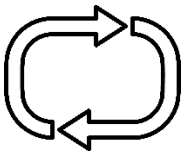
Ergonomics in the workplace: Identifying and controlling manual handling hazards

OHS information for employers, supervisors and workers

This bulletin provides an overview of musculoskeletal injury (MSI) hazards associated with manual handling tasks, with information on contributing factors, required controls and best practices. It is part of the *Ergonomics in the workplace* series that focus on applying ergonomics to meet Alberta's occupational health and safety (OHS) requirements.

Manual handling is a common task in the workplace and includes lifting, lowering, pushing, pulling and carrying. There are three primary hazards that can contribute to injury during manual handling:

awkward or sustained postures



repetition

forceful exertions

Having one or more of these hazards present during a manual handling task can increase a worker's risk for MSIs (also known as musculoskeletal disorders and repetitive strain injuries).

For more details on these hazards, refer to Ergonomics in the workplace: Identifying and controlling MSI hazards.

Hazard assessment

It is the employer's responsibility to assess the hazards of a manual handling task and control them appropriately.

Before a worker manually lifts, lowers, pushes, pulls, carries, handles or transports a load that could injure the worker, the Alberta OHS Code requires the employer to perform a hazard assessment that considers:

- the weight, size, and shape of the load,
- the number of times the load will be moved, and
- the manner in which the load will be moved.

Workers must also be involved in the hazard assessment.

Awkward or heavy loads

Heavy or awkward loads include equipment, goods, supplies, persons and animals. There is not a specific safe weight limit because many factors can impact how safe a weight is.

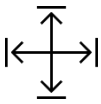
For help in determining if the weight of an object being lifted is within a reasonable limit, refer to the lifting assessment tool on page six of this bulletin.

Consider the following when assessing manual handling hazards.

Weight

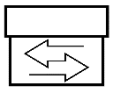
Heavy loads can increase the chance of overexertion injury, particularly in the back and upper limbs.

To determine if a load is within a recommended weight limit refer to the lifting assessment tool on page six of this bulletin.

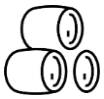


Dimensions
Loads that are the same weight may have different hazard levels due to their size. Larger loads are difficult to keep close to the body's centre, increasing the likelihood of awkward postures and stress on the lower back and arms.

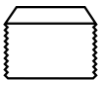
In pushing and pulling tasks, the load should be a size that the worker can control (e.g. carts should not be loaded so high that the worker's line of sight is blocked).



Centre of mass
The centre of mass of a load may shift during transport (e.g. people, animals, liquid in containers, etc.). The weight distribution of a load can also impact how much weight a worker can safely lift.



Shape
The shape of a load can affect the weight distribution and create an imbalance of effort between the muscles used when lifting.



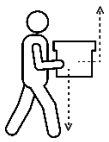
Sharp edges
A load with sharp edges can be difficult to grasp and may result in awkward postures to avoid the sharp edges.

Handholds
Loads with no handles or unevenly distributed handles require increased grip strength and muscle effort.

Frequency
The more frequent the lift, the greater the total effort required by the body. Consider how many times a minute, hour or day the load is moved, and the total duration of the activity.

Rest periods
Consider whether there is a long enough rest time between lifts to allow muscles to recover.

How the load is moved
The way a load is moved can affect posture and how the muscles are used. Consider if the load will be lifted, lowered, pushed or carried.

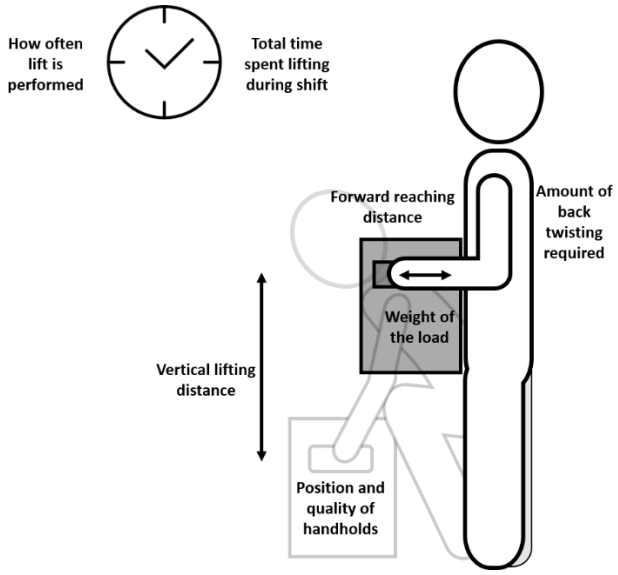


Body movement and position relative to the load
The start and end location of the load can impact a worker's posture during manual handling tasks. Consider how high and far a worker will need to reach.

The farther the load is away from the body, the more effort required, placing more stress on the back and upper limbs.

Equipment use
Consider what mechanical aids are available to assist with the task. The wrong equipment or poorly maintained equipment may contribute to MSIs.

Individual factors
Personal characteristics such as a person's age, pre-existing injury or medical conditions, fitness level, experience and skill can affect how much a person can safely lift.



Common hazards associated with manual handling.

Hazard controls

Alberta's OHS Code states you must follow the hierarchy of controls to eliminate or control hazards. Controls must be implemented in the following order:

See the Example lifting scenario on page seven of this bulletin to see how the lifting calculator is used.

- Elimination – Remove the hazards if possible/reasonable.
- Engineering – Isolate people from the hazard by controlling it at its source.
- Administrative – Change the way people work.
- Personal protective equipment (PPE) – Protect workers with PPE. PPE is only introduced after engineering and administrative controls are found to be insufficient for specific hazards. Workers must be trained in the proper use of the PPE and the equipment must be maintained in working order.

If a hazard can't be eliminated or controlled by using a single control method, the employer may use a combination of controls to give a greater level of worker health and safety.

Manual handling equipment

Employers must provide appropriate equipment to move heavy or awkward loads whenever reasonably possible. Employers must ensure the equipment is used by workers, and workers must use the equipment provided.

Here are some examples of equipment used to minimize exposure risk during manual handling activities.

Carts or dollies

Forklifts

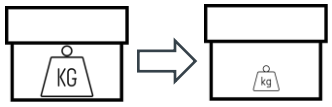
Hoists or cranes

Conveyors

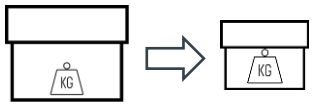
Adapting heavy or awkward loads

If providing equipment is not reasonably possible for a heavy or awkward manual handling task, then the employer must either adapt the load or otherwise reduce the amount of manual handling required to move the load.

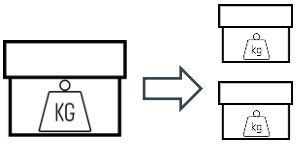
Here are some ways to adapt or reduce awkward or heavy loads:



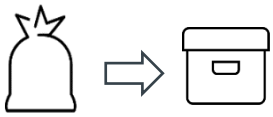
decreasing the **weight** of the load



decreasing the **size** of the load

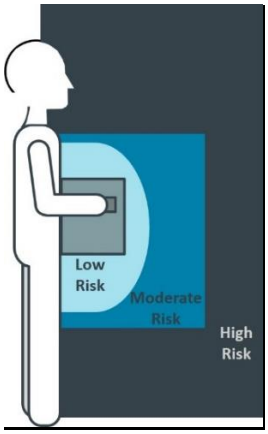


splitting the weight into multiple loads



improving **handles** on the load

decreasing the **distance** travelled



keeping the load in the **low risk zone**

Team handling

Team handling is when more than one person is involved during a manual handling task. It is an administrative control and should only be used after engineering controls such as task design and equipment options are fully considered.

A large, awkward load may exceed one worker's ability but could be within the safe lifting capability of two or more workers. Depending on the load size and shape, two to four workers may be able to coordinate a team lift, however more than that typically becomes difficult and awkward. Consider the following:

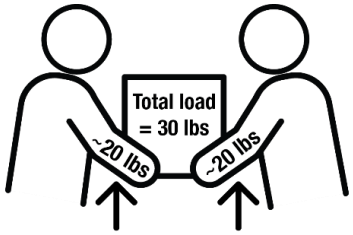
- Use equipment and multiple workers together (e.g. one worker using a hoist to lift a heavy load while a second worker guides the movement of the load).

- When possible, select workers of similar height and strength to work together, this will help keep the load even and balanced.
- Assign one person to lead the team handling activity to provide clear communication to coordinate the lift (e.g. saying “1-2-3-and-lift”).
- Ensure each worker involved in team handling understands the task and is capable to do it.
- Train workers in team handling techniques if it is required in their work.

TEAM LIFTS

When considering team handling, note that each worker in a two-person lift holds approximately two-thirds of the total load weight. For example, if a total load weighs 15 kg (33 lbs), each worker in a two-person lift would exert 10 kg (22 lbs) of lifting effort to handle that load.

This distribution of weight and physical demand on each worker is important to recognize. For example, it **cannot** be assumed that two workers who individually can lift up to 10 kg (22 lbs), could safely lift double that weight at 20 kg (44 lbs) in a team lift.



Approximately two-thirds of the total load is held by each worker, when doing a team lift with two workers.

Design changes and control measures

Here are some common manual handling hazards and example controls.

Heavy lifting
- provide lifting equipment
- reduce the weight of the load
- reduce the size of the container (to lighten the load)
- organize workstations so lifting occurs between knee and chest height (i.e. in the low risk zone)

Awkward postures while lifting
- provide lifting equipment
- change workstation or workstation layout so neutral postures can be used to limit reaching
- provide long-handled tools to reduce the need for reaching
- maintain clear work areas to allow for neutral, safe body positioning
- reduce the size of the load to reduce reaching
- avoid lifts that start or end below knee height and above shoulder height
- use powered lifts to raise pallets or product to better handling heights

Frequent lifting
- provide lifting equipment
- use mobile storage racks to avoid unnecessary loading/unloading
- reorganize work to decrease the need to handle and re-handle loads
- rotate workers to tasks with light or no manual handling

Pushing/pulling tasks
- eliminate the need to push/pull by installing conveyors
- use power-assist moving equipment
- adjust handles on carts so they are between waist and chest height
- reduce the distance of the push/pull through work organization
- maintain a clear and unobstructed pathway
- do not obstruct worker’s view by overloading equipment
- reduce required force by making sure wheels are maintained and are well lubricated

Lifting assessment tool

Use this lifting assessment tool to help determine if lifting activities are within recommended limits to reduce the risk of MSIs. Be advised this tool is a guide and workers' individual factors must also be considered.

If the job involves a number of lifts with different weights and/or different postures, use steps 1-6 to assess the heaviest object lifted and the most awkward part of the lift. In step 3, use the Frequency + Duration Adjustment for all of the lifting done in a typical workday.

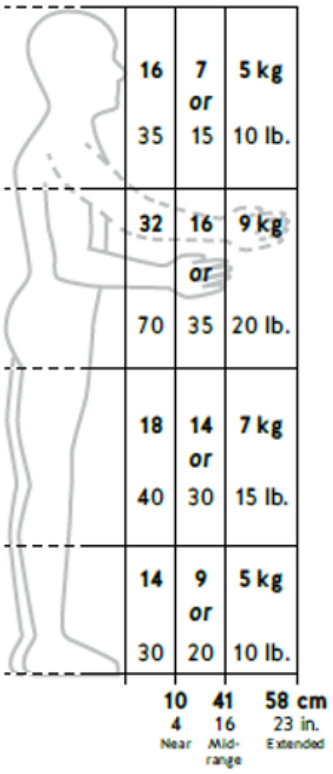
Step 1

Determine the actual weight of the object that the worker lifts.

Actual Weight: ☐

Step 2

Determine the Unadjusted Weight Limit. Determine the most extreme hand position during the lift/lower task. Mark that spot on the diagram below. The number in that box is the **Unadjusted Weight Limit**.



Unadjusted Weight Limit: ☐

Step 3

Determine the Frequency + Duration Adjustment.
Find out how many times the worker lifts per minute and the total number of hours per day spent lifting. Use this information to look up the Frequency + Duration Adjustment value in the following table:

How many lifts per minute?	For how many hours per day?		
	1h or less	1h to 2 h	2h or more
1 lift every 2-5 min.	1.0	1.0	0.85
1 lift every min.	0.95	0.95	0.70
2-3 lifts every min.	0.90	0.85	0.60
4-5 lifts every min.	0.85	0.70	0.50
6-7 lifts every min.	0.60	0.50	0.35
8-9 lifts every min.	0.40	0.30	0.15
10+ lifts every min.	0.20	0.10	0.05

Note: For lifting performed less than once every five minutes, use 1.0.

Frequency + Duration Adjustment: ☐

Step 4

Determine the Twisting Adjustment.

If the worker twists their back/body **more than** 45 degrees:	0.85
No twisting or twisting less than 45 degrees:	1.0

Twisting Adjustment: ☐

Step 5

Calculate the Weight Limit. Multiply the Unadjusted Weight Limit (step 2) by the Frequency + Duration Adjustment (step 3) and the twisting adjustment (step 4) to get the Weight Limit.

☐ x ☐ x ☐ = ☐

Step 2 **Step 3** **Step 4** **Weight**

Actual Weight ☐ Weight Limit ☐

Step 6

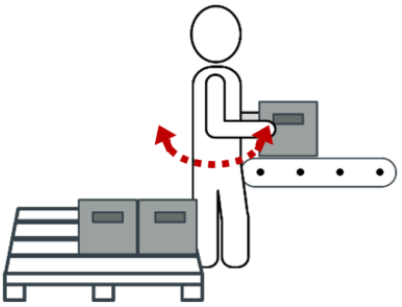
Analysis. Compare the Actual Weight (step 1) to the Weight Limit (step 5). If the Actual Weight is greater than the Weight Limit there is an increased risk for MSI and controls should be put in place to eliminate or reduce the risk.

This tool is adapted from WorkSafeBC. For an online version visit their website.

Example lifting scenario

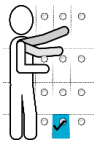
Job task: Packing orders from a conveyor belt

A worker is lifting 8 kg products off a conveyor belt and stacking the product on a pallet directly behind them. The conveyor sets the pace of the task, and the worker is performing 2-3 lifts per minute.



- The position of the pallet causes the worker to twist while placing the product on the pallet.
- The pallet is at ground level, so the worker must also bend down to place the product just below knee height.
- The worker performs this task for more than 2 hours every day.

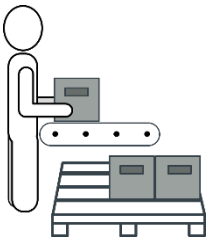
Using the Lifting assessment tool on page 6:

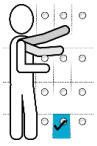
Step 1: Actual weight of load:	**8 kg**	**Step 3:** Worker twist more than 45 degrees?	☒ **Yes** ☐ **No**
Step 2: Most extreme position of the hands**:**		**Step 4:** Number of lifts/lowers per minute:	**2-3 lifts per min**
		Step 5: Total hours per day:	**2 hrs or more**
		Step 6: Recommended weight limit:	**4.6 kg**

Outcome: Under these conditions, the actual weight lifted (8 kg) is greater than the recommended weight limit (4.6 kg). A change is required.

Use of administrative control only is insufficient:

The employer implements procedures requiring the pallet to be positioned directly beside the worker, eliminating the need to twist more than 45 degrees during the lift. The calculations below show that the recommended weight limit has increased to 5.4 kg.



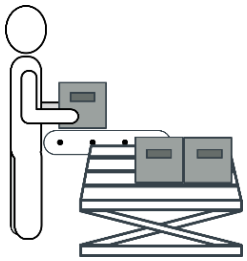
Step 1: Actual weight of load:	**8 kg**	**Step 3:** Worker twist more than 45 degrees?	☐ **Yes** ☒ **No**
Step 2: Most extreme position of the hands:		**Step 4:** How many lifts or lowers per minute?	**2-3 lifts per min**
		Step 5: How many hours per day?	**2 hrs or more**
		Step 6: Recommended weight limit:	**5.4 kg**

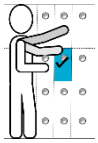
The actual weight of the load (8 kg) is still in excess of the recommended weight limit (5.4 kg) and further controls are required to protect the worker.

…/continued next page

Combining engineering and administrative controls achieves the level of control needed:

In addition to relocating the pallet, a weight-sensing spring loaded pallet is used. An empty pallet starts at the worker's waist height, and lowers as it is loaded. As a result, the worker is always placing the product on the pallet at waist height. By eliminating twisting, and keeping the load at waist height, the calculations below show that the recommended weight limit is now 9.6 kg.



Step 1: Actual weight of load:	**8 kg**	**Step 3:** Worker twist more than 45 degrees?	☐ **Yes** ☒ **No**
Step 2: Most extreme position of the hands:		**Step 4:** How many lifts or lowers per minute?	**2-3 lifts per min**
		Step 5: How many hours per day?	**2 hrs or more**
		Step 6: Recommended weight limit:	**9.6 kg**

The actual weight of the load (8 kg) is within this recommended weight limit (9.6 kg) and is acceptable for the worker to perform this task (assuming there are no personal factors affecting the worker's ability to do manual handling tasks).

Contact us

OHS Contact Centre
(Complaints, questions, report serious incidents)
Anywhere in Alberta
- 1-866-415-8690

Edmonton and surrounding area
- 780-415-8690

Deaf or hearing impaired
- 1-866-232-7215 (Alberta)
- 780-427-9999 (Edmonton)

Call the OHS Contact Centre if you have concerns that involve immediate danger to a person on a work site.

Notify OHS of health and safety concerns online
alberta.ca/file-complaint-online.aspx

Report a potentially serious incident online
alberta.ca/report-potentially-serious-incidents.aspx

Report a mine or mine site incident online
alberta.ca/report-mine-or-mine-site-incidents.aspx

Website
alberta.ca/ohs

Get copies of the *OHS Act*, Regulation and Code

Alberta Queen's Printer
qp.gov.ab.ca

OHS
alberta.ca/ohs-act-regulation-code.aspx

For more information

CSA Standard Z1004-12 Workplace Ergonomics – A management and implementation standard
csagroup.org/store/product/Z1004-12/

Ergonomics in the workplace: Identifying and controlling MSI hazards (ERG045)
ohs-pubstore.labour.alberta.ca/erg045

Ergonomics in the workplace: MSI prevention training (ERG044)
ohs-pubstore.labour.alberta.ca/erg044

Prevention Initiative Resources – Musculoskeletal disorders (MSDs) / Musculoskeletal injuries (MSIs)
ohs-pubstore.labour.alberta.ca/musculoskeletal-disorders

Work Safe BC – Lift/lower calculator
worksafebc.com/en/resources/health-safety/interactive-tools/lift-lower-calculator?lang=en