ASTUTIS

NEBOSH International General Certificate in Occupational Health and safety

Element 6

Health hazards – Musculoskeletal

Element 6: Table of Contents

6.0 Learning outcomes

The learner should be able to:

- Do a general risk assessment in their own workplace – profiling and prioritising risks, inspecting the workplace, recognising a range of common hazards, evaluating risks (taking account of current controls), recommending further control measures, planning actions.

  5-11 **Produce** a risk assessment of a workplace which considers a wide range of identified hazards (drawn from elements 5-11) and meets best practice standards (*'suitable and sufficient'*).

6.1 Work Related Upper Limb Disorders (WRULDs)

Work related upper limb disorders (WRULDs) are aches, pains, tension and disorders involving any part of the arm from fingers to shoulder, or the neck. They include problems with the soft tissues, muscles, tendons and ligaments, along with the circulatory and nerve supply to the limb and are caused or made worse by work.

Other terms such as repetitive strain injury, cumulative trauma disorder or occupational overuse syndrome are often used as synonyms for WRULD. However the terms can be misleading as they do not address the range of causal factors. WRULD is the preferred term.

In the UK, in 2017/18 the Labour Force Survey (LFS) indicated that 469 000 Workers suffered from new or longstanding work-related musculoskeletal disorders (of which 197 000 were WRULDs) with 156 000 new cases.

The causes of WRULDs are not clear, but key risk factors are:

- repetitive work
- uncomfortable working postures
- sustained or excessive force
- carrying out a task for a long period of time
- poor working environment (*e.g.* temperature and lighting)
- poor work organisation (*e.g.* work pressure, job demands, work breaks or lack of them)
- individual differences and susceptibility (some workers are more affected by certain risks).

Workers may be more likely to suffer an upper limb problem if exposed to more than one risk factor.

Symptoms may be short lived and may settle with rest, but can become long term in spite of rest. Although the symptoms often are localised with pain, aching, burning, redness and swelling, they can become widespread.

Typical symptoms include:

- tenderness
- aches and pain
- stiffness
- weakness
- tingling
- numbness
- cramp
- swelling.

Well-recognised disorders include:

Disorder	Description
Tendonitis (fingers/hand/forearm)	Inflammation of the tendon (Tendon is the fibrous tissue connecting muscle to bone)
Tenosynovitis (hand/forearm)	Inflammation of the tenosynovium (tendon sheath) and tendon
De Quervain's	Tenosynovitis affecting thumb tendons
Trigger finger	A stenosing tenosynovitis locking a finger in either a bent or straight position Stenosing = narrowing of tendon sheath
Carpal tunnel syndrome	Tendonitis or tenosynovitis of tendon passing through the carpal tunnel compresses the median nerve affecting sensation on the palm side fingers and thumb
Shoulder capsulitis (frozen shoulder)	Inflammation of the shoulder capsule – connective tissue around the shoulder joint
Epicondylitis (*e.g.* tennis elbow)	Tendonitis affecting the elbow or knee (A condyle is a knuckle joint)
Cervical spondylosis	Degenerative osteoarthritis of the joints between the centra of the spinal vertebrae in the neck (Centra is the pleural of centrum – the *'main body'* of a vertebra)
Tension neck syndrome	A variety of symptoms such as pain, tenderness and stiffness of muscles, signs of hardened bands or nodularities, and muscle spasm

Table 6.1: WRULD – example disorders

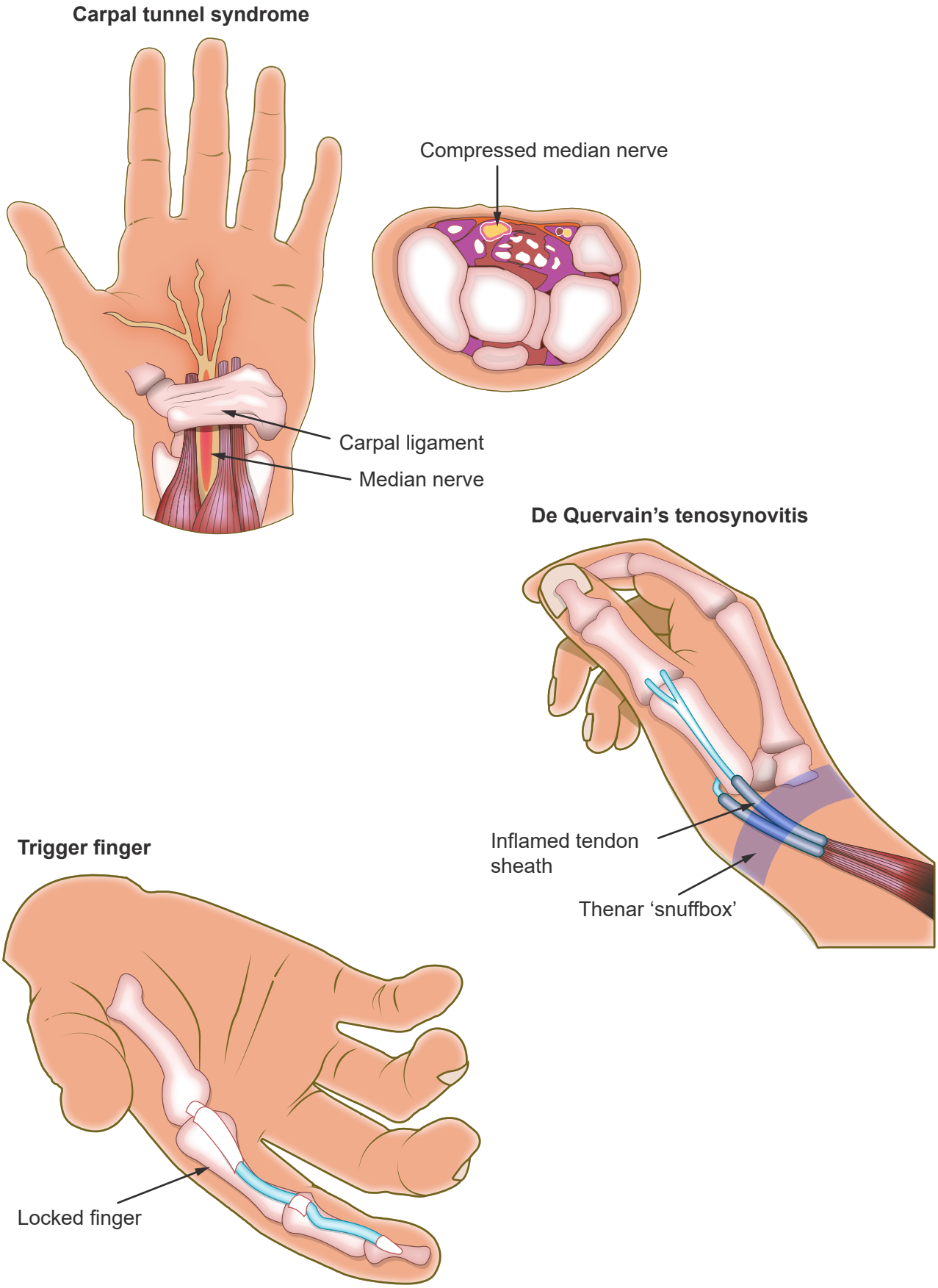


Figure 6.1: Illustrations of WRULDs

Risk factors and control measures

WRULDs can be successfully managed in the workplace by effective assessment and management of risks. Table 6.2 shows typical illustrations and control measures for the main risk factors.

Risk factor	Example	Control measures
Repeating an action (Task)	The more a task is repeated using the same muscles over and over again, the greater the risk. Speed of action can be a risk factor however movement of the whole arm at low speed is as risky as small quick movements.	Break up work periods involving a lot of repetition with several shorter breaks instead of one long break. Allow for short, frequent pauses for very intensive work. Mechanise higher risk tasks.
Uncomfortable working positions (Task)	These include moving the arm to an extreme position, *e.g.* working above head height, working with a very bent elbow, or holding something in the same place for a period of time.	Design tasks and equipment for workers of different sizes. Accommodate left-handed workers. Provide adjustable platforms, chairs and foot rests so that the workstation is appropriate for the work. Provide tools with a suitable size grip.
Using a lot of force (Load)	• handling heavy objects • carrying out fast movement • overcoming friction, *e.g.* undoing a bolt.	Reduce the weight of items, or the distance moved or slide them instead of lifting. Provide levers. Provide lightweight tools or supports, jigs etc. Purchase low vibration tools and maintain them properly so that they are not stiff. Distribute force, *e.g.* over the palm of the hand and not just one finger.

Table 6.2: WRULD risk factors and control measures (1 of 2)

Risk factor	Example	Control measures
Carrying out a task for a long period of time (Task)	The risk of injury generally increases with the length of time that a task is carried out. Short tasks are unlikely to cause an injury, except where the task requires a lot of effort.	Rotate workers between tasks (each task needs to be sufficiently different to benefit the worker). Allow workers to carry out more than one step of a process (provided the steps do not have the same risks). Introduce short frequent breaks in the more risky activities.
Poor working environment (Environment)	The following can increase the risk of WRULDs: • working in cold temperatures or handling cold items • poor lighting which causes a worker to adopt an awkward position to see better • vibration.	Make sure that the temperature is reasonable, and avoid putting workstations too near air vents. Make sure that the lighting is good or provide a personal lamp. Avoid reflections and glare by moving lights, providing blinds on windows, or moving workstations.
Underlying effects of the work and conditions (Organisation)	Lack of control over the work and its speed, excessive demands. Fears over loss of job, and lack of status. (Psycho-social issues).	Encourage teamwork, and provide good communication between workers and management. Rotate workers between tasks to reduce boredom. Watch the production speed to keep the workload reasonable and work targets realistic. Train workers so that they feel able to do the task. Get the right balance for bonus schemes as such schemes could encourage workers to work beyond their natural limits. Involve workers in decisions about them and their work.
Workers' individual differences (Individual)	Individuals are different in terms of their body size and reach, age, ability (particularly in the case of new or pregnant employees), health and disabilities. Some workers are more affected by certain risks. Some may differ in their attitude towards safe working practices and in reporting any symptoms.	

Table 6.2: WRULD risk factors and control measures (2 of 2)

Occupations at risk

Some examples of work activities that pose a particular risk include:

- assembly work of small components
- checkout operators
- bricklaying
- keyboard operators (see section on Display Screen Equipment).

Assembly work of small components

Specific risk factors would include:

- demanding productivity targets and/or penalties for non-achievement
- level of repetition involved and time allowed for rest breaks
- poorly designed workstation layout causing the worker to over-reach, stoop, twist etc.
- level of precision work involved, which may require gripping and fine manipulation of components.

Controls may include:

- ensuring adequate rest breaks and achievable productivity targets
- considering a job rotation system on the assembly line
- ensuring the workstations are ergonomically designed to avoid or minimise over-reaching, stooping or twisting
- ensuring an adequate level of lighting and providing additional task lighting if necessary.

Checkout operator

Specific risk factors would include:

- level of repetition and time to recover between customers, especially at busy times
- over-reaching and twisting to reach items especially if seated
- varying and unpredictable weight of some items, which may also be difficult to grasp.

Controls may include:

- adequate staffing levels on checkouts especially at busy times
- ensuring adequate rest breaks and job rotation

- providing sufficient space to sit or stand and ensuring they are aware of how to minimise upper limb stress *e.g.* by standing for some or all of the time, by sliding items rather than lifting etc.
- an ergonomic design of the checkout is included at installation or refurbishment.

Bricklaying

Specific risk factors would include:

- the length of the shift and possible associated time pressure due to working deadlines
- the frequency of laying bricks / blocks, dictated by mortar drying time, size / weight of brick / block, length and nature of run (straight, corners, etc.), experience of worker
- the hand forces when gripping the bricks and gripping and operating hand tools
- awkward and changing postures when laying bricks at lower and higher levels, or when reaching for the supply bricks
- pre-existing medical conditions
- cold weather conditions.

Controls may include:

- providing working platforms where possible to avoid or reduce the need to stretch, stoop or reach, and locate the supply bricks close the working area
- ensuring adequate rest breaks and reasonable working deadlines
- provide ergonomically designed tools for easier gripping and use
- provide suitable clothing for the weather, and adequate welfare facilities.

Display Screen Equipment

Display screen equipment (DSE) is any work equipment having a screen that displays information. Typical examples are computer screens which are often called monitors or VDUs.

Health surveys have found that high proportions of DSE workers report aches, pains or eye discomfort. Mostly these conditions are not serious, but as so many people are potentially affected it makes sense to avoid them as far as possible.

The main types of harm caused by computer use are:

- musculoskeletal disorders (MSD) including back pain and work related upper limb disorders (WRULDS)
- visual fatigue
- mental stress.

The likelihood of experiencing MSD, visual fatigue and stress is related mainly to the frequency, duration, intensity and pace of spells of continuous use of DSE, and the amount of discretion the person has over the extent and methods of display screen use.

Other minor or alleged health effects include:

Epilepsy Work with DSE has not been known to induce epileptic seizures. People with photosensitive epilepsy can safely do normal office tasks using a display screen.

The charity epilepsy in action say the following regarding DSE equipment.

'Computer screens are unlikely to be a seizure trigger. However if there are flashing or flickering images, or some types of pattern on the screen, these could be a seizure trigger'.

To protect workers from the risks of DSE employers should:

- analyse workstations to assess and reduce risks
- ensure workstations meet minimum acceptable requirements
- plan work activities so that they include breaks or changes of activity

- provide eye and eyesight tests on request, and special spectacles if needed
- provide information and training.

In the UK workers are classified as *'users'* or *'operators'* depending on the nature of use. Workers classified as *'users'* are considered to be at greater risk and therefore require greater protection.

User classification

The combination of factors which give rise to risks makes it impossible to lay down hard-and-fast rules about who should be classified as a user or operator. Consideration should be given to:

- continuous spells of an hour more
- daily use of DSE
- fast information transfer
- high attention and concentration
- high dependency on the DSE
- little choice whether or not to use the DSE
- special training or skills.

Analysis of workstations to assess and reduce risks

A suitable and sufficient analysis should be:

- systematic, including investigation of non-obvious causes of problems
- appropriate to the likely degree of risk
- comprehensive, considering:
- the findings of the workstation assessment
- organisational factors, including things like workloads and working patterns, provision of breaks, training and information
- any special needs of individuals (such as people with a disability).

A typical workstation assessment checklist is shown in Table 6.3:

Screen	• Comfortable to read • Stable image • Adjustable image – brightness / contrast • Adjustable position – swivel and tilt • Free from glare and reflections	
Keyboard	• Separate from screen • Comfortable keying position – level forearms / room to rest wrist • User technique • Legibility of key characters	
Mouse / trackball etc	• Suitable for use • Positioned near user • Works smoothly • Adjustable response – speed and accuracy • Room to rest wrist	
Software	• Suitable for the task • Responsive and user friendly	
Furniture	• Adequate space • Properly organised • Glare free surfaces • Suitable stable fully adjustable chair	
User position	Eyes approximate level with top of screen • Forearms horizontal over desk surface • Feet flat on floor or supported by foot rest	
Environment	• Space • Lighting • Heating	• Noise • Air condition

Table 6.3: DSE workstation assessment checklist

Portable computers / laptops

Portable computers will require a risk assessment when setting up a portable workstation away from the office.

In addition to the workstation assessment a risk assessments should also address risks from manual handling, and violent theft.

Design features of portables can lead to postural and other problems.

Use in unsuitable locations, *e.g.* a car should be discouraged. If used as a main work computer the portable should be used with a docking station or plug-in full-sized keyboard and mouse, enabling the height and position of the portable's screen to be adjusted by placing it on raiser blocks.

Desirable features for a portable are low weight (including any accessories) and a large clear screen which can be used comfortably for the tasks to be done.

Workstation minimum requirements

Minimum workstation requirements will vary depending on the nature of the DSE and the tasks undertaken. The requirements for a basic office DSE workstation are shown in figure 6.2.

Figure 6.2: Workstation minimum requirements

1. adequate lighting
2. adequate contrast, no glare or distracting reflections
3. distracting noise minimised
4. leg room and clearances to allow postural changes
5. window covering if needed to minimise glare
6. software: appropriate to task, adapted to user, providing feedback on system status, no undisclosed monitoring
7. screen: stable image, adjustable, readable, glare/reflection-free
8. keyboard: usable, adjustable, detachable, legible
9. work surface: with space for flexible arrangement of equipment and documents, glare-free
10. chair: stable and adjustable
11. footrest if user needs one.

Planning work activities

Breaking up long spells of DSE work helps prevent fatigue, eye strain, upper limb problems and backache. Other work such as telephone calls, filing, photocopying etc. should be interspersed with DSE work.

If the user does not have discretion to organise his own work the employer should take responsibility for planning the users work to allow for adequate changes of activity and breaks.

Users should be encouraged to:

- stretch and change position
- look into the distance from time to time, and blink often.

Breaks should be taken before users get tired, rather than to recover and short frequent breaks are generally better than longer, infrequent ones.

Breaks should be taken away from the screen if possible. In some cases imposed rest breaks may be the only solution, *e.g.* in some call centre work.

Eye and eyesight tests

Users, or those about to become users, can request the employer to pay for an eye and eyesight test. If the test shows they need glasses specifically for DSE work, the employer has to pay for a basic pair of frames and lenses.

If users' normal glasses for other work are suitable for DSE work the employer does not need to pay for them.

Users are entitled to further tests at regular intervals after the first test, and in between if they are having visual difficulties which may reasonably be considered to be caused by their DSE work.

The employer can decide what arrangements to make to provide eye and eyesight tests. Some employers let users arrange tests for themselves and settle the bill whereas others prefer to send all their staff to be tested by a nominated optician.

Information and training

The employer should provide users with adequate information on:

- health and safety relating to their workstations
- risk assessment and steps taken to reduce risks
- breaks and changes of activity
- eye and eyesight tests
- requirements for training.

Users should be provided with training on the risks associated with DSE use and safe behaviour and practices. Good user training should address:

- the risks from DSE work
- the importance of good posture and changing position
- how to adjust furniture to help avoid risks
- organising the workplace to avoid awkward or frequently repeated stretching movements
- avoiding reflections and glare on or around the screen
- adjusting and cleaning the screen and mouse
- organising work for activity changes or breaks if necessary
- who to contact for help and to report problems or symptoms
- contributing to the risk assessment, *e.g.* completing checklists.

6.2 Manual handling

'Handling' is a broad category of work-related injury. Handling injuries include:

- injuries due to lifting, carrying, pushing or pulling loads
- strains
- sprains
- trapped fingers
- cuts from sharp objects.

As shown in Table 6.4 manual handling accounted over 1 100 specified injuries and over 13 700 O7D injuries to employees in the UK in 2017/18. Handling injuries accounted for 0 (zero) fatal injuries in 2017/18, and typically accounts for less than 1% of fatal injuries each year. Manual handling injuries is the second largest category of non-fatal injuries (after slips, trips and falls) accounting for more than 20% of all reported non-fatal injuries.

Injury	Employee
Fatal	0
Specified	1 112
Over-seven-day	13 730
Total	**14 842**

Table 6.4: Handling, lifting and carrying injuries, 2017/18 (RIDDOR)

A detailed analysis of more than 216 000 accidents between 2006/07 and 2010/11 identified the main causes of manual handling injuries as shown in the pie chart at Figure 6.3.

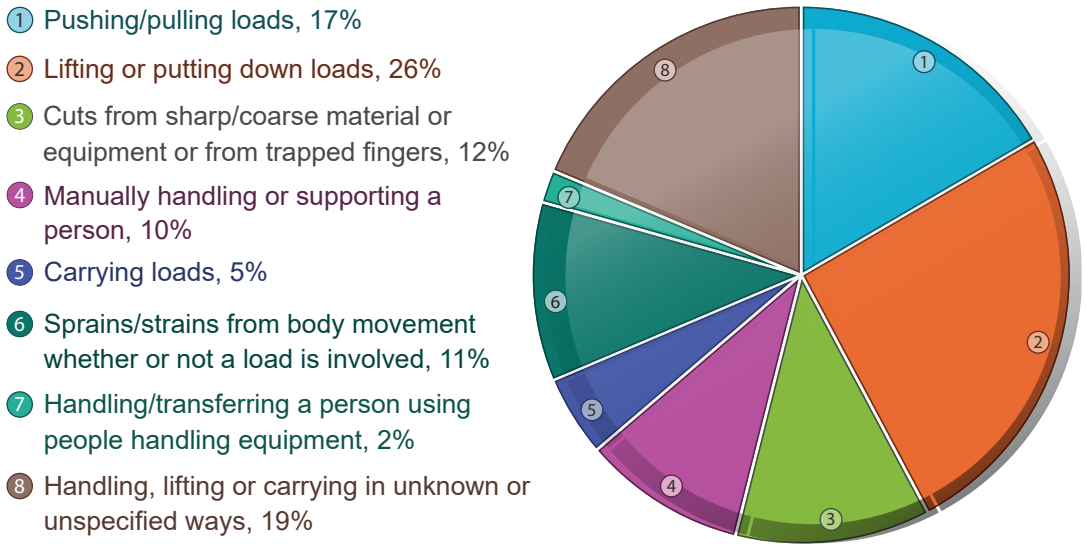


Figure 6.3: Main causes of manual handling injuries

Manual Handling Operations

A manual handling operation is defined as:

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

Manual handling includes both transporting a load and supporting a load in a static posture. The load may be moved or supported by the hands or any other part of the body, *e.g.* the shoulder.

'Bodily force' may be applied directly to the load, or indirectly by hauling on a rope or pulling on a lever. Effort applied for purposes other than transporting or supporting a load does not constitute a manual handling operation (*e.g.* lifting a control lever on a machine is not manual handling).

A load must be a discrete movable object (includes people and animals). An implement, tool or machine, such as a chainsaw or fire hose is not a load when in use for its intended purpose.

The employer should, so far as is reasonably practicable:

- avoid the need for manual handling jobs which involve a risk of injury
- assess the risks arising from manual handling tasks that cannot be avoided
- reduce the risk of injury (preferably by automation or mechanisation)
- inform employees of:
  - the weight of each load
  - the heaviest side of any load whose centre of gravity is off centre.

Risk assessment filter

In the UK the HSE has published a risk assessment filter to quickly confirm, or otherwise, that an activity believed to be low risk is actually low risk. If the risk is within the risk filter guidelines a full assessment would not be required, unless vulnerable workers were exposed to risk (*e.g.* young/pregnant/disabled).

The filter can be applied to the following four categories of activity, and assumes that the load is easy to grip and the working environment is suitable:

- lifting and lowering
- carrying for short distances
- pushing and pulling
- handling while seated.

Lifting and lowering

Each box Figure 6.4 contains a guideline weight for lifting and lowering in that zone.

Note: The guidelines should not be regarded as safe weight limits for lifting. There is no threshold below which manual handling operations may be regarded as *'safe'*, however application of the guidelines should provide a reasonable level of protection to around 95% of working men and women.

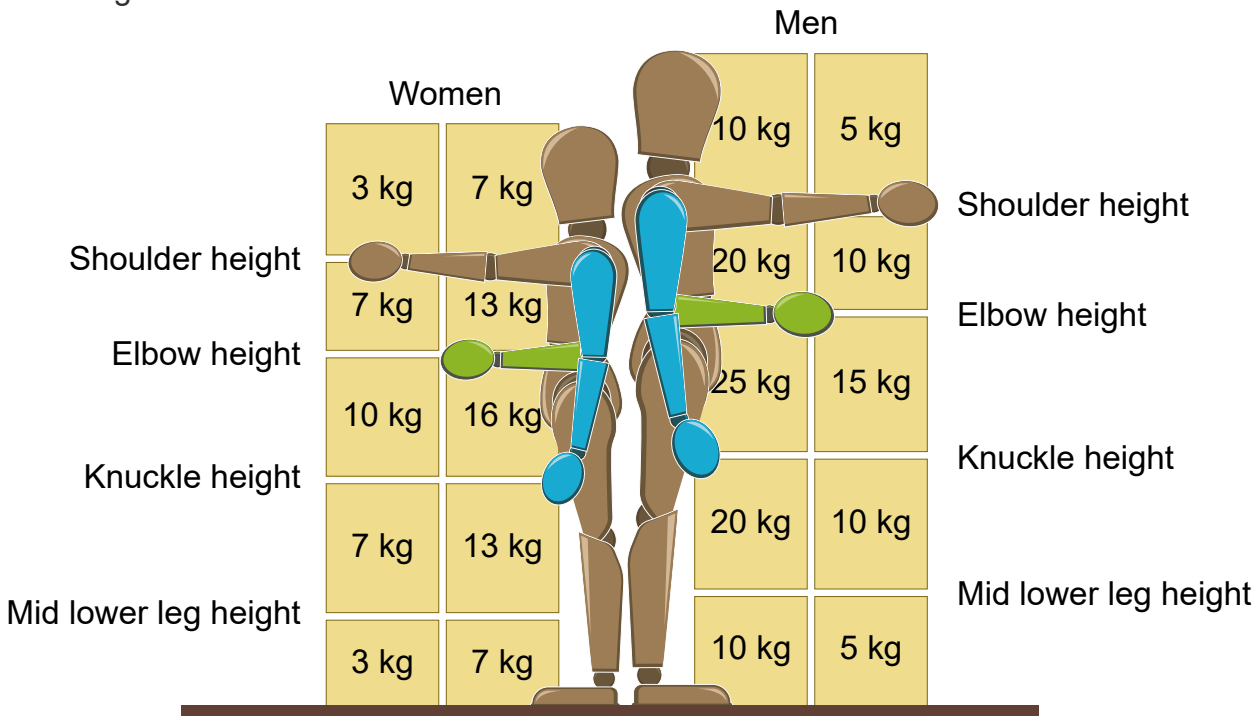


Figure 6.4: Lifting and lowering

The basic guidelines apply for relatively infrequent operations. (up to 30 lifts per hour). For more frequent activity the guideline figures should be reduced as per Table 6.5.

Where operations are repeated:	Figures should be reduced by:
Once or twice per minute	30%
Five to eight times per minute	50%
More than 12 times per minute	80%

Table 6.5: Guidelines for frequent lifting and lowering

The guideline figures will also need to be reduced (as per Table 6.6) if the operation involves twisting and turning the upper body with static feet.

If handler twists through:	Figures should be reduced by:
45o (from front)	10%
90o (from front)	20%

Table 6.6: Guidelines for frequent lifting and lowering

Carrying for short distances

The guideline figures for lifting and lowering (Figure 6.4) can be used for carrying operations where the load is:

- held against the body
- carried no further than about 10 m without resting.

Where the load can be carried securely on the shoulder without first having to be lifted (*e.g.* unloading sacks from a lorry) the guideline figures may be applied to carrying distances in excess of 10 m.

Pushing and pulling

For pushing and pulling operations (whether the load is slid, rolled or supported on wheels) the guideline figures in Table 6.7 should be applied.

The figures assume:

- the force is applied with the hands, between knuckle and shoulder height
- the distance involved is no more than about 20 m.

	Men	Women
Force to stop or start the load	20 kg	15 kg
Sustained force to keep the load in motion	10 kg	7 kg

Table 6.7: Pushing and pulling guidelines

Handling while seated

The basic guideline figures for handling operations carried out while seated, shown in Figure 6.5, are 5 kg for men and 3 kg for women, assuming that the hands are positioned within the indicated box zone.

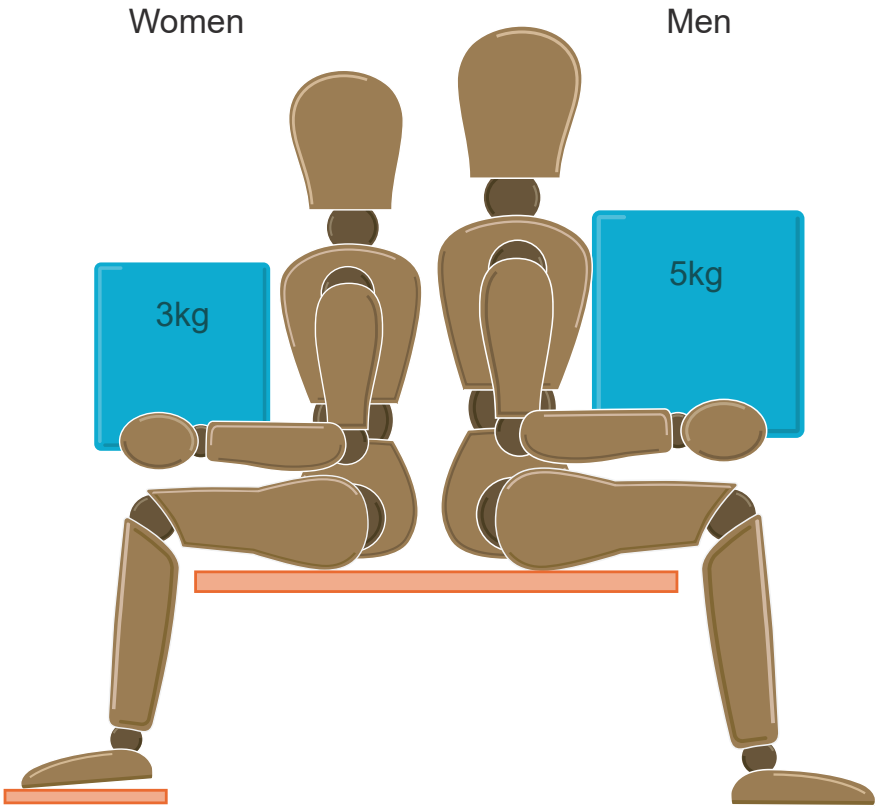


Figure 6.5: Guideline figures for handling whilst seated

Risk assessment

A suitable and sufficient risk assessment is required when hazardous manual handling is unavoidable.

The assessment should identify:

- where the risk lies
- an appropriate range of options for reducing the risk for injury.

A checklist can help with this process by applying a systematic examination of all the potential risk elements.

Table 6.8 shows a basic checklist of risk factors for lifting and carrying with some suggestions for reducing the risk of injury.

	Problems to look for when making an assessment	Ways of reducing the risk of injury
Task	• Does the task involve: • holding loads away from the body? • twisting, stooping or reaching upwards? • large vertical movement? • long carrying distances? • strenuous pushing or pulling? • repetitive handling? • insufficient rest or recovery time? • a work rate imposed by a process?	Can you: • use a lifting aid? • improve workplace layout to improve efficiency? • reduce the amount of twisting and stooping? • avoid lifting from floor level or above shoulder height, especially heavy loads? • reduce carrying distances? • avoid repetitive handling? • vary the work, allowing one set of muscles to rest while another is used? • push rather than pull?
Individual capability	Does the job: • require unusual capability, *e.g.* above-average strength or agility? • endanger those with a health problem or learning/physical disability? • endanger pregnant women? • call for special information or training?	Can you: • pay particular attention to those who have a physical weakness? • take extra care of pregnant workers? • give your employees more information, *e.g.* about the range of tasks they are likely to face? • provide more training?

	Problems to look for when making an assessment	Ways of reducing the risk of injury
Load	Is the load: • heavy, bulky or unwieldy? • difficult to grasp? • unstable or likely to move unpredictably (like animals)? • harmful, *e.g.* sharp or hot? • awkwardly stacked? • too large for the handler to see over?	Can you make the load: • lighter or less bulky? • easier to grasp? • more stable? • less damaging to hold? If the load comes in from elsewhere, can the supplier help by providing handles or smaller packages?
Environment	Does the working environment have, or cause: • constraints on posture? • bumpy, obstructed or slippery floors? • variations in levels? • hot/cold/humid conditions? • gusts of wind or other strong air movements? • poor lighting conditions?	Can you: • remove obstructions to free movement? • provide better flooring? • avoid steps and steep ramps? • prevent extremes of hot and cold? • improve lighting?
Organisational factors	• Is the work repetitive or boring? • Is work machine or system paced? • Do workers feel the demands of the work are excessive? • Have workers little control of the work and working methods? • Is there poor communication between managers and employees?	Can you: • change tasks to reduce the monotony? • make more use of workers' skills? • make workloads and deadlines more achievable? • encourage good communication and teamwork? • involve workers in decisions? • provide better training and information?
PPE	• Are there restrictions on movements or posture from clothes or personal protective equipment (PPE)?	Can you: • provide protective clothing or PPE that is less restrictive? • ensure your employees' clothing and footwear is suitable for their work?

Table 6.8: Manual handling assessment checklist – lifting and carrying

Training

Manual handing operations should be designed to be as safe as is reasonably practicable and where possible to suit individuals.

Effective training will complement a safe system of work, and has an important part to play in reducing the risk of manual handling injury. It is not a substitute for a safe system of work and cannot, on its own, overcome unsuitable loads or bad working conditions.

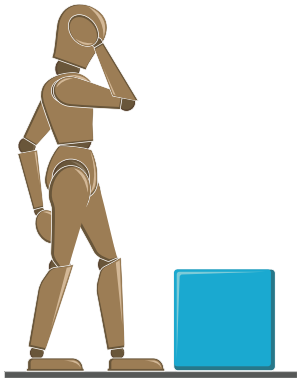
Training should cover:

- manual handling risk factors and how injuries can occur
- how to carry out safe manual handling including good handling technique
- appropriate systems of work for the individual's tasks and environment
- use of mechanical aids.

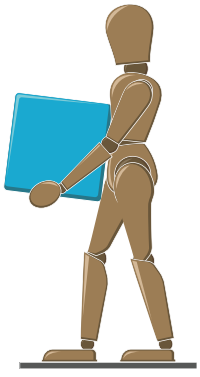
Training should involve practical exercises that give the trainer an opportunity to identify and put right anything the trainee is not doing safely.

Safe lifting technique

There is no single correct way to lift. The following process illustrates some important points which are relevant to a two-handed symmetrical lift, (*i.e.* a lift using both hands in front of and close to the body). It is based on research by the Institute of Occupational Medicine (IOM), for the HSE.



1. **Plan the lift/handling activity.**
   - identify the drop off point
   - ensure the route is free of obstructions
   - consider the need for assistance or rest breaks etc.
2. **Keep the load close to the waist.**
   - keep the load close to the waist for as long as possible while lifting
   - keep the heaviest side of the load next to the body.



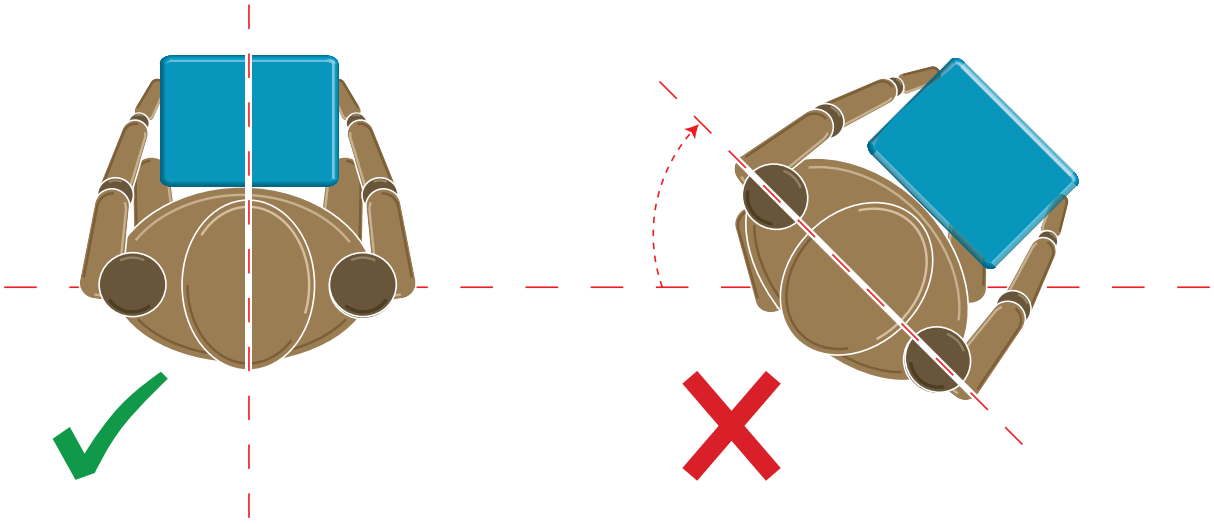
3. **Adopt a stable position.**
   - the feet should be apart with one leg slightly forward to maintain balance (alongside the load if it is on the ground)
   - the worker should be prepared to move their feet during the lift to maintain a stable posture
   - wearing over-tight clothing or unsuitable footwear may make this difficult.

4. **Ensure a good hold on the load.**
   - Hug the load as close as possible to the body. This may be better than gripping it tightly only with the hands.

5. **Moderate flexion.**
   - Slight bending of the back, hips and knees at the start of the lift is preferable to either fully flexing the back (stooping) or fully flexing the hips and knees (full/deep squatting).

6. **Don't flex the back any further while lifting.**
   - This can happen if the legs begin to straighten before starting to raise the load.

7. **Avoid twisting the back or leaning sideways especially while the back is bent.**
   - Keep shoulders level and facing in the same direction as the hips
   - Turning by moving the feet is better than twisting and lifting at the same time.



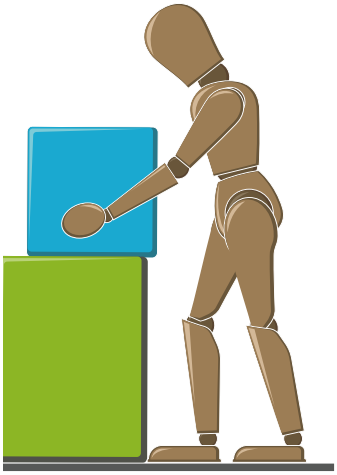
8. **Keep the head up when handling.**
   - Look ahead, not down at the load once it has been held securely.

9. **Move smoothly.**

- Do not jerk or snatch the load as this can make it harder to keep control and can increase the risk of injury.

10. **Don’t lift or handle more than can be easily managed.**

- There is a difference between what people can lift and what they can safely lift. If in doubt, seek advice or get help.



11. **Put down and then adjust.**

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

6.3 Load handling equipment

Where a risky manual handling operation cannot be avoided appropriate measures must be introduced to reduce the risk of injury to the lowest level reasonably practicable.

To be *'appropriate'* the measures should address the problem in a practical and effective manner.

This can often be achieved by the introduction of mechanical assistance through the use of handling aids. Some manual handling is retained but bodily forces are applied more efficiently, reducing the risk of injury.

Any mechanical aids provided will be *'work equipment'* and will need to be:

- suitable for the intended task and the working conditions
- demonstrably safe for use (maintained and inspected)
- used only by competent people
- fitted with suitable safety measures where necessary.

The ongoing effectiveness of handling aids should be monitored. This can be done proactively by observing working practises and discussing the issues with the handlers, and reactively by checking accident statistics regularly.

If the monitoring indicates that the handling aids are not appropriate and effective alternative solutions should be sought.

Common types of manually operated lifting aids include:

- trucks and trolleys
- people handling hoists
- people handling aids.

Trucks and trolleys

There is no clear distinction between general purpose trucks and trolleys though:

- **trolleys** tend to be of lighter weight construction and designed for more specific applications
- **trucks** are generally used to move and support larger loads. Trucks can be flat-topped or fitted with a variety of sides and wheels to suit different uses. Platforms can be designed to be raised or lowered, reducing the need for bending during loading and unloading.

Trucks and trolleys allow one person to transport loads from A to B. Using a truck or trolley is likely to increase the efficiency of a manual handling operation several-fold as well as reducing the load.

Pushing or pulling a truck or trolley is still a manual handling operation and requires a risk assessment. When people push and pull trucks or trolleys, there may be risk of other musculoskeletal disorders (MSDs), which will need to be risk managed.

Pulling causes 12% more accidents than pushing – needs to be changed in NGC as well.

The most frequently reported sites of injury were the back (44%) and the upper limbs (hand to shoulder) with 29%.

Many trucks and trolleys will have powered options as well as manually operated versions.

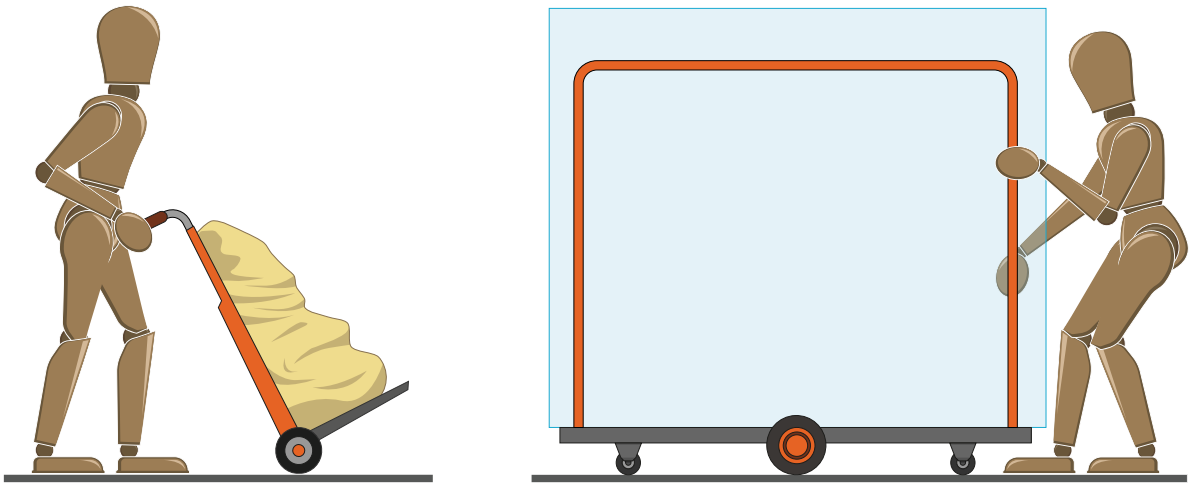


Figure 6.6: Industrial trucks and trolleys

The following TILE factors could contribute to pushing and pulling related injuries, and should be considered in risk assessments (Note: these are in addition to the factors for lifting and carrying outlined in Table 6.7).

Task

- transporting over longer distances
- repetitive pushing and pulling
- insufficient rest/recovery time
- effort required to start or stop the load moving or even to keep it moving.

Individual

- height (too tall / too short) may affect posture and visibility
- competence issues – need for specialised training or instruction
- requirement for unusual capability (*e.g.* great physical strength)
- vulnerable workers – young, pregnant, disabled etc.

Load

- weight of the load within capacity of trolley
- load is secure and stable for negotiating slopes, corners etc.

Environment

- very cold environments can affect grip and increase the risk of slipping
- steep slopes and rough surfaces can increase the amount of force required to push/pull a load.

Other factors – equipment

The issues in Table 6.9 should be considered:

Problems to look for when making an assessment	Ways of reducing the risk of injury
• Is the device the correct type for the job? • Is it well maintained? • Are the wheels on the device suited to the floor surface? • Do the wheels run freely? • Is the handle height between the waist and shoulders? • Are the handle grips in good order and comfortable? • Are there any brakes? If so, do they work?	Can you: • Provide equipment that is more suitable for the task? • Carry out planned preventive maintenance to prevent problems? • Change the wheels, tyres and/or flooring so that equipment moves easily? • Provide better handles and handle grips? • Make the brakes easier to use, reliable and effective?

Table 6.9: Equipment issues – pulling and pushing trucks or trolleys

People handling hoists

A hoist is a mechanical device used for lifting a load vertically. People handling hoists are used in nursing and care activities to facilitate transfers of people from chair to bed, bed to trolley etc.

Patient lifting hoists fall into one of two general categories:

- mobile
- overhead.

Mobile hoists come in a range of sizes and designs. The standing hoist shown in Figure 6.7 is specifically designed to assist people with unreliable standing ability to stand for transfers and toileting.

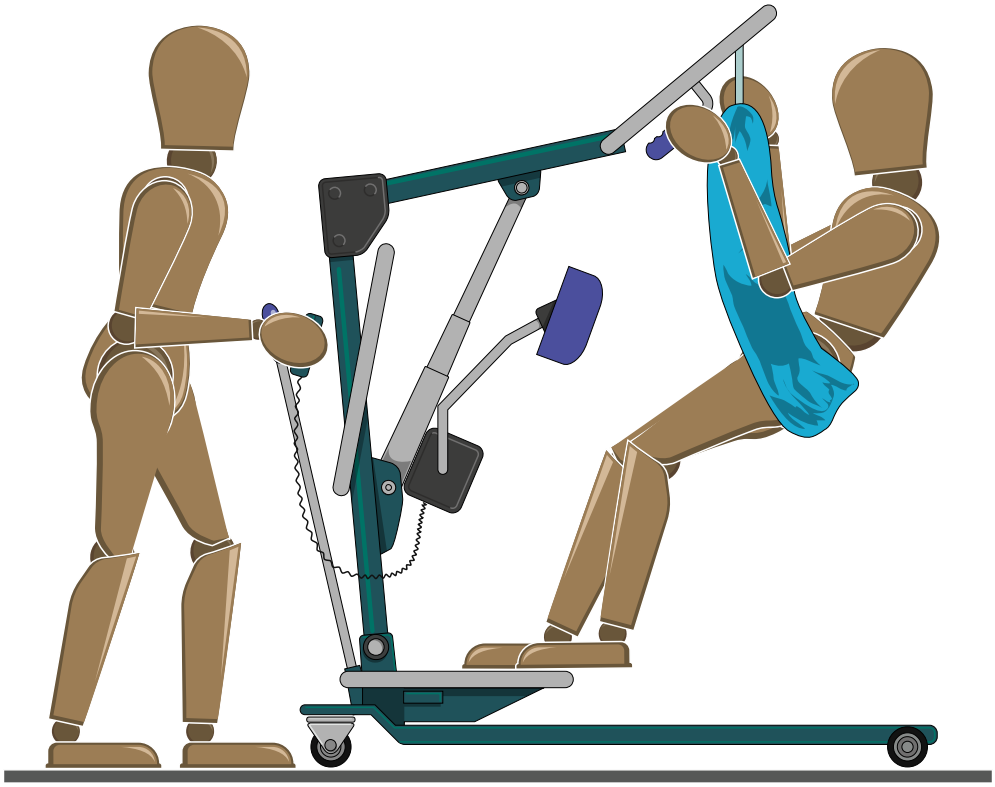


Figure 6.7: Patient standing hoist

Overhead hoists may be fixed to a suitable point in the ceiling over a bed, or fitted to ceiling mounted tracks to allow horizontal movements as well as lifting and lowering.

Overhead hoists have advantages over mobile hoists in that they do not take up space and do not need to be manually handled into position, the disadvantage is of course the lack of manoeuvrability.

There are a range of slings available for use with people handling hoists:

- hammock slings – Support each leg separately, and usually the back and head
- toilet/access slings – Less supportive but allow access for toilet transfers
- walking slings – supports upper trunk to enable standing, dressing etc.
- stretcher slings – for lifting a person while lying flat.

Lifting equipment should be:

- sufficiently strong, stable and suitable for the proposed use
- positioned or installed to prevent the risk of injury, *i.e.* people falling or getting trapped
- visibly marked with the safe working load (SWL). (Lifting appliances – slings and chains must also be marked with the SWL)

- visibly marked as suitable for lifting people
- examined and inspected after installation or assembly
- thoroughly examined every six months (including accessories).

Lifting operations must be planned, supervised and carried out in a safe manner by competent people.

People handling aids

There are numerous patient handling aids in use in nursing care environments and they are known by many different trade names.

Sliding patients up the bed is one of the most common patient-handling manoeuvres. **Slide sheets** are coated with a low friction material (*e.g.* silicon) to enable patients to be slid up the bed or rolled over in bed more easily by reducing the amount of pushing and pulling required and reducing the risk of damaging the patient's skin.

A **turning disc** consists of two low friction circular discs, one of which rotates over the other. They are used for turning patients in seated or standing positions to help transfers from bed to chair, in and out of cars etc.

Powered load handling equipment

This section considers the following options for mechanising load handling operations:

- fork-lift trucks
- conveyors
- cranes
- other lifts and hoists.

Although greatly reducing the need for manual handling operations, each introduces different hazards and has different requirements for risk control.

Fork lift trucks

Lift trucks are widely used throughout industry for moving materials and goods, but they also feature prominently in worksite accidents. Every year in the UK there are about 8 000 lift truck accidents resulting in injury, on average ten of them fatal.

There are many different designs of lift truck, with fork or other attachments, which have a range of uses in different industrial sectors.

This section describes some of the main types of industrial lift truck, and a range of attachments.

Industrial counterbalance lift truck

Figure 6.8: Industrial counterbalance lift truck

The counterbalance is a counterweight to the rear of the truck which balances the load on the fork arms, which project out from the front of the machine.

Loads can be raised or lowered vertically and the mast will typically be able to be tilted forwards or backwards by about 5° degrees.

This type of lift truck is only suitable for use on substantially firm, smooth, level and prepared surfaces such as a warehouse yard. A wide range of attachments is available.

Industrial reach truck

The reach truck mast moves forwards or reaches out to pick up the load. When travelling, the load is reached back and carried within the wheelbase. The reach truck has greater manoeuvrability than the industrial counterbalance truck and is used in areas where space is restricted, such as the aisles of a warehouse. It is only suitable for use on substantially firm, smooth, level and prepared surfaces.

Figure 6.9: Reach truck

Rough-terrain counterbalance lift truck

Similar in design to the industrial counter -balanced lift truck but is equipped with larger wheels and pneumatic tyres, giving it greater ground clearance.

It has greater ability to operate on uneven and soft ground and is mainly used in the construction industry and in agriculture. It may be used with a range of attachments.

Figure 6.10: Rough-terrain counterbalance lift truck

Telescopic materials handler (tele-handler)

Figure 6.11: Telescopic materials handler (tele-handler)

The tele-handler has a boom that pivots at the rear of the machine, and is raised and lowered by hydraulic rams. The boom can also be extended or retracted (telescoped) to give extra reach or height.

Tele-handlers may be two – or four wheel drive, and have two-wheel, four-wheel or crab steering.

They are used mainly in agriculture and construction and can be used with a range of attachments.

Fork lift truck hazards

The main hazards associated with forklift trucks are:

1. instability of the truck
2. falling loads
3. hazards associated with propulsion systems
4. falling from loading bays or trucks
5. collisions with pedestrians or other vehicles
6. collisions with structures, racking etc.

Note:

Items 4, 5 and 6 are discussed in **Element 2**.

Instability of the truck

Fork lift trucks can be unstable longitudinally (front to back) and laterally (side to side).

Longitudinal stability

A counterbalanced lift truck is basically designed along the principle of a see-saw. The front load carrying axle is the fulcrum or pivot point. The load exerts downward pressure to the front and the weight of the truck, counterbalances it to the rear. The weight of the counterbalance is exerted further away from the fulcrum than the weight of the load.

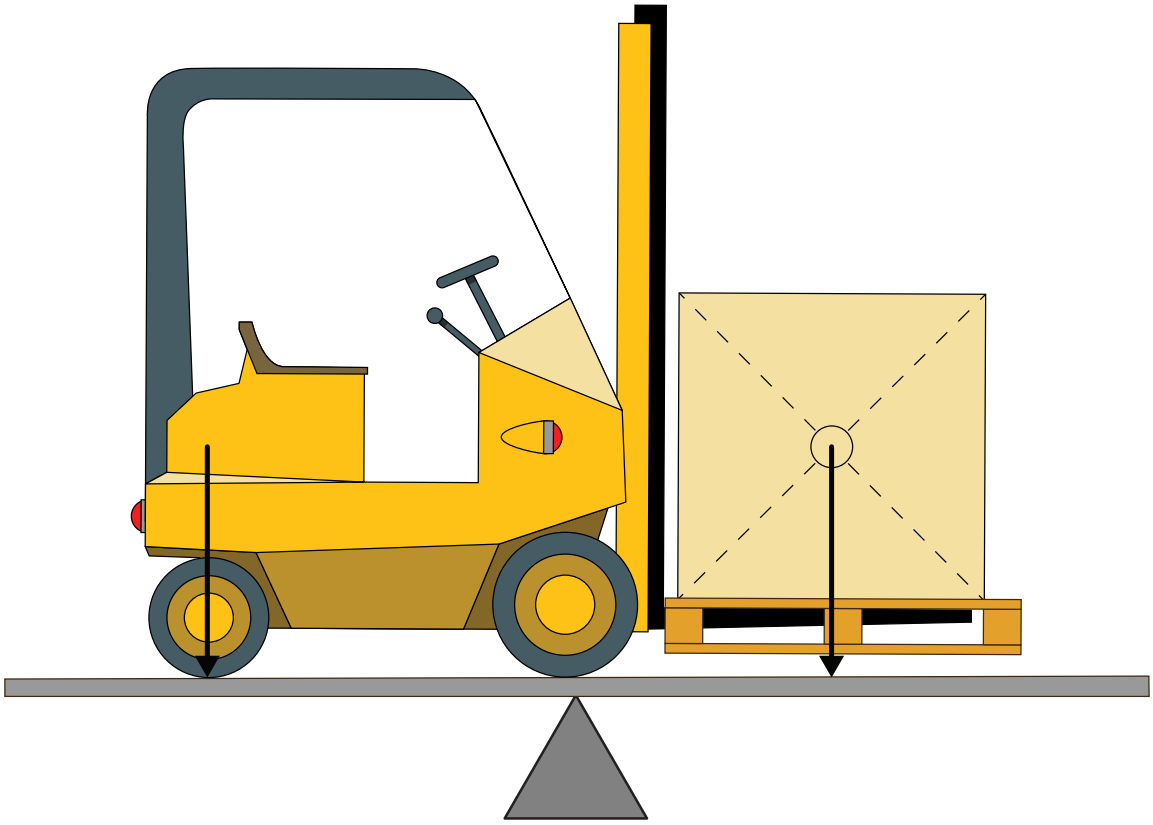


Figure 6.12: balanced forces of a fork lift truck

Issues affecting longitudinal stability

- overloading
- loads too far forward on the forks
- travelling forwards downhill
- travelling with a raised load

Note: all are made worse under heavy braking.

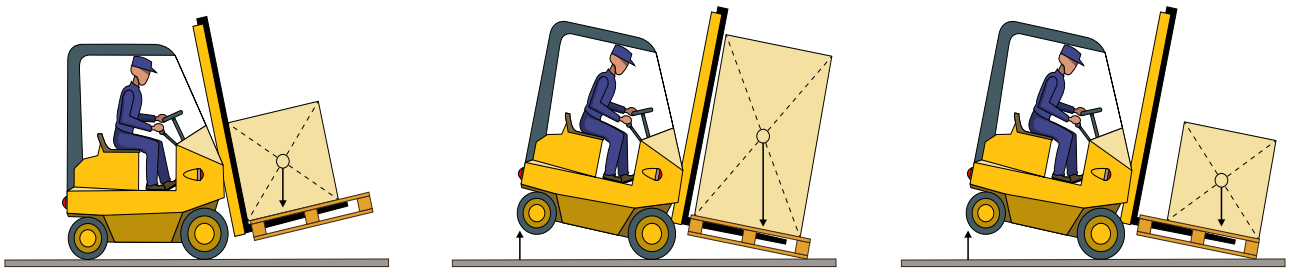


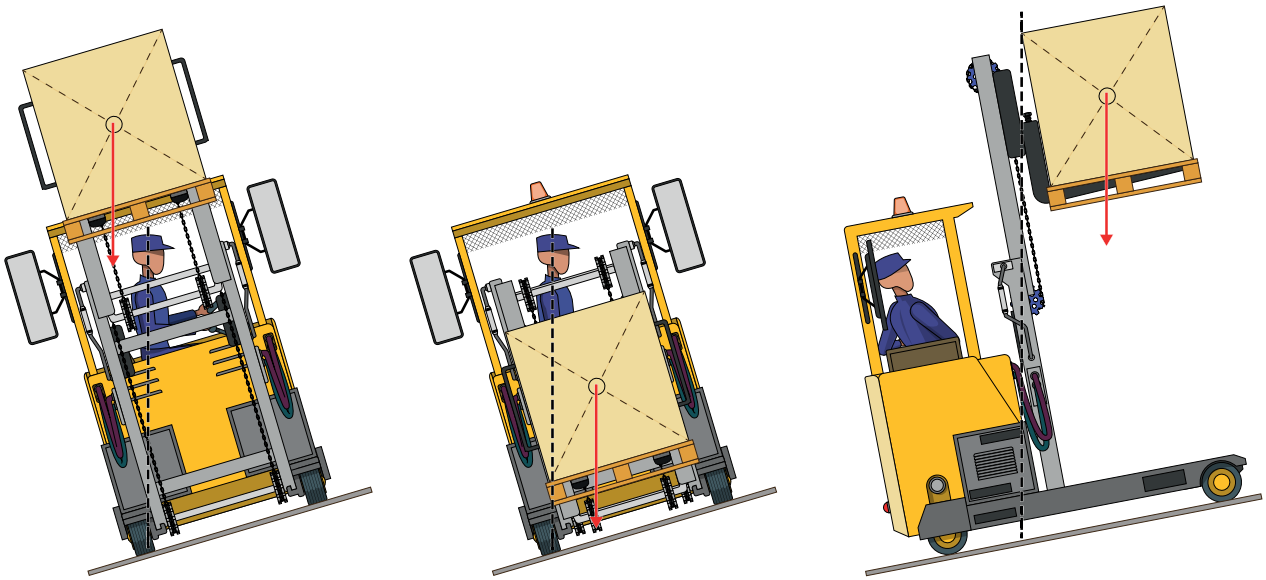
Figure 6.13: Longitudinal Stability

Lateral Instability

Compare to a car a fork lift truck has a narrow wheel base, high sides and a lack of suspension and is more vulnerable to overturning sideways.

Issues affecting lateral instability include:

- unevenly balanced loads (centre of gravity to one side)
- moving loads (*e.g.* a swinging suspended load)
- turning too fast
- turning with a raised load
- travelling across a gradient
- uneven ground or potholes
- suspension or tyre faults.



Raised load increases risk of toppling sideways

Lowered load is more stable

Load is exerted within wheelbase

High load with mast tilted back - risk of tipping sideways or even backwards

Figure 6.14: Lateral instability

Because of the high sides of a fork lift truck, if it overturns it is likely to rest on its side and not toll. If there is a risk of a vehicle rolling roll over protective structure (ROPS – *e.g.* a roll cage) should be provided. Seat belts, if provided should be worn and the driver should stay in the truck and not try to jump clear.

Falling loads

If there is a risk of objects falling onto the fork lift truck (*e.g.* from warehouse racking) a falling object protective structure (FOPS) should be provided. This may be a cab roof or protective canopy, often made of mesh to allow the operator overhead visibility.

Hazards associated with propulsion systems

Fork lift trucks may be powered by electricity (batteries) or by internal combustion engine. Engines may be fuelled by diesel, petrol or LPG (liquefied petroleum gas). Each poses specific hazards as outlined in Table 6.10.

Batteries	• Battery powered trucks are quiet and may not be heard by pedestrians • Battery charging liberates explosive hydrogen gas • Battery acid is corrosive • Changing batteries requires manual and/or mechanical handling
Diesel / Petrol	• Fuel storage and fuel handling • Exhaust fumes • Heat from exhaust system • Noise
LPG	• Fuel storage – either LPG tank and direct fuelling or LPG cylinders • Manual handling of LPG cylinders • Exhaust fumes

Table 6.10: Hazards associated with propulsion systems

Fork lift truck selection

As with all work equipment a fork lift truck must be suitable for its intended use, and the environment in which it is to be used. A range of features should be taken into account when determining the suitability of a truck, including:

Power source – Choice of battery, diesel or LPG might be influenced by environmental factors such as working indoors or outdoors, or working in flammable atmospheres.

Size and manoeuvrability – A key issue in environments where space is limited, *e.g.* warehouses with very narrow aisles.

Rated capacity – Safe working loads – weights to be lifted must be within the capacity of the truck.

Reach – Able to retrieve goods from high racking.

Suspension and tyre choice – A key determinant of suitability for the environment. A warehouse truck would not be suitable for a construction site.

FOPS – If falling objects are a concern a falling object protective structure is required.

ROPS – If rolling through more than 90o is a concern a rolling over protective structure is required.

Weather protection – If the truck is used outdoors an enclosed cab.

Lighting – Required if the truck is used outdoors after dark or on a highway.

Warning systems – Horn, flashing beacons etc.

Selection and training of FLT operators

Fork lift trucks should only be operated by people who are properly trained, competent and authorised in writing to do so. Authorisations are truck specific.

Potential operators should be:

- reliable
- responsible in their attitude
- physically capable
- adequately supervised if under 18, unless they have the necessary competence and maturity.

Operator training should be carried out by a competent person and always include the three stages of training:

- **basic training:** the basic skills and knowledge required for safe operation
- **specific job training:** knowledge of the workplace, operating principles and controls of the lift truck to be used, and experience of any special site rules, systems of work and specific handling attachments
- **familiarisation training:** operation on the job under close supervision. Operators should be reassessed every three to five years.

Safe storage and parking of FLTs

When not needed for use fork-lift trucks should be returned to a designated parking area.

The parking area should be on firm level ground and in a safe position (*i.e.* not impeding vehicle or pedestrian movements and away from emergency exits).

When parked the truck should be left with the mast tilted forward and the forks resting on the floor. The controls should be in neutral and the parking brakes applied.

The ignition key should be removed and retained by the operator or returned to a controlled key store.

Pre-use checks should include checking:

- tyres for wear and damage
- the horn is operable
- all lights, warning bleepers and beacons are working
- mirrors are in good repair
- brakes and handbrakes are functioning correctly
- seatbelts or restraints are in good repair and working
- fuel levels (diesel/charge of battery/gas) are acceptable
- forks, attachments and lifting chains are visibly in a good condition
- steering is functional
- all parts of the structure including any ROPS and FOPS are free from damage.

Conveyors

There are many mechanical means of conveying materials in the workplace, including:

- belt conveyors
- screw conveyors
- roller tracks
- ball tracks
- vibrating plates
- monorails.

All of the above may be termed *'conveyors'* and all pose similar hazards. The term conveyor typically relates to a continuous belt conveyor and it is the belt conveyor that is focussed on here.

Belt conveyor

A belt conveyor uses a moving belt with a continuous rubber or polymeric surface to convey materials. The belt is usually driven by a pulley at one end (the head), passing over a free-running pulley at the other end (the tail). The upper (load carrying) part of the belt may be supported by free-running idlers (rollers) or flat surfaces.

The conveyor may be arranged for horizontal or inclined travel.

The hazards associated with the use of belt conveyors are:

Mechanical hazards

- **Traps**
  - in running nips between belt and pulleys
  - in running nips / drawing in hazards at transfer points (*e.g.* belt to belt)
  - in running nips in power transmission moving parts between motor and head (drive) pulley (Depending on the arrangement entanglement may also be a relevant hazard)
- **Contacts**
  - cuts from sharp edges
  - abrasion from contact with moving belt surface
- **Ejections**
  - failure of belt
  - falling materials.

Non – mechanical hazards

- **Electrical** – Power source and static discharges from movement of belt and/or materials
- **Thermal** – Heat generated by moving parts
- **Ergonomic** – Poorly designed working positions with bad posture, and possibly manual handling of loads on or off the conveyor
- **Hazards associated with the conveyed material** – *e.g.* dusts posing health and/or explosion hazard.

The majority of conveyor accidents occur around the head and tail pulleys and the drive mechanisms. Many accidents occur during cleaning and maintenance activities.

The major precautions are guarding of the *'danger zones'*:

- fixed enclosing guards can be used to protect the drive mechanism, and head and tail pulleys (Figure 6.15)
- the sides of the conveyors can be enclosed or nip guards fitted to the supporting rollers
- transfer points can be guarded with fixed or interlocked tunnel guards (Figure 6.16), nip guards (Figure 6.18) or other devices such as 'pop-out' rollers (Figure 6.17)
- perimeter fencing can be provided to generally keep people away from operating areas.

Other precautions include:

- suitable work clothing to reduce the risk of sleeves getting caught in the conveyor
- suitable design and layout to allow safe movement of people, or provision of safe crossing points
- emergency stop pull cords running alongside the conveyor (Figure 6.21)
- safe systems of work for cleaning and maintenance and start-up of conveyors.

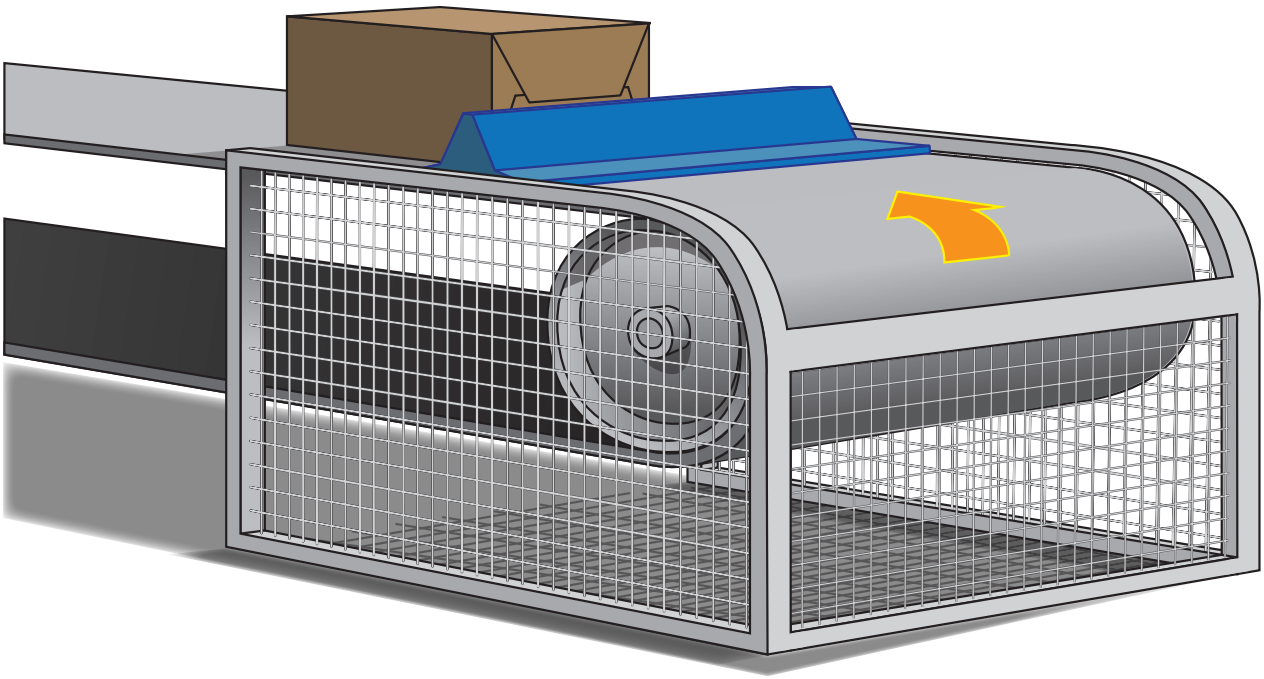


Figure 6.15: Fixed enclosing guard at tail pulley

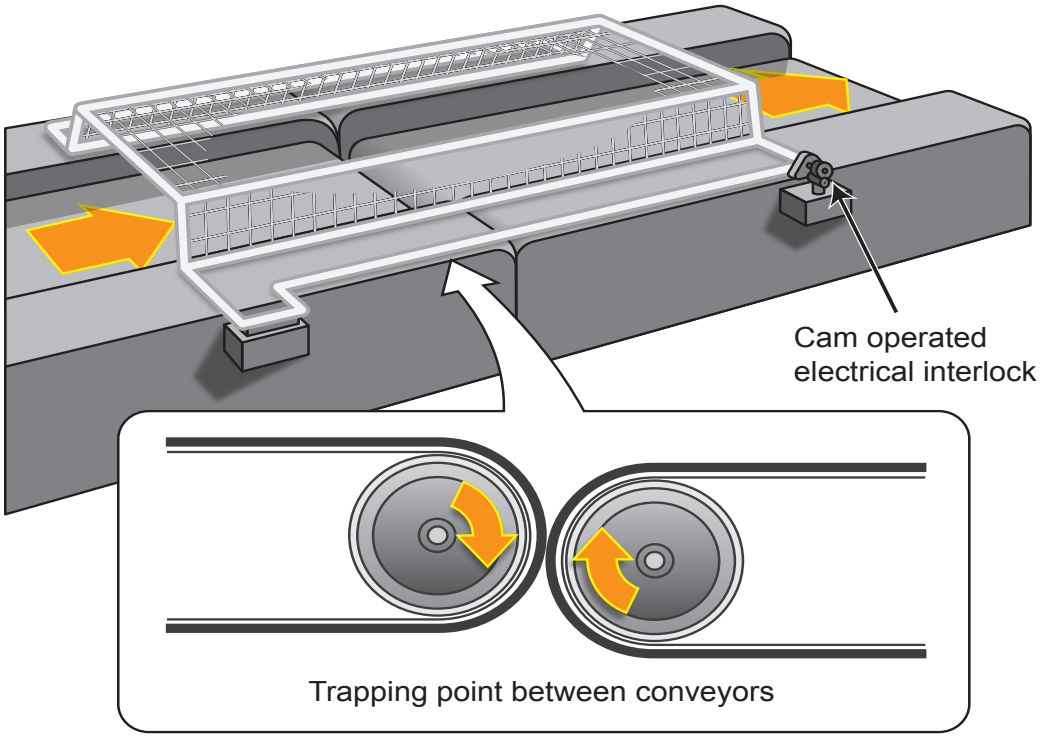


Figure 6.16: interlocked tunnel guard at transfer point

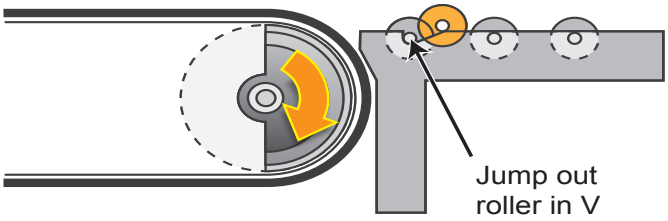


Figure 6.17: Jump out roller at transfer point to roller track

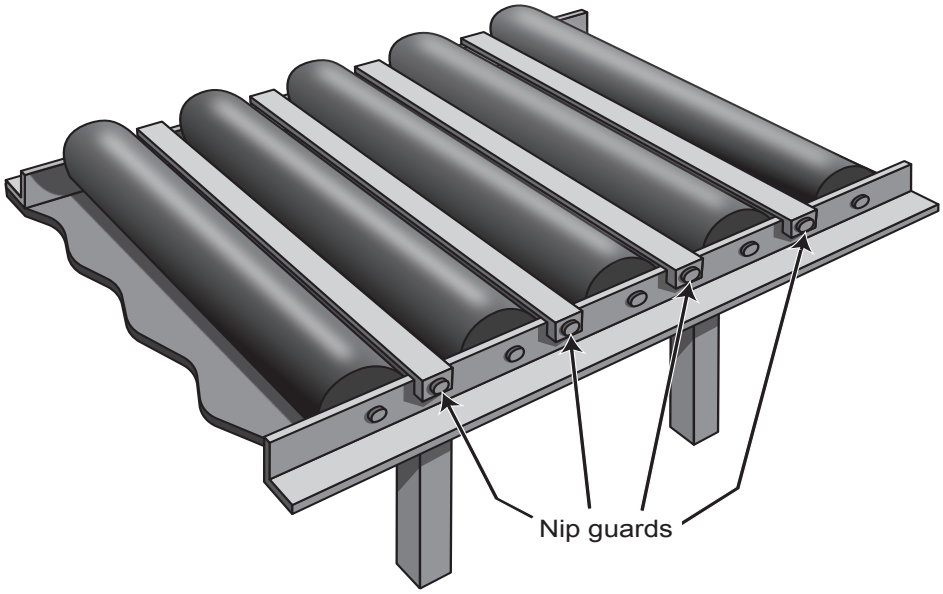


Figure 6.18: Nip guards on roller track

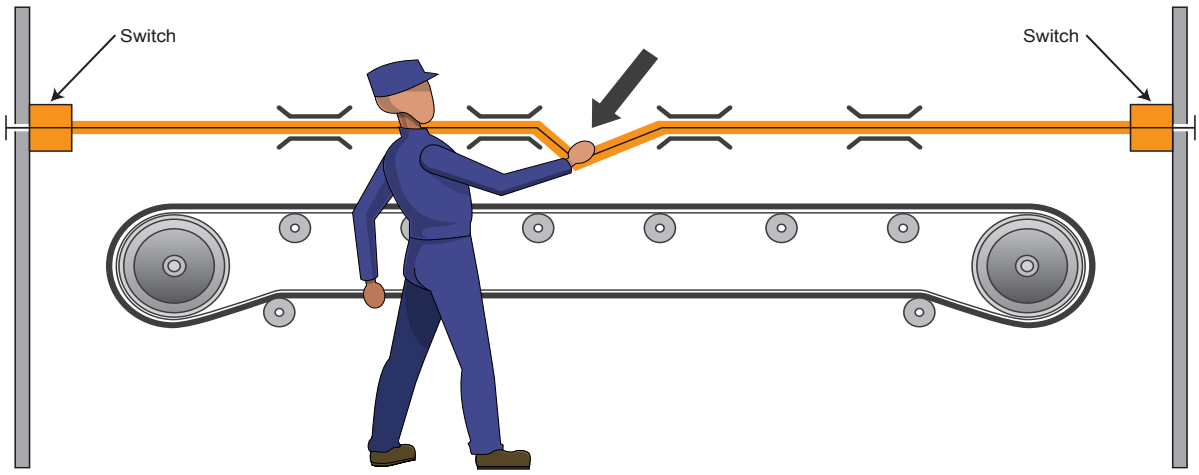


Figure 6.19: Emergency stop pull cord

Cranes

Crane options

Cranes typically seen on construction sites include: mobile, crawler and tower cranes. Gantry and overhead cranes are typically seen in industrial and engineering environments.

Figure 6.20: Overhead crane

Each type of crane has certain features making it more suitable for a particular application.

Telescopic mobile cranes are suitable for short duration operations and where mobility around a site is important.

Crawler cranes are more suitable for longer duration operations and for pick and carry duties and over relatively short distances. Crawler cranes are generally uneconomic for short site visits due to the high mobilisation costs associated with transport and rigging/de-rigging.

Tower cranes provide coverage over large areas and take up minimal room at ground level. Operators have excellent views of lifting operations. Mobilisation and foundation costs are relatively high restricting their use to longer term operations.

Figure 6.21: Telescopic mobile crane Mini crane/crawler tracks/outriggers in use

Crane selection

The choice of a suitable crane depends upon:

- the characteristics of the load to be lifted
- the selection of suitable lifting accessories (the weight of the lifting accessories must be taken into account when sizing the crane)
- the crane position, where the load is to be lifted from, the route that the load will take during the lift and where it will be landed
- constraints on erection and dismantling
- site and environmental constraints (*e.g.* headroom or load bearing capacity).

Crane hazards

The hazards for all crane types are essentially the same, with mobile cranes having the additional concern of the moving plant.

- crane collapse/failure due to overloading
- crane overturns due to overloading and unsuitable ground conditions
- load drops due to incorrect slinging or failure of tackle (overloading)
- moving crane hits structure, overhead obstruction, other vehicle, or person
- moving load hits structure, vehicle or person.

Crane stability

The three basic factors affecting the stability of a crane in use are:

- load combinations and their relation to the centre of gravity of the crane
- the support arrangement, *i.e.* ground conditions, foundations and any tying in arrangements
- operator control.

Crane – technical safeguards

The following safety devices should be fitted:

Rated capacity indicator (RCI): The RCI is used on jib cranes to give a warning as the safe working load (SWL) is approached and a further warning when an overload occurs.

Load radius indicator (LRI): Jib cranes with safe working loads varying at different radii use an LRI to indicate accurately the SWL and radius for each working configuration.

Motion limit devices (MLD): MLD can be fitted to limit any crane motion which could threaten the stability of the crane, *e.g.* hoisting, derricking (vertical movement of the jib), travelling, slewing, traversing or climbing.

Overload cut out devices: Switches or other devices may be fitted to cut out crane movement when the crane is in an overload situation.

Level indicator: Used to ensure that the crane is not operating outside of specified tolerances.

Anemometer (wind-speed measuring devices): Minimum in-service wind speeds that the crane must be able to withstand safely are typically 14 m/s (31 mph) for mobile cranes and 20 m/s (45 mph) for tower cranes.

Planning lifting operations

All lifting operations should be planned so they are carried out safely with foreseeable risks taken into account.

The lifting plan should be developed by a competent person with adequate practical and theoretical knowledge and experience of the lifts being undertaken.

The plan should address:

- the risks identified by a risk assessment
- the resources required
- procedures and responsibilities to ensure the lifting operation is carried out safely.

The plan should ensure that the lifting equipment remains safe for the range of lifting operations for which it might be used.

Safe systems of work

The lifting plan should result in a safe system of work (method statement) which should be documented for complex lifts. Everyone involved in the lifting operation should understand the requirements of the method statement and their role in the operation.

In principle all safe systems of work for crane operations are identical and should include the following:

- planning the operation – including site preparation, crane erection and dismantling
- selection of the correct crane and associated equipment
- maintenance of the crane and associated equipment
- ensuring that all necessary test certificates and other documents are in order and available
- safe slinging and signalling arrangements
- selection of appropriately trained and competent personnel
- preventing unauthorised movement or use of the crane and equipment
- provision of adequate, properly trained and competent supervision
- provision for the safety of those involved in, and others who may be affected by, the operation
- effective communication between all of the relevant parties.

Note: The legal responsibilities for safe lifting operations are usually shared between the crane hirer and crane user.

When a crane is hired the responsibility for planning, supervising and carrying out lifting operations rests with the user unless they are contracted to the crane hire company under a *'contract lift'*.

Inspection requirements

Lifting accessories

Lifting accessories or *'tackle'* is the work equipment used to attach loads to machinery for lifting, including:

- chain, wire rope and textile slings
- hooks, rings, shackles and eye bolts
- lifting beams and pulley blocks.

Lifting accessories can fail due to any combination of overloading, lack of maintenance and inappropriate use.

Figure 6.22: Lifting accessories

Other Lifts and Hoists

Other lifts and hoists include:

- passenger lifts (elevators)
- goods lifts
- 2 and 4 post vehicle lifts
- mechanical winches
- vertical or inclined construction hoists
- patient hoists (as discussed in section 6.3).

All of which present similar hazards associated with:

- movement of mechanical parts (mechanical hazards)
- failure of components
- falling people and/or objects.

Lifting equipment requires a thorough examination by a competent person:

- before it is put into service for the first time
- after installation or reassembly
- during its exposure to conditions which cause deterioration.

Lifting equipment which is exposed to conditions causing deterioration likely to result in dangerous situations should be thoroughly examined as follows:

• **Lifting accessories** • **Equipment for lifting persons**	• At least every 6 months
• **All other lifting equipment**	• At least every 12 months • In accordance with an examination scheme • After exceptional circumstances which are liable to jeopardise the safety of the lifting equipment.

Table 6.11: Schedule of thorough examinations

Note: it may also be appropriate for the lifting equipment to be inspected by a competent person at suitable intervals between thorough examinations, to ensure the equipment is maintained in good order and that any deterioration is detected and remedied in good time.

The competent person is required to immediately notify the employer and enforcing authority of any identified defects involving existing or imminent risks of serious personal injury, *e.g.*

- amputation
- electric shock
- fracture other than to fingers, thumbs or toes.

The employer should then remove any such defective equipment from use for disposal or repair.

The competent person also has to provide the employer with a written report of the findings of the thorough examination as soon as is practicable.

In the European Union (EU) the employer has to keep available for inspection any EU declaration of conformity relating to the lifting equipment for as long as he operates it and to keep the records of thorough examinations available for inspection as in Table 6.12.

Examination before first use – lifting equipment	Until employer ceases to use.
Examination before first use – moveable lifting equipment	Until it ceases to be used at place of installation or assembly.
Examination before first use – lifting accessories	Two years after report is made.
Periodic examinations	Until the next report or two years – whichever is later.

Table 6.12: Record keeping

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