

The information included in this guide is designed to help you find ways to work more comfortably and effectively. However, only you can determine the best environment and workstation arrangement for your work. Your choices, though, should be based on an understanding that working intensely, or for a long time in uncomfortable or unnatural positions, can pose risks.

Many factors in our work environment determine whether we work efficiently and in a manner that promotes good health and safety. By considering, acting on, and periodically reevaluating the recommendations described in this guide, it is possible to create a more comfortable, more efficient, healthier, and safer environment.

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# Posture Considerations

Most people think of sitting as a resting position. However, in most situations exactly the opposite is true. Many of the seated postures we assume exert considerably more strain on the anatomy than standing.

Backaches, headaches, stiff and sore muscles, and fatigue are common symptoms of unhealthy posture. The ideal posture minimizes the anatomical strain of sitting and maximizes freedom of movement in the waist.

## Prolonged Overbending

- Strains ligaments and muscles in back
- Compresses abdominal organs impeding normal function

### Symptoms

- Lower back pain
- Fatigue

## Prolonged Extension of Arms

- Strains muscles in neck and shoulders

### Symptoms

- Stiffness and pain in neck and shoulders

## Ideal Posture

- Permits free movement

### Open Angle (+90°)

- Reduces compression of organs and back strain

### Arms Relaxed at Your Side

- Reduces neck and shoulder strain

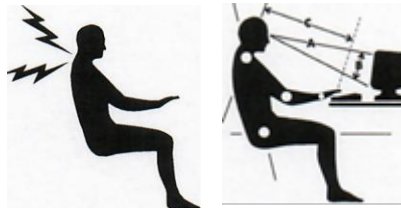
### Head Erect

- Minimizes neck and shoulder strain

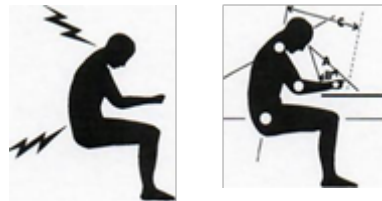
Three main factors affecting the way we sit are:



Focal Distance (A) – the distance required to effectively see task objects

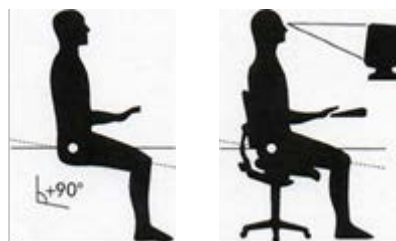


Axis of Vision (B) – the maximum angle we are able to effectively see task objects without bending our neck



Reach (C) – the minimum distance required to effectively reach task objects without altering position of the upper body

## Height, Angle, & Distance



Position equipment and materials to maintain the ideal posture

# Equipment

## Display Screens

When selecting a video display screen, choose one designed to fit the task(s) to be completed by the user. It is best to choose a screen large enough to display a sizable amount of information. For clear and stable images, the screen characters should not have a perceptible flicker or waver. Geometric designs of letters and symbols should not be distorted or appear to melt together. Character size should be sufficient for the viewing distance (i.e., based on a 20-inch viewing distance, the minimum character height should be 1/9 of an inch). The screen should have brightness and contrast controls easily accessible to the user. Screens which swivel horizontally and tilt or elevate vertically enable the operator to adjust for the best viewing angle. Mounting a video display monitor on an adjustable arm allows movement in all directions. This allows maximum adjustability and frees up work space. While an adjustable arm is the optimum solution, less expensive remedies such as small platforms should not be ruled out.

When adjusting the height of the screen, the uppermost line of the display should not be higher than the user's eye level. Most people prefer a viewing distance of 20-26 inches from their eyes to the screen.

The human eye is most sensitive to light in the green part of the color spectrum. For this reason, it is recommended that the color of the characters fall within the green-yellow part of the color spectrum. However, the character color is secondary to the need for adequate contrast and clarity of the display.

## Keyboards

Choose a detachable keyboard to allow for independent positioning and angle adjustments. Detachable keyboards allow enough flexibility to suit most tasks and the physical needs of the operator. A thin profile keyboard, fitted with a palm rest, supports the heel of the operator's

hand, minimizing both hand contact with sharp table edges and wrist deviation. A matte-finished surface reduces reflections, easing operator eye strain.

## Document Holders

The document holder should be stable and adjustable (height, distance and angle of view), provide full support of the document, and have the flexibility to be used on either side of the monitor.

The document holder should be placed adjacent to and at the same height as the display screen so the operator can look from one to the other without having to refocus or move the neck or back.

## Work Surfaces

Adjustable work surfaces need to accommodate multiple operators and a variety of tasks. It should be large enough to accommodate all required equipment. A separate keyboard shelf is also recommended. To minimize glare and reflections, work surfaces should have a matte finish.

Adequate clearance under the work surface is required to prevent injury to knees, legs, shins or thighs. The minimum depth for knee space is 23.5 inches at knee level and 31.5 inches at toe level; minimum width for knee space is 27 inches.

## Chairs

The first considerations in selecting a chair are the individual's preference, task requirements and workplace surroundings. With these considerations in mind, the key factors should be addressed:

### **Stability**

Choose a chair with a five-point base for maximum stability.

### **Seat Pan**

The seat pan contour should promote lower back contact with the backrest. The seat covering material should be porous and

breathable. Slippery seat covers cause the person to slide away from the backrest, providing no back support.

To determine the ideal seat pan length for each individual:

- have the person sit in the chair with his or her back in contact with the backrest
- measure the distance between the front edge of the seat pan to the bend of the knee. The ideal distance is a 3 to 3.5-inch allowance.

A seat pan length of 16 inches fits most people. Lengths less than 13 inches do not give adequate support under the thighs. This shifts the weight load to other tissues, leading to discomfort during long periods of sitting.

### **Seat Padding**

The front edge of the seat pan should have a softly padded, rounded front edge (waterfall edge). Hard, unpadded, flat seat pans are uncomfortable for periods of more than one hour. Soft, deeply padded seat pans cause the person to sink in too far. This transfers the weight from the buttocks to the surrounding tissues, causing tension in the hip muscles. The front edge of a straight, unpadded seat pan compresses the thigh tissues, restricts blood circulation, and causes the legs to fall asleep and leg pain.

### **Backrests**

The backrest angle and height should be easily adjustable. Specifically, backrests should have a 20-inch or higher support surface, be about 13 inches wide, and contour to the curve of the lower back with a lumbar adjustment of 2 inches. The backrest should be large enough to support the entire back, including the lumbar region. However, it should not be so large that it interferes with the use of the arms during the performance of the assigned task.

### **Armrests**

Adjustable armrests are important to allow the individual flexibility for multiple tasks.

Armrests should be:

- low enough to allow the chair to fit under the work surface
- short enough to allow the user to get close to the work while maintaining contact with the backrest.

The most comfortable armrests support the entire forearm. High armrests elevate the shoulders causing stiffness or pain to the shoulders or neck muscles. Armrests that are too low tend to promote slumping and leaning to one side, causing stress to the lower back and possibly pain.

### **Footrests**

If the operator's feet do not rest completely on the floor once the chair height has been properly adjusted, a footrest should be provided. Footrests need to be large enough to support the soles of both feet and its incline should not exceed 30 degrees.

Ideal footrests are:

- adjustable in height and inclination
- not restrictive to leg movements
- easy to move
- covered with a nonskid material to reduce foot slippage.

## **Suggested Adjustments**

### **Work Surfaces**

The work surface height should be adjustable from 23 to 30 inches. The keyboard height should range from 26 to 28 inches.

If a fixed-height work table is used, the table surface and keyboard surface should be separate, with the table surface about 29 inches high and the keyboard surface about 27 inches high.

### **Chair Height**

Correct height for a chair is when the entire soles of the feet rest completely on the floor or

footrest. The back of the knee is also slightly higher than the seat of the chair to allow free blood circulation in the legs and feet.

To properly adjust the chair height: (it helps to have assistance when doing this)

- Sit toward the front edge of the chair with feet squarely on the floor
- Place a straight edge (horizontally) under both thighs just behind the knee
- Use a yardstick to measure the distance from the floor to the top of the straight edge
- Sit back in the chair and adjust the chair height using the measurement obtained in the previous step and determine whether this height is comfortable
- If this height causes pressure to the underside of the thighs, lower the chair slightly-too low of an adjustment will create excessive flattening of the lower back.

Ideally, the chair should be adjusted first and then the workstation. In reality, the work surface height often cannot be adjusted and is normally too high. In this case, the chair height needs to be adjusted upward until the work surface is at a comfortable level. A footrest is then added as needed to compensate for the increased chair height.

## **Keyboards**

With the operator's hands resting on the keyboard, the upper arm and forearm should be approximately at a 75-125 degree angle. The hands should be positioned in a reasonably straight line with the forearms.

## **Environment**

Reach considerations are another factor when organizing your work area. Ninety-five percent of adults can reach from 22-26 inches. The maximum work area is determined by the reach of the operator without leaning forward. The most effective work area is the space under the operator's forearm without extending the arm or leaning forward.

Organize your work so that:

- routine operations are within easy reach
- your work is directly in front of you
- it is as close and comfortable to the body as possible.

The work area should also:

- accommodate the operator
- allow the operator full range of motion to perform various tasks
- provide adequate room for all required equipment and materials.

## **Lighting**

Correct lighting adds to your work effectiveness and comfort. Lighting should be arranged to support the type of work you do most often. For example, if most of your work is done sitting in front of the computer, then you should consider the following factors when arranging the lighting.

- Position the equipment or sources of light so that glare or bright reflections on the display are minimized.
- If your office has windows, use blinds, shades or drapes to control the amount of daylight in the room.
- Try locating the computer away from windows or position them at right angles to windows. This may help to minimize glare on the screen.
- Position the display between the rows of overhead light to avoid glare.
- Combine the general and task lighting for your lighting needs, but avoid bright light sources in your field of vision.
- Use recessed or indirect lighting to avoid bright spots on the display.
- To minimize glare and avoid eye fatigue surrounding walls and work surfaces should be a medium color and have a nonreflective finish.
- Screen glare filters reduce glare, but can contribute to blurring and poor contrast of screen characters. Using screen filters is a

supplementary solution and not a substitute for proper lighting.

- Overhead lighting should be equipped with diffusers, cube louvres or parabolic louvres to reduce glare.

## **Noise**

Research has indicated the sound levels produced by VDT workstations and associated equipment were consistently below those that damage hearing. However, equipment noise can still be disruptive, annoying and distracting. It is good practice to isolate main CPUs and disk drives. High-speed printers should have acoustical dampeners to control noise.

## **Radiation**

Published studies indicate that ionizing radiation emissions (such as x-rays) from VDTs are negligible and do not constitute a health hazard. Video display terminals do not produce hazardous levels of nonionizing radiation like produced by ultraviolet radiation, visible light, infrared radiation, microwaves and radio frequency radiation.

Research on two other types of nonionizing electromagnetic radiation is VLF (very low frequency) and ELF (extremely low frequency) have produced inconclusive results. Until further studies are completed, it is recommended that operators work at arm's length from the screen. Each workstation should also be positioned at least four feet from the sides or backs of other monitors.

# Personal Health

## **Fatigue**

Operator fatigue can be reduced by following a few simple steps:

- Encourage VDT operators to get up and move around regularly.
- Design the operator's workload to accommodate reasonable rest pauses.
- Practice good posture.

- Eye and body exercises help prevent operator discomfort and fatigue.
- Job rotation or substitution of a less demanding activity can allow the operator to recover from fatigue.

## **Vision Care**

Anyone may experience eye problems for a number of reasons, including aging, sleepiness, general fatigue, improper lighting or untreated vision conditions. Eye examinations should be conducted for early detection and correction of poor vision. Ongoing complaints indicate the need for prompt and complete eye examinations.

Discuss the type of work you do with your eye care specialist to ensure the best corrective lenses are prescribed. Knowing the viewing distance from your eyes to the VDT screen will help determine the focal distance. This distance can be easily measured by holding a piece of string from the bridge of your nose to the screen.

As we get older, the eye lens hardens and focusing up close becomes more difficult. This becomes noticeable about age 35 to 40. Using a VDT does not bring on this change, but it may bring it to your attention. VDT users over 40 should pay particular attention to viewing distance, glare reduction and adequate lighting. The use of bifocals or trifocals depends on personal preference as well as the kind of job being done.

Studies show that one out of every three people have some kind of uncorrected vision problem. Have your vision checked as part of your regular health care program.

# Checklist

## Work Surface

- 1. Height of work surface: Adjust 23 to 30 inches (58.4 to 76.2 cm)
- 2. Nonadjustable work surfaces: Table surface should be about 29 inches (73.6 cm) high with a keyboard surface height of 27 inches (68.5 cm)
- 3. Width of work surface: 30 inches (76.0 cm)
- 4. Thickness of work surface: 1 inch (2.5 cm)
- 5. Knee room height: Minimum of 26.2 inches (66.5 cm) nonadjustable surface and 24 inches (60.9 cm) adjustable surface
- 6. Knee room width: 27 inches (68.5 cm) minimum
- 7. Knee room depth: Minimum of 23.5 inches (59.7 cm) knee level; 31.5 inches (80.0 cm) toe level

## Chair

- 8. Seats: Easily adjustable swivel chairs on five-point base
- 9. Seat height: Adjustable 16 to 20.5 inches (40.6 to 52.1 cm)
- 10. Seat size: 15 to 17 inches (38.1 to 43.2 cm) depth; 17.7 inches (45.0 cm) to 20 inches (51.0 cm) width; "waterfall" front edge
- 11. Seat slope: Adjustable 0 degree to 24 degrees backward slope
- 12. Backrest size: 20 inches or higher (50.8 cm); 13 inches wide (33.0 cm)
- 13. Backrest height: Adjustable 3 to 6 inches (8.0 to 15.0 cm) above seat
- 14. Backrest tilt: Adjustable 30 degrees
- 15. Angle between backrest and seat: 90 degrees to 105 degrees
- 16. Angle between seat and lower leg: 60 degrees to 100 degrees
- 17. Footrests: If operator cannot keep both feet flat on floor when chair height is properly adjusted to work surface

## Entry Devices

- 18. Keyboards: Thin; detached from console; palm rest
- 19. Angle between upper arm and forearm in relation to keyboard should be between 75 and 125 degrees and the hands should be in a reasonably straight line with the forearm
- 20. Non-keyboard entry devices: Position devices following same guidelines for keyboards

## Screens

- 21. Readable with no perceptible flicker; brightness control necessary; and tilt, swivel and height adjustments
- 22. Viewing distance: 16 to 22 inches (40.6 to 55.8 cm) for focusing at close range. Research regarding VLF and ELF electromagnetic radiation advises VOT operators to work at arm's length from the screen
- 23. Eyes in relation to screen: Top most line of display should not be higher than user's eyes
- 24. Position the display screen directly in front of you
- 25. Adjust the character brightness to achieve maximum clarity of the characters
- 26. VOT screen placed at right angles to windows.



## **Glare Control**

- 27. Windows with curtains, drapes or blinds to reduce bright outside light
- 28. Lighting levels at 30 to 50 foot-candles when using a VDT; 50 to 70 foot-candles where documents are read, compared to normal office levels of 75 to 160 foot-candles.
- 29. Diffusers, cube louvers, or parabolic louvers to reduce overhead-lighting glare
- 30. Movable task or desk lights used as supplemental lighting
- 31. Adjust the character brightness to achieve maximum clarity of the characters
- 32. VDTs located between rows of overhead lighting; screen filters and/or hoods if above not successful

## **Other**

- 33. Position the height, angle and distance of task equipment and materials to maintain the ideal posture
- 34. Place document holder at approximately the same distance from your eyes as the screen
- 35. Cables and Cords: Concealed, covered or out of the way
- 36. Ventilation: Additional ventilation or air conditioning to compensate for heat generated by more than one VDT workstation in the same room
- 37. Temperature and Humidity: Maintain thermal comfort; 30-60 percent relative humidity
- 38. Noise: Acoustical enclosures for printers; main CPUs and disk drives isolated
- 39. Training: Operators trained on how to adjust chair, workstation heights, screen brightness, and correct seat posture

## **Personal Comfort**

- 40. Ensure chair height allows you to maintain the proper arm and hand position; the chair supports your lower back; and feet rest firmly on the floor or on a foot rest
- 41. Keep forearms and wrists parallel with the floor when you type; do not angle forearms upward
- 42. Type with wrists in a natural, straight position. Avoid bending, arching or angling wrists
- 43. Use the minimum amount of force needed to push down the keys. Avoid banging on the keys
- 44. Vary tasks during the day to avoid sitting in one position for several hours or performing the same tasks with your hands without interruption
- 45. Take periodic breaks and rest your eyes occasionally by focusing on a fixed point in the distance
- 46. Stretch and exercise several times a day
- 47. Be sure your screen is free of fingerprints and dust
- 48. Have your eyes examined regularly by a vision care specialist

# Individual Assessment

The following provides a tool to assess individual workstations. Other environments may necessitate adaption of this assessment tool.

Worker's Name: \_\_\_\_\_

Worker's Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

Department: \_\_\_\_\_ Job Title: \_\_\_\_\_

Shift Hours: \_\_\_\_\_ Hours/week: \_\_\_\_\_ Breaks: ~ \_\_\_\_\_

Number of employees on this same job: \_\_\_\_\_

Describe task(s) performed (in sequence):

Does the employee rotate to other jobs/workstations? YES NO

If so, how often? \_\_\_\_\_ Describe the other jobs/workstations:

How often does the employee work overtime? \_\_\_\_\_ How long? \_\_\_\_\_

Is overtime voluntary? YES NO

List machines and accessories at the workstation

Item	Manufacturer	Model	Dimensions
Footrest:			
Wrist rest:			
Chair:			
Computer:			
Keyboard:			
Desk:			
Task Light:			
Document holder:			
Others:			

## Workstation Features

Are there sharp edges that press on the worker's:

Hands      Fingers      Wrists      Forearms      Thighs      Other

Are the following items easily adjustable?

	Yes	No	Broken	Comments
Seat height	_____	_____	_____	_____
Backrest height	_____	_____	_____	_____
Backrest movement forward/back	_____	_____	_____	_____
Backrest tension	_____	_____	_____	_____
Footrest	_____	_____	_____	_____
Desk height	_____	_____	_____	_____
Computer screen height	_____	_____	_____	_____
Computer screen tilt	_____	_____	_____	_____
Distance from computer to operator	_____	_____	_____	_____
Keyboard height	_____	_____	_____	_____
Keyboard angle	_____	_____	_____	_____
Distance from keyboard to operator	_____	_____	_____	_____
Chair arms	_____	_____	_____	_____
Copy stand (document holder)	_____	_____	_____	_____
Lighting	_____	_____	_____	_____
Other	_____	_____	_____	_____

Incentive Factors	Yes	No
Is there a performance system for job evaluations (keystrokes/hour, number of errors, etc.)	_____	_____
If yes, how is the system set up?		
Is the work pace beyond the worker's control?	_____	_____

## **Seated Posture**

Ask the operator to perform keying as they normally would and observe the following:

	Yes	No
Are both feet firmly on the floor?	_____	_____
Are the knees bent at approximately right angles?	_____	_____
Are thighs approximately parallel to the floor?	_____	_____
Is the upper back supported by the back rest?	_____	_____
Does the lumbar support the lower back?	_____	_____
Are the upper arms hanging approximately by the sides?	_____	_____
Are the lower arms approximately parallel with the floor?	_____	_____
Are the wrists kept approximately straight with extension no greater than 15 degrees?	_____	_____
Do the thighs fit comfortably under the desk?	_____	_____
Is the neck bent forward to look at the task?	_____	_____
Is the neck bent forward/down to look at documents?	_____	_____
Does the worker lean forward from the waist while performing task?	_____	_____
Is the operator hunched over his/her work?	_____	_____

*Note: The above assessment may be aided by videotaping the operator.*

## **Training and Education**

Is the operator knowledgeable in ergonomic principles and the appropriate controls to abate ergonomic hazards such as:	Yes	No
Workstation "fit"	_____	_____
Appropriate use of workstation accessories	_____	_____
Importance of workstation flexibility	_____	_____
Proper body posture from head to toe	_____	_____
Body mechanics	_____	_____
Proper work practices	_____	_____

	Yes	No
Rest breaks	_____	_____
Reduction of glare	_____	_____
Screen contrast/brightness adjustment	_____	_____
Management support of ergonomic controls	_____	_____

# OSHA's Risk Factor Checklist

The General Risk Factor Checklist is a quick way of identifying obvious risk factors for musculoskeletal disorders while doing a specific job or task. Each task being performed as part of an employee's job is scored separately. If more than one task is performed, the scores are added together. Conduct a job safety analysis for scores of six or more and make corrections or modifications. The following are brief explanations of each of the risk factors.

## General Risk Factor Checklist

Job \_\_\_\_\_ Department \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Employee \_\_\_\_\_ Analyst \_\_\_\_\_

**Duration** means the amount of time a person is exposed to a risk factor during the work shift. Determine the total amount of exposure time to the risk factor to determine the appropriate duration column (i.e., 5-59 minutes, 1-4 hours, or more than 4 hours). For example, if performing "repetitive, twist/bend" of the hand/wrist for the first 50 minutes of the shift and the last 50 minutes of the shift, the total duration would be 1 hour and 40 minutes. The appropriate column in the table for 1 hour and 40 minutes is the "1-4 hour" column.

RISK FACTOR	5-59 minutes	1-4 hours	More than 4 hours	Cause of Risk Factor / Comments
Repetitive every few seconds	0	1	3	

**Repetitive** means motions or motion patterns repeated every few seconds. A motion is a voluntary muscle exertion to do work with or without a change in posture. For example, performing 10 wrist motions per minute or two shoulder motions per minute.

**Static Load** means the continuous exertion of a body part for more than five minutes, for example, working with your hands above your head.

HAND FORCE (Repetitive Force)	5-59 minutes	1-4 hours	More than 4 hours	Cause of Risk Factor / Comments
Grip 10+ pounds	1	2	3	
Pinch Object	1	2	3	

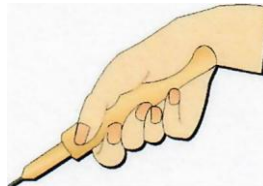
Holding an object that weighs more than 10 pounds (like a big crowbar) in a "power grip." Pinching an object that weighs more than two pounds (such as a big phone book) with the tips of the fingers.

<b>AWKWARD POSTURES</b> (Repetitive or Static)		5-59 minutes	1-4 hours	4+ hours	Causes of Risk Factor / Comment
Neck:	Twist/bend	0	1	2	
Shoulder:	Overhead work	0	1	2	
	Extended reach	0	1	2	
Elbow/forearm:	Twist	0	1	2	
Hand/wrist:	Bend/twist/pinch	0	1	2	
Trunk:	Twist/bend	0	1	2	
Knee:	Squat/kneel	0	1	2	

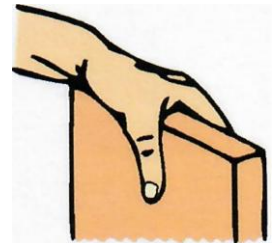
The following illustrations are examples of "awkward postures":



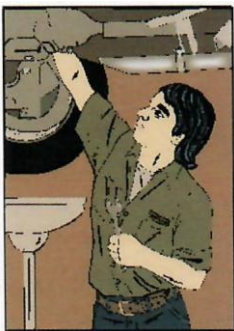
**Extended Reach**



**Elbow/forearm twist**



**Hand/wrist bend/pinch**



**Overhead Work**



**Neck/shoulder bend/twist**



**Trunk twist/bend**

