The mechanics of MATERIALS handling

Given that more than a third of all over-three-day injuries reported each year to the HSE are caused by manual handling – the transporting, or supporting of loads by hand or bodily force – the use of mechanical aids should always be considered, as they can improve productivity as well as safety. Duncan Abbott gives a brief overview of some of the solutions that can be easily implemented in any workplace.

Manual materials handling (MMH) means moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining and is the most common cause of occupational fatigue, low back pain and lower back injuries. To avoid such injuries it would be prudent to either eliminate the heavy MMH tasks, or have the tasks performed by a powered or mechanical handling system.

Heavy lifting or carrying can be made easier and safer through the use of such mechanical aids as hoists, lift trucks, cranes, elevating conveyors, or gravity chutes. All of these can help eliminate, or significantly decrease stresses attributable to MMH tasks. However, mechanical aids need to be used in a safe and well-designed environment and this factor, as well as body mechanics, should be taken into account when designing MMH tasks.

Safe working practices can be achieved by examining the following working practices that relate to MMH tasks in your organisation.

Pneumatic balancing 'arms' facilitate lifting and lowering operations and are particularly useful for awkwardly-shaped or distributed loads

Photo of the Ergolift courtesy of Tawi UK

Bending

Bending movements can be reduced if lift tables, work dispensers and similar mechanical aids are used. A simple approach is to raise the work level by putting planks on A-frames to serve as a temporary workbench. To avoid bending to pick up items have them put on to ply sheets that fit into specially designed racks, which can then be wheeled out to a loading bay. Long horizontal reaches can be eliminated by storing frames upright to avoid reaching across when lifting them.

Carrying

Carrying forces can be reduced by converting the task to a pushing or pulling task. The use of aids, or equipment such as conveyors, slides, chutes, forklifts, two or four-wheel hand trucks and trolleys can assist in this. If mechanical assistance is unavailable object weight can often be reduced by changing the object size, container capacity and weight, the load in each container, and the number of objects carried at any one time. Work area layout can also be improved by evaluating the work flow to determine if heavy loads can be moved mechanically over any distance, or whether storage or delivery points should be brought closer to production. It is better to make several trips with lighter loads if a cart or trolley is not available.

Pushing and pulling

Pushing or pulling can be eliminated by using powered conveyors, powered trucks, slides, chutes, monorails, air tables and similar mechanical aids. Loads should be easy to push or pull, grips or handles on loads or mechanical aids should be placed to provide optimal push force and designed to prevent awkward postures. Forces can be reduced by lowering the load weight by using non-powered conveyors or hand trolleys with good bearings, large-diameter wheels, and fitted with castors appropriate to the particular terrain being travelled.

Lifting and lowering

Lifting and lowering can be reduced by using a forklift truck, drum and barrel dumper, stacker, elevating conveyor, articulating arm, hoist, or balance. Work levels can be raised, or the worker's position lowered so that gravity dumps and chutes can move items using gravitational forces to act on the object. Power-lift tail gates on trucks and hand trucks can ensure the easy transfer of material from a truck to ground level, and portable ramps or conveyors can lift and lower loads on to workstations. By using a unit or bulk load concept, such as palletised loads, object weight can be increased to allow it to be handled mechanically.

Reaching and twisting

Reaching movements can be reduced by repositioning tools and machine controls closer to the worker. Materials, work pieces, and other heavy objects should be sited as near to the worker as

Photo courtesy of Hymo

possible, and load containers can be reduced in size. Twisting movements can be reduced by positioning all tools and materials in front of the worker and by using conveyors, chutes, slides or turntables so that the direction of the material moved can be changed.

Workstation design

The design of the work environment is an important element of back injury prevention and the following constitutes good practice.

Changes in the work area layout can decrease MMH-related demands. The distance over which the load has to be moved can be altered by relocating the production and storage areas. Workstations can be designed so that they can store and handle all material between knuckle and shoulder height; waist height is the most desirable. It is recommended that the materials handling task should start and finish at the same height. The worker should be able to face the load and handle materials as close to the body as possible. This will also help the worker avoid having to adopt awkward postures, or use an extended reach.

Confined spaces that hinder the ability to use good body mechanics should also be avoided, where possible. Access to material should be facilitated by providing workbenches and other workstations with toe cut-outs. To help workers get closer to load supply bins the bins should be fitted with removable sides, and obstructions like unnecessary railings should be removed.

Storage

Storage boxes and containers should be designed so that they can be lifted mechanically, rather than requiring manual handling. Deep shelving should be avoided as it makes retrieving or placing a load difficult. If possible, use racks or shelf trucks to store material, as this will eliminate the need for lifting the containers at a later stage. Storage bins and containers with fold-down sides will make it easier to access the load.

(Above left): Scissor-lifts help reduce bending, reaching and twisting movements by alternating the height of the load, bringing it closer to the worker and the delivery point

(Above right): Twisting movements can be reduced by placing the load on a lift table, which can then be brought closer to the worker

Environmental factors

An optimum environment can only be achieved if all relevant environmental factors are addressed. For example, can lift instructions be heard in a noisy environment? If not, accidents may occur. A possible solution would be to use headsets, or define standard and easily understandable hand signs (these are especially useful in crane-lifting operations).

Lighting levels should be adequate for the workplace. If the work area for MMH tasks requires precise placement then it should be illuminated at the level of 200 lux. Task lights or other additional light sources should be used for tasks requiring a fine visual discrimination, while angular lighting and colour contrast can be used to improve depth perception (this is essential where MMH tasks require the worker to climb stairs, or move in passageways).

Aisles should be kept clear of obstacles, and signs should be posted where the floor slopes. Wherever possible, such slopes should be limited to 10 degrees.

The worker

Maximising the time available to perform the job can decrease job demands. This can be accomplished by reducing the frequency of the lift, and by incorporating work/rest schedules, or job rotation programmes into the work design. Heavy tasks can be alternated with lighter ones to reduce the build-up of fatigue. Putting two workers on the lift task will also have the effect of lightening the load.

Handling materials safely

Workers passing through a materials handling area risk serious injury if proper safety procedures aren't followed. When using mechanical aids the following must be assessed:

- Is there safe clearance for equipment through aisles and doorways?
- Are aisles designated, permanently marked, and kept clear to allow unhindered passage?
- Are chutes equipped with sideboards of sufficient height to prevent the materials being handled from falling off?
- Are chutes and gravity roller sections firmly placed or secured to prevent displacement?
- At the delivery end of the rollers or chutes, are provisions made to brake the movement of the handled materials?
- Are pallets usually inspected before being loaded or moved?
- Are hooks with safety latches or other arrangements used when hoisting materials so that slings or load attachments won't accidentally slip off the hoist hooks?
- Are securing chains, ropes, chocks or slings adequate for the job to be performed?
- When hoisting material or equipment, are provisions made to assure no one will be passing under the suspended loads?

Heavy lifting from a squatting or kneeling position has been linked to the development of osteoarthritis in the knees

Heavy manual work can accelerate the degeneration processes that occur in the spine with age. When disc tissue degenerates – often because it has been subject to excessive force or 'loading' – it can lose its gel-like texture, along with its ability to maintain proper distribution of mechanical stress and strains. Disc regions subjected to loads for which they are not well suited can alter tissue, which can, in turn, increase pressure on the spinal nerves. This results in the worker experiencing pain.

This is contrary to the prevailing notion that back injuries are discrete, sudden events. There is also good epidemiological evidence (studies that seek to find associations between exposure and disease, or cause and effect) for an association between work that entails heavy lifting in a squatting or kneeling position and osteoarthritis in the knees.

Education or training may help prevent lower back disorders and can be achieved by teaching the principles of back functioning, training in lifting techniques, and training the body via physical fitness. But many studies show that training alone is unlikely to be effective if the ergonomic factors in the work remain poor. For example, basic training needs to include how to spot potential risks and what to do if found, as well as safe physical handling techniques. Achieving successful intervention is often related to the extent to which intervention philosophy is embedded in the company, including company management. SHP

About the author

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