



# Computer Workstation Ergonomics

## Components

Appropriate placement of the components and accessories for the desktop computer workstation will allow you to work in neutral body positions, help you perform more efficiently, and work more comfortably and safe.

A laptop workstation creates special challenges due to its computer design, size, and the variety of areas in which it is used. While many aspects of this guide will be applicable to laptops, special considerations may be necessary when working with laptop units.

The sections that follow explain how to select and arrange specific workstation components. For additional information on workstation ergonomics, see the guide *Computer Workstation Ergonomics: Posture, Process & Environment*.

## Monitors

Choosing a suitable monitor and placing it in an appropriate position helps reduce exposure to forceful exertions, awkward postures, and overhead glare. This helps prevent possible health effects such as excessive fatigue, eye strain, and neck and back pain.

You should choose a monitor and consider its placement in conjunction with other components of the computer workstation, including the keyboard, desk, and chair.

Consider the following issues to help improve your computer workstation.

## Viewing Distance

### Potential Hazards

- ◆ Monitors placed too close or too far away may cause you to assume awkward body positions that may lead to eyestrain.
  - Viewing distances that are **too long** can cause you to lean forward and strain to see small text. This can fatigue the eyes and place stress on the torso because the backrest is no longer providing support.

- Viewing distances that are **too short** may cause your eyes to work harder to focus (convergence problems) and may require you to sit in awkward postures. For instance, you may tilt your head backward or push your chair away from the screen, causing you to type with outstretched arms.

## Possible Solutions

- ◆ Sit at a comfortable distance from the monitor where you can easily read all text with your head and torso in an upright posture and your back supported by your chair. Generally, the preferred viewing distance is between 20 and 40 inches (50 and 100 cm) from the eye to the front surface of the computer screen. *Note*—text size may need to be increased for smaller monitors.
- ◆ Provide adequate desk space between the user and the monitor (table depth). If there is not enough desk space, consider doing the following:
  - Make more room for the back of the monitor by pulling the desk away from the wall or divider; or
  - Provide a flat-panel display, which is not as deep as a conventional monitor and requires less desk space; or
  - Place monitor in the corner of a work area. Corners often provide more desk depth than a straight run of desk top.
  - Move back and install an adjustable keyboard tray to create a deeper working surface.



## Viewing Angle–Height and Side-to-Side

### Potential Hazard

- ◆ Working with your head and neck turned to the side for a prolonged period loads neck muscles unevenly and increases fatigue and pain.

### Possible Solutions

- ◆ Position your computer monitor directly in front of you, so your head, neck and torso face forward when viewing the screen. Monitors should not be farther than 35 degrees to the left or right.
- ◆ If you work primarily from printed material, place the monitor slightly to the side and keep the printed material directly in front. Keep printed materials and monitors as close as possible to each other.

### Potential Hazard

- ◆ A display screen that is too high or low will cause you to work with your head, neck, shoulders, and even your back in awkward postures. When the monitor is too high, for example, you have to work with your head and neck tilted back. Working in these awkward postures for a prolonged period fatigues the muscles that support the head.

### Possible Solutions

- ◆ The top of the monitor should be at or slightly below eye level. The center of the computer monitor should normally be located 15 to 20 degrees below horizontal eye level.
- ◆ The entire visual area of the display screen should be located so the downward viewing angle is never greater than 60 degrees when you are in any of the four reference postures. In the reclining posture the straight forward line of sight will not be parallel with the floor, which may increase the downward viewing angle. Using very large monitors also may increase the angle.

- ◆ Remove some or all of the equipment (computer case, surge protector, etc.) on which the monitor may be placed. Generally, placing the monitor on top of the computer case will raise it too high for all but the tallest users.
- ◆ Elevate your line of sight by raising your chair. Be sure that you have adequate space for your thighs under the desk and that your feet are supported.

### Potential Hazard

- ◆ Bifocal users typically view the monitor through the bottom portion of their lenses. This causes them to tilt the head backward to see a monitor that may otherwise be appropriately placed. As with a monitor that is too high, this can fatigue muscles that support the head.

### Possible Solutions

- ◆ Lower the monitor (below recommendations for non-bifocal users) so you can maintain appropriate neck postures. You may need to tilt the monitor screen up toward you.
- ◆ Raise the chair height until you can view the monitor without tilting your head back. You may have to raise the keyboard and use a foot rest.
- ◆ Use a pair of single-vision lenses with a focal length designed for computer work. This will eliminate the need to look through the bottom portion of the lens.

## Viewing Time

### Potential Hazard

- ◆ Viewing the monitor for long periods of time may cause eye fatigue and dryness. Users often blink less while viewing the monitor.

### Possible Solutions

- ◆ Rest your eyes periodically by focusing on objects that are farther away (for example, a clock on a wall 20 feet away).
- ◆ Stop, look away, and blink at regular intervals to moisten the eyes.
- ◆ Alternate duties with other non-computer tasks such as filing, phone work, or customer interaction to provide periods of rest for the eyes.

## Viewing Clarity

### Potential Hazard

- ◆ Monitors that are tilted significantly either toward or away from the operator may distort objects on the screen, making them difficult to read. Also, when the monitor is tilted back, overhead lights may create glare on the screen. This can result in eyestrain and sitting in awkward postures to avoid eye glare.

### Possible Solutions

- ◆ Tilt the monitor so it is perpendicular to your line of sight, usually by tilting the screen no more than 10 to 20 degrees. This is most easily done if the monitor has a riser/swivel stand. A temporary solution involves tilting the monitor back slightly by placing a book under the front edge. *Note*—Tilting the monitor back may create glare on the screen from ceiling lighting and a glare screen may be needed.
- ◆ Monitor support surfaces should allow the user to modify viewing distances and tilt and rotation angles.

### Potential Hazards

- ◆ Factors that reduce image quality make viewing more difficult and may lead to eye strain. These factors include:
  - electromagnetic fields caused by other electrical equipment located near computer workstations, which can result in display quality distortions; and
  - dust accumulation, which is accelerated by magnetic fields associated with computer monitors and can reduce contrast and degrade viewing conditions.

### Possible Solutions

- ◆ Computer workstations should be isolated from other equipment that may have electrostatic potentials in excess of +/- 500 volts.
- ◆ Computer monitors should be periodically cleaned and dusted.

## Keyboards

Proper selection and arrangement of the computer keyboard helps reduce exposure to awkward postures, repetition, and contact stress.

You should choose a keyboard and consider its placement in conjunction with other components of the computer workstation, including the pointer/mouse and wrist/palm rests.

Consider the following factors when evaluating your computer workstation.

### Keyboard Placement—Height

#### Potential Hazard

- ◆ Keyboards, pointing devices, or working surfaces that are too high or too low can lead to awkward wrist, arm, and shoulder postures. For example, when keyboards are too low you may type with your wrists bent up, and when keyboards are too high, you may need to raise your shoulders to elevate your arms. Performing keying tasks in awkward postures such as these can result in hand, wrist, and shoulder discomfort.

#### Possible Solutions

- ◆ Adjust the chair height and work surface height to maintain a neutral body posture. Elbows should be about the same height as the keyboard and hang comfortably to the side of the body. Shoulders should be relaxed, and wrists should not bend up or down or to either side during keyboard use.
- ◆ Remove central pencil drawers from traditional desks if you can't raise your chair high enough because of contact between the drawer and the top of the thighs. The work surface should generally be no more than two inches thick.
- ◆ A keyboard tray may be needed if the work surface or chair cannot be properly adjusted. The keyboard tray should
  - Be adjustable in height and tilt,
  - Provide adequate leg and foot clearance, and
  - Have adequate space for multiple input devices (for example, a keyboard and pointer/mouse).

- ◆ The keyboard's vertical position should be maintained within -45 to +20 degrees. The tilt of the keyboard may need to be raised or lowered using the keyboard feet to maintain straight, neutral wrist postures while accommodating changes in arm angles.

### Keyboard Placement—Distance

#### Potential Hazard

- ◆ A keyboard or pointer/mouse that is too close or too far away may cause you to assume awkward postures such as reaching with the arms, leaning forward with the torso, and extreme elbow angles. These awkward postures may lead to musculoskeletal disorders of the elbows, shoulders, hands, and wrists.

#### Possible Solutions

- ◆ Place the keyboard directly in front of you at a distance that allows your elbows to stay close to your body with your forearms approximately parallel with the floor.
- ◆ A keyboard tray may be useful if you have limited desk space or if your chair has armrests that interfere with adequate positioning.

### Design and Use

#### Potential Hazard

- ◆ A traditional keyboard may cause you to bend your wrists sideways to reach all the keys. Keyboard tilt, caused by extending the legs on the back of the keyboard or by a steep design angle, may cause the wrist to bend upward. Smaller keyboards, such as those found on laptops, may also contribute to stressful postures. These awkward wrist postures can create contact stress to the tendon sheath and tendons that must move within the wrist during repetitive keying.

### Possible Solutions

- ◆ Reduce awkward wrist angles by lowering or raising the keyboard or chair to achieve a neutral wrist posture.
- ◆ Elevate the back or front of keyboards to achieve a neutral wrist posture. For example, if the operator sits lower in relation to the keyboard, slightly elevating the back of the keyboard may help maintain a neutral wrist. Similarly, raising the front of the keyboard may help maintain neutral wrist postures for users who type with the keyboard in a lower position. Do not use keyboard feet if they increase bending of the wrist.
  - Consider alternative keyboards to promote neutral wrist postures. Alternative keyboards may be provided on a case-by-case basis. Users may need time to become accustomed to these devices. *Note*—alternative keyboards help maintain neutral wrist postures, but available research does not provide conclusive evidence that using these keyboards prevents discomfort and injury.
- ◆ Keyboards should be of appropriate size and key-spacing to accommodate most users. Generally, the horizontal spacing between the centers of two keys should be 0.71 to 0.75 inches (18 to 19 mm) and the vertical spacing should be between 0.71 to 0.82 inches (18 to 21 mm).

### Left Hand Key Usage

#### Potential Hazard

- ◆ Most keyboards are manufactured with a 10 key keypad permanently affixed to the right side of the keyboard. This arrangement can be limiting to left handed workers or right handed workers who are recovering from injury and are attempting to remain functional during their recovery. This arrangement is also a problem if one is attempting to create work-rest regimens by alternating principle hand usage during the work day or work week.

## Possible Solutions

- ◆ Alternative left hand keyboards which have the keypad permanently affixed to the left side of the keyboard are available as are keyboards with a detached keypad. These allow the user to switch positions for either left or right hand use. These may be especially useful for applications where workers share computers.
- ◆ Programmable stand alone keypads are available which can be programmed to facilitate either right or left hand usage

## Pointer/Mouse

Pointing devices such as a mouse now come in many sizes, shapes, and configurations. In addition to the conventional mouse, there are trackballs, touch pads, finger tip joysticks, and pucks, to name a few. Selection and placement of a pointer/mouse is an important factor in creating a safe computer workstation.

Consider the following factors when evaluating your computer workstation.

### Pointer Placement

#### Potential Hazard

- ◆ If the pointer/mouse is not near the keyboard you may be exposed to awkward postures, contact stress, or forceful hand exertions while using the device. Working in this position for prolonged periods places stress on the shoulder and arm and increases the likelihood that you will assume awkward wrist and shoulder postures, which may lead to musculoskeletal disorders.

#### Possible Solutions

- ◆ Position the pointer/mouse to allow you to maintain a straight, neutral wrist posture. This may involve adjustments in your chair, desk, keyboard tray, etc.

- ◆ If the keyboard tray/surface is not large enough to accommodate both the keyboard and mouse, try one of the following to limit reaching:
  - Use a mouse platform positioned over the keyboard. This design allows the mouse to be used above the 10-key pad.
  - Install a mouse tray next to the keyboard tray.
- ◆ Use a keyboard that has a pointing device, such as a touchpad, incorporated into it.
- ◆ Use a keyboard without a ten-key pad, which leaves more room for the pointer/mouse.
- ◆ Install keyboard trays that are large enough to hold both the keyboard and mouse.
- ◆ Use a mouse pad with a wrist/palm rest to promote neutral wrist posture.
- ◆ Substitute keystrokes for mousing tasks, such as Ctrl+S to save, and Ctrl+P to print.

### Pointer Size, Shape, and Settings

#### Potential Hazard

- ◆ Inappropriate size and shape of pointers can increase stress, cause awkward postures, and lead to overexertion. For example, using a pointing device that is too big or too small may cause you to increase finger force and bend your wrist into awkward positions. Using the left hand to operate a device that is designed for right-hand use can also create force and posture issues and may create contact stress to the soft tissue areas in the palm of the hand. Contact stress can create irritation and inflammation.

## Possible Solutions

- ◆ Select a pointing device designed to fit the hand that will normally operate it. Many devices are available in right hand/left hand models and also come in sizes to fit large and small hands. A device that is designed for either hand use may be desirable, since changing from right- to left-hand operation provides periods of rest for one hand. You should test a device prior to purchase and long term use to ensure proper fit and feel.
- ◆ Select pointing devices that are appropriately sized and that require minimal force to generate movement. For example, a puck device must be small enough for single-handed operation (generally, 1.5 to 2.5 inches wide, 2.5 to 4.5 inches long, and 1 to 1.5 inches high).
- ◆ Reduce the strain on hands by reducing pointing device use. Using keyboard functions, such as page down, may reduce mouse use and provide rest for hand and arm muscles.
- ◆ Use another type of device that fits the hand better or doesn't require bending the wrist while gripping. A fingertip joystick, touchpad, or trackball may be less fatiguing for certain tasks. Always try out any new product prior to selection and long term use.

## Potential Hazard

- ◆ When the sensitivity for the input device is not appropriately set, you may need to use excessive force and awkward hand postures to control the device. For example, a mouse that is too sensitive may require excessive and prolonged finger force to provide adequate control. A mouse that has insufficient sensitivity may require large deviation of the wrist to move the pointer around the screen. Exerting prolonged force or repeatedly bending the wrist can fatigue the muscles of the hand and arm and increase the risk of musculoskeletal injuries.

## Possible Solutions

- ◆ Sensitivity and speed (how fast the pointer moves on the screen when the pointing device is moved by the hand) should feel comfortable and be adjustable. The pointer should be able to cover the full screen while the wrist is maintained in a straight, neutral posture.
- ◆ Sensitivity should be set so you can control the pointing device with a light touch. Most current devices have sensitivity settings that can be adjusted through the computer control panel.
- ◆ Avoid tightly gripping the mouse or pointing device to maintain control.
- ◆ A trackball's exposed surface area should be at least 100 degrees. It should feel comfortable and rotate in all directions to generate any combination of movement.

## Wrist/Palm Supports

Proper arrangement of the keyboard and mouse help create a comfortable and productive workstation. Wrist or palm rests can also increase your comfort.

Although opinions vary regarding the use of wrist/palm supports, proper use has been shown to reduce muscle activity and to facilitate neutral wrist angles.

## Design and Use

### Potential Hazards

- ◆ Performing keying tasks without a wrist rest may increase the angle to which users' wrists are bent. Increasing the angle of bend increases the contact stress and irritation on tendons and tendon sheaths. This is especially true with high repetition or prolonged keying tasks. Keying without a wrist rest can also increase contact stress between the users wrist and hard or sharp workstation components.
- ◆ Resting the wrist/palm on a support while typing may inhibit motion of the wrist and could increase awkward wrist postures.

## Possible Solutions

- ◆ Your hands should move freely and be elevated above the wrist/palm rest while typing. When resting, the pad should contact the heel or palm of your hand, not your wrist.
- ◆ If used, wrist/palm rests should be part of an ergonomically-coordinated computer workstation.
- ◆ Reduce bending of the wrists by adjusting other workstation components (chair, desk, keyboard) so the wrist can maintain an in-line, neutral posture.
- ◆ Match the wrist support to the width, height, and slope of the front edge of the keyboard (keeping in mind that the goal is to keep wrist postures as straight as possible).
- ◆ Provide wrist/palm supports that are fairly soft and rounded to minimize pressure on the wrist. The support should be at least 1.5 inches (3.8 cm) deep.

## Document Holders

Document holders keep printed materials needed during computer tasks close to the user and the monitor. Proper positioning of document holders depends on the task performed and the type of document being used. Appropriate placement of the holder may reduce or eliminate risk factors such as awkward head and neck postures, fatigue, headaches, and eye strain.

The position of the document holder is also related to the placement of the monitor, keyboard, and a well-adjusted chair.

### Source Document Position

#### Potential Hazard

- ◆ Documents positioned too far from the monitor may require awkward head postures or frequent movements of the head and neck to look from the monitor to a document. Those awkward postures can lead to muscle fatigue and discomfort of the head, neck, and shoulders.

## Possible Solutions

Document holders should

- Allow you to place documents at or about the same height and distance as the monitor screen, and
- Be stable when loaded with heavier documents such as a textbook.
- ◆ A document holder can be positioned directly beneath the monitor. This provides a sturdy writing surface, if written entries are necessary, and reduces frequent movement of the head, neck, or back.
- ◆ Task lighting on the document should not cause glare on the monitor.

## Desks

A well-designed and appropriately-adjusted desk will provide adequate clearance for your legs, allow proper placement of computer components and accessories, and minimize awkward postures and exertions. The installation, setup, and configuration of comfortable and productive workstations involves the following considerations:

### Desk or Work Surface Areas

#### Potential Hazards

- ◆ Limited space on the work surface may cause users to place components and devices in undesirable positions. This placement may lead to awkward postures as you reach for a pointer/mouse or look at a monitor that is placed to the side.

#### Possible Solutions

- ◆ Work surface depth should allow you to:
  - View the monitor at a distance of at least 20 inches (50 cm), and
  - Position the monitor to achieve the appropriate viewing angle, which is generally directly in front of you.
- ◆ Using a corner rather than a straight run of desk may provide additional space and depth to accommodate large monitors or multiple items.

- ◆ The location of frequently-used devices (keyboard, phone, and mouse) should remain within the repetitive access (primary work zone).



### Potential Hazard

- ◆ Some desks and computer equipment have hard, angled leading edges that come in contact with a user's arm or wrist. This can create contact stress, affecting nerves and blood vessels, possibly causing tingling and sore fingers.

### Possible Solutions

To minimize contact stress,

- ◆ Pad table edges with inexpensive materials such as pipe insulation,
- ◆ Use a wrist rest, and
- ◆ Buy furniture with rounded desktop edges.

### Areas Under the Desk or Work Surface

#### Potential Hazard

- ◆ Inadequate clearance or space under the work surface may result from poor design or excessive clutter. Regardless of the cause it can result in discomfort and performance inefficiencies, such as the following:
  - Shoulder, back, and neck pain due to users sitting too far away from computer components, causing them to reach to perform computer tasks; and
  - Generalized fatigue, circulation restrictions, and contact stress due to constriction of movement and inability to frequently change postures.

### Possible Solutions

- ◆ Provide, to the extent possible, adequate clearance space for users to frequently change working postures (see recommended dimensions in the section "Work Space" that follows). This space should remain free of items such as files, CPUs, books, and storage.
- ◆ Be sure clearance spaces under all working surfaces accommodates at least two of the three seated reference working postures, one of which must be the upright seated posture.
- ◆ Limit the number of items that are stored under the work surface. There should be no items stored that will limit the space needed for workers' legs and feet.

#### Potential Hazard

- ◆ Desk surfaces that are too high or too low may lead to awkward postures, such as extended arms to reach the keyboard, and raised shoulders.

### Possible Solutions

- ◆ Raise work surfaces by inserting stable risers such as boards or concrete blocks under the desk legs if necessary.
- ◆ Remove center drawers of conventional desks to create additional thigh clearance if necessary.
- ◆ Lower work surfaces by cutting off desk legs if necessary. If the work surface cannot be lowered, raise the chair to accommodate the user. If needed, provide a footrest to support the user's feet.
- ◆ Provide height-adjustable desks. Clearance for the legs, under the desktop, should generally be between 20 to 28 inches (50 to 72 cm) high.

## Work Space

The clearance space under the work surface should provide adequate room for the users legs when in the upright seated posture and at least one other of the seated reference postures. This can be accomplished by using Method One or Method Two.

### Method One—Upright and Reclined Seated Postures

The following dimensions represent clearances that accommodate the majority of users (fifth percentile female to 95th percentile male) when in a seated posture where the top of the legs are about parallel with the floor.

#### Minimum dimensions

- ◆ 20 inches (52 cm) wide.
- ◆ 17 inches (44 cm) deep at knee level.
- ◆ 24 inches (60 cm) deep at foot level.
- ◆ 4 inches (10 cm) high at the foot.

#### Variable dimensions

- ◆ Height is adjustable between 20 and 27 inches (50 and 69 cm) near the user.

### Method Two—Upright, Reclined, and Declined Seated Postures

The following dimensions accommodate the largest operator clearance spaces (fifth percentile female to 95th percentile male). Thus, specifications conforming with Method Two will meet Method One requirements. This method also includes postures where the knee is slightly lower than the buttocks (declined-seated).

**Minimum dimensions** (see Method One above)

#### Variable dimensions

- ◆ Adjustable between 20 and 28 inches (50 and 72 cm) high at the hip.
- ◆ Adjustable between 20 and 25 inches (50 and 64 cm) high near the user's knee.

## Chair Quick Tips

- ◆ The backrest should conform to the natural curvature of your spine, and provide adequate lumbar support.
- ◆ The seat should be comfortable and allow your feet to rest flat on the floor or footrest.
- ◆ Armrests, if provided, should be soft, allow your shoulders to relax and your elbows to stay close to your body.
- ◆ The chair should have a five-leg base with casters that allow easy movement along the floor.

## Chairs

A chair that is well-designed and appropriately adjusted is an essential element of a safe and productive computer workstation. A good chair provides necessary support to the back, legs, buttocks, and arms, while reducing exposures to awkward postures, contact stress, and forceful exertions.

Increased adjustability ensures a better fit for the user, provides adequate support in a variety of sitting postures, and allows variability of sitting positions throughout the workday. This is particularly important if the chair has multiple users.

To ensure that the chair will provide adequate support, it is important that you try out different chairs before purchasing one.

You should adjust your chair along with appropriately placing your monitor, keyboard, and desk.

The following parts of the chair are important elements to consider in creating a safe and productive workstation.

### Backrest

#### Potential Hazard

- ◆ Poor back support and inappropriate postures may result from inadequate backrest size, material, positioning, or use. Working in these postures may lead to back pain and fatigue. For example, a chair without a suitable or adjustable backrest will not provide adequate lumbar support or help maintain the natural S-shape curvature of the spine.

## Possible Solutions

- ◆ If your current chair does not have a lumbar support, use a rolled up towel or a removable back support cushion to temporarily provide support and maintain the natural curve of the spine.
- ◆ Use a chair with a backrest that is easily adjustable and able to support the back in a variety of seated postures. A backrest should have the following:
  - A lumbar support that is height adjustable so it can be appropriately placed to fit the lower back. The outward curve of the backrest should fit into the small of the back.
  - An adjustment that allows the user to recline at least 15 degrees from the vertical. The backrest should lock in place or be tension adjustable to provide adequate resistance to lower back movement.
  - A device enabling it to move forward and backward. This will allow shorter users to sit with their backs against the backrest without the front edge of the seat pan contacting their knees. Taller users will be able to sit with their backs against the backrest while still having their buttocks and thighs fully supported. *Note*—some chair designs provide this adjustability by adjusting the position of the seat pan.

## Seat

### Potential Hazard

Using a chair with a seat that is too high may force you to work with your feet unsupported or encourage you to move forward in the chair to a point where your back is unsupported making it more difficult to maintain the S-shape of the spine. These awkward postures can lead to fatigue, restricted circulation, swelling, numbness, and pain.

### Possible Solutions

- ◆ If the seat cannot be lowered (for example, it would make the keyboard or monitor too high), use a footrest to provide stable support for the feet.

- ◆ Provide a chair with a seat pan that is adjustable and large enough to provide support in a variety of seated postures. It is recommended that the seat should be:
  - Height adjustable, especially when shared by a number of users. The chair height is appropriate when the entire sole of the foot can rest on the floor with the back of the knee slightly higher than the seat of the chair.
  - Padded and have a rounded, “water fall” edge.
  - Wide enough to accommodate the majority of hip sizes. Chairs with oversized seat pans should be provided for larger users.

### Potential Hazard

- ◆ An inappropriately sized seat pan can be uncomfortable, provide inadequate support to the legs, and restrict movement. One that is too short can place excess pressure on the buttocks of taller users, one that is too long can place excess pressure on the knee area of shorter users and minimize back support. One that is too small can restrict movement and provide inadequate support. Prolonged use can restrict blood flow to the legs and create irritation and pain.

### Possible Solutions

- ◆ Seat pan should be “depth” adjustable to adequately support taller users while allowing shorter users to sit with their back fully supported. The seat pan should provide support for most of the thigh without contact between the back of the user’s knee and the front edge of the seat pan.
- ◆ Provide a footrest, which may elevate the knee slightly to relieve pressure on the back of the leg.
- ◆ Provide a chair that is sized to fit small or large users. *Note*—this is especially important if the chair is to be shared by several users.

## Armrest

*Note*—Using an armrest is up to you and the system integrators. Consider factors such as the amount of time during the workday that the user performs computer work, whether the user is experiencing or has experienced a musculoskeletal disorder (MSD) or symptoms, and user preference.

### Potential Hazards

- ◆ Armrests that are not adjustable, or those that have not been properly adjusted, may expose you to awkward postures or fail to provide adequate support. For example armrests that are:
  - **Too low** may cause you to lean over to the side to rest one forearm. This can result in uneven and awkward postures, fatiguing the neck, shoulders, and back.
  - **Too high** may cause you to maintain raised shoulders, which can result in muscle tension and fatigue in the neck and shoulders.
  - **Too wide** cause you to reach with the elbow and bend forward for support. Reaching pulls the arm from the body and can result in muscle fatigue in the shoulders and neck.
  - **Too close** can restrict movement in and out of the chair.
  - **Too large** or inappropriately placed may interfere with the positioning of the chair. If the chair cannot be placed close enough to the keyboard, you may need to reach and lean forward in your chair. This can fatigue and strain the lower back, arm, and shoulder.
- ◆ Armrests that are made of hard materials or that have sharp corners can irritate the nerves and blood vessels located in the forearm. This irritation can create pain or tingling in the fingers, hand, and arm.

## Possible Solutions

- ◆ If your armrests cannot be properly adjusted, or if they interfere with your workstation, remove them, or stop using them.
- ◆ Position adjustable armrests so they support your lower arm and allow your upper arm to remain close to the torso. Properly adjusted armrests will be:
  - Wide enough to allow easy entrance and exit from the chair,
  - Close enough to provide support for your lower arms while keeping your upper arms close to the body,
  - Low enough so your shoulders are relaxed during use (Adjust your arm rests so they just make contact with your lower arms when positioned comfortably at your sides.), and
  - High enough to provide support for your lower arms when positioned comfortably at your sides. You may be able to add padding to the top of your armrests if they are too low and not adjustable.
- ◆ Armrests should be large enough to support most of your lower arm but small enough so they do not interfere with chair positioning.
- ◆ Armrests should be made of a soft material and have rounded edges.

## Base

### Potential Hazard

- ◆ Chairs with four or fewer legs may provide inadequate support and are prone to tipping.
- ◆ Inappropriate choice of casters, or a chair without casters, can make positioning the chair in relation to the desk difficult. This increases reaching and bending to access computer components, which can lead to muscle strain, and fatigue.

## Possible Solutions

- ◆ Chairs should have a strong, five-legged base.
- ◆ Ensure that chairs have casters that are appropriate for the type of flooring at the workstation.

## Telephones

Many office tasks today are centered around telephones and computers as key workstation components. For example, employees making reservations may take information from customers and transfer it into the computer. They may also receive information from the computer and relay it to customers by telephone.

Telephones add to the convenience of a workstation; however, telephones have cords that can get tangled up, and can cause the user to assume awkward postures. Consider the following to help prevent musculoskeletal disorders.

### Telephone Quick Tips

- ◆ Use a speaker phone or head set for long conversations.
- ◆ Keep it close enough to avoid repeated reaching.

## Placement and Use

### Potential Hazard

- ◆ Placing the telephone too far away can cause you to repeatedly reach, resulting in strain on the shoulder, arm, and neck.

### Possible Solutions

- ◆ Place the telephone in the primary or secondary work zone, depending on usage patterns. This will minimize repeated reaching, reducing the possibility of injury.
- ◆ Keep the telephone cord out of working areas so it does not create a tripping hazard.

### Potential Hazard

- ◆ Prolonged conversations with the phone pinched between your shoulder and head may cause stress and neck pain.

### Possible Solution

- ◆ Use a “hands-free” head set if you plan to spend a lot of time on the phone. Speaker phone options may also be appropriate, provided the volume of this feature does not annoy your co-workers.

## Evaluation Checklist

This checklist can help you create a safe and comfortable computer workstation. A “no” response indicates that a problem may exist. Refer to the appropriate section of the guide for assistance and ideas about how to analyze and control the problem.

### Working Postures

The workstation is designed or arranged for doing computer tasks so it allows your:

1. Head and neck to be upright, or in-line with the torso (not bent down/back).  
 Yes  No (If “no” refer to the sections “Monitors,” “Chairs” and “Desks.”)
2. Head, neck, and trunk to face forward (not twisted).  
 Yes  No (If “no” refer to the sections “Monitors” or “Chairs.”)
3. Trunk to be perpendicular to floor (may lean back into backrest but not forward).  
 Yes  No (If “no” refer to the sections “Chairs” or “Monitors.”)
4. Shoulders and upper arms to be in-line with the torso, generally about perpendicular to the floor and relaxed (not elevated or stretched forward).  
 Yes  No (If “no” refer to the section “Chairs.”)
5. Upper arms and elbows to be close to the body (not extended outward).  
 Yes  No (If “no” refer to the sections “Chairs,” “Desks,” “Keyboards, and “Pointers.”)
6. Forearms, wrists, and hands to be straight and in-line (forearm at about 90 degrees to the upper arm).  
 Yes  No (If “no” refer to the sections “Chairs,” “Keyboards,” and “Pointers.”)
7. Wrists and hands to be straight (not bent up/down or sideways toward the little finger).  
 Yes  No (If “no” refer to the section “Keyboards,” or “Pointers.”)
8. Thighs to be parallel to the floor and the lower legs to be perpendicular to floor (thighs may be slightly elevated above knees).  
 Yes  No (If “no” refer to the section “Chairs” or “Desks.”)
9. Feet rest flat on the floor or are supported by a stable footrest.  
 Yes  No (If “no” refer to the section “Chairs,” and “Desks.”)

### Seating

Consider these points when evaluating the chair:

10. Backrest provides support for your lower back (lumbar area).  
 Yes  No
11. Seat width and depth accommodate the specific user (seat pan not too big/small).  
 Yes  No
12. Seat front does not press against the back of your knees and lower legs (seat pan not too long).  
 Yes  No
13. Seat has cushioning and is rounded with a “waterfall” front (no sharp edge).  
 Yes  No
14. Armrests, if used, support both forearms while you perform computer tasks and they do not interfere with movement.  
 Yes  No

“No” answers to any of these questions should prompt a review of the section “Chairs.”

## Keyboard/Input Device

Consider these points when evaluating the keyboard or pointing device. The keyboard/input device is designed or arranged for doing computer tasks so the:

15. Keyboard/input device platform(s) is stable and large enough to hold a keyboard and an input device.  
 Yes  No
16. Input device (mouse or trackball) is located right next to your keyboard so it can be operated without reaching.  
 Yes  No
17. Input device is easy to activate and the shape/size fits your hand (not too big/small).  
 Yes  No
18. Wrists and hands do not rest on sharp or hard edges.  
 Yes  No

"No" answers to any of these questions should prompt a review of the sections "Keyboards," "Pointers," or "Wrist Rests."

## Monitor

Consider these points when evaluating the monitor. The monitor is designed or arranged for computer tasks so the:

19. Top of the screen is at or below eye level so you can read it without bending your head or neck down/back.  
 Yes  No
20. User with bifocals/trifocals can read the screen without bending the head or neck backward.  
 Yes  No
21. Monitor distance allows you to read the screen without leaning your head, neck or trunk forward/backward.  
 Yes  No
22. Monitor position is directly in front of you so you don't have to twist your head or neck.  
 Yes  No
23. Glare (for example, from windows, lights) is not reflected on your screen which can cause you to assume an awkward posture to clearly see information on your screen.  
 Yes  No

"No" answers to any of these questions should prompt a review of the section "Monitors."

## Work Area

Consider these points when evaluating the desk and workstation. The work area is designed or arranged for doing computer tasks so the:

24. Thighs have sufficient clearance space between the top of the thighs and your computer table/keyboard platform (thighs are not trapped).  
 Yes  No
25. Legs and feet have sufficient clearance space under the work surface so you are able to get close enough to the keyboard/input device.  
 Yes  No

## Accessories

Check to see if the:

26. Document holder, if provided, is stable and large enough to hold documents.  
 Yes  No
27. Document holder, if provided, is placed at about the same height and distance as the monitor screen so there is little head movement, or need to re-focus, when you look from the document to the screen.  
 Yes  No
28. Wrist/palm rest, if provided, is padded and free of sharp or square edges that push on your wrists.  
 Yes  No
29. Wrist/palm rest, if provided, allows you to keep your forearms, wrists, and hands straight and in-line when using the keyboard/input device.  
 Yes  No
30. Telephone can be used with your head upright (not bent) and your shoulders relaxed (not elevated) if you do computer tasks at the same time.  
 Yes  No

"No" answers to any of these questions should prompt a review of the sections "Desks," "Document Holders," "Wrist Rests" or "Telephones."

Yes  No

## General

31. Workstation and equipment have sufficient adjustability so you are in a safe working posture and can make occasional changes in posture while performing computer tasks.  
 Yes  No
32. Computer workstation, components and accessories are maintained in serviceable condition and function properly.  
 Yes  No
33. Computer tasks are organized in a way that allows you to vary tasks with other work activities, or to take micro-breaks or recovery pauses while at the computer workstation.  
 Yes  No

"No" answers to any of these questions should prompt a review of the sections "Chairs" or "Desks."

Source: U.S. Occupational Safety and Health Administration

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#1260\_ComputerWorkstationErgonomicsComponents\_0410

