

SECTION 4

Ergonomics & Materials Handling

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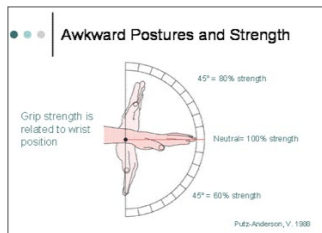
This section provides information about designing your work area and completing tasks in a way that makes your job more efficient and comfortable. Ergonomics and proper materials handling techniques make your job safer and help to prevent injuries.

Ergonomics

Ergonomics focuses on how your work affects your physical well-being. It is the science of matching the job to the worker to improve efficiency and to reduce the risk of discomfort or injury. Ergonomic changes can include restructuring or changing the work environment or modifying a task by using different tools or procedures. In the area of materials handling, ergonomic interventions can include training in back safety, reducing the weight of objects lifted, using mechanical lifting devices, or changing the height of a pallet or shelf. The goal of ergonomics is to reduce your exposure to work hazards. A hazard is defined as a physical factor within your work environment that can harm your body. Ergonomic hazards include working in awkward or uncomfortable postures and using excessive force or high repetition.

Work Smarter, Not Harder

Many jobs require you to work in awkward postures or to use repetitive or prolonged force. The risk of injury increases with exposure to hazards, combined with longer exposure times and insufficient rest or recovery time.



Posture is Important

An awkward posture occurs when a joint is held in a “non-neutral” position at the extreme ends of its range of motion. A joint becomes weaker as it is moved away from its mid-point. Awkward postures place the muscles out of balance, make tasks more physically demanding, and add stress to the body.

An example of an awkward posture is when the wrist is bent up and down at the extreme ends of its range of motion.

Awkward postures can occur in shops when doing bench work, especially if tools and materials are placed outside of the “power zone”. The power zone is close to the body, between mid-thigh and mid-chest height. This zone is where the arms and back can lift the most with the least amount of effort. The risks associated with lifting and carrying are magnified when items must be retrieved or placed outside of the power zone. Examples of specific high-risk postures can be found in Table 4.1.

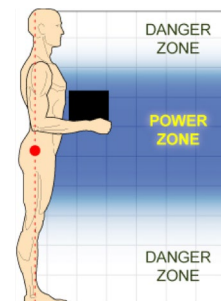






Table 4.1 – High-Risk Postures

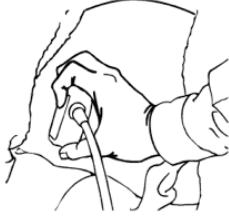
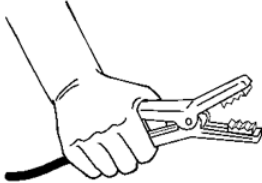
	<p>Working with hands above the head, or with the elbows above the shoulders for prolonged periods without frequent breaks</p>
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	<p>Working with the neck bent more than 45° without support or frequent posture changes for prolonged periods</p>
	<p>Working with the back bent forward without support or frequent posture changes</p>
	<p>Squatting or kneeling to work repetitively or for prolonged periods</p>
	<p>Working outside of the power zone</p>

Avoid Forceful Exertions

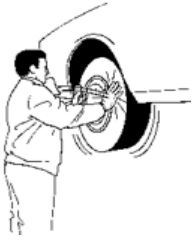

Force is defined as exerting effort to accomplish something. Shop work involves various types of force, including high hand forces, contact pressure, and high force associated with lifting and carrying tasks. Table 4.2 depicts examples of high hand force that occur when using tools.

Table 4.2 – High Hand Forces

	<p>Holding and operating a hand tool weighing two pounds or more, or pinching with a force of four pounds or more (comparable to using a pair of pliers or hammer) for more than three hours per day. Risk is increased when using the following awkward wrist postures</p>
	<p>Working with the neck bent more than 45° without support or frequent posture changes for prolonged periods</p>

Another type of force that can cause injury is contact pressure. Contact pressure occurs when a body part that is not protected by muscle or padding is compressed against a hard surface or sharp edge. Prolonged compression on a padded surface can also result in contact pressure. An example of this activity is kneeling to work using knee pads or a floor mat. Examples of contact pressure are in Table 4.3.

Table 4.3 – Contact Pressure

	<p>Using the hand (heel/base of palm) as a hammer more than once per minute</p>
	<p>Using the knee as a hammer more than once per minute or kneeling for prolonged periods on knee pads or a mat</p>

More is Not Always Better

Doing too much will not only make you tired, but it can also wear your body out! Highly repetitive tasks can put you at high risk of discomfort or injury. The risk of injury is even greater when you work in awkward postures. High repetition tasks commonly seen in shops include:

- Use of hand tools such as saws, hammers, screwdrivers, and wrenches
- Hand sanding or grinding

Too little movement can also be as harmful as too much movement. Prolonged or sustained postures occur when we do not move. Discomfort and fatigue can result from holding tensed muscles in fixed positions for long periods. The risk of injury increases if you hold fixed positions in awkward postures. An example of an awkward and prolonged posture is bending over to caulk or drill without changing tasks for long periods of time.

Lifting and Carrying

Many lifting injuries can be prevented by reducing the weight and number of lifts as much as possible, and by learning how to use appropriate lifting techniques when it is necessary to lift and carry objects.

Using proper lifting techniques can reduce or eliminate the potential for injury when you must lift or move objects by hand. Use forklifts, hoists, carts, dollies, and other types of lifting equipment when you have to lift or move heavy or bulky objects.

Before lifting an object, assess the situation by asking yourself the following questions:

- Can you lift this load safely, or is it a two-person lift?
- How far will you have to carry the load?
- Is the path clear of clutter, cords, slippery areas, overhangs, stairs, curbs or uneven surfaces?
- Will you encounter closed doors that need to be opened?
- Once the load is lifted, will it block your view?
- Can the load be broken down into smaller parts?
- Would gloves improve your grip or protect your hands?

Size up the load:

- Test the weight by lifting one of the corners. Stop lifting if it is too heavy or difficult to handle.
- Consider asking for help from fellow workers.
- Break down the load into smaller parts.
- Use a mechanical lift or a hand truck.

The Art of Lifting

There is really no single “right way” to lift. However, there are more and less demanding ways to lift. The key to working safely is to figure out how to lift in the least demanding way possible.

Here are some guidelines to reduce risk of injury when lifting.



Staggered Stance. Lifting with the feet close together and in line with each other makes it more difficult for you to use your legs to help with the lift. Staggering your stance encourages the legs to become involved and reduces the demands on your back. Simply stepping toward a load (with a staggered stance) moves the center of gravity closer to the load and minimizes the demands of the lift. If you feel your weight shifting forward onto your forward leg, you know you have successfully transferred this weight demand from your back to your stronger legs.



Keep It Close and Keep the Curves! The closer a load is kept to your power zone, the easier it is to keep the natural curves of your back. The vertebra, discs, ligaments and muscles are in their strongest and most supportive position when the natural curvature of the spine is maintained.



Build a Bridge. In most cases, the demands of any lift are determined by the position of a person's upper body during the lift. Many people lift by bending over at the waist and leaving their upper body hanging like a "one-sided bridge". This places all the demands of the lift onto the lower back and increases the risk of injury. This can be avoided by "building a bridge" to support the weight of the upper body. To do this, place an arm on your leg or a nearby stationary object. If you need both of your arms to manage the object you are lifting, step forward toward the load with one leg and create a "bridge" with your legs to reduce the workload on your back.



Feet First. Moving your feet first gets you closer to the load and reduces the amount you have to reach. The farther you reach, the more you have to lift your upper body as well as the load. Moving your feet first also helps reduce the risk of twisting while you lift.

Prepare and Compensate

Let Your Body Breathe. Lifting and carrying loads can be hard work. Like athletes, workers can avoid injuries or discomfort by preparing the body for work. Muscles are more flexible and less prone to injury when they are warm and full of oxygen. Stretching and moving around prior to work helps pump blood into your muscles. Blood warms up muscles and brings in oxygen, allowing your muscles to "breathe". This can be particularly effective at the beginning of the workday, after breaks, or if you work in cold environments.

Compensating for work demands simply means letting the body recover from work in an efficient manner. Performing periodic stretches can minimize accumulation of fatigue throughout the day. Stretches can "apologize" to the body for working it so hard.

Use Mechanical Lifting Devices Whenever Possible

The best way to avoid a back injury is to reduce the number of lifts you carry out as much as possible. Hand trucks, push carts, and forklifts are great engineering controls that reduce your exposure to lifting hazards. If you use a forklift, make sure you have received the appropriate training and are authorized to operate one.

Tips for Using Hand Trucks and Carts:

1. Push rather than pull. It is easier and safer to push than to pull. You can use your body weight to assist when pushing, and you can see where you are going. You are also less likely to twist when pushing.
2. Keep close and lock your arms. Stay close to the load, try not to lean over, and maintain the curves of your back when pushing or pulling.
3. Use both hands. Carts are easier to push and control using both hands.
4. If necessary, use tie-downs to secure the load.
5. Use powered carts when available.



Setting Up A Safe Work Environment

Avoiding exposure to work hazards such as awkward postures, repetition and high forces is the best way to avoid discomfort and injury. Here are some ways that you can set up a safe work environment.

Tool Design

Shop workers use many different tools. The design of the tool can affect your working posture and the force and repetition you are exposed to while working. To reduce your risk exposure, use Table 4.4 to match your tool selection to the task you must complete.

Table 4.4 – Tool Selection

For tasks requiring a POWER GRIP	
<p>SINGLE-HANDLE TOOLS</p>  <p>Handle Diameter= 1¼" to 2"</p>	<p>DOUBLE-HANDLE TOOLS</p>  <p>Open Grip Span = <3 ½" Closed Grip Span = >2"</p>
For tasks requiring PRECISION	
<p>SINGLE-HANDLE TOOLS</p>  <p>Handle Diameter= ¼" to ½"</p>	<p>DOUBLE-HANDLE TOOLS</p>  <p>Open Grip Span = <3" Closed Grip Span = >1"</p>

Guidelines for Tool Selection

Keep the following guidelines in mind when selecting tools:

- Select tools with smooth, non-slippery, padded handles. Avoid tools with finger grooves, hard plastic handles, sharp edges, small or large diameter handles.
- Use grips or tape to build up small diameter tools, especially if you need to use them with a power grip. Better still, select tools with larger diameter handles (1¼"-2") and soft grips.
- Use longer handle tools (screwdrivers, wrenches) for better leverage.
- Use vises, clamps, or jigs to stabilize objects to avoid prolonged forceful gripping with the hand.
- Avoid gripping or pinching with your wrist in awkward positions. Take frequent breaks to stretch and rest hands.
- Alternate activities frequently throughout the day. Rotate heavy and/or repetitive tasks with lighter, less repetitive tasks.

Task Modification

The way you complete your work tasks can influence your level of fatigue and your exposure to risk. The following suggestions can help you work more efficiently and comfortably:

- Use two hands to lift rather than one, even with light objects and tasks.
- Slide or push and pull objects instead of lifting.
- Avoid jerky movements when lifting objects.
- Use power devices when available.
- Keep reaching to a minimum. Position objects close to the body within easy reach (the “neutral reach zone”).
- Use a step stool or ladder when necessary to reach above shoulder level, or to lift objects overhead.
- Alternate tasks throughout the day. Rotate heavy and/or repetitive task with lighter, less repetitive tasks.

The Neutral Reach Zone

