

HAZARDOUS MANUAL HANDLING

1.0 What Are Manual Handling Tasks?

Manual handling tasks are defined as any activity where workers grasp, manipulate, carry, move (lift, lower, push or pull), hold or restrain a load. This includes operating a lifting a carton of beer or a computer, repairing machinery, driving a forklift, and moving a keg.

2.0 What Is A Hazardous Manual Handling Task?

Hazardous manual handling tasks are ones that involve:

- lifting heavy objects
- pulling, pushing or pressing with high force
- repetitive or sustained lifting, pulling, pushing or pressing – *even if not heavy, not high forces*
- awkward body positions or bad postures – EITHER *repetitive* OR for *prolonged periods*
- exposure of whole or part of body to sustained vibration – e.g. using a power tool; driving a vehicle with significant vibration
- manual handling of loads that are difficult to hold (e.g. slippery), or unstable / unbalanced
- manual handling of live people or animals.

3.0 The Risk Management Process

Risk management for manual tasks involves a systematic process aimed at preventing work-related musculoskeletal disorders. Major stages in the risk management process include:

- **Risk identification.** Identify the problem jobs³/tasks which are likely to, or have caused injury. If there is more than one, decide in what order they should be investigated.
- **Risk assessment.** Investigate the problem jobs/tasks, determine the risk factors and evaluate them, assess their importance, and look for their causes
- **Risk control.** Decide on solutions, trial and implement them, and check later to see the changes are working successfully.

3.1 Who Could Be Involved?

Successful risk management of manual tasks needs the involvement of employers and workers plus the WHSR, WHS committee and the WHSO.

Other people who could be involved in different stages of the risk management process, depending on the size of the workplace, include:

- area supervisors

- health professionals on staff
- officer responsible for purchasing specifications
- process engineers
- rehabilitation co-ordinator.

Make sure the officer responsible for risk management of manual tasks has the appropriate skills. It may also be necessary to call on people from outside the organisation or workplace with suitable expertise.

3.2 Developing a Risk Management Plan

You should develop a comprehensive risk management plan to follow the Manual Tasks Code of Practice. This can be tied in with the overall health and safety risk management plan and other plans for hazardous substances, plant etc. The risk management plan should:

- nominate a co-ordinator of the strategy (OHS co-ordinator/committee/management team/external consultant)
- contain copies of the forms used in the risk management process *eg. job discomfort survey or task analysis forms.*

Support the plan by policies or procedures where necessary. Consider the following areas:

- the consultation process for manual tasks
- the training program for manual tasks
- how problem jobs are to be identified and prioritised
- procedures to administer the discomfort survey and monitor whether action was taken, and its success
- procedures for how accident and incident reports will be investigated, monitoring action taken and records maintained
- standard operating procedures for selected manual tasks

3.3 Keeping Records

Records should be kept of:

- any risk assessment conducted, the controls implemented and the evaluation of the control measures
- training and education activities

Other records which could be kept include:

- injury and incident reports and action taken

- design modifications to, and specifications of, plant and work processes
- maintenance records for the period of service of equipment and tools.

These records show steps you have taken towards risk management.

Maintain all records associated with the implementation of this Code of Practice in a central location and make them available to workers, their representatives and other health and safety personnel.

3.4 Tools for the Risk Management Process

Risk factors and control options. This includes for each risk factor:

- a checklist for use during the assessment phase; and
- options for risk control that can be consulted when making decisions on solutions.

Optional tools to assist with the risk management process include a discomfort survey and task analysis worksheets. See below.

3.5 An Overview of the Risk Management Process

<p><u>Risk Identification</u></p> <p>Find the problem jobs which need investigating – not all manual tasks are hazardous.</p>	<p>Problem jobs should be identified:</p> <p>When making a change analyse the effects on workers when changing any part of the work process.</p> <p>When there are indications something could be wrong observe work processes and speak with workers. Use a checklist to identify problems. Occasionally use a discomfort survey to pick up problems.</p> <p>After an incident has happened investigate all new incidents, and look for trends in past records.</p>
<p><u>Risk assessment</u></p> <p>Analyse the problem jobs to find out the risk factors that are causing problems.</p>	<p>A task analysis on identified problem jobs should be carried out. The worksheets provided can be used for this.</p> <p><i>Prepare.</i> Get ready to assess the task by observing the task being done and taking any necessary measurements.</p> <p><i>Consult.</i> Talk to the workers doing the job, and the supervisor or mechanic.</p> <p><i>Checklists.</i> Use the checklists to analyse risk factors.</p> <p><i>Decide.</i> Examine the risk factors, decide which need to have solutions found for them, and place in priority order for attention.</p>

<p><u>Risk Control</u></p> <p>Prepare the control implementation plan and include a time frame</p>	<p>Having determined the risk factors and causes –</p> <p><i>Select the solutions.</i> Look at all the control options and choose the best (see control options)</p> <p><i>Put them into place.</i> Test the solutions first to see if they work</p> <p><i>Review them.</i> Check out the solutions to make sure they are working as expected.</p>
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3.6 Risk Identification

The first step in managing risk is to target potentially risky jobs/tasks for assessment.

Problem tasks can be identified:

1. when changes in the work environment are planned
2. when there are indications for potential injury
3. after an incident or injury has occurred.

The following are methods that can be used in identifying problem jobs.

3.7 Planning for New or Changed Work Processes

The most cost-effective prevention strategy is to develop and apply controls during the planning phase. Look for potential risks when:

- new workstations or storage facilities are designed
- renovations are made to the work area
- tools are selected, or equipment designed or redesigned
- work processes or work methods are designed or changed
- containers or other objects which are to be manually handled are purchased or designed (ie with relation to factors such as size, shape, weight and packaging)
- work schedules are reorganised (*eg longer working days etc*)
- staff are assigned to new tasks or new staff are assigned to a task.

Consultation: Consult the WHSO or WHSR before making changes to the workplace or plant. Consultation with workers involved with the new arrangement can also be valuable.

3.8 Observation and Surveys

Jobs with potential problems can be identified by:

- regular observation of work processes
- consultation with workers
- surveys of workers with regard to potential health problems in their jobs.

3.9 Work Inspections

Observe work in progress during regular work inspections and audits. Look carefully at tasks being performed and note working postures. Watch out for clues that may signal problems of developing disorders. Workers often improvise changes to their workplace when they are having problems.

Look out for:

- workers who are obviously uncomfortable, for example workers:
 - stretching their backs as if to relieve tension
 - wearing a support bandage on the wrist or elbow
 - guarding or protecting low backs, necks, shoulders, elbows or wrists.
- improvisations made by workers that may indicate problems, for example:
 - stacked mats or flattened cartons used to stand on
 - tool handles padded with layers of tape to reduce exposure to vibration or cold.

3.10 Checklists

Checklists can assist as a rapid screening tool when doing a walk through survey to identify jobs with potential harmful exposures. Customise checklists to the specific needs of different work areas using information.

A checklist for the office section of the workplace will emphasise different aspects of risk factors from one for a manufacturing section. Ideally, checklists can be systematically completed covering different work sections.

3.11 Consultation

Consultation with workers on walk through surveys is valuable. Talk to workers about their job.

Workers know which tools and activities contribute to their discomfort and have practical suggestions or potential solutions. Find out why workers are uncomfortable if any of the above signs were noticed.

Find out which jobs are the most tiring or uncomfortable. Workers may be able to suggest modifications to make their work areas more user-friendly.

3.12 Discomfort Survey

A discomfort survey can be helpful in indicating problem tasks. Early reporting of symptoms of injury can lead to controls being put into place before an injury occurs.

The survey should try to ascertain if the worker is experiencing discomfort that could be work-related and what the worker thinks is the likely cause.

Encourage workers to report pain or discomfort at work or at any other time. Follow up the reasons for the problem. Even if only one worker reports problems, assess the presence of a risk factor. It could be that the job is not suitable for this particular worker, but is satisfactory for others.

3.13 Records Analysis

Records of injuries are important as they indicate jobs/tasks or equipment that can contain risk factors related to musculoskeletal disorders.

3.14 Investigate New Reports

Investigate each incident or first aid report as soon as possible after it has been notified. Near misses that only result in damage to equipment should also be reported and investigated.

Design the report as an aid to preventing further incidents. It is best for it to provide sufficient information so problems can be identified, such as:

- the area of the workplace where it happened
- the occupation, or job/task of the injured worker/s
- the type of equipment or machine involved
- the part of the body injured *eg back, neck or shoulder*
- the type the injury *eg strain or sprain*
- the severity of the injury *eg days unable to work*
- the treatment administered and any further treatment needed
- how the incident happened *eg carrying a load or pushing a trolley*
- what could have been done to prevent it.

3.15 Analyse Injury Statistics

Examine records regularly to identify trends related to injuries in certain jobs or work areas. Other sources of information include first aid reports and medical aid records. To assess the impact of each injury, note the initial and subsequent costs.

Examine and compare:

- the number of injuries in particular locations

- frequency and severity of injuries compared to numbers of workers, hours worked or areas of work
- the number of injuries related to each job and how serious those injuries have been
- the injury pattern with particular industry standards.

3.16 Examine Personnel/Production Data

Examine personnel and production data that can indicate the presence of adverse health effects. For instance:

- absenteeism rates and patterns
- staff turnover
- decreasing production or quality rates.

3.17 Prioritise Problem Job/Tasks

The last step in the risk identification process is to decide which jobs are most in need of assessment. Consider:

- the number of risk factors found in that job which need controlling, particularly if there are two or more of the direct stressor risk factors *eg awkward wrist postures and high repetition combined with vibration*
- how often the task is done
- the proportion of workers doing the same or a similar task.

Data on manual tasks related injuries in industries could also help indicate the priority of dealing with a problem task.

4.0 Select Controls

Solutions to a problem can involve both types of controls. Choose design controls wherever possible with preference for controls that eliminate the risk. If this is not possible, select controls that minimise the risk.

Use administrative controls only:

- where it is not possible to design problems out of tasks,
- to supplement design controls *eg when training is provided with the introduction of a new mechanical device or a maintenance schedule drawn up.*

Criteria used to evaluate solutions include:

- **Effectiveness.** The degree to which the solutions control the risk factors. In situations where risk factors affect more than one body part, it is necessary to evaluate the effectiveness of a solution on each affected body part.
- **Timeliness.** The overall time to fully implement a solution which works effectively to eliminate or minimise risk factors.

Interim controls. If a control must be designed and implementation is several months off, then provide an interim solution/s. Sometimes an administrative control such as job rotation can be implemented while a better solution is designed.

Interim controls can also be used when an allocation of future budgets is necessary to make significant updates to plant or equipment.

4.1 Possible Control Measures for Manual Tasks

The risk management process provides mechanisms for the prevention of musculoskeletal injuries.

Design controls involve the alteration of the work process or physical aspects of the workplace such as the equipment or the workstation. Design controls are preferred as they are permanent and they can eliminate or minimise exposure to the risk factors. Design controls include:

- a. job design/redesign – altering the way a job is done or making changes to the work area, tools or equipment
- b. mechanical aids – providing mechanical aids to reduce the physical effort required by workers to do the job.

Administrative controls focus on reducing the amount of time workers are exposed to a risk factor. They are not preferred as they do not remove the cause of the problem, they may be forgotten under stressful conditions and they require ongoing supervision to ensure that they are used. Administrative controls include:

- a. work organisation – rotating workers, avoiding peaks in workflow, etc.
- b. task-specific training – ensuring that workers are trained in their specific work including the use of tools or mechanical aids
- c. maintenance programs – servicing and maintaining tools and lifting equipment on a regular basis
- d. personal protective equipment (PPE) – providing PPE such as knee pads or gloves where needed.

Develop and implement solutions that work by:

- a. finding and selecting the best control option. All control options should be considered, however design type controls are best. Interim controls may need to be chosen where permanent controls will take time to implement

- b. implementing the chosen control. It is recommended that controls be tested prior to implementation where possible to ensure that they are suitable
- c. monitoring and reviewing the corrective measures to ensure they are working as planned and they have not created a new risk or problem.

4.2 Methods of Risk Control

Control measures for manual tasks fall into two major categories: design and administrative controls as shown in the following table.

Risk control categories	Methods of risk control
<p>Design controls involve the arrangement, or alteration of the work process⁸ or physical aspects of the workplace such as equipment or work stations.</p> <p>Design controls are preferred because they:</p> <ul style="list-style-type: none"> • can eliminate or at least minimise exposure to risk factors • have the advantage of being permanent. <p>For these reasons, implement design controls wherever possible.</p>	<p>Job design and redesign. The aim of job redesign is to make sure that all components of a task are arranged to reduce the risk of injury. It includes such factors as the:</p> <ul style="list-style-type: none"> • design of work area and objects or tools being handled during a task • movements and body positions required to carry out the task, how often it is repeated and for how long. <p>Provide mechanical aids that will assist workers to carry out their tasks. This can lower the risk of injury by reducing the muscular effort required to do the job.</p>
<p>Administrative controls are achieved primarily by modifying existing personnel functions <i>eg worker training, job rotation and matching workers to jobs.</i></p> <p>Administrative controls do not remove the root cause of potential problems. Administrative controls:</p> <ul style="list-style-type: none"> • can only reduce exposure to risk factors. • may be forgotten under stressful conditions <i>eg meeting deadlines, or coping with staff reductions</i> • need ongoing supervision. 	<p>Work organisation. Examine possibilities for rotating workers, rearrange the workflow to keep a constant workload and avoid peaks.</p> <p>Task-specific training. Training in work methods for a specific task, including the use of tools or mechanical devices and handling methods, helps workers to carry out their tasks in the most effective way.</p> <p>Preventive maintenance programs. Service and maintain tools on a regular basis. This will ensure the effort needed to operate them is not increased.</p> <p>PPE (such as kneepads or gloves) provides another control that could be used to supplement design or administrative controls.</p>

Work process - the sequence of activities and the interaction of persons, equipment, materials, energy and information

Load handling refers to the transfer of loads in a workplace. Lifting and carrying, which are common handling methods in industry, are a major cause of lower back disorders. The shoulder is also affected in these activities by supporting the load. Pushing and pulling are also causes of back sprain.

Factors which increase the risk of injury include:

- **Handling in awkward postures** (such as twisting, bending and over-reaching) when combined with load handling is potentially harmful because of the stress on the lower back.
- The further the centre of gravity is away from the spine, the stress on the back increases.
- **Combining two activities.** Twisting while bending is particularly harmful.
- **Repetitive handling.** This increases the risk of cumulative damage happening, particularly when done for a prolonged time. The risk increases with the length of time repetitive lifting is done over the long term.
- **Static load.** Carrying loads involves static effort in stabilising the shoulders and trunk. This can affect the muscles of the back, shoulder and arms and, as well as cause wear and tear on the intervertebral discs. The carry distance can affect the duration of static loading and increase the risk of adverse health effects.
- **Asymmetric lifting.** Lifting loads asymmetrically *eg by twisting the trunk or lifting with one hand* can cause hazardous stresses to the lumbar area of the spine.
- **Constricted work space.** Handling materials with limited ability to manoeuvre or stand up straight increases the muscular exertion needed to perform a manual task.

Assess load handling at every stage including:

- transport and reception
- handling at the workstation
- storage and distribution.

5.0 Risk Factors

'Risk factors' are part of the demands of a job. They affect the worker and can contribute to injury. Risk factors are used to analyse manual tasks and are divided into three categories:

No risk factor occurs alone. There is a crossover between the different categories.

5.1 Direct Stressors

Direct stressors contribute directly to injury and include:

- a. forceful exertions (the level of muscular force exerted)
- b. working postures (awkward, uncomfortable or fixed, static postures)
- c. repetition and duration (how often actions are repeated and the length of time workers are exposed)
- d. vibration (absorbed from tools and equipment).

There is a risk of injury related to manual tasks only when a direct stressor is present.

5.2 Contributing Risk factors

Contributing risk factors are what cause the direct stressors and include:

- a. the work area design (where the particular task is based and includes furniture, equipment and work benches used by the worker to perform the task)
- b. use of tools (the design and the amount of time the tool is used)
- c. nature of loads (the size, shape, dimensions, weight, etc. of the load)
- d. load handling (whether the load is lifted, lowered, pushed, pulled or carried, and effort is required).

If contributory risk factors are redesigned, the impact of the direct stressors can be reduced. A contributory risk factor is not a risk without a direct stressor.

5.3 Modifying Risk Factors

Modifying risk factors can contribute to a further change in the impact of other risk factors, for example:

- a. individual factors such as a worker's physical capacity
- b. work organisation such as the speed at which paced work is set, staffing levels, breaks or maintenance schedule.

A modifying risk factor is not a risk without a direct stressor.

5.4 Control Options – Load Handling

5.4.1 Lifting/Carrying

Consider manual lifting or carrying of heavy loads only as a last resort

To reduce exposure to lifting/carrying loads, consider the following:

- **Provide mechanical handling aids.** The best way to prevent injuries is to eliminate the manual work by using mechanical devices. A wide range of mechanical aids is available across and within specific industries.

Mechanical handling aids include:

- **Industrial trucks** - forklifts, platform trucks and pallet trucks
- **Mobile lifting devices** - lift tables, mechanical and hand stackers, lift trolleys, keg trolleys, two-wheel elevating hand trucks and pallet movers.
- Mechanical aids should be:
 - designed to suit the load and the work being done
 - as light as their function will allow
 - easy to use and not cause an obstruction
 - located close to the work area so as to be readily available
 - in good working order, so set up a maintenance schedule
 - brought to staff attention when new so they do not introduce any additional risks eg a forklift appearing without warning in a work area.
- **Aids for raising objects.** The effort to raise loads can be eliminated or reduced through the use of:
 - mechanical devices such as hand winches
 - hydraulic pumps
 - battery powered motors.
- **Modify the handling task.** Where it is not feasible to use handling aids, redesign the task by:
 - modifying the load weight, size and shape
 - reducing the amount of loading/unloading by using mobile racks for pallets, containers or trays
 - keeping heavy work items at working height when moving from one workstation to the next so there is no need for raising or lowering movements
 - converting from carrying to pushing, pulling, sliding or rolling suitable loads
- **Avoid asymmetric handling.** This puts uneven stresses on the discs and back muscles. Risks increase with the carry distance and the duration of the activity:
 - provide suitable handholds for loads which have to be held or carried at the side of the body
 - for off-centre loads, improve packaging and provide attachments to assist hand grip, or use team lifting for bulky loads i.e. keg handling, handling of cartons of beer.

- **Constrained workspaces.** Lifting/carrying capacity is at its best level when:
 - the worker can stand up straight - reduce the load when there is only limited head room
 - access ways are suitable for the load - narrow passage ways can reduce carrying capacity
 - shelf opening clearances are not too narrow.
- **Sitting at work.** A seated worker cannot handle as heavy a load as when standing:
 - The load should be placed as close as possible to the worker to avoid bending.
 - A swivel-seat will help the worker to move a load without twisting the trunk.
 - Sliding an object is preferable to lifting an object while seated.
- **Improve storage of loads.** The best level of muscular effort can be exerted at about knuckle height (70 - 80 cm). Where possible:
 - store loads at this level
 - avoid storage above shoulder level or close to the floor except for light or infrequently used items
 - provide an intermediate surface so the worker can rest the load for a moment before shifting grip if the object must be lifted from a low to a high position.

The following table sets out guidelines for the design of storage, shelving and racks.

Height	Depth	Application
<60cms	45cms	Reserve storage for light or rarely required items. Not suitable for heavy objects
60-80	45	Fair for heavy items, good for light items
80-110	60	Optimal zone for storage
110-140	60	Good for light items – visibility unimpeded. Poor for heavy items
140-170	30	Limited visibility and accessibility. Could be suitable for light items on the edge of the shelves
170-220	30	Very limited access
> 220		Out of reach for everybody.

- **Change location of loads.** Improve work area layout to reduce carry distances *eg relocate storage production areas.*
- Stipulate to suppliers where products are to be delivered. Plan the location to minimise the distance from where loads are stored to where they will be used.

- **Use team handling** only in emergency situations. Team handling should be used only if equitable sharing of the load for the duration of lift, carry and set down can be ensured.

5.5 Checklist - Load Handling

1. Do the workers rate the effort required to handle the load as too high?	Yes	No
2. Is lifting or carrying carried out when mechanical aids could be used?	Yes	No
3. Are loads located in a position at the beginning or end of lifting which:		
a) require awkward postures (bending, twisting or reaching etc)?	Yes	No
b) make it difficult to reach, grasp or hold?	Yes	No
c) require manoeuvring to be placed accurately into position?	Yes	No
4. Is the load stored:		
a) below the worker's knuckle height or above shoulder height?	Yes	No
b) Where it requires extended reach?	Yes	No
7. Is a seated worker required to lift or push/pull a heavy load?	Yes	No
8. Could the distance between where loads are located and where they will be used be reduced?	Yes	No
9. Is a worker working alone required to handle heavy/bulky loads?	Yes	No
10. Is pushing/pulling performed:		
a) when the body is twisted?	Yes	No
b) during reaching?	Yes	No
c) with the handle at a height that allows best force application?	Yes	No
d) using trolleys with wheels that are too small?	Yes	No
11. When sliding, pulling or pushing an object, is the object easy to move?	Yes	No

5.6 Team Lifting

Team handling as a control measure may bring its own risks, so redesign tasks if there is a regular need for team handling.

Problems with team lifting include:

- inexperience in one or some of the helpers may mean the load is not shared as well as it could be
- workers may not exert force simultaneously

- coordination loss by individual workers due to foot/hand adjustments they make to fit in with other team members will reduce the force each can exert
- if operating on steps or a slope, most of the weight will be borne by handlers at the lower end
- unexpected increased loading and/or change in balance because one team member loses his/her grip.

Whenever team handling is used, it is essential to co-ordinate and carefully plan the lift.

Make sure:

- there is an adequate number of workers in the team (the lifting capacity of a team is not equivalent to the sum of their individual capacities)
- one person is appointed to plan and take charge of the operation
- enough space is available for the handlers to manoeuvre as a group
- team members are of similar height where possible
- team members know their responsibilities during the lift
- training in team lifting has been provided and the lift rehearsed, including what to do in case of emergency
- aids to assist with handling (a stretcher, slings, straps, lifting bars, lifting tongs, trolleys, hoists) are used where possible.

6.0 Pushing/Pulling

Pushing and pulling involve three phases requiring different levels of muscular effort:

- starting the load in motion
- sustaining the motion
- stopping the load moving.

The initial force generally requires the greater level of muscular effort.

The following table summarises controls to reduce effort in each phase:

6.1 Reduce Initial Effort

- use aids such as non-powered conveyors, air bearings, ball castor tables, monorails etc.

6.2 Reduce Effort in Keeping the Load Moving

- make sure hand trucks and trolleys are as lightly constructed as possible, have large wheels or castors that are sized correctly and roll freely
- have handles at approximately 1m (vertical handles allow workers to find their own level)

- provide good maintenance of hand trucks and trolleys
- treat surfaces where loads are slid to reduce rolling resistance.

6.3 Reduce Effort in Stopping the Load

- know where the load needs to stop and slow down gradually

6.4 Improve Capability of Applying Force

The amount of force a worker can exert is influenced by:

- the height of exertion (for **pushing** hands should apply force above waist height, for **pulling** below waist height)
- the position of the arms for pushing)arm strength is greatest with the elbows bent so that distance between the shoulders and handle is about 50% of the reach distance (elbows bent), and lowest with arms outstretched)
- higher forces can be generated when standing than when sitting because the body weight can be used.

6.5 Pushing v Pulling

Pushing loads is preferable to pulling because it involves less work by the muscles of the lower back and generally allows better vision.

- **Improve workplace layout.** Reduce the distance of push or pull by improving workplace layout and by relocating items closer to where they will be used.

Floor surfaces, house keeping and environmental conditions such as cold or heat are also important items when analysing handling activities.

The centre of gravity of a regular object is situated at its centre. If an object is of uneven weight distribution, it is towards the heavier side.

7.0 Implement Controls

Implementation normally consists of the following steps:

- Trial solutions before making them permanent. Some ideas do not work as well in practice as on paper. Find out if solutions actually work, or if additional modifications are needed.
- Make modifications or revisions where needed.
- Train workers in the new work process.
- Implement the solution when satisfied it works well.

Testing can be done in several ways:

- A mock-up of an improved workstation to provide an understanding of the workspace, reaches and clearances.
- A single work area can be modified first, so ensuring that all necessary changes have been identified before full-scale changes to multiple workstations occur.
- Improved work methods can be tested on training lines or training workstations. All users should test for one shift each. Typically, these workstations have slower speeds or are completely off-line and can be stopped, making them ideal for testing purposes.
- Tests on full-speed production lines can be done by inserting an extra workstation, then having a worker perform the new work method or use the new tool at a reduced rate.

Consultation. Feedback from workers before setting up the trial and during this testing period is important. This may help determine how well the proposed solution actually works and could identify any additional modifications.

Involving workers at this testing stage and using their feedback on the proposed solutions is essential.

Revise controls. After the initial testing period, the proposed solution may need to be revised. Conduct further testing to see that the correct changes have been made.

Full-scale implementation should follow complete testing and satisfaction with the proposed solutions.

Prioritise implementation. Implement first the controls that will help to correct the most prevalent or the most serious risk factors.

Set a time frame for controls to be installed and evaluated.

7.1 Steps in the Control Implementation Process

The following is a guide to completing the 'control implementation plan':

1. Summarise the activities which need controlling. Some are common to more than one task, or more than one element. List in the 'activities/elements' column.
2. List the common risk factors concerned in the second column.
3. Determine the cause of the risk factors and note under 'cause' in column 3.
4. Consult the risk control options to help decide on a solution to assist with selecting controls. If a suitable solution is not contained in the control options, look for other solutions. Note the solution under 'controls' in column 4.
5. Decide on the action necessary to implement the controls and allocate the staff member who should carry out the action under 'action – responsibility' in column 5.
6. Allocate a date for completing the action and enter under 'finish date' in column 7.

7. The column titled 'status and date' is for monitoring progress of controls that may take time to put in place. It is good practice to review the control implementation plan regularly to assess the status of compliance. In addition, specify the date for evaluation of the risk controls and any other follow-ups.

8.2 Task Analysis – Control Implementation Plan (Example)

Activity/Element	Risk Factor	Cause	Controls	Action Responsibility	Status and date	Finish date
Push and manoeuvre keg trolley	Forceful/sustained pushing	Trolley design – handle too low, small wheels	Upgrade trolley next budget	Maintenance section	Next Budget	1/3/2000
		Lack of trolley maintenance	Establish maintenance program for trolley	Maintenance section	ASAP	16/8/99-
		Bad floor condition	Repair floor surfaces	Maintenance section	ASAP	16/8/99
			Regular cleaning floor surfaces	Cleaners to be advised	ASAP	10/8/99
Grasp and handle of cartons of beer	Repetitive , forceful gripping Awkward wrist and upper limb postures	Items badly packaged, no handles	Review purchased products re packaging, weight and size	Contact supplier re change in specifications for packaging	6 months on	1/2/2000
Handling packages of cartons of beer	Repetitive lifting and lowering	Job to be completed within first 3 hours of the shift – 1 worker completing whole task	Split the job between 2 workers Job to be done continuously for < 30 minutes by each worker	Trial both methods	ASAP	16/8/1999
Place and slide cartons of beer onto shelves	Awkward postures Knees, upper limb	Layout of the shelves (height, depth and stock location) Poor visual access to shelves during placement through poor lighting	Rearrange package placement into priority access locations avoiding extreme low and high Change and improve shelf labelling for package locations. Reduce depth/height of highest shelves Upgrade lighting storage area.	Consult workers renew arrangements Building officer to arrange	Start during quiet time Next budget	1/1/2000 1/3/2000

8.0 Evaluate and Review Implemented Controls

The final step in the risk management process is to monitor and review the effectiveness of the controls. This follow-up is necessary to make sure the implemented process is complete and closes the loop back to the original identified risks.

Perform the evaluation no later than eight weeks after implementing solutions unless a problem becomes evident at an earlier stage.

The first step is to check all actions planned have been carried out. Consult notes or the control implementation plan if one was used:

- Make sure selected controls were implemented as planned
- Check to see introduced controls are working successfully and are being used correctly
- Look at the task in action to determine whether the initial risk factors have been minimised as intended
- Make sure no new risk factors have been introduced, nor any existing problems made worse

Consult with workers and supervisors at this stage so different levels of experience are taken into account. Check that tasks, which were difficult before, are easier to perform now. Assess also whether workers have any unwanted effects that may indicate risks have not been controlled adequately.

Problems. If any are found:

- work out what may have prevented the system working as planned
- decide what needs to be changed or added to the system to make it work more effectively.

If new problems have occurred, or if there has been change to the work requirements or equipment used, then conduct a further risk assessment.

Long term monitoring of the controls could include observation during walk through surveys and monitoring injury reports to ensure problems have been resolved.

9.0 Force Exertion

9.1 Lifting/Carrying

The muscular effort needed to lift and carry loads is a primary risk factor for low back disorders. The muscular exertion needed depends primarily on the:

- **weight** of the load, and
- **distance** of the load's centre of gravity from the body.

This is referred to as the 'bending moment', and is calculated by the product of the load's weight (kg) and distance (cm). The moment indicates the effort muscles need to exert to hold the load.

Because the load on the spine varies with distance, the further away a load of a certain weight is from the body, the greater the effort needed to handle it *eg a 20 kg weight held close to the body will require the same effort as a 4 kg held at a distance of 50 cm.*

9.2 Effect of Posture on Muscular Effort

In some postures, it is not only the load back muscles have to support. For instance, when lifting with the trunk bent forward, the back muscles have to support the weight of the load plus the weight of the upper body.

The below figure shows a person holding a 20kg load in both the standing and bent-over positions. There is a 278% increase in the forces on the spine in the bent position when compared with the straight position.



Injuries are more likely to occur to the structures of the back (muscles, tendons, ligaments and discs) when the back is fully bent forwards because the muscles are fully extended and cannot work properly. It can therefore put a considerable load on tissues, such as the ligaments between the vertebrae, when lifting from a low position.

9.3 Effect of the Posture on Discs

Disc pressures are smallest when the spine is upright. Pressures increase with a change in posture or when the back muscles are working. Disc pressures over a certain level can lead to injury.

When force is applied with the back bent, as when picking up a load, the front part of the disc is squeezed. Doing this repeatedly can cause cumulative damage. Combining bending forwards with bending sideways or twisting also increase disc pressures.

Note: loads a worker is physically able to handle can still increase disc pressures to a level that could lead to cumulative damage. Injury can occur if the task is carried out repetitively.

9.4 Factors Affecting Muscular Effort

The weight and distance of the load from the body are not the only factors that determine how much muscular effort is needed, or if disc pressures are at unsafe levels.

The following list summarises factors that increase task demands:

A. Distance load has to be lifted

- The difference (vertically) between the start and the end of the lift

B. Twisting

- Having to twist the trunk and shoulders to handle the load

C. Frequency of lifting

- Number of lifts to be performed over a shift
- Lifting duration
- Total time in a work shift spent lifting

D. Load placement clearance

- Careful manoeuvring to place loads at their final location increases the holding time

E. Load shape and composition

- Loads which are bulky, unwieldy or unstable with the contents likely to shift

F. Off-centre loads

- Loads that are unevenly balanced with regard to their weight distribution

G. How easy the load is to grip

- Lack of suitable handles or slippery texture of a load can result in a worker having to use additional gripping force

H. How far the load has to be carried

- Time the load is supported usually increases with the distance the load has to be moved

In addition to the above, other factors include:

- the workplace environment, such as whether slopes or stairs have to be negotiated when carrying loads, or whether access ways are cluttered
- hot and humid conditions as heat adds to the load on a worker when physically demanding manual tasks are being done (*eg repetitive lifting and carrying of heavy loads*)
- cold conditions which can decrease work capacity with muscle and body cooling (*protective clothing can also limit work capacity and mobility due to its bulk*)

- the capacity of individual workers.

9.5 Implications for Handling Loads

Train workers to:

- keep the load as close to the body as possible during all lifting and carrying procedures
- avoid lifting
 - with the back fully bent
 - from a position where it is necessary to twist or bend sideways to place the load
 - after prolonged periods with the back bent
 - after a prolonged period of exposure to whole body vibration as in driving a vehicle.

10.0 How Much Weight To Handle

Arbitrary weight limits for loads to be handled manually cannot be set because of the many factors involved. The effect on the worker (the effort needed and increased load on the lumbar disc) is the vital factor, but is not measurable in normal life.

The following tools have been developed to assist with this complex problem:

- A formula for assessing lifting tasks developed by the National Institute of Occupational Safety and Health US takes the following factors into account –
 - distance of the load's centre of gravity from the worker
 - height of the hands at the beginning of the lift and distance the load travels
 - the average frequency of lifts (lifts/minute or /hour).
- Mital et al have developed tables of recommended weights which deal with two handed symmetrical lifting, lowering, carrying, pushing and pulling for both males and females. Recommended times for holding loads are also included.

Recommendations for a weight limit in a particular industry could be made by consulting either tool, deciding on a general combination of handling circumstances and deriving a value.

11.0 Posture, Force Exertion and Fatigue

The working posture has a direct effect on the level of muscular exertion in performing a task and on how quickly muscles fatigue.

11.1 Type of Posture

There are two types of posture produced by different types of muscle activity. Postures are either:

- **Dynamic**, which means a movement is performed; or
- **Static**, which means a body part is in a fixed position *e, the neck bent forward while using the keyboard of a computer*. Although there is no movement, the muscles produce tension to maintain the position of the body part.

Daily tasks are made up of both types of posture. In the figure below, dynamic muscle activity produces the working movements. The shoulder, arms or back are held in a stable position to allow the work to be done through static muscle tension.



11.2 Posture and Fatigue

Posture influences how long workers can do their job without fatigue or adverse health effects. Fatigue can produce an inflammatory response that can result in damage to tissues such as muscles and tendons. It also limits the time someone can work at a task.

Fatigue occurs earlier when muscles maintain body parts in a static position than when a movement is produced. This is because blood flow is restricted and the supply of energy for the muscle can run out if the static position is held for a long time. Static postures therefore make workers tire faster and take longer to recover from the effort.

11.3 Posture and Forceful Exertion

Forceful muscular exertions place high loads on the muscles, tendons, joints and discs, and are associated with most musculoskeletal disorders. Muscles fatigue with increased muscular exertion, and the time needed to recover increases. If recovery time is limited, an injury is more likely to occur.

More muscular exertion is necessary when the position of joints is away from their normal position. The further away, the more muscular effort is needed to produce a movement, hold a load, or maintain a body part in a fixed position.

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11.4 Forceful Exertions

Forceful muscular exertions place high loads on the muscles, tendons, joints, and discs, and so are associated with most musculoskeletal disorders. Muscles fatigue with increased muscular exertion,

and the time needed to recover increases. If recovery time is limited, soft tissue injury is more likely to occur.

The level of muscular effort is affected by a number of factors:

- **Working posture.** The level of muscular exertion needed for a task increases when a body part is in an awkward posture.
- **Static postures.** Holding a body part, such as the neck, back or shoulder, in a fixed position, for instance while holding a load or working with the hands places considerable stress on the body part. Figure above illustrates a worker with a static position of the shoulder while working with the hands.
- **Handling loads.** Loads which are heavy and/or bulky, or difficult to grip increase the muscular exertion needed from body parts such as the back and shoulders.
- **Fast movements.** Extra force is needed at the beginning and end of fast movements such as throwing or catching loads.
- **Type of grip.** Force requirements increase if the operator can not use a power grip which allows a large area of the hand to contact the handle or other gripping surface.
- **Vibrating tools or equipment.** Operators need to use increased grip force in working with vibrating equipment.

Forceful exertions are an integral part of other risk factors such as awkward postures, work area layout, tool use, nature of loads and load handling. Checklists and controls measures aimed at reducing the muscular exertion in performing tasks will be dealt with under these risk factors.

11.5 Working Postures

Working postures result from task demands and work area design. Posture affects the muscular effort needed to perform a job and how quickly muscles fatigue. Posture is particularly important when forceful and/or repetitive tasks are performed or static postures are maintained. The working posture is therefore important in preventing injury.

Postures either involve movement (dynamic posture) or a fixed position (static posture). Static postures result in earlier fatigue than dynamic postures because the blood flow is restricted and energy supplies can run out

Awkward postures are postures where the body parts are not in their normal position (that is, the trunk and head upright, the arm by the side of the body, forearms hanging straight or at a right angle to the upper arm, and the hand in the handshake position).

As a joint moves further away from the normal position, more muscular effort is needed to achieve the same force.





















Awkward postures are not necessarily harmful in themselves. In fact they can be necessary for good body function by increasing joint mobility and strength. However an awkward posture can cause damage to the muscles and other tissues in combination with:

- the exertion of muscular force, particularly with the joint in an extreme *position eg the back bent forward as far as it can go*
- another awkward posture *eg the back being bent and twisted*
- repetitive actions (because this increases wear and tear)
- repetitive actions where small muscles are involved, such as in the hand, because small muscles fatigue earlier
- maintenance of a static posture for a prolonged period. Even without a load being handled, the weight of a body part can lead to overload during static work (figure below).

Other working postures Other working positions that can be harmful are prolonged standing or sitting:

- Continuous standing (without walking) can lead to lower back discomfort and swelling of the legs, because of blood pooling in the lower legs.
- Prolonged sitting even with good chair design can lead to back pain and disc degeneration. This is linked to problems caused by the static posture with (a) the nutrition of discs, (b) decreases in the circulation and (c) pooling of blood in the lower legs.
- The risks from sitting are increased by twisting or bending the back while sitting, or using a chair that does not fully support the body.

11.5.1 Checklist - Working Postures

<p>1. Back Is work performed or loads supported with the back:</p>			
<p>a) bent forward?</p>		<p>Yes</p>	<p>No</p>
<p>b) twisted?</p>		<p>Yes</p>	<p>No</p>
<p>c) combined bending and twisting? (either sitting or standing)</p>		<p>Yes</p>	<p>No</p>
<p>2. Head and neck Is work performed when the head or neck is:</p>			
<p>a) bent forward?</p>		<p>Yes</p>	<p>No</p>
<p>b) bent backwards?</p>		<p>Yes</p>	<p>No</p>
<p>c) bent sideways?</p>		<p>Yes</p>	<p>No</p>
<p>d) Twisted sideways?</p>		<p>Yes</p>	<p>No</p>
<p>e) Bent and twisted</p>		<p>Yes</p>	<p>No</p>
<p>3. Arms and shoulders Is work performed (including reaching) without support for the forearms or elbows:</p>			
<p>a) above shoulder height?</p>		<p>Yes</p>	<p>No</p>
<p>b) with elbows out to side?</p>		<p>Yes</p>	<p>No</p>
<p>c) beyond forearm length in front of the body?</p>		<p>Yes</p>	<p>No</p>
<p>d) with arm reaching behind the body?</p>		<p>Yes</p>	<p>No</p>
<p>4. Elbow and forearm Is work performed with:</p>			
<p>a) twisting movements to end of range?</p>		<p>Yes</p>	<p>No</p>
<p>b) twisting movements with the wrist bent?</p>		<p>Yes</p>	<p>No</p>
<p>5. Wrist and hand Is work done with:</p>			
<p>a) excessive bending up or down of the wrist?</p>		<p>Yes</p>	<p>No</p>
<p>b) the wrist bent to either side?</p>		<p>Yes</p>	<p>No</p>
<p>c) the fingers straight with the wrist bent up?</p>		<p>Yes</p>	<p>No</p>
<p>d) the fingers bent with the wrist bent down?</p>		<p>Yes</p>	<p>No</p>
<p>e) the palm facing down when lifting heavy objects?</p>		<p>Yes</p>	<p>No</p>
<p>6. Hands and fingers Is it necessary to use:</p>			
			

b) a wide span?



Yes No

7. **Legs and feet** Are any of the following performed repeatedly:

a) sustained squatting or kneeling?



Yes No

b) jumping

Yes No

c) foot pedal work while standing?

Yes No

8. **Other postures** Are the following sustained for long periods:

a) standing continuously without walking?



Yes No

b) sitting continuously?

Yes No

c) sitting without back support and/or foot support?

Yes No

11.5.2 Control Options – Working Postures

Controlling poor working postures is done through redesign of the contributory risk factors that influence task demands *eg the work area, tools or equipment, loads, and load handling activities*. Although control options relating to these factors are listed, it is best also to consult the specific contributing risk factor itself.

Where it is not possible to redesign the task, work organisation factors such as job rotation may need to be considered to decrease the duration of exposure to an awkward posture

Back

- **Bending** movements can be reduced by the following:
 - design suitable work heights adjustable for workers of different heights and for different tasks
 - position materials between thigh and shoulder height
 - design workstations with adequate knee and foot clearance so that workers can get close to a work item without bending
 - provide items or equipment such as tilted work surfaces (height and angle adjusted), parts bins, and spring loaded surfaces
 - provide gravity-assisted devices or automatic feed devices
 - raise the work level using scissor lift tables, work dispensers and similar mechanical aids
 - provide a pallet lifter to maintain the top of the pallet at thigh height while loading cartons
 - provide good lighting so the worker does not have to bend to have good visibility of the work piece and other materials or items
 - use tilting or spring-loaded containers to reduce reaching over and into containers.
- **Bending** caused by reaching motions can be reduced by the following:
 - position tools, machine controls and work items close to workers to eliminate routine horizontal reaches over 30 cm from sitting and 50 cm from a standing position provide a pallet turner so the pallet can be filled from one position without over-reaching.
- **Twisting**
 - Place the most used work items on the worker's preferred side and within easy reach to avoid lifting across the body.
 - Design work area supply and disposal areas so operators do not twist to get supplies or dispose of completed units.
 - Educate workers to move their feet to turn, rather than twist their back in reaching behind.
 - Provide adjustable swivel chairs for seated workers.
 - When lifting, the pick-up and set down positions are often at an angle to one another. Provide sufficient work space for the worker to turn the whole body.

- Use turntables to allow rotation of loads for easy access.

Head and Neck

- Use an inclined work surface to reduce forward bending of the neck for tasks with hand-eye coordination such as drawing or precision work with tools.
- Work with documents and displays in front of the worker at a height to avoid the neck twisting and bending forwards
- The computer screen may need lowering for people wearing bifocal glasses. The viewing angle of the glasses can cause backward bending of the head if the screen is too high.
- Use a jig to reorient the work piece to improve the viewing angle for a task and so reduce twisting of the head.
- Have the working surface high enough for precision work.
- Improve the visibility of the task by reviewing levels of light. Inadequate levels of light can contribute to awkward postures.

Arms and Shoulders

- Keep work below shoulder height by modifying equipment or providing a platform to raise the effective height of the worker.
- Place computer mouse adjacent to keyboard at same level or lower, to reduce shoulder elevation and static shoulder load.
- Provide arm supports if manipulative tasks must be performed in a raised position. Arm supports reduce the load on the shoulders and the spine.
- Design work area supply and disposal areas so operators do not have to reach back to get supplies or dispose of completed units.
- Design workstations so work is performed with the forearm pivoting around the elbow (upper arm close by trunk).
- Shorten reaches so that workers can get close to objects to be handled.
- Use conveyors or turntables to shorten reaches when working with loads.
- Support the forearm or the tools being handled during sustained reaching by using arm rests for the forearms or counterweights for the tools.

Elbow and Forearm

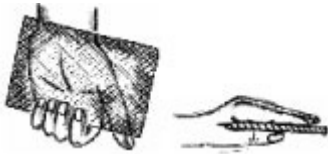
- Select tools that do not require the forearm to turn.
- Use jigs or other mechanical aids when assembling components that would otherwise need to be turned *eg threaded fittings*.
- Design equipment controls to avoid forearm rotation.
- Avoid rotating the forearms in opposite directions (clothes wringing action). Fix one section to stabilize so movement is needed from only one hand.

Wrist and Hand

- Use tools or levers that allow the wrist to remain straight. Follow the principle of 'bend the tool or tool handle not the wrist'
- Position the work piece during assembly or maintenance operations to reduce awkward wrist positions. Use jigs and fixtures to hold parts in the best orientation to reduce bending the wrist.
- In packaging operations, consider tilting either or both, the table or conveyor to reduce wrist bending.
- When working with the fingers in a straight position, keep the effort very low and do not bend the wrist backwards.
- Avoid working with the wrist bent down when the fingers are moving or an object is being gripped. Grip strength decreases rapidly under these circumstances.
- When objects have to be moved around the working surface, slide rather than lift them.
- Reduce the time it is necessary to repetitively apply high hand force with a bent wrist by rotating staff *eg automotive assemblers*.

Hands and Fingers

- Avoid using pinch grips unless precision is required. Use a hook grip where possible when handling thin items



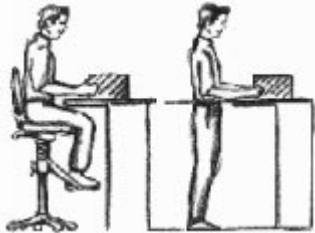
- Avoid gripping requirements in repetitive work that spread fingers and thumb apart more than 6 cm. Vibrating hand tools with a wide grip are of particular concern.

Legs and Feet

- Organise work so only necessary stages must be performed at low levels that require squatting or kneeling.
 - Provide a cushioned surface, such as knee pads or padding on the floor
 - Avoid squatting in repetitive work
 - Limit squatting to low-duration tasks
- Use mechanical devices instead of the knee as a hammer.
- Fit suitable steps to heavy vehicles and loading docks to deter jumping.

Other

- Relieve a static standing posture by providing:
 - an opportunity for sitting down during short breaks
 - a seat or sit-stand chair so workers can change posture when needed



- adequate foot and knee space under the work surface
- a horizontal bar or rail at the base of workbenches or counters for foot support tilting the hip and easing strain on the lower back muscles.



- a wooden platform or anti-fatigue matting on hard floor surfaces.



- work component positioning so the worker has to walk a few steps to get them.
- Relieve a sitting posture by:
 - designing the job so the worker has to get up and walk around occasionally
 - storing some items a distance away so the operator must get up to obtain supplies

- encouraging workers to take a micro break every hour to stand up and stretch.

11.6 Repetition and Duration

Repetition is a major component of most musculoskeletal disorders. Repetition refers to the performance of similar work cycles with the same actions *eg assembling circuit boards or packing boxes*. This means the same muscles are being used continuously.

Repetition itself is hazardous but is even more so when combined with awkward postures, forceful exertions, fast movements and cold conditions. Repetitive movement can result in–

- an increase in ‘wear and tear’ of body tissues because of the limited opportunity for them to recover during repetitive work
- a greater potential for muscle fatigue, which may be followed by an inflammatory response and tissue damage.

Work is considered repetitive when:

- the duration of a work cycle is less than 30 seconds; or
- a fundamental activity in the work cycle is repeated for more than 50% of the work cycle time *eg when obtaining, packing and disposing of a box, the 10 separate actions needed to pack 20 bottles in the box is the repetitious fundamental activity taking more than 50% of the work cycle.*

Work must be performed continuously for a minimum of 60 minutes in order to be considered repetitive.

Duration refers to the amount of time a worker is exposed to a risk factor such as repetitive movement, awkward postures and vibration. The duration of tasks can have a substantial effect on the likelihood of both general and muscle fatigue.

11.6.1 Checklist - Repetition and Duration

1. Does the work cycle repeat every 30 seconds or less?	Yes / No
2. Does the worker apply force repetitively or continuously?	Yes / No
3. Do repetitive tasks performed by a worker in a working day have similar physical demands eg <i>writing, typing and stapling or lifting, stacking and picking?</i>	Yes / No
4. Is it necessary for highly repetitive work to be done continuously for more than 60 minutes?	Yes / No
5. Does the work involve repetitive forceful gripping of tools for most of the working day?	Yes / No
6. Is high repetition work over 4 hours in total distributed through an eight-hour shift?	Yes / No
7. Are any of the following work postures sustained for more than a total of 2 hours?	
a) working with the back bent forward?	Yes / No
b) overhead work?	Yes / No
c) work with arms out from the body with elbows at or above mid-trunk height?	Yes / No
d) bent wrists?	Yes / No
e) kneeling or squatting?	Yes / No
8. Are long shifts or regular overtime worked where jobs involve:	
a) repetitive and forceful work involving the hand/arm?	Yes / No
b) heavy load handling (lifting, carrying, pushing/pulling)?	Yes / No

11.6.1 Control Options – Repetition and Duration

Some repetitious tasks can be eliminated by job redesign; however other repetitious tasks or activities of long duration can only be reduced by altering exposure time through work organisation factors.

Job Redesign

- **Share the load.** In some situations it may be possible for customers or clients to do some of the repetitious work:
 - delivery of goods (cartons of beer, boxes of fruit and vegetables to be unloaded and stored in the designated storage place by the delivery personnel.

Job Mechanisation

- Engineer products to allow machinery to do highly repetitive tasks and leave more variable jobs to workers.

- Provide mechanical aids.

Work Organisation

- **Change task order.** Analyse the sequence of tasks to see where both long static contractions and frequent repetitions occur. Changes could include:
 - alternating the working hand to reduce repetitions
 - varying heavy handling tasks with lighter tasks
 - alternating repetitive with non repetitive tasks.

The alternative tasks should allow the active muscles to recover.

- **Job rotation** helps to distribute the work load over a larger number of workers and give individuals the chance to recover from fatigue. Plan rotation activities carefully so that the same body parts are not exposed to similar risk factors *eg if one task stresses the left shoulder, then the next task in the rotation should allow the left shoulder to recover.*

In general, the length of rotation should depend on the physical demands of the task. Effective rotations are usually 2-4 hours or less for jobs requiring fine hand/eye coordination.

- **Job enlargement.** Restructure jobs so each worker has a larger number and more varied tasks to perform *eg getting supplies or moving finished work.* This should include a corresponding increase in the time to do a task.
- **Work/recovery cycles.** Rest breaks are necessary in repetitive or heavy work to prevent fatigue and to allow recovery of body tissues. Rest breaks are also necessary if performance and efficiency are to be maintained in these tasks.

In general the longer the period of continuous work, the longer the recovery period should be. The length and frequency of breaks depend on the task/s. Generally, frequent short breaks promote recovery better than less frequent longer breaks after long periods of activity. The following table describes different types of break.

Spontaneous Breaks

Opportunities to pause occur naturally in most jobs. It is best if workers can take regular mini rest pauses (1 minute or less) on their own initiative and within the constraints of the job they are doing.

Take the opportunity to reduce stress on muscles and tendons by stretching the working muscles (as sports people do). For example:

- If sitting with the back and head inclined forward, stand and stretch with the back slightly backward.
- Hold the wrist in the opposite direction from its position while working.

Working Breaks

Overcome fatigue by moving to another task using a different body part

Fixed Breaks

In some jobs, it could be necessary to design rest breaks into the work pattern or task.

Extended hours. Determine whether the type of work is suitable for shifts longer than 8 hours. Repetitive, physically or mentally demanding work could need further consideration before increasing the exposure to risk factors. In general:

- redesign tasks when overtime is scheduled for heavy or repetitive work
 - provide additional recovery time where overtime occurs often, or is a normal part of a job
 - do not require workers recovering from injury to work overtime.
- **Training in work technique.** Identify the best way to do the more difficult, repetitious tasks *eg the sequence of task elements or the way the job should be broken up so muscle, tendon and joint strain is minimised*. Train workers in the techniques.

11.7 Work Area Design

The work area (or workstation) is part of the workplace where a particular job is based. It includes work benches, conveyors, furniture and fittings and the equipment used by workers doing that job.

The positioning and relationship of the different elements in a work area to each other and to the worker are important because of the effect on working postures through the:

- amount of reaching, bending or twisting needed increasing the muscular effort needed to handle loads in these positions
- static postures which can affect the back, neck and shoulders in particular
- height at which tasks are performed, with the problems of having the neck and back bent if too low, and the shoulder and arms raised if too high
- visual access to the work which can affect having to bend the neck and/or back to see the work properly.

A well-designed work area lets workers work in an upright position, shoulders in a natural position (not elevated) and upper arms close to the trunk most of the time without large reaches to perform.

11.7.1 Checklist - Work Area Design

1. Does the worker have easy access to all components and equipment needed for the task without bending, reaching or twisting?	Yes / No
2. Are controls, switches or keys on tools, equipment or instruments:	
a) beyond easy reach?	Yes / No
b) difficult to grasp or activate?	Yes / No
3. Are displays difficult to read from the worker's usual working position?	Yes / No
4. Are the working surfaces:	
a) too high so the elbows are raised or the upper arms are out to the side?	Yes / No
b) too low, so it is necessary to bend forward?	Yes / No
c) oriented for good visibility?	Yes / No
5. Are frequent reaches needed to grasp equipment or objects performed with the arm straight out in front or out to the side of the body?	Yes / No
6 Does seating:	
a) accommodate all workers?	Yes / No
b) support the lower back during prolonged seating tasks?	Yes / No
7. Computer use. Are awkward postures of the head, shoulder or wrist caused by the location of:	
a) the screen or document?	Yes / No
b) the keyboard and pointing device?	Yes / No

11.7.2 Control Options – Work Area Design

Placement of Components for Manual Tasks

- Provide all materials, tools, controls and maintenance items in front of the worker and between waist and shoulder height.



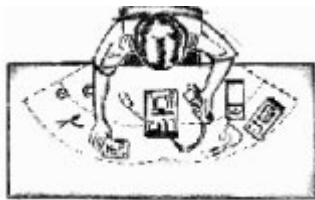
- Design work area supply and disposal areas so operators do not twist to get supplies or dispose of completed units.
- Place bins or pallets supplying materials with their top at about elbow height.

- Place components on the worker's preferred side.
- Change the orientation of parts arriving on conveyors so the worker does not have to bend the wrist to grasp them.

Displays and Control Instruments

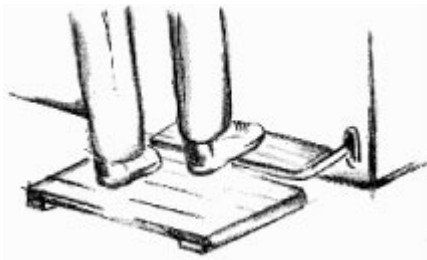
An effective layout of both displays and control instruments will make monitoring easier and reduce having the head and neck in awkward postures.

The primary hand movement area for frequent use is about a half-arm reach distance from the body (with the forearm pivoting around the elbow). The secondary hand movement area is at about a full arm reach (with the shoulder and arm relaxed) measured from the palms not the fingertips







Consider the following in selecting and positioning displays and controls:


- Place frequently used displays and controls or controls used in emergencies *eg stop buttons* directly in front of the operator.
- Operate controls at around elbow height without bending or twisting the body.
- Select control instruments and their position so fingers and hands can be used for quick precise movements and arms for operations requiring force.
- Select foot controls rather than hand controls if greater force is required.
- Pedals are best operated from a seated position. If the worker has to stand up, make the pedal large and for use with either foot. Locate a foot pedal at floor level to avoid uncomfortable foot and leg positions (figure below).



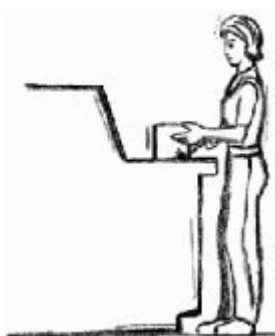
Working Height

The following table summarises the recommended working height for different types of tasks –

Vertical location	Task
<p data-bbox="230 405 516 478">Above elbow height (4-6 cm)</p> 	<p data-bbox="524 405 1377 520">Tasks with high visual demands such as delicate or precision work. A sloping work surface may also be necessary for some tasks to meet visual demands and to allow the worker to work without bending forward.</p> <p data-bbox="524 552 1377 625">Using a slanting desk of 45° can help produce a head position at about the recommended angle for vision</p>
<p data-bbox="230 783 516 856">Elbow height, or just above</p> 	<p data-bbox="524 783 1377 856">Tasks where the hands make a narrow range of movements, and where the elbows can rest on the work surface</p> <p data-bbox="524 888 1377 961">Tasks that have hand/eye coordination. A sloping surface will reduce muscle effort on the arms and shoulders.</p>
<p data-bbox="230 1161 516 1234">Just below elbow height</p> 	<p data-bbox="524 1161 1377 1234">General light manipulative tasks or tasks involving the use of a keyboard. Do not restrict arm movement by armrests or cluttered work surfaces</p>
<p data-bbox="230 1539 516 1612">Between elbow and hip height</p> 	<p data-bbox="524 1539 1377 1570">Tasks incorporating a range of arm movements using the shoulder</p>

<p>Hip height</p> 	<p>Tasks requiring considerable muscular effort or use of the body for leverage</p>
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It is the height at which the hands are working which is more important than the working surface height. The work surface height should be the recommended height minus the thickness of the item being worked on (figure below)



Working Reaches

Locate work components at a comfortable distance from the body. Workers should be able to perform frequent reaches, particularly in repetitive tasks, and/or when handling loads without (a) bending forward or sideways the back or (b) twisting the back. The upper arm should be as close to vertical as possible to reduce the load on the shoulder.

Frequent reaches should be no more than 30 cm to the front of the body in a seated position and 50cm in a standing position.

Infrequent reaches should be no more than 50 cm, or so that the elbow is not straight when force is applied *eg when using tools or picking up loads*.

Handling capability decreases as reach distance increases. Occasional long reaches *eg to turn off a switch*, can be beneficial in sedentary jobs.

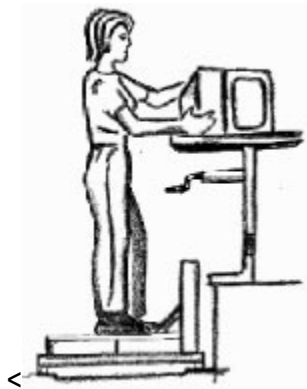
Other reaches to be avoided if done frequently include:

- reaching above shoulder or head height
- holding the arms in front or to the side of the body
- reaching behind the back.

Adjustable Workstations

Differences in body size of workers are usually large in any workplace. A single work surface height may not be suitable for all workers in a multi-worker station.

Adjustable work surfaces, work stands and table tops allow work surface heights to be quickly matched to a range of workers and changing tasks *eg from working on large to working on small objects*



Changing the orientation of the work surface (by tilting) may be necessary particularly for tasks requiring manipulation.

Where it is not possible for workstations to be adjustable, design:



- height to suit tall workers and raise shorter workers by providing moveable platforms or benches reaching distances for shorter workers and the largest workers will also be able to reach comfortably
- knee and leg clearance under work surfaces so larger workers can move the body easily
Smaller workers will have all the more room.



Seating

Seating should generally be adjustable and have the following features:

- a contoured backrest with a lumbar curve except those where the backrest would interfere with the actions to be performed
- chairs which swivel to prevent twisting to reach workstation components
- arm rests where hand activity is not continuous and the worker is able to rest the arms from time to time.

Key points for chair adjustment include the following:

- the seat height should allow the elbows to be at the correct height above the working surface - a separate foot rest or foot bar on the chair pedestal if the seat height does not allow the feet to be flat on the floor
- an adjustable backrest to support the lumbar region of the back.

Computer Workstations

Locate the keyboard so that the forearms are approximately horizontal with the elbows at the level of the home row of keys:

- Locate monitor so the screen is no higher than the operator's eyes. Keep the screen and document at the same distance from the eyes so the eyes do not have to keep adjusting to distance.
- Locate the screen and the document as follows:
 - if the screen and document are viewed equally, have them side by side, at the same height in front of the user
 - when one is the primary object for viewing, position it in front of the keyboard and the other to the side, but as close as possible.

11.8 Hand Tool Use

Poor design and excessive use of hand tools are associated with chronic disorders of the hand, wrist and forearm *eg carpal tunnel syndrome and wrist tendonitis*. Major factors affecting the potential for injury include:

- **Muscular effort** in using (holding, operating and guiding) tools because of poor handle design, heavy, poorly balanced and/or poorly maintained tools
- **Static loading** of arm and shoulder muscles from holding tools. This can lead to fatigue when maintained for prolonged periods and eventually to injury.
- **Awkward wrist positions**. Holding tools with the wrist bent up, down or sideways causes additional muscular effort in using tools
- **Contact stresses**. Pressure on tissues or joints, such as tools pressing into the palm at the base of the thumb where blood vessels and nerves pass through the hand. This contributes to the development of carpal tunnel syndrome
- **Wide grip span** can cause tendon injury known as 'trigger finger'. The risk is increased when force is exerted at the limits of the grip span.

11.8.1 Checklist - Hand Tool Use

1. Are tools used which bend the wrist up, down or sideways?	Yes / No
2. Are tools selected which are :	
a) able to be used in either hand?	Yes / No
b) evenly balanced?	Yes / No
c) designed for specific purpose?	Yes / No
3. Are tools of more than 1.5 kg used without aids to assist in supporting them?	Yes / No
4. Tool handle design . Are problems caused because they:	
a) need to be held firmly through not having good friction with the hand?	Yes / No
b) are made of non-resilient material (metal etc)?	Yes / No
c) dig into the palm area?	Yes / No
d) require use of a wide grip span (scissors or pliers etc) which is excessive (more than 10cm) or cause discomfort?	Yes / No
e) require a lot of force applied by the back of the fingers and thumb to open the handles of tools such as pliers, scissors or shears?	Yes / No
5. Tool handle dimensions :	
a) Do they have a grip diameter suitable for most workers?	Yes / No

b) Are they long enough to pass along the whole hand/palm and allow all of the hand and fingers to stay on the grip? Yes / No

6. Does the design of the **trigger** allow:

a) use by only one hand? Yes / No

b) activation only by the finger tips? Yes / No

c) it to be locked on if activated for more than 30 seconds? Yes / No

7. Is there repeated shock to the hand or wrist through tool design, such as the reaction of power tools after the torque limit is reached? Yes / No

8. Can torque be resisted other than by muscle force? Yes / No

11.8.2 Control Options - Hand Tool Use

Tools used infrequently do not cause harm. It is when they are used repeatedly and/or for long periods that hand tool and work area design become critical.

The primary purpose of controls for hand tools is to minimise the level of muscular effort, including loading of the shoulder and wrist needed to use them. Support tool use with (a) a maintenance program to keep the effort in using them at the lowest possible level, and (b) by training for workers in their use.

The work station situation as a whole may also need to be evaluated *eg work surface height, product orientation*. These factors can also cause problems even when a properly designed hand tool is used. Make sure space is provided for the range of movement of the tool and limbs of the operator using the tool.

General Characteristics

- **Tool handle and work piece orientation.** Choose tools that can be held with a neutral wrist or handshake position and the hand with a comfortable span (not too open or too closed). Orient jigs and fixtures holding the work piece so the wrist does not have to bend.
- **Use in either hand.** Select tools which can be operated in either hand. Controls should also be placed so they can be operated from either side. Tools should be able to be used in either hand because:
 - workers should be able to use the preferred hand because it is stronger, faster and more accurate where precise manipulation is important (left handed people make up about 10-12% of the population)
 - in repetitive work it is desirable to be able to change hands, whatever the dominant hand, so as to rest the working limb. It also reduces the load on that shoulder.
- **Power tools.** Use power tools where possible to reduce the muscular effort needed i.e. electrical slicer for slicing meats for the kitchen, or a hand held blender.

- **Special purpose tools.** Provide specially designed tools of the right size, weight and strength, for instance, knives, and other hand tools for operations with highly repetitive actions.

Tool Weight

The weight of a hand tool will determine how long it can be held or used and how precisely it can be manipulated.


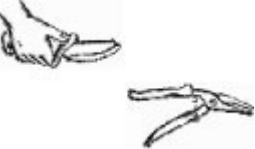
- **Effective weight.** The weight supported by the worker should be:
 - as low as possible for precision tools, but not more than 1.75 kg.
 - for power tools, preferably about 1.5 kg, but not more than 2.3 kg.

The muscular effort in holding a tool can also be reduced by :

- altering the length of the tool handle using ratchet handles
- using reaction bars
- using articulating arms.
- **Balance of tool.** Where possible the heaviest part of the tool should not be in front of the wrist.

If it is not well balanced, the effort needed to grip the tool to stop it tilting forward is increased.

- **Heavy Tools.** Consider the following where heavy tools must be used:
 - **Suspended tools** for operations repeated in the same place
 - **Balancers.** Provide counterbalancing equipment for repetitive work with heavy tools, or if tools have to be held away from the body. Keep balancers adjusted.
 - **Grip/handle design.** The handles should be cylindrical or oval and designed for a power grip so the hand can wrap round the handle. The following table summarises control measures for handles –

<p>Gripping surface</p>	<p>Handles with a knurled surface or small indentations are best for good friction between hand and tool.</p> <p>Finger grooves are undesirable, as they add extra pressure with the hands rarely conforming to the grooves.</p>
<p>Handle covering</p>	<p>Covering the handle with a compressible material (if made of hard plastic or metal) produces a better grip. Rubber, compressible plastic or wood are the best materials.</p>
<p>Contact stress</p>	<p>Avoid sharp edges <i>eg thin scissor handles</i> or areas that dig into the fingers or palm of the hand.</p>
<p>Grip span</p> 	<p>For tools with two handles (scissors) grip spans should be about 6 cm, and not more than 9 cm. The grip becomes weaker as it gets wider.</p>
<p>Spring returns</p>	<p>Provide pliers, scissors and wire cutters with a spring return to return a tool to its starting position. Check the mechanism to see they do not bring other problems such as being hard to close</p>
<p>Grip guard</p> 	<p>A guard or stopper at the front of tools such as knives or soldering irons allows more force to be exerted</p>

Grip/Handle Dimensions

The dimensions are important in providing a good grip and so letting the task be done without increasing the muscular effort needed. Approximate dimensions are as follows.

Power tools	Grip length about 12 cm (add 1.5 cm for use with gloves) and about 5 cm in diameter to allow a good contact area between the palm and the handle. Tools used in highly repetitive operations should not spread fingers and thumb more than 6 cm .
Precision tools	The length about 10 cm and the diameter about 1 cm to allow for a comfortable pinch grip.

Trigger Design

The design should facilitate force exertion and allow easy activation by either hand:

- **Trigger strip** of at least 5cm is best so that it can be activated by 2 or 3 fingers and so reduce muscle fatigue
- **Trigger locks** should be used where the grip has to be sustained for more than 30 seconds.

Tool Use

- **Reach distance.** Keep the distance between the body and the work piece as small as possible. The level of muscular effort needed increases with the reach distance.
- **Secure work item.** Use an aid such as a vice or clamp to reduce static postures in holding an item.

Impact Force

- **Shock loadings.** Use internal damping to reduce repeated shocks to the hand and wrist from hand-held power tools.
- Avoid prolonged exposure to repetitive use of hammers for assembly because of the repeated shocks to the wrist and hand.
- **Torque.** Limit torque reaction by using:
 - clutch-type tools, shutoff tools, hydraulic pulse tools, and external devices such as torque bars or articulating bars as small a tool as possible to reduce torque during use

11.9 Nature of Loads

Loads that have to be manually handled by workers can increase the potential for overexertion and fatigue through the amount of muscular effort needed to handle them.

Important factors include:

- **Size and shape of load.** Loads which are large or bulky and cannot be held close to the body, or are asymmetric and put uneven forces on the spine
- **Loads difficult to grip** through unsuitable handles or handholds or surface textures
- **Unstable or unwieldy loads** can create sudden high muscle forces and result in overloading of muscles, tendons or discs.

11.9.1 Checklist - Nature of Loads

1. Is the load heavy or bulky?	Yes / No
2. Are the dimensions of the load:	
a) too wide (> 50 cm)?	Yes / No
b) too long (> 30 cm)?	Yes / No
c) too high for comfortable handling <i>eg to see over the top?</i>	Yes / No
3. Are handles or handholds:	
a) provided on heavy loads?	Yes / No
b) too small for workers' hands to fit through?	Yes / No
c) too small if gloves are required?	Yes / No
d) positioned low on the load?	Yes / No
e) of textures so they make the load harder to grasp <i>eg wire?</i>	Yes / No
4. Is the weight distribution of the load uneven, with no ready identification of the heavy side?	Yes / No
5. Is the load difficult to grasp because:	
a) it is smooth, slippery, greasy, wet?	Yes / No
b) designed with sharp edges or protrusions?	Yes / No
a) uncomfortably hot or cold?	Yes / No
6. Can the load move suddenly because:	
a) it has contents that can move suddenly?	Yes / No
b) it is an awkward shape <i>eg sheet material?</i>	Yes / No

11.9.2 Control Options – Nature of Loads

It is important that employers specify to suppliers how items coming into the workplace are sized and packaged etc

Load Size and Shape

Modify loads to facilitate handling in the following ways:

- Repackage load into a different weight, size or shape:
 - put in smaller containers,
 - specify smaller or more manageable loads when purchasing or reduce the size or capacity of those produced in-house.
- Reduce the number of objects handled at one time.
- Increase object weight – could be better handled mechanically using a unit or bulk load concept such as palletised loads. Make sure workers are trained in how to use the equipment properly.
- Provide lifting eyes or similar lifting points so mechanical lifting aids can be used. These designated lifting points allow loads to be handled with minimum risk.

Load Dimensions

To allow the best grip on a package or container, the ideal dimensions are as follows:

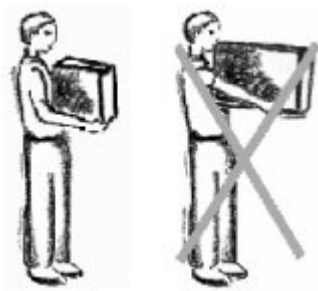
- The width of the load (measured across the body) no more than about 50 cm to allow the elbows to be supported against the trunk



- The length of the load should not extend more than 30 cm away from the body so its centre of gravity is close to the worker's body



- Any two dimensions are no more than 75 cm



- For loads without handles, it should be possible to reach the bottom front corners of the load when carrying it at hip height.
- Load height should allow workers to see where they are going or where loads have to be placed.

Container Handles/Handholds

Loads with handles require less effort in gripping, and are easier to manipulate. Ask suppliers to deliver goods in sturdy boxes or containers with handles/handholds. If made of cardboard, the area near the handhold should be reinforced so that it does not rip when the box is picked up.

Avoid single handles which require one-handed lifting and always provide two handles/handholds:

- on heavy loads
- on containers that are moved frequently
- when the nature of a load makes it difficult to grasp.

Container handles should have the following features:

- Width enough for the palm and of a depth to accommodate the knuckles *eg 11 cm wide by 5 cm*. Add 2.5 cm to these dimensions if using gloves.
- Placed towards the top of a load for stability and to reduce the distance it has to be lifted if stored at a low level.
- Cylindrical handles of about 4 cm in diameter.
- Handle covering *eg padding* to reduce local contact stresses from hard or sharp surfaces. Use lightly ribbed or textured handle surfaces when hand slippage is a problem.

Uneven Weight Distribution of the Load

Off centre loads should be positioned for handling with the heavy side closest to the body. Indicate the heaviest side *eg with an arrow drawn on the packing carton* and train workers so that they are aware of what this means.

Difficult to Grasp Loads

Where handles or handholds can not be provided:

- consider the possibility of providing handheld hooks or suction pads for suitable loads
- make sure the outside surfacing is easy to grip, and not slippery
- arrange for hot or cold materials to be in insulated containers, otherwise the operator may hold the load away from the body for protection
- use handling grip devices adapted to the particular object to be carried.

Risk of Sudden Movement of the Load

Arrange items in a package so they are well anchored and will not shift unexpectedly while being handled:

- Where the load as a whole lacks rigidity, use slings or other aids to maintain effective control during handling.
- Fill containers holding liquids or free moving powder, leaving only a small amount of free space.
- Use baffles, dividers or packing to keep the contents stable in partly filled packages.

Unstable Loads

Under windy conditions, materials carried vertically such as glass or plasterboard can place unpredictable physical stress on the hand taking the weight, and the shoulder on which it is supported.

11.10 Load Handling

Load handling refers to the transfer of loads in a workplace. Lifting and carrying, which are common handling methods in industry, are a major cause of lower back disorders. The shoulder is also affected in these activities by supporting the load. Pushing and pulling are also causes of back strain.

Factors which increase the risk of injury include:

- **Handling in awkward postures** (such as twisting, bending and over-reaching) when combined with load handling is potentially harmful because of the stress on the lower back.
- The further the centre of gravity¹¹ is away from the spine, the stress on the back increases
- **Combining two activities.** Twisting while bending is particularly harmful.
- **Repetitive handling.** This increases the risk of cumulative damage happening, particularly when done for a prolonged time. The risk increases with the length of time repetitive lifting is done over the long term.

- **Static load.** Carrying loads involves static effort in stabilising the shoulders and trunk. This can affect the muscles of the back, shoulder and arms and, as well as cause wear and tear on the intervertebral discs. The carry distance can affect the duration of static loading and increase the risk of adverse health effects.
- **Asymmetric lifting.** Lifting loads asymmetrically *eg by twisting the trunk or lifting with one hand* can cause hazardous stresses to the lumbar area of the spine.
- **Constricted work space.** Handling materials with limited ability to manoeuvre or stand up straight increases the muscular exertion needed to perform a manual task.

Assess load handling at every stage including:

- transport and reception
- handling at the workstation
- storage and distribution.

11.10.1 Checklist - Load Handling

1. Do the workers rate the effort required to handle the load as too high?	Yes / No
2. Is lifting or carrying carried out when mechanical aids could be used?	Yes / No
3. Are loads located in a position at the beginning or end of lifting which:	
a) require awkward postures (bending, twisting or reaching etc)?	Yes / No
b) make it difficult to reach, grasp or hold?	Yes / No
c) require manoeuvring to be placed accurately into position?	Yes / No
4. Is the load stored:	
a) below the worker's knuckle height or above shoulder height?	Yes / No
b) Where it requires extended reach?	Yes / No
7. Is a seated worker required to lift or push/pull a heavy load?	Yes / No
8. Could the distance between where loads are located and where they will be used be reduced?	Yes / No
9. Is a worker working alone required to handle heavy/bulky loads?	Yes / No
10. Is pushing/pulling performed:	
a) when the body is twisted?	Yes / No
b) during reaching?	Yes / No
c) with the handle at a height that allows best force application?	Yes / No
d) using trolleys with wheels that are too small?	Yes / No
11. When sliding, pulling or pushing an object, is the object easy to move?	Yes / No

11.11 Individual Factors

Individual factors that can increase the likelihood of health and safety problems include:

- **Skills and experience.** Being inexperienced in a job is a significant risk factor particularly in tasks involving high force.
- **Physical characteristics.** An overload situation may result from a mismatch between the workers and the task.
 - Workers under 18 years have not reached physical maturity and can have difficulty in coping with physically demanding work
 - Older workers may have a decreased physical capacity, and this should be considered in physically demanding or fast work.
 - Workers with a recent work-related injury have a greater chance of being re-injured.
 - Pregnancy affects the risk of back pain because the changing shape of the body places more work on the back muscles in supporting the weight of the uterus.
- **Unaccustomed work.** Workers who are new, have transferred from another job or are returning from extended absences and whose muscles are not conditioned to the work.
- **Job satisfaction.** There is increasing research that a worker's ability to influence the planning of their work and breaks helps prevent musculoskeletal injuries. Job stress can cause increased tension in muscles and an increased potential for injury.
- **Personal protective equipment (PPE) and clothing** either because it is lacking or unsuitable, can increase the potential for injury. For instance, incorrectly sized gloves interfere with a worker's gripping ability and manual dexterity and so contribute to increased muscular effort and fatigue.

11.11.1 Checklist - Individual Factors

1. Are inexperienced workers doing:	
a) heavy load handling tasks?	Yes / No
b) machine paced tasks where the speed has been set for experienced workers?	Yes / No
2. Have workers received training for specific tasks with regard to:	
a) the use of specialised equipment including power tools?	Yes / No
b) safe and efficient work methods including handling of loads?	Yes / No
c) the use of mechanical devices?	Yes / No
3. Are there physical factors that indicate a mismatch between the worker and the task?	Yes / No
4. Has the worker:	
a) been allowed a period of adjustment after an absence?	Yes / No
b) who is new to the task or returning from an absence been expected to perform at full production rates straight away?	Yes / No
5. Does the worker have:	
a) some say in the planning and arrangement of work tasks?	Yes / No
b) control over the timing of breaks?	Yes / No
6. Are workers wearing clothing/PPE for manual tasks such as:	
a) clothing which allows a task to be done in the most efficient way?	Yes / No
b) gloves that do not reduce grip stability, dexterity and strength of grip?	Yes / No
c) knee pads for repeated or sustained kneeling? error in standard	Yes / No

11.11.2 Control Options – Individual Factors

Skills and experience

The practiced ability to perform a task skilfully is important in working safely and efficiently. See that a worker's skill matches the task particularly where:

- heavy or repetitive load handling is concerned
- work is done at a fast pace, with the individual worker not being able to vary the pace.

Training

Training is an important supplement to the control process in allowing new equipment to be used, or work processes to be done in the safest way. Make sure:

- training specific to the task has been provided
- workers have been allowed a period of time to consolidate their learning to reach their optimum capacity.
- training has been updated where new tools, equipment or methods have been introduced

Do not use training as a control in itself or as a substitute for job redesign. Reliance should not be placed on people working safely in a hazardous environment.

Physical capacity of workers

Adapt work systems to accommodate the health/fitness status of a worker. If this is not possible allocate the worker to other tasks:

- Avoid allocating young (under 18 years) or older workers to physically demanding or fast work
- Assess tasks for workers with a previous back injury
- Remove pregnant workers from physically demanding tasks such as lifting or carrying heavy loads, particularly in the last 12 weeks of pregnancy.

Allow pregnant women to have a self-regulated pace of work so they can take adequate rest pauses.

Increase the proportion of work that can be done from sitting and avoid prolonged standing (figure 10.33).

When making decisions about individual workers, it may be necessary to seek assessment through a health professional *eg an occupational therapist* in relation to the specific duties of a job.

The current health status might only be temporary (such as recovery from injury, surgery or illness). For such workers, arrange a gradual adjustment to physically demanding work activities.

Unaccustomed Work

Unaccustomed work can affect workers:

- who are new or transferred
- returning from extended absences (*eg* and injury, vacations or layoffs)
- working on a process which has been redesigned.

To reduce the risk of injury, provide transition periods for such workers to work up to full speed. Provide an adjustment process through:

- reduced line or machine speeds
- reduced workloads or more frequent breaks

- job rotation.

Job Satisfaction

Let workers have some flexibility in going about their work to prevent or reduce job stress. Where possible allow workers to:

- alternate between different tasks where it does not upset other work procedures
- take short breaks doing another task when the job is monotonous
- get help from another person when necessary
- have a say in the introduction of new working methods.

Clothing and PPE

To prevent a decrease in work efficiency or an increase in injury potential, consider the following.

- Clothing which restricts the ability to move freely should not be worn.
- When gloves have to be worn:
 - provide different sizes so the right size can be selected
 - cover only the area of the hand necessary to protect the worker (vibration).
- Provide knee protectors for work involving kneeling to reduce stress on the knee.

Note: Abdominal belts are not considered effective PPE as they have not been shown to offer protection against the risk of back injury.

11.12 Work Organisation

Work organisation factors can intensify task demands by:

- increasing the duration of exposure
- increasing the frequency with which tasks are performed is particularly detrimental in repetitive tasks
- reducing recovery time.

Organisational factors that are detrimental include:

- **staffing levels** too many/few workers for load demands
- **pace of work and bonus schemes** by causing excessive demands to be made on workers which can contribute to increasing muscle tension and reduced functional capacity.
- **lack of task variability** can increase the load on muscles and tendons due to lack of changes in posture and the chance for recovery.

- **inadequate rest breaks** may not allow enough time between exertions and so contribute to fatigue and overexertion. The accumulation of fatigue and lack of recovery can lead to permanent muscle injury.

11.12.1 Checklist - Work Organisation

1. Is the work affected by:	
a) insufficient workers to complete tasks within a deadline?	Yes / No
b) peaks in demand or seasonal volumes of work?	Yes / No
c) bottlenecks or sudden changes or delays to the flow of materials?	Yes / No
2. Are the task demands such that the worker is able to:	
a) vary or control the pace of work?	Yes / No
b) vary the nature of the work to prevent monotony or overuse of the same muscles?	Yes / No
c) take regular short breaks easily <i>eg machine pacing, bonus schemes, short staffing, peak demands?</i>	Yes / No
3. Do any paced tasks require:	
a) forceful exertions?	Yes / No
b) getting into awkward postures in trying to keep up with the pace?	Yes / No
4. Does the method of work increase the work rate (bonuses, piecework, quotas)?	Yes / No
5. Are there adequate procedures for a worker to report unsafe equipment or environmental conditions?	Yes / No
6. For tools, equipment and mechanical handling devices are there adequate:	
a) selection processes?	Yes / No
b) purchasing specifications?	Yes / No
c) instructions in safe use?	Yes / No
d) maintenance programs	Yes / No

11.12.2 Control Options – Work Organisation

Work load

Periodic peaks in workload can be controlled by:

- arranging staff levels so there are workers available to complete tasks within deadlines or at peak periods
- anticipating peak work loads by preparing work for those times when deadlines become urgent
- scheduling work to avoid recurrent deadline stress as many jobs have predictable peak periods that may result in large variations in job demand

- planning resources and organisation of tasks to prevent increased risks during these peak periods.
- rearranging materials flow round the worksite or between different parts of the work process, to smooth out peaks and troughs in workloads and reduce double handling.

Work Pacing

Do not increase work rates where there is exposure to risk factors at unsafe levels. When a work rate needs to be established, employers must consult with WHSR/s and WHSO/s and the workers concerned.

- Self-paced work is preferred for critical or physically demanding tasks.
- Provide adequate supplies of materials needed for the job so workers do not have to leave their work area and fall behind in production.
- For workers on an assembly line or who are machine paced, provide buffers to allow material to be taken off-line
- Buffers are especially important for inspectors or in positions where the time to perform a task can vary.
- Provide adjustability in the line speed. Reduce the speed for abnormal conditions such as poor-quality raw materials or new products.
- Where adjustability is provided, discuss increases in line speed with the workers on the line and the equipment suppliers to determine safety concerns.

Task Variation

To help prevent problems with repetitious activity and to decrease job monotony. Consider the following:

- Combine two or more tasks to be done by one worker and provide the necessary changes in the work area and tools to allow this.
- Combine a series of tasks so the work cycle time per worker becomes longer.
- Allow rotation of jobs within a certain number of workers so each worker can have frequent changes of task.

Reporting Procedures

Specify clear guidelines for workers on how and to who to problems should be reported and for supervisors on how to take action. Situations could include:

- Reporting problems with tools or equipment that need attention. Early reporting is desirable, otherwise these items could be causing unnecessary muscular strain.
- Seeking help when a heavy or unwieldy load has to be moved.

Maintenance and Servicing

Establish procedures for the routine maintenance and regular servicing of power tools and equipment to the manufacturer's specification.

List which equipment and tools require servicing and specify for each:

- who is responsible for the servicing (either by workers or qualified personnel)
- the nature of the servicing needed
- the frequency of servicing which may need to increase with the age of the equipment or tool.

Purchasing Specifications

When purchasing tools or equipment, it is necessary to specify the:

- uses or functions of the plant and equipment
- general performance characteristics required to reduce the risk to health and safety from handling loads
- vibration specifications
- need to accommodate a range of physical characteristics of workers.

12.0 Training

Training and induction are important in effective risk management. Training must be given to workers in the jobs they will be doing and in sufficient depth to do their jobs safely.

Note: Training *eg in lifting techniques* should not be used as a substitute for the redesign of a task and/or use of mechanical aids. Relying on 'safe' worker behaviour is the least effective method of controlling the risk of injury

12.1 Who Should Be Trained?

Provide relevant training for all workers when:

- they are being inducted into jobs which contain risks from manual tasks
- a new manual task is introduced, or a task has been redesigned
- new equipment (mechanical aids), tools or furniture (adjustable items) are introduced.

Refresher training should also be provided to make sure safe work practices are maintained. It is necessary when workers return to the job following an extended absence.

Supervision is important in the training process to make sure training has been understood and tasks are being performed safely. In addition, do periodic checks to make sure competencies are maintained.

Other people for training In addition to workers, other groups who could receive training include:

- supervisors and managers of workers involved in manual tasks
- WHSO and WHSR
- in-house designers, engineers and workers responsible for the selection and maintenance of plant, job and task design and organisation
- officers responsible for the risk management process for manual tasks
- volunteers and non-permanent staff such as people from agencies.

12.2 Training Content

Tailor the contents of the manual tasks training program to specific needs by using examples based on:

- common manual tasks performed in the organisation, or in the unit where the worker will be employed
- the injury pattern of the organisation or industry sector.

Arrange for practical on-site demonstrations using tasks workers will be doing. This has the added advantage of reminding workers and supervisors of correct procedures.

The following table lists competencies workers should have in order to do their jobs safely and efficiently.

TOPIC	COMPETENCIES
Personal safety	<ul style="list-style-type: none"> • how to do a <u>basic</u> risk assessment • the types of workplace injuries associated with the manual tasks performed, their causes, early signs of injury and risk factors • how to avoid poor working postures • the need to vary posture occasionally if doing tasks that involve static body positions • the best ways to carry out the more difficult and repetitious tasks to minimise muscle strain • if handling loads (lifting, carrying, pushing etc) <ul style="list-style-type: none"> ○ how to handle loads safely ○ when to call for help ○ when and how to use mechanical aids • if using tools <ul style="list-style-type: none"> ○ recognising risks associated with specific tools and the safety

	<p>precautions</p> <ul style="list-style-type: none"> ○ minimising hand grip force ○ understanding why tools should be well maintained
Job and work area operation	<ul style="list-style-type: none"> • how to adjust chairs and other adjustable work surfaces, tools and equipment • any points about the equipment or tools which makes their use safer • the proper use of any mechanical handling devices.
Administrative procedures	<ul style="list-style-type: none"> • the need to report symptoms early, the procedures for reporting and the designated officer for receiving reports. • how to report problems with the maintenance or operation of tools or equipment.

12.3 Training for Workers Involved in Risk Management

Because risk assessments can be complex, it is desirable to have a special staff member/s to conduct assessments and develop in-house solutions.

Training for this work could include:

- how to identify jobs and workers at-risk
- the risk factors and the various types of musculoskeletal disorders that can result from exposure
- task analysis methods
- possible changes to prevent injury
- how to assess whether the changes are working successfully.

This worker could also be responsible for, or have input into the design, purchase and/or use of equipment or workstations.

12.4 Training for Other Staff

Other staff members mentioned above should receive training in the relevant competencies of the training content and training for workers involved in risk management. Other topics could include:

- reporting and recording mechanisms and procedures
- the risk factors and the various types of musculoskeletal disorders that can result from exposure.

12.5 Training Program Review and Evaluation

Review training regularly and also when there is change in:

- workplace layouts, task design or work organisation, or introduction of new or modified plant or equipment
- work practices including the introduction/changes in control measures for manual tasks
- legislation/standards
- injury experience of other workplaces in the industry or other industries with similar jobs.

12.6 Training Records

Keep records of induction and training given to workers. The records can include:

- date of the session
- topics dealt with
- name and signature of the trainer and each of the workers who attended the session.