

INTRODUCTION

MOST MAJOR HOUSEHOLD APPLIANCES HAVE LIFE SPANS OF 10 TO 20 YEARS. TYPICAL APPLIANCES CAN COST SEVERAL HUNDRED DOLLARS TO REPLACE, BUT DO NOT GENERALLY PLAY A MAJOR PART IN THE DECISION TO BUY A HOUSE. IN MORE EXPENSIVE HOMES, APPLIANCES CAN COST THOUSANDS OF DOLLARS EACH. APPLIANCES CAN BE REPLACED MUCH MORE EASILY THAN THE STRUCTURE, ROOF, PLUMBING, HEATING OR ELECTRICAL SYSTEMS.

THIS CHAPTER PROVIDES AN OVERVIEW OF SOME COMMON HOUSEHOLD APPLIANCES. THERE ARE A TREMENDOUS VARIETY OF APPLIANCES, AND ALL ARE NOT CONSIDERED IN THE FOLLOWING PAGES. WE RECOMMEND THAT OWNER'S MANUALS BE CONSULTED FOR REGULAR MAINTENANCE ON ALL HOUSEHOLD APPLIANCES. IF THE MANUALS ARE NOT ON HAND, THEY ARE USUALLY AVAILABLE FROM THE MANUFACTURER, OFTEN ONLINE.

HOUSEHOLD APPLIANCES MAY BE BUILT-IN OR PORTABLE (OFTEN REFERRED TO AS FREESTANDING). GENERALLY SPEAKING, INSTALLED APPLIANCES REMAIN WITH THE HOUSE WHEN IT IS SOLD, BUT FREESTANDING APPLIANCES ARE OFTEN REMOVED. THE PURCHASE AGREEMENT NORMALLY STIPULATES WHICH APPLIANCES STAY WITH THE HOUSE. APPLIANCES ARE NOT INCLUDED IN A STANDARD HOME INSPECTION UNDER THE STANDARDS SET BY CAHPI (CANADIAN ASSOCIATION OF HOME INSPECTORS) AND AIBQ (ASSOCIATION DES INSPECTEURS EN BATIMENTS DU QUEBEC). APPLIANCES ARE INCLUDED IN THE STANDARDS SET BY ASHI (AMERICAN SOCIETY OF HOME INSPECTORS).

1.0 Ranges

DESCRIPTION A range is a cooking appliance that includes a cooktop and an oven. These are also referred to as stoves. The ovens bake and broil, and some have a convection cooking component.

Separate cooktops and wall ovens combine to provide the same functionality as a range. Standalone cooktops and wall ovens provide more flexibility in terms of location and functionality. Wall ovens are often smaller than range ovens, and double wall ovens are common. A range is typically less expensive than a separate cooktop and oven(s). Ovens are discussed in more detail in Section 2.0 of this chapter.

FUELS Ranges can operate on electricity, natural gas, or propane. The determining factors include personal preference and fuel availability. There is often an increased cost in replacing the range if changing from one fuel source to another.

GAS VERSUS ELECTRIC Some people prefer gas burners to electric, since they provide a visual reference to the amount of heat they provide. Controlling the intensity of the flame is quite straightforward – the bigger the flame, the more heat. Gas burners heat up and cool more quickly than electric elements, providing better cooking control according to many. This control is useful when simmering delicate sauces or when providing the quick bursts of heat needed for cooking with a wok, for example.

Electric elements take longer to heat up and cool down than gas burners. They maintain low temperatures by cycling on and off at full current, not by using a steady small amount of electricity. On low settings, they alternate between providing too much heat and none at all. This makes control more difficult.

Some people are not comfortable cooking with gas. They worry about the open flame and the possibility of a gas leak and explosion.

LIFE EXPECTANCY The life expectancies of ranges are typically 10 to 20 years.

ANTI-TIP BRACKETS (RANGE STABILITY DEVICE) There is the potential for serious injury if a freestanding range tips over, which may occur if weight is placed on an open door. Modern units come with a bracket, which is secured to the wall or floor. This bracket holds one of the rear legs of the oven, preventing it from tipping over. These have been required in many jurisdictions since 1991.

1.1 Electric Ranges

Ranges come in a variety of sizes and configurations. The cabinetry and the floor plan of a kitchen usually determine the range's width, with 30 inches being very common. Ranges (cooktops) can be built into the counter top and cabinets or stand by themselves. Freestanding ranges which fit between sections of base cabinets are the most popular. These units typically have four elements or burners on top and an oven below.

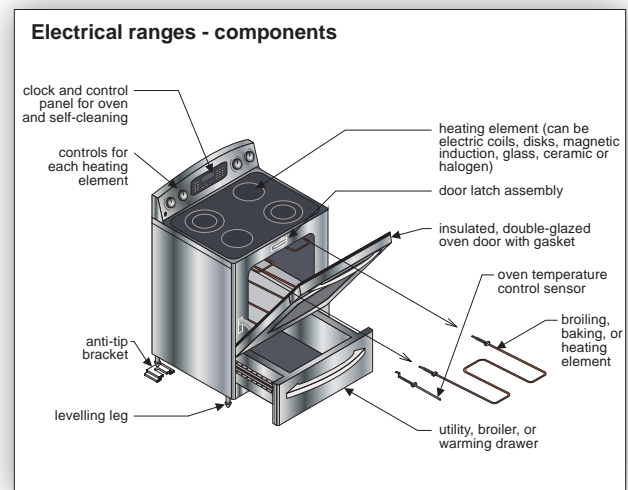
CONTROLS The majority of electric ranges have their control knobs located on the back guard where they are easy to see and are out of the reach of children. Others are located at the front, so that one does not have to reach across hot surfaces to adjust controls. Some knobs have to be pushed in before they turn, to help prevent children from turning them on accidentally. All dials are marked to indicate which element they operate. On most, a light indicates which element is on, since a hot element can look much like a cold one.

ELECTRIC COILS Traditional heating elements are electric coils. They consist of a metallic-sheathed resistance-coil material wound in a flat spiral. High quality models may have two elements placed side-

by-side in a continuous spiral or one element wound in the center portion of the burner and the second around the outside. This allows one half, or the center portion, to be used for small pots while both halves may be turned on for large pots.

MAINTENANCE Drip bowls under each element catch spills and require periodic cleaning. These bowls should never be covered with aluminum foil, since this can result in a shock hazard, improper cooking or damage to the elements. All electric elements are "self cleaning" since spills burn off quickly. Soaking an electric element in water can damage it.

POWER RATINGS Coils come in various sizes and wattages ranging from six-inch diameter, 1,250 watt units, to eight-inch diameter, 2,400 watt elements.



- DISKS** Solid disks, originally used in Europe, appeared in North America in the early 1980s. They are flat, heavy iron plates with heating elements embedded in them. These units have twice the surface area of conventional coil elements and provide more even heat. Because of their greater contact with the cooking utensil, they are more efficient than coils. Disks do not require reflector pans or drip catchers, making them easy to clean.
- PROTECTIVE LIMITER** Solid disks are equipped with built-in limiters to prevent overheating. The limiter is activated when a pot is unable to properly conduct heat away from the element. This may occur when an element is left on with no pot or when a pot boils dry. The limiter reduces the wattage, preventing overheating or pot meltdown. This safety feature is not often found with coil elements.
- POWER RATINGS** Disks range from six-inch diameter, 1,500 watt units, to ten-inch diameter, 2,600 watt units. Although disks are rated at a higher equivalent wattage than coils, coils heat up and cool down faster, since they have a smaller mass.
- SAFETY CONCERNS** Disks remain grey even when very hot, and they cool down slowly. An element can burn someone when it looks cool. Food will continue to cook longer after the element is turned off. This can make control more difficult. Disks are not recommended for areas supplied with 208-volt electrical services or less (typical of some high-rise buildings).
- MAGNETIC INDUCTION** Magnetic induction elements generate a high frequency, fluctuating magnetic field. This field causes the metallic molecules in the pot to move in the direction of the field, which changes rapidly. This heats the pot, which then cooks the food. Good control is provided through quick heating and cooling. Power levels are also variable.
- COOKWARE** Only iron or steel (ferrous metal) cookware is used with induction elements.
- These ranges usually have a one-piece cooktop that contains several cooking areas marked so pots can be centered on the coil. Since the range does not get hot, (other than the heat conducted from the pan), it is extremely safe. It is also easy to clean, since spills do not burn onto the surface.
- GLASS-CERAMIC** These range tops have a large glass-like cooking surface, about 1/4 – inch thick. The elements below the glass conduct heat up through the surface to the pot. The surface allows heat to move up to the pot, but resists heat transfer laterally across its surface. The smooth surface may look the same whether cold or hot, so a light indicates when the surface is hot. This light may be near the control knob or on the cooking surface. The light stays on after the power is turned off, as long as the element is hot. The surface is relatively easy to clean.
- HALOGEN** Halogen elements use infrared halogen lamps below a flat glass cooktop surface. When turned on, halogen elements glow brightly and provide instant heat. These units provide even heat distribution. They are also as easy to clean as glass ceramic cooktops. Usually, no more than one or two of the four elements on a cooktop are halogen type.
- FIRE HAZARDS** Curtains and other combustibles should be kept well away from the top of ranges, as they can easily ignite. Generally speaking, combustibles should be at least 30 inches above the range. Range hoods may be 24 inches above the cooking surface. Manufacturers' installation requirements should be observed.
- Clearances from ranges to combustibles on either side are also typically determined by the manufacturer.

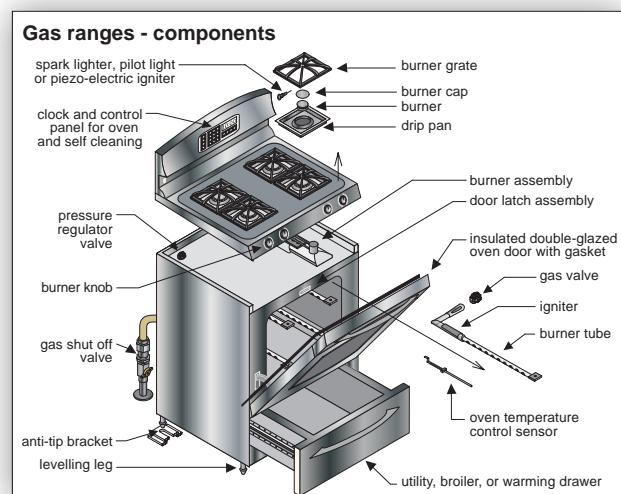
- BUILT-IN EXHAUST** Some cooktops have a built-in exhaust to carry steam and odors outdoors. These units, which are often down-draft, include a filter, a fan, metal ductwork and an external vent. Some have the fan on the exterior wall to reduce noise. The ductwork should be kept as short and straight as possible. The filters should be cleaned regularly, as needed. Many filters can be put in a dishwasher.
- GRILLS, GRIDDLES, ETC.** Some cooktops have interchangeable accessories for various types of cooking. These include grills, griddles, and woks.

Common Problems with Electric Ranges

- INOPERATIVE ELEMENT(S)** When one or more elements will not work, this may be caused by an interrupted power supply, a burned out element, a reset button that can be pushed, or a defective control.
- DAMAGED/ DEFECTIVE/ MISSING – KNOBS /OUTLETS/TIMERS /LIGHTS** Other problems include uneven heating conditions, defective outlets and timers, etc. For the most part, these are nuisance issues that can be readily corrected.

1.2 Gas Ranges

- CONTROLS** Gas ranges burn either natural gas or propane. Switching fuels is possible, but some equipment modifications are necessary. Gas ranges have their controls located on the front to avoid having to reach across an open flame. Most of these controls are also “push and turn”, but there may be no indicator light, since it is obvious which burner is on. Gas ranges need 120-volt electrical supplies for their controls and lights.
- GAS BURNERS** Gas burners rely on convection, conduction and radiation to transfer heat from the burner to the pot. In order to take advantage of the radiant heat transfer, the bowls under the burners should be kept polished and clean. The intensity of the flame is controlled by the throttling valve (the control on the front of the range). For simmering, some units have a small burner in the center of the main burner.



- PILOT** Traditionally, gas burners have been ignited with a pilot. In this system, a small flame (pilot) is always burning in the center of the range below the range top. When a burner is turned on, gas flows through a small tube towards the pilot. The pilot flame ignites the gas and the flame travels back up the open-ended tube to the burner, igniting the burner.
- ELECTRONIC IGNITION** Modern systems have electronic ignition, consisting of a transformer and “spark plug” which activates when the burner is turned on. The “spark plug” generates a spark at the burner, igniting the gas.
- PIEZO-ELECTRIC IGNITION** An alternate system uses a piezo-electric crystal to provide ignition. The crystal is attached to the control knob by a small pin which bends the crystal when the knob is turned. Bending the crystal generates a small amount of electricity which produces a spark.
- GAS PIPING** Please see the Heating chapter for information on gas piping and gas leaks.
- EXHAUST GASES** Natural gas produces primarily water and carbon dioxide when burned completely. Incomplete combustion can produce toxic carbon monoxide gas. Although not required, a range exhaust hood vented outside will reduce the risk of carbon monoxide poisoning. Some recommend the use of carbon monoxide sensors in kitchens with gas appliances.

Common Problems with Gas Ranges

- GAS LEAK** This is a serious condition. If gas is smelled, the occupant should leave the house and contact the utility. No devices should be used in the home that may cause a spark, including cell phones and computers.
- BURNER WON'T LIGHT** If a burner will not light, this may be caused by no gas supply to the range, no electrical supply to the range, the pilot being out, blocked gas ports, faulty gas valve, faulty igniter or defective controls.
- UNEVEN FLAME** Blocked or dirty gas ports can result in a burner that does not light evenly.
- FLAME COLOR** A yellow flame (rather than blue) indicates a poor fuel/air mix, requiring an adjustment.
- DRIP PAN MISSING /RUST/DAMAGED** Drip pans below burners catch spills and should be kept in place and in good order.
- DAMAGED/ DEFECTIVE/ MISSING – KNOBS /OUTLETS/TIMERS /LIGHTS** Other conditions include uneven heating conditions, defective outlets and timers, etc. For the most part, these are nuisance issues that can be readily corrected.

2.0 Ovens

FUELS Ovens operate on electricity, natural gas, or propane. Replacing an oven with one which uses a different fuel will involve extra expense if a gas/electric line is not already in place. The life expectancies of ovens are typically 10 to 20 years.

Ovens come in a variety of sizes and configurations; either freestanding or built-in. The cabinetry and floor plan of the kitchen will determine the type used.

FREESTANDING Freestanding ovens (ranges or stoves) are portable appliances that sit on the floor. Ranges are discussed in more detail in Section 1.0 of this chapter. These typically fit between sections of the base kitchen cabinets with the top approximately flush with the counter top. The cooktop normally has four surface elements, and there is typically a storage drawer below the oven. Ranges may be described as freestanding, slide-in or drop-in ranges.

BUILT-IN Wall ovens are built into the cabinetry, often at a height that allows access without stooping. Wall ovens are often doubled, with one installed directly above another. Wall ovens are typically smaller capacity than freestanding ovens.

CONTROLS The oven temperature is thermostatically controlled. Some also have a sensor probe that measures the temperature of the meat at the tip of the probe. Once the meat reaches a pre-determined level, the oven reverts to a keep-warm mode or shuts off.

TIMER Most ovens also have a timer that can be set to start and stop the oven at pre-set times.

2.1 Electric Ovens

Electric oven elements are made of a metallic-sheathed resistance-coil material. Most ovens have two elements that are plugged in so they can be replaced easily. The lower element is used for baking and roasting, and the upper is for broiling.

CONVECTION OVENS Convection ovens have the same elements as conventional ovens, but use a fan to circulate the hot air. The fan works continuously, increasing the convective currents in the oven. This cooks food more quickly, evenly, and with less energy than a conventional oven. Some convection ovens have a third element on the back wall of the oven.

SELF-CLEANING OVENS The most common type of self-cleaning oven uses very high heat (roughly 900°F) to burn food off the inside of the oven. Major spills should be cleaned up before starting a cleaning cycle. Many oven doors are locked closed during the cleaning cycle so people don't burn themselves on the oven. These ovens typically have better insulation than a conventional oven and are typically slightly more expensive. They are more efficient for everyday cooking, since heat escapes from the oven more slowly due to the better insulation levels.

Common Problems with All Ovens

- WIRING/
THERMOSTAT/
TIMERS/KNOBS/
LIGHTS** Electrical problems with wiring and controls, including thermostats and timers are common.
- DOORS/VENTS** Defective doors can open violently, or fail to close properly, and obstructed oven vents can cause the oven to overheat. Gasket problems may prevent doors from closing tightly, causing inefficient operation and overheating of the kitchen.
- TIPPING** Where an anti-tip bracket has not been provided, the oven can tip over and cause injury. This can happen if children stand on an open oven door to reach for something, for example.

Common Problems with Electric Ovens

- INOPERATIVE
ELEMENTS** Electric ovens are fairly simple. Apart from the issues described above, failed baking or broiling elements are the most common problems.

2.2 Gas Ovens

Gas ovens burn either natural gas or propane. Switching fuels is possible but some equipment modifications are required. The burners are most often located at the top and bottom of the oven. The bottom burner is used for baking and roasting; the top for broiling. The lower burner is normally covered with a metal baffle.

Gas ovens require 120-volt electrical power for the controls and lights.

Ventilation slits in the baffle allow the natural circulation of air in the oven while protecting the user from open flames. Because of the burners, gas ovens have a slightly smaller volume than an electric oven of the same external size.

- GAS PIPING** Please see the Heating chapter for information on gas piping and gas leaks.
- SELF-CLEANING
OVENS** The most common type of self-cleaning oven uses very high heat (roughly 900°F) to burn food off the inside of the oven. Major spills should be cleaned up before starting a cleaning cycle. Many oven doors are locked closed during the cleaning cycle so people don't burn themselves on the oven. These ovens typically have better insulation than a conventional oven and are typically slightly more expensive. They are more efficient, since heat escapes from the oven more slowly due to the better insulation levels.

Common Problems with Gas Ovens

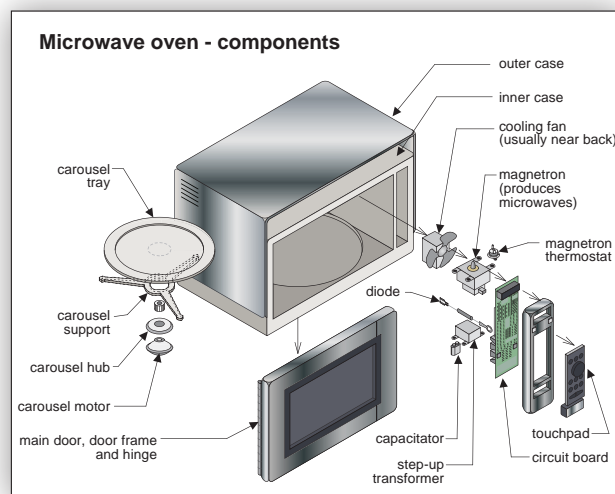
- BURNER/PILOT
PROBLEMS** In addition to the issues with any type of oven described above, gas ovens can have problems with burners that are out of adjustment or clogged. Burners can also suffer corrosion. Pilot, spark and electronic ignition systems may be inoperative or may operate inconsistently.

2.3 Microwave Ovens

These may be portable or built-in, and operate on 120-volt electrical power. Microwave ovens should be plugged into grounded receptacles and are ideally on a dedicated circuit.

MAGNETRON Microwave ovens generate high frequency electro-magnetic radiation. The radiation is generated by increasing the household power from 120 volts AC to 4,000 volts DC. The electricity is then supplied to a device called a magnetron. This electronic tube generates high frequency microwaves with the help of a magnetic field.

WAVE GUIDE The microwaves are emitted from an antenna, and travel along a metal conduit called a wave guide into the oven. A fan-like device (stirrer) at the top of the oven disperses the microwaves into the oven as they leave the wave guide. In some units, a rotating tray on the oven bottom turns the food to ensure even cooking. A fan removes the heat generated by the food, and helps cool the magnetron.



COOKWARE Microwaves penetrate most materials except metal. Metal reflects microwave energy, causing it to bounce from surface to surface. This can damage the magnetron. Cookware should be designed for use in microwave ovens, and as a general rule, should contain no metal. Aluminum foil should not be used in a microwave oven.

BROWNING Microwaves cause the water molecules in food to vibrate, producing heat from friction, which cooks the food quickly. Because foods are not cooked from the outside in (as in a conventional oven), the browning, typical of a conventional oven, does not occur. Browning can be accomplished using special browning dishes. Some units also have a special browning element.

SAFETY All microwave ovens have a double interlock system to prevent operation when the door latch is released. In addition, a computerized monitoring system stops the oven if one or both of the interlocking systems fail.

The door seal is designed to prevent leakage of microwave energy, and the glass window on the oven door is shielded with a metal screen. Because of the strict safety standards, owner service and disassembly are discouraged. Most manufacturers will void their warranties if the oven has been tampered with. Service technicians can check microwave ovens for leakage.

Microwave ovens should never be turned on when empty, since this may damage the magnetron.

LIFE EXPECTANCY Life expectancies in the range of 10 years are typical.

MICROWAVE/ CONVECTION OVEN This oven combines the speed and efficiency of a microwave with the browning of a conventional oven. Like an ordinary microwave, it makes short work of heating leftovers and thawing foods. Like a traditional oven, it can brown foods. These units operate on microwaves only, convection only, or a combination of the two.

When in the combination mode, the unit cycles back and forth between microwave and convection cooking.

Common Problems with Microwave Ovens

INOPERATIVE An inoperative microwave may be the result of no electrical power, a faulty control system, or a faulty magnetron.

A service technician should be contacted if any problems with the door are suspected. The door gasket should seal tightly, and the microwave should shut off when the door latch is opened.

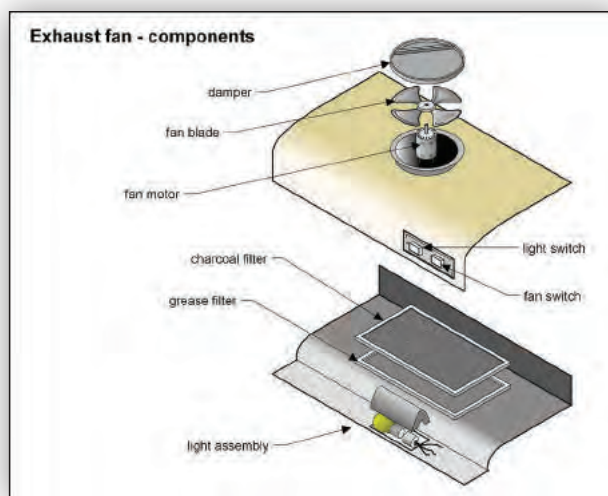
POOR LOCATION Microwave ovens should not be installed above cooktops unless they are rated for this location. The manufacturer’s installation guide will usually indicate this.

3.0 Kitchen Exhaust Fans

Exhaust fans may be located above the cooktop or built into the range. The vents remove moisture, odors and grease as they come off the cooktop. Some exhaust the air outside, while others clean and re-circulate the air. Life expectancies are five to 15 years, depending on original quality, amount of use and maintenance.

BLOWERS All vents contain blowers and electric motors to move the air. The blower can be located in the hood above the range, in the range below the cooktop, or outside, where the vent discharges. The outdoor location is the quietest for people in the home. Some microwave ovens have an exhaust vent for a cooktop built into the bottom. Some vents have variable speed blowers.

FILTERS Some units have mechanical filters only, while the re-circulating type typically use charcoal filters to help remove odors. In either case, filters are a regular maintenance item. Most mechanical filters are washable, and many can be cleaned in a dishwasher.



DISCHARGE OUTSIDE Vent systems discharging outside should go directly to the exterior through ductwork that is as short and straight as possible. Vents should not discharge into attics, crawl spaces, or chimneys, for example. Ductwork passing through unheated space should be insulated to prevent condensation.

LIGHTS Most vents that are above a cooktop have one or more lights to brighten the work area.

Common Problems with Exhaust Fans

INOPERATIVE Exhaust fans that don't work may have an electrical supply or motor problem, or the fan itself may be seized.

FILTER/DUCT ISSUES Filters may be dirty or missing. Ductwork to the outdoors may be incomplete, disconnected, un-insulated in the attic or have a poor discharge arrangement. The discharge should have a flap that prevents cool air and pests from coming in when the fan is idle.

SWITCHES/LIGHTS /NOISY Common problems include defective switches or lights and noisy blowers. Blowers may be noisy due to balance or bearing problems.

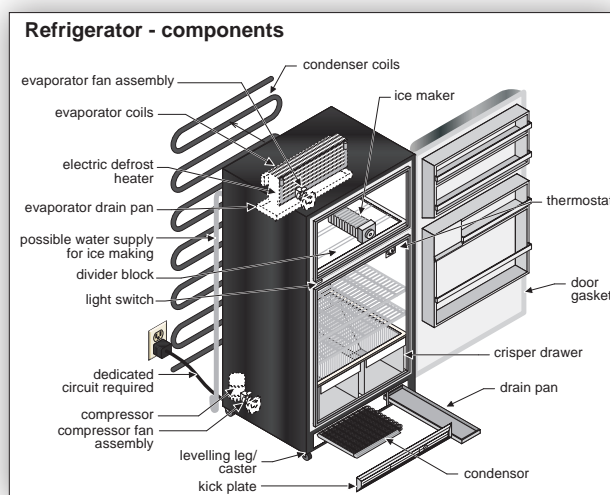
4.0 Refrigerators

Refrigerators can be freestanding or built-in. They may or may not include a freezer. Some high-quality refrigerators look like cabinet drawers.

DEDICATED CIRCUIT Most refrigerators require a grounded 120-volt electrical outlet. The refrigerator circuit is ideally not shared with any other outlets, since a blown fuse or tripped breaker may not be noticed immediately, resulting in spoiled food.

COMPRESSOR The compressor is the heart of the refrigerator. It pumps the refrigerant gas through the system, increasing the gas pressure and temperature. The pumped refrigerant changes pressure and temperature, and changes between a gas and a liquid as it flows through the system. This is what allows heat to be removed from the relatively cool refrigerator and freezer, and dumped into the relatively warm kitchen air.

The compressor is the most expensive single component of the refrigerator. Although compressors can be replaced, it is often more practical to replace than repair a refrigerator with a failed compressor.



- CONDENSER** The condenser coils allow the warm refrigerant to transfer heat to the kitchen air as the refrigerant changes from a gas to a liquid. Most refrigerators have natural draft condensers, with the condensing coils on the back of the refrigerator. Air circulation should be maintained around the back and top of these refrigerators. Forced-draft condensers (on the bottom of the refrigerator) use a fan to move air over the coils. All coils should be kept clean (vacuumed) to transfer heat efficiently.
- EVAPORATOR** The cold refrigerant in the evaporator coils removes heat from the inside of the refrigerator as the refrigerant changes from a liquid to a gas. Condensation on the coils drips into a pan below the refrigerator. This tray should be checked occasionally and emptied as required. The evaporator coils are usually not visible without disassembling the refrigerator.
- DEFROSTING METHODS** Older refrigerators require manual defrosting. Most new models are frost-free.
- FROST FREE** Frost-free refrigerators keep the cooling surfaces in a small separate compartment. A fan blows cool air from this space into the storage compartments. This cooling unit is typically defrosted with a small electric heater. This system provides a more even temperature throughout and can be used for both the refrigerator and freezer compartments. The moving air will, however, dry out uncovered foods and increase energy costs.
- DOOR GASKET** Frost may build up around the door gasket in humid weather. A small heating element is often built into the door edge to prevent this from happening. Energy saving models may have a switch to turn this electric heater off when it is not needed. In some refrigerators, warm refrigerant circulates around the door edge to prevent frost build up.
- Poorly sealed door gaskets increase energy consumption. Door gaskets are simple to replace. Cracks in the interior plastic liner should be sealed to prevent moisture soaking the insulation inside.
- OTHER FEATURES** Many modern refrigerators have ice cube makers, and crushed ice and/or chilled water dispensers. These require water supply piping. Any refrigerator with these accessories should be moved with care to avoid damaging the water supply line.
- ENERGY EFFICIENCY** Modern refrigerators are considerably more energy efficient than older units. Replacing an older refrigerator can reduce electrical consumption noticeably. Refrigerators use more electricity over the course of the year than most appliances, other than furnaces and water heaters.
- LIFE EXPECTANCY** The life expectancy of most refrigerators is 12 to 20 years.

Common Problems with Refrigerators

- INOPERATIVE** If the refrigerator is not running, the power cord may be damaged, the fuse or breaker at the main panel may have tripped, the compressor may be inoperative, or the refrigerator may be turned off or unplugged. There may also be a problem with the thermostat.
- NOT COLD** If the refrigerator is running, but is not very cold, the temperature setting may be too high, the refrigerant level may be low, the airflow over the cooling surface may be blocked or restricted, the condenser coils may be dirty, the defrost mechanism may be inoperative, or the compressor may be failing.

NOISY A noisy refrigerator may have worn motor bearings for the evaporator or condenser, or the refrigerator may not be level.

CONDENSATION Too much condensation inside may indicate the unit is on “economy” setting or that the heater is inoperative. A leaky door gasket may cause condensation around the door.

LEAK Leaks are often the result of a clogged or disconnected defrost drain line. Leaks may also be from the icemaker or water dispenser.

5.0 Dishwashers

Dishwashers may be built-in or portable. Some portable dishwashers may be converted to built-in units. Typical life expectancies are eight to 15 years.

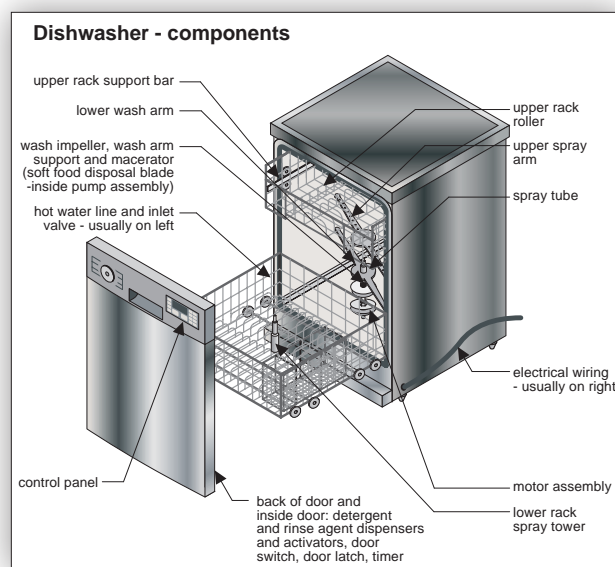
Most dishwashers require a 120-volt electrical supply and a supply of hot (140°F) water. Built-in units are connected to the waste plumbing system, typically upstream of the trap below the kitchen sink.

SOLENOID Hot water enters the dishwasher through a solenoid (electrically operated) valve. Some dishwashers use a booster heater to raise the temperature to 140°F. This allows the house hot water to be kept at roughly 120°F. An overflow switch shuts the solenoid valve when enough water has entered the machine.

PUMP Water is distributed through the dishwasher by rotating spray arms. A strainer helps prevent food particles from clogging the pump, located at the base of the washer.

Dishwasher soap and rinse agent are dispensed from cups, usually located on the door. The discharge is controlled by the same timer that controls the sequence and duration of the cycles.

WASTE CONNECTION When a wash or rinse cycle is finished, the pump discharges the dirty water into the waste piping below the kitchen sink or through a food waste disposer.

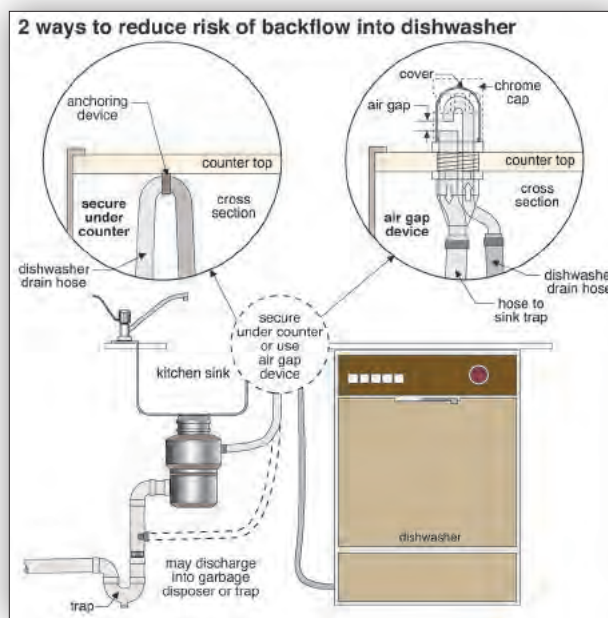


AIR GAP Some areas require an air gap in the waste line to avoid a cross-connection or siphoning. This is typically a chrome device projecting above the counter at the rear of the kitchen sink. Other jurisdictions consider the solenoid valve to be adequate protection.

DRYING CYCLE Once the rinse cycle is complete, the dishes are dried by either the heating element in the bottom of the tub or a combination heater and fan. On some units, the dryer element can be turned off to save energy.

DOOR GASKET Door gaskets must seal tightly to avoid leaks. Damaged gaskets can be replaced readily. Door latches that do not close properly may not allow the dishwasher to start.

TIMER The timer controls the sequence of the wash, rinse and dry cycles. Commonly, there are several settings for different cycles.



Common Problems with Dishwashers

INOPERATIVE If the dishwasher does not operate, the fuse or breaker at the main panel may have tripped, the timer may be faulty, there may be a loose electrical connection, one of the switches may be faulty, a high water level switch may have tripped, or the door interlock switch may be defective. A specialist should be engaged to diagnose and correct the problem.

WON'T FILL If the dishwasher will not fill with water, the solenoid valve may be faulty, the timer or overflow switch may be defective, or the supply plumbing may be shut off.

WATER WON'T SHUT OFF If the water does not shut off, the timer or overflow switch may be defective, or the solenoid valve may be inoperative.

WATER WON'T DRAIN If the water does not drain out, the pump motor may be defective or clogged, the drain hose may be blocked, the strainer may be clogged, or the timer may be faulty.

INOPERATIVE HEATER If the heater does not work, the timer may be defective, or the heating element may be loose or burned out.

LEAKS If the dishwasher leaks, there may be a damaged gasket, a broken door hinge, a faulty overflow switch, loose hose clamps, a plugged air gap, or a drain blockage.

NOISY If the dishwasher is noisy, the sprayer arms may need adjusting, or the solenoid valve may be defective.

OTHER ISSUES If the soap dispenser does not open. The door may be obstructed by cutlery, the spring or switch may be broken, the dispenser may be clogged, or the timer may be faulty. Racks and their rollers can be damaged or warped.

The interior compartment or door may be rusted. The dishwasher door may drop open violently if the spring or springs are defective.

6.0 Food Waste Disposers

Food waste disposers are installed below the kitchen sink and connect to the waste plumbing upstream of the trap. They pulverize food waste into particles that move with the water through the drain lines. Some claim that disposals should not be connected to septic systems. Other experts say this is not a problem. The authors are not aware of septic problems caused by disposers, although tanks may need to be emptied more often if a disposer is used.

Some municipalities do not allow waste disposers, based on the premise that these increase the load on the municipal sewage treatment system.

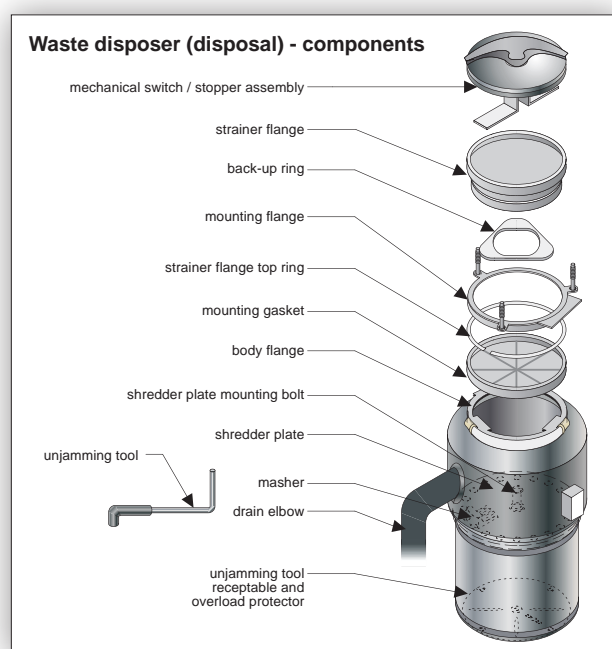
LIFE EXPECTANCY Life expectancies are 6 to 12 years.

GRINDER These units have two basic parts; the grinding unit and the electric motor. The grinding unit, driven by the motor, consists of a rotating plate or flywheel and a stationary shredder ring. The ring is a metal band with a series of sharp-edged holes that cut the waste into pieces. Waste particles entering the hopper are thrown against the shredder ring by the rotating plate (grind wheel) at the bottom of the grinding unit. Once reduced sufficiently in size, the particles pass through the holes in the shredder ring into the waste pipe.

GENERAL WASTE The disposer is designed to grind such things as bones, vegetables, coffee grounds, etc. Fibrous waste such as corn husks, pea pods, or celery should be avoided or mixed with other food waste for disposal.

WATER FLOW A good flow of cold water should run through the disposer and only a small amount of waste should be ground at a time, to minimize the possibility of a blockage. The water not only flushes waste down the pipe, it also lubricates the seal around the motor. Cold water solidifies grease and fat, allowing them to be shredded.

ABUSE The disposer should never be used to grind glass, plastic, metal, styrofoam, seafood shells, cardboard, etc. However, even under normal operating conditions, the unit may jam. If this happens, the



motor may stop and hum. The thermal overload protector cuts the power off after roughly 30 seconds. A jammed electric motor will eventually blow the fuse or trip the circuit breaker if the thermal overload does not trip.

If the disposer jams, the flywheel must be freed. On some units, this can be done by switching the disposer to “reverse”. With others, the flywheel must be freed using a stick or service wrench. If the problem persists, the material must be removed from the flywheel with pliers or a similar tool. When placing something into the disposer, the unit must be turned off, and under no circumstances should anyone insert their hand into the hopper. After freeing the unit, grinding ice cubes may help to clear and freshen the unit.

OVERLOAD PROTECTOR If the thermal overload protector has tripped, it takes roughly 15 minutes for the motor to cool down. Once cool, the protector can be reset. Some disposers have a reset button on the motor, while others reset themselves. If the fuse has blown or the circuit breaker tripped, it must be replaced or reset.

WIRING Waste disposers may be permanently wired in, or may be plugged into an accessible outlet. If plugged in, the cord should be between 18 and 36 inches in length and should not pass through a cabinet. If flexible conduit is used, the conduit should have a drip loop. Non-metallic sheathed (Romex) cable is not allowed in some jurisdictions. There should be a strain relief clamp on the waste disposer.

CONTINUOUS FEED There are two basic types of disposers; continuous and batch feed. Continuous feed units are activated by a switch located near the unit. The disposer operates continuously while waste is fed down its throat. This allows the unit to handle a large volume of waste quickly.

BATCH FEED Batch feed models are activated with the drain stopper. To load the disposer, the stopper is removed from the drain. Waste is loaded into the disposer chamber, and the stopper is then placed in the drain, closing a switch to turn the disposer on. The unit will operate as long as the stopper is in this position. In either system, cold water should be flushed through the disposer while it operates. (The stopper is in place, but in the open position to allow water to flow.)

Common Problems with Food Waste Disposers

- INOPERATIVE** If the disposer is inoperative, the fuse or breaker at the main panel may have tripped, the overload protector may have tripped, the stopper or wall switch may be faulty, or the motor may be faulty.
- DOES NOT GRIND** If the disposer does not grind, the motor may be faulty or the flywheel may be jammed.
- GRINDS SLOWLY** If the disposer grinds slowly, there may be insufficient water flow, the shredder ring may be dull, a flyweight may be broken, or the drain line may be clogged.
- LEAKS** If the disposer leaks, there may be a loose plumbing connection or defective gasket.
- NOISY** If the disposer is noisy, the motor may be faulty, a flyweight may be broken, a metal object may be in the unit, or the unit may be loose.
- SPLASH GUARD** If the splash guard is worn, damaged or missing, it should be replaced.
- LOOSE** If the unit is loose, it should be re-secured.

7.0 Trash Compactors

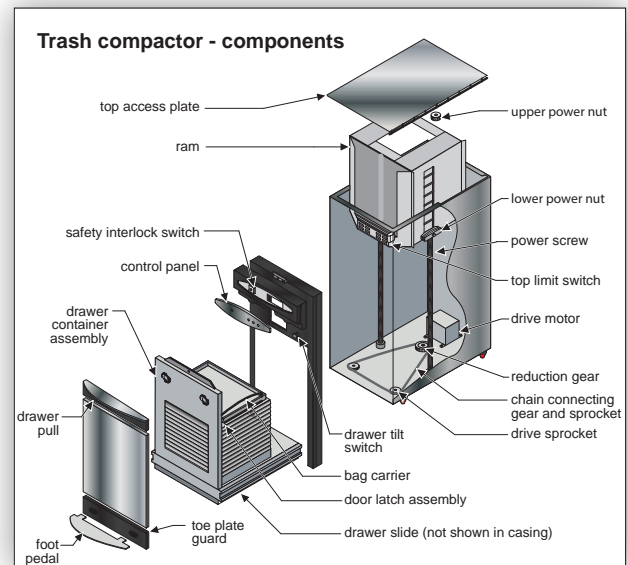
DESCRIPTION AND LIFE EXPECTANCY Trash compactors come in a variety of sizes and configurations. They may be located under the counter top or may stand alone. Compactors operate on a standard 120-volt household circuit, and normally last ten to 15 years.

OPERATION A compactor reduces the volume of waste loaded into it. A ram compresses the waste in a metal bin. The ram, operated by an electric motor, generates forces of up to 5,000 pounds.

SAFETY Compactors have numerous fail-safe devices. The compactor will not operate if the door is open, the unit is not level, the bin latch mechanism has not been closed, or if the safety interlock switch is not activated.

The switch is a key lock that must be in the “ON” position for the unit to work. The removable key allows the unit to be deactivated. If bottles and glass must be compacted, they should be at the bottom and additional waste placed on top. Aerosol cans or other explosive objects should never be placed in the unit.

ODORS Preferably, only dry trash should be used in the compactor, since this will reduce odors. Most units are equipped with an automatic aerosol deodorant dispenser. This is activated once the ram has completed its cycle.



Common Problems with Trash Compactors

INOPERATIVE If the compactor does not operate at all, the fuse or breaker at the main panel may have tripped, the safety interlock switch may be “off “ or faulty, the motor may be faulty, the overload protection switch may have tripped, or there may be a loose electrical connection or damaged cord.

If the ram does not compact trash, the drive chain or belt may be loose or broken, the gears or pulleys may be loose, or the ram may be seized.

NOISY If the compactor is too noisy or vibrates excessively, the drive chain or belt may be loose, the compactor may need lubricating, or there may be loose mechanical connections. If the unit is loose, it should be re-secured.

WON'T OPEN If the drawer will not open, the ram may be jammed, or the unit stopped working part way through a cycle.

If the compactor continues to run, one of the switches may be faulty.

8.0 Washing Machines

Modern washing machines combine water, detergent and mechanical action to clean clothing. There are two common configurations of washing machines – top-loading and front-loading.

TOP LOADERS Top-loading washing machines use a motor-driven agitator to provide the mechanical cleaning action in the water-filled tub. The rotating agitator pulls clothing down to the bottom of the tub and pushes the clothing to the outside of the basket, where it rises to the top to repeat the cycle again. The agitator is used both during the wash cycle and the rinse cycle.

BASKET The basket surrounding the agitator is also driven by the motor during the spin cycle to remove water from the clothing.

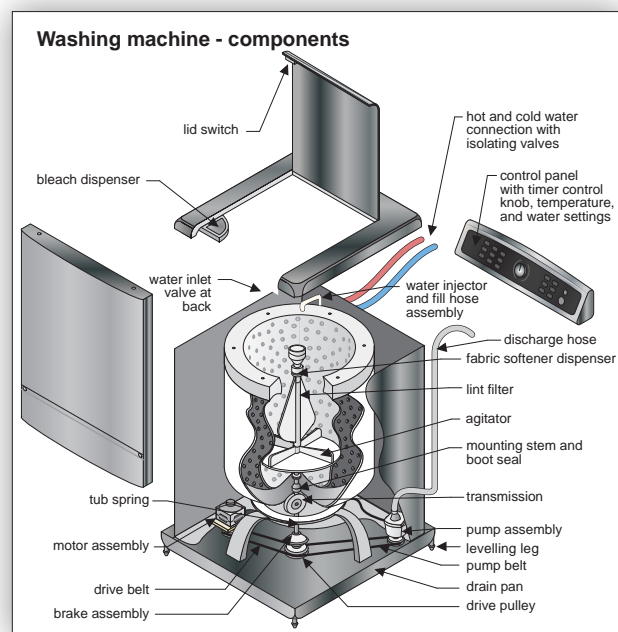
PUMP A pump is used to remove water from the tub.

FRONT LOADERS Front-loading washing machines do not use a separate agitator. The rotating action of the horizontally-mounted basket tumbles the clothes to provide agitation. Since the tub does not need to be filled, front loaders use less water and soap. Front loaders are somewhat simpler than top loaders.

ELECTRICITY AND WATER NEEDED Washing machines require a 120-volt electric outlet and supply and waste plumbing. Both hot and cold water hook-up are needed. Isolating valves are typically provided for connecting the hoses. Chambers are provided on the supply plumbing pipes in some cases to prevent “water hammer”, which may be caused by quick-closing solenoid valves.

HOSES Braided steel hoses are preferable to rubber hoses for connecting washing machines to supply piping in the home. A ruptured hose can result in serious water damage in a short time, especially if the laundry area is in or above a finished area of the home. For even more protection, there are automatic shut-off valves available that turn off the water in the event of a burst hose.

DRAIN PAN When a leaking washing machine (or hoses) may cause damage to finishes, a washing machine drain pan may be installed to collect water in the event of a failure. Fittings on these pans should be connected to a drain so that the water can be safely discharged.



- DISCHARGE HOSE** The waste hose can discharge into a laundry sink or into a waste standpipe connected to the waste plumbing through a trap. The waste standpipe (standing waste pipe) should extend 18 to 30 inches above the trap. The drain hose should fit loosely into the standpipe so that there is an air space to prevent back-siphoning.
- LIFE EXPECTANCY** Washing machines have a typical life expectancy of 10 to 15 years.

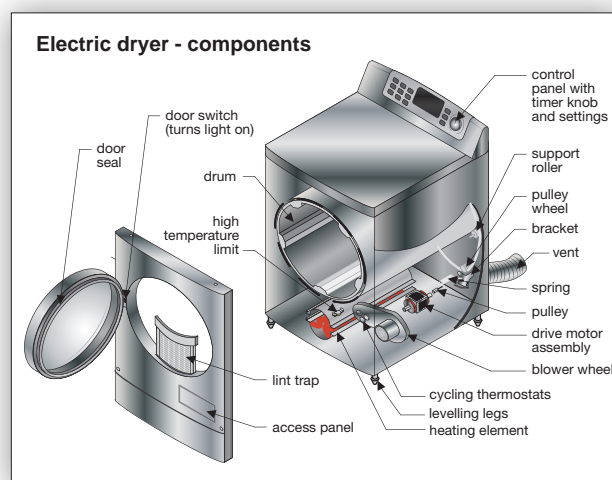
Common Problems with Washing Machines

- INOPERATIVE** If the washing machine does not work, the power cord may be damaged or disconnected, the fuse or breaker at the main panel may have tripped, the motor may be inoperative, a control switch may be defective, or the water may be shut off or disconnected.
- WON'T DRAIN** If the washing machine won't drain, the pump or one of the control switches may be inoperative. A drip pan and drain should be provided for machines above finished spaces.
- WON'T FILL** If the washing machine won't fill, one of the solenoid valves or control switches may be inoperative, or the water valves may be closed.
- LEAKS** Leakage may come from the water supply hoses, pump, tub seals, or the drain hose. There may also be a problem with the water level switch, or the tub itself may be damaged. On front loading machines, there may be a problem with the door or door seal.
- NOISY** Unbalanced loads or a machine that is not level often cause excessive vibration. There may also be problems with the motor bearings, the transmission or drive belt.
- ODOR** Front-loading washers can be prone to odor problems. These musty odors are often the result of water that does not completely drain out of the washer. The stagnant water may collect beneath the door gasket, in the fabric softener dispenser, or another location. In many cases, cleaning these areas will correct the problem, and leaving the door open will allow the water to evaporate without becoming stagnant.

9.0 Clothes Dryers

Clothes dryers tumble wet clothing in a rotating drum through which heated air is circulated. The hot air removes moisture from the clothing and is vented to the exterior.

- FUEL** Heat may be generated by electric elements or by gas burners.
- ELECTRIC** Electric dryers require a 240-volt electric outlet on a dedicated circuit. This circuit is typically capable of carrying at least 30 amps.



GAS Gas dryers require gas piping with an accessible shut off valve. Please see the Heating chapter for information on gas piping and gas leaks. Gas dryers also require a grounded 120-volt electrical outlet to power the motor and for the controls and timer.

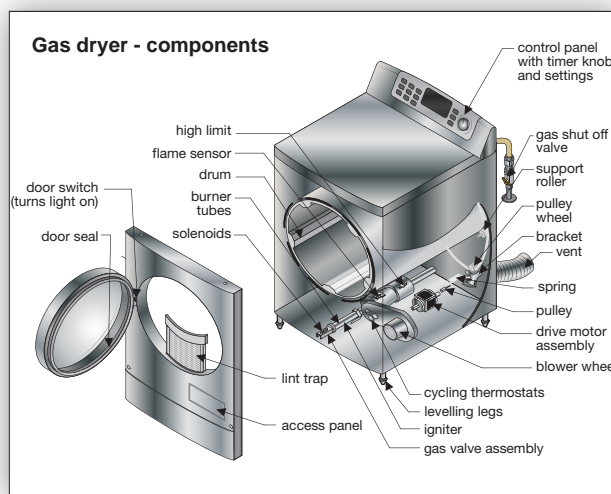
LINT TRAP As the hot air leaves the dryer, it goes through a screen that collects lint. Lint can interfere with the proper venting of exhaust. Lint traps are typically cleaned after each load.

VENT PIPE The exhaust vent pipe connects the dryer to the exterior of the home. The vent pipe should be as short, straight, and smooth as possible to reduce the risk of lint collecting inside the duct. There should be no screws that extend into the duct. Many recommend avoiding flexible plastic ducting, although in some cases, it may be used for short distances as a transition duct as long as it is exposed. Rigid metal ducting is preferred.

ADEQUATE AIR NEEDED Clothes dryers need to move lots of air through them to dry efficiently. They should not be in confined cabinets.

ENERGY EFFICIENCY Dryers that turn off automatically when the clothes are dry use less energy than those that are controlled by a timer.

LIFE EXPECTANCY Common life expectancies for clothes dryers are 12 to 18 years.



Common Problems with Dryers

INOPERATIVE If the dryer is inoperative, the dryer may be unplugged, the breaker or fuse may be tripped or blown, a switch or control may be defective, or the motor may be defective.

DRIES SLOWLY If a dryer takes a long time to dry clothing, the lint trap may be clogged, or the vent may be kinked, clogged, or too long. There may also be lint clogging internal areas. The heating elements or burner may also be inoperative.

NO HEAT If an electric dryer does not generate heat, a breaker or fuse may be tripped or blown, or a heating element or burner may be defective.

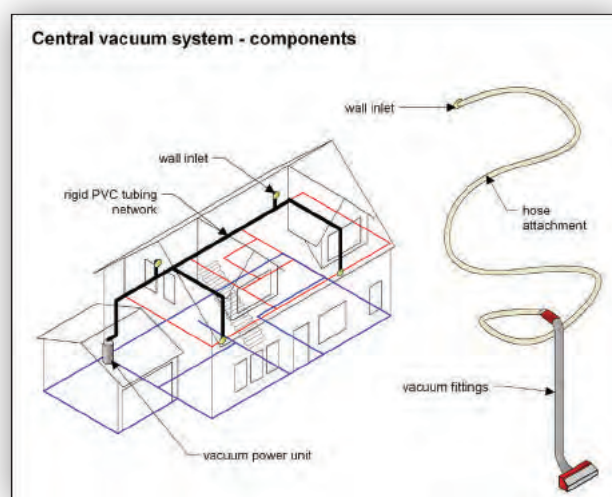
If a gas dryer does not heat, the gas valve may be turned off, the pilot light may be out, or the ignition system may be defective.

DISCHARGE INSIDE Although there are heat re-claimers that can be used in the vent ducting to direct dryer air back into the house, these are not recommended. They also direct excess moisture and lint back into the home. These should never be used with gas dryers, since this would send potentially dangerous products of combustion into the house air. Dryers should be vented to the exterior.

- POOR EXHAUST VENT** Exhaust vents may be damaged, kinked, clogged, leaky, too long, or an inappropriate material.
- VENT CAP ON DISCHARGE** Dryer vent caps on the exterior wall may be damaged or clogged with lint. Flappers on these caps may be missing or damaged. The discharge point should not be near an air conditioner coil. If covers are missing, pests may get into the system, and heat loss from the house may be increased in cold weather.
- NOISY** If the dryer is noisy, the motor bearings, pulleys, or rollers may be worn, or the drum belt may be defective.

10.0 Central Vacuum System

A central or whole house vacuum system consists of a canister located in the garage or the basement. A series of lightweight plastic pipes run from the canister to outlets located around the house. The outlet flap is lifted and the vacuum hose is inserted into the outlet. A metal band or similar device on the end of the hose completes a circuit between two contacts in the outlet. This switches the system on. A number of accessories may be attached to the hose.



- CANISTER** The main canister usually has an on/off switch and may have a suction outlet as well. The exhaust may discharge directly from the canister or it may be piped through an exterior wall. Generally, units that do not have a filter must discharge to the exterior. Units equipped with a filter may discharge to the exterior or interior. The canister can be opened or removed to empty the unit. Some filters are self-cleaning while others require cleaning by the homeowner.
- MOTOR** Units without filters may allow dust to build up on the motor causing it to overheat and burn out sooner than a unit with a filter. Units with an external motor and no filter may allow dust to build up on the fan blades, causing uneven bearing wear. The motor is the most common repair item and may require repair or replacement every five to ten years, depending on how often the unit is used and cleaned.

Common Problems with Central Vacuum Systems

INOPERATIVE If the unit does not operate, the fuse or breaker at the main panel may have blown or tripped, a built-in breaker or thermal overload may have tripped, the wiring or switches may be defective, or the motor may be faulty.

If only one or two outlets do not operate, there may be a problem with the control wiring or switch for the area affected.

WEAK SUCTION If the suction is weak, the canister may be full, the filter may be dirty, the exhaust may be obstructed, or the pipes may be partially obstructed. Disconnected pipes are a less common problem.