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Choosing and Using Your Refrigerator

Michigan State University Extension Service

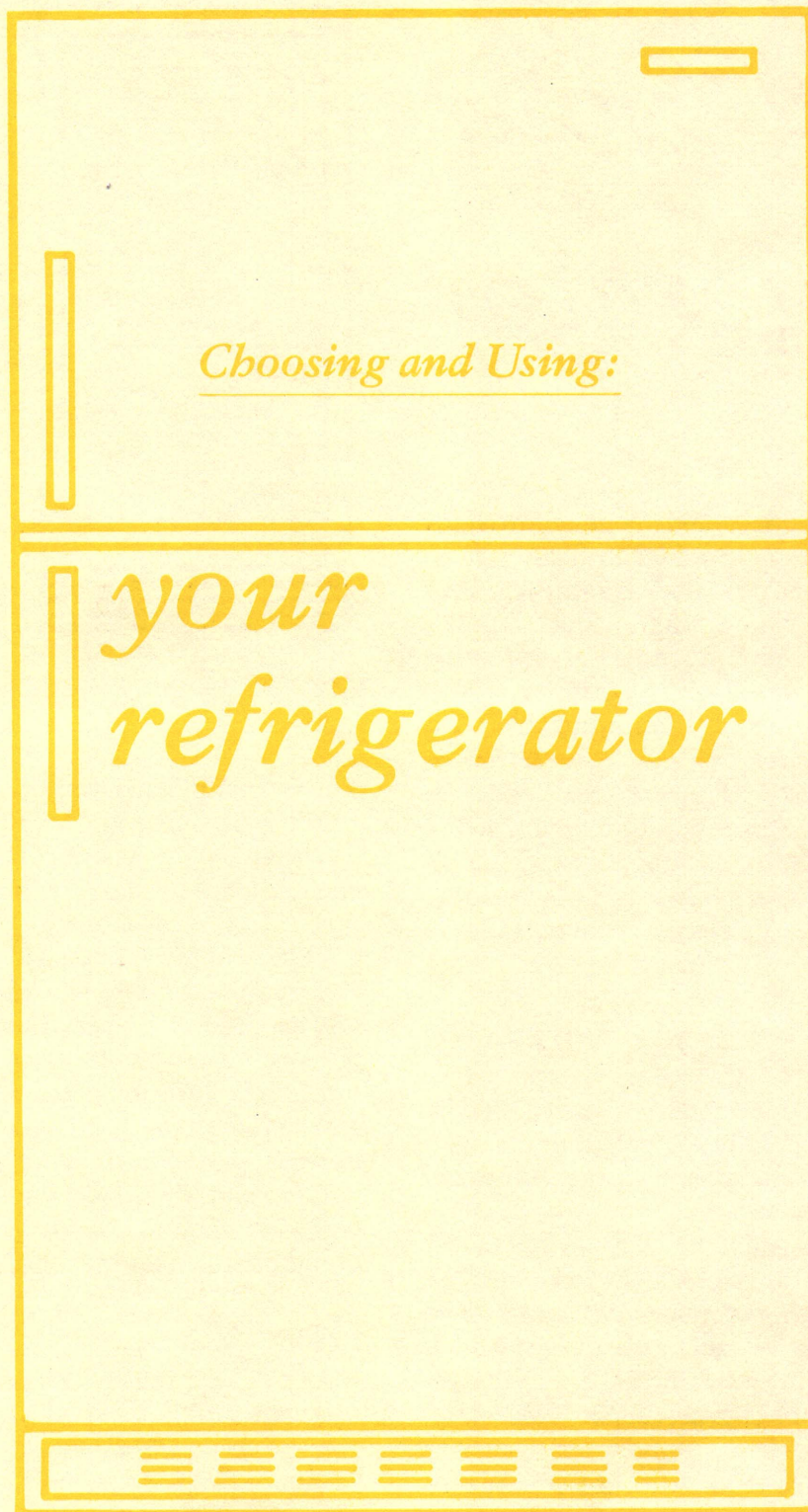
Anne Field, Family Ecology; Constance Burgess, University of California

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*This bulletin, with revisions by Anne Field, Extension Specialist in Family Ecology, Michigan State University, is reprinted from Leaflet 21007 of the same title, published in February 1978 by Cooperative Extension, Division of Agricultural Science, University of California. The author of Leaflet 21007 is Constance Burgess, home economist emeritus, University of California.*

## Choosing and Using:

# *your refrigerator*

A refrigerator retards food spoilage; provides temperatures from cool to cold to below freezing; enables you to buy in larger quantities, save leftovers, and cut down waste; and requires little besides regular cleaning, defrosting (depending on the model), and electricity.

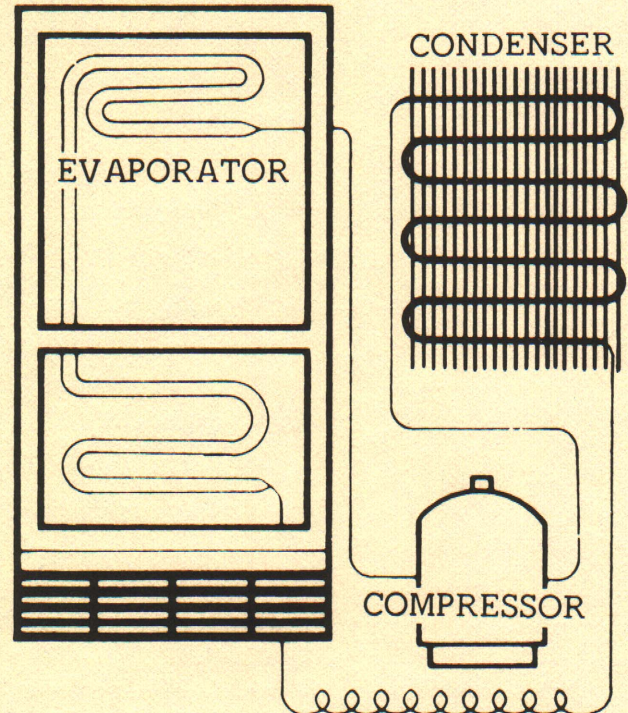
The many refrigerators manufactured offer a wide variety of models with a choice of sizes, features and defrosting methods. Refrigerators differ in the temperatures maintained inside the fresh-food and freezer compartments, provisions for eliminating frost, and operating (energy) efficiency. Prices vary according to features selected.

### HOW A REFRIGERATOR WORKS

A refrigerator is designed to preserve food by cooling the air surrounding it. Whether a refrigerator also provides long-term storage of frozen food depends on the model.

All refrigerators must have some means of removing the heat that is brought in by food or that enters through the door and walls. The heat is absorbed by a **liquid refrigerant** which circulates through evaporator coils. As the refrigerant absorbs heat from inside the refrigerator, it becomes so hot that it changes into vapor. The compressor raises the temperature and pressure of the vapor as it moves into the condenser. Heat then flows from the vapor to the cooler air in the room. As the vapor cools, it condenses into a liquid again and the whole cycle starts over. The air inside the refrigerator

is cooled, and the air outside the refrigerator is warmed.



### REFRIGERATOR MODELS

The two main groups of refrigerators are the conventional or standard models, and combination refrigerator-freezers. There are also compact models for special uses.

Standard models provide fresh-food storage and short-term preservation of a limited amount of frozen food. The freezer section is part of the total refrigeration space, and constant air movement takes place naturally between the two compartments.

In combination refrigerator-freezers, the two compartments are sealed off from each other, and there is no air movement between them.

#### Compacts

Most of these small, one-compartment refrigerators have less than 5 cubic feet of storage area, although a few have 6 cubic feet. Compacts can be moved around, loaded into cars and taken to camps or wherever electricity or gas is available. Most compacts are operated by electricity, although a few gas models are available, mostly for recreational vehicles. Manual defrosting is the most common type.

## Conventional, or Standard

Conventional refrigerators are usually the lowest-priced models of each manufacturer's line (except for compacts). Operating costs are usually lower than those of combination refrigerator-freezers.

The defrost method is manual; few conventional refrigerators have automatic defrost. Most have a temperature control with a defrost position.

Conventional models have a single exterior door. The fresh-food and frozen-food compartments are not sealed off from one another. The frozen-food section is always at the top; and one set of evaporator coils, located in or around this section, serves both compartments.

Because the heavier cold air is always moving downward from the frozen-food section, a standard refrigerator usually has an adequate temperature in the fresh-food storage compartment. But the naturally rising warmer air moves up into the top compartment, so that food kept for more than 2 to 3 weeks in the frozen-food storage area rapidly deteriorates in quality and loses food value.

The frozen-food storage area, therefore, is not a true freezer and should not be used as such. Temperatures in this compartment average from 10° to 15° F. United States Department of Agriculture research has shown temperatures ranging from 10° to 28° F in models tested at standard cold-control settings. At the coldest settings, temperatures went below 0°F in some cases. In all cases, temperatures in the fresh-food storage area went below freezing at the coldest settings because of cold air dropping from the freezing compartment. Adjustment of the airflow might lessen this problem (see below).

The fresh-food compartment usually has temperatures ranging from 37° to 45°F. The defrost or chiller tray, directly below the evaporator coils, provides storage for fresh meats. Unless protected by heavy insulating paper, food may freeze in this location.

To control air flow between the freezing section and the fresh-food compartment, some models have an adjustable, narrow, crosswise flap or baffle at the rear of the compartment, often attached to the back of the defrost pan or to the back of the food compartment. When clos-

ed (flat), the baffle keeps more of the cold air in the upper section. When opened, it allows more cold air to drop into the fresh-food compartment—especially important in warm weather.

In some models, the baffle is operated automatically in connection with the cold control. In other conventional models, the flow of air may be controlled by adjusting the position of the defrost tray. Whatever method is provided, airflow should be easy to regulate to give you better control over temperature.

Before you buy, check the inside door that covers the front of the frozen-food section. If this door is hinged on the side rather than at the bottom, it is more convenient to reach into the compartment without fully opening the outside door. Also check on how easily you can remove and replace the defrost or chiller tray, since you'll be using it often.

## Refrigerator-freezer combinations

Prices of refrigerator-freezers range from moderate to high, depending on the number of automatic features and extra conveniences included. Combinations usually have more deluxe features than standard refrigerators.

Costs of operating combination models are also moderate to high, depending on cubic feet, defrost method, temperature of freezer and efficiency of that model.

The freezer section maintains approximately 0°F, which permits freezing of foods and long-term storage of frozen foods. Temperature in the fresh-food compartment is often several degrees lower than in a standard model.

The location of the evaporator coils determines whether air circulation is natural or must be forced. When the coils are inside the compartments, air can circulate naturally. If the coils are outside, a fan is needed to force the cold air into each compartment and to pull the warm air back to the coils. Since cold air falls naturally, it is usually forced into the compartment through vent openings at the top. However, moving cold air may be admitted at several locations to keep food at desired temperatures. Moving cold air keeps the frost formation down and prevents packages in the freezer section from sticking together.

Outside coils are generally not visible, because they are between the liner and the insula-

tion; some may be at the bottom, others at the back of the refrigerator.

Frost forms regardless of the location of evaporator coils, because moisture vapor condenses when it touches a cold surface and freezes if the surface is cold enough. Frost may be removed manually or automatically.

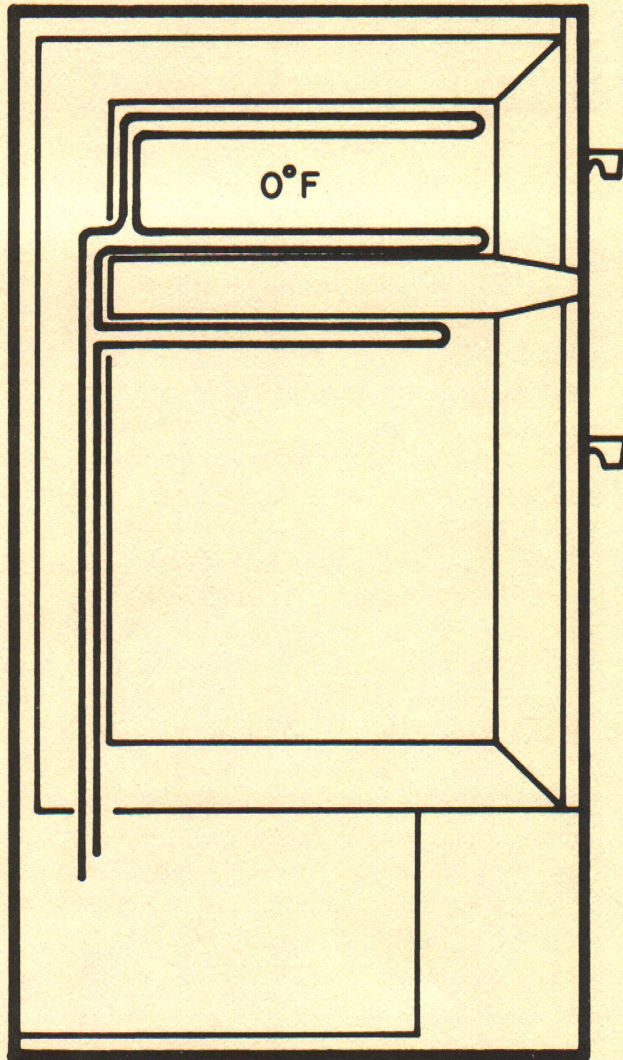
"Cycle defrost" usually refers to models with evaporator coils on the inside. The fresh-food, or refrigerator section usually defrosts automatically every time the cycle goes off. The freezer section is manually defrosted, normally about two or three times a year. Since the freezer compartment is insulated from the refrigerator section, it collects frost slowly if used properly. By scraping off light frost occasionally, you can cut defrosting time to a minimum.

### Frostless Models

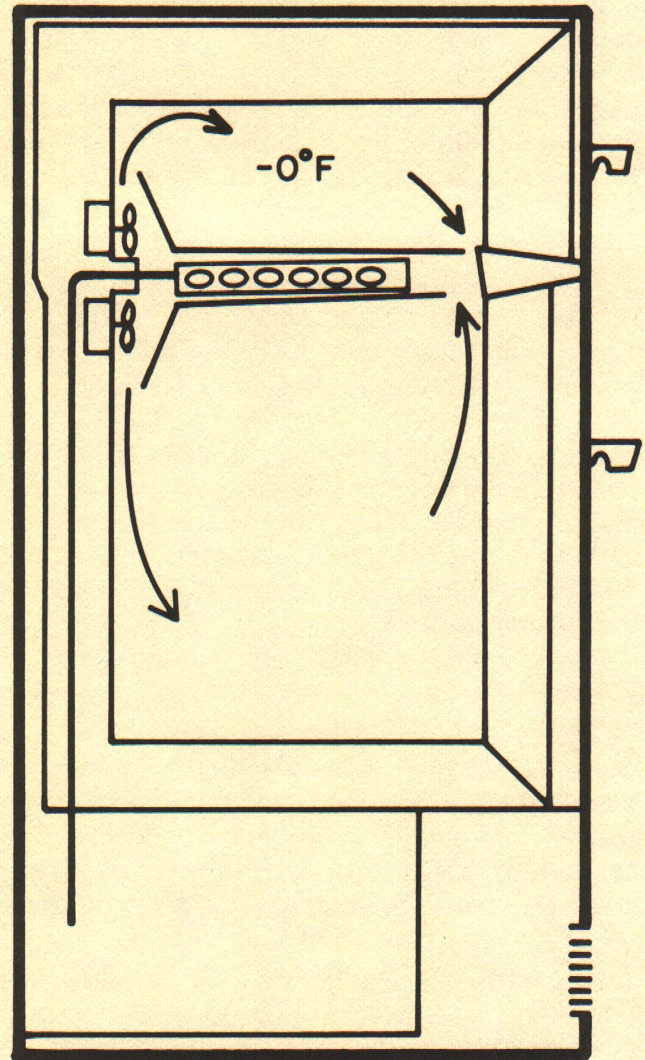
"Frostless" models are also called "no-frost," or "frost-free." In such models, forced cold air moves through both the refrigerator and freezer sections. Coils are always on the outside.

The refrigerator section of frostless models defrosts automatically by the cycle method. However, since there are no coils inside, there will be no defrost water inside. The defrost water drains to a tray below and evaporates.

The freezer section of frostless models collects very little frost. Defrosting occurs once every 24 hours or every 8 hours of compression running time. In some cases, defrosting is speeded up by an electric element next to the coils



COMBINATION REFRIGERATOR-FREEZER—CYCLE DEFROST, natural air circulation, contact-freezing in freezer.



COMBINATION REFRIGERATOR-FREEZER—FROSTLESS, forced air circulation with fans, little or no contact freezing.

that comes on for 6 to 10 minutes. Other manufacturers use a "reverse refrigeration" method that sends the warm refrigerant temporarily back into the coils. During defrosting, the forced air is halted, which may result in a temporary 5° to 15°F warmup in the freezer, and may soften ice cream.

Operating costs are higher in frostless refrigerator-freezers because (1) forced cold air is being circulated in both compartments, (2) such models generally have more cubic feet of space and (3) the coils are colder.

Highly perishable foods, such as fresh meats, may not keep more than a few days in any type of refrigerator except those with a special meat-keeping compartment. In some frostless models, the entire meat compartment is "wrapped" by constantly moving cold air. The compartment should have a tight cover to prevent the meat from losing moisture.

The fan-forced circulating air in frostless models keeps the air dry in the refrigerator and freezer sections. This may cause excessive drying of foods unless they are tightly covered or properly wrapped.

"Contact freezing" occurs when packages of unfrozen food are placed in direct contact with evaporator coils. Manufacturers generally use the term "true freezer" to denote freezers that maintain a 0°F temperature. A true freezer makes contact freezing possible when food packages touch walls or shelves.

### ITEMS TO CONSIDER

Features vary from year to year; some are improvements, others may not be. Consider carefully the features that are important to you, and decide whether they are worth the extra cost they may add to the price tag. Frequently, new features that appear only on the top of the line one year may appear a year or two later on less expensive models.

#### Energy consumption

The refrigerator can use 10% of your electricity. The size of the refrigerator, the size of the freezer and how cold the freezer is kept all affect energy requirements. Some new, larger frostless models now have energy-saving features such as better insulation, more accurate

defrost timing, more efficient compressor design and a switch to turn off heaters around the door openings. These heaters around the door opening are used to control "sweating" or condensation around that area during humid weather. The switch allows you to shut off the heater during dry weather or when the room is dry during the winter heating season.

Under a program administered by the Federal Trade Commission, labels were expected to appear in fall 1979 on refrigerators, listing average costs of operation. While your own costs of operation will vary greatly according to the way you use the refrigerator, these labels will allow you to compare relative efficiencies of different models before you buy.

#### Estimated Electrical Energy Usage for Various Types and Sizes of Refrigerators

Refrigerator		
Energy used*	Size	Type
	cu ft	kwh/day
Standard	12	2
	14	2.5
Frostless	12	3
	14	4
	17	4.2-5.3
Frostless (energy efficient)	14	3-3.3
	17	3-3.5

\*Kilowatt-hour (kwh): 1 kwh is 1,000 watts of electricity used for 1 hour—for example, ten 100-watt lamps turned on for 1 hour.

Operating efficiency of a refrigerator is a very important part of what it costs you to own that refrigerator. It is plugged in and working 24 hours a day, every day of the year in most homes. The "life-cycle cost" or cost of owning a refrigerator over its lifetime has been estimated to be made up of the following three items:

Purchase cost . . . . . 29%  
 Servicing cost . . . . . 6%  
 Energy cost . . . . . 65%

What this might mean to your pocketbook could be illustrated from the figures in the chart above. The more energy-efficient model 17 cu. ft. refrigerator would use about 1½ less kwh per day to do the same refrigeration, or **547 less kwh per year**. At a price of 5 cents per kwh, this more efficient model would cost \$27.35 less to

operate each year than the regular model. It would probably cost you more to buy in the first place because of better insulation and materials.

Suppose it did cost you \$50 more to purchase this efficient model. In two years you could make up that difference in operating cost saved at \$27 a year. Refrigerators last about 15 years on the average, so you'd be saving **at least \$27** on electricity each of the other 13 years, more as the price of electricity rose above 5 cents per kwh. (You could calculate your own savings with your local utility rate.)

### **Trays, shelves, special compartments**

Look for good-quality materials, good construction, easy-to-manipulate and easy-to-clean features.

Meat trays and vegetable crispers should be made of a high-grade plastic or of porcelain enamel. Cantilevered shelves, butter and cheese compartments, and sometimes even egg racks are examples of cost-adding features. Any part that will be handled frequently, such as trays or shelves that slide, needs to be sturdy and free of sharp edges. All pull-out shelves should have a positive lock position to prevent them from coming all the way out. Ice-cube ejectors, automatic ice-making equipment, and ice-water dispensers should be evaluated for cost and family usage. The ice-maker mechanism takes up about 1 cubic foot of freezer space (which is colder and therefore more costly to maintain than refrigerator space), which then cannot be used for storage of frozen food. It also requires connection to the water supply.

Tall bottles require special storage space. Some models have a two-level shelf for this purpose. For greater convenience, look for shelves that permit removing and replacing bottles without tipping them.

Some of these features make cleaning more difficult. Also, remember that your refrigerator may last 15 years—you may not want to pay high prices for accessories that may wear out long before your refrigerator does.

### **External features**

In part, the square, built-in, flush look is accomplished by the use of semiconcealed door hinges. These permit a closer fit of the refrigerator to adjacent walls or cabinets. On the back of some refrigerator-freezers is a black gridlike construction. This is not the evaporator coil. Its purpose is to prevent placing the refrigerator too close to the wall. Usually, a fan forces the warm air out the bottom where the condenser is located.

Look for construction that will permit you to open the door without having to leave extra swing space at the corner. Try removing crispers and other features when the door is partially opened. If the door has to be swung open more than a right angle (90°), it will interfere with placing your refrigerator in a corner. Some door handles may be more comfortable to reach and grasp than others. A foot pedal is a convenience, particularly if you have limited counter space next to the door opening.

A few models have rollers to make it easier to move the refrigerator when cleaning.

### **Insulation**

This is of key importance in refrigerator construction. The greater the difference in temperature between hot and cold objects, the more rapid the heat transfer. Traditional insulating materials have been primarily fiberglass and mineral or rock wool. Because of the low temperatures inside, this type of insulation should be about 3 inches thick if used alone.

Foam plastics also serve as good insulators. Rigid sheets are formed into permanent shapes from a liquid polyurethane or other plastic resin poured into a mold. As the liquid is processed, it foams up to fill the space. The outside layer forms a tight skinlike membrane that resists the entrance of vapor.

### **Storage temperatures**

Fresh meat, poultry, and fish keep best at temperatures between 30° and 35°F. Milk, cream, and cheese should be kept at about 40°. Although a small amount of butter may be held at 50° to 55° in a butter container, the bulk of it needs about 40° to 44°F.

## Safety catches

Federal regulations require door catches that can be opened by someone inside exerting no more than 15 pounds pressure. Most use a magnetic closure. A magnetic closure is easier and quieter, but may not be as positive as a latch-type closure, especially if the appliance is not level.

## Seals of approval

Electric appliances should carry the **Underwriters' Laboratory (UL) seal of approval**. While not a guarantee of performance, this seal assures you that the appliance has passed certain tests for safety.

The **AHAM (Association of Home Appliance Manufacturers) certification seal** certifies the cubic feet of storage space in refrigerator and freezer compartments and the square feet of shelf space.



## Noise

Many people who replace a refrigerator they've had a long time think the new one sounds different and noisier. There may be several reasons for the new sounds.

If it has more storage space or a colder temperature freezer compartment, it will operate differently to cool this space properly. Modern high efficiency compressors operate much faster than older kinds and have a higher-pitched sound. Other sounds come from the parts used to operate the "frost-free" automatic defrosting system. If you have an icemaker this produces occasional sounds of flowing water or of dropping cubes especially in an empty cube container. And energy-efficient foam insulation, while it does an excellent job of keeping heat out, doesn't muffle sounds from within the refrigerator as well as earlier types did.

## REFRIGERATOR CARE

Defrosting methods vary according to the manufacturer and model. Follow directions for your refrigerator. If you have an automatic defrost or "frost-free" refrigerator, be sure to find out where the defrost pan is located so that it can be cleaned frequently.

If only the freezer section of your refrigerator is manual defrost, you'll need to defrost two or three times a year, or when the frost is  $\frac{1}{4}$  to  $\frac{1}{2}$  inch thick. Some manufacturers provide a plastic or wooden scraper to remove frost that is in the form of snow. This may save you from defrosting quite so often. Never use a sharp or pointed tool for this job—you can puncture the evaporator coils with a sharp instrument. An electric fan may be used to hasten defrosting by placing it where it blows air toward the frost buildup.

In a true freezer compartment of a combination refrigerator-freezer, you will notice that most of the frost first appears at the top of the compartment. If you remove the frost frequently with the scraper, there will be less frost buildup elsewhere.

## Cleaning and Maintenance

Check door gaskets to be sure of a tight seal, and replace them when necessary. You can check the gaskets on most models by closing the door on a piece of paper towel or a dollar bill. The paper should not pull out easily. A worn gasket allows warm air to enter the box and makes your refrigerator less efficient. Keep the door gasket free of grease; avoid handling it when closing the door. Clean by wiping with a cloth wrung out of detergent water. Rinse and dry.

Clean the refrigerator section regularly, even if your model requires no defrosting. A disadvantage of automatic defrosting is that the need for regular cleaning is sometimes overlooked. Wipe up spills immediately. When cleaning, remove all food and removable interior parts. Wipe inside the cabinet with a cloth or sponge thoroughly dampened in warm detergent water, or use 1 to 2 tablespoons of baking soda to 1 quart warm water. You can wash most glass shelves and plastic parts in detergent water. Remember that cold plastic may crack under a sudden temperature change. Rinse and dry.



Clean the freezer section periodically. Consult your instruction book for the method of cleaning the freezer section.

Wipe the outside of the cabinet with a damp cloth. If the exterior finish is synthetic enamel (as most are), it might be wise to use a specially formulated white cream wax about twice a year to protect the surface. Since these waxes are naphtha-based, they may be used successfully to clean the surface as well as to protect it.

Vacuum the condenser coils periodically. If the kitchen is carpeted or if there are pets in the home, vacuum once a month.

### Efficient use

Regular care of your refrigerator includes:

1. removing frost when it builds up to  $\frac{1}{4}$  inch
2. vacuuming the condenser coils
3. replacing worn gaskets to make it operate more efficiently.

Other actions you perform can help cut the amount of electricity it takes to run that refrigerator.

Where you place it in the kitchen is important. Since the refrigerator's job is to remove heat from inside the box, and since even the thickest insulation and tight door closing do not keep all heat out, placing it near a heat source such as a range, radiator or register, or a sunny window will make it work harder and use more electricity.

Each time you open the door, warm air rushes in and the refrigerator has to work harder to remove it. Organizing your refrigerator storage so you can find often-used items easily, thinking what you want **before** you open the door, taking out items you want at one time, and having a "landing spot" beside the refrigerator to set things you are putting away or taking out, can help to cut "open door time." A wheeled cart can be used if you have no counter space there.

When storing foods in the refrigerator, cover them to prevent moisture loss. This not only preserves food quality better; it also cuts energy cost, especially in a no-frost refrigerator where moisture picked up by cold circulating air forms additional frost which then has to be removed by the mechanism. Leave space between foods for air to circulate. Don't crowd the space tightly.

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From the standpoint of safety, foods should be refrigerated promptly. They can be placed in the refrigerator while slightly warm. Obviously, it makes a good deal of sense from the standpoint of saving energy to partially precool foods at room temperature before refrigerating. However, better set a timer so you do not forget to place the cooled food in the refrigerator promptly. If there is any chance that you will not be returning to the kitchen area, refrigerate it while still warm.

### Quick ways to precool food

1. Set the pan of hot food in a sink basin or large container of cold water. A low flat pan or tall narrow cylindrical pot exposes maximum surface area to the cold water.

2. Stir hot mixtures while cooling.

Thaw frozen foods that need to be defrosted in the refrigerator, it's safer for the food and helps keep the refrigerator cool, just as though you had put a block of ice in there. Don't use the refrigerator to store items that do not require refrigeration, such as jelly and mustard. Use leftovers promptly.

### IT'S UP TO YOU

A refrigerator or combination refrigerator-freezer is a long-time investment. Under normal use and with proper care, your appliance will last for many years.

Many refrigerators are traded in because a family wants a new model, not because the appliance is worn out. For example, in one recent year only 26 percent of the refrigerators reported as trade-ins had to be discarded by dealers. This compares with 50 percent of the washers, 64 percent of the dishwashers, and 68 percent of the electric water heaters that could not be resold.

Select your refrigerator carefully, and use it to best advantage. Operating costs will be greatly increased if you open the doors too often or leave them open long. Food storage will be more satisfactory if you follow the directions for placement within the refrigerator and for cleaning.