



Appliances

Universal design

People who inhabit and visit the houses we live in come in all shapes and sizes, ranging from infants to seniors, with various ever-changing abilities and skills. As we grow up, grow old and welcome new people to our homes, our housing needs change. A house that is designed and constructed to reflect the principles of universal design will be safer and more accommodating to the diverse range of ages and abilities of people who live in and visit these homes.

One of the goals of universal design is to maximize the usability of environments. Everyone appreciates having a well-designed kitchen that is safe, spacious, relaxing and easy to use. Equally important are kitchen appliances that are safe and user-friendly.

Effective universal design and construction can only occur when we truly appreciate how persons with disabilities engage the built environment. Universal design is only a subtle shift from what is typically done; designing for greater accessibility, then, is not a new way of designing, simply a more focused one. By providing flexibility in the selection of design features and incorporating adaptability into home design, the life and usability of a home is extended, which promotes the concept of **aging in place**.

This concept is increasingly popular with families and individuals who choose to stay in their homes and neighbourhoods as they grow and age. Planning for individuals' changing needs and abilities allows for periodic kitchen customization based on changing requirements and reduces the need for future costly renovations.

Planning for future needs is good practice. Principles of universal design encourage flexibility, adaptability, safety and efficiency.

Appliance designers have increasingly taken into consideration the principles of universal design, realizing that this increases the usability of appliances, making them simpler to use, quieter and safer, equipped with dials and controls that are easier to operate and read. The concept is to produce a product that is designed for the user as opposed to the user being forced to accommodate to the design.

Universal design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size and ability. "The Principles of Universal Design" are found on page 12.

Bolded terms throughout this fact sheet are defined in the Glossary on page 10.



Selecting an appliance

Many factors need to be considered when selecting an appliance, whether it is a toaster or a washing machine, a rice cooker or a can opener. The most important consideration is that it suit your needs, as well as the needs of your family. Make sure the appliance is compatible with your lifestyle and individual requirements concerning safety, usability, cost, storage, cleaning, programming and ease of installation (see figure 1).

Purchasing appliances that maximize safety and convenience is the cornerstone of good design.

Important considerations that will help you identify the most positive appliances include the following factors:

- Safety
- Manoeuvring space
- Ease of use
- Cost and energy efficiency

Safety

The first consideration in selecting any appliance is safety. The CSA certification mark on electronics and appliances provides assurance that these products have been tested and certified to meet applicable Canadian standards for performance and safety.

Be sure to look for the CSA mark when purchasing any appliance (see figure 2).

Here are some personal safety issues to consider when selecting an appliance:

- Is it easy to operate?
- Are the controls easy to read?
- Is it easy to install?
- Is it too heavy to handle?
- Is it equipped with a **fail-safe** feature, such as an automatic shut-off?
- Is it equipped with a **lock-out feature** to prevent turning it on inadvertently?
- Does it pose a burning hazard?
- Will there be sufficient manoeuvring space?
- Are the controls intuitive and easy to use?
- Which way does the appliance door swing?
- What programming options does it offer?
- Can I test it before I purchase it?
- Where do I find more information for comparing similar appliances?

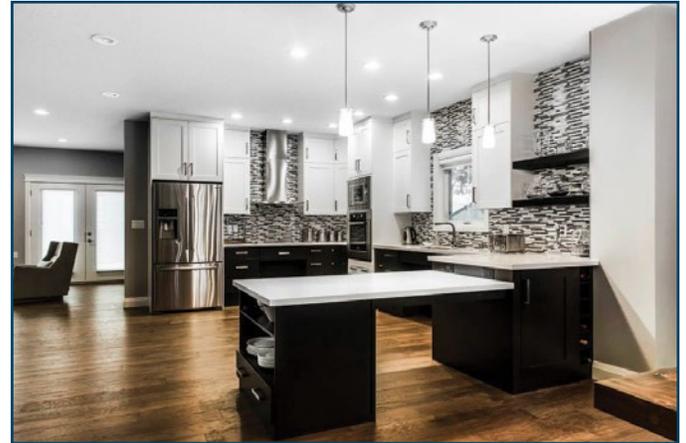


Figure 1: Large accessible kitchen complete with accessible appliances
Photo by Ron Wickman



Figure 2: CSA certification marks
Photo by Ron Wickman



Automatic shut-off is a design feature available with some appliances, such as kettles, irons and even stoves. This feature builds in a tolerance for error that can prevent fires and injuries. Some stoves incorporate a motion detector feature that automatically shuts off the stove if no movement is detected within a preset amount of time. Selecting an appliance with an automatic shut-off is sensible for everyone, but is especially useful in homes where there are children and/or aging relatives.

Operating smaller appliances, such as waffle irons and toaster ovens, can pose a safety hazard if the exterior of the appliance heats up. Look for appliances with a **cool touch** feature that prevents the exterior surfaces from becoming extremely hot. Cool touch appliances are especially appreciated by people who are blind or have low vision who may orient themselves by “feeling” their way around the kitchen.

Selecting stoves or countertop ranges with controls at the side or in front, rather than at the back is a good idea. This will increase safety for everyone, especially anyone who operates a stove from a wheelchair, in that it eliminates the need to reach over the burners.

However, side or front controls such as knobs and buttons can also be misused by children who can reach them. Limiting access to appliances, such as stoves, can be achieved by installing an **override switch** that must be activated prior to operating the appliance. The placement of the override switch should be carefully considered so that it is protected against use by those at risk but still easily accessible to others. While this feature is an important consideration for households with children, it should also be considered in households with people with cognitive disabilities and people with dementia.

Safety hazards can result from the inadvertent use of an appliance, particularly children climbing into a washer, dryer or oven. Some appliance manufacturers offer a lock-out feature that can be set to prevent doors from being opened.

Choose appliances that incorporate duplicate alert systems and/or safety features (also known as redundant cueing features) that reinforce the safe use of the appliance for everyone. For example, a toaster oven that emits a sound when the food is ready, but also shuts itself off, or a microwave oven that “beeps” when the time is up but also flashes a text message on the control panel.

Access by all members of the household to the water shut-off valves for washers and dishwashers, as well as emergency controls for other appliances, should be planned during the design and installation process.

Manoeuvring space

When it comes to kitchens and laundry rooms, manoeuvring space around appliances is a key consideration, as space may be required for a walker or a wheelchair. A clear manoeuvring space of at least 1,500x1,500 mm (60 x60 in.) should be provided for people who use a manual wheelchair and 2,100x2,100 mm (83x83 in.) for people who use a larger power wheelchair or a scooter.

It is always important to consider how work is going to be done. Planning for clear floor space around all appliances in the kitchen is an important design consideration (see figure 3).

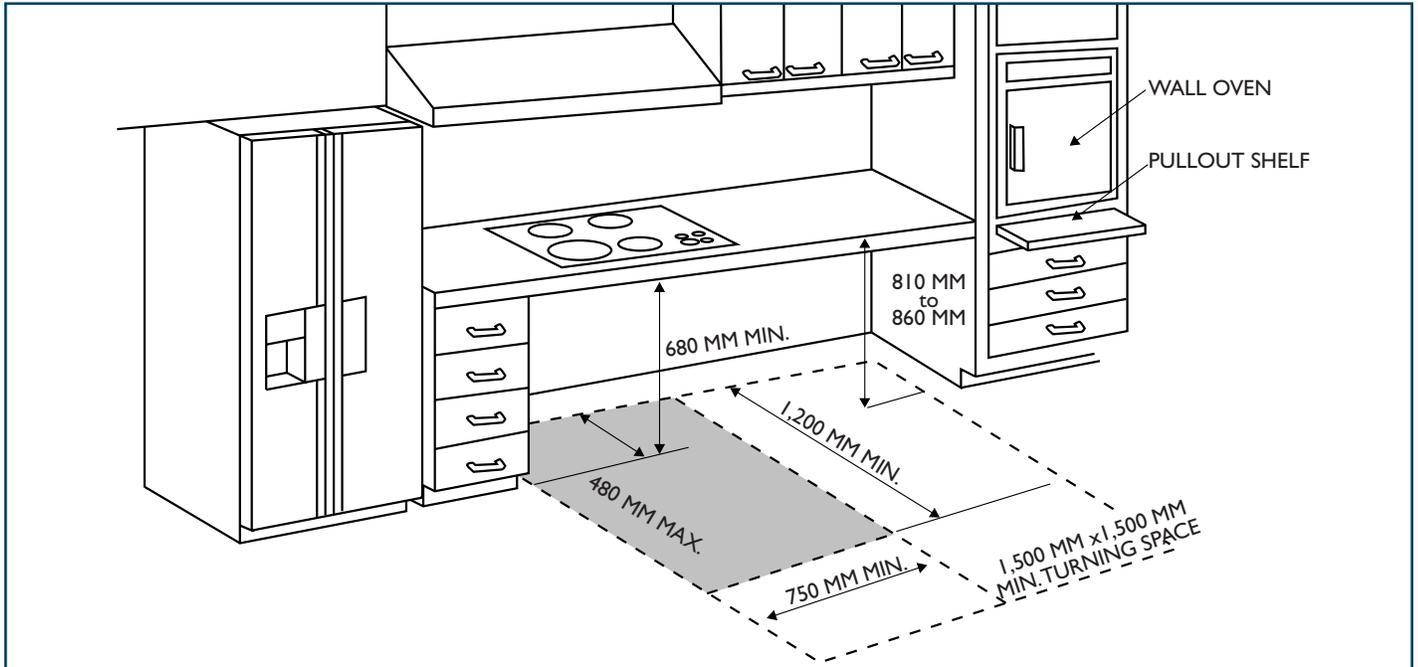


Figure 3: Clear floor space requirements around appliances
Diagram by DesignAble Environments Inc.

Ease of use

There is a wide range of choices available to us when purchasing an appliance. Appliances come in a variety of colours, styles, speeds and with various levels of complexity of operation. In universal design, appliances should be designed to promote user efficiency and ease—to minimize lifting, reaching, stooping or other off-balance movement.

A mixer that is too heavy to lift will remain in the cupboard; a dishwasher with too many programming options will be run at only one speed; a vacuum that is too heavy or awkward to carry will not be used and a refrigerator that is too difficult to clean will become unsanitary. Before buying an appliance, research different models with various features to make sure your choice of appliance meets everyone’s needs.

Appliances, such as coffee machines, microwaves, refrigerators, etc., are available in a variety of sizes, shapes, costs and degrees of complexity. Programming the appliance may require that you read an instruction manual. When selecting an appliance, think about the usability and complexity of the appliance and its instructions. Choosing an appliance that is simple and intuitive to use is a good idea whether the appliance is for you or a gift for someone else.

Some appliances have a small LED screen that provides programming instructions. The size and location of the screen, as well as the colour and size of the on-screen characters, should be considered to ensure that they will work for you.

Consider appliances that provide information in a mixture of different modes, including audible, visual and tactile operational information. **Dual-signalling** appliances that alert you visually as well as audibly are recommended. People who are deaf or hard of hearing will be able to see the visual signal and people who are blind or visually impaired will hear the signal. This is a universal design approach that works for everyone.



Legibility

The exterior and interior of the appliance should have sufficient lighting to enable people to see and safely operate the appliance. The instruction text and controls should contrast in colour to the background area. In addition, some manufacturers allow the customer to program the size of letters and characters to maximize readability, a feature appreciated by many customers. The control area should also be free of glare and non-reflective. The surface materials offered by manufacturers vary from glass, to enamel, to stainless steel, some of which make controls more difficult to see and operate. Legibility of operating controls and instructions is an especially important issue for persons with reduced vision.

Controls

Controls should be easy and intuitive to operate for everyone, regardless of language, cognitive ability, ability to grasp and use of fine motor skills (see figure 4). Also, since the controls will be used by different people, they should be clearly visible and within the reach of both seated and standing persons.

Touch-pad operation is great for busy hands and arthritic fingers, but tough on weak eyes.

There are cooking appliances that feature a control panel that is separate from the oven or cooktop unit, thereby allowing custom placement of controls to meet the needs of the user.

Controls that are easy to operate:

- incorporate good colour contrast for instructions and other characters (either dark text on a light-coloured background or light text on a dark-coloured background);
- are located on non-reflective and non-glare surfaces;
- do not require too much strength to operate;
- provide information for people who rely on sight, hearing or touch; and
- have **tactile features** and colour-contrasting markings to clearly indicate the on-off positions, for safety.

Storage

Designing storage space for various appliances is often left to the last minute. Careful consideration of the storage requirements for small appliances will increase efficiency and usability, as well as reduce the likelihood of home accidents (see figure 5). For example, storing a heavy mixer at the bottom of a cupboard will likely mean it is seldom used. There are a number of storage systems available to homeowners that assist in the efficient use of space, such as a swing-up shelf for a heavy appliance, which will eliminate the need for heavy lifting.



Figure 4: Tactile controls with high-contrast text
Photo by Ron Wickman

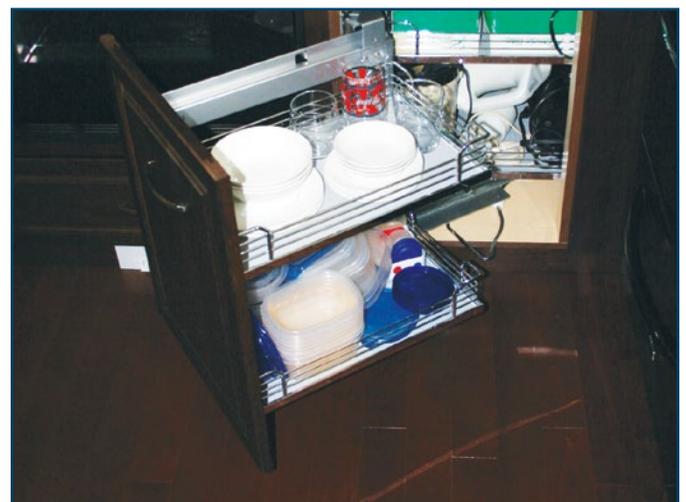


Figure 5: Swing-out shelf for small appliances and other kitchen items
Photo by Ron Wickman



Cleaning

The ability to easily clean an appliance is an important health and safety consideration and can also be a factor in the proper functioning of the appliance itself. A self-cleaning feature in an oven is not only convenient and labour-saving, but also enhances safety by limiting the need for using chemical cleaners and removing the need to bend and reach into the oven for cleaning—an advantage for all users.

Check that racks, drawers and shelving in refrigerators, stoves, toaster ovens, etc., can be easily removed for cleaning. Some small appliances incorporate removable parts that can be put in the dishwasher for cleaning. Be sure to investigate all the options when choosing your appliance.

Cost

Cost is always an important factor. Sometimes the convenience offered by a household appliance will outweigh the higher cost. Refrigerators, stoves, dishwashers, washers and dryers are all available with a variety of different door swing and shelving configurations. It usually costs no more to purchase an appliance that offers the configuration that suits your needs best.

Cost savings can result from carefully comparing the potential energy consumption of different models or types of appliances. Look for the EnerGuide and ENERGY STAR® labels when shopping for appliances.

The major appliances to consider include the following:

- Refrigerators and freezers
- Dishwashers
- Cooktops
- Wall ovens
- Microwaves
- Washers and dryers

Refrigerators and freezers

Side-by-side refrigerators and freezers are preferred by some people since they are easy to see into and are accessible to people who use wheelchairs who cannot always bend down that far. Another advantage for persons in wheelchairs and who use walkers is that the doors do not swing out as far, making them easier to navigate around and save on manoeuvring space. However, they offer limited storage for large amounts of food. Some people may prefer the freezer to be located in the upper compartment of a split-level refrigerator, making it is easier to see into, while others may prefer the freezer compartment at the bottom (see figure 1).

Whichever model is selected, pullout shelves and a self-defrost feature increase the ease of reach and cleaning—both important considerations.

The kitchen layout and appliance placement should permit easy access to refrigerator drawers and pullout shelves. Refrigerators can be purchased with your preferred door swing direction, providing more flexibility to the kitchen designer and homeowner. Also remember that, although icemakers and cold water dispensers are convenient, they may reduce the amount of storage space inside the refrigerator and freezer.

Under-the-counter or drawer-type refrigerators make it easy to place food items within reach. However, they can be expensive. Using this type of refrigerator in a separate location, such as a family room or wet bar is a good idea.



Dishwashers

Kitchen designers usually locate the dishwasher close to the sink. As a result, manoeuvring space around an open dishwasher is an important design consideration, especially for people who use mobility devices such as walkers or wheelchairs. If you are a wheelchair user, try to provide knee space under one of the cabinets immediately adjacent to the dishwasher—this will allow you to get closer to the dishwasher for loading and unloading.

Single-drawer dishwashers can be purchased with finishes that match the design of the kitchen cabinets. Having small two-drawer dishwashers can eliminate the need to store dishes elsewhere and, while more expensive, may suit the needs of some people. (see figure 6).

Dishwasher controls are sometimes found on the top of the door. Such a configuration usually results in limited legibility, which may not suit some people, especially those with visual impairments.

Controls on dishwashers should be easy to see and should comply with the requirements for controls outlined earlier on page 5. Additionally, they should incorporate good colour contrast, be intuitive and easy to use, as well as simple to program. Ease of loading and unloading the dishwasher will depend on the configuration of the racks and pullout baskets.

Look for a dishwasher with a “quiet feature;” this is appreciated by everyone, but it is especially important in households that include someone who has a hearing impairment. Background noise from an appliance such as a dishwasher can reduce that person’s ability to hear and communicate effectively.

Cooktops

A counter-mounted cooktop with clear knee space underneath is an excellent approach when designing for someone who uses a wheelchair. The knee space should be at least 750 mm (30 in.) wide, 680 mm (27 in.) high and 480 mm (19 in.) deep. Additional toe space at least 300 mm (12 in.) high should be provided beyond the knee space (see figure 7).

Induction cooktops are the latest development in stove top ranges. The smooth glass surface does not have buttons or knobs and is operated by touch. The sensor uses the interruption of a beam of light to operate the off/on switches, and element and temperature controls. These are marked out on the surface of the glass top. The heat is created by electromagnetic coils that transfers heat to the bottom of the steel or cast iron cookware. This heats the



Figure 6: Undercounter, single-drawer dishwasher
Photo by Ron Wickman



Figure 7: Cooktop in accessible kitchen
Photo by Ron Wickman



cookware sitting on the element and the surface of the glass remains relatively cool to the touch. It is the cookware that gets hot and does the cooking reducing heat loss from the element and saving 85 to 90 per cent in electrical energy compared to regular electrical stove tops.

This type of smooth touch control is also great for people with arthritic hands, as they don't have to grasp large round knobs. The absence of knobs also prevents clothing or mobility devices from getting caught.

Either way, if you have a separate cooktop or a range and want to up your safety quotient, consider a wireless system. This system attaches to an electric stove or cooktop and includes a built-in motion detector that monitors movement in the vicinity. If the user does not return within a specified time frame, the stove shuts off automatically, preventing fires before they begin.

Ensure that appliances have front-mounted controls (to eliminate reaching over burners) with safety LEDs to show the burner is hot or active. Avoid raised heating elements on ranges in favour of smooth glass surfaces (for sliding pots instead of lifting). A faucet over a cooktop is much safer than lugging a pot to and from the sink.

Some cooktops are designed specifically for persons who are blind; they are designed with touch controls that let users feel and hear the stove top's power levels.

Wall ovens

Wall ovens offer flexibility, as they can be installed at any height to suit the needs of the household. Wall ovens that open sideways are preferred by many people who find them easier for removing food. Please note that wall ovens with side swinging doors can be difficult to find, and the ones that are available can be rather costly. A pullout shelf under the oven and a counter on the open side of the oven are practical design features that enhance safety (see figure 8).



Figure 8: Wall oven with pullout shelf underneath
Photo by Ron Wickman

Microwaves

Microwaves are useful for everyone, but particularly for some people with activity limitations because they are easy to operate and can quickly defrost and heat up pre-prepared meals. Microwaves should be located at an appropriate height for easy access to the controls and interior space, with a clear counter space beside, so that food can be removed from the microwave and slid along the counter, eliminating the need to carry hot food items (see figure 9).

A microwave drawer is a microwave designed to be installed under the countertop, into a cabinet or under any gas or electrical wall oven. Instead of a door that swings out when opened, requiring the individual to reach into the microwave, a drawer pulls out allowing a person to easily place an item in the microwave or take it out.

The innovative design of this product is not only a space-saving idea and easy to use for individuals who are fit and ambulatory, it is well suited to a universal designed kitchen. The microwave drawer is suitable for people living independently with moderate motor skill loss to those who use a wheelchair.



Figure 9: Microwave with pullout shelf underneath
Photo by Ron Wickman



As with all operational controls, microwave controls should have good colour contrast and be simple and easy to operate. One appliance that helps those persons with limited vision is a talking combination oven/microwave. It is a combination oven, which means it has all the uses that a normal fan oven would have except this one talks to you. You can bake, grill or even roast things. It has a heating element at the back of the oven and a fan that circulates the air over the entire oven with a thermostat to control the temperature. The grill part of it is on the top of the oven and it is an infrared grill element. The oven just tells you what the temperature is and what you are doing, for how long and when it is done.

In accessible kitchen design, it is a good idea to consult with a professional, such as an occupational therapist. It also helps to consult with an architect, an interior designer or another design professional who is familiar with the design of accessible residences. During the design, work with the designer and occupational therapist to determine the most positive kitchen layout and best placement of countertops and appliances.

Washers and dryers

Front-loading washers and dryers are preferred by many people, including people who use wheelchairs. Top-loading machines may be preferred by someone who finds it difficult to bend comfortably. Whichever model is selected, front-mounted controls are preferable as they are easier for everyone to see and operate. Stacked washer and dryer units are often used when there are space limitations; however, they may not be a good design option for people who use wheelchairs, as these appliances can be difficult to operate and see into. Some combination washer-dryers are electric and ventless, perfect for remodels and where space is precious.

Pedestal base units that range from 254 to 381 mm (10 to 15 in.) are available for many models of front-loading washers and dryers making them easier to reach into (see figure 10). The raised storage platform can be used to store large bottles of detergents. Careful consideration should be given to the location of the soap dispenser, as it may be located on the top of the machine, making it inaccessible to people who use wheelchairs. Also, check the location of the lint catcher. Some dryers even feature audible alarms that inform you when the lint catcher needs to be cleaned.

Choose washers and dryers that offer multiple modes of information on the status of the laundry cycle, including visual, tactile and audible alerts. Such features will maximize accessibility for people with a variety of different capabilities.

The location of the washer and dryer in the home should be designed to be easily accessible and free of hazards. Well-planned storage will increase the efficiency as well as the safety of the laundry area.

The manoeuvring space in front of the appliances should be at least 1,500x1,500 mm (60x60 in.), in addition to the area where dirty clothes are stored. Storage of soap and other supplies should be located nearby, at a maximum height of 1,200 mm (48 in.).

A laundry sink and an area for folding clothes should be located within close proximity to the washer and dryer. If clothes are to be ironed within the laundry area, an easily accessible electrical outlet should be incorporated and a fold-down ironing board should be considered. Also, do not forget to plan a space to store the iron.



Figure 10: Front-loading washer and dryer mounted on pedestal with pullout drawers. Photo by Ron Wickman



Glossary

Aging in place: the ability to remain in one's home safely, independently and comfortably, regardless of age, income or ability level throughout one's changing lifetime.

Automatic shut-off: a feature that is either factory programmed or programmable by the user and that automatically shuts off an appliance.

Cool touch: the exterior surface of the product remains at room temperature and is "cool to the touch."

Dual-signalling: two distinct means of transmitting information to the user, which are separate and not reliant upon each other—an audio and a visual signal for example.

Fail-safe: the ability of the device to safely operate or fail without danger to people or other devices.

Lock-out feature: a feature designed to prevent unsupervised or inadvertent use or entry.

Override switch: a lock-out feature that prevents accidental activation or entry into an appliance. Deactivating the lock-out feature does not, in and of itself, activate the device—it simply enables the user to take the normal steps for activation or entry.

Tactile feature: a feature that allows a person to use the sense of touch to read or receive information.

Additional resources

Books

Barrier Free Environments Inc. *The Accessible Housing Design File*. New York: John Wiley & Sons, 1991.

Behar, S., and C. Leibrock. *Beautiful Barrier-Free: A Visual Guide to Accessibility*. New York: Van Nostrand Reinhold, 1993.

CMHC. *Housing Choices for Canadians with Disabilities*. Ottawa, ON, Canada: CMHC, 1995.

Dobkin, I. L., and M. J. Peterson. *Gracious Spaces: Universal Interiors by Design*. New York: McGraw-Hill, 1999.

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Goldsmith, S. *Universal Design: A Manual of Practical Guidance for Architects*. Oxford, England: Architectural Press, 2000.

Jordan, Wendy A. *Universal Design for the Home*. Beverly, Massachusetts: Quarry Books, 2008.

Leibrock, C., and J. E. Terry. *Beautiful Universal Design: A Visual Guide*. New York: John Wiley & Sons, 1999.

Mace, R. *Residential Remodeling and Universal Design: Making Homes more Comfortable and Accessible*. Darby, PA: Diane Publishing Co., 1996.

Pierce, Deborah. *The Accessible Home: Designing for All Ages and Abilities*. Newtown, CT: The Taunton Press, 2012.

Wylde, Margaret, Adrian Baron-Robins, and Sam Clark. *Building for a Lifetime: The Design and Construction of Fully Accessible Homes*. Newtown, CT: The Taunton Press, 1994.



Websites

American Council for an Energy-Efficient Economy—Consumer Guide to Home Energy Savings Online (February 2016)

<http://www.smarterhouse.org>

Association of Home Appliance Manufacturers—Safety (June 2016)

https://www.aham.org/AHAM/Safety/AHAM/Safety/Safety_Home.aspx?hkey=2204551a-a883-4a08-83fa-9e0502db6104

Consumer Union of U.S.—Consumer Reports (February 2016)

<http://www.consumerreports.org/cro/index.htm>

Institute for Human Centered Design (February 2016)

<http://humancentereddesign.org/>

IDEA Center for Inclusive Design and Environmental Access (February 2016)

<http://idea.ap.buffalo.edu/>

Home for Life (February 2016)

<http://www.homeforlife.ca/>

NC State University: College of Design (February 2016)

<http://www.design.ncsu.edu/>

Livable Housing Australia (February 2016)

<http://livablehousingaustralia.org.au/>

Miscellaneous websites

<http://www.universaldesign.com/>

<http://www.houzz.com/ideabooks/5350132/list/How-to-Choose-Kitchen-Appliances-for-Universal-Design/>

http://www.remodeling.hw.net/business/design/9-universal-design-details-youre-forgetting_o

<http://www.protradecraft.com/universal-design-and-kitchen-appliances>

Natural Resources Canada: Office of Energy Efficiency—EnerGuide (February 2016)

<http://www.nrcan.gc.ca/energy/products/energuide/12523>

Natural Resources Canada: Office of Energy Efficiency—ENERGY STAR®

in Canada (February 2016)

<http://www.nrcan.gc.ca/energy/products/energystar/12519>

Virginia Tech—Center for Real Life Kitchen Design (February 2016)

<http://www.ahrm.vt.edu/about/ahrm-spaces/center-rlkd/index.html>

Vision Australia Accessible Design for Homes (February 2016)

<http://www.visionaustralia.org/living-with-low-vision/learning-to-live-independently/living-at-home/making-the-best-of-your-vision>



The Principles of Universal Design

Principle 1: Equitable use

This principle focuses on providing equitable access for everyone in an integrated and dignified manner. It implies that the design is appealing to everyone and provides an equal level of safety for all users.

Principle 2: Flexibility in use

This principle implies that the design of the house or product has been developed considering a wide range of individual preferences and abilities throughout the life cycle of the occupants.

Principle 3: Simple and intuitive

The layout and design of the home and devices should be easy to understand, regardless of the user's experience or cognitive ability. This principle requires that design elements be simple and work intuitively.

Principle 4: Perceptible information

The provision of information using a combination of different modes, whether using visual, audible or tactile methods, will ensure that everyone is able to use the elements of the home safely and effectively. Principle 4 encourages the provision of information through some of our senses—sight, hearing and touch—when interacting with our home environment.

Principle 5: Tolerance for error

This principle incorporates a tolerance for error, minimizing the potential for unintended results. This implies design considerations that include fail-safe features and gives thought to how all users may use the space or product safely.

Principle 6: Low physical effort

This principle deals with limiting the strength, stamina and dexterity required to access spaces or use controls and products.

Principle 7: Size and space for approach and use

This principle focuses on the amount of room needed to access space, equipment and controls. This includes designing for the appropriate size and space so that all family members and visitors can safely reach, see and operate all elements of the home.

