

Portable Computers and Ergonomics

Introduction

The use of portable computers, otherwise known as laptops or tablets, continues to increase as the technology improves and as a mobile workforce gains value from the practical application of computer technology. A great deal of attention has been paid to health and safety issues related to computers with the focus primarily directed toward conventional desk top models as used in typical office settings. Portable computers, which are designed for quite different use “out in the field” pose some interesting challenges from an ergonomic perspective. This article addresses some of these issues and provides practical guidelines for safe use of portable computers.

In a general sense, ergonomic evaluation of a portable computing situation varies little from any other computer or other ergonomic evaluation. In this case, as in others, loss control equals operations control, which requires consideration of three production factors: equipment, material, and people. The focus of this article is on equipment selection, equipment arrangement, equipment use, and training of people.

Selecting Equipment

The effectiveness of any tool or piece of equipment is in part dependent upon design factors. Therefore, selection of portable computing equipment plays a key role from both ergonomic and production standpoints. Prior to selection of any hardware, clearly define the way the portable computer will be used. Then, match the design features to the anticipated use. Consider the following significant design features when selecting a portable computer:

- Weight
- Overall size (including profile)
- Screen size
- Screen resolution (including back lighting, color)
- Screen adjustment controls: location, function
- Keyboard:
 - construction
 - sensibility (touch)
 - key layout
 - touchpad or button mouse or alternative
- Other input device: (mouse, pen, joystick, trackball, touchpad)
 - size (diameter, length)
 - accessibility
 - sensibility (touch)
 - port (stability)
 - battery requirement

LOSS CONTROL TIPS

- Battery:
 - size/weight
 - accessibility (for replacement)
- Compatibility for left or right handed users
- Mouse/trackball compatibility
- Carrying case:
 - size
 - equipment accessibility
 - straps
- Cable connections:
 - ease of use
 - accessibility
 - non-interference with position
- Ease of desktop connection
- Usability:
 - overall comfort
 - static holding
 - posture
- Screen sensibility (“feel,” pen control)
- Stand (for desktop use):
 - available
 - stability
 - allows height adjustment
 - allows angle adjustment

From an ergonomic perspective, each design feature offers its own set of advantages and disadvantages. Consider the trade-offs carefully, weighing the pros and cons relative to the intended use. For example, the small size of a portable computer may be an advantage when work surface space is limited. However, the small size of a portable computer screen may be a disadvantage relative to long term visual concentration. A trial period is probably the best way to evaluate the features of any piece of equipment and to determine true usability of the equipment.

There is a perception that portable keyboards are smaller than standard desktop keyboards. Certainly, the overall size of the keyboard is smaller when the numeric keypad has been eliminated. In fact, elimination of the numeric keypad is an advantage to right handed mouse users because it brings the mouse into better position. However, actual key size and spacing may or may not differ from that of a standard keyboard. Some portable keyboards maintain standard key size and spacing. These keyboards will effect little or no change on keystroke.

The design and function of the carrying case are particularly important for portable computers, especially tablet computers, which are designed to be held while in use. Handles and straps on carrying cases should be accessible, reliable, and comfortable.

Arranging Equipment

Equipment arrangement is a function of equipment design, workspace configuration, and user preference. Basic principles of body mechanics guide equipment arrangement. The same principles of body mechanics apply to desktop and portable computer use. The optimal position of body and equipment for all computer users is described in the accompanying table.

The design differences between portable and standard desktop computers present some interesting opportunities and challenges in terms of equipment arrangement. Portable computers are easily moved. They also take up less work surface space. On the other hand, independent screen height and angle adjustment may be limited or impossible. Built-in trackballs or buttons allow no flexibility for position adjustment. LCD monitors are more difficult to read and may require more frequent contrast and light level adjustment.

Many limitations may be of little ergonomic significance if the computer is used on a truly intermittent basis. However, these factors must be considered and adjustments in equipment arrangement may require compromise based on priority of needs and design features.

Equipment Use and the Work Environment

The way work is organized and the way the equipment is used can affect the health of computer users. This is true in the portable computing environment as well as other work environments. Automation may introduce changes in the pace of work and the variety and nature of tasks. These issues may be exacerbated in the environment of portable computing because, by nature of its portability, the device is always with, or available to the user. In addition, it may be more difficult to monitor these issues through remote supervision. The following guidelines address these issues:

- Provide clear job description and performance specifications.
- Consider the nature of the tasks and work flow. Implement actions to minimize monotony.
- Establish clear lines of reporting.
- Establish clear deadlines and schedule work to avoid recurrent deadline stress.
- Anticipate peak workloads.
- Discuss and agree upon workloads with staff.
- Provide ergonomic awareness training to facilitate user responsibility for comfort and health.
- Establish an ergonomics program that includes monitoring and follow-up.

Portable computers are designed for “portable use.” This generally means intermittent rather than extended use in a non-traditional environment (“on the road”). Some portable equipment is not appropriate for extended desk top use. If extended desk top use is intended, it may be necessary to provide alternative desk top equipment, e.g., standard monitors and keyboards. In the case of tablet computers, mouse compatibility and availability is necessary for desk top use.

Training People

Effective integration of new technologies depends on how comfortable users are with the changes that come about as new technologies are introduced. Successful use of new technology depends upon our ability to work with it comfortably. In order to facilitate this process and to maximize proper use of portable computer equipment, users must be knowledgeable in several areas:

- familiarity with the equipment itself, including design features and components
- general understanding of the principles of body mechanics
- general understanding of ergonomic principles and the application of these principles to the work and workstations
- familiarity with appropriate channels of communication, particularly with respect to seeking assistance with equipment and ergonomic issues when necessary.

Summary

The proliferation of portable computers is further evidence of ongoing technological advances. Ergonomic related question/concerns are evident. In fact, some users have reported physical discomforts which seem to be related solely to use of these portable computers. Observation has revealed various risk factors including static postures, awkward postures and limited keyboard/mouse work space. Preliminary findings have indicated that equipment design, workstation configuration, workstation space factors, and the way the equipment is used combine to create these risk factors.

The use of portable computers must be evaluated from an ergonomic perspective. Ongoing ergonomic evaluation should address these key elements: equipment design and

function, field use, desk top use, and carrying case design. Some tips for use of portable computers follow:

Ergonomic Tips for Laptop Use

- Use your portable computer for short periods of time. If extended use is required, take frequent breaks.
- For regular desktop use, use external monitor, keyboard and pointing device (e.g., mouse). If an external monitor is not available, elevate the laptop screen by using a portable computer stand and plug in an external keyboard and pointing device.
- In flight, position the portable computer so that your wrists are straight, your upper arms are close to the sides of your body and your elbows are at about a 90-degree angle. Close the window shade to reduce direct sunlight and reflections on the screen.
- When using a portable computer in flight or remotely in other circumstances, take frequent breaks. Get up and walk around if possible. Look away from the display periodically.
- Avoid awkward, unsupported postures when using a portable computer casually. Try to get yourself into a supported, seated position.
- Use a carrying bag with a wide, padded strap to distribute the weight. When carrying your computer bag long distances, such as in an airport, switch sides frequently. Consider a rolling case.
- If the work surface is above elbow level (high), use a book or another object to tilt the portable computer toward you in order to keep your wrists straight. Tilt the computer will also raise the screen to a more appropriate height.
- Position the portable computer in your lap if this position promotes improved (neutral) arm and wrist postures.
- Follow the general guide for the optimal position of body and equipment for computer users (see attachment).

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford’s Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

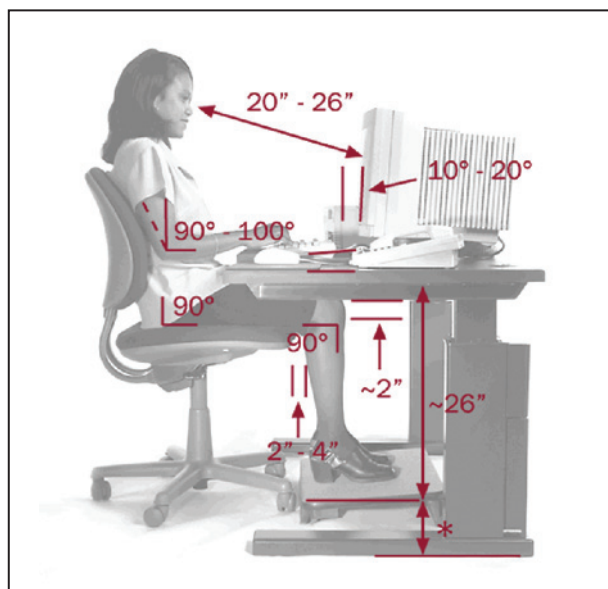
The information provided in these materials is intended to be general and advisory in nature. It shall not be considered legal advice. The Hartford does not warrant that the implementation of any view or recommendation contained herein will: (i) result in the elimination of any unsafe conditions at your business locations or with respect to your business operations; or (ii) will be an appropriate legal or business practice. The Hartford assumes no responsibility for the control or correction of hazards or legal compliance with respect to your business practices, and the views and recommendations contained herein shall not constitute our undertaking, on your behalf or for the benefit of others, to determine or warrant that your business premises, locations or operations are safe or healthful, or are in compliance with any law, rule or regulation. Readers seeking to resolve specific safety, legal or business issues or concerns related to the information provided in these materials should consult their safety consultant, attorney or business advisors. All information and representations herein are as of March 2009.

Optimal Position of Body and Equipment for Computer Users

The following information is provided as a generic guide to assist you in your efforts to improve the comfort of computer users. Variations in specifications may be acceptable and should be determined individually.

1. Optimal position of body while seated at your computer:

- a. Ears, shoulders, and hips in vertical alignment.
- b. Arch in back supported by chair or pillow.
- c. Feet flat on floor or stool.
- d. Thighs supported evenly on chair.
- e. Shoulders in neutral position (i.e., not elevated).
- f. Upper arms near sides of body.
- g. Forearms approximately parallel to floor.
- h. Wrist in neutral position (knuckles slightly higher than wrist).



2. Optimal equipment position:

- a. Top line of screen slightly below eye level or lower.
- b. Monitor screen at approximately 20 to 26 inches from user's eyes.
- c. Keyboard and monitor positioned in alignment in front of user (unless monitor is referred to only intermittently).
- d. Keyboard (height) positioned such that home row (ASDF) is at approximately elbow level.
- e. Mouse (height) positioned at elbow level and as central as possible.
- f. Document holder located near monitor at same height and distance from user as screen.
- g. Work surface at height to allow appropriate arm/wrist/hand position while also allowing adequate leg space.
- h. Chair – seat and back rest height and angle adjusted to allow comfortable posture.
- i. Shelf height and location within comfortable reach.
- j. All frequently used equipment, manuals, etc. within comfortable reach.