

---

**THE UNIVERSITY OF TEXAS AT AUSTIN**



**UTILITIES AND ENERGY  
MANAGEMENT**

**MATERIAL HANDLING PROGRAM**

**August 2007**

---

## TABLE OF CONTENTS

---

<b>1.0 Introduction .....</b>	<b>1-1</b>
1.1 PURPOSE .....	1-1
1.2 APPLICATION .....	1-1
1.3 SCOPE .....	1-1
<b>2.0 Common Type of Injuries .....</b>	<b>2-1</b>
<b>3.0 Personal Protective Equipment .....</b>	<b>3-1</b>
<b>4.0 Proper Lifting Techniques .....</b>	<b>4-1</b>
4.1 DOS AND DON'TS OF LIFTING .....	4-4
4.2 TEAM LIFTING .....	4-5
<b>5.0 Using Equipment for Assistance with Material Handling .....</b>	<b>5-1</b>
<b>6.0 Proper Valve Turning Techniques .....</b>	<b>6-2</b>
6.1.1 Without Mechanical Advantage.....	6-2
6.1.2 With Mechanical Advantage.....	6-2
6.1.3 With Powered Assistance .....	6-3
<b>7.0 At-Home Modifications .....</b>	<b>7-1</b>
<b>8.0 The Effects of Aging on Material Handling Ability .....</b>	<b>8-1</b>

## 1.0 INTRODUCTION

### 1.1 Purpose

Preventing sprains and strains of the lower back, shoulders and upper limbs is a major challenge to many employers. At The University of Texas at Austin Utilities and Energy Management Department (UT Utilities), more than 37% of all workers compensation insurance claims from 2001 through 2005 were for strains and sprains, including back injuries.

According to the Bureau of Labor Statistics (BLS), more than one million workers suffer back injuries each year, with back injuries accounting for one out of every five workplace injuries and illnesses. One fourth of all compensation indemnity claims are a result of back injuries. This problem produces pain and discomfort to employees, and can have a dramatic change in their productivity and lifestyles.

A BLS survey shows that four out of five of these injuries were to the lower back and that three out of four occurred while lifting. This survey shows the importance of reducing back injuries caused by improper lifting. In addition, UT Utilities has experienced a large number of strains and sprains during the opening and closing of valve wheels.

To reduce the rate and severity of material handling injuries experienced by UT Utilities personnel, this program has been created to establish best practices for lifting objects and for turning of valve wheels.

### 1.2 Application

This Materials Handling Program applies to manual moving of objects and turning of valves. See other The University of Texas at Austin Utilities and Energy Department (UT Utilities) Safety Program documents for mechanical moving of objects, with equipment such as powered industrial trucks and hoists and cranes.

### 1.3 Scope

This program applies to all work performed by UT Utilities employees regardless of jobsite location. All employees who move or lift heavy objects or turn valve wheels must be trained in appropriate material handling practices. These work practices must always be followed. In addition, employees are encouraged to use the same practices at home and to pay close attention to the effects on their physical abilities due to lifestyle and aging.

## 2.0 COMMON TYPE OF INJURIES

Potential injuries that can occur when manually moving materials, including the following:

- Strains and sprains from lifting loads improperly or from carrying loads that are either too large or too heavy,
- Fractures and bruises caused by being struck by materials or by being caught in pinch points, and
- Cuts and bruises caused by falling materials that have been improperly stored or by incorrectly cutting ties or other securing devices.

Of particular concern for UT Utilities are back and overexertion injuries. Back injuries occur when the muscle, ligaments and/or tendons in the back are damaged due to overstretching or overuse of the muscles in the back. These injuries can result in strains, sprains and tears. Herniated disks are also a type of back injury found in workplace situations. A herniated disk occurs when an injury to the spine causes the outer layer of the disk resulting in the cushioning gel to bulge out. Overexertion injuries are the result of excessive repetitive handling, (i.e. lifting, pushing, pulling, holding, turning, carrying or throwing of an object), and/or the use of excessive force for a single handling. These injuries involve the nerve, tendons, muscles and supporting structures of the body.

Most back injuries can be attributed to one of these six causes:

- Lifting a load that is too heavy
- Posture
- Body Mechanics/Work Habits
- Stressful Living
- Loss of Flexibility
- Poor Conditioning

### **3.0 PERSONAL PROTECTIVE EQUIPMENT**

Using the following personal protective equipment prevents needless injuries when manually moving materials:

- Hand and forearm protection, such as gloves, for loads with sharp or rough edges,
- Eye protection,
- Steel-toed safety shoes or boots, with soles that are not overly worn to prevent slipping, and
- Metal, fiber, or plastic metatarsal guards to protect the instep area from impact or compression.

## 4.0 PROPER LIFTING TECHNIQUES

The National Institute of Occupational Safety and Health (NIOSH) conducted a review of evidence to examine the relationship between selected musculoskeletal disorders (MSDs) of the upper extremity and low back, and exposure to physical factors at work. The review established strong evidence that low-back disorders are associated with work-related lifting and forceful movements. The review also cited strong evidence of a causal relationship between low-back disorder and whole body vibration (WBV), which occurs when mechanical energy oscillations are transferred to the body as a whole. Typical exposures for WBV include driving automobiles, trucks and operating industrial vehicles. Other physical workplace factors found to have an association with back disorders include awkward posture and heavy physical work, such as turning valve wheels.

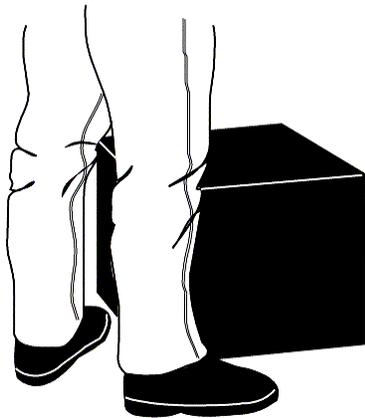
To minimize the likelihood of a back injury when lifting materials, the following steps should be taken:

### 1. Plan ahead before lifting.

Know what you're doing and where you're going to help prevent you from making awkward movements or turning awkwardly while holding heavy object. Clear a path, and if lifting something with another person, make sure both of you agree on the plan.

### 2. Stand Close to the Load:

Stand close to the load with your feet spread apart about shoulder width. Place one foot slightly in front of the other for balance.



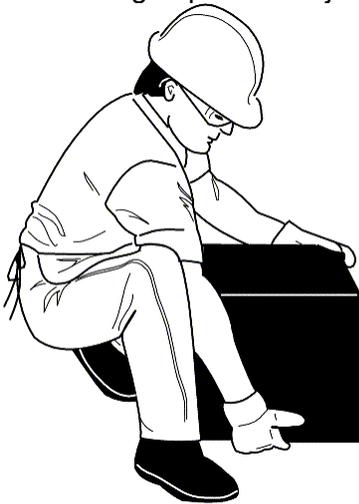
### 3. Bend at the Knees:

Squat down bending at the knees (not your waist). Tuck your chin while keeping your back as vertical as possible.



**4. Control the Load:**

Get a firm grasp of the object before beginning the lift.



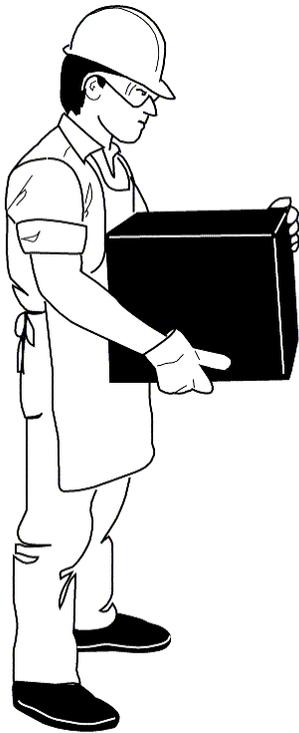
**5. Lift with Your Legs:**

Begin slowly lifting with your LEGS by straightening them. Never twist your body during this step.



**6. Keep Load Close to Body:**

Once the lift is complete, keep the object as close to the body as possible. As the load's center of gravity moves away from the body, there is a dramatic increase in stress to the lumbar region of the back.



If you must turn while carrying the load, turn using your feet-not your torso. Keep your eyes up. Looking slightly upwards will help you maintain a better position of the spine.

Note: If the load is heavy, do not turn or pivot on one leg as this type of motion can cause knee injury.

When moving an item from a hard-to-reach place, position yourself as close to the item as possible. Slide it out to get it closer and be sure that you have adequate room for your hands and arms. Be aware of adjacent obstructions, on either side or above the load.

If an object is too heavy, or awkward in shape, make sure you have someone around who can help you lift. To place the object below the level of your waist, follow the same procedures in reverse order. Remember, keep your back as vertical as possible and bend at the knees.

Think about where the item will be placed once you've lifted it: Will it be:

- Overhead?
- Under an overhang?
- In a narrow spot?

Try to allow yourself as much room as possible to set the load down. You can always shift it slightly later. Check your path from place to place - remove tripping hazards, protect openings, set up a "well wheel" or a "bucket and line" if you need to get materials up a ladder. Make sure that the lighting is sufficient to see where you are going. Stabilize uneven or loose ground, or choose an alternate route. The shortest way isn't always the fastest, or the safest.

## **4.1 Dos and Don'ts of Lifting**

Always use both hands when lifting and lift slowly and deliberately. The ideal situation is to have someone or something to help you when lifting, but if that's not possible, follow all the above listed guidelines to minimize your risk of injury.

Following is a review list of dos and don'ts when bending and lifting:

### **Dos**

- Do place your feet and knees at least shoulder width apart or front to back in a wide-step position. This will help you bend at the hips, keeping your back relatively straight and stress free.
- Do lean over or squat with the chest and buttocks sticking out. If you do this correctly, your back will be flat and your neck will balance in a relaxed neutral position.
- Do take weight off one or both arms if possible. When you squat down or push back up, use your hand or elbow as support on your thigh or any available structure. This takes some of the compression and strain off of the lower back.
- Do balance your load on either side if possible, or switch sides so that both sides are equally stressed.

**THE UNIVERSITY OF TEXAS AT AUSTIN  
UTILITIES AND ENERGY MANAGEMENT  
MATERIAL HANDLING PROGRAM**

---

- Do level the pelvis or tuck in your buttocks and suck in your abdomen, when reaching or lifting overhead. Keep your chest up and use a step stool to keep the low back and neck in neutral alignment.
- Do walk around and use backward-bending and/or stomach-lying positions before or after bending or heavy lifting, especially if you've been sitting for a while.

**Don'ts**

- Don't lift things when your feet are too close together. If your feet are closer than shoulder width you'll have poor leverage, you'll be unstable, and you'll have a tendency to round your back.
- Don't lift with your knees and hips straight and your lower back rounded. This is the most common and stressful bad lifting move. Twisting the trunk during this bad move compounds the problem.
- Don't tense and arch the neck when lifting. This crams your neck joints together and causes pain especially if maintained for a long period of time.
- Don't twist or turn when carrying a heavy load.
- Don't lift and/or carry an unbalanced load.
- Don't lift and bend too much in a short period of time.
- Don't lift objects that are too heavy for you.
- Don't mistakenly believe that a lifting belt will increase your maximum lifting potential.
- Don't lift heavy objects directly following a sustained period of sitting, especially if you have been slouching.
- Don't lift things overhead with your neck and back arched, if possible.

## **4.2 Team Lifting**

Team lifting should be used rarely, as the likelihood of injury due to slipping, tripping, falling and dropping is greatly increased. Whenever team lifting is employed, the participants should carefully discuss the plan for the lift, including any verbal instructions that will be used to initiate actions and to warn of hazards.

## **5.0 USING EQUIPMENT FOR ASSISTANCE WITH MATERIAL HANDLING**

Ergonomics is defined as the study of work and is based on the principle that the job should be adapted to fit the person rather than forcing the person to fit the job. Ergonomics includes restructuring or changing workplace conditions, to make the job easier, and reducing stressors that cause musculoskeletal disorders. In the area of materials handling, ergonomic principles may require controls such as reducing the size or weight of the objects lifted, installing a mechanical lifting aid, or changing the height of a pallet or shelf.

Many times an item could be moved with a piece of equipment, such as a dolly, a handtruck or a forklift. Consider using mechanical assistance wherever possible. When using mechanical assistance, remember to push, not pull - you'll have more control, and greater leverage. Also, fasten the load to the equipment, so sudden stops or vibration don't jar it off.

Consult the UT Utilities Safety Coordinator for ergonomic assessments of high risk moving activities. When evaluating a worker's lifting habits, the following variables will be considered: frequency of lifting, angle of body, height of load, duration of such activities, and type of lifting, as well as the worker's state of health, body size, age and general physical fitness. Material handling tasks may be redesigned to minimize the weight, range of motion, and frequency of the activity. Alternatively, mechanical assistance may be employed.

## 6.0 PROPER VALVE TURNING TECHNIQUES

Various conditions, such as ambient temperature, valve maintenance, frequency of valve use, pipe contents and their physical parameters, and an individual's physical condition, can vary the amount of force required to open a valve. When a manually opened valve has significantly increased in opening or closing force, discontinue the job and report the situation to the Utilities Safety Coordinator. In some cases, conditions might warrant a change of procedures to include the use of mechanical advantage or powered advantage.

### 6.1.1 Without Mechanical Advantage

When possible utilize the following best practice steps for minimizing the chance of sprains and strains from opening valves without mechanical advantage:

1. Position body to be centered on valve wheel,
  - a. Use approved platforms to improve positioning, when necessary,
2. Grab valve wheel with both hands,
3. Spread hands as much as possible,
4. Turn the valve wheel with slow, controlled motions.
  - a. Do not use maximum force
  - b. Reset hands and body position after turning not more than 90 degrees

### 6.1.2 With Mechanical Advantage

Utilize the following best practices for minimizing the chance of sprains and strains from opening valves with manual mechanical advantage:

1. Thoroughly plan the use of mechanical advantage devices and comprehend potential results if the device slips,
2. Only use approved mechanical advantage devices to open a valve and always refer to the manufacturer's instructions,
3. Position entire body ahead or behind end of device, depending on whether it is to be pushed or pulled,
4. Hold device with both hands,
5. Space hands so no more than shoulder width apart,
6. Keep back straight and legs bent when pushing or pulling the device. Pushing is preferable to pulling.),
7. Turn the valve wheel with slow, controlled motions,
  - a. Do not use excessive force,
  - b. Reset hands and body position after turning not more then 90 degrees,

### **6.1.3 With Powered Assistance**

When valves cannot be easily opened manually, even with a mechanical advantage, then the use of powered mechanical advantage will be considered. The use of powered mechanical advantage must be approved by the UT Utilities Safety Coordinator.

## 7.0 AT-HOME MODIFICATIONS

Sprains, strains and lower back pain on the job can be partially attributed to what you do or do not do outside the workplace. Below are some recommendations to follow to protect against non-workplace injuries:

- Maintain a reasonable weight, eat nutritious meals, and exercise to maintain well-conditioned muscles.
- Sleep on a firm mattress and avoid sleeping on your stomach. When sleeping on your side or back, bend your knees. Place a pillow under your head, another between or beneath your knees.
- When you awake, remember that your muscles are still at rest. Gradually stretch your leg, arm, back and stomach muscles before you get up. Do some more stretching exercises after you are out of bed. Early morning is the recommended time for these exercises, but any time of the day is all right. More important than the time of day is the development of a regular exercise program. This is particularly important for individuals who do limited physical work, but a regular exercise program is also valuable for individuals who are involved in heavy physical labor.

## **8.0 THE EFFECTS OF AGING ON MATERIAL HANDLING ABILITY**

As the body ages, certain musculoskeletal changes occur that can reduce the ability to do physical labor. The clinical manifestation of these changes can be decreased strength, increased vulnerability to fractures, and joint stiffness and inflammation. The primary reasons for these changes are decreased muscle fiber number and diameter, diminished bone mineral content, increased stiffness of tendons and connective tissue, and diminished joint cartilage. In addition, the changes can be accelerated due to a sedentary lifestyle (disuse atrophy) and osteoporosis.

The workplace implications of age induced musculoskeletal changes are increased risk for injuries, such as strains and sprains, increased risk for fractures, decreased ability to do heavy work and decreased ability to do constant repetitive work. As these implications are identified, employees should work with supervision and the UT Utilities Safety Coordinator to adjust material handling expectations and practices appropriately.