

# GUIDELINES ON OCCUPATIONAL SAFETY AND HEALTH FOR SEATING AT WORK

DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH MINISTRY OF HUMAN RESOURCES MALAYSIA 2002

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Director General Department of Occupational Safety and Health, Malaysia

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# 1. INTRODUCTION

1.1 These guidelines explain how suitable seating contributes to the safety and health of people at work, for example by helping to prevent back pain - one of the commonest causes of time off work. They provide advice on the design and selection of seating and some examples of seating arrangements for different kinds of work. They do not specifically cover seating in vehicles or mobile plant such as lift trucks or cranes.

1.2 The advice in these guidelines is intended to be of interest mainly to employers, safety and health staff and to manufacturers, designers and suppliers of industrial and office furniture.

1.3 Sitting in an unsuitable chair can result in tiredness and discomfort. This affects employees general welfare, and also have adverse consequences for safety and health. Employers who provide suitable seating are not only fulfilling their legal responsibilities but are contributing to the efficiency of their workforce.

1.4 These guidelines deal mainly with seating for people at work. Other seating should be suitable for its purpose. Seating in rest areas should be comfortable and have restful characteristics. In changing areas, on the other hand, a bench might be sufficient.

## 2. LEGAL REQUIREMENTS

### 2.1 OCCUPATIONAL SAFETY AND HEALTH ACT 1994

The Occupational Safety and Health Act 1994 aims to secure the safety, health and welfare of persons at work, for protecting others against risks to safety or health in connection with the activities of persons at work. Under the Act employers, employees and self-employed are required to meet certain standard on safety, health and welfare.

Employers must ensure the safety, health and welfare of their employees. To comply, employers must;

- Provided or maintain equipment and systems of work that are safe and without risk to health.
- Ensure that equipment and substances are used, stored and transported safely and without risks to health.
- Provide information, instruction, training and supervision that ensure the safety and health of employees.
- Maintain their place of work in a safe condition including entrances and exits.
- Employers must also ensure the safety and health of visitors to the places of work.

Employees must;

- Cooperate with their employers in their efforts to maintain the required level of safety and health.
- ☑ Take reasonable care of the safety and health of one-self and others.

Designers, Manufactures and Suppliers of equipment and substances must;

- Ensure that products are safe and not a risk to health when properly used.
- > Provide clear information about the safe use of their products.
- Solution Make available information about research and testing.

Section 18 (1) of the Act, required that an occupier of a non-domestic premises which has been made available to persons, not being his employees, as a place of work, or as a place where they may use plant or substance provided for their use there, shall take such measures as are practicable to ensure that the premises, all means of access thereto and egress there from available for use by persons using the premises and any plant or substance in the premises or provided for use there, is or are safe and without risks to health.

### 2.2 FACTORIES AND MACHINERY (SAFETY, HEALTH AND WELFARE) REGULATIONS 1970

Regulation 30 (1), stipulated that in every factory where persons employed have in the course of their employment, reasonable opportunities for sitting without detriment to their work, there shall be provided and maintained suitable and sufficient seating facilities for their use.

Regulation 30 (2), prescribed that:-

- a) there shall be provided and maintained for any person employed in that work a seat of a design, construction and dimensions suitable for him and the work, together with a foot-rest is necessary to support his feet in order to reduce fatigue; and
- b) the arrangements shall be such that the seat is adequately and properly supported while in use for the purpose for which it is provided.

# 3. SEATING WORKSTATION: GENERAL PRINCIPLES

3.1 The design of the workstation, including seating should be based on a careful assessment of all aspects on the job, and any special needs of the individual worker. The aim should be to ensure that each task can be carried out safely, comfortably and as efficiently as possible. Such an approach helps in the selection of appropriate seating and also ensures that the layout of workstation, the method of working and the order in which tasks are carried out are properly matched.

3.2 In a well designed workstation, a worker should be at a comfortable height and position in relation to the work. All equipment in frequent use, and the work itself, should be kept within easy reach (see figure 1). It is important to eliminate the need for workers to make repeated twisting or stretching movements, as these are a common cause of injury. Lighting should be adequate for the task and correctly positioned, so that workers do not strain or take up an uncomfortable position in order to see properly. A seated worker will normally prefer to work with both hands at roughly elbow level or lower as raising of the forearms above the horizontal for any length of time is tiring. Lifting load while seated can cause strain on the back, and lifting should be kept close to the body.

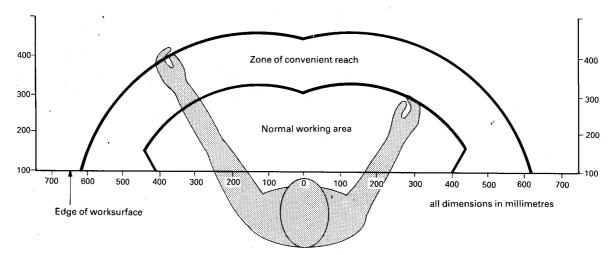


Fig.1 : Reach in the horizontal plane. (The distances shown can be reached by 95% of women)

3.3 As a general rule physically it is less stressful to sit than to stand for any length period of time. Work should therefore be organised so that it can be done sitting down where period ever possible. Where work has to be done at standing position but there are occasional lulls, seats should be provided nearby to allow workers to sit when they can. If workers have to stand for long periods, comfortable seating should be provided for their use during breaks.

3.4 Sitting in one position, for long periods can lead to discomport and inefficiency, and ultimately may cause long-term ill-effect. Many people who work sitting down can avoid discomfort by changing position, or by standing up and moving around. Others jobs may be less flexible unless opportunities for movement are deliberately build in, for example by giving workers a greater variety of tasks or arranging the workstation so that workers can be either sit or stand. (see figure 2)

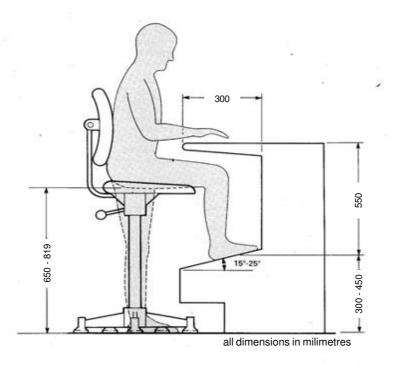


Fig 2 : Workstation where workers can sit or stand

3.5 People often accept and adapt to unsatisfactory working conditions. They may not realise their body is under strain until they feel actual pain, and even then may not understand the cause. It is for employers to take the initiative in providing suitable seating, not to wait until complaints are received or until workers take time off with back pain. Employees should be on the lookout for signs that seats are not suitable, for example workers using cushions of their own or makeshift footrests.

3.6 Basic Workstation Checklist are attach at appendix 1, basically most useful tools to make assessment of individual workstation. This Checklist also can use as a guidance to identified the potential problems or workstation hazard at the work place.

3.7 There are a number of basic requirements which all seating provided at work should meet. Seating should:

- \* support a worker in a position in which worker can work comfortably and efficiently;
- \* allow a worker to change position easily and without losing support;
- \* not press uncomfortably on the buttocks or thighs;
- \* cater for any special needs of, for example, very tall or short workers, or those who are disabled. In some cases, special seating may be required; and
- \* suit the workstation, including the height of the work surface and the layout of furniture and equipment.

## 4. DESIGN OF SEATING

4.1 Anthropometry is concerned with the size and proportions of the human body at work. A few anthropometri principles of importance to the ergonomics of posture and movement at the sitting workplaces. The desiners of sitting workplaces, accessories and suchlike must bear in mind differences in body size of the potential users. A seated which is suitable for a person of average stature can be unsuitable for a tall or short person. A seated which is adjustable over a sufficient range is the solution if the chair is to be used by several people.

4.2 However there is no single, standard formula for the design of seating used at work. So, any design should take account of the comfort of the worker and be soundly constructed and reliable in use. The following design guidance is for a typical adjustable chair suitable for many work situation. This is illustrated at figure 3(a) and (b).

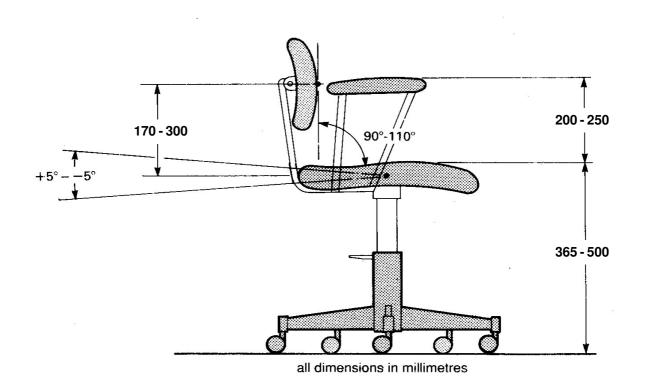
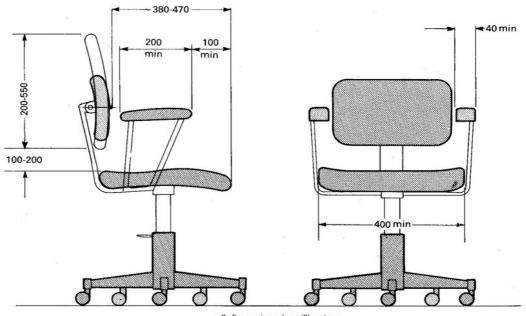


Fig 3(a): Recommended adjustability



all dimensions in millimetres

Fig 3(b): Recommended chair dimensions

### 4.2.1 Seat

The seat should be adjustble in height to suit workers ranging from the very short to the very tall. The size of the seat is important. It should be wide enough to seat big people comfortably. It should be deep enough to support the leg of tall people properly, but not so deep that shorter workers cannot use the backrest. The surface of the seat should not be hollowed or deeply shaped, as this makes it harder to get up or change position. The front edge should be rounded and well-padded so that it does not dig into the thighs.

### 4.2.2 Backrest

The backrest should give firm support to the lower and middle part of the back. Unless the backrest is high and provides complete support for the back, height adjustment is desirable. There should be adequate space for the buttocks; this is usually achieved by leaving a gap between the seat and the backrest. Backrest which tilt with the worker, or angle can be adjusted, can provide comfort to the users.

### 4.2.3 Armrests

For most jobs armrests are not essential. Some armrests can restrict the arm movements required for certain tasks. However, for many jobs they do provide extra comfort. They should be set back from the front edge of the seat to allow the chair to be drawn up close to the work surface even when the seat is at the high adjustment. The height is important - they should neither be so high that workers hunch their shoulders, nor so low that workers have to lean to use them, For some people, armrests can give valuable support, especially when getting up or sitting down.

### 4.2.4 Footrests

Any worker who cannot easily place his feet flat on the floor, when using the seat adjusted to be correct working height, needs a footrest. Footrests can be either sloping or flat, fixed or free-standing, and they should be large enough to enable the worker to vary the position of the feet. Free-standing footrests should not be so light that they are easily moved accidentally. Some high-seated chairs have a build-in footrest.

### 4.2.5 Mobility

Swivel-action chairs with castors or glides have great advantages over static chairs in most work situations. They make simple action such as getting up, drawing the chair up to the work, and turning from one task to another more comfortably and place less stress on the body. They help to make everyday tasks safer, for example by helping the worker to avoid awkward twisting movements when reaching into a low desk drawer. (see Figure 4)



Fig 4 : A potentially unsafe bend and twist position

It is important to ensure that chair with castors do not present a hazard by sliding away too easily, for example when the user gets up or sits down. This can be a problem with chairs used on hard floors, and those with a high or tilting seat. Different types of castors are available to meet varying needs; some seating is designed so that a brake is applied when the chair is sat on, or brake released when a load is removed. Some are designed for use on carpeted floor, others for hard floors. It is important to choose the type which best suits the intended use. In some situations glides are a safe alternative to castors.

## 4.2.6 Adjustability

Adjustments are common to seat heights and the backrests height and tilt, as mentioned above. In some chairs the seat and backrest tilt forward together; this feature can reduce neck discomfort and also improve the workers reach over the work surface. Some backrest can be adjusted backwards and forwards, in effect changing the depth of the seat to suit the individual worker. Armrests which adjust in height can be useful in jobs which require a steady arm, as they can give the arm support at precisely the right height for the individual.

The design of adjustment mechanisms should be such that workers will find them convenient to use from a sitting position. They must be strong and reliable: workers will have their weight on the seat when making adjustments and any sudden slip or failure could be dangerous. Mechanisms must also be designed in such a way that the user cannot trap his or her fingers even when carring out adjustments by feel.

## 4.2.7 Gas lift chairs

Many pedestal chairs have compressed gas in a cylinder under the seat which enables the seat height to be easily adjusted. There have been a few incidents, affecting chairs of a particular design, where the cylinder has failed through metal fatigue causing parts to be forcefully expelled. The following advice applies to all gas pedestal chairs:

- If the seat wobbles suddenly, or tips, do not examine or try to fix it-leave well along. Telephone the supplier at once to ensure the chair receives expert attention.
- Nobody weighing more than 100 kg should use a gas lift chair unless it has been specially designed to accommodate heavier people safely.
- The chair must not be misused.
- Contact the supplier if any defect is noticed and before having the chair renovated.

## 4.2.8 Upholstery

The seat, armrests and backrest should be well padded, so that the workers body does not press uncomfortably on the frame of the chair. Padding should be firm, rather than soft, and of good quality, so that a chair remains comfortable in use for a reasonable period of time.

Chair covers should be non-slip, easy to clean or wash, and of a fabric which breathes, i.e. is permeable to moisture. It is best to choose good-quality, durable covers, especially if they cannot easily be changed. Moulded armrest can be a good, and extremely durable, alternative to the upholstered sort.

In very dusty or dirty environments, PVC-covered chairs which can easily be wiped down or sport-cleaned may be more practical than chairs with fabric covers, although they are less comfortable to sit in for long periods or in warm atmospheres. Corners and edges should be well-padded to reduce the likelihood of damage. Chairs with removable covers which can be frequently washed or cleaned may be suitable alternative. Moulded plastic chairs are practical from a cleaning point of view, but are not comfortable to sit in for long periods; they may also be unsuitable in very warm conditions, where they may lose their rigidity, and in cold conditions, where they can become brittle.

### 4.2.9 Durability

Seating at work has a tough life. It is often subject to use for long periods at a time. Both for safety and durability, seating must be strong and stable. So, the design and construction of seat should follow an equivalent standard to eliminate any design or manufacturing weakness which could cause sudden failure and possible injury.

## 5.0 SELECTION OF SEATING

5.1 When selecting work seating, the general principe set out before (section 3) are obviously relevant. An adjustable chair of the type described above and illustrated at figure 3 is suitable for a wide range of work. In some work situations, a non-adjustable chair may be adequate, though it will not fit all size of workers. Adjustable chair are preferable as they are more versatile and suit a wider range of people.

5.2 The importance of analysing the tasks required of the worker and designing the job and the workstation accordingly, has already been stressed. It is worth considering carrying out user trials, which can help in avoiding expensive mistakes. These could, for example, involve people of different sizes and shapes trying out sample seating for a period. It is in any case sensible to consult workers on any important changes to their place of work, including new seating - their ideas can often result in improved efficiency.

5.3 When choosing seating for work, employers will find it helpful to remember the following points:

- Solution Chairs should be comfortable to sit in for substantial periods, and should normally be adjustable.
- **b** The seat and backrest should be firmly padded and the front edge of the seat in particular should be well padded. The covers should be comfortable to the touch.
- **b** The armrests, if any, should not stop the chair being drawn up close to the worktop or restrict arm movements.
- The distance between the seat and working height (desktop, workbench, keyboard etc) should be between 210 mm and 300 mm. The underside of work top should clear the seat by at least 170 mm, preferably more. This is illustrated in figure 5.
- The backrest should be of a size and shape which support the lower and middle back properly. It should be set neither too far back nor to far forward, and it should not be so large as to restrict movements of arms and shoulders.

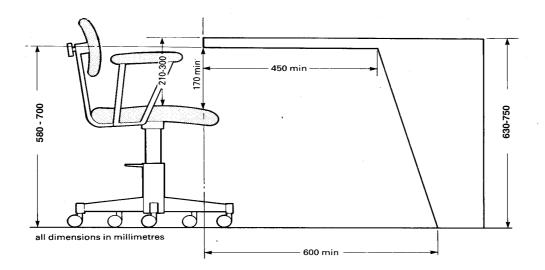


Fig 5 : Dimensions of and relationships between chair and worksurface

5.4 Seating for workers with mobility problems, back troubles or other disabilities should be given special consideration. The workers preferences and available medical advice should be taken into account. The following points should be borne in mind:

- Workers who find difficuty in getting out of a chair may need a higher than normal seat. The work surface may have to be raised as a result. Armrests and a forward tilting seat can also make rising easier. Castors should be avoided if there is any risk of the chair slipping back when the armrests are used as support when rising.
- Workers using wheelchairs may need to have the access to the workstation widened and the height of their work surface modified.
- Workers who suffer from back, shoulder or neck pain may need a high supportive backrest. Armrests can help people who are infirm.

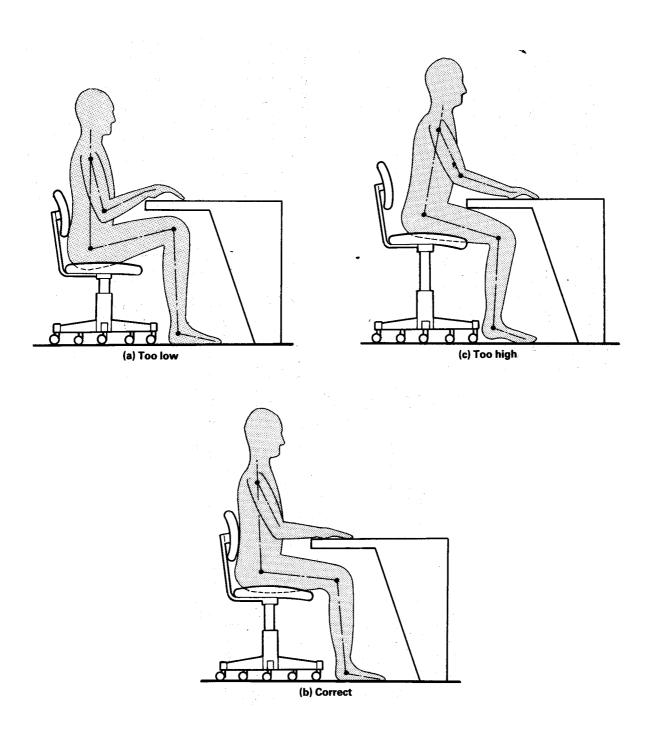


Fig 6 : Well and poorly adjusted seats

# 6.0 SEATING IN USE

6.1 It is important that employees know how to adjust their chair, and actually do so, to find a position that is comfortable for them. They should also be encouraged to use the backrest so that their back is properly supported. If a worker complains of discomfort, or adopts an obviously unsatisfactory position, it is important to investigate the cause and to try to eliminate it. The chair may simply need to be adjusted to suit the individual. Alternatively the chair may be unsuitable, because for example it is non-adjustable or will not adjust sufficiently to suit the individual or the height of the work surface. The padding may have lost its firmness and need replacing. On the other hand, the problem may lie with poor positioning of equipment, or of the work itself, in relation to the worker, resulting in strain on the back, shoulders, neck or arms. People often try to offset the problem by perching on the edge of the seat, but this can itself put strain on the back and should not be regarded as a satisfactory position to work in.

6.2 Seating must be treated properly if it is to remain safe in use and give good service. It is bad practice to put too much weight on the armrests by sitting on them or leaning heavily over them, to rock backwards so that the front castors lift off the floor, or to stand on chairs or use them for moving furniture or equipment. These practices can be dangerous, and can cause damage which may leave chairs unsafe to use. Employers have a responsibility for ensuring that seating remains in a clean, safe condition.

6.3 It is good practice for seating to be regularly checked which inneed of for signs of damage and excessive wear, particularly on the adjustment mechanisms, service or repaire if necessary. Unsafe seating should be removed or made safe without delay.

6.4 While remain seated, moving about pedalling with feet is to be avoided as this would creat undue stress to the vertebral column.

# 7.0 EXAMPLE OF SEATING AND WORKSTATION LAYOUT

### 7.1 Work with machinery

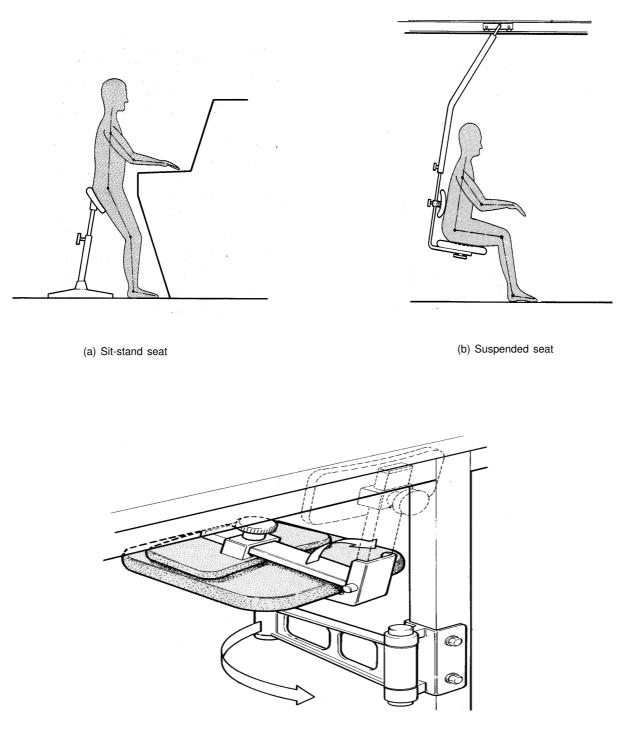
When workers operate or monitor machinery, the workstation should be arranged such that they can sit, or if necessary stand, and carry out their tasks in a comfortable position. Strained positions, for example craning the neck or leaning to one side, and repeated twisting or stretching movements, are uncomfortable and will eventually lead to injury. It is therefore important that the workstation and the job are designed in such a way that these are avoided. Hand controls should be within easy reach and designed for easy use. Sufficient room should be provided for the knees and legs. If materials have to be fed into a machine by hand, bending can be avoided by having the material at waist height and on a rack which can be raised mechanically as the pile of material reduces.

In some situations, it may not be practical to use a standard chair. Nevertheless some form of seating should be provided wherever possible, with the seat at the correct height for the task. Several possibilities include:

*Lean-on or sit-stand seats.* These can be helpful when working with machinery, or at an assembly line or high bench, where a conventional chair is not practicable - for example because of inadequate knee-room. The worker leans on a forwards-sloping seat, which adjusts in height to suit the individual, taking some of the weight off the feet. see figure 7(a).

*Wheeled, sliding or suspended seat*. These are sometimes used when workers need to move frequently from one machine or to another at different locations. see figure 7(b).

**Fixed seats.** These may be used where space does not permit a normal chair. They may be of the swing-out or flap-down type which tuck away when out of use. If the seat is fixed to a machine, it should not vibrate as this can cause discomfort. see figure 7(c).



(c) Fold away seat

Fig 7: Some special types of seating

### 7.2 Prosess or assembly work

If a job involves a sequence of tasks, the work ideally should be arranged in a semi-circle around the worker, rather than in a straight line. A swivel chair should be provided so that all point on the semi-circle can be reached from a sitting position. It is more efficient for the work to place within reach to the worker where turntables, jigs and holders can all be used to ensure such requirements. Chair with a forward-tilting seat and backrest can help the worker to reach further without loss of support. Others ways of improving workers reach and comfort include using a slightly sloping work surface or sloping component trays. Rack for finished items and materials should be within easy reach and at a comfortable height.

### 7.3 Precision work

Instrument engineers, laboratory technicians and draughtsmen are examples of workers who tend to lean forward and adopt a tense posture. This can give rise to pain in the back, shoulder or neck. A worker will need a comfortable chair with an adjustable, supportive backrest. It may also be helpful to have a chair with a forward-tilting seat and backrest, and/or a work surface which slopes towards the worker. see figure 8.

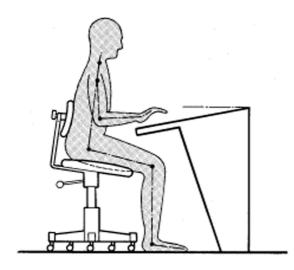


Fig 8 : Tilting seat - shown here with sloping worktop - to improve comfort and reach

#### 7.4 Keyboard work

Table for typing work are normally slightly lower than normal writing desks to allow for the extra height of the typewriter. Higher tables can be placed at right angles for filing trays and non-typing tasks. However, modern word processors often have a very low keyboard which can be used on a normal height desk. For typists, a fairly high backrest can reduce discomfort by allowing the back and shoulders to relax during pauses, but it should not be so wide that it restricts arm movements. Workers who type or key information from a document lying flat on the work surface is likely to suffer from neck pain result of stooped posture. see figure 9 and 10.

Work with visual display units (VDUs) call for careful planning. A common problem is the difficulty of finding a suitable seat height, either because desk thickness does not give enough clearance for the thigh or the seat is not adjustable.

(Please refer to Guildelines for Work with VDU's, ISBN 983-2014-27-1)

Fig 9 : Typist workstation



Fig 10 : VDUs workstation

### 7.5 Check-outs counter

Check-outs counter in shops call for careful planning because of the various task which have to be carried out in normally very limited space area. The working area should design with frequent tasks kept within easy reach (about 400mm of the worker), and allow a worker to sit close to the task without anything pressing on his or her legs. Chairs should preferably be chosen in consultation with the workers themselves. It should be possible for workers to reach everything without strain and without having to perch on the edge of the seat. Chairs should not be fixed to the floor, as each worker will have his or her preferred position. If space is limited, a fairly compact design can be chosen, but not to sacrifire comfort. Controls to adjust the seat and backrest should be easily accessible without moving the chair and should be easy to operate from a sitting position.

With variable design of check-out areas available, it is not possible to recommend one single design of chair. For example the height of the seat will depend on the height of the counter, which may be set fairly high for customers convenience, and on whether the working area is raised above the shop floor or not. Certain features will be important in all cases. The upholstery should feel comfortable, and be durable and easy to clean. The seat should swivel, adjust in height, and be well padded especially at the front edge. The backrest should adjust both in height and in tilt. A footrest will usually be necessary, as the chair is likely to be used by a number of people of varying size. A forward-tilting seat can help the user to reach further without strain. Staff should be shown how to adjust the chair to suit themselves, and be encouraged to do so at the beginning of each shift.

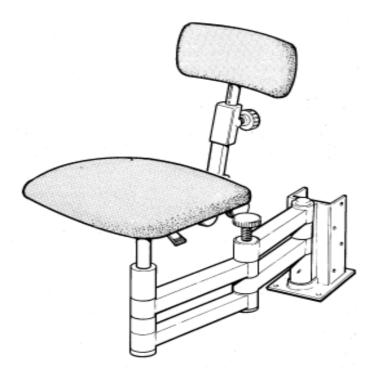


Fig 11 : An example of good check-out counter chair

#### 7.6 Microscope Workstation

Looking through a microscope for extended periods is not what we were designed for. It requires holding our bodies in an unnaturally rigid position. It is important to adopt a correct, ergonomic working posture. This means fitting the workstation to the worker, not vice versa. It is also important to take regular breaks.

Ideally, the microscope should be on a bench which is adjustable for height and the seating position is adjusted followed by the bench height. Examples for Microscope Workstation as Figure 12 and Figure 13 with improvement working posture.

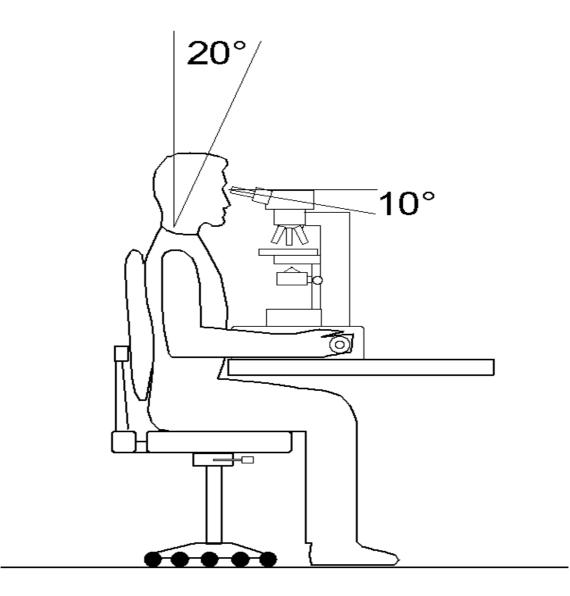


Fig 12 : Microscope Workstation



**BEFORE** : Microscope workstation, leads to uncomfortable work posture with bending



AFTER : Height-adjustable the microscope allows comfortable, upright work posture

Fig 13 : Improvement Microscope Workstation

When set-up for microscope workstation, the following points should be in mind;

- Oculars level with eyes, raise bench or microscope to suit with the operator
- Oculars over front edge of bench, move microscope to suit with th operator
- Upright posture with major joints at near-right angles
- Ergonomic chair adjusted to support back and thighs
- Fore-arms supported, not under long periods of static load
- Wrists straight, hands in 'shake-hands' position
- Feet comfortably supported by floor or footrest.

### 8.0 REFERENCES AND FURTHER READING

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Appendix 1

## **BASIC WORKSTATION CHECKLIST**

### Guidance for use of the workstation checklist.

The workstation checklist is designed for use in assessment of individual work area.

The general principles also apply to other workstation such as laboratory benches and drafting benches.

The checklist may be used by staff for their guidance and to enable identification of potential problems areas.

If you can tick all of the white boxes then the workstation meets the minimun required standard				
Name	:			
Location	:			
Date checl	ked :			

### FURNITURE

Desks or benches large enough to accommodate all work? (*Desk size at least 750mm x 1500mm*)

It is height of the desk top surface between 630mm to 730mm?

Sufficient leg room beneath the desk or bench? (Legspace at least 800mm width of legspace beneath the desk, 600mm deep & 450mm deep below the desk top surface)

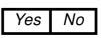
It is desk top no thicker than 30mm above the legspace?

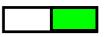
Chairs adequately padded?

Chair with adjustable height? (The seat height adjustable range at least 360mm to 520mm)

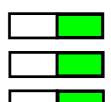
Chair with the effective seat width at least 400mm?

Chair with adjustable seat and backrest angle? (Seat angle adjustable limited to between 10° forward and 5° backward) (Backrest angle between 90° to 110° backward)









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	Yes No
Chairs with swivel through 360 degrees?	
Chair have five base support points?	
Feet on floor or footrest with thighs parrallel to floor?	
Footrest surface large enough for both feet if footrest is used?	
It the armrest height between 200mm and 250mm?	
Are the armrest at least 40mm?	
Is the spacing between inside edges of armrest at least 475mm and no more than 530mm?	
Neck - twisted or strained in order to see work?	
Suitable copyholder used if necessary?	
KEYBOARD	

### KEYBOARD

Thin keyboard (30mm or less)?

Keys-stiff to touch?

## MOUSE

Mouse within easy reach?

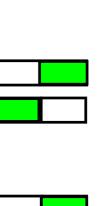
Mouse buttons-stiff to touch?

## **VDU SCREENS**

Screen at a comfortable reading distance?

Image clear and stable?

User looking at top edge of screen when looking straight ahead?



## LIGHTING

Does the lighting level appear to be satisfactory?

Is there glare on the VDU screen?

Are the reflections from work surfaces?

Are VDU screens located so that operators don't look directly toward or away from windows?

## NOISE

Does the noise level allow concentration?

## SPACE PER PERSON

Is there 3 square metres of floor space exclusive of furniture, fittings and equipment per person? Floor space.....

Yes	No

