

## **COLORADO STATE UNIVERSITY ERGONOMIC FURNITURE SPECIFICATIONS**

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This document was created to further detail the furniture and workstation design specifications deemed necessary for office/computer users at Colorado State University (CSU).

Because of the significant difference between individuals in the workforce, it is important to ensure correct design with respect to the layout and dimension of computer workstations. To fit a majority of the population, workstations should fit from the 5<sup>th</sup> percentile female to the 95<sup>th</sup> percentile male. Specifications below account for this range of the population using most updated ergonomic and anthropometric guidelines.

With inappropriate workstation design and a mismatch between user and equipment, task performance times of up 22% can be experienced. In order to decrease injury risk exposure and prevent injuries while continuing to support improvements in efficiency in an office computer workstation environment, the below specifications should be followed when implementing ergonomic computer furniture and accessories.

Office workspace and workstation designers, whether internal CSU design employees or external furniture manufacturers, distributors or vendors are expected to meet or exceed the guidelines listed in this document as well as those listed in the Business Institutional Furniture Manufacturers Association (BIFMA) *Ergonomics Guideline for Furniture used In Office Work Spaces Designed for Computer Use*. Special circumstances may arise where certain criteria cannot be met and/or alternative designs may be warranted. In these situations, consultation with the CSU Ergonomics Coordinator should take place.

The below specifications do not necessarily pertain to visitors chairs, side chairs, or lounge furniture but are to be used for an office computer workstation environment.

These specifications should be reviewed and revised annually or more frequently as needed by the ergonomics program coordinator.

### **POSTURES**

In order to maintain comfort and increase productivity, computer users should frequently change postures. Four reference postures at a computer workstation are discussed below:

- Upright sitting
  - Allows for vertical position of 90 and 110 degrees of the upper torso with thighs near horizontal and lower legs vertical
- Reclined sitting
  - Allows for a recline of the user's torso and neck to be between 105 and 120 degrees
- Declined sitting
  - Allows for the user's thigh position to be angled downward with the hips above the knees, with the upper torso vertical or slightly reclined with an angle of greater than 90 degrees between the torso and thighs
- Standing
  - Allows for the knees, hips, torso and neck to be in line vertically

Computer workstation design should ideally allow for use of all four reference postures. Height adjustable workstations should be incorporated to allow for alternating between sitting and standing and "fit" a majority of users.

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**All approved furniture vendors must be able to provide height adjustable furniture which allows for seated and standing postures and meets the minimum acceptable criteria below.**

### **WORKING HEIGHT & WIDTH**

Table height (and the height of input devices such as the keyboard & mouse, etc.) should be adequately adjustable to allow for each user to adjust for the height of the work to be at or slightly below elbow height where the elbow angle is approximately ~90-110 degrees. The height of the work surface should be as follows:

- Work surface height allowing for both sitting and standing should be adjustable from:
  - Ideal – 22” – 50”
  - Acceptable – 24” – 48”

Adjustments above or below the minimum are also ideal. (i.e. below 22” and/or above 50”)

**Height adjustable workstations/tables should be a part of all workstation designs whenever feasible.**

- Work surface height for a fixed work surface for seated work only should be in the range of:
  - 28” – 30”
- Work surface height for seated only workstations should be adjustable from:
  - Ideal – 22” – 30”
  - Acceptable – 24” – 30”

Work surfaces that do not meet the above criteria require additional equipment to allow various users to properly fit into the workstation. This equipment should be provided as a standard on the work surface when height adjustable workstations are infeasible. This equipment includes a height adjustable keyboard tray **and/or** height adjustable foot rest. Additional specifications on keyboard trays and foot rests are listed below.

Approved vendors should be able to provide accessories items that meet ergonomics specifications listed within this document. If the above specifications cannot be met, the CSU ergonomics program administrator should be consulted prior to purchase.

### **ADJUSTMENT TYPE**

- Tables and other workstations used for both sitting and standing should be adjustable via either a pneumatic, counterbalance, electric or equivalent adjustment capability. (Crank adjustable tables should not be used where alternating regularly between sitting and standing will take place).
- All work surfaces should provide adequate clearance for the legs and not impact the top of the thighs.
  - I.e. pencil drawers, file drawers, etc. should not be designed directly under the portion of the table/desk where the user will perform computer work as this will interfere with leg clearance and sitting postures. Refer to the leg clearances section below for more detailed specifications.

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## **ADDITIONAL WORK SURFACE SPECIFICATIONS**

- Sufficient space on top of the work surface should be provided to allow for multiple input devices (both keyboard and mouse, tablet, etc.), computer monitors, telephone and other equipment.
  - The horizontal space on top of the work surface which provides adequate width for computer input devices, writing materials, etc. should be at least 40" – 45"
    - The below section on work surface dimensions further specifies actual work surface dimensions to be incorporated in workstation design.
- Height adjustable work surfaces (or keyboard trays) should provide visual specifications marking the adjustment for height and tilt. (i.e. control panel, dial indicators, etc.)
- Work surface edges should be rounded (radius of at least 0.1") and have a non-reflective surface.
- All obstructions under a workstation/table should not interfere with the workstation height adjustment range.
  - I.e. file drawers, etc. should be designed such that there will be no interference with the workstation height adjustment and allow the work surface to be lowered to its minimum height range and not impact a file drawer or other obstruction.
- Workstation/table design should allow for a keyboard tray to be attached under the work surface.
  - I.e. table/workstation supports structures, beams, etc. under the workstation/table should not interfere with the installation of a keyboard tray. The table/workstation should be designed to allow for an approved keyboard tray to be attached to the underside of the work surface with no obstructions.
  - There should be sufficient space for the keyboard tray to retract completely under the work surface.
- Work surface depth should allow for ideal placement, depth and angle of the monitor. (See monitor section below).
  - I.e. a 30 inch work surface is likely sufficient to allow for the keyboard, mouse, document stand, etc. to be placed on the work surface without forcing the monitor too close to the eyes/body.
  - If a work surface depth of 24 inches is implemented, a keyboard tray is likely needed to allow the monitor to be pushed further away from the body.

## **KEYBOARD TRAYS**

Keyboard trays are recommended especially when height adjustability is not implemented. This will allow individual user adjustments for the proper seated elbow height of the keyboard and mouse.

- Keyboard trays and other height adjustable platforms should have the following adjustment features.
  - The platform or surface of an articulating arm keyboard tray should be at minimum:
    - Ideal – 27" wide, 10" deep
    - Acceptable – 26" wide, 9" deep
  - Keyboard tray platforms should have a thickness of :
    - Ideal – 1/8" – 1/4"
    - Acceptable – less than 1"
  - Keyboard trays should be adjustable in height and tilt.

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- The tray should have an independent height and tilt adjustment
- The height adjustment should be at least 6"
- The tray should require minimal force to adjust height, tilt, pivot, etc.
- Tilt angle should be:
  - Ideal – +10° to -15°
  - Acceptable – 0° to -15°
- Keyboard trays or other height adjustable platforms should provide visual specifications marking the adjustment for height and tilt. (i.e. control panel, tilt indicator, height indicator, etc.)
- The tray should have no obstructions under the surface which interfere with leg clearance.

Height adjustable keyboard trays, bi-level keyboard and mouse platforms built into the desk and other height adjustable equipment intended to hold the keyboard and mouse which do not meet the above specifications are unacceptable. Tray exceptions can be made if prior approval is granted by the CSU Ergonomics Team prior to purchase and implementation.

### **FOOT RESTS**

Foot rests are necessary for shorter users if the work surface height does not lower adequately or the work surface height is not adjustable. Foot rests (or keyboard trays as mentioned above) should be provided as a standard if the desktop is not adjustable or does not lower adequately. (This will be the case for approximately 90% of workstations).

- Foot rests should:
  - Be at least 12 inches deep.
  - Be adjustable in height from 1-9 inches.
  - Not have an inclination of greater than 30 degrees.
  - Have a nonskid surface.

If vendors cannot provide adequate foot rests, they should provide recommendations where these can be obtained or refer end users to the CSU ergonomics coordinator.

### **CLEARANCES**

The below criteria should be followed in workstation design to allow for adequate clearance for a user's feet and legs under the work surface.

- For seated only workstations, the below should be applied:
  - Seated workstations should provide adequate clearance for feet and legs with no obstructions and allow users to adjust through the seated reference postures mentioned above.
  - Movement right/left from one portion of the workstation (such as the designated computer workstation) to an adjacent workstation (such as in an "L" or "U" shaped workstation) should not have leg obstructions of any kind which interfere with movement of the chair.
  - Drawers beneath the work surface for storage (i.e. pencil drawers, file drawers) should be properly located during design to avoid interference with the legs when users move to various portions of the workstation.

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- I.e. drawers should not prevent turning of the chair or impact the lower legs, knees, or feet.
  - File drawers should not interfere with height adjustable table range as mentioned above. A user should be able to lower the table completely to the bottom end of the range (ideally 22 inches).
    - 95% of users need the table below standard height and file drawers should not prohibit ideal table height adjustment in any way.
    - File drawers may need to be lower/smaller, mobile and designed not to be located under the work surface to accommodate work surface height adjustments.
  - Work surface/table thickness should be no more than 1.5”
    - All leg obstructions (i.e. pencil drawers, file drawers) should be eliminated directly under the workstation where computer work is designed to take place to allow for the addition of a keyboard tray as well as allow for ideal leg clearance and chair height adjustment.
  - Clearance in work surface depth at foot level should be at least 23.5 inches under the work surface (front to back) to allow sufficient room for the feet and legs under the desk.
    - Additional clearance may be needed to allow for further extension of the legs at the knee.
  - Knee space width should be at least 30 inches.
- For standing workstations, the below should be applied:
  - Clearance under the work surface for foot height should be at least 4.5”
  - Clearance under the work surface for foot depth should be at least 5”
  - Width clearance under the work surface at foot level should be at least 20”
  - Standing workstations designed with obstructions such as file drawers underneath should not have chairs/stools as these create ergonomic hazards that cannot be avoided.

If a fixed standing height workstation is implemented, appropriate leg clearance for sitting should be accounted for as well as proper chairs/stools implemented. These workstations are not recommended however.

## **CHAIRS**

Chairs should meet the below criteria and have the below adjustments to allow users to adjust from at least two of the three seated reference postures as mentioned above. Chairs that do not have these features and specifications listed below should be reviewed by the CSU ergonomics coordinator prior to purchase.

- Adjustable seat height
- Height adjustable back rest (bendable or flexible back support in response to movement may suffice)
- Adjustable seat pan tilt (whether adjustable by a lever, knob or by adjustments through counterbalance and body weight)
- Adjustable back rest tilt (whether adjustable by a lever, knob or by adjustments through counterbalance and body weight)
- Tension adjustment with seat lock or stop (a counterbalance option may suffice)

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- Adjustable seat depth or seat sizes
- Waterfall or rounded front edge
- Armrests (if provided) must provide sufficient clearance under the workstation and are not to interfere with the use of any of the four reference postures.
- Overall chairs should allow for dynamic postural changes and movements to allow for adjustment between above mentioned seated reference postures. Flexible seat materials which bend along with user movements are also acceptable.

### Adjustment Features

#### Seat pan

- Seat pan height should range from 15" – 22"
- Seat depth should range from 16.3" – 21"
  - When fixed, seat depth should be no more than 16.3"
- Seat pan width should be at least 19.2"
- Seat pan and back rest angle should be adjustable from at least 90 – 120° (Not less than 90°)
  - Angles beyond 120° require a user adjustable headrest
- Seat pan tilt should be adjustable by the user in the range of at least 4 degrees (0-4° rearward)

#### Backrest

- Width of the backrest should be at least 14.2"
- The backrest should not create pressure points on the back or the back of the arms.
- Backrest height should be at least 14" and provide support for the entire back and shoulders.
- Backrest height adjustment (lumbar support) should ideally be user adjustable within the range between 5.5" – 10" above seat height.

#### Armrests

- Armrests should adjust in height, width, pivot, fore and aft and be detachable.
  - Fixed armrest heights should not be used for computer intensive tasks.
- The surface of the armrest should be padded and not exacerbate contact pressure on the elbow/forearm.
- Armrests should adjust from approximately 7" to 11.5" above the seat height and be no shorter than 8"
- Width clearance of armrests should be adjustable from 13" to 21".
- Arm rests should be adjustable as mentioned above so that they do not come into contact with the work surface while performing computer intensive tasks.
  - The design of the workstation/table itself may interfere with the armrests as well. For example "corner" workstations may interfere with armrests and worker posture. Corner workstations should be avoided whenever feasible so that the surface does not interfere with the arm rests.
- Arm rests which do not meet the above guidelines should be easily detachable.

Vendors should be able to assist with proper education on the available chair adjustments and how they are used. Simply dropping off a chair user's guide is insufficient.

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## **STOOLS**

Stools can be defined as chairs which have an increased seat lift and rise higher than the standard chair height range as indicated above (adjust higher than 22"). Stools should have all the same properties and adjustment features as office chairs as mentioned above along with an adjustable height foot ring and sufficient height adjustment range to meet the elevated work surface height.

However, stools should be avoided in office environments where computer work is performed especially when there is a height adjustable work surface. Work surface heights should adjust throughout an acceptable height range as mentioned above. When sitting, the work surface should be lowered to allow both feet to be firmly on the ground and ideally not on the foot ring of a stool.

Stools prevent ideal foot support and prohibit ideal postural changes. Elevated sitting on a stool should only be seen when there is an elevated and fixed work surface height above 36 inches; however fixed desk heights above 36 inches should also be avoided.

## **MONITORS**

Monitor arms which suspend and support the monitor(s) above the work surface are recommended and should be included when feasible as part of overall computer workstation design to allow for proper monitor adjustment. Monitor position is important in accommodating each individual user's line of sight and should allow for easy adjustment of height, tilt, angle and distance.

Adjustments of the monitor on a monitor arm should allow for the following adjustments (when incorporated). Monitor arms should allow the monitor to have the below features:

- Vertical height adjustment of at least 11.0 inches (sitting)
- Vertical height adjustment of at least 14.6 inches (standing)
- Horizontal depth adjustment from at least 15.7 – 30 inches
- Tilt adjustment to allow the monitor to adjust from 0 to 35 degrees from the vertical
- Require minimal force to adjust height, depth, and tilt

Additional adjustment of the monitor may be needed for users with prescription lenses. Adjustments closer than 15.7" will require additional evaluation by an ergonomics specialist.

As mentioned above, obstructions which interfere with the placement of the monitor and adjustment of the height, depth, etc. should be avoided (with or without a monitor arm). Examples of such obstructions include overhead shelves and storage compartments, cubicle walls, walls of the office itself, etc. Space should be accounted for in the design of the office space and workstation and should not interfere with monitor placement and adjustment.

## **LIGHTING**

Overhead lighting design significantly affects the computer workstation design and placement of the computer in a work space. Placement of a workstation in relation to the overhead lighting should ensure that direct or indirect sources of glare are kept to a minimum.

Designers responsible for lighting for an office, shared cubicle space, etc. should ideally lower the overhead lighting when computer work is predominant.

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The total amount of lighting required for computer use is much different from that of working with paper documents. Lighting designs often incorporate more light than is necessary for computer work and given computer use in the office environment is outweighing paperwork, the overall lighting output can be reduced to minimize the risk of eye strain, headaches, neck and shoulder pain.

Overhead lighting should be in the range of 5-50 footcandles. The lower end of the range is preferred and varies based on the work performed.

- Predominantly computer tasks
  - 5-10 footcandles for work primarily performed on the computer.
- Predominantly paperwork tasks
  - 20-50 footcandles for work primarily performed with paperwork.

If overhead lighting is minimized to ~5-10 footcandles for computer work, additional lighting will need to be made available to employees who perform paperwork tasks. Adjustable task lights are recommended in this situation. Adjustable task lighting where additional lighting is needed for paperwork tasks should be as follows:

- Be easily adjustable with one hand on an articulating arm. The base of the light should be heavy enough to allow the user to avoid having to hold the base down with an opposite hand while moving the light source into place.
- Have a dimmer function/control (ideal).
- Be designed to be placed on the opposite side of dominant hand. This will help avoid casting of a shadow when writing.
  - With multiple monitors, careful placement of the ambient light source should be given so that proper illumination of paperwork can be provided.
- Should not be mounted in a fixed position under a cabinet/overhead shelf. These light sources are not recommended because they cannot be adjusted into specific locations as dictated by the user.
  - Workstation design should not designate monitor placement underneath an overhead shelf where there is a light source. This impacts both monitor height and viewing of the monitor due to unnecessary illumination and glare.

### **WORK SURFACE DIMENSIONS**

Work surface dimensions will need to vary from one user to another and in addition, the space and dimensions within the office space will also play a role in the dimensions of a workstation. However, aesthetics should not compromise human factors, biomechanics or comfort. Criteria for standard workstation dimensions are listed below. Adaptation of these basic specifications can be made however review may be necessary by the ergonomics program coordinator if specifications above are not met.

- Overall computer work surface dimensions are recommended to be approximately 24" x 42" (at minimum). To ensure proper viewing distance of the monitor the below should be considered:
  - If a 24" depth is used, an articulating arm keyboard platform is recommended as ~24" is a less than ideal depth to hold all components of a computer and allow for the monitor to adjust horizontally away from the eyes and allow for the complete visual distance range of the monitor.
  - If a keyboard tray is not used, the work surface depth should be ~30" where computer work is performed.

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- Adjacent sections of the desk (i.e. L-shaped or U-shaped desks) should be designed to minimize leg clearance issues as mentioned above.
- Work surfaces with straight edges (as illustrated below) should be implemented whenever feasible. Desire for desk configurations with rounded curvatures in the corner of the workstations may need to be reviewed by the ergonomics program specialist prior to implementation as these can introduce numerous ergonomic hazards. A curvature with a larger radius is needed in these situations to ensure no interference with the arm rests.
- The workstation design should ensure no interference with the placement and adjustment of the monitor (i.e. no overhangs where the monitor will be placed) and allow for adequate leg clearance as mentioned above.

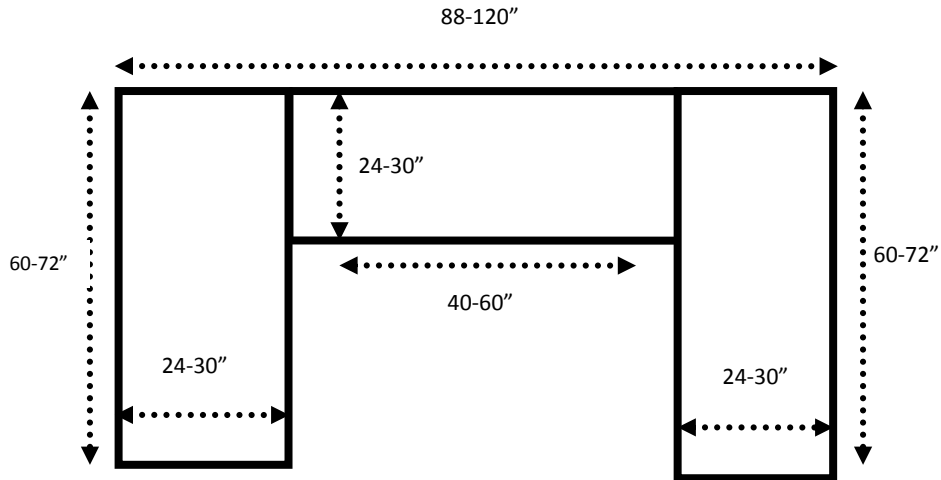
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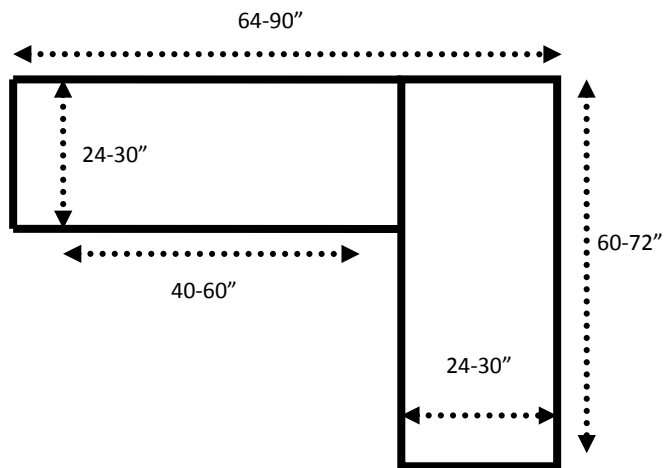
**STANDARD WORK SURFACE CONFIGURATION**

Standard workstation configuration is illustrated below. The ergonomics program coordinator should be consulted for final approval of ergonomic design of atypical workstations.

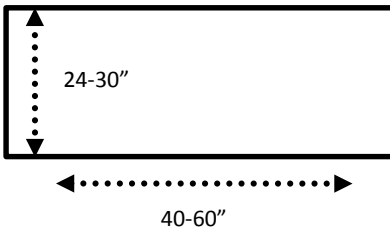
**U Shaped Workstation**



**L Shaped Workstation**



**Computer Workstation**



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