

# MSI prevention guidance

## Pushing and pulling

Pushing and pulling are common causes of musculoskeletal injury (MSI). This resource provides information to help employers identify, assess, and control the risks to workers when pushing up or down, pushing from side to side, or pulling down.

### Risk identification

As an employer, you're responsible for identifying and assessing the risks for any jobs that require workers to forcefully push or pull — for example, moving levers up or down, pulling hoses or cables, pushing objects from side to side, or pushing up on heavy lids or shafts. The risk of injury can come from a single traumatic event or from repetitive exertions over a long period of time.

### Risk assessment

Once you've identified areas where workers may be at risk of MSI from pushing and pulling, the next step is to assess the risks.

Consider the following when assessing the risk of MSI while pushing or pulling:

- Are workers pushing or pulling at heights above shoulder level or below the knees?
- Are workers reaching away from the body?
- Are workers' wrists bent or twisted?
- Are workers restricted or constrained in certain postures (e.g., seated or kneeling)?
- Do workers use only one hand?

- Are loads awkward to push or pull?
- Is there a lot of resistance?
- Are loads pushed or pulled over long distances?
- Are loads pushed or pulled over rough or uneven surfaces?
- Are workers pushing or pulling repeatedly or for long periods of time?

Answering yes to one or more of these questions indicates that there are factors present that increase the risk of MSI when pushing or pulling.

### Measuring force

A common method for assessing the risk of MSI from pushing or pulling is to directly measure forces using a push-pull dynamometer (a strain or force gauge). These force values are not the same as the actual weight of the object being pushed or pulled. They are expressed in newtons (N), pounds of force (lbf), or kilograms of force (kgf). There has been some research to determine safe limits for pushing and pulling tasks based on maximal strength measurements, but there is no universally accepted safe limit. Each push or pull has many factors that affect the recommended limit.

For two-handed horizontal pushing or pulling, you can calculate the suggested maximum force by using the **Push/Pull/Carry Calculator** available on [worksafebc.com](https://worksafebc.com).

Other types of pushing and pulling tasks are more complex. You will likely need to consult with a specialist when assessing safe limits for tasks such as:

- Pulling down from head and shoulder height
- Pulling up from floor, elbow, and shoulder heights
- Pushing down from elbow height
- Standing one-handed pushes and pulls
- Seated pushes and pulls

An ergonomist or other specialist can provide limit values for these tasks based on assessment tools that address these more complex pushing and pulling tasks.

## Risk controls

As an employer, you're required to control the risk of MSI to workers. Always follow the **hierarchy of controls**. Whenever possible, eliminate the hazard or substitute a less-hazardous material or process. If elimination and substitution are not practicable, use engineering or administrative controls. Finally, consider using personal protective equipment (PPE) to protect workers, or use PPE in addition to other controls (e.g., ensure workers have footwear with a good grip to minimize slippage between the floor and shoes).

The following are some examples of controls to help reduce the risk of MSI from pushing and pulling.

## Eliminate the need to push or pull

- Automate pushing and pulling tasks (e.g., use powered conveyors or gravity-feed systems).
- Use mechanical devices such as powered tuggers, cable pullers, forklifts, cranes, or vacuum lifts.
- Modify the process to eliminate unnecessary pushing and pulling.

## Engineering controls: Reduce the forces required to push or pull

- Reduce the weight or size of the load.
- Maintain equipment so it takes minimal force to operate it.
- Reduce friction between the object being pushed or pulled and its contact surface.
- Provide handles.
- Change the layout of the workplace to minimize pushing and pulling distances.

## Administrative controls: Optimize working postures and technique

- Design tasks so hands are positioned between the knees and shoulders when pushing or pulling.
- Redesign tasks to use pushing rather than pulling. Pushing is usually less stressful because workers can use the weight of their bodies and maintain a forward-looking, more neutral posture.

Before making changes to work procedures, talk to workers about their concerns and possible solutions. Also, consult with the joint health and safety committee or worker health and safety representative, as applicable.

Encourage workers to report concerns right away, and follow up on those concerns. Orient and train new workers on work processes and tools to reduce MSI risks.

## For more information

**Sections 4.46 to 4.53** of the Occupational Health and Safety Regulation outline the requirements for MSI prevention. The corresponding **OHS guidelines** offer additional support.

For more information and resources on reducing MSI risks, visit the **Ergonomics** page on [worksafebc.com](https://www.worksafebc.com).