

## 4 Ergonomics

### 4.1 General

All health facilities should be designed and built in such a way that patients, staff, visitors and maintenance personnel are not exposed to avoidable risks of injury.

The design of common elements such as workstations and typical rooms will have a significant impact on the occupational health, safety and welfare of staff and patients. Many jurisdictions now place a legally enforceable duty of care on designers and manufacturers to ensure a safe work environment.

Ergonomics incorporates aspects of functional design - the practise of designing elements to consider the proper use and to suit the people expected to use them. There is a vast body of expert opinion available on ergonomic standards. While there are differences on some ergonomic aspects such as sitting posture or monitor angles there is general agreement on the majority of issues.

Ergonomic standards provide a baseline for design that will suit a majority of situations and people. It is not possible to arrive at a solution that is applicable to all due to individual differences. Ergonomic principles endorse the possible use of adjustable spaces and objects to allow for the special needs of staff, patients and visitors as far as possible. Such provisions are typically expensive, so their use must be balanced against the real benefits and the facility budget.

Designers typically design for their target populations based upon percentages of the population described as percentiles. It is common to design for all falling between the 5<sup>th</sup> percentile of females to the 95<sup>th</sup> percentile of males. The 5<sup>th</sup> to the 95<sup>th</sup> Percentile range accommodates 90% of the target population as represented in the diagram below.

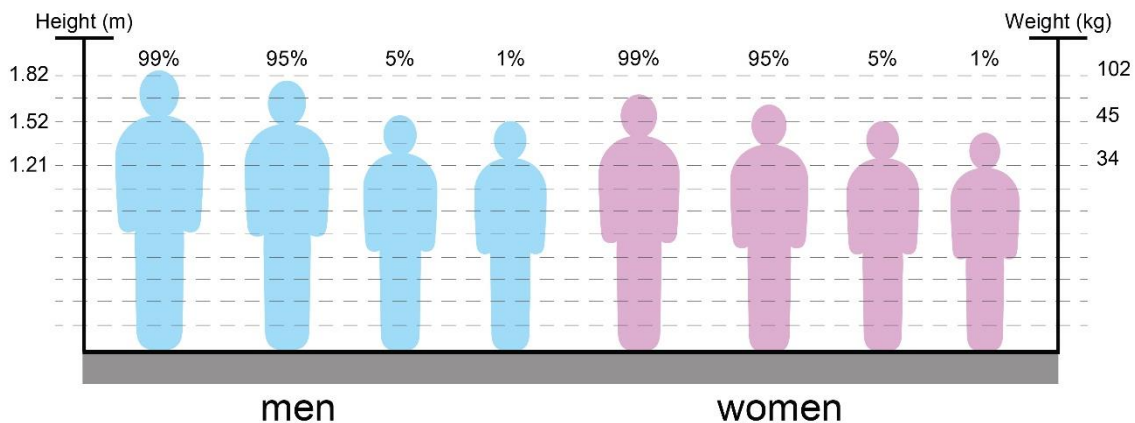


Figure 3.1: The relative sizes of different percentile adult humans (from All Steel Ergonomics and Design, A Reference Guide)

Nothing in these guidelines is intended to create a situation where the needs of all possible preferences or indeed the highest possible standards are implemented in all situations.

The ergonomics standards included in these guidelines are those commonly debated and considered in relation to Healthcare Facilities.

For additional information and relevant standards, please refer to the References and Further Reading list at the end of these Guidelines.

Where a facility is designed for staff or patients with special needs, some deviation from these Guidelines may be appropriate. In such circumstances, it is recommended that designers seek advice from specialist ergonomics experts or OH&S officers.

## 4.2 Accessibility Standards

Readers should refer to local mandatory Standards for Accessibility and Barrier Free design that cover the subject of access for people with disabilities.

Special consideration is given to the following:

- Access ways and circulation
- Corridors and pathways suitable for wheelchair users
- Facilities for people with ambulatory or sensory disabilities
- Avoidance of discrimination for people with disabilities

Parts of the facility may be specialised for use by patients (or staff) with particular disabilities. In such areas, the specialised needs will override the more common provisions for people with disabilities. In short, 'specialisation' is not seen by these Guidelines as non-compliance in relation to other Accessibility Standards.

It is the requirement of these Guidelines that a minimum number of rooms suitably sized and designed for use by people with disabilities are provided. This is separate to the expected number of patients with disabilities or patients in a wheelchair as a result of their illness. This is due to the fact that the attendance of a patient at a hospital with some form of disability may be unrelated to that disability. For example, a patient using a wheelchair may attend a hospital for a heart condition. These are identified in the relevant sections of the FPU in part B of these Guidelines.

## 4.3 Ergonomic Standards for Benches and Shelving

These ergonomic guidelines cover the average use of facilities by able bodied persons.

For simplicity, the Ergonomics standards are presented in a table form under several categories. All items should be regarded as recommendations unless noted as mandatory.

Item	Condition of Use	Depth mm	Height mm	Thickness mm	Mandatory	Remarks
Work bench	Utility	600	900	Max 35	No	Flat Monitor
Writing bench	Keyboard use	720-750	680-720	Max 35	No	Flat Monitor
Writing bench – height adjustable	Keyboard use	720-750	580-760	Max 35	No	Seated user
Writing bench – height adjustable	Keyboard use	720-750	660-1180	Max 35	No	Seated or standing user
High Counter (parcel shelf)	Over bench of 720 AFFL	250	1130-1150	20-35	No	600mm reach to the inside edge of counter
High Counter (parcel shelf)	Over bench of 900 to 1000 AFFL	250	1200-1250	20-35	No	600mm reach to the inside edge of counter
Shelving	Over 900mm high bench	350	1520-1810	20-25*	No	2 shelves
Shelving	Over 720mm high bench	350	1370-1710	20-25*	No	2 shelves
Shelving Unit	Full Height	350-400	1500-1810	20-25*	No	7 shelves adjustable

Table 2: Recommended ergonomic dimensions in work areas

\*Shelf thickness is subject to span, intended load and method of support

The recommended heights and dimensions for work benches are demonstrated in the figures below.

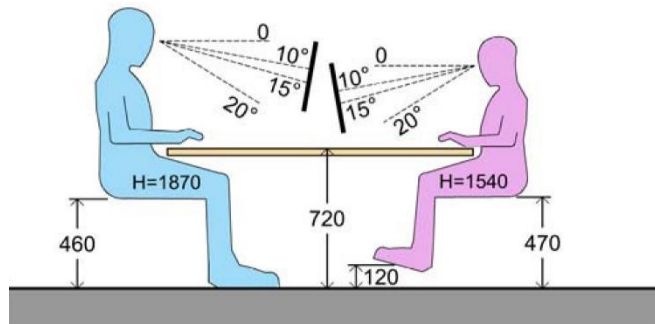


Figure 3.2: People of different heights sitting at a fixed height workstation

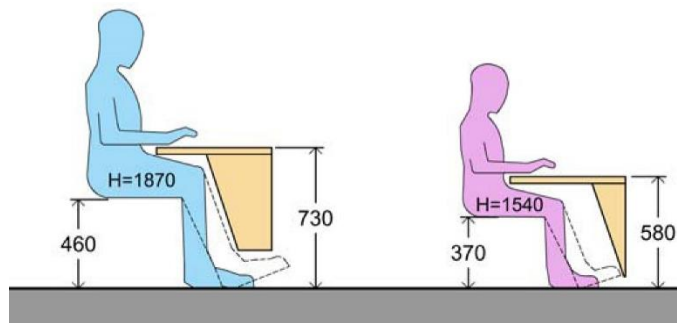


Figure 3.3: People of different heights sitting at an adjustable height workstation

#### 4.4 Reception / Staff Stations

##### General

The functions undertaken at the Reception or Staff Station (or Nurse Station) may include:

- Reception of visitors and enquiries
- Staff work base and control station
- Reporting and recording patient records
- Dispensing to patients and relatives

The Reception/ Staff station will generally consist of a workbench or workstation and may include a high counter (parcel shelf or service counter).

Refer to Ergonomic Standards in section 4.3 for standards applicable to workbenches.

##### High Counter

The Reception/ Staff Station may include a high counter (also known as a parcel shelf or service counter) to partially conceal objects, records and equipment from view and may also be used as a writing surface for filling forms or signing documents.

Design of high counters should address the following:

- If the counter is used for communication and contact between staff and visitors, care should be taken to avoid excessive reach across the workstation area and to avoid excessive height which can be a barrier to communication.
- The workstation surface width should be 600mm deep minimum.
- If a flat panel display is required, the workstation surface width should ideally be 750mm deep but 600 deep can also work in tight situations.
- If the high counter is used as a writing surface and to transfer items and documents, the workstation depth should be reduced to provide a 600mm maximum reach from the edge of the workstation surface to the high counter edge.
- The recommended height of the high counter used against a work surface height of up to 720mm above the floor is 1150mm above floor level. This height will allow a typical person to gain sufficient privacy for work whilst being able to look over the top to visitors, standing or

sitting.

- The recommended height to the top counter used against a work surface height of 900mm to 1000mm is between 1200mm and 1250mm above the floor level. The use of a sitting/ standing height adjustable table is not recommended for this application.

### **High-Low Design**

Where children or visitors using wheelchairs are expected at the Reception or Staff Station counters, a design incorporating a high section (for staff privacy) as well as a low section is recommended.

The low section is typically at 720 to 870mm above the floor to allow users in wheelchairs to approach the counter front on. Adequate leg room beneath the work surface is required.



Figure 3.4: Examples of Staff Stations design integrating both high and low counters

### **Security Barriers**

In some situations, it may be necessary to provide a security barrier at the counter. This may be of a high-quality plastic or in a variety of security glass including laminated glass, toughened glass, laminated & toughened glass and glass with a special security film.

In such situations, the barrier will include a slot that is sufficient to allow the passage of sound and small objects. A slot of 125 mm minimum is recommended. If a glazed security barrier is provided at a counter used for public interaction, then an intercom system may be provided to amplify the sound for persons with hearing impairments.



Figure 3.5: Staff Station with security glazing barrier used in a mental health facility

At counters such as Pharmacy Dispensing Counters, it may be necessary to pass larger objects from one side to the other. In such situations a two-way drawer or cupboard may be used. These should be lockable.

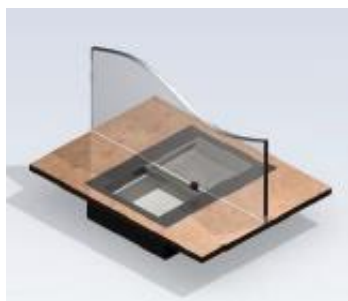


Figure 3.6: Counter with security barrier and pass through drawer

If the Reception/ Staff Station or counter is the only barrier between a department and areas outside the department (FPU), it may be necessary to provide after-hours security.

If a full height barrier such as security glazing has been provided as described, this may be sufficient. Alternatively, a lockable security grille or similar device should be provided.

The grill or similar device should be operable by the staff from the normal standing height. The operation of such a grille (or shutter) may operate in the vertical or horizontal direction.



Figure 3.7: Reception with vertical roller shutter for after-hours security

## 4.5 Workbenches

### General

Workbenches may be designed for sitting or standing positions depending on the preference and work practises of the staff using them.

Both options are suitable for their intended purpose. However, the ergonomic standards for the two will vary as identified below.

### Sitting Position Workbench

The height of a workbench used in the sitting position should be between 680mm to 720mm above the floor. The typical minimum depth is 600mm. Consideration should be given to clearance behind the rear of a chair especially when a fixed object or another workstation is placed back-to-back. The recommended minimum clear distance is 1200mm.

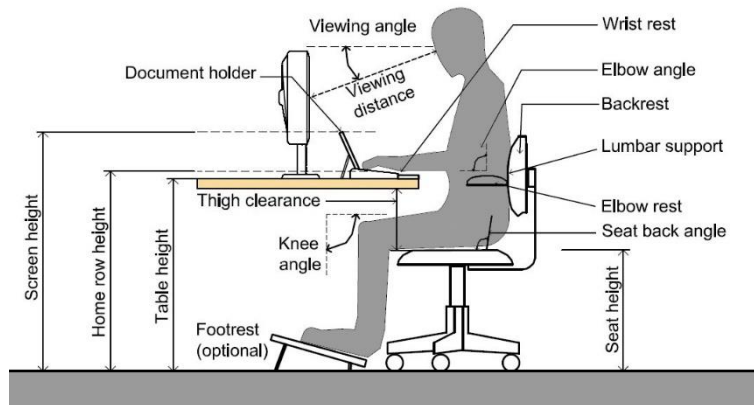


Figure 3.8: Ergonomic elements of the workbench used in the sitting position

### Standing Position

The standing height workbench may also be used for seated activities. In this circumstance, ideally the work bench would be height adjustable.

The height of a workbench used primarily in the standing position, even with keyboard work should be 900-1000mm above the floor. Examples include Staff Stations, Reporting stations, Pharmacy Counters.

If the workbench is used for a majority of work in the standing position but seated for keyboard work then the recommended height is 900mm above the floor. This option is most frequently used in Utility Rooms, Laboratory benches and Kitchens. If seated activities are required at a standing position workbench, a high stool with a footrest should be provided.

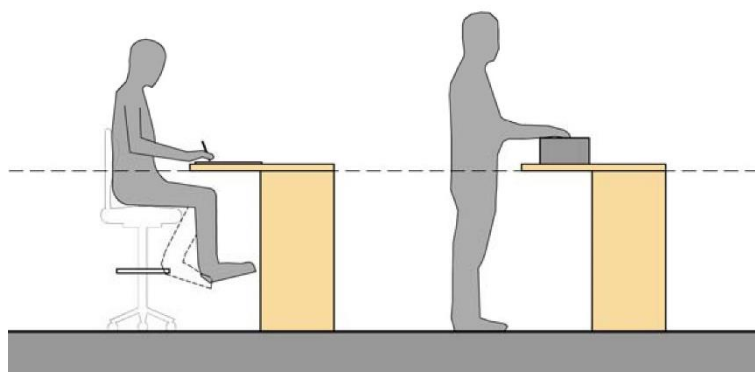


Figure 3.9: Standing height workbenches with seated position and standing positions

### Foot Support

Shorter staff may use footrests in the sitting position to lift the feet to the optimum ergonomic position. Chairs used at work benches used in the standing position should have foot support rings and be height adjustable. Standing height work benches where high stools are used may be

constructed with built-in footrests. The footrest should be located 700mm below the height of the counter and recessed by about 150mm to prevent striking by shins.

Refer to Figure 3.9 for appropriate foot support while seated at a standing height workbench.

### **Bench Support**

Many people tend to sit on the edge of the bench from time to time. It is important to support the bench with robust materials to avoid the collapse of the bench and becoming a danger to users. The support may be gained by using sufficiently thick and sturdy materials such as 32mm fibre board or thinner materials such as 25 mm fibre board supported by a steel frame.

Ideally, the maximum thickness of the bench including any support over the user's knee should be no more than 35mm. Supports should be designed to avoid contact with the user's knees.

Support for the bench may be by metal legs or joinery blades. The design should avoid conflicts and entanglement with the chair and the peoples knees as far as possible.



Figure 3.10: Workbench top of 32mm thickness with bench supports

### **Adjustable Keyboard Shelves**

Where a fixed height workstation is selected, adjustable keyboard shelves can provide some flexibility in the provision of height adjustment. Adjustable keyboards were more popular in the decades past but are increasingly un-common as they reduce the flexibility of benchtop use. Another reason is the increasing use and familiarity with the use of laptop (notebook) computers with integral keyboards. Therefore, adjustable keyboard shelves are not considered mandatory. If, however they are preferred the following section can be considered.

The advantages can be summarised as follows:

- Lower keyboard location results in the hands and fingers being straight or leaning slightly forward. This typing posture is considered ergonomically preferred to hands and fingers leaning upward to reach the keyboard
- Lower keyboard can better accommodate shorter staff without changing the height of the entire work surface provided that other critical ergonomic adjustments are also made, e.g. the height of monitors

The keyboard shelf, if provided should be large enough to accommodate the keyboard and computer mouse pad with the mouse handheld in a natural position.

The disadvantages can be summarised as follows:

- Placement of the keyboard is restricted to one area
- The adjustment mechanism below may snag clothing and compromise knee space
- If the adjustable support is too small to accommodate both the mouse and the keyboard, it will result in the mouse being placed on the desk. Then the user will be forced into a poor posture with shoulders not level and spine curved

On balance, keyboard shelves are not recommended. If maximum flexibility is intended a better option is a height adjustable desktop.

## 4.6 Typical Workstations

Workstations include proprietary corner workstations, workstations without a side bench and desks which may include a side return.

A workstation intended for working, writing or keyboard use while in seated position should be within the range of 680mm and 720mm high (with 720mm being the default). The ideal width of the bench may be 750mm to 800mm. In very tight situations a 600mm bench can also be considered, especially for laptop computer use.

If the workstation includes a side return, the depth of the return may be between 450mm and 750mm with 600mm being the optimum recommendation. This will allow for under-bench storage such as pedestal units, filing or drawer units.

Workstations designed with an angled corner to accommodate a computer should provide a minimum dimension of 400mm across the corner to allow for a keyboard or laptop computer.

The workstation should be designed to allow for adequate knee space. The space must be large enough so that the action of turning to use under bench units does not result in hitting the knees against these units.

One end of the workstation may be shaped to form a meeting table. For this purpose, rounded edges are recommended. Such workstations may suit doctors consultation rooms.

Workstations should include a modesty panel if they face onto an open area or if visitors are expected to sit across the workstation.



Figure 3.11: Typical corner workstation with privacy screen/ pinboard/ modesty panel

Workstations should have provision for safe cable management. With the advances in workstation design and height adjustable desks, many alternatives for cable management are available. However, the better systems all have the commonality of easy access to outlets, both power and data.

It should not be possible to accidentally knock out cables or spill liquids into power outlets.

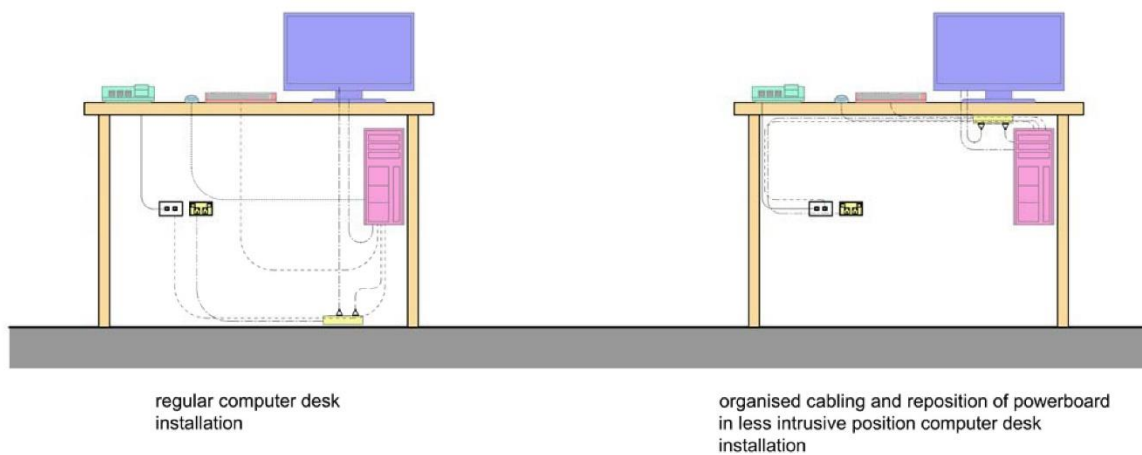


Figure 3.12: Cable management system before installation and after installation

#### 4.7 Hot-desks / Mobility Centre

In the modern work environment staff tend to be highly mobile, hot-desking is a system of organisation allowing multiple staff to use a single shared work point at different time periods.

Hot-desks can take many forms, from a full shared workstation to multiple smaller desks which may be occupied for limited periods of time. Collections of such may be referred to as Mobility Centres.

Hot desk stations should have easily accessible, typically above desk, power and data connection points. Desks should be ideally height adjustable to accommodate different personal dimensions and should be 750mm to 800mm deep to accommodate a laptop computer, a PC monitor and separate keyboard.

Where it is anticipated that Hot-Desk users would be using laptop computers it is recommended that the work point be established with monitors and keyboards ready for connection to the laptop to provide users with an ergonomically safer environment.

#### 4.8 Sitting – Standing workstations

Research has suggested that sitting for extended periods of time may have some health risks. Accordingly, it is becoming more common for staff to demand work stations that accommodate both sitting and standing working options.

A Sit – Stand workstation should be electronically height adjustable between the heights of 660mm to 1180mm. Suitable arrangements for the provision of power and data connections must be made, typically either wall below the lowest desk height or preferably soft wired desk mounted outlets to remove the risks associated with trailing power and data cables as the desk is raised or lowered.

Sit – Stand work points are not suitable in all locations and it is recommended that work points for public interface should be either sit or stand to suit the application required.

#### 4.9 Computers

##### *General*

People tend to use computers in a variety of ways. It is difficult to dictate a particular position to suit all people. The following guidelines represent the most typical preferences and standards.

##### *Computer Monitors*

The type of monitor will dictate the depth of the work surface. Older type CRT (Cathode Ray Tube) monitors which require greater workstation depth to permit a comfortable distance from the user's eyes are rarely used now. Flat screen monitors require less depth of surface and are easier to look at for longer periods as they are low glare and almost eliminate screen flicker. The lighter weight and support stand design of flat panel screens also provide greater flexibility to adjust monitor height to improve user posture.

### Monitor Position

Ideally, the monitor position should be adjustable both vertically and horizontally to suit different users. The height of the User will influence the vertical position of the monitor. The best option is for an adjustable monitor arm. These are, however, expensive and are not recommended for all conditions as most flat panel monitors come with some height adjustability built into the monitor stand. For most users, a fixed monitor is acceptable.

The angle of view to the centre of the monitor should be within a range defined by a horizontal line taken from the user's eye down to 15 degrees depending on the user's preference. The recommended head tilt sustained over a long period is 15 degrees, excessive head tilt may result in fatigue. The most comfortable viewing zone is between 32 degrees and 45 degrees below the horizontal as represented in the diagram below.

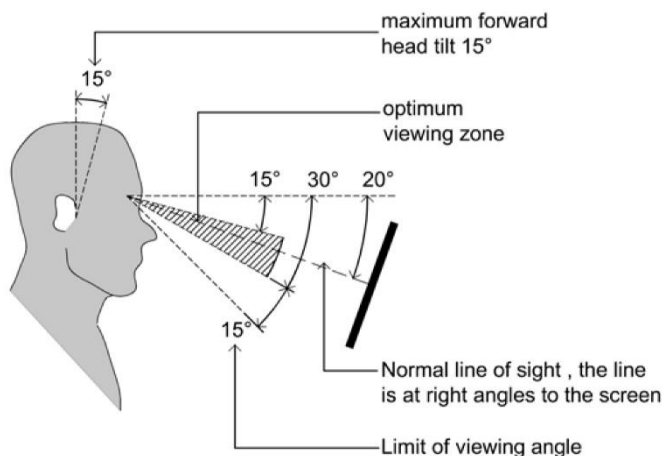


Figure 3.13: Recommended viewing angle (Source: AS 3590.2-1990 Screen based workstations Part 2 Workstation furniture)

The optimum areas for the location of key objects on the workstation or desk are demonstrated in the diagram below.

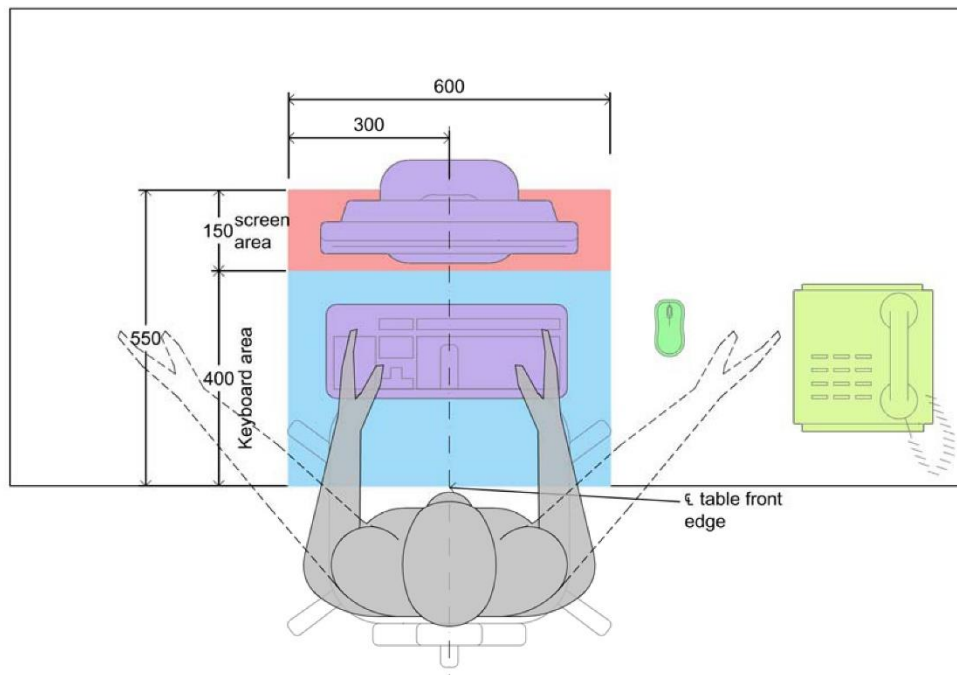


Figure 3.14: Optimum location of key elements on a workstation (Source: AS 3590.2-1990 Screen based workstations Part 2 Workstation furniture)

## Laptops

The modern laptop is a powerful and portable device which is frequently used in place of desktop computers, particularly for mobile staff and staff using hot-desks. Laptops are designed for portability and that inherently creates a conflict with good ergonomic positioning of both screen and keyboard.

Where Laptop computers are used for periods of time in excess of one hour the laptop should be supplemented with a stand to allow its screen to be placed in an ergonomically correct position and a supplementary keyboard. Alternately a separate monitor, set up in an ergonomically correct position that can be connected to the laptop and supplementary keyboard is recommended.

Nothing in this section prevents the use of laptop computers as desktop replacements. This type of computer is acceptable for occasional typing and is recommended for maximum space saving and user flexibility.

## 4.10 Shelving

### General

The design of shelving should address issues of depth, height, spacing and strength. Shelving covered by these guidelines include shelving units (proprietary or joinery), strip shelving, bookcases, metal shelving units and racking and shelves within cupboards.

### Depth

Shelving depth recommendations are as follows:

- Shelves below a bench should be the same depth as the bench
- Shelves that are wall mounted including shelves over a bench or workstation should be 350mm deep, if cupboard doors are required the total depth should remain 350mm.
- Shelves for medical records should be 400mm deep to allow for files to be stored laterally.

### Height and Spacing

For all types of wall shelving, height and spacing recommendations to optimise reach for persons are as follows:

- The lowest shelf should be not less than 150mm above the floor.
- The highest shelf should be up to 1810mm above the floor.
- Any shelf higher than 1810mm this will require a step ladder to access.
- Shelving above a 720mm high work surface should start at 1350mm to the underside. The underside of the shelf will be 630mm above the work surface.
- Shelving above a 900mm to 1000mm high work surface should start at 1500mm to the underside. The underside of the shelf will be 500mm to 600mm above the work surface.
- Shelving for medical records should be 2100mm high with 7 shelves starting at 150mm above the floor up to a maximum height of 1800mm.
- Shelving used for linen storage should be 450mm deep and a minimum of 400mm apart. For linen shelves located above a linen supply trolley the depth of the shelf should match the depth of the trolley.

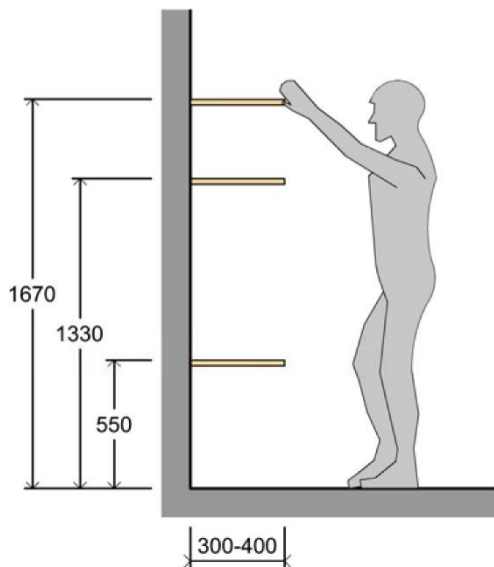


Figure 3.15: Reach of standing person to shelving over desk



Figure 3.16 Shelving installed over desk

It is recommended that all shelving be adjustable as far as possible. Joinery units may include fixed shelves when items to be stored require additional support.

Note: In heavy use areas of health facility the conventional metal pins inserted into joinery walls often fail. In such situations, proprietary metal strips to hold shelf supports may be preferred.

Designers should refer to local infection control policies and Part D of these guidelines for suitability of proprietary shelving systems for clinical areas.

### Strength

Design of shelving should suit the weight of items to be stored. Heavy items may require fixed shelving, additional shelving thickness, shorter shelving spans or use of stronger material such as metal.

Adjustable shelving does not have the strength of fixed shelving and is more suitable for light weight objects.

### Disabled Access

Shelves designed for use by people with disabilities including patients, visitors or staff should comply with relevant accessibility standards.

Recommended reach heights to shelving and across a bench for persons in a wheelchair are demonstrated below:

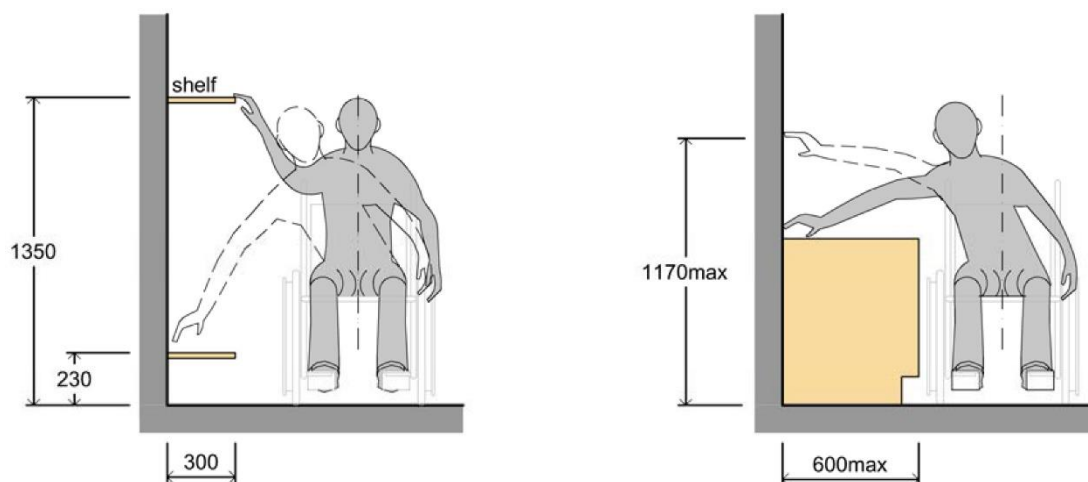


Figure 3.17: High and low side reach of a person in a wheelchair to shelving and to a bench.