Lessons for Lifting

and Moving Materials

INFORMATION

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Lessons for Lifting

and Moving Materials

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For More Information

If, after reading Lessons for Lifting and Moving Materials, you would like further assistance on identifying manual materials handling hazards, developing control methods or solutions, or setting up company-wide orgonomic programs, please give Labor and Industries a call. Labor and Industries provides free, confidential on-site consultations by trained staff in the areas of occupational safety, industrial hygiene and ergonomics. For assistance, call the office below that's closest to you or dial 1-800-4BE-SAFE (423-7233).

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The following ergonomics-related publications also are available from the Department of Labor and Industries:

- *Work -Related Musculoskeletal Disorders: Washington State Summary 1992-1994*
- *An Ergonomics Program Guideline — Fitting the Job to the Worker*
- *Office Ergonomics Guidelines*
- *Cumulative Trauma Disorders and Your Job, Carpal Tunnel Syndrome: A Preventable Disease*
- *The Backbelt Fact Sheet*
- *Commonly Asked Questions about Ergonomics*

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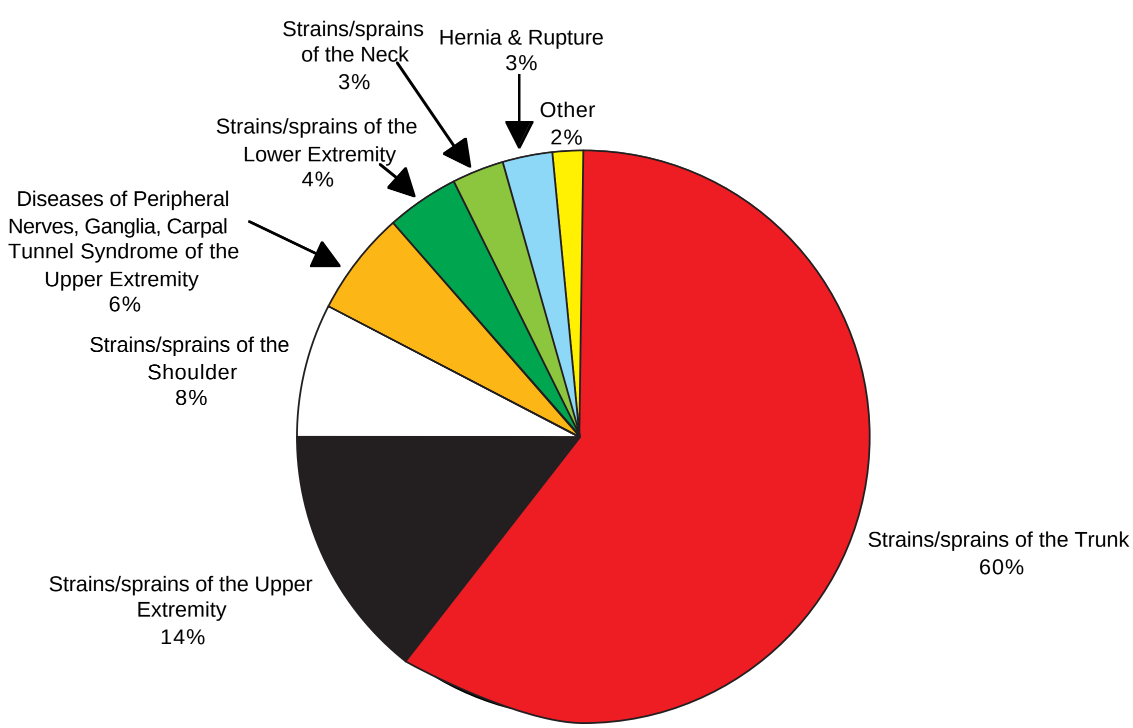
Purpose

This publication is designed to help floor supervisors, safety committees, health and safety managers and employees reduce injuries that occur when lifting and moving materials. It identifies work areas, tasks and procedures that place employees at risk of injury. Examples cover actual methods that have been used by businesses to reduce the risk of injury. Labor and Industries encourages employers to apply this information to their own workplaces, identify high-risk tasks and implement solutions to reduce risk.

Background

Between 1992 and 1994, Labor and Industries accepted 487,836 workers' compensation claims from State Fund employers. Of those, 131,187 were the result of an "overexertion" type of exposure. That's almost 27 percent of all State Fund claims. An **overexertion** claim is defined as any non-impact injury that results from lifting, pulling, pushing, carrying, wielding or throwing objects. Overexertion claims cost the State Fund over $468 million between 1992 and 1994 — an average of $156.5 million per year. The following pie chart shows the distribution of overexertion claims by the nature of injury.

Percent of Distribution of Overexertion Claims by Nature of Injury 1992 - 1994



The majority of these injuries, classified as **sprains/strains of the trunk**, result from lifting, pushing, pulling and carrying objects (also known as **manual handling**). Although manually handling materials in the workplace is not the sole cause of back pain in workers, it's certainly a major contributor to the problems employees experience with their back. Other factors that may contribute to low back pain, and should be considered when investigating possible causes include:

- Poor physical fitness
- Lack of flexibility
- Participation in certain recreational activities
- Emotional stress
- Lack of rest
- Poor back support when sleeping
- Poor posture when sitting and standing for long periods

Although an employer may have some control over these factors, in most cases employees have the greater control. This handout will focus on those factors that the employer can control in the workplace and suggest methods to eliminate hazards on the job that contribute to back pain and disability.

Back Pain and Common Disorders

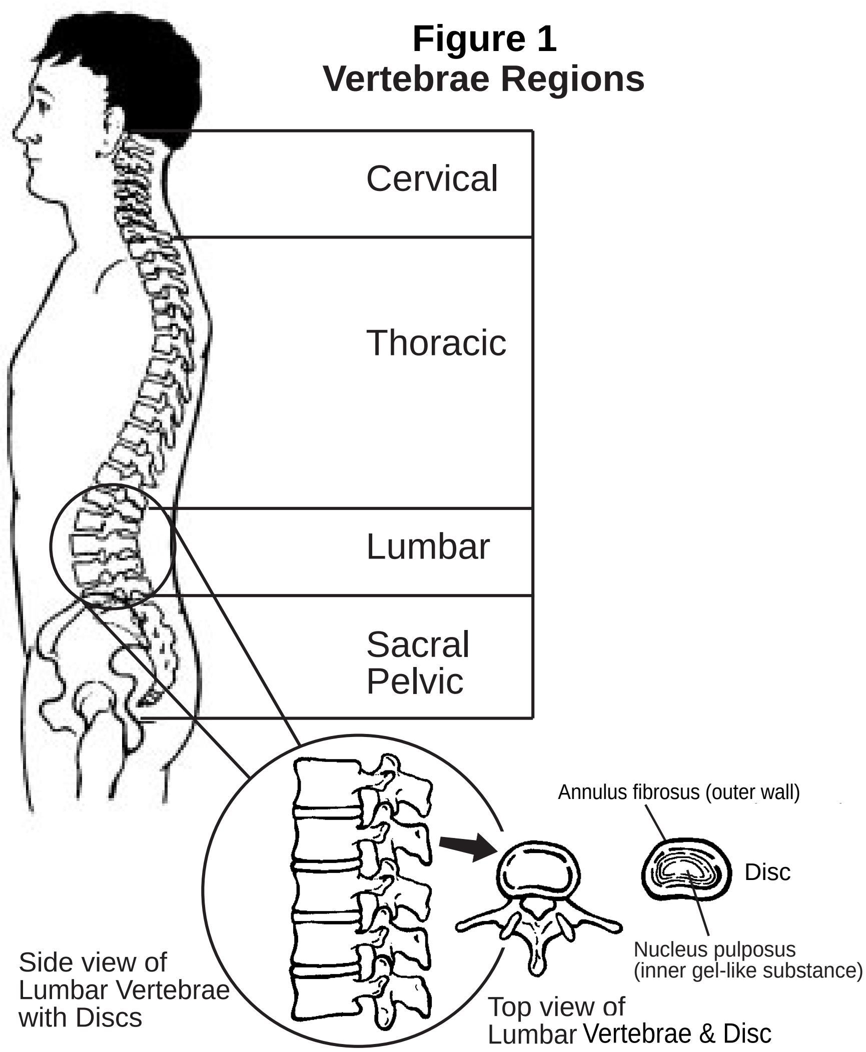
Before one can start to identify tasks or processes in the work environment that are responsible for overexertion injuries and back pain, it's important to understand how the back is designed and what causes breakdowns.

The main structure in the back that provides support and allows for movement is the spine. The spine is composed of 33 separate bones or **vertebrae**, 24 of which are movable. Each of the 24 movable vertebrae are stacked on top of each other and separated by a fibrous cartilage called a **disc** (Figure 1). Each disc consists of a tough fibrous band of tissue that surrounds the inner core of gel-like substance. The inner gel-like substance consists mainly of water, and acts like a hydrostatic shock absorber to protect the spine from large compressive forces. The outer wall protects the inner contents and prevents the gel from leaking out.

Over time the outer wall can start to break down due to frequent stresses from activities such as repetitive lifting, awkward work postures and standing on hard surfaces, all of which accelerate the process. When the disc wall develops a weak spot, it can begin to bulge. This **disc bulge** can put pressure on the nerves in and around the disc, causing pain. If pressure, and wear and tear continue on the disc, the outer wall can rupture or herniate. Not only can this put additional pressure on the disc and spinal nerves, it can make the vertebrae on top and below the disc unstable. This instability can place more pressure on the surrounding nerves as well as stressing ligaments attached to each vertebrae.

In addition to low back pain associated with disc problems, pain can commonly be attributed to **muscle and fascia strains and ligament sprains**. These strains and sprains occur when the back is bent too far in one direction, bent repeatedly, or when too much load is applied in a bent position. When damage to the muscle or ligament occurs from overstretching or overloading these structures, inflammation can occur which, in turn, may cause pain. In addition, the larger muscles in the back may begin to spasm, also referred to as muscle guarding. If the muscle and ligaments aren't allowed to heal properly before being stressed again, scar tissue can develop. Because scar tissue is not as strong or flexible as normal muscle or ligament tissue, it is prone to recurring injury.

Figure 1
Vertebrae Regions

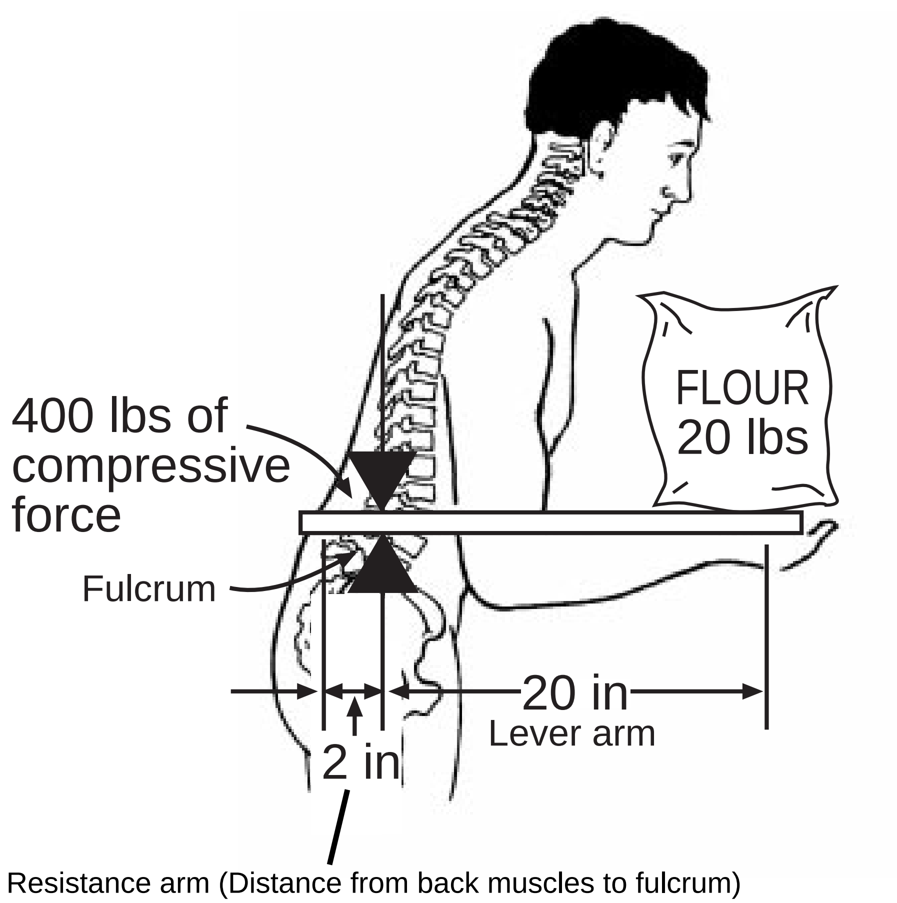


Causes of Back Pain and Injury

Overexertion back injuries, as defined above, are rarely the result of a single event or accident. In some cases, an accident may have resulted in a pulled muscle. But the muscle really didn't become bothersome until after several weeks or months of repetitive lifting or awkward work postures. In other cases, months or years of repetitive lifting, pushing, pulling and carrying didn't become noticeable until a single lift produced significant pain from a bulging or ruptured disc.

The low back is especially susceptible to breakdown due to the mechanics of the human body and the type of tissue and structures that make up the spine. As illustrated in Figure 2, the upper body can be thought of as a **lever arm** and the low back as the **fulcrum point** at which the trunk rotates around. For this reason, the **compressive forces** on the spine are the greatest in this region and consequently can cause the most damage to the discs that sit between each vertebrae. For instance, lifting a 20 lb. bag of flour 20" away from the body produces approximately 400 lbs. of compressive force on the disc at the fulcrum point. This is 20 times the weight of the actual object lifted! In this case it is not only the distance of the sack of flour from the body that contributes to the large compressive force, but also the weight of the trunk as it's bent forward. Not only do the muscles in the back have to work to support the flour sack, but also the weight of the upper body. For this reason, even if a person is not lifting an object, large compressive forces are produced just to maintain the trunk in a forward bent posture. Therefore, tasks that require employees to work in forward bent postures, also contribute to the risk of developing low back pain.

Figure 2



Risk Factors Associated with Lifting and Moving Materials

Risk factors are characteristics of the job or task that increase the risk or chance of sustaining a low back injury. The more risk factors that are present on the job, the greater the employee's risk of back injury. With lifting injuries, one of the most obvious risk factors is the weight of the object. Heavier objects require more muscle force to stabilize the trunk and produce greater compressive forces on the spine. Heavier objects are also more hazardous to handle for the following reasons:

- Heavier objects require more strength to handle which limits the number of employees who can safely handle them.

- When an object is too heavy for an employee to easily move, he/she may attempt to force the object to move by assuming an awkward posture or using momentum to jerk or twist. Abruptly twisting the back while lifting or quickly accelerating objects produces even larger forces on the spine, and greatly increases the risk of muscle and ligament strains and sprains as well as wear and tear on the discs.

- Heavier objects require more energy to handle and can cause early whole-body and muscle fatigue. As an employee becomes fatigued, he/she will be more likely to make errors, use improper lifting techniques and cause an accident that could produce more severe consequences than a back injury.

These are just a few of the potential side effects of allowing employees to handle objects that are beyond their physical capabilities. The next section will describe additional workplace risk factors that can contribute to back pain. Provided with a description and example of each risk factor, are examples of control methods for eliminating or reducing the employees exposure to each risk factor.

Controlling Risk Factors in the Workplace

Control methods are changes that can be made to the physical work environment, equipment, tools, work processes, and employees' behavior to reduce the number or level of risk factors. Control methods can be thought of as solutions that eliminate or reduce employees' exposure to risk factors. Most control methods fit into one of three general categories:

- **Engineering controls** are physical changes or modifications to workstations, tools, or equipment that make it easier for employees to handle materials. Engineering controls may also improve material handling by using equipment or tools in areas where they weren't used in the past. An example would be using a hand truck to move bags of flour from a pallet to a mixing area, rather than manually carrying them. Another example of an engineering control would be raising the height of a work surface to reduce the amount of bending forward required by the employee to work on materials.
- **Administrative controls** are procedures for safe work methods that reduce the duration, frequency, or severity of exposure to a hazard. Administrative controls include gradual introduction to work, regular recovery pauses, job rotation, job design and maintenance and housekeeping. One example would be redesigning a job that normally requires two hours of continuous handling, to include a five-minute recovery period (performing housekeeping duties with little or no manual handling) for every 15 minutes of continuous handling. Reorganizing the order in which tasks are performed can significantly reduce physical and mental stress and potentially prevent a fatigue-related injury or accident.
- **Training** involves educating workers and managers about the potential risks of back and manual handling injuries, their causes, symptoms, prevention and treatment. Training can also involve education on safe lifting techniques and proper body mechanics. Training should also involve employees by letting them know they can come to management when they recognize a hazard and work together to develop a solution. When physical changes are made to the workplace (new equipment or tools, for example), employees should be trained to use them correctly.

The best approach usually involves a combination of the three control methods. For example, you may find a mechanical lifting aid that could easily replace the old method of manual lifting, but unless employees receive training on how to use the new device and its advantages, they may use it improperly or not at all.

Risk Factors and Risk Reduction

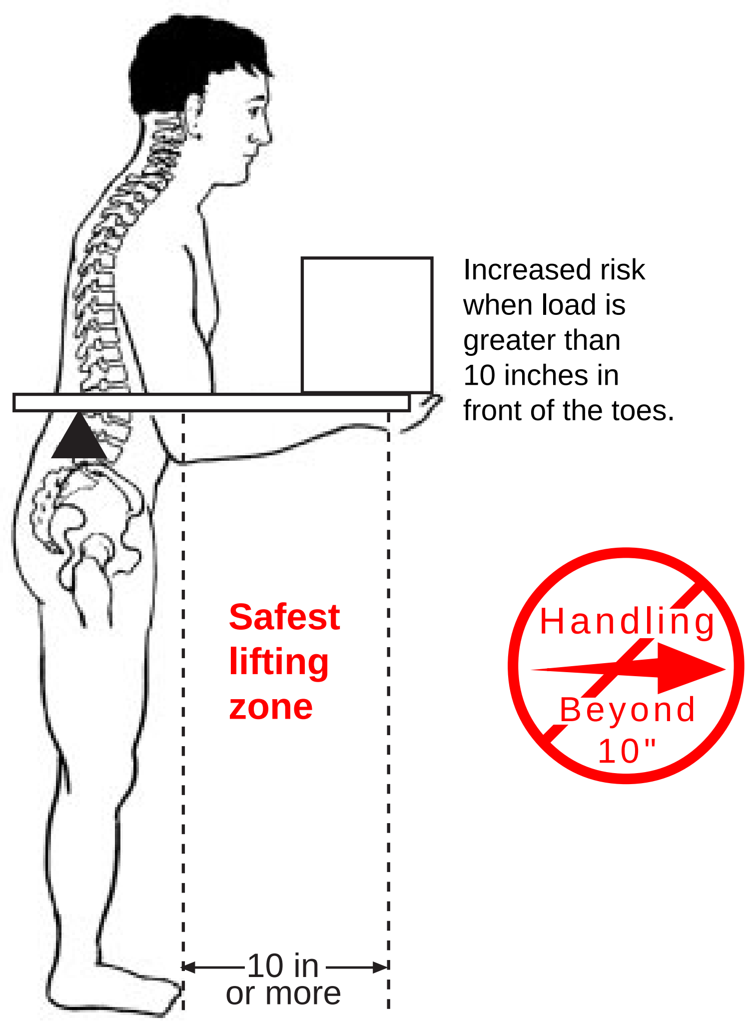
This section provides some examples of common risk factors that are associated with various work processes. Examples of ways to reduce or eliminate the risks are also presented. The guide may best be used by an individual or committee designated to conduct a survey of the workplace. The surveyors can use the guide in two ways. They may use the risk factors to determine whether the same risk factors exist at their work site. Once the risk factors are identified, one or more of the corresponding control examples may be adapted. Another way is to look through the examples and identify similar work processes. When adapting control methods, be careful not to create another risk factor!

Horizontal Distance of Load from Body

The horizontal distance of the load away from the body is the distance from the low back to the hands when handling an object in front of the body. The greater this distance, the larger the compressive forces on the vertebrae and discs. For most tasks, the horizontal distance combined with the weight of the object is the most important factor in terms of producing the greatest stress on the back. The following characteristics of the materials and workplace increase the horizontal distance.

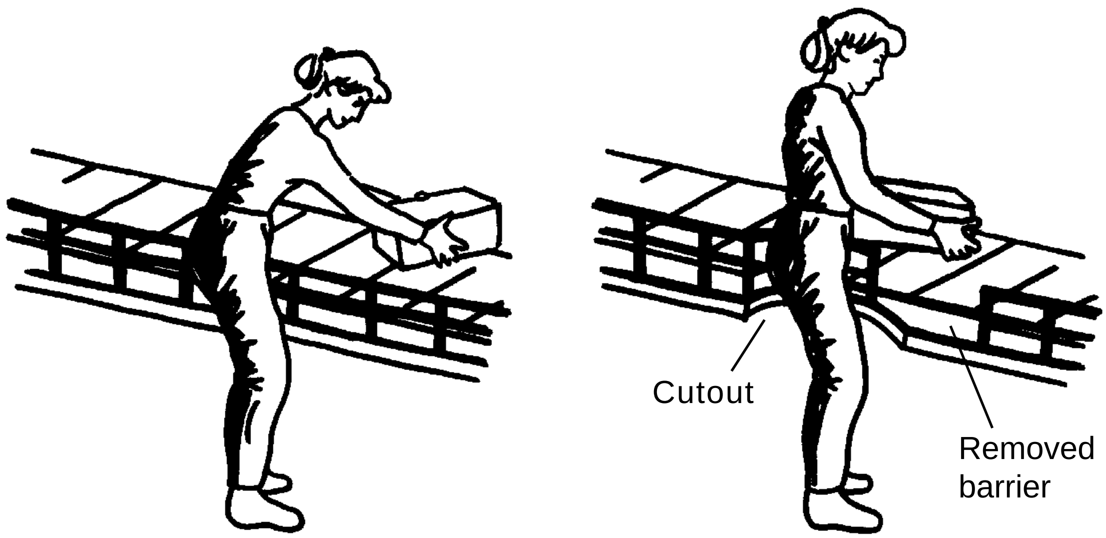
- Wide objects (distance in front of the body).
- Obstacles or barriers between the worker and the object.
- Tasks requiring extended reaches in front of the body to handle objects.
- Lifting objects near floor level.

Engineering controls should seek to eliminate these characteristics whenever possible.
Rather than trying to measure the actual horizontal distance of the load away from the spine, a simpler method would be to estimate the distance from the employee's toes. A general guideline is to design for products that can be handled within 10" or less
from the front of the toes.



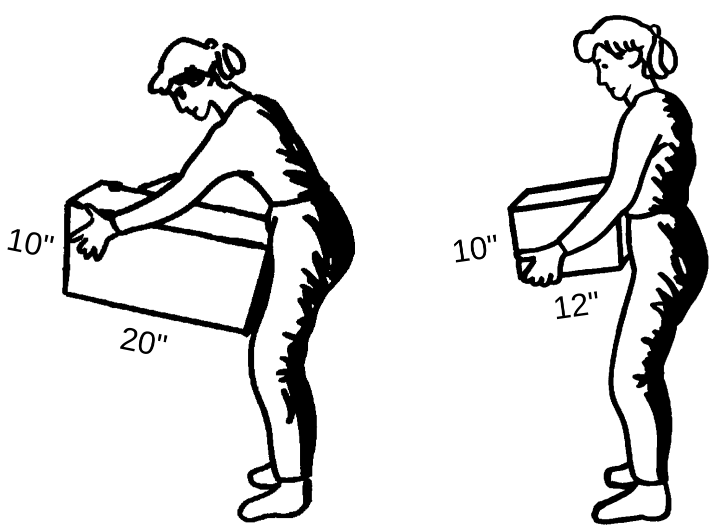
Example 1 - Employee has to bend and reach over barrier in front of a conveyor belt transporting packages.

Control Measure - A section of the barrier has been removed and a cutout allows the employee to get much closer to the packages before lifting them off the conveyor.



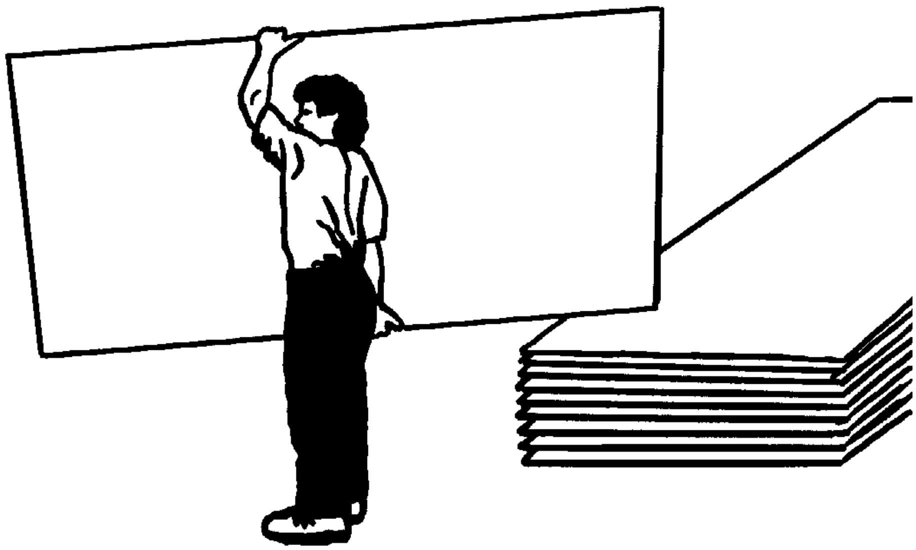
Example 2 - Large awkward packaging increases the horizontal distance and the compressive forces on the spine.

Control Measure - A request is made to the supplier to reduce the size of packaging, thus reducing the horizontal distance.



Weight of Object

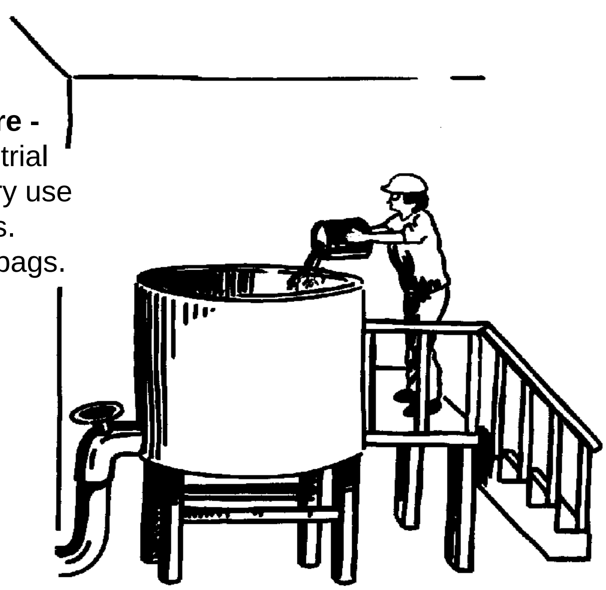
As mentioned earlier, the weight of an object is one of the most obvious risk factors for producing low back pain. Lifting heavier objects requires more strength and energy. With a heavy object, workers are more likely to use awkward postures, such as twisting, where momentum may be used. Heavier objects also increase the risk of bruises, contusions, and broken bones when they are mishandled or dropped.

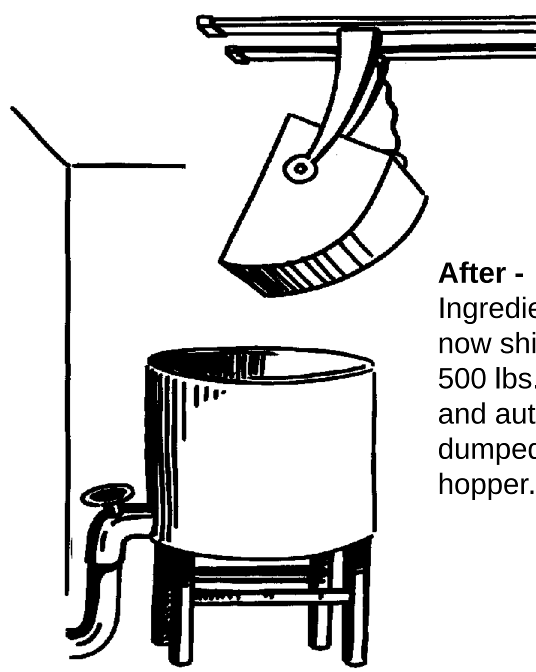


Depending on the work environment, the materials being handled, and the financial resources of the company, several controls may be possible. The most obvious example is reducing the weight of the object by reducing the package contents, or the size of the object. For instance, one of the country's largest food-manufacturers, General Mills, asks its suppliers to provide dessert mixes in 50 lbs. bags instead of 100 lbs. bags whenever possible The smaller bags are easier to handle and the company has reduced the risk of back injuries.

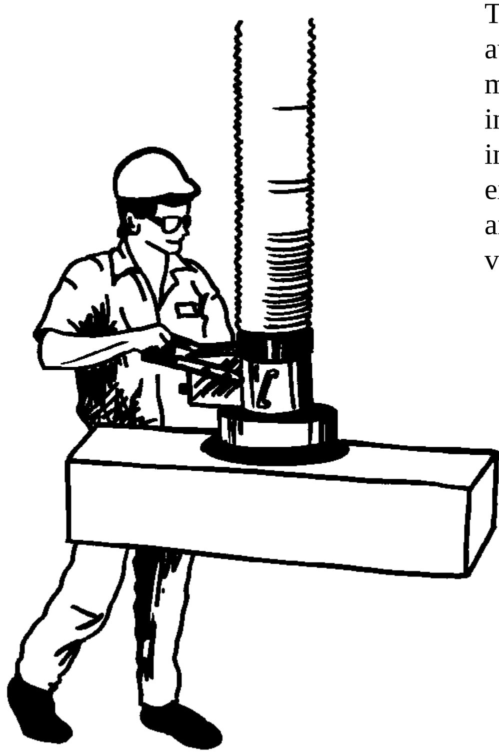
The other extreme can also apply, that is, increasing the weight of the object to a point where it's impossible for one person to handle it. For instance, an industrial bakery that orders ingredients in 50 lbs. bags could request suppliers to ship ingredients in large totes weighing 500-1000 lbs. The totes could then be dumped automatically into hoppers that feed filling stations on the production line. The heavy totes would make it impossible for workers to handle them manually.

Before - Industrial bakery use 50 lbs. flour bags.



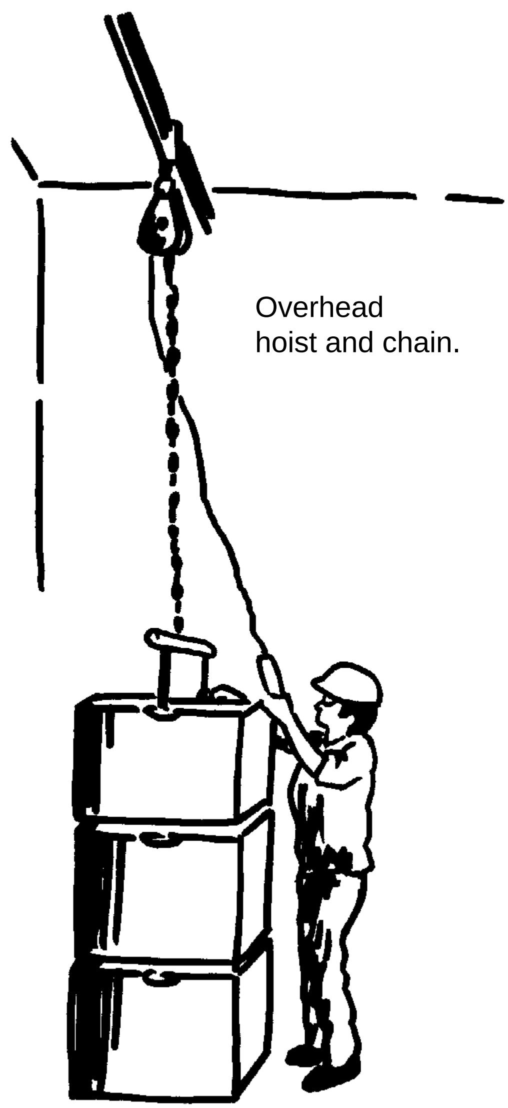


After - Ingredients are now shipped in 500 lbs. totes and automatically dumped into hopper.



The use of mechanical lifting devices to handle large, heavy or awkward objects can also save backs and considerable time and money. Although mechanical lifting aids can be a large initial investment, businesses can quickly see a return on that investment if workers' compensation claims are a significant expense. Mechanical aids range from simple overhead hoist and chain systems to hydraulic lift tables to electrical powered vacuum lifts.

Electrical powered vacuum lift.



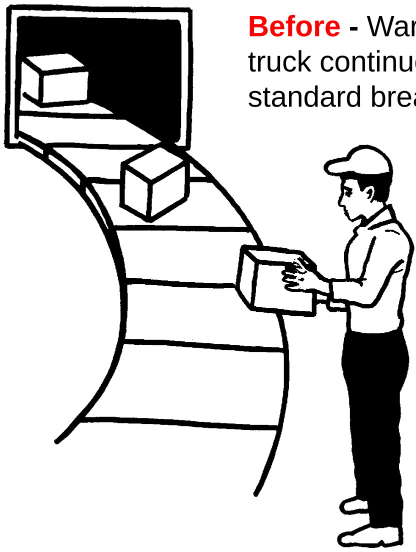
Overhead
hoist and chain.

Another possible solution is to have two or three workers lift as a team. This approach can be easy, inexpensive, and quite effective if certain precautions are taken. As for the cost, in many cases it may only mean reorganizing work so one or two additional employees are available when manual handling is required.

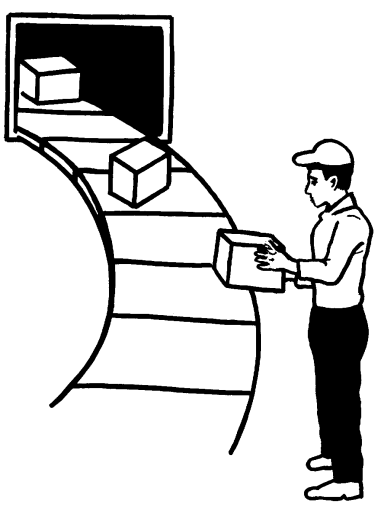
Team handling makes sense in those cases where all other approaches are either too costly or not feasible. Team handling does require coordination between the workers, therefore training should be a big part of this approach. Also, consideration should be given to matching the team members in terms of size and strength. Teaming a 5' 2", 110 lb. female with a 6' 4", 220 lb. male will likely result in an awkward posture for one or both of the workers and an unequal distribution of the object weight.

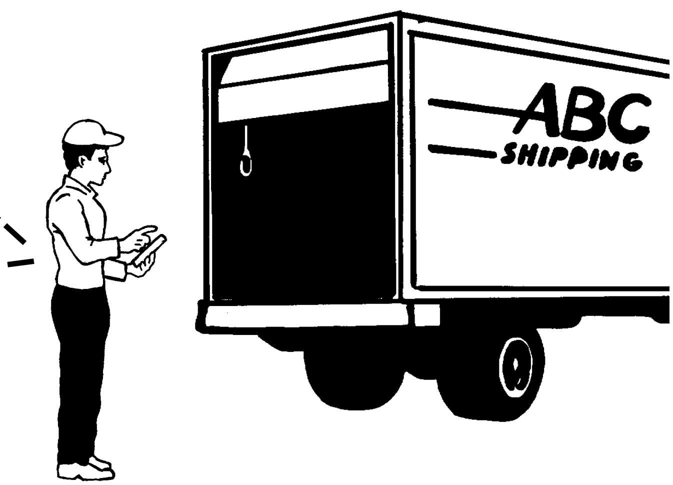
Frequent Handling for Long Periods

The frequency at which objects are handled is a major risk factor in that it determines the repetitiveness of the task. Frequency is defined as the number of times objects are handled in a specified time period, for example, lifts per minute. Since most damage to the back from manual handling occurs over a period of time, the frequency at which objects are handled is a major contributor to the occurrence of back pain. Frequency also affects the worker's energy requirements. The more frequently materials are handled, the greater the chance of worker fatigue, which likely increases the probability of injury.



Before - Warehouse worker loads truck continuously for 8 hours with standard breaks.





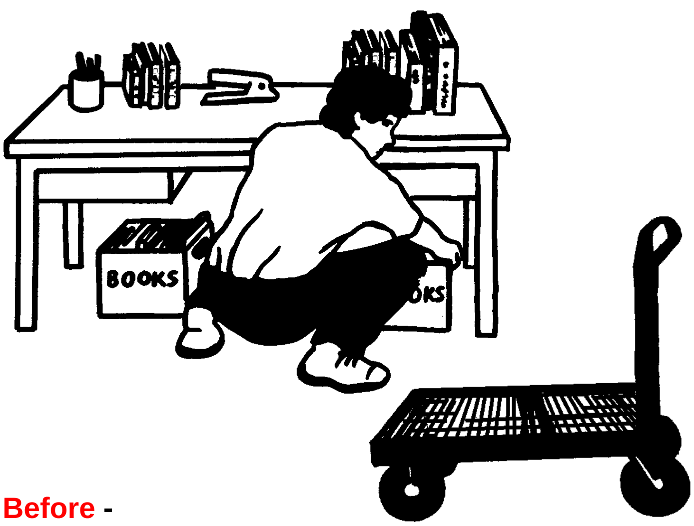
After - Warehouse worker is cross-trained to perform inventory and data entry work. No single job task is performed for more than 2 hours at a time.

Frequent or repetitive handling is almost always the result of job demands, that is, characteristics of the job and work environment. In other words, the only way to reduce the repetitiveness is to change the job itself by:

- Slowing production down
- Increasing staff size
- Cross-training employees to perform several jobs
- Eliminating piece-rate and incentive programs
- Reorganizing work methods

Slowing production down is one of the least desirable options for most businesses. However, there are benefits such as less worker fatigue, fewer human errors, and decreased injuries and costs associated with these injuries. Cross-training employees to perform several different jobs also reduces the risk of injury. When deciding which jobs to cross-train employees on, make sure the jobs use different muscle groups and don't stress the same areas of the body. Rotating employees between jobs provides natural recovery breaks. It also gives employees greater variety and employers great flexibility when employees are sick or on vacation. Studies have also shown that employees who have a better understanding of the entire work process and contribute more overall tend to be more satisfied with their jobs and are more concerned with product quality.

Reorganizing work methods can reduce the frequency that materials are handled: the order of work can change or the number of times materials are handled can be decreased. For example, a large public library system that used to store book bins directly on the floor to be transported to other library branches now stores the bins on carts. Now workers only lift the book bins once as they place them into the transport van. With the previous method, the book bins had to be moved twice — from the floor to the cart, then the cart to the van. Reorganizing methods to avoid redundant handling not only reduces the risk of back injury but also makes the process more efficient and safe.



Before -
Bookbins are stored on floor.
Loaded bins are lifted onto cart.

After -
Bookbins are stored on cart.
Lifting loaded bins onto cart is eliminated.

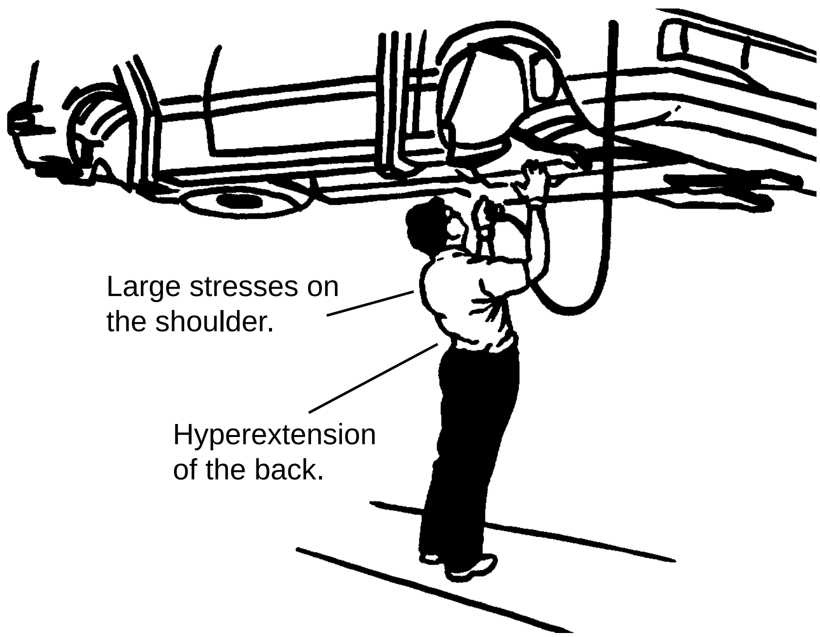
Vertical Location of Objects

Where materials are located in relation to the floor at the start and end of lifting, lowering, or carrying, can adversely affect the back and shoulders. Lifting near the floor creates the following problems:

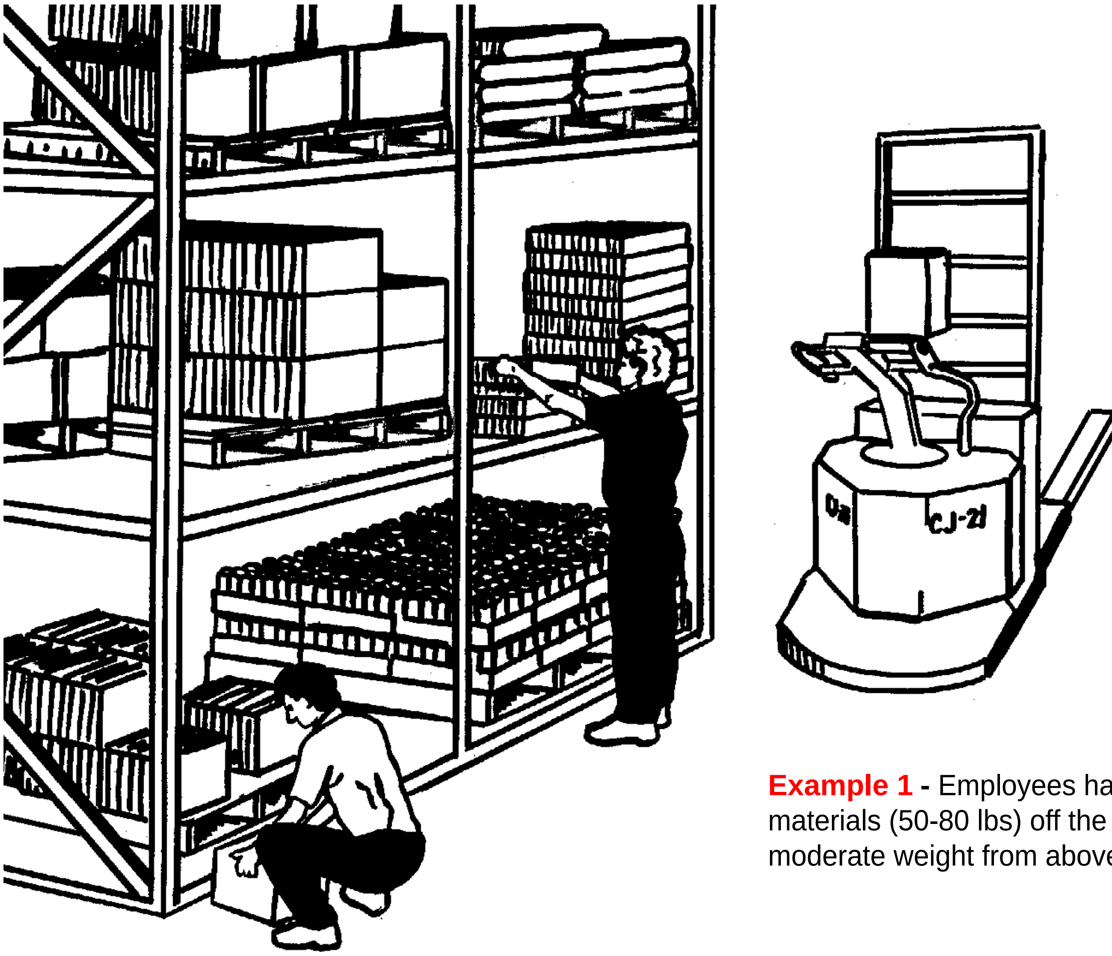
- Requires bending of the trunk (i.e., greater compressive forces on the spine) or squatting of the legs (i.e., greater forces on the knees).
- Requires greater energy expenditure which increases whole-body fatigue.
- Bending when lifting is the most common cause of occupational low back pain.

Lifting above shoulder height creates the following problems:

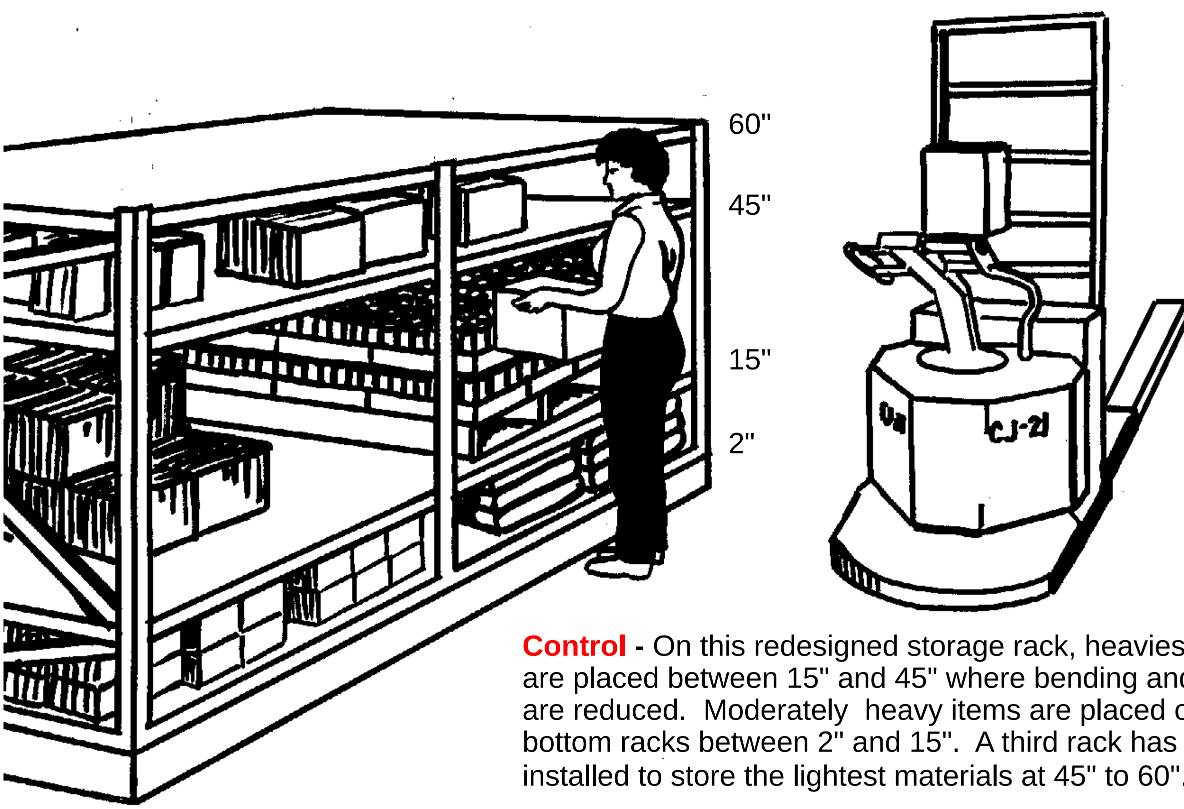
- Can require hyperextension of the trunk which concentrates compressive forces on the back of the disc.
- Produces large stresses on the shoulder joint increasing the risk of shoulder injury.



Fortunately, employers normally can control the vertical location of materials. Even though they may have less control over the weight or dimensions of the object, or how frequently the employee handles materials, they usually directly control where objects are stored and to where they are moved. Materials should be stored at heights that allow a majority of the work force to handle objects between mid-thigh and shoulder height. For example, if your shortest material handler is 5' 4" tall and your tallest is 6' 4" your ideal mid-thigh height will be somewhere between 24" and 32" and your shoulder height between 47" and 63". In this case, the design should accommodate the shortest worker so that materials are stored between 24" and 47". Although the tallest worker may have to bend down to pick up items at 24", this is more desirable than the shortest worker having to reach several inches above the shoulder to handle materials. If it's impossible to store most or all materials at this height, at least try to store the heaviest and/or most frequently handled materials in this range.

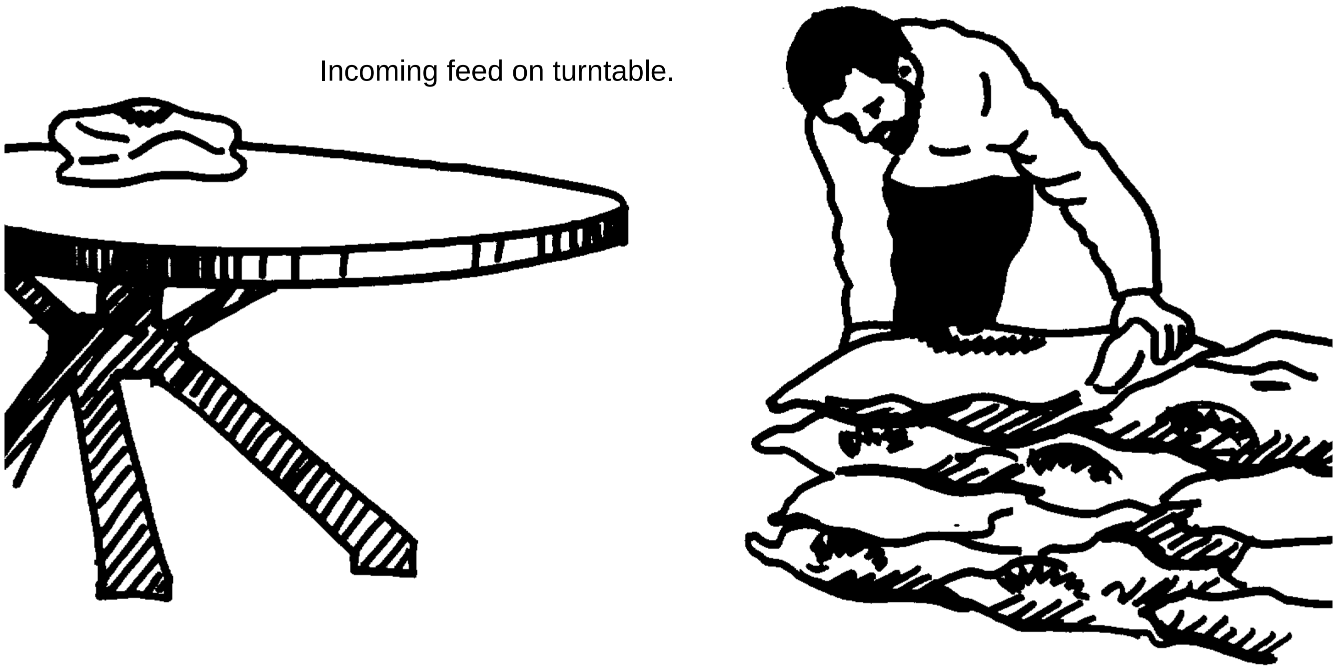


Example 1 - Employees have to lift heavy materials (50-80 lbs) off the floor and lower moderate weight from above shoulder height.

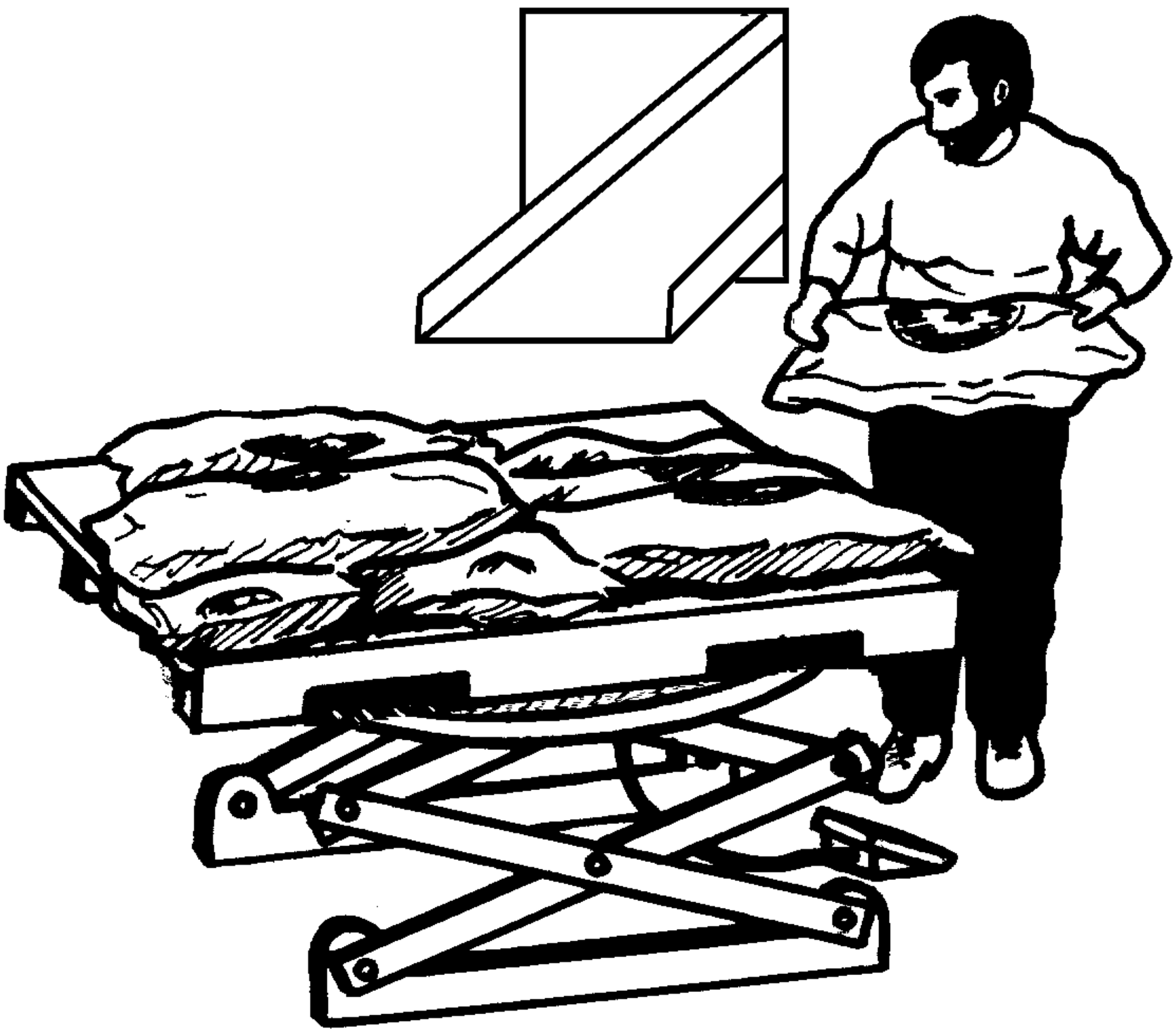


Control - On this redesigned storage rack, heaviest materials are placed between 15" and 45" where bending and stresses are reduced. Moderately heavy items are placed on the bottom racks between 2" and 15". A third rack has been installed to store the lightest materials at 45" to 60".

Example 2 - In the illustration below, an employee has to bend and stoop to lower 60 lbs. bags of feed onto a pallet. The employee also has to reach across the pallet or over other bags when stacking feed.



Control - Below, a scissors pallet lift with a 360 degree rotating turntable has been installed. When loading the pallet, a worker can adjust the pallet lift to the ideal height by using a hydraulic control operated with a foot pedal. The rotating turntable eliminates the need to walk around the pallet and reach across the bags to stack properly.



Twisting while Lifting and Bending Forward

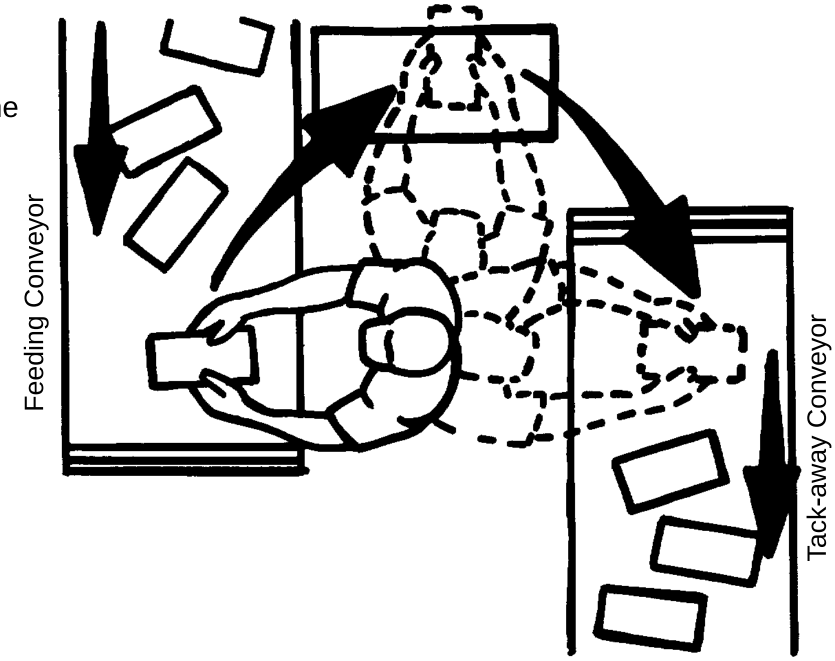
Twisting the back while lifting and bending forward put major stress on the vertebrae and discs. Twisting while bending forward not only increases the compressive forces on the low back, it also places torsional stresses that can overstretch ligaments. When this occurs, the vertebrae become less stable and the chances of a disc herniating increase.

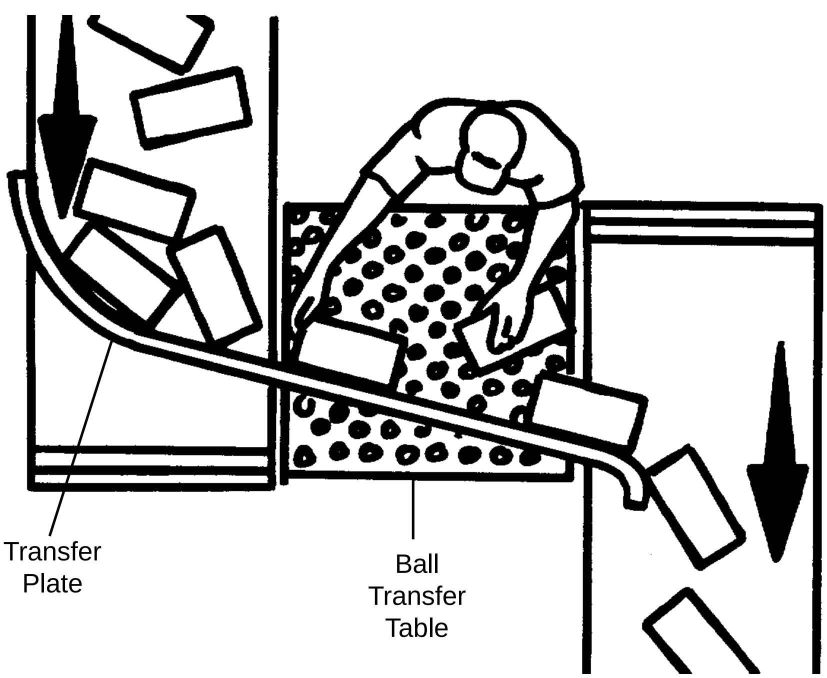
The workspace layout, the employee's technique when moving, or the two combined, may lead to twisting when lifting and lowering objects. Although good training on proper technique may reduce twisting movements in some employees, a well-designed layout of storage areas, equipment, and materials will do much more than just telling employees to step and turn before lifting. In cases where the layout can not be modified, more emphasis should be placed on:

- Training employees to step turn and square up the load before bending and lifting.
- Reducing the frequency of lifts/lowers.

In many cases where frequent lifting is required, even a well-designed layout and good body mechanics training can not compensate for a task that requires an employee to constantly bend, reach, lift, and lower at a fast pace. Therefore, twisting can often be minimized by reducing the frequency of lifts.

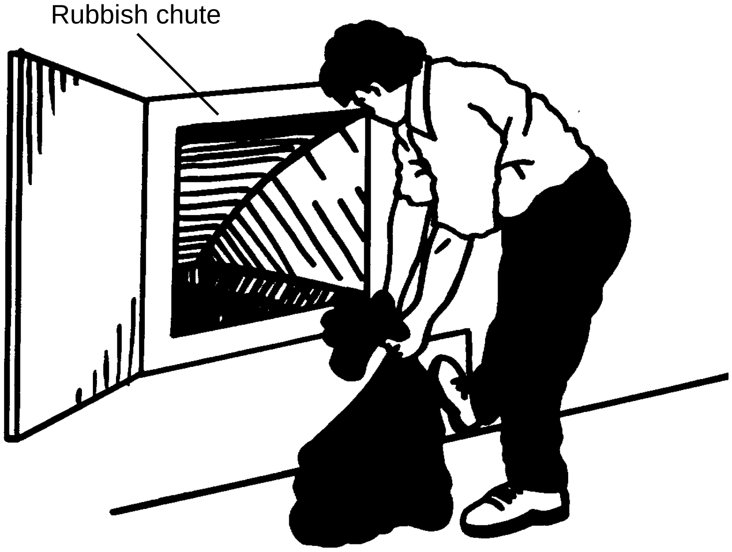
Example 1 - In the illustration at right, an employee is required to lift packages off the feeding conveyor, step or twist to place them on the table for inspection then lift and turn to place them on the take-away conveyor.



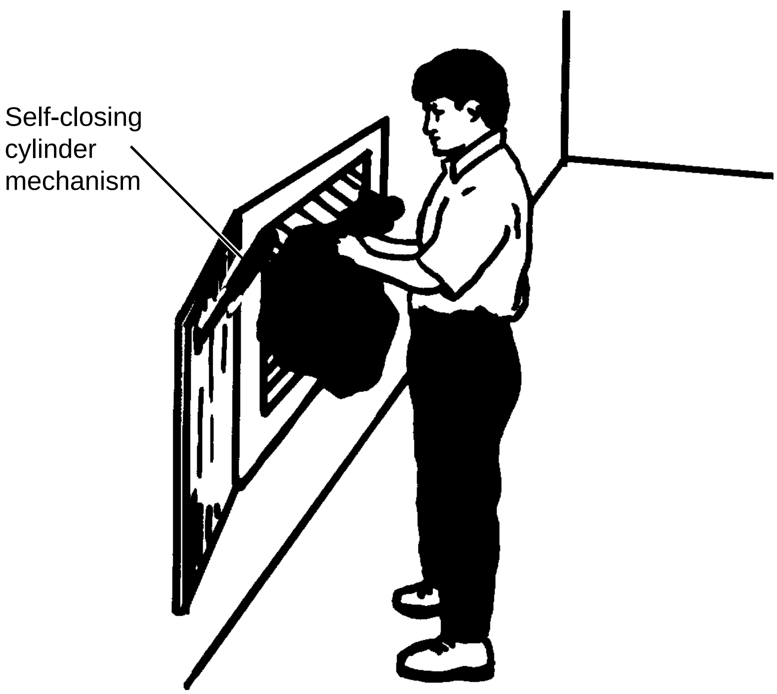


Control - In the illustration at left, a transfer plate and ball transfer table are installed and the employee moves to the opposite side of the conveyor. With the transfer plate, materials are directed closer to the employee, which reduces bending, while the ball transfer table allows packages to be pushed and pulled from the feeding conveyor to the take away conveyor rather than lifted. Twisting, bending, and lifting are essentially eliminated.

Example 2 - A hospital housekeeping worker opens the rubbish chute with a foot pedal and then has to twist his trunk in order to lift the garbage bag while his foot maintains contact with the pedal.



Control - The foot pedal is removed and the rubbish door is modified with a self-closing door. The worker can now open the door, which stays open long enough for the employee to use proper body mechanics while lifting and pushing the garbage bag into chute.

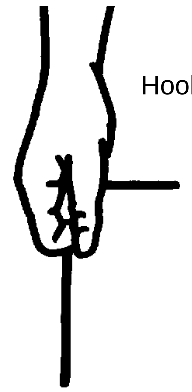


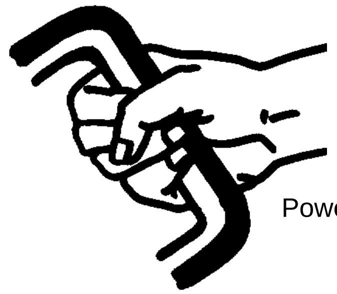
Poor Handholds

Handling materials without adequate handholds increases the chance of dropping the load. It also decreases by about 10 percent the amount of weight the worker can safely handle. Without handholds, the hands and arms need more force to support the load; awkward postures are more likely if the object starts to slip or the worker needs to change grasp positions while lifting, lowering or carrying. Also, when lifting objects from the floor, the worker will have to bend down further if there are no handles to grasp.

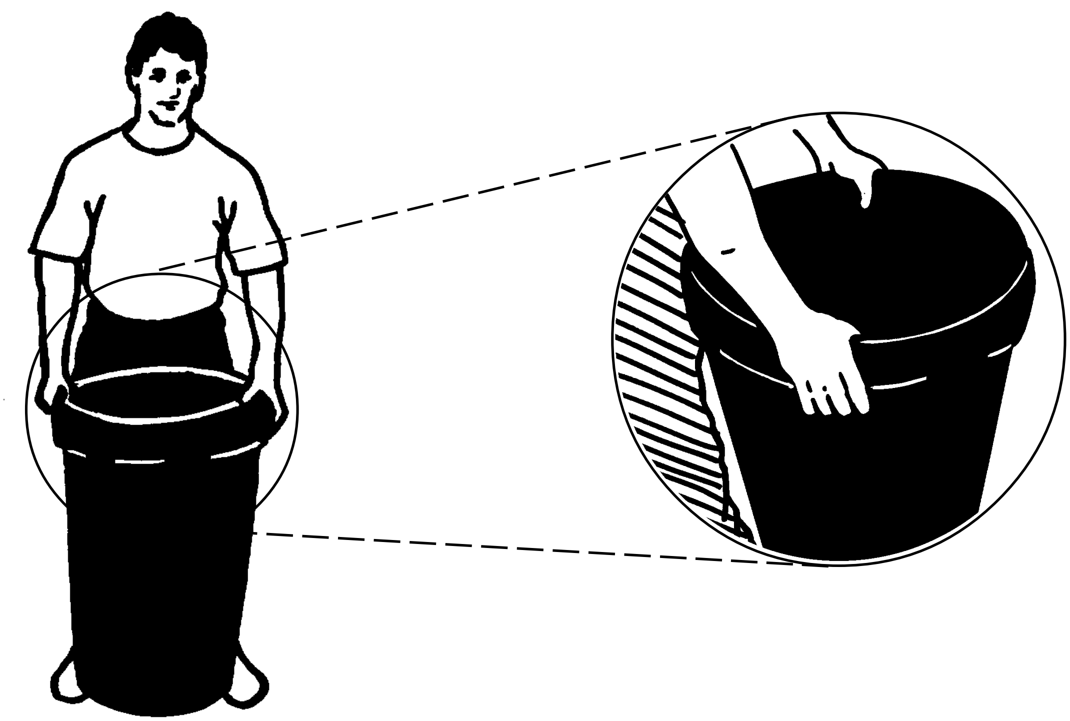
If hand holds can be provided, the following guidelines should be considered in the design phase:

- The handhold should be wide enough to accommodate a very large hand.
- In most cases, the best design will allow for the most powerful grasp which in many cases is the power grasp.
- The second best design will allow for a hook grasp. If the object must be lifted from the floor, a hook grasp is actually the most preferred. A hook grasp will reduce the amount of bending or squatting when lifting from the floor.
- Handholds with sharp edges or square corners should be avoided when possible.
- Locate the handhold at or slightly above the center line passing through the center of mass of the object.

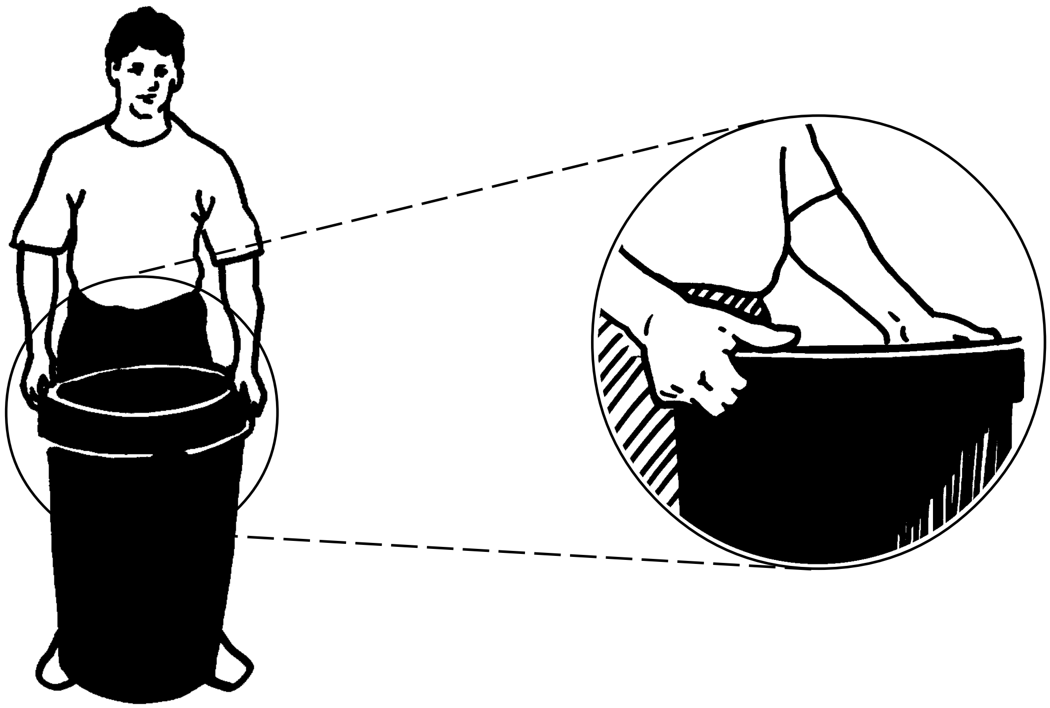




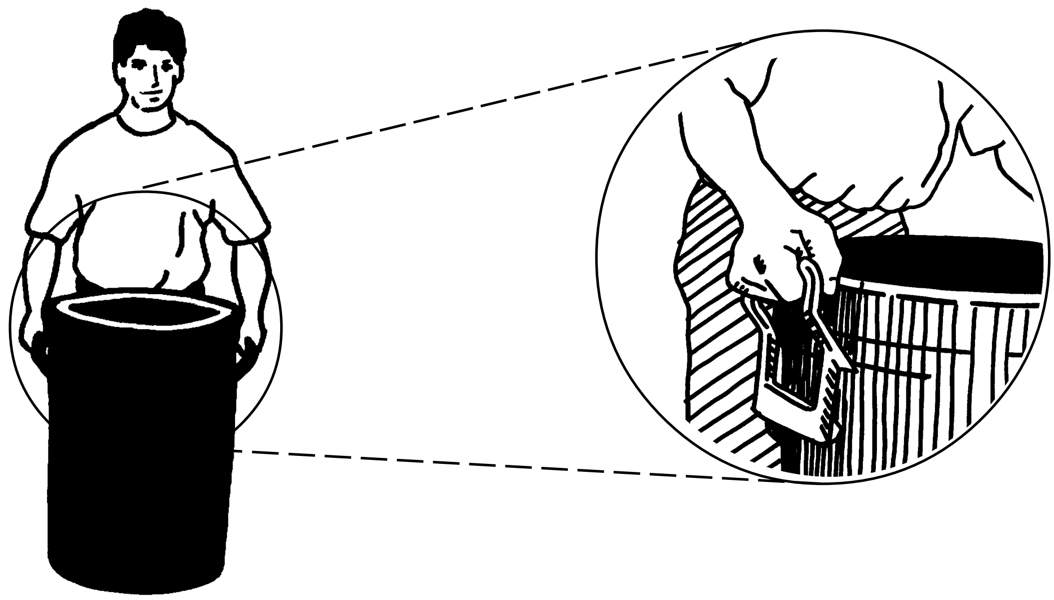
Example 1 - When lifting trash cans without handles, this refuse worker must grasp the top lip of the can in order to lift and dump it.



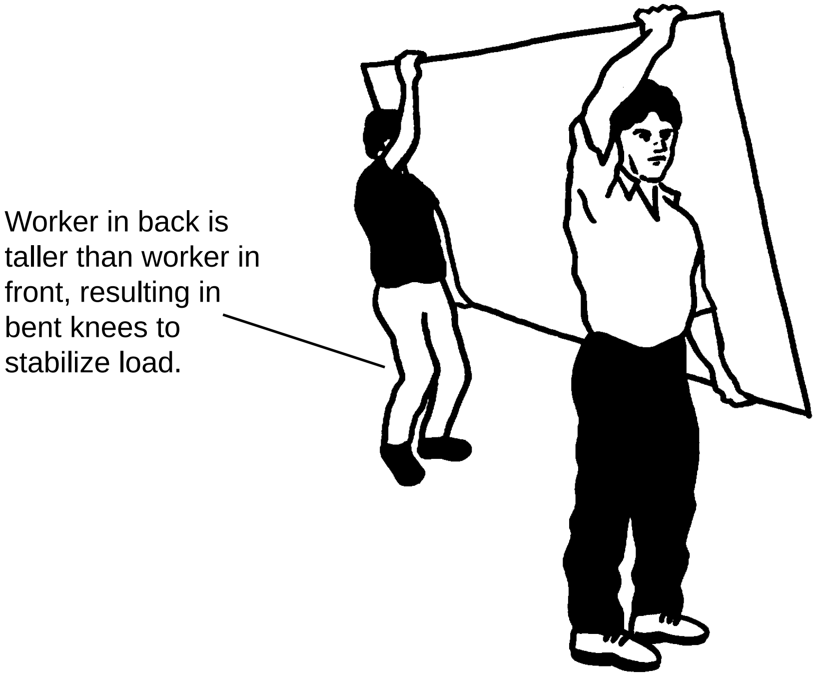
Control 1 - A better designed can has a “drawer type” handle where the worker can hook his hand underneath the lip for a better grasp.



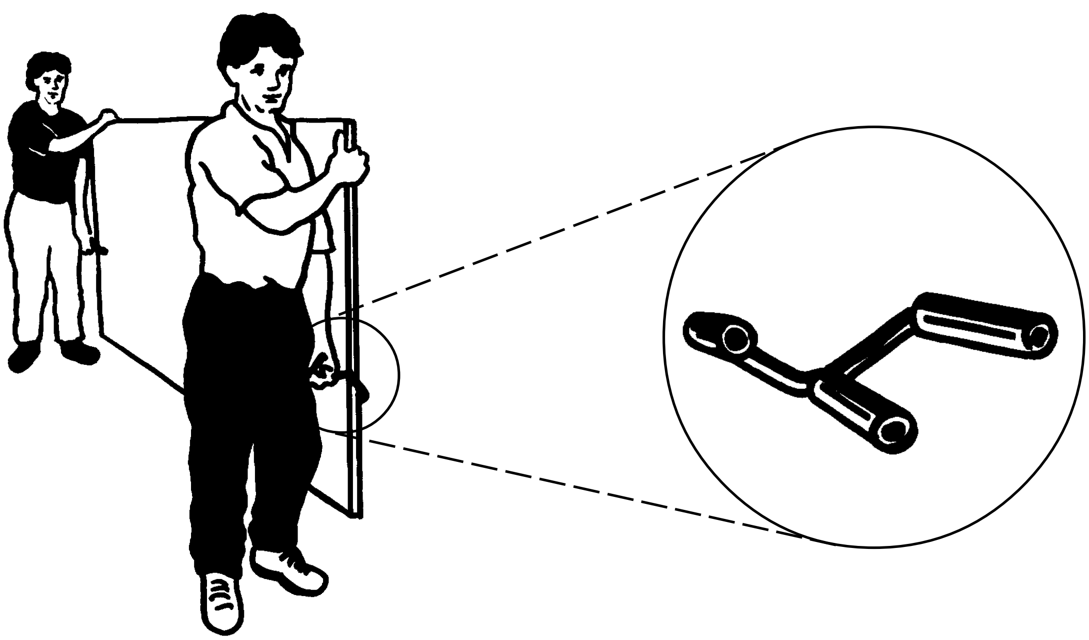
Control 2 - A best designed can has rounded handles where the worker can use a “power grasp” to grip the handle to lift and dump.



Example 2 - In the illustration below two workers lifting and carrying drywall have to grasp each board with one hand underneath to support the weight and one hand on top to stabilize the load. When two workers of different stature perform this lift and carry, awkward trunk postures are common.



Control - Below, a small, lightweight handle that easily attaches to the ends of the board be used by each worker and grasped with one hand. The handle has cylindrical ends which can be grasped using a power grasp.



Work Processes and Administrative Policies

Besides redesigning the work environment to reduce physical stress, the employer must consider the work processes and administrative policies as potential contributors. The frequency at which materials are handled are often dictated by production goals and expected output, therefore the employer can often control these factors to reduce risk. The following are examples of processes and policies that should be identified and modified as needed:

- **Machine Paced Jobs -** Does the worker have control over the speed of the process or is it controlled by a machine? Try to design work processes that allow the worker to control the pace. When control of the pace is given to the operator, he/she is less likely to suffer a fatigue-related injury if recovery breaks can be taken when needed. Also, allowing the worker to control the pace will likely reduce awkward postures and fast movements of the trunk. Control by the employee allows more time to use proper body mechanics and smooth movements when lifting, lowering and carrying materials.

- **Daily Deadlines/Production Standards -** Although deadlines and production goals may seem like a necessity in many workplaces, relying too much on these methods can result in high levels of emotional stress, increased errors, poor morale, and reduced attention to health and safety on the job. Setting realistic deadlines and production standards should motivate workers to complete the job on time without pressuring them to work beyond their physical capabilities on a regular basis.

- **Piece Rate Jobs -** Jobs where employees are paid by the piece or receive bonuses when exceeding a production goal are designed in part to motivate workers to work faster. As previously discussed, this often creates repetitive jobs that increase wear and tear on the body as well as increase the chance of fatigue and accidents. Alternative incentive programs should be designed to reduce the repetitiveness of jobs when possible.

Lifting Hazard Assessment

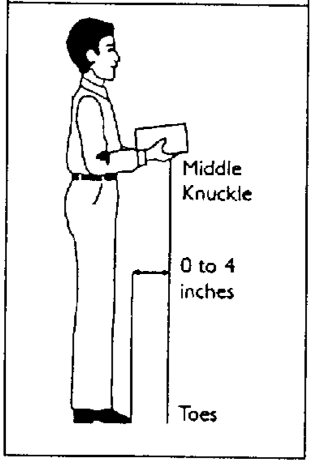
In some manual handling situations there may be a question as to whether the task should be considered a hazard or not. For example, there may a lifting task where employees have experienced back pain and other problems periodically, but no one has identified it as a major hazard. In this case, it would be beneficial if the task could be analyzed to determine if a hazard exists, and if there's a risk to employees, what factors are creating the most risk. The **quick assessment sheet** on the following page can be used to help determine whether a particular lifting task poses a risk of employees developing low back pain. This assessment sheet is based on the **National Institute for Occupational Safety and Health (NIOSH) Revised Lifting Equation (1991)**. The sheet is designed to be a quick and easy method for determining maximum safe lift limits without going through the detailed process of measuring task variables and inputting them into the NIOSH lifting equation. A **score of 6 or more** means the lift is unsafe for some workers and consideration should be given to reducing the factors that score the highest on the worksheet. The worksheet is only designed for analyzing lifting tasks where the object weighs is 10 pounds or more. *See next page for worksheet.*

Lifting Hazard Assessment Worksheet
(To be used when manually handling 10 pounds or more)

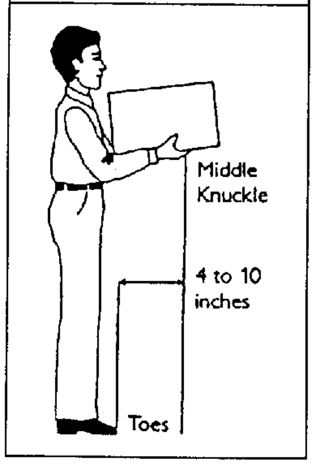
STEP 1:
Determine if the lift is Near, Middle or Far (body to hands)

- *Use an average horizontal distance if lift is made every 10 minutes or less.*
- *Use the largest horizontal distance if more than 10 minutes pass between lifts.*

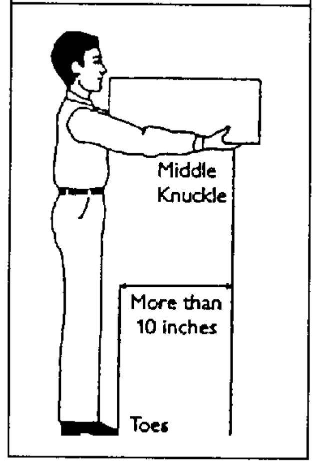
NEAR LIFT



MIDDLE LIFT



FAR LIFT



STEP 2:
Find the Lifting Zone and estimate the weight lifted (pounds)

- *Use an average weight if a lift is made every 10 minutes or less.*
- *Use the heaviest weight if more than 10 minutes pass between lifts.*
- *Enter 0 in the total score if the weight is less than 10 pounds.*

Zone	NEAR LIFT	MIDDLE LIFT	FAR LIFT
DANGER ZONE	More than 51 lbs 5 points*	More than 35 lbs 6 points	More than 28 lbs 6 points
CAUTION ZONE	17 to 51 lbs 3 points	12 to 35 lbs 3 points	10 to 28 lbs 3 points
SAFE ZONE	Less than 17 lbs 0 points	Less than 12 lbs 0 points	Less than 10 lbs 0 points

* If lifts are performed more than 15 times per shift, use 6 points.

STEP 2 SCORE (enter 0, 3, 5 or 6): ______
IF 0, STOP HERE

STEP 3:
Determine the points for other risk factors

- *Use occasional lifts if more than 10 minutes pass between lifts.*
- *Use the more than 1 hour points if the risk factor occurs with most lifts and lifting is performed for more than 1 hour.*

Risk Factor	Occasional Lifts Performed For 1 Hour or Less in Total Per Shift	Lifts Performed for More Than 1 Hour in Total Per Shift	
Twist torso during lift	1	1	
Lift one-handed	1	2	
Lift unstable loads (people, liquids, or loads that shift around or have unequal weight distribution)	1	2	
Lift between 1 to 5 times per minute	1	1	
Lift more than 5 times per minute	2	3	
Lift above the shoulder	1	2	
Lift below the knuckle	1	2	
Carry objects 10 to 30 feet	1	2	
Carry objects farther than 30 feet	2	3	
Lift while seated or kneeling	1	2	

STEP 3 SCORE: ______

TOTAL SCORE (Add scores from steps 2 and 3): ______

Additional Sources of Information on Manual Materials Handling

The mention of any company names or products does not constitute endorsement by Washington State Department of Labor and Industries.

Technical References

U. S. Department of Health and Human Services. *Applications Manual for the Revised NIOSH Lifting Equation.* National Technical Information Services, National Institute for Occupational Safety and Health DHHS (NIOSH) Pub. No. 94-10, Cincinnati, OH. 1991.

National Safety Council. *Making the Job Easier: An Ergonomics Idea Book.* 1988

Mital, A., Nicholson, A. S., and Ayoub, M. M. *A Guide to Manual Materials Handling.* Bristol, Pennsylvania: Taylor and Francis, 1993.

Snook, S. H., Ciriello, V. M. (1991). The Design of Manual Handling Tasks: Revised Tables of Maximum Acceptable Weights and Forces, *Ergonomics*, Vol. 34, No. 9, pgs. 1197-1213.

Chaffin, D. B., Andersson, G. *Occupational Biomechanics.* 2nd edition. New York: John Wiley & Sons, Inc. 1991.

Product Information and Guides

Workplace Ergonomics: 1996 Buyers Guide.
March/April 1996
Stevens Publishing Corp
P. O. Box 2573
Waco, TX 76702-9910

The North American Ergonomic Resources Guide.
CTDNews
LRP Publications Dept 450
747 Dresher Rd.
P. O. Box 83
Horsham, PA 19044
Phone: 1-800-554-4283

Occupational Health & Safety Buyers Guide
Stevens Publishing Corp.
P. O. Box 2573
Waco, TX 76702-2573
1-800-727-7573

The Advanced Ergonomics Manual
Ergonomics Product Report
Advanced Ergonomics, Inc.
5550 LBJ Freeway, Suite 350
Dallas, TX 75240
1-800-682-0169 ext. 203

Job Evaluation Software

ErgoWeb Toolbox 2.0.
ErgoWeb Inc.
75 East 400 South, Suite 300
Salt Lake City, UT 84111
Phone: (801) 323-9444
World wide web site: http://www.ergoweb.com

2D and 3 Dimensional Static Strength Prediction Prog.
University of Michigan Software Program
Intellectual Properties Office
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Phone: (303) 764-8202

Revised NIOSH Program for Manual Lifting
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CompuTask
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P. O. Box 939
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Phone: 1-800-320-7581