

Ergonomic Tips for Computer Workstations and Mobile Devices

Risk Control from Liberty Mutual Insurance



A workplace computer may be a desktop unit on workstation furniture in an office or work-at-home environment, or a laptop or notebook computer used virtually anywhere. Mobile devices include smartphones and touch screen tablet computers.

Highlights:

- How to create a good ergonomic match between operator and workstation
- Measurement techniques
- Adjusting the workstation: chair, monitor, keyboard and mouse
- Dual monitors and laptops: what to consider



Figure 1

- | | | |
|---------------------|------------------|-------------------|
| A. Adjustability | F. Line of Sight | K. Leg Space |
| B. Back Posture | G. Keyboard | L. Mouse Position |
| C. Neck Posture | H. Arm Posture | M. Work Surfaces |
| D. Glare | I. Leg Support | |
| E. Viewing Distance | J. Foot Position | |

Regardless of the device, a systems approach involving adjustable workspace/equipment, ongoing comprehensive training and management support can help reduce computer-related musculoskeletal and visual symptoms from using these devices.

The importance of getting a good ergonomic match between the employee and the work is clear. But how do you create that match?

Importance of Training

Research has shown that when employees are given an adjustable/flexible work space coupled with training, musculoskeletal and visual symptoms will decrease and performance will increase. When people are engaged in, and learn from training, they will change their computing behaviors in ways that positively impact their safety, musculoskeletal and visual health, and performance.^{1, 2, 3} An investment in office furniture with the latest ergonomic features can be wasted unless operators are taught to adjust their workstations correctly and unless management follows through to see that the adjustments are made.

Keyboard work is demanding. Let your employees know that you are concerned with their comfort and you want to minimize the physical stress of working with the computer or mobile device. **Figure 1** shows a computer workstation and the factors you need to consider to ensure employee comfort.



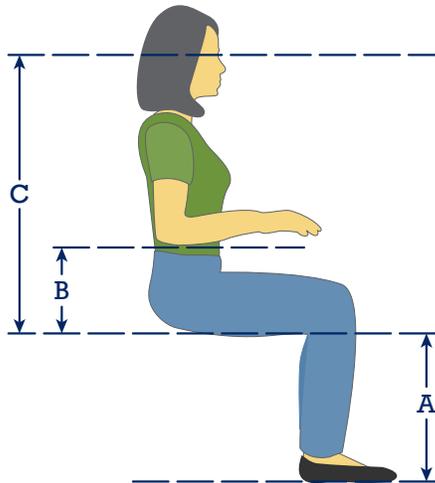


Figure 2

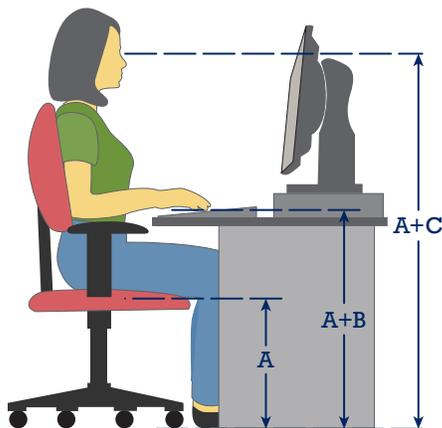


Figure 3

Computer Workstation Adjustments

Two methods are common for performing computer workstation assessments: observational techniques that estimate the correct height through knowledge of “neutral” posture, and direct measurement techniques.⁴ For details on observational techniques see Liberty Mutual Insurance Reference Notes Visual Display Terminals, RC 186; *Visual Display Terminal Individual Workstation Assessment*, RC 5188; and *Visual Display Terminal—Individual Workstation Assessment Solutions Guide*, RC 5189.

Direct Measurement Techniques⁵

Measure each operator individually to determine the appropriate height adjustments for their workstation. Seat the operator on a table or desk, as shown in **Figure 2**, so that the edge of the tabletop just touches the back of the knees.

Operator Measurements

A = Knee Height: Measure the person from the crease behind their knee to the bottom of the heel. Make sure the person is wearing the type of shoes normally worn on the job.

B = Elbow Height: Measure the person from a fixed surface (i.e., tabletop) to the tip of their elbow. The person should be relaxed but sitting up straight. This measurement is easier if the person holds the upper arm against the body and reaches the hand toward the neck.

C = Eye Height: Measure the person from a fixed surface (i.e., tabletop) to the eyes. Again, the person should be relaxed but sitting up straight.

Adjust the Chair Height

Once you have measured knee height (A), elbow height (B) and eye height (C), set the height of the chair front at knee height (A) initially. The seat pan may drop an inch or two when the operator sits down. If this is the case, raise the seat pan to offset the height change.

It is important the employee be trained on every chair adjustment feature. Some adjustment features may be optional, such as the seat pan adjustment.

Manufacturers may offer small, medium or large chairs to allow for longer legs. Make sure the employee has been fitted with the right chair.

If the seat is too high and cannot be lowered to the appropriate level, get a footrest and adjust the seat so that the vertical distance between the footrest and the front edge of the seat is equal to knee height (A).

If the seat pan has a tilt mechanism, the operator should tilt the seat to the most comfortable angle for work. In jobs that require a lot of data entry, such as word processing, some operators prefer a forward-tilted seat. For less-intensive keyboard work, many operators prefer a backward-tilted seat. Tilting the seat pan usually changes the height of the seat, so readjust the front edge of the chair to knee height (A). For more information on recommended seated postures see *Visual Display Terminals*, RC 186.

Position the Keyboard and Mouse

The center (or home) row of the keyboard should be adjusted to a height equal to knee height plus elbow height (A + B) above the floor, as shown in **Figure 3**. If a footrest is necessary, its height should also be added. The intent is to place the center row level with the tip of the elbow, thus keeping the forearms in a horizontal position.

If the keyboard height is not adjustable, raise or lower the chair height so that the difference in height between the chair seat and the keyboard is equal to elbow height (B). Provide footrests if needed.

If the keyboard is thin (1 to 1.5 inches), place it about 2 inches back from the edge of the table. If the operator is using a thicker keyboard, provide a padded palm rest.

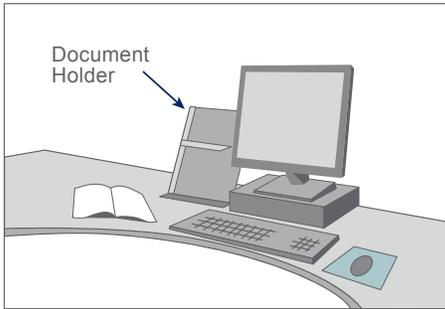


Figure 4: Monitor/Display and Document Holder placement



Figure 5

The mouse or input device should be at the same level as the keyboard. If using a keyboard tray, the tray should be wide enough to accommodate the mouse.

Position the Monitor

There are a variety of visual displays used in offices, including cathode ray tube (CRT) monitors and flat panel liquid crystal displays (LCD) monitors. Configuration can be single- or dual-monitor setup.

Raise or lower the display so that the top of the screen is level with or slightly below the eyes, about equal to knee height plus eye height ($A + C$). If the operator wears bifocals or trifocals, a lower position may be more comfortable.

Position the display at least 20 inches away from the operator's eyes or at arm's length.

For tasks in which the operator must read documents in addition to looking at the screen, place the document holder immediately adjacent to the visual display (see **Figure 4**).

Darken the screen while the operator checks for light reflectance or glare. Tilt the screen to eliminate as much glare or reflectance as possible. If the screen is right or left of center, moving it to the other side may help reduce glare.

Dual Monitor Guidelines

Both monitors should be matched in size and quality (luminance and contrast). If not matched in size, the center viewing angle for documents on both screens should be the same (see **Figure 5**).

If possible, flat panel displays should not be paired with CRT monitors.

Both monitors should be placed at the same height and viewing distance. Viewing distance to each monitor should be at least 20 inches away from the operator's eyes or arm's length.

Place both monitors as close to each other as possible.

Provide adjustable monitor stands that are secure and allow for adjusting vertical height, screen tilt and screen angle.

Set up one monitor as the primary and the other as the auxiliary screen. Place the computer screen that is used more frequently closer to the center viewing angle and the auxiliary monitor to the side, left or right, and slightly angled toward employee.

Laptop Computers

Laptop computers are no longer just for people who spend a large portion of their time away from a traditional office. Workers who rarely leave their office are using them too. Unfortunately, this has led to user complaints of back, neck, and wrist pain because the laptop is designed for portability, not ergonomics. With the keyboard and screen attached as one unit the user must decide between a comfortable head and neck position or a comfortable wrist and arm position.

When discussing laptop use, there are two situations to consider:

1. The operator in an office environment with docking station, external monitor, keyboard and mouse
2. A mobile worker who uses the laptop in airports, hotels, or office without any external device

Operators in an office environment with external devices should follow the same height adjustment guidelines mentioned above. Mobile worker solutions are more challenging.

Positioning the Laptop

Positioning a laptop can be a challenge. Placing the laptop low (in your lap or on a desk) for a comfortable arm position means that you have to tilt your neck forward to view



Figure 6

the screen; raising the screen to an acceptable level means that your hands are now reaching too high.

Some operators prefer placing the laptop on the work surface directly in front of them, with the back elevated slightly to raise the display height. This can be accomplished inexpensively by using a specially-designed laptop stand or 3-ring binder, with the binder at the back of the laptop. This technique will angle the keyboard, which may or may not be desirable. Tilting the screen too far may increase glare from overhead lights. Screen distance should follow the same guidelines as above.

Other operators prefer raising the entire laptop, so the screen is at eye level, by using a monitor stand or other means, and using an external keyboard and mouse. Inexpensive and portable monitor stands and external keyboards are readily available from mobile worker ergonomic accessory vendors and websites (see **Figure 6**).

Other Considerations

Instruct the operator to:

Use a light touch when keying or using the mouse.

Use the index and middle fingers instead of the thumb to move the cursor via the touch screen. Move the hand toward the touch screen to eliminate stretching the fingers and alternate between hands.

Take short breaks every 20–30 minutes.

Use a bag with wheels when transporting the laptop. If the operator must carry the laptop, provide a bag with a wide shoulder strap and alternate between shoulders.

Minimize the weight by carrying only what is needed. Reduce the number of peripherals such as disc drives, CD-ROM drives, etc.

Obtain Employee Feedback

After employees have had an opportunity to work at their adjusted workstations for a time, go back and check whether they find the arrangement comfortable. Readjust if necessary, but try to avoid making substantial height changes. The operator must be satisfied with the arrangement over a long period of time under actual working conditions.

Mobile Devices; Smart Phones and Tablet Computers

Share the following tips with your employees to help avoid discomfort while using their mobile devices.⁶

Reduce keystrokes. More keystrokes equals more strain on hands and thumbs, so keep messages brief.

When possible, take advantage of word prediction or auto complete tools offered on the device.

When selecting a device, pick one that has a full keyboard. Some models require users to tap the keys two or three times to select the letter they need. This increases repetition.

Use shortcuts. Shortcuts reduce the need to scroll and help you get things done quickly. Refer to the user manual to find shortcuts.

Use a neutral grip when holding the device. A neutral grip is when the wrist is straight, not bent in either direction.

Maintain an upright posture while texting.

Avoid bending your head down and rounding your shoulders.

Rest the thumb by using alternative fingers.

Type using the pad of your fingertip. Avoid using the tip of your fingernails. This can create an awkward bent position for the thumb which can lead to possible discomfort.

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libertymutualgroup.com/riskcontrolservices   @LibertyB2B



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