ELEMENT 4 MUSCULOSKELETAL HAZARDS AND RISK CONTROL

Learning outcomes

On completion of this element, candidates should be able to demonstrate understanding of the content through the application of knowledge to familiar and unfamiliar situations. In particular they should be able to:

Learning outcomes

- Explain work processes and practices that may contribute to musculoskeletal disorders, work related upper limb disorders and the appropriate control measures.
- Explain the hazards and control measures which should be considered when assessing risks from manual handling activities
- Explain the hazards and control measures to reduce the risk in the use of lifting and moving equipment with specific reference to manual and mechanically operated load moving equipment.

4.1 DISPLAY SCREEN EQUIPMENT SAFETY

In the last twenty years manual typewriters have been replaced by computers. Along with the new technology have come new hazards which can, if not controlled, cause injuries to those using computer workstations. Users may include a wide variety of employees including those involved in construction related activities such as architects and surveyors.

The Health & Safety (Display Screen Equipment) Regulations 1992 (as amended) set legal standards for those who use computers for a significant part of their normal daily routine. However, the standards they specify are good practice whether you use the computer for half an hour a day or seven hours a day.

These regulations cover users and not everyone who uses a computer or display screen at work.

"USER" - Anyone who habitually uses a DSE for a significant period at work.

Equipment such as calculators, cash point machines, typewriters and portable laptops are excluded from these regulations.

a. POSSIBLE EFFECTS ON HEALTH

The introduction of VDU'S and other display screen equipment has been associated with a range of symptoms related to the visual system and working posture. Certain health problems can occur and relate mainly to musculo-skeletal complaints, eye strain and operator stress. These often reflect bodily fatigue. All can be eliminated when the installation and use of DSE is based on sound ergonomic principles.

Upper limb pains and discomfort

Prolonged static posture of the back and neck and head are known to cause muscular-skeletal problems. Awkward positioning of the hands and wrist e.g. as a result of poor working technique or inappropriate work height are further likely factors. A range of conditions affecting the arm, hand and shoulder areas linked to work activities are now described as work related upper limb disorders (WRULD). They are particularly associated with the use of fast keyboard operations for prolonged periods. This includes tenosynovitis, tendonitis, carpal tunnel syndrome and tennis elbow.

Visual Fatigue

There is medical evidence to show that DSE use is not associated with damage to eyes or eyesight, nor are existing visual defects made worse. However, "Users" / "operators" with pre-existing defects, may become more aware of them and find such work more tiring or stressful than would otherwise be the case. Temporary visual fatigue can occur through:-

- glare due to poor positioning of the VDU
- poor legibility of the screen or the source document
- unsuitable or inadequate lighting.

Fatigue and Stress

Many symptoms described by display screen workers reflect stresses arising from the task. They may be caused by poor job design or work organisation e.g. insufficient control of the work by the user, under utilisation of skills, high-speed repetitive working and social isolation.

Facial dermatitis

This condition is a rare occurrence and may be caused by workplace environmental conditions such as low humidity and static electricity. Symptoms such as rashes and reddened skin may occur.

Epilepsy

This is not known to be induced by DSE work but if an individual suffers from this condition then they could be at risk. The extent of the risk will depend on their condition, the lighting, colours used and flicker rate of the screen.

b. THE HEALTH AND SAFETY (DISPLAY SCREEN EQUIPMENT) REGULATIONS 1992

SUITABLE AND SUFFICIENT ANALYSIS

For each workstation used by a user. This should highlight the main hazards and consider the user, the DSE equipment, the environment and the office equipment being used.

NEW WORKSTATION REQUIREMENTS

Screen - adjustable contrast and colour, must tilt and swivel, glare minimised
Keyboard - separate from computer & can be angled, legible keys
Work desk - adequate space
Chair - adjustable seat and back rest and stable.
Other issues which may need to be addressed: ventilation, noise, heat & humidity

An amendment to the regulations was introduced in 2002, the requirement to ensure the minimum standards of work stations should cover all work stations and not just those used by users and operators as in the current legislation. This would cover employees and non employees who use these work stations.

DOCUMENT HOLDERS & FOOT RESTS

These should only be provided where they help reduce the risk of injury for an individual user. They do not automatically need to be issued to every “USER”.

PLAN WORK ACTIVITY

Ideally other non keyboard work should be available to allow for breaks from the keyboard. If this cannot be achieved, adequate breaks away from the terminal must be provided. Any software used should be suitable for the tasks involved.

EYE SIGHT TESTS

These must be provided free of charge to users. If corrective appliances are required for DSE work then these must be paid for by the employer. (Up to the cost of basic NHS lenses and frames)

TRAINING, INFORMATION

This should cover how the equipment can be set up to reduce the risk of injury, what the adverse effects are, how to obtain an eye test, who to report problems to and the importance of planning the work to avoid long periods at the keyboard.

Regulations 5 and 6 were amended and clarified to ensure they covered people recruited as DSE “users” since 1992, as these were inadvertently excluded from the original Regulations.

c. DISPLAY SCREEN GUIDANCE FOR USERS

When using your Display Screen Equipment:

- Raise or lower your seat until your forearms are horizontal. Make sure your wrists are straight when your hands are on the keyboard.
- Sit right back in the chair so that the backrest can support you.
- Form a relaxed curve in your back and adjust your backrest to provide support when in this position.
- Use a footrest if your feet do not comfortably touch the floor.
- Remove any obstructions from under the desk.
- Position your document holder, if you have one, near to the screen.
- Set your viewing distance to suit the screen character - no closer than 14 inches.
- Adjust your screen and document holder to suit your sitting position.
- Change your screen adjustments hourly to suit the differing lighting levels.
- Rest your arms and shoulders whenever your work routine allows.
- Clean your screen regularly as it will attract dust readily.
- The screen should be free from glare and reflection, if you can see your face in the screen it is in the wrong position.
- The keyboard can be tilted to improve accessibility, keep a clear space in front of the keyboard to support hands and forearms.
- Do not stay at your workstation in the same position all the time, stretch you arms and legs, look out of the window to relax your eyes.

4.2 ERGONOMICS – AN INTRODUCTION

Although defined in 1963 as "**the fitting of the task to the person**", ergonomics developed as a co-ordinated subject during World War II. This involved scientists, engineers, psychologists, physiologists and doctors working together to consider the effects of work related tasks on people.

In a work related context, once production is underway, success can only be guaranteed if managers, supervisors and operators are aware of ergonomics in addition to their equipment and tasks. Safer equipment and a safe place of work alone cannot secure safe standards for employees.

The first part of the process is to identify ergonomic problems, this should be done proactively before changes are made but also needs to consider the tasks already undertaken.

Action then needs to target the ergonomic issues identified, staff should be encouraged to look out for the effects of their work on themselves and give suggestions for improvement.

Posture

- Postures should not require high levels of static effort to sustain them.
- Variations in working posture should be permitted but not at the expense of operator comfort or performance.
- Designers should consider the use of either sitting or standing postures early in their decision-making.
- Sitting down while working reduces the degree of static work required of the body.
- The operator should be able to adopt an upright and forward-facing posture.
- If standing, the body weight should be borne by both feet equally.
- The posture should be balanced so that additional muscle activity is not required to support or stabilise the body as a whole, or individual limbs, such as would result from leaning forwards.
- The head should remain reasonably upright or slightly inclined to the front.
- The hands should not have to pass above elbow height on a regular basis or for extended periods of time.
- The largest (appropriate) muscle groups should be used to apply necessary forces in a direction which is compatible with their structure.

Handle design and construction

A tool handle should not have a hard or smooth surface which will allow the hand to slip during use.

- When applying downward force with a tool (e.g. a drill), a moulded collar will prevent the hand from slipping as pressure is applied.

- Handles made from metal which may be cold should be avoided due to the possibility of reducing the temperature of the hand.

- The handle should be covered in a soft and textured material to make it easier to grip.

- Contouring on handles such as finger grooves should be avoided unless their design has been based on anthropometric data specific to the intended user group.

- A single-handle tool should be approximately 40mm in diameter but an increase to 65mm may be acceptable if torque is exerted about the axis of the handle (e.g. when using a screwdriver).

- The handle should be a minimum of 100mm in length with an extra 10mm if gloves are worn.

Handedness

Tools should be designed for operation by both left and right-handed users. Alternatively, specifically designed tools for left-handed users should be provided as appropriate.

Weight

- The tool weight should be kept to a minimum (except for those tools which require weight to prevent transmission of vibration and those which enable even pressure to be exerted over a surface).
- Heavy tools should be supported by a counter-balance or placed in a holster when not in use. Users should be encouraged to put the tool down when not in operation.
- The centre of gravity of the tool should be kept close to the hand.
- The length of air lines and other attachments should be kept to a minimum to limit the effect on the tool's balance.

Areas of use

Access to the application area should be made easier by inclining surfaces when necessary, removing obstacles and padding any surfaces which may be leaned on.

Example Construction Related Repetitive Tasks **Factors contributing to the risks**

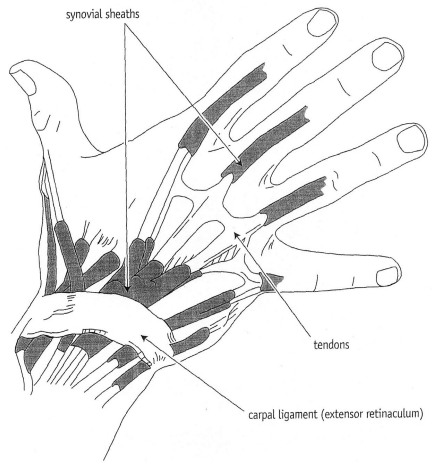
4.3. UPPER LIMB DISORDERS

The concept of repetitive strain injuries or upper limb disorders associated with work is not new. Repetition is just one factor which may increase the risk of injury. The terms RSI and ULD do not relate to just one type of injury or condition but to a range

of conditions which can be brought about by work which exerts stresses on the upper limbs of the body.

Work and play can affect the likelihoods of ULDs, certain hobbies and sports can be as damaging as certain work activities such as knitting and home computer use.

Tenosynovitis - This is where the lining of the synovial sheaths that protect the tendons become inflamed, it normally occurs in the hand and wrist. The tendons should be able to move freely in their sheath but repetitive movement and trauma events like a heavy blow can also result in damage and injury. Forceful gripping, with the hands away from their neutral position or away from the body, can increase the risk of injury. The signs and symptoms include pain, swelling, weakness in gripping ability and a cracking noise during movement.



Trigger Finger - If the tendons in the fingers are damaged this tends to be known as trigger finger. The tendons most at risk are the flexors which are the ones which allow the hand to form a fist. After injury smooth movement can prove difficult.

Carpal Tunnel Syndrome - The tendons which move the fingers, the median nerve and blood vessels all pass together through the hand and forearm through a carpal tunnel under the main capital ligaments. The median nerve gives sensation to the thumb, palms and a majority of the fingers.

Dupuytren's Contrature - This is caused by the thickening of the fibrous fan of the palm of the hand. The thickening and tightening of this causes the hand and fingers to bend. Repeated minor injuries can lead to this condition such as a carpenter using a chisel (banging it with his hand) This can also be a congenital condition.

Ganglion - This is a fluid bag which is normally located on the back of the hand or wrist. They are not normally painful and may not be work related. However they can be caused by adopting poor postural positions when working.

Epicondylitis - This condition is more commonly known as tennis or golfers elbow. This is an inflammation of the epicondyle which is the bony lump on the outside of the elbow. Movements which require some force from the hand, wrist and arm may contribute to this condition. Heavy repeated lifting away from the body can also be an issue.

Tendinitis - This is a condition which can effect any tendon in the body, usually it is the tendons from muscles which raise and rotate the arm and shoulder.

4.4 MANUAL HANDLING

The national impact of injuries caused by manual handling is very significant. Over 1,000,000 people per year suffer from work-related back pain, repetitive strain injury and problems associated with joints, muscles and tendons.

The consequential impact to employers is lost work time, civil liability costs, re-training and lost efficiencies. For the employee there is loss of quality of life, career prospects and earning potential.

All employers have a duty under the Manual Handling Operations Regulations 1992 (as amended in 2002) to minimise the risk to employees and others and adopt good management practice to deal responsively when problems do arise.

Manual handling is not just lifting, it is all those operations that require physical effort to move an object from A to B. The Regulations apply to a wide range of manual handling activities including lifting, lowering, pushing, pulling or carrying. Work-related ill health affects significant numbers of construction workers. For example, musculoskeletal disorders are more common in construction than in any other industry. Back problems, cement dermatitis and vibration white finger can ruin lives and force people out of work and are being targeted by the HSE.

Typical MH Injuries can include:- Slipped Disc, Muscle Strains, Hernias, Fractures, Abrasions, Cuts, Sprains, Damaged Tendons and Torn Ligaments. Fingers and toes also can be crushed by falling or unsecured loads.

What is manual handling?

It is Transporting/Supporting a Load by Hand or Bodily Force. It includes pulling, Pushing, Lifting, Carrying.

Typical activities on a construction site which may include manual handling include

- Placing re-bar, blockwork, installing structural elements, eg, I-beams.
- Stooping while working
- Fixing re-bar, finishing concrete, digging, scabbling concrete, pipe-laying,
- spreading concrete,
- Working above shoulder height - Brickwork, scaffolding, installing services, glazing
- Working with a twisted neck
- Working in confined spaces, eg, installing services.
- Working while kneeling or with legs bent
- Fixing HD bolts, in confined spaces, finishing concrete, scabbling concrete, pipe-laying,

- Carrying heavy loads re-bar, blockwork, steel sections;

What is a load?

Any Person, Animal or Item

Manual Handling Operations Regulations 1992 – Overview

Regulation 2 - Employers & Self Employed have the same duties

Regulation 4 - Risk Assessment

Eliminate hazardous manual handling where possible **- "so far as is reasonably practicable avoid risk of injury".** Where the risk cannot be eliminated a suitable and sufficient risk assessment must be carried out. The four key parts in this assessment must be: -

The Task / Load / Environment / Individuals / Other factors

Or **"TILE"**

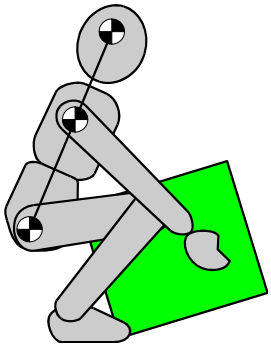
The factors under each of these headings need to be considered to highlight any conditions which could increase the risk of injury. Once these are highlighted they should lead to the identification of risk control measures.

Examples :

The Task – Hazardous Body Movements, Frequency, Rest periods, Twisting, Stretching, Distance of movement etc.
Load - Heavy, Bulky, Sharp, Moving Centre of Gravity, Hot, Human, Animal, Dirty
Environment - Space, Temperature, Ventilation, Stairs, Outdoors
Individuals - Strength, Height, Pregnant, State of Health, Size, Horse play, Experience, Training.
Other – PPE worn, clothing worn

The requirement to complete a risk assessment was amended in 2002 to ensure that the risk assessment takes into account:-

- The physical suitability of the employee
- The clothing, footwear and other person effects worn
- The employees knowledge and training
- Whether the employee is in a group especially at risk
- Any health surveillance results



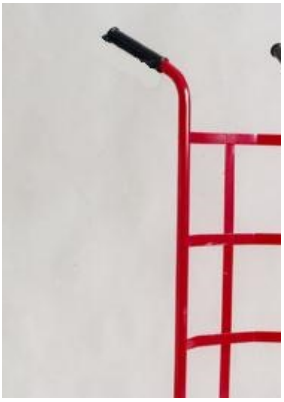
In most cases employers following best practice would have already been meeting this requirement.

Who should carry out the assessment? A competent person.

After the assessment is completed the first consideration for the employer is can the manual handling task be eliminated. Possibly by the use of mechanical equipment, if this is not possible other control measures are required. This could include:-

- Mechanical Assistance
- Automation
- Avoid handling when seated
- Suitable PPE and clothing
- Provide work rest periods
- Improve the Task / Environment
- Break Down Load
- Training
- Labelling of load with weight
- Two people lifts
- Good lighting
- Use of handles, etc.
- Health Surveillance
- Providing information on the load
- Instruction
- Supervision

A variety of non mechanical equipment may be used to reduce the MH risks on site this includes sack trucks, pallet trucks and wheelbarrows: -



Mechanical Equipment use to move loads on site includes:-

Excavator

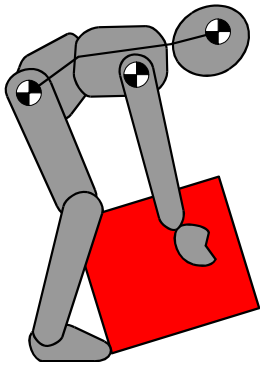
Rough terrain truck

Telehandler **Dumper Truck**

Regulation 5 - Employees have a legal duty to following training and use any equipment provided to reduce the risk.

The Principles of Kinetic Lifting

- Assess the load and environment
- Secure grip with both hands
- Bend knees
- Keep arms close to body
- Chin up as you lift
- Do not jerk
- Do not twist trunk
- Use legs to take the weight
- Keep back straight



Useful Information: HSG 121 A Pain in your workplace, 149 Safe Manual Handling in Construction. HSG

CONSTRUCTION HEALTHY HANDLING

This note has been prepared by HSE Construction Division.

TOP TIPS

- Plan and organise storage and delivery areas before work starts
- Design scaffolds to keep building entrances clear
- Tidy as you go and at the end of each working day
- Provide rubbish chutes to remove waste from working platforms

HSE INSPECTORS WILL EXPECT TO FIND:

• clean, tidy and well organised sites that are kept in good order;
• pedestrian access routes and places of work kept free from obstructions;
• materials stored and left in a safe and accessible condition.

Order and organisation

Disorderly sites and poor organisation can result in serious injury from slips and trips and longer term disability arising from musculo-skeletal disorders

CONSIDER …

- untidy conditions
- blocked ladder access
- unsafe storage
- trip and slip hazards

TOP TIPS

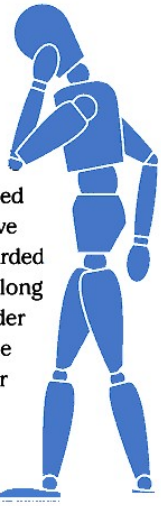
- Design-in safe lifting points for lintels and cills and identify the weight of all items to be manually handled, using lighter components where practicable
- Use mechanical means to deliver materials to the point of use. Organise scaffolding to make block laying easier, for example by providing tables or half lifts to minimise bending and twisting
- Use mechanical placement aids, e.g. vacuum lifts for kerbs and slabs

Getting to grips with manual handling

Good handling technique

Here are some important points, using a basic lifting operation as an example.

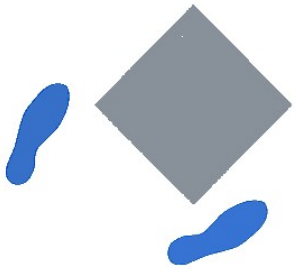
Stop and think



Plan the lift. Where is the load to be placed? Use appropriate handling aids if possible. Do you need help with the load? Remove obstructions such as discarded wrapping materials. For a long lift, such as floor to shoulder height, consider resting the load mid-way on a table or bench to change grip.

Position the feet

Feet apart, giving a balanced and stable base for lifting (tight skirts and unsuitable footwear make this difficult). Leading leg as far forward as is comfortable and if possible, pointing in the direction you intend to go.

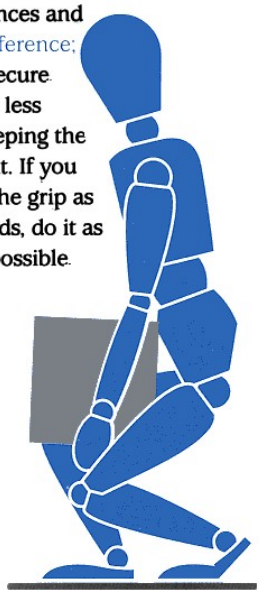


Adopt a good posture

When lifting from a low level, bend the knees. But do not kneel or overflex the knees. Keep the back straight, maintaining its natural curve (tucking in the chin helps). Lean forward a little over the load if necessary to get a good grip. Keep the shoulders level and facing in the same direction as the hips.

Get a firm grip

Try to keep the arms within the boundary formed by the legs. The best position and type of grip depends on the circumstances and individual preference; but must be secure. A hook grip is less tiring than keeping the fingers straight. If you need to vary the grip as the lift proceeds, do it as smoothly as possible.



8

Keep close to the load

Keep the load close to the trunk for as long as possible. Keep heaviest side of the load next to the trunk. If a close approach to the load is not possible, slide it towards you before trying to lift

Don't jerk

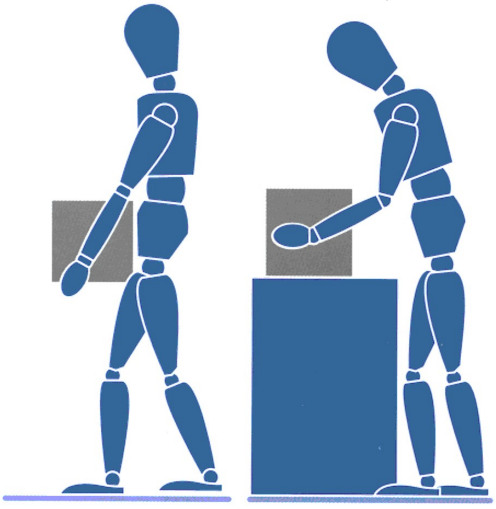
Lift smoothly, raising the chin as the lift begins, keeping control of the load.

Move the feet

Don't twist the trunk when turning to the side.

Put down, *then* adjust

If precise positioning of the load is necessary, put it down first, then slide it into the desired position.



8 How do I know if there's a risk of injury?

It's a matter of judgment in each case, but there are certain things to look out for, such as people puffing and sweating, excessive fatigue, bad posture, cramped work areas, awkward or heavy loads or a history of back troubles. Operators can often highlight which activities are unpopular, difficult or arduous.

Can you be more definite?

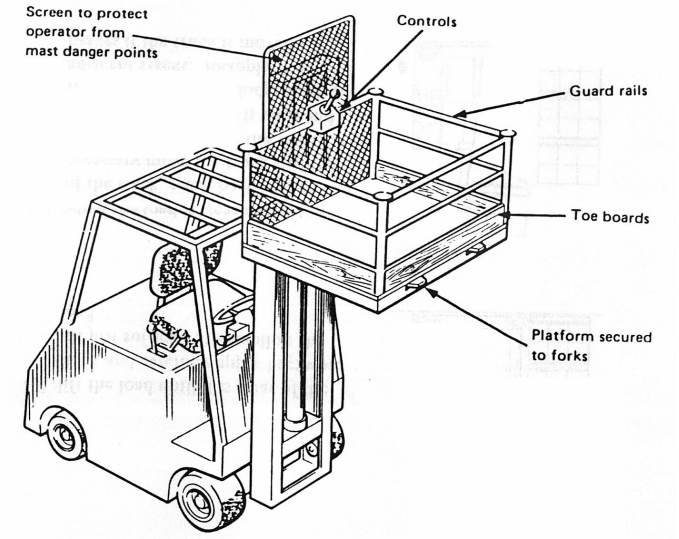
There is no such thing as a completely 'safe' manual handling operation. It's difficult to be precise: so many factors vary between jobs, workplaces and people. But the general risk assessment guidelines filter (see section 9) should help to identify when a more detailed risk assessment is necessary. Working within the guidelines will reduce the need for a more detailed risk assessment.

AQS-SE-140c

4.5 MECHANICAL HANDLING - FORK LIFT TRUCKS

PRINCIPLE - COUNTER BALANCE

- All companies must train users to a known standard on any FLT with a counter balance.
- Standards are set out in ACOP
- Covered by Provision And Use of Work Equipment Regulations



OPERATOR HEALTH

- Disability does not automatically exclude any individual
- If glasses are normally worn they must be worn when operating FLT
- Stable Mentality which normally requires operators to be over 18 years of age

The load must be as near to forks as possible or the force it exerts on the truck will be increased.

RATED CAPACITY PLATE (RCP) – SAFE WORKING LOAD

Every FLT and attachment must have a RCP fitted and not just painted on, this will tell the driver not only the weights that can be lifted but also the load centre which is appropriate. Extended forks can be fitted but must have their own RCP which must then be followed.

Rated Capacity

Load Centre	Weight
50 cms	500kg
75 cms	400kg
100cms	300kg

This plate shows that if the centre of the load is 50cms from the face of the forks it can lift a load of 500kg, but if the load centre is 100 cms away the weight that can be lifted is reduced.

What are the main hazards which may cause a fork lift truck to tip either laterally or longitudinally?

LONGITUDINAL	LATERAL
MOVEMENT OF LOAD	OFF CENTRE LOAD
HIGH LEVEL OBSTRUCTIONS	UNEVEN FLOOR
HARSH BRAKING	GRADIENTS
MOVING WITH THE LOAD RAISED	TYRES FLAT OR DEFLATED
TRENCHES OR KERBS	OBSTRUCTIONS
FRONT BLOCKING VISION	FAST CORNERING

All operators should be taught not to jump out if the FLT tips over as they could be crushed to death.

PRE OPERATIONAL CHECKS

The following components should be checked prior to the truck being used on a daily basis, normally the check will be recorded on a checklist.

Tyres	Forks	Hydraulics
Battery or fuel	Chains	Brakes
Horn/warning lights		

FLT's can be fuelled by Battery, LPG or Diesel.

TANDEM LIFTING - It is permissible to allow two trucks to lift a large load in tandem. If this is the case the maximum amount that can be lifted is one and half times the capacity of the smallest truck.

WORKING PLATFORM - The FLT should never be used to raise people above the ground unless a proper purpose built working platform is fitted. Even in these cases the manoeuvres must be co-ordinated from the ground and the truck must never be moved with a person in the raised position.

A Few Hazards

- Overloading
- Uneven load
- Deflated tyres
- Hydrogen Gas – from charging of electric batteries
- Battery Acid – burns from batteries
- Electric shock – charging of batteries
- Fire/Explosion – from propane gas cylinders
- Fumes – from diesel truck
- Collisions – electric trucks are very quiet
- Undercutting – dragging a load rather than lifting it
- Lifting with only one fork
- Crushing & Impact

Mechanical handling devices include cranes and fork lift trucks.

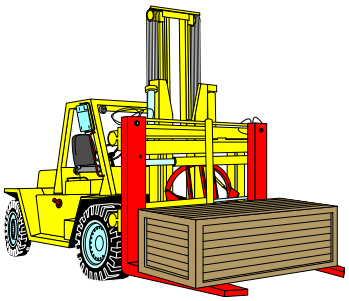
Example Question

Identify the health hazards presented by a diesel operated fork lift truck. ((Hint safety hazards cause injuries, health hazards may lead to occupational ill health.) (4)

Identify typical controls which could reduce the risk of operators suffering from ill health effects from these hazards. (4)

Keeping the Truck Safe When Not In Use

- Security of keys – not to be left in truck
- Park in well lit area
- Do not obstruct walkways
- Do not obstruct traffic routes
- Brakes on
- Park on level surface
- Forks pointed down and on the ground
- Remove the load



4.6 OTHER MECHANICAL LIFTING EQUIPMENT

General Requirements for all lifting and moving operations on site:

- Ensure the equipment is strong enough, stable and suitable for the loads and environment
- All equipment and components must be properly installed
- Visually marked with their safe working load (SWL)
- All lifting operations must be planned, supervised and carried out in a safe manner by competent people

There is a variety of different lifting equipment which you may encounter: hoists, conveyors, mobile elevated platforms, cradles, cranes etc. The key hazards of all of these involve the following four components:

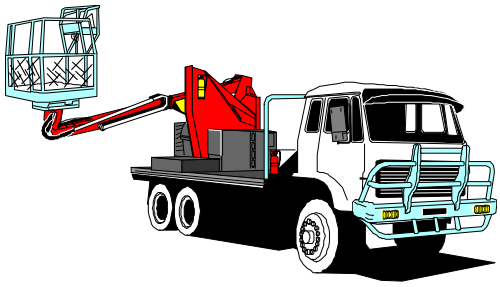
The Equipment – Is it suitable, in good condition, of sufficient strength and tested?

The Environment – Are ground conditions suitable, is there enough space to allow access, what are weather conditions like? – wind could cause problems. Is there adequate lighting, are there measures to keep others away from the danger area? Any overhead or under ground obstructions?

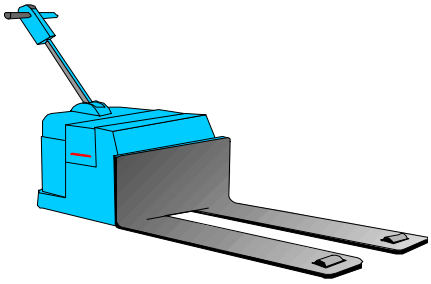
The Load – What size, shape and form does it take? Is it securely packaged? Is the centre of gravity known?

The People – Are those using the equipment and co-ordinating the lift trained? Do they have good vision around the area? Is there an agreed way of communicating to others in the area?

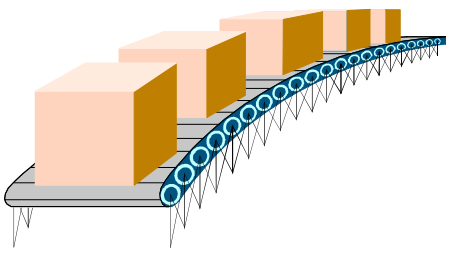
Mobile Elevated Platform



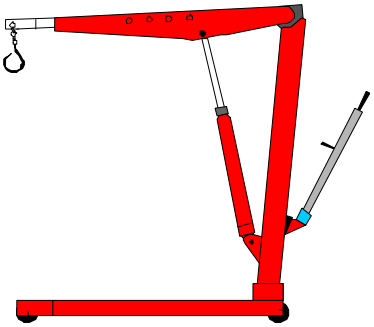
Pedestrian Operated Loader



Conveyor



Mobile Hoist



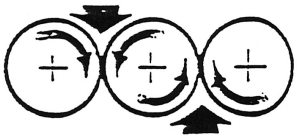
The principles already covered in the module on fork lift trucks can be used to develop relevant precautions and controls to ensure mechanical equipment is used safely.

CONVEYORS

There are a range of different portable and fixed conveyor systems which can be used to reduce manual handling activities. These include roller, screw, belt, plate and monorail conveyors. They may also be used as an integral part of live racking systems.

Conveyors present a variety of hazards, the main mechanical hazards include:

- Entanglement – with a moving roller or belt
- Contact / Abrasions – from the moving components
- Ejection – of items from the conveyor
- Impact – from moving items
- Trap/Drawing in – at tensioning points for the belt or between rollers (See diagram.)



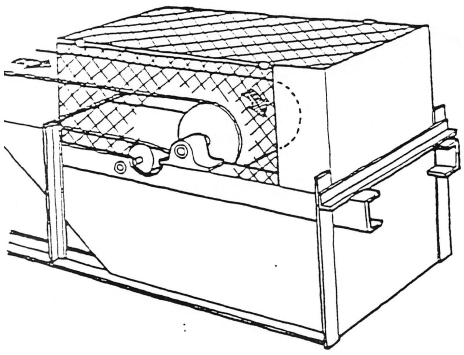
Non mechanical hazards include:-

- Manual Handling
- Noise
- Slips when standing on conveyor
- Ergonomic issues – associated with the height and ease of access to the conveyor and its loads.

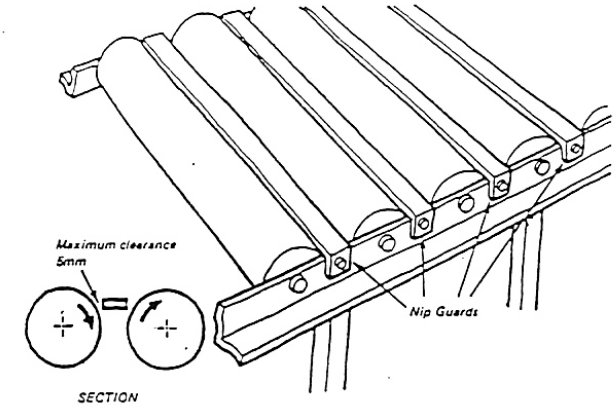
Controlling the risks

Adequate fixed guarding should be provided are far as possible. This could include guards against in running nips on roller conveyors, guards around the screw conveyors and guards around the head pulley on a belt conveyor.

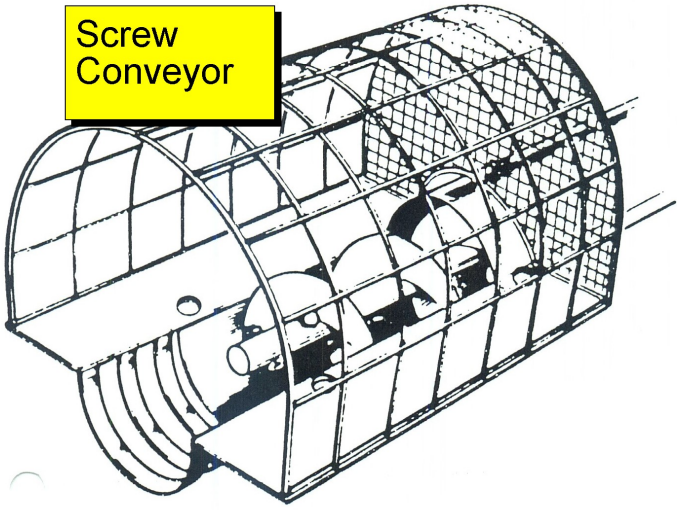
- Trip devices at nip points
- Mesh fencing/guarding to reduce the risk of becoming entangled
- The rollers may be designed to allow them to pop out of place if a problem arise so they will not cause a trapping point. (Jump out rollers)
- Jump out rollers should be used between any rollers and belts.
- Trip wires and emergency stops should be in place at strategic points to ensue the conveyor can be stopped should a problem arise.
- Employees should not the wear loose fitting clothing
- Guards may be needed to stop items falling from the conveyor especially if it is over shoulder height
- Procedures must be in place to ensure the conveyor is not started until the cause of any stoppage is established.
- Suitable guarding must be in place for the motors and transmission machinery.



Fixed guarding at the end of a roller belt conveyor.



Fixed guarding to stop nip points



4.7 CRANE SAFETY

Lifting operations in construction are commonly carried out using cranes and they should be covered in the Health and Safety Plan. When constructing the plan consideration would need to be given to the ways in which the cranes are intended to be used, ie, by the manufacturer and hirer, and any limitations that would affect safety in the conditions expected on site.

Consequently, information would need to be provided by various parties so that factors influencing crane safety can be assessed at a sufficiently early stage.

All those involved in the specification, installation or use of cranes to be made aware of the fundamental criteria and planning issues needed to ensure that lifting operations are initiated and proceed in a logical and safe manner.

While contractors have a duty to operate cranes safely, these duties can be made extremely difficult by thoughtless design, which puts pressure on them to use cranes at their operating limits and beyond.

Information relating to the site is an important contribution to a safe system of work particularly with regard to planning the lifting operation and selection of the correct crane and associated equipment.

TYPES OF CRANES

There are many types of crane and a detailed classification is given in ISO 4306. However, the vast majority of cranes used for construction work in the UK can be classed as:

a) **Lorry Loaders,** which are suitable for delivery purposes and routine lifting operations associated with the vehicle on which they are fitted.

b) **Truck Mounted/Mobile Cranes,** which are suitable for short duration operations where mobility around site is important.

c) **Crawler Cranes**, which are suitable for longer duration operations and ‘pick and carry duties’ and mounted crane would not be appropriate.

d) **Tower Cranes** are suitable for semi-permanent installation for covering large areas whilst taking up relatively little room at ground level.

Within each class of the above classes there is a wide variation of types and lifting capacities. Descriptions of the various types and details of requirements

for their safe use are given in the respective parts of BS 7121.

The same principles and hazards which apply to FLT's and other mechanical lifting equipment also apply to cranes.

However the risks are usually greater because of the increased weights carried and environment where they are used. It is essential that their use is controlled even more thoroughly than a fork lift truck.

While economic factors may influence the choice of a crane, it is essential that the crane selected is capable of lifting ALL loads that it would be expected to handle, **within its capacity and stability limits**. Manufacturers supply duty charts, which show the SWLs for specific duties. These would give designers useful information about the size of crane required and, consequently, the space and loading requirements on the site.

Automatic safe load indicator - A device that ,when fitted to a crane automatically gives a warning of the approach to the safe working load on the crane and a further warning when the safe working load has been exceeded.

Competent Person - A person with both practical and theoretical knowledge, experience of the crane and the equipment used in the lifting operation as is necessary.

Crane Driver (Operator) - The person who is operating the crane.

Load Radius Indicator - A device fitted to a crane that shows the radius at which the crane is operating and its corresponding safe working load.

Overload Cut Out Devices - Switches or other devices may be fitted to cut out crane motions when the crane is in an overload situation.

Level Indicator - Where fitted, crane level indicators should be used in accordance with the instruction manual and maintained in good working order.

Anemometer - Anemometers or other wind-speed measuring devices should have their indicators mounted in clear view of the crane driver. They need to be checked regularly.

FACTORS AFFECTING SAFETY WITH CRANES

For a safe lifting operation, it is necessary to know the weight, dimensions and position of the Centre of Gravity [CoG] of the load. Therefore, the information provided should, at least, include:

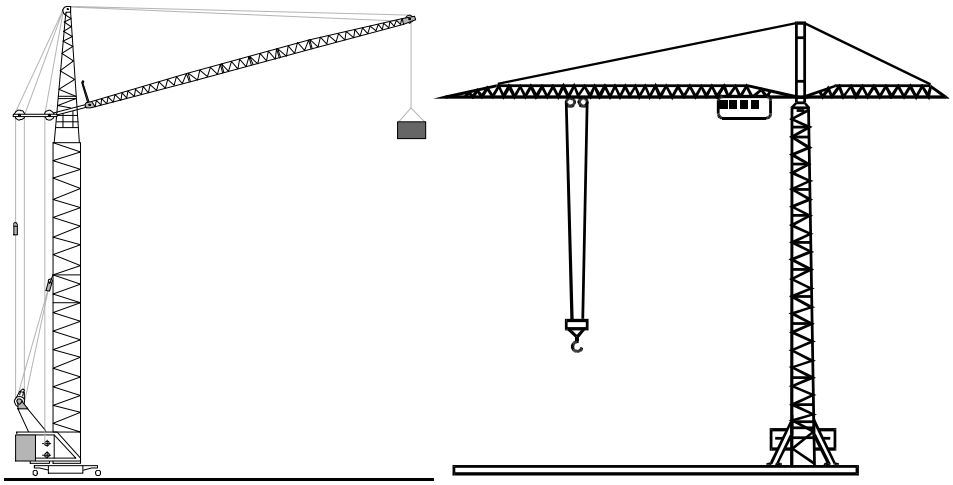
a) The maximum weight to be lifted;
b) Any non-routine handling instructions that are necessary for a safe lift;
c) The position of the CoG of asymmetric loads or loads of non-uniform mass [preferably marked].

Special lifting accessories may have to be designed for lifting asymmetric loads or loads of non-uniform mass. Lifting is made safer when designated lifting points are either provided or marked on the load.

The weight and dimensions of lifting accessories add to the weight to be lifted.

The crane position - Where the load is to be lifted from, the route it will take during the lift and where it will be landed should be taken into account. Therefore potential obstructions, either permanent or temporary, should be taken into account. Obstacles include: buildings and other structures, trees, overhead power lines, etc;

If the crane is to be positioned on or next to an existing structure it may overload such a structure – a design calculation check may be required to establish whether temporary strengthening or propping is needed.



The radius over which a crane has to lift will have a significant effect on the loads that can be lifted and to
what height they can be lifted.

Radius [m]	Capacity [t]	Max height [m]
3	30	50
10	7.3	47
20	2.2	44
30	0.5	35

Clearances

Safe distances of the crane from the structure under construction, adjacent buildings, roads and pedestrian accesses must be maintained.

Mobile cranes need adequate space for the correct deployment of outriggers. In addition, they should be able to slew and manoeuvre the load with adequate clearance from obstructions. A minimum clearance of 600mm should be allowed for.

Other, equally important, considerations include:
a) Clearance to overhead electric cables: Cranes must never be positioned in the exclusion zone around overhead electricity cables. Lifting operations close to electricity cables or pylons may have to be scheduled during power off conditions.

b) Clearance to railway tracks, overhead catenaries and public highways: If a crane is to be positioned adjacent to a railway, canal or public highway an independent design check may be required.

Cranes should only be used by trained and certificated drivers, the crane must be tested and fully inspected regularly. Test certificates and examination records must be kept available. The ground conditions must be suitable with no under-ground tunnels or overhead obstructions.

When deciding what type of crane is required the environment needs to be considered, e.g. the amount of space on site and at access points may limit the size of crane which can gain entry. The distance and height of the lift will determine the length of the jib needed.

Site weather conditions

Prevailing weather conditions and exposure of the site can affect a lifting operation. Wind, in particular, can affect how a load behaves when it is lifted. Structural items, which offer a large effective area to the wind can be difficult to control, even in very moderate winds, eg, shutters for concrete.

Manufacturers will specify maximum wind speeds for erection, lifting, out of service and dismantling operations. In very exposed areas (eg.cliff tops) or areas subject to wind turbulence (eg. built-up areas), these speeds may have to be reduced.

Cranes need access routes and space for erecting and extending them and vehicles delivering the loads.
Special access may be required for both the crane and high capacity trailers often used for deliveries such as counter-weights and jib sections.

When working in city centres, getting the crane on and off the site will require advance planning often in conjunction with police and local authorities and will possibly require facilities for overnight working.

For cranes, safety considerations may include:

- formal training and authorisation procedures.
- safe access to cab.
- safe working loads indicated.
- safe working methods employed, particularly if operated outdoors.
- adequate guarding and emergency controls/devices.
- formal safe working procedures for maintenance work.
- recorded system of planned preventative maintenance.
- full training of crane drivers and slingers in respective duties. (British Steel Distribution have prepared a useful pocket hand book No 2: Slinging and Lifting Operations, Guidance for Safe Use); use of ‘standard signals.’
- recommended that, in a busy multi-crane operation, a full permit -to -work system should be followed for maintenance inspection work on Electric Overhead

Travelling Cranes (EOT cranes) or, in less busy environments, a formalised procedure for locking off the crane etc.

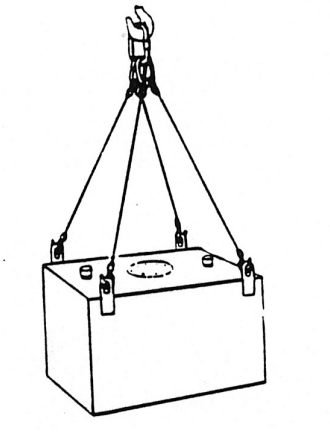
USEFUL REFERENCES

ISO 4306-1:1990 Cranes- Vocabulary Part 1: General
ISO 4306-2:1994 Lifting Appliances- Vocabulary Part 2: Mobile Cranes
BS 7121:Part 1:1989 Code of practice for the safe use of cranes – General requirements.
BS 7121:Part 3:2000 Code of practice for the safe use of cranes – Mobile Cranes.
BS 7121:Part 4:1997: Code of practice for the safe use of cranes – Lorry Loaders
BS 7121:Part 5:1997 Code of practice for the safe use of cranes – Tower Cranes
BS 1377: Methods of test for soil for civil engineering purposes
BS 5930: Code of Practice for Site Investigations
BS 1377: Methods of test for soil for civil engineering purposes
Crane stability on Site: CIRIA publication 131

4.8 SLINGING

What is a sling? Anything between the hook and the load. e.g. chain, rope, eye bolts etc.

Before any sling is used the slinger must estimate the angle which will exist at the hook, this is the included angle and will determine the strength of the sling needed. Every sling must be marked with its safe working loads, and may have details of the included angles as well.

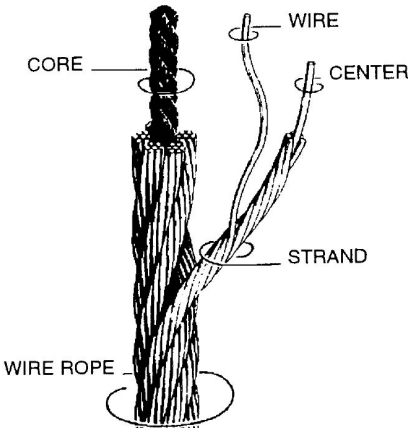


Each sling must have a certificate as issued by the manufacturer, inspection reports which must be carried out every 6 (for devices which lift people) or 12 months and a register of all slings should also be kept on site.

Everyone who uses a sling must be trained, the standards are laid down in GS39. At the end of the training people must pass a test to prove their knowledge and understanding. (This person is normally known as a slinger)

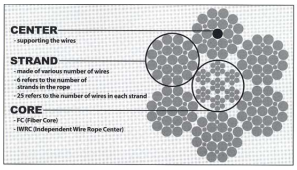
Safe use of lifting equipment can be best achieved by:

- Good design
- Good workmanship and manufacture techniques
- Suitable selection
- Correct use
- Regular inspection and examinations
- Safe and secure storage



Main Types Of Slings

Chain, iron rope, stainless steel, steel wire, copper, teryelene, polyester, nylon, polypropylene & natural rope. Slings may have one or more legs.



There are many different types of slings made of different materials. So when a sling is being selected you must consider the load to be lifted (it may be hot/cold/sharp/fragile), the environment where it is to be used (this may have chemical fumes, be very hot or cold) and where it is to be lifted to.

Chemical resistance – various materials are resistant to different chemicals. Natural fibre ropes have no chemical resistance. Nylon is immune to alkali but can be attacked by acids. Polyester is resistant to acids but is damaged by alkalis.

Abrasions – Cotton is the smoothest of rope, manila can be coarse. Packaging may be needed to protect the sling and the load.

Elongation – All ropes stretch when the load is applied. Man made fibres normally stretch more than natural ropes.

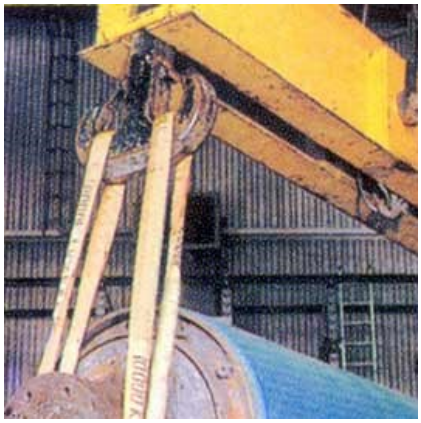
Deterioration – Natural fibre ropes deteriorate with age as their natural lubricants dry out. Mould and mildew can attack them. Manmade fibres do not suffer in this way but can be affected by ultra violet (UV) light.

Temperature – Fibre ropes are not normally suitable for temperatures of over 100^{o}C.

Choice of Slings

What is the load – Is it hot, cold, large, small, heavy etc.
The Environment where the lift is to take place – Is it indoors, outdoors, hot, chemical fumes etc. How much space is there? Any obstructions?
The Task – Where is the load now? Where is it going to?
The People – Trained, on one directly under the load.
The Sling – In good order, no visual defects, suitable for the load and task, e.g. using a chain sling would not be the best to lift glass.
Identifying problems

Webbing / material slings



Surface chafe. In normal use, some chafing will occur to the surface fibres. This is normal and has little effect. However, the effects are variable and as the process continues, some loss of strength should be expected. Any substantial chafe, particularly localised, should be viewed critically. Local abrasion, as distinct from general wear, can be caused by sharp edges whilst the sling is under tension, and can cause serious loss of strength.

Cuts. Cross or longitudinal cuts, or chafe damage to selvedges, cuts to stitching or eyes.
Chemical attack. Chemical attack results in local weakening and softening of the material. This is indicated by flaking of the surface which may be plucked or rubbed off.
Heat or friction damage. This is indicated by the fibres taking on a glazed appearance and in extreme cases, fusion of the fibres can occur.
Damaged or deformed fittings.

Wire Rope

Regularly inspect wire rope slings and, in the event of the following defects, refer the sling to a Competent Person for thorough examination: illegible markings; distorted, worn or damaged fittings; broken or cut wires; kinks; protrusion of core; corrosion; heat damage or discolouration; signs of movement at splices and ferrules; any other visible defect to the wire rope, thimbles or fittings. If over 10% of the wires are broken or damaged the sling must not be used.

Chain

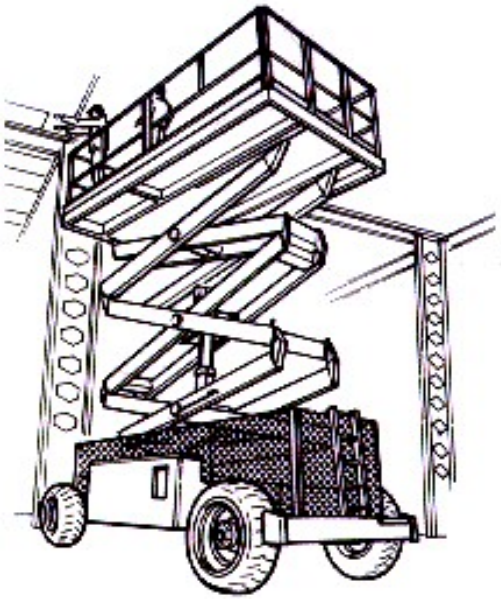
- These must be in good condition, not frayed or corroded.
- Any thimbles must be in good condition
- Ropes and wires must be protected from sharp edges of the load by packaging
- No knots or hitches must be present
- Ensure links are not stretched or locked so they cannot move
- Distorted links must not be used
- Corroded, worn or pitted chains must not be used
- Do not cross, twist or knot any chain

The Safe Use of Slings With Cranes

1. Check the crane is located on suitable ground
2. Competent crane driver/ slinger/signaller/ banksman if required
3. Check the area is clear – no overhead obstructions
4. Check weather conditions – do not lift in strong wind
5. Select the correct and suitable sling – free from defects
6. Barrier off the area
7. Ensure agreed signals are used between the driver and slinger
8. Do not exceed safe working load of sling/crane
9. Attach the sling – check the load is even
10. Test lift – raise slightly off the ground
11. Attach tag line to guide load and keep it under control
12. If the load lifts evenly, raise the load fully and move to correct position
13. Move load slowly
14. Lower load and then remove sling
15. Check sling for signs of damage
16. Notify driver that lift has been completed
17. Return sling to correct storage area

4.9 LIFTING OPERATIONS & LIFTING EQUIPMENT REGS 1998 (LOLER)

Approved Code of Practice. (ISBN 0-7176-1628-2)



The aim of these regulations is to reduce risks from lifting equipment at work, the regulations operate in conjunction with the Provision and Use of Work Equipment Regulations which cover all work equipment, including that used for lifting operations.

Coverage: Equipment used for lifting /lowering at work (hoists, cranes, fork lift trucks, mobile elevated platforms etc.) The definition also includes chains, slings, eye bolts etc.

Excludes: Escalators as these are already covered by the Workplace (Health, Safety & Welfare) Regulations 1992.

If employees bring their own lifting equipment onto your premises for use at work then this equipment is also covered.

Do the regulations apply?

Equipment for lifting used at work is covered – they do not apply for equipment primarily used by members of the public. E.g. shopping centre lifts. However this equipment is still covered by the Health & Safety At Work Act 1974.

Key points for safe lifting

- Suitable, stable and strong enough for use – marked with the safe working loads
- Positioned to prevent/reduce risks
- Visible markings
- Operations planned and supervised – used only by competent people
- Thorough examination – every 6 mths for equipment used to lift people / 12 months other lifting appliances/ prior to first use by the employer and after any accident where the lifting gear may be damaged.
- Examination report – where action is required
- Examinations and inspections by competent people

Lifting equipment used in the following places is covered:

Factories, offices, shops, hospitals, hotels, construction sites and places of entertainment etc.