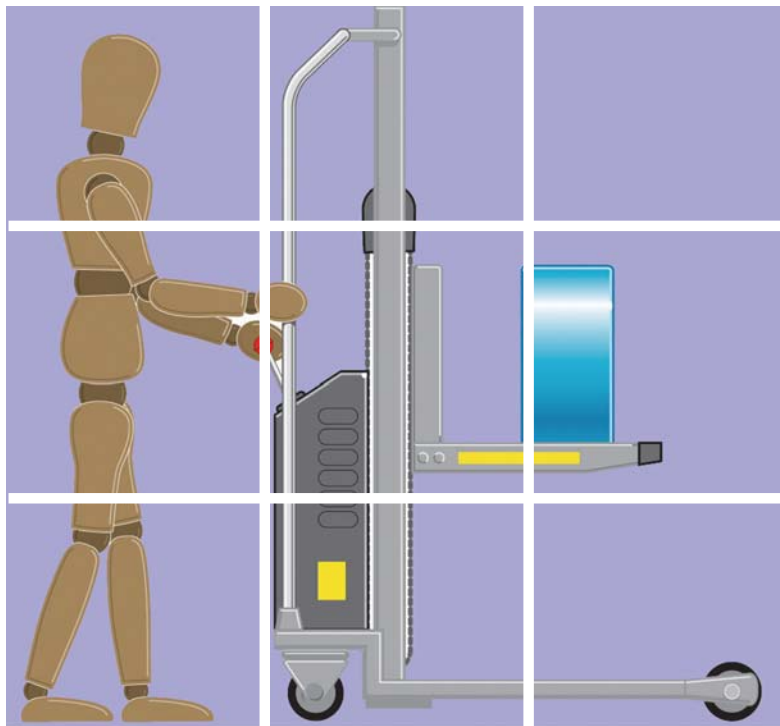




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## Ergonomics in the Workplace



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# Ergonomics in the Workplace

# Introduction

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The purpose of this short guide is to provide information to the reader on the subject of Ergonomics. It also provides guidance on where to source further information. It is not within the bounds of this guidance to discuss in detail all the main aspects of knowledge in the field of Ergonomics. However efforts will be made to give the reader an understanding of different Ergonomic principles aswell as an appreciation of relevant and useful literature and textbooks, which cover the subject of Ergonomics in more detail.

The guidance is designed to assist those who deal with Ergonomic issues in a workplace setting and these include architects, designers, engineers, manufacturers, suppliers, contractors, health and safety professionals, safety representatives, employers and employees.

“Ergonomics applies information about human behaviour, abilities and limitations and other characteristics to the design of tools, machines, tasks, jobs and environments for productive, safe, comfortable and effective human use” (McCormick and Saunders 1993).

A number of factors play a role in Ergonomics; these include body posture and movement (sitting, standing, lifting, pulling and pushing), and environmental factors (noise, lighting, temperature, humidity). (Dul et al 1993).

## THE IMPACT OF ERGONOMICS ON WORKPLACE DESIGN

The goal of Ergonomics is to provide maximum productivity with minimal cost; in this context cost is expressed as the physiological or health cost to the worker. In a workplace setting there are seldom a large number of tasks that exceed the capabilities of most of the work force. There may be jobs that will include a specific task that requires

extended reaches or overhead work that cannot be sustained for long periods, by using Ergonomic principles to design these tasks; more people should be able to perform the job without the risk of injury.

Ergonomics has already been defined and its primary focus is on the design of work activity that suits the person in that it takes account of their capabilities and limitations. Matching the requirements of a job with the capabilities of the worker is the approach to be adopted in order to reduce the risks of musculoskeletal injuries resulting from handling materials manually.

Proactive Ergonomics emphasises the prevention of work related musculoskeletal disorders through recognising, anticipating and reducing risk factors in the planning stages of new systems of work or workplaces. In effect, to design operations that ensures proper selection and use of tools, job methods, workstation layouts and materials that impose no undue stress and strain on the worker. Additional costs are incurred in redesigning or modifying work processes therefore it is more cost effective to reduce risk factors at the design stage.

A proactive approach to Ergonomics will ensure that:



- Designers will receive training in ergonomics and have appropriate information and guidelines regarding risk reduction
- Decision-makers planning new work processes should have knowledge of Ergonomics principles that contribute to the reduction or elimination of risk.
- Design strategies emphasise fitting job demands to the capabilities and limitations of workers. For example, for tasks requiring heavy materials handling, use of mechanical assist devices to reduce the need for manual handling would be designed into the process
- Other aspects of design should be considered including load design, layout of the workplace to allow for ease of access when using mechanical aids and eliminating unnecessary lifting activities.






## ERGONOMIC PRINCIPLES THAT CONTRIBUTE TO GOOD WORKPLACE DESIGN



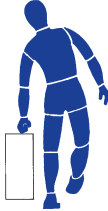
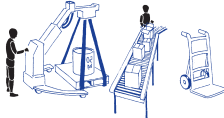
The goal for the design of workplaces is to design for as many people as possible and to have an understanding of the Ergonomic principles of posture and movement which play a central role in the provision of a safe, healthy and comfortable work environment. Posture and movement at work will be dictated by the task and the workplace, the body's muscles, ligaments and joints are involved in adopting posture, carrying out a movement and applying a force. The muscles provide the force necessary to adopt a posture or make a movement. Poor posture and movement can contribute to local mechanical stress on the muscles, ligaments and joints, resulting in complaints of the neck, back, shoulder, wrist and other parts of the musculoskeletal system.

Ergonomic principles provide possibilities for optimising tasks in the workplace These principles are summarised in Table 1 below:

**TABLE 1:**

ERGONOMIC PRINCIPLE		DESCRIPTION
Joints must be in a neutral position		In the neutral position the muscles and ligaments, which span the joints, are stretched to the least possible extent
Keep work close to the body		If the work is too far from the body, the arms will be outstretched and the trunk bent over forwards

ERGONOMIC PRINCIPLE		DESCRIPTION
Avoid bending forward		<p>The upper part of the body of an adult weighs about 40kg on average. The further the trunk is bent forwards, the harder it is for the muscles and ligaments of the back to maintain the upper body in balance</p>
A twisted trunk strains the back		<p>Twisted postures of the trunk cause undesirable stress to the spine</p>
Alternate posture as well as movements		<p>No posture or movement should be maintained for a long period of time. Prolonged postures and repetitive movements are tiring.</p>
Avoid excessive reaches		<p>It is necessary to limit the extent of forward and sideways reaches to avoid having to bend over or twist the trunk</p>
Avoid carrying out tasks above shoulder level		<p>The hands and elbows should be well below shoulder level when carrying out a task</p>

ERGONOMIC PRINCIPLE		DESCRIPTION
Limit the weight of a load that is lifted		There are guidance weight limits for both males and females detailed in Figure 2 of this document
Use mechanical aids		Many lifting accessories are available to help lift and move loads
Avoid carrying loads with one hand		When only one hand is used to carry a load, the body is subject to mechanical stress
Use transport accessories		There are a large number of accessories such as roller conveyors, conveyor belts, trolleys and mobile raising platforms, which eliminate or reduce manual handling.

## ERGONOMICS AND IRISH LEGISLATION

### *The Manual Handling of Loads Regulation*

Many of the Ergonomic Principles, which have been detailed above, have been incorporated into Irish Legislation. The Safety Health and Welfare at Work (General Application) Regulations of 1993 contain regulations dealing specifically with the manual handling of loads.

The regulation is titled the Manual Handling of Loads Regulation. These regulations are likely to be remade in 2006 without substantive changes. There is detailed guidance on this regulation in the Health and Safety Authority publication *Management of Manual Handling in the Workplace*.

The Regulation details a definition of Manual Handling as:

“any transporting or supporting of a load by one or more employees, and includes lifting, putting down, pushing, pulling, carrying or moving a load, which by reason of its characteristics or **unfavourable ergonomic conditions**, involves risk, particularly of back injury, to employees”

There is a schedule attached to the Manual Handling of Loads Regulation, which details these unfavourable ergonomic conditions or risk factors for the manual handling of loads. The Manual Handling regulations require the employer to have regard to these risk factors when assessing manual handling activities.

These risk factors mirror many of the Ergonomic principles already described in this guidance leaflet. The Regulation sets out a framework for employers to avoid or reduce manual handling activity through a risk assessment process, which takes account of the risk factors detailed in the schedule. Ideally the risk assessment process should take place at the design or planning stage of new systems of work, but must happen as a matter of course for any existing systems of work, which involve manual handling.

### ***Manual Handling Risk Assessment:***

Risk assessment is a process which involves gaining a detailed understanding of a task being carried out, collecting all relevant technical details of the task, identifying if there are risk factors/hazards present, exploring what options or solutions are available to reduce or



eliminate the risk factors/hazards and putting a plan in place to introduce agreed control measures.

There are a number of steps in the manual handling risk assessment process and these are described briefly below:

### **Step 1: Identify the Manual Handling Tasks that need to be assessed**

A list should be put together of all tasks being performed on site where manual handling activity is a key component of the task.

### **Step 2: Develop a risk assessment schedule**

A plan should be put in place that will identify what tasks are going to be assessed and when the assessments are going to be carried out. Involving staff in the planning and implementation of the risk assessment process can be an important way of increasing the likelihood of success of the process.

### **Step 3: The Risk Assessment Process**

There are a number of key stages in this process and these are briefly discussed below.

#### **Task Observation and description**

The objective at this stage is to gain a detailed understanding of how a task is performed and to identify the sub tasks that contribute to the completion of the overall task.

#### **Collect Task Data**

A well-documented manual handling risk assessment will have good quality information about the task, which will include technical information and general information. Examples of technical information include data on load weights, physical measures of a work area, dimensions of a

load, number of manual lifts in a task, light levels, noise levels. Frequency of lifts (lifts per min/hour/day) and duration.

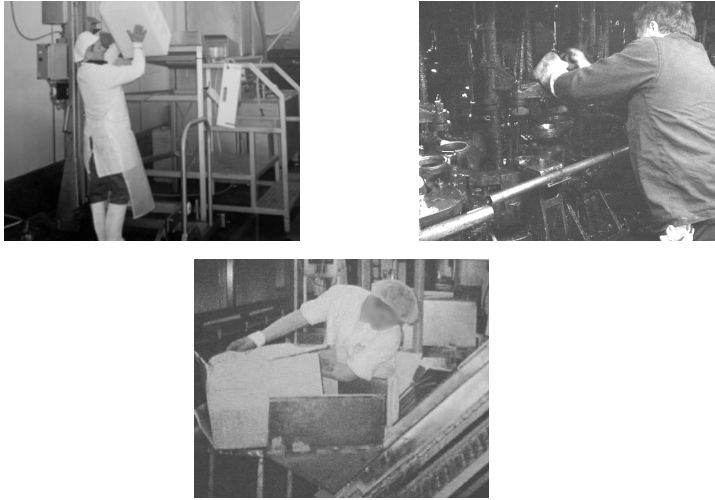
### **Identification of Risk Factors**

The Schedule in the regulation details the unfavourable ergonomic conditions or risk factors, which should be considered as part of the risk assessment process. Figure 1 details examples of some of these risk factors. Ergonomics Research which has been conducted to identify workplace factors that contribute to the development of musculoskeletal disorders including back injury, has demonstrated the following as important risk factors:

#### *Awkward Posture*

Body postures determine which joints and muscles are used in the activity, more stress is placed on the spinal discs when lifting, lowering or handling loads with the back bent or twisted compared with when the back is straight. Activities requiring frequent or prolonged work over shoulder height can be particularly stressful.

FIGURE 1: EXAMPLES OF AWKWARD POSTURES

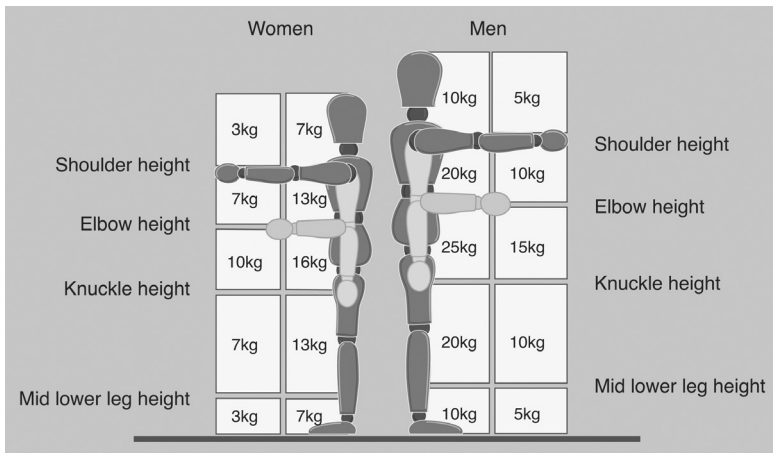


*Forceful Exertion:* Tasks that require forceful exertions place higher loads on the muscles, tendons and joints. Increasing force means increasing body demands such as greater muscle exertion. The weight of a load that has to be lifted, the height that the load has to be lifted and the frequency of lift are all factors that contribute to the level of exertion on the muscles and joints. The Regulations set no specific requirements such as weight limits.

However there are numerical guidelines, which take account of weight, repetition and location of lifts as a means of identifying activities, which involve risk. In using the guideline weights in Figure 2, the assessor should take account of the type of work activity and have an appreciation of what realistic improvements can be put in place to avoid or reduce risk. When assessing manual handling activities it is important to keep in mind that weight is not the only factor that needs

to be considered, other factors that should be considered include repetition, individual capacity, posture and the work environment. The Guideline Weights can be used to determine if the load is too heavy. Working outside these guidelines is likely to increase the risk of injury.

**FIGURE 2: GUIDELINE WEIGHTS**



### *Example*

A man is lifting a load weight of 40kg, the man is lifting it close to his body and he lifts the load from floor level to knuckle height. In looking at the guideline weights it is evident that the lifter's hand enter more than one box during the operation, therefore the smallest weight figure applies. In this case the smallest weight is 10kg. Therefore the conclusion is that there is an increased risk of injury as the load weight is greater than the guideline figure. It is important to look at the activity in more detail to identify what control measures can be put in place to avoid or reduce the risk of injury.

The Guideline Weights assume that the load is readily grasped with both hands and that the operation takes place with the lifter in a stable body position. The guideline weights are for infrequent operations up to about thirty operations per hour, where the pace of work is not forced, adequate pauses to rest or use different muscles are possible, and the load is not handled by the lifter for any length of time.

Reduce the weights if the operation is repeated more often. As a guide:

Where operations are repeated	Figures should be reduced by
Once or twice per minute	30%
Five to eight times per minute	50%
More than 12 times per minute	80%

*Repetitive Motions:* If motions are repeated frequently (e.g. every few seconds) and for prolonged periods such as an eight-hour shift, fatigue and muscle strain can accumulate. Effects of repetitive motions from performing the same work activities are increased when awkward postures and forceful exertions are involved. In industrial jobs, the time to complete one unit of assembly or to inspect one item is defined as a cycle. This activity is considered repetitive if the cycle time is two minutes or less and is repeated throughout a shift. Highly repetitive tasks have cycle times of 30 seconds or less. (Eastman Kodak 1986).

### **Solution Development and Plan of Action**

The risk factors that exist in the task must be documented and evidence of each risk factor, should be outlined. The

development of solutions is the process of eliminating or reducing the risk factors. The employer in consultation with the workers should carry this out. It is necessary to evaluate that controls are feasible, the reason for deciding on a control measure must be clearly documented and should outline why other control measures were not possible and how the suggested control measure will avoid or reduce the risk of injury. The introduction of any control measure such as a mechanical aid or a new work layout means the introduction of a new system of work. Therefore a new system of work must also be assessed to ensure that any new hazards are identified and controlled.

### **Review the Effectiveness of the Control Measures**

Effectiveness is the degree to which control measures have avoided or reduced the risk of injury. This will depend on how timely the changes were implemented and the level of worker acceptance.

### ***The Display Screen Equipment Regulation***

The Safety Health and Welfare at Work (General Application) Regulations of 1993 contains regulations dealing specifically with Display Screen equipment.

There is a schedule attached to the Display Screen Equipment Regulation which details factors, which must be considered as part of the risk assessment process of Display Screen equipment workstations. This schedule takes account of seating requirements, environmental factors such as temperature and lighting as well as other relevant requirements.

## ERGONOMICS: POINTS TO REMEMBER

- Ergonomics applies information about human behaviour, abilities and limitations and other characteristics to the design of tools, machines, tasks, jobs and environments for productive, safe, comfortable and effective human use
- The goal for the design of workplaces is to design for as many people as possible and to have an understanding of the Ergonomic principles of posture and movement which play a central role in the provision of a safe, healthy and comfortable work environment
- Ergonomics has been incorporated into Irish Legislation. The Safety Health and Welfare at Work (General Application) Regulations of 1993 contain regulations dealing with manual handling of loads and Display Screen equipment.
- Risk Assessment of manual handling activities and Display Screen equipment workstations should always take account of Ergonomic Principles. The Schedules outline the appropriate factors that must be considered as part of the risk assessment process.

***Useful Links:***

Health and Safety Authority [www.hsa.ie](http://www.hsa.ie)

European Agency for Health and  
Safety at Work [europe.osha.eu.int/OSHA](http://europe.osha.eu.int/OSHA)

Health and Safety Executive [www.hse.gov.uk/index.htm](http://www.hse.gov.uk/index.htm)

Occupational Safety & Health Administration [www.osha.gov/](http://www.osha.gov/)

National Institute of  
Occupational  
Safety and Health [www.cdc.gov/niosh/homepage.html](http://www.cdc.gov/niosh/homepage.html)

Worksafe Australia [www.nohsc.gov.au/](http://www.nohsc.gov.au/)



***Useful Textbooks and Guidance on the subject of Ergonomics:***

Dul, J and Weerdmeester, B, 1993, *Ergonomics for Beginners*, Taylor and Francis.

Eastman Kodak, 1986, *Ergonomic Design for people at work: (Volume 2)*, John Wiley & Sons.

Health and Safety Authority, 2005, *Management of Manual Handling in the Workplace*.

Health and Safety Executive, 1998. *A Pain in your workplace: Ergonomic problems and solutions*, HS (G) 121, HSE Books

Health and Safety Executive, 2000, *Moving food and drink, Manual handling solutions for the food and drink industries: HSG196*, HSE Books

Helander M, 1995, *A Guide to Ergonomics in Manufacturing*: Taylor & Francis.

International Labour Office, 1998, *Work Organisation and Ergonomics: (ILO)*

Kroemer K.H.E., and Grandjean E, 2000, *Fitting the Task to the Human*, Taylor & Francis.

Mital A and Nicholson and Ayoub M.M. 1997, *A Guide to Manual Materials Handling (2nd Edition)*, Taylor & Francis

Pheasant, Stephen 1999, *Bodyspace*, Taylor & Francis

Sanders M.S., McCormick J., 1992, *Human Factors in Engineering and Design*, McGraw Hill International.

# Ergonomics in the Workplace

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HEALTH AND SAFETY  
AUTHORITY HEADQUARTERS

10 Hogan Place, Dublin 2

**Tel. 1890 289 389**

Callers outside  
Republic of Ireland

00353-1-6147000

Fax. (01) 614 7020

website: [www.hsa.ie](http://www.hsa.ie)



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