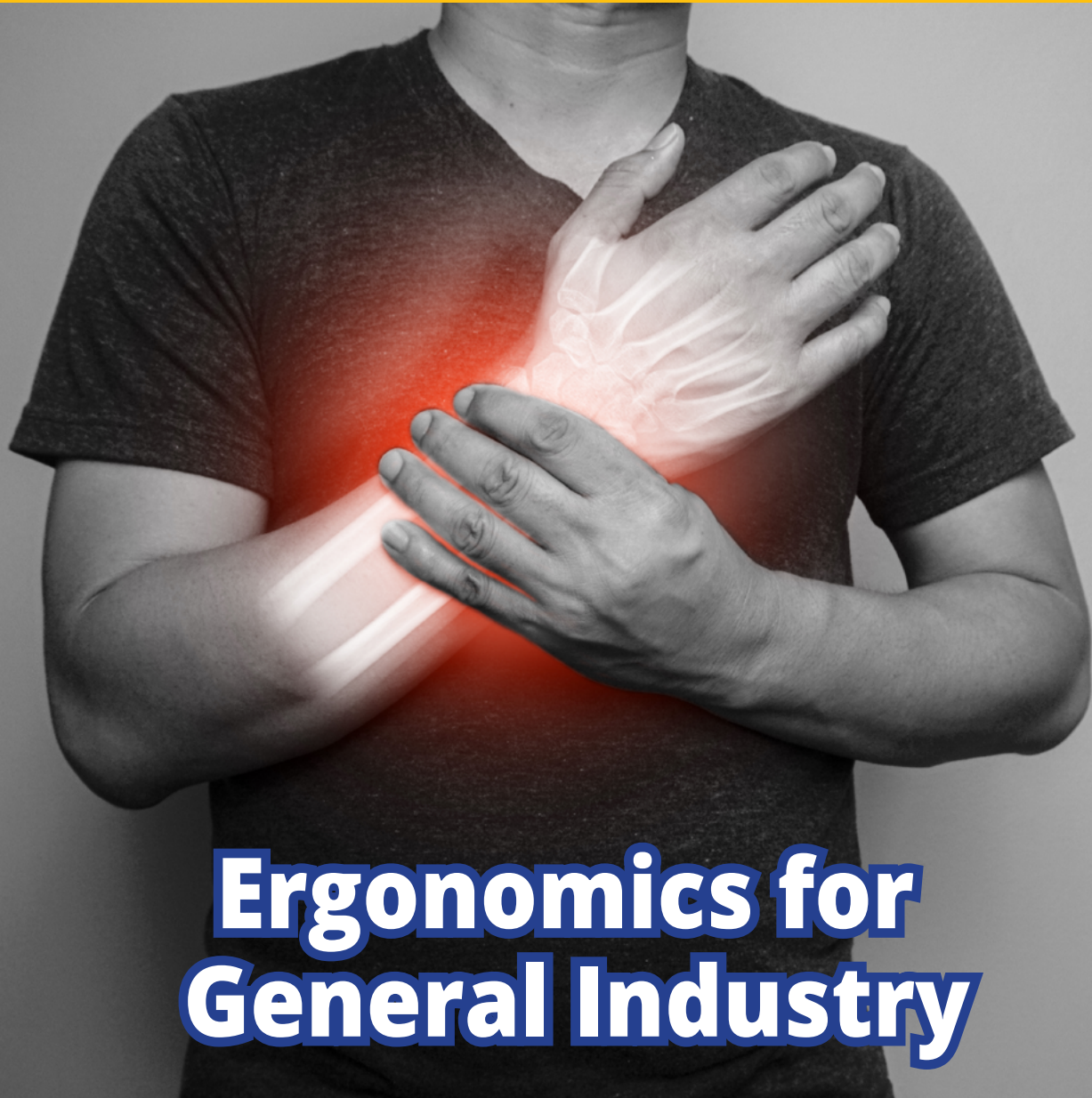


**TDI**

**Safety @ Work**  
Division of Workers' Compensation



# Ergonomics for General Industry



**Workplace  
Program**

# What is ergonomics?

## **Musculoskeletal Disorders (MSDs) – Injuries to the muscles, nerves, tendons, joints, cartilage, or spine.**

**Ergonomics** is the study of ways to help people work more efficiently and injury-free in their environment. In a workplace, ergonomics helps fit the job to the worker. The Greek form of the word is broken into ergo (work) and nomos (laws of). So, the literal meaning of the word ergonomics is "the laws of work."

Ergonomics draws on many other disciplines, such as **physiology** (the study of living organisms and their parts), **anthropometry** (the study of the measurements and proportions of the human body), and **biomechanics** (the study of how a living body moves). To understand how to fit the job to the worker, an understanding of how the human body works is vital.

Once there is an understanding of body mechanics, **ergonomists**, those trained in ergonomics, assist in designing machines, tools, and other equipment that are easier and more comfortable to use. **Ergonomically-engineered equipment** assists in protecting workers from one or more MSDs. Examples may include cubicles designed with adjustable work surfaces to meet workers' height needs; longer handles on pliers so workers can apply more pressure with less stress to the wrist; or adjustable handcarts to help employees move heavy items while keeping their backs safe from injury.

Ergonomists also draw on social sciences for information. Disciplines, such as **psychology** (the study of mind and behavior) and **sociology** (the study of human society), can explain people's interactions with their workplaces and help reduce stressful situations.

Ergonomists want to understand how people deal with this stress, both as an individual and as a society so that they can design better working environments. Stress causes muscle tension, one of the many causes of MSDs; and MSDs cause pain that increases stress. Ergonomists try to end the cycle of job-related injuries and stress and create a more healthful, productive workplace.

Ergonomists also draw on **history**. The first ergonomic disorders were named after occupations where individuals suffered similar ailments. **Carpenter's elbow**, for example, referred to an inflammation of the elbow caused by the back-and-forth motions of sawing and hammering. Today it is referred to as **tennis elbow** because carpenters now use nail guns and electric saws. Tennis players, however, still use **repetitive motions** to swing the racket during play. These types of repetitive motions throughout history are what ergonomists look at to help prevent MSDs today.

# What are some common risk factors?

The workplace of today strives for paperwork reduction and job specialization. Paperwork reduction puts people in front of computers more often and for a longer time. Job specialization also keeps workers at the same workstations performing the same jobs day-in and day-out. These factors, coupled with growing production demands, increase the chances of suffering from MSDs.

MSD risk factors are found in most occupations, from construction, manufacturing, restaurants, retail stores, and offices. While the potential for on-the-job injuries are many, the following work activities and conditions increase the chances for MSDs:

- **Repetitive motions**  
Hourly or daily production targets may require a worker's wrists, arms, back, neck, or knees to perform repeated movements at a fast pace. Frequent repetitive motions fatigue the muscles and can damage nerves, joints, and ligaments.
- **Excessive force**  
Many work tasks require moments of excessive force or localized pressure, such as removing a rusty bolt. Force requires muscle effort, which causes fatigue and increases the chances of MSDs.
- **Awkward postures**  
Neutral postures lessen stress on muscles, tendons, nerves, and bones. Bending, reaching, or twisting the neck, back, arms, or legs can put muscles and tendons at a disadvantage and increase the probability of MSDs.

- **Vibration**  
Whole-body or hand-arm vibrations increase shoulder, hand, and neck MSDs. Work tasks such as using grinders, sanders, needle guns, chipping hammers, impact wrenches, or chainsaws can slowly rob the body of much-needed blood flow and result in injury to the blood vessels, nerves, or muscles.
- **Force**  
Forceful exertion, such as lifting, pulling, gripping, or pushing heavy or awkward items, can overload muscles and lead to MSDs.
- **Cold temperatures**  
Colder temperatures can increase muscle tension and reduce both dexterity and sensitivity. Cold environments may also cause a worker to grip a tool more tightly, restricting blood flow or causing the tissue to become stiff, creating discomfort and pain.
- **Stationary positions**  
Static or stationary positions rob the muscles of needed oxygen and can result in fatigue and MSDs. Examples of potentially damaging postures include standing in the same position for eight hours, holding a hand tool for 60 minutes straight, or keeping arms raised overhead for 30 minutes.
- **Contact stress**  
Contact stress results from constant rubbing between hard or sharp surfaces and sensitive body tissue, usually on the fingers, palms, thighs, or feet. The localized pressure contact stress places on an area of the body can reduce blood flow, nerve function, and the movement of tendons and muscles.

Certain occupations – such as mining, construction, agriculture, and sectors of the service industry -- are associated with increased arthritis, specifically, **osteoarthritis**.<sup>10</sup> Osteoarthritis is a type of arthritis caused when the protective cartilage that cushions the ends of a person's bones wears down over time. Common features of these occupations are physically demanding and heavy labor tasks, such as lifting or carrying heavy loads, exposure to vibration, and long periods of working in awkward or unnatural postures, such as kneeling or crawling.

## What can be done to prevent MSDs?

Whether it is changing positions, lifting correctly, or taking appropriate breaks, everyone can do something to prevent MSDs. These common ergonomic principles can reduce the risks of MSDs and are easily adaptable in all organizations and work areas:

- **Maintain a neutral posture**

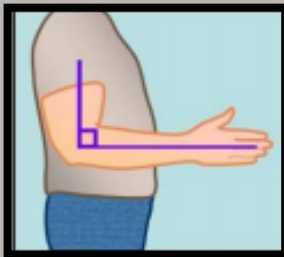
A neutral posture represents the natural stance the body wants to take. A straight line can be drawn from the ear through the shoulder, the hips, the knees, and the ankles when standing in a neutral posture. Work surfaces at about waist level prevent an employee from reaching above or below the body's mid-range. To help, place items, as much as possible, in a position that keeps elbows bent at about a 90-degree angle. While seated, try to keep the back straight, and the knees bent parallel to the hips with feet flat on the floor. Workstations and offices should be designed with a neutral body position in mind.

- **Prevent excessive repetition**

One of the major causes of CTS, tendonitis, and other MSDs is excessive repetition. There are several ways to prevent repetitive movements while working. If possible, try not to perform the same task all day. Vary work routines and taking short breaks every 20 to 30 minutes, when possible. If the same tasks are performed every day, try completing them in a different sequence. The key to preventing excessive repetition is not sitting or doing the same things for hours on end.

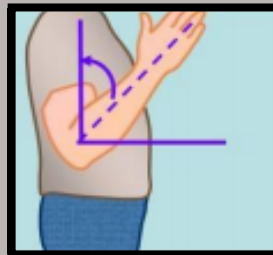
For employees who spend most of their time in front of a computer, consider an ergonomic keyboard and mouse or foam wrist pad to keep wrists from bending upward or side-to-side. Change hand grips on tablets and mobile phones often. Alternate between thumb and fingers when texting. Use a hands-free option as much as possible.

**Neutral Posture**

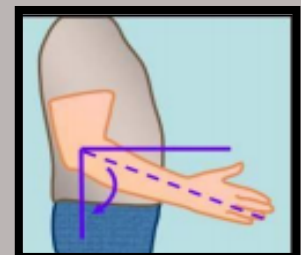


**Awkward Postures**

**Elbow Flexion**



**Elbow Extension**





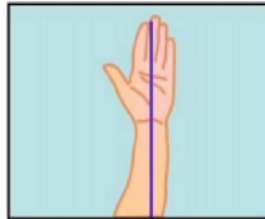
- **Adjust work surfaces**

Whether standing or sitting, work surfaces need to encourage individuals to keep a neutral posture. The work surface should be about at waist height, keeping the worker from stooping over or having to raise their shoulders to reach. A workstation that fits one person may place another worker in an awkward posture. Adjustable work surfaces are the best option to

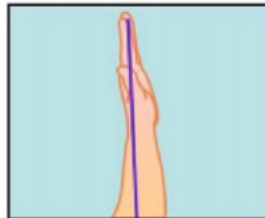
allow different people to work at the same workstation. If adjustable workstations are not feasible, adjust the station for the taller employees and supply platforms or stepping stools for shorter employees. If more than one station exists in the company, adjust one higher than the other and assign employees to the appropriate station. The bottom line is to maintain the most neutral posture possible and keep employees working erect.

### Neutral Posture

View #1  
(minimal radial/ulnar deviation)

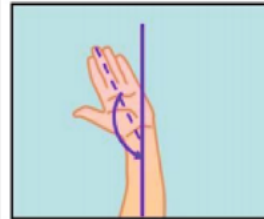


View #2  
(minimal flexion/extension)

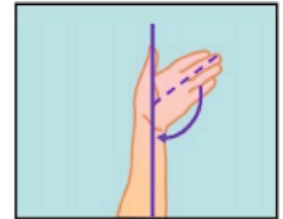


### Awkward Postures

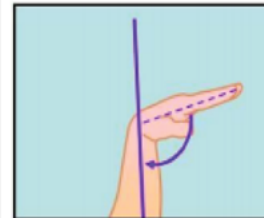
Radial Deviation



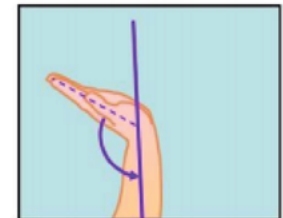
Ulnar Deviation



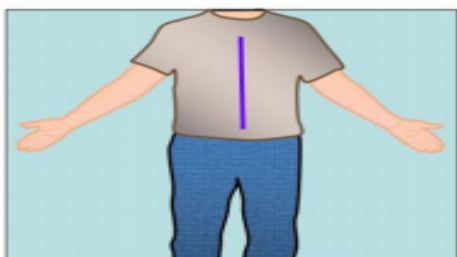
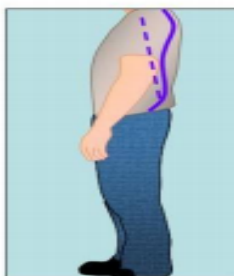
Flexion



Extension

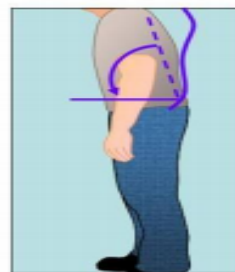


### Neutral Posture

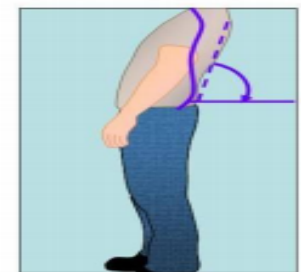


### Awkward Postures

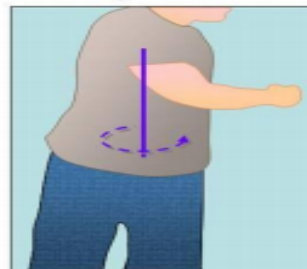
Back Flexion



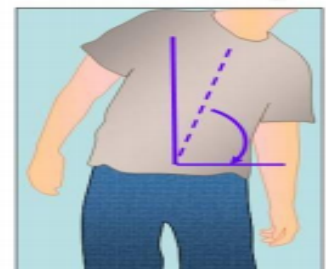
Back Extension



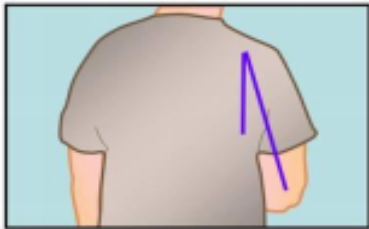
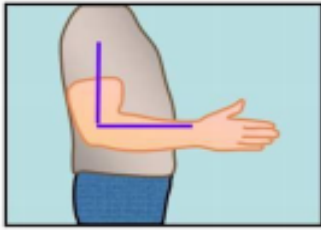
Twisting about Waist



Lateral Bending

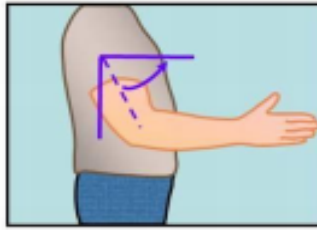


## Neutral Posture

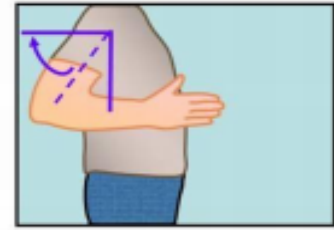


## Awkward Postures

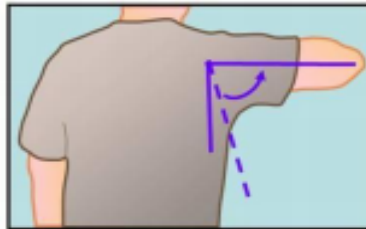
Shoulder Flexion



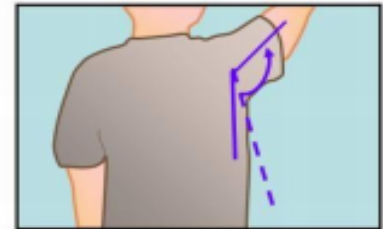
Shoulder Extension



Shoulder Abduction



Shoulder Abduction & Extension



- ***Avoid reaching***

Bursitis is an inflammation of the bursa, a fluid-filled sac or sac-like cavity that works as a cushion to reduce friction between body tissue. Bursitis in the shoulder can result from repetitive work with the arms stretched out or reaching. Reaching also puts stress on the back even when lighter items are lifted repetitively. Always place tools and items close that are used most. In the same respect, place heavier items close and nearer to the body's mid-range. This practice reduces stress on the back and shoulders when lifting. An ergonomically-arranged workstation can alleviate many shoulder and upper back injuries.

- ***Control environmental factors***

Employees working in cold environments, such as meatpacking plants or refrigerated warehouses, should receive personal protective equipment (PPE) at no cost and training

on its proper use. It is also critical in cold environments that employees are provided with appropriate tools for the climate, such as those with slip-resistant handles. Control the environmental factors where possible and supply the proper equipment to operate safely where the factors cannot be controlled.

- ***Reduce eye strain***

Having too little or too much light can cause eyestrain. Supply task lighting to areas and offices with poor lighting. Extra lighting can also reduce slips, trips, and falls. Let eyes rest regularly, especially if staring at a computer screen for hours. Looking at a digital screen for long periods each day can lead to headaches, blurred vision, and dry eyes. Use the 20-20-20 rule to relieve digital eye strain: every 20 minutes, look 20 feet away for 20 seconds. Use natural light when possible. Position the monitor so that the employee neither faces the sunlight nor has it directly from behind.

- **Lift properly**

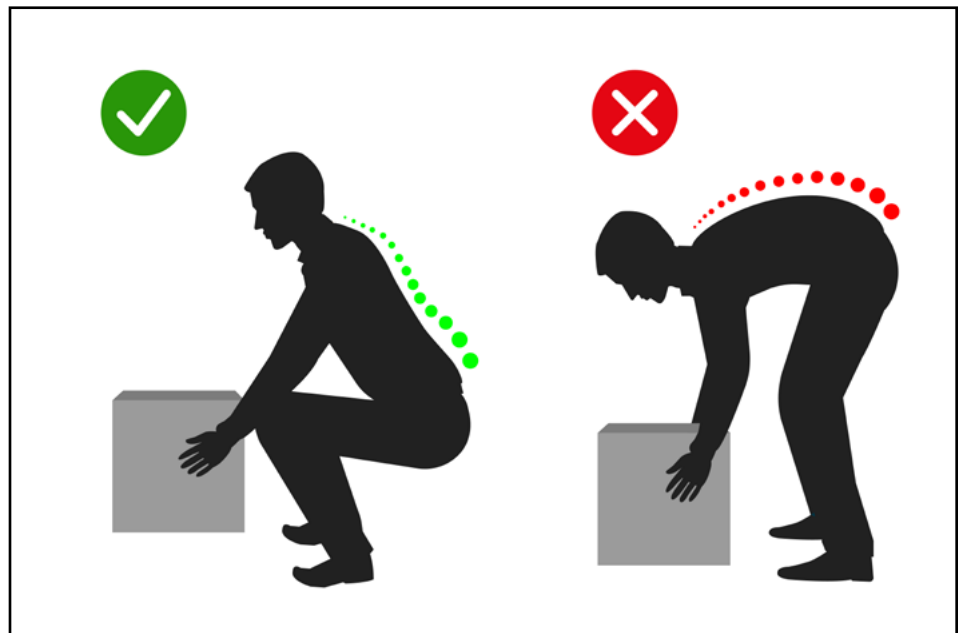
There are two basic types of back injuries. The first type, which is not typically classified as an MSDs, results from slips, trips, and falls. The second type includes back strains caused by improper lifting. These MSDs are caused when employees do not use proper lifting techniques or do not properly use equipment to lift heavy loads. Many companies have a Back Injury

Prevention Program. Still, steps such as using containers that hold smaller amounts of product or boxes with grips can help put less stress on the back. Often suppliers and distributors prefer packages in smaller containers to keep their employees' backs safer, too. Also, always provide lots of hand trucks, carts, and dollies, along with the training on [safe lifting](#) and [proper load handling when using industrial trucks](#).

- **Take time to recover**

Recovery is an essential part of preventing MSDs. One method of prevention is to give the body recovery time by taking advantage of any scheduled breaks. Performing even little stretches makes the blood flow back to parts of the body that have been stationary. Stretching also increases mobility and flexibility in the joints.

Micro-breaks are short 20 to 30-second pauses where employees can stop tasks and stretch. They are recommended about every 15 minutes, especially in jobs with repetitive tasks. Micro-breaks



allow the body to rest from repetitive or strenuous work without taking the employee away from the task. Even in small amounts, breaks allow the body to start healing itself from the stress and minor injuries of the day.

Emotional stress, which also causes muscle tightness, can result in MSDs. Company incentives designed to modify individual behaviors, such as employee exercise and stretching programs, help relieve stress. Getting plenty of sleep also allows the body time to heal and can be an effective means of reducing MSDs.

- **Understand the risk factors**

The first step in reducing MSDs is finding problems before they become issues. Knowing the risk factors discussed earlier -- excessive vibration, repetitive motions, awkward postures, extreme temperatures, heavy lifting, and overexertion -- can make it easier to spot the dangers. Train employees to minimize these hazards and think ergonomically.