

Guide to the Safety, Health and Welfare at Work (General Application) Regulations 2007



Chapter 5 of Part 2: Display Screen Equipment

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**Guide to the
Safety, Health and Welfare at Work
(General Application)
Regulations 2007**

**Chapter 5 of Part 2:
Display Screen Equipment**

Contents

Introduction	5
Regulation 70: Interpretation for Chapter 5 (of Part 2)	6
Regulation 71: Non-Application of Chapter 5 (of Part 2)	7
Regulation 72: Duties of Employer	8
Regulation 73: Provision of Eye Tests and Corrective Appliances	12
Schedule 4: Minimum Requirements for All Display Screen Equipment	15
1. Equipment	17
2. Environment	20
3. Employee/computer interface	22

Guide to Chapter 5 of Part 2 of the General Application Regulations 2005

Chapter 5 of Part 2: DISPLAY SCREEN EQUIPMENT

Introduction

This Guide is aimed at safety and health practitioners, employers, managers, employees, safety representatives and others to give guidance on Chapter 5 of Part 2 (Regulations 70 to 73) and the related Schedule 4 to the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) relating to display screen equipment. The objective of the Guide is to give general guidance aimed at the prevention of occupational accidents or ill health. *It is not intended as a legal interpretation of the legislation.*

Chapter 5 of Part 2 of the Regulations transposes Directive 90/270/EEC on the minimum safety and health requirements for work with display screen equipment. In effect, the provisions relate to the safety and health requirements for employees who habitually use display screen equipment (VDUs) as a significant part of their normal work.

From 1 November 2007, Chapter 5 of Part 2 of the General Application Regulations 2007 replaces Part VII, Regulations 29 to 32, and the Tenth Schedule to the Safety, Health and Welfare at Work (General Application) Regulations 1993 (S.I. No. 44 of 1993) relating to display screen equipment, which are revoked from that date.

The General Application Regulations 2007 are made under the Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005) referred to elsewhere in this Guide as the “2005 Act” or “the Act”.

Employers are required to evaluate health and safety at workstations with particular reference to eyesight, physical difficulties and mental stress. Appropriate steps must be taken to control any risks identified. The employer needs to carry out an analysis of individual workstations and a competent person with the necessary skills, training and experience must complete this analysis. It is not sufficient to allow employees to use a software package to assess their own workstations, the employer must be actively engaged in completing a physical risk assessment/analysis of the individual workstation. The analysis of a workstation must take account of the minimum requirements in Schedule 4 to the General Application Regulations. The results of the workstation analysis must be shared with the employee and a written record must be kept of the analysis of the workstation. Any changes to be made to the workstation to meet the requirements of Schedule 4 must be recorded.

In this Guide the text of the Regulations and Schedule is shown in italics.

Employees covered by Chapter 5 of Part 2 of the General Application Regulations:

- (i) are entitled to have their workstation assessed in line with the requirements of Regulation 72
- (ii) must be trained in the use of the workstation and be given information about health and safety factors
- (iii) must also have periodic breaks or changes of routine, away from VDUs
- (iv) must be informed by their employer that they are entitled to an appropriate eye and eyesight test (or may opt for either) before working with VDUs and at regular intervals
- (v) are entitled to an appropriate eye and eyesight test (or may opt for either) before working with VDUs and at regular intervals. If at any time working with VDUs an employee experiences visual difficulties he or she has a similar entitlement.

If special corrective appliances (spectacles) are required exclusively for working at a display screen they must be provided at no cost to the employee. Should the spectacles be used also for other purposes the employer must cover the cost of the correction required for working with display screens.

Requirements are included about the various components of the workstation from chairs to the display screen etc. and as regards the general environment of the workstation, including lighting, noise levels, heat, radiation and humidity.

The duties in the 2005 Act, particularly as regards protective and preventive services, risk assessment, information, consultation and participation and training apply to the requirements in Chapter 5 of Part 2 of the General Application Regulations dealing with VDUs. There are other specific duties in the 2005 Act which also apply to these requirements, which relate to the need for employee co-operation on matters related to safety, health and welfare.

Regulation 70: Interpretation for Chapter 5

70. *In this Chapter:*

“display screen equipment” means any alphanumeric or graphic display screen, regardless of the display process involved;

“employee” means an employee who habitually uses display screen equipment as a significant part of his or her normal work;

“workstation” means an assembly comprising display screen equipment, which may be provided with a keyboard or input device or software, or a combination of the foregoing, determining the operator and machine interface, and includes—

- (a) a work chair and work desk or work surface,*
- (b) any optional accessories and peripherals, and*
- (c) the immediate work environment of the display screen equipment.*

The definition of “display screen equipment” (referred to in this Guide as VDUs) covers computer screens and microfiche readers and applies to both conventional cathode ray tube (CRT) display screens and other display processes such as liquid crystal displays. Display screens when showing films, videos, television pictures or for surveillance purposes are not covered. However, display screens capable of being used for a range of functions such as video viewing, as a television screen, as well as for word-processing or viewing of data and graphics will need to be assessed to establish the use of the screen and whether, if there is greater habitual use for data and graphics, it falls within the scope of the Regulations.

A laptop is not covered by these Regulations due to the fact that under these Regulations the keyboard shall be tiltable and separate from the screen so as to allow the user to find a comfortable working position which avoids fatigue in the arms or hands. A laptop does not have a separate keyboard and should not be used for long periods of time and a risk assessment must be carried out to assess the usage of the laptop and the set up of the temporary laptop workstation.

(Please refer to the exclusions under Regulation 71.)

“Employee”, as defined for Chapter 5 of Part 2 of the Regulations does not include employees engaged in maintenance or cleaning of VDUs. The following will help as regards deciding whether an employee is covered by the Regulations, which apply:

- (a) If the employee has no choice but to use the VDU to carry out his or her work
- (b) If the employee normally uses the VDU for continuous periods of more than one hour
- (c) If the VDU is generally used by the employee on a daily basis.

The definition of “workstation” is all-encompassing and includes VDUs and all the individual pieces of equipment, chair, desk and work environment, which can constitute a workstation. One of the most critical factors affecting the health of employees working at VDUs is the design and layout of the workstation. A badly arranged workstation may lead to the adoption of a bad working posture with consequent pains in muscles and joints and also visual problems. There are particular requirements on this in Schedule 4 to the General Application Regulations.

Regulation 71: Non-Application of Chapter 5

This Chapter does not apply to—

- (a) *drivers’ cabs or control cabs for vehicles or machinery,*
- (b) *computer systems on board a means of transport,*
- (c) *computer systems mainly intended for public use,*
- (d) *portable display screen equipment not in prolonged use at a workstation,*
- (e) *calculators, cash registers and any equipment having a small data or measurement display required for direct use of the equipment, and*
- (f) *typewriters of traditional design, of the type known as “typewriter with window”.*

This is a list of equipment to which the duties as regards VDUs do not apply. This does not dilute an employer’s general duties of care under the 2005 Act.

Regulation 72: Duties of Employer

72. (1) *An employer, when providing display screen equipment for use by an employee at a workstation, shall—*
- (b) *ensure that the general use of the equipment is not a source of risk for the employee, perform an analysis of the workstation in order to evaluate the safety and health conditions to which it gives rise for the employees, particularly as regards possible risks to eyesight, physical problems and problems of mental stress, and, on the basis of that evaluation, take appropriate measures to remedy any risks found, taking account of—*
- (i) *the minimum requirements specified in Schedule 4, and*
- (ii) *any additional or combined effects of any such risks so found,*

Workstations must be laid out and kept tidy so as to avoid any employee slipping, tripping or falling.

Workstations must be analysed to evaluate possible risks which may give rise to visual or physical difficulties or to mental stress. This means examining each workstation taking account of the requirements in Schedule 4 to the Regulations. A competent person must carry out the analysis of the workstation and this analysis must be documented. A person is deemed to be competent if he or she possesses sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken, which in this case refers to the analysis of a workstation. Any employee using a workstation should be given the opportunity to comment in the course of the analysis. This is in addition to the employer's general duty to consult employees on health and safety matters.

A copy of the completed analysis should be given to the employee for their records and for further follow-up where required, to ensure all outstanding actions are addressed.

A documented analysis or risk assessment of a workstation should include the following:

- Brief overview of the tasks completed at the workstation
- Evidence that all aspects detailed in Schedule 4 to the Regulations were taken into account as part of the analysis
- Details of issues that need to be followed up
- Details of an action plan to address outstanding issues, which stipulates who is responsible, what actions will be taken and when they will be completed.

Some common examples of complaints that may arise from working with VDUs, which should be taken into account, are as follows:

Upper limb pains and discomfort (WRULDs)

A range of effects on the arm, hand and shoulder areas linked to work activities is now described as work-related upper limb disorders (WRULDs). These range from temporary fatigue or soreness in the limbs, to cramp, to ongoing pain in the muscles or nerves.

These effects are probably due to a number of factors rather than any single cause. Holding a part of the body rigid for a long time such as the back, neck and head may cause discomfort in the muscles, bones and tendons. Awkward positioning of the hands and wrist relative to the work being carried out is another likely factor.

These effects can be avoided by using proper equipment and suitable furniture, and through training and changing the way in which the work is carried out. Problems can be avoided by good workplace design so that one can work comfortably and by good working practices. Prevention is easiest if action is taken early through effective analysis of a workstation, having regard to the minimum requirements in Schedule 4 to the Regulations.

Effects on the eyes

Some employees may experience temporary eye fatigue, with such symptoms as failure to see clearly, red or sore eyes and headaches. Eye fatigue may also lead to employees adopting awkward postures which may cause discomfort of the limbs. Medical evidence shows that using VDUs does not cause damage to eyes or eyesight, nor does it make existing defects worse.

Eye fatigue may be caused by:

- Staying in the same position and concentrating for a long time
- Poor positioning of the VDU
- Poor legibility of the screen or source documents
- Poor lighting, including glare and reflections
- A drifting, flickering or jittering image on the screen.

While using a VDU does not cause eye damage, it may make employees with pre-existing vision defects, which are not corrected, more aware of them. Such uncorrected defects may make working with a VDU more tiring or stressful than would otherwise be the case.

Fatigue and stress

The volume of VDU work to be carried out by employees can vary widely between different employments and activities. The work may range from air traffic control to accounting, stock recording and control, or documentation creation and revision. Some tasks may require a very high degree of concentration and vigilance. More routine tasks can even give rise to boredom. Some tasks can result in stress or fatigue.

Several symptoms, including fatigue, described by VDU users can also be caused by stress arising from broader aspects of their work. They are more likely to be caused by poor organisation of the work, lack of control by the employee over the pace of the work, under-utilisation of skills, high-speed repetitive work or working in isolation. The onset of fatigue and stress can be minimised by careful design, selection and location of VDUs, good design of the workstation, its environment and the task involved as well as training, consultation and involvement of the employee.

Having examined each workstation, particularly as regards possible risks to eyesight, physical problems and problems of mental stress as outlined in Schedule 4 to the Regulations, the employer must take any necessary preventive measures to avoid risks to employees. Guidance is provided on the requirements of Schedule 4 to the Regulations which are minimum standards. Employers may apply higher

standards if they wish. Employees should be informed of the steps taken following the assessment and be provided with training. The appropriate measures that are taken must be recorded in writing and shared with the employee concerned.

The employer needs to carry out an analysis of a workstation to ensure that the workstation design meets the minimum requirements of Schedule 4 to the Regulations. If the workstation needs to be altered to meet these requirements, then a written record should be kept of all the changes put in place.

Regulation 72(1)(c): Duties of employer (continued)

- (c) plan the activities of the employer's employees in such a way that daily work on display screen equipment is periodically interrupted by breaks or changes of activity which reduce workload at the display screen,*

Employers must plan work so that daily work at VDUs is interrupted periodically by breaks or changes in activity which reduce the work at the screen. Although the Regulations set no frequency for breaks, no single continuous period of work at a screen should, in general, exceed one hour.

Regulation 72 does not specify the frequency and duration of work breaks when working with VDUs, nor is there any generally accepted standard. In some countries, including Ireland, there are employer–trade union agreements on work breaks at company level.

The flow of work to a VDU user should be designed to allow natural breaks to occur. Alternatively, a change in the pattern of work by combining VDU and non-VDU work could be introduced. However, rest breaks are essential where continuous VDU work, requiring sustained attention, is likely to result in fatigue. Ideally, the length of the rest should reflect the intensity of the individual job. However, there are four important points:

- Rest breaks or changes in the pattern of work, where they are necessary, should be taken before fatigue sets in. Some employees suffer symptoms from the effort used to keep up performance while fatigued
- The employee should not sit in the same position for long periods and should make sure to change posture as often as practicable
- Short, frequent rest breaks are more satisfactory than longer breaks taken occasionally
- Rest breaks should be taken away from the VDU. Other duties may be assigned during this period, provided they are not too intensive.

Regulation 72(1)(d): Duties of employer (continued)

- (d) without prejudice to section 9 of the Act, provide information to the employer's employees in relation to the measures applicable to workstations which have been implemented under this Regulation and Regulation 73,*

In addition to the requirement on employers under Section 9 of the 2005 Act to provide information on safety and health matters to employees, this paragraph requires an employer to provide information on VDU workstations.

Employers must inform employees of any measures taken to protect eyesight, any risks to eyesight, physical effects or stress, as well as the arrangements for rest breaks in VDU work, or changes in work activity which are planned, as well as the results of any eye or eyesight tests which are conducted. This information may include a written copy of the workstation assessment with a record of actions or changes put in place to ensure the workstation meets the minimum requirements specified in Schedule 4 to the Regulations.

Regulation 72(1)(e): Duties of employer (continued)

- (e) *without prejudice to section 10 of the Act, provide training to employees in the use of workstations before commencing work with display screen equipment and whenever the organisation of the workstation is substantially modified, and*

In addition to the requirement on employers under Section 10 of the 2005 Act to provide training on safety and health matters to employees, this paragraph requires employers to provide training in the use of the workstation before an employee commences work on a VDU and, again, should the organisation of the workstation be altered. Training should include:

- A general appreciation of the computer system to which the VDU may be linked
- Appropriate induction training. Employees should understand how the work is organised so as to comply with Chapter 5 of Part 2 of the General Application Regulations. This could include a written record of the changes made to the workstation and information on rest and posture breaks. The employees should be informed why the changes were made and the benefits of such changes
- Instruction on the general principles of ergonomics, the proper adjustment of furniture, screens, keyboard, lighting etc. so as to suit individual employee's height, reach etc. This should include a general understanding of the use of different adjustments on the work chair and correct positioning of such accessories as the mouse, document holder and telephone. If an employee spends a lot of time on the telephone during the workday, consideration should be given to the provision of telephone headsets.

A general understanding of how to adjust brightness and contrast controls on the screen to suit lighting conditions in the room.

Regulation 72(1)(f): Duties of employer (continued)

- (f) *perform a further analysis of the workstation as referred to in subparagraph (b) where—*
- (i) *an employee transfers to a new workstation, or*

- (ii) *significant new work equipment, change of equipment or new technology is introduced at an individual's workstation.*

There will be situations where employees will move to a new workstation due to changing work commitments. The employer needs to carry out a new workstation assessment at the employee's new workstation. A system should exist so that when changes such as this take place a formal request is submitted to have a new workstation assessment carried out. The analysis should take account of any changes in equipment or technology.

Regulation 72(2): Duties of employer (continued)

- (2) *Schedule 4 applies only to the extent that the components concerned are present at a workstation and that the inherent requirements or characteristics of the work do not preclude such application.*

The requirements of Schedule 4 to the Regulations do not apply when analysing a workstation under Regulation 72(1)(b) to a particular component if it is not normally part of a workstation or where the nature of the task makes compliance impossible. The following are examples where the need to comply fully with Schedule 4 may not arise:

- Where a VDU is part of a console in a plant control room and does not require a desk or, perhaps, a chair
- Radar screens used in air traffic control have characters with blurred "tails", which may be considered not to be well defined or clearly formed to indicate the movement of aircraft. Compliance in this case is not practicable.

There may be cases, for instance, in which an employee suffering from a back complaint, or perhaps in a wheelchair, may need to use a suitable alternative chair rather than one which complies with Schedule 4 to the Regulations as regards adjustability etc.

Regulation 73: Provision of Eye Tests and Corrective Appliances

73. *An employer shall, taking into account any entitlement which an employee may have to any tests and appliances provided by the State relating to eyesight and appliances, ensure that—*
- (a) *the provision of an appropriate eye and eyesight test, carried out by a competent person, is made known to and is made available to every employee—*
- (i) *before commencing display screen work,*
- (ii) *at regular intervals thereafter, and*
- (iii) *if an employee experiences visual difficulties which may be due to display screen work,*

The employer must inform employees that they are entitled to be provided with an appropriate eye and eyesight test, which would be carried out by a competent person. The employer may do this in a number of ways including the following:

- Consult with the safety representative(s) and formulate a memo to be placed on a notice board
- Inform the human resource manager/specialist and request that he or she inform all relevant employees of the availability of such tests

- Inform the employee while carrying out the analysis of the workstation
- Other appropriate means of effective communication.

Eye and eyesight tests

Every employee who habitually uses a VDU as a significant part of normal work has a right to opt for an eye test and an eyesight test, which must be made available by the employer at his or her own cost, except where there may be a social welfare entitlement. While VDUs are now a common feature in many

employments, this right applies only to employees with habitual and significant use. This could mean using a VDU for one continuous hour or more as part of everyday work.

Eyesight test (visual ability)

An eyesight test means a test of a person's ability to see (visual ability), to focus at various distances (including the intermediate distance, 30 cm to 60 cm, at which the VDU screen is normally placed) and to keep the two eyes co-ordinated. A doctor or optometrist can carry this out. It may also be carried out by a person (including a nurse) trained to use a vision-screening machine. The person operating the machine must know when to refer employees who do not pass the eyesight tests at the screening level to a doctor or optometrist. Problems with visual ability, which arise at any stage during life, may give rise to a need to wear spectacles.

Eye test

An eye test means an examination of the eye using an ophthalmoscope normally carried out by a doctor or optometrist. Though entitled to an eye test and eyesight test, the first approach by an employee is likely to be to have an eyesight test. If the eyesight test results in the employee being referred on to a doctor or an optometrist, they will probably do a further eyesight test as well as an eye test and will decide if the employee needs particular lenses for VDU work. While the tests should be available to all eligible employees, those suffering from visual difficulty or eyestrain, either before or during work with a VDU, should, in particular, avail of the option.

Combined eye and eyesight test

The combined eye and eyesight test performed by an optometrist or doctor should include the following tests:

- Either monocular vision or good binocular vision. In the latter case, heterophoria should be well compensated, with prisms if necessary. Diplopia is not admissible
- No obvious central (+/- 20 degrees) visual field defects in the dominant eye
- Normal near points of convergence and accommodation for the user's age
- Clear ocular media. Absence of ocular disease
- Normal colour vision is ONLY required if the VDU work is unusually colour dependent
- Measurement and assessment of refractive error.

Schedule for testing

Employees have the right to an eye and eyesight test before taking up work if it is habitual work with a VDU (one continuous hour or more every day) as well as at regular intervals. In determining the intervals, factors such as the ages of the employees and the intensity of VDU work should be taken into account in deciding the frequency of repeat tests.

Regulation 73(b): Provision of eye tests and corrective appliances (continued)

(b) if the results of a test under this Regulation show that it is necessary, an ophthalmologic examination is carried out on the employee concerned, and

Where complex problems are detected the doctor or optometrist will refer the employee to a specialist ophthalmologist for attention.

Regulation 73(c): Provision of eye tests and corrective appliances (continued)

(c) where the results of a test or an examination under this Regulation show that it is necessary, and if normal corrective appliances cannot be used, the employee concerned is provided with special corrective appliances appropriate to his or her work.

Where eye tests carried out by the doctor or optometrist reveal that particular lenses are required for VDU work, the costs of minimum requirement frames and lenses must be borne by the employer, taking account of any social welfare entitlement that might apply. Where an employee already wears glasses to correct a visual defect (normal corrective appliances), and routine change of lenses arises, if these glasses are adequate also for VDU work, the employer is not liable as regards meeting the cost. The cost of dealing with more general eye problems which are revealed as a result of the tests and which are not directly related to working with a VDU is a matter for the employee as part of his or her general health care, taking account of health care entitlements.

SCHEDULE 4

Regulation 72

MINIMUM REQUIREMENTS FOR ALL DISPLAY SCREEN EQUIPMENT

1. Equipment

(a) Display screen

- (i) *The characters on the screen shall be well defined and clearly formed, of adequate size and with adequate spacing between the characters and lines.*
- (ii) *The image on the screen shall be stable, with no flickering or other forms of instability.*
- (iii) *The brightness or the contrast (or both) between the characters and the background shall be easily adjustable by the employee and easily adjustable to ambient conditions.*
- (iv) *The screen shall be free of reflective glare and reflections liable to cause discomfort to a user.*
- (v) *The screen shall be able to swivel and tilt easily and freely to suit the needs of the user.*
- (vi) *It shall be possible to use either a separate base for the screen or an adjustable table.*

(b) Keyboard

- (i) *The keyboard shall have a matt surface to avoid reflective glare.*
- (ii) *The arrangement of the keyboard and the characteristics of the keys shall be such as to facilitate the use of the keyboard.*
- (iii) *The symbols on the keys shall be adequately contrasted and legible from the design working position.*
- (iv) *The keyboard shall be tiltable and separate from the screen so as to allow the user to find a comfortable working position which avoids fatigue in the arms or hands.*
- (v) *The space in front of the keyboard shall be sufficient to provide support for the hands and arms of the user.*

(c) Work desk or work surface

- (i) *The work desk or work surface shall have a sufficiently large, low-reflectance surface and allow a flexible arrangement of the screen, keyboard, documents and related equipment.*
- (ii) *The document holder shall be stable and adjustable and shall be positioned so as to minimise the need for uncomfortable head and eye movement.*
- (iii) *There shall be adequate space for users to find a comfortable position.*

(d) *Work chair*

- (i) *The work chair shall be stable and allow the user easy freedom of movement and a comfortable position.*
- (ii) *The seat shall be adjustable in height.*
- (iii) *The seat back shall be adjustable in both height and tilt.*
- (iv) *A footrest shall be made available to any user who requires one.*

2. *Environment*

(a) *Space requirements*

The workstation shall be dimensioned and designed so as to provide sufficient space for the user to change position and vary movements.

(b) *Lighting*

- (i) *Lighting (including room lighting, spot lighting or work lamps) shall ensure satisfactory lighting conditions and an appropriate contrast between the screen and the background environment, taking into account the type of work and the user's vision requirements.*
- (ii) *Possible disturbing glare and reflections on the screen or other equipment shall be prevented by co-ordinating the layout of workstations within the place of work with the positioning and technical characteristics of the artificial light sources.*

(c) *Reflections and glare*

- (i) *Workstations shall be so designed that sources of light, such as windows and other openings, transparent or translucent walls and brightly coloured fixtures or walls cause no direct glare and, as far as possible, no distracting reflections on the screen.*
- (ii) *Windows shall be fitted with a suitable system of adjustable covering to attenuate the daylight which falls on the workstation.*

(d) *Radiation*

All radiation, with the exception of the visible part of the electromagnetic spectrum, shall be reduced to negligible levels from the point of view of the protection of employees' safety and health.

(e) *Noise*

Noise emitted by equipment belonging to a workstation shall be taken into account when a workstation is being equipped, in particular so as not to distract attention or disturb speech.

(f) *Heat*

Equipment belonging to a workstation shall not produce excess heat which could cause discomfort to employees.

(g) *Humidity*

An adequate level of humidity shall be established and maintained.

3. *Employee/computer interface*

In designing, selecting, commissioning and modifying software, and in designing tasks using display screen equipment, the employer shall take into account the following principles:

- (i) *software shall be suitable for the task,*
- (ii) *software shall be easy to use and, where appropriate, adaptable to the employee's level of knowledge or experience; no quantitative or qualitative checking facility may be*

- used without the knowledge of the employees,*
- (iii) systems shall provide feedback to employees on their performance,*
- (iv) systems shall display information in a format and at a pace which are adapted to employees, and*
- (v) the principles of software ergonomics shall be applied, in particular to human data processing.*

Commentary

Many of the above requirements are self-explanatory and guidance is provided below only where necessary.

1. Equipment

(a) Display screen

- (i) The characters on the screen shall be well defined and clearly formed, of adequate size and with adequate spacing between the characters and lines.*

The characters on the screen should be well defined and clearly formed so that letters and numerals may be easily recognised and clearly distinguished. The spacing between characters and between lines should also allow for an easily legible text on the screen. The legibility of characters, which depends mainly on the way they are created, their size and shape, is particularly important for avoiding eyestrain. It may be useful to provide training to employees on the use of relevant software so that they can make their own adjustments to documents to allow easy readability.

A minimum character height of between 3.1 mm to 4.2 mm in the 350 mm to 600 mm viewing range – with a maximum viewing range of not more than 700 mm – is recommended.

- (ii) The image on the screen shall be stable, with no flickering or other forms of instability.*

In order to keep the characters visible on the screen, the signal must be continuously refreshed, i.e. regularly rewritten on the VDU. A flickering, swimming or shimmering effect which can arise may be minimised by operating VDUs at a recommended minimum 50 hertz refresh rate.

- (iii) The brightness or the contrast (or both) between the characters and the background shall be easily adjustable by the employee and easily adjustable to ambient conditions.*

The VDU should be capable of adjustment for contrast and brightness by the employee to obtain a suitable working condition. This will help avoid eyestrain and should help to maintain the quality of work produced. Excessive contrast between the characters and the general background on the VDU should be avoided.

(iv) The screen shall be free of reflective glare and reflections liable to cause discomfort to a user.

The display screen should be free of reflections and work surroundings should have a low-reflectance finish. When replacing monitors preference should be given to

those with a non-reflective finish. The assessment should also take account of the position of the monitor in relation to the source(s) of light.

(v) The screen shall be able to swivel and tilt easily and freely to suit the needs of the user.

Equipment on the market will in general be capable of being swivelled and tilted.

(vi) It shall be possible to use either a separate base for the screen or an adjustable table.

To adjust the screen and the working height or position of the employee, it should be possible to move the screen upwards or downwards as necessary. This is possible either by using a stand on an adjustable arm or an adjustable stand or building blocks.

(b) Keyboard

(i) The keyboard shall have a matt surface to avoid reflective glare.

(ii) The arrangement of the keyboard and the characteristics of the keys shall be such as to facilitate the use of the keyboard.

The keyboard should be designed so that the employee can work efficiently in reasonable comfort. The position of the keyboard should allow sufficient resting space for the employee's hands and arms to be supported. There should be no friction between the edge of the keyboard and the employee's wrists. The keyboard should be detachable so that the employee can find a suitable working position and avoid straining hands and arms.

It should be positioned so that the angle at the employee's elbow (when seated) between the forearm and the upper arm is in the range of 70° to 90°.

The employee should be able to look at parts of the keyboard used frequently without lowering the head. The keys should have low-reflectance surfaces and should have concave tops to follow the contours of the fingertips.

The employee should be able to maintain neutral wrist posture when working at the keyboard.

(iii) The symbols on the keys shall be adequately contrasted and legible from the design working position.

Modern keyboards on the market will meet these requirements based on current standards.

(iv) The keyboard shall be tiltable and separate from the screen so as to allow the user to find a comfortable working position which avoids fatigue in the arms or hands.

Keyboards which can be tilted and which are separate from but connected to the screen are currently available.

- (v) *The space in front of the keyboard shall be sufficient to provide support for the hands and arms of the user.*

There should be sufficient space on the desk to place the lower arms and hands so as to avoid fatigue.

(c) Work desk or work surface

- (i) *The work desk or work surface shall have a sufficiently large, low-reflectance surface and allow a flexible arrangement of the screen, keyboard, documents and related equipment.*

The work desk, which should have a matt or semi-matt surface, should permit a flexible arrangement of the screen, keyboard and document holder. The desktop should be as thin as possible to allow for knee clearance but should be sufficiently strong. It should also be adjustable to allow adequate thigh clearance for the employee. Devices for adjusting the desk should be within easy reach of the employee when seated. Storage space for documents etc. should be provided in the desk without interfering with comfortable use of the screen. The area underneath should be clear of any materials in order to allow adequate knee clearance. There are standards available, which will give recommended specifications for office desks, which will allow for adequate knee and thigh clearance as well as other important design considerations.

- (ii) *The document holder shall be stable and adjustable and shall be positioned so as to minimise the need for uncomfortable head and eye movement.*

Standard equipment available on the market meets this requirement. The document holder should be positioned in a manner which allows the employee to read the document without awkward extension or bending of the neck.

- (iii) *There shall be adequate space for users to find a comfortable position.*

(d) Work chair

- (i) *The work chair shall be stable and allow the user easy freedom of movement and a comfortable position.*
- (ii) *The seat shall be adjustable in height.*
- (iii) *The seat back shall be adjustable in both height and tilt.*
- (iv) *A footrest shall be made available to any user who requires one.*

Work chairs should be stable and should allow the employee easy freedom of movement. The seat height of all chairs should be adjustable with backrests adjustable in height and tilt. The support area produced by back rests for the employee's lower back should be as large as possible so as to avoid undue pressure on the employee's thighs and spine. All employees using VDUs should be

instructed in how to adjust chairs properly in order to find the best sitting posture to avoid the long-term problems of muscular strain and backache.

2. Environment

(a) Space requirements

The workstation shall be dimensioned and designed so as to provide sufficient space for the user to change position and vary movements.

There should be sufficient space for the employee to feel comfortable and to have room to stretch or reach arms or legs and to turn from side to side. In office environments, 4.65 square metres should be the minimum amount of floor space allowed for every person employed in any room, including the area occupied by the office desk and chair but excluding filing cabinets and other office furniture.

(b) Lighting

- (i) *Lighting (including room lighting, spot lighting or work lamps) shall ensure satisfactory lighting conditions and an appropriate contrast between the screen and the background environment, taking into account the type of work and the user's vision requirements.*
- (ii) *Possible disturbing glare and reflections on the screen or other equipment shall be prevented by co-ordinating the layout of workstations within the place of work with the positioning and technical characteristics of the artificial light sources.*

Correct lighting arrangements are essential if eye fatigue is to be avoided. Suitable background lighting is required for VDU work to provide an appropriate contrast between the screen and the background environment and to avoid problems of reflection and glare. As a general rule, a level of lighting of 300 to 500 lux should be appropriate. If more light is required for reading documents, local lighting should be used. However the light from a table lamp etc. must not shine on the VDU or the immediate surrounding area. Below are some general points to consider in relation to lighting:

- All lights should be provided with shades or glare shields
- A lux meter is a simple device for measuring light levels
- The use of reflective colours and materials on machines, apparatus, table tops, switch panels and so on should be avoided.

(c) Reflections and glare

- (i) *Workstations shall be so designed that sources of light, such as windows and other openings, transparent or translucent walls, and brightly coloured fixtures or walls cause no direct glare and, as far as possible, no distracting reflections on the screen.*
- (ii) *Windows shall be fitted with a suitable system of adjustable covering to attenuate the daylight which falls on the workstation.*

Reflections and glares may cause discomfort for the employee by making it difficult to see the information on the VDU. It is essential that VDUs should be positioned so that neither the screen nor

the employee is facing a window. For greatest comfort the employee's line of vision should be parallel with the lines of overhead light fittings. Where fluorescent lights are used, they should be fitted parallel to the sides of the VDU and not parallel to the screen face. VDUs should not be positioned

directly under overhead lights. Windows should be fitted with suitable blinds etc. that can be adjusted to reduce light and glare.

(d) Radiation

All radiation, with the exception of the visible part of the electromagnetic spectrum shall be reduced to negligible levels from the point of view of the protection of employees' health and safety.

In view of the design of VDU 's and the published data no special protective measures such as additional screens are considered necessary to protect the health of people from radiation.

(e) Noise

Noise emitted by equipment belonging to a workstation shall be taken into account when a workstation is being equipped, in particular so as not to distract attention or disturb speech.

Certain keyboards and printers, or numbers of them located near each other, may be sources of noise at computer workstations. Noise can disrupt the employee's concentration particularly where a number of computer workstations are in operation. The repositioning of printers and other equipment can reduce noise. Reflected sound can be reduced by the use of sound absorbent partitions and suitable floor coverings. Where printers are installed near the employee, suitable housings designed to reduce noise should be provided.

(f) Heat

Equipment belonging to a workstation shall not produce excess heat which could cause discomfort to employees.

VDU equipment and light sources discharge a certain amount of heat. Work areas should be well ventilated, kept at a comfortable temperature and free of draughts so as to avoid fatigue or discomfort.

For comfort indoors, the following guidelines may be applied to sedentary work, which involves little or no manual effort: at 18 to 24 degrees Celsius the relative humidity can fluctuate between 30% and 70% without creating thermal discomfort (Kroemer K.H.E, and Grandjean E, *Fitting the task to the Human*, 2000).

(g) Humidity

An adequate level of humidity shall be established and maintained.

Hot dry air will cause the eye surface to dry, creating eye irritation, which may lead to fatigue. Relative humidity of the air in the room should not fall below 30% in winter. In summer the natural relative humidity usually fluctuates between 40% and 60% and is considered comfortable (Kroemer K.H.E, and Grandjean E, *Fitting the task to the Human*, 2000).

Tests may be carried out using a wet and dry thermometer or other measuring equipment. This is particularly important where work is carried out in a relatively confined space or where there are several VDU workstations.

3. Employee/computer interface

In designing, selecting, commissioning and modifying software, and in designing tasks using display screen equipment, the employer shall take into account the following principles:

- (i) software shall be suitable for the task,*
- (ii) software shall be easy to use and, where appropriate, adaptable to the employee's level of knowledge or experience; no quantitative or qualitative checking facility may be used without the knowledge of the employees,*
- (iii) systems shall provide feedback to employees on their performance,*
- (iv) systems shall display information in a format and at a pace which are adapted to employees,*
- (v) the principles of software ergonomics shall be applied, in particular to human data processing.*

The operation of VDU systems should enable employees to work comfortably and without undue pressure or stress. Software chosen should be appropriate to the particular task and not too complicated for the employee using it. There should not be any fear on the part of employees that hidden checks on performance are being carried out. VDU systems should have features which indicate error messages, suitable assistance (help) and messages about changes in the system, malfunctions or overloading. There are limitations on the capacity of individuals to process data on VDUs and the software must be adaptable to the employee's capacities.

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