Diamond / HMIS Labels
- Health, Fire, and Reactive Hazards

HMIS Label

●	HEALTH
●	FLAMMABILITY
●	REACTIVITY
○	PROTECTIVE EQUIPMENT

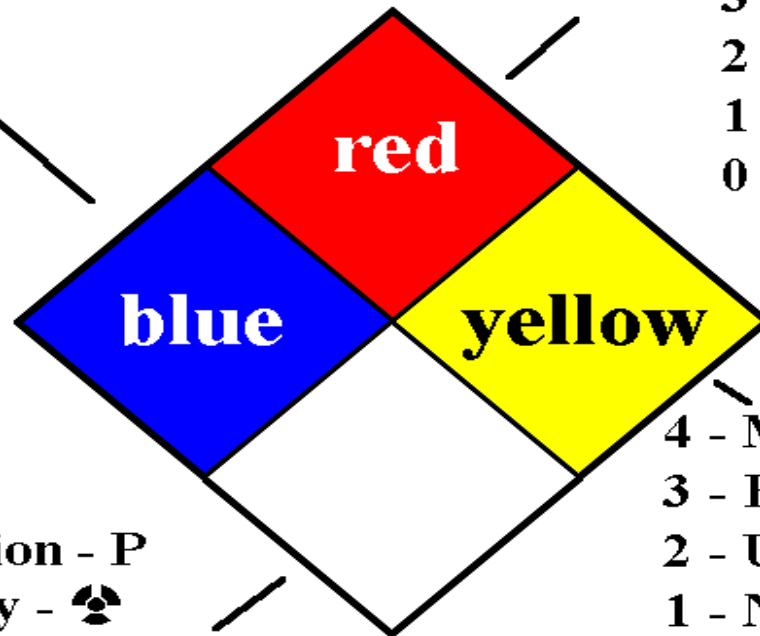
NFPA Diamond

Health

- 4 - Severe
- 3 - Serious
- 2 - Moderate
- 1 - Slight
- 0 - None

Special Hazards

ACID
ALK
COR
OXY
Polymerization - P
Radioactivity - ☢
Use No Water - W



Flammability

Flash Points

- 4 - $<73^{\circ}\text{F}$
- 3 - $<100^{\circ}\text{F}$
- 2 - $<200^{\circ}\text{F}$
- 1 - $>200^{\circ}\text{F}$
- 0 - Will not burn

Reactivity

- 4 - May Detonate
- 3 - Explosive
- 2 - Unstable
- 1 - Normally Stable
- 0 - Stable

Material Safety Data Sheets

- Identity of Material and Manufacturer
- Hazardous Ingredients
- Physical and Chemical Characteristics
- Fire and Explosion Hazard Data
- Reactivity Data
- Health Hazard Data (Limits, Symptoms, etc.)
- Precautions for Safe Handling
- Control Measures and First Aid

Respiratory Hazards

- Toxic
 - Dusts, fumes, and mists (particulate)
 - Gases and vapors
- Oxygen deficiency or enrichment
- Immediately Dangerous to Life and Health (IDLH)



Respiratory (Occupational) Exposure Limits

- Permissible Exposure Limit - OSHA PEL
- Threshold Limit Value - ACGIH TLV
- Time-Weighted-Average - TWA
- Short Term Exposure Limit - STEL
- Ceiling Limit - TLV-C or PEL-C
- “Skin” notation
- Protection for a Working Lifetime

Respiratory Protection

- Air-Purifying (APR)
 - Dust Mask
 - Half Face
 - Full Face
 - Powered Air-Purifying Respirators (PAPR)
- Supplied Air (SAR)
 - Air-line
 - Hood style
 - Facepiece style
 - Half Face
 - Full Face
 - Escape provisions
 - Self Contained Breathing Apparatus (SCBA)



Respirator Protection Factors (PF)

- Air-Purifying (APR)¹
 - Dust Mask - 10
 - Half Face - 10
 - Full Face - 50
 - Powered Air-Purifying Respirators (PAPR) - 100

¹-Negative pressure in face piece

- Supplied Air (SAR)²
 - Air-line
 - Hood style - 100
 - Facepiece style - 1000
 - Escape provisions - >10,000
 - Self Contained Breathing Apparatus (SCBA) - >10,000

²-Positive Pressure in face piece

Limitations



- Air-Purifying (APR)
 - Concentration of contaminant (PF)
 - Oxygen level (19.5%-23.5%)
 - Cartridge useful life
 - Warning properties (some substances can't be detected or are too toxic)
- Supplied Air (SAR)
 - Concentration of contaminant (PF)
 - Must provide "Grade D" air source
 - More cumbersome / unwieldy
 - Mobility (air line style)
 - Length of work time (SCBA style)

Respirator Program Elements

- Written Procedures
- Selection of Respirators
- Training of Users
- Fit-Testing
 - Initial
 - Annual
 - Changing brand
- Cleaning and Storage
- Maintenance
- Inspection
- Work Area Surveillance
- Medical Fitness
- Program Auditing
- Using Certified Respirators
- NO BEARDS
- No Glasses with Full Face

Personal Protective Equipment

- Required when engineering or administrative controls are inadequate.
- Must be properly selected and worn.
- Training is required.
- Pre-Job analysis
 - Hazard Assessment



Head Protection

- Hard Hats (Safety Helmets)
 - Class A - Limited voltage protection
 - Class B - High voltage protection
 - Class C - No voltage protection
 - Class D - Firefighter's helmet
- Bump Caps
 - Not recommended



Eye and Face Protection

- Safety Glasses (minimum requirement)
- Goggles - better protection for chemicals, splashes, dusts, or projectiles.
- Face Shield - better for splashes or projectiles
- Chemical Splash Hood
 - shoulder length or longer



Hand and Foot Protection

- **Gloves / sleeves**

- General duty
 - Cotton, leather
- Sharp objects
 - Leather, kevlar
- Cuts
 - Kevlar
- Chemical
 - Multiple types

- **Shoes / Boots**

- Steel toe
 - Compression, puncture
- Metatarsal guards
 - Protects top of foot behind toe
- Chemical resistant
 - Prevents contact with chemicals

Chemical Protective Clothing

- Qualities

- Puncture resistance
- Wear resistance
- Tactility
- Degradation
- Permeation



- Types

- Full Encapsulating suit
- Splash suit
- Coveralls
- Hoods
- Gloves
- Boots
- Boot / Shoe covers

Protective Clothing Materials

- Tyvek (white suits)
 - dusts, dirt, grease
- Saranex
 - coated tyvek, better for mild chemicals
- Polyethylene
 - alternative to tyvek
- PVC
 - rain suits, splash suits
 - moderate chemicals
- Neoprene
 - acids, caustics, solvents
- Butyl rubber
 - resists gases
- Nomex
 - flame protection
- Kevlar
 - cut protection
- MANY OTHERS

Levels of Protection

- Level A
 - full encapsulating suit
 - SCBA or SAR
 - Gloves, boots, hat, etc. as needed
- Level B
 - Chemical Suit (CPC)
 - SCBA or SAR
 - Gloves, boots, hat, etc. as needed
- Level C
 - Chemical Suit (CPC)
 - Air purifying respirator
 - Gloves, boots, hat, etc. as needed
- Level D
 - Work uniform
 - Hard hat
 - Safety glasses
 - Gloves, etc. as needed

Hearing Conservation

- Hearing Loss
 - Disease
 - Age
 - Excessive Noise
 - workplace
 - environmental
 - recreational
- Other Effects of Noise
 - Elevated blood pressure, stress, sleeplessness



Noise Levels

- Measured in decibels (dB)
 - Whisper - 10-20 dB
 - Speech - 60 dB
 - Noisy Office - 80 dB
 - Lawnmower - 95 dB
 - Passing Truck - 100 dB
 - Jet Engine- 150 dB
- OSHA Limit (PEL) - 85 dB



Noise Exposure

- Continuous
 - constant level over time
- Intermittent
 - levels vary over an area or start and stop
- Impact
 - sharp burst of sound (nail gun, hammer)

Hearing Protectors



- Ear Plugs - preferred (NRR* 20-30 dB)
- Ear Muffs - 2nd choice (NRR 15-30 dB)
- Double Hearing Protectors (plugs and muffs) (NRR 30-40 dB) used for levels over 115 dB

(*NRR = Noise Reduction Rating - an approximate decibel reduction provided by the protector in lab conditions. Subtract 7 dB for approximate “real world” attenuation)



Audiometric Testing

- Initial Testing - Baseline for reference
- Annual Testing - periodic monitoring
- Performed when exposure exceeds OSHA limit
- Assures protection is adequate
- Evaluation is age-adjusted



Fall Protection



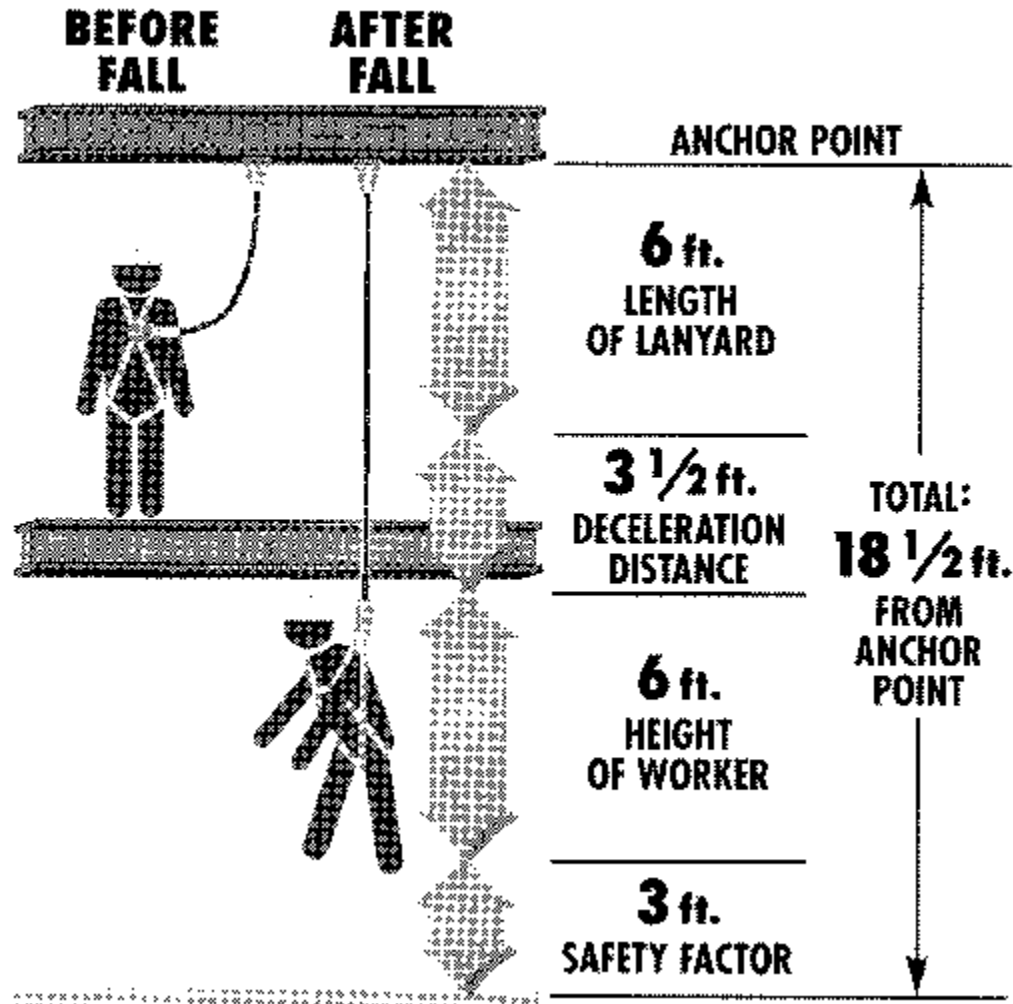
- Any open edge higher than six (6) feet
 - Guardrail System
 - Safety Net System
 - Personal Fall Arrest System
- Any fixed ladder higher than 20 feet
 - Ladder Safety Device (with body harness)
 - Safety Cage with offset landings every 30 feet

Personal Fall Arrest System

- Full Body Harness
- Lanyard (regular or retractable)
- Shock Absorber
- Locking Snap Hooks (no single action)
- Lifeline (as needed)
- Anchorage
 - Must hold 5000 lbs.



Fall Clearance (not a sale!)



Scaffolding

- Erected by “Competent Person”
- Sound, rigid footing
- No overloading
- Scaffold Grade
Planking
- Railings / toeboards
- Tie-off if no railing
- Access ladders
- Get down from “rolling” scaffold to move it
- No portable ladders on scaffolding

Portable Ladders

- Use only approved ladders
- Inspect before use
- Use both hands
- One person only
- Firm, level footing
- Do not use as platform or scaffold
- Use fall arrest if > 6 ft. working from ladder
- Secure top of extension ladders
- Extend 3 feet above access or working level
- Use 4:1 lean ratio



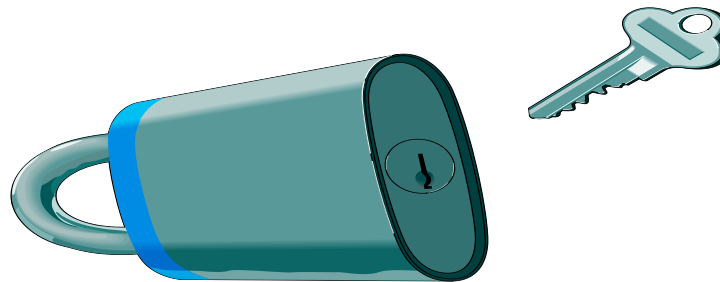
Lockout/Tagout

- Control of Hazardous Energy
 - Electrical
 - Mechanical
 - Thermal
 - Pressure
 - Chemical
 - Kinetic / Gravity
- Prevention of injuries caused by release of Hazardous Energy



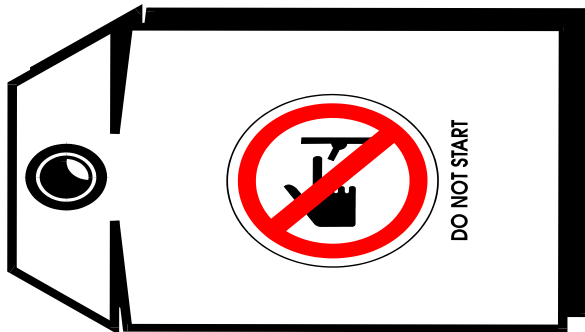
Lockout

- Lock device applied to energy control point
- A positive means to secure isolation point
- Individual responsible for own lock & key
- Preferred method



Tagout

- Tag device applied to energy control point
- Used in conjunction with Lockout
- Used when Lockout not feasible
- Name, date, time, purpose, etc.



Performing Lockout/Tagout

- Preparation
 - Identify the energy source(s)
 - Determine how to control the energy
 - Dissipate residual energy
 - Block components subject to movement
- Shutdown Equipment
 - Follow normal stopping procedures
 - Allow motion to stop

Applying Lockout/Tagout

- Close or shut off all energy sources
- Apply locks and/or tags
- Verify isolation - “Try”
 - Try the switch
 - Try the start button
- Contractors may need assistance or procedures to identify all energy sources



Removing Lockout/Tagout

- Remove tools and equipment
- Replace guards and covers
- Check for all clear
- Remove your locks and tags
- Other locks & tags may remain
- Notify responsible party of completion

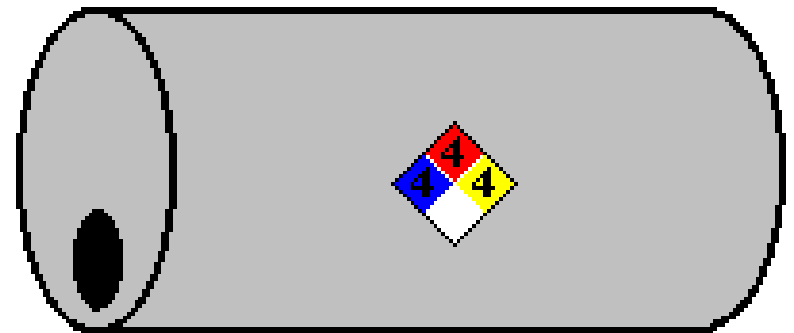
Confined (Permit) Space Entry



- OSHA Definition
 - Limited means of entry or exit
 - Not intended for human occupancy
 - May / could contain a hazardous atmosphere
 - Contains engulfment or entrapment hazards
 - Contains other hazards
- Tanks, vessels, storage hoppers, pipelines, manholes, tankers, bins, excavations, etc.

Atmospheric Hazards

- Oxygen Deficiency / Enrichment - below 19.5% or above 23.5%
- Flammable / Explosive - LEL above 5%
- Toxic - above PEL, unknown, or IDLH
- Control with testing, ventilation, and/or PPE



Other Hazards

- Hazardous Energy - Lockout / Tagout
 - Electrical, Thermal, Mechanical, Pressure, Chemical
- Entrapment - plan for avoidance and retrieval
- Engulfment - plan for avoidance and retrieval
- Rescue - plan for retrieval, must have Attendant and communications

Confined Space Permits

- Facility issued
- Contractor issued
- Supervisor prepares
- Sign In / Out
- Atmospheric testing
- Hazard controls
- Renew when expired



Entrants, Attendants and Supervisors

- Entrants
 - Enter the space
 - Perform the work
 - Exit on Attendant's orders
- Supervisor
 - Perform air monitoring
 - Control other hazards
 - Complete permit
- Attendants
 - Be present continuously
 - Maintain headcount
 - Maintain contact with entrants
 - Orders evacuation, activates rescue
 - Prevent unauthorized entry

Confined Space Ventilation

- Positive - blowing air into the space, exhaust is through openings
- Negative - pulling air out of the space, exhaust is through blower
- Explosion-proof equipment if needed
- Purging / Inerting - inert gas (nitrogen, carbon dioxide, argon) used to replace oxygen atmosphere in space for HOT work

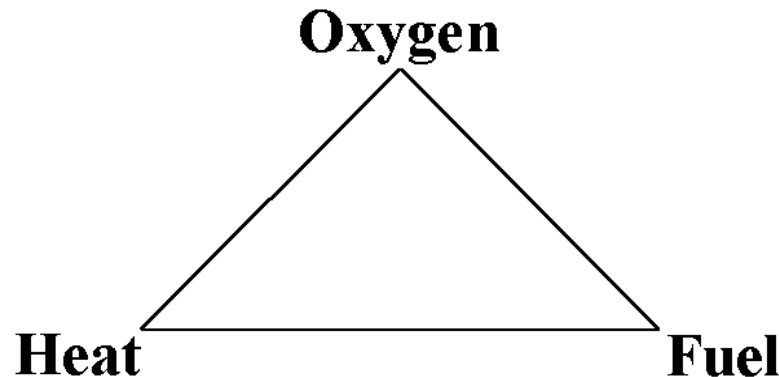
Special Equipment - Confined Space Entry

- Full Body Harness – often required
- Lifeline (Retrieval Line)
- Mechanical Retrieval System - required for vertical entries exceeding five (5) feet
- Fall Protection Anchorage
- Testing meters
 - Oxygen
 - Combustible gas
 - Toxic chemicals



Elements of Fire

- Elements of Combustion (Fire Triangle)
- All required for a fire to occur.
- Trend is to include “Chemical Reaction” as fourth element (Fire Tetrahedron).



Tetrahedron is a 3-D triangle – a triangle base pyramid.

Fire Properties & Chemistry

- Fuel must release gases/vapors – may require heating. (Ray Bradbury – Fahrenheit 451)
- Fuel gases must mix /w Oxygen in proper proportion (Lean / Rich - Flammable Range).
- Must be a source of ignition.



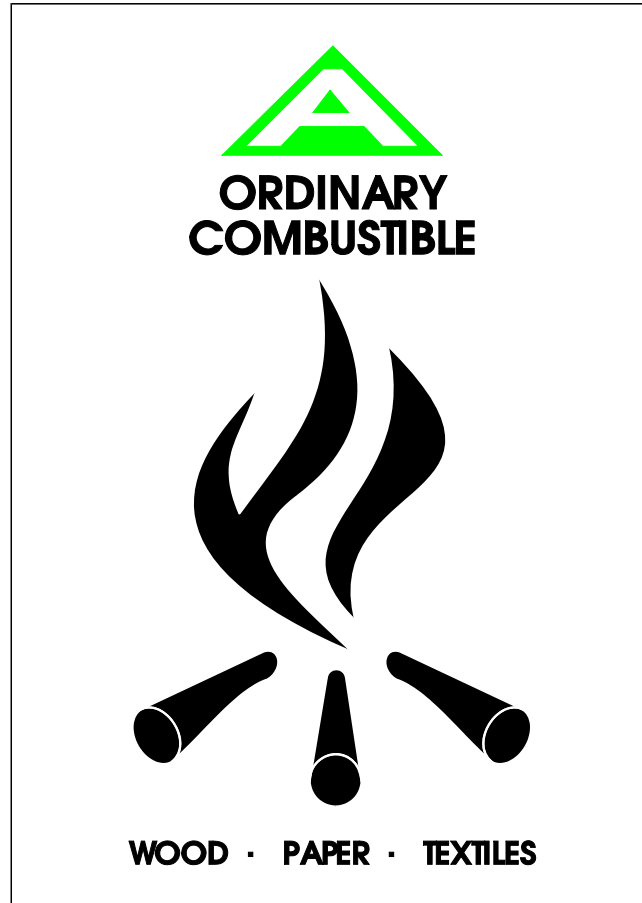
Fire Terms

- Flash Point
- Flammable Range (Lean/Rich)
- LEL/UEL (LFL/UFL)
- Ignition Temperature
- Flammable vs. Combustible liquids
- Bonding and Grounding



- 1 - **Flash Point** – minimum temperature a fuel must be heated before it will ignite
- 2 - **Flammable Range (Lean/Rich)** – when there is an appropriate fuel/air mixture for combustion I.e. not too lean (too little fuel), not too rich (too much fuel)
- 3 - **LEL/UEL (LFL/UFL)** – Lower Explosive (Flammability) Limit / Upper Explosive (Flammability) Limit. These are the upper and lower limits of the Flammable Range.
- 4 - **Ignition Temperature** – How hot the ignition source has to be – usually higher than the flash point.
- 5 - **Flammable vs. Combustible liquids** – Flammable liquids have flash points less than 100F for OSHA rules, 140F for DOT rules, and 140F for EPA Hazardous Waste rules (EPA uses the term “ignitable” instead of “flammable”). Combustible liquids have flash points higher than those. Flammable liquids are at or above flash point at normal/ambient temperatures.
- 6 - **Bonding and Grounding** – refers to procedures to dissipate static electricity during handling or transfer of flammable/combustible liquids. Bonding means to electrically bond 2 containers. Grounding means to electrically connecting them to ground.

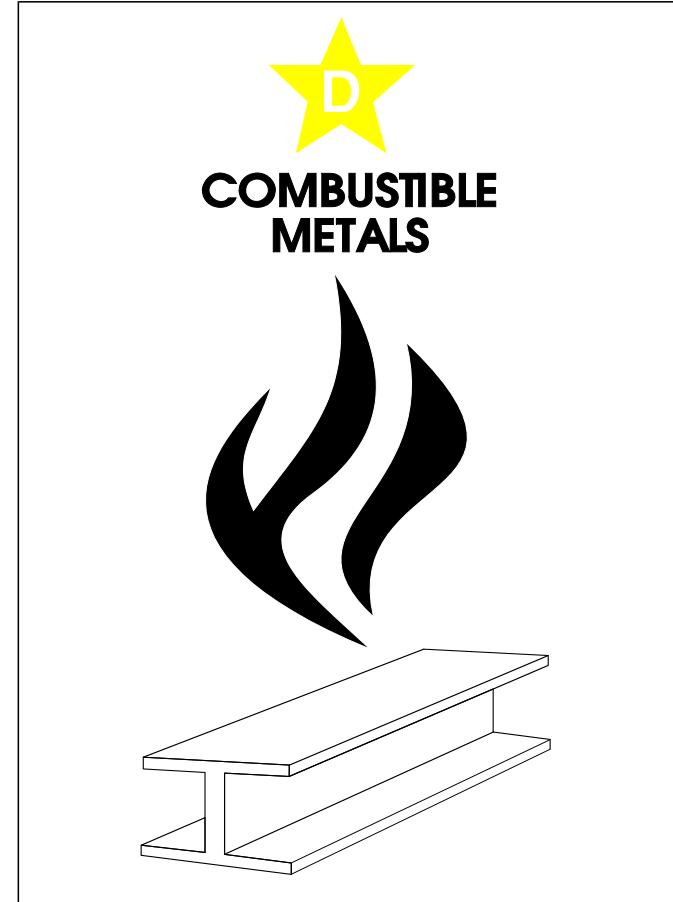
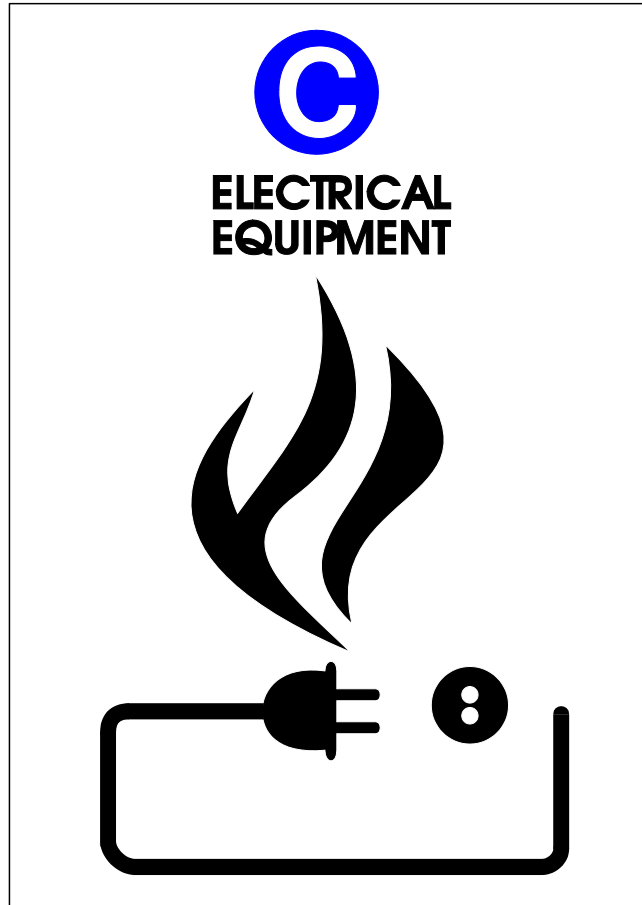
Classes of Fires



Class A – most common fire. A burning house is a class A fire.

Class B – at home would occur with household chemicals (paint, strippers, solvent cleaners, etc.) or fuels (gasoline, oils, etc.) or in the kitchen with grease.

Classes of Fires



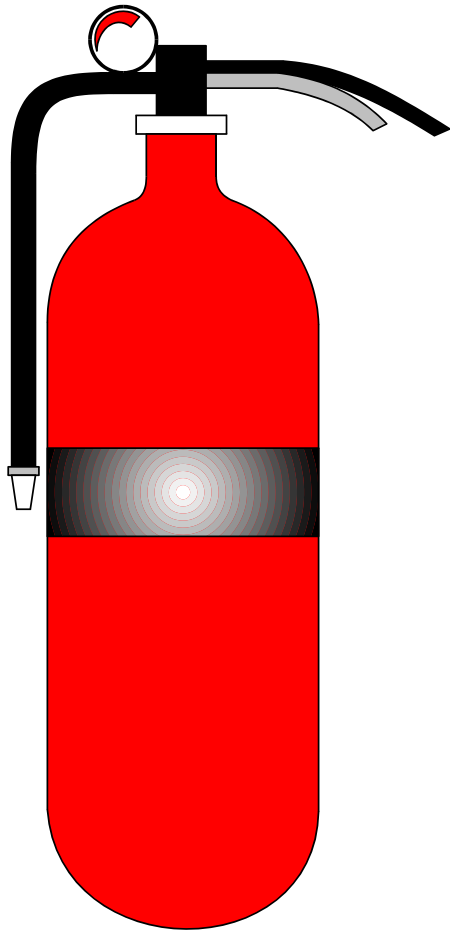
Class C – danger from live electricity. GET POWER TURNED OFF.

Class D – many metals will burn magnesium, aluminum, metallic sodium, are examples. Metal burns easier if it is in powder form or chips. Putting water on a metal fire is very dangerous – it may explode.

Fire Extinguishant Materials

- Water - class A only - cools /removes heat
- Dry Chemical - class A, B, or C - interferes with chemical reaction
- Carbon Dioxide - class A, B, or C (usually C) - removes Oxygen / smothers fire
- Halon – (being phased out - ozone) class A, B, or C (usually C) - removes Oxygen / smothers fire
- Metl-X - class D only - specialized dry chemical for metal fires
- Foam – Class B, holds down vapors

Fire Extinguisher Features



- Operating lever
- Locking pin
- Pressure gauge
- Discharge nozzle
- Label
 - type of extinguisher (A,B,C,D)
 - instructions

Fire Extinguisher Use

- Select correct extinguisher for class of fire
- Pull the locking pin
- Aim at base of fire
- Squeeze and hold the discharge lever
- Sweep from side to side
- CAUTION - monitor the area, the fire could re-ignite
- Always notify supervisor of extinguisher use so it can be replaced or recharged and the fire investigated



Basic First Aid

- Shock
 - Lay victim down
 - Keep victim warm
 - Keep victim calm
 - Get assistance
- Bleeding
 - Use clean bandage
 - Apply pressure
 - Elevate wound
- Burns
 - 1st Degree - redness only, flush with cool water
 - 2nd Degree - blisters, place damp bandage, use no ointments
 - 3rd Degree - white or charred, use dry bandage
 - 2nd or 3rd - get medical attention

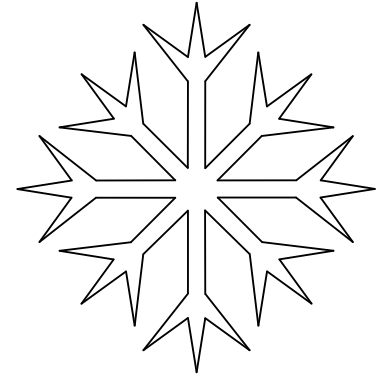
Basic First Aid (cont.)

- Fractures
 - Closed fractures - (no protruding bones), immobilize
 - Open fractures - immobilize, control bleeding
- Head and Neck Injuries
 - DO NOT MOVE VICTIM
- Chemical Burns
 - Flush with water for 15 minutes minimum
- Bites and Stings
 - Be aware of bee sting allergies
 - Poisonous bites - seek medical attention

Bloodborne Pathogens

- Aids
- Hepatitis
 - Hep-B vaccines for designated persons
- No contact with blood or body fluids
- Wear protective equipment, especially gloves & safety glasses
- Hospital / Laboratory Waste - “Red Bag”
- Sharps disposal

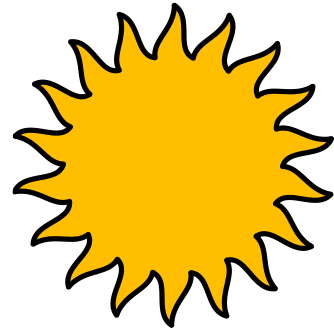
Temperature Stress - Cold



- Dress in layers
- Limit exposed skin
- Frostbite - localized frozen tissue
 - Do not rub area, limit motion, warm slowly
- Hypothermia - lowered body temperature
 - Remove wet clothing, use dry blankets
- Seek medical attention

Temperature Stress - Heat

- Sunburn - keep skin covered
- Heat Cramps - drink dilute “Gatorade”
- Heat Exhaustion - heavy sweating, cool skin
 - Cool victim, seek medical attention if vomiting
- Heat Stroke - medical emergency
 - Hot, dry skin, rapid then weakening pulse
 - Cool victim immediately



Good Safety Practices

- Inspect work area daily
- Be an observer - stay alert
- Housekeeping, Housekeeping, Housekeeping
- Use your best safety device - THINK
- If you're not sure - ASK someone!!
- Report Injuries/Incidents/Illnesses
- Report safety issues to the safety committee

Module - 1

BARRICADING

Definition of Barricade

- Barricades are warning devices
- alerts others of the hazards created by construction activities,
- should be used to control traffic, both vehicular and pedestrian,
- ensure safely through or around the work site.

Purpose of this Standard

- To provide a safety guideline

- for selection and

- use of appropriate barricade

for various type of construction, demolition work.

Associated Hazards

- **Fall.**
- **Injury.**
- **Damage to vehicle and equipment.**
- **Fire .**
- **Electrical hazards .**

General Requirements

- Contractors are responsible for the installation of barricades.
- Consultants, site-in-charge from E&P Division and Departments are responsible **to ensure that the work site is properly barricaded by the contractors.**

General Requirements

Substantial barricades shall be provided



And for DEMOLITION site

General Requirements

Prevent trespassing into vital installations as per the requirement of prevailing laws



General Requirements

An opening measuring **30 cm or more in its least dimension**, in any floor, platform, pavement or yard through which person may fall; such as hatch way, stair or ladder opening, pit or large manhole should be barricaded.



Man hole



Lift Well



Floor Opening

Types of Barricades

Barricades can be classified **into two** groups

Indicative Barricades



Safety Tapes



Cone



Road Runner

Protective Barricades



Guard Rails



Fencing

General Requirements

-  All barricades shall be visible from a safe distance, to alert people well in advance.
-  Caution board, division board, shutdown board to be displayed at both end of barricade.
-  No material to be projected beyond barricades.
-  Only authorized persons shall remove the barricades once the job is complete.

Barricading Construction Sites

- Wherever construction debris is dropped the area is to be barricaded.

These drawings are attached to the standard for easy access.

- Areas with temporary wiring operating at more than 600 volts shall be barricaded with **indicative barricade** comprising “Red-White” safety tape, if the job requires **at most one day** to complete.

If job requires longer time, then the site is to be barricaded with **protective barricades**.

Plastic barriers must **not** be used to barricade the work area.

Barricading Construction Sites

The swing radius of the rotating superstructure of cranes or other equipment is to be protected using 2 strands of minimum 50 mm wide 'Red-White' safety tapes.

One strand at 300 mm from ground

Another at 1000 mm from ground



Barricading Construction Sites

Excavations – A protective barricade of at least 1200mm high must be erected around a trench that is 1 metre or more deep.

This barricade is to be firmly fixed with the ground with the help of pegs.

Barricading Construction Sites

- Piling site is to be barricaded using indicative barrier for warning.



- Gas-cutting & Welding site shall be barricaded using minimum 50 mm wide 'Red-White' safety tapes for warning.

Barricading Demolition Sites

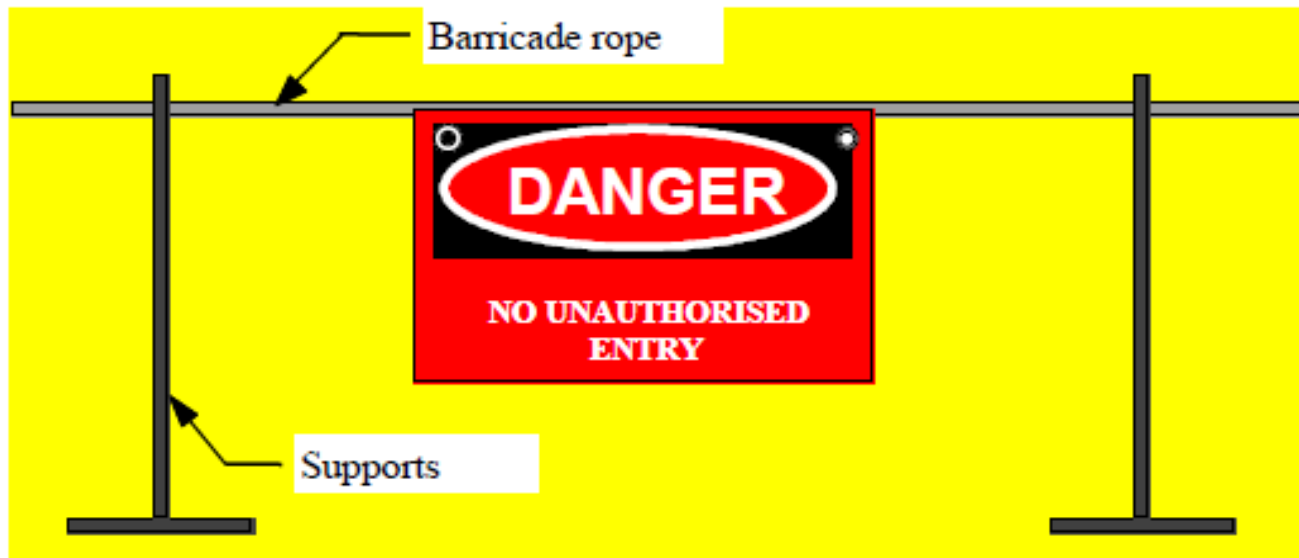
- ☀ All the roads and open areas adjacent to demolition site shall be barricaded with caution board. Unauthorized entry to demolition site must be prevented.
- ☀ Properly cover or securely barricade all floor or roof penetrations, lift shaft entrances and doorways where staircases are to be removed.
- ☀ When floors are being removed, the area underneath shall be properly barricaded to prevent any other workmen to work under the floor.
- ☀ All floor openings / wall openings shall be adequately guarded / barricaded and provided Danger caution notices.
- ☀ During night, red light and/or luminescent danger signs shall be placed on and around the barricades.

Barricading Roads

- Care should be taken to block only one-half of road width at a time. **Caution board and division board** is to be placed at both side of barricade.
- If entire road width is to be blocked, in addition to the caution board, the **road diversion sign** is to be prominently placed on both ends of the work area.
- Drum painted white with red stripes at the middle and barricade with red / white safety tape may be used as barricade.

Barricading Roads

- Two persons with red / green flag and whistle to be deputed at both sides of the barricade to regulate traffic.
- Red light to be provided if job is to be done after sunset.
- No material to be projected beyond barricades.
- Barricade is to be provided around if equipment is left unattended near a roadway at night.



Module - 2

**Machine
Guarding**

The Problem

- Workers who operate and maintain machinery each year suffer approximately
 - 18,000 amputations, lacerations, crushing injuries, and abrasions
 - 800 deaths



The Problem: Machinery Associated with Amputations

1. Mechanical power presses
2. Power press brakes
3. Powered and non-powered conveyors
4. Printing presses
5. Roll-forming and roll-bending machines
6. Shearing machines
7. Food slicers
8. Meat grinders
9. Meat-cutting band saws
10. Drill presses
11. Milling machines
12. Grinding machines

Causes of Machine Incidents

- Reaching in to “clear” equipment
- Not using Lockout/Tagout
- Unauthorized person doing maintenance or using the machines
- Missing or loose machine guards
- Lack of training

Prevention

- Any machine part, function, or process which may cause injury must be safeguarded.
- Where the operation of a machine can injure the operator or other workers, the hazard must be controlled or eliminated

Machine Guarding



3 Basic Areas To Be Safeguarded

- Point of Operation
- Power Transmission Apparatus
- Other Moving Parts

- Point of Operation - The point where work is performed on the material, such as cutting, shaping, boring or forming of stock.
- Power Transmission Apparatus - All components of the mechanical system which transmit energy to the part of the machine performing the work. Including flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks and gears.
- Other moving parts - all parts which move while machine is working. Includes reciprocating, rotating and transverse moving parts, feed mechanisms etc.

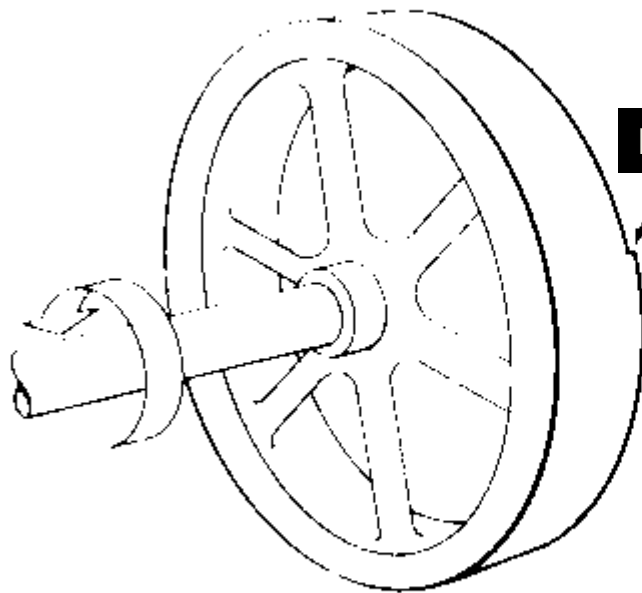
Hazard Identification

- Motions
 - Rotating (including in-running nip points)
 - Transverse
 - Reciprocating
- Actions
 - Cutting
 - Punching
 - Shearing
 - Bending

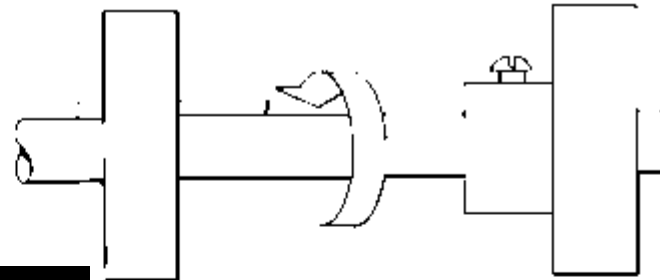
Rotating Motion

- Hazard – Machinery grips and moves clothing, hair and body parts into danger area
- Danger increases when projections are present
 - Screws, bolts, nicks, abrasions, etc.

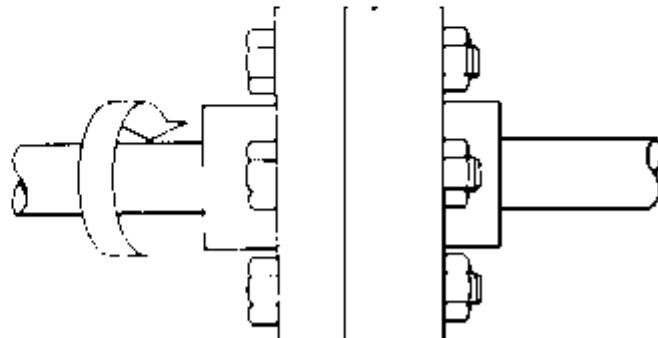
Rotating Parts with Projections



Rotating pulley with spokes and projecting burr on face of pulley



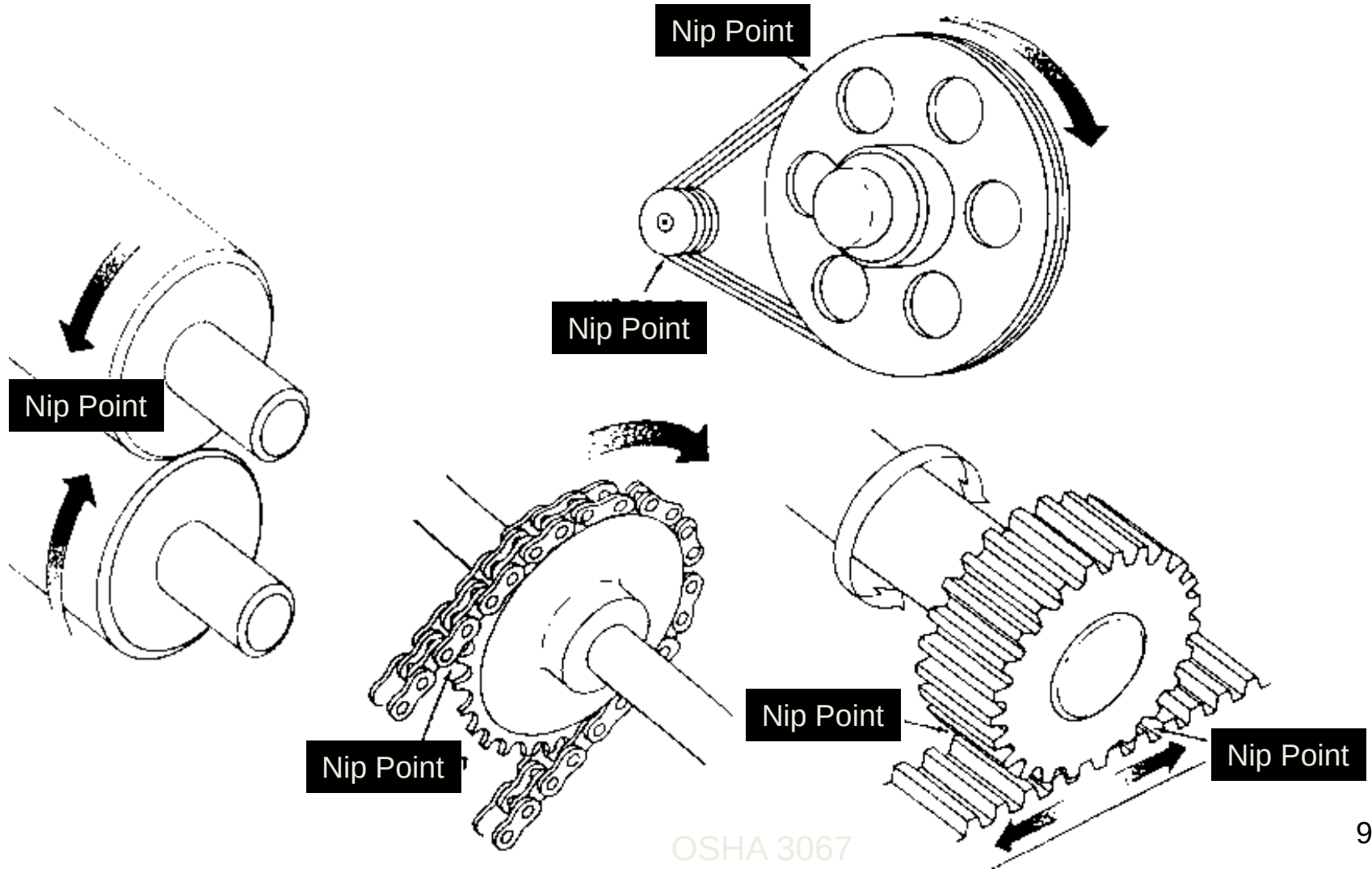
Rotating shaft and pulleys with projecting key and set screw



Rotating coupling with projecting bolt heads

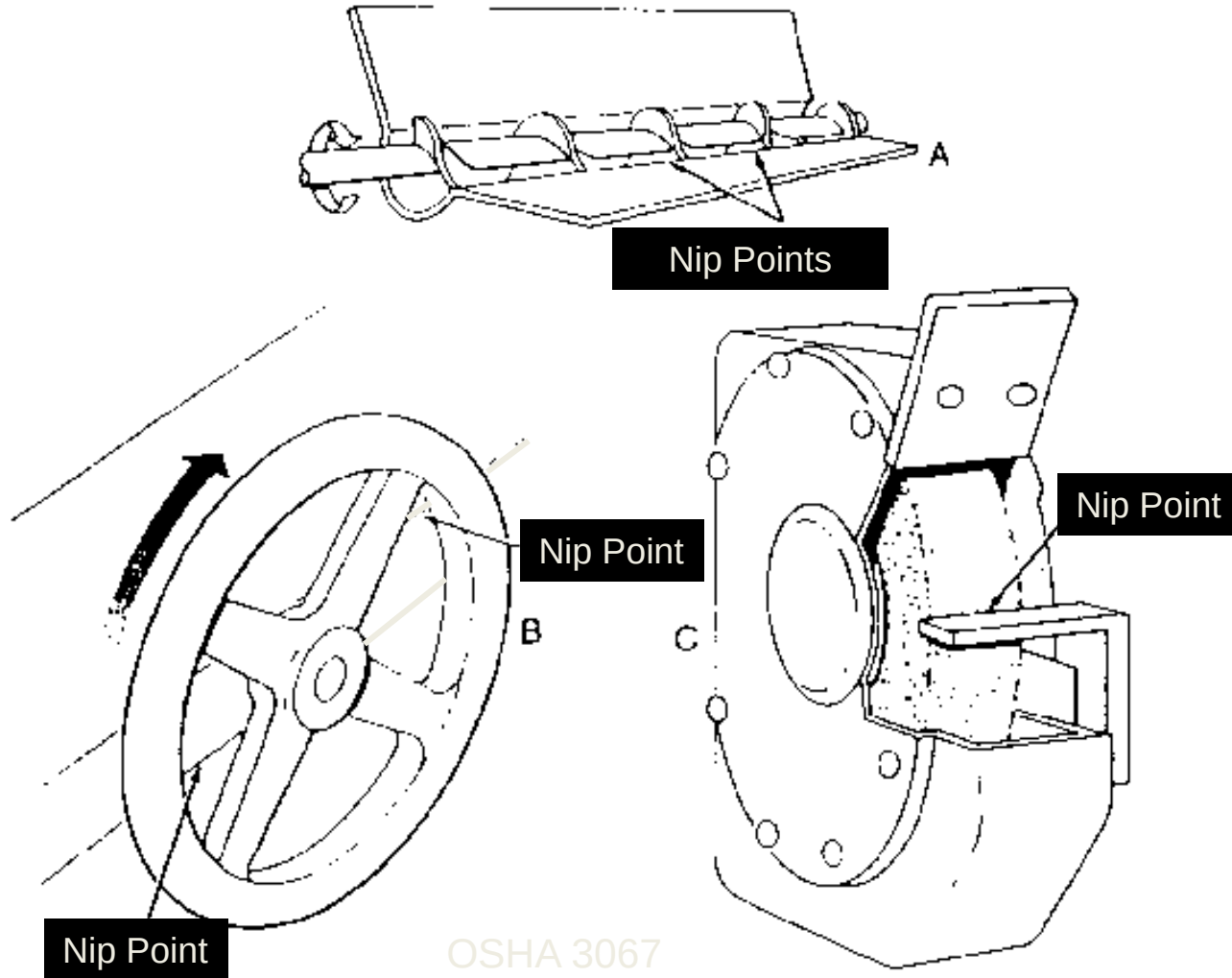
OSHA 3067

In-Running Nip Points



- In-running nip point hazards are caused by the rotating parts on machinery. There are three main types of in-running nips.
- Parts can rotate in opposite directions while their axes are parallel to each other. These parts may be in contact (producing a nip point) or in close proximity to each other (where the stock fed between the rolls produces the nip points). This danger is common on machinery with intermeshing gears and rotating cylinders.
- Another type of nip point is created between rotating and tangentially moving parts; for example, a chain and a sprocket, a rack and pinion, or the point of contact between a power transmission belt and its pulley.

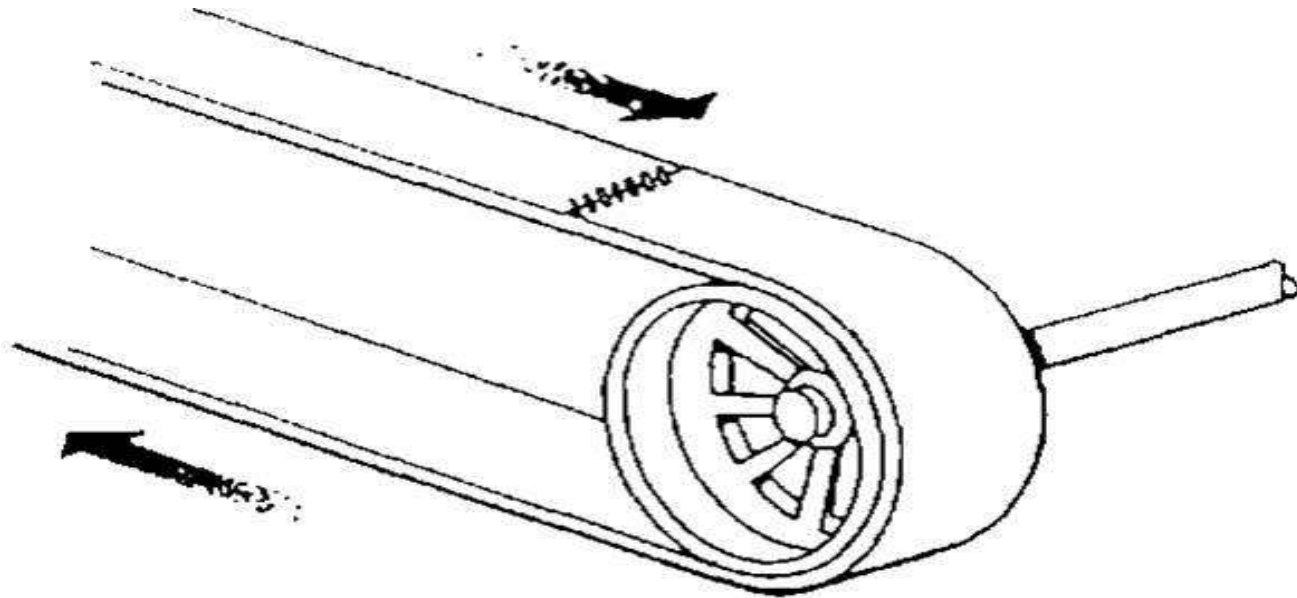
In-Running Nip Points



Nip points can also occur between rotating and fixed parts which create a shearing, crushing, or abrading action; for example, spoked handwheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

Transverse Motion

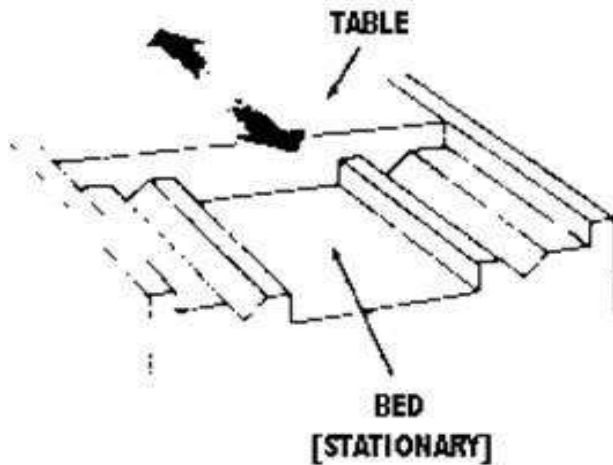
- Movement in a straight, continuous line around rotating component
- Hazard may strike or catch employee a pinch or shear point



Motion may strike or catch an employee in a pinch or shear point created by the moving part and a fixed object

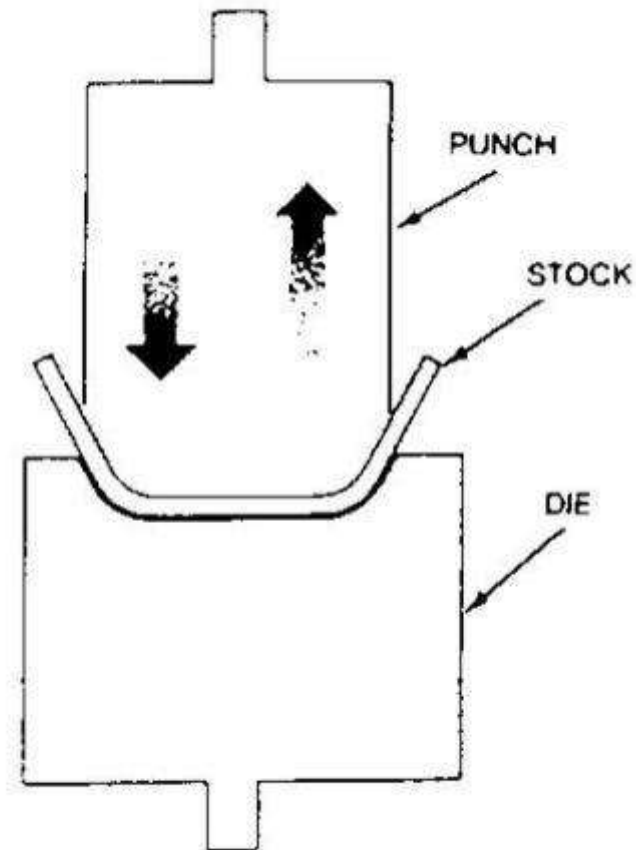
Reciprocating Motion

- Back and forth / up and down
- Hazard - Caught between moving part and stationary object



Bending Actions

- Power applied to slide to draw or stamp metal or other materials in a bending motion
- Example: Press Brake, Tube Benders



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The hazard occurs at the point of operation where the employee typically inserts, holds, or withdraws the stock by hand.

Bending Actions

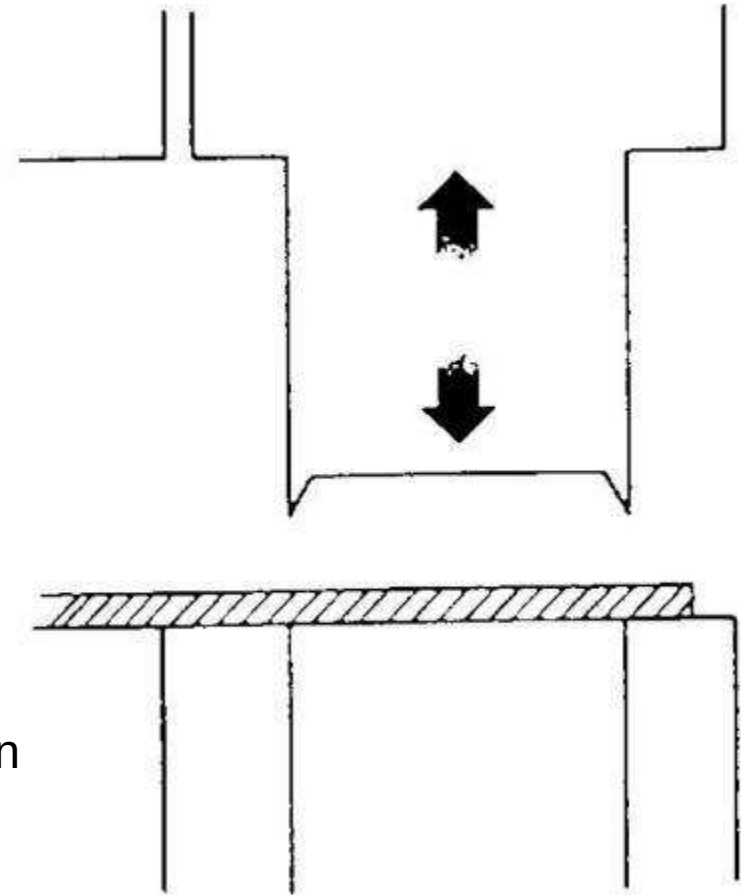
Press Brake

Press Brake – personal picture.
The hazard occurs at the point of operation where the employee typically inserts, holds, or withdraws the stock by hand.



Punching Actions

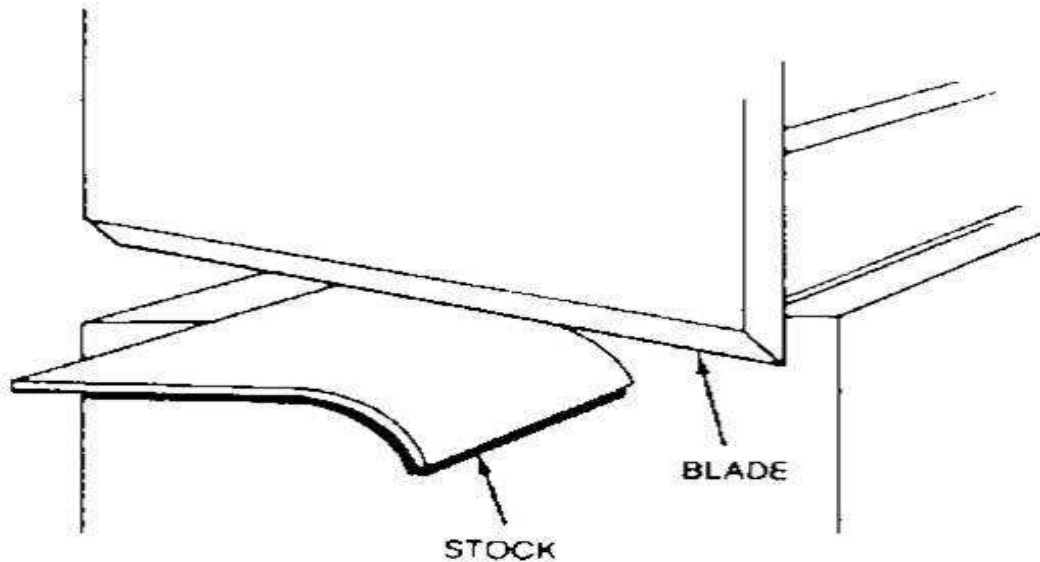
- Power applied to slide ram for purpose of blanking, drawing or stamping
- Example: Power press



The hazard occurs at the point of operation where the employee typically inserts, holds, or withdraws the stock by hand.

Shearing Actions

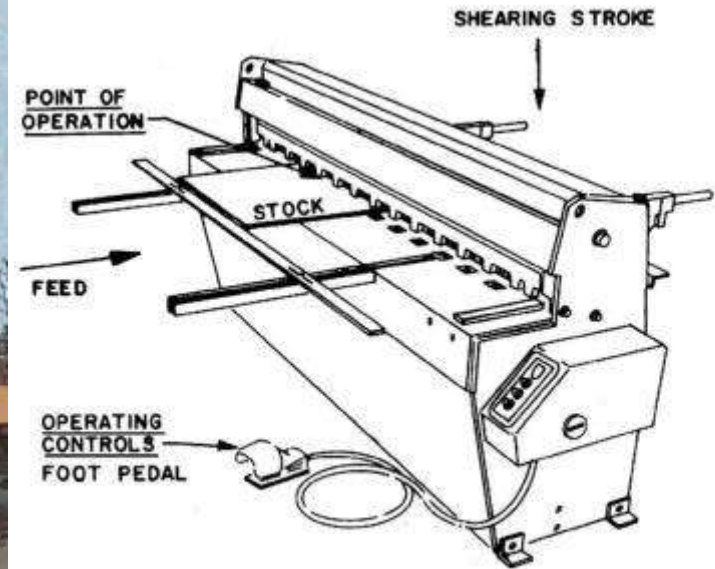
- Apply power to slide or knife to trim or cut



The hazard occurs at the point of operation where the employee typically inserts, holds, or withdraws the stock by hand.

Shearing Actions

Sheet Metal Shear

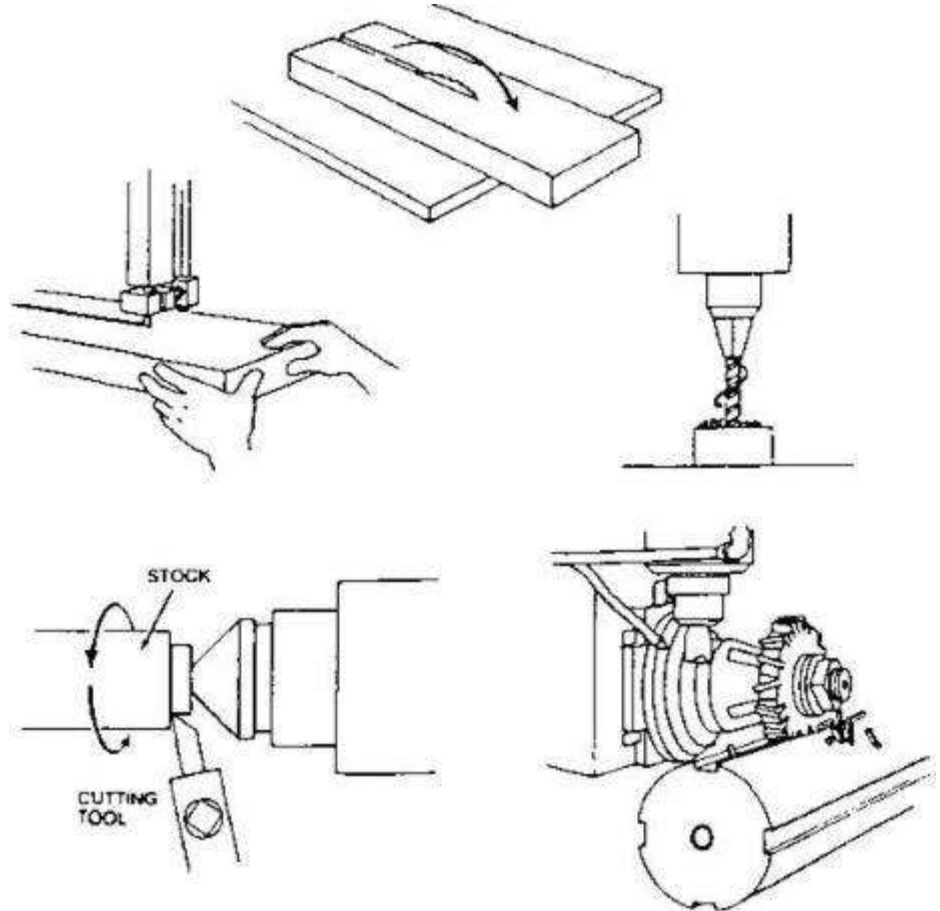


OSHA 7100

SHEET METAL SHEAR

Cutting Actions

- Rotating, reciprocating or transverse motion
- Examples: Band saw, circular saws, lathes, drills



OSHA 3067

Classification of Safeguards

- Guards
- Devices
- Location/distance
- Automatic/semiautomatic feed or ejection
- Miscellaneous

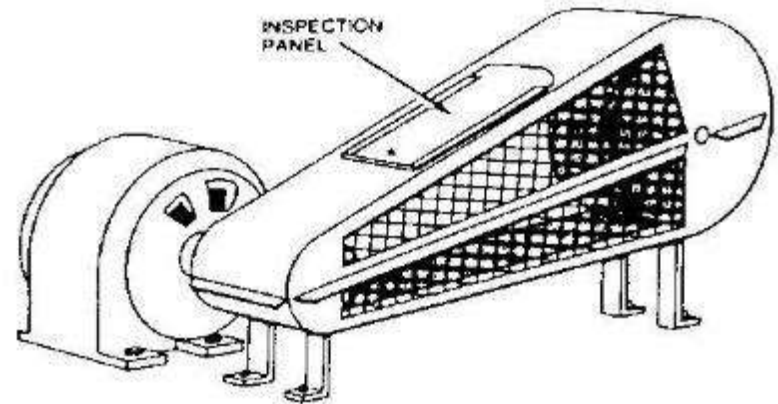
- Guards: physical barriers that enclose dangerous machine parts and prevent employee contact
- Devices: Controls or attachments that, when properly designed, applied and used, usually prevent inadvertent access by employees to hazardous machine areas.
- Location/distance: may involve an operator holding and supporting a work-piece with both hands at a predetermined minimum safe distance or, if both hands cannot be used to hold the work-piece at a distance so that the operator cannot reach the hazard with the free hand.

Types of Guards

- Fixed
 - Provide secure barrier
- Interlocked
 - Cuts off power when guard opened or removed
- Adjustable
 - Barrier manually moved to accommodate stock or operation
- Self-adjusting
 - Barrier automatically moves to accommodate operation

Fixed Guards

- Advantages
 - Maximum protection
 - Variety of applications
 - In-house fabrication
 - Low cost & maintenance
- Disadvantages
 - Poor visibility
 - Must remove for repairs requiring LOTO



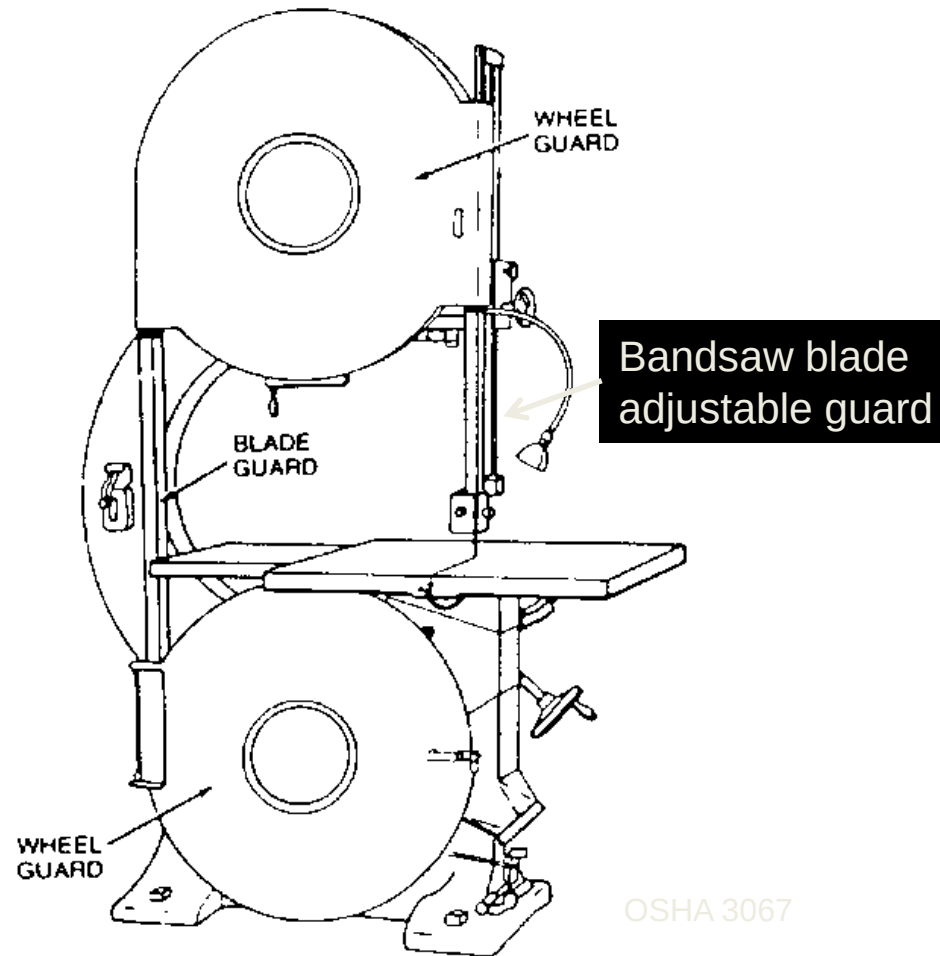
Interlocked Guards

- Switch that when opened stops power
- Advantage
 - Maximum protection
 - Portion of guard easily removed for access
- Disadvantage
 - Can be overridden by employee
 - High cost
 - Maintenance required

- Advantages: Allows access for some minor service work, in accordance with the lockout/tagout exception, without time-consuming removal of fixed guards.
- Disadvantages: May require periodic maintenance or adjustment; movable section cannot be used for manual feeding; some designs may be easy to defeat; and interlock control circuitry may not be used for all maintenance and servicing work.

Adjustable Guards

- Advantage
 - Flexibility
 - In-house fabrication
- Disadvantage
 - Not maximum protection
 - Rely on worker to properly position
 - May prohibit easy access

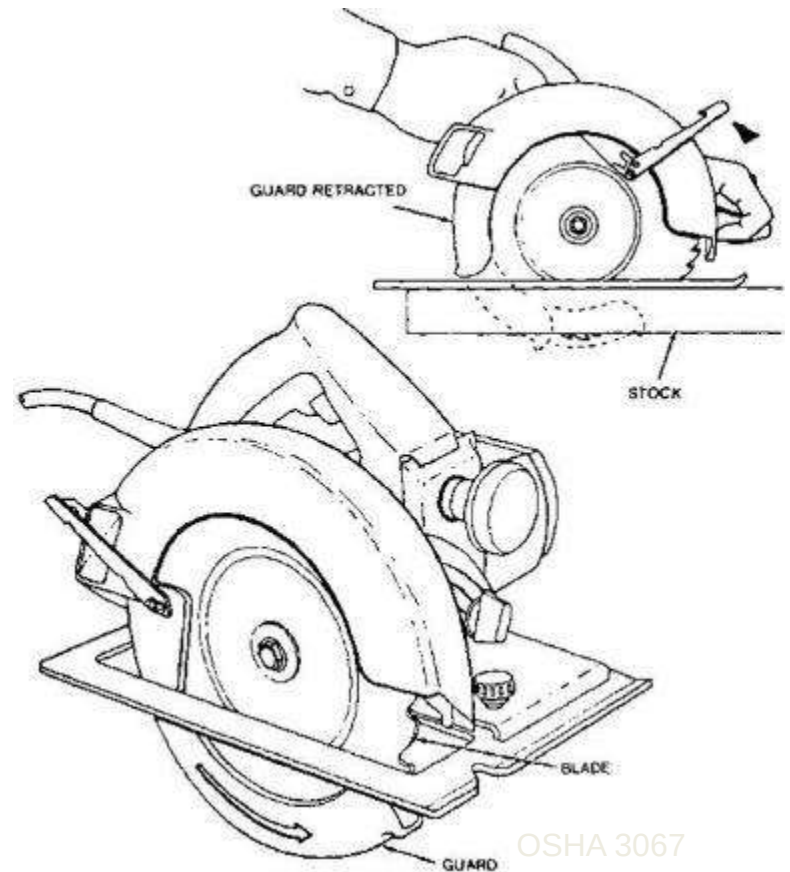


OSHA 3067

- Advantages: Can be constructed to suit many applications; and can be adjusted admit varying stock sizes.
- Disadvantages: May require frequent maintenance or adjustment; and operator may make guard ineffective

Self-adjusting Guards

- Advantage
 - Employee not involved in positioning
 - Readily available
- Disadvantage
 - Not maximum protection
 - May need frequent fine tuning



- Advantages: Off-the-shelf guards are often commercially available
- Disadvantages: Does not provide maximum protection; and may require frequent maintenance and adjustment.

Self-adjusting Guard Table Circular Saw

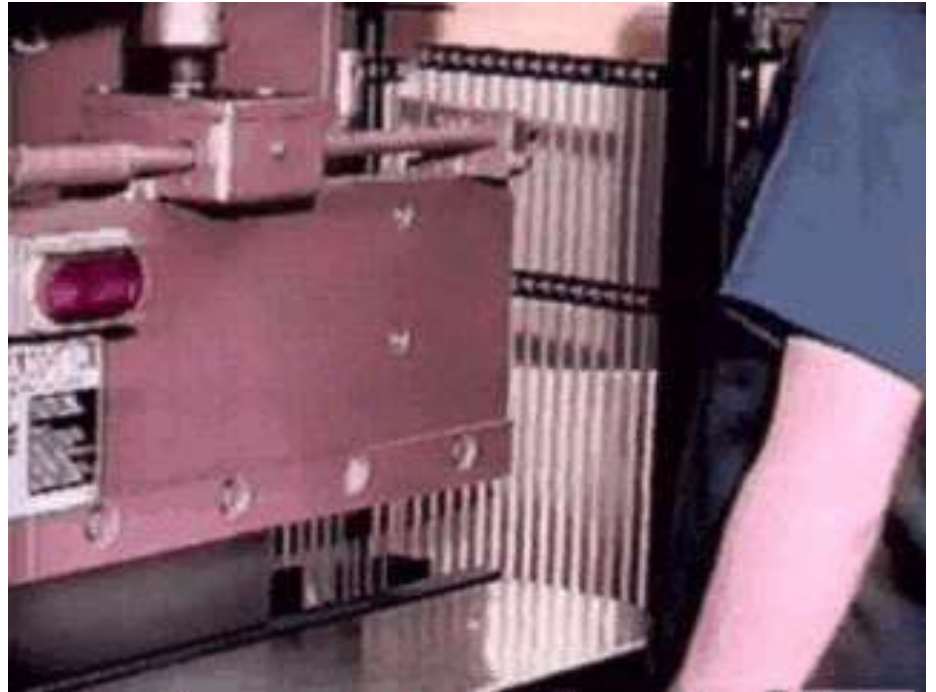


OSHA 10 Hour GI Presentation

Devices

- Presence sensing
 - Photoelectrical
 - Radiofrequency
 - Electromechanical
- Safety Controls
 - Safety trip control
 - Two-hand control/trip
- Gates

Presence-Sensing Device

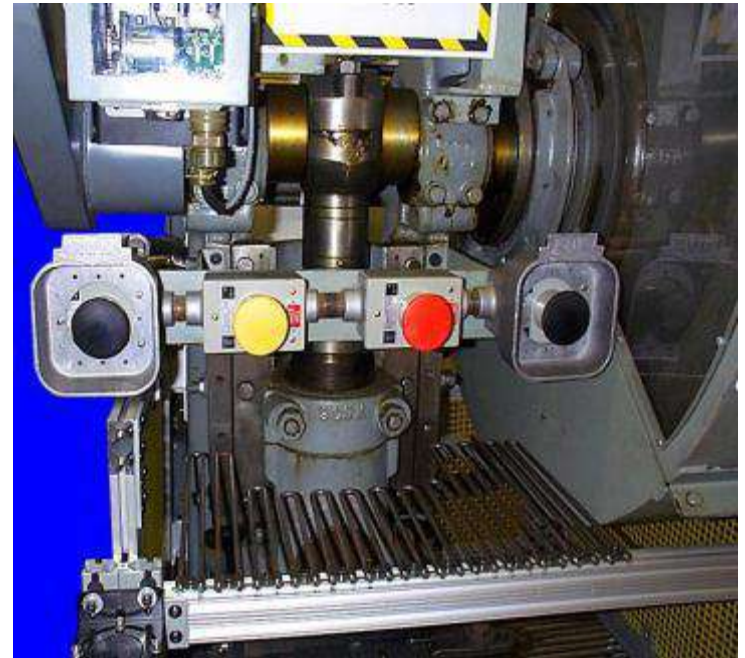


www.osha.gov/SLTC/etools/machineguarding/presses/psd.html

- Interlocks into the machine's control system to stop operation when the sensing field (photoelectric, radio frequency, or electromagnetic) is disturbed.
- Advantages: adjust to fit different stock sizes; allows access to load and unload the machine; and allows access to the guarded area for maintenance and set-up activities.
- Disadvantages: Restricted to machines that stop operating cycle before operator can reach into danger area (e.g., machines with partial revolution clutches or hydraulic machines); Must be carefully maintained and adjusted; does not protect operator in the event of a mechanical failure; and operator may make device ineffective.
- There are also presence-sensing mats that interlock into machine's control system to stop operation when a predetermined weight is applied to the mat. A manual reset switch must be located outside the protected zone.

Two-Hand Control

- Requires constant, concurrent pressure to activate the machine
- The operator's hands are required to be at a safe location (on control buttons) and at a safe distance from the danger area while the machine completes its closing cycle



OSHA 10 hour

- This kind of control requires a part-revolution clutch, brake, and brake monitor if used on a power press as shown.
- A similar device, known as a two-hand trip, requires concurrent application of both of the operator's control buttons to activate the machine cycle, after which the hands are free. This device is used with machines equipped with full-revolution clutches. The trips must be placed far enough from the point of operation to make it impossible for the operators to move their hands from the trip buttons or handles into the point of operation before the first half of the cycle is completed to prevent them from being accidentally placed in the danger area prior to the slide/ram or blade reaching the full "down" position.
- Advantages: operator's hands are at a predetermined safe distance; and operator's hands are free to pick up new parts after completion of first part of cycle.
- Disadvantages: Requires a partial cycle machine with a brake and anti-repeat feature; operator may make devices without anti-tiedown ineffective; and protects the operator only.

Safety Tripwire Cables

- Device located around the perimeter of or near the danger area
- Operator must be able to reach the cable to stop the machine

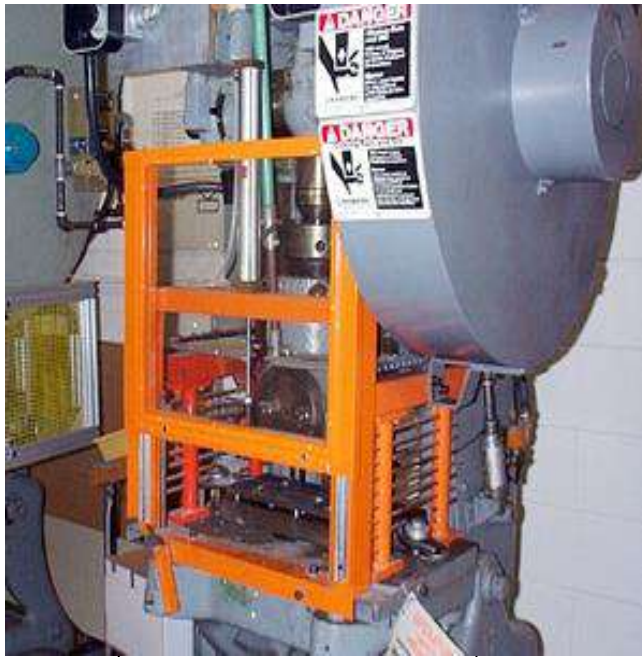


OSHA 10 hour

- Safety trip controls provide a quick means for deactivating the machine in an emergency situation. For example a pressure-sensitive body bar, when depressed, will deactivate the machine. If the operator or anyone trips, loses balance, or is drawn toward the machine, applying pressure to the bar will stop the operation. Trip-rods and trip-wires are also used in the same fashion. Tripwire cables must be manually reset to restart the machine.

Gate

- Movable barrier device which protects the operator at the point of operation before the machine cycle can be started
- If the gate does not fully close, machine will not function



Gate Open

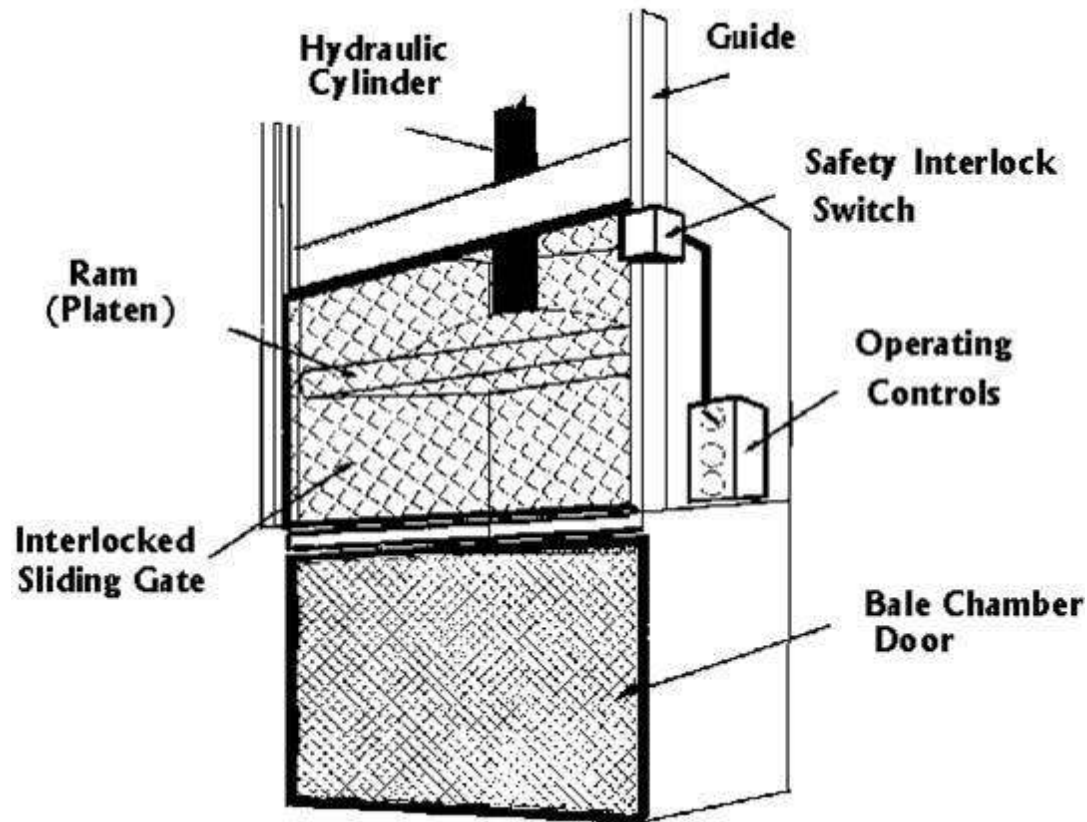


Gate Closed

- Power Press: Provides barrier between danger area and operator until completion of machine cycle. Another potential application of this type of device is where the gate is a component of a perimeter safeguarding system. Here the gate may provide protection not only to the operator but to pedestrian traffic as well.
- Advantages: prevents operator from reaching into danger area during machine cycle; and provides protection from machine repeat.
- Disadvantages: may require frequent inspection and regular maintenance; and may interfere with operator's ability to see work.
- On some machines, gate may only prevent access on the downstroke. This may increase production by allowing the operator to remove and feed the press on the upstroke.

Gate

Vertical Downstroke Baler



When gate is lifted, interlock switch prevents baler from operating.

Safeguard by location/distance

- Position dangerous parts of machine in inaccessible areas during normal operation
 - Moving parts more than 7 feet above floor
 - Controlled access room
 - Control station at safe distance from machine

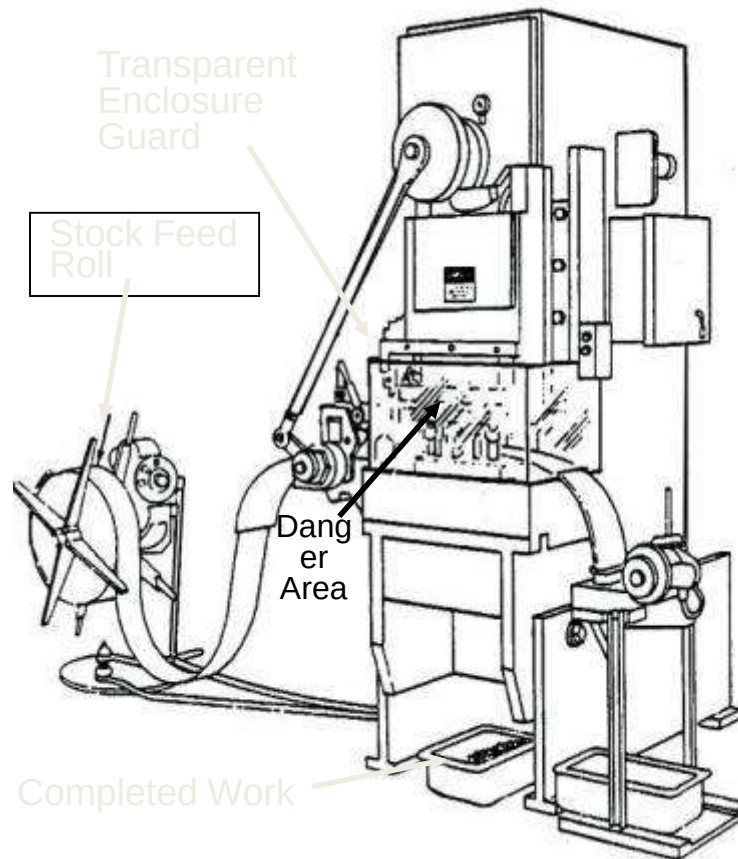


OSHA 10 hour

Feeding and Ejection Methods

- Automatic / semiautomatic feed
- Automatic / semiautomatic ejection
- Robots

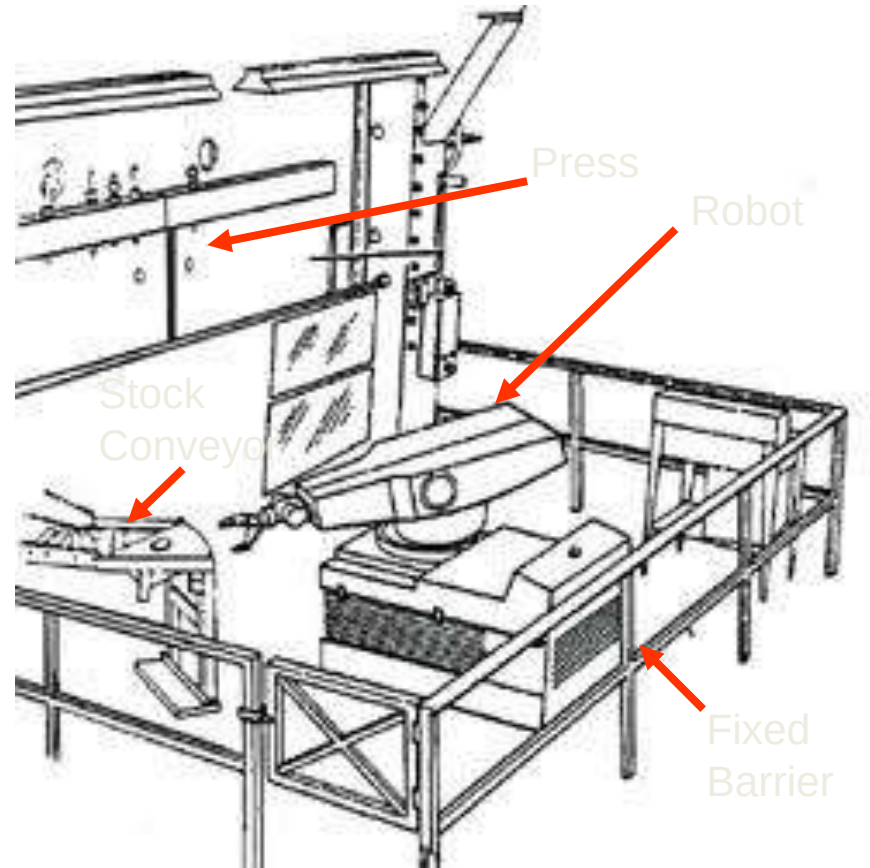
Automatic Feed (shown on power press)



OSHA 3170

Robots

- Machines that load and unload stock, assemble parts, transfer objects, or perform other tasks
- Best used in high-production processes requiring repeated routines where they prevent other hazards to employees



OSHA 3170

- Robots may create hazards themselves. If they do, appropriate guards must be used. The most common technique is to use perimeter guarding with interlocked gates.
- The American National Standards Institute (ANSI) safety standard for industrial robots, ANSI/RIA R15.06-1999, presents certain basic requirements for protecting the worker. However, when a robot is used in a workplace, the employer should accomplish a comprehensive operational safety and health hazard analysis and then implement an effective safeguarding system which is fully responsive to the situation. [Various effective safeguarding techniques are described in ANSI B11.19-1990 (R1997).]
- Studies in Sweden and Japan indicate that many robot accidents did not occur under normal operating conditions, but rather during programming, program touch-up, maintenance, repair, testing, setup, or adjustment. During these operations, workers may temporarily be within the robot's working envelope where unintended operation could result in injuries.

Miscellaneous

- Awareness Barriers
- Protective Shields
- Hand tools

Awareness Devices

- Alert employees to hazard
 - Signs
 - Awareness signals (audible or visual)
 - Awareness barriers (allows access to machine danger areas, but is designed to contact employee, creating an awareness that employee is close to danger point)



Some Examples of Machine Guarding

Abrasive Wheel Machinery

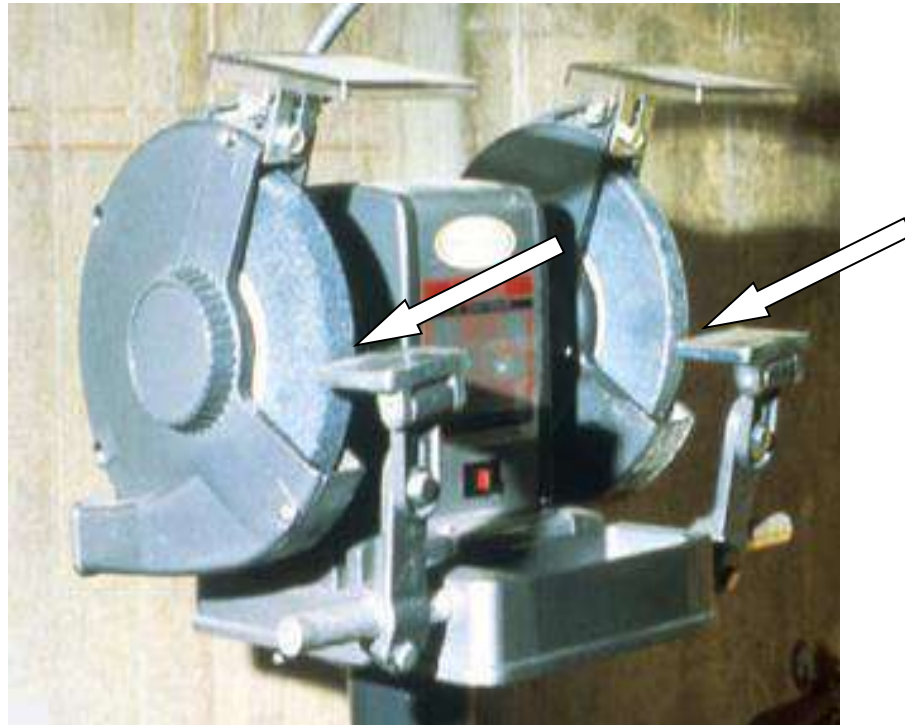
Improper Work Rest and Tongue



Work rests are used to support the work.. Work rests shall be kept adjusted closely to the wheel with a maximum opening of one-eighth inch to prevent the work from being jammed between the wheel and the rest, which may cause wheel breakage

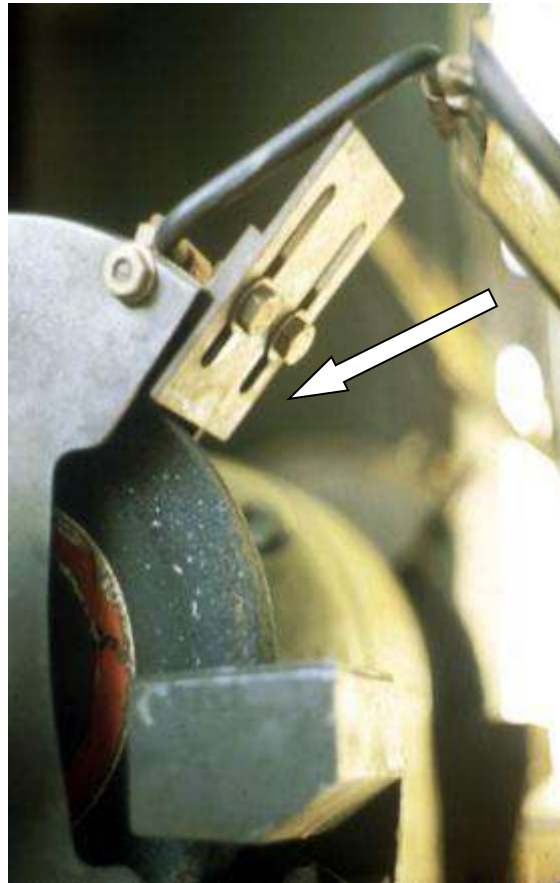
Abrasive Wheel Machinery

Work rests on offhand grinding machines must be kept adjusted closely to the wheel with a maximum opening of 1/8-inch to prevent the work from being jammed between the wheel and the rest, which may result in wheel breakage.



Abrasive Wheel Machinery

The distance between the wheel periphery and the adjustable tongue must never exceed 1/4-inch.



Abrasive Wheel Machinery

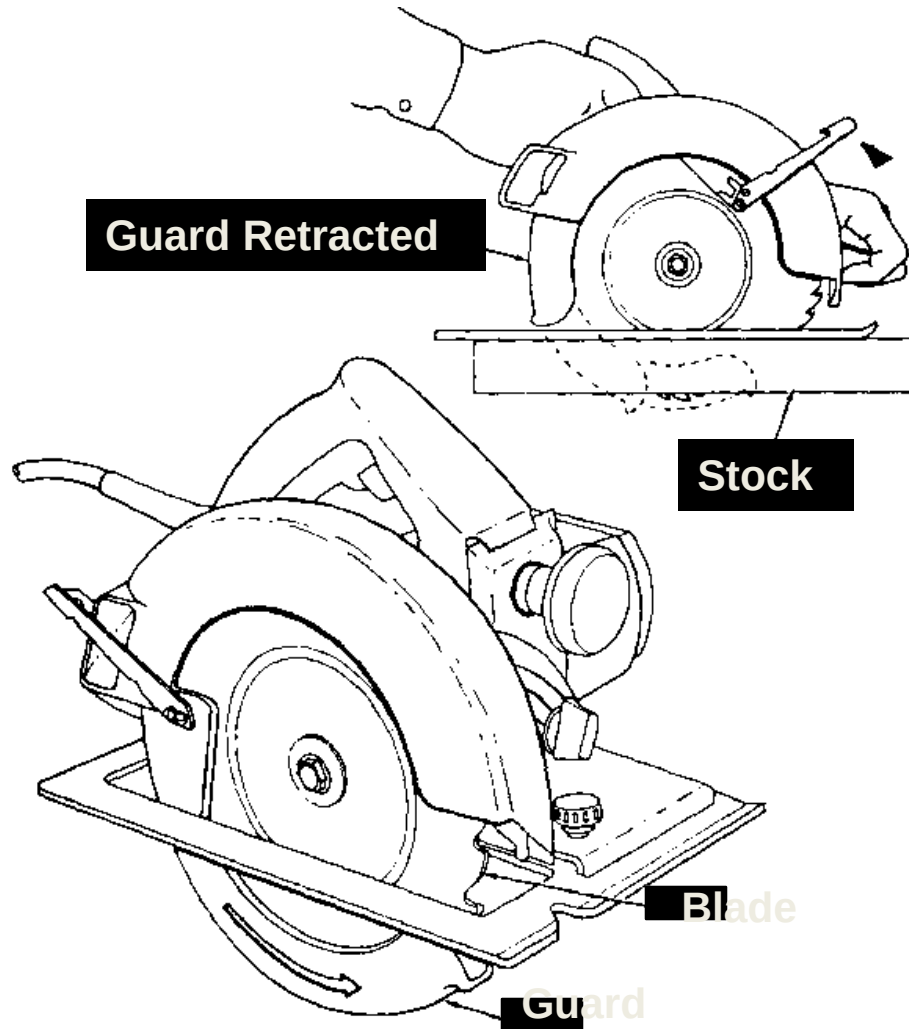
- When installing new abrasive wheel
 - Inspect for condition and compatibility
 - Conduct ring test



Click on picture
for video

OSHA 7100

Portable Circular Saws



1910.243(a)(1)(i) All portable, power-driven circular saws having a blade diameter greater than 2 in. shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to covering position.

1910.243(a)(2)(i) All hand-held powered circular saws having a blade diameter greater than 2 inches, electric, hydraulic or pneumatic chain saws, and percussion tools without positive accessory holding means shall be equipped with a constant pressure switch or control that will shut off the power when the pressure is released. All hand-held gasoline powered chain saws shall be equipped with a constant pressure throttle control that will shut off the power to the saw chain when the pressure is released.

Table Saw



- On/off switch should be located at knee height -- so you can turn off machine while your hands are on the material
- Blade must be guarded
- Automatic brake a good safety feature

Module - 3

HIRA

Hazard Identification & Risk Assessment (HIRA)

- A hazard is generally realized as a loss of containment of a hazardous material. The routes for such loss of containment can include release from pipe fittings containing liquid or gas, releases from vents/relief and releases from vessel rupture. Adhering to good engineering practices alone may not be adequate for controlling plant hazards thus, a variety of techniques of hazard identification and probability of their occurrence have been developed for analysis of processes, systems and operations.
- The objective of hazard identification is to identify and evaluate the hazards and the unintended events, which could cause an accident. The first task usually is to identify & the hazards that are inherent to the process and/or plant and then focus on the evaluation of the events, which could be associated with hazards. In hazard identification and quantification of probability of occurrence it is assumed that the plant will perform as designed in the absence of unintended events (component and material failures, human errors, external event, process unknown), which may affect the plant/process behaviour.

Hazard Identification and Risks Assessment

This module will outline:

- What are the Hazards and Risks?.
- What is Risk Assessment?
- Introduce methodology for conducting Risk Assessment.

The Risk Assessment Process is

- a process whereby *hazards present* in a workplace are *identified, evaluated* and corrective action(s) is *prioritized* in order to *eliminate or reduce risks* to acceptable levels.
- to be used for Personal Safety

Risk Assessment is not

- for tasks where the hazards/risks are obvious and well-known and clearly understood.
- Intended to be used to classify hazards or risks associated with PSM.... follow PHA

The Risk Assessment Process

Benefits & Strengths:

- Eliminate most serious hazards
- Fulfill Regulatory & Policy requirements
- Involves teams from all levels in organization
- Focus on the actual work activities
- Improve awareness of hazards and/or identify new ones.
- Ensure that the correct “control measures” are in place and reflected in proper job procedures
- Continuously improve Safety Management systems and conditions of work
- Reduce Safety incidents

Risk Assessment Planning/ Strategy

- Review HIRA process to deliver the value to your organization.
- Support the sites to implement HIRA.
- Upgrade/ Develop HIRA procedure to incorporate the methodology described in this package.

When is it required?

HIRA is required when.....

- Proper safety procedures are not in place
- Existing procedures are not adequate
- When New job, task, chemical, and/or machine has been introduced
- Existing task has been changed significantly
- New/ different people doing the task
- Changes in technology
- Unplanned work
- To continue work after an incident or injury has occurred
- Result of medical surveillance

When is it required – some examples

Must do HIRA

- High pressure cleaning
- Confined space Entry
- Line Break
- Working at heights
- Deviations from procedures and SOP's
- Rigging & Hoisting
- Hot Work (flames / sparks)
- New tasks/jobs
- Etc.

Suggest to do HIRA if:

- Details of task are not known
- Dangerous chemicals involved
- Other tasks in same area
- Contractor work
- Task takes more than 2h
- Tasks done during night
- Tasks with > 1 person
- No barricaded area
- Not familiar with the job

HIRA Procedure/ Training Overview

HIRA technique is for General Safety,,,,
*not intended to be used to classify hazards or
risks associated with PSM.*

Purpose of Training Workshop:

Successfully delivered in a way that:

- Priority can be given to the execution of a Risk Assessment.
- One knows when a RA should be applied
- One is capable of :
 - doing a HIRA
 - documenting a HIRA
 - preparing/implementing control measures
 - taking action on the gaps identified
- One can decide who is needed for the HIRA.

What constitutes a HIRA?

Divide the task into sub-tasks

- Identify the hazards
- Evaluate the risk
- Implement control measures that can eliminate or minimize risks
- Take action on the gaps identified

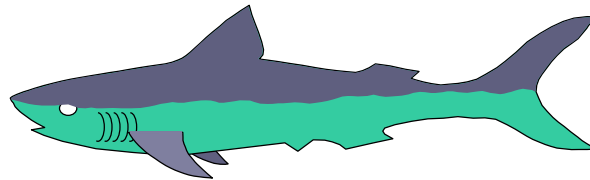
Hazard & Risk



Definitions

Hazard

something that can cause injury or damage to ones health.



Risk

the chance which can lead to the potential consequences

Example of Hazards & Risks

Task = *changing rotary cutter*

Hazard = *sharp edges of cutter blades*

Risk = *cut by the blades*

Task = *MCC switching*

Hazard = *arc flash*

Risk = *burn by arc flash*



Definitions

Severity:

- possible serious injury
- definite critical injury

Probability:

- the practical chance that it will happen

A = Severity			
(Damage)	(Illness)	(Injury)	
Near miss no loss or damage	Discomfort	Discomfort	0
Minor loss or damage	Minor irritation	First-aid case	1
Moderate loss or damage	Sickness, diarrhoea, vomiting	Medical treatment case	2
Severe loss or damage	Non serious short term illness	Lost Time Injury	3
Major loss or damage to the environment	Cancerous or serious long term illness	Fatal injury	4
Catastrophic loss threatening business continuity	Terminal illness	Multiple fatalities	5

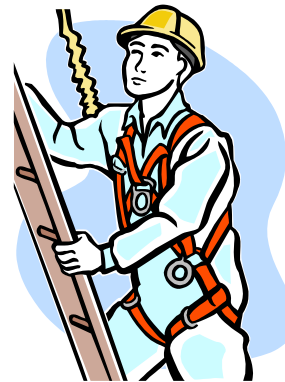
B = Likelihood		
(Hazard ID stage)	(Risk Assess stage)	
Never	Barely conceivable	0
Not in my Industry	Extremely unlikely	1
Occurred in my Industry	Very unlikely	2
Occurred in my Company	Unlikely	3
Occurred at my Site	Possible to probable	4
Occurred in my Department	Likely	5

C = Control Hierarchy	
V High (Elimination)	0
High (Reduce)	1
Medium (Isolation / distance)	2
Moderate (Engineering control)	3
Low (PPE)	4
V Low (discipline, signs and procedures)	5

**Evaluating Protection
through
Existing Control Measures**

Some Examples of Existing Control Measures

- Safety Interlocks
- Machine guarding
- Special tools and equipment
- Wearing PPE
- Permit-to-work
- Job instruction



Generic Roles and Responsibilities

HIRA Originators:

Maintenance / Engineering / Contractors Engineers (job Initiators)

ARA TEAM LEADER

- Operations coordinators
- Project Coordinator or Section Heads
- Maintenance Section Heads

ARA TEAM MEMBERS

- a) ARA Team Leader
- b) HIRA Originator
- c) HSE Advisor
- d) Project Eng. or contractor HSE Eng. If they involved in the activity.

ARA Team Leader can invite any required members like:- Inspection Eng., Process Eng., Elect Eng., Civil Eng. Etc.

Stage 1: *Identify and form the ARA Team.*

The ARA is normally conducted within the Department responsible for doing the activity and should include personnel who are:

- Responsible for the task;
- Competent to conduct an ARA;
- Have sufficient knowledge, expertise and competence in the activity to be performed to have an understanding of the hazards it presents;
- Knowledgeable about the location, and the hazards that are present;
- Will be involved in carrying out the task.

The ARA should be undertaken prior to origination of the permitry. Where appropriate, the team should visit the worksite. The activity can be broken down into a number of smaller tasks where it is considered necessary.

3.4.3

Stage 1

IDENTIFY AND FORM ARA TEAM

Stage 2

IDENTIFY HAZARDS

Stage 3

IDENTIFY INITIAL RISK

Stage 4

IDENTIFY CONTROLS & RECOVERY MEASURES

Stage 5

REVIEW RESIDUAL RISK

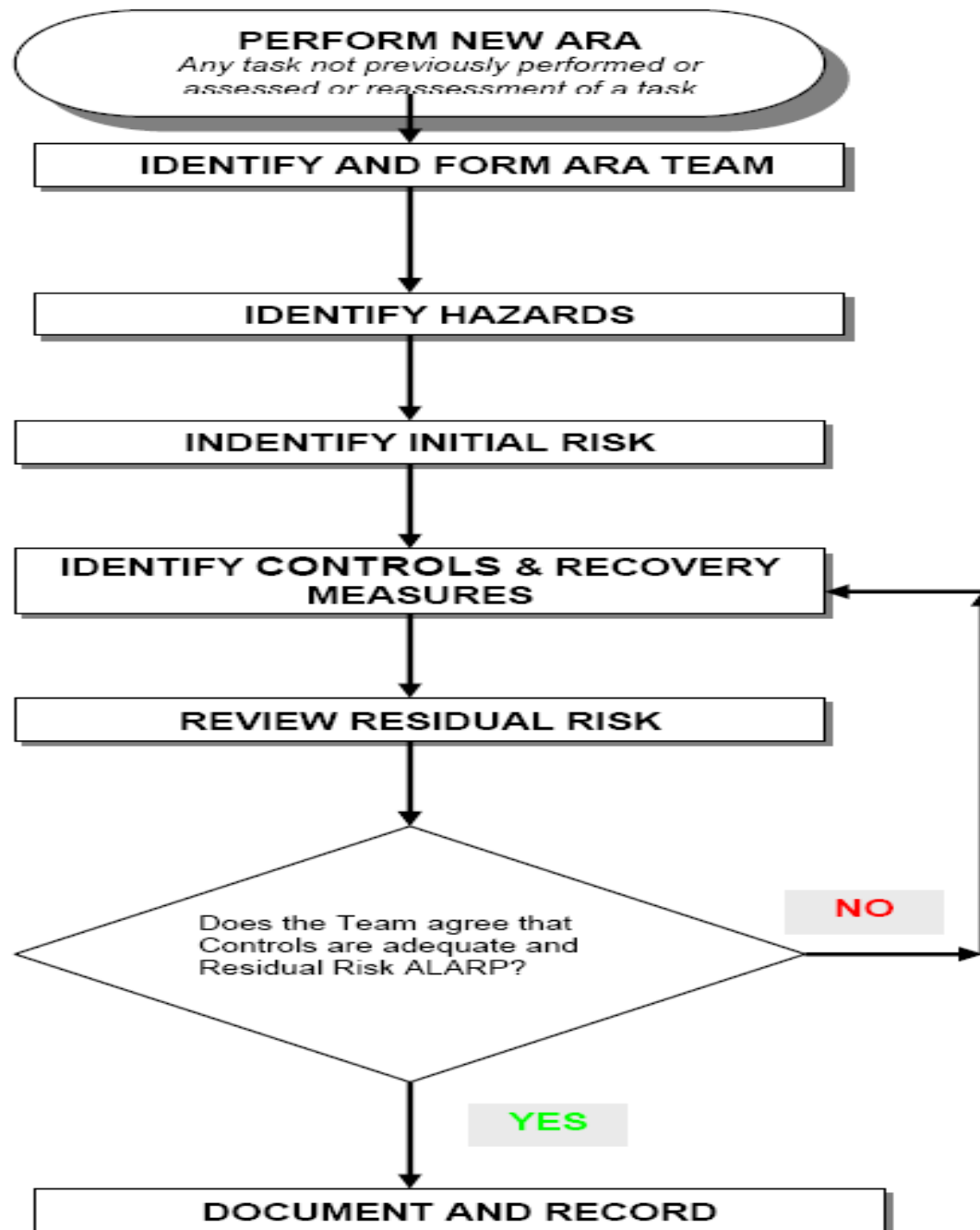
Does the Team agree that
Controls are adequate and
Residual Risk ALARP?

NO

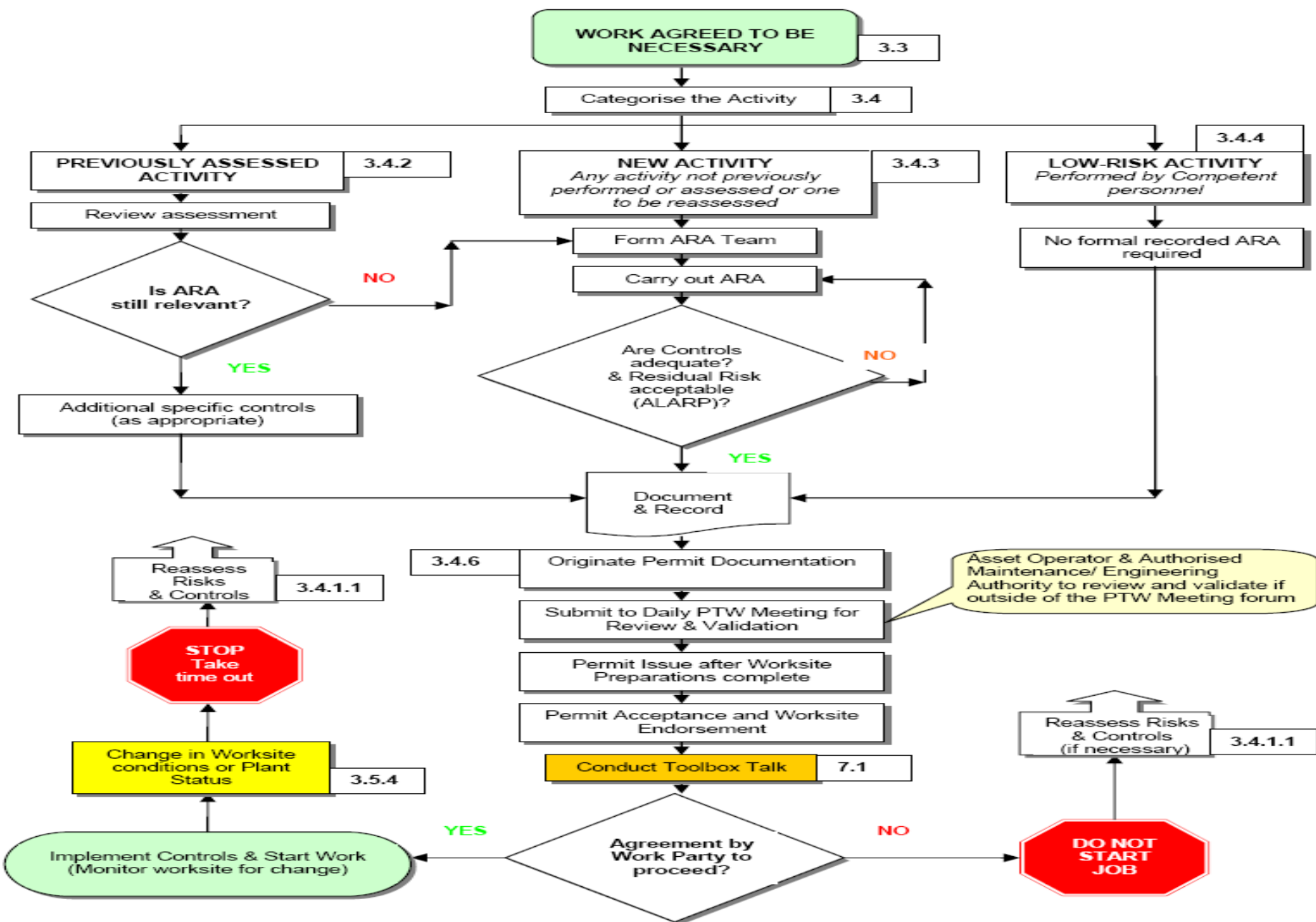
YES

Stage 6

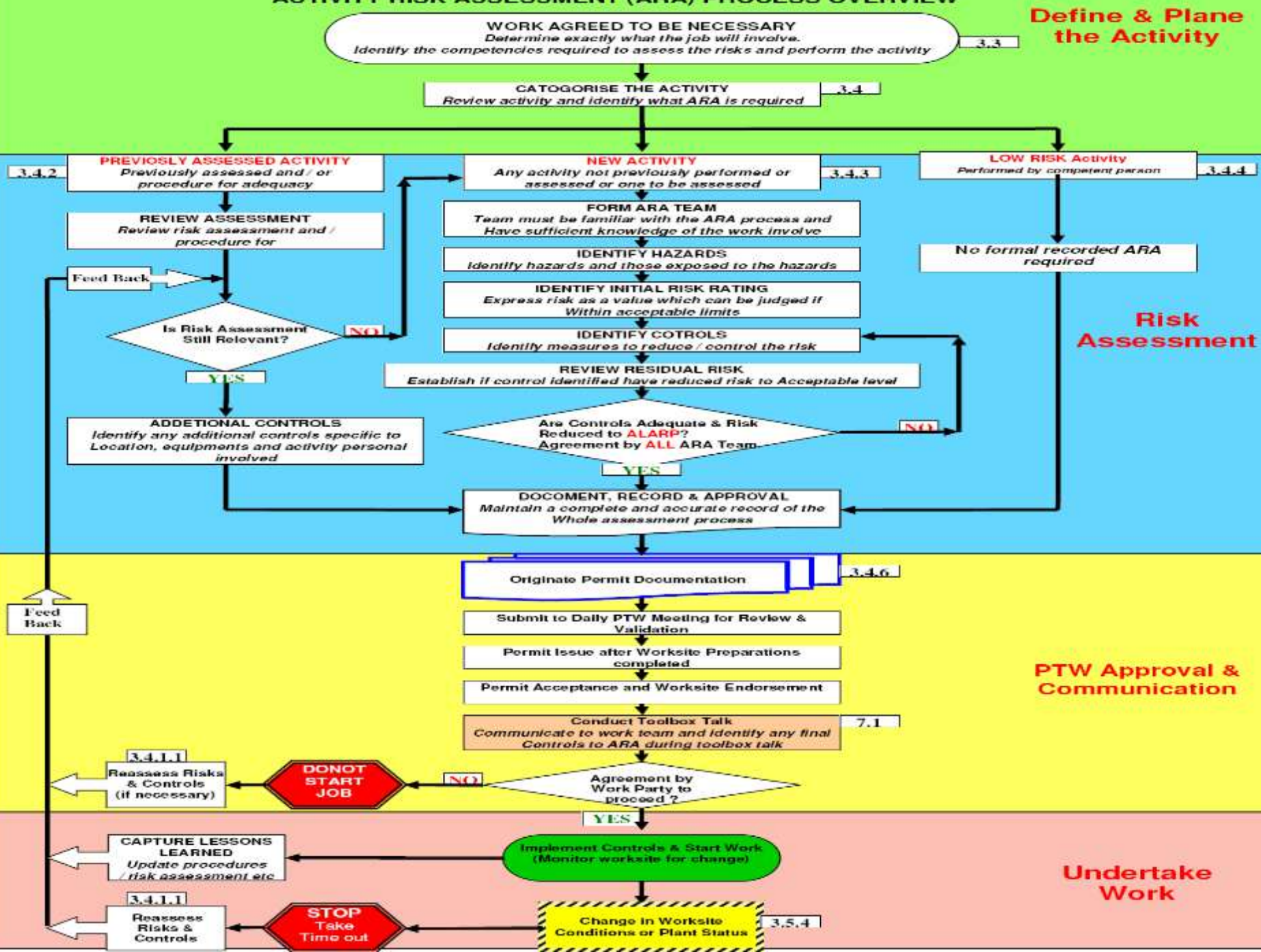
DOCUMENT AND RECORD



ACTIVITY RISK ASSESSMENT (ARA) PROCESS OVERVIEW



ACTIVITY RISK ASSESSMENT (ARA) PROCESS OVERVIEW



HIRA APPROVER

In side the plant:-

- 1) Superintendents
- 2) Operation Coordinators

Outside side the plant:-

- Maintenance Section Heads
- Project Managers

•Note: Before the PTW meeting, HIRA approval will be completed and the team Members will sign the ARA.

HIRA APPROVER WHEN RESIDUAL RISKS ARE MEDUM OR HIGH

- Division Manager
- Operations Manager
- Project/ Engineering Managers

Physical Hazards

Electrical,

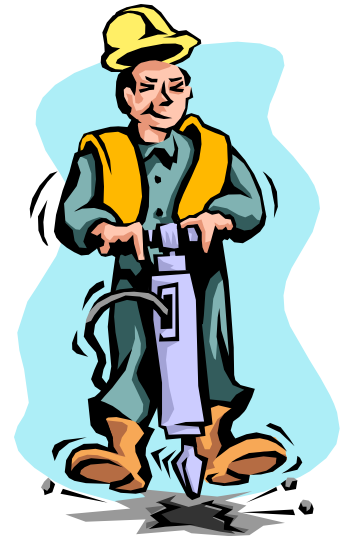
Radiation,

Sound, vibration,

Mechanical/machines,

Falling (objects & people)

Fire



Chemical Hazards

Liquids, Gasses, Solids

Enter the body by means of :

Swallowing (mouth)

Absorbtion (skin)

Inhaling (nose)



Chemical Hazards

Explosive

Irritation

Oxidation

Sensitivity

Flammable

Cancer causing

Poisonous

Mutation

Chemical burning

Reproductive



Ergonomic Hazard

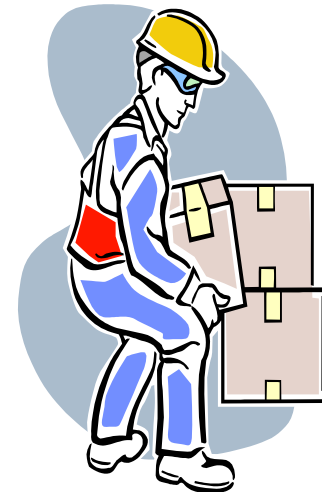
Back injury

Hand, wrist, arm, neck stress as a result of computer use

Uncomfortable positions which cause stress to the muscles

Injury due to over exertion

Muscle tearing



Biological Hazards

Hepatitis,

Hiv-infected

legionnaires disease



This is a highly specialized area, where health care professionals should be consulted

Environmental Hazards



- Emissions
- Spills
- Products that pollute the earth
- Ground water
- Wastes

Hierarchy of Control measures

- 1. Elimination
- 2. Substitution
- 3. Engineering Control
- 4. Administrative Control
- 5. Personal Protective Equipment

Examples of Elimination

- 1. Lockout equipment
- 2. Install blind /blank
- 3. Modify process to eliminate need for hazardous activity (e.g auto sampling)
- 4. Fully automate process



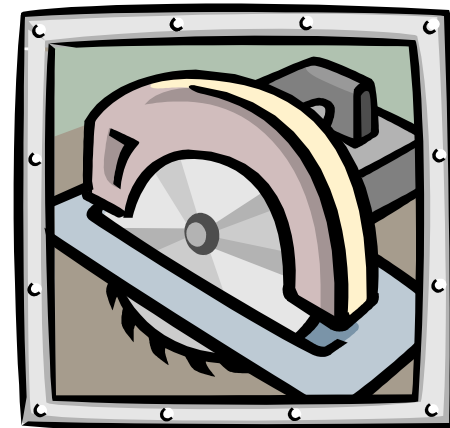
Examples of Substitution

- 1. Use alternate materials (eg lower flash point)
- 2. Use tools instead of handling with bare hands
- 3. Use trolley and truck (instead of carrying)
- 4. Automate process



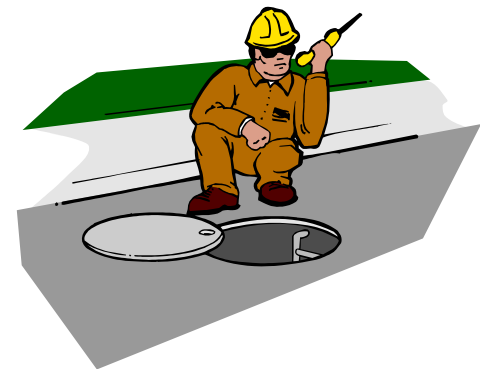
Examples of Engineering Control

- 1. Installing interlocks
- 2. Modifying equipment
- 3. Use special tools for the job
- 4. Redesign workplace layout
- 5. Install noise enclosure
- 6. Machine guarding



Examples of Administrative Controls

- 1. Implementing permit-to-work system
- 2. Barricading area
- 3. Job rotating (to reduce fatigue)
- 4. Following job procedures /work instructions
- 5. Working in pairs
- 6. Testing for hazardous atmosphere



Examples of PPE

- 1.Wearing safety harness
- 2. Wearing Kevlar gloves
- 3. Wearing Nomex coverall
- 4. Wear respirators



Work Permit System

Standard Operating procedure

and

Six Directional Hazard



Work Permit System

Purpose: The purpose of “Permit to Work” system is to provide formal written authority to an employee or Contractor to carry out work .

Objective:

- To provide a standardized & uniform procedure for obtaining authorization to perform work.
- Requiring special consideration to ensure the safety of personnel, and protection of facilities.
- To provide a system to perform a job safely and a Clear understanding between the working agencies, executing agency and ownership of the equipment / areas.

Applicability:

It is applicable to:

- all the jobs when two or more individuals or group or people ,from different agencies, need to co ordinate the activities to ensure that their work is completed safely.
- Any maintenance & repair work, inspection, testing , construction , dismantling , modification , cleaning etc.
- All non routine activities which may require hazard identification and mitigation.

Responsibility

1. **Owner agency**
2. **Executing agency**
3. **Working agency**
4. **Employees**
5. **Contractors and consultants**

Responsibility- Permit requested by(Supervisor of the executing agency)

- Verifying the permit to work form filled up by the working agency
- State clearly the nature and scope of work
- Making **request for power** cutting ,gas hazard ,confined space & other clearances (if required)
- Making **contact with the owner agency** for issuing the permit to work to the working agency
- Making **SOP prior to the job** and **giving training to the working agency** about the SOP and six directional hazard form. In case of contractor as a working agency then training to be given to **their supervisor**.
- Assisting with the owner agency for completely positive isolation of all energy sources.
- **Auditing the place of work** as per contractor site audit methodology
- Ensure standard **tools & tackles ,PPE's**.
- Ensure **competence certificate** at applicable areas

Responsibility - Permit issued by (Supervisor of the Owner agency)

- All process related & proximity hazards associated with the job are identified and all necessary precautions are implemented including isolation of process.
- To ensure “It is Safe” to work prior to issue of any work permit to the working agency in consultation with the executing agency for process related & proximity hazards.
- In case of any emergency, communicating to executing agency as well as the working agencies
- Ensuring communication to any other person who may be affected by the work
- Checking six directional hazard identification part to ensure operations related hazards are identified in consultation with the working agency.

Responsibility - Permit taken by (Supervisor of the working agency)

- Completely filling the work permit form
- The permit is available at the site.
- Giving undertaking for the safe tools and PPE's being used and medically fit person is employed
- The working agency stays within the limitations set on the permit(physical boundaries ,type of work and validity time.)
- Putting personal positive isolation lock (if energy isolation is required)
- Giving training of SOP and six directional hazards to the fellow workers.
- On completion or suspension of work the site is left in a safe condition and the issuing agency is informed.
- Implementation of SOP at the work places
- Conduct audit for identifying site severity in prescribed format.

Individual working within the permit to work system:

- Do not start any work requiring a permit ,until it has been properly authorised and issued
- Follow the instructions specified in the permit
- When they stop work ,the site and any equipment they are using is left in a safe condition
- If any doubt or if circumstances change ,they must stop work and consult with their supervisor

Contractor's management:

- Understanding the broad principles of permit to work system
- Appropriate training to their employees about understanding the operation of the permit to work system and their specific responsibilities within it
- Monitoring the training of their employee
- Provide standard tools & Equipment's ,PPE.

Meaning

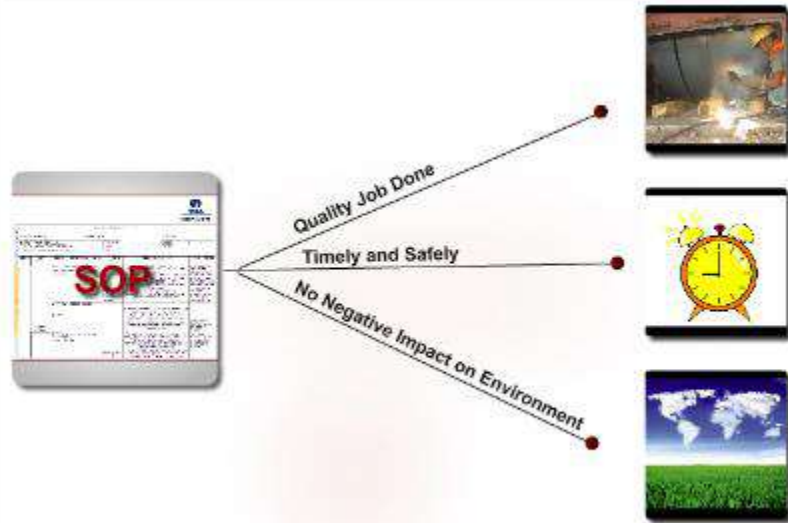
Permit requested by: – Permit will be requested by the executing departmental agency under which job will be carried out in all cases

Permit Issued by: - Permit will be issued by Owner of the area / equipment in all cases

Permit taken by: - Permit will be taken by the agency (Employee/ Contractor) that will perform the job.

In case of central agency (ENGG SERVICES, CONSULTANT ,etc...), permit will be taken by central agency or permit will be taken by central agency and contractor under central agency on same form at prescribed area.

Standard Operating Procedure



Characteristics of adequate SOP

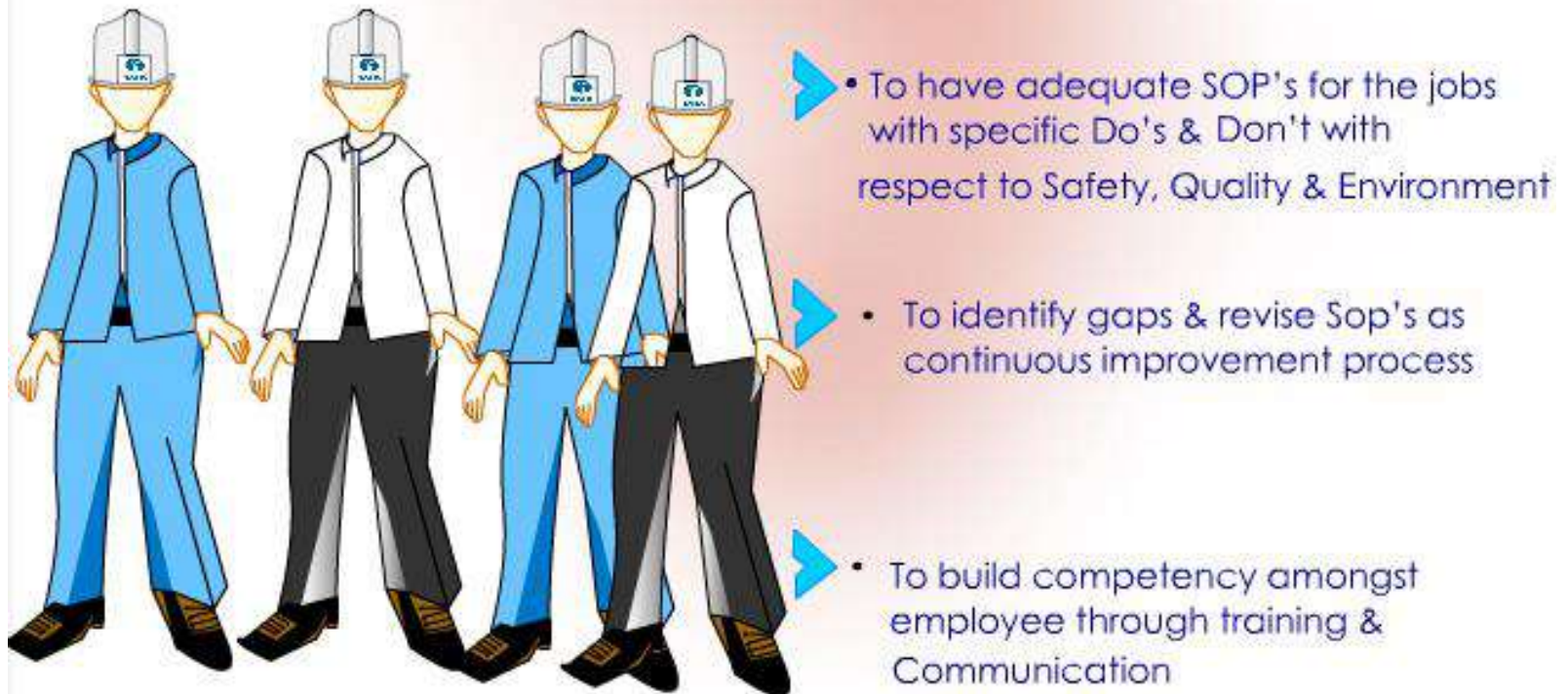
- 1 All the activities of the job are written sequentially on the prescribed format
- 2 Each activity is divided into sub steps
- 3 Quality requirement, safety hazard and environmental impact for each sub divided steps are identified and written separately
- 4 Clear cut responsibility for each sub step is mentioned
- 5 Quality requirement, safety hazard and environmental impact are addressed with suitable corresponding counter measures with the help of Equipment, PPE and Process

SOP preparation & Training responsibility

- SOP should be made in advance, in the prescribed format by the executing department.
- Training of SOP should be provided to all Contractors' Supervisors by Executing department.
- In case of Contractor under central agency is working , then SOP should be prepared & training on the Standard operating procedure should be imparted by the central agency.

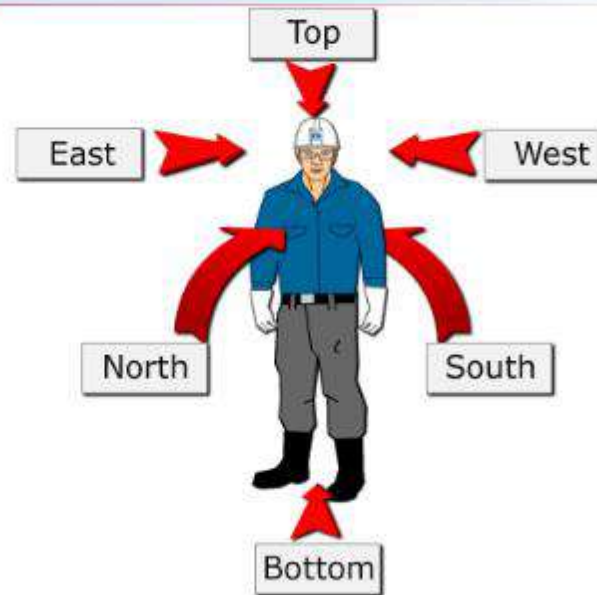
Job Cycle Check

A tool for checking adequacy & Compliance of Standard Operating Procedure



6 (Six) Directional hazard identification

Six Directional Hazards



SIX DIRECTIONAL HAZARD FORM (To be filled by executing agency)

Direction	Hazards Observed	Precautions/Measures to be taken	Remarks
North			
South			
East			
West			
Top			
Bottom			

Sign. of Permit Requested by

Common Violations Observed

- Incomplete Work Permit form
- Ownership of work permit form
- Availability of work permit at job site
- Inadequate Six directional hazard identification
- Inadequate SOP training

Module - 4

**Incident
Investigation**

Incident Investigation

Incident Definition

An incident is an event that results in



• Injury or illness



• Damage to property



• Significant impact
on
environment



• Unavoidable impact
on
the public



• Interruption
in
business

Why We Investigate Incidents??



- Increasing employees confidence in safety



- Identifying the systems that contribute to other incidents



- Preventing recurrence by taking appropriate action

All incidents should be investigated to

- Demonstrate management's commitment to safety by increasing employees' confidence in safety.
- Spot the deficiencies in safety management by identifying the systems and conditions that can contribute to other incidents.
- Prevent recurrence by taking appropriate action and communicating the lessons learned.

Line management is responsible for investigating all incidents.

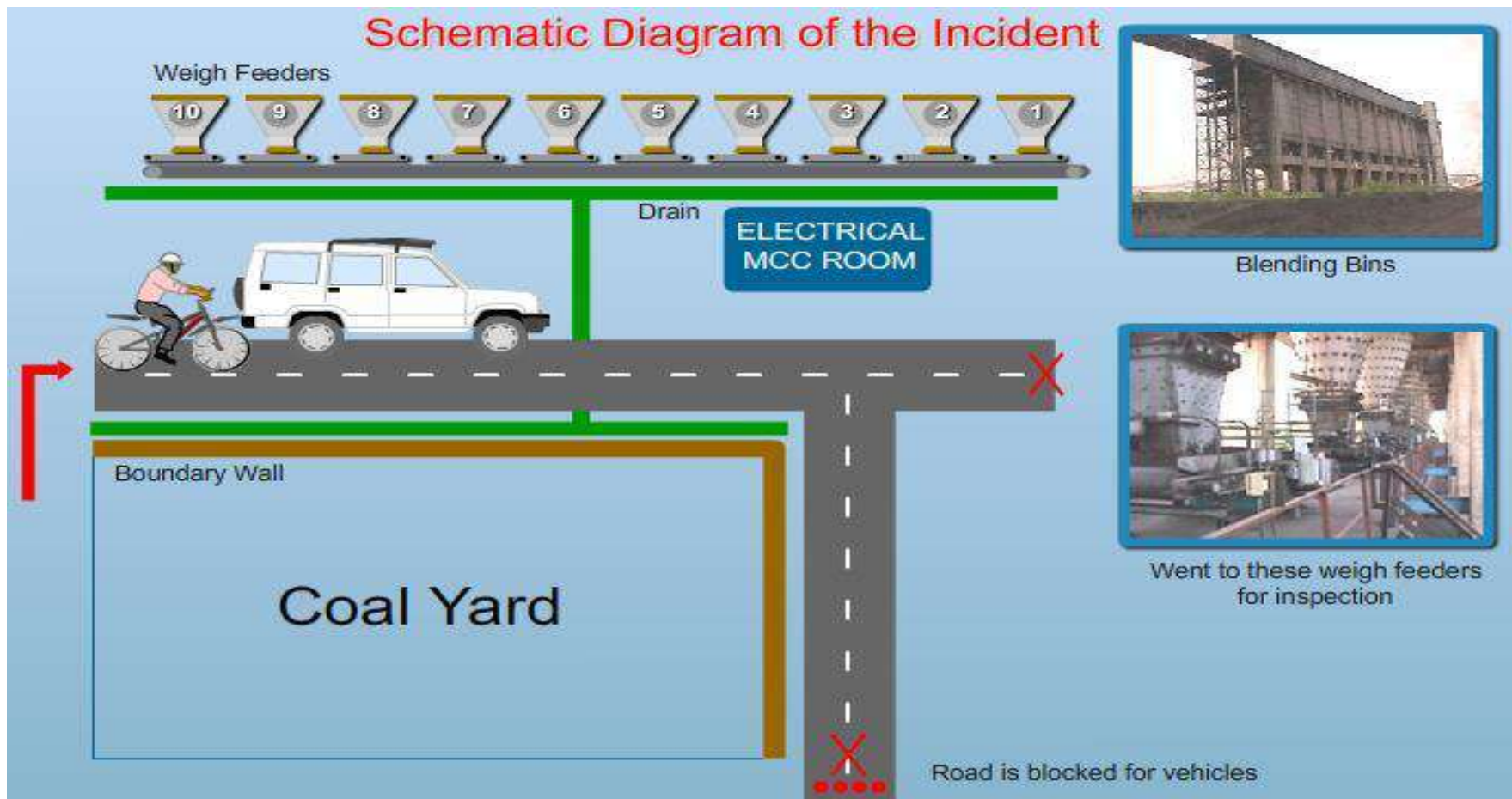
Incident Management



Incident management refers to the activities of an organisation to identify, analyse and eliminate hazards. Incident management also helps to restore normal operations as quickly as possible with least impact on either the business or the user, at a cost-effective price. Steps of incident management are:

- Initial response
- Incident reporting
- Process of investigation

Initial response and report



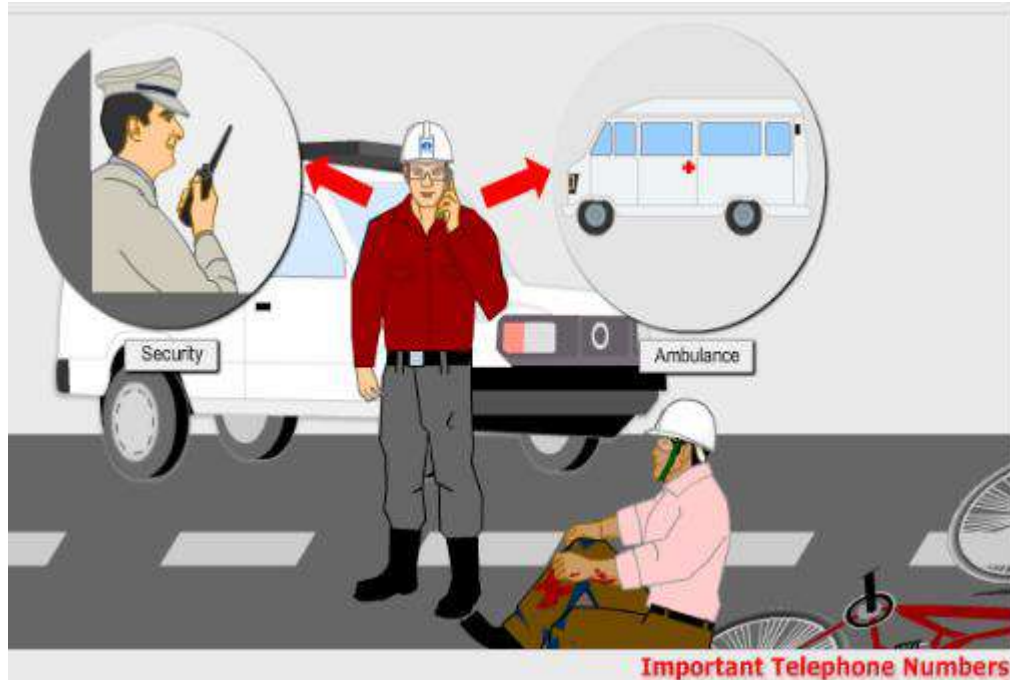
- Brief
- Limited to known facts (Date, time, what happened, immediate action taken)

Initial Response

Once an incident occurs the initial response of the department is

- Coordinating with the emergency response team
- Carrying out initial investigation at the site of incident
- Identifying and interrogating the witnesses present at the site
- Preserving evidences at the site of incident
- Controlling any secondary incident

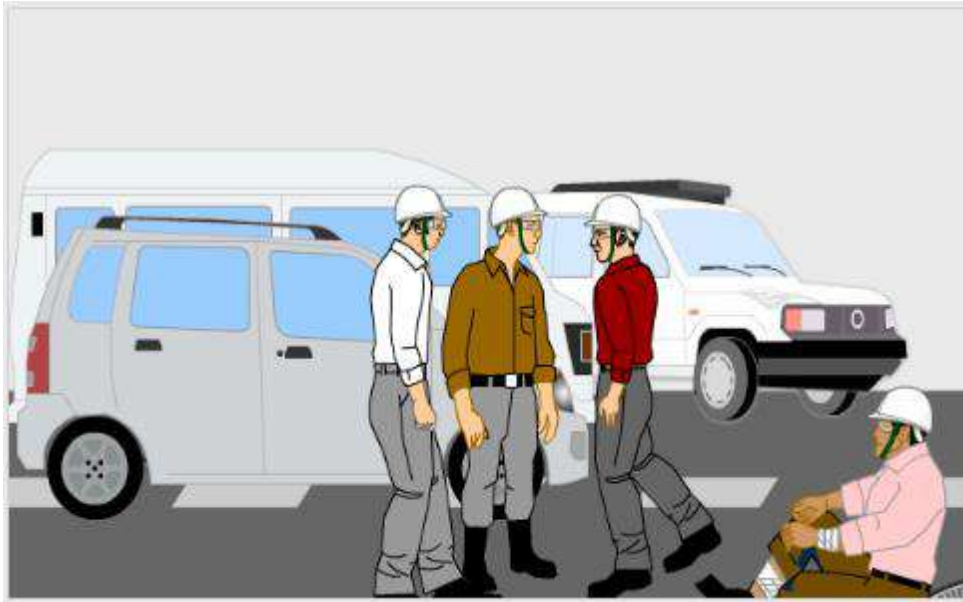
Co-Ordinating with emergency Response team



Coordinating with the emergency response team like the ambulance (first Aid station) Fire brigade, safety, security, emergency management centre (in case of gas leakage) etc is informed for taking necessary action

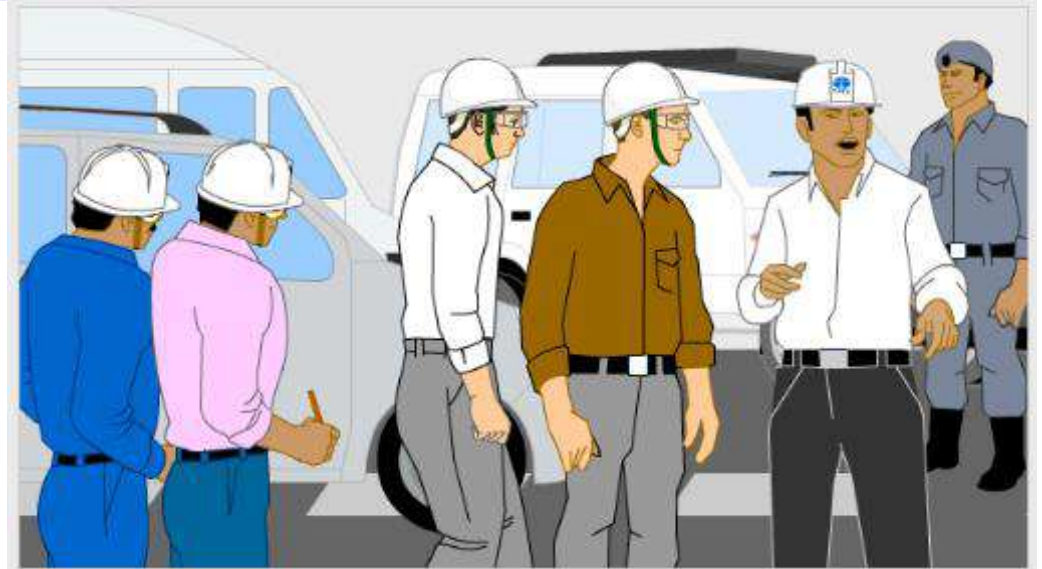


Carry out the initial investigation at the site of incident



Carrying out initial investigation at the site of incident: The concerned authorities visit the incident site and carry out the investigation. Technical incident should be investigated by technical people

Identify and interrogate the witnesses present at the site and keep a record of information

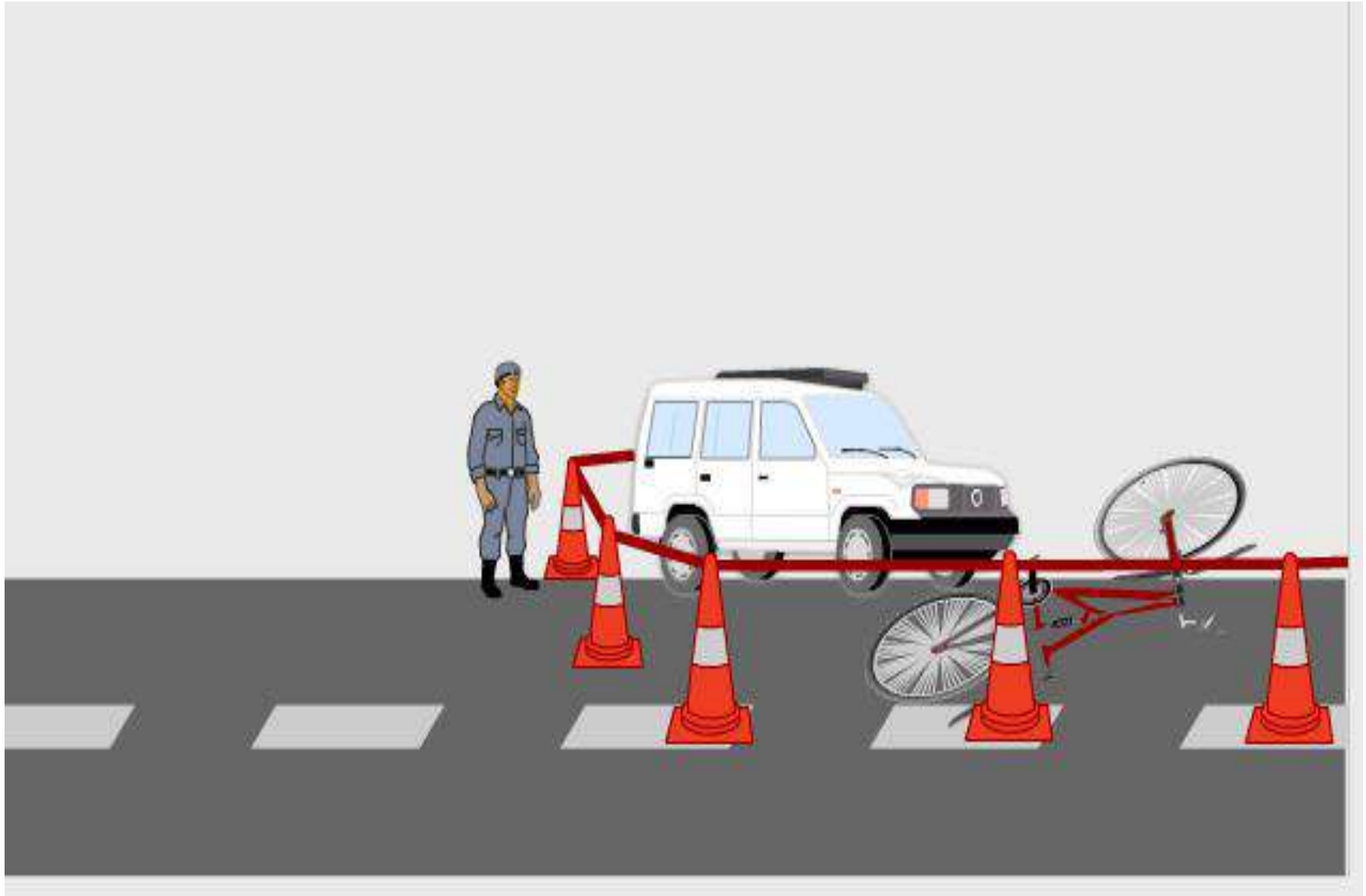


Preserving evidence at the site of incident



Preserving evidences at the site of incident: This is done by removing the people from the incident site and securing the area with barricades, posting security personnel etc. Preserve evidences till clearance is obtained from safety department.

Controlling Any Secondary Incident



Process of Investigation

The steps involved in the process of investigation are:

		← Probability				
		A	B	C	D	E
↑ Consequence	1	1	2	4	7	11
	2	3	5	8	12	16
	3	6	9	13	17	20
	4	10	14	18	21	23
	5	15	19	22	24	25



- **Prioritisation of the incident based on the risk score**

- **Formation of the investigation team**



- **Investigation**



- **Recommendations**

Incident Prioritisation & Risk Score Calculation



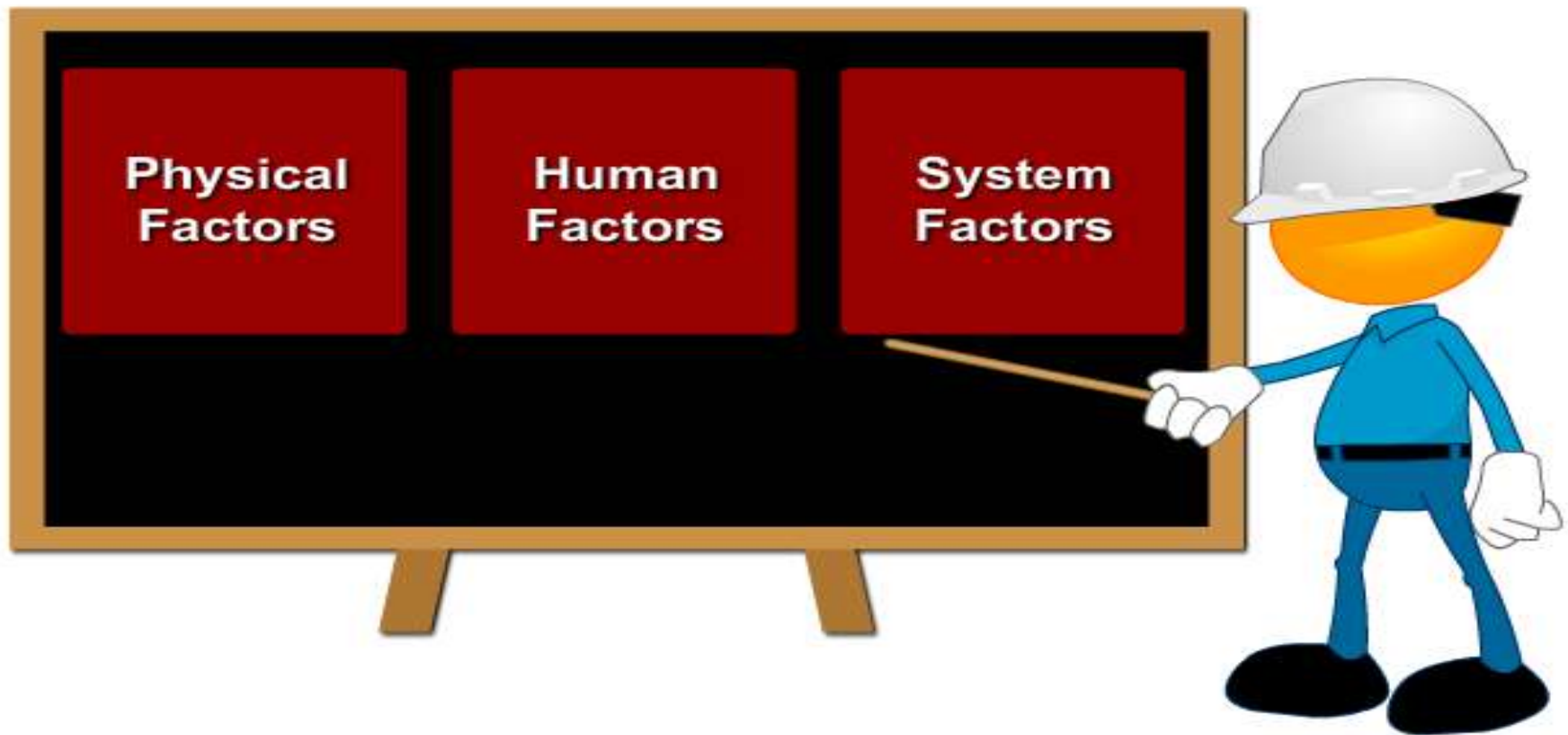
Risk score calculation: Risk score is calculated for human damage as well as property damage separately to prioritise the incidence. Based on the risk score the decision to investigate the incident should be taken. Detailed investigation is mandatory if the risk score is less than or equal to 15. Detailed investigation is optional if the risk score is greater than 15. It is on the discretion of the Chief or Head of the concerned department to demand investigation for such cases or not.

Investigation Team



Investigation team is formed based on risk score to conduct detailed investigation to find the root cause of the incident.

- Select the team members (skills and knowledge?)
- Define the responsibilities (terms of reference)
- Define the scope (boundaries) of the investigation



The investigation team collects the facts and evidences that are relevant to the incident. The facts are explored and they are categorised into physical, human and system factors. The physical factors are:

- Weather conditions
- Condition of the machinery
- Tools used in the process
- Personal protective equipment used
- Work area
- Heat/Temperature
- Noise
- Illumination



Weather



Machinery



Tools



PPEs



Work area



Heat/Temperature



Noise



Illumination

The investigation team collects the facts and evidences that are relevant to the incident. The facts are explored and they are categorised into physical, human and system factors. The physical factors are:

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- Work area
- Heat/Temperature
- Noise
- Illumination



**Employee Attitude
and Motivation**



Lack of Awareness



**Violation of
Safety Rules**



PPEs not used



Horse Play



**Use of Drug
or Alcohol**



**Bypassing
Safety Devices**



**Improper Work
Technique**



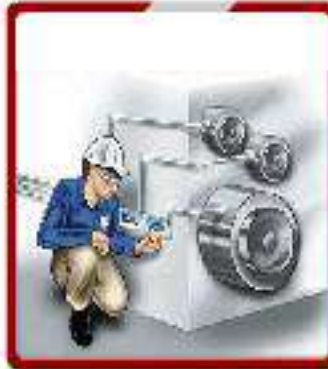
Training



Documentation



Rules or
Procedures



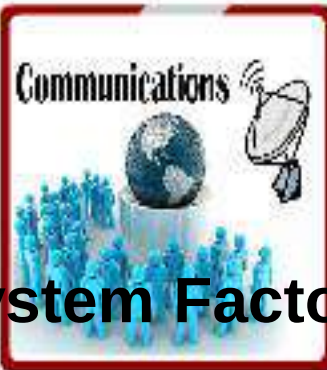
Preventive
Maintenance



Job Safety
Analysis



Previous Results
(audits and observations)



Communication



Standards
of Performance



Supervision Practices
and Standards



Availability
of PPEs

System Factor

Categorisation Of Incident Causes

Some Areas to Question : Physical

Unsafe Conditions (Physical)

Poor workstation design or layout
Congested work area
Hazardous substances
Fire or explosion hazard
Inadequate ventilation
Improper material storage
Improper tool or equipment
Slippery conditions
Poor housekeeping
Excessive noise
Inadequate guarding of hazards
Defective tools/equipment
Insufficient lighting
Inadequate fall protection

Some Areas to Question : Human

Unsafe Acts (Human)

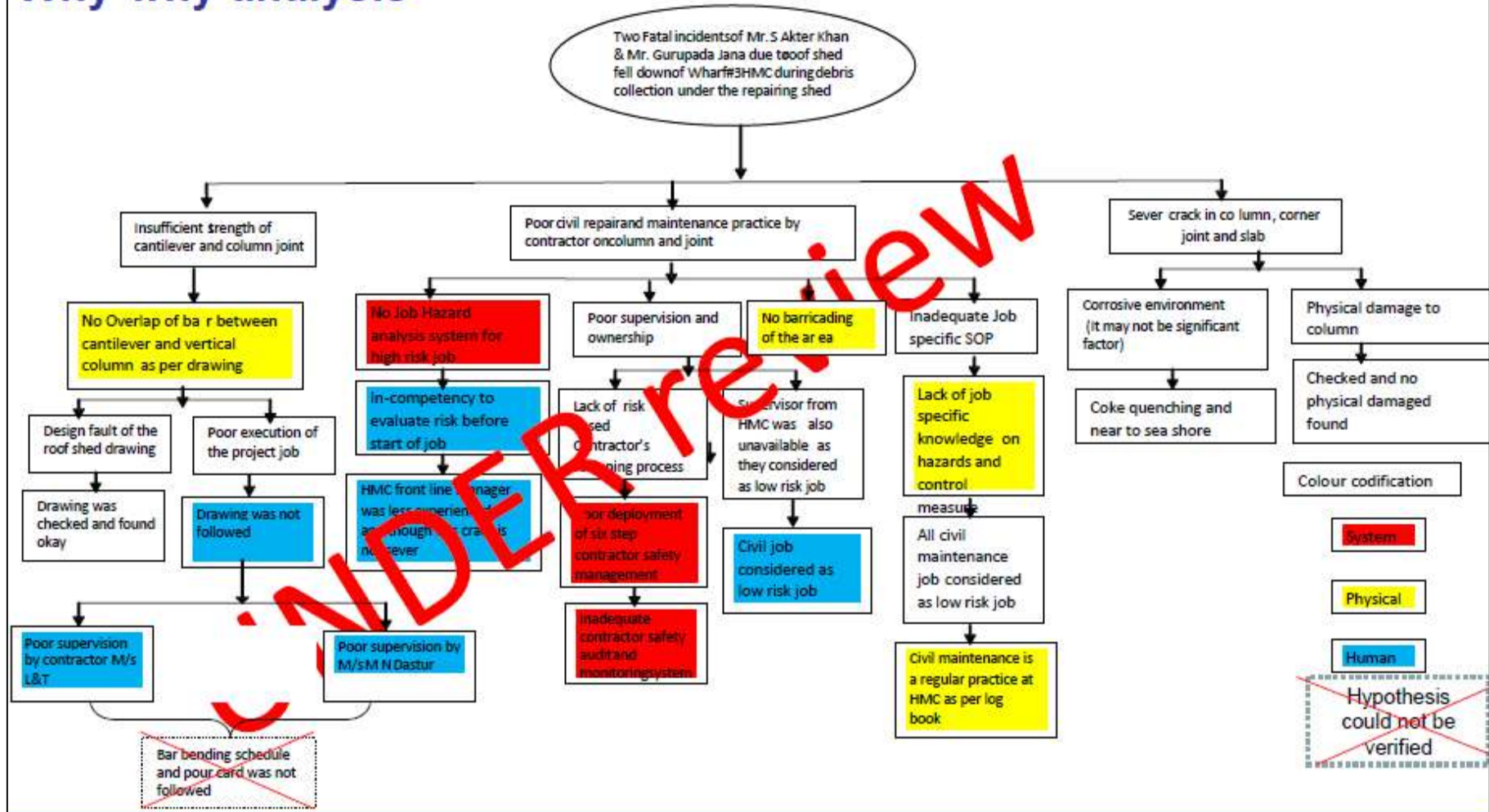
Improper work technique
Safety rule violation
Improper PPE or PPE not used
Operating without authority
Failure to warn or secure
Operating at improper speeds
By-passing safety devices
Guards not used
Improper loading or placement
Improper lifting
Servicing machinery in motion
Horseplay
Drug or alcohol use
Unnecessary haste
Unsafe act of others

Some Areas to Question : System

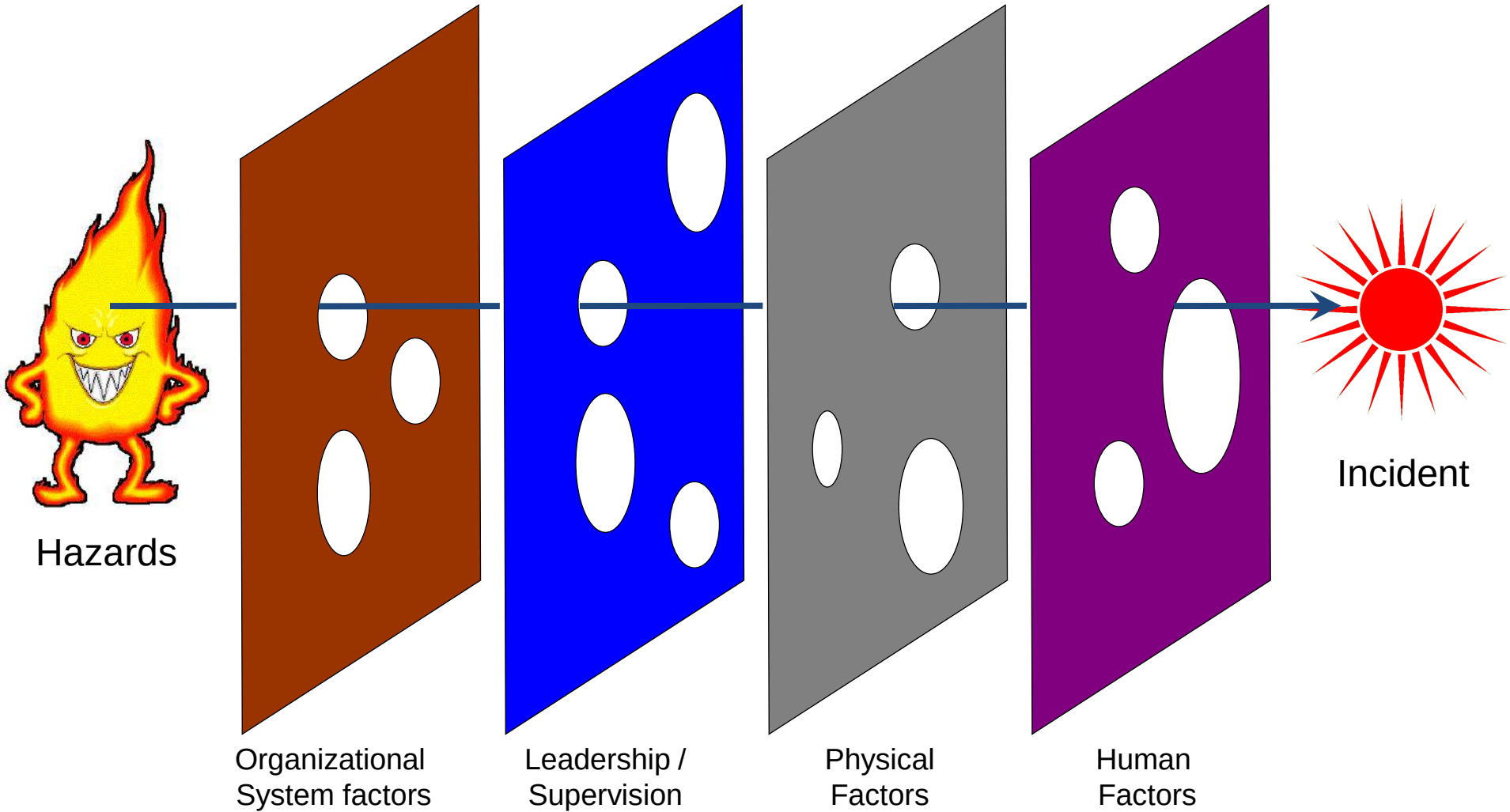
Operating system

- Training
- Documentation
- Rules/ Procedures
- Preventive Maintenance
- Job safety analyses
- Previous results (Audits & Observations)
- Communication

Why-why analysis



Barrier Analysis



Recommendations



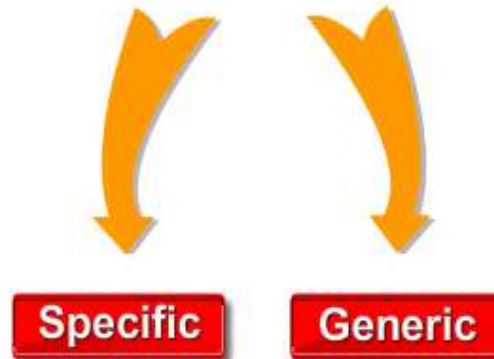
Develop Recommendations

Corrective and preventive actions should be

SMART:

- Specific & precise
- Measurable (Should have KPI)
- Achievable (Should be implementable)
- Relevant (linked to some cause)
- Time Bound - (It should be close ended – means implementable within specific time duration) : Immediate, Short term & Long term

Recommendations can be classified on the basis of applicability





Fool Proof

Recommendations can be classified on the basis of prevention methods as

Fool proof: Executing a plan that will eliminate the root cause in such a way that even a fool will not be able to commit a mistake. For example, where job was being done manually, providing mechanisation or automation can eliminate mistakes.

Module - 5

**Safety in Material
Handling**

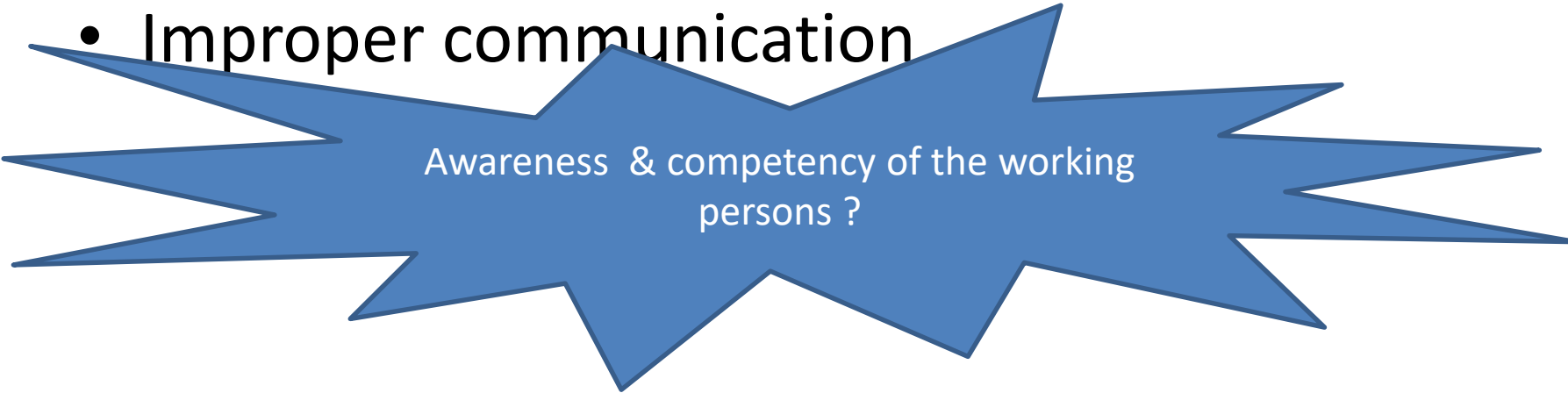
Material Handling Hazards

- Back injuries
- Workers being struck by or crushed by falling loads due to improper rigging and sling failures
- Workers being electrocuted due to power line contact
- Workers being struck by falling materials which are improperly stored
- Being caught in pinch points
- Workers slipping, tripping, and falling



Reasons for incidents

- Failure of material handling equipments
- Unsafe position of the persons
- Improper method of handling
- Swing of the materials
- Unstable / insecure material
- Improper communication



Awareness & competency of the working
persons ?

Type of material handling

1. Manual material handling



2. Mechanized material handling i.e. material handling via machine

1. Manual materials Handling

- ❖ Carrying bags or material
- ❖ Unpacking materials



Hazard during Manual materials Handling

- Improper manual lifting or carrying loads that are too large or heavy.
- Being struck by materials or being caught in pinch points.
- Crushed by falling materials or improperly stored materials.

Improper lifting of objects is a major cause of back injuries in the work place.



Risky Moves

Certain actions are more likely to cause back injuries than others. Anytime you find yourself doing one of these things, you should think:

DANGER! My back is at risk!

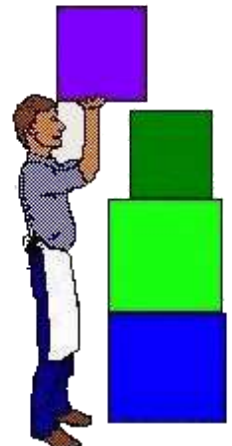
Heavy lifting...especially repetitive lifting over a long period of time



T **wisting at the waist** while lifting or holding a heavy load. (This frequently happens when using a shovel.)



Reaching and lifting...over your head, across a table, or out the back of a truck.

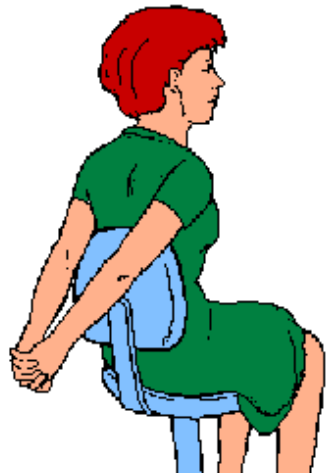




More Risky Moves

Lifting or carrying objects with awkward or odd shapes

Working in awkward, uncomfortable positions... gardening, kneeling, tasks that require you to bend over for long periods of time...



Also, sitting or standing for too long without shifting.

Contributing Factors to Handling/ Injuries



Overdoing it...

- Don't be afraid to say, **"This is too heavy for me to lift alone."**
- It's important to recognize your physical limitations and abilities. Many people have injured their backs because they were afraid to *ask for help*.

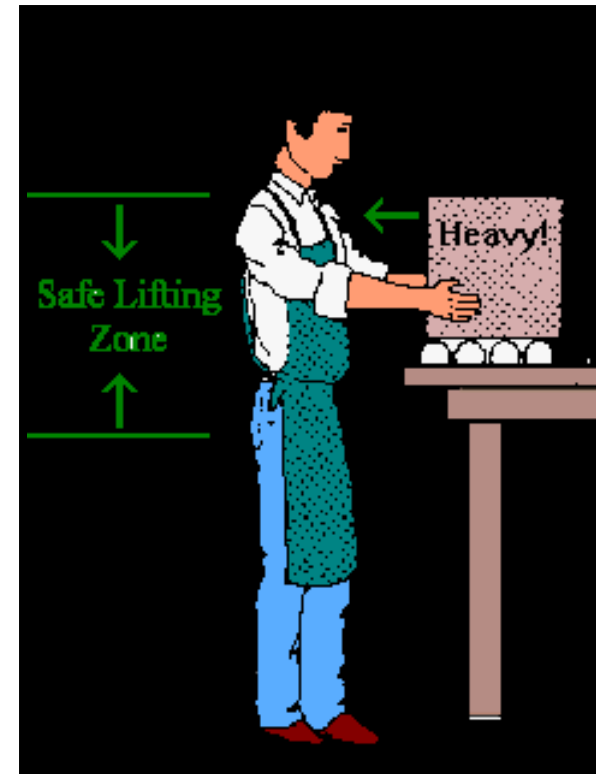
Preventing Back Injuries

The best way to prevent back injuries is to develop habits that reduce the strain placed on the back. There are some basic things you can do to help.

Avoid Lifting and Bending Whenever You Can!

Place objects up off the floor. If you can set something down on a table or other elevated surface instead of on the floor, do it so you won't have to reach down to pick it up again.

Raise / lower shelves. The best zone for lifting is between your shoulders and your waist. Put heavier objects on shelves at waist level, lighter objects on lower or higher shelves.



4 common causes of back injuries

bending



reaching



twisting



heavy lifting



© 2004 Gary Rosenbaum

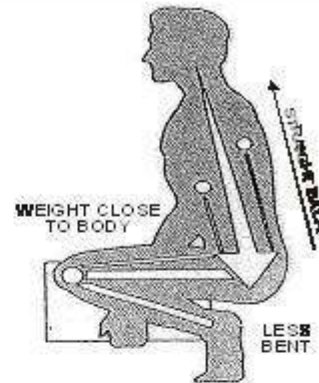
always lift properly to prevent painful back injuries

gr 0083

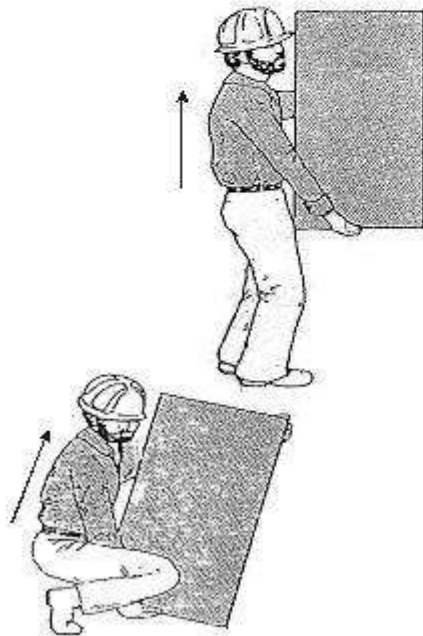
www.safetytoons.com



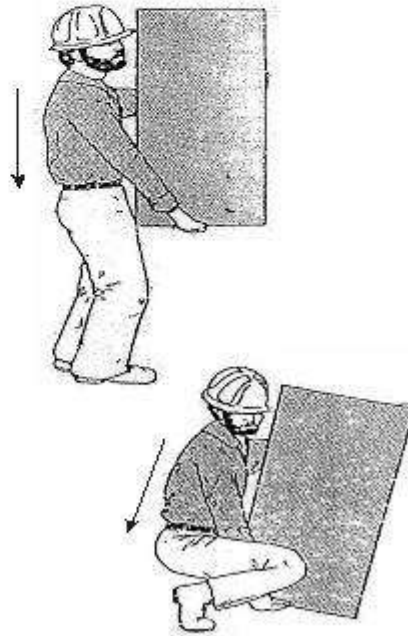
Failure to lift a heavy load properly can result in serious back injury.



Leg muscles must be used when lifting any size load - never the back.



The proper way to lift a shoulder high load.



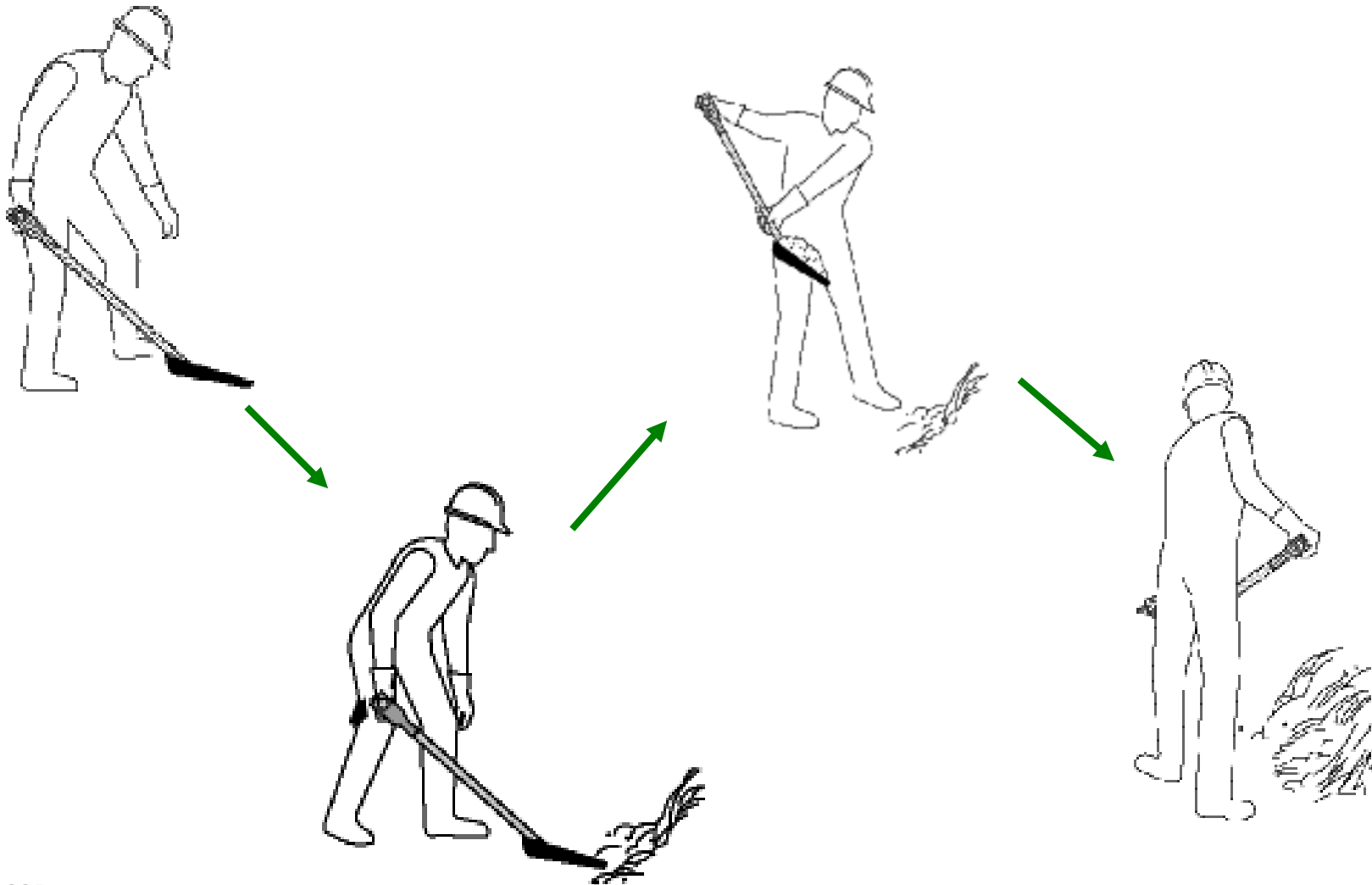
The load must be put down as carefully as it was lifted.

•Safe lifting postures

ALWAYS OBEY THE NEVERS!

- Never allow more than one person to control a lift or give signals.
- Never raise the load more than necessary.
- Never leave the load suspended in the air.
- Never work under a suspended load.

Shoveling and Throwing

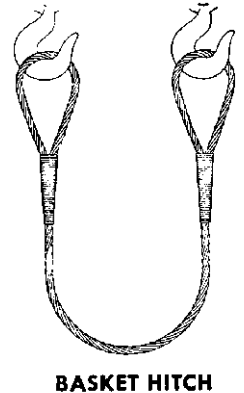
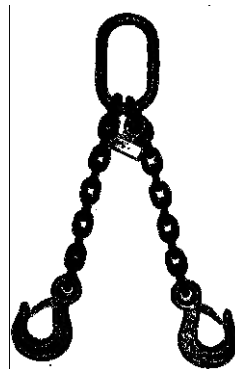
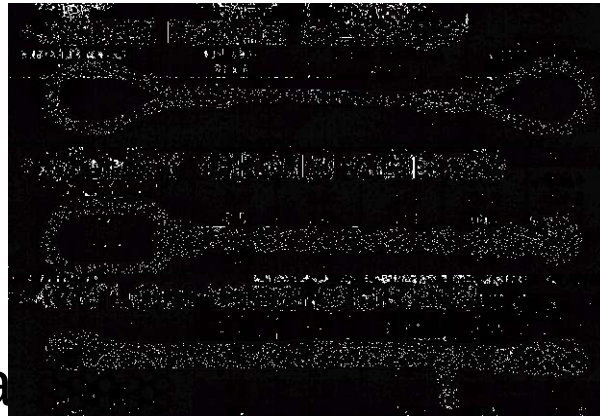


Shoveling and Throwing

- To minimize twisting while shoveling and throwing: Keep feet wide apart. Place front foot close to shovel. Put weight on front foot. Use leg to push shovel. When lifting, put your weight on your front foot. Shift weight to rear foot. Keep load close to body. Turn feet in direction of throw. Always avoid twisting your back

Rigging

- Always use rigging to connect the load to the hook
- Materials
 - Wire rope
 - Fabric
 - Chain
- Slings
 - Straight (regular)
 - Choker
 - Basket
 - Double, triple, etc.



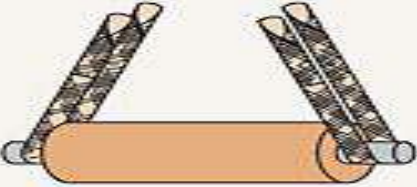
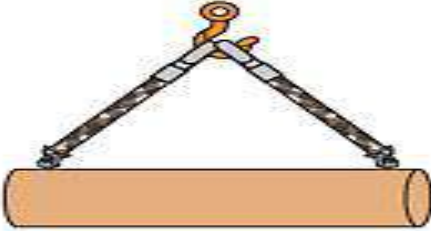
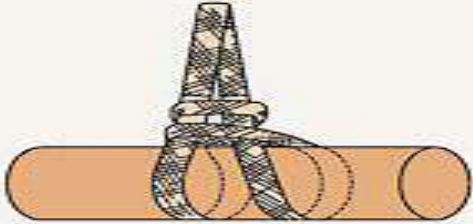
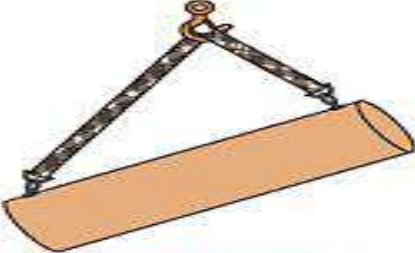
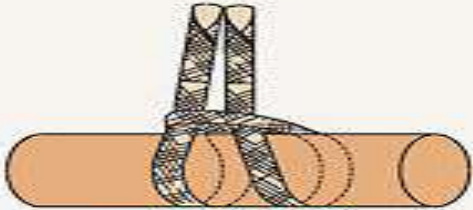
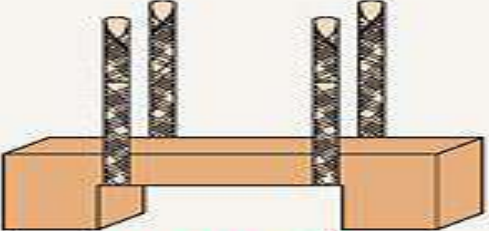
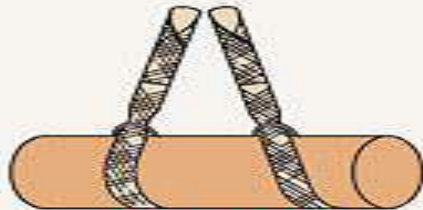
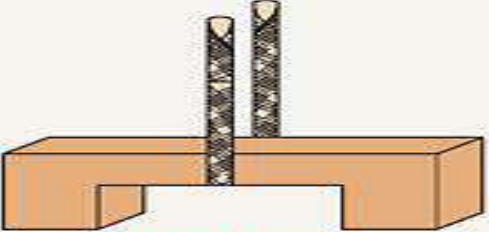
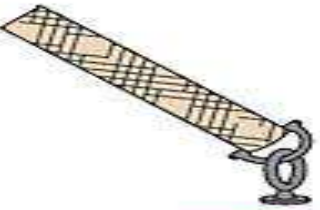
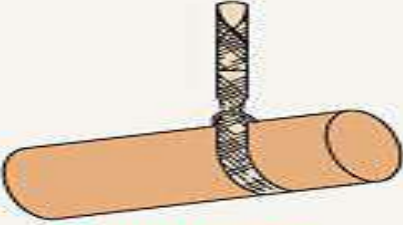
Rules for Rigging Safety

- Know the weight of the load
- Know the center of gravity of the load.
- Make load attachment above the center of gravity of the load.
- Select hitch that will hold and control.
- Know the rated capacity of slings and hardware.

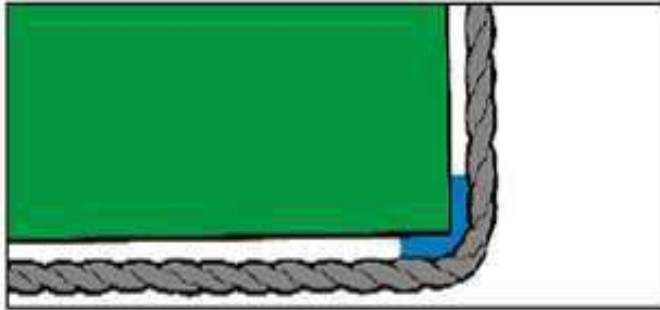
Rules for Rigging Safety

- Select sling best suited for load.
- Inspect all rigging before the lift.
- Protect sling from sharp surfaces
- Proper calculation of increased tension caused by sling angles (on all rigging components!).

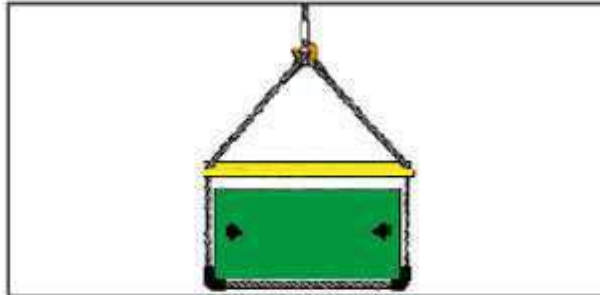
BASIC RIGGING TECHNIQUE(SLING)

RIGGING TECHNIQUES		
BASKET HITCHES	EYEBOLTS	CHOKER HITCHES
 CORRECT	 CORRECT	 CORRECT
 INCORRECT	 INCORRECT	 INCORRECT
 CORRECT	 CORRECT	 CORRECT
 INCORRECT	 INCORRECT	 INCORRECT

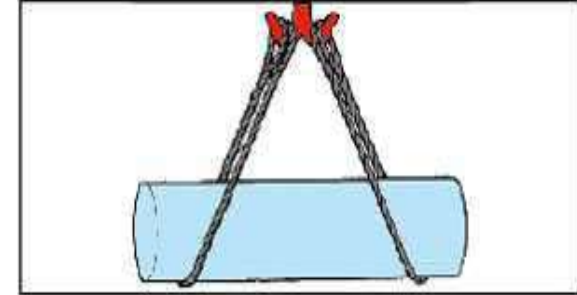
BASIC RIGGING TECHNIQUE(SLING)



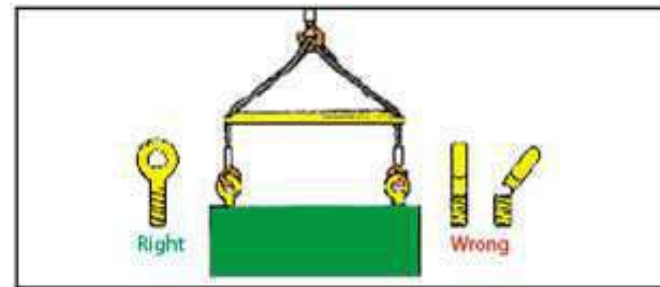
Protect slings during the lift with blocking or padding



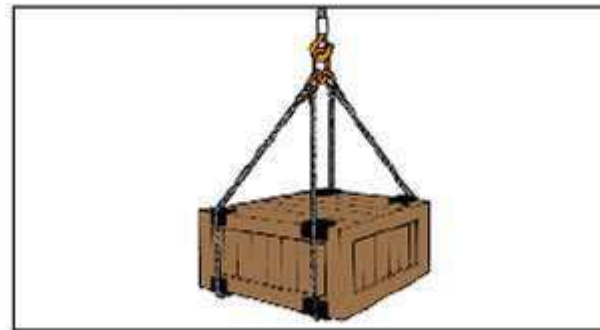
Use a spreader bar between sling legs



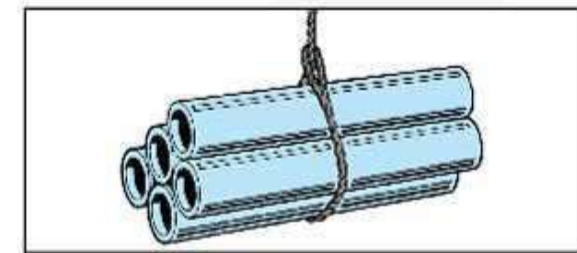
Two slings rigged in a basket hitch provide better balance .



When attaching slings to eye bolts, always pull in line with the bolt axis. A side pull may break the eye bolts. Eye bolts without shoulders cannot be used for angular lifting.

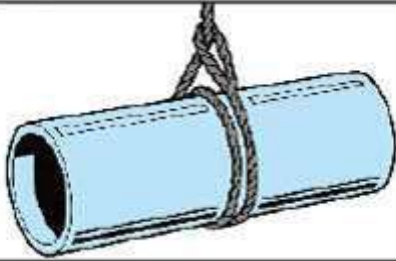


When lifting crates use spreader bars and sling protection to prevent damage.

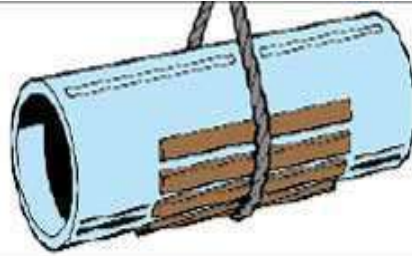


When lifting a bundled load, a choke is more effective than a basket hitch. Odd numbers of rounded objects will nestle as even numbers tend to slide out. If practical use more than one sling and employ a double wrap choke hitch.

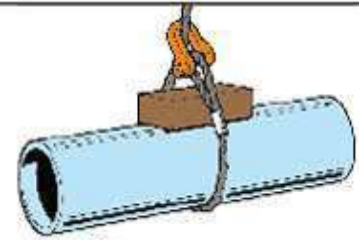
BASIC RIGGING TECHNIQUE(SLING)



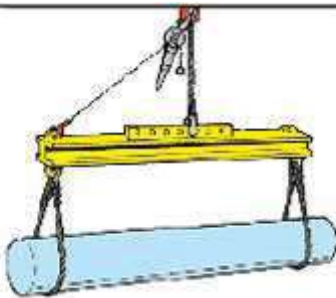
Use a double wrap choke hitch around the load for 360° load contact, to prevent load slippage. To be used in different position for balance.



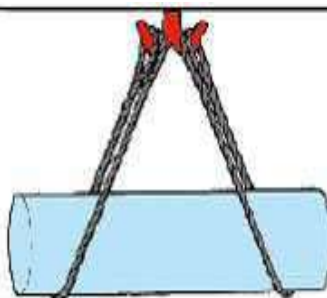
Use blocking or padding to protect hollow vessels, Remember Please Note: One sling is depicted for illustration purposes only.



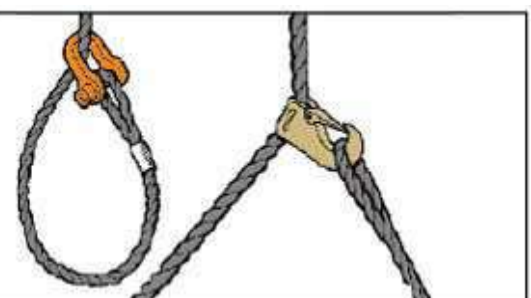
You can improve the angle of a choke with blocking between the hitch and the load. Please Note: One sling is depicted for illustration purposes only.



An equalizing bar with two slings rigged in a basket hitch reduces the tendency of slings to slide and keeps the load level.

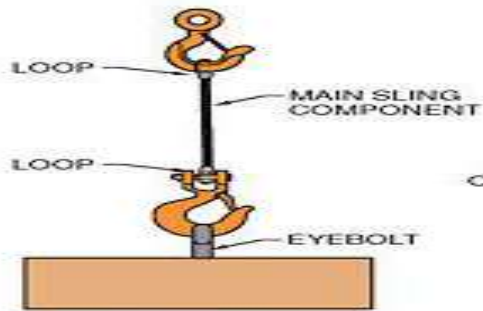


Two slings rigged in a basket hitch provide better balance for loads. Be sure that slings cannot slide along the load when the lift is made and use extreme caution.

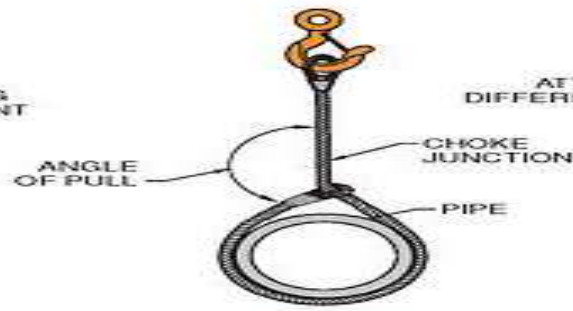


Use a shackle in sling eyes during a choke to protect sling body against excessive distortion. Always put shackle pin through sling eye, rather than against the sling body.

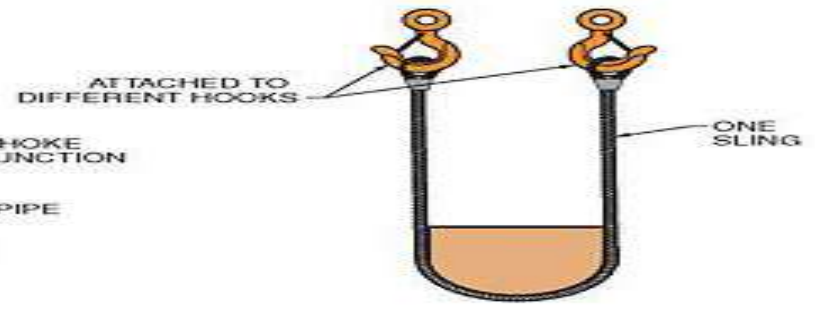
BASIC SLING COMBINATIONS



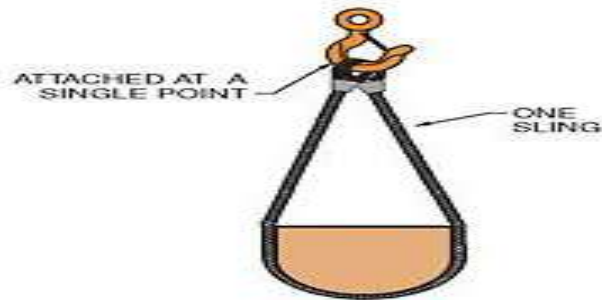
**VERTICAL
(SINGLE-LEG)**



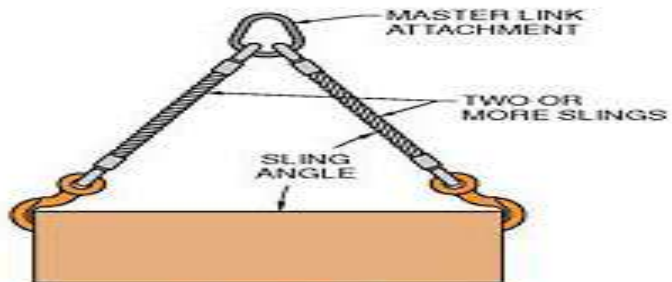
CHOKER



U



BASKET



BRIDLE

**SLING ROPE LOAD CAPACITY 6 x 36
CLASSIFICATION (2000 LB TON)**

Rope Dia*	Choker	Vertical Load	2-Leg 30°	2-Leg 45°	2-Leg 60°
1 1/4	9.9	11.0	11.0	16.0	20.0
1 3/8	12.0	14.0	14.0	19.0	24.0
1 1/2	14.0	18.0	16.0	21.0	29.0
1 3/4	19.0	22.0	22.0	23.0	38.0
2	25.0	28.0	24.0	40.0	49.0

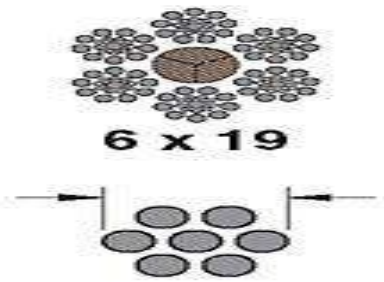
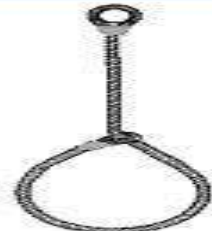
* in in.

**VERTICAL SLING COMPONENT LOAD CAPACITY
6 x 19 IPS-FC CLASSIFICATION* (2000 LB TON)**

Rope Dia†	Spelter/ Swaged	U-Bolt	Wedge	Mechanical Splice
1/4	.54	.43	.43	.49
3/8	1.22	.97	.97	1.09
1/2	2.14	1.71	1.71	1.92
3/4	4.76	3.80	3.80	4.28
1	8.36	6.68	6.68	7.52

* rates include safety factor of 5
† in in.

SLING MATERIAL STRENGTH CAPACITIES*

 6 x 19 ROPE DIA†	Rated Capacities (in Tons)‡		
	 VERTICAL	 CHOKER	 BASKET
$\frac{1}{4}$	.51	.38	1.0
$\frac{5}{16}$	.79	.60	1.6
$\frac{3}{8}$	1.1	.85	2.2
$\frac{7}{16}$	1.5	1.1	3.0
$\frac{1}{2}$	2.0	1.5	4.0
$\frac{9}{16}$	2.5	1.9	5.0
$\frac{5}{8}$	3.1	2.3	6.2
$\frac{3}{4}$	4.4	3.3	8.8
$\frac{7}{8}$	6.0	4.5	12.0
1	7.7	5.9	15.0

* improved plow steel/fc

† in in .

‡ rates include safety factor of 5

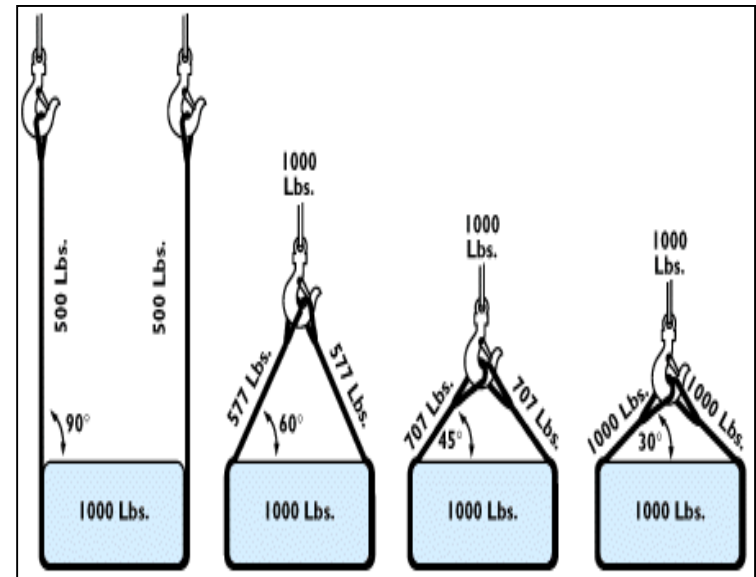
Rigging Basic- Sling Angle

Sling angle has a dramatic effect on the actual load on the sling. Take a sling that has a 1000 pound vertical lifting capacity in a basket hitch:

As angle decreases - tension on each leg increases – increasing the strain on each leg

A different look, with the same load and sling, changing the angle has a similar dramatic effect

Sling Angles in Degrees	Factor	Sling Angles in Degrees	Factor
15	.259	55	.819
20	.342	60	.866
25	.423	65	.906
30	.500	70	.940
35	.574	75	.966
40	.643	80	.985
45	.707	85	.996
50	.766	90	1.000

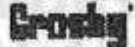
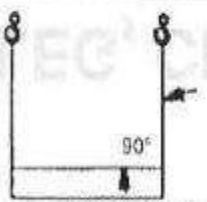
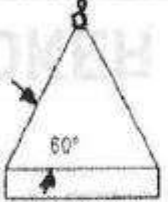
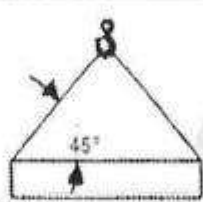
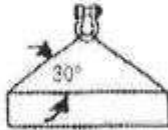


Rigging Basic- Sling Angle

WIRE ROPE SLING CAPACITIES (LBS.) – FLEMISH EYE – ANSI B30.9

3

6 X 19 AND 6 X 37
IMPROVED PLOW STEEL – IWRC 5/1 DESIGN FACTOR

WIRE ROPE SIZE	 Q & T CARBON SHACKLE MINIMUM SHACKLE SIZE FOR A D:d > 1 AT LOAD CONNECTION		 ANGLE 120	 90°	 60°	 45°	 30°
	SHACKLE SIZE	VERTICAL (SINGLE LEG)	CHOKER	TWO LEG OR BASKET HITCH	60 DEGREE SLING ANGLE	45 DEGREE SLING ANGLE	30 DEGREE SLING ANGLE
1/4	5/16	1120	820	2200	1940	1500	1100
5/16	3/8	1740	1280	3400	3000	2400	1700
3/8	7/16	2400	1840	4800	4200	3400	2400
7/16	1/2	3400	2400	6800	5800	4800	3400
1/2	5/8	4400	3200	8800	7600	6200	4400
9/16	5/8	5800	4000	11200	9600	7900	5600
5/8	3/4	6800	5000	13600	11800	9600	6800
3/4	7/8	9800	7200	19600	16900	13800	9800
7/8	1	13200	9600	26400	22800	18600	13200
1	1-1/8	17000	12600	34000	30000	24000	17000
1-1/8	1-1/4	20000	15800	40000	34600	28300	20000
1-1/4	1-3/8	26000	19400	52000	45000	36700	26000
1-3/8	1-1/2	30000	24000	60000	52000	42400	30000

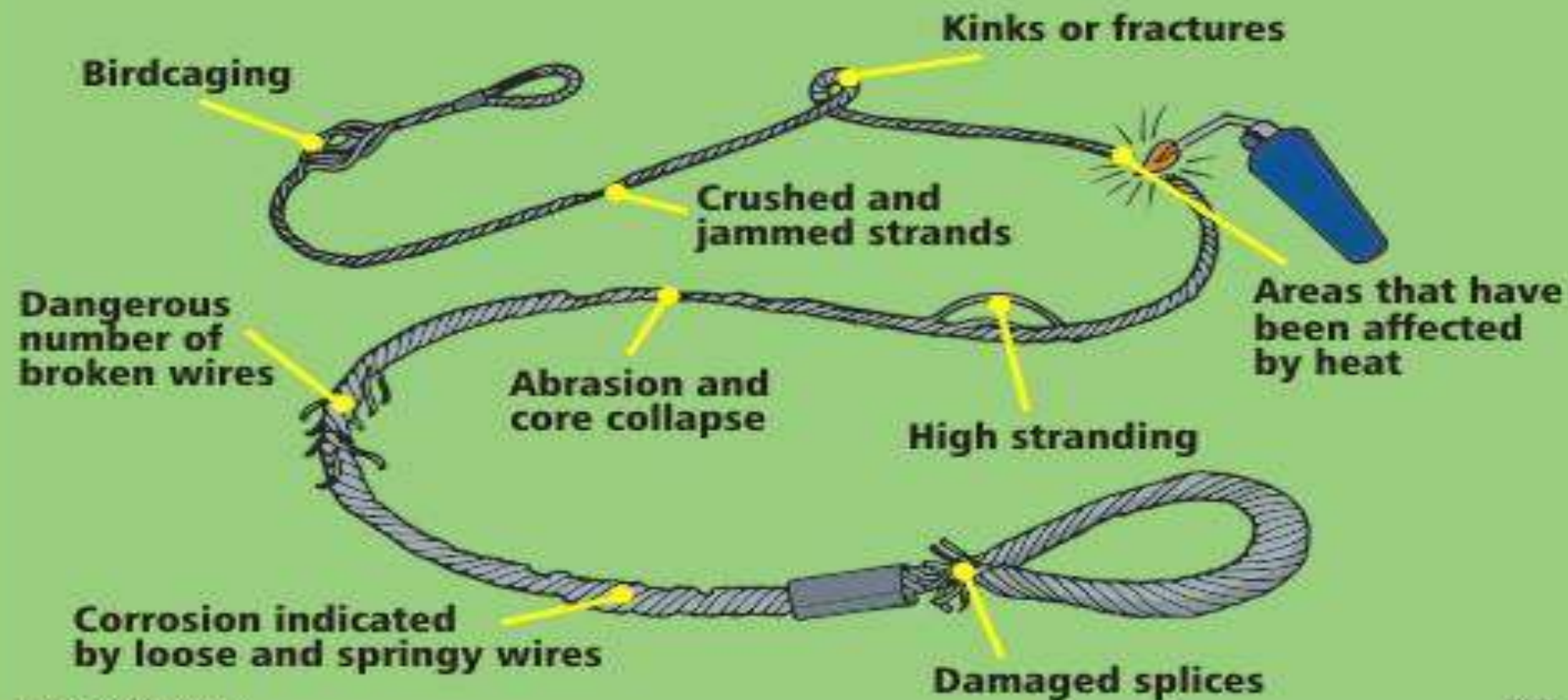
- RATED CAPACITIES BASED ON PIN DIAMETER OR HOOK NO LARGER THAN THE NATURAL EYE WIDTH (1/2 X EYE LENGTH) OR LESS THAN THE NOMINAL SLING DIAMETER

REFER TO ANSI B30.9 FOR FULL DETAILS

HORIZONTAL SLING ANGLES OF LESS THAN 30 DEGREES ARE NOT RECOMMENDED

Flexible Steel Wire Rope Checks

Before you use a flexible steel wire rope be sure to check for:

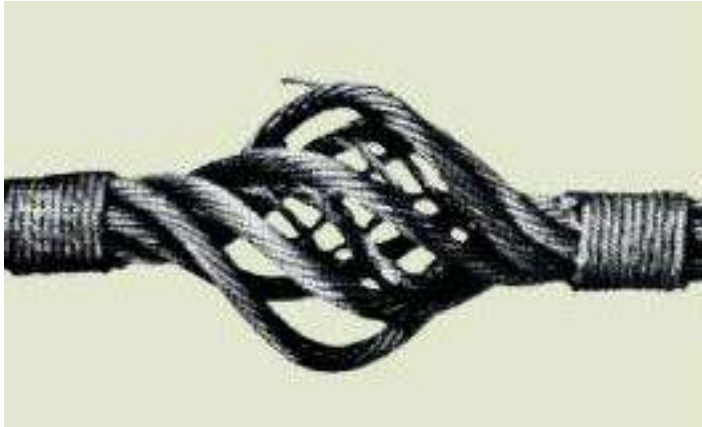


Wire Rope Slings

Remove From Service

Wire Rope Sling Inspection. Visually inspect before each use. Check the twists or lay of the sling. If ten randomly distributed wires in one lay are broken, or five wires in one strand of a rope lay are damaged, do not use the sling. End fittings and other components should also be inspected for any damage that could make the sling unsafe.

Bird cage -- Wire rope strands are untwisted and become spread outward. Caused by sudden release of tension and the rebound of the rope from the overloaded condition. These strands and wires will not return to their original positions.



Bird Caging



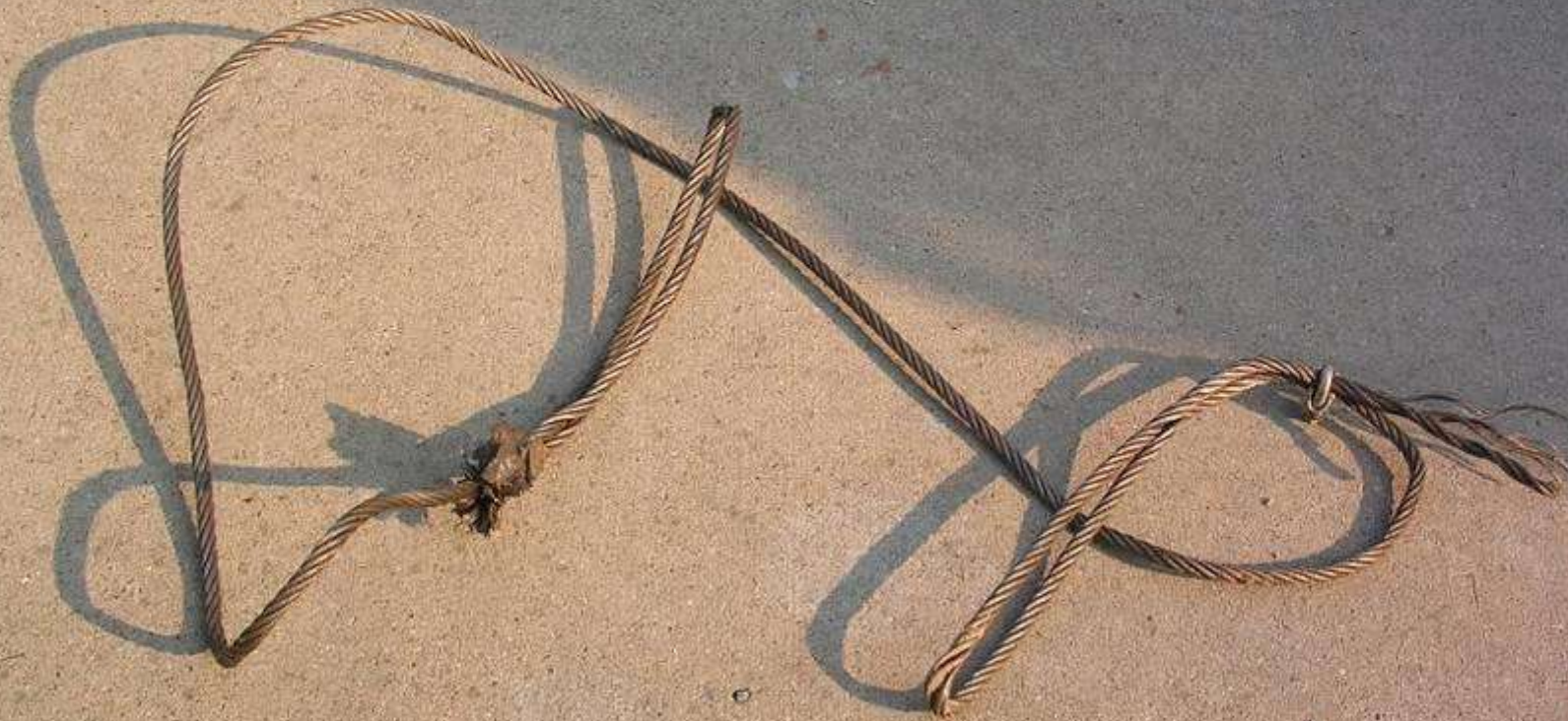
Kinking



Crushing

This photograph shows a makeshift sling that should be taken out of service. You should also be sure to check winch lines on rigs for damage.

makeshift slings and other rigging devices are unacceptable



Corrective Actions: never try to repair a broken or badly damaged rigging device; use only approved rigging devices

Rope Replacement Criteria based on Visual Inspection



A THIS ROPE WAS DAMAGED BY BEING ROLLED OVER SOME SHARP OBJECT.



E THIS EFFECT OF DRUM CRUSHING IS EVIDENCE OF BAD WINDING CONDITIONS.



C AN OCCURRENCE THAT IS CALLED A POPPED CORE.



D THIS IS A TYPICAL BIRD CAGE CONDITION.



E THIS IS THE APPEARANCE OF A TYPICAL TENSION BREAK: A RESULT OF OVERLOADING.



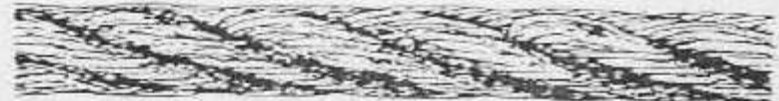
F HERE THE STRAND WIRES WERE SNAGGED.



G



H A) SERIOUS WEAR RESULTING FROM EXCESSIVE BENDING, AND B) LOCALIZED WEAR BROUGHT ABOUT BY POOR CUT-OFF PRACTICE



THIS IS AN ILLUSTRATION OF A SERIOUS CONDITION WHERE THE ROPE SLIDES OVER OR AGAINST ITSELF

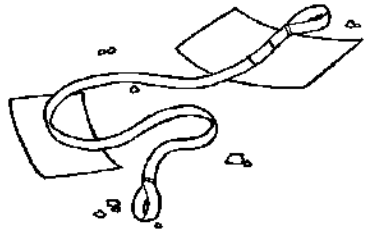
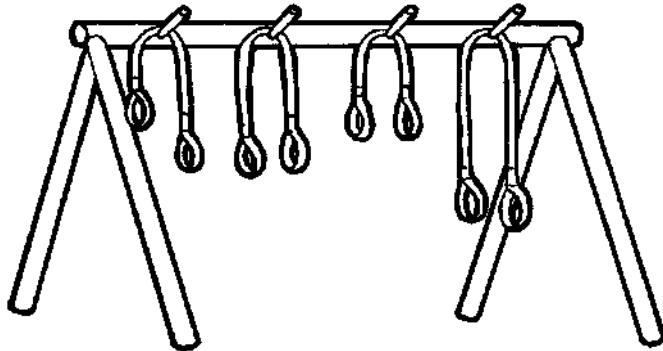


J AN ILLUSTRATION OF VALLEY TYPE FATIGUE BREAKS: FLEXING THE ROPE EXPOSES BROKEN WIRES HIDDEN IN VALLEYS BETWEEN STRANDS.

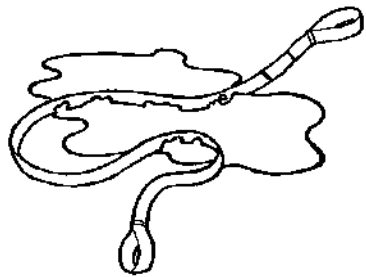


K THESE DAMAGES WERE THE RESULT OF BAD DRUM WINDING.

WIRE ROPE STORAGE & MAINTANANCE



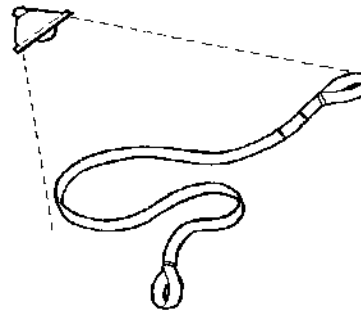
**Never
stored on
the ground
or floor.**



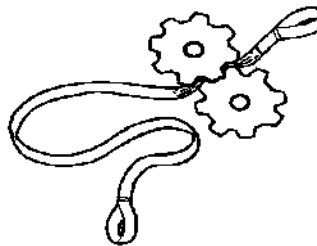
**Stored away
from atmosphere
or liquid
chemicals.**



**Stored in a clean, dry
and well ventilated
place.**



**Stored out of the
direct sunlight,
ultra-violet light
or florescent
lighting.**



**Stored in an area
where they cannot be
mechanically
damaged.**

CHAIN BLOCK

In Tata steel these three types of chain blocks are recommended for use and all the Chain block must be inspected through MSG Mech before use in the plant



M Type Chain pulley Block

MORRIS

ARMSEL

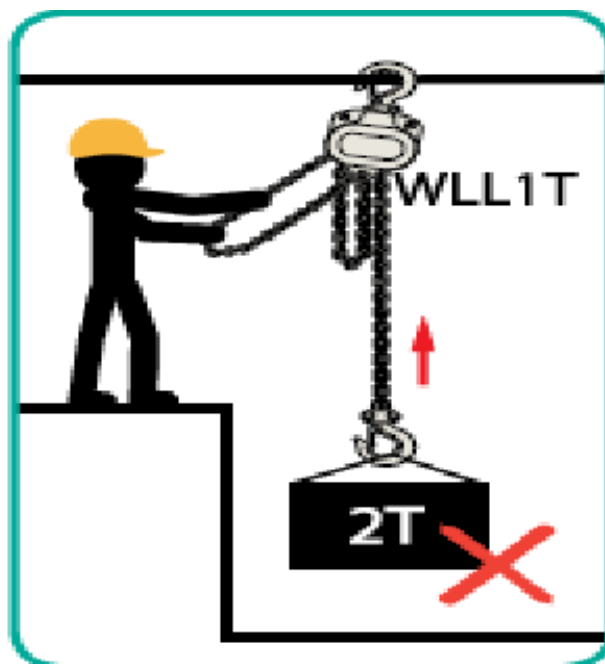
ELEPHANT



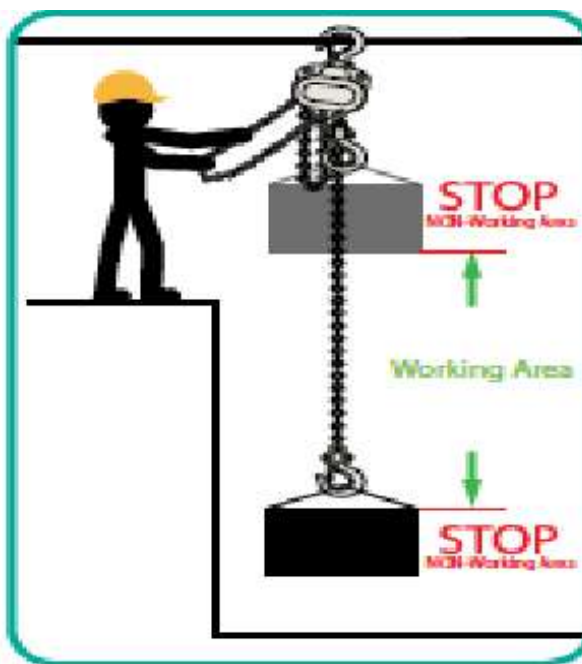
P Type Chain Pulley Block



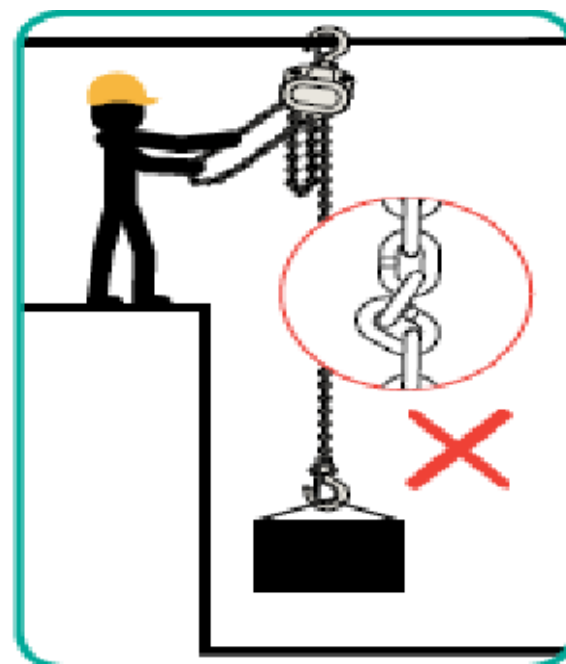
DANGER! Don't when operating Chain Block's



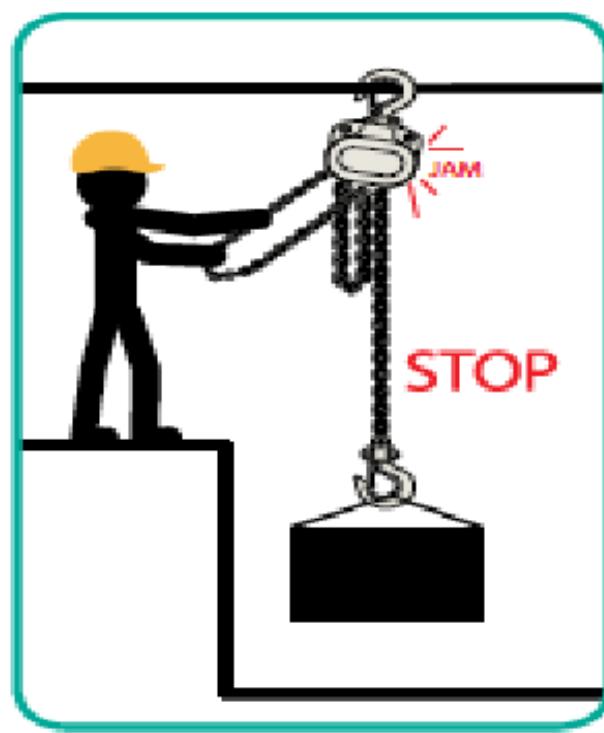
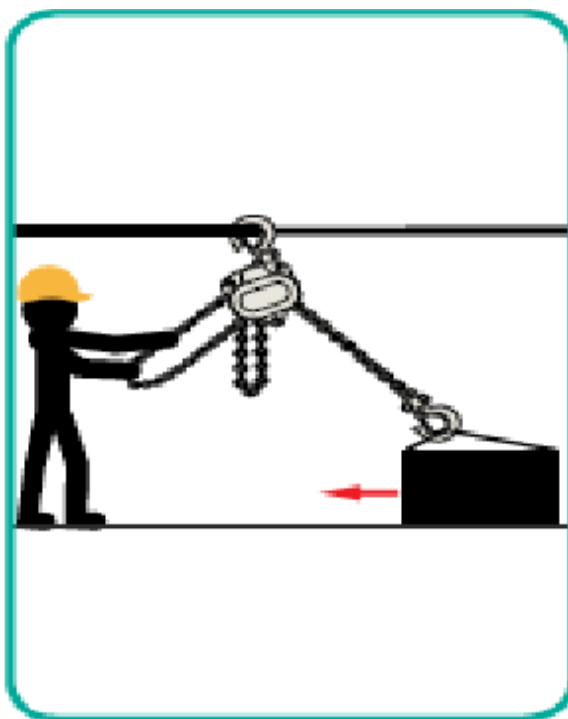
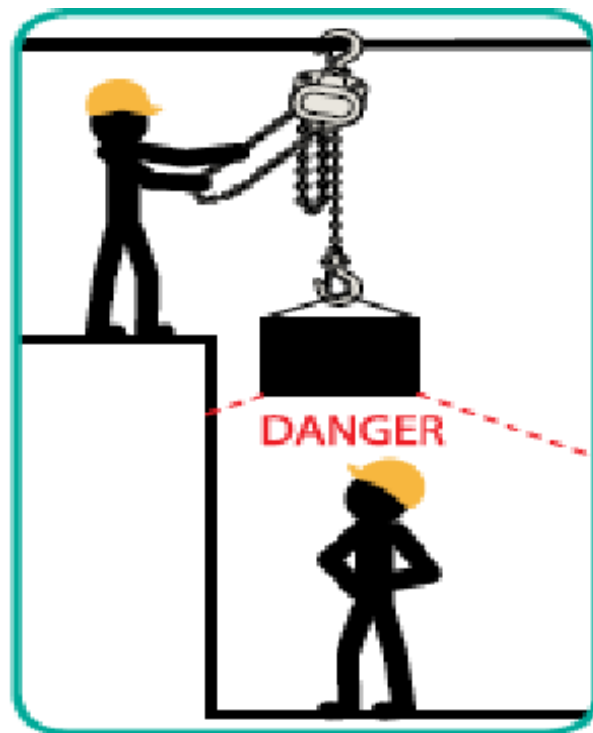
Don't lift a load exceeding the capacity of the chain block.



Don't try to hoist further than the hook limit to the block or lower a load to the limit of the chain stop.



Don't hoist a load while the chain is kinked, twisted or damaged



Don't walk under
a suspended load.

Don't use a chain
block to drag a load
along the ground.

Don't try to pull
hand chain if the
block jams.

SHACKLE, EYE-BOLT & LIFTING RING CHECKS

Before you use a shackle, eye-bolt or lifting ring be sure to check for damage or wear

DO NOT USE

Make sure shackles don't have more than 10% wear and lifting rings don't have more than 5% wear



DO NOT USE

Check the shackle is not gouged, cut or nicked



DO NOT USE

Check shackle for signs of stretching or elongation



DO NOT USE

Check shackle is not twisted or kinked



DO NOT USE

Check the SWL/WLL is displayed and legible



DO NOT USE

Check shackle for signs of heat damage



DO NOT USE

Check there are no cracks or fractures



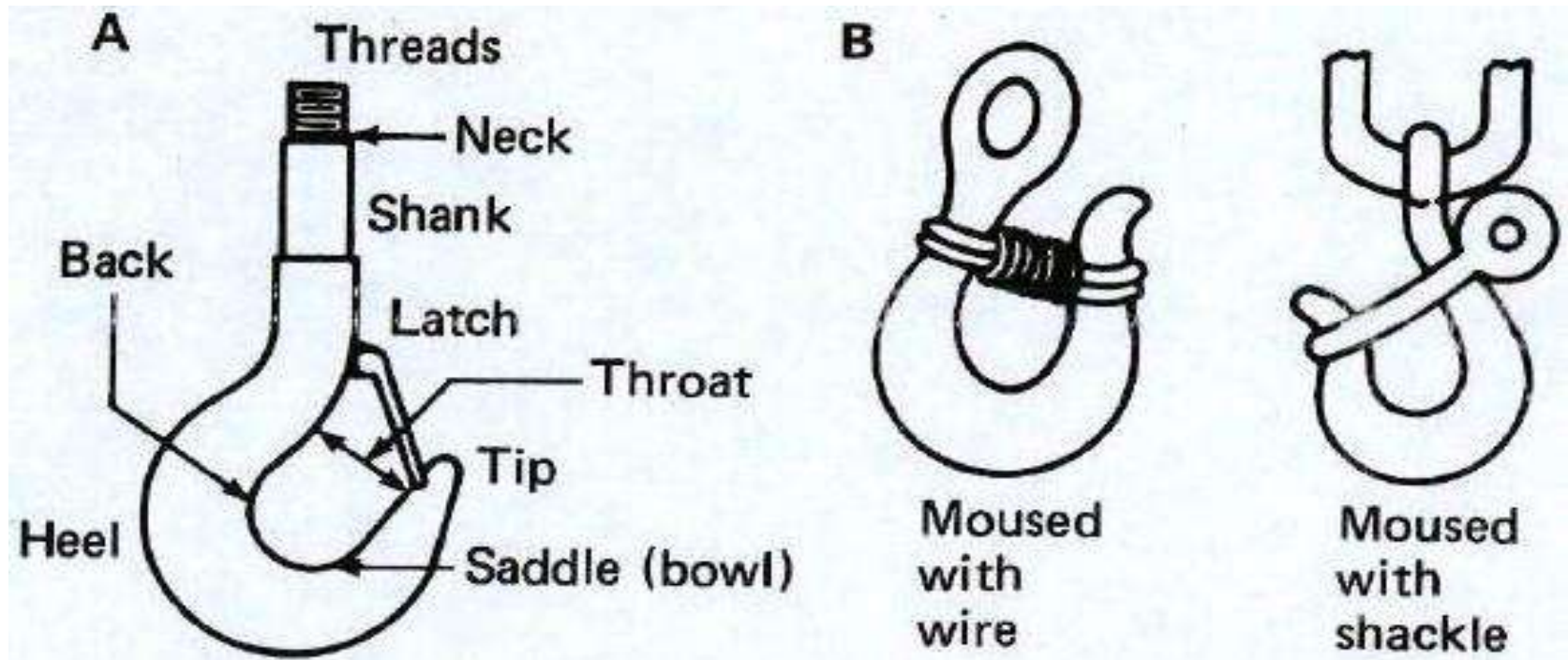
DO NOT USE

Check the pins fit properly and are the correct size



PURPOSE OF A LATCH?

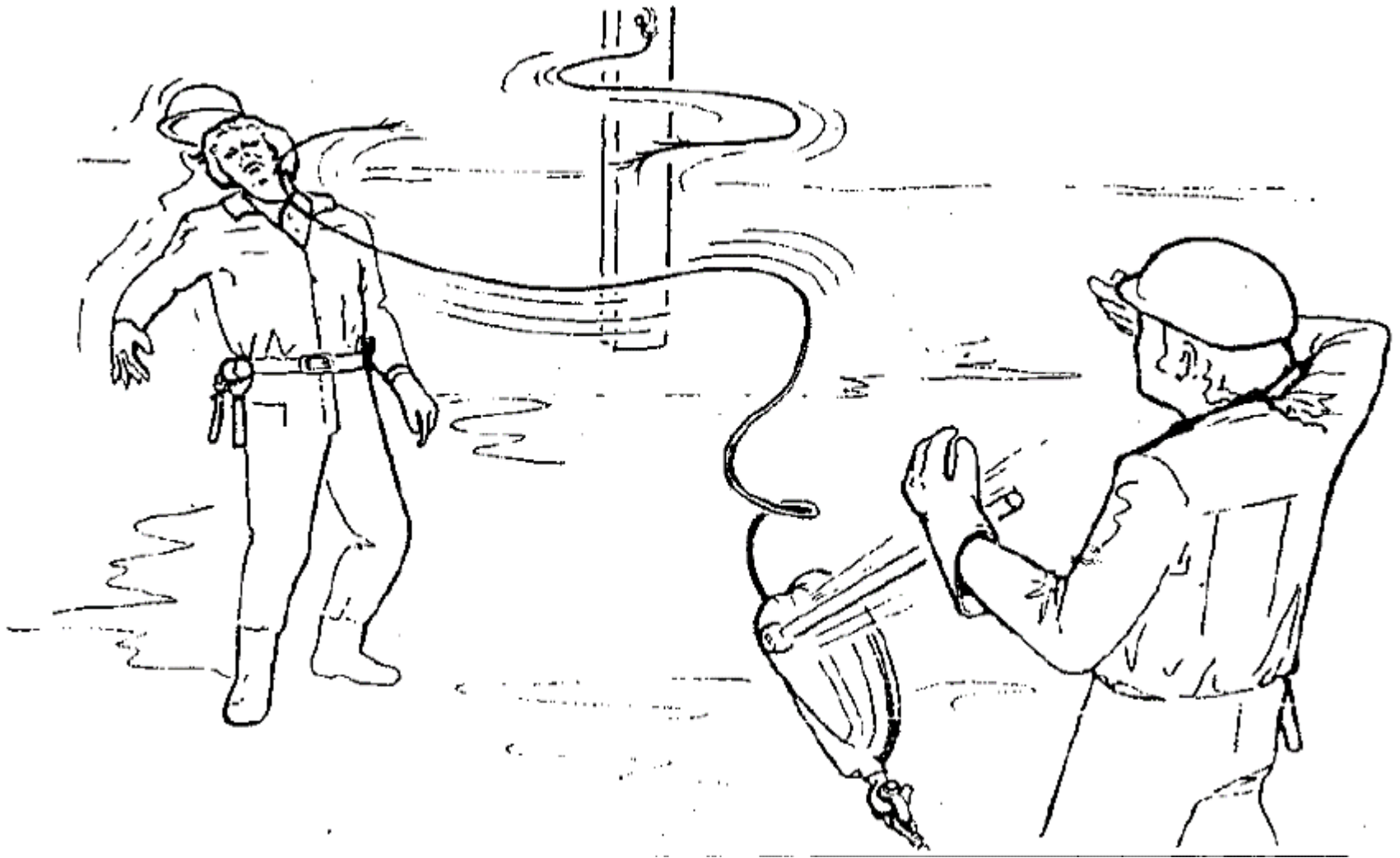
- Purpose is to retain slings in the hook
 - Not intended to support the load
 - Should be sturdy enough to retain the sling if the moving load should catch on something
- Latches are used to close the throat opening
- Must be provided on hoist and crane hooks



CRITICAL POINTS FOR CHAIN BLOCK

- No one except the chain manufacturer shall repair the load chain by welding or any other means.
- Make sure that, if the chain binds, jumps, or is noisy, first clean and properly lubricate it. If the trouble persists, inspect the chain and mating parts for wear, distortion, or other damage.
- Examine the chain for gouges , nicks, corrosion, weld spatter, or distorted links. Any of these conditions shall be sufficient reason for questioning safety and considering replacement.
- The chain slings are joined by connecting links to avoid welded joints, which are the weakest link in a metal slings.
 - Make sure that load slings or other approved attachments are sized properly and seated correctly in the hook saddle
 - Avoid swinging of the load or load hook
- Apply lubricant to load chain as recommended by the chain block manufacturer
- Protect load chain from weld spatter or other damaging contaminants.
- Check the condition of the chain regularly, it should be changed immediately if any of its links are cracked or deformed. Link wear must not exceed 10 % of the diameter of the steel.

Result of over loading



Unreeling
and Uncoiling Of
wire ropes

RIGHT WAY



WRONG WAY



RIGHT WAY



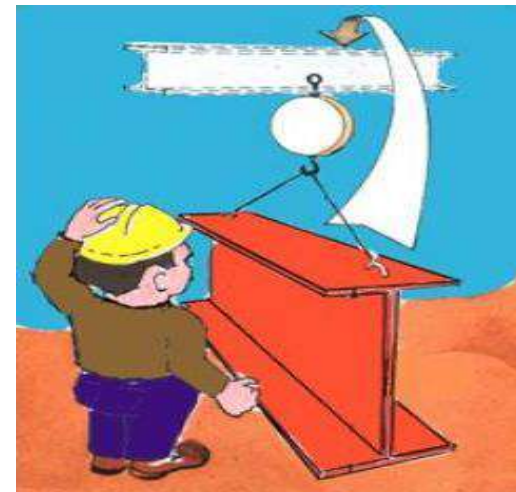
WRONG WAY



Proper winding
rope

Precautions during material handling via machine

- All persons shall **strictly use helmets and safety shoes**
- Barricade the swing area of the crane and no unauthorized person should allow to enter the barricaded area.
- Do not stand in swing area of the load while lifting.
- Do not walk or cycle in front of crane or forklift while in motion. Keep safe distance of at least 10m from moving equipment.



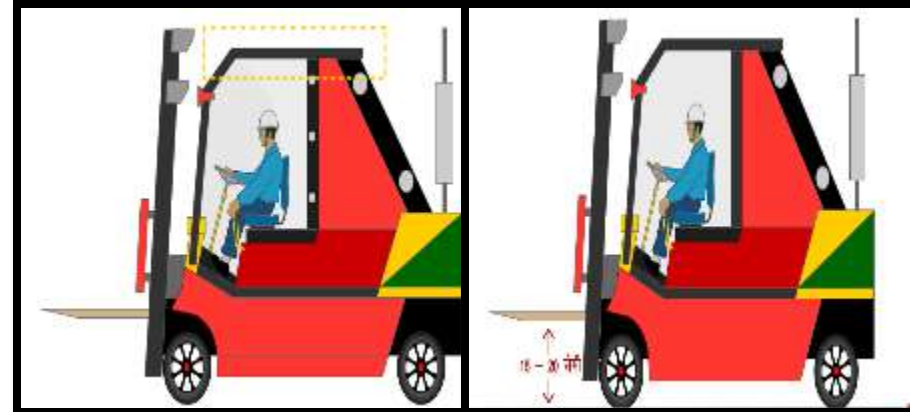
Precautions during material handling via machine

- Do not try to stop the swing of the load with hand. Use extended bar or rope to stop the swing of load.
- Alert & make peoples away to moving load while travelling of material is being carried out.
- Do not try to climb on vehicle or on load in unsafe way.



Precautions during material handling via machine

- Never remove the canopy of the Forklift
- Do not attach any extra trolley or other arrangement with Forklift
- Do not climb on conveyor belt



Precautions during material handling via machine

Do not use damaged slings, Rope, Chain etc for material handling.



Do not use damaged Hook for material handling.



Do not use damaged suckle for material handling.

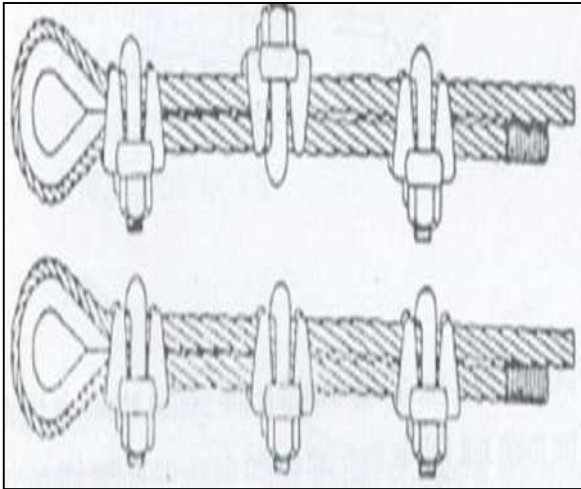
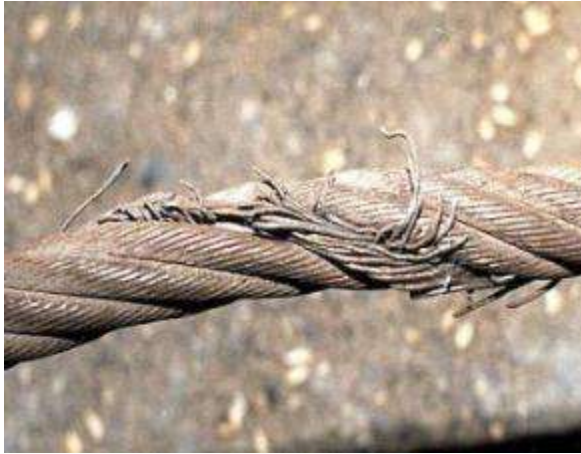


Do not use damaged I bolt for material handling.



Precautions during material handling via machine

Do not use these type of rigging equipment, Inform your superior



Lifting Safety

Stacking and Storage



Improper storing and handling of material and equipment can cause "struck by," "crushed by," and "slip, trip, and fall" injuries.

Planning of Storage Layout

- For any site, there should be proper **planning of the layout** for stacking and storage of different materials, components and equipments with proper access and proper maneuverability of the vehicles carrying the material. While planning the layout, the requirements of various materials, components and equipments to be stored shall be considered.
- Materials stored at site shall not obstruct fire alarm boxes, fire extinguishers, first-aid equipment, lights , electric switches, gas line drip pots and water seals. **Spares shall be placed at least 3 meters away of such emergency items.**
- All spares shall be segregated and stored in respective **designated Places.**
- Storage areas shall be **kept free from accumulation of materials** that constitute hazards from tripping, fire or explosion.
- The material storage area shall be **appropriately barricaded** and no material shall Protrude beyond the barricade.

- No material shall be stored or lie on the pathway, to avoid tripling hazards. Aisles and Passage-ways shall be kept clear to provide for the free and safe movement of Material handling equipment or of employees.
- Any pipe line (water supply, gas etc.) or electrical installation should not be used for Supporting any material or hanging any load.
- All material stored in tiers shall be stacked, racked, blocked or otherwise secured to prevent sliding, falling or collapse, toppling.
- Maximum safe load limits of floors within buildings and structures in all storage areas shall not be exceeded.
- Incompatible material shall be stored in segregated manner so as not to cause fire/ other emergency situation.

Pipes and Conveyor pulley

- Pipes and Conveyor pulley shall preferably be stored on appropriately designed sills or racks, and must be safety blocked to prevent rolling or spreading.
- Alternately, pipes of diameter higher than 300mm may be stored on ground with maximum two layers high and with proper use of choker block and dunnage, in order to prevent rolling. When stacked in such fashion, the top most pipes are to be taken out first for use.
- When Many small diameter pipes/rods are stored on ground, the pipes/rods are to be bundled into 3-4 units. Proper guards are to be provided to arrest any accidental rolling of the pipes.
- Stopping of rolling or sliding of pipes or Conveyor pulley with hands or feet is strictly prohibited.

Fabricated items:

- Fabricated material shall be checked for stability at ground level. It is to be ensured that there is no chance of tilting, falling or rolling or slipping of material.
- The ground shall have sufficient strength to bear weight of the fabricated items.
- Fabricated items shall not be placed on loose soil.
- The storage area must be properly barricaded.

Sheet material:

- All bundles shall be separated by strips of wood to facilitate handling when the material is needed, to lessen chances of shifting or sliding of the pipes of material.

Scaffolding Materials:

- All Material and parts of scaffold, when not in use shall be kept under good condition at designed place.
- Good Scaffold materials should not be mixed with unsuitable materials and parts.

Scrap Materials

- Scarp shall be removed from Storage Yard and disposed of promptly. Before
- Removal, scrap storage area shall be barricaded.
- Packaging material should be disposed of quickly and shall not be allowed to remain at storage yard.
- Wooden material with projected nail shall not be stored for future use. If the wooden materials are needed, all nails are to be removed, by appropriate means.

Fabrication Debris

- Debris shall not be thrown from upper stories, but be removed either by machinery or enclosed tilted passage / enclosed chutes. Accumulated debris shall be appropriately barricaded.
- All waste material and rubbish shall be removed from the immediate work area as the work progresses.
- All solvent waste, oily rags and flammable liquids shall be kept in metal containers with lid. These wastes shall be kept away from other combustible material (such as wood, papers, tyres etc.)
- Waste bins shall be kept at designated places for collection of different wastes (ferrous / non- ferrous / other waste categories as relevant and categorized by the contractor.

Storing Materials

Secure materials stored in tiers by stacking, racking, blocking, or interlocking to prevent them from falling



Keep aisles and passageways clear



1926.250(a)

Maximum safe load limits of floors within buildings and structures, in pounds per square foot, shall be conspicuously posted in all storage areas, except for floor or slab on grade.

Aisles and passageways shall be kept clear to provide for the free and safe movement of material handling equipment or employees.

When a difference in road or working levels exist, means such as ramps, blocking, or grading shall be used to ensure the safe movement of vehicles between the two levels.

Bags and bundles must be stacked in interlocking rows to remain secure. Bagged material must be stacked by stepping back the layers and cross-keying the bags at least every ten layers. To remove bags from the stack, start from the top row first.

Boxed materials must be banded or held in place using cross-ties or shrink plastic fiber.

Drums, barrels, and kegs must be stacked symmetrically. If stored on their sides, the bottom tiers must be blocked to keep them from rolling. When stacked on end, put planks, sheets of plywood dunnage, or pallets between each tier to make a firm, flat, stacking surface. When stacking materials two or more tiers high, the bottom tier must be chocked on each side to prevent shifting in either direction.

When stacking, consider the need for availability of the material. Material that can't be stacked due to size, shape, or fragility can be safely stored on shelves or in bins. Structural steel, bar stock, poles, and other cylindrical materials, unless in racks, must be stacked and blocked to prevent spreading or tilting. Pipes and bars should not be stored in racks that face main aisles; this could create a hazard to passers-by when removing supplies.

Storing Materials

- Don't store noncompatible materials together
- In buildings under construction, don't place stored materials within 6 feet of a hoistway or floor opening



1926.250(b)(1) and 1926.152

Do not place material stored inside buildings under construction within 10 feet of an exterior wall which does not extend above the top of the material stored.

Store flammable and combustible materials according to their fire characteristics.

- Flammable liquids, for example, must be separated from other material by a fire wall.
- Also, other combustibles must be stored in an area where smoking and using an open flame or a spark-producing device is prohibited.

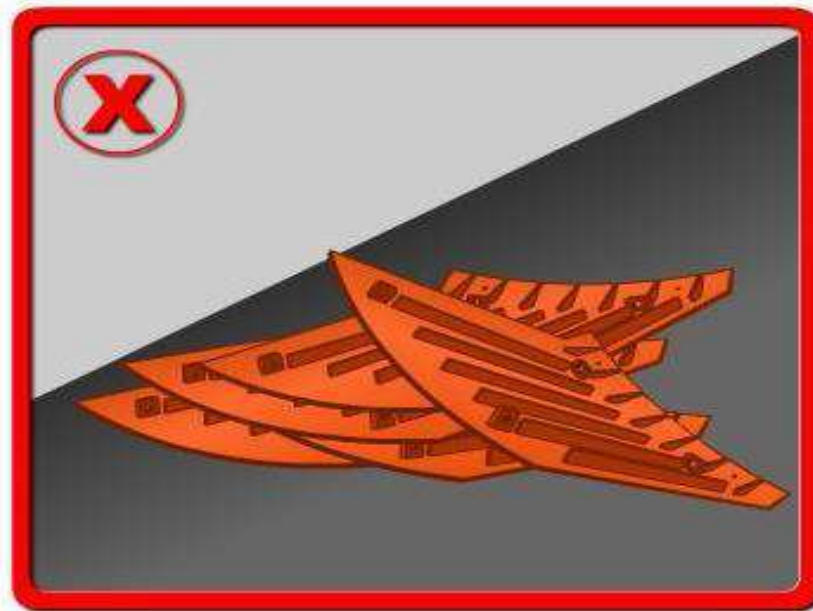
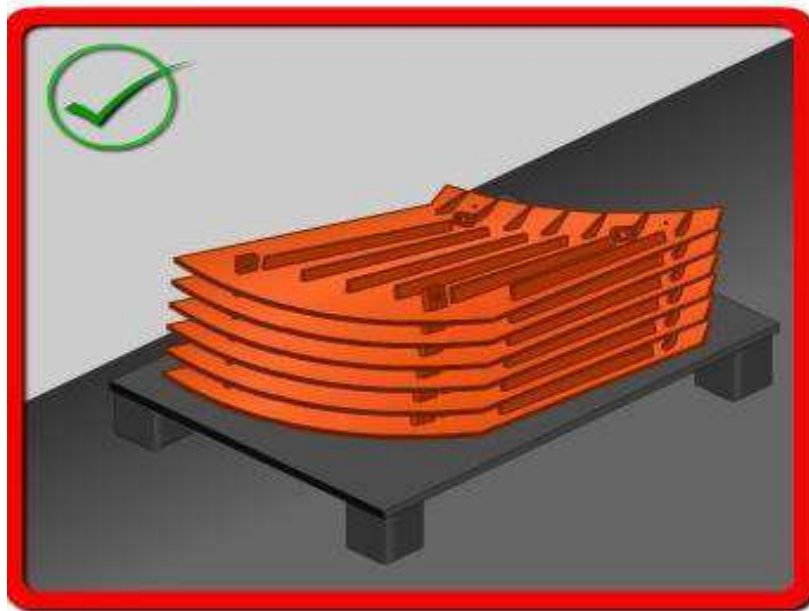
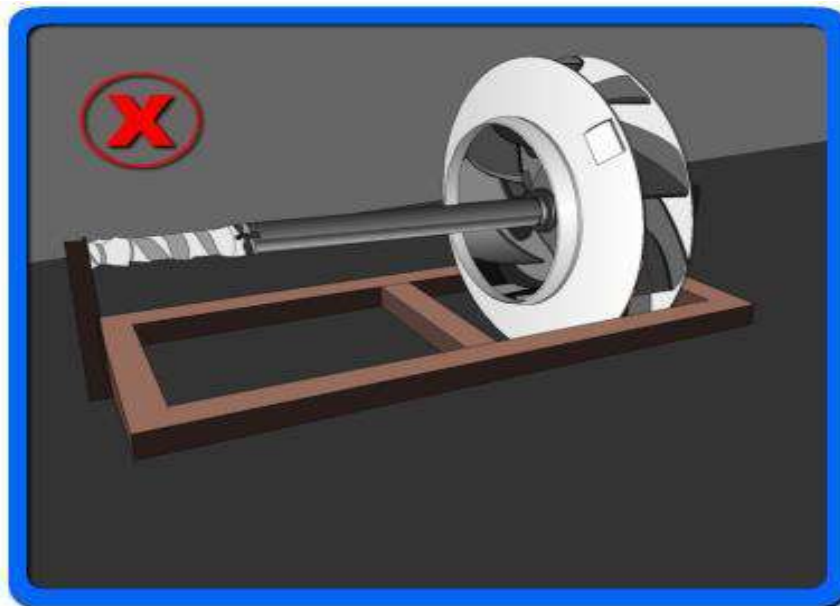
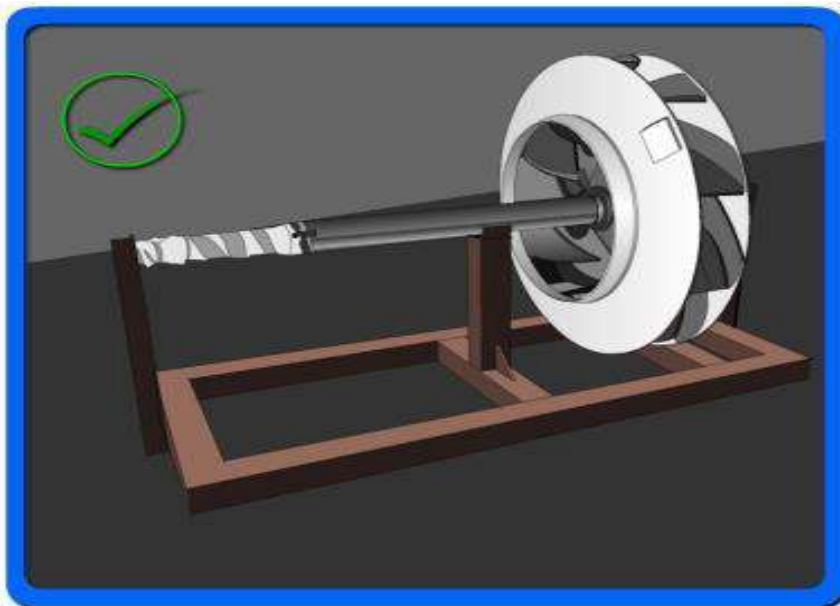
Housekeeping

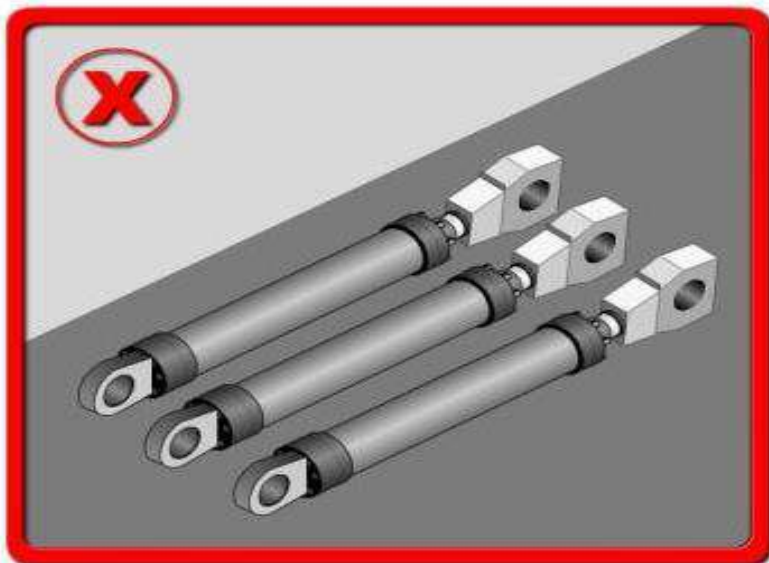
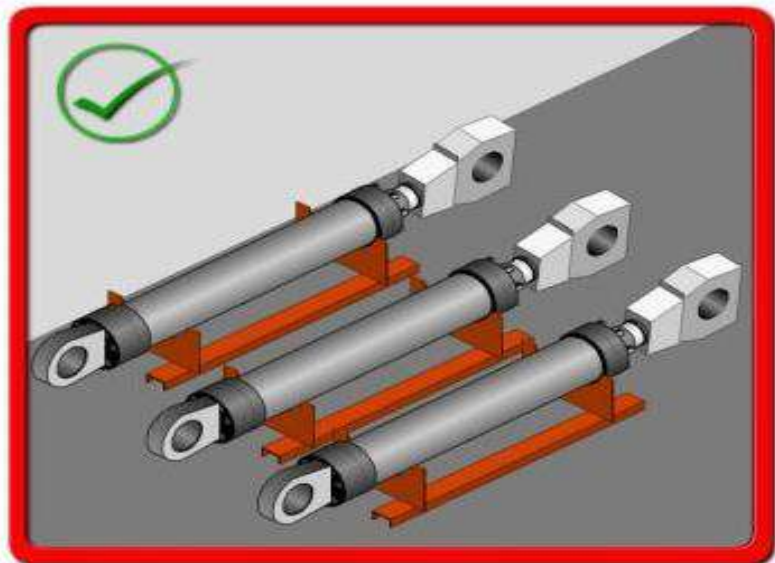
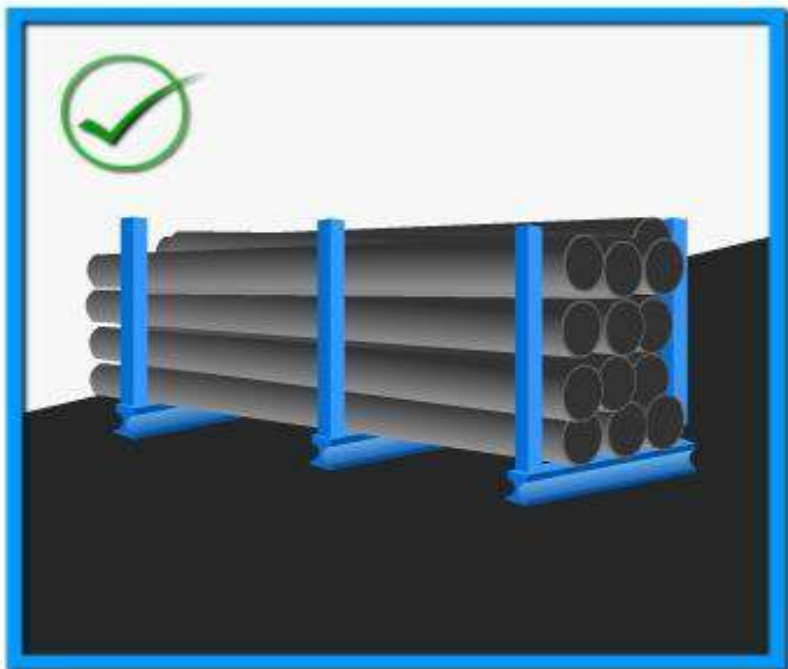


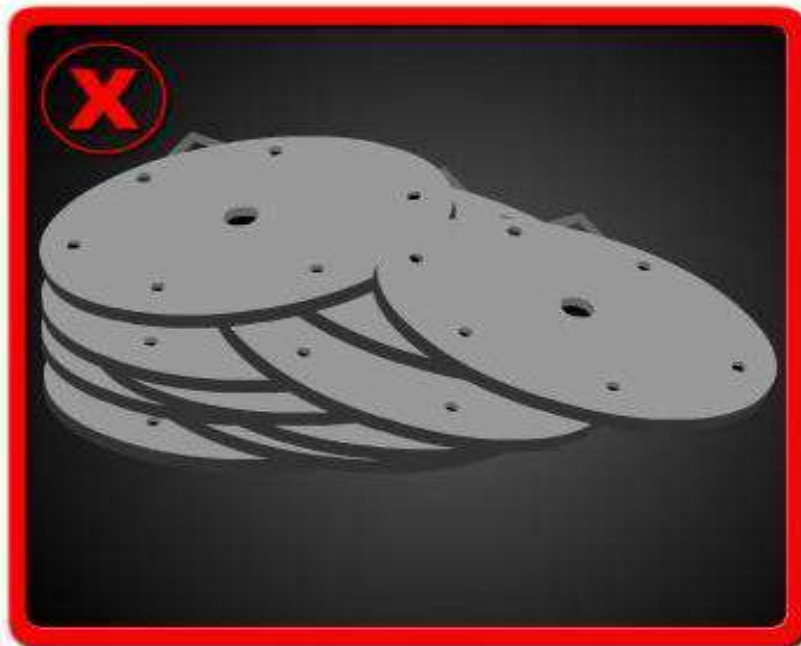
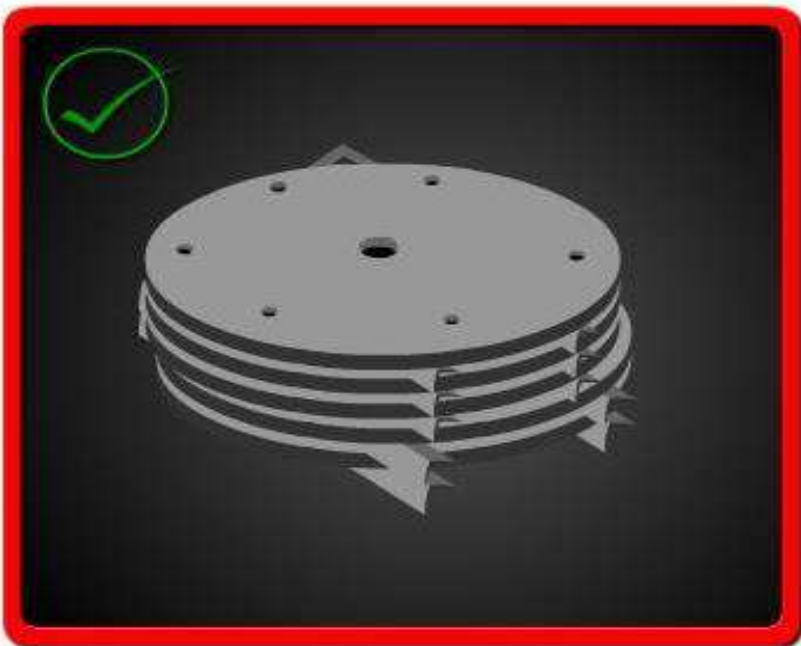
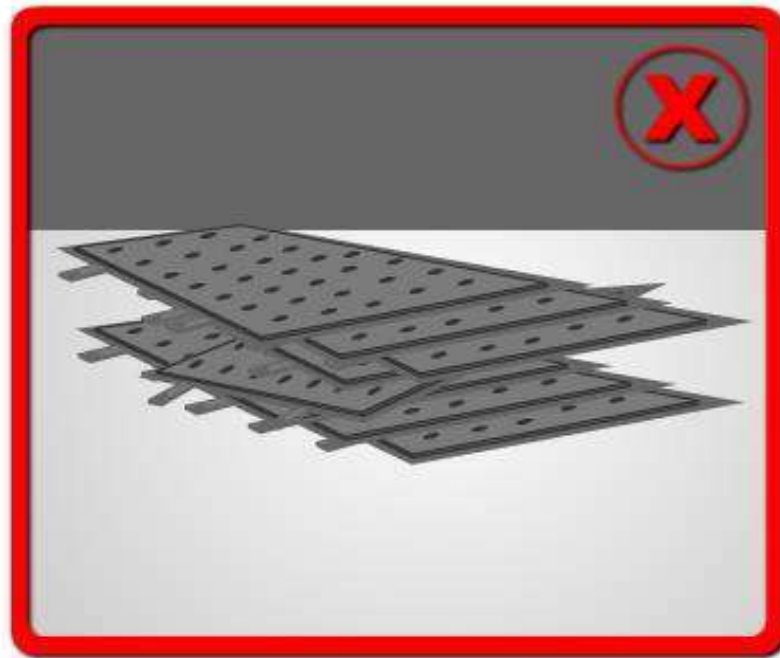
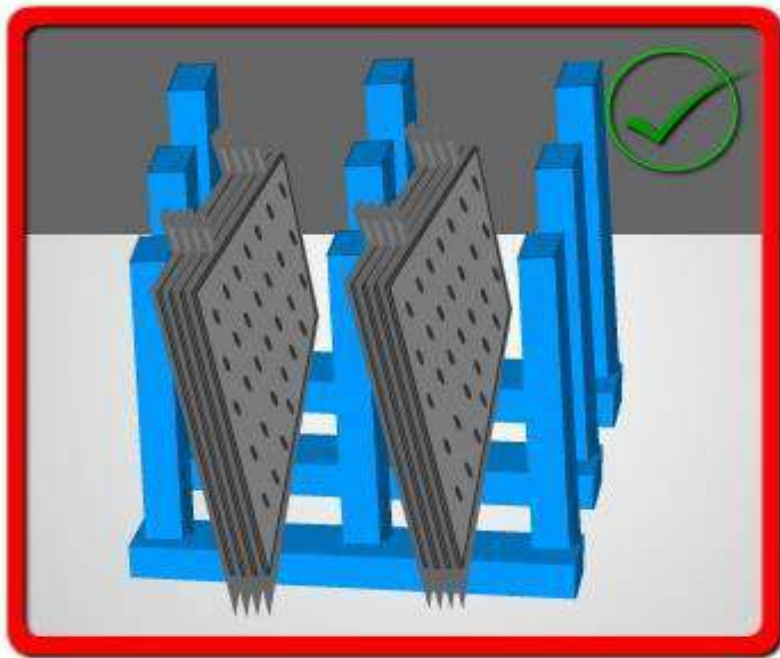
Keep storage areas free from accumulated materials that cause tripping, fires, or explosions

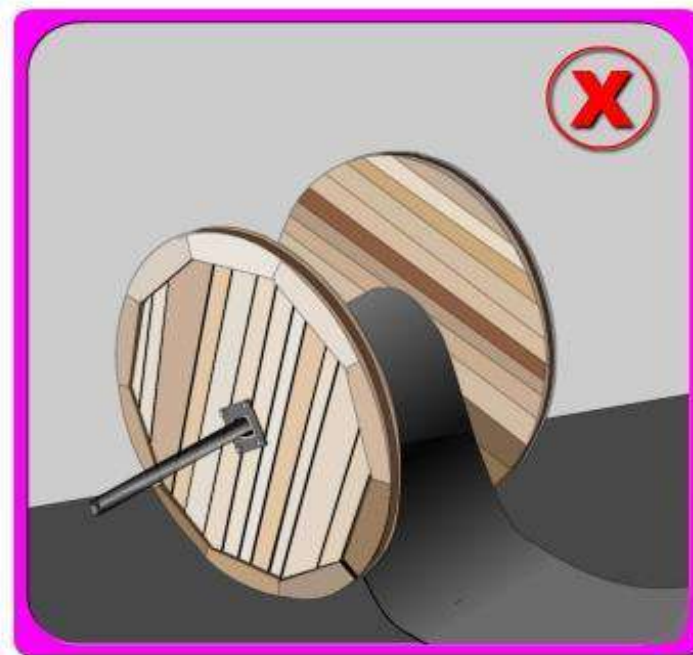
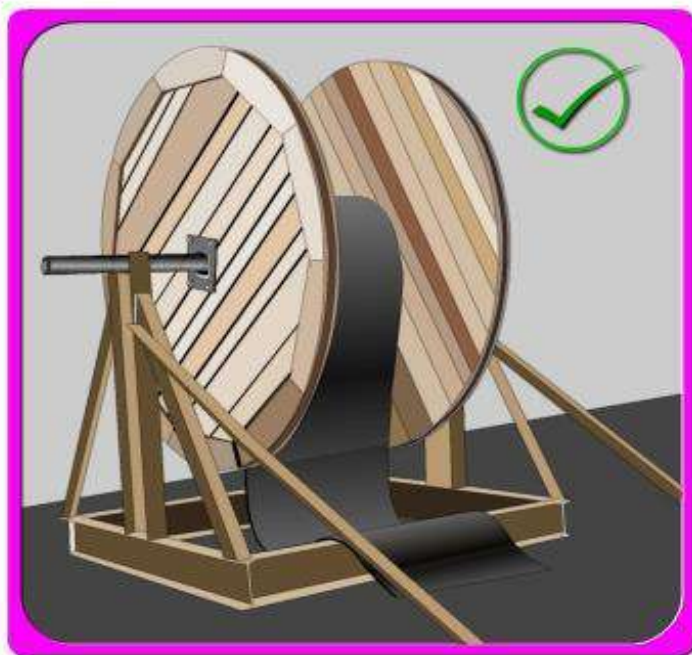
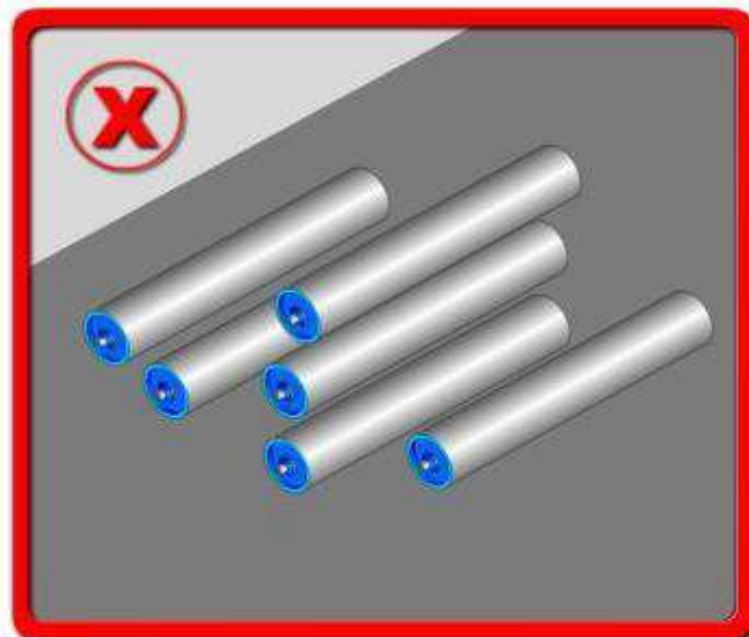
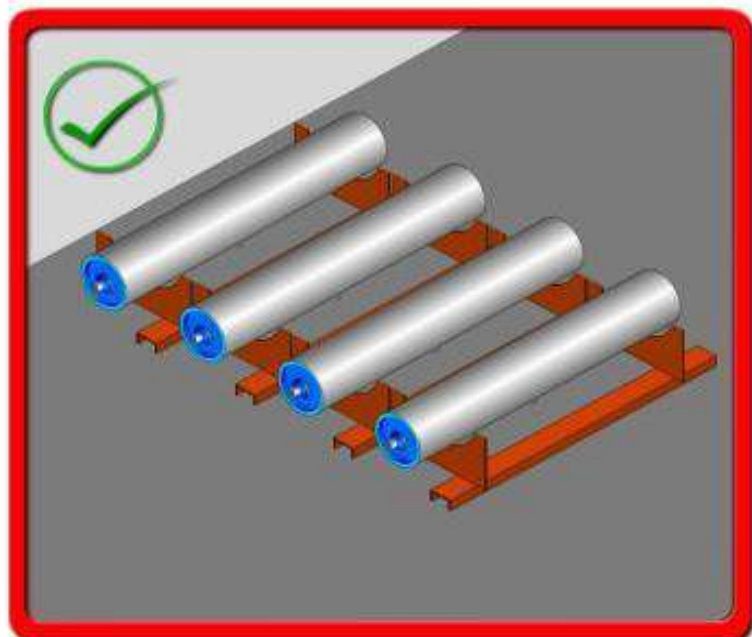
Stacking and Storage (continued)









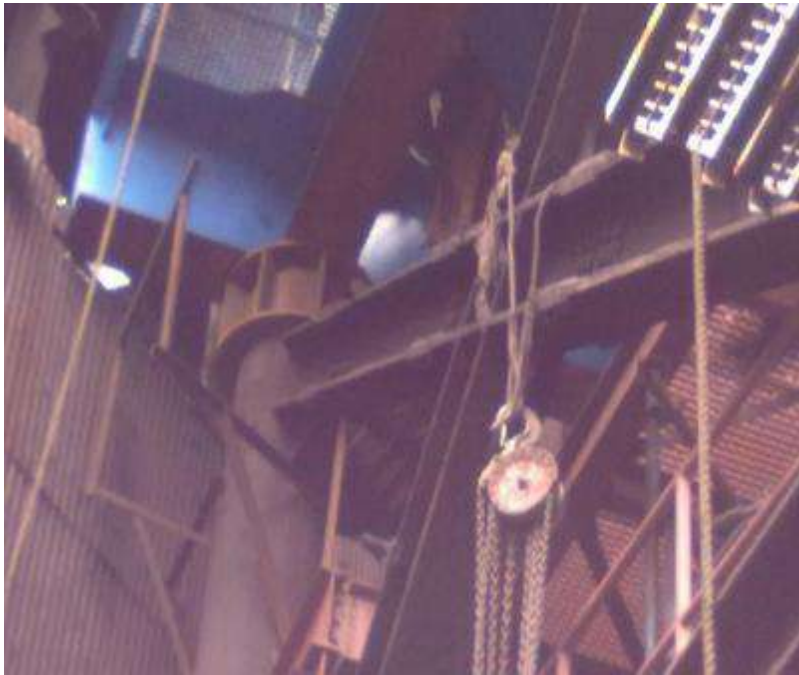


Common Non compliances

- Overcrowded material handling area
- Substandard lifting tools and tackles
(wire rope, chain blocks , D Shackles etc.)
- Improper signaling
- Un barricaded material handling area
- Insecure materials in the storage area
- Material are kept on the pathway
- Taking support from vulnerable sources
- Use of hand and other body part at the pinch points

Snap shot of non compliances:





Expectations :

Compliance of ten key points during material handling

1. Know the **hazards, its mitigation plan** by your supervisors and help in **Cordoning off** the material handling area
2. Use of inspected and **tested lifting tools and tackles**
3. Deploying **competent signal man** for communication and co ordination
4. Ensure the **securing of material on** the floors (where ever kept)
5. Keep **yourself away from the swing zone** of the load
6. Never **use your hands/legs for directing the loads.**
7. Help in timely **removal of used spares & materials** from the working area
8. Ensure your activity donot create hazard to **other working groups** during material handling in the same working area
9. **compliance of SOP** and **six directional hazard mitigation**
10. **Raise the concern** for any unsafe practice

General Requirements for storage

- **Materials stored at site shall not obstruct fire alarm boxes, fire extinguishers, first-aid equipment, lights, electric switches, approach to substation buildings, offices, workshops and plants. Materials for construction shall be placed at least 3 meters away from such emergency items.**
- **All construction materials shall be segregated and stored in respective designated places.**
- **Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire or explosion.**

- **The material storage area shall be appropriately barricaded and no material shall protrude beyond the barricade.**
- **No material shall be stored or remain on the pathway, to avoid tripping hazards. Aisles and passage-ways shall be kept clear to provide for the free and safe movement of material handling equipment or of employees**
- **Any pipe line (water supply, gas etc.) or electrical installation should not be used for supporting any material or hanging any load.**
- **Any pipe and other materials required for road-side construction purpose shall be stacked at least 2m away from the metal portion of the road and shall be barricaded, with red night lamps to eliminate traffic hazards.**

- **Material stored inside buildings under construction shall not be placed within 2 m of any hoist way or inside floor openings.**
- **All materials stored in tiers shall be stacked, racked, blocked or otherwise secured to prevent sliding, falling or collapse.**
- **Maximum safe load limits of floors within buildings and structures in all storage areas shall not be exceeded.**
- **Bagged materials shall be stacked by taking adequate precautions to prevent collapse of stack.**
- **Combustible materials such as packing boxes, fuel, lubricants, and gunny bags are to be kept separately on a designated area before disposal.**
- **All materials shall be stacked tidily and up to a safe height to prevent them from falling or causing some other pile to fall.**
- **Steel and other material shall not be placed on ground. Proper spacers (dunnage) should be used to separate the stored material from ground.**

Bricks and Masonry blocks

- Bricks shall not be dumped at site. For proper inspection of quality and ease of counting, the stack shall be 50 bricks long and 1.5 meter high. Clear distance between adjacent stacks shall preferably be not less than 0.8 meters.
- Brick must never be stacked for storage purposes on scaffolds or runways. This does not prohibit normal working supplies on bricklayers' scaffolds during actual bricklaying operations.
- When masonry blocks (PCC, stone) are stacked higher than 2 m, the stack shall be tapered back one half blocks per tier above 2 m level.

Cement Bag:

- **Cement shall be stored in a building or in a shed which is dry and leak proof / moisture proof as possible.**
- **Cement bags shall be stacked on wooden plank in such a way as to keep them 150 -200mm clear from the floor and a space of 450 mm minimum shall be left all around between the exterior wall and the stack.**
- **The height of the stack shall not be more than 15 bags; width of the stack shall not be more than 4 bags length or 3 meters.**
- **While stacking more than 8 bags high, the cement bag shall be arranged alternatively length-wise and cross-wise so as to tie the stacks together and minimizing toppling hazard.**

Pipes & bar stocks:

- **Pipes and bar stock shall preferably be stored on appropriately designed sills or racks, and must be safely blocked to prevent rolling or spreading.**
- **Alternately, pipes of diameter higher than 300mm may be stored on ground with maximum two layers high and with proper use of choker block and dunnage, in order to prevent rolling. When stacked in such fashion, the top most pipe is to be taken out first for use.**
- **When many small diameter pipes/rods are stored on ground, the pipes/rods are to be bundled into 3-4 units. Proper guards are to be provided to arrest any accidental rolling of the pipes.**
- **Stopping of rolling or sliding of pipes or bar stock with hands or feet is strictly prohibited .**

Fabricated Steel items

- **Fabricated material shall be checked for stability at ground level. It is to be ensured that there is not any chance of tilting, falling or rolling or slipping of material.**
- **The ground shall have sufficient strength to bear the weight of the fabricated items & it should not be placed on loose soil. The storage area must be properly barricaded.**

Sheet Metals

- **All bundles shall be separated by strips of wood to facilitate handling when the material is needed and to lessen chances of shifting or sliding of the piles of material.**

Scaffolding Material

- **All materials and parts of scaffold, when not in use shall be kept under good condition at designated place and these should not be mixed with unsuitable material and parts.**

Storage of Scrap Material

- **Scrap shall be removed from construction site and disposed off promptly. Before removal, scrap storage area shall be barricaded.**
- **Packaging material should be disposed off quickly and shall not be allowed to remain at construction site.**
- **Wooden material with projected nail shall not be stored for future use. If the wooden materials are needed, all nails are to be removed, by appropriate means.**

Storage of construction debris

- **Debris shall not be thrown from upper storeys, but be removed either by machinery or enclosed tilted passage / enclosed chutes. Accumulated debris shall be appropriately barricaded.**
- **All waste material and rubbish shall be removed from the immediate work area as the work progresses.**
- **All solvent waste, oily rags and flammable liquids shall be kept in metal containers with lid. These wastes shall be kept away from other combustible material (such as wood, papers, tyres etc.)**
- **Waste bins shall be kept at designated places for collection of different wastes (ferrous / nonferrous / other waste categories as relevant and categorized by the contractor.**

Any pipe and other material required for road side construction purpose shall be stacked at least **2 METER** away from the road and shall be barricaded with red night lamps to eliminate traffic hazards.



Materials not
Kept at 2 Mtr
distance from
road **SEVERITY**
RATING 3



Module - 6

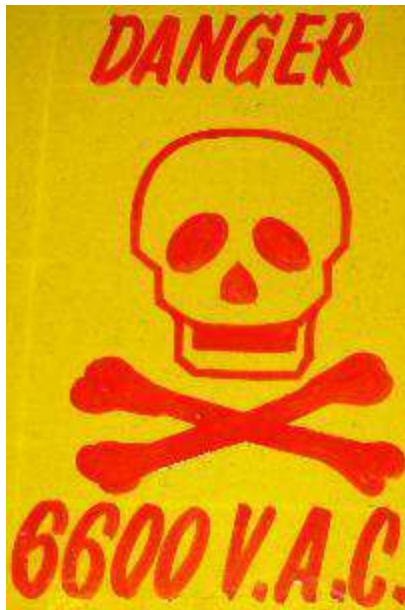
Electrical Safety

Objective

The purpose of this safety standard is to achieve adequate safety of personnel working in Electrical Room. This outlines the safety requirements for the personnel's working in Electrical rooms.

Safety Guidelines

- The electrical installations for medium, high and extra high voltage should have a danger notice



- **Following tools and devices shall be made available in Electrical rooms**



Kool Koat



Safety Belt



Safety gloves



Electrical overshoes

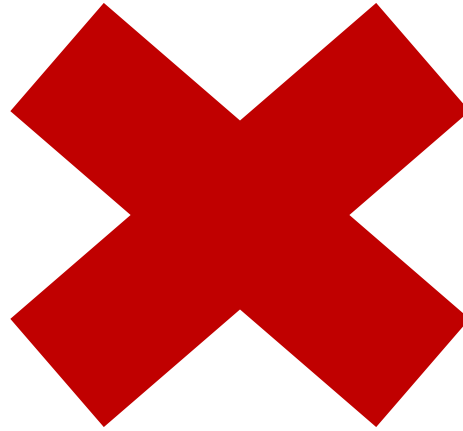


Earthing device



Power tester

- **Do not** wear loose clothing, metal watch straps, bangles or finger rings while working on electrical appliances



finger rings



metal watch straps



bangles

- **The Electrical installations for high and extra high voltage shall have a running tap water and in case of electric burns , the burnt portion should be cooled down using water.**



✓ **Service water should not be used, only drinking water to be used**

- **No high and extra high voltage system/switchgear which has been disconnected , for 6 months of more for any maintenance job should be energized without testing and written clearance by testing department**

- **Records of all tests, repairs, maintenance work of all electrical equipments should be kept in registers.**



- **Precautions against auxiliaries circuits :**
Precautions to be taken to ensure that control circuits to equipment are disconnected from the supply before work

- **Detachable type Screw driver should not be used as it may fall and cause flashover**



- **Bus charging of the 3 kv and above to be avoided in evening hours and 1 hr before shift change.**

- The digital multi meter (DMM) shall comply the safety requirement
- ✓ Safety Class – **Cat III** for voltage range of DMM up to 1000 V
- ✓ Safety Class – **Cat IV** for voltage range of DMM to 650 V

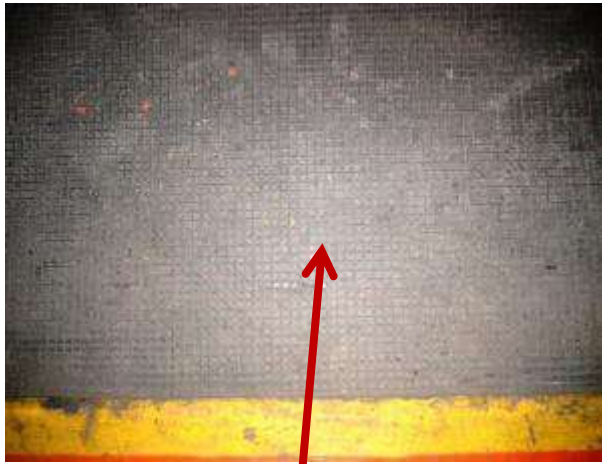


- Hand lamps and torches should be insulated type, not metallic

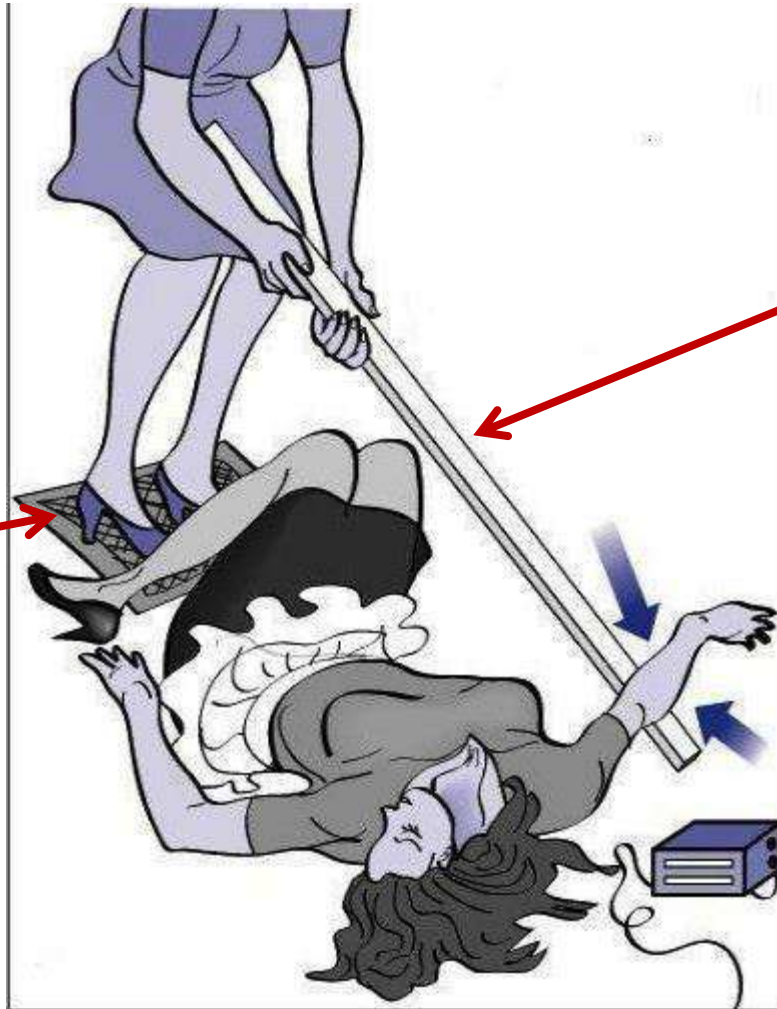


- Always use portable hand lamps of insulated safety type and provided with insulated handle and insulated wire guard

- Don't attempt to disengage a person in contact with live apparatus without standing on rubber mat or dry board.
- Don't touch his body, use dry wood/ insulated rod



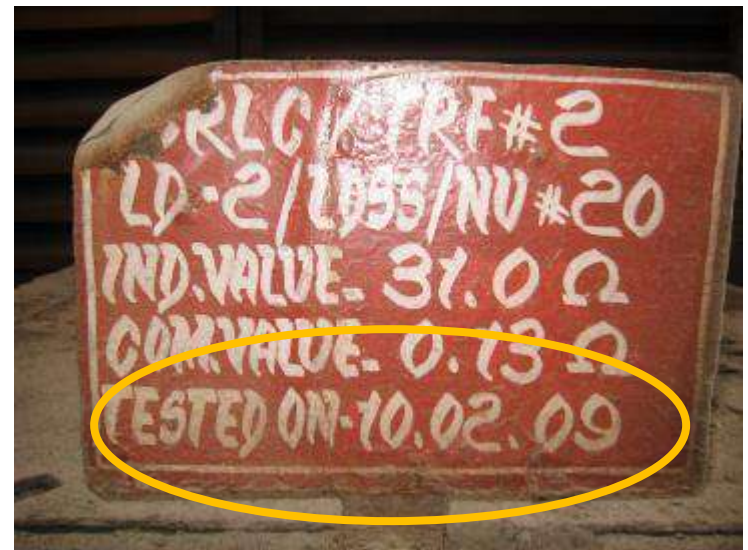
**rubber mat
/ dry board**



**Wood/
insulated rod**

- **Make sure that voltage transformer is dead and isolated before it is examined. Care to be taken to ensure that transformer is not liable to be live due to feed back via the secondary side**
- **Earthing of equipment to be done as per standard eg;**

Every earthing system shall be tested for its resistance to earth on a dry day not less than once a year



- **Lead Acid Battery Rooms**



- ✓ The battery rooms should have the explosion proof lighting, exhaust fan and acid resistant floors
- ✓ Lead acid battery rooms should have **one packet of lime (1/5 kg)** permanently to neutralize leaked acid

• **Artificial Respiration**

- ✓ In every high and extra high voltage sub section, an artificial respirator to be provided
- ✓ Do not discontinue artificial respiration until recovery or death declared by doctor. It may take even more than 2-3 hours for recovery



- **Fuse**

- ✓ **When removing the fuse, pull out the supply end first and during replacing , the supply end should be put last**
- ✓ **No attempts to be made to rewire a non-wire able fuse**
- ✓ **Switch Fuse Unit (SFU) to be discarded if phase barrier are found damaged**

- ✓ Fuse should be replaced with original make and should not be interchanged



- **MCCB used in Motor feeder shall have auxiliary contact for tripping of contractor in case of MCCB tripping**
- **After switching off the isolator no live parts shall be exposed in the MCC module . If it is so it shall be replaced.**
- **Under trickle charging conditions stratification of the electrolyte can occur and it is recommended that at intervals of approximately 2 years the batteries should be charge and discharge cycle, alternatively a boost charge to ensure its reliable operation**

- **Electrolytic Capacitors**



- ✓ **Electrolytic capacitors deteriorate when out of use or in store**
- ✓ **Spare capacitors should be kept permanently charged at their rated voltage and should therefore be stored in charging rack with suitable interlock to prevent shock when handling**
- ✓ **Spare capacitors having paper dielectric need not be kept charged but should be kept dry**

• **Circuit Breaker**

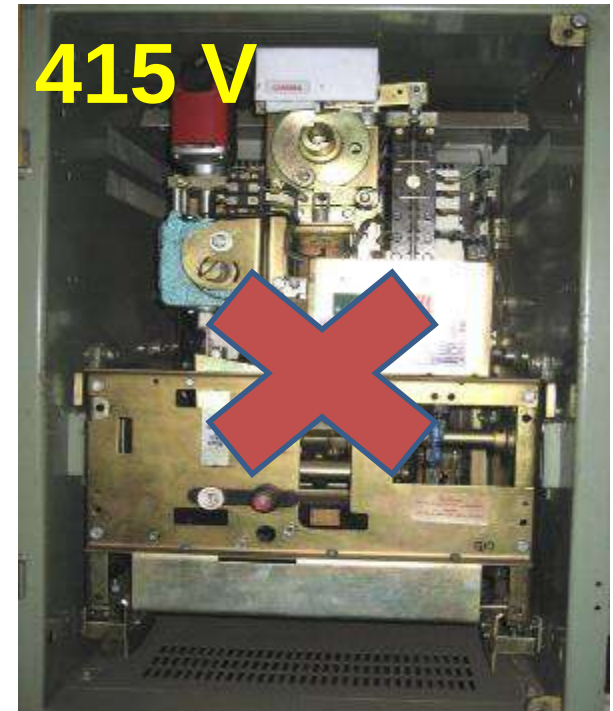
- ✓ **Racking - in and Racking – out of breakers having isolating contacts in vertical plane are very risky and these breakers shall be racked – in or out under protection plasma shield & Kool coat or through Tele – breaker racking device**



- ✓ **HV Breaker trolley shall always be pushed and not pulled to avoid toppling and fall on the person**
- ✓ **Isolation of the withdraw able metal clad circuit breaker should be delayed for not less than 10 minutes after operation on fault to allow for the dispersal of any ignitable gases in the live spouts**

- **Power testing not to be carried out on moving equipments such as EOT cranes, oven machines in coke oven, loco etc as there are chances of flash over due to sudden jerk in the testing leads. Proper clearance to be taken to ensure that equipments stand still while working**

- **No work to be carried out in panel exposed to 415 volt supply**



Handling of Electrical Panels



Handling of Electrical Panels

To Define Safety Precautions for

- Lifting of Electrical Panels
- Shifting of Electrical Panels

Handling of Electrical Panels

Associated Hazards

- **Injury** to operators
- **Injury** to other personnel
- **Damage** to Capital Equipment

Handling of Electrical Panels

Background

After unloading of Electrical Panels at the entry point of the building at ground level, the panels are either,

- **shifted** to their installation positions **at ground level**

OR

- **lifted to upper floors** before shifting to installation positions.

Handling of Electrical Panels

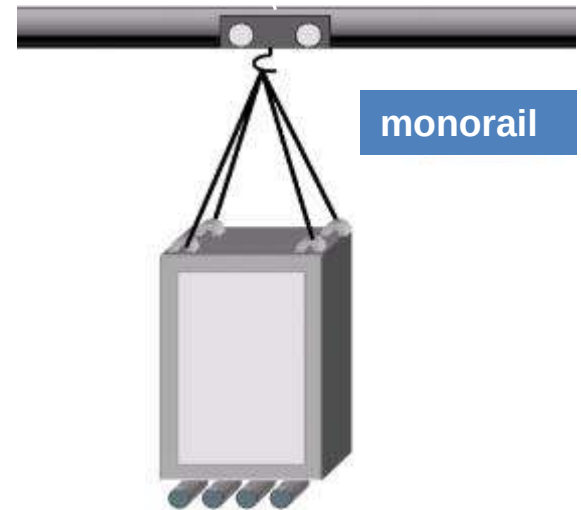
Before Moving Electrical Panels

- Provide **slings/chains** from the top anchoring points of the **panel**.
- Fix the **slings with** an overhead strong anchorage point of the **building**.
- Take **minimum 4** nos. of same diameter **pipes** in good condition having length greater than the width of the panel.
- Keep the **pipes below** the **panel**.
- **No man** should be standing **behind the panel** when keeping the pipes.
- **Stop** the panel from **sliding**.
- Secure the **pipe with wedge** temporarily during this operation .

Handling of Electrical Panels

Moving Electrical Panels – using Monorail

- Move the panel by **rolling over the pipes** keeping its **top anchored** with the monorail through a clamp or a chain pulley block.
- Push the panel slowly so that the **pipes that roll** out below the panel **from its rear** side are **placed** again below the panel **from its front** side .
- Ensure that **minimum 3 pipes** always **support the centre of gravity** of the panel adequately.
- **Select** the type and size of pipes based on size and weight of the panel.



Handling of Electrical Panels

Moving Electrical Panels – using Chain Pulley Block

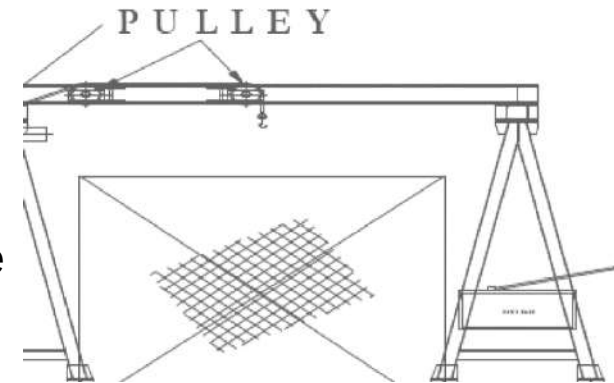
- lift panel slightly over the floor and move



Handling of Electrical Panels

Moving Electrical Panels – using Standard Panel Lifting Trolley

- Move the panel handling trolley towards the panel kept on ground so that the **top frame of the trolley** comes **over the panel**.
- **Attach the end of the rope** of the hydraulically operated rope pulley arrangement **to the top anchor points** of the panel.
- **Lift** the panel attached to the rope with the manual actuation of a hydraulic Cylinder operated **through a trolley mounted power pack**.
- The **whole trolley** with the lifted panel is then **moved** to its installation position.



Handling of Electrical Panels

Moving Electrical Panels

- **Pipes** should be **kept below the panel** and the **panel top** should be kept **anchored** with the monorail when the panels are moved to the designated place over a cutout/opening on the floor for the final installation.
- If monorails **does not exists**, provide suitable **anchorage points** of adequate strength **from the roof top or on the side walls** for holding the top points of the panels with slings.

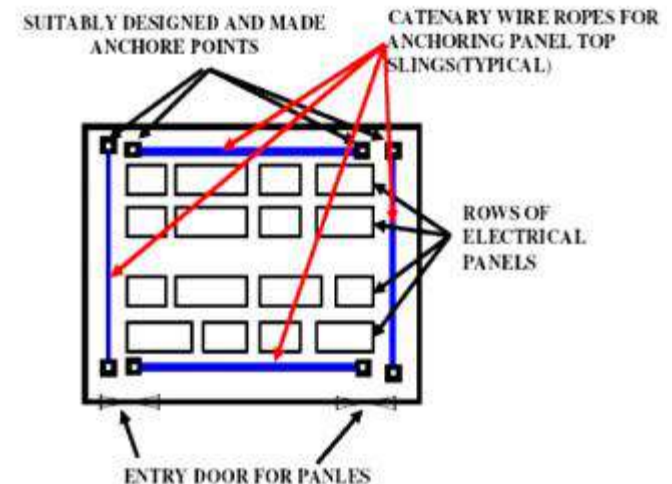


FIG.-3 : TYPICAL LAYOUT OF A NEW RCC BUILDING WITH RCC CONSTRUCTION, SHOWING SUGGESTED LOCATIONS OF ANCHORAGE POINTS PROVIDED FROM BELOW THE ROOF.

Handling of Electrical Panels

Moving Electrical Panels – in Multistoried ECR Building

- Provide **one projected monorail** of adequate capacity **from the roof level** of the top most panel floor, **clearing** the panel landing platforms at each floor.
- The platforms should include the **maximum panel width** at each floor of the ECR building.
- At each landing platform, provide **open slot and detachable hand railing** below the centre line of the monorail.

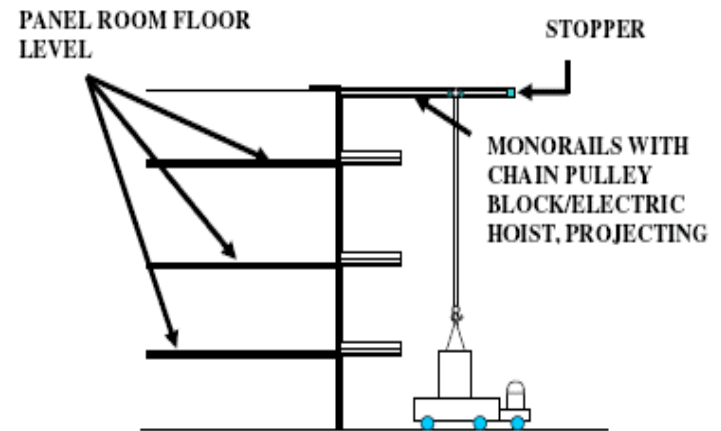


FIG.: 4 - MULTISTORIED ECR BUILDING WITH HANDLING FACILITY OF PANELS OUTSIDE THE BUILDINGS

Handling of Electrical Panels

Moving Electrical Panels – in Multistoried ECR Building

- For **lower level handling**, **panel landing openings** at higher floors should be created.
- To create such openings, provide **hinged/sliding chequered plates/coverings** over landing openings which should be moved to facilitate the proper placement of panel.
- The **monorails at the roof level** at each floor need to be kept **close to the panel landing platform**, for subsequent panel movement inside the floor.

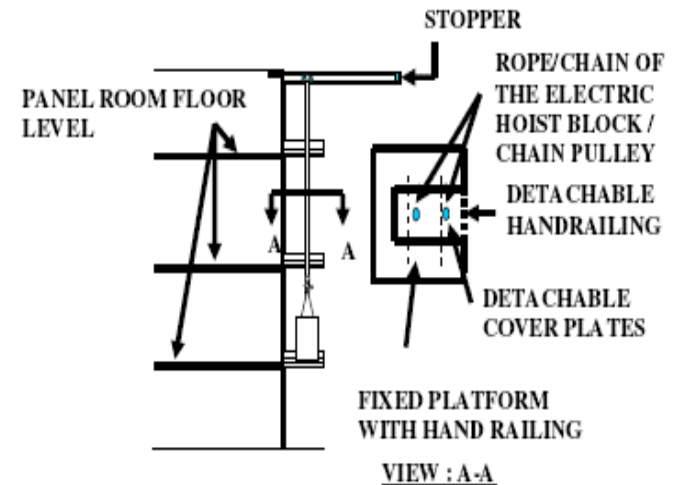


FIG.: 5- ELECTRICAL PANEL SHOWN
LIFTED AT LOWER LEVEL PLATFORM

Handling of Electrical Panels

Monitoring & Reviewing

Frequency	Mechanism	Record	Responsibility
Before and during panel lifting	Inspection	Inspection Record	Line Engineer /Consultants /Contractor

Module - 7

Scaffolding

Scaffolds :Generic Information

- **Scaffolds are intended to provide safe working positions at elevations.**
- Ensure that scaffolds must have complete handrails, midrails and complete decking
- Do not use fall arrest equipment as a substitute for handrails, midrails, or a complete deck.
- No scaffold shall be erected or be substantially altered or be dismantled except under immediate supervision of a responsible and competent person.
- All material for any scaffold shall be inspected by a competent person before being taken into use. Contractors shall engage such competent persons and shall arrange for their training as necessary.

Scaffold-Generic Information

- Every scaffold shall be securely supported or suspended and shall, where necessary, be sufficiently and properly strutted or braced to ensure stability.
- Every platform, gangway, run or stairs shall be kept free from any unnecessary obstruction, material, rubbish and projecting rails. When surface become slippery, appropriate steps shall be taken by way of sanding, cleaning or otherwise to remedy the situation.
- All extended open bars at construction site as well as at plants or other projected bars must be protected with Bar-cap, to cover the sharp projection of the bar (Bar Guard Material No, UMC 0122A0364)

Related Hazards:

Electrical Hazards

- Care shall be taken to see that no un-insulated electric wire exists within 3 m of the working platform, gangways, runs, etc., of the scaffold.
- While carrying rods or pipes or any kind of conducting material more than 3 m. length in the vicinity of electric wires, special care shall be taken that these do not touch the electric wires.

Mechanical and Traffic Hazards

- Care shall be taken to see that no part of a scaffold is struck by a truck or other heavy moving equipment and no material shall be dumped against it.
- Scaffolds on thorough fares shall be provided with warning lights, if general lighting is not sufficient to make it clearly visible.
- Access to fire alarms, cable tunnels, hydrants, etc., shall remain free at all times. Care should be taken for underground cables and equipment when parts of scaffolds or other fasteners have to be driven in the ground.

Means of access

- There shall be suitable and sufficient safe access to and egress from every place at which any person at any time works.
- A safe and convenient means of access should be provided to all platform level of scaffolds. Means of access may consist of;

☐ **Ladder**

☐ **Ramp**

☐ **Stairway**

☐ **Ladder:** Portable ladders are not recommended for flights above 4 m. They should be placed at an angle of approximately 75° from the horizontal. Both top and bottom should be secured to prevent displacement, and the ladder rails should be extended at least 1 m above the top landing. Fixed ladders should be provided for flights above 4 m. Fixed ladder should have landings of minimum 600 mm width and intervals not greater than 6.0 m. The width of ladder shall not be less than 300 mm.

CONSTRUCTION OF PLATFORM, GANGWAYS & RUNS

- No gangway or run with the slope, exceeding 1 vertical to 1.5 horizontal shall be used.
- Gangways or runs must be fitted with stepping laths @450 mm c/c if the surface is slippery or if the slope is steeper.
- Corrugated sheets may be used as platform, gangway and runs provided they are designed for strength and stability, fixed properly and made up of good quality material. For a platform of maximum width 800mm, members directly supporting the corrugated sheet / board shall be minimum 25mm dia. rods @ 750mm c/c (max). Alternatively, 40NB Pipes can also be used up to 1250mm width of platform @ 750mm c/c (max).
- Platform shall rest securely and evenly on its supports and have at least 3 supports to avoid any sagging of corrugated sheet.
- Side of a working platform (more than 2 m ht.), Gangways, Stairs shall be provided with Guard rail to a height of 1.15 m above the platform or place.
- Toe board of at least 100 mm high.
- An intermediate guard rail at not more than 765 mm height.
- Platform shall be kept free from all rubbish and projecting nails

AVOIDANCE OF DANGER FROM COLLAPSE OF STRUCTURE

- Scaffolds must always be erected maintained and dismantled by competent & trained person
- Scaffold must be properly braced and when necessary tied into building or the structure.
- All platforms must be properly supported and they should not be overloaded.
- Guard rails and toe boards must always be fitted and be maintained in position.
- Loose packaging such as bricks should never be used below vertical members.
- Diagonal bracing parallel to the face of the building and full height of the scaffold should be provided at 3.0 m intervals.
- Bracings shall be provided to take care of the stability of scaffolds in both directions.

CONSTRUCTION AND MATERIAL

- Every scaffold and every part thereof shall be of good construction, of suitable and sound material and of adequate strength for the purpose for which it is used. **The Contractor/Sub-contractor shall be responsible for the design and safety of scaffold system**
- For scaffolding construction the individual tube or tubes forming part of the unit frame shall conform to the requirements **of IS: 1161:1968.**
- **The design of Steel Scaffold and all its components shall conform to IS: 2750:1964**
- The base plate shall have a level surface area of at least 15 cm x 15 cm or equivalent area, concentric with the axis of the shank to which it shall be securely attached.
- Before starting the scaffolding erection, the surface on which it has to be erected must be made firm and level.
- Once the surface is ready, sole plates have to be kept. It can be a timber sleeper or steel plate. Sole plates may be avoided in case the scaffold is erected on a firm ground like concrete floor etc.
- Base plates are a must, irrespective of where the scaffolding is erected. It should be 150 x 150 mm steel plate of thickness not less than 6mm. Sole plates and base plates support the entire load of the scaffolding. They distribute the load and prevent the scaffold from sinking.
- Do not use corroded / deformed couplers and make sure that threads are in good condition
- No Dropping or throwing materials from the top shall be allowed

SUSPENDED SCAFFOLD

- 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 outriggers, joists, run-ways, rail tracks or other equally safe anchorage.
- 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 operation when the operating handle or lever is released.

TRESTLE SCAFFOLD OR MOBILE SCAFFOLD BOATSWAIN'S CHAIRS, CAGES etc

- All trestles and supports used for the construction of any trestle scaffold shall be of –
- Good construction, suitable and sound material;
- Adequate strength for the purpose for which they are used and free from any defects.
- The width of the said platform is such as to leave sufficient clear space for the transport of material along the platform.
- The trestles or supports are firmly attached to the platform and adequately braced to prevent displacement.
- 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.
- No scaffold, or Boatswain's chair, etc. shall be used unless –
- It has been inspected during the previous 7 days by a competent person;
- It has been inspected after a rough weather conditions likely to have affected its strength or stability or to have displaced any part.
- The details of each inspection are recorded. Records are not required for scaffolds under 2 m in height or for ladder or trestle scaffolds.

Training

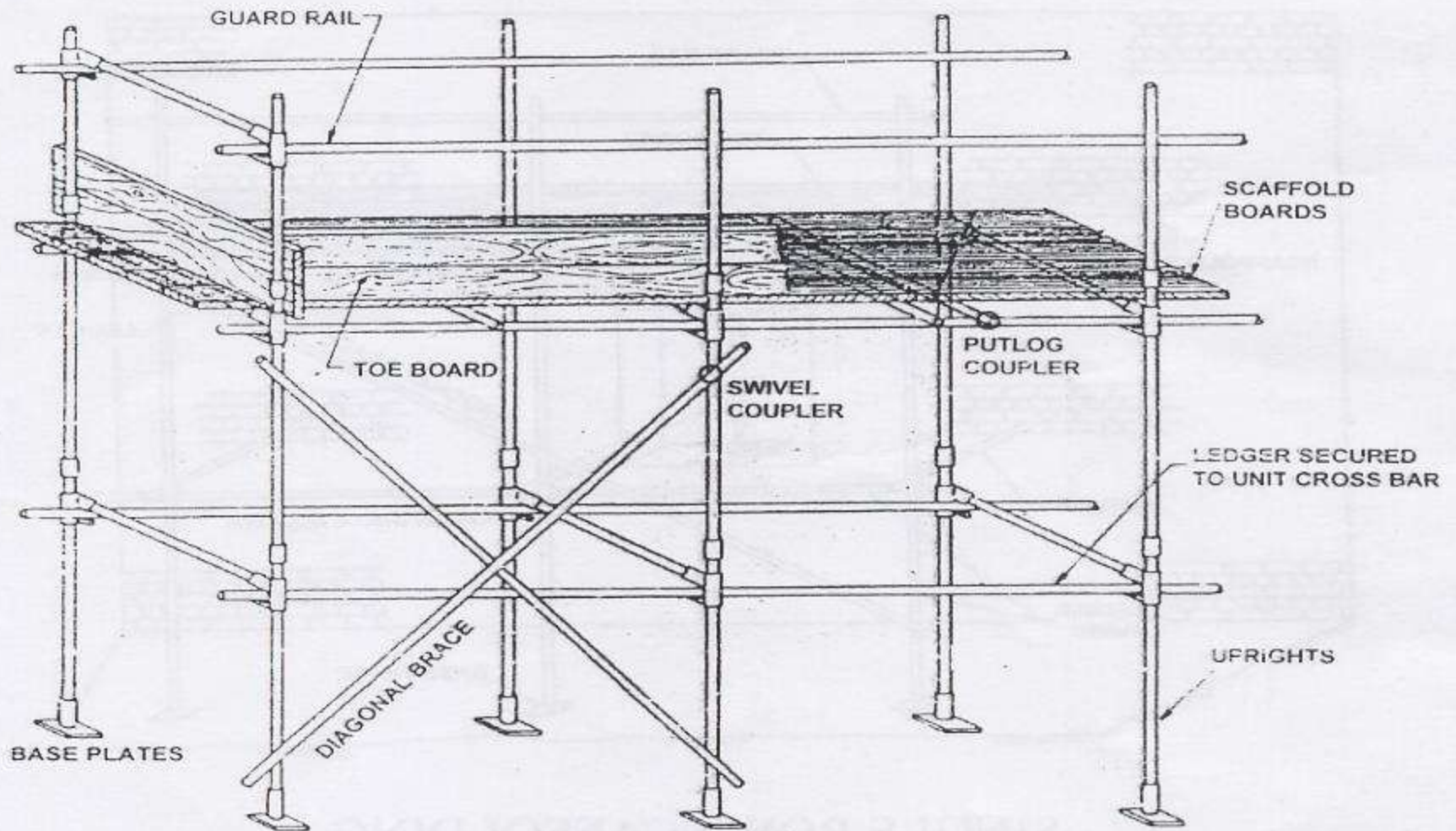
- ❑ Employees involved in the erection, dismantling, moving, repairing, etc., of scaffolding shall receive training from a competent person. The purpose of the training is to recognize any hazards associated with the work in question. Training shall consist of:
 - the correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question
 - the design criteria, maximum intended load carrying capacity, and its intended use
 - Various hazards like electrical hazards, fall hazards, falling object hazards in the work area
 - The correct procedures for dealing with electrical hazards and for erecting, maintaining, and disassembling the fall protection systems and falling object protection systems used
 - The proper use of the scaffold and the proper handling of materials on the scaffold
 - The maximum intended load and the load carrying capacities of the scaffolds used

Check-list

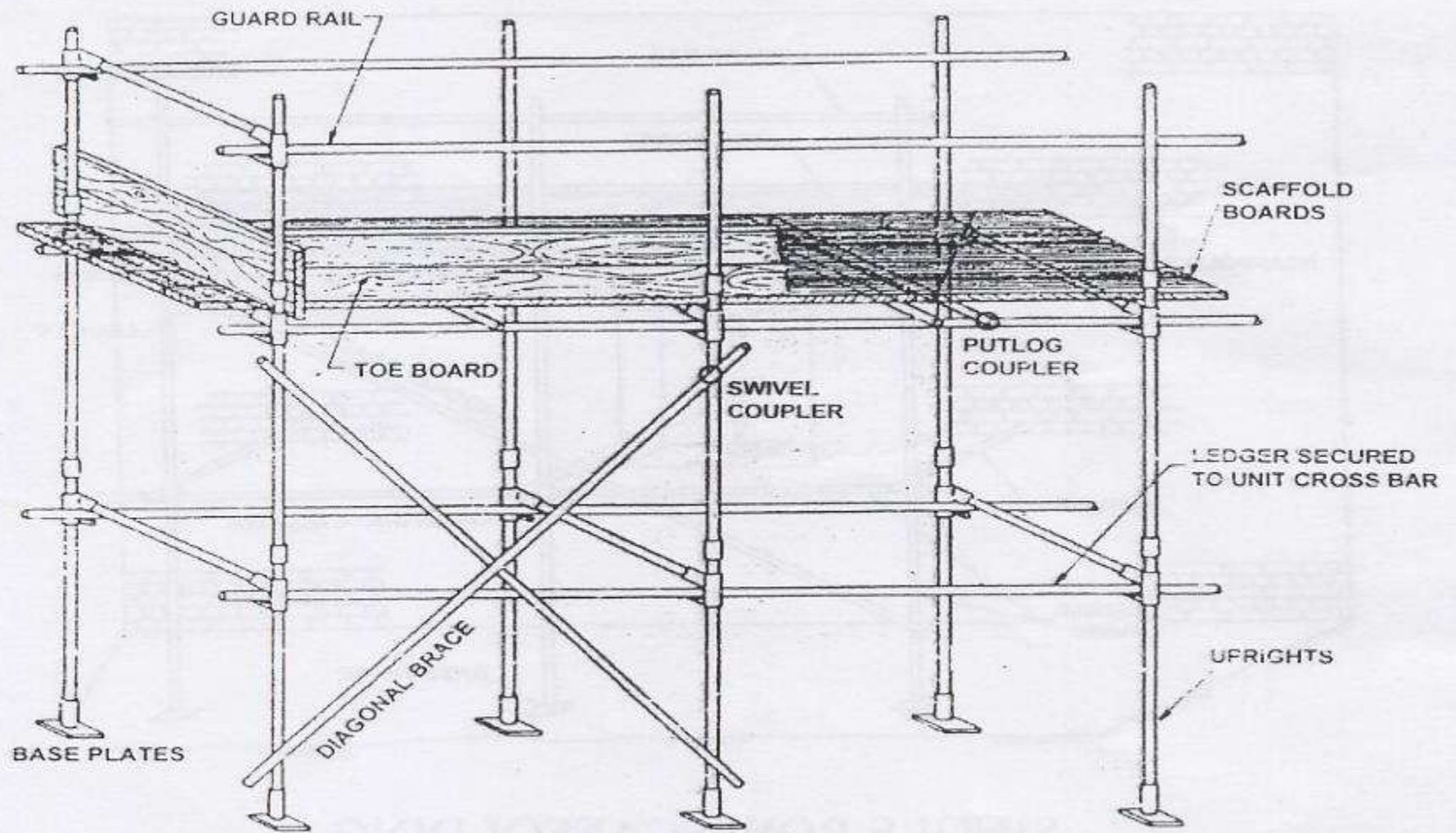
Requirement of the standard

- Scaffolds are having handrails, mid-rails, and decking.
- Every scaffold is sufficiently and properly strutted or braced to ensure stability.
- The foot or base of any standard or upright shall be placed on an adequate base plate.
- No un-insulated electric wire exists within 3 m of the working platform, gangways, runs, etc..
- No opening in working platform is present.
- Working platform is free from rubbish and other unwanted materials.
- Toe board height is at least 100mm
- Suitable and sufficient safe access and egress are present
- All portable ladders are approximately at 75° with the horizontal.
- Ladder rails are projected by 1 meter beyond the top landing
- Ladders are properly anchored at top and at bottom.
- The gap between any two consecutive steps is less than 300mm and the spacing is uniform.
- Employees who perform work can recognize hazards associated with the type of scaffold being used and understand the procedures to control those hazards.
- Inspection register containing the inspection records is available at work site.
- Tags showing “ **Safe for use**”, “**Do not use**” or “**Erection /Dismantling is on progress**” shall be displayed on all scaffolds at all time.

Standard Scaffold



INDEPENDENT SCAFFOLD



INDEPENDENT SCAFFOLD

TYPICAL SIGNS & TAGS

IDENTIFICATION NO:

SCAFFOLD INSPECTOR:

DATE OF ERECTION:

DO NOT USE

NO ACCESS

**SCAFFOLDING ERECTION / DISMANTLING
IN PROGRESS**

SAFE FOR USE

Module - 8

**Manually
Propelled Mobile
Ladder**

Purpose:

To define the requirements for materials, fabrication and performance of manually propelled mobile ladder stands and scaffolds.

Associated Hazards:

- ☐ **Falling from height,**
- ☐ **Over head electric lines**
- ☐ **Exposed parts of components**
- ☐ **High velocity wind**

Compliance Requirement:

Permissible stresses on structural design of tubular steel / aluminum alloys scaffoldings as specified below -

Light : 25 lb/ft sq. (122 kgf/m sq.)

Medium: 50 lb / ft sq.(244 kgf/m sq.)

Heavy : 75 lb/ft sq.(366 kgf/m sq.)

Barrels, boxes, loose tile blocks or other unsuitable objects should not be used as supports for working platforms.

The platform edges should be equipped with toe board to eliminate hazard of tools or other objects falling from the platform.

The location where the manually propelled scaffold and ladder structure rests should be reasonably leveled.



The platform and stairs should be kept free from oil, grease & any unnecessary material.

The mobile Platform should be only used for which it has been designed.

Defective ladders should be promptly repaired or replaced.

Ladders leading to landing or walkways should extend at least one meter above the landing and should be secured at the upper end.

To prevent slipping, a ladder should be secured at the bottom end. If this cannot be done, a person should be stationed at the base whenever it is in use.

The pitch at which a lean-to-ladder is used should be such that the horizontal distance of its foot from the vertical plane of its top should not be more than one quarter of its length.

No ladder should be placed or leant against window-panes, sashes or such other unsafe or yielding objects, nor placed in front of door opening towards it.

If set up in driveways, passageways or public walkways, it should be protected by suitable barricades.

When ascending or descending, the user should face the ladder.

Ladder should not be overcrowded.

Employees should use at least one hand to grasp the ladder when they are climbing and descending.

In order to reach a larger area from a single setting of the ladder, the user should not lean more than 30 cm to side.

Men should not be allowed to work from portable scaffolds during storm or high winds.

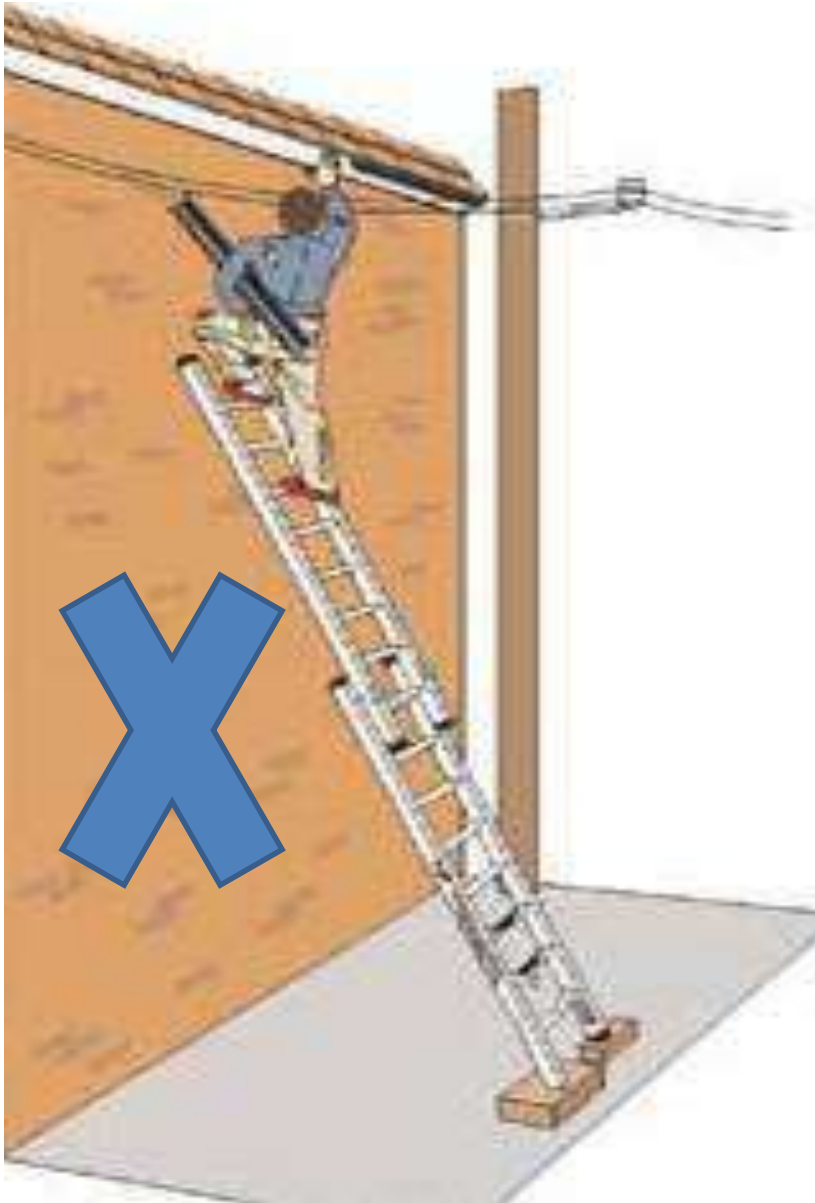
Trestle and extension trestle ladders should always be used in a fully spread position.

Electrical Hazards:

Work should be stopped in case of Un-insulated electric wire within 3 m of the working platform of the scaffold.

Special permission should be taken from the authorized person in case of presence of high tension line within 3 m working platform & positive isolation should be done.

Metal ladders should not be used around electrical equipment or circuits of any kind.



Un- insulated electrical wire

Both hands engaged

High Pitch for ladder

Ladder placed on bricks

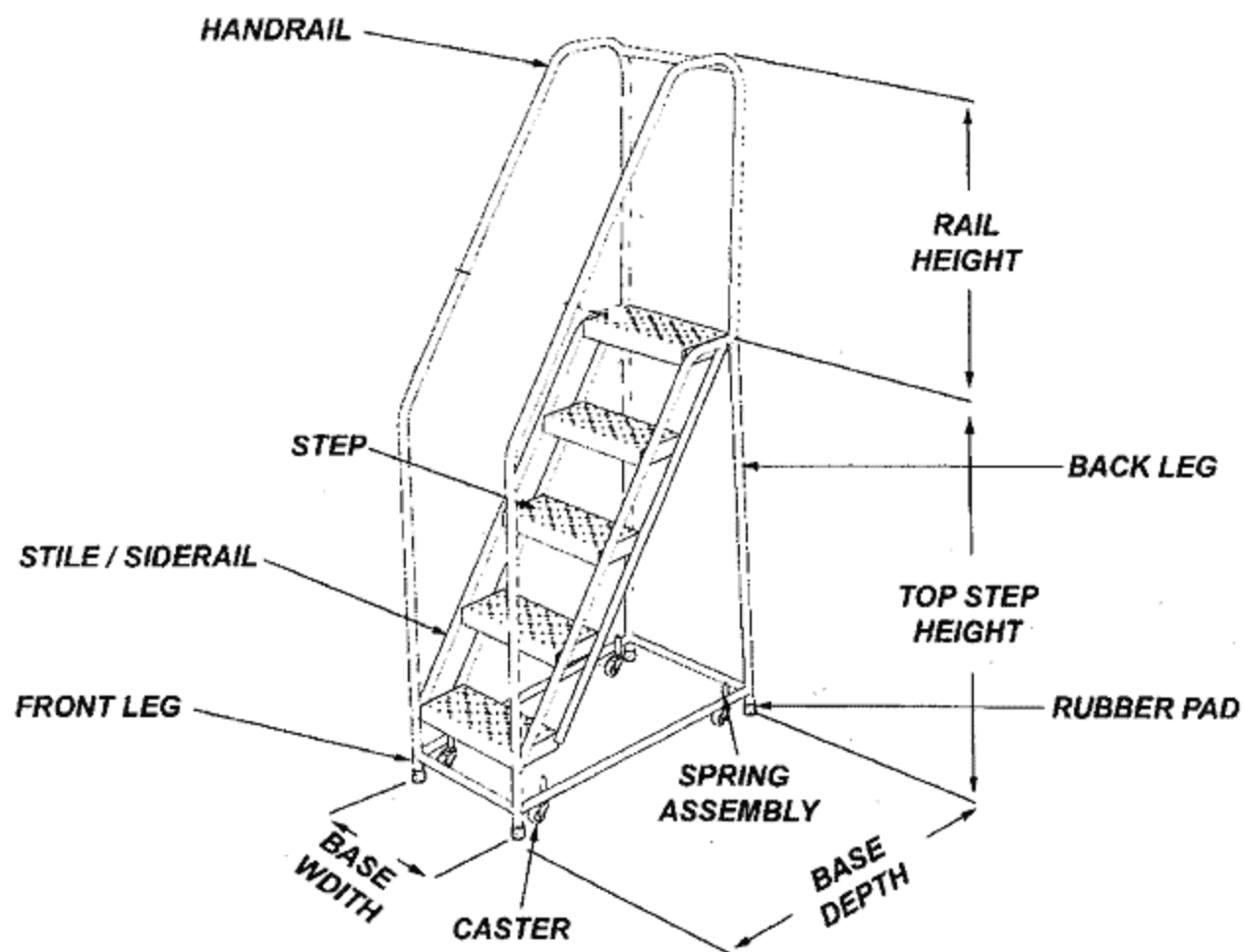
Inspection:

A competent person must periodically inspect ladders for defects and after any occurrence that could make them unsafe

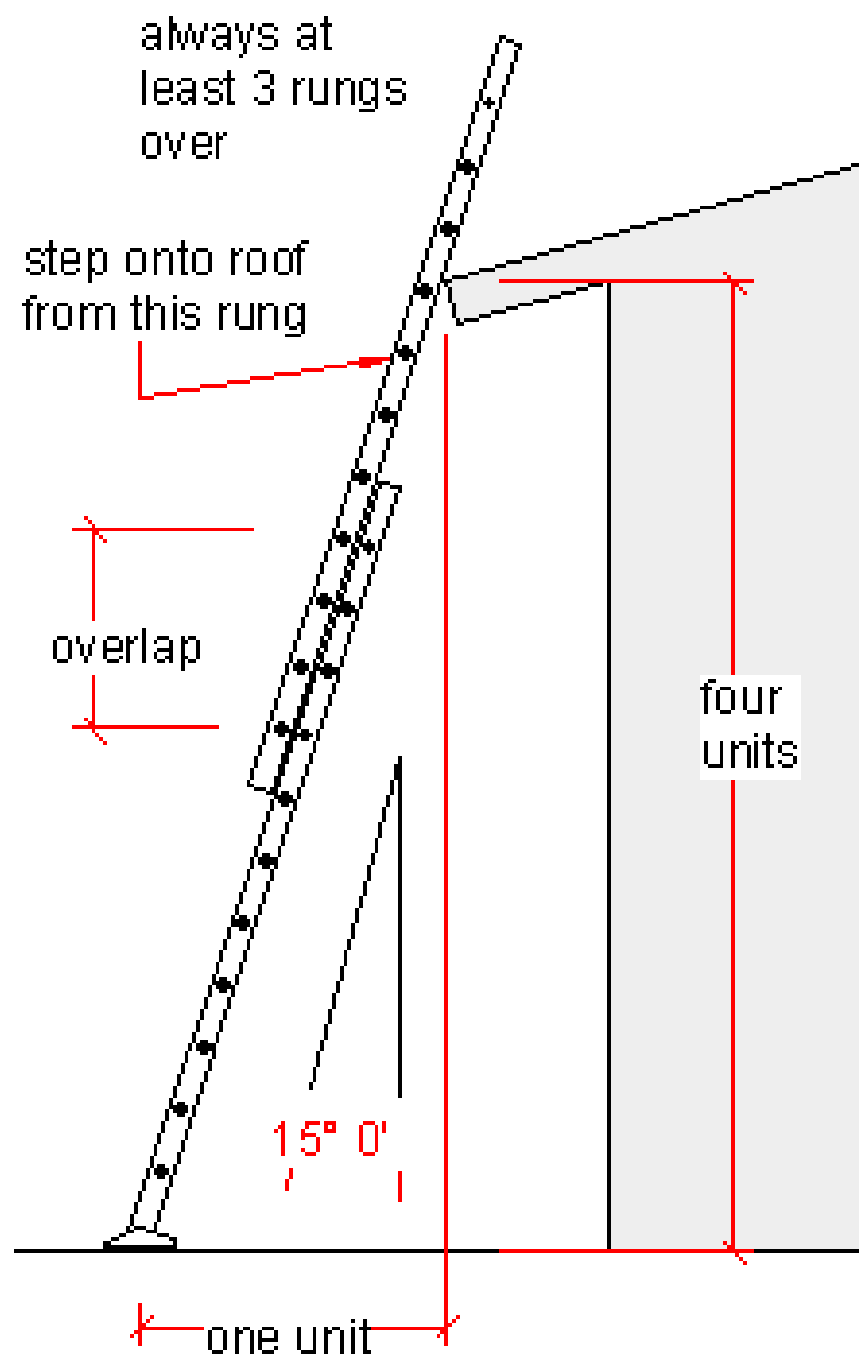
Scaffolds should also be inspected **every fortnight, during use and again before starting use**

Records:

Records on checking and inspection shall be maintained by the User Department.







Module - 9

**Working at Height
and Fall
Protection**

Purpose

To provide safety guidelines for working at height (>2.0m) and necessary protective measures against possible falling hazard.



CAUSES OF FATAL INJURIES IN THE CONSTRUCTION INDUSTRY

- 44% Falls from height
- 17% Struck by moving vehicles
- 17% Trapped by collapse or overturning
- 8% Struck by moving/falling object
- 17% Other

Glossary

Fall arrest system:

Consists of mainly an anchorage, connector, lifeline, lanyard and full body harness.

Anchorage:

A secure point of attachment to which lifeline or lanyard are affixed (Capacity > 2000 Kilogram).

Connector:

A device for attaching a lifeline / lanyard etc. to the anchorage. Carabineer is a oval or trapezoidal shaped connector with a gate / locking arrangement.



Glossary

Lifeline:

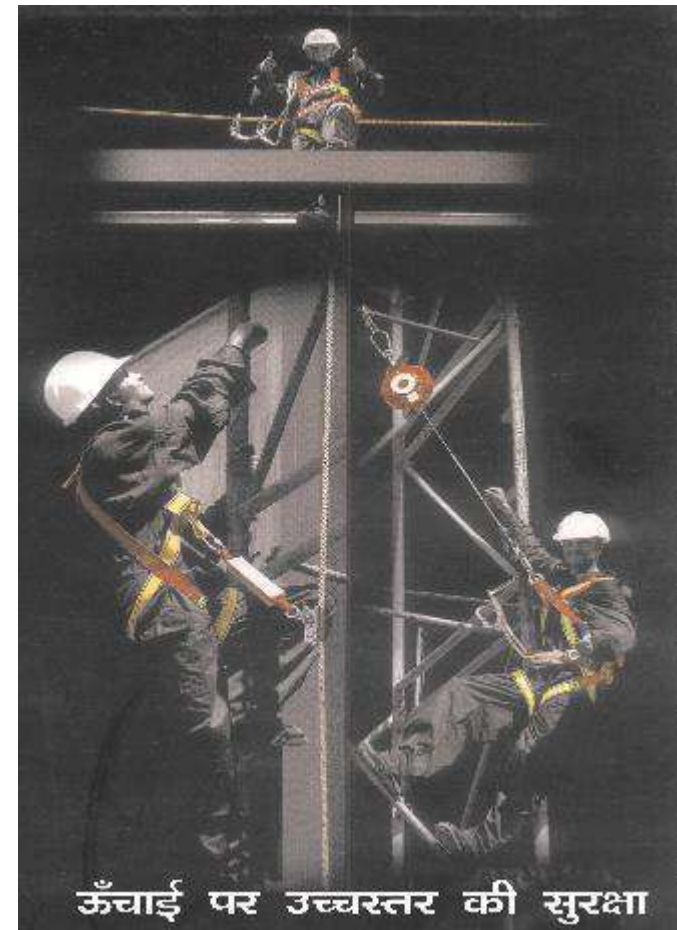
A flexible vertical or horizontal line secured to the anchorage to which a lanyard is attached.

Full body harness:

A device with straps fastened around the body to distribute the fall arrest forces over the upper thighs, pelvis, chest and shoulders.

Retractable lifeline:

A lifeline which allows free travel without slack rope but locks instantly when a fall begins. To be used by one person at a time.



Glossary

Safety net system:

- To be installed as close as practicable below the working surface.
- Shall pass drop test by 180kg bag of sand falling from minimum 1.1m height.
- Adequate projection from edge of working surface shall be maintained as follows:

Vert. distance

1.5m

1.5m – 3.0m

> 3.0m

Horz. projection at edge

2.4m

3.0m

4.0m

Most common and dangerous fall hazards

- Installation and painting of overhead cranes, monorails, conveyors, piping
- Insulation of overhead piping
- Erection and painting of tanks, chimneys
- Construction of exterior brickwork, finishing and cladding work
- Erection and dismantling of scaffolds
- Working on pile driving rig

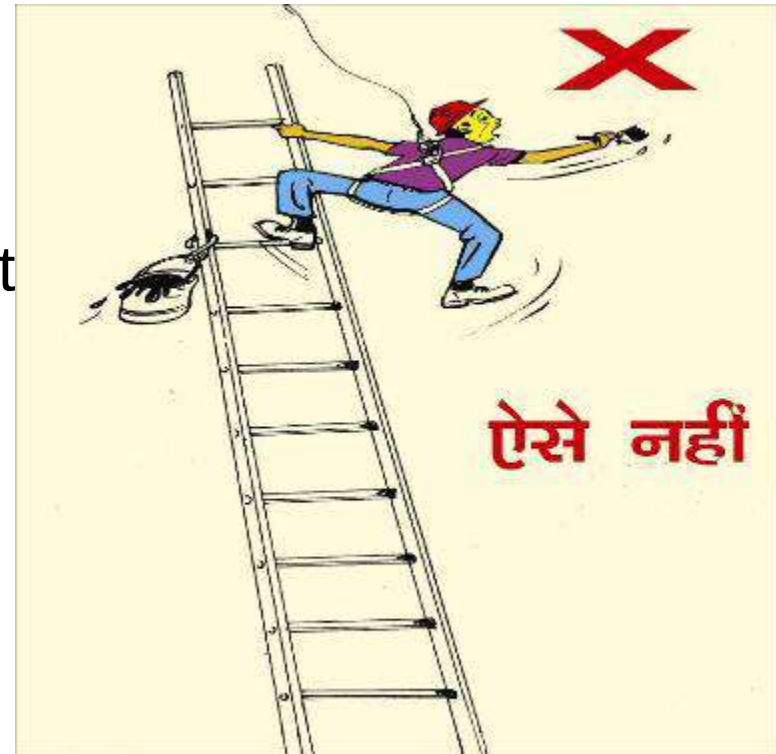


Special attention shall be paid to this kind of job.

Work permit

- Ensure the check points mentioned at the back of the form before issuance, e.g.

- 1) Whether a certified rigger?
- 2) Fit for working at height (No vertigo)? Ask for medical certificate for working at height
- 3) Has got training for working at height?
- 4) Equipped with fall arrester / safety belt, safety helmet with chin strip?



Work permit (Contd...)

- 5) Whether proper approach like steps, ladder is in place? Assess their conditions.
- 6) Whether the working platform is properly made with handrails, toe boards etc.?
- 7) Whether the scaffolding is safe and as per standard?



Work permit (Contd...)

- Check clearance with any power line or mobile equipment in the vicinity?
- Communicate to the workmen about the possible hazards in the working area, like gas lines, power lines etc.



Records

- Concerned Site in-charge shall maintain the work permits for at least a year.
- Records of incident / accident shall be maintained at the working department and at the safety department for at least five years.

Before work starts....

- Ensure that the area below working platform is barricaded.
- Check that workmen and equipment are not exposed to **adverse weather like high wind, storm, lightning etc.**
- Ensure that the job is carried in presence of a competent Supervisor, who knows to deal with the emergencies.



At the end of the day....

- The working platform must be cleared off tools, equipment and debris etc.
- Power connection for the job is switched off.
- Working area should not be accessible to trespassers.

Mobile elevated working platform (MEWP)

- Safe access to height.
- Used in firm and level ground. Preparation required in advance.
- To be placed away from power line ($>3.0\text{m}$) and vehicular traffic approach.
- Fall protection necessary second line of protection.

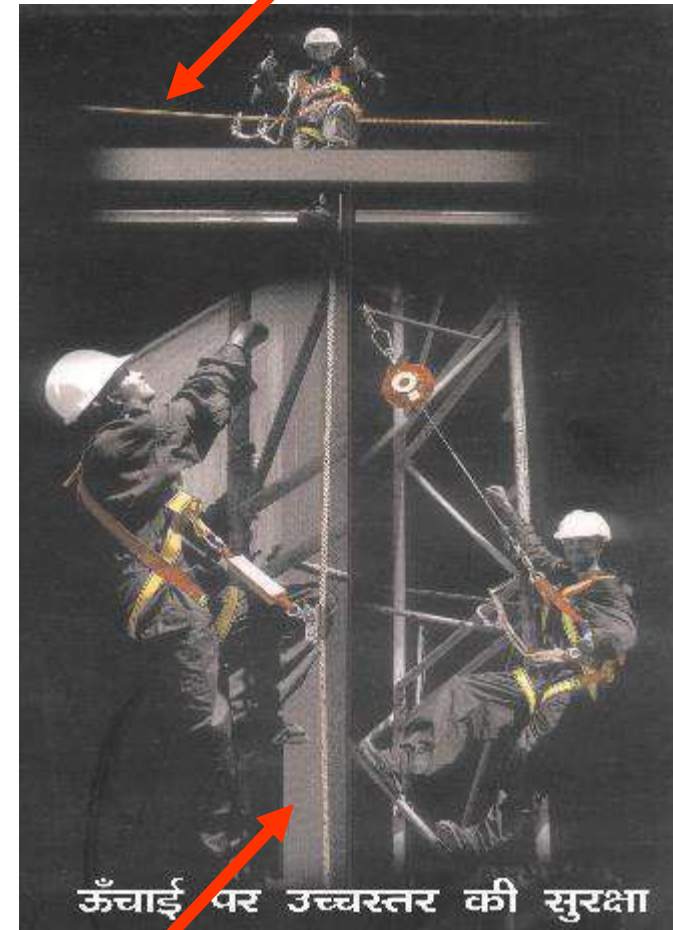


Checklist

Horizontal lifeline

Lifelines:

- Minimum breaking strength 2000 Kilograms
- Protected from abrasive or cutting edge
- Workman should not hold it for balance
- Life line should be minimum 12 mm dia. wire rope.
- Not more than two persons shall be permitted to attach their lanyards to a single horizontal life line, at one time
- The lifeline shall be anchored between two posts/supports not more than six meter apart
- No more than one person may tie-off to a vertical lifeline



Vertical lifeline

Checklist

Anchorage point:

- Must be independent of working surface
- Capable of supporting min. 2000 Kilograms
- Located at or above shoulder height



Checklist (contd..)

Lanyard

- Not longer than 1.8m
- Should have shock absorbing properties (227-272 kg)
- Tying of knots prohibited from lanyard to lifeline
- It shall not break under a minimum load of 2000 kg
- The lanyard shall meet the requirement of IS: 3521 (Or equivalent)

Snap hook

- Inspect regularly against wear, distortion etc.
- Two snap hooks shall not be connected to each other

Body harness

- Inspect regularly against abrasion, broken stitching, missing hardware
- Instruct the workers about the use and care of the same

Module - 10

**Gas Safety
&
Confined Space**

Types of gases in Steel Plant

1. Coke Oven Gas
2. Blast Furnace Gas
3. LD Gas (Linz Donawitz)/Corus Gas
4. Propane
5. Nitrogen
6. Hydrogen
7. Ammonia
8. Sulphur
9. Chlorine
10. Oxygen etc.

What happens in case of CO gas leakage ?

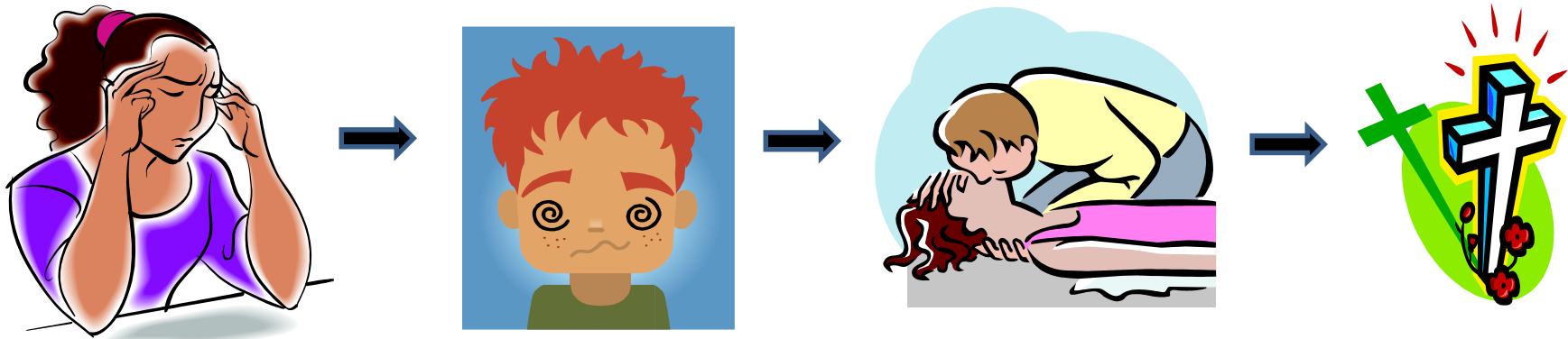
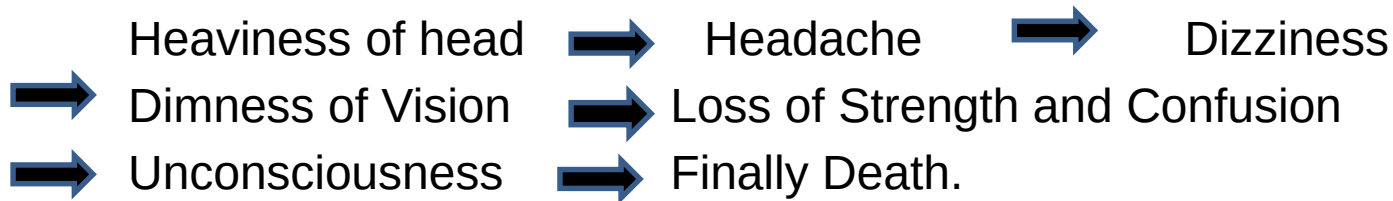
1. Gas comes into the atmospheric air and starts diffusing.
2. During our breathing when we breath in such contaminated air, we inhale Carbon-monoxide along with atmospheric air (21% O₂ + 78% N₂).
3. This air goes to the alveoli of the lungs where exchange of gas takes place.
4. As the hemoglobin having about 300 times more affinity compare to oxygen, even a trace amount of carbon-monoxide prevent the formation of oxy-haemoglobin and itself produce carboxy-haemoglobin in the blood.



What happens in case of gas leakage ?

So long we will be exposed to such atmosphere more and more carboxy-haemoglobin will be formed in the blood and oxygen deficiency in blood occurs which results in the following symptoms.

Symptoms of gas exposure :



Effect of gas poisoning with saturation in blood

**% of Carboxy hemoglobin
in blood**

Symptom

5-10

Heaviness of head

10-15

Headache

15-20

Dizziness

20-25

Dimness of vision

25-30

Loss of Strength and confusion

30-40

Above symptoms get intensified

40-50

Unconsciousness

50-60

D

earth

Specific odour of gases

Coke Oven Gas



Give smelling of burning tar



Blast Furnace Gas



Gives smell of rotten egg or rotten fish



LD Gas



Impurities is negligible so gives no smell, sometimes gives smell of lime

Ammonia



Having smell of urinals



Chlorine



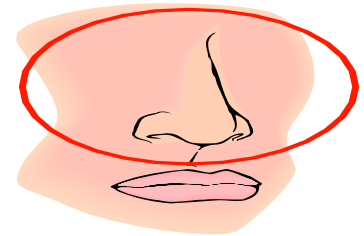
Having smell of Bleaching powder

Eight steps of gas safety

1. Know the area where gas is in use and be alert. While working in these areas keep watch on gas using gas detector.



2. These poisonous gases either have their own smell (ammonia and chlorine) or gives smell due to presence of impurities.



The Nose

Eight steps of gas safety

3. Know the symptoms of Gas Exposure (effect of gas poisoning with its saturation in blood)



4. Don't work in empty stomach, under sick condition or under intoxicating state in a gas hazard area.



Eight steps of gas safety contd..

5. Don't take rest or sleep in the area where gas is used. (gas hazard area).
6. Don't take risk if there is gas leakage, use gas mask and do the job.



Eight steps of gas safety contd..

7. Before working in the gas hazard area test the area for presence of gas and also take written permission for working (works permit) in gas area.



8. Do not operate or handle the gas line or gas system without full awareness of system / layout / job to be done. Don't do the unplanned job.



CONFINED SPACE

What is confined space ?

Confined Space is a space that meets all three criteria:

- Is large enough and so configured that an employee can enter bodily and perform work;
- Has limited means of entry and exit ;
- Is not designed for continuous human occupancy ;
- Has deficiency of breathable air.

Examples: Tank, pit, silo, tunnel, well, sewer, underground utility, vault

Examples

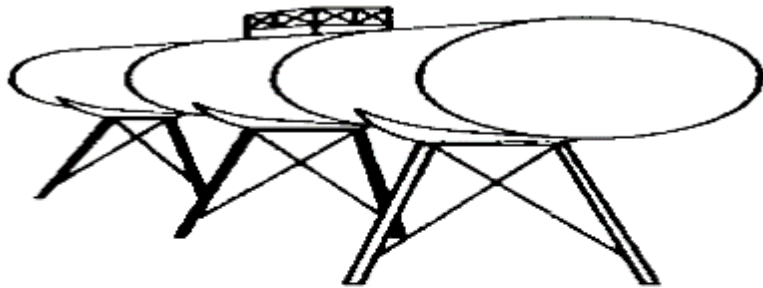
- tanks
- pits
- tunnels
- vaults
- boilers
- sewers
- shafts
- ventilation ducts
- crawl spaces



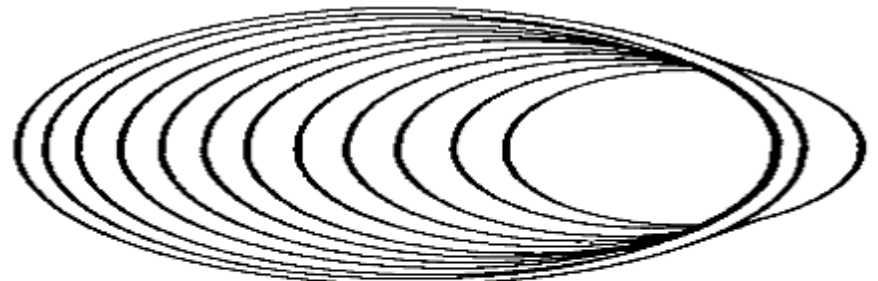
Examples contd..

- Manholes
- Furnaces
- Silos
- Hoppers
- Gas Holders
- Dust Catcher
- Cooling Tower
- Cable tunnel
- Vessels
- Well
- Mixing Chamber
- Pipes
- Trenches
- Ducts
- Bins
- ESPs
- Cyclones
- Chimney
- Conveyor tunnel
- Duct
- Furnace

Examples contd..

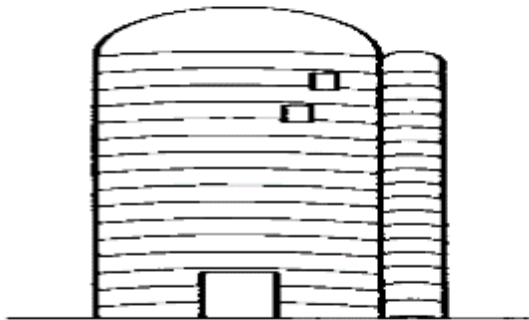


Storage Tank

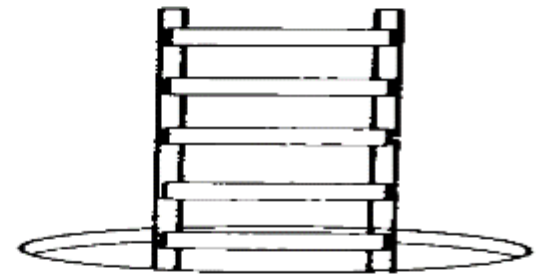
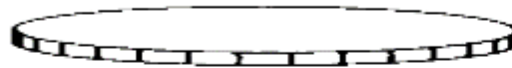


Pipeline

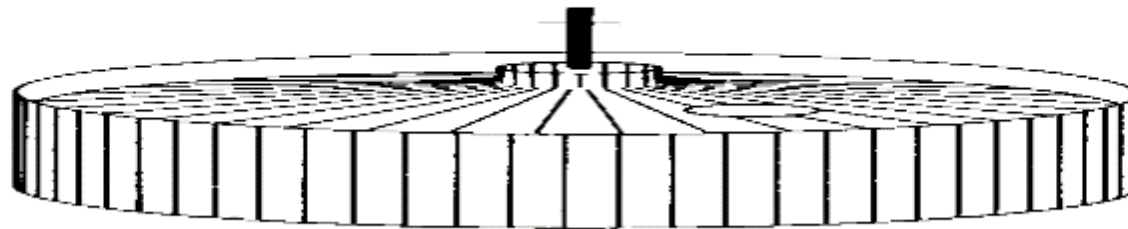
Examples of Confined Spaces



Silo



Manhole



Digester

Examples contd..



RESTRICTED ENTRY AND EXIT



Entry

"Entry" is when a person passes through an opening into a permit-required confined space



Any part of the body passing through the opening is considered entry.

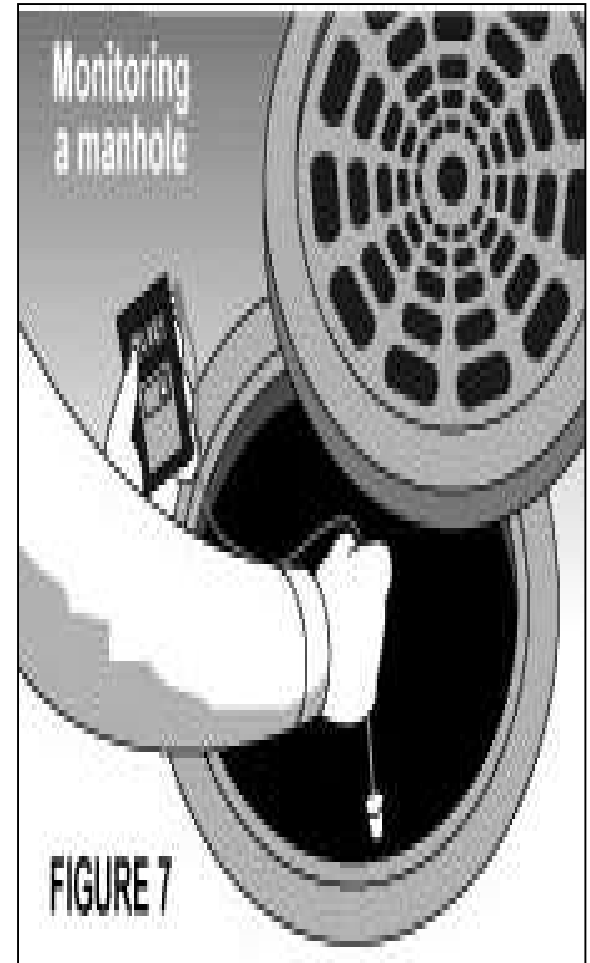
Before Entry

- Ventilate, eliminate, or control the space's atmospheric hazards
- Blind or disconnect and cap all input lines so that no hazardous materials can enter the space
- Positive Isolation (Lockout/Tagout)
- When entrance covers are removed, guard the opening immediately



Atmospheric Monitoring

- Test permit space before entry
- Periodically monitor permit space to determine if entry conditions are maintained
- Test all areas (top, middle, & bottom)
- Observe status of existing hazards and those created during entry operations



PPE

- Full-body Harness
- Respirator (half-mask, gas mask, Air-line Respirator, etc.)
- Helmet, safety shoe, safety goggles, nose mask, proper clothing and suitable hand gloves,



Respiratory Equipment



Trvox 120 Gas Mask



BG4 GAS MASK



LIFE OXYPACK



Air Line Respirator

Safety Equipment



TRIPOD RETRIVAL SYSTEM



FALL ARREST HARNESS



INERTIA REEL BLOCK



GAS MONITORING DEVICE

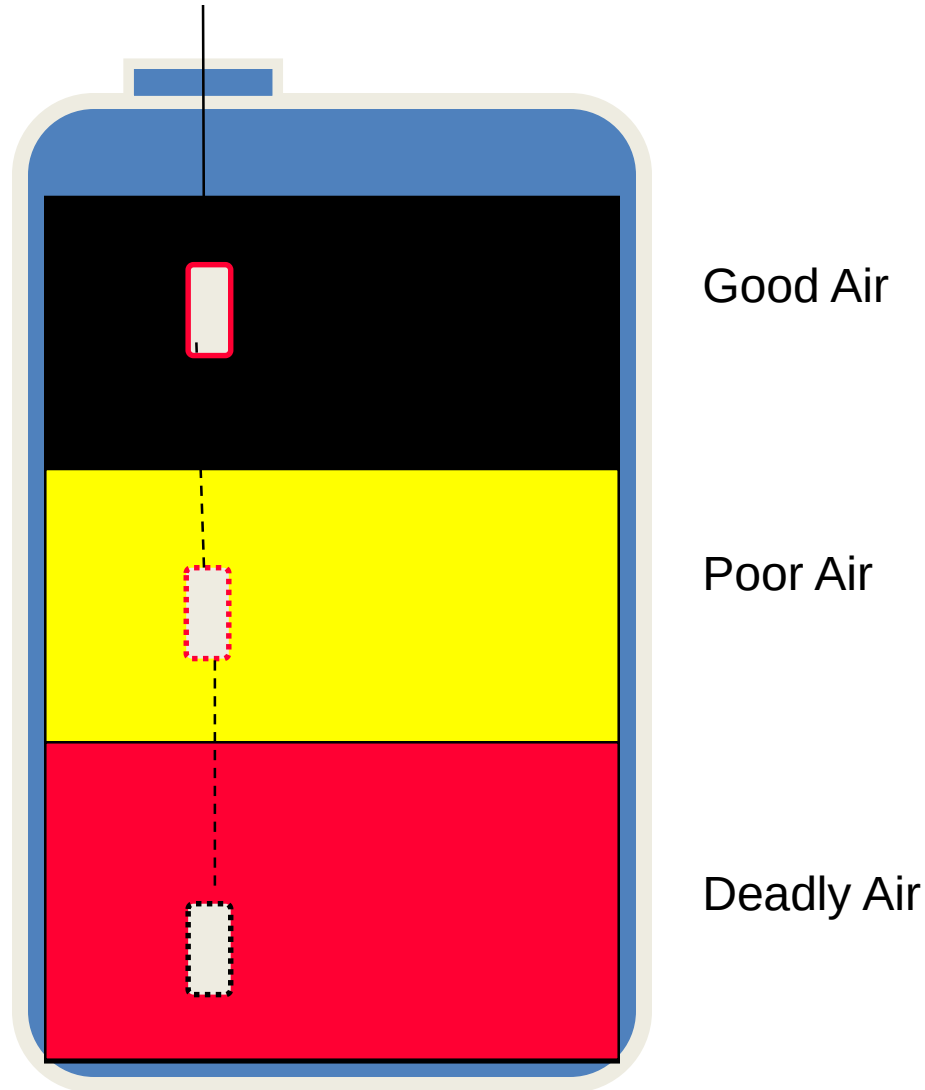


BREATHING APPARATUS

Test the atmosphere

Always test the air at various levels to be sure that the entire space is safe.

Good air near the opening does NOT mean there is good air at the bottom!



NOTICE

Any time a limit is exceeded, no matter what the reason, all personnel shall immediately exit the space, and no others shall enter until atmospheric conditions are returned to safe levels.

THERE ARE NO EXCEPTIONS TO THIS!

ENTER THE SPACE AND PROCEED WITH WORK

- An attendant shall be posted near the entrance for the duration of the work. He shall be in constant communication with the entrants while the job is in progress.
- All entrants shall sign the sign in log when entering the space and sign out when exiting.
- The attendant shall maintain the permit and sign in log for the duration of the work.

WHEN THE JOB IS DONE

- Remove all personnel, tools, and debris from the space. Sign off the log register.
- Close the space.
- Cancel the permit.
- Review the job with the host employer (hazards, problems, other employers, etc.)

EVALUATE THE SPACE

- Determine that the space meets all the conditions set forth in the non-permit justifications
- Conduct atmospheric testing
- Evaluation must be certified by Site Supervisor's signature
- Determine that the confined space does not:
 - contain or have the potential to contain a hazardous atmosphere
 - Continuous mechanical ventilation not acceptable as good atmosphere
 - contain a material with the potential for engulfment
 - Has an internal configuration which could trap or asphyxiate, or
 - contain any recognized serious safety or health hazard

WELDING IN CONFINED SPACE

Continuous ventilation should be provided in the confined space. Pure oxygen should never be used for ventilation.

Conduct continuous monitoring throughout the entry to ensure that the area remains safe for entrants.

Gas cylinders and welding power sources should remain outside the confined space.



CONCLUSION

1. POSITIVE ISOLATION OF ALL ENERGY SOURCES.

2. VENTILATION OF SPACE BY SUPPLYING FRESH ATMOSPHERIC AIR AND REMOVING CONTAMINANTS.

3. TESTING OF ATMOSPHERE IN SPACE BY COMPETENT PERSON.

4. IF ATMOSPHERE IN CONFINED SPACE FREE FROM CONTAMINANTS THEN FOLLOW NEXT STEP OR ELSE GOTO STEP 2.

5. ISSUE OF ENTRY PERMIT BY COMPETENT PERSON, THEN ISSUE OF WORK PERMIT BY LINE MANAGEMENT.

6. MANTAINING OF REGISTER FOR THE ENTRANTS.

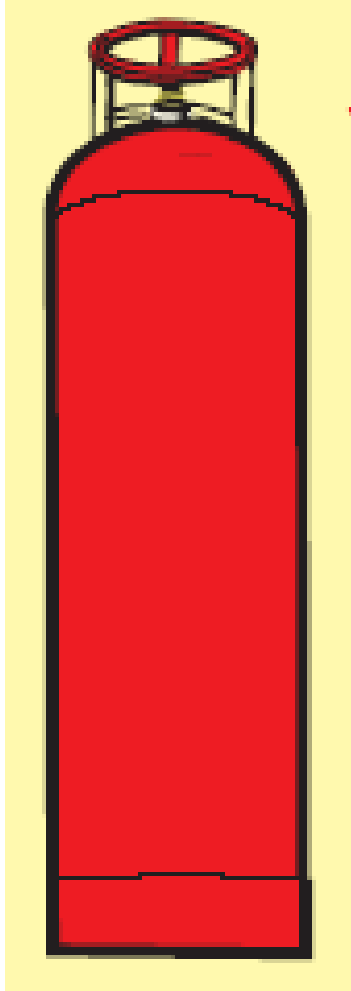
7. PREPARATION FOR ENTRY INTO SPACE (TRIPOD RETRIEVER, FALLARRESTER, Etc. AND RESCUE EQUIPMENTS INSTALLED).

8. ENTRY OF ENTRANTS INTO THE SPACE WITH ALL REQUIRED PPEs. RESPIRATORY EQUIPMENTS TO BE TAKEN IF REQUIRED.

9. WORK TO BE DONE UNDER SUPERVISION AND CONTINUOUS MONITORING OF THE SPACE TO BE DONE.

10. SAFE EXIT OF THE ENTRANTS. REGISTER TO BE MANTAINED FOR SAFE EXIT OF ENTRANTS.

11. RETURN OF WORK PERMIT.



Storage, handling & use of gas cylinder

Purpose:

To provide guidelines for proper storage, handling and usage of gas cylinder at work sites to minimize possible hazards.

Possible hazards :

Fire, Explosion, Gas Leak, Bursting of Gas Cylinders etc.



Basic requirements of storage

The gas cylinder storage shall have:

- Designated place in isolated area .
- Roof to protect from direct sunlight.
- Adequate ventilation in storage area.
- Warning signs, no smoking caution and displayed safety instructions.
- All gas cylinders shall be capped when not in use.
- All the gas cylinders shall be kept in upright position secured with chain to prevent accident fall.



Storage

contd....

Storage shall be away from:

- Exits and egress routes
- Damp area
- Salt and corrosive chemicals, heat, fumes
- Inflammable chemicals, fuel storage area, source of combustion, open flames, steam pipes
- Electrical cables, wires
- Battery room or oil storage room

Note: Full and empty cylinders are to be stored separately & FIFO to be followed.



Colour code of gas cylinders



D.A.

Air

Argon

Cl_2

O_2

H_2



Handling and usage of cylinders

DOs :

- Provide suitable cradles to hold the cylinders.
- Use Red hose for acetylene and other fuel gases black / green hose for oxygen.
Never interchange
- Nozzle tips to be kept clean to prevent back fire.
- Use hoses of equal length
- Close valves when a system is not in use.
- Use pressure relief valves in down stream lines to
prevent high pressure build up.



Handling and usage

DOs :

contd....

- Use only approved valves, regulators, manifold, piping, **flash back arresters** etc.
- Ensure that correct pressure gauges on regulators.
- Conduct periodic maintenance for Valves/ regulators
- Perform visual inspection before usage
- Carry out repair works of Valves/regulators by qualified persons only.
- Display the license details near LPG manifold site



Handling and usage

DOs :

contd....

- Keep in upright position with chaining and capped when not in use.
- Protect cylinders from striking, falling objects, corrosion or damage from public tampering etc.
- Damaged or leaking cylinders must be reported immediately for proper disposal.



Handling and usage (contd...)

DON'Ts :

- Do not use cylinders as rollers or jacks
- Sliding, dropping of cylinders are strictly prohibited.
- Cylinders shall not be picked up by the cap.
- Magnets shall not be used for lifting cylinders.
- Do not use welded, leaking, defective and corroded containers.
- Do not use chain slings for lifting cylinders; only fiber sling should be used.



Handling and usage

DON'Ts :

contd....

- Do not lay gas cylinders on wet soil.
- Do not lubricate cylinders valve threads.
- Oil or grease shall not come in contact with the cylinder valve assembly or the regulator fittings.
- Do not coil the hoses around regulator or cylinder.



Additional guidelines :

- Don't use flammable gases shall near ignition sources
- Ensure that fire extinguishers are available for fire emergencies
- Flames shall not be used for detecting leaks. A leak detection solution shall be used for leak detection.
- Spark proof tools to be used for flammable gas cylinder.
- Access doors to areas which use or store flammable gases shall be posted "No Open Flames."
- Don't use oil in any apparatus, where oxygen is used.

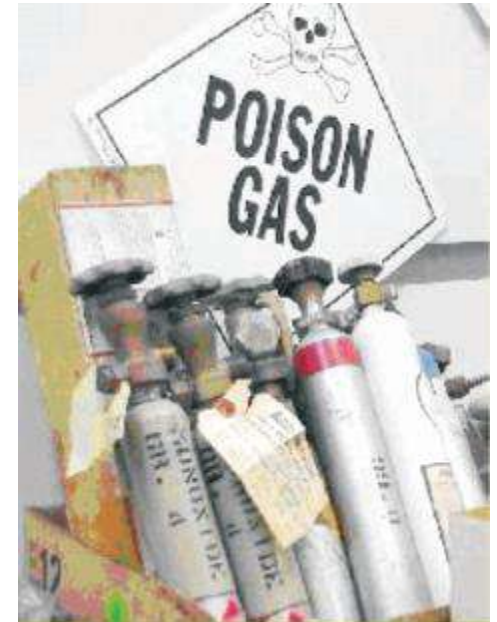


Preplanning and emergencies

Users must be familiar with :

- The nature of the operation of equipment
- Safe Operating Procedures
- Necessary safety precautions
- Chemical, physical and hazardous properties of gas (e.g., its toxicity, corrosivity and flammability).
- Possible accident scenarios
- Post-accident employee responses etc.

Tag mandatory



Preplanning and emergencies

contd...

Contingency plan : Following should be posted at site.

- Building evacuation routes
- Emergency telephone numbers
- Chemical containment procedures
- Fire extinguisher usage, etc.



Minor / major leaks



For minor leakage:

Verification : Use a flammable gas detector or **soap water** solution (Never use flame).

Action : Move the cylinder to an isolated, well-ventilated place and put plastic bag, rubber shroud or similar device over the top and tape it if possible.

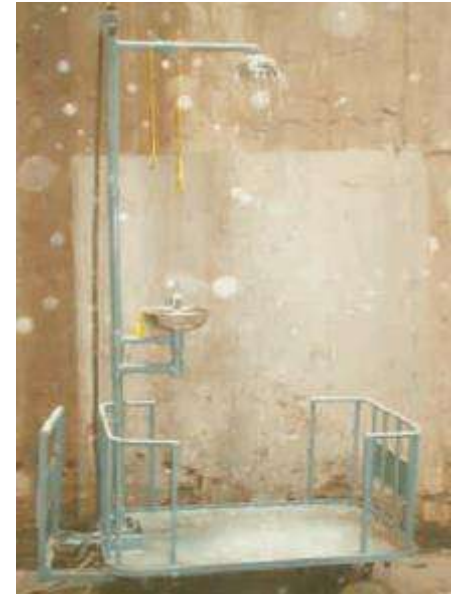
For major leakage:

- Activate fire alarms
- Evacuate the area
- Call Fire Brigade and report the incident
- Provide emergency response with details of the problem upon their arrival.

Post-accident response (Personnel injury)

Assist and administer immediate first aid by:

- Washing under a safety shower, in case of burning clothing or chemical exposures.
- Removing contaminated clothing
- Irrigating the eyes at eyewash
- Administering artificial respiration (CPR).
- Notify personnel in adjacent areas of any potential hazards (e.g., activate building or area alarms).
- Move injured personnel only if necessary to prevent further harm.



Module - 11

Road Safety

MAJOR CAUSES OF ROAD ACCIDENTS

- **Wrong overtaking**
- **Over Speeding**
- **Under influence of alcohol**
- **Rash and negligent driving**
- **Violation of traffic rules and signs.**
- **Fatigue and insufficient rest.**

What are the Loop holes

- Testing the competence of drivers at the time of licensing
- Checking the physical fitness of vehicles and their compliance with regulations at the time of registration and periodical fitness check of commercial vehicles
- Statutory use of helmets, wearing of seat-belts, detection / prosecution of drunken driving and prevention of plying of overloaded vehicles.

Regulatory Requirement

All drivers, contractors, transporters, vendors and visitors must follow all government laws and regulations concerning driving, including

- Following alcohol/illegal drug prohibitions.
- Having a valid driver's license or permit to operate the vehicle being driven.
- Maintaining vehicles that are being driven on in roadworthy condition.
- Obeying all traffic signage and regulations.
- A valid vehicle pass for driving the vehicle at Tata Steel Locations.

General Road Safety Rules FOR FOUR WHEELER DRIVERS

Use safety belts before starting the vehicle. (driver and passengers both).

Use of Seat belt
is mandatory
while using Four
wheeler

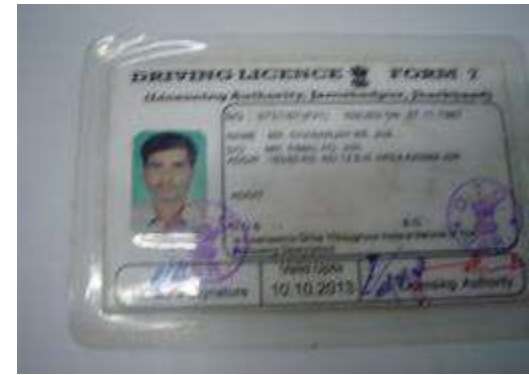


Use of mobile while driving phone is strictly prohibited

strictly
prohibited.



Driver must carry the vehicle permit and the driving license.

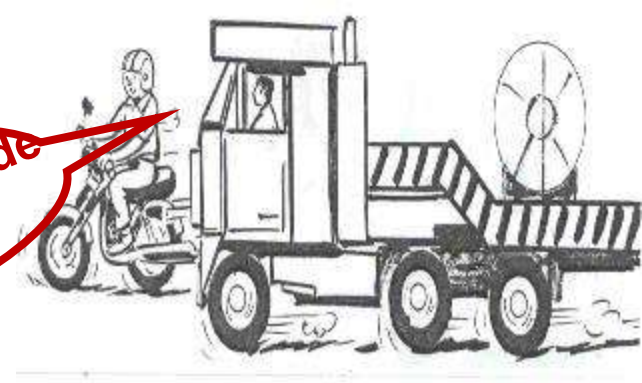


Speed limit is 20 Km/hr on main roads and 16 km/hr on Office road.

Use blinkers 30 m before turning on the road.

**Overtake in case of urgency
from right side of the vehicle.**

overtake from right side



**Keep safe distance (Braking
distance of 2 seconds minimum)
from vehicles ahead.**



**Use of High beam is allowed only in
case of emergency.**



Park the vehicle at the designated places only, Use of hand brake is compulsory.



Stop at Zebra crossing and allow the pedestrians to cross the road



At all crossings. **STOP, LOOK** and then **PROCEED**.



Stop before the STOP mark on the road at the traffic signals.

STOP LINE



Tread Depth of the tyres should not be less than the thickness of the match stick.



Only Tata Steel registered vehicles are allowed in the premises.

Vehicle sticker



General Road Safety Rules

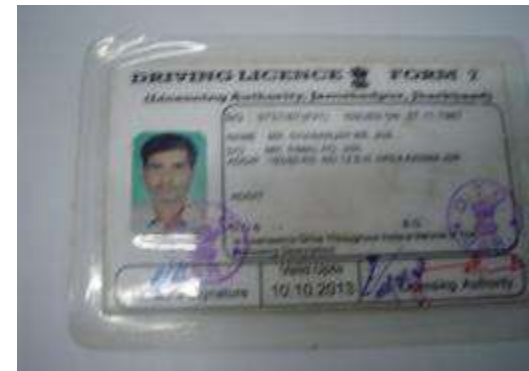
For Driving Two Wheeler

Condition of the vehicle should be checked before entering the premises.

Tread Depth of the tyres should not be less than the thickness of the match stick



Driver must carry the valid vehicle pass and the driving license while entering the premises.



Use crash helmet with visor of ISI registered make only. (Both driver and pillion).

Use crash helmet with visor of ISI registered make only



Chin strip of crash Helmet should be tightened sufficiently so that helmet doesn't come out in case of any impact.

Chin Strip Should be tightened



Use blinkers 30 m before turning on the road.

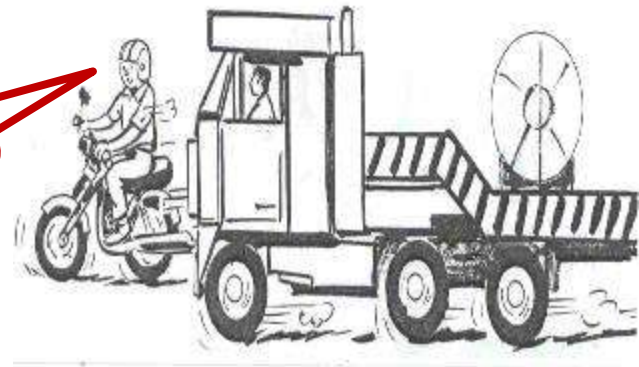
Use left and right side rear view mirror to keep watch on rear moving vehicle.

Rear view mirror



In case of emergency only, overtake from right side of the vehicle.

overtake from right side



Use of mobile phone whether hand hold or hand free is strictly prohibited while driving.

Strictly Prohibited



Keep safe distance (Braking distance of 2 seconds minimum) from vehicles ahead.



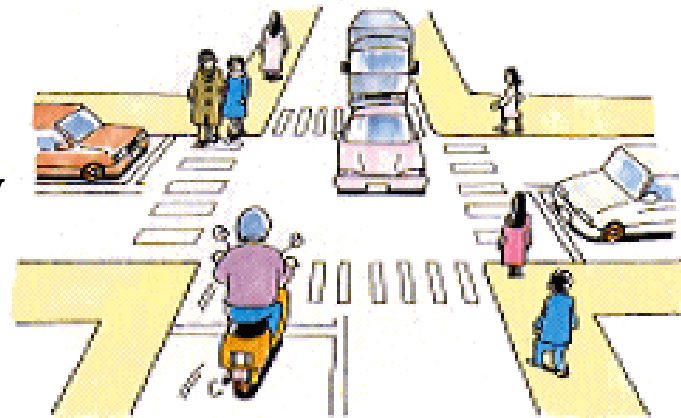
At all rail crossings. **STOP**, **LOOK** and then **PROCEED**.



Park the vehicle at the designated parking places only.



Stop at Zebra crossing and allow the pedestrians to cross the road.



Stop before the STOP mark on the road at the traffic signals.

Stop Mark



General Road Safety Rules

For Cycling

Use all the required PPE's (safety helmet, safety goggles and safety shoes) while cycling.



Use only cycle path, wherever available, while cycling.



Do not cycle abreast on the road.



Maintain safe distance (at least a distance equal to a cycle length) from the other cycles.



Only one person is allowed on the cycle.

At all the crossings, Stop, Look and then Proceed.



Do not carry any heavy material on the cycle.

For crossing the road, cyclist must get down from the cycle and cross the road. Use only zebra crossing wherever applicable.

Use of mobile phone is strictly prohibited while cycling.



Never cross the track line diagonally



Always cross the rail track straight



General Road Safety Rules

For Pedestrians

Use all the required PPE's (safety helmet, safety goggles and safety shoes) while moving on road.

Use only Footpath/Cycle path wherever available. (If not then always walk on left side of the road). Do not walk abreast on the road.

Use only Zebra Crossing to cross the road.



Before crossing the road, first look right then left and again right and ensure there is no vehicle movement.

Don't cross the road zigzag

Where ever zebra crossing not provided, cross the road straight



General Road Safety Rules

For Driving Heavy Vehicles

Driver must carry the vehicle permit and the driving license.

Before starting the vehicle, check the fitness of the vehicle. (Run over protections as per the Tata Steel Standards)

Run over protection guard



Before moving on the road, ensure no body is beneath or near the vehicle. (Use the three piece mirrors).



Driver's right side



Driver's left side

Driver (and passengers) must use seat belts before starting the vehicle.

Passengers are not allowed to sit in load body (dala).



Speed limit is 35 Km/hr on main roads and 16 km/hr on Office road.



Use of helper along with heavy vehicles is prohibited inside the Tata Steel premise.

Use blinkers 30 m before turning on the road.

Use of mobile phone while driving is strictly prohibited.

**Park vehicle at only designated parking places.
Use scotch blocks while parking.**

**No movement is
allowed during safety
timing.**

**Safety timing: 5.45am to
6.15am, 7.50am to 8.10am,
1.45pm to 2.15pm, 4.55pm to
5.20pm, 9.45pm to 10.15pm**

**Do not overtake any vehicle without getting
signal to do so from front moving vehicle.**

Vehicle should be slowed down to avoid any spillage.



At all crossings. **STOP, LOOK** and then **PROCEED**.



Do not seat or slip in front of or under a parked vehicle



Do not overload the vehicle



Push Pull Start should not be adopted.



There are Three Types Of Signage

1. Mandatory or Regulatory
2. Cautionary
3. Informatory

Mandatory or Regulatory Signage Examples



Straight Prohibited or No Entry



Cycle Prohibited



Pedestrians Prohibited



One Way Sign



One Way Sign



Compulsory Cycle Track

Cautionary Signage Examples



Cycle Crossing

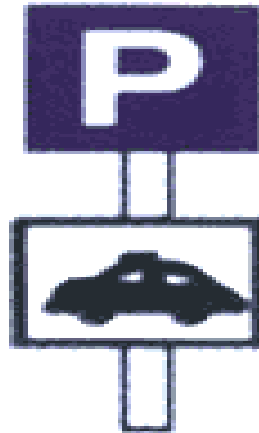


Pedestrian Crossing

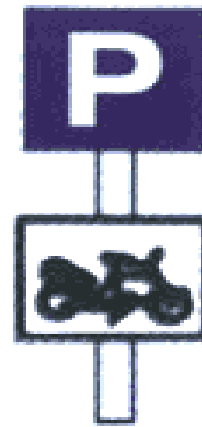


Cross Road

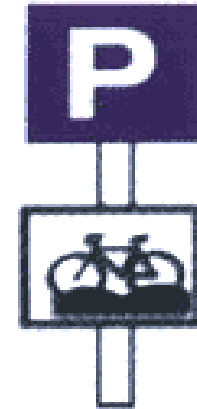
Informatory Signage Examples



Car Parking



Two Wheeler Parking



Cycle Parking

**At every six minutes one human life
is lost in road accident
Who knows
Next can be one of US**

Instead of discussing what best **other can do
we must think what best **I** can do.**

**Today
we take an oath that
we all will follow traffic rules,
and help to save precious human lives.**

THANKS