



DEVELOPING WORKPLACE HEALTH & SAFETY GUIDANCE

for the

RECREATIONAL & LIGHT COMMERCIAL
BOATING INDUSTRIES

WHS GUIDANCE MATERIAL

SECTION 3

HAZARDOUS MANUAL

TASKS

Prepared between January 2010 & October 2011 with the generous support & assistance of individuals and businesses within the membership of the Boating Industry Association of NSW (BIA).

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DISCLAIMER: This research was funded under the WorkCover Assist Program. The research conclusions are those of the authors and any views expressed are not necessarily those of WorkCover NSW or the Boating Industry Association of NSW.

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Introduction

Achieving a safe site with safe work practices requires a business's ongoing commitment and action. It is process of continual improvement to adapt to changes in technologies, changes in plant and equipment, taking on new personnel, as well as to meet requirements under various health and safety regulations, codes of practice and Australian Standards.

Australia is moving towards a national model of managing health and safety at workplaces, and from 2012 it is planned that all states and territories will be adopting the new:

- Work Health and Safety Act
- Work Health and Safety Regulations and
- Codes of Practice.

These laws will replace the NSW Occupational Health and Safety Act (2000) and the NSW Occupational Health and Safety Regulation (2001)

The following guidance material has been prepared for BIA members to provide information on managing selected 'hazardous' issues in the industry:

- height safety
- undertaking hazardous manual tasks
- working in confined or enclosed spaces and
- moving boats.

In each section there is:

- an overview of the hazard
- an outline of the legal requirements for addressing each of the hazard areas
- case studies from BIA members illustrating how different businesses have tackled the hazards
- lists of other potential options that could also be considered for controlling risks
- references for where to look for further guidance and more technical information

This guidance is not 'prescriptive' but rather provides BIA members with suggestions and options from businesses that face similar health and safety challenges. It encourages the user to follow the risk management approach to identify hazards, assess the risks and to eliminate or otherwise control the risks so far as reasonably practicable. Under the WHS Act this means *"that which is, or was at a particular time, reasonably able to be done in relation to ensuring health and safety of workers, taking into account and weighing up all relevant matters including:*

- (a) the likelihood of the hazard or the risk concerned occurring; and*
- (b) the degree of harm that might result from the hazard or the risk; and*
- (c) what the person concerned knows, or ought reasonably to know, about:*
 - (i) the hazard or the risk; and*
 - (ii) ways of eliminating or minimising the risk; and*
- (d) the availability and suitability of ways to eliminate or minimise the risk; and*
- (e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk"*

When undertaking risk assessments in the workplace it is a legislative requirement that consultation with workers is carried out as part of the process. By drawing on the experience, knowledge and ideas of the workers a business is more likely to identify all hazards in the workplace and choose effective control measures.

When implementing control measures within a workplace the Hierarchy of Control should be utilised. The Hierarchy of Control ranks the levels of control from the highest level of protection and reliability to the lowest level of protection and reliability.

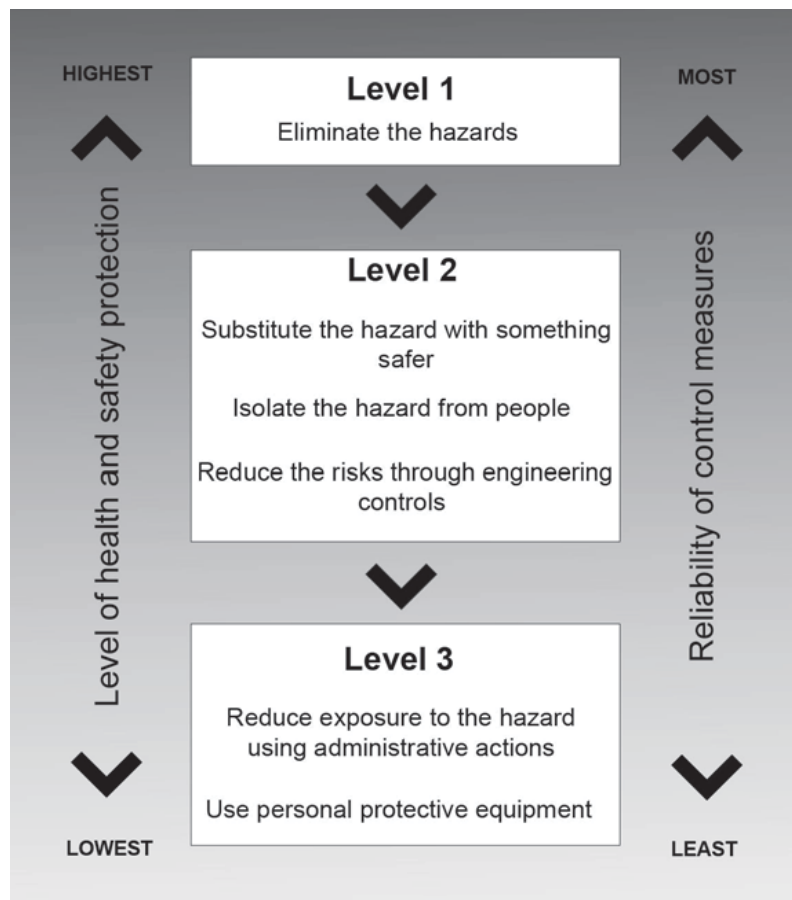


Diagram 1 - Hierarchy of Control (Model Code of Practice – How to Manage Work Health and Safety Risks)

Methods used by other businesses to eliminate or control risks may be easy to copy, or may need to be adapted to suit, or may not suit the conditions and personnel at other businesses. Regardless of which option is the best fit for individual businesses it is hoped that this guidance will assist BIA's members to review and upgrade their existing health and safety management and generate new ideas for managing hazards at work.

Further Guidance

Work Health and Safety Act 2011

Work Health and Safety Regulation, Safe Work Australia

Model Code of Practice – How to Manage Work Health and Safety Risks, Safe Work Australia

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WORKPLACE HEALTH AND SAFETY ISSUE – HAZARDOUS MANUAL TASKS OVERVIEW



The problem

Most jobs and occupations involve some aspect of manual work. Those manual tasks that have the potential to cause musculoskeletal disorders (MSDs) are referred to as "*hazardous manual tasks*".

Musculoskeletal disorders (MSDs) are the main cause of injury and workers compensation costs in the marine industry in NSW, accounting for almost 40% of all claims (*WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009*).

MSDs refer to injuries and disease processes that develop from:

- manual tasks such as lifting, carrying, pushing, pulling, holding and restraining
- undertaking repetitive movements
- working in awkward, or unnatural postures
- working in 'static' (sustained or still) postures for long periods
- exposure to vibration (hand / body)

The typical problems that develop from body stressing are 'musculoskeletal disorders' including:

- sprains and strains of muscles, ligaments and tendons
- damage to the spinal discs and spinal nerves
- joint and bone injuries or degeneration
- nerve injuries (eg carpal tunnel syndrome)
- muscular and vascular disorders as a result of hand-arm vibration

The consequence

These workers compensation claims are often costly to business, with workers requiring long periods off work followed by a gradual return to their normal work to avoid re-injury. Examples of recent MSD claims (*WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009*) in the boating industry include:

- Working in a cramped posture in an anchor locker – lumbar injury
- Decanting resin from a 44 gallon drum – shoulder strain
- Drilling steel for long periods - elbow injury (epicondylitis)
- Lifting a long roll of material out of a ute - shoulder & back strain

Injuries can be 'acute', 'cumulative' or a combination:

- "**Acute injuries** are associated with a relatively short exposure to loads which exceed tissue tolerance.
- **Cumulative injuries**... occur as a consequence to relatively long term exposure to load... (and) the general mechanism of injury is ... an accumulation of microdamage which exceeds the tissue's capacity for repair.

- Injuries may also occur as a **combination**where a history of cumulative loading leads to reduced tissue tolerance, which is then exceeded by short term exposure to a relatively high intensity load".
(Burgess-Limerick 2003)

This 'combination' is similar to the story of the 'straw that broke the camel's back', where the tissue tolerance is limited from previous stress, and then is more easily damaged by further loading.

Acute injuries may resolve quickly - with a short period of rest and/or undertaking other duties, together with some physiotherapy and/or anti-inflammatory medication. Injuries that have developed from 'cumulative trauma' tend to be more complex, and recovery can take much longer. This is why early injury reporting is so important.

Workers should be encouraged to immediately report if they experience any of the following symptoms as these can indicate injury or illness from body stress: tingling, numbness, pain, stiffness, loss of coordination, loss of strength, differences in temperature in limbs, and skin discolouration.

The law

The national Work Health and Safety legislation requires that the person conducting a business must eliminate or control risks from hazardous manual tasks, as listed below.

If it is not reasonably practicable to **eliminate** the risk of a worker being affected by a musculoskeletal disorder then the risk must be **minimised** as far as is reasonably practicable by:

- **changing the design** of the work area and the layout of the workplace
- **changing the systems** of work, considering schedules, job autonomy, job control & support
- **changing the nature, size, weight or number of items** used in the task
- **providing mechanical aids**
- **changing the environment**, or
- **using a combination** of these measures.

There is also a requirement to:

- *Provide information, instruction and training* to minimise any remaining risk.
- *Review and revise* risk control measures

When undertaking risk assessments in the workplace it is a key requirement that consultation with workers is carried out as part of the process. By drawing on the experience, knowledge and ideas of the workers a business is more likely to identify all hazards in the workplace and choose effective control measures.

The Hazardous Manual Tasks guidance material provides information on how to meet the legislative requirements that are listed above plus provide real examples of how members of the NSW BIA have eliminated or controlled the risks from hazardous manual tasks at their worksites.

Does your business comply?

Check how well YOUR business is currently managing hazardous manual tasks by completing the *Hazardous Manual Tasks - Self Assessment Tool*. Score yourself in each of the areas, and identify areas of non-compliance. This tool also outlines the elements of a safety system for managing manual tasks.

Use this self-assessment tool as a baseline first. Then once you have looked over the guidance material and the case studies you will identify areas where your systems can be improved. By following the information outlined in this guidance material, you will achieve better safety for all people on your site, as well as better compliance with work, health and safety legislation.

The guidance material

Guidance has been developed on topics that are common to many sectors within the boating industry. The guides follow the risk management approach, providing suggestions of hazards to look for, risks to assess, and options for risk control.

The emphasis of this guidance, as required under the hierarchy of risk control, is to encourage businesses to provide well designed equipment, in well designed work areas, and with well designed work schedules as this allows people to work as efficiently and safely as possible.

The guidance on manual tasks includes:

- MT 01 Handling blocks for standing boats
- MT 02 Climbing in and out of small boats
- MT 03 Handling drums
- MT 04 Handling fibreglass rolls
- MT 05 Handling stern drives
- MT 06 Tipping and pouring from drums & other containers
- MT 07 Selecting hand tools and power tools
- MT 08 Selecting trolleys
- MT 09 Handling very heavy loads
- MT 10 Working in awkward postures
- MT 11 Why team lifting is not recommended

Refer to the guidance material to check if there are further improvements you can make to your work systems or equipment to reduce the risk of musculoskeletal injuries and illnesses.

Further Guidance

Work Health and Safety Act 2011

Work Health and Safety Regulation, Safe Work Australia

Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia

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Hazardous Manual Tasks Self Assessment Tool

Key steps to a safe system:	Hazard Identification	Risk Assessment	Risk Control	Review	Consultation	Instruction & Training	Supervision
NON-COMPLIANCE	No identification of potential MSD* hazards	No assessments of MSD hazards have been done	No attempt has been made to eliminate or reduce potential risk/s of MSDs	No evidence of follow up and review of the key steps in managing MSDs	No evidence of management consulting with workers	Workers have not received training and instruction in managing risks and MSDs, or training is limited to 'correct lifting'	Workers are left unsupervised with no agreed or stated safe work methods for common work tasks
WORKING TOWARDS COMPLIANCE	Some MSD hazards have been identified with or without incidents or injuries occurring	Assessments have been done on an ad hoc basis and/or are incomplete	Some controls have been put in place, but do not follow the 'hierarchy of hazard control' and/or are incomplete	Some actions are checked and followed up	Consultation is on an ad hoc basis, and/or workers' feedback and views are not valued or taken into account	Some training has been provided in some aspects of managing MSD risks to some workers but is incomplete or inconsistently applied.	The supervision provided does not always ensure that safe work procedures are being followed.
COMPLIANCE	Proactive identification of all MSD hazards is done regularly & includes observing tasks, consulting workers & reviewing available information	Assessments are done regularly and show consideration of all risk factors – physical factors & systems of work	All risks relating to hazardous manual tasks are eliminated or appropriately controlled.	Guidelines on MSD management have been followed to ensure that new risks were not introduced when new work layouts or equipment were designed or purchased	Agreed consultation arrangements are in place and working effectively. Workers are consulted on an ongoing basis at each step in the management of MSDs	All workers are inducted and trained in the identification, assessment and control of MSD risks before commencing a task	Supervision ensures the safe work methods are followed and any problems are immediately acted on and remedied

*MSD = musculoskeletal disorders

Based on the WorkCover NSW BackWatch Scoreboard, 1998

3b Hazardous Manual Tasks – Self Assessment Tool V3

WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS – Handling blocks for standing boats

HAZARDOUS TASKS identified

The most frequently reported hazardous manual task at marine businesses is lifting and handling blocks for standing boats. When boats are taken out of the water for various maintenance tasks (such as anti-fouling and repainting) they are typically positioned on hardwood timber blocks, then have various lateral support systems or cradles. These timber blocks placed under the keels are used in both slipway and hardstand settings.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

When building these supports, workers are exposed to risk of musculoskeletal disorders (MSDs) from:

- lifting, carrying or dragging the blocks
- pushing and manoeuvring the blocks to form a stable stack
- gripping with fully extended hands and fingers
- working with very heavy loads at below thigh height
- may be walking on wet, slippery and sloped surfaces (eg on a slipway to set up a cradle)

Hardwood is known for its strength, and it is also a very heavy material, with a piece of recycled timber railway sleeper weighing almost 40kg per metre (section approximately 250x150mm).



The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

Site visits to marine repairers using slipways and hardstand areas revealed a range of methods for standing boats that reduced many of the risks associated with the traditional and manual methods of using hardwood blocks.

MT 01 Handling blocks for standing boats V3

Some labour-saving approaches for standing boats that should be considered include:

- Using lighter-weight materials to support boats where possible
- Developing pre-formed stacks that can be lifted into position by aids such as forklifts or trolleys, with individual timber blocks used just to achieve the final levelling
- Where the boat has been slipped/lifted at the business previously, using this experience and the exact specifications on the best block design to suit the vessel

Examples of each of these approaches are provided in the case studies below.

Case study – Using lighter materials

To reduce the heavy lifting associated with hardwood blocks consider using a lighter material – such as softwoods.

Some marine businesses in Sydney have found that for many smaller vessels blocks made with pieces of treated pine provide a suitable support. This material is significantly lighter than hardwood, and can be just half the weight for the same sized piece, making individual pieces much easier and safer to manually lift.



Blocks built using a mix of hardwoods and softwoods

Case study – Using pre-formed stacks

One large marina has made pre-fabricated stacks of blocks by building large cube shapes from pieces of treated pine. Various sizes allow for flexibility to suit a range of vessels.

These block stacks are designed to be lifted into place by the tines of a forklift. The only 'manual' handling is to use one or two pieces of timber for any small adjustments. This initiative has reduced the need to lift and carry blocks from approximately 5-12 pieces per stack to just the final adjustment pieces (one or two).



Before:
Manually lifting heavy, hardwood blocks



After:
Using a forklift to move a pre-fabricated block

Case study – Using pre-formed stands

Another marina has also reduced the manual handling involved in supporting boats. They use steel stands which can then be supplemented by timber blocks. The steel stand can be moved into position using a trolley or a mechanised aid.

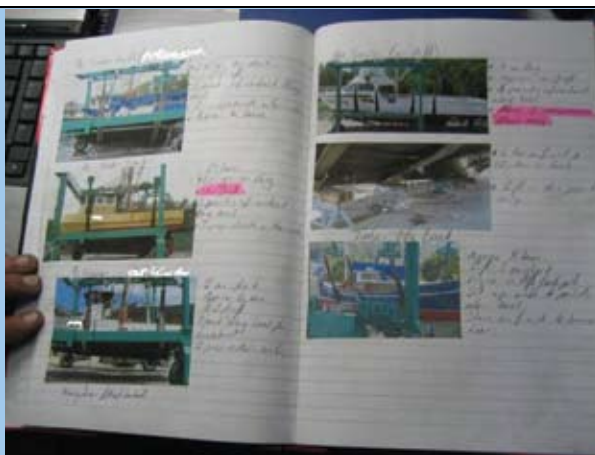


The steel stand used as part of the boat support

Case study – Using advice from previous standing or slipping

Some marinas have developed simple, but very effective systems that save them time and effort when they are seeing repeat customers and standing their boats out of the water and/or using the travel-lift. The first time they take out a customer's boat they make notes of the characteristics of the vessel's hull, keel, engine location, transducer locations and other features that may influence the method of lifting and standing the vessel, taking photos of the key features. They also take photos or make notes of the sling location and block design that they find best suits the vessel.

The notes and information for all their vessels is then utilised each time the vessel is taken out of the water. This allows the marinas to quickly and efficiently build the most suitably designed stack. It's also reduced the need to try and remember the intricacies and differences between their customers' wide variety of boats – reducing any surprises when the underside is revealed.



A page from a marina's notebook showing the different block and sling arrangements they use to ensure they suit different vessels.

Further guidance

- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS – Climbing in and out of small boats

HAZARDOUS TASKS identified

The action of physically getting in and out of small boats has been identified as contributing to a number of musculoskeletal disorders (MSDs), in particular sprain and strain injuries, typically to the back, knees and ankles. Common locations where these injuries occur are:

- Boat showrooms
- Workshops
- Slipways

People in the boating industry use various step aids as well as workers climbing in and jumping out of boats – some of these methods contribute to injury.

Although the height of the boat may be low (less than 1 – 1.2metres), injuries can develop when the movement involves:

- High forces – such as from jumping – as this places significant stress on the muscles, tendons, ligaments and vertebral discs
- Repetition of a stress on a body part – as this can result in 'cumulative trauma' and the gradual development of injuries including to the: spinal discs; knee meniscus; knee and ankle ligaments etc.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

Check how you and your colleagues currently get in and out of small boats. Also inspect your current step aids for their suitability for the task, including:

- Is the base non-slip?
- Is it rated to support your heaviest staff member, plus any tools and equipment they may be carrying*?
- Are all steps evenly spaced?
- Are all standing surfaces non-slip?
- Is it well maintained?
- Can wheeled devices be locked into position?
- Does the aid bring you to the best height to reach most boats?
- Can the aid be positioned close to the boat's side?
- Is a hand rail required, and if so, is one fitted?

*Most commercial steps are rated to 150kg, while domestic steps are often only rated to 90kg

Old milk crates and other plastic crates are widely used in the boat repair and maintenance industry as step aids and as seats, but the bases and tops are very slippery and these crates fail to provide suitable strength and support. Discussions with workers in the industry indicate that there have been incidents where crates have suddenly slipped or collapsed, resulting in the worker falling.




Unsuitable step aids

The law requires that risks associated with hazardous manual tasks must be eliminated or otherwise controlled following the hierarchy of control.

RISK CONTROL options

The table below illustrates some commercially available and custom made products

 <p>Shelf-mate order picker</p> <p>2 step tubular frame with sprung castors and push/pull handle. Top step:580mm high</p> <p>These can be ordered without the top handle if required to allow closer access to the hull</p>	 <p>Giant Step</p> <p>Heavy, solid steps for use as a work platform and a step. Top 500mm high, with 480x480mm top area. Weight 18kg, no castors.</p>
 <p>Poly Kickstep</p> <p>Dimensions: 385 top dia. x 395 h Rated to 150kg With sprung castors</p>	 <p>Poly Safe-T-Step</p> <p>Dimensions: 380 l x 380 w x 360 h Rated to 250kg 'Non-slip' tread</p>



Commercially available 'walk-up stands'

Features:

- Designed to look into boat rather than for access
- Large top platform
- Handrail
- Non-slip chequer-plate
- Safe working load displayed

Improvements may include:

- Sprung wheels



Custom made steps in a marine workshop

Features:

- Non-slip chequer-plate
- Height and size designed to suit the business's most common boats

Improvements may include:

- Handrail
- Sprung wheels
- Safe working load displayed

Case study – 3 points of contact rule

Workers who need to get in and out of small boats face similar injury issues to truck drivers and their vehicles. Climbing in and out of truck cabs and from flat top vehicles has long been identified as a high risk task, with many drivers tripping and falling and/or landing awkwardly and injuring their backs, knees, and/or ankles. The agreed 'safe method' of getting out of truck cabins and off flat platforms is to:

- step backwards
- maintain 3 points of contact at all times
- step, don't jump.



Consider how this technique can be applied at your workplace with small boats

Integral Energy implemented an education and awareness program regarding problems from alighting from trucks, and this resulted in a significant reduction in injuries from this task

Further guidance

- Work Health and Safety Act 2010
- Work Health and Safety Regulation
- Code of Practice – Managing the risk of Falls at Workplaces, Safe Work Australia
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- Australian Standard 1657 – 1992 – Fixed platforms, walkways, stairways and ladders – Design, construction and installation
- Australian & New Zealand Standard 1892.1 – 1996 Portable ladders Part 1: Metal
- Australian & New Zealand Standard 1892.2 – 1992 Portable ladders Part 2: Timber
- Australian & New Zealand Standard 1892.3 – 1996 Portable ladders Part 3: Reinforced plastic
- Australian & New Zealand Standard 1892.5 – 1999 Portable ladders Part 5: Selection, safe use and care

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS –Handling drums

HAZARDOUS TASKS identified

Handling heavy and awkward loads are hazardous manual tasks, and this includes handling drums. In the boat repair and manufacturing businesses workers use drums of oils, resin and various solvents. Drum handling has caused sprain and strain injuries in the boating industry, and the law requires that the risks must be eliminated or reduced.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

Features of drums and other large liquid containers that can contribute to injury risk are:

- the large size, that affects ease of rolling, carrying and/or moving the load
- they often lack handholds or easy points to grasp
- the loads are unstable when being moved
- the very heavy weight, with a 205 litre drum of resin weighing approximately 230kg
- the shape and size of the load prevents it from being held close to the person's centre of gravity



The photo shows drums in 'cradles'. Note the bunding around the cradles on the right hand photo that will capture any liquids in case of a spill. Bunding is a requirement under WHS legislation.

The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

MT 03 Handling drums V3

RISK CONTROL options

Handling drums




The following aids reduce the need to manually handle drums and other large liquid containers, and therefore reduce the risk of workers developing strain and sprain injuries to their backs, necks and arms:

- Mobile drum handlers (eg trolleys)
- Drum attachments for forklifts.

Examples of these options are described in the following table.

Some drum handling can also be reduced through the use of various pumps and other dispensing systems. Refer to guidance document **'Manual Tasks – Decanting and pouring from drums and other containers'** for more information.

The table below illustrates some commercially available products. Prior to purchasing any aids businesses should review the manufacturer's specifications to ensure the aid is suitable for the task.

Mobile Drum Lifter/Rotator These 350kg capacity units are designed for de-palletising, lifting, rotating, racking, stacking & decanting 205 litre drums. There are 3 methods of engaging the drum: <ul style="list-style-type: none">• via a cam locked steel band• via grippers operated by a remote quick action toggle latch• via a screw operated rim clamp that grabs the rims of containers.	 <p>D620 about to safely lift a drum</p> <p>D21 cost effective drum lifer/rotator "economical one"</p>  <p>DR16 rotating a "Mauser" plastic drum</p>
Drum Jack Designed to lift and move drums up to 300kg <ul style="list-style-type: none">• Dual action hydraulic system – clamps drum then lifts• Cast iron pump design• Sealed bearing castor and dolly wheels enable easy positioning in tight spaces• Suited to both open and closed drums	

<p>4T4 Drum Trolley</p> <p>Designed to lift and move drums up to 300kg</p> <ul style="list-style-type: none"> • open or closed drums • fits standard doorways • Available in a large wheel version for rough surfaces <p>10:1 Leverage Ratio.</p>	
<p>Multi-Purpose Drum Trolley</p> <p>This drum trolley is used to:</p> <ul style="list-style-type: none"> • take drums on and off pallets • move the drum on four wheels • place the drum horizontally for emptying • assist to rotate the drum for bung positioning. <p>The floating axle reduces operator effort.</p>	
<p>Drum Trolley</p> <p>This stainless steel trolley claims to keep forces to below 20kg even when the load being lifted is 300kg.</p> <p>Specifications:</p> <ul style="list-style-type: none"> • Max SWL: 300kg • Max input force: 20kg • Ground clearance: 75mm • Drum sizes: 50-230lt • Width: 795mm 	 <p>Use with any Drum</p>

<p>Heavy Duty Drum Cradle</p> <p>Drum cradle fitted with retractable handles</p> <ul style="list-style-type: none"> • Durable zinc plated finish • 300kg capacity 	 <p>Left: Handle extended Right: Handle retracted</p>
<p>Drum Dollies</p> <p>Dollies are designed to store and transport different sized drums. They have a various finishes including galvanised steel, and with or without rims, fitted with castors.</p> <p>Capacity is 400kg for the 205 litre versions.</p>	

Forklift attachments suited to drums include:

Auto-clamping drum lifters

These engage around the drum and lock under the drum's central rolling hoop.



The Grab Beak

This is designed for use with 205litre steel drums, plastic drums, open top and ring lock drums. The design provides a high clamping force, so can also be used over uneven ground.



Case study – Are drums really necessary at your business?

A marine business on the Central Coast explained that they used to always purchase products in drums as there was a clear cost saving. However the business has recently moved to buying smaller containers stating the cost advantage was no longer significant.

Other advantages they reported with the small containers were:

- saving time on handling the drums
- saving effort on handling the drums
- no need to tap the container
- less spills
- less waste from product 'going off' in the drum
- less space required for their storage

Instead of moving to smaller containers, other businesses go to bulk systems with dispenser mechanisms. Refer to guidance document '**Manual Tasks – Tipping and pouring from drums & other containers**' for more information and other options for making decanting liquids easier and safer.

Further guidance

- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- Australian Standard 2359.1, 1995, Powered industrial trucks – General requirements
- Australian Standard 2359.2, Powered industrial trucks – Operation
- Australian Standard 2359.12-1996, Powered industrial trucks - Hazardous areas
- Australian Standard 2359.10-1995, Powered industrial trucks - Fork-lift trucks - Hook-on type fork arms - Vocabulary
- Australian Standard 2359.6-1995, Powered industrial trucks - Safety code
- Australian Standard 4973-2001, Industrial trucks - Inspection and repair of fork arms in service on fork-lift trucks
- Australian Standard 2359.15-2005, Powered industrial trucks - Fork-arm extensions and telescopic fork arms - Technical characteristics and strength requirements
- Australian Standard 1763-1985, Industrial trucks - Glossary of terms

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS –Handling fibreglass rolls

HAZARDOUS TASKS identified

Working in the fibreglass boat repair and manufacturing businesses require using rolls of fibreglass. Lifting and handling these loads has been associated with musculoskeletal disorders (MSDs), particularly sprain and strain injuries. The law requires that risks associated with hazardous manual tasks are eliminated or reduced.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

As the weight of a load increases, the risk of injury also increases, although injuries can occur with what can be considered "light" loads. This is particularly the case where the person is in an awkward posture to reach or to lower the object, if the load is awkward to grasp and/or if the lifting task is done repeatedly.

Some of the features of rolls of fibreglass materials that can contribute to injury risk are:

- boxed rolls of fibreglass materials are very heavy – typically between 20-50kg
- the rolls and boxes do not have handholds or easy points to grasp
- the load is long and narrow, so is awkward and hard to hold close
- the material also cannot be held against the skin and tends to be held out from the body
- when the material is out of the box it is relatively fragile and should be kept horizontal where possible
- loads are often lifted above shoulder height (eg to place a roll of fibreglass onto a rack or dispenser above a cutting table)
- the loads are generally too heavy and awkward to be handled safely by one person

A common method of moving and handling rolls of fibreglass is to use 2 person lifts. Unfortunately these 'team handling' approaches pose their own risks and are NOT recommended,



nor are they permitted in the draft Code of Practice – Hazardous Manual Tasks (Safe Work Australia) as a standard means of controlling risks.

Refer to guidance for Manual Tasks: 11. ***Why team lifting is not recommended*** for further information.

The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.



RISK CONTROL options

Handling rolls of fibreglass

Some of the aids that can assist to move fibreglass loads more safely include:

- Manual roll lifter prong on a mobile lifting device
- Forklift attachments for rolls

The table below illustrates some commercially available products. Prior to purchasing any aids businesses should review the manufacturer's specifications to ensure the aid is suitable for the task.

<p>A slip-on mount roll prong –</p> <p>Prongs of various sizes can be attached to a walk-behind electric forklift – eg 40mm prong x 1200mm long, with a safe working load of 200kg</p>	
<p>A 'Multi Lift' truck</p> <p>This manual or battery/electric operated lifter can be used to lift and move a wide variety of loads, depending on the selected attachment type.</p> <p>Options include:</p> <ul style="list-style-type: none">• A custom-made prong, suited to lift rolls (manufacturer suggests a 950mm prong for a 1200mm long roll)• A spool/roll manipulator• A drum tipper	 <p>The Multi-lift illustrated to grip and rotate cylinders and long reels. This can also be fitted with a prong to lift rolls</p>

Case study – Aids to reduce the need to manually handle fibreglass rolls

A fibreglass supplier routinely moves and unrolls large quantities of fibreglass materials and then wraps the rolls in plastic. Previously they manually handled the rolls but found the following problems:

- heavy and awkward loads to lift
- risk of damage to the product
- time consuming

To solve the above problems the workers at the company developed a custom-made tool that has a mandrel that inserts into the core, and holds the roll in a horizontal position. This device allows material to be unwound from the roll and transferred onto other rolls for customers who require smaller quantities of the product. They also use a hydraulically operated trolley raised to the required heights to move the rolls around.

Benefits of the roll transfer device and the hydraulic trolley are:

- less labour is required
- less risk of damaging the product
- time saving



The mandrel to assist in moving product between rolls

Further guidance

- Work Health and Safety Act 2010
- Work Health and Safety Regulation, Safe Work Australia
- Draft Code Of Practice - How To Manage Work Health And Safety Risks, Safe Work Australia
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- Australian Standard 2359.1, 1995, Powered industrial trucks – General requirements
- Australian Standard 2359.2, 1985, Powered industrial trucks – Operation

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS – Handling stern drives

HAZARDOUS TASKS identified

Handling and working on stern drives is a commonly reported hazardous manual task in boat mechanics and maintenance work. The design of stern drives – with the engine just forward of the transom and the drive unit just outside the hull – often makes service and maintenance tasks of these units difficult.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

Stern drive units are heavy, and can often weigh well in excess of 100kg. Other factors making them awkward to lift and move are:

- unbalanced load
- shape is awkward to grip
- unit is greasy and slippery
- the fragile nature of the load



The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

Moving stern drive units can be made significantly safer, easier and faster through the use of various lifting aids and trolleys.

Some options to consider are commercially available units suited for different engine manufacturers, or custom-made jigs.

Commercially available stern drive lifters / trolleys:



From a catalogue



As seen in a marine workshop

Suppliers of stern drive lifters such as those above claim that they:

- can work on all makes and models
- allow one person to remove and install stern drives
- are useful on boats with integrated swim platforms
- avoid damaging boats while trying to hoist the drive unit
- can be built with extra long clamping arms and wheel base
- have a heavy duty lifting capacity for extra heavy drives
- are suited to dual propeller drives
- reduce injury risk

Case study - Workshop makes stern-drive lifter from scissor-lift trolley

A large service centre and workshop in Sydney has also developed their own stern-drive lifter, and theirs is based on an existing, rated scissor lift trolley. As you can see in the following images, the trolley has been extended and has a long bracket on the top to support the stern-drive unit.

A foot pedal allows the trolley to be raised or lowered to the height of the boat and also allows for an easy transfer of the unit to the workbench jig.



A custom made stern drive lifter and trolley

Use of an existing device that is rated and certified for specific tasks will be affected by any modifications. A competent person should assess the device to determine its lifting capacity. By properly assessing the lifting capacity this can assist in demonstrating WHS compliance.

Case study – Workshop makes stern-drive lifter from hydraulic jack

Because lifting and moving stern drives was awkward, the mechanics at one marina designed their own stern-drive trolley using a rated hydraulic jack for its base and had it fabricated by a qualified welder. The device has now been in use for 3 years and should last many more given its sturdy construction. Pneumatic tyres were selected so that the load can “go cross country without bogging down and without losing the load!” The cost of the materials used to build the trolley was negligible as it was made largely from existing material available from their well stocked workshop.



The custom made 'Leg Lifter 2000' stern drive trolley

Use of an existing device that is rated and certified for specific tasks will be affected by any modifications. A competent person should assess the device to determine its lifting capacity. By properly assessing the lifting capacity this can assist in demonstrating WHS compliance.

Case study – Using a commercial stern-drive trolley

A company specialising in engine servicing utilises a wide range of lifting and handling aids to make tasks safer and easier for staff, including a commercially available stern-drive trolley. As the company is a distributor for one brand of engine it was cost effective for them to purchase the custom-made stern drive trolley. The trolley has been used for many years now and the manager claims it's one of the most useful aids he has bought.





Commercially available stern drive lifters. All lifting mechanisms should display the device's safe working load and all personnel should know the maximum safe lifting capacity.

Further guidance

- Work Health and Safety Act 2011
- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- WorkCover NSW Plant Guide

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS –Tipping and pouring from drums & other containers

HAZARDOUS TASKS identified

Injury data from WorkCover NSW (*WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009*) shows that tipping and pouring liquids from heavy containers can be a hazardous manual task in the boating industry. In boat manufacturing and repair businesses many liquid substances are delivered in drums and various other large containers, including:

- resins – eg in 205 litre drums
- gelcoats
- catalysts
- cleaning products
- adhesives
- paints – eg in 20 litre containers

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

There are many risks associated with tipping and pouring from containers, especially when the containers are heavy and not well designed for pouring. Musculoskeletal disorders (MSDs), such as sprains and strains, can be caused by:

- high forces to tip the load
- sustained or 'static' forces to hold and balance the load while the liquid is being dispensed
- cumulative 'fatigue' in the muscles when the task is undertaken repeatedly through the day or week




In addition to the stress on the body's musculature are the potential chemical hazards from exposure, spills and splashback onto the worker. Product is also wasted in spills and from dribbles down the sides of the containers.

The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

The tasks of lifting the container and of manually tipping can each be eliminated through the use of various dispensers, pumps and/or through tipping and pouring aids. A side benefit to using these aids is that they are also more productive and reduce wastage. The following table illustrates some commercially available products to consider.

<p>Dispensers</p> <p>Some suppliers provide bulk deliveries and have various options for dispensing depending on the clients' needs.</p> <p>The advantages of these systems are:</p> <ul style="list-style-type: none"> • Reduced need to carry containers of chemicals • Reduced need to lift and tip out chemicals • Less risk of spills and human error • More accurate measures, so safer • Less chemical wastage 	 <p>This dispenser is used for various lubricants and is used at company that has a large amount of plant and machinery to maintain.</p>
<p>Hand Pumps – medium sized containers</p> <p>These are designed to be inserted into containers ranging from 15 to 25 litres.</p> <p>For example, the pump illustrated is for kerosene, two-stroke mix and non-corrosive liquids. Output is 100mls on the lift stroke. It comes with a 1.8m delivery hose with non-drip metal nozzle and built-in hose hanger & nozzle bung adaptors.</p>	 <p>An example of a hand pump used for small drums and other containers</p>
<p>Drum Pumps</p> <p>The use of a drum pump can be an easy and effective way to decant liquids from vertical drums. Different pump designs are available to suit a range of liquids including motor oils, gear oils, petrol, diesel, kerosene, acetone, and other selected chemicals.</p> <p>Pumps are designed to deliver measured amounts of the liquid, and this also reduces waste and the risk of spillage.</p> <p><i>NOTE: Be careful to choose a pump that suits the liquid as there are different pumps for fluids with high viscosity, high flammability liquids, and concentrated acids and alkalis etc. Check with your supplier and read the Safety Data Sheet.</i></p>	 <p>An example of a lever action pump designed for a 205 litre drum of oil</p>

<p>Drum Decanters eg 'Safe Pour'</p> <p>There are devices to hold 15, 20 and 25 litre round or square containers in secure frames that pivot on a stand. These allow workers to tip the frame and container for precise and safe control of the pouring action while the stand supports the load's weight.</p>	 <p>Safe Pour devices in use in a workshop</p>
<p>Drum Stands</p> <p>This simple stand is designed for supporting drums for tapping.</p> <p>This aid allows the drum to be transferred between vertical and horizontal with less effort than doing it manually, and provides an easy means for decanting the product.</p>	 <p>Drum stand with tapped drum</p>
<p>Drum tippers</p> <p>There are various commercially available products to support and tip drums</p>	

Case study – Using tippers for gelcoats and flowcoats

A boat manufacturer in regional NSW has a bank of tipping and pouring aids that are used for various gelcoats and flowcoats. They have used these devices for many years now and report that they save effort, save product and reduce some of the mess.



Decanting flow-coat.

Further guidance

- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- Code of Practice for the control of workplace hazardous substances – WorkCover NSW
- Safety Data Sheets for all chemicals - checking requirements for their safe use and safe storage

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE

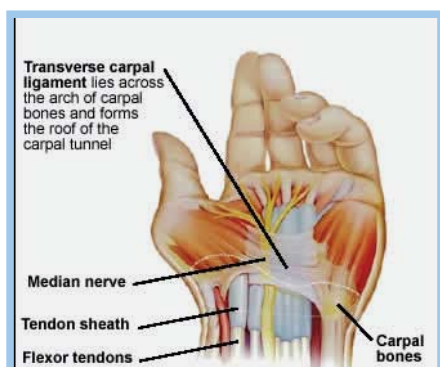


MANUAL TASKS –Selecting hand tools and power tools

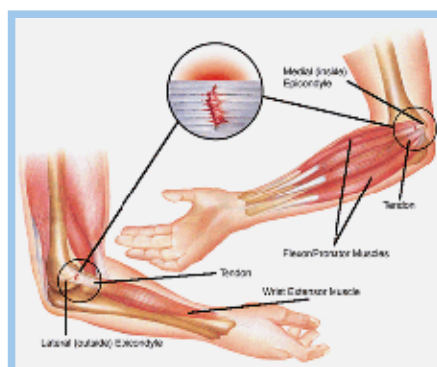
HAZARDOUS TASKS identified

Injury data for members of the BIA (*WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009*) has revealed that most musculoskeletal disorders (MSDs) – in particular, sprain and strain injuries – are not from heavy lifting but are from using tools, which can be made worse when the task is done for long periods or done frequently.

'Wear and tear' on your joints, tendons and other soft tissues tends to develop slowly, over time, and it is the cumulative impact of this wear and tear that becomes a problem and can result in injuries such as tendinitis, tenosynovitis, 'tennis elbow', carpal tunnel syndrome, 'golfers elbow' etc.



In carpal tunnel syndrome, wrist movements and working with very bent wrist postures can result in inflammation in the narrow wrist space (eg from swelling of the tendon sheath). This swelling presses on the median nerve resulting in tingling, numbness and/or pain in the thumb side of the hand.



In tennis elbow and golfer's elbow (or medial and lateral epicondylitis) there is inflammation and/or micro-tearing in the tendons that attach to the outside of the elbow, and this is from repeated and/or forceful movements at the wrist.

Good ergonomic design is crucial for tools that are used for long periods – such as those used for buffing and polishing a hull.

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RISKS to assess

Tools must be carefully selected to suit the user and their tasks. Some of the most common design problems that increase the risk of wrist and arm injury are those:

- with a grip span that is beyond the user's comfortable reach
- designed for use in the right hand, used by left handers
- that are heavy and are used for long periods, such as a heavy grinder or a buffer
- with triggers that must be held by one finger for long periods such as on a sander
- that require strong grip and transmit high impact forces such as hammers and nail guns
- that create vibration forces, such as impact wrenches ('rattle guns')
- that are poorly balanced, with the heaviest part of the tool in front of the wrist, as this requires additional force to grip the tool and stop it tilting forward
- with handle diameters not suited to the user, or those with prominent edges or are too short that press into the palm
- with a handle shape that requires the wrist to be in a bent or crooked position to hold and operate it
- with a handle surface that becomes moist / slippery when used.- especially for extended periods.

Use the checklist at the end of this document whenever you are choosing new tools to help you choose the most 'ergonomically designed' ones.

As well as tool design, other factors that increase the risk of using hand and power tools are the amount of time that you use the tool each day and each week, plus the general body postures that you need to use to do the task. Refer to guidance document ***Manual Tasks – Working in awkward postures*** for further information.

The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

See the checklist to assist you to choose tools with the best designs. The following table provides some suggestions of commercially available tools that members of the BIA members report are good to use.

Case Study – New buffer is lighter and easier to use

A fibreglass repair shop recently purchased a new tool system for grinders, polishers and buffers that is integrated with a mobile vacuum dust extraction system. Workers found that the tools with this system are not only much lighter than their old tools (for example the new buffer is 2.5kg as compared with the old one at 3.5kg) but also provide a better job.



A grinder/buffer with a dust extraction system

Case Study – Easy ways to cut fibreglass mat

When using scissors to cut fibreglass, it's critical that the scissors are well maintained and sharp. An experienced fibreglass fabricator and boat repairer advised that a 12" pair costing approximately \$50 would be the minimum for suitable scissors.

When cutting is required repeatedly or undertaken for long periods, the cumulative strain on the wrist and fingers from opening and closing the scissor blades can contribute to serious and ongoing MSDs. Tools to reduce effort include manual rotary cutters that are wheeled through the material like pizza cutters, or battery operated tools with a similar rotating blade. A decent blade on these tools is critical to reduce effort and strain and provide a clean edge.



Manual rotary cutters



Battery operated rotary cutter

Case Study – New buffer is lighter and easier to use

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A grinder/buffer with a dust extraction system

Case Study – Pneumatic vs electric powered tools

Experienced power tool users provide the following tips for selecting new tools:

Electric tools

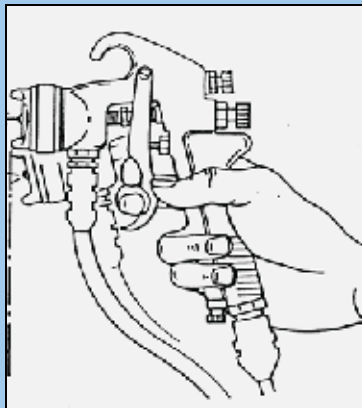
- heavier units to lift
- no need for air leads, which tend to be stiffer, less flexible to move around
- there's "more to hold"
- are the more traditional tools, so there is a large range of products to choose from

Pneumatic tools

- lighter tools
- well suited to manufacturing/indoor service centres where the same tasks are done frequently
- good where the compressor is built-in and doesn't need to be lifted or pulled to the job
- need large compressor and long air lines
- compressors and lines need maintenance
- a limited number of tools can be used at once
- less danger of electrocution

Case study – Tips for choosing & using a spray gun

A scientific study into spray gun use revealed that users are at risk of serious hand and arm injuries from the potentially high grips and high trigger forces. Experienced users in the boating industry recommend spending the money to buy a quality gun that provides a good finish while being comfortable to use.



Operating a spray gun

The following tips are suggested to reduce fatigue and improve comfort:

Trigger force

Trigger force shall be as low as possible, since it decreases the load on the wrist and hand. The trigger force can be lowered through:

1. Decreasing of the spring pressure on the fluid needle through screwing the fluid-flowscrew anti-clockwise until the fluid needle reaches its maximal length of stroke. If there is a fluid leakage or the fluid flow gets too high, you can:
 - decrease the fluid pressure from the fluid pump or fluid barrel, or
 - control that the nozzle set is proper for the used type of paint and the desired flow (an unsuitable nozzle set may force the user to increase the fluid pressure), or

- change to a new nozzle set, or
- mount an external fluid regulator.

2. Grease the valve-mechanism

3. High-pressure spray guns in general have higher trigger force than other types of guns. To reduce trigger force on these devices you may:

- change to a high-pressure spray gun with adjustable trigger force, or
- change to a servo-assisted high-pressure spray gun, which decreases the trigger force, or
- change to a high-pressure spray gun with a four-finger trigger.

Handle and trigger design

The distance between the lower end of the trigger and the lower side of the front heel should be as short as possible.






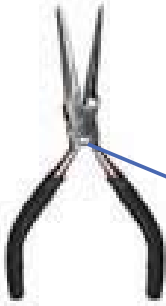
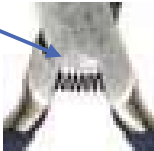
Choose as light and compliant gun-with-hoses as possible, since it decreases the load on the shoulder, the arm, and the wrist/hand. High-pressure spray guns are generally lighter than other spray guns with their hose. There are big differences in weight and compliance between hoses, and there are big ergonomic benefits to be made by changing hoses.



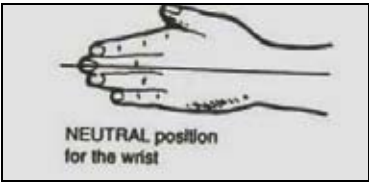



A method to increase the compliance of high-pressure spray gun outfits is to connect the gun to a thin and compliant hose (approx. 1 m) which in its turn is connected to a thicker and less compliant, but more durable hose, which goes to the fluid pump.

A method to increase the compliance of low-pressure and HVLP spray gun outfits is to use a combined paint and air hose.

Use rotating nipples (swivels) where possible, since they will make it easier to handle the gun. Choose also nipples as short as possible. A first measure is to check that the hoses are not fastened into the spray gun in such way that they tend to twist the spray gun when it is pointed forward.

(Advice adapted from Björing & Hagg 2000, image from ITW Finishing Technologies)

Checklist for buying new tools		
1	For single-handle tools used for power tasks: Does the tool feel comfortable and have a handle diameter between 33 and 52mm?	
2	For single-handle tools used for precision tasks: Is the handle diameter of between 7 – 12mm so it can be held between thumb and fingers?	 
3	For double-handle tools used for power tasks: Is the grip span at least 50mm when closed and no more than 90mm when open?	
4	For double-handle tools used for precision tasks: Is the grip span no less than 27mm when closed and no more than 75mm when open?	
5	For double-handle tools: Is the handle spring-loaded, allowing it to return to the open position?	 

Checklist for buying new tools		
6	Is the tool handle <i>without</i> sharp edges or finger grooves?	
7	Is the tool handle coated with smooth, soft, slightly compressible material that is also non-slip?	
8	Can the tool be used while keeping your wrist straight? 	
9	Can the tool be used with your dominant hand or with either hand?	
10	For high-force tasks: Is the handle longer than the widest part of your hand (usually 100mm to 150mm)?	

Checklist for buying new tools	
11	<p>Does any trigger requiring <i>force</i> and used for long periods have activation by thumb muscles and a locking mechanism?</p> <p>For tasks requiring <i>precision</i> for prolonged duration, can the trigger be used by the ends of the finger(s) of either hand and have a locking mechanism (eg latch) which can be deactivated quickly in case of an emergency</p> <p>Is the maximum pressure to activate the trigger excessive? (ie > 10N)</p>
12	<p>Do the vibrating tools have damping materials to absorb vibration?</p> <p>Exposure to vibrating tools should be limited. (Check manufacturer's specifications to ensure the tool complies with the Australian Standard 2763-1988 .)</p>
13	<p>Is the weight of precision tools as low as possible but not more than 1.75 kg?</p> <p>Is the weight of power tools preferably about 1.12 kg, but no more than 2.3 kg?</p>
14	<p>Is the weight of the tool balanced about the axis?</p>



Tool selection advice adapted from:

- Mital A & Kilbom A, 1992, Design, selection and use of tools
- NIOSH, 2004, A guide to selecting non-powered handtools, 2004
- Saunders M, 2004, Ergonomics and the management of musculoskeletal disorders, Butterworth Heineman
- Code of Practice – Hazardous Manual Tasks
- Bjoring G & Hagg G, 2000, The ergonomics of spray guns: Users' opinions and technical measurements on spray guns compared with previous recommendations for hand tools, International Journal of Industrial Ergonomics, Vol 25, 405-414

Further guidance

- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks
- Australian Standard 2763-1988 Vibration and shock - Hand-Transmitted Vibration – Guidelines for measurement and assessment of human exposure.
- Specialist tool suppliers

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS – Using trolleys to move tools and loads

HAZARDOUS TASKS identified

While trolleys are designed to reduce effort from lifting and carrying, poorly designed trolleys and trolleys not 'fit for purpose' have caused a range of musculoskeletal disorders (MSDs), including shoulder rotator cuff injuries, wrist injuries and back injuries.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

When you are reviewing your existing trolleys or selecting new ones, consider:

- the tasks you want them for
- the workers who will use them, and
- the environments that they will be used in.

How well suited are the trolleys? How well do they reduce risks, or would different trolley designs be better suited to the tasks at your workplace?

Features of trolley designs that can contribute to MSDs include:

- trolleys that must be pulled, as this places strain on the shoulder's rotator cuff
- trolleys with castors that are used on rough or uneven floor surfaces
- trolleys that do not adequately support or contain the load, causing awkward postures and movements while holding / restraining load and pushing trolley simultaneously.
- hand-trucks that are used over long distances as the user is constantly supporting some of the load
- bin type trolleys where the user needs to bend and reach down into the bin to grasp items



- small wheels as they have a higher rolling resistance than larger ones, and are more affected by gaps, ridges and irregularities in floor and ground surfaces
- wheels made from hard materials such as cast iron and nylon used on surfaces with gravel or other small obstructions
- pneumatic tyres that are not well inflated, therefore increasing the rolling resistance
- trolleys that hold loads at a different height than their destination/origin, such as when a heavy load cannot easily be tipped or slid to or from its storage area
- trolleys that require the operator to stoop or to twist to reach the load being moved

*"Postures and movements that pose a risk if they are **repetitive** or **sustained** include:*

- ***reaching behind the body***"

(from the draft Code of Practice
– Hazardous Manual Tasks)




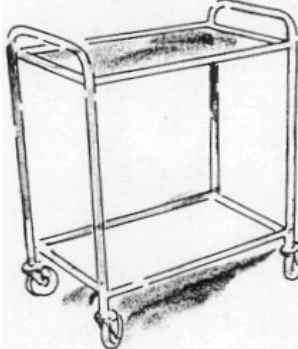
The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options





Trolleys for different tasks

Ensure you have a range of trolleys that are designed for the different tasks undertaken. The table below illustrates some commercially available products.

Also see section on 'Optimal Design Features' for further information.

Task requirements	Recommended trolley type
<ul style="list-style-type: none"> ✓ Tall items that must be picked up and set down at floor level ✓ Uneven terrain and over gutters ✓ Delivery work where the trolley itself is frequently lifted on and off the vehicle. <p>For example this trolley would suit moving tall loads such as cylinders, small drums, sail bags, buckets of chain etc.</p> 	<p>Two-wheel trolleys</p> <p>Two-wheel trolleys or "hand trucks" are versatile and widely used.</p>  <p>A D-handled, 2 wheeled trolley. The D-handle design also allows the load to be lowered to horizontal, and slid off if required</p>
<ul style="list-style-type: none"> ✓ Moving large cartons ✓ Carrying a large volume of stock without the overall height becoming excessive ✓ Moving loads over relatively long distances without needing to support the trolley weight in the hands and arms 	<p>Low-platform trolleys</p> 
<ul style="list-style-type: none"> ✓ Holding loads at an easy height for transferring on and off ✓ Holding tools and equipment that are frequently used 	<p>High-platform (traymobile) trolleys</p> 

<ul style="list-style-type: none"> ✓ Holding and carrying loads of odd sizes and shapes that are not designed to be stacked, and to carry small, loose items ✓ Easy access to deep boxed trolleys can be achieved with opening sides or spring assisted inserts. <p>For example these trolleys would be suited to carrying tools, small tins of paint, bags etc</p>	<p>Box-sided trolleys</p>   
<ul style="list-style-type: none"> ✓ Very heavy loads are transferred between surfaces ✓ Loads are regularly moved ✓ Scissor lifts are made to safely take loads ranging in weight from 150kg to 1000kg 	<p>Height adjustable lift tables / trolleys</p> 
<ul style="list-style-type: none"> ✓ Where loads are routinely moved, it makes good economic sense to have a dedicated, special trolley. ✓ The trolley opposite is used to test boat trailer electrics, and holds a 12 volt battery and switching unit and a selection of tools. 	<p>Special trolleys</p> 

<ul style="list-style-type: none"> ✓ Heavy tools must be moved ✓ Distances can be long ✓ The surfaces suit wheels 	<p>Tool bag & tool box trolleys</p>    <p>There are a variety of commercially available rigid, trolley cases that can be used for tool storage.</p>
<ul style="list-style-type: none"> ✓ Load is a unique shape – eg masts etc ✓ These may require custom-made solutions to best suit the load 	<p>Mast trolley</p> 

- ✓ Folding trolleys are useful when you need to stow the aid in a car or in a boat etc.
- ✓ The trolley pictured is rated to 250kg, and the lighter version is rated to 125kg

Folding, compact trolleys



Case Study – height adjustable trolley for transferring loads between bench and truck

This height-adjustable trolley is used by a tradesman to move items from his workshop bench on and off his tray-top vehicle. He no longer needs to lift and carry heavy parts that he's been working on, but can slide them at waist height, unassisted. The trolley top is easy to raise using a foot pedal, and the trolley has a safe working load of 200kg.



Adjusting the trolley height with the foot pedal

Case study – New red trolleys save time and effort

One marine business sourced these box-sided trolleys for their tradespeople. A special feature of these trolleys is their hinged, drop down sides that provide easy access to the loads. workers who use these trolleys say that the large pneumatic tyres are easy to move over the hardstand area, and they hold enough tools and equipment to reduce the need for multiple trips back to the workshop. The trolley's drop-down sides provide easy access for any heavy loads.



The new red trolleys showing the detail of the hinge allowing the sides to drop down.

Optimal design features

The trolley should aim to minimise push/pull forces, including the forces required to initiate the trolley movement and then to sustain the trolley movement. The key methods to reduce these forces are to:

- reduce the total weight of the loaded trolley
- replace rough ground surfaces with smooth, hard surfaces
- use wheels with a lower rolling resistance such as those with large diameter wheels, hard tyres, and/or good bearings
- keep trolleys well maintained.

In addition, the loads in the trolley must be easy to access, without placing unnecessary strain on the back.

Past research has identified specific design features that can reduce effort and injury risk in trolley use (Lawson & Potiki 1994 & WorkCover 1996):

Large wheel diameters

- A minimum diameter of 200 mm is recommended for all trolleys that have a laden weight over 200 kg or that are used outdoors.
- For other trolleys a minimum diameter of 125 mm is recommended.

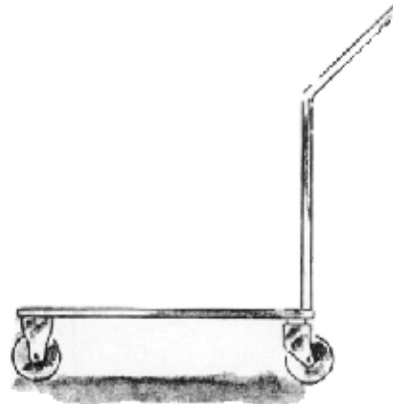
Platform suited to load

- Where possible loads should be positioned so that they are easy to access with the hands between mid-thigh and waist height, and without the need to stoop or twist.
- A trolley with a platform around 800 mm high satisfies this requirement for handling heavy cartons

- A low platform, about 250 mm high, is better for handling items like pails of paint and small drums that have a handle at the top.
- Trolley platforms and storage areas that have smooth shelves without a lip allow the loads to be slid on and off easily.

Good trolley handle designs

- Handles that allow the trolley to be pushed (not pulled)
- Optimum height for a handle for pushing and pulling is between 910 mm and 1000 mm above the ground, depending on the height of the workers.
- In general, the handle should be a little below elbow height. A middle height of 950 mm is a good compromise for most people.
- Vertical handles, instead of a horizontal bar, allow users to find their own most convenient height and should be about 450 mm apart to ensure good control of the trolley.
- The handle should protrude at least 200 mm from the back edge of the trolley to provide room for a normal walking stride
- Trolleys with swivel castors at both ends may also have handles at both ends to maximise manoeuvrability in confined areas.



Suitable bearings

- Sealed precision ball bearings provide the lowest rolling resistance and are recommended for hand pushed trolleys that are used frequently or over reasonable distances
- Roller bearings are more commonly available for industrial castors but need periodic lubrication to maintain low rolling resistance.
- Plain metal bearings are acceptable on trolleys moved only infrequently and over short distances, but the rolling resistance is higher than ball or roller bearings and increases markedly if not regularly lubricated.
- Plastic (usually nylon or acetal) plain bearings are acceptable for light loads and do not require lubrication.
- Thread guards should be used to stop bearings from becoming clogged when used in environments where there are fibres and dust. They are also reasonably effective at keeping dust and debris out of unsealed bearings, therefore requiring less frequent maintenance.

Brakes

- Brakes on at least two wheels are important if the trolley has to be loaded/unloaded on sloping surfaces or where it is important to stop movement while transferring large items
- Castors are available with 'total brakes' that prevent swivelling of the castor as well as rotation of the wheel.

Wheels and tyres for outdoor use


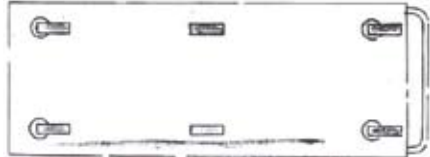
- Pneumatic tyres roll easily over bumps and unpaved surfaces and may be preferred for some outdoor applications. However, they have higher rolling resistance on smooth floors, and correct inflation is critical.
- Some softer tyre materials may have high friction on some floor surfaces and make it hard for the wheels to swivel into alignment when the trolley is started, resulting in a higher initial force.
- For high load applications it is important to try out different wheels on the floor where they will be used, prior to purchase.

Wheels for indoor use on smooth surfaces

- Hard materials such as cast iron and nylon have the lowest rolling resistance on hard smooth surfaces such as concrete and are suitable in industrial applications provided there are no obstructions such as stones or waste.

Wheel / Castor layout

Different wheel and castor arrangements will affect the trolley's use, with different designs suited to different tasks and different environments. See the options in the following table.

Wheel / Castor design	Best suited to:	Disadvantages:
<i>Four swivelling wheels</i>	<ul style="list-style-type: none">✓ Most manoeuvrable✓ Can be moved in any direction✓ Short distances in congested or confined spaces on level floors	<p>Not so well suited to long distances as it requires more effort to steer than other arrangements.</p> <p>On sloped surfaces it may tend to drift sideways and require twisting effort to maintain straight travel.</p> <p>Less stable than two swivelling wheels</p>
<i>Two swivel, two fixed wheels</i> 	<ul style="list-style-type: none">✓ Best suited to long distance pushing and sloped or uneven surfaces.	<p>The swivelling wheels should be at the handle (rear) end of the trolley so that you can steer by a light sideways force rather than a more hazardous twisting force.</p>
<i>Four swivel, two fixed centre wheels</i> 	<ul style="list-style-type: none">✓ Best for long trolleys. The trolley pivots in its own length and is easy to steer around corners in passageways	<p>Is not easily manoeuvred into a corner or parked against a wall.</p>

Further guidance

- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- Guidelines for Design and Selection of Trolleys, in BackWatch Collections, WorkCover NSW 1996
- Research Report: Development of Ergonomic Guidelines for Manually-Handled Trolleys in the Health Industry Lawson J & Potiki J., 1994, (Unpublished). Central Sydney Area Health Service & Worksafe Australia.

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BEST PRACTICES FOR HIGH RISK TASKS



MANUAL TASKS – Handling very heavy loads

HAZARDOUS TASKS identified

In both the maintenance and manufacture of boats, very heavy loads such as engines, gear boxes, masts, rudders, centre boards and lead keels need to be manoeuvred in and out of the boat and/or within the workshop and other work areas.

RISKS to assess

Features of heavy loads that contribute to the risk of musculoskeletal disorders (MSDs) include the load being:

- unbalanced
- large
- fragile
- have no hand holds or attachment points
- require moving within small access points
- awkward shapes and sizes
- greasy and slippery
- having to be held away from body (eg fibreglass rolls)

The law states that risks associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

Visits to marinas and marine workshops revealed a range of options for reducing the human effort in moving very heavy loads - from simple chain blocks to various crane systems and boat-turning devices. A range of commercially available and custom made devices are illustrated in the following table.

	
Commercial engine lift – folded for easy storage	Custom-made engine lift utilising a rated winch

MT 09 Handling very heavy loads V2



Commercial engine lift



Engine stand showing the certification plate with the safe working load



Load Turner – Pal-Turn

The above sequence of photos shows a commercially available 'load turner' in operation. This device uses either straps (for loads up to 20 tonnes) or chains (loads up to 45 tonnes) to lift and rotate unusually shaped loads such as boats.



Manufacturer's supplied lifting attachment allowing the use of the above engine lifts

Case study – Monorail saves time and effort for mechanics

The manager at a regional marine workshop identified that lifting and moving engines, gearboxes and large outboard motors was not only awkward and dangerous but was also slow (taking at least 2 people to lift and manoeuvre them).

After some preliminary design ideas and material specifications checks, the manager constructed a clever 'monorail' system. This consists of an overhead track that runs in the workshop and extends out to a covered area, including over their test tank.

This innovation has resulted in much safer and easier handling and allows staff to work more efficiently too.



Overhead monorail system within the workshop and extending outside, above the test tank

Further guidance

- Work Health and Safety Act 2011
- Work Health Safety Regulation
- Code of Practice – Hazardous Manual Tasks
- WorkCover NSW Plant Guide

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



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Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

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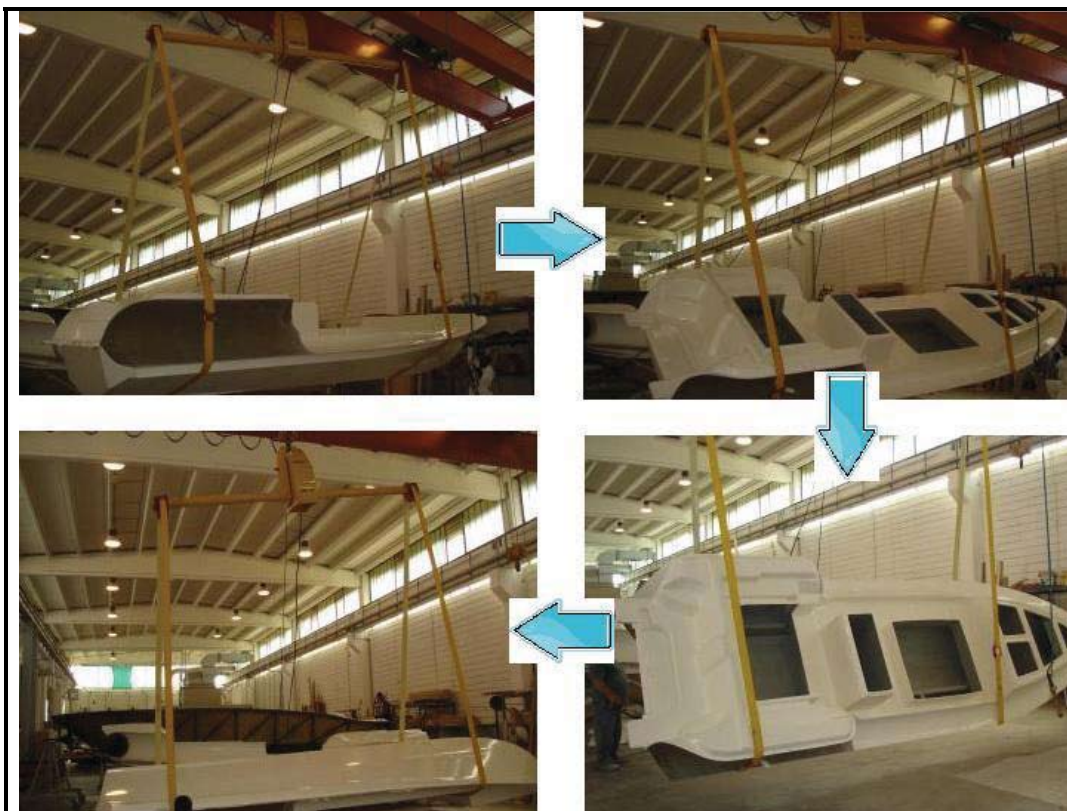
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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



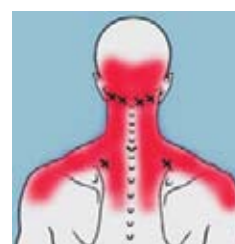
MANUAL TASKS –Working in awkward postures

HAZARDOUS TASKS identified

The term 'manual tasks' often makes people think of heavy lifting tasks, but sprains and strains and other forms of 'body stress' that contribute to musculoskeletal disorders (MSDs) can also be caused by postures and movements where there is **no** load and **no** lifting.

The injury data from the boating industry (*WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009*) show there were lots of injuries from people working in awkward postures, with some of the most hazardous tasks being:

- working on engines in small, restricted spaces
- grinding propellers
- working under trailers
- working under and around a hull and a keel detailing
- sanding and buffing, especially above shoulder height



These awkward postures can affect any areas
- the back, neck, shoulder, elbows, wrists etc

In one incident, while working in a cramped posture in an anchor locker to undertake repairs, - a worker developed back strain and was certified unfit to work for more than 10 weeks. (WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009)

The law states that risks associated with hazardous manual tasks must be eliminated or reduced.

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

Each joint has its ideal or strongest position, and also its weakest and most awkward positions. Problems are likely to develop if the joint's position causes the body's posture to be awkward and if the task:

- is done repetitively (eg the same movement is performed twice a minute or more often) and/or
- requires the position to be held still or uses a forceful grip for more than 30 seconds at a time – a 'static' posture.

The extreme or 'end of the joint range' positions cause the worst body postures. Some of the most tiring and potentially damaging postures for the body are working with the:

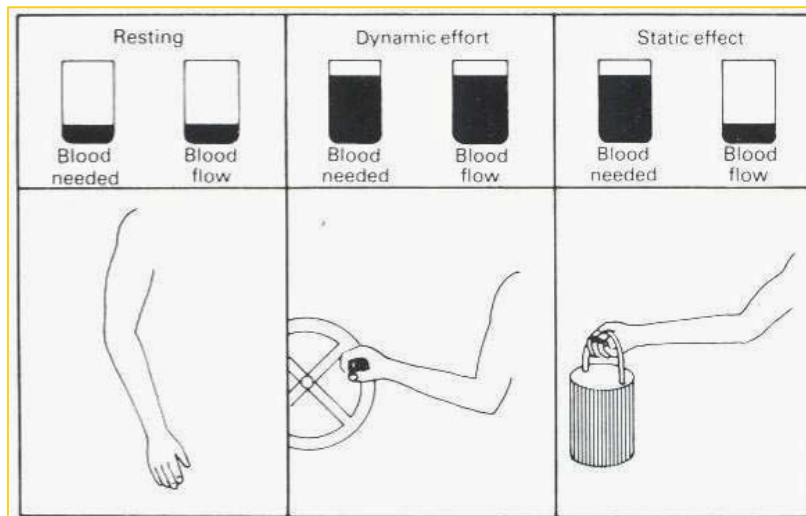
- neck - bent backwards, bent forwards, or twisted
- back - bent backwards, bent forwards, or twisted
- shoulders – working with the hands behind the shoulder or above shoulder height
- arms – reaching a long way from the body
- wrists – bent to any extreme – backwards, forwards or sideways
- hands and fingers – very wide grip, very small grip, using force
- knees – bent to more than 90 degrees



Why is 'static' work more demanding than 'dynamic'?

In dynamic (active) work the muscles are moving a joint and the muscles contract then relax then contract, relax etc. This rhythmic movement acts to pump blood around and allows the exchange of blood flow, nutrients and muscle wastes.

In contrast, with static work there is no movement, and the muscles supporting the joint or joints remain in a contracted state. The internal pressure of the muscle tissues compresses the blood vessels and reduces blood flow to the muscle, resulting in a reduction of oxygen and nutrients reaching the muscle cells and causing the waste products to accumulate in the muscle.



(Grandjean 1988)

While static positions are a common requirement for many tasks, it is when the postures are *frequently* required and the postures are held for *long periods* that chronic problems can develop in the muscles. These changes can include a chronic reduction in local oxygen concentration, swelling within the muscle, and complex biochemical changes and degenerative changes affecting joints, muscles, ligaments and nerves. These responses are an example of the 'cumulative trauma' that can develop in the musculoskeletal system.

Some of the symptoms that you may experience from cumulative trauma to your musculoskeletal system include:

- Stiffness
- Tingling
- Clumsiness
- Loss of coordination – dropping things unexpectedly
- Loss of strength
- Changes in temperature
- Numbness
- Pain
- Skin discolouration
- Weakness
- Muscle wasting



'Long board' sanding

In 'long board' sanding, there is a combination of both static muscle work and dynamic muscle work. There is static work by the fingers to grasp the board firmly, and dynamic work to move the board. Working above shoulder height (as illustrated) generally requires high levels of static work in the shoulder and neck musculature to keep the arms elevated and these areas can rapidly fatigue. Muscles need some 'recovery' time between these static contractions to replenish the blood supply and to remove the build up of waste products.

The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

Given the problems with static postures and awkward postures, the main thing to do is to minimise your exposure to them.

Adjust the work area

The best way to reduce the need for awkward postures is to adjust the work area as much as possible. So if you need to work with your arms reaching over shoulder level, even a small increase in your height for easier reach can make a significant difference to the impact on the shoulder joints and the strain on the rotator cuff.

Improve the job design

Where awkward postures are inherent in certain jobs – such as working in small spaces in a boat's hull etc – try to design your work to provide a range of tasks each day and through the week to allow for variations in postures and variations in the type of muscle work. This may include spending some periods in the awkward and/or static postures, but frequently interspersing those tasks with other tasks where you can be working in a more comfortable, upright and symmetrical posture.

These 'other' tasks may include physical tasks (such as standing and working at a bench) or lighter/more sedentary tasks (such as catching up on paperwork, getting organised for the next job, returning phone calls etc). Research has shown that people are most productive and efficient when they have tasks that provide a variety of physical and cognitive demands, rather than doing one task all the time.

Do tailored exercises

There are benefits in doing regular stretches and exercises. The stretches and exercises should be tailored to the posture you have been in, so if you have been working in a very forward flexed posture, do the opposite – and allow your back to slightly extend backwards. Where you have been doing a lot of gripping, it's good to extend your fingers and hold them in an outstretched position. With any exercises or stretching it's important to be doing it correctly and to suit your own body and any past injuries etc, so it's always recommended to see a health professional for tailored advice.

Case study - Rolling on paint vs spraying

Using a paint roller to anti-foul a large hull can be time-consuming, and also requires some very awkward postures to reach underneath the vessel. A marina manager described significant savings in terms of both time and effort when comparing roller painting anti-foul on a boat as compared with spraying the paint. The manager estimated he could spray a boat in 30 minutes or roller it in 3 hours. He changed from rolling to spray painting after developing a back injury as he finds that spray painting is much less stress on his back.

While spray painting may place less strain on the back, there can also be musculoskeletal stress from spray gun triggers and grips. See guidance note '*Selecting tools*' for tips on spray gun use. Spray guns also bring additional considerations in terms of air pollution, risk of overspray, an increased amount of preparation for the task (eg masking up), and additional painting skills to achieve an even coverage and a good finish. .

Other ways to reduce awkward postures in roller painting are to use various extension handles, with one operator finding pool poles to be well suited to some reaching tasks.



Applying paint with a roller



Applying paint with a spray gun

Further guidance

- Work Health and Safety Act 2011
- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia
- Grandjean E, 1988, Fitting the task to the man – a Textbook of Occupational Ergonomics, Taylor & Francis

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WORK HEALTH AND SAFETY INDUSTRY GUIDANCE



MANUAL TASKS –Why team lifting is *not* recommended

HAZARDOUS TASKS identified

Injury statistics (*WorkCover NSW Workers Compensation Data 2004/2005 – 2008/2009*) from the boating industry show that team handling or 2 person handling methods can be very hazardous.

The draft Code of Practice - Hazardous Manual Tasks states:

Team lifting.... "should only be used as an interim control measure"

Consultation is a legal requirement and an essential part of managing health and safety risks.

A safe workplace is more easily achieved when everyone involved in the work communicates with each other to identify hazards and risks, talks about any health and safety concerns and works together to find solutions. This includes cooperation between the people who manage or control the work and those who carry out the work or who are affected by the work. By drawing on the knowledge and experience of your workers, more informed decisions can be made about how the work should be carried out safely.

RISKS to assess

Team lifting can increase the risk of musculoskeletal disorders (MSDs) if:

- there is a lack of coordination of the lift, eg do we lift *on* 3 or *after* 3?!
- there are people of different height, with some needing to lift in a bent posture, and others working at or above shoulder height
- one person is walking backwards and twisting to see, or both moving with the spine twisted sideways
- the load is unevenly carried, with one end taking excessive weight
- the load cannot be held close to each person's body, causing an increased biomechanical disadvantage
- workers do not exert force simultaneously
- people lose their grip or their footing, placing sudden and high forces on the remaining worker/s
- performed on steps or on a slope where most of the weight will be borne by handlers at the lower end

The law requires that risk associated with hazardous manual tasks must be eliminated or reduced.

RISK CONTROL options

As with all hazards the law requires that you eliminate or control the risks.

The priority is to eliminate the need to lift, or to redesign the task to allow the use of mechanical equipment. Team lifting is considered a 'low level' control on the Hierarchy of Control as it is less safe and less reliable in controlling the risks.

For specific advice regarding safer alternatives to team lifting, refer to the guidance material on some common lifting situations that occur in the boating industry:

- Handling blocks for standing boats
- Handling drums
- Handling fibreglass rolls
- Handling stern drives
- Tipping and Pouring from drums and other containers
- Handling very heavy loads
- Working in awkward postures

However where a team lift is used in an emergency situation or as a temporary interim control measure, the technique is critical. It is essential to match workers, co-ordinate and carefully plan the lift.

The person organising the lift must:

- select any available aids such as slings, trolleys, lifting bars etc to assist
- plan the route, making enough space and avoiding steps and stairs
- select a suitable number of people of similar height and capability, based on the load weight, size and awkwardness (choosing more rather than less people)
- prior to commencing, brief the group on the task and their responsibilities during the lift
- check training in team lifting has been provided and the lift rehearsed, including the use of aids as well as what to do in case of an emergency
- inform the group of the call or signal for the lift to ensure good coordination

The people assisting in the lift must, where possible

- orient their bodies to avoid twisting and bending
- get a close and firm grip, keeping the load close to themselves

Also ensure that the load is realistic for the number of people. Research has shown that:

*"...the capacity of lifting teams is **less** than the summed capacity of individual team members..."* (Barrett RS & Dennis GJ, 2005)

Case study – Is training in 'safe lifting' effective?

To reduce injury risk companies often spend time and money training staff in 'safe lifting'. Much of this training has focused on the "straight back and bent knees" principles, and on lifting rather than any other manual tasks (eg repetitive hand tasks, pushing, pulling, carrying etc).

Research into teaching 'safe lifting' has now proven that teaching lifting techniques is **not** an effective intervention by itself. The risk isn't controlled and it relies on worker behaviours.

As the Code outlines, manual handling programs need to focus on design and engineering

MT 11 Why team lifting is not recommended V3

controls to remove the need to handle in the first place. It is more effective and safer to spend time and effort in redesigning the task and/or getting good equipment.

Training is an important element to reducing body stress at work, but the most useful training is in how to identify, assess and manage risk and how to design a safe work area. Elements of this may include: how to select the right tools, how to set up the work area, how to use an engine hoist, how to design a work schedule with a suitable mix of tasks, how to identify the early signs of an injury and who to report this to.

Further guidance

- Work Health and Safety Act 2011
- Work Health and Safety Regulation
- Draft Code of Practice – Hazardous Manual Tasks, Safe Work Australia

References

Barrett RS & Dennis GJ, 2005, Ergonomic issues in team lifting, Human Factors & Ergonomics in Manufacturing and Service industries, Vol 15: 293–307.

Note: This material provides a brief overview of some of the key issues and readers are directed to the further guidance material provided and to seek expert advice as required. Each business should utilise risk management principles, including consulting relevant workers, to ensure any control measures implemented are properly tailored to the site, workers and tasks.

To ensure you comply with your legal obligations you must refer to the appropriate legislation. Information on the latest laws can be checked by visiting the NSW legislation website (www.legislation.nsw.gov.au).

This publication does not represent a comprehensive statement of the law as it applies to particular problems or to individuals or as a substitute for legal advice. You should seek independent legal advice if you need assistance on the application of the law to your situation.