

## 7-Step Process to Reduce the Risk of MSI

B.C.'s Occupational Health and Safety Regulation requires employers to eliminate or, if that is not practicable, minimize the risk of musculoskeletal injury to workers. Employers address the Ergonomics (MSI) Requirements listed in sections 4.46 to 4.53 of the Regulation by using a seven-step injury prevention process. Employers can obtain more information in the following pages and/or by accessing **Preventing Musculoskeletal Injury (MSI): A Guide for Employers and Joint Committees**, available on the WorkSafeBC web site at [WorkSafeBC.com](http://WorkSafeBC.com)

### Step 1: Consultation

Consult with joint health and safety committees or worker health and safety representatives during each step in the MSI prevention process.

### Step 2: Education

Educate workers about risk factors, signs and symptoms of injury, and potential health effects.

### Step 3: Risk Identification

Identify jobs with risk of MSI. Identify risk factors on those jobs.

### Step 4: Risk Assessment

Assess identified risk factors to determine the degree of risk to workers. Consult with affected workers and a representative sample of other workers who perform the same tasks.

### Step 5: Risk Control

Implement control measures where required to eliminate or minimize the risk to workers.

### Step 6: Training

Train workers in the use of control measures.

### Step 7: Evaluation

Evaluate control measures to determine their effectiveness to eliminate or minimize the risk of MSI. Where the risk has not been effectively controlled, re-examine the task.

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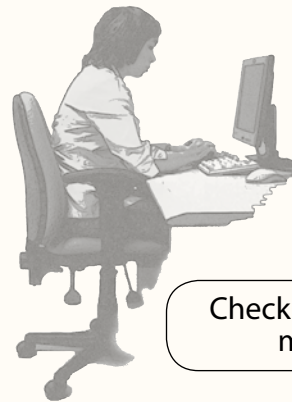
WORKING TO MAKE A DIFFERENCE  
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This publication was produced for workers and health and safety professionals as a guide in their daily work routines or for their inspections on the jobsite. They may also refer to or use the information contained in this document to assist them in carrying out their occupational health and safety roles and responsibilities.

This document does not replace the Occupational Health and Safety Regulation or the *Workers Compensation Act*. This document is not intended to

explain the many health and safety requirements that apply to industry. Employers and workers should always refer to the Act/Regulation and applicable guidelines for specific requirements that apply to their work operations and activities.



Check [WorkSafeBC.com](http://WorkSafeBC.com) for more information.

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## Making It Right



**Preventing  
Musculoskeletal Injuries (MSIs)  
in Manufacturing**

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# 1 Know Your Body

## What causes injuries

Certain actions can lead to fatigue, discomfort, or pain when you do them over and over without a break:

- ✎ Working in awkward postures (for example, bending or twisting your back to reach for a tool)
- ✎ Exerting force to do a task or use a tool (for example, pressing down on a knife)
- ✎ Remaining in the same position for a long time (for example, sitting at a sewing machine)
- ✎ Pressing on hard surfaces (for example, leaning your wrist against the corner edge of the counter while performing a task)
- ✎ Working in cold conditions
- ✎ Holding vibrating tools or working on a vibrating surface

## What to watch for

Signs and symptoms that might indicate you have an injury:

- ✎ Pain
- ✎ Tingling
- ✎ Weakness
- ✎ Decreased range of motion
- ✎ Numbness
- ✎ Swelling
- ✎ Changes in skin colour

If you feel discomfort or have any other symptoms, you must change the way you work or the equipment you use. If no changes are made, your symptoms may get worse and keep you from working at all.

## What to do if you are injured

Do not wait if you think you might have an injury:

- ✎ Talk to your supervisor about your symptoms right away
- ✎ Seek medical treatment to prevent the problem from getting worse
- ✎ Work with your supervisor and health and safety committee to find the cause of the problem
- ✎ Think about the movements/tasks that are related to your discomfort
- ✎ Always look for better ways to do your job

## The “duration factor”

Look at the risk duration and ask yourself: "How long ..."

- ✎ How long do I use force (for example, to lift or grip an object)?
- ✎ How long do I perform a task with an awkward body posture?
- ✎ How long do I perform a repeated task?
- ✎ How long does one part of my body remain in contact with a hard surface?

## The “magnitude factor”

Look at the risk magnitude and ask yourself: "How much ..."

- ✎ How much force am I using?
- ✎ How severe is the awkward posture?
- ✎ How fast am I doing the repeated movements?
- ✎ How hard is the surface I am touching?

## 2 Prevent Slips, Trips and Falls

A slip or trip may result in a fall, which can cause head injuries, broken bones, sprains, strains, and bruises.

### What causes slips

Slips occur when there is too little traction or grip between your footwear and the walking surface as a result of:

- Wet, waxed, or oily floors
- Ice, rain, or snow
- Loose mats or other material covering the floor (for example, plastic, cardboard, or cloth)
- Wrong footwear (for example, shoes when boots are needed)



Good housekeeping prevents slips, trips and falls

### What causes trips

Trips occur when you hit something that causes you to lose your balance, such as when you are carrying or handling something that stops you from seeing a hazard in front of you. Trips can also be caused by:

- Poor lighting
- Wrinkled material covering floors
- Uneven surfaces
- Clutter
- Cables and cords

### What to do to avoid falling

A well-maintained work environment is the first and most important step in preventing slips, trips, and falls. Make sure that work areas are kept free of hazards:

- Clean all spills immediately
- Mark spills and wet areas with warning signs
- Spread grease-absorbing compound on oily surfaces
- Use tacks or tape to secure any material covering the floor
- Always close cabinet and storage drawers
- Cover or tape cables and cords that cross walkways
- Keep work areas and walkways well lit and free of clutter

You can also prevent slips, trips, and falls by wearing proper anti-slip footwear, working at the appropriate pace, and thinking about visibility:

- Take your time and pay attention to where you are going
- Adjust your pace to suit the type of flooring and the tasks you are doing
- Walk with your feet pointed slightly outward
- Make wide turns at corners
- Make sure you have enough light for your tasks. Ask for more lighting if you have concerns
- Make sure nothing you carry, push, or pull prevents you from seeing what is ahead of you

## 2 Prevent Slips, Trips and Falls

### 3 Awkward Posture – Bending / Twisting

#### Awkward Posture

Awkward posture refers to any unnatural body position. Unnatural ways of turning your neck and back, moving your shoulder, or holding your wrist can put stress on your tendons, muscles, and other soft tissues. You can cause injuries when bending, twisting, squatting, stooping, standing, or sitting. The more awkward the posture and the longer you hold it, the greater the risk of injury.



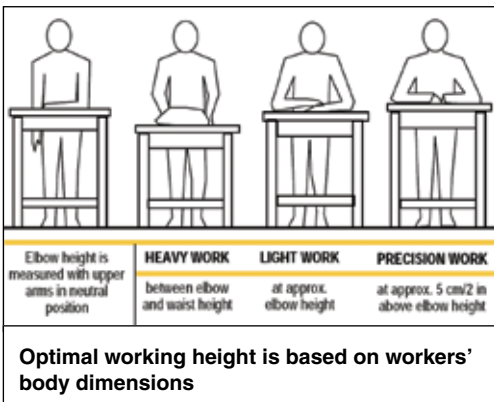
Awkward bending/twisting posture



Awkward bending posture

You can prevent injuries caused by bending and twisting:

- ✎ Make sure your work surface is at the right height for the task



- ✎ Store frequently used materials, parts, or tools within easy reach and as close to waist/hip height as possible
- ✎ Use mechanical aids to move materials and products around the workplace



Working at an appropriate level by using a scissor lift

### 3 Awkward Posture – Bending / Twisting



## 4 Awkward Posture – Extended Reaches

Extended reaching is an awkward posture. Here are a few examples of extended reaching:

- Hands above the head
- Elbows above the shoulders
- Reaching forward or behind the body



Working with an extended reach

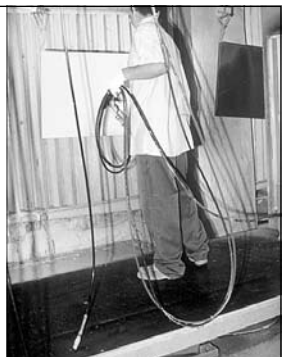
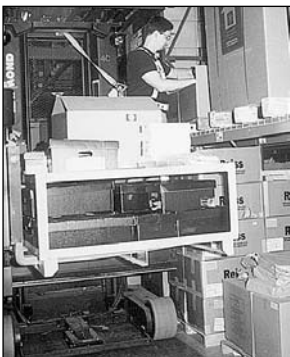
You can prevent injuries caused by working with an extended reach:

- 📎 Use extension poles or appropriate height ladders, scaffolds or adjustable height work platforms
- 📎 Make it possible to move closer to your equipment or work (for example, create a cut-out in your workstation)
- 📎 Avoid extended or repeated long reaching to do your work

Typically using an awkward posture beyond 4 hours per day is considered high risk.



Create a cut-out work station to reduce the reach



Use adjustable work platforms to bring the work below shoulder height

## 4 Awkward Posture – Extended Reaches

## 5 Awkward Posture – Squatting / Sitting

### Squatting

Prolonged squatting can lead to discomfort and injury to the knee. You can prevent injuries caused by squatting:

- ✎ Sit on a stool



Using an employee-modified stool to prevent squatting or kneeling

- ✎ Kneel instead of squat – use knee pads
- ✎ Make sure you have enough access or clearance to work without squatting or stooping for prolonged periods
- ✎ Use tools with extended handles
- ✎ Squatting is an awkward posture, and you should limit your time to four hours per day



Prolonged squatting posture

### Sitting

Prolonged sitting can cause discomfort, fatigue and even injury. You can reduce discomfort associated with prolonged sitting:

- ✎ Use a chair with an adjustable lumbar support
- ✎ Ensure that you can sit all the way to the back of the seat and that you have 2 to 3 finger widths between the edge of the seat and your calves
- ✎ Adjust your chair to a comfortable height for your work
- ✎ Use a footrest if your legs are slanted downward when sitting



Better sitting posture with leg support

## 6 Working On Your Feet

Prolonged standing can cause fatigue leading to pain:

- Do not stand on sloped, uneven, hard, or slippery surfaces for prolonged periods of time
- Use anti-fatigue mats or insoles to improve comfort while standing for prolonged periods of time
- Use proper footwear for your workplace
- Provide methods to alter standing posture, such as:
  - placing feet on a footrest
  - using a sit-stand stool



Placing one foot on a footrest can improve comfort when standing for prolonged periods



A sit-stand stool can be used to alter position

### Anti-fatigue Mats

Anti-fatigue mats come in many different sizes and forms, and are suited for different environments. You should be aware of the specific needs of your work environment before looking for anti-fatigue mats.

What you should know about anti-fatigue mats:

- Most people think “The softer and thicker the mat, the better.” Not true!
- There is evidence that very soft and/or very thick mats actually increase a worker’s leg and back fatigue. Thicker is not always better. Anti-slip mats and other regular mats are NOT anti-fatigue mats.
- Some mats are designed for slippery environments.
- Anti-fatigue mats should not slide on the floor.
- Anti-fatigue mats have a life span ranging from 1-10 years. Cost may be a concern, so be sure to check out the mats’ life expectancy.
- Be sure that the mats have sloped edges so that they don’t become a trip hazard, and it is still easy to roll carts over them without running into a bump.
- Easy cleaning and sanitizing of the mat is important. Mats are less likely to be used if they are difficult to clean.



Standing on anti-fatigue mats

**NOTE:** The most important gauge of an anti-fatigue mat is how it feels to the users.

# 7 Workstation Design

## Workstation design criteria

A workstation should:

- ✎ Allow the worker to sit in a balanced body position
- ✎ Ensure that the alignment of the spine is the same whether the worker sits or stands
- ✎ Allow the worker to move the spine freely



Sitting on a poor surface

Design tasks so they require movement of the spine and encourage the worker to alternate positions frequently:

- ✎ Avoid an excessive range of movement by:
  - providing all materials at working level
  - positioning tasks within easy reach
  - not lifting and transferring loads while sitting, if possible



Store heavy items as close to waist or hip level as possible

- ✎ Position visual tasks to maintain the vertical alignment of the head and spine
- ✎ Design a sitting task that encourages the worker to alternate positions frequently
- ✎ Store heavy, awkward items close to waist/hip level
- ✎ Reduce the number of tasks that require manual handling
- ✎ Fit loads with hand grips



### Lighting Criteria

The lighting system should:

- Provide good general lighting
- Provide task lighting where necessary
- Avoid glare

## Foot task considerations

- ✎ Position foot tasks so that they can be done without twisting hips
- ✎ Design foot tasks to avoid movement and exertion by only one leg
- ✎ Provide the appropriate support for both the working and the non-working leg

## Control design considerations

- ✎ Ensure that controls are within easy reach
- ✎ Make controls consistent with the expectation of what they do and with other similar equipment, i.e., all forklifts have controls in the same place
- ✎ Ensure the labels give the user proper information



## Reducing Musculoskeletal Injuries (MSI)

An MSI is defined as an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels, or related soft tissues. These kinds of injuries are also called sprains and strains. They can result from certain tasks that require a worker to bend, reach, or turn. They can also happen when a worker repeats the same movement many times, grips something tightly, works in cold conditions, or comes in contact with vibrating machinery. An MSI can affect the neck, back, shoulders, arms, elbows, wrists, fingers, or knees, and can cause pain, weakness, and numbness.

To reduce/eliminate the risk of MSI requires increased workplace awareness. In particular, workers and employers need to:

- Recognize the signs and symptoms of MSI
- Identify **Risk Factors (19)**
- Eliminate or minimize risks



**A difference in stature can mean a job is awkward for one person but not for another**

## 8 Lifting Tips

### 1 Eliminate unnecessary lifting

Whenever possible, eliminate manual materials handling by combining operations or shortening the distances that material must be moved. Look at material flow through the facility, and eliminate any unnecessary lifts.

### 2 Automate or mechanize lifting

If it's not possible to eliminate the lift, consider automating the lifting task or using a mechanical lifting device. Devices such as hoists, cranes and manipulators can eliminate the forces on the spine associated with manual materials handling. Therefore, the likelihood of back injuries is also reduced.



Using a mechanical lifting device

### 3 Modify the job to fit within worker capabilities

If material must be handled manually, design the job to reduce the stress on the body as much as possible using some of the job modifications listed below:

✎ Allow for lifting loads as close to the body as possible. Some techniques to reduce reaching distances are:

- Eliminate any barriers such as the sides of bins or boxes
- Use a turn table for loads on pallets
- Use a tilt table to allow for better access into bins



Turn Table



Tilt Table

- ✎ Place the load as close to waist height as possible. This may be accomplished by using adjustable lift tables or inclined conveyors to locate the object to be handled at waist height
- ✎ Reduce twisting by moving the feet and by aligning the beginning and the end points of the lift
- ✎ Reduce the weight of the load

## 9 Force – Lifting and Lowering

### Force

Force refers to the effort you must use to lift, lower or carry an object. More force is required when you handle objects that are heavy, slippery, odd-shaped, fragile, very small or very big. The greater the force needed to do a job, the greater the risk of injury.

- 34 kg (75 lb.) once a day is a **heavy lift**
- 25 kg (55 lb.) 10 times a day is a **heavy lift**
- 4.5 kg (10 lb.) twice per minute, two hours a day is a **frequent lift**
- 11 kg (25 lb.), above the shoulders, below the knees or at arms length, 25 times a day is an **awkward lift**



Lifting heavy or large objects presents high risk to the back

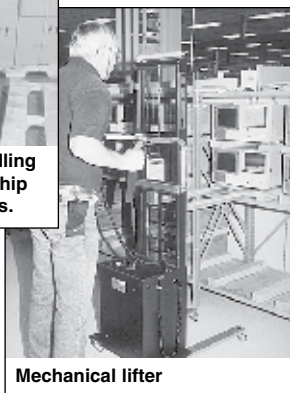
You can prevent injuries caused by lifting and lowering objects:

- Always try to lift within the “lifting safety zone” – elbow to knuckle height
- Use proper lifting techniques – bend your hips and knees and hold objects close to your body

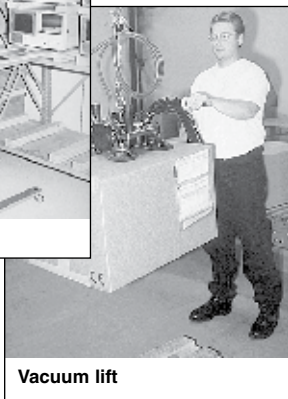


Rollers can reduce handling requirements. Height at hip improves lifting postures.

- Use grips that allow elbows to remain at or near your sides
- Use mechanical aids to help with lifting when possible



Mechanical lifter



Vacuum lift

For more information about lifting, please refer to the WorkSafeBC **Lift / Lower Calculator**:

<http://www2.worksafebc.com/calculator/l/c/default.htm>

## 10 Force – Pushing and Pulling

You can prevent injuries caused by pushing and pulling objects:

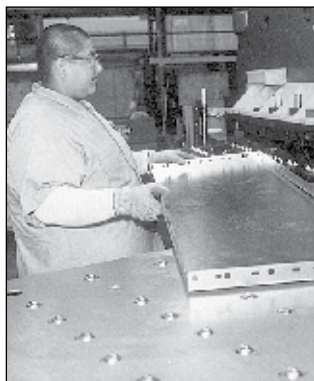
- ✎ If you have a choice, push rather than pull an object—pushing uses stronger back and leg muscles
- ✎ Reduce the distances that material needs to be pushed or pulled
- ✎ Use wheels that are appropriate for the surface
- ✎ Maintain the wheels of carts
- ✎ Make sure that floors are kept free of debris and good housekeeping is maintained
- ✎ Use automated or powered carts when possible



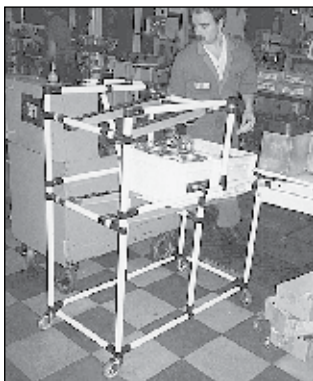
Whenever possible, push rather than pull



Pushing heavy carts on sloped or uneven ground can cause injuries



Roller tables can reduce the forces needed to push or pull products



Mobile light-weight trolleys with adjustable shelves are ideal for moving products

For more information about pushing and pulling, please refer to the WorkSafeBC **Push / Pull / Carry Calculator**:

<http://www2.worksafebc.com/ppcc/default.htm>

## 11 Force – Carrying

You can prevent injuries caused by carrying objects:

- 📌 Use mechanical aids to help with carrying when possible
- 📌 Shorten the distances that materials need to be carried
- 📌 Avoid carrying wide or tall loads
- 📌 Assure that material has appropriate handles for carrying
- 📌 Only carry a load one-handed if it is compact



Carrying heavy, awkward boxes can contribute to injuries



Adjustable tilt table can be used to transport heavy items

For more information about carrying, please refer to the WorkSafeBC **Push / Pull / Carry Calculator**:

<http://www2.worksafebc.com/ppcc/default.htm>



Powered lift truck can ease lift and transport of heavy loads



Conveyor can be used to shorten carry distances



### Contact Stress

Contact stress refers to physical contact between part of your body and hard objects such as edges, tools, machinery or products. Contact stress usually involves the knee, shoulder, elbow, wrist, or hand. Point pressure may also occur at the sides of fingers. Pressure over sensitive areas can affect nerves and blood flow. If the object presses on an area without much protective tissue, such as the wrist or palm, there is more risk of injury. There is also more risk if pressure is applied repeatedly or held for a long time.

You can prevent injuries caused by leaning on edges:

- ✎ If possible, add padding to work surfaces
- ✎ Wear padded clothing, gloves, knee pads, or elbow pads when appropriate
- ✎ Use well-designed tools with handles that are rounded, soft, and padded
- ✎ Pad or adapt handles that have hard edges or deep grooves
- ✎ Ensure that handles extend beyond the hand



Contact stress on the fingers

For more information about tools, see [Handling Tools \(13\)](#).



Armrest reduces contact stress on the arms while using the microscope



Gloves can reduce the contact stress from the handle grooves

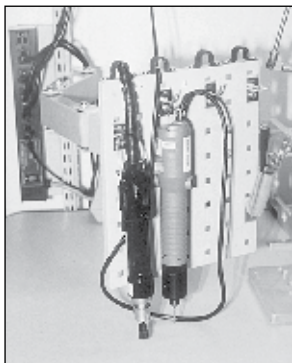


Reducing stress on the knees by using knee pads

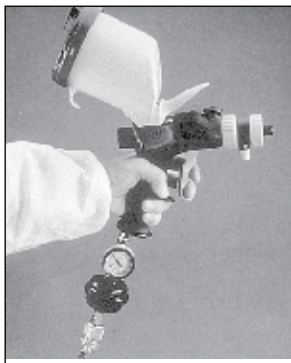
## 13 Handling Tools

You can prevent injuries caused by handling tools:

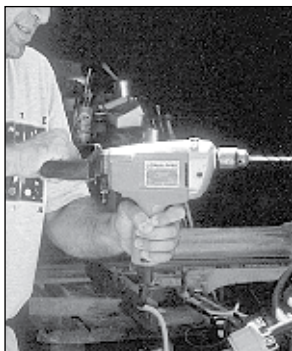
- Use well-designed tools with handles that are rounded, soft, and padded
- Pad or adapt handles that have hard edges or deep grooves
- Ensure handles extend beyond the hand (at least 120 mm)
- Use counterbalancing suspension for tools
- Ensure a handle diameter of 50-60 mm to fit the hand comfortably
- The handle span should not exceed 76 mm for good mechanical advantage
- Avoid handles with ridges or grooves when selecting tools
- Spring-loaded handles reduce forces and the time required to open the handle



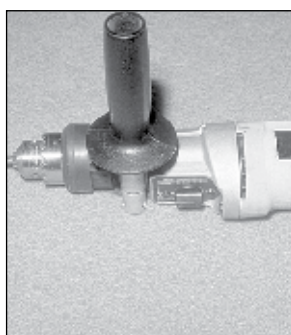
Trigger-less tools – contact switches replace triggers



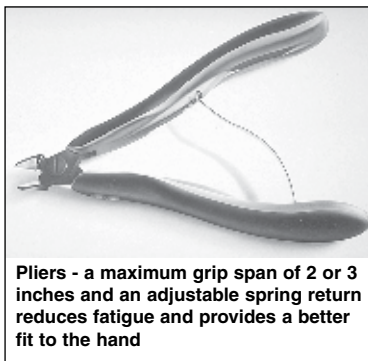
Well-balanced tool (sprayer) with a swivel connection for the hoses



Two handles help improve control and reduce force



Extra handle to improve control and grip



Pliers - a maximum grip span of 2 or 3 inches and an adjustable spring return reduces fatigue and provides a better fit to the hand

## 14 Repetition

### Repetition

Repetition refers to using the same muscles to repeat a task or motion over and over again. If there is not enough time for the muscles to recover between repetitions, an injury may result. The more times you repeat the task or motion and the less time you have to recover, the greater the risk of injury.

The risk of injury is greater when repetitious jobs involve awkward postures or exertions. Injuries may also develop when highly repetitious jobs are combined with low-force exertions such as light assembly tasks.



Repetition can be difficult to control, but there are things that can be done to control the risk:

- ✎ If possible, reduce the number of times you repeat the task or motion
- ✎ Make sure you give your muscles a chance to rest at intervals throughout the day by using micro-pauses and breaks
- ✎ Enlarge the job to include a variety of tasks and increase the cycle time
- ✎ Rotate to different tasks with different muscle loads to reduce exposure to repetition
- ✎ Reduce other risks such as awkward postures, force or cold
- ✎ Wherever possible, allow the worker to control the pace of work
- ✎ Train in good techniques

### Environmental Factors

Environmental factors refer to conditions in your workplace—such as cold temperatures or vibrations from equipment—that can contribute to an injury. For example, working in a cold draft reduces blood flow to the hands and can mean a worker needs to use more force to grip an object. The longer the exposure to these conditions, the greater the risk of injury.

Consider the following points when looking at working conditions in cold temperatures:

- ✎ Are workers exposed to cold temperatures for prolonged periods without ability to warm up?
- ✎ Do workers wear appropriate clothing and gloves when working in coolers or freezers?
- ✎ Are workers experiencing numb hands?

### Reducing MSI risks in cold temperatures

Apply the following strategies:

- ✎ Wear high-friction, well-fitting gloves
- ✎ Use clothing that keeps workers warm without adding a lot of bulk
- ✎ Store hand tools in a warm place prior to use
- ✎ Have workers alternate between periods of cold work and periods of warm work
- ✎ Avoid tools that discharge cold gases over the hand
- ✎ Use portable heaters
- ✎ Ensure worker education about the adverse effects of cold and its influence on MSI
- ✎ Stay well-hydrated



Dress warmly when working in a cold environment

## Workplace Awareness

Being aware of the factors that can contribute to injury is the first step toward preventing an MSI:

- ✎ Layout and condition of the workplace/workstation (for example, a work surface that is too high or too low can force a worker to use awkward working postures)
- ✎ Characteristics of objects handled (for example, an object that is slippery or large can mean a worker has to use more force to handle it)
- ✎ Organization of work tasks (for example, a job that requires a worker to perform a particular task throughout the day can mean the worker is exposed to the same risk factor for a longer time)

The more risk factors a task involves, the greater the risk of injury. For example, someone repeatedly lifting boxes to a storage shelf is exposed to multiple risks:

- ✎ **Awkward Posture (3)** — bending at the waist and reaching forward with one shoulder
- ✎ **Force (9)** — lifting a heavy weight with one hand
- ✎ **Contact Stress (12)** — grasping narrow strapping
- ✎ **Repetition (14)** — performing the same task all day
- ✎ **Environmental factors (15)**



## 16 Environmental Factors – Vibration

There are two types of vibration that could cause injury to the body: hand-arm vibration and whole body vibration. In a manufacturing environment, hand-arm vibration is usually the one of concern.

- ✎ When using moderately vibrating tools (e.g., grinder, sanders, jig saw), limit exposure to 2 hours total per day
- ✎ When using high vibrating tools (e.g., impact wrenches, chainsaws, jack hammers, riveting hammers), limit exposure to 30 minutes total per day

You can prevent injuries caused by vibration:

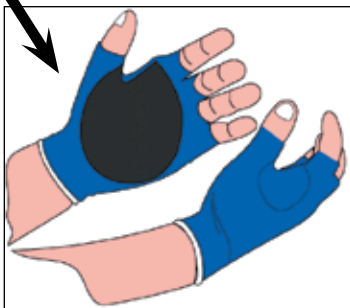
- ✎ Use an alternative or low-vibration tool when possible
- ✎ Use the right tool for the job – sometimes machinery is more effective than a hand tool
- ✎ Maintain tools
- ✎ Use vibration-dampening wraps on handles
- ✎ If you must stand or kneel on a vibrating surface, use mats with anti-vibration properties on the floor or work platform



Pneumatic tools can transmit damaging levels of vibration to the hands



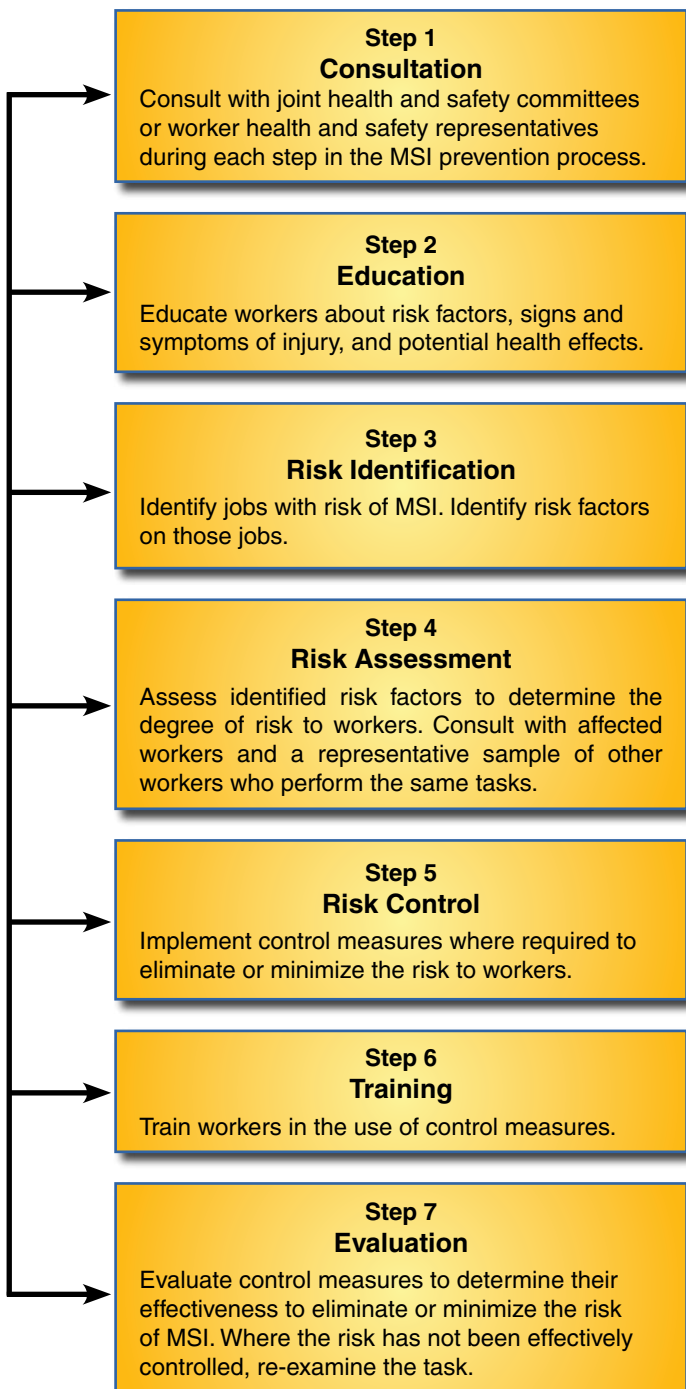
Anti-vibration gloves can reduce the risks associated with vibrating tools



# 17 7-Step Process to Reduce the Risk of MSI

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## Steps in the MSI Prevention Process



# 18 Step 1: Consultation / Step 2: Education

## Step 1: Consultation

Employers must consult with the joint committee or the worker health and safety representative at every step of the MSI prevention process. "To consult with" means to seek information or advice from the joint committee or worker health and safety representative.

When doing a risk assessment, employers must also consult with a sample of workers who carry out the tasks being assessed and with workers who have experienced signs or symptoms of MSI. Workers can also be consulted at other steps since they may know the job best.

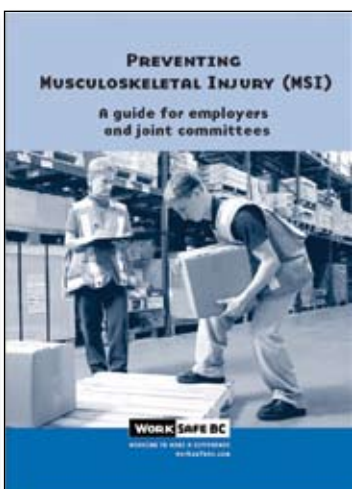
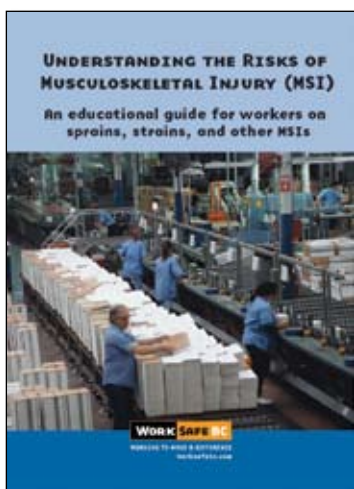
## Step 2: Education

Employers must ensure that workers are educated about:

- ✎ Risk identification related to their work (factors that may put workers at risk for MSI)
- ✎ The signs and symptoms of injury
- ✎ The potential health effects of MSI

The WorkSafeBC publication **Understanding the Risks of Musculoskeletal Injury (MSI)** can help with this education.

This and other helpful publications are available on the WorkSafeBC web site at **WorkSafeBC.com**.



## 19 Step 3: Risk Identification

### Step 3: Risk identification

Employers are required to identify factors in the workplace that may expose workers to a risk of MSI. Risk identification should be conducted by people who understand both the work process and the risk factors and who have some education and training in the principles of risk assessment.

**Priority** for risk identification should be given to jobs where a worker has:

- already had a work-related MSI claim,
- been injured and reports to first aid with an MSI, or
- reported signs or symptoms of MSI.

Early risk identification can help prevent injuries in the following situations:

- ✍ A worker or supervisor observes high exposures to risk factors in a job—for example, during workplace inspections and observations of current work methods
- ✍ A new job is introduced or a process changes

There are several tools (e.g., checklists, worksheets) available. Tools to help identify jobs or tasks incorporating exposures that pose a risk of MSI can be obtained from a WorkSafeBC officer. These tools help identify risk factors that require further investigation to assess the risk to workers.

Other methods can be used to identify risk factors as long as they include the risk factors listed in the **Occupational Health and Safety Regulation**. The WorkSafeBC web site has links to various resources. You can also contact your local WorkSafeBC office and talk to an officer to get further guidance on risk identification for your workplace.

If the risk identification step reveals an obvious and effective risk control that will eliminate or minimize the risk to workers, you do not need to conduct a separate risk assessment.

For example, if a receptionist twists her neck to view the computer monitor (which has been placed to one side), the employer may decide to alter the counter so there is room for the monitor to be placed directly in front of the worker. This control measure can be implemented without first assessing how long the worker is in that posture or how severe it is.



Incorrect monitor position

## 20 Step 4: Risk Assessment

### Step 4: Risk Assessment

Employers must assess the degree of risk (high, moderate, or low) to the workers in those jobs or tasks where exposure to risk factors has been identified.

**Risk Assessment** should be performed by people who understand the work process, the MSI risk factors, and the principles of risk assessment and control.

For example, you may have identified an awkward stooping posture when a worker reaches to perform a task. During the risk assessment, you may find out that the worker does this task only occasionally or for a very short period of time during the day. There may be exposures to other factors (e.g., high force, repetition) associated with other tasks the worker performs for longer durations. In this example, force and repetition pose a greater risk and need **Risk Control (21, 22)** measures more urgently. Some situations, however, may not require a specific risk assessment.

As stated in **Risk Identification (19)**, if the risk control is obvious and effective, **Risk Identification** can lead directly to **Risk Control**.

The basic principles of Risk Assessment involve looking at the “Extent of Exposure” to assess how great the risk is. Extent of exposure includes magnitude (how much), duration (how long), and frequency (how often, how fast).

Magnitude



Duration



Frequency

Three main factors contribute to the “Extent of Exposure”

To take extent of exposure into account, consider questions such as the following:

- What is the magnitude of the exposure?  
For example, how much force is needed, or how severe is the awkward posture?
- How long (total time) is the worker exposed to the risk?  
For example, is the worker exposed to the risk for a full shift, or for two hours?
- How frequently is the worker exposed to the risk?  
For example, is the task repeated many times each shift, or does it occur only occasionally?

A Risk Assessment should also consider the following:

- What is the combined effect of all the identified risk factors?  
For example, lifting heavy objects from the floor to a height above the shoulders several times a minute poses a greater risk than lifting the same objects between the knee and waist level infrequently.
- What body part is most likely to be affected?  
For example, when a person is working overhead, the shoulders and neck may be affected.

Risk Assessment tools are available from a WorkSafeBC officer or from **WorkSafeBC.com**



## 21 Step 5 Risk Control

### Step 5: Risk Control

The employer must eliminate the risk of MSI, or, if that is not practicable, must minimize that risk. You should implement the risk controls without undue delay.

First consider engineering or administrative controls that eliminate the risk to workers. If this is not practicable, introduce controls that minimize the risk.

📌 **Engineering Controls** are the arrangement, design, or alteration of the physical work environment, equipment, or materials.

For example, a mechanical lifting device is an engineering control that health care workers can use to reduce the risk of MSI when moving patients.

📌 **Administrative Controls** include the use and scheduling of resources and staffing to improve how the work is organized and performed.

For example, limiting the hours a cashier spends at an express checkout is an administrative control that can reduce the amount of repetitive motion.

📌 **Personal Protective Equipment (PPE)** and clothing may be used as a control if other controls are not practicable, or in addition to other controls.

For example, workers may wear vibration-dampening gloves while using a chainsaw or wear knee pads while working on their knees to install flooring.

**Personal Protective Equipment (PPE)** can be used only if engineering or administrative controls are not practicable.



Repetitive motion can be reduced by limiting duration of the task

### Preventing MSI in the Workplace

Some control measures will eliminate the exposure to the risk factor. Where that is not possible, control measures should result in the extent of exposure being reduced in at least one of the following ways:

① **Reduced magnitude of exposure:** Controls that reduce the magnitude of exposure may involve, for example, reducing the force required or making the work posture more comfortable:

- 📌 Use better-designed tools to reduce the effort. For example, use a lighter tool or a suspended tool to reduce the force needed to grip the tool (engineering control).
- 📌 Redesign the work station. For example, change the height of the work surface to reduce the reaching distance and an awkward shoulder posture (engineering control).
- 📌 Modify the work practice. For example, use two people to lift a heavy object instead of one person (administrative control).

## 22 Step 5 Risk Control (Continued)

**2 Reduced duration of exposure:** Reduced duration of exposure to the risk over the work shift involves reducing the total time the worker is exposed to the risk:

- Use some mechanization to reduce the time spent during the day doing physical tasks.

For example, use a mechanical stacker for some products during the shift (engineering control).

- Rotate jobs to reduce the time spent doing manual handling.

For example, rotate workers between manual stacking and forklift driving (administrative control).



Mechanization can reduce exposure

**3 Reduced frequency of exposure:** Reduced frequency of exposure to the risk involves reducing the number of times the task is done in a period of time:

- Use partial mechanization to reduce repetition.

For example, use power tools for parts of the job, and use hand tools only where the power tools are not practical (engineering control).

- Combine other tasks with the job to reduce repetition.

For example, let a worker doing intense keyboarding tasks also handle non-keyboarding tasks such as customer service (administrative control).

**4 Improved pattern of exposure:** The pattern of exposure can be improved if the time the worker is exposed to the risk is divided into smaller blocks of time over the work shift. This control can be used where it is not practical to reduce the total duration of time on the task:

- Organize the work so that highly physically demanding tasks are interspersed with less physically demanding tasks.

For example, rotate workers so that each worker does the physically demanding task in two blocks of two hours instead of one block of four hours (administrative control).

Please see [Summary of Risk Control Options \(24\)](#) for more information.

### Step 6: Training

The employer must ensure that workers are trained to use the **Risk Control (21,22)** measures. For example, if you provide a worker with a mechanical lifting device, the worker must be trained to use the device properly. In addition, where safe work procedures have been implemented to reduce the risk of MSI, workers must be trained and supervised in those procedures. Workers must follow the safe work procedures they have been trained to use and must use any engineering controls and required PPE and clothing.

### Step 7: Evaluation

The employer must evaluate the control measures to determine how effective they are in eliminating or minimizing the risk of MSI. Some ways to evaluate the controls are:

- 📎 Interviewing workers
- 📎 Looking for decreases in the number and severity of signs and symptoms of MSI
- 📎 Observing a reduction in the number of risk factors or in the severity of risk factors
- 📎 Using a checklist or other tool to compare the exposure to risk factors before and after controls are implemented

If the risk has not been effectively controlled or if new risks have been created, re-examine the task and reconsider which controls may be needed.

The employer is required to evaluate the overall MSI prevention program at least once a year to make sure it continues to meet the objective of eliminating or minimizing the risks to workers.

## 24 Summary of Risk Control Options

| Risk Factor                | Possible Risk Control Options   |
|----------------------------|---|
| Awkward Posture            | <ul style="list-style-type: none"> <li>• change height, reach or orientation of work or workstation/equipment/tools, or worker</li> <li>• use adjustable stands</li> <li>• use turntables or conveyors to bring items closer</li> <li>• ensure adequate vision</li> <li>• use tilted work and/or spring-loaded surfaces</li> <li>• design hand tools for neutral wrist/thumb posture</li> <li>• use fixtures and clamps to hold materials, suspend tools</li> <li>• provide armrests where arms are elevated</li> <li>• use job rotation, micro-pauses</li> </ul> |
| Working Heights            | <ul style="list-style-type: none"> <li>• use spring-bottom bins, lift tables, levelators, tools with extendable arms, adjustable work surfaces, stools, ladders</li> </ul>  |
| Working Reaches            | <ul style="list-style-type: none"> <li>• redesign to bring items closer: use tilting mechanism, electronic eyes, rollers, etc.</li> <li>• reorient product, remove obstructions</li> </ul>  |
| Sitting                    | <ul style="list-style-type: none"> <li>• for multiple users, make adjustable</li> <li>• provide seating instructions and training</li> <li>• allow sufficient leg room, and micro-pauses</li> </ul>   |
| Repetition                 | <ul style="list-style-type: none"> <li>• combine or eliminate some parts of task</li> <li>• ensure worker has some flexibility over pace and breaks, and takes frequent micro-pauses</li> <li>• give people time to accommodate to repetitive tasks</li> <li>• train in good techniques</li> </ul>  |
| Force                      | <ul style="list-style-type: none"> <li>• reduce weight of objects held, use devices to hold</li> <li>• reduce gripping or improve grip on tool</li> <li>• replace muscles with motors or mechanization</li> <li>• use larger, stronger muscles</li> <li>• ensure gloves are well-fitting and improve friction</li> <li>• reduce hand tool vibration and minimize cold</li> </ul>  |
| Manual Materials Handling  | <ul style="list-style-type: none"> <li>• minimize material movement through good design</li> <li>• use mechanical assists (lift trucks/platforms/hoists)</li> <li>• reduce weight of object, assign more people</li> <li>• provide better grip with handles</li> <li>• reduce horizontal distance with good access</li> <li>• limit stacking heights, heavy objects at waist height</li> <li>• change layout to reduce twisting, use good techniques</li> </ul>   |
| Pushing, Pulling, Carrying | <ul style="list-style-type: none"> <li>• reduce force with good wheels and handles</li> <li>• minimize distances</li> </ul>   |
| Contact Stress             | <ul style="list-style-type: none"> <li>• distribute pressure over as wide an area as possible</li> <li>• use tools with long enough handles, round surfaces</li> <li>• pad surfaces with softer material</li> </ul>   |

## How to Use this Publication

Some of the tasks we perform at work—such as lifting, reaching, and repeating the same movements—can strain our bodies. In some situations, these tasks can result in an injury to the muscles, tendons, ligaments, nerves, blood vessels, and joints of the neck, shoulders, arms, wrists, legs, and back. This type of injury is called a musculoskeletal injury, or MSI.

MSI is a common type of workplace injury in manufacturing industries in British Columbia. MSI claims resulting from overexertion and repetitive motion accidents account for about one-third of claims accepted by WorkSafeBC. In some industries, this proportion is much higher.

This educational publication provides guidance to help employers, joint health and safety committees, and worker health and safety representatives understand the risk of MSI and make simple changes in the workplace to reduce the risks and make manufacturing tasks easier to perform. Each section of the publication looks at common risks associated with certain body movements and exposures, and identifies ways to eliminate or minimize them in a manufacturing setting.