

WORK INSTRUCTIONS ON MANUAL MATERIALS HANDLING (MMH)

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Manual Materials Handling (MMH)

Introduction

What is manual materials handling?

Manual materials handling (MMH) means moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining. MMH is also the most common cause of occupational fatigue, low back pain and lower back injuries.

What makes manual materials handling hazardous?

MMH is always hazardous but the level of hazard depends on what you are handling, what the task is, and what the conditions are at the workplace or work site.

For example, the material or load that you are handling may be:

- too heavy for the task that is being done,
- located too high or low for a safe lift,
- too big or may have a shape that makes it hard to handle,
- wet, slippery, or have sharp edges that makes it hard to grasp, or
- unstable or can shift its centre of gravity because contains some that can flow (e.g., a partially filled drum or concrete in a wheelbarrow), or
- too big to see where the feet are.

The task can make MMH hazardous if a worker:

- uses poor lifting techniques (lifting too fast, too often or too long; lifting with back bent or while twisting or reaching too far; lifting while sitting or kneeling, etc.),
- has to move material over long distances,
- not taking appropriate rest breaks; insufficient recovery time, and
- has a combination of handling tasks (e.g. lifting, carrying and lowerin).

The conditions where you are working can also contribute to hazards of MMH and result in injuries; for example,

- walking surfaces that are uneven, sloping, wet, icy, slippery, unsteady, etc.,
- differences in floor levels or walking surfaces,
- poor housekeeping that causes slip, trip and fall hazards,
- inadequate lighting,
- cold or very hot and humid working conditions,
- strong wind or gusty conditions,
- working at high pace,
- movement is restricted because of clothing or personal protective equipment, or
- space is small or posture is constrained or both.

Other information on manual materials handling?

More information on various topics related to manual materials handling such as:

- MMH and health hazards/injuries,
- Back injury prevention,
- Back belts,
- Pushing & Pulling General,
- Pushing & Pulling Handcarts,
- Shovelling,
- Recommended weight limits (RWLs) and the Revised NIOSH Lifting Equation,
- Handholds on load and gripping aids (I and II),
- General safe lifting and MMH practices,
- safe MMH practices for specific kinds of loads (compact loads, small bags, large sacks, drums, barrels, cylinders, sheet materials (e.g., metal, glass),
- Layouts for working and storing materials,
- Materials flow, and
- Mechanical aids for handling and transporting materials (I, II, Levers).

General Practice

What types of protective clothing should be worn?

DO WEAR

- lightweight, flexible, tear and puncture-resistant clothing,
- safety boots with toe caps and slip-resistant soles, and
- protective gloves, appropriate for the materials being handled.

DO NOT WEAR

- aprons, coats,
- clothing with exposed buttons, zippers or loose flaps, or

• heavy duty mitts.

What should you do before lifting?

- Always check before lifting to see if mechanical aids such as hoists lift trucks dollies or wheelbarrows are available.
- Get help with heavy or awkward loads.
- Assess the weight of the load.
- Identify the weight of the load.
- Be sure that you can lift the load without over-exertion.
- Be sure that the load is "free" to move.
- Check that the planned location of the load is free of obstacles and debris.
- Be sure that the path to the planned location of the load is clear. Grease, oil, water, litter and debris can cause slips and falls.
- Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, sheet materials like metal or glass).
- Do not lift if you are not sure that you can handle the load safely.

What are some general tips for lifting?

- Prepare for the lift by warming up the muscles.
- Stand close to the load and face the way you intend to move.
- Use a wide stance to gain balance.
- Be sure you have a good grip on the load.
- Keep arms straight.
- Tighten abdominal muscles.
- Tuck chin into the chest.
- Initiate the lift with body weight.
- Lift the load as close to the body as possible.
- Lift smoothly without jerking.
- Avoid twisting and side bending while lifting.

Work Space Layout

What are some important elements of a workplace layout?

Layout or organization of the work area which allows materials to be handled without excessive bending, twisting and stretching reduces injuries.

- Have all materials at work level.
- Use adjustable elements at the workplace.



Workbench with adjustable height and tilt improves working position.



Self-adjusting platform automatically matches worker's height.

Ensure that there is enough room to turn around to prevent twisting.



• Use adjustable supports or suspenders to operate heavy tools.



Tool suspender reduces muscular effort and compression on the back.



Tool support eliminates over-stretching and overreaching.

• Use bins that allow easy access.



Lift-and-tilt device and side opening on bin reduces bending.

Layouts for Storing

What should be remembered when setting up a storage area?

- Store materials at a convenient height.
- Leave the lowest shelf unused if necessary.
- Use vertically mobile shelves to avoid bending and overhead reaching.



• Use bin racks for storing small items.



• Store heavy and frequently used materials at waist height.



• Do not store materials at floor level.



• Use hand trucks with elevating devices in storage and loading areas.







Winch operated. Coil handling. Use trucks with a tilting device to avoid bending.

Position work.



Box tilter.

• Use elevating platforms to avoid overhead reaching.



Materials Flow

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What can be done to reduce the amount of times material is moved or handled?

- Use rollers to eliminate manual lifting and carrying.
- Use floor rollers while loading or unloading trucks to reduce lifting.



• Use a sliding bed while loading and unloading small trucks to avoid overreaching and carrying in an awkward position.



- Eliminate extra loading or unloading steps where possible.
- Unload as close as possible to the place where material will be needed.



Use ramps to avoid lifting and dragging over edges.



• Use containers that allow fluids to pour or empty without lifting the container.



Handholds on Load and Gripping Aids - I Does a good grip matter?

Yes. Good handholds make lifting and carrying easier and safer.

• Use the "power grip" on loads with handles.



• Use the "hook grip" on loads with cut-out handholds.



- Curl your fingers around the edge.
- Do not hold the load with fingertips.



• Use containers with handles located more than halfway up the side of the container.



• Use the "ledge grip" to handle regularly shaped objects without handles.



• Hold the object with hands placed diagonally.



• Wear gloves where practical.

Handholds on Load and Gripping Aids - II

What else should I know about grip aids?

Use gripping aids to lift or carry awkward loads that do not have handles.

• Use lifting straps for cylindrical objects.





• Use carrying handles for boxes.



• Use a 'Gator grip' to handle awkward objects with sharp edges.



• Use vacuum lifters to handle sheet materials or plates.



Use furniture straps to lift and move heavy, bulky objects.



• Position buckle between the body and the load.



• Keep body straight.



Compact Bags

What are some tips for carrying compact bags?

The best way to handle a bag depends on its size, weight and how far it is to be carried. When lifting, remember to:

- Straddle the end of the bag.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.
- Lean forward, straightening the knees to set the bag upright.
- Readjust the straddle position moving feet closer to the bag.
- Readjust the grasp, with one hand clasping the bag against the body and the other under it.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Thrust the bag up with the knee while straightening the body.
- Put the bag on the shoulder opposite the knee used to thrust the bag up.
- Stabilize the bag on the shoulder.
- Move off without bending sideways.

What should be done when lowering the bag?

Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from a coworker.

- Stand close to the platform.
- Place one foot in front of the platform.
- Bend hips and knees.
- Keep the back straight.
- Ease the bag off the shoulder and put it upright on the platform.
- Pull the bag slightly over the edge of the platform.
- Stand close to the platform with the bag touching the chest.
- Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
- Step back.

- Bend hips and knees, keeping back straight.
- Ease the bag on the floor.



Compact Loads

How should a compact load be lifted?

A compact load can be lifted between the knees.



Examples of a compact load

When lifting, remember to:

- Stand close behind the load.
- Straddle the load:
 - Place the leading foot flat beside the load in the direction of travel.
 - Place the rear in the direction of travel.
- Bend the hips and knees.
- Keep your back straight.
- Grasp the load with elbows inside the thighs:
 - Use a power grasp for loads with handles.
 - Use slings or hooks to improve grasp when loads do not have handles.
 - Use blocks under loads without handles to make lifting them up easier and safer.
 - Use a ledge grasp for loads without handles.



- Grasp with one hand at the outer, upper corner, over the leading foot and the other hand on the lower, opposite corner.
- Lean forward with the rear arm straight. This position gets the load moving.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Keep the load close to the body.
- Keep the rear arm straight.
- Move off without twisting the body.



What should be remembered when putting a load down?

- Take a wide stance with one foot in front of the other.
- Keep the load close to the body.
- Keep the back straight.
- Bend the hips and knees.
- Set the load down onto the ground.
- Keep the load tilted to avoid bruising fingers.
- Remove fingers from under the load.
- Stand up smoothly, easing muscles.
- Avoid jerky releases.

Lifting

General Practice

What types of protective clothing should be worn?

DO WEAR

- lightweight, flexible, tear and puncture-resistant clothing,
- safety boots with toe caps and slip-resistant soles, and
- protective gloves, appropriate for the materials being handled.

DO NOT WEAR

- aprons, coats,
- clothing with exposed buttons, zippers or loose flaps, or
- heavy duty mitts.

What should you do before lifting?

- Always check before lifting to see if mechanical aids such as hoists, lift trucks dollies or wheelbarrows are available.
- Get help with heavy or awkward loads.
- Assess the weight of the load.
- Identify the weight of the load.
- Be sure that you can lift the load without over-exertion.
- Be sure that the load is "free" to move.
- Check that the planned location of the load is free of obstacles and debris.
- Be sure that the path to the planned location of the load is clear. Grease, oil, water, litter and debris can cause slips and falls.
- Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, sheet materials like metal or glass).
- Do not lift if you are not sure that you can handle the load safely.

What are some general tips for lifting?

- Prepare for the lift by warming up the muscles.
- Stand close to the load and face the way you intend to move.
- Use a wide stance to gain balance.
- Be sure you have a good grip on the load.
- Keep arms straight.
- Tighten abdominal muscles.
- Tuck chin into the chest.
- Initiate the lift with body weight.

- Lift the load as close to the body as possible.
- Lift smoothly without jerking.
- Avoid twisting and side bending while lifting.

Assessing Relevant Handling Factors

Is there a way to know if a lift is too heavy?

The following recommendations are based on the "Revised NIOSH equation for the design and evaluation of manual lifting tasks" (NIOSH is the National Institute for Occupational Safety and Health in the United States).

The NIOSH lifting equation takes into account the weight plus several other variables in lifting tasks that contribute to the risk of injury. For example, if the situation requires frequent lifts or lifting loads far away from the body, there is an increased risk of injury. Under these conditions, the weight limit would be reduced from a baseline weight or "load constant" (LC) to a recommended weight limit (RWL). A "load constant" (LC) of 23 kg (about 51 lb) was established by NIOSH as a load that, under ideal conditions, is safe for 75% of females and 90% of males.

The recommended weight limit is calculated by using the NIOSH lifting equation.

What do you have to know to calculate the recommended weight limit (RWL)?

First, you have to measure or assess several variables related to the lifting task. The six variables that are considered in determining the recommended weight limit (RWL) are:

- the horizontal distance (H) the load is lifted (distance of hands from midpoint between ankles),
- the starting height of the hands from the ground, (vertical location, V),
- the vertical distance of lifting (D),
- the time between lifts or frequency of lifting (F),
- the angle of the load in relation to the body (e.g., straight in front of you or off to the side, A), and
- the quality of the grasp or handhold based on the type of handles available (hand-to-load coupling, C).

Each of these variables is then assigned a numerical value (multiplier factor) from look-up charts. The NIOSH equation includes six multiplier factors to calculate the recommended weight limit (RWL):

 $RWL = LC \times HM \times VM \times DM \times FM \times AM \times CM$

where LC is the load constant and other factors in the equation are:

- HM, the "Horizontal Multiplier" factor,
- VM, the "Vertical Multiplier" factor,
- DM, the "Distance Multiplier" factor,
- FM, the "Frequency Multiplier" factor,
- AM, the "Asymmetric Multiplier" factor and
- CM, the "Coupling Multiplier" factor.



Label "AM" - angle of the body in relation to the load

Where these multiplier factors are all in the best range the weight limit for lifting or lowering is 23 kg (or about 51 pounds). Where the multiplier factors are not in best ranges, the weight limit must be reduced accordingly.

How do I figure out which multiplier value to use?

For example, to figure out the "horizontal multiplier", first measure the distance the object is from the body. To do this, measure (in centimeters) the distance from in between the person's ankles to their hands when holding the object. Write down this number. Next, look up the number on the "horizontal distance" chart (see Calculating Recommended Weight Limit (RWL given earlier). and find the matching "multiplier factor". Use this factor in the lifting equation.

Do the same for the other five factors.

- Vertical Multiplier is the distance is measured as the starting point of the lift and is the distance of the hands up from the ground. Measure this distance and use the number to determine which value to use on the chart (see Calculation Recommended Weight Limit).
- Distance Multiplier is the number of centimetres the load travels up (or down) from the starting position. Again, measure this distance and use the number to determine which value to use on the chart (see Calculation Recommended Weight Limit).
- Frequency Multiplier is how often the lift is repeated within a certain time period. You need to determine if the lift is done while standing or stooping, for more or less than one hour (in total time for the shift), and how much time there is for rest between lifts.
- Asymmetric Multiplier measures if the body must twist or turn during the lift. This measurement is done in degrees (with 360 being one complete circle).
- Coupling multiplier determines the "coupling" or type of grasp the person has on the container. It rates the type of handles as good (handles), fair (make-shift cut outs in cardboard boxes) or poor. You also need to know if the lift is done in a standing or stooping position.

Once you have all these values, you can use the Revised lifting equation calculator to determine a recommended weight limit.

Compare this value with the actual weight of the object. If the recommended weight limit is lower than the actual object, you will have to determine which factor(s) is contributing the highest risk and modify the lift. (The factors that are contributing the highest risk will have the lowest multiplier values).

Where can I find more information about these factors?

Other OSH Answers documents in this section for examples which show how to use this information and to reduce the risk of injury:

- Horizontal Distance Factor
- Vertical Distance Factor
- Frequency Factor
- General Practice
- Compact Loads

Can I use this equation in all situations?

No. The Revised NIOSH Lifting equation only applies in certain situations. It does not apply in situations where a person is lifting (or lowering):

- with one hand,
- for over 8 hours,
- while seated or kneeling,
- in a restricted work space,
- objects that are unstable (such as buckets or containers of liquids),
- while pushing or pulling,
- with wheelbarrows or shovels,
- with high speed motion (faster than about 30 inches/second),
- extremely hot or cold objects or in extreme temperatures, or
- with poor foot/floor coupling (high risk of a slip or fall).

So, when do I use this equation?

This recommendation applies to most workers for:

- two-handed lifting,
- comfortable lifting postures, and
- comfortable environments and non-slip floorings.

Calculation of recommended lifting limit using this formula indicates which of the six components of the task contribute most to the risk. The lower the factor, the more it contributes to the risk.

Horizontal Distance Multiplier Factor

How can the horizontal distance affect the weight limit?

Example: A worker lifts 15 kg boxes from the table to the shelf five times an hour. Notice that there is a barrier between the worker and the box.

To calculate the recommended weight limit (RWL) for the task:

• Determine the weight of the load.



Weight - 15 kg

Assess the six components of the lifting task. Refer to <u>Assessing Relevant Handling Factors</u> for an explanation of the terms.

H (Horizontal Distance) -	50 cm
V (Vertical Distance) -	75 cm
D (Lifting/ carrying Distance)-	115 cm
F (Frequency) -	12 min
A (Angle) -	0°
C (Coupling/quality of grip) -	fair

- Select the multiplier factors for each component of the lifting from the tables in <u>Calculating</u> <u>Recommended Weight Limit (RWL)</u>.
- Determine the Recommended Weight Limit for the task. Refer to <u>Assessing Relevant Handling</u> <u>Factors and Calculating Recommended Weight Limit (RWL).</u>

23 Kg x 0.50 x 1.00 x 0.95 x 1.00 x 1.00 x 1.00 = 10.9 kg

• Compare the weight of the load against determined Recommended Weight Limit for the task.

Conclusion:

The weight of the load is 15 kg. This value is higher than the weight limit of 10.9 kg.

Therefore, the **TASK IS DANGEROUS**.

Recommendations

 Assess which components of the task contribute most to the risk. Refer to <u>Assessing Relevant</u> <u>Handling Factors</u>

The critical component is H, the horizontal distance of the box from worker's body.

• Remove the barrier to allow worker to get closer to the box.



Evaluate the Redesigned Task

- Assess the six components of the task in redesigned layout.
- Determine the new Recommended Weight Limit for the task. Refer to <u>Assessing Relevant</u> <u>Handling Factors</u> and <u>Calculating Recommended Weight Limit (RWL)</u>.

23 kg x 0.80 x 1.00 x 0.95 x 1.00 x 1.00 x 1.00 = 17.5 kg

Compare weight of the load against Weight Limit in new layout.

The weight of the load at 15 kg is now lower than the recommended weight limit of 17.5 kg.

Therefore, MOST WORKERS CAN SAFELY PERFORM THE TASK.

Vertical Distance Multiplier Factor

How can the vertical distance affect the weight limit?

Example: A worker lifts a 15 kg load from loosely piled pieces of metal from the floor to the table five times an hour.



To calculate the recommended weight limit (RWL) for the task:

• Determine the weight of the load.

• ASSESS the six components of the lifting task.

H (Horizontal Distance) -	30 cm
V (Vertical Distance) -	0 cm
D (Lifting/ carrying Distance) -	115 cm
F (Frequency) -	12 min
A (Angle) -	0°
C (Coupling/quality of grip) -	poor

- Select the numeric multiplier factors for each component of the task from the tables in Calculating Recommended Weight Limit (RWL).
- Determine the Recommended Weight Limit for the task. Refer to <u>Assessing Relevant Handling</u> <u>Factors and Calculating Recommended Weight Limit (RWL).</u>

23 Kg x 0.80 x 0.80 x 0.86 x 1.00 x 1.00 x 0.90 = 11.4 kg

• Compare weight of the box against the determined Recommended Weight Limit for the task. The weight of the load at 15 kg is higher than the recommended weight limit calculated to be 11.4 kg.

Therefore the TASK IS DANGEROUS.

Recommendations

• Assess which of components of the task contribute most to the risk. Refer to Assessing Relevant Handling Factors.

The components: V - starting height, D - lifting distance and H - horizontal distance and C - poor grasp contribute similarly to the risk.

• Raise the starting height by providing materials at the best starting height (75 cm). This change also decreases D, the lifting distance.



Evaluate the Redesigned Task

- Assess the six components of the task in redesigned layout.
- Determine the new Recommended Weight Limit. Refer to Assessing Relevant Handling Factors.

• Compare weight of the load against the Recommended Weight Limit in new layout.

The weight of the load at 15 kg is lower than the recommended weight limit now calculated to be 15.7 kg.

• Further improvement can be achieved by providing the working materials in containers with handles; this would increase RWL up to 17.5 kg.

Therefore, **MOST WORKERS CAN SAFELY PERFORM THE TASK.**

Frequency Factor

How can the frequency factor affect the weight limit?

Example: A worker lifts 10 kg boxes from the conveyor to the cart ten times every minute for two-hours.



To calculate the recommended weight limit (RWL) for the task:

• Determine the weight of the load.

Weight - 10 kg

 Assess the six components of the lifting task. Refer to Assessing Relevant Handling Factors for more information.

H (Horizontal Distance) -	20 cm
V (Vertical Distance) -	75 cm
D (Lifting/ carrying Distance) -	0 cm
F (Frequency) -	5 sec
A (Angle) -	90°
C (Coupling/quality of grip) -	fair

- Select the appropriate multiplier factors for each component of lifting from the tables in <u>Assessing</u> <u>Relevant Handling Factors</u>.
- Determine the Recommended Weight Limit for the task. Refer to <u>Assessing Relevant Handling</u> <u>Factors</u> and <u>Calculating Recommended Weight Limit (RWL)</u>.

23 kg x 1.00 x 1.00 x 1.00 x 0.13 x 0.70 x 1.00 = 2 .1 kg

- Compare weight of the load against determined Weight Limit for the task.
- The weight of the load at 10 kg is higher than the calculated recommended weight limit of 2 .1 kg.

Therefore, TASK IS DANGEROUS.

Recommendations

- Assess which of components most contribute to the risk. Refer to <u>Assessing Relevant Handling</u> <u>Factors</u>.
 - the critical factor is FM for the frequency of lifting and duration of task.
- Shorten the frequency of lifting by:
 - reducing the frequency of incoming boxes in half, or
 - assigning additional workers to the task, or
 - shorten the time of the task to 1 hour.



Evaluate the Redesigned Task:

- Assess the six components of the task in redesigned task.
- Determine new Weight Limit. Refer to <u>Assessing Relevant Handling Factors</u> and <u>Calculating</u> <u>Recommended Weight Limit (RWL)</u>.
 - 23 kg x 1.00 x 1.00 x 1.00 x 0.80 x 0.70 x 1.0 = 12.9 kg
 - Compare weight of the box against Recommended Weight Limit for redesigned task.

The weight of the load at 10 kg is now lower than the weight limit calculated to be 12.9 kg.

Therefore, MOST WORKERS CAN SAFELY PERFORM THE TASK.

Calculating Recommended Weight Limit (RWL)

What is the Revised NIOSH lifting equation?

The equation is:

$LC \times HM \times VM \times DM \times AM \times FM \times CM = RWL$

where LC is the load constant (23 kg),

- HM, the "Horizontal Multiplier" factor,
- VM, the "Vertical Multiplier" factor,
- DM, the "Distance Multiplier" factor,
- FM, the "Frequency Multiplier" factor,
- AM, the "Asymmetric Multiplier"factor,
- CM, the "Coupling Multiplier" factor, and
- RWL, the "Recommended Weight Limit".

For each value, look up the corresponding "factor" and use this number in the equation. See <u>Assessing</u> <u>Relevant Handling Factors</u> for explanation of terms.

As quoted in Labour Rules 2015 the allowable loads to be lifted are as follows.

Maximum allowable load to be carried overhead or by hand:

a) Adult male	. 50 kg.
b) Adult female	. 30 kg.

Large and Heavy Sacks

How should heavy large sacks be lifted?

Lift heavy and large sacks in two stages using an intermediate platform.

When lifting, remember to:

- Straddle the end of the sack.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the end closest to you. Keep elbows inside the thighs.
- Lean forward and straighten the knees to set the bag upright.
- Move your feet closer to the sack.
- Squat with the sack between the thighs with one foot flat on the floor in front of the other.
- Grasp with elbow inside the thighs. With one hand clasp the sack against the body and the other hand is holding the bottom of the sack.
- Stand up in one smooth motion.
- Place the sack upright on the platform.
- Place one foot in front of the other with the front foot along side of the platform.
- Bend the hips and knees and keep the back straight.
- Put one shoulder against the sack.
- Readjust your grasp.
- Lean the sack on the shoulder.
- Stand up and straighten the hips and knees.



How should bulky sacks be lifted?

Bulkier sacks are easier to carry on your back. Lift onto your back from a platform as described above.

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight.
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.



How should a "two-person lift and stack" be done?

- Position one person on either side of the sack.
- Squat with one foot balancing behind the sack.
- Keep back straight.
- Grasp with the outer and on the upper corner, the other holding the bottom of the sack.
- On one person's command:
- Stand up and straighten the hips and knees.
- Move towards the stack
- Put the sack on the stack



Hoisting and Moving Heavy Objects

What equipment can be used to help with heavy objects?

- Selecting the right equipment for the task minimizes handling.
 - Use a pulley to eliminate manual lifting.



• Select multiple pulleys according to the weight of the object to be hoisted.



• Mount pulley on movable frame to lift and move heavy objects.



• Use a portable floor crane to lift and move heavy objects.



- Use lift tables to lift objects or to level work.
- Select the lift table according to the weight of the anticipated load.



• Use a portable conveyor to move materials.



• Use a combination of lift tables and rollers to move materials horizontally and vertically.



Drums and Barrels

How should drums and barrels be lifted?

Handling drums and barrels can be dangerous. Do not handle drums and barrels without training.

How should a drum be raised from the ground?

Use mechanical aids whenever possible. Do not attempt to raise a full drum alone.

- Make sure that the drum is empty before raising it.
- Stand at the end of the drum.
- Place one foot forward at the side of the drum, the other behind.
- Bend your hips and knees.
- Keep the back straight.
- Grasp the rim about 15 cm from the ground with the elbows inside thighs.

- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Bring the back leg forward as if you are walking. Keep close to the drum.
- Stop at the balance point to change hand grip.
- Set the drum on its base by moving back leg forward. Use the body weight as a counter balance.



How should a two-person lift be done?

- Use two people to lift a full drum.
- Use the same technique as with one person, but have two people squatting at either side of the drum.



How should a standing drum be moved?

- Stand close to the drum with feet apart. One foot at the front and the other behind.
- Keep knees slightly flexed.
- Put your hands firmly against upper rim of the drum.
- Keep arms straight with the elbows "locked".
- Rock the drum gently to get the feel of its contents before you move it.
- Push the top of the drum away by extending the back leg and shifting your body weight onto your front leg.
- Stop tilting the drum at the balance point. Use back leg as a counter balance.



Should drums be lifted manually when they are stacked?

No. Always use cranes or lift trucks to stack drums.

Tall Cylinders

How should tall cylinders be lifted?

• Use carts or tracks to transport cylinders



- Make sure that two people transport a cylinder if carts can not be used.
- Use lifting straps to improve grip.



How should one person lift a cylinder onto a platform?

- Roll the cylinder to within 1 metre of the platform.
- Position the forward foot around the cylinder, the back foot about 30 cm behind the cylinder.
- Bend knees slightly.
- Place one hand on the valve protective cap, the other hand underneath the cylinder about 30 cm from the ground.
- Tilt the cylinder onto the thigh of the back leg.
- Balance the cylinder on the thigh by pressing down with the back hand while lifting the cylinder with the forward hand.
- Extend both knees to initiate and forward movement of the cylinder and continue by pushing up and forward with the arms until the cylinder is located on the platform.
- Climb on the platform.
- Straddle the cylinder at the valve end.
- Grasp the valve protective cap of the cylinder with both hands between the thighs.
- Lean forward and straighten the knees to set the cylinder upright.



Sheet Materials

How should sheet materials be lifted?

Handling sheet material single-handed is always difficult and hazardous.

- Store the sheet materials at a convenient height above ground.
- Do not lift and carry sheets without training.

What should be done when lifting sheet material?

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the mid-point of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.
- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending and twisting body.



What should be done when carrying the load?

- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.
- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.



Mechanical Aids for Transporting Materials - I

What mechanical aids can be used?

Mechanical aids reduce physical effort, making materials handling easier and safer.

- Check for the availability of mechanical aids before lifting or moving loads.
- Select the right equipment to complete the task.
- Do not operate any equipment if you are not trained to use it.
- Keep the equipment in good operating condition. It saves effort while transporting loads.
- Use rolling platforms to assist in carrying and handling heavy objects where limited space does not allow for comfortable body position.



• Use a hand truck to move bulky objects.



• Use a shelf truck to move a variety of objects.



• Use a platform truck to move heavy, irregularly shaped objects.



• Use a semi-live skid for temporary storage of work.



• Select the rack or bin that suits the task and mount on semi-live skid or platform truck.



Mechanical Aids for Transporting Materials - II What other mechanical aids can used?

Specific tasks or objects require specialized equipment.

- Select the right equipment to complete the task.
- Do not operate any equipment if you are not trained to use that equipment.
- Keep the equipment in good operating condition. It saves effort while transporting loads.
- Select a stair climbing truck when moving load on stairs.



• Choose a sturdy frame hand truck with larger wheels to move materials in rough terrain. Additional set of handles allows for assistance.



• Use a pump truck to move materials stored on pallets.



• Move and dump waste materials with dump trucks.



• Move and empty drums with tilting drum cradles and drum dollies.



• Handle sheet materials with an "A" frame hand truck or dolly.



Mechanical Aids: Levers Why and how should levers be used?

why and now should levers be used?

Using levers reduces the force required to handle materials and avoids bending and stooping.

• Use a steel bar to shift an object horizontally.



• Use the lever and rollers to move a load horizontally.



• Use rollers on an angle to change the direction of the load.



• Use "Come-Alongs" to move heavy load. Ensure load is fully on the skid to prevent drag or resistance.



• Mount lever on wheels to assist in when moving load. Ensure that wheels can be locked.



Lever on a rolling platform lifts and moves objects



Lever on wheels lists and moves coils.

• Use an extended handle to lift, shift or move objects without bending.



Team Handling

What is "team handling"?

Team handling occurs when more than one person is involved during the lift.

- Use team lifting and carrying where other solutions are inappropriate.
- Remember that the combined strength of the team is less than the sum of individual strength.
- Select team members of similar height and strength.
- Assign a leader to the team.
- Determine a set of commands to be used such as "lift", "walk", "stop", "down". Make sure that everyone knows what to do when they hear the command.
- Follow the commands given by the team leader.
- Practice team lifting and carrying together before attempting the task.

What should be done when lifting and carrying long objects as team?

- Use a shoulder pad to reduce compression.
- Carry load on the same shoulder.
- Walk in step.



What should be done when lifting and moving furniture as a team?

- Use straps.
- Adjust the length of the straps according to your height.



Webbing to secure straps

- Use webbing around straps to secure them from slipping off.
- Obtain assistance while loading a heavy object on the truck.
- Use your body weight to tilt the object.
- Place the lip of the truck under the object.



• Tip the truck back with assistance.



• Move off. The assisting person directs the movement.



Health Hazards Can MMH affect your health?

MMH is the most common cause of occupational fatigue and low back pain. About three of every four Canadians whose job includes MMH suffer pain due to back injury at some time. Such back injuries account for about one third of all lost work and even more than one third of all compensation costs. More important than financial cost is human suffering. Each year several thousand Canadian workers are permanently disabled by back injuries. Many others are unable to return to their former jobs. Their lives are disrupted.

All these facts make prevention of back injuries a crucial and challenging problem for occupational health and safety. This document focuses on preventing back injuries caused by MMH in the industrial workplace and is limited to the handling of inanimate objects.

What are the immediate health effects of MMH?

Immediate and short-term effects include accidental injuries and fatigue. Sharp or rough surfaces, and falling and flying objects are common causes of wounds, lacerations or bruises during MMH. The worker can also suffer these injuries by falling or by colliding with objects.

Fatigue is a common and expected effect of MMH. The effort required to perform MMH tasks uses up muscular energy. Where the pace of work is not too high, workers can find enough time between individual tasks to recover their energy, and work can be resumed and continued safely throughout the whole shift. On the other hand, a fast pace of work shortens the time between tasks and allows the workers to restore their energy. As a result, workers who try to maintain such a fast pace may become increasingly tired as the shift progresses. Recent development in research on the causes of back injury shows that even a moderate pace of lifting, not necessarily at the maximum lifting limit, if maintained for a prolonged time without breaks rapidly decreases workers' lifting ability by speeding up their fatigue. Fatigue not only causes instant and obvious discomfort but its effects add up over time. For that reason fatigue can also contribute to serious injuries to the musculoskeletal system. These injuries can later develop into chronic conditions that can become difficult to treat effectively. Additionally, fatigue decreases workers' alertness, making them more likely to act without due caution. This, in turn, increases their risk for accidents.

What are the long-term effects of MMH?

More serious problems related to MMH are the long-term health effects -- chronic back pain.

Back pain can result from various causes. The most common causes are strains and cramps in the back muscles. Back pain can also result from tears in the tendons connecting the back muscles to the spine, or from sprains and tears in the ligaments interconnecting the vertebrae (bones of the spine). Less frequently it arises from direct damage to the vertebrae or the discs that separate them.

A worker can sustain a back injury from a single episode such as lifting too heavy a load, slipping and falling, or receiving a blow to the back. However, most often it is not the single episode that causes back injury. It is the repetition, as in manual handling, that contributes most to the occurrence of injuries. Performing MMH tasks continually, even at a moderate intensity, will cause mechanical stress to accumulate in the worker's back, increasing the likelihood of injury. Eventually, even a mild effort in MMH can result in back injury and disabling back pain. Recovery from back injuries can take a long time and further injury may occur, making the problem worse.

Which work factors contribute to back injury during MMH?

Work-related factors include the weight of the load lifted, the range of the lift, the location of the load in relation to the body, the size and shape of the load, and the number and frequency of lifts performed. Excessive bending and twisting also increase the risk for back injury.

For most workers, lifting loads over 20 kilograms results in an increased number and severity of back injuries. While the weight of the load is the most obvious factor, it is not the only one that determines the risk of injury. The location of the load is also important. A load lifted far from the body imposes more stress on the back than the same load lifted close to the body. A bulky object is harder to lift than a compact one of the same weight because it (or its centre of gravity) cannot be brought close to the body. Lifting a bulky object also forces a worker into an awkward and potentially unbalanced position. The preferred range for lifting is between knee and waist height. Lifting above and below this range is more hazardous.

How often the worker performs MMH tasks, and for how long, are extremely important factors. Frequently repeated and long-lasting tasks are the most tiring and therefore the most likely to cause back injury. Highly repetitive MMH tasks also make the worker bored and less alert. This, in turn, can affect safety.

Poor layout of the workplace also increases the risk for injury. For example, shelving that is too deep, too high or too low causes unnecessary bending or stretching. Lack of space to move freely increases the need for twisting and bending. Unsuitable dimensions of benches, tables, and other furniture force the worker to perform MMH tasks in awkward positions that add stress to the musculoskeletal system. Similar stressful body movements occur where work areas are overcrowded with people or equipment.

Tasks that involve manual handling exceeding the worker's physical capacity and a poor workplace layout are the most common causes of back injuries.

Are there environmental factors that contribute to back injury?

Temperature and humidity affect the worker performing MMH. When it is too hot and too humid, the worker tires more quickly and becomes more susceptible to back injury. On the other hand, cold temperatures decrease the flexibility of muscles and joints. This stiffness also increases the likelihood of musculoskeletal injuries.

Inadequate lighting in the work area indirectly affects the worker performing MMH, particularly where the precise placement of handled objects is important. In compensating for poor visibility the worker often must handle objects in an awkward position for extended periods of time. Poor lighting on steps and stairways, ramps, and loading docks increases the potential for accidents resulting in back injuries. By misjudging distances, the height of steps, or ramp angles the worker can easily lose balance and fall while carrying a load.

Whole body vibration alone can cause back pain. It imposes compression on the spine that gradually damages the discs between the vertebrae. Combining MMH with vibration multiplies the risk for injury.

Are female workers at greater risk for back injury?

The capacity to perform MMH varies considerably among individuals. In general, the lifting strength of women as a group is less than that of men. However the individual ranges of strength are wide. This means that some women can safely handle greater loads than some men. Therefore, discrimination against women for MMH is not justified. In a situation where selection is the only way to minimize the possibility of injury, women and men should be given an equal opportunity of being selected for the job. However there are certain working conditions that even alone and more particularly when combined with MMH create greater health hazards for women. Owing to body composition and structure, women are less tolerant of heat and whole body vibration. Such hazardous conditions should be fully controlled and not serve as an excuse for gender discrimination.

Is age a risk factor for back injury?

Ageing diminishes strength. Since the rate of decline varies greatly with the individual, discrimination against older workers solely on this basis is unjustified. Statistics show that back injuries among workers over 45 years of age are less frequent than among those between 20-45 years of age. Experience seems to counterbalance decreasing physical capacity. With experience come skills, dexterity and practical knowhow for completing tasks, all of which are very important factors contributing to safe MMH. The unskilled, inexperienced worker is at greater risk in tasks that require skills in handling. On the other hand, the older, experienced worker is at risk in tasks requiring sheer physical strength.

Stretching - At the Workstation

Why is stretching important?

No matter how well a workstation is designed, problems may arise if attention is not paid to the way the work is done. Working at a computer often involves very few changes in body position. This lack of movement can lead to muscle pain and strain. What can be done to minimize this strain?

It is recommended that a person break for 5-10 minutes for every hour spent at a workstation.

- Vary the work tasks. Break up keyboarding tasks work by doing other job duties or tasks that involve moving around or changing body position. Try to stand up and move around.
- Look away from the screen occasionally and focus your eyes on an object far away.
- Take regular rest breaks to ease muscle aches, eye strain and stress.
- Relax your muscles, stretch and change position.

What are some stretches for the hands and forearms that can be done at the workstation?

1. a) Start with your hand open.



b) Make a fist. Keep your thumb straight, not tucked under your fingers.



c) Slide your fingertips up your paim so the tips of your fingers are near the base of you fingers and you should feel a stretch. Do not force your fingers with your other hand if something is painful.



2. With your hand open and facing down, gently bend wrist from side to side, as far as possible. Hold for 3 to 5 seconds. Repeat 3 times.



3. Start by stretching your arm and hand out and slowly rotate the wrist down until you feel a stretch. Hold for 3 to 5 seconds. Next, rotate the palm up until you feel a stretch. Repeat 3 times.



4. Grasp your hand and hold your fingers with the other hand. Slowly bend your wrist down until you fell a stretch. Hold for 3 to 5 seconds. Relax. Repeat 3 times. Then slowly bend your wrist up until you feel the stretch. Hold and relax as above.



5. Sitting with your elbows on the table and palms together, slowly lower wrists to the table until you feel a stretch (your elbows will move outward a bit). Be sure to keep your palms together throughout the stretch. Hold 5 to 7 seconds. Relax. Repeat 3 times.



What are some stretches for the neck and shoulders?

1. Shoulder Shrug: The purpose of the shoulder shrug is to relieve early symptoms of tightness or tension in the shoulder and neck area.

• Raise the top of your shoulders towards your ears until you feel slight tension in your neck and shoulders. Hold this feeling of tension for 3 to 5 seconds. Then relax your shoulders downward into their normal position. Do this 2 or 3 times.



2. Head Glide: The head glide helps to stretch your chest, neck and shoulder muscles.

• Sit or stand upright. Without lifting your chin, glide your head straight back. You are know you are doing this exercise right if it gives you the feeling of a double chin. Hold for 20 counts and repeat 5 to 10 times.



- 3. Neck Relaxer: This exercise helps to relax the neck.
 - Drop your head slowly to the left, trying to touch your left ear to your left shoulder. Repeat on the right side. Slowly drop your chin to your chest, turn your head all the way to the left, then turn all the way to the right.



- 4. Shoulder Roll: This exercise will help relax the shoulder muscles.
 - Slowly roll your shoulders backward five times in a circular motion. Next, roll your shoulders forwards.



What are some stretches for the back, side and legs?

1. Back / Side Stretch:

• Interlace your fingers and lift your arms over your head, keeping the elbows straight. Press arms as far back as you can. To stretch your sides, slowly lean to the left and then to the right.



- 2. Middle / Upper Back Stretch:
 - Hold your right arm with your left hand just above the elbow. Gently push your elbow toward your left shoulder. Hold stretch for 5 seconds. Repeat with your left arm.



- 3. Back Curl (will also stretch your legs):
 - Grasp your shin. Lift the leg off the floor. Bend forward (curling your back), and reach your nose to your knee. Repeat with the other leg.



- 4. Ankle Flex and Stretch:
 - Hold one foot off the floor with your leg straight. Alternately flex your ankle (point your toes up) and extend (point your toes down). Repeat with the other leg.



- 5. Leg Lift:
 - Sit forward on the chair so that your back is not touching the chair's back. Place feet flat on the floor. With a straight leg, lift one foot a few inches off the floor. Hold momentarily, and return your foot to the floor. Repeat with the other leg.

