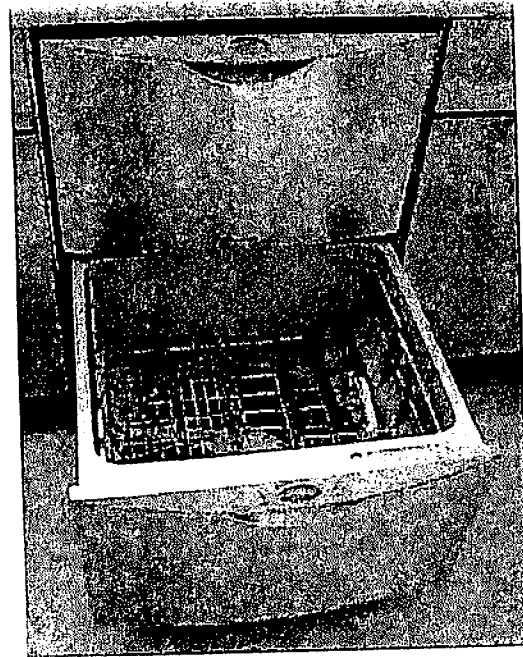


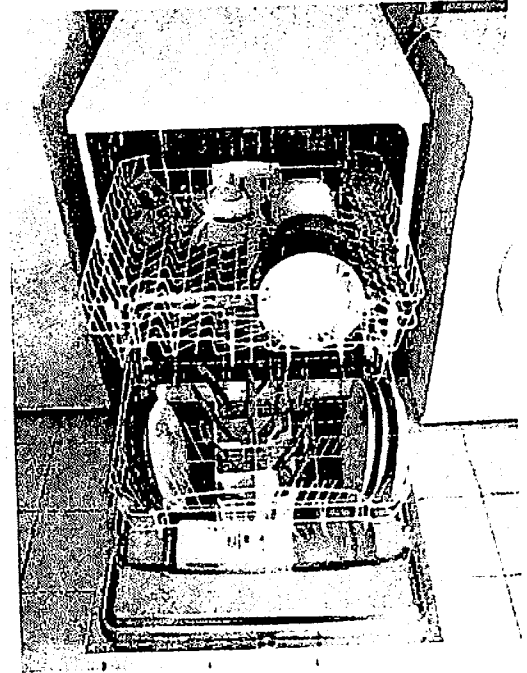
Dishwasher

From Wikipedia, the free encyclopedia

This article discusses the appliance of the same name, for information on manual



A two draw DishDrawer dishwasher



A dishwasher

dishwashing see the Dishwashing article

A **Dishwasher** is a mechanical device for cleaning food utensils for preparation, keeping, serving and eating and drinking. They are found in restaurants and also in many kitchens of homes.

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How dishwashers work

Unlike manual dishwashing, which relies largely on physical scrubbing to remove soiling, the mechanical dishwasher cleans by spraying hot (55-65 degrees Celsius or 130-150 degrees Fahrenheit) water on the dishes. First detergent-added water for cleaning purposes, then clean water (though sometimes with a rinsing aid added) to remove the detergent residue. The hot water may be direct from the supply or brought up to temperature by an element. As there is no human contact during the process, strong detergents may be used which would be too alkaline for habitual exposure to the skin. Some dishwashers also contain a heating element to achieve fast drying of the dishes.

History

The first reports of a mechanical dishwashing device are of an 1850 patent by Joel Houghton of a hand-powered device.

Modern dishwashers are descended from the 1886 invention of Josephine Cochrane, also hand-powered, which she unveiled at the 1893 Chicago World's Fair. Cochrane was quite wealthy and was the granddaughter of John Fitch, the inventor of the steamboat. She never washed dishes herself and only invented the dishwasher as her servants were chipping her fine china.

Models installed with permanent plumbing arrived in 1920s, and electric drying elements were added in 1940.

Adoption was greatest at first in commercial environments, but by the 1970s dishwashers had become commonplace in domestic situations in the developed world.

Characterisation

Capacity

The international standard for the capacity of a dishwasher is expressed as standard place settings. Dishes or plates of irregular sizes may not fit properly in a dishwasher's cleaning compartment, so it is advisable to check for compatibility before buying a dishwasher.

Size

Dishwashers that are installed into standard kitchen cabinets have a standard width and depth of 60 cm (Europe) or 24 inches (US), and most dishwashers must be installed into a hole a minimum of 86 cm (Europe) or 34 inches (US) tall. Portable dishwashers exist in 45 and 60 cm (Europe) 18 and 24 inch (US) widths, with castors and attached countertops. Dishwashers may come in standard or tall tub designs; standard tub dishwashers have a service kickplate beneath the dishwasher door that allows for simpler maintenance and installation, but tall tub dishwashers have approximately 20% more capacity and better sound dampening from having a continuous front door.

Features

The inside of a dishwasher, called the tub, can be composed of plastic or stainless steel. Stainless steel tubs resist hard water, provide better sound dampening, and preserve heat to dry dishes faster. They also come at a price premium. Older models used a baked enamel on steel and are prone to chipping and erosion; chips in the baked enamel finish must be cleaned of all dirt and corrosion then patched with a special compound or even a good quality two-part epoxy.

Mid-to-higher end North American dishwashers often come with hard food disposal units, which behave like miniature garbage (waste) disposal units that eliminate large pieces of food waste from the wash water. One manufacturer that is

known for omitting hard food disposals is Bosch, a German brand; however, Bosch does so in order to reduce noise. If the larger items of food waste is removed before placing in the dishwasher, pre-rinsing is not necessary even without integrated waste disposal units. Pre-rinsing under a running tap beforehand simply wastes water.

Many newer dishwashers feature microprocessor-controlled, sensor-assisted wash cycles that adjust the wash duration to the quantity of dirty dishes (sensed by changes in water temperature) or the amount of dirt in the rinse water (sensed chemically/optically). This can save water and energy if the user runs a partial load. In such dishwashers the electromechanical rotary switch often used to control the washing cycle is replaced by a microprocessor but most sensors and valves are still required to be present. However, pressure switches (some dishwashers use a pressure switch and flow meter) are not required in most microprocessor controlled dishwashers as they use the motor and sometimes a rotational position sensor to sense the resistance of water, when it senses there is no cavitation it knows it has the optimal amount of water.

Sound Damping

Using blankets, panels, and sound-absorbing materials in various configurations, dishwashers can achieve sound damping levels down to 44 decibels or so. Undampened, low-end dishwashers generally output noise levels of anywhere from 65-70 decibels. Manufacturers generally use their own nomenclature with sound damping, i.e. QuietGuard (Kenmore), QuietPartner (Whirlpool), Whisper Package (Maytag), followed by a number. Higher numbers usually indicate higher sound damping and thus less noise output. Thus, a QuietPartner 1 or QuietGuard 2 dishwasher, despite the "Quiet" designation, may not actually be quiet at all.

Sound damping is the primary factor that determines the cost of a standard built-in dishwasher.

Detergent

Hand-washing dish detergent must never be used in a dishwasher, as it will create a large foam of bubbles which will leak from the dishwasher. If hand-washing detergent is accidentally used, the foam may be removed by spraying with salt, and the dishwasher should be forced into a drain cycle to remove the soap and water.

Dishwashing detergent contains:

- Phosphates
 - Solublises calcium and magnesium ions to prevent 'hard-water' type limescale deposits.
- Oxygen-based bleaching agents
 - Breaks up and bleaches organic deposits.
- Non-ionic surfactants
 - Lowers the surface tension of the water, emulsifies oil, lipid and fat food deposits, prevents droplet spotting on drying.
- Enzymes
 - Breaks up and solublises protein-based food deposits, and possibly oil, lipid and fat deposits. They do this by emulsifying them.
- Anti-corrosion agents
 - Often sodium silicate, prevents corrosion of dishwasher components.

it may also contain:

- Anti-foaming agents
 - Used as foam decreases the effectiveness of the washing action.
- Additives to slow down the removal of glaze & patterns from glazed ceramics
- Perfumes
- Anti-caking agents (in granular detergent)
- Starches (in tablet based detergents)

- Gelling agents (in liquid/gel based detergents)
- Sand (inexpensive powdered detergents)

Dishwasher detergents are strongly alkaline (basic).

Intuition suggests that a powder will provide a better scrubbing action due to a soft media sandblasting effect, though liquid detergents have marketed themselves as premium products. Inexpensive powders sometimes actually contain sand, which can be verified by dissolving the powder in boiling water and then passing the solution through a coffee filter; these detergents should be avoided to prevent wear of the dishes and the dishwasher.

Rinse aid

Rinse aid is used to prevent 'spotting' on glassware caused by insoluble deposits left behind on surfaces by droplets of water that dry by evaporation. Rinse aid contains surfactants that prevent droplet formation by reducing the surface tension of the water, so that it drains from the surfaces in thin sheets, rather than forming droplets.

A common household product that can be used as a rinse aid is vinegar. Add 1/4 cup vinegar to the rinse aid container in the dishwasher before each load.

Dishwasher salt

Dishwasher salt is used to recharge the built-in ion-exchange water softener in dishwashers. Unlike salt used for culinary purposes, it does not have added iodide salts. However, it should have minimal iron and manganese salt content, as these mineral ions tend to form precipitates that clog the ion-exchange resin.

Some dishwasher detergents are marketed as not requiring the use of dishwasher salt. These use increased levels of phosphates to increase the solubility of hard water ions. In very hard water areas, the amount of phosphate may be insufficient.

Hazing of glassware, prohibition on dishwashing lead crystal

Glassware that is washed by dishwashing machines often develops a white haze on the surface over time. This may be caused by any or all of the below processes, only one of which is reversible:

- Limescale deposit
 - If the dishwasher has run out of the salt that recharges the ion exchange resin that softens the water, and the water supply is 'hard', limescale deposits can appear on all items, but are especially visible on glassware. It can be removed by cleaning with vinegar or lemon juice, or a proprietary limescale removal agent. The dishwasher should either be recharged with salt, adjusted appropriately for the hardness of the supply water - or possibly this is a symptom of failure of the ion exchange resin in the water softener (which is one of the more expensive components). The resin may have stopped working because it has been poisoned by iron or manganese salts in the supply water.
- Silicate filming/etching/accelerated crack corrosion
 - Silicate in the detergent **protects** glass from etching but only during the wash cycle - it is rinsed away after the wash. Etching occurs in the final (hot) rinse if the water supply has a high temporary (i.e. bicarbonate) hardness *and* the water softener is used. The water softener replaces calcium with sodium. Sodium bicarbonate decomposes to sodium carbonate (by losing CO₂) in the hot final rinse. Sodium carbonate solution is alkaline and leaches out SiO₂ from the glass.
- Physical abrasion
 - Glassware placed such that it is physically touching can abrade and produce a milky surface.

Lead crystal should not be cleaned in a dishwasher as the corrosive effect of dishwasher detergent is high on such types of

glass - that is, it will quickly go 'cloudy'. In addition, the lead in the crystal glass can be converted into a soluble form, which is not good for the health of subsequent users.

Level of sterilisation

Dishwashers do not sterilise the utensils, as proper sterilisation requires autoclaving at 121 °C with pressurised wet steam for at least 15 minutes. Commercial dishwashers can use one of two types of sanitisation methods: hot water sanitising (using final rinse water at a temperature of at least 83 °C (180 °F)), or chemical sanitising (by injecting chlorine in the final rinse water). Not all dishwashers are capable of reaching the high temperature required for hot water sanitising.

Most consumer dishwashers use a 75°C thermostat in the sanitizing process. During the final rinse cycle, the heating element and wash pump are turned on, and the cycle timer (electronic or electromechanical) is stopped until the thermostat is tripped. At this point, the cycle timer resumes and will generally trigger a drain cycle within a few timer increments.

It is likely that most consumer dishwashers use 75°C rather than 83°C for reasons of burn risk, energy consumption, total cycle time, and possible damage to plastic items placed inside the dishwasher.

Commercial dishwashers

Large heavy-duty dishwashers are available for use in commercial establishments (e.g. hotels, restaurants) where a large number of dishes must be cleaned. Commercial machines can wash a rack of dishes in just a few minutes. NSF (http://www.nsf.org/business/food_equipment/standards.asp?program=FoodEqu) sets the standards for wash and rinse time along with minimum water temperature for chemical or hot water sanitizing methods. There are many types of commercial dishwashers including undercounter, single tank, conveyor, flight type, and carousel machines. One of the best known brands of commercial dishwasher is Hobart [1] (<http://www.hobartcorp.com/>).

Dishwashers and the environment

Dishwashers vs. washing dishes by hand

Comparing the efficiency of automatic dishwashers and hand-washing of dishes is difficult because hand-washing techniques vary drastically by individual. At least one privately funded, non-peer-reviewed study concludes that automatic dishwashers use less water than even the most efficient hand-washers, while relative energy use depends on hand-washing technique. [2] (<http://www.mtprog.com/ApprovedBriefingNotes/BriefingNoteTemplate.aspx?intBriefingNoteID=286>) The study does not address costs associated with the manufacture and disposal of dishwashers.

Waterless dishwasher concept

A team of students from the University of New South Wales in Sydney won top honors in the 2004 Electrolux Design Laboratory competition for their Rockpool waterless dishwasher design. Its primary feature was the use of supercritical carbon dioxide in place of water in closed-loop operation. Pressurized carbon dioxide behaves like a nonpolar solvent, which can effectively remove grease. It also demonstrates the physical properties of a liquid, hence the solvent effectiveness, and a gas, which fills its container and thus does not require as much mechanical agitation. The grease is filtered from the carbon dioxide and removed from the system. Supercritical carbon dioxide has previously been used in dry cleaning. The primary benefit of this concept is the fact that it uses no water directly.

Dishwasher detergents and rinse aids

Most dishwasher detergent contains complex phosphates, as they have several properties that aid in effective cleaning. However, the same chemicals have been removed from laundry detergents in many countries as a result of concerns raised

about the increase in algal blooms in waterways caused by increasing phosphate levels (see eutrophication).

In addition, rinse aids have contained nonylphenol and nonylphenol ethoxylates. These have been banned in the European Union by EU Directive 76/769/EEC.

References

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- http://www.ccspace.org/conseducation/SDAC_autodish.html
- <http://www.newi.ac.uk/buckleyc/materials.htm#Glass>
- <http://www.scienceblog.com/community/older/2003/F/20033788.html>
- <http://www.yale.edu/ynhti/curriculum/units/1997/7/97.07.05.x.html>
- <http://archives.tcm.ie/businesspost/2005/01/30/story1860.asp>
- Study of dishwashers vs. washing dishes by hand (<http://www.mtpro.com/ApprovedBriefingNotes/BriefingNoteTemplate.aspx?intBriefingNoteID=286>)

See also

- Home appliances
- Dishwasher salt
- Dishwashing

External links

- How Dishwashers Work (http://www.repairclinic.com/0088_9_3.asp) Article by RepairClinic
- Do-it-yourself Appliance Repair Forums (<http://www.applianceguru.com/>) Forums by Fixitnow.com Samurai Appliance Repair Man
- Vintage Appliance Commercials (http://automaticwasher.org/vintage_video.htm), including commercials for 1950s dishwashers.
- Dishwasher Care (<http://www.dishwasher-care.org.uk/>) UK site that claims to give unbiased information on dishwashers.
- Acme, how a dishwasher works (<http://www.acmehowto.com/howto/appliance/dishwasher/dishwasher.php>)
- Finishinfo - Information about dishwashing (<http://www.finishinfo.com.au/>)

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Categories: Domotics | Home appliances

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