

INTRODUCTION

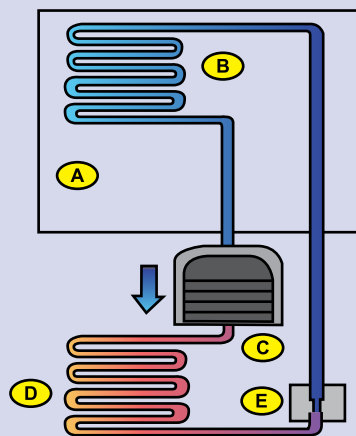
Home Refrigerator, often called a “fridge”, has become an essential household appliance. Refrigerators are extensively used to store fruits, vegetables and other edible products which perish if not kept well below the room temperatures, normally a few degrees above 0°C, the freezing point of water.

A refrigerator is a cooling appliance that transfers heat from its thermally insulated compartment to the external environment, and thus cooling the stored food in the compartment. It also normally houses a “freezer”, where temperatures below the freezing point of water are maintained, primarily to make ice and store frozen food. Crisper which draws inside moisture to keep vegetables and fruits fresh for longer time, is normally in-built in most of home refrigerators.

REFRIGERATION SYSTEM BASICS

Box 1

Basic components of the system include an evaporator, compressor, condenser, and an expansion device. A refrigerant circulates in these components. It vaporizes in the evaporator absorbing the heat from the warm inside air drawn across the evaporator coil. This cools and dehumidifies the air. The compressor raises the pressure and temperature of the refrigerant vapors. The condenser condenses the refrigerant and transforms the high pressure vapor into high pressure liquid. Heat is rejected via outside air drawn across the condenser. The expansion device transforms the high pressure high temperature liquid refrigerant to low pressure low temperature mixture of refrigerant liquid and vapor. The refrigerant goes to the evaporator, and the cooling cycle continues.



- (A)** Inside the Refrigerator
- (B)** Evaporator
- (C)** Compressor
- (D)** Condenser
- (E)** Expansion valve

Two types of home refrigerators are typically available in market. These are:

Direct Cool Refrigerators: These refrigerators are with or without crisper, ice making or frozen food storage compartment. Cooling of food is primarily obtained by natural convection within the refrigerator. However, some refrigerators may have a fan to avoid internal condensation of water but are not claimed as ‘frost free’. Formation of frost/ice in the refrigerator reduces cooling. Therefore these refrigerators need manual defrosting periodically.



Frost Free Refrigerators: These refrigerators normally have direct cooling system along with door cooling technology. These refrigerators cool the stored food through continuous internal movement of air that restricts the formation of frost and sticking of food items with each other. A frost free freezer has three basic parts: a timer, a heating coil and a temperature sensor. The heating coil is wrapped around the freezer coils. Every six hour or so, the timer turns on the heating coil and this melts the ice off the coil. When all the ice is removed, the temperature sensor senses the temperature rising above 0°C and turns off the heating coil.

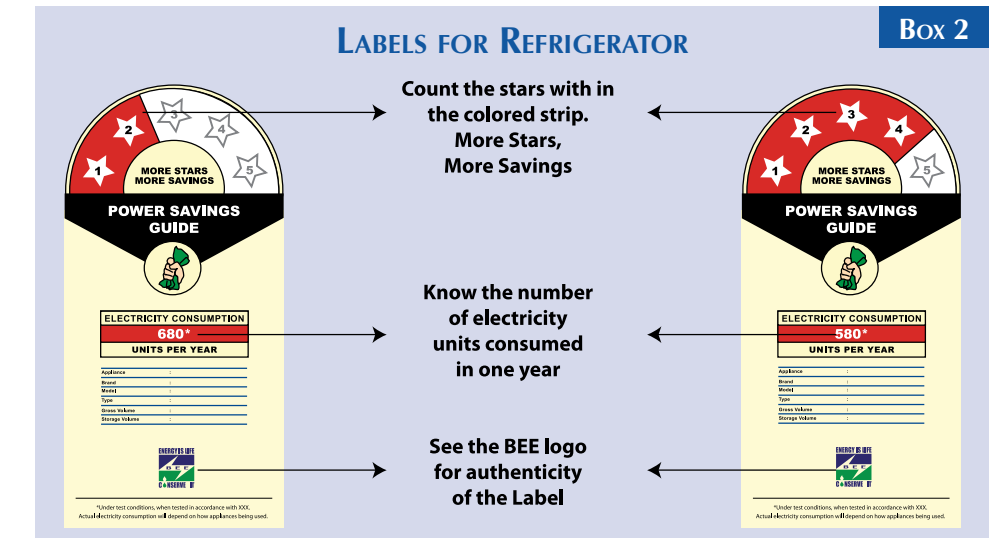


BEE STAR RATING AND LABELING OF REFRIGERATORS



In May 2006, Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power launched Standard and Labeling Program of electrical home appliances including Direct Cool and Frost Free Refrigerators. Under this program, for the benefit of general public, the appliance manufacturers could voluntarily affix BEE Star Label on their appliances showing the level of energy consumption by the appliance both in terms of absolute values as well as equivalent number of stars varying from one to five, in accordance with specific stipulation. The greater

the number of stars on the label, higher the appliance energy efficiency and lower its electricity consumption (Box 2). However, from January 2010, affixing BEE star label has been made mandatory for Frost Free Refrigerators, whereas, BEE Labeling is still in the voluntary phase for Direct Cool Refrigerators.



Source: Bureau of Energy Efficiency

Table 1 highlights the energy cost savings for a frost free refrigerator with different Star Ratings.

Table 1: Energy and Cost Saving for 250 liters Frost Free Refrigerator with different Star Ratings

| Star Rating | Energy Consumption Per Year (Approx.) | Per Unit Charge (Approx.) | Electricity Cost/year | Total Savings (w.r.t No Star Every Year) | Refrigerator Cost (Approx) | Cost Difference | Pay Back Period |
|-------------|---------------------------------------|---------------------------|-----------------------|--|----------------------------|-----------------|-----------------|
| | Units (kWh) | Rs. | Rs. | Rs. | Rs. | Rs. | Years |
| No Star | 1100 | 2.50 | 2750 | 0 | 14000 | 0 | 0 |
| 1 | 977 | 2.50 | 2443 | 308 | 15000 | 1000 | 3.25 |
| 2 | 782 | 2.50 | 1955 | 795 | 15500 | 1500 | 1.89 |
| 3 | 626 | 2.50 | 1565 | 1185 | 16500 | 2500 | 2.11 |
| 4 | 501 | 2.50 | 1253 | 1498 | 17500 | 3500 | 2.34 |
| 5 | 400 | 2.50 | 1000 | 1750 | 18500 | 4500 | 2.57 |

Source: Bureau of Energy Efficiency

BEFORE BUYING THE REFRIGERATOR

Before buying a refrigerator, it is important to consider its energy efficiency aspects apart from price, warranty, after-sales service, etc. In this context, while selecting a refrigerator, do refer to the BEE Star Rated Label affixed on the refrigerator and also refer to the Star Rating analysis promoted by BEE from time to time through its web site (www.bee-india.nic.in) and advertisements.

CHOOSING THE RIGHT SIZE

Refrigerators with **storage volume** ranging from 86 to 605 litres (with gross volume ranging from 99 to 653 litres) are typically available in the market at present. Make sure you are choosing a refrigerator that is approximately sized for your storing and cooling needs. If your fridge is too small, you may be overworking it. If it is too large, you are paying higher initial cost, and potentially wasting energy and home space. Always ascertain the **storage volume** of the refrigerator because this is the actual space available to you for storing food items. Therefore make a judicious decision while buying the refrigerator.



IDENTIFYING THE RIGHT LOCATION

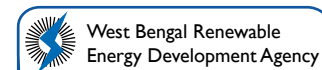
While placing the refrigerator in home, ensure that it is at least 100 mm (4 inches away) from the walls to facilitate effective heat rejection particularly from the rear side. Care should be taken that the unit is sufficiently away from heat sources such as stove, oven and direct solar radiation. These heat sources affect the heat dissipation from the fridge condenser, and may force the compressor to run longer leading to more electricity consumption. The refrigerator unit should also be leveled appropriately to ensure that its door closes easily and tightly after its use to minimize unwanted warm air infiltration in the cooling space.

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ENERGY SAVING TIPS

- Make sure that refrigerator is kept away from all sources of heat, including direct sunlight, and appliances such as cooking range, oven, radiators, etc.
- Refrigerator motors and compressor generate heat, so allow enough space for continuous airflow around refrigerator. If the heat does not escape, the refrigerator's cooling system will work harder and use more energy.
- Over filling of the storage capacity of refrigerator with food items should be avoided, to ensure adequate air circulation inside.
- Do not keep fridge door open for longer period as it consumes more electricity. Therefore decide what you need before opening the door. By this practice, you will reduce the amount of time the door remains open.
- Allow hot and warm foods to sufficiently cool down before putting them in refrigerator. It is also advisable to put them in sealed (air tight) containers. Refrigerator will use less energy and water condensation will also be lesser.
- Make sure that refrigerator's rubber door seals are clean and tight. They should hold a slip of paper snugly. If paper slips out easily, replace the door seals. The other way to check this is to place a flashlight inside the refrigerator when it is dark, and close the door. If light around the door is seen, the seals need to be replaced.
- When dust builds up on refrigerator's condenser coils, the compressor works harder and uses more electricity. Therefore clean the coils regularly.
- In manual defrost refrigerator, accumulation of ice reduces the cooling power by acting as unwanted insulation. Therefore, defrost freezer compartment regularly in a manual defrost refrigerator.
- Give the maintenance contract of refrigerator directly to the manufacturer or its authorized company which has trained and well-qualified technical staff.
- If refrigerator is older and needs major repairs, it is likely to become inefficient after repairs. It may be advisable to replace old refrigerator with a new and energy-efficient one.

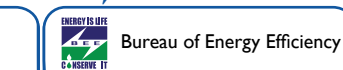
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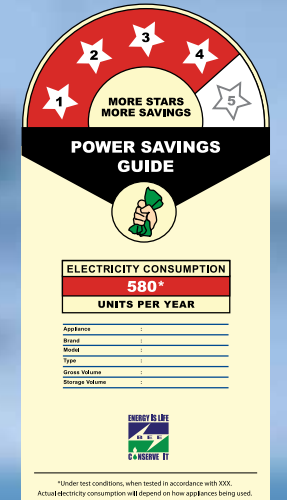


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Energy Efficiency Guide

Buying and Maintaining an Energy-Efficient Home Refrigerator



Regional Energy Efficiency Center for Home Appliances
 West Bengal Renewable Energy Development Agency, Kolkata

