



THE UNIVERSITY  
OF BIRMINGHAM

# Health and Safety Guidance

## Workstation Design

**GUIDANCE/5/wd/98**

Poor design of the layout of workstations can result in risk of damage to users' muscles and joints. Careful design and set-up will eliminate or significantly reduce these risks. University Health and Safety Policy (UHSP/0/01) requires that workplaces are arranged to allow for the tasks to be carried out safely and without risks to health.

This document is intended to help Budget Centre compliance with Health and Safety Policy. Guidance is given on the **principles of design** and the **setting up** of workstations. Specific guidance on workstations for using display screens is provided in an Appendix.

When considering workstations which use display screen equipment reference should be made to University Policy UHSP/7/DSE/96 *Display Screen Equipment Use*.

Further health and safety and purchasing information and advice may be obtained from the Health and Safety Unit and the University Purchasing Office respectively.

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# CONTENTS

	Page
<b>INTRODUCTION</b>	
1. Application of the guidance	1
<b>GUIDANCE</b>	
1. Who is the guidance aimed at?	1
2. General principles	1
3. Design considerations for standing workstations	2
4. Design considerations for seated workstations	2
5. Design considerations for tables and desks	4
6. Other design consideration for workstations	4
<b>APPENDICES</b>	
1. Design of seated and standing workstations	6
2. Further advice and information	10

# INTRODUCTION

## APPLICATION OF THE GUIDANCE

The guidance applies to all places where people work at a **static** location. This includes workstations where people are required to stand or sit. It also gives guidance on general considerations for all workplaces. Appendix 1 deals particularly with personal computers and other display screen equipment.

The guidance is based on ergonomic principles and sets down a basis for the design and use of new and currently existing workstations. The aim is to avoid damage to muscles and joints from poor design of the workstation. The back, neck, shoulders and upper limbs are particularly at risk. Discomfort will result from a poor workstation design and if this continues over a period of time it may result in permanent damage to health.

## GUIDANCE

### 1. WHO IS THE GUIDANCE AIMED AT?

This guidance is aimed at those who:

- purchase or order furniture;
- design workstations;
- construct or set up workstations;
- supervise staff at workstations;
- advise on health and safety in their Budget Centres.

### 2. GENERAL PRINCIPLES

When designing a workstation the activity and the posture required to carry out that activity should be considered. Ill health can arise from:

- poor work position and posture;
- high levels of force (e.g. punching holes, undoing tight screws);
- high levels of repetition (e.g. pipetting, typing, assembly work);
- awkward manual handling tasks;
- excess bending, stretching or effort.

To minimise the risk of ill health the following general principles should be applied:

- assess the task to minimise the amount of physical work, (e.g. automate, use correctly designed equipment);
- assess who is going to use the workstation, (e.g. able bodied or disabled, exceptionally short or tall);
- where possible, keep the body posture in a neutral position, (e.g. no twisting of the neck or the back and no bent wrists). This will reduce the amount of physical stress on the body and if strength is required, muscles can exert greater force in a neutral position;
- avoid bending the head and neck forward to look at work as this requires the neck muscles to support the head;
- avoid bending the trunk forward as in this position, the upper body has to be held up by the back and shoulder muscles;
- avoid holding the arms and hands in a raised position;

- avoid twisting of the body;
- allow for changes in posture and movement. It is unnatural for the human body to be held in one position for a sustained period of time.

When carrying out any workstation design an early decision needs to be made about whether the operator should be standing or seated or given the opportunity to do both. Workstations can be designed for both standing and sitting. This will allow the user to change position and alter posture more regularly, which is helpful in preventing discomfort or long-term problems.

### 3. DESIGN CONSIDERATIONS FOR STANDING WORKSTATIONS

#### Examples at the University:

laboratory benches	sorting tables	wash up areas	photocopiers
workshop benches	food preparation tables	stores distribution point	printing machines
computer stations	food serveries	book distribution points	collating tables

The height of the work surface is vital and depends on the task being carried out. If the work surface is too low, the user will have to bend over to work, if the work surface is too high then the user will have to raise their arms which puts undue pressure on the shoulders.

Although it is not possible to fit a workstation height to all members of the population, in general, it is possible to fit the middle 90% of the population.

The general recommended heights for work surfaces is between 95cm to 110cm from the floor. However the height of the work bench will also depend on the task being carried out.

For tasks which require precision, the work should be positioned 5cm to 10cm below elbow height. For those classified as light work, for example requiring little force, the work should be positioned between 10cm and 15cm below elbow height. For tasks classified as heavier work and requiring more force to carry them out, the working surface should be 15cm to 40cm below elbow height. (See Appendix 1, figure 3)

If possible adjustability should be built into workbenches. However, where this is not possible, raising the floor level should be considered for shorter users.

### 4. DESIGN CONSIDERATIONS FOR SEATED WORKSTATIONS

#### Advantages of seated work

- takes the weight of the legs;
- can avoid unnatural body postures;
- reduces energy consumption;
- puts fewer demands on the cardiovascular system.

#### Disadvantages of seated work

- restricts mobility;
- cannot use large hand forces;
- causes slackening of the stomach muscles;
- causes curvature of the spine.

#### Basic Requirements for Seating

- support the worker in a position in which he or she can work comfortably and efficiently;
- allow the worker to change position easily and without losing support;

- prevent the seat pan from compressing the buttocks or the thighs;
- cater for special needs, e.g., short, tall, disabled, well built;
- the seat should suit the workstation including the height of the work surface, layout of the furniture and other equipment;
- should have a back rest.

## Seat pan

Should be adjustable for height between 38cm and 53cm from the floor to allow the user to sit with their legs at 90° and their feet flat on the floor. If the user is particularly short and their feet cannot comfortably rest on the floor then an adjustable foot rest will be required. If the height of the work surface is higher than normal then users should be able to adjust the seat pan upwards. Again there may be need for a footrest.

The seat surface should be padded especially at the front to prevent it from cutting into the back of the knee.

## Seat Width

Should be a minimum of 40cm.

## Seat Depth

Should be designed to allow all sitters to use the backrest. The maximum length of the seat depth is 43cm measured from the front edge of the backrest to the front of the seat pan. Providing the seat height is adequate all users should be able to sit comfortably.

## Upholstery

The cushioning should compress down by 1cm to 2cm when pressed by hand. If too soft cushioning will not give any support to the buttocks or the backs of the thighs. If too hard may cause compression on the buttocks. Contouring the seat may help reduce compression. The type of material used to cover the seat will be dependant on where the seat is to be used. E.g. in the case of a laboratory where liquids are used which could contaminate the seat an impermeable material should be specified. **This is particularly important where radioisotopes and micro-organisms are handled.**

## Seat Angles

The angle of the seat pan may either be forward tilting, backward tilting or flat. A forward tilting chair may be of use where the worker needs to reach forward or is carrying out precise work. However forward tilting will result in slippage if the wrong upholstery materials are used. Users sitting in a forward tilting position will need to use their legs to support themselves therefore it is essential that feet reach the floor or they have an adequate footrest. Backward tilting seats push the user against the backrest and prevent slipping from the chair. When using flat seat pans, users must be encouraged to use the backrest correctly.

## Backrests

There are generally two types of backrest. Low, which support the lumbar region only and high, those that support the head and neck. For high backrests the rest should extend to the tallest person's shoulder height. Unless a high backrest is used, the backrest should be adjustable. Recommended measurements include the height from the seat pan to the mid backrest of 17cm to 30cm. The backrest should be contoured to the shape of the spine and give support to the lumbar curve (lower

back). The lumbar support should stand out 4cm from the backrest as this gives a similar curve to that in people in the standing position.

The backrest angle has two functions. It prevents the occupant slipping forward and helps the body lean against the backrest with lumbar support. For reaching, the backrest angle should be between 101° to 104° as required, and for relaxing between 105° to 108°, measured from along the seat pan.

## **Interaction of the Seat with the Workstation**

It is vital that any seat interacts correctly with the workstation it is used with. Workstation height is important but with an adjustable chair the main concern is that the largest and smallest users can fit the workstation. If the chair has arms it is important that the arms do not impede the comfortable use of the workstation. E.g., arms may prevent the chair being able to be drawn up close enough to a desk. A chair with adjustable height arms may need to be considered.

## **5. DESIGN CONSIDERATIONS FOR TABLES AND DESKS**

The dimensions of tables and desks should allow the user to sit comfortably and have enough space on the top surface to allow all required equipment to be kept and used safely. If the table is too small, it is often difficult to work using safe posture. Before any new design is chosen, the tasks that are to be carried out and the equipment required should be considered, preferably with the intended user, to ensure that there will be adequate space for everything.

The height of the underside of a table or desk should be 66cm or more from the floor.

## **6. OTHER DESIGN REQUIREMENTS FOR WORKSTATIONS**

### **Reaching**

Workstations should be designed to avoid excessive reaching. (See Appendix 1, figure 4.)

Any equipment used frequently by the staff member should be within a radius of 50cm of the user. As a practical guide the individual can stretch their arms in front of them and draw imaginary arcs at their workstation. Most items frequently used should be within that area.

The most important pieces of equipment should be closest to the user during work tasks.

### **Lighting**

Lighting has four main purposes:

- to ensure the safety of people;
- to ease the performance of tasks;
- to create an appropriate visual environment;
- to avoid eye-strain.

There should be adequate light in a working environment to allow particular work tasks to be carried out and recommended illumination levels for specific work tasks are available (Ref to *Lighting at Work, HS(G)38*). Where possible, natural lighting should be used. There is however little control over daylight and it is recommended that blinds be used on windows to reduce glare and reflection problems from the sun.

For both natural and supplied lighting, it is vital that glare should be avoided. This can be carried out by the careful positioning of workstations and lighting in relation to each other. Reflection from work surfaces can also create problems in seeing work tasks and can be reduced by using furniture and equipment with low reflectance surfaces.

In some cases task or local lighting may be appropriate to ensure an adequate source of light. Care must be taken to ensure that localised lighting is not causing a problem with glare to other workers nearby.

## **Space**

There should be sufficient space to access the workstation safely and conveniently and prevent interference between workstations. In offices the minimum space per person should be 11m<sup>3</sup>, disregarding any space more than 3m above the floor.

## **Temperature and ventilation**

The temperature and ventilation in an indoor workplace should allow for reasonably comfortable working conditions. The minimum temperature for sedentary work after the first hour of work should be 16°C and there should be an adequate supply of fresh air.

## **Noise**

Noise levels should be kept as low as possible including irritating noises. If the noise level is 85db or more a noise survey should be carried out.

## **Flooring**

Flooring should be suitable for the work being carried out. It should be non slip, easy to clean and not be prone to damage.

# APPENDIX 1

## Design of workstations

Design of seated workstation:

Rear view

Figure 1

Side view

Figure 2

Design of workbench

Standing heights

Figure 3

Bench layout

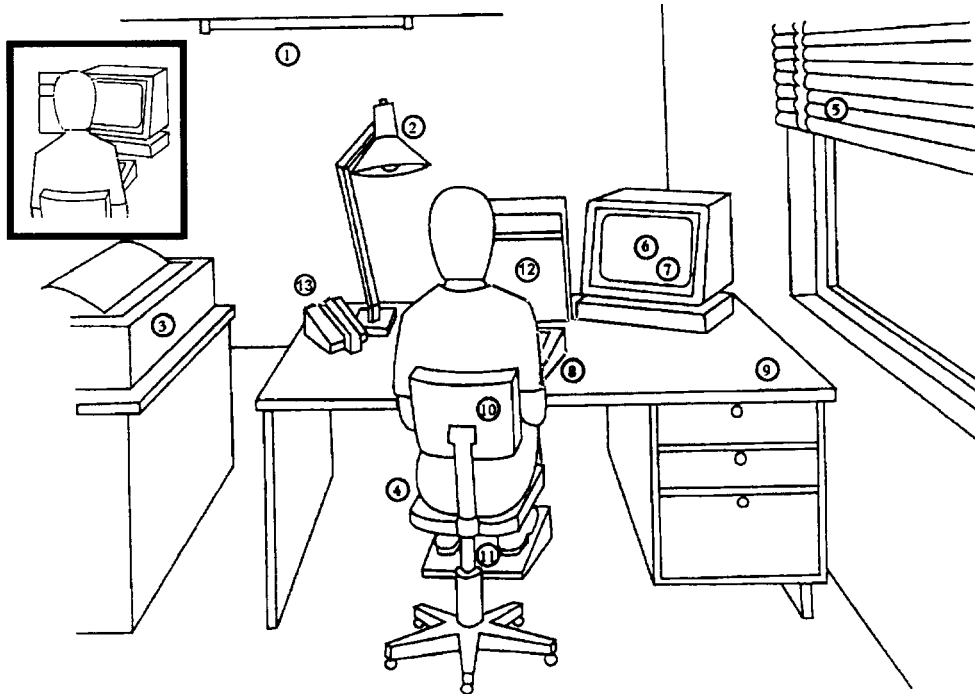
Figure 4



# Design of seated workstations

Figure 1

**Typical Seated Workstation (rear view)**  
(The display screen equipment could be replaced by other seated tasks)



The main diagram shows the document holder in front of the person and the display screen to one side. This is the correct arrangement for a person who works almost exclusively from documents and only occasionally looks at the screen. E.g. a touch typist.

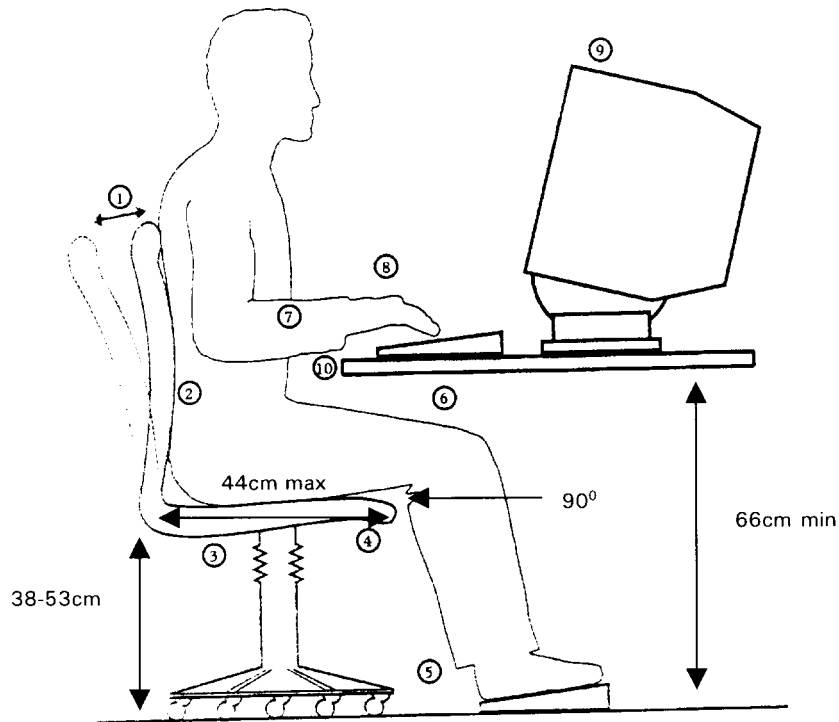
The inset diagram shows the document holder and display screen in front of the person. This is the correct position for a person who frequently looks at both documents and the screen.

## Key points:

- 1 Adequate lighting
- 2 Adequate contrast, no glare or distracting reflections
- 3 Distracting noise minimised
- 4 Leg room and clearances to allow postural changes
- 5 Window covering
- 6 Software: appropriate to task and adapted to user
- 7 Screen: stable image, adjustable, readable and glare and reflection free
- 8 Keyboard: usable, adjustable, detachable and legible
- 9 Work surface: allow flexible arrangements, spacious (0.4m<sup>2</sup>) and glare free
- 10 Work chair: adjustable
- 11 Footrest: adjustable
- 12 Document holder: adjustable
- 13 Often used equipment (e.g. telephone): accessible without stretching

**Figure 2**

**Typical Seated Workstation (side view)**  
(The display screen equipment could be replaced by other seated tasks)



**Key points**

- 1 Seat back adjustability
- 2 Good lumbar support
- 3 Seat height adjustability
- 4 No excess pressure on underside of thighs and backs of knees
- 5 Foot support if required
- 6 Space for postural change, no obstacles under desk
- 7 Forearms approximately horizontal
- 8 Minimal extension, flexion or deviation of wrists
- 9 Screen height, angle and distance should allow comfortable head position without eye strain
- 10 Space in front of keyboard to support hands and wrists during pauses in keying

# Design of workbenches

Figure 3

## Recommended heights of benches for standing work

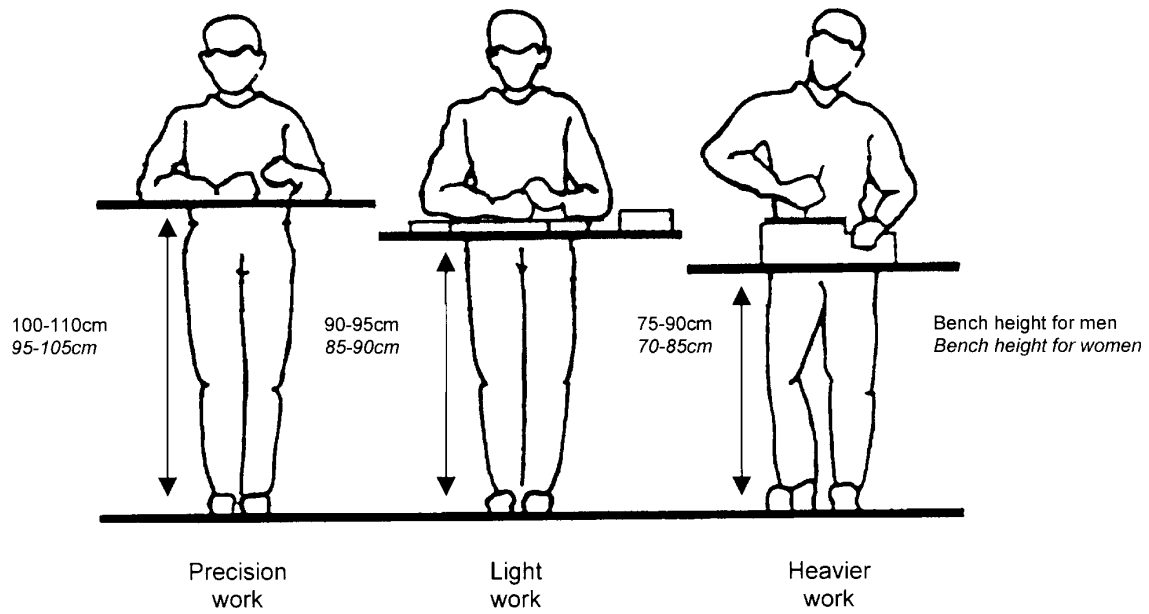
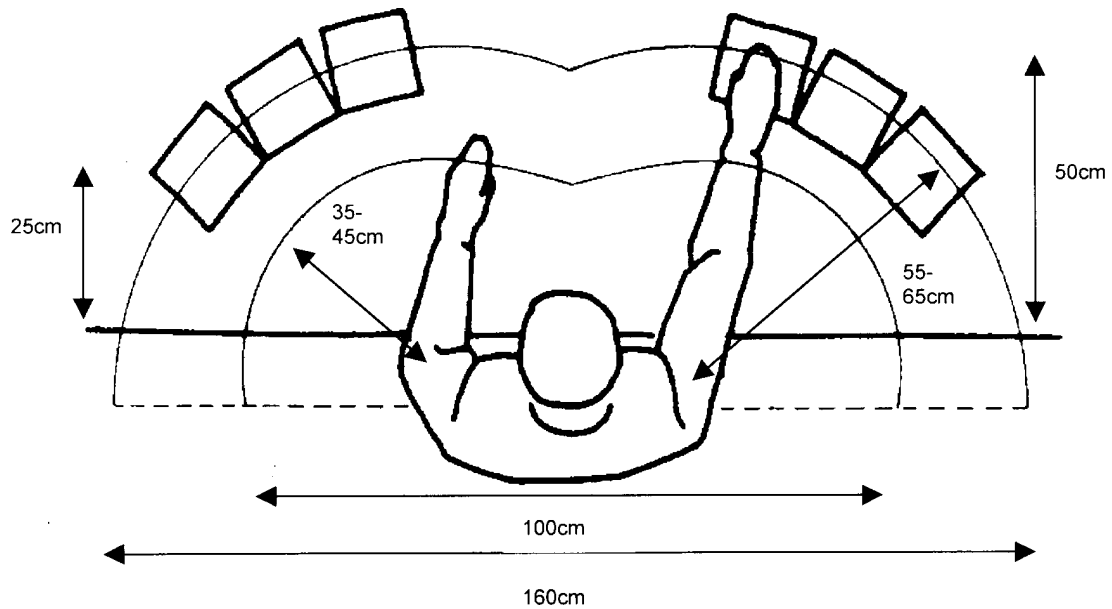


Figure 4

## Recommended position of articles on a bench top

Where possible, all materials, tools, controls and containers should be within this area



## APPENDIX 2

### FURTHER ADVICE

If there is an ergonomic problem with an existing workstation or possible problem with a planned workstation then the Health and Safety Unit will be able to advise.

If new workstations are to be purchased advice and a list of approved suppliers can be obtained from the University Purchasing Office.

### FURTHER SOURCES OF INFORMATION

#### Standards

BS 7179 *Ergonomics of design and use of visual display terminals (VDTs) in offices Parts 1 to 6.*

#### HSE Publications

HSE, *Work equipment. Guidance on the Provision and Use of Work Equipment Regulations L22*, 1992, HSC.

HSE, *Guidance on the Workplace Health, Safety and Welfare Regulations L24*, 1992, HSC.

HSE, *Work related upper limb disorders: a guide to prevention*, HS(G)60, 1990, HMSO.

HSE, *Ergonomics at work*, IND(G)90L, HMSO.

HSE, *A pain in your workplace: ergonomic problems and solutions*, 1994, HSE.

HSE, *Lighting at Work* HS(G)38, 1998, HMSO.

HSE, *Seating at Work* HS(G)57, 1998, HMSO.

#### Books

Dul, J. and Weerdmeester, B., 1993, *Ergonomics for beginners: A quick reference guide*, Taylor and Francis, London.

Grandjean, E., 1988, *Fitting the task to the man: A textbook of occupational ergonomics*, Taylor and Francis, London.

Osborne, D.J., 1987, *Ergonomics at work*, John Wiley and Sons, Winchester.