



Manual Material Handling

Ergonomics for USask Employees

2017

Safety Resources



UNIVERSITY OF
SASKATCHEWAN

How to Use this Document:

This document provides basic guidelines that will allow you to proactively set up and /or adjust your office equipment to reduce risk of musculoskeletal disorders (MSD).

Disclaimer:

The guidelines presented in this manual are voluntary and may not be suitable in every situation. This guide is not intended to address specific injuries, restrictions nor medical conditions. The information herein does not constitute a comprehensive or complete analysis and should not be relied upon as such. If you are experiencing significant pain, discomfort or other musculoskeletal symptoms, then consult a health care professional. If specific information or guidance is required for your particular situation, then please contact your supervisor.

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For more information visit www.safetyresources.usask.ca or call 306-966-4675.

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Preventing Injury in the Workplace

Employer and Worker Responsibilities

Both you and your employer are responsible for injury prevention in the workplace.

Employees may be required to perform manual material handling tasks and injuries may occur if adequate steps in preventing injuries are not taken in a timely manner.

It is your responsibility to be aware of any of your actions that may put you at risk for injury and take steps to work safely.

If aspects of your work are repetitive, symptoms of repetitive strain/cumulative trauma injuries may occur. Such symptoms may be minimized with early identification and appropriate management. Talk to your supervisor if you believe you are at risk.

The employer has the responsibility to inform you of the risks of injury in your job and providing you with the proper tools, training, and information to minimize these risks. If you feel that there is a hazard that is not being managed appropriately in your working environment, then inform your supervisor.

Components of the Musculoskeletal System

The main components of the musculoskeletal system are:

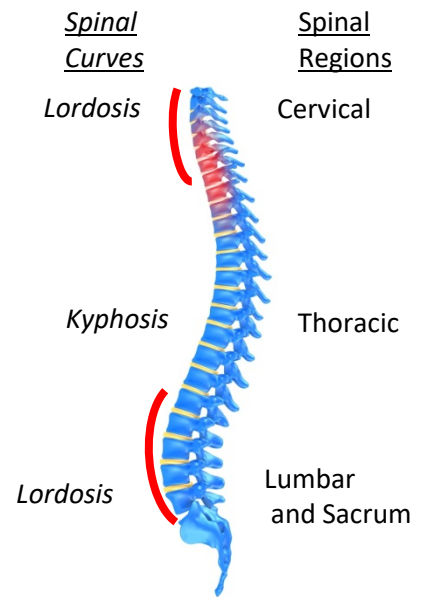
- **Ligaments** – dense, strong, fibrous tissue that joins bone to bone, usually crossing a joint. Ligaments provide stability to joints and they tend to heal slowly.
- **Tendons** – strong, more elastic, fibrous tissue that connects muscle to bone. Some run in sheaths that provide lubrication and protection.
- **Muscles** – the tissue that generates force to move the body. Injuries to muscle heal relatively quickly due to their excellent blood supply.
- **Joints** – allow the body to move by allowing a point of articulation between adjacent bones. Have several structures such as cartilage, fluid, and capsule to perform this function.
- **Nerves** – these allow communication between the brain and almost all structures of the body. Motor nerves signal the muscles to contract and sensory nerves relay feedback signals from muscles, tendons, ligaments and joint structures to allow for smooth coordinated movement and proprioception or the sense of where the body segments are in space and in relation to each other.
- **Blood Vessels** – provide nutrition to almost all structures in the body to enable their function, maintenance, and repair.

The Spine

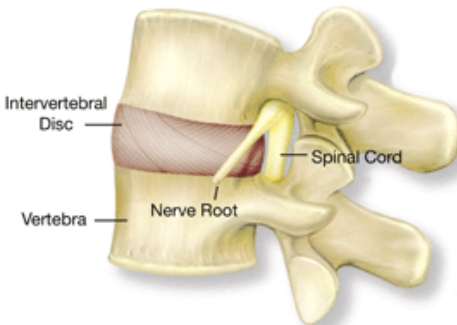
The human spine forms the core of the musculoskeletal system and is robust and sturdy. It is subject to significant mechanical forces. It is the site of many material handling injuries. When respected and properly maintained, the spine serves us well despite its reputation as a vulnerable part of the body.

The spine is composed of 24 vertebrae in three regions, lumbar (5) or low back, thoracic (12) or where the 12 pairs of ribs attach, and cervical (7) which comprise the neck. The vertebrae are connected by discs and strong ligaments. The spine protects the spinal cord and a pair of spinal nerves exits between each vertebrae. The triangular bone at the base of the spine is called the sacrum.

The spine, viewed from the side has an S shape. The thoracic and sacral curves are called kyphosis. The cervical and lumbar curves are called lordosis. When the curves are maintained and the spine is not rotated or bent to the side, this is called the “neutral” position of the spine. In this position, the spine is most stable and able to cope with external forces.



Normal Spinal Segment

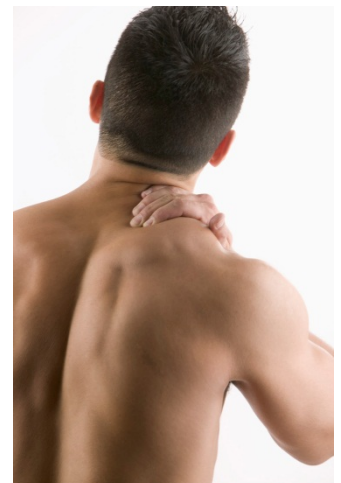


The spine is subject to certain mechanical problems, which can be minimized or avoided by maintaining spinal flexibility and trunk muscle fitness, keeping active, and having a good level of aerobic fitness, minimizing excessive forces applied to the spine from heavy material handling, using good body mechanics for all daily activities, and maintaining good posture when sitting, standing or lying.

Mechanical back problems include muscular strain, ligament sprains, joint problems (stiffness, hypermobility, and arthritis), disc bulges and herniations, and nerve root compression. While most adults (80%) will experience low back pain at some point in their life, most back pain is self-limiting and 90% of acute cases will recover within 6 weeks.

For information on musculoskeletal injuries to limbs consult:

<http://www.ccohs.ca/oshanswers/diseases/rmirsi.html>



What Causes Injuries?

Certain ergonomic risk factors can lead to fatigue, discomfort, or pain. These include:

- Exerting **force** to perform a task or to use a tool
- Working in **awkward postures**, such as bending or twisting the back, overhead reaching, kneeling, or stooping
- Actions that are **repetitive**, i.e. repeated rapidly over and over in the same pattern of movement with inadequate rest
- Remaining in a **sustained posture** for a long time with little or no movement
- Continuous pressure from a hard surface or edge on any part of the body (**contact stress**)
- Working in **hot or cold** temperatures
- Holding equipment that **vibrates** (for example, the handle of a pressure washer)

If You Develop Any Symptoms or Signs:

Such as: Persistent or recurring pain, numbness or tingling, swelling, weakness, stiffness, cold hands, changes in skin colour (redness, bruising, whiteness), increase in skin temperature in area.

- **Talk** with your supervisor about your symptoms right away
- **Seek** medical treatment to assess the problem and recommend appropriate treatment, especially if your symptoms do not decrease or go away within a few days, if they increase, or if they continue to recur. Early treatment is more effective
- **Consult** with your supervisor to determine the cause and to seek alternate ways to conduct your work

What Can You Do Right Away?

For minor pain and swelling in the acute stage of the injury (first 7-10 days), you can try the **PRICE** principle.

This acronym stands for:

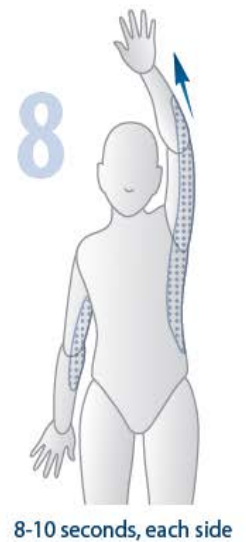
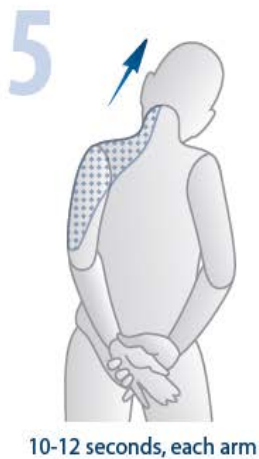
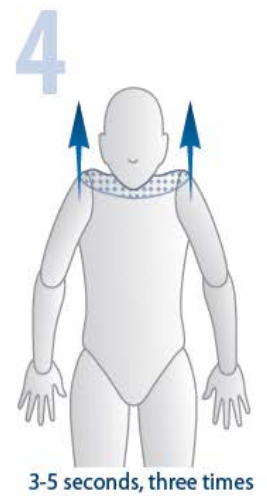
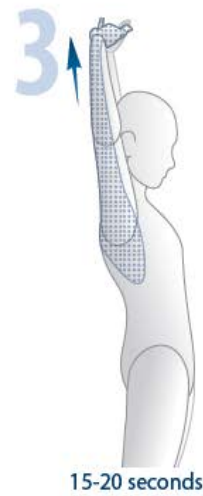
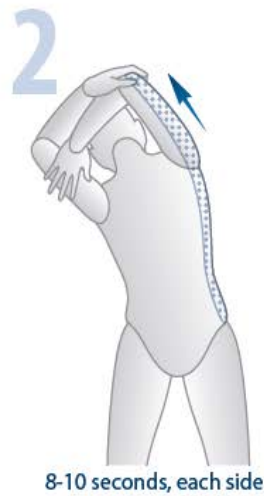
- **Protect**
- **Rest**
- **Ice**
- **Compression**
- **Elevation**

For details on this treatment regimen consult the following resource:

<http://sportsmedicine.about.com/cs/rehab/a/rice.htm>

General Upper Body Stretches

These can be performed at any time to prevent or help alleviate symptoms. The stretches below focus on the upper body, arms and hands, which is where the majority of overuse injuries occur.



There are many online resources for stretching such as:

<http://www.mayoclinic.org/healthy-lifestyle/adult-health/multimedia/stretching/sls-20076525>

For specific instructions, or if you have a medical condition, please consult your health care practitioner.

Injury Reporting

1. All faculty and staff should report any work-related injury *as soon as possible* to their supervisor.
2. All faculty and staff must complete an Incident Report Form found on the U of S Safety Resources website, <http://www.safetyresources.usask.ca>. The report is submitted to SR in electronic form. *Please note: the incident report is an internal U of S document and completing one does not generate a Worker's Compensation Board claim.*

Workers' Compensation

3. When a staff member requires medical attention (i.e. is seen by a physician, chiropractor or physical therapist) and/or misses time from work after the first day of a workplace injury, the employer is obligated to file a report with the Workers' Compensation Board (WCB). **The supervisor should contact Wellness Resources (4580), as soon as they become aware of an injury, to assist in the reporting process.** The supervisor must complete a WCB E1 form **within 5 days of being made aware of the injury.**

Note: At this time faculty and teaching professions are exempt from the Workers' Compensation Board legislation, and time loss due to work injury is covered under their disability plans.



Manual Material Handling

Manual material handling can be described as work activities involve moving or handling loads by hand. These activities include:

- **Lifting and Lowering.** These tasks may be further defined by the range in which they occur:
 - floor to waist
 - waist to chest
 - chest to overhead
 - floor to overhead
 - or any combination thereof
- **Carrying**
 - Unilateral (with one hand)
 - Bilateral (with both hands)
- **Pushing and Pulling**
 - Dynamically – where the object being handled moves over a distance, (a cart or dolly for example)

Note: Moving very light items (less than 0.5 kg) is not generally considered material handling unless the task frequency is high.



Materials, Task, Environmental, Operator and Personal Characteristics

The risk of injury when handling an object will be increased depending on the characteristics of the object being handled, how it must be handled and where it must be handled. These characteristics will increase the biomechanical demands on the worker's body and make the object more hazardous to lift.

Material Characteristics:

- **Weight** (mass) - Higher weights or forces increase the loading on muscles and joints.
- **Size** - A large object will be more difficult to handle and move than a more compact object.
- **Shape** – An irregularly shaped object may require awkward postures to move.
- **Hand/Object Coupling** - If the object does not have a convenient place to grip, proper handles, or has slippery or sharp surfaces then the ease of handling will be reduced.
- **Unbalanced load** - If a load can move suddenly or has a changing center of mass such as a sliding load in a box, container of liquid, or sack of loose material, then it may be more difficult to handle.

Task Characteristics:

- **Frequency** - Higher frequency movements increases physical demands of that task.
- **Duration** - Longer task durations will increase fatigue.
- **Speed** of the movement required - High speed body actions increase the risk of injury.
- **Position** required of the worker - Awkward positions such as material handling while twisting, sitting or kneeling, or if the worker is not close to the load increase biomechanical loading.
- **Range of movement** required when performing the task - Lifting in different ranges such as floor to waist or overhead increase biomechanical demands.
- **Activities prior to the task** - Prolonged forward bending of the spine or sedentary activities performed immediately prior to MMH can increase the risk of injury as the stability of the spine is temporarily reduced and the muscles and joints are not "warmed up".
- **Machine paced** tasks - Appropriate rest breaks may not be possible with this type of work.
- **Accuracy** and **precision** required for movements due to fragile loads or specific unloading location.

Environmental Characteristics:

- **Extreme heat, cold** and/or **humidity** - These increase the physiologic demands on the body
- **Footing** conditions - Slippery conditions will decrease the load that can be moved easily
- **Lighting** - Poor lighting may obscure hazards
- **Noise** - This can be a distraction and/or a barrier to effective communication
- **Physical obstacles** - These may increase distances travelled while material handling
- **Constraints** to proper movement - Tight spaces will increase the difficulty of lifting tasks or make the use of proper lifting techniques difficult or impossible

Operator Characteristics:

- General health, medical conditions
- Physical factors such as height, reach, flexibility, strength, body weight, aerobic capacity
- Pre-existing musculoskeletal problems
- Bulky clothing and/or personal protective equipment required
- Psychological factors such as stress and motivation

Personal Considerations:

- Keep yourself fit for work by exercising regularly – about 20 minutes at least three times/week.
- Consult your doctor before starting any exercise program.
- Wear appropriate clothes that are comfortable around your hips, knees and shoulders.
- Avoid wearing clothes with exposed buttons or loose flaps.
- Shoes should be closed toe, closed heel with non-slip soles and broad based low heels.
- Wear safety rated footwear where a potential for foot injury exists.

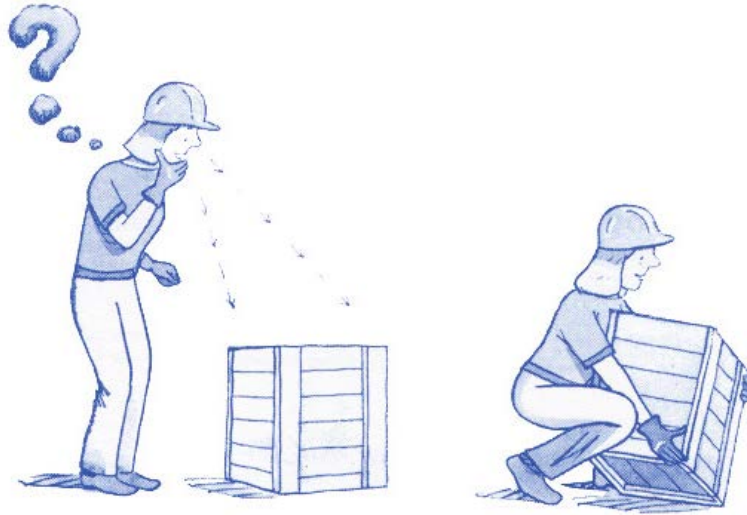
Canadian Standards Association (CSA) Green Patch Certification for Safety Footwear



The CSA Green triangle patch indicates sole puncture protection with Grade 1 Protective toe to withstand impacts up to 125 joules.

Sole puncture protection is designed to withstand a force of not less than 1200 Newtons (270 pounds).

Basic Lifting Principles - Planning



1. Plan the lift if it is unfamiliar.
2. Make sure the area is clear and you are not confined in your movements.
3. Ensure the path and area you are moving to are clear and ready.
4. Check for any tags or labels that will tell you the weight of the object or how the object should be lifted.
5. Test the load for stability and weight by gently trying to slide or nudge the load if you are unsure.
6. Ideally, items that are handled manually and are heaviest should be stored at, or near, waist level, medium weight items below waist level, and lightest items at shoulder level or above.



Basic Lifting Principles – Keep the Load Close



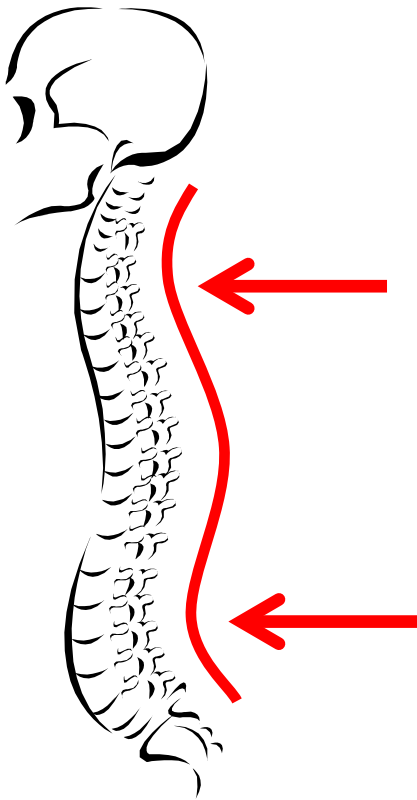
Keep the load close to your body at all times.

This is one of the most important factors in reducing the load on the spine.

Basic Lifting Principles – Neutral and Stable Spine

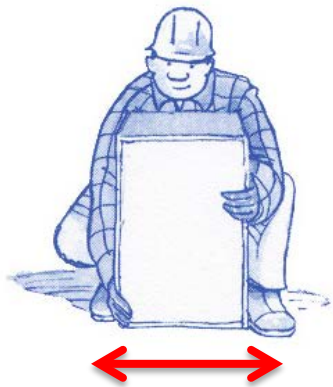
The spine is best protected from injury when it is kept in a “neutral” position. This means maintaining the normal curves of the spine. In this position there is **less** stress on the discs, joints, ligaments and muscles of the spine.

Engage your core trunk muscles by tightening your abdominals. Think: “pull your navel in”. This will help increase the stability of the spine as you lift.



Basic Lifting Principles – Base of Support and Inertia

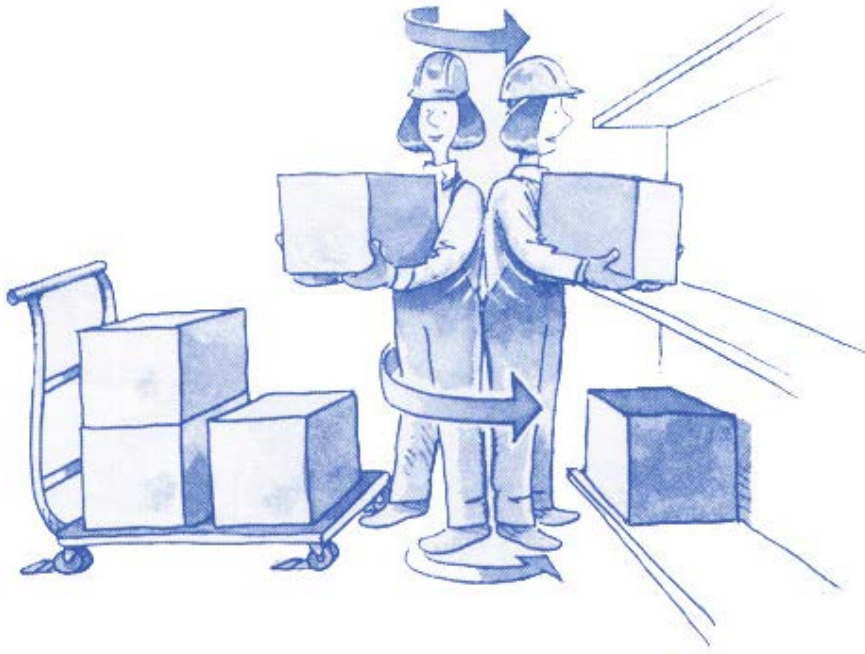
1. Keep your feet shoulder width or wider to create a stable base of support for the lift.
2. Shift one foot slightly in front of the other to further improve stability. This is called a diagonal lift.
3. Use your thigh and leg muscles as you lift in one smooth movement.
4. Do not use excessive inertia or a jerking motion to initiate the lift as this will create unnecessary stress on the body.



Basic Lifting Principles – Avoid Back Lifting and Twisting

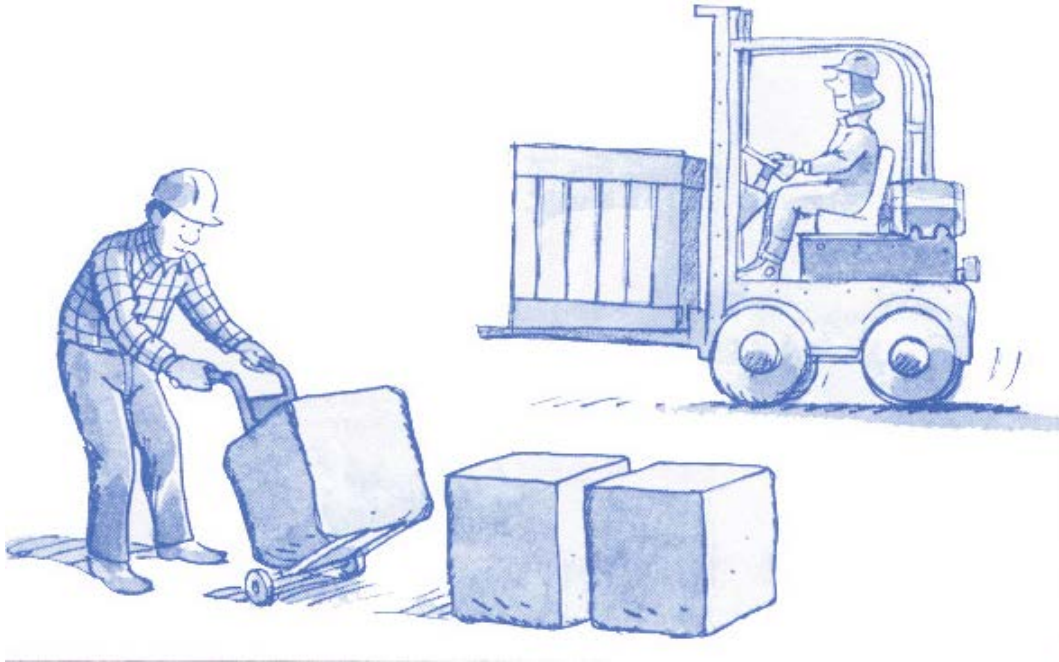
Avoid lifting with straight legs straight and a forward bent spine. This puts the discs under increased pressure, the ligaments on stretch, and the muscles at a disadvantageous length to function efficiently.

Do not hold your breath while lifting. This can cause increased blood pressure and reduced blood flow to the heart which can cause fainting.



Do not twist the spine while lifting or transferring loads. Move your feet instead.

Basic Lifting Principles – Mechanical Aides



Use mechanical aides if the load is too heavy or awkward for you to handle safely. There are many specialized machines available to handle specific types of objects.

These might include:

- Cart with shelves
- Flatbed cart
- Dollies
- Hand truck (two wheeler)
- Powered pallet jack
- Pallet lifter or turntable
- Forklift
- Drum or barrel handler
- Crane or hoist

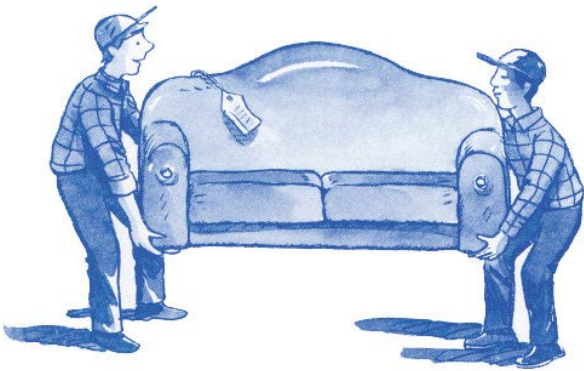
**Eliminating or reducing the forces required for the lift is the first priority
in controlling a manual material handling hazard.**

Modified Lifting Techniques:

If the load is too heavy to handle by yourself, then get assistance from a co-worker.

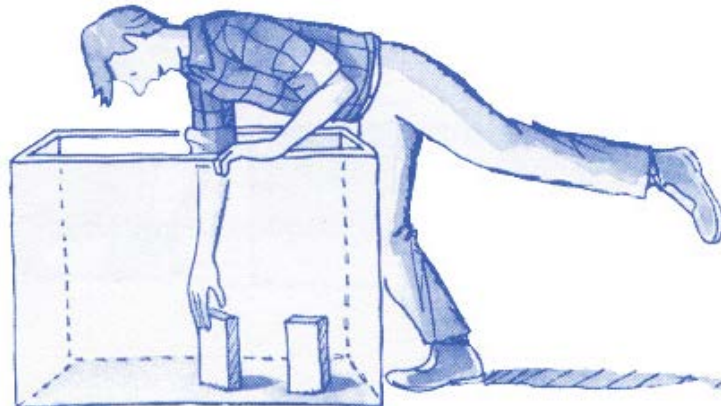
Two Person Lift

1. Both persons should be about the same height, if possible.
2. One person takes charge of the lift, so that you are working together not against each other.
3. Lift together, walk in step and lower the load together.



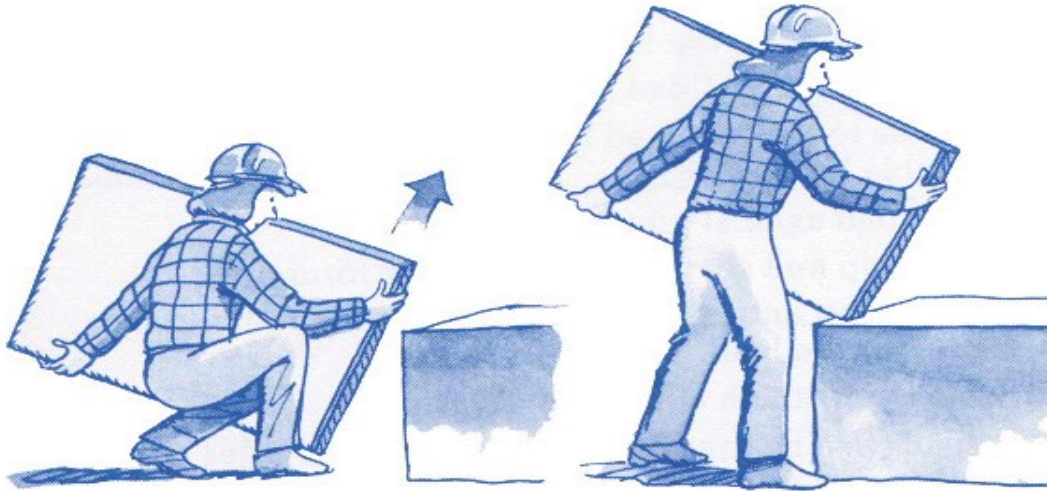
Golfer's Lift

If the object is very light, or the situation does not allow for optimal body mechanics, then the golfer's lift is an acceptable alternative lift technique. The extended leg counterbalances the body and allows the spine to remain relatively neutral.



Sheet Goods

Sheet goods such as plywood, drywall, glass, or panelling required a specialized technique to lift as they can be awkward to grip and lift and are frequently heavy.

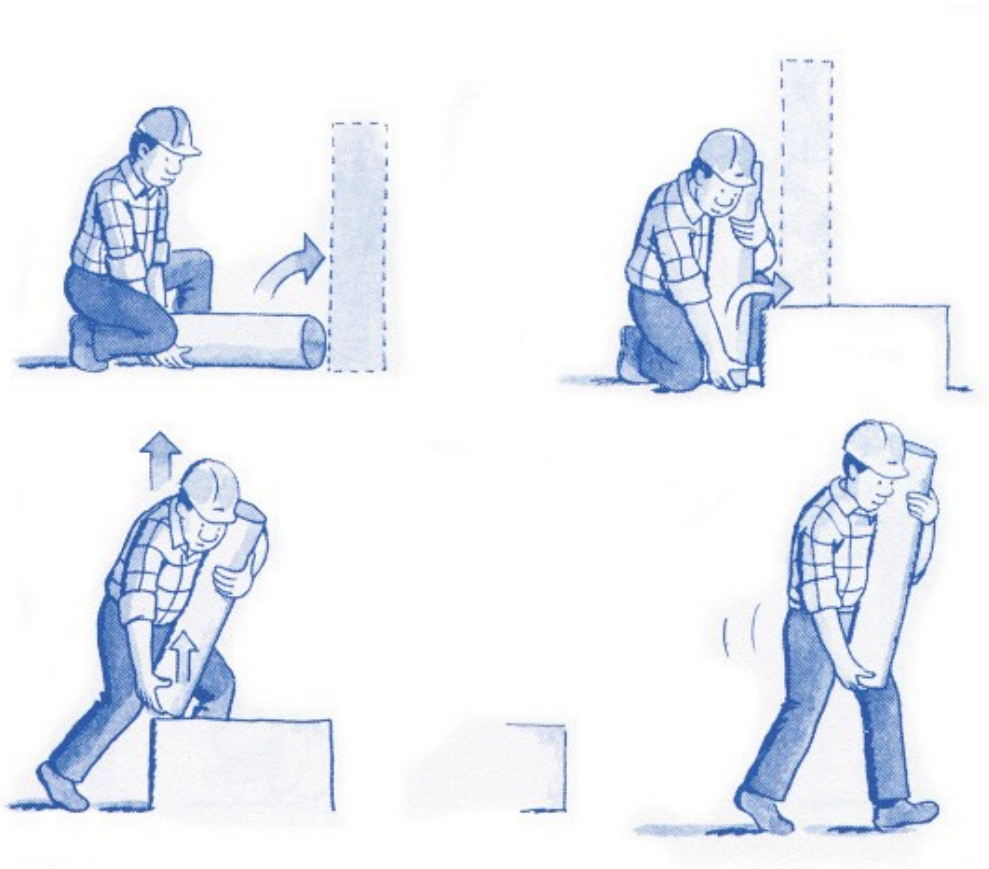


1. Use extra care to avoid twisting the spine.
2. If your arm span is less than that of the load, get help and use a two person lift.
3. Adjust your hands to get the best hold possible.
4. Use your whole hand not just the fingers (power grip).
5. Use the leg and thigh muscles, not your back to lift the load.
6. Lift the sheet onto a platform in order to secure a better grip for carrying.
7. Lower the sheet using lifting techniques in reverse.



Long Loads – One Person Lift

Long objects require specialized handling techniques because of the awkwardness of the load



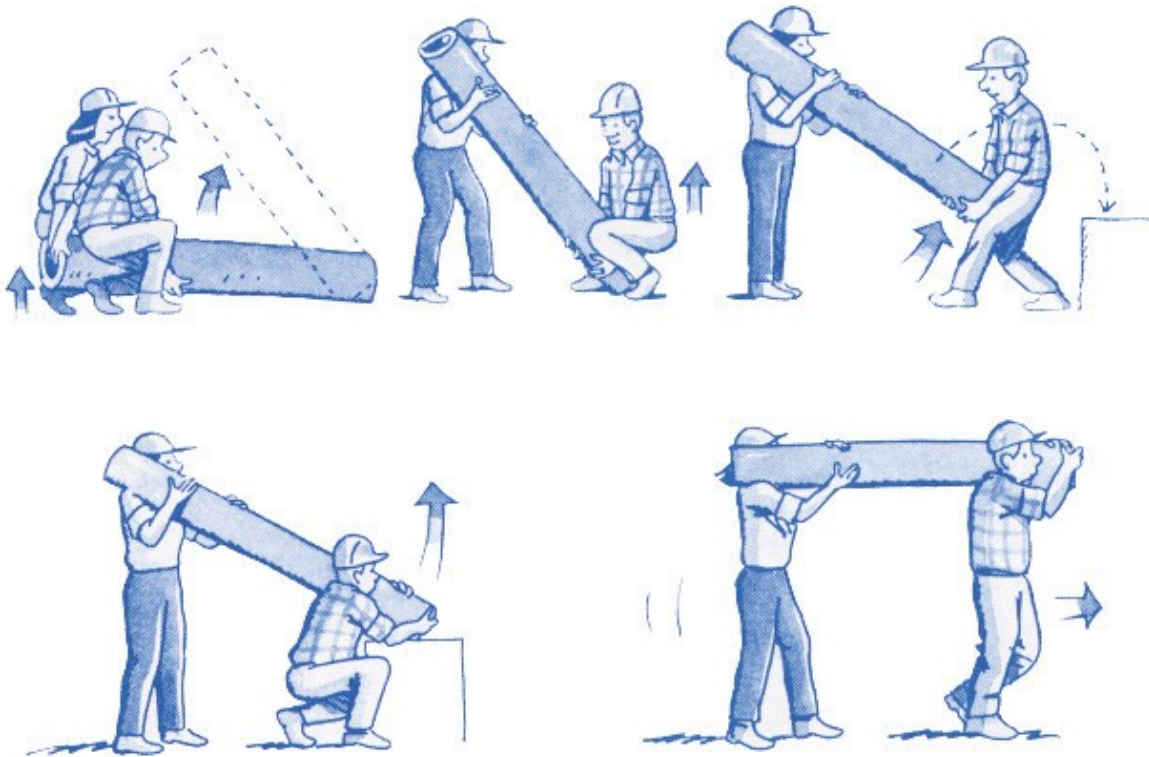
1. Straddle one end of the load, grasping it with both hands.
2. Stand up, raising the load to an upright position.
3. Stand close to the load and lower your body to a comfortable level.
4. Lean the load against your shoulder.
5. Straighten up and set it upright on a platform.
6. Bend the knees until your shoulder is level with the centre of gravity of the load
7. Lift using your thigh and leg muscles.

Long loads may be able to be dragged, or rolled on edge, after being placed in an upright position.

This is frequently easier than carrying the entire object.

Long Loads - Two Person Lift

An extra person is usually required for long loads can be difficult to control.



1. One lifter takes charge of the lift.
2. Both lifters start at the heavier end of the load.
3. Bring one end of the load up to shoulder height.
4. One lifter takes the weight on his/her shoulder, while the second goes to the opposite end and lifts the load onto a platform and then onto his/her shoulder.

Sacks

Sacks can be difficult to handle due to the instability of the load, shifting of the centre of gravity, and frequent lack of handles.

Platform-lift

- 1) Stand at one end of the sack.
- 2) Lift the sack to an upright position.
- 3) Straddle the load.
- 4) Place one hand under the bottom of the sack and use the other to hold the sack against your body.
- 5) Bend the knees and lift the sack onto a platform.
- 6) Stand as close to the lifting platform as possible.
- 7) Bend the knees until the sack can be balanced onto your shoulder.
- 8) Straighten up in one smooth movement.



Free-lift

Alternatively, if no platform is available, you can use your thighs to support the load while you lift from a kneeling position as shown above:

- 1) Lean the sack onto your kneeling leg.
- 2) Slide the sack up onto your kneeling leg.
- 3) Slide the sack onto the other leg while keeping the sack close to your body.
- 4) Keep the sack close to your body as you stand up.



**If the sack is small, place it in a box or container with handles and carry.
Use a cart or hand truck if the item is heavy.**

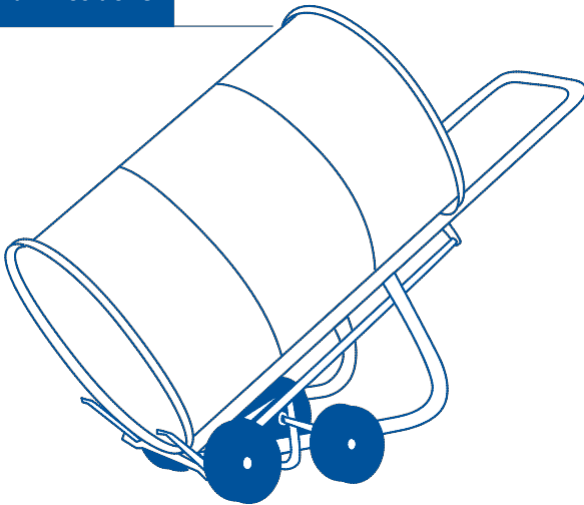
Barrels and Drums

Drum handling can be hazardous because drums and barrels are frequently are heavy, awkward shape and size, and do not have convenient handles.

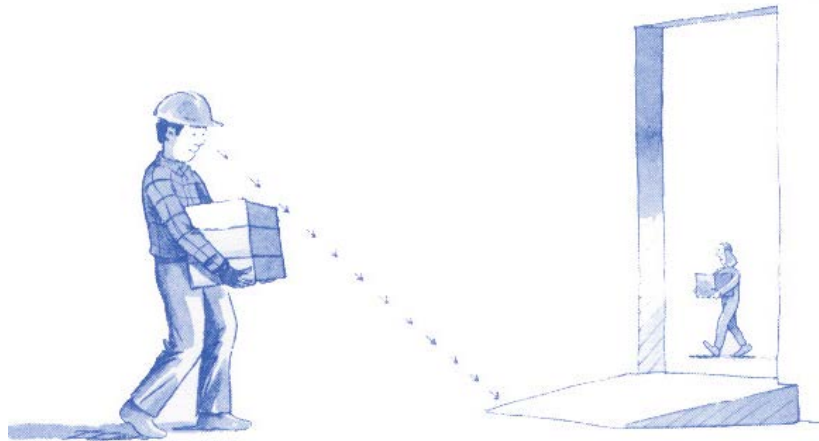
- Use a siphon or pump instead of lifting and pouring from the drum.
- Consider using bulk handling to eliminate the use of drums.
- Use a drum dolly (positioner) for handling drums or barrels unless they are very light or empty.
- Extra care is needed when the drum is almost upright, due to possible shifting of the contents.
- A drum tilting lever can make the job of manoeuvring a drum onto a lifting device much easier.



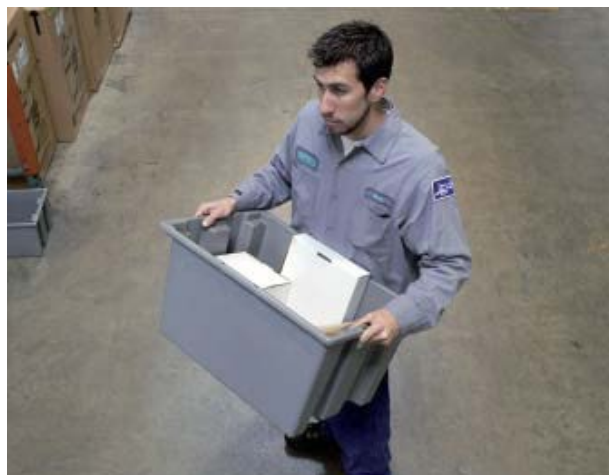
Drum Positioner



Carrying



- Convert a carry task into a push or pull task by using a mechanical aide such as a cart or trolley.
- Do not carry a load that obscures your view of your walking path.
- Avoid slopes and stairs when carrying if possible.
- Whenever appropriate, use two hands to carry containers.
- When carrying containers with one hand, alternate hand.
- If possible, it is preferable to balance the forces on the spine by carrying an object in each hand.



Pushing and Pulling



- Consider mechanized means such as motorized carts or pallet jacks for heavy push/pull tasks
- Ensure carts, trolleys or other mechanical aides are in good working order especially the wheels and casters. Large diameter castors help reduce rolling resistance over obstacles
- Pushing is generally preferable to pulling:
 - Uses larger muscle groups and hence can produce larger forces.
 - It is easier to see your path.
 - Joints are in a better biomechanical position.
- Do not push one load and pull another load simultaneously. This puts the body in an awkward position and creates potentially high forces.
- Ensure the load does not block your vision. If so, then take fewer items.
- Do not lift the cart or trolley to overcome obstacles.

Applicable Legislation:

[Saskatchewan Occupational Health and Safety Regulations:](#)

- Part VI, 78, Lifting and handling loads
- Part VI, 81, Musculoskeletal injuries

Drawings, photos and information adapted from *Industrial Accident Prevention Association: Safe Lifting and Carrying Guide* (May 2008) and *NIOSH: Ergonomic Guidelines for Manual Material Handling* (2007 -131)