Those who have experience a breakdown of an in-home-appliance such as washers, dryers, and refrigerators realized how vital a repairer can be. Service technicians or home appliance repairers help to ensure that home appliance operate correctly and that potential breakdowns are avoided. Some workers work specifically on small devices like microwaves while others concentrate on larger devices such as dishwashers, washers, dryers, and refrigerators.

Repairers must carry out visual inspections, listen for unordinary noise, check for leaks and vibrations as well as disconnected parts in order to diagnose the problem. Workers will rely on service instructions, troubleshooters, and their own experience to identify hard to find problems. In order to look for corroded or worn parts, a worker might take the appliance apart. They utilize the wiring diagrams and employ tools like ammeters and watt meters to test for shorts or bad connections.

Once the problem has been located, a repairer will make the necessary repair or replace the part that is bad, like a belt, motor or gear. They then ensure that each part is aligned and tightened correctly, and repairers also take time to clean and lubricate components as needed. They use typical tools like pliers, wrenches, screwdrivers and files, while also using more specialized such as soldering guns. When working on appliances, it may be necessary to replace electronic components such as circuit boards.

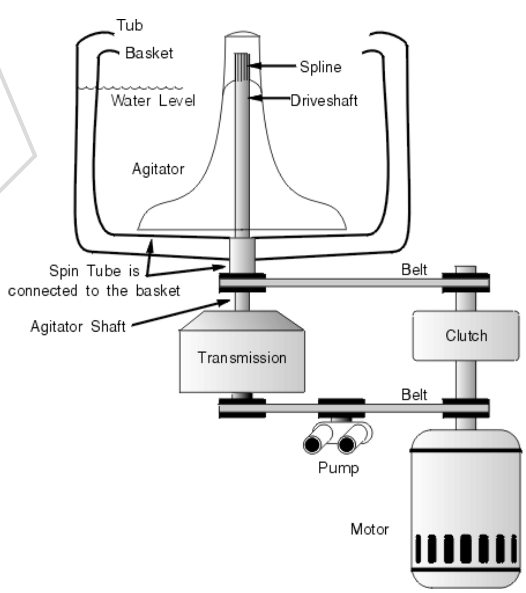
Washing Machine Repair

PROBLEMS COMMON
TO ALL WASHER BRANDS

Washing machine designs vary widely, but there are *some* things that *all* washers have in common. For example, all washers have an electric motor. All washers have both spin and agitate cycles. And since both cycles are driven by the same electric motor, all washers have some sort of mechanism to change between the two.

CYCLES :FILL CYCLE : During the FILL cycle, a solenoid-operated water mixing valve opens and allows hot or cold water to enter the tub. There is no pump operating at this time; the tub fills strictly from house pressure.

Typical Drive Train



WASH/RINSE CYCLE

After the water valve closes, an electric motor starts which drives the transmission, sometimes through a belt, and in some cases through a clutch arrangement, too. The transmission converts the rotary motion of the motor to the back-and-forth motion of the agitator. A driveshaft extends from the top of the transmission to the agitator, where it is connected to the agitator.

Agitation will continue for a certain amount of time, which is controlled by the timer. During agitation, some washers use their pump to circulate water, sucking it from the bottom of the tub and pumping it to the top of the tub. The pump is driven by the same electric motor.

SPIN AND DRAIN CYCLES

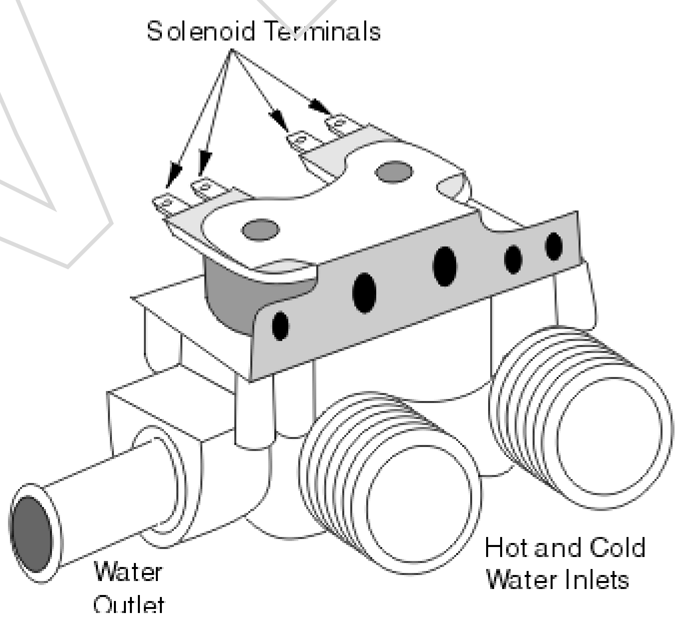
After agitation comes a drain cycle, sometimes combined with a spin cycle. During the drain cycle, the pump sucks water from the tub and sends it down the drain. During the spin cycle, the same motor that drove the agitator now drives a spin tube which is concentric with the agitator shaft. The spin tube spins the basket, slinging excess water out of the clothes by centrifugal force. There is a clutch arrangement which allows the basket to come up to speed slowly. This prevents a heavy load from being thrown onto the motor suddenly.
At the end of the spin cycle, or whenever the lid is lifted, most models have a braking arrangement that stops the tub from spinning. This helps to prevent people from accidently sticking their hands into a spinning basket.

FILL SYSTEM

The basic components of the fill system are the hoses, the fill valve, and the pressure or float switch.

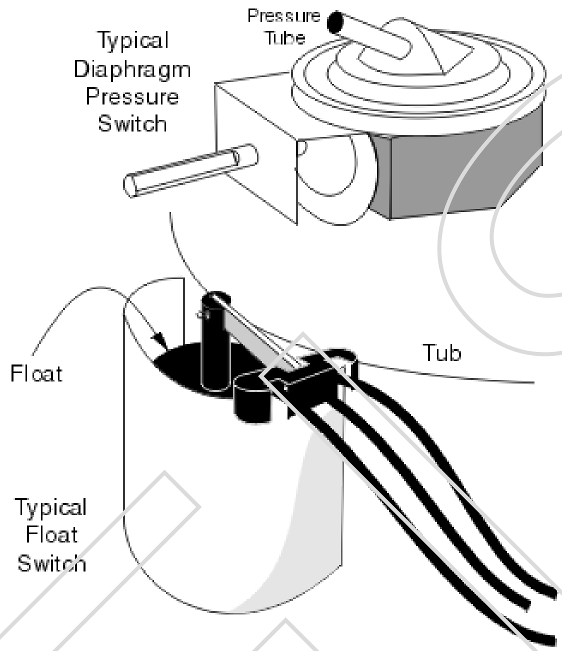
The fill valve is simply a solenoid valve that opens when activated and allows hot and/or cold water to flow into the tub. Most modern washers use dual solenoid valves, which have both hot and cold solenoids in one valve body. When warm water is desired, both valves open to mix hot and cold.

Typical Fill Solenoid Valve



When the water in the tub reaches the desired level, the pressure or float switch closes the circuit to the fill valve. Float switches are pretty rare; you'll find them only in older washers. A diaphragm-type pressure switch is more common.

Typical Water Level Switches

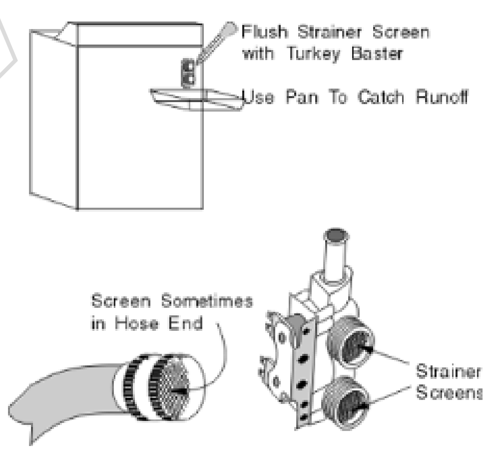


DIAGNOSIS : If your washer is not filling properly, or is overflowing, there could be several reasons.

SLOW OR NO FILL, OR WATER TOO HOT OR TOO COLD

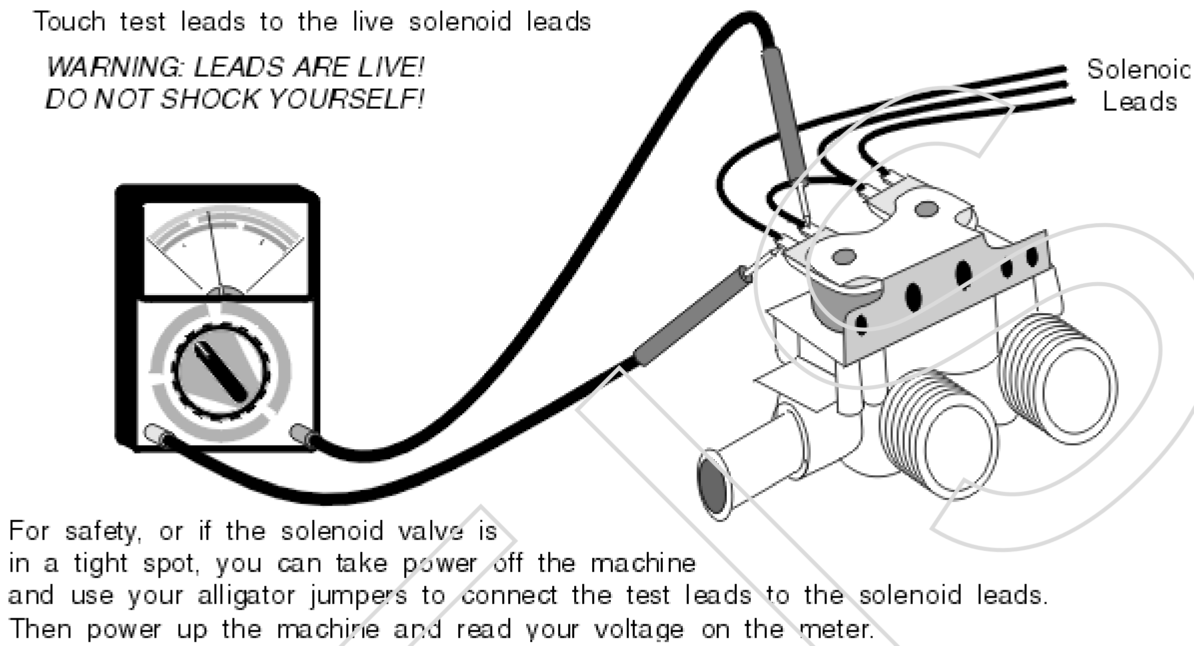
If your washer is filling very slowly or not at all, or the water temperature is always too hot or too cold, check the fill hose and valve strainers. These are little screens placed in the fill hose and/or water valve to prevent rust and scale from your house's piping system from getting into the water valve. The strainers can get clogged up over time and prevent water flow.
In some instances, the screen is non-removable, and you will need to replace the hose or valve. Neither is very expensive.

Fill Strainer Screens



When re-installing the hoses, always use new hose washers. Also, take care not to over tighten the hose on the plastic threads of the solenoid valve; tighten just enough to stop it from leaking.

Checking Voltage Across Water Solenoid Valve Coils

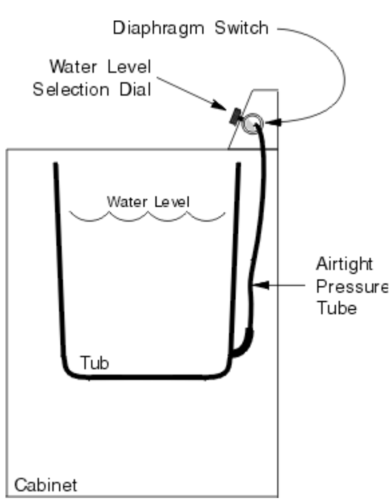


If so, you're getting power to your valve, but it's not opening. Replace the valve.

If you're not getting power to the valve, refer to the wiring diagram for your machine and trace the source of the interruption. Sometimes it's a broken wire, but more commonly, there will be a problem with the water level switch, timer, lid switch, or temperature switch. Replace the defective switch. The control board may also be defective.

OVERFILL : As the tub fills, water pressure increases at the bottom of the tub. This pressure is transmitted to the diaphragm in the water level switch by a rubber or plastic tube. When the tub reaches the right level, the diaphragm trips the switch, closing the solenoid fill valve and starting the agitate cycle.

Water Level Pressure Tube



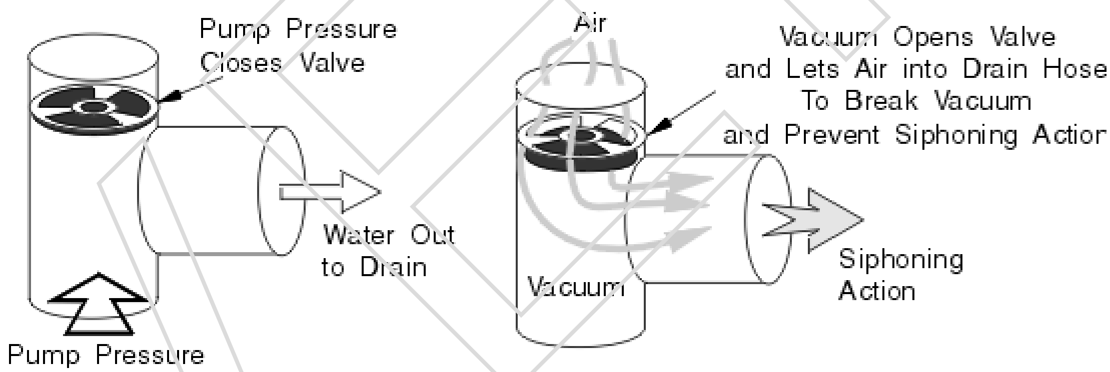
If the tube or diaphragm is leaking badly, the water level switch will not sense any pressure, and thus will not shut off the water flow, so the tub will overflow. If this tube is leaking slowly, the washer may exhibit odd fill symptoms.

DOES NOT STOP FILLING, AND/OR WATER LEVEL KEEPS GOING DOWN

If the house washer drain starts backing up, you get a rooter and clear the drain, right? But some people would just seal it up so it couldn't overflow, instead of clearing the drain, as they should.
But that air break between the washer's drain hose and the house's drain pipe is important.

If there is no air break, and the drain system fills with water, it can actually start siphoning water right through the pump and down the drain. Depending on how bad the drain is backing up, the washer might never fill completely; the solenoid valve will just stay open and water will just keep siphoning straight out the drain.
There is a solution, even if you don't want to root out the drain blockage as you should.
When the drain line is under pressure, the flapper valve closes and no leakage occurs. When the drain line is under a vacuum the flapper valve opens and air is allowed into the drain line, breaking the siphoning action.

Vacuum Break Valve



PUMP; DRAIN AND RECIRCULATION SYSTEMS

The pump can perform several functions. In all washers, it is used to pump water out of the tub at the end of an agitate or soak cycle. In some washers, it also circulates water during the agitate cycle. It may also provide flush water for a bleach or softener dispenser. Therefore, the pump *may* be required to pump in two different directions or more during a cycle.

DIAGNOSIS

Sometimes the most obvious answers are the first ones overlooked. If the tub isn't draining, first check the drain system. Check the drain hose to make sure it isn't kinked. Also check any lint filter that may be installed. On some Whirlpool/Kenmore models, there is also a side-check valve at the tub outlet that can get clogged.

There aren't too many things that can go wrong with a pump. The pump bearings can seize, stopping it from turning. The pump can be jammed by socks or other small items. The impeller blades can break off due to junk entering the pump; if this happens, the pump may seize up, or it may just stop pumping. The usual solution is to replace the pump.

If you suspect that something is jamming the pump, drain the tub and pull the hoses off the pump. Look into the hoses and the pump and pull out whatever is jamming it. If you can't see anything jamming the pump, feel around the inside of the pump inlets and outlets with a pair of needle nose pliers. If all else fails, and you still can't find the jam, pull the pump out of the machine and check it.

LEAKS

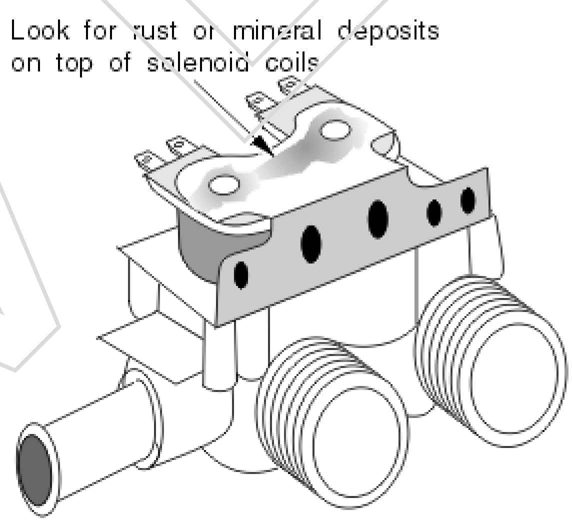
Although there are a few leaks common to all brands, most brands have leaks that are peculiar to their design
A common "leak" zone is not a leak at all; the wall drain backs up and overflows onto the floor. This is commonly misdiagnosed as a leak.
If it isn't the drain, run the machine with a full load. Without moving the machine, get right down on the floor and look under the machine with a flashlight. Try to find the general area where water is dripping to the floor; front or back of the machine, left or right side.

Open the cabinet and look for mineral or soap deposits where there shouldn't be any.

Trace the deposits in the natural direction of water flow back to the source of the leak. Fill the machine again and run it through a cycle or two. The *usual* places for leaks are:

WATER VALVE: The guts of the fill solenoid valve sometimes will corrode. You may see water leaking from, or rust on the top of the solenoid. Since the valves only open during a fill cycle, this may appear as an intermittent leak. The solution is to replace the valve.

Leaky Water Solenoid Valve



PUMP: Usually from around the pulley seal. Some washer pumps have a hole that allows water to weep out when the seal starts to go bad. The solution is to replace or rebuild the pump.

BLEACH DISPENSERS: Bleach is **VERY** hard on plastic parts. If the bleach dispenser gets old and brittle, it can crack or break off, and the flush water can leak out.

But since the dispenser may only be flushed at certain times in the cycle, this will appear as an intermittent leak. The solution is to replace the dispenser.
HOSES: Though hose leaks are a bit less common than other leaks, any hoses with a few too many miles on them may be suspect. Replace the hose.

TUB: If the tub is rotted through, it's probably time to replace the washer. If a consistent imbalance in the basket has caused it to wear a hole in the tub then you may be able to fix it with an epoxy patch.

TRANSMISSION AND DRIVE TRAIN

Besides driving the pump in most washers, the main drive motor has two main functions: to spin the basket and reciprocate the agitator. One motor is used to do both.

Within the transmission there is typically a crank gear and connecting rod arrangement to provide the reciprocating motion to the agitator. However, some designs use a differential gear, slider, eccentric, or other design.

The spin motion comes directly from the rotary motion of the motor, through some clutch arrangement. Usually there is some kind of reduction arrangement in the belt or gearing.

There must also be some mechanism to change between spin and agitate. There are two ways that this is most commonly done.

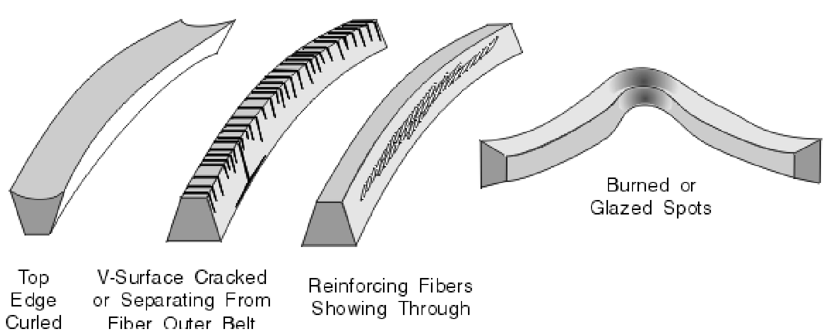
Many washer designs use a direct-reversing motor. When the motor turns one way, a mechanical arrangement such as a helical shaft, centrifugal clutch or torsion spring engages and spins the basket. When the motor reverses, the brake locks the basket and the transmission engages, so the agitator agitates.

The basket braking arrangement is often a part of the clutch arrangement

BELTS

Look closely at the surface of the belt. If you see any of the problems shown in figure, replace it. Broken or worn out belts are a common problem.

Drive Belt Wear



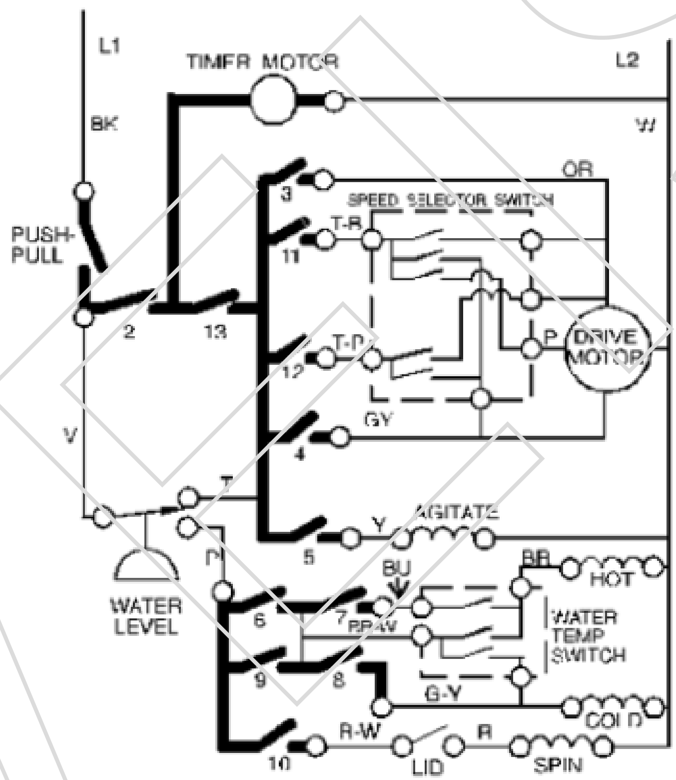
AGITATOR

If your washer is agitating weakly or not at all, the splines that connect it to the driveshaft may be stripped. It's a fairly common problem. Remove the agitator as described in the chapter specific to your washer. If the shaft is rotating but the agitator is not, replace the agitator or spline insert.

TESTING ELECTRICAL COMPONENTS

Sometimes you need to read a wiring diagram, to make sure you are not forgetting to check something. Sometimes you just need to find out what color wire to look for to test a component. It is ESPECIALLY important in diagnosing a bad timer.

Typical Wiring Diagram

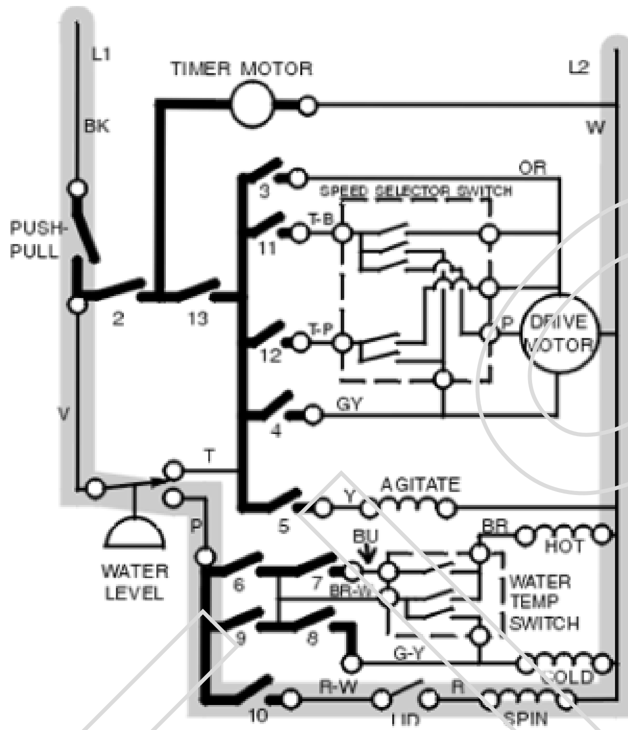


Switches may be numbered on the diagram, but that number will not be found on the switch. Those numbers are there to help you follow the timer sequencing chart. To find a switch with a certain number, look for the color of the wires leading to the switch.

Wire colors are abbreviated; for example, BU means blue, BL or B means black, V means violet, T means tan.

NOTE: *Green wires are ground wires and MUST be re-connected when removed.*

Tracing the Spin Solenoid Circuit



Check out why the spin solenoid is not working. Following the gray-shaded circuit in figure This switch is located inside of the timer and it must be closed. The power then goes through the violet wire to the water level switch then through the pink wire back into the timer. Inside the timer, it goes through switch number 10. It then comes out of the timer in a red wire with a white stripe that leads to the lid switch . From the lid switch, it goes through a red wire to the spin solenoid. Finally it leaves the spin solenoid in a white wire, which leads back to the main power cord .

To test for the break in the circuit, simply isolate each part of the system (remove the wires from the terminals) and test for continuity.

To check for a wire break, you would pull each end of a wire off the component and test for continuity through it.

INTERLOCKS

When diagnosing an electrical problem, there are many interlocks in the system that you need to check. Here are a few of the more common safety interlock mechanisms to watch out for:

LID SWITCH: It prevents the basket from spinning while the washer lid is open.

IMBALANCE INTERLOCK: If the washer has detected a substantial imbalance in the load during the spin cycle, the motor will stop. Usually a buzzer will sound. To reset this interlock, the lid must be opened and closed or the timer turned off and back on.
WATER LEVEL INTERLOCK: On some washers, the basket will not start spinning until the water is nearly pumped out of the tub. The start of the spin cycle is dependent on the pump pumping out water and the water level switch sensing that the water level is low enough.

SWITCHES AND SOLENOIDS

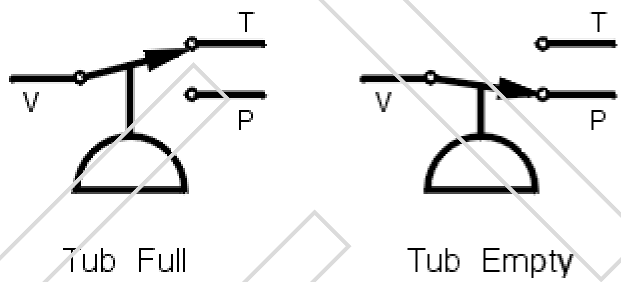
Testing switches and solenoids is pretty straightforward. Take all wires off the component and test resistance across it.

WATER LEVEL SWITCHES

Water level diaphragm switches are usually shown on a wiring diagram by the symbol in figure G-10. The numbering or lettering of the terminals may differ, but basically all switches are tested the same way.

To test the switch, first fill the tub to the highest water level. Unplug the machine and set the water level switch on the lowest water level setting. Remove the three leads from the switch. Label the wires to make sure you get them back on the proper terminals.

Water level Switch Schematic



TUB FULL: No continuity from V to P, continuity from V to T

Re-attach the wires, plug in the machine and set the timer on "spin" or "drain." When the tub is pumped dry, stop the spin cycle and unplug the washer. Remove the wires from the water level switch and test continuity again. With an empty tub, the continuity should be reversed:

TUB EMPTY: Continuity from V to P, no continuity from V to T.

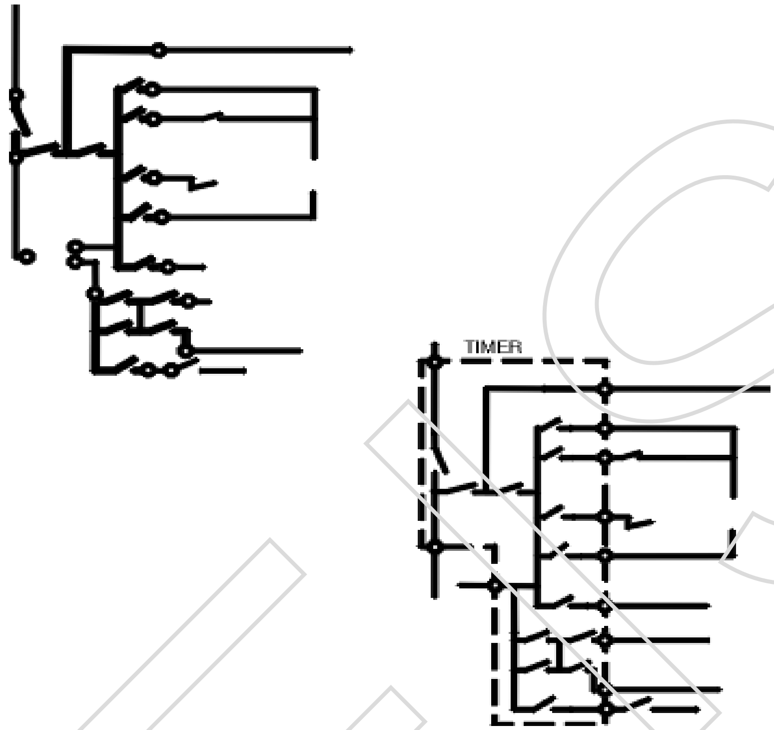
If you do not get these readings, the water level switch is bad, or there's a leak in the air pressure tube leading to it. Replace the switch or tube.

The labeling of the three water level switch leads is different in just about every brand, but the switch is tested in the same way. See the chapter about your brand for details about the labeling of the switch leads.

TIMERS

The timer is the main part of the washer. It controls everything in the cycle. In addition to telling the motor when and which way to run, it tells any clutch solenoids when to engage, the fill valve when to open, dispenser solenoids when to open, etc.

Typical Timer Schematic



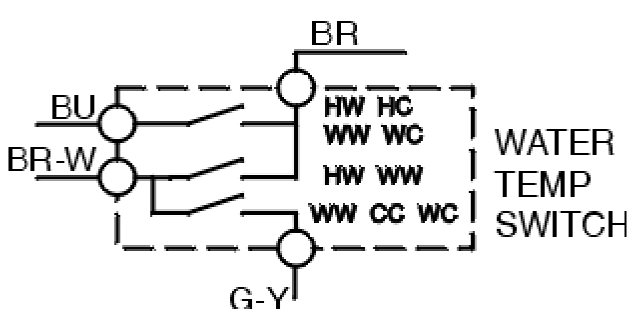
DIAGNOSIS

If the timer is not advancing, well, that's pretty obvious. Replace the timer or timer drive motor, a timer is simply a set of on-off switches. The switches are turned off and on by a cam, which is driven by the timer motor. Timer wires are color-coded or number-coded.

You should see continuity make and break at least once in the cycle; usually many times. If it doesn't, the internal contacts are bad; replace the timer.

SPEED SELECTOR AND WATER TEMPERATURE SWITCHES

Typical Selector Switch



The lettering inside the box will tell you what terminals to test

DRIVE MOTORS, START SWITCH, AND CAPACITORS

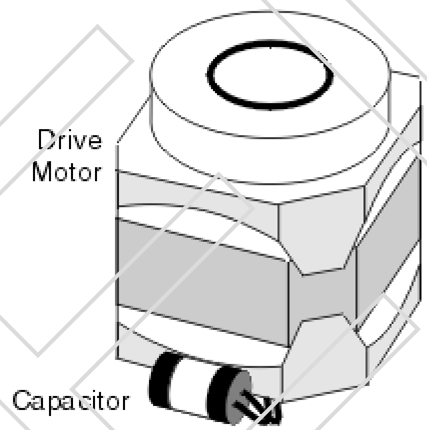
A motor that is trying to start, but can't, disconnect power and take all the load off it. For example, disconnect the drive belt, pump drive system, etc.

Try to start the motor again. If it still won't start, the motor, starting capacitor or speed selector switch is bad. If you have an ammeter, a stalled motor will be drawing 10 to 20 amps or more. Replace the bad component.

If the motor DOES start with the load removed, the pump or transmission may be locked up;
CAPACITOR

On machines that do, most external capacitors are mounted on the motor.

Figure Capacitor



If your machine has an external capacitor, unplug the machine and After discharging the capacitor, disconnect its leads and test it. If capacitor is faulty, replace the capacitor.

MOTOR

If your motor is stalled (buzzing and/or tripping out on the overload switch) and the capacitor, starting switch and speed selector switches test O.K., the motor is bad. Replace it.

REFRIGERATION SYSTEM BASICS

DEFROST SYSTEM

However, when you opened that door to put the food into the fridge, you also let in a big charge of warm, relatively moist (humid) air. The evaporator is SO cold that the humidity from the air will freeze directly onto it, creating **FROST**. To prevent too much frost from collecting on the evaporator coils, a self-defrosting refrigerator will actually stop itself for a few minutes every six to twelve hours or so, and melt its own frost.

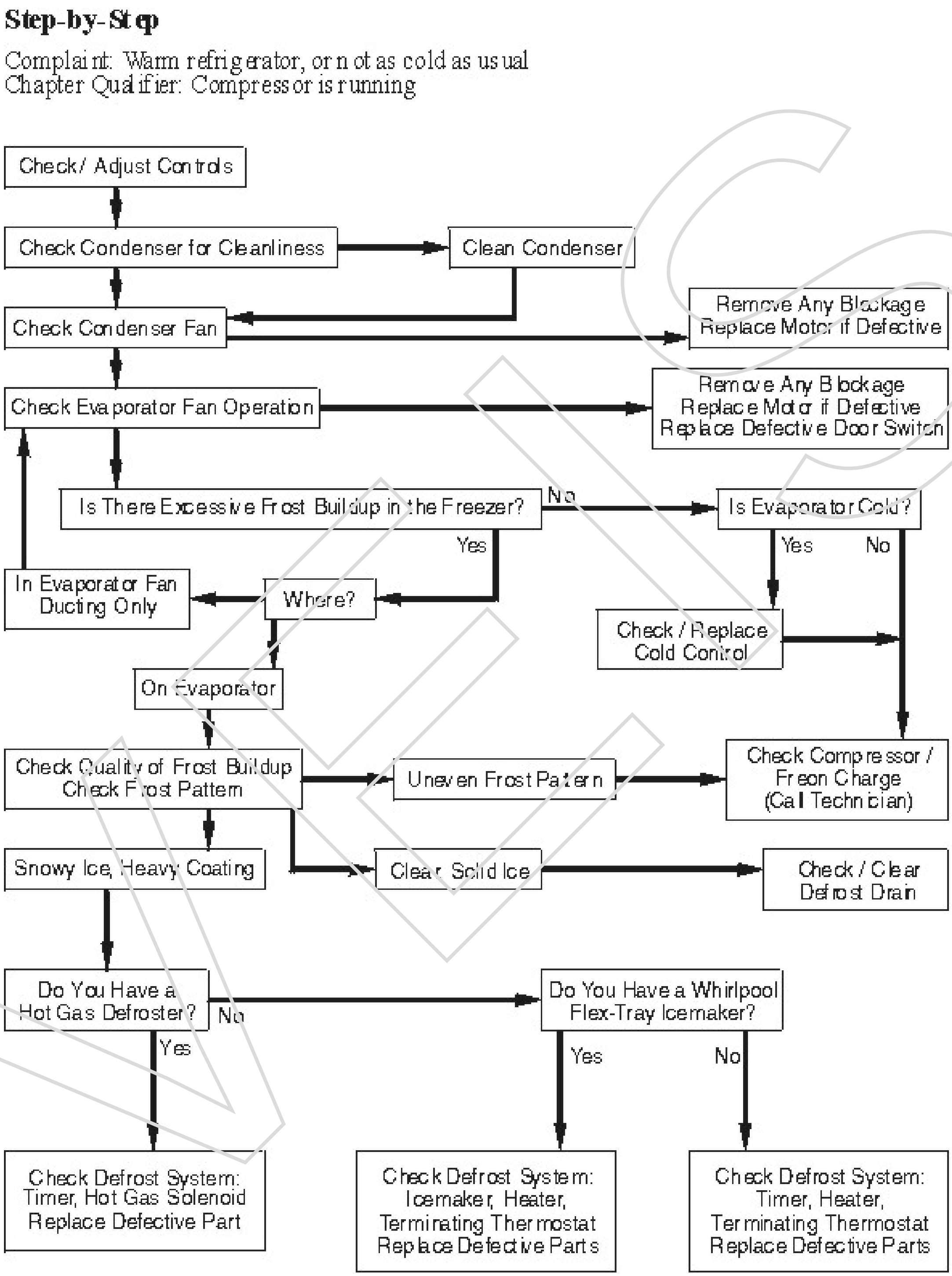
TEMPERATURE CONTROL

As the food in the fridge gets colder, it gives off less heat, and the air inside the fridge will remain colder. A thermostat called a **COLD CONTROL** will cycle the cooling system on and off to keep the temperature inside your fridge within a certain range. You can adjust that range using one of the dials within your fridge.

CONDENSER :

In order to re-use the Freon for cooling more air, the heat that WAS in your food and is NOW in your Freon must somehow be gotten rid of. The Freon gas goes to the **COMPRESSOR** where it is compressed into a hot gas . The Freon then flows through the **CONDENSER**, which is the warm grille you'll find either behind or underneath your refrigerator. After the Freon loses the excess heat in the condenser, it is de-compressed, or expanded, by simply putting it through a constriction that lets the pressure drop. This readies the Freon to go through the evaporator again, and the cycle begins all over.

COMPRESSOR IS RUNNING
BUT REFRIGERATOR IS NOT COLD



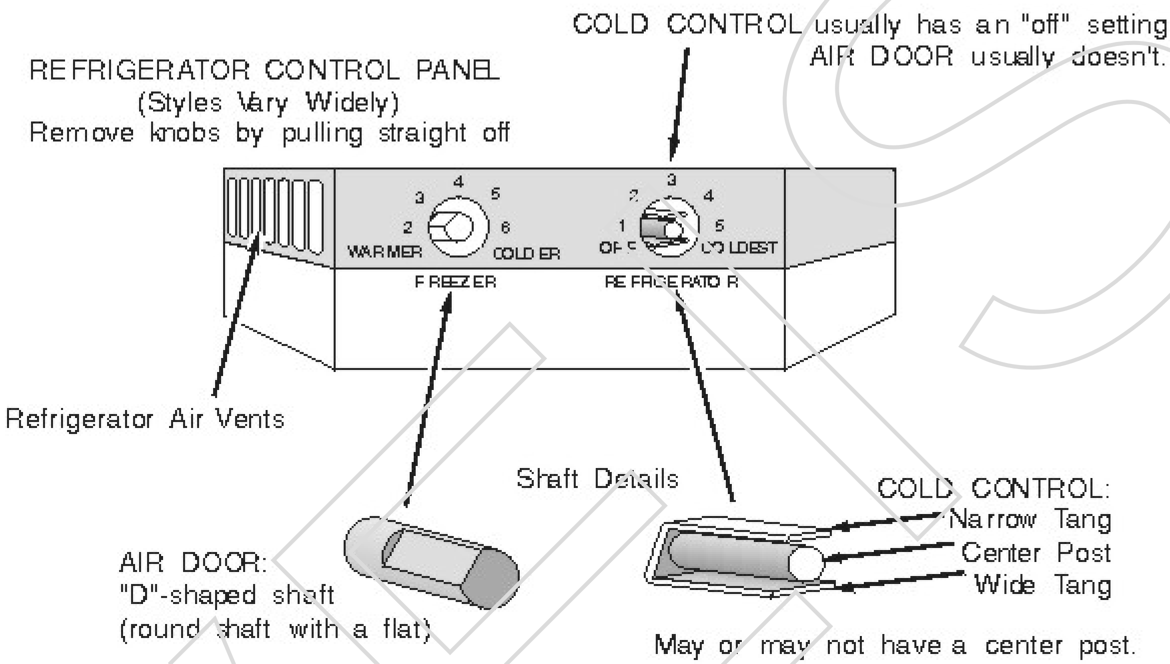
COMPRESSOR IS RUNNING BUT REFRIGERATOR IS NOT COLD

Before you perform any of the other tests in this chapter, make sure that the compressor is running. Some refrigerators are very quiet and smooth when they operate. If you cannot hear your refrigerator running or feel the compressor vibrating.

CONTROLS

If your compressor is running and your refrigerator is warm in both compartments first check your CONTROLS

Figure Cold Control / Air Door Identification

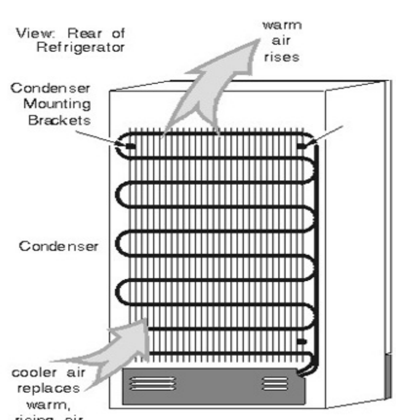


CONDENSER AND CONDENSER FAN

Next, check your condenser and condenser fan.

The locations of the most common types of condensers are shown in Figures. Any type condenser mount may be used on bottom-freezer, top-freezer or side-by-side units.

Back-Mounted Condenser



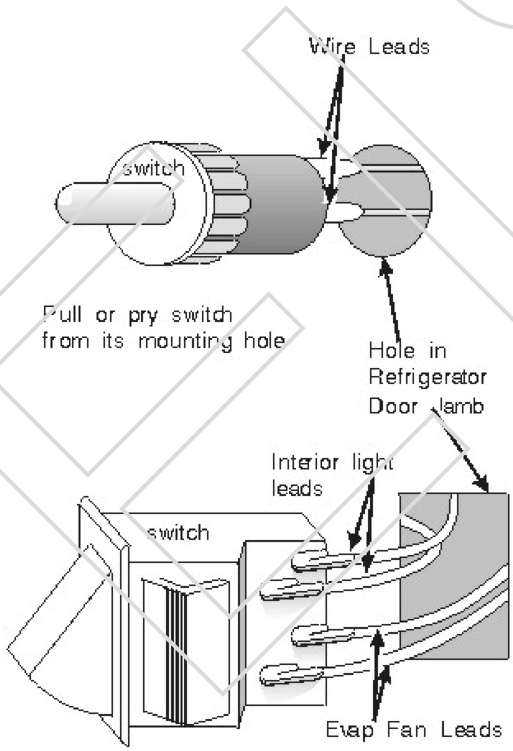
DIAGNOSIS AND REPAIR

If you have a back-condenser refrigerator, make sure that nothing has fallen behind your fridge that might block the airflow.

If you have a bottom condenser, remove the baseplate from the bottom front of the refrigerator and look beneath it with a powerful flashlight. If you have kids or dogs or if your clothes dryer is installed nearby, you are a prime candidate to have a blocked condenser.

After you clean your condenser, pull the lower back panel off the fridge. Make sure that the condenser fan is running and not blocked by any loose insulation or other objects.

Typical Fan and Light Door Switches



SLOW-RUNNING EVAPORATOR FAN MOTOR

Sometimes the evap fan will run *slower* than it should. This can be difficult to diagnose. It *can* cause ice to build up in the internal ductwork.

REPLACING THE EVAPORATOR FAN MOTOR

In replacing the fan motor, you must make sure that the rotation of the new fan motor is the same as the old one. The easiest way to do this is to look for the shading poles on the old fan motor (Figure 16).

If they are on opposite corners from the ones on the new fan motor core, it is a simple enough task to reverse the new rotor in its core. Carefully remove the bearing cage screws and simply turn the rotor around so the shaft sticks out the other end of the motor.

FROST PROBLEMS

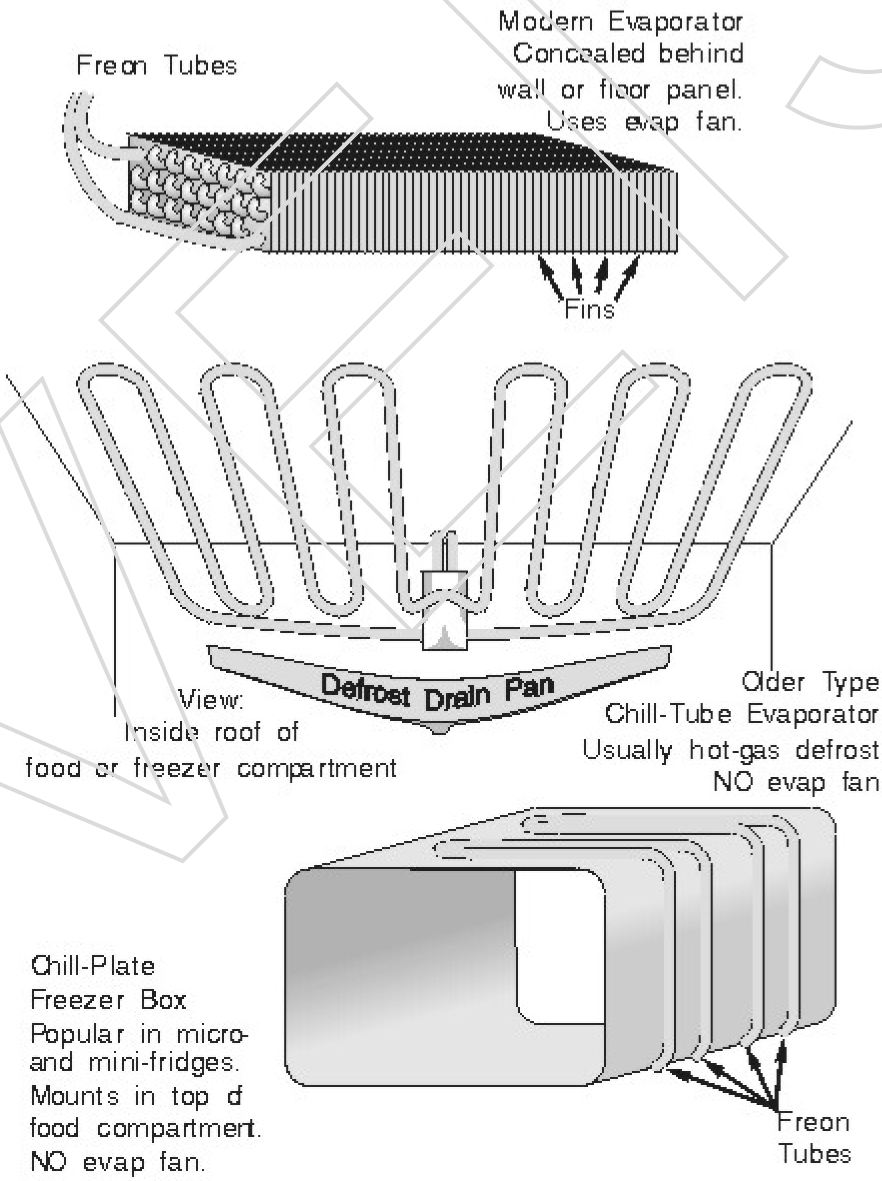
Remove everything from your freezer, including all food and any shelves.
Look at and feel the panel covering the bottom or back of the freezer compartment.
Is there ice forming on, If yes, there's probably a defrost problem.

EVAPORATOR TYPES

There are countless different arrangements for the evaporator and its fan and ducting, but almost all arrangements are relatively simple and easy to trace.

The evaporator looks like a group of looped aluminum tubes, usually with fins attached. The fins are sharp; be careful not to cut your hands on them.

Typical Evaporator Types



WHEN YOU GET THE PANEL OFF, examine the *quality* of the ice that's built up on the evaporator. Is it frosted heavily enough to block the airflow, or is it just a thin white coating? Does it have a fluffy (snowy) white consistency, or is it solid and clear-ish or slightly milky white-ish?

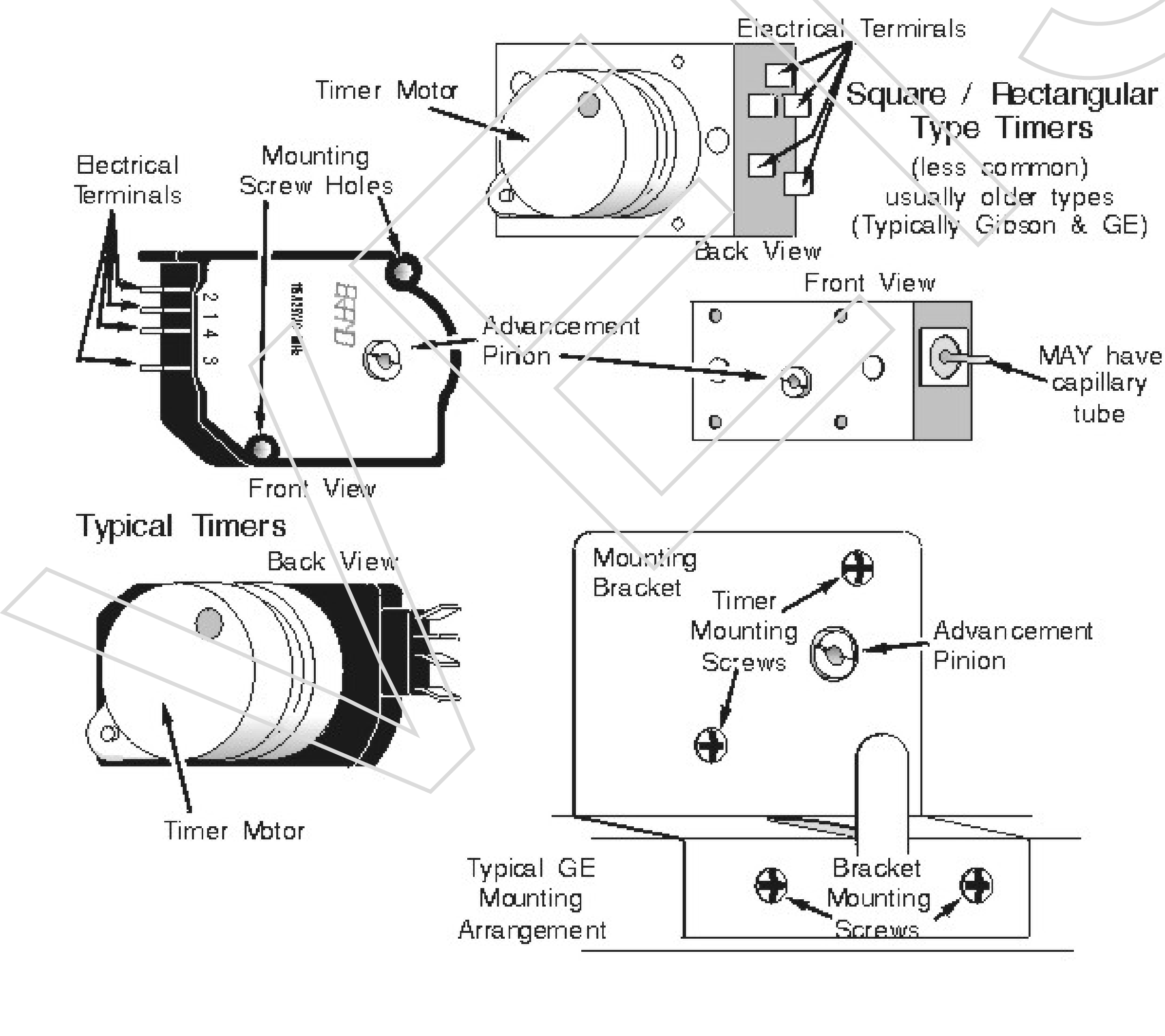
DEFROST SYSTEM

If the frost is snowy and white in appearance, you have a defrost problem. The three main components of the defrost system are the defrost timer, the defrost heater and the terminating thermostat.

DEFROST TIMERS AND ADAPTIVE DEFROST CONTROL

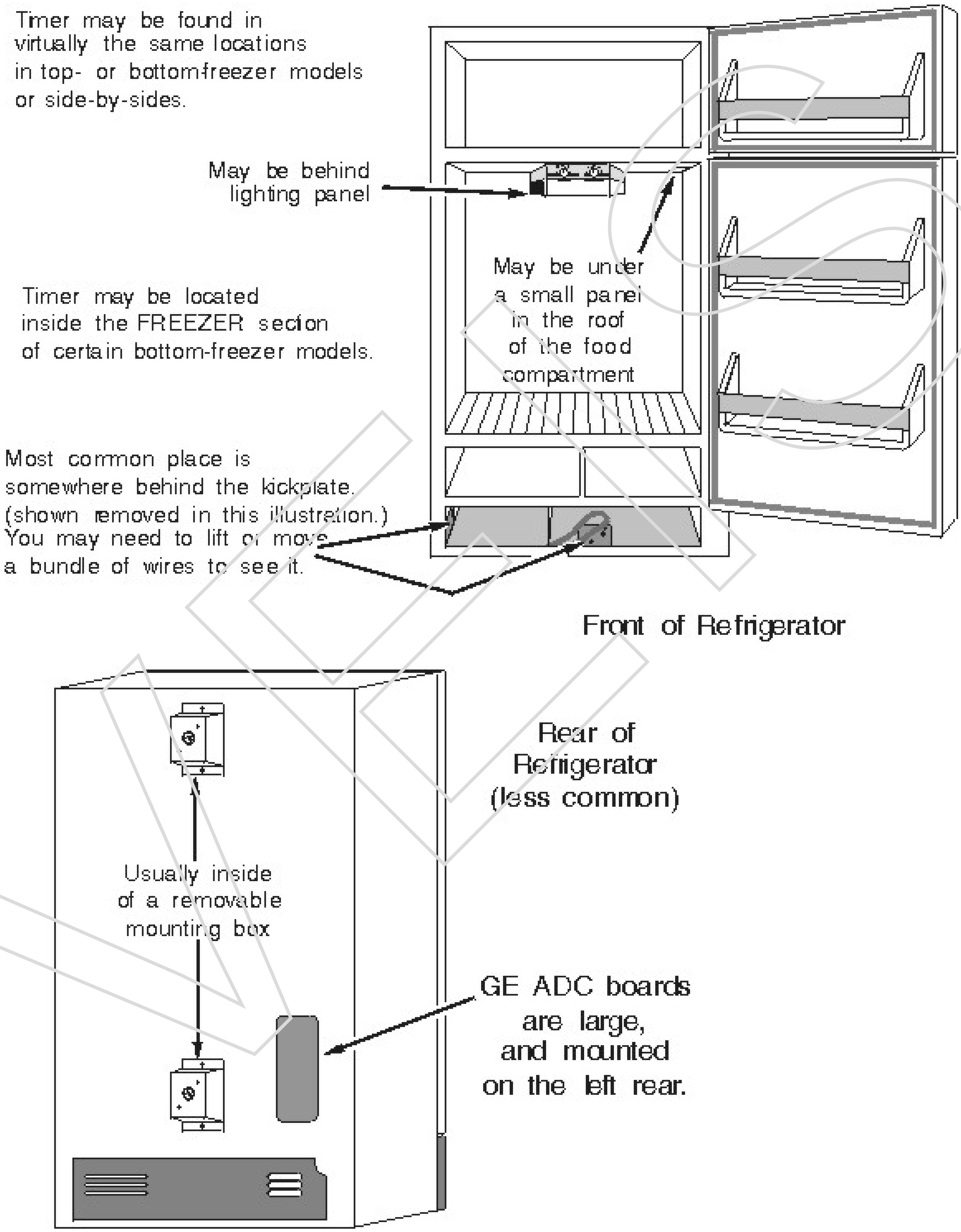
In most older refrigerators and some newer ones, a motor-driven timer is used to stop the compressor and initiate a defrost cycle. This timer controls how often the cycle occurs, and how long the defrost heater stays on. This is a fixed cycle; for example, the refrigerator might stay in the cooling cycle for 10 hours, then spend 20 minutes in the defrost cycle.

Figure: Typical Mechanical Defrost Timers



Obviously, refrigerators operate under a wide variety of conditions, all of which affect the amount and speed of frost buildup. Such factors include ambient humidity and temperature, the water content and temperature of the food you put into the fridge, icemaking within the freezer, and how often the door is opened and closed.

Defrost Timer Mounting Locations

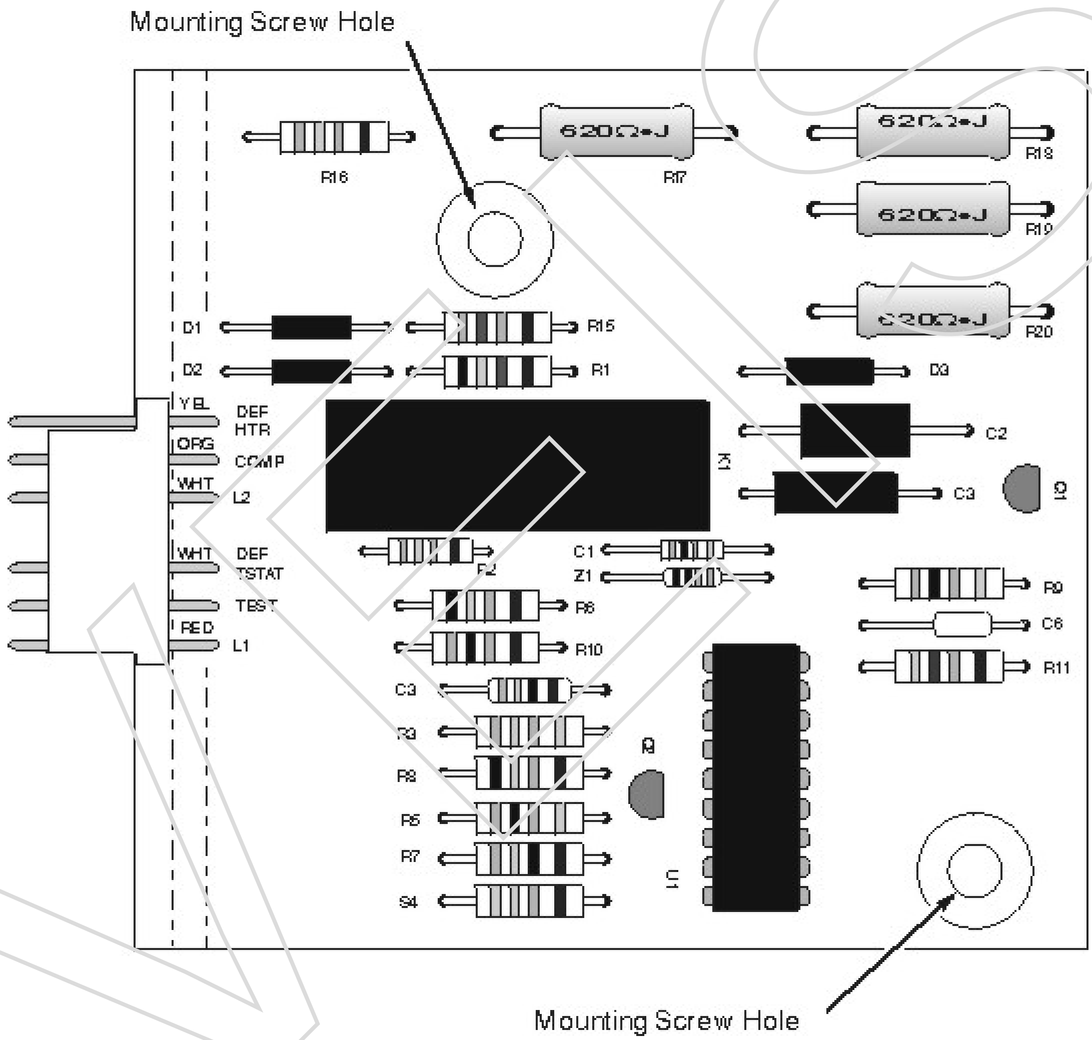


**DEFROST TIMER AND
ADC BOARD LOCATIONS**

Mechanical defrost timers can be a bit difficult to find. They come in many different styles. Often they are mounted under a cover plate or in a bracket that hides all but the advancement pinion. Figure 21 shows some different style timers and what the timer might look like installed; Figure 21A shows some typical mounting locations.

ADC boards are mounted in similar locations to defrost timers. However, they do not look the same as a mechanical timer.

Typical Adaptive Defrost Circuit Board



DEFROST HEATER

Defrost heaters are always located in the evaporator compartment.

Figure: Glass Tube Defrost Heater

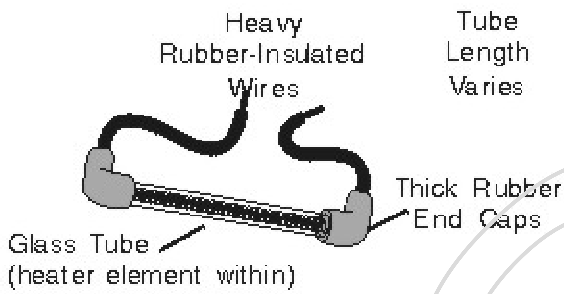
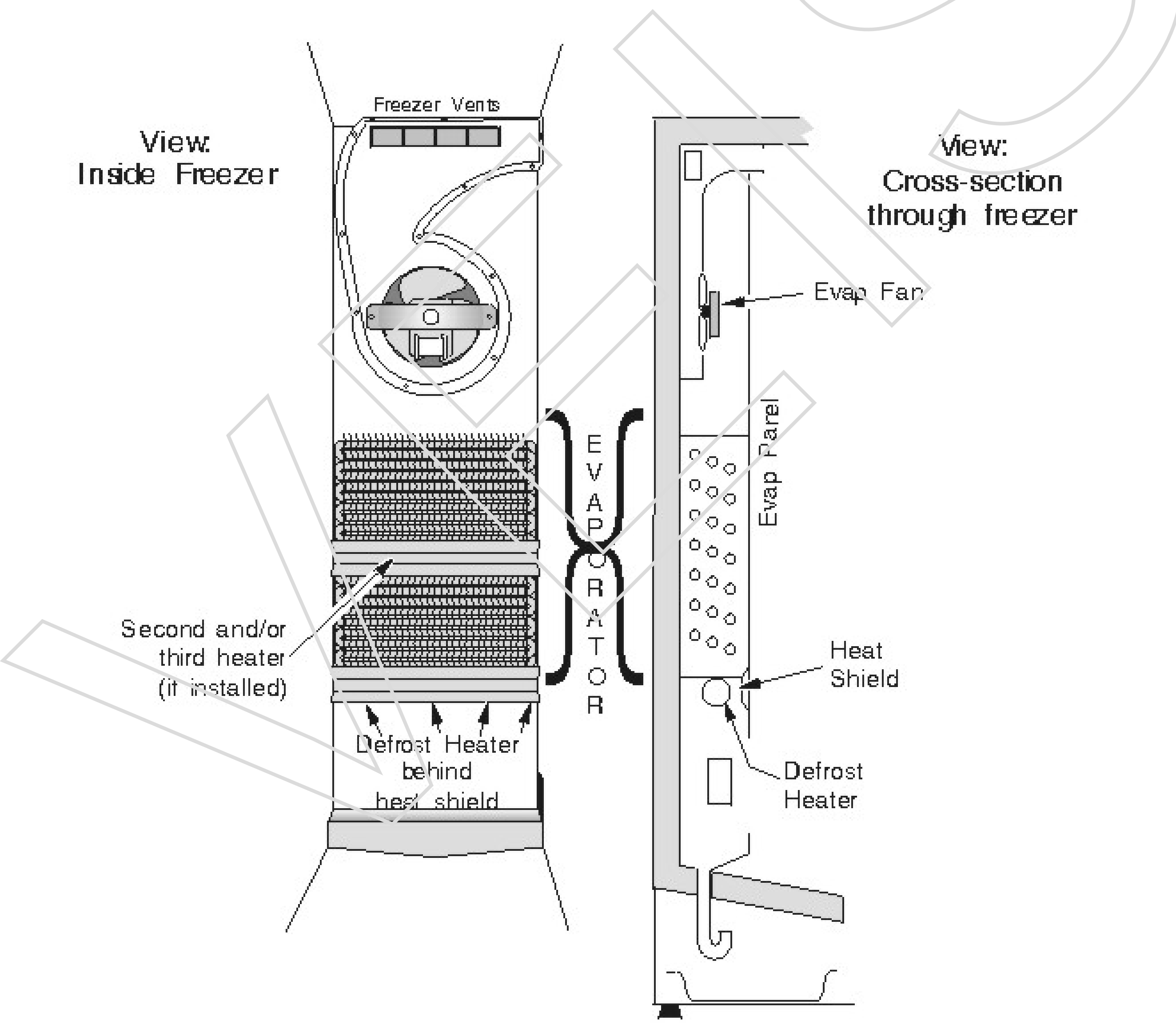
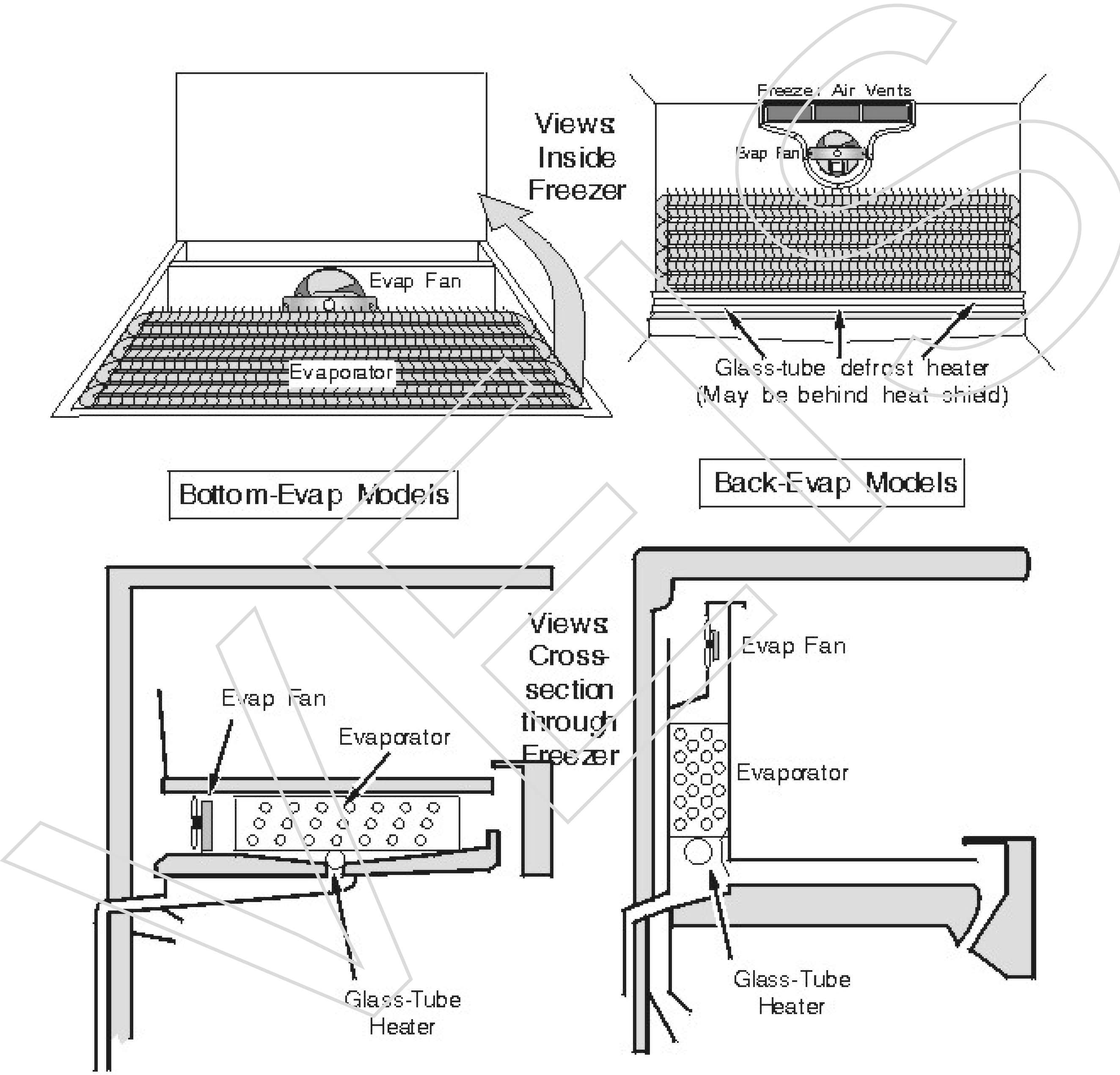


Figure: Glass Tube Defrost Heater Mounting Location (Typical Side-By-Side)



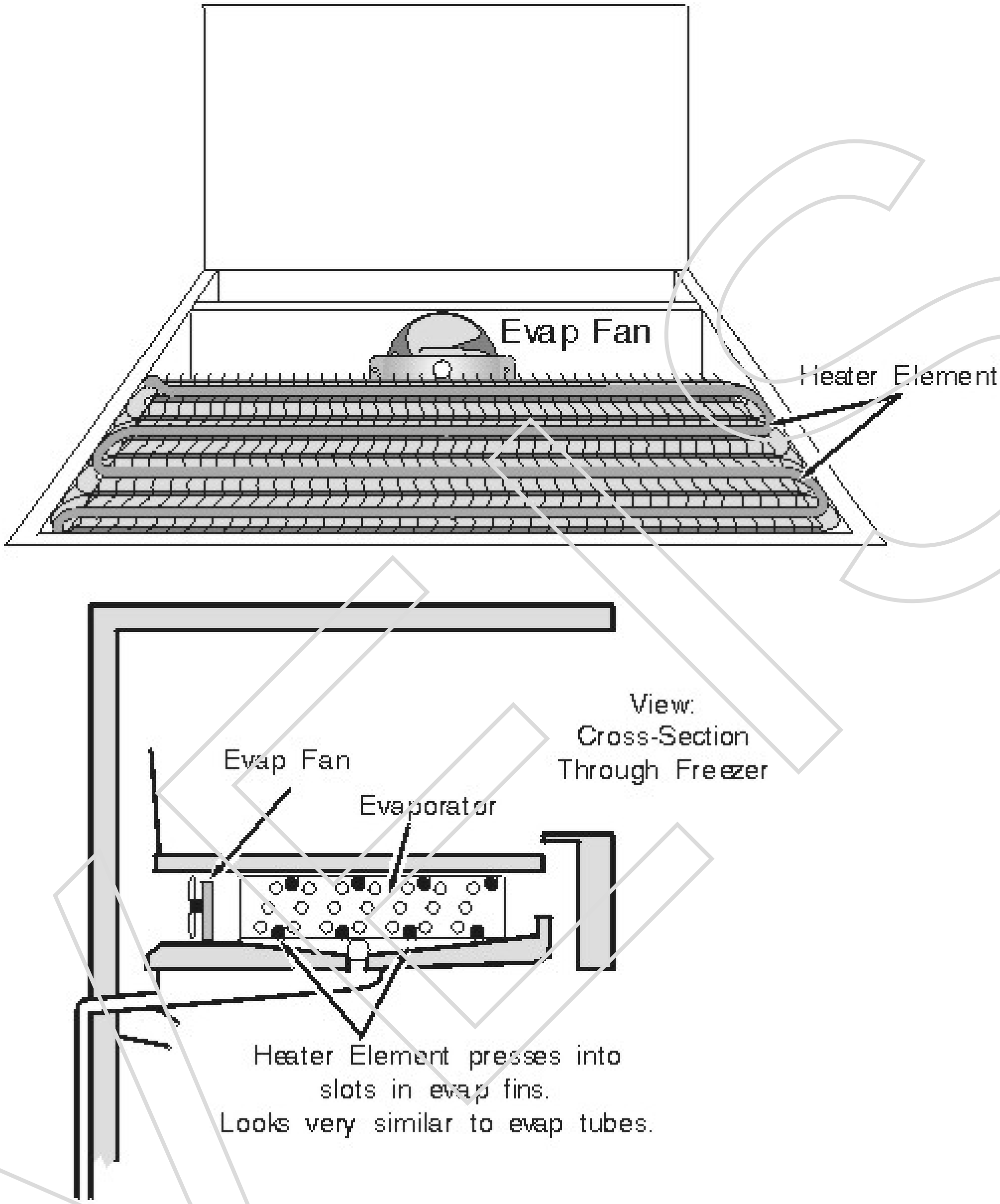
Glass-tube defrost heaters: The heating element is encased in a glass tube mounted beneath the evaporator. Sometimes two or three small glass-tube-type heaters will be used instead of one big one; usually you'll see this arrangement in side-by-sides.

Figure: Glass Tube Defrost Heater Mounting Locations (Typical Top-Freezer)



Aluminum tube heaters: These heaters look just like the evaporator tubes and press into the evaporator fins. They are usually used on bottom-evap models. The easiest way to see the heater is to look for the heavy, rubber-coated wires leading to it; one on each end. Often there are clips holding the ends on to the evaporator coils; watch for these when you remove the heater.

Figure: Typical Aluminum-Tube Defrost Heater Mounting Locations



Bare element heaters: Found most commonly on top-freezer back-evap models. The element has no protective tubing and generally wraps around beneath the evaporator in a large "U" shape.

You must exercise caution when handling these heaters to prevent burning yourself. They all run very hot; glass tube and bare element heaters even glow red while in operation.

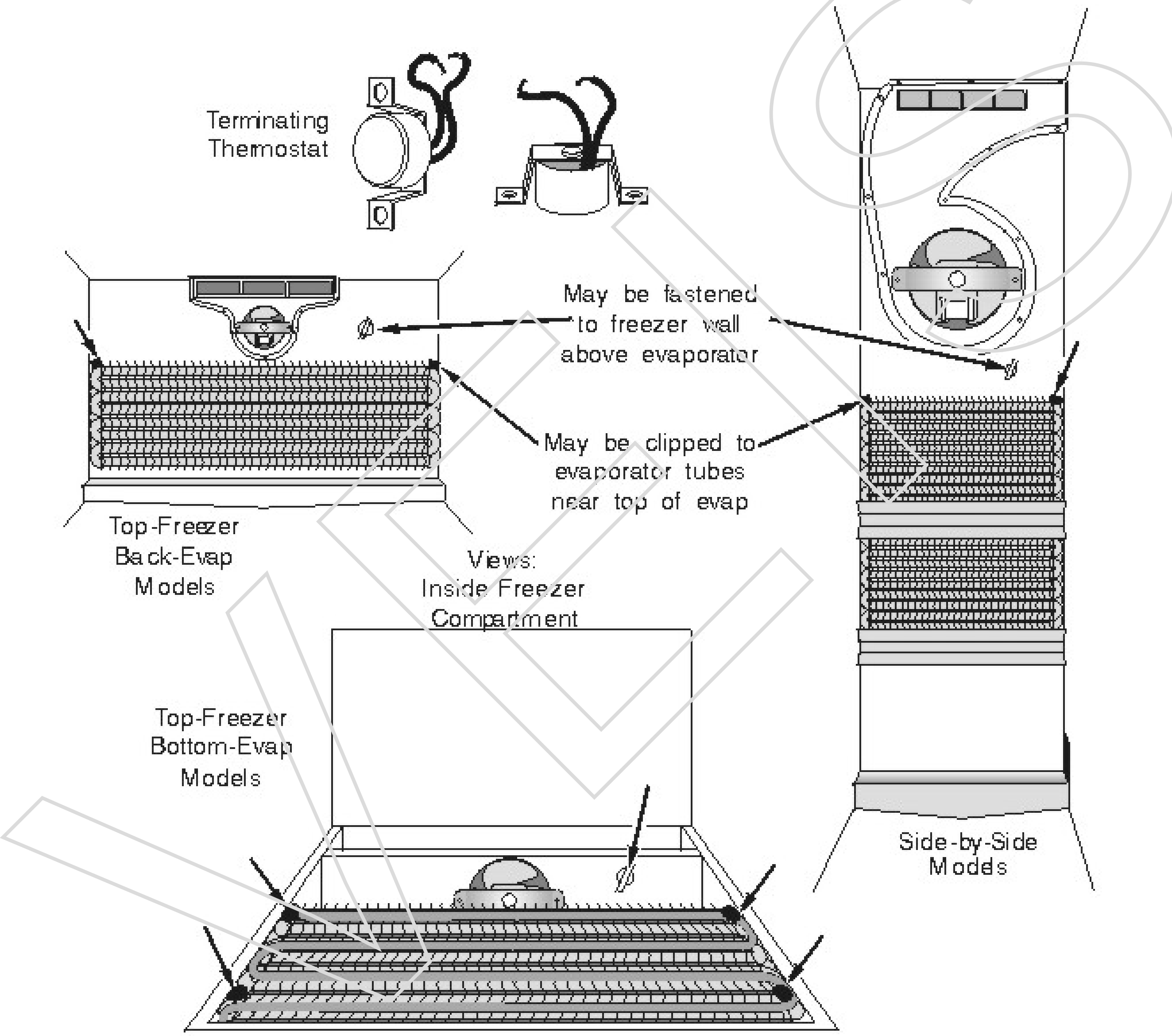
TERMINATING THERMOSTAT

A terminating thermostat will also be located somewhere in the evaporator compartment, usually to the evaporator itself or against the side or back wall of the compartment.

It looks like a small cylindrical disc about 1" or so in diameter and about 3/4" to 1" thick

It is wired in series with the defrost heater; when it opens, the heater shuts off. One of the two heater wires will lead directly to it.

Figure: Terminating Thermostats: Mounting Locations



DEFROST SYSTEM DIAGNOSIS AND REPAIR

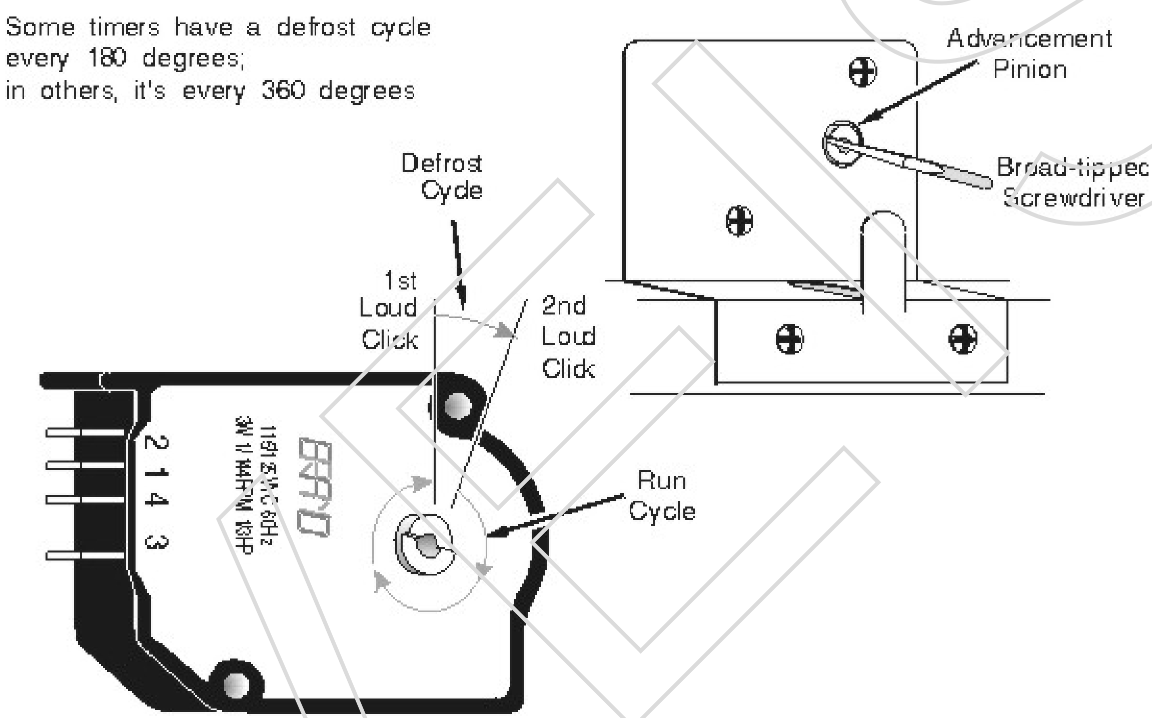
Defrost ***starts*** when a timer turns on the defrost heater. The timer may be mechanical and motor driven, or it may be an electronic ADC board.

Defrost ***stops*** when one of two things happens.

If the evaporator is lightly frosted, the frost will melt fairly quickly. If that happens, you want to turn the heater off soon after the ice melts, to prevent the evaporator compartment from heating up too much. If the **terminating thermostat** senses too high a temperature in the compartment, it opens, and cuts power to the heater. The thermostat will then stay open until the compartment again reaches a very low temperature.

If the evaporator is more heavily frosted, the ice may not all melt within the time allotted by the timer. In this case, the terminating thermostat will remain closed throughout the defrost cycle. The heater will stay on until the ***timer*** stops the defrost cycle, and restarts the cooling cycle.

: Advancing the Defrost Timer



INITIATING DEFROST: MECHANICAL TIMER

If you have a mechanical defrost timer, find the timer (see section 4-5(a).) Put a screwdriver in the advancement pinion and advance it (clockwise only, or you will break it). (Figure 24) Sometimes it takes a pretty firm twist to advance it. You will feel it clicking. At some spot in the cycle, you will hear and feel a loud click; after you advance it 10-20 more degrees or so, you will feel and hear another loud click.

DEFROST HEATER DIAGNOSIS

Within ten minutes (usually much less) you should be able to see a red glow from the defrost heater(s), which is (are) mounted beneath the evaporator.

If you have an aluminum-tube heater as described in section , it will not glow red, but you *will* see ice melting away from its coils. Be careful; all defrost heaters run hot enough to burn you. You will probably also hear popping and sizzling; this is defrost water hitting the heater and boiling off.

REPLACING THE DEFROST TIMER

If the problem is your timer, it must be replaced.

IF YOU SEE OR HEAR NO SIGNS OF THE DEFROST HEATER HEATING UP, unplug your icemaker, remove the BLACK lead from the defrost switch and electrically test the switch for opening and closing. Using your resistance meter, you should see continuity (and no resistance) between the empty terminal (where the BLACK lead was) and the PINK terminal.

You should see NO continuity between the empty (BLACK) and ORANGE terminal.

IF YOUR DEFROST HEATER DID HEAT UP when you dismounted the defrost switch, then you need to replace the gear sets in your icemaker.

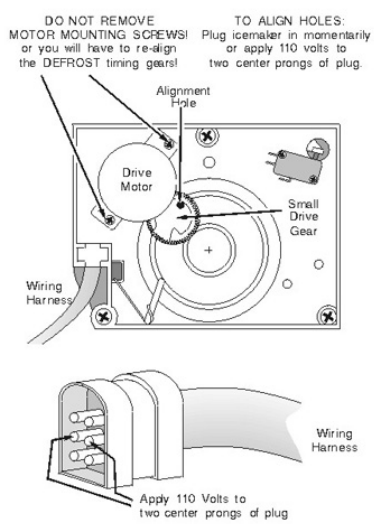
Get *both* sets of gears (timing gears *and* drive gears) from your appliance parts dealer. Alignment of the gears is critical; follow the instructions that come with the gear sets carefully. When you replace the gear sets, it is also a good idea to replace the defrost switch.

RE-ASSEMBLY

If you have not removed the defrost timing gear housing from the back of the icemaker head or the motor from the front of the head, you will not need to re-align the *defrost timing* gear mechanism. However, you *will* need to realign the *drive* gear mechanism.

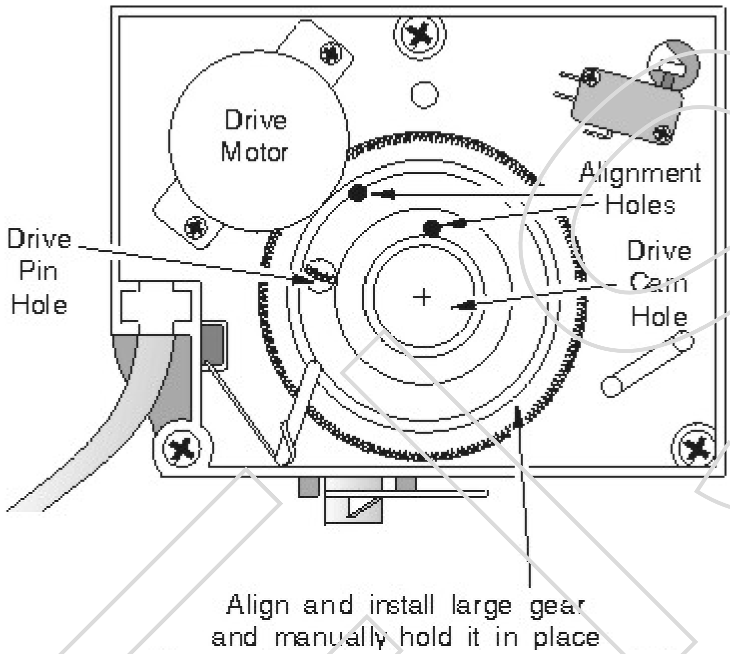
Align the hole in the small drive gear with the alignment hole in the icemaker head and install the gear. Check alignment by inserting a 3/32" rod (a drill bit will do) into the holes to make sure they line up.. If they do not line up perfectly, momentarily plug the icemaker in or apply 110 volt power to the two center leads of the plug This will turn the drive motor slightly. Repeat the process until the holes align.

Figure: Aligning and Installing the Small Drive Gear



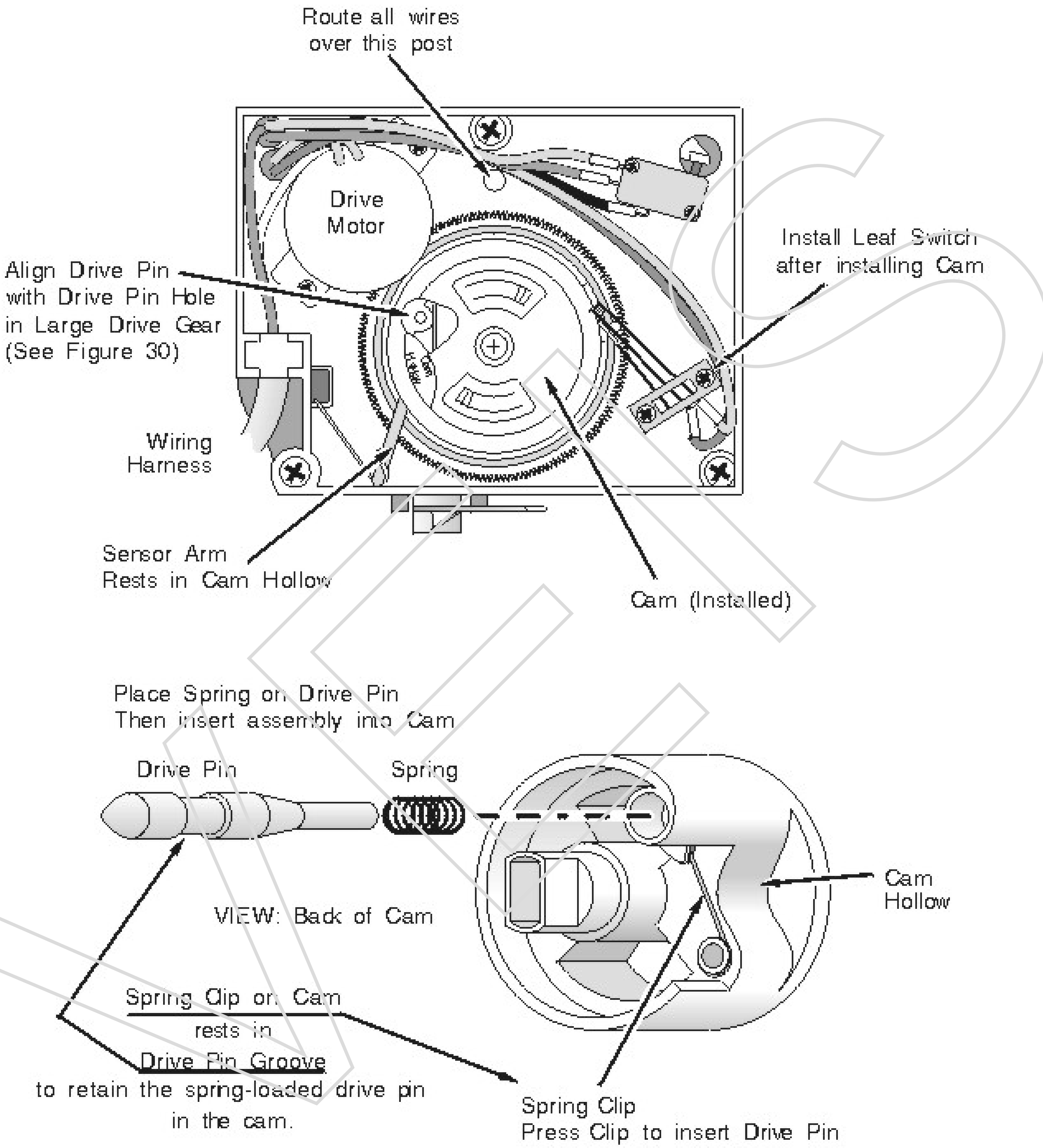
Install the large drive gear and align it on the same alignment hole. A second alignment hole is shown in Figure. The large drive gear must line up on *both* alignment holes *and* on the large drive cam hole in the center of the icemaker head.

Figure: Drive Gear Installation



Carefully holding the drive gear in its aligned position, install the drive cam . Line the drive pin up on its hole on the drive gear. Lift the spring-loaded shut-off arm (ice level sensor) as you install the cam and let it rest in the cam hollow. Install the leaf switch. Sometimes the stuff in this paragraph takes three hands and your belly, but be persistent. You'll get it together.

Figure: Installing the Drive Cam



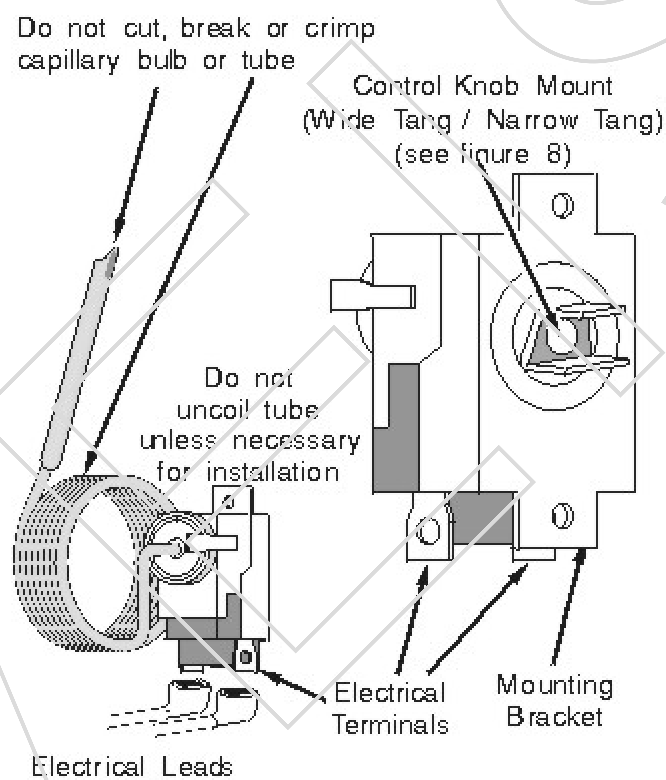
Make sure the wiring for the leaf switch and the defrost switch is routed over the post above the drive gear. Carefully install the metal cover plate, making sure the end of the wire shut-off arm (ice level sensor) is in its pivot hole in the metal cover plate. Install your three screws. The drive pin will pop up through the metal cover plate.

Install the ice tray into the ice maker, and re-assemble your fridge.

COLD CONTROL

If your refrigerator is cold but not as cold as usual, and you cannot trace it to any of the other problems in this chapter, your cold control may be defective. To test its cut-in and cut-out temperatures, you can try putting the capillary bulb in ice water and measuring the temperature with a thermometer, but it's a wet, messy, job and it's difficult to control the temperatures.

Figure: Cold Control



If you hear your compressor "short-cycling" (starting and stopping at short intervals) try jumping across the two leads of the cold control with an alligator jumper. If there is a green *third* lead, ignore it for this test; it is the ground wire. If the fridge starts running constantly, the cold control is bad. Replace it.

To test or change the cold control. Pull the knob off it and remove any plastic cover plate or housing from it. (Figure)

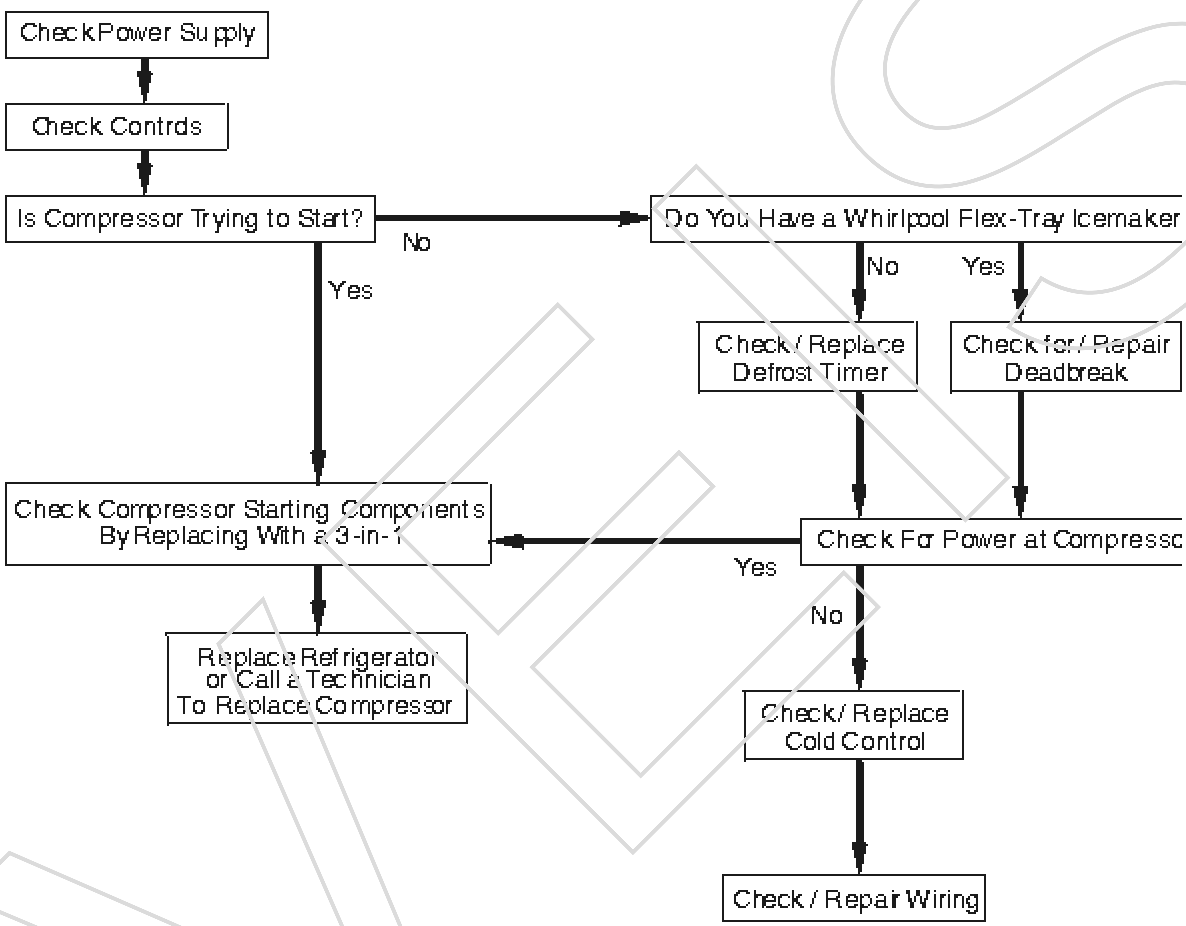
You will see two wires leading to it
If you are just *testing* (electrically) the cold control, you can jumper directly from one wire lead to the other. By doing this, you are closing the switch manually, and assuming the machine is not in the defrost mode, the compressor should start.

If you are *replacing* the cold control, it will be necessary to trace where the capillary tube goes, and remove the whole tube *with* the cold control. The new tube is replaced directly. Be careful not to kink the new tube (bend it too sharply) when installing it.

REFRIGERATOR IS NOT COLD
AND COMPRESSOR IS NOT RUNNING

Step-by-Step

Complaint: Warm refrigerator, or not as cold as usual
Chapter Qualifier: Compressor is not running



POWER

If your refrigerator is not cold (or not as cold as usual) and you have determined that the compressor is not running , first check that the fridge has power. If you have interior lights in the fridge, you have power. If you *don't* have interior lights, check your house breaker. Also check your wall outlet by unplugging the fridge and plugging in a portable appliance such as a blow-dryer or electric shaver.

CONTROLS

When you have established that power is getting to the fridge, check your controls. They sometimes have a way of getting magically turned off, especially in households with kids. (See section 4-1)

DIAGNOSIS AND REPAIR

Listen carefully to the fridge if the compressor is working. There is something wrong with the compressor or compressor starting components (relay or overload.) .

DEFROST TIMER OR ADC BOARD

How you diagnose a non-starting compressor depends much upon whether you have a mechanical defrost timer or ADC (Adaptive Defrost Controls.)

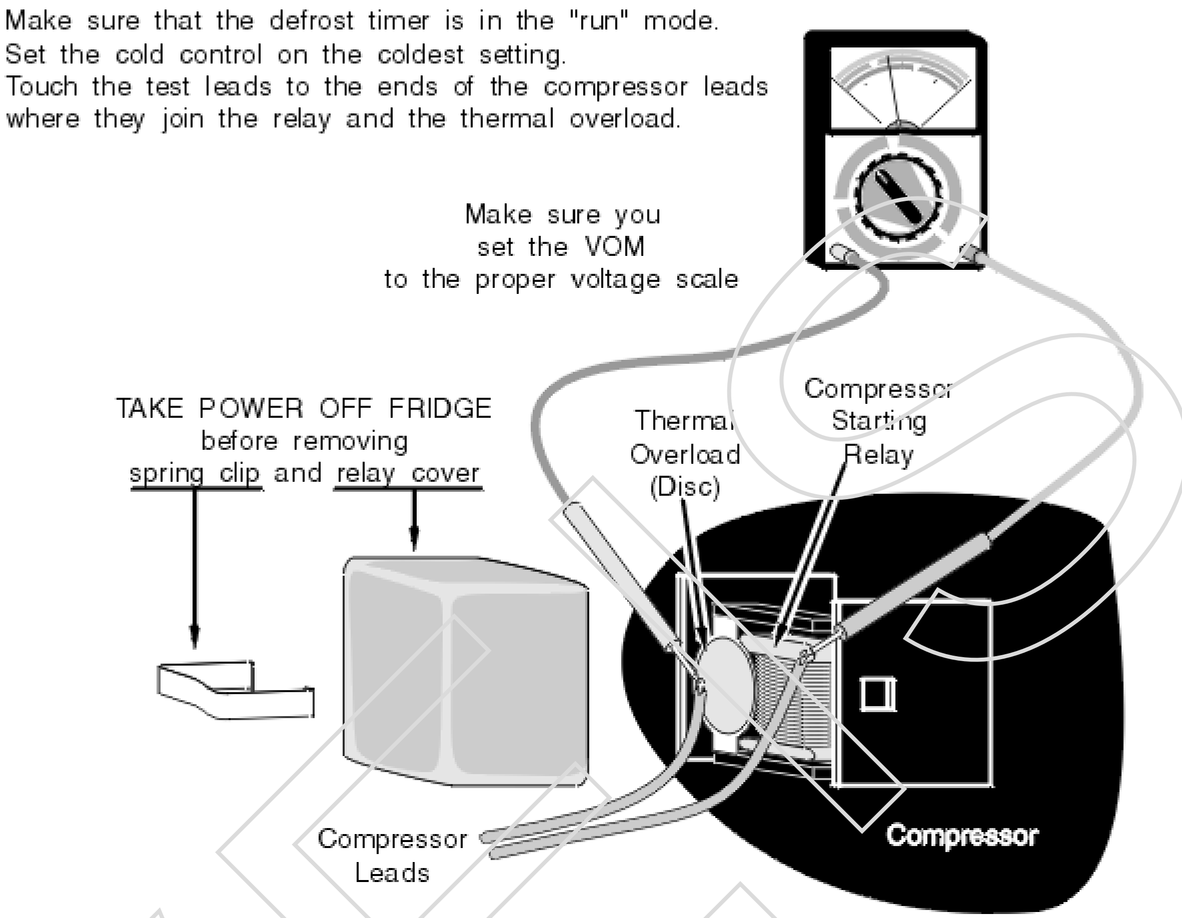
TESTING THE COMPRESSOR FOR POWER

If you *still* hear nothing at all, pull off the lower back panel of the fridge, remove the compressor relay cover. This is the square-ish plastic or bakelite box attached to the side of the compressor. Test for voltage at the two compressor leads.

COLD CONTROL

If you have a mechanical timer, and you don't have voltage to the compressor, use your alligator jumpers to connect the two wires of the cold control. If you now have power to the compressor, the cold control is bad. Replace it.

Testing for Voltage at the Compressor



If you have ADC, jumper the cold control terminals as descibed above, and wait for 30 minutes, then check for voltage at the compressor. This will give the ADC time to finish any defrost cycle it might be in, and re-enter the cooling cycle. If you now have power to the compressor, the cold control is bad. Replace it. If not, the ADC board is bad. Replace it.

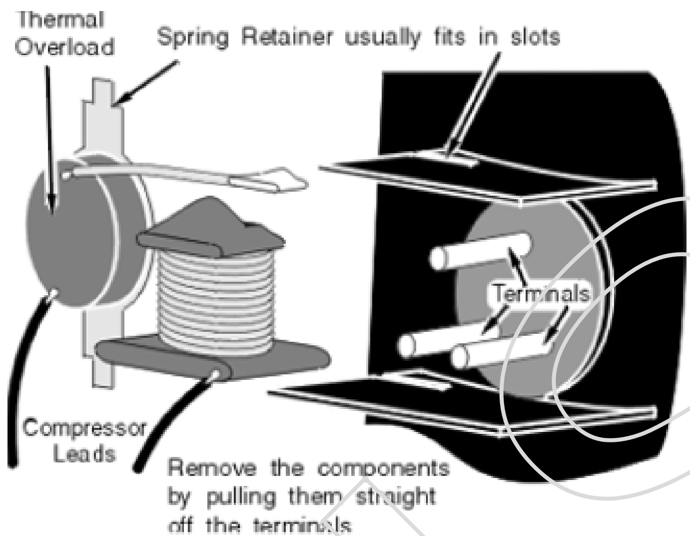
WIRING AND ELECTRICAL

If doesn't start the compressor, you're going to have to get a wiring diagram (there may be one pasted to the back of the refrigerator) and start tracing wires with your VOM to figure out where you're losing power..

COMPRESSOR STARTING

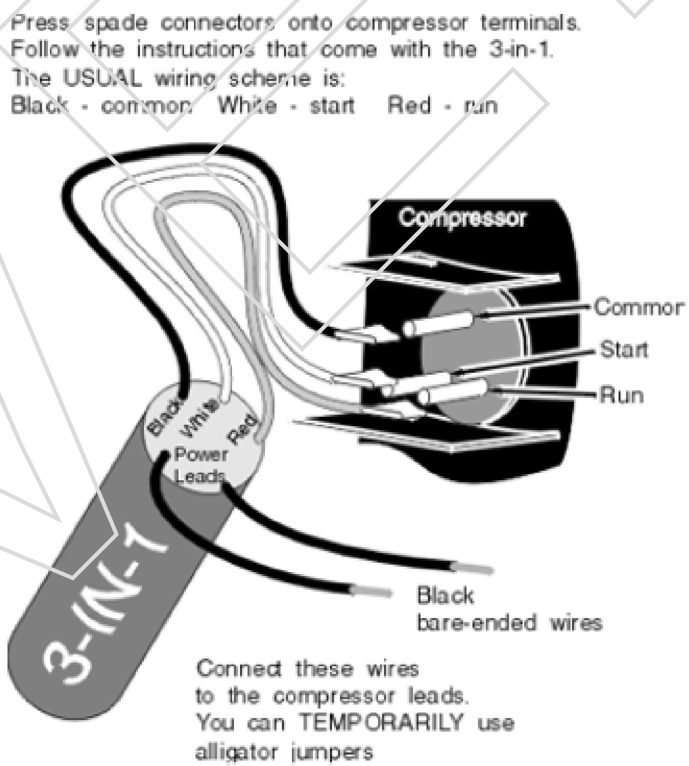
It might be that one of your compressor starting components is bad, or that your compressor motor is wearing or worn out.
You may be able to test each starting component and replace the bad one.

Removing Compressor Starting Components



If your refrigerator has solid state starting components, the "3-in-1" may fit onto your fridge directly, or it may not fit at all. If your case is the latter, you will need to get the original equipment replacement relay assembly for your fridge.

Figure Connecting a 3-in-1



Make sure that none of the compressor terminals are touching each other or the metal housing of the compressor. Also make sure you cover the compressor terminals with a shield; usually you can use the old plastic relay cover and just lead the wires into it.

If the *cause* of your compressor's not starting was bad starting components, it will continue to run indefinitely.

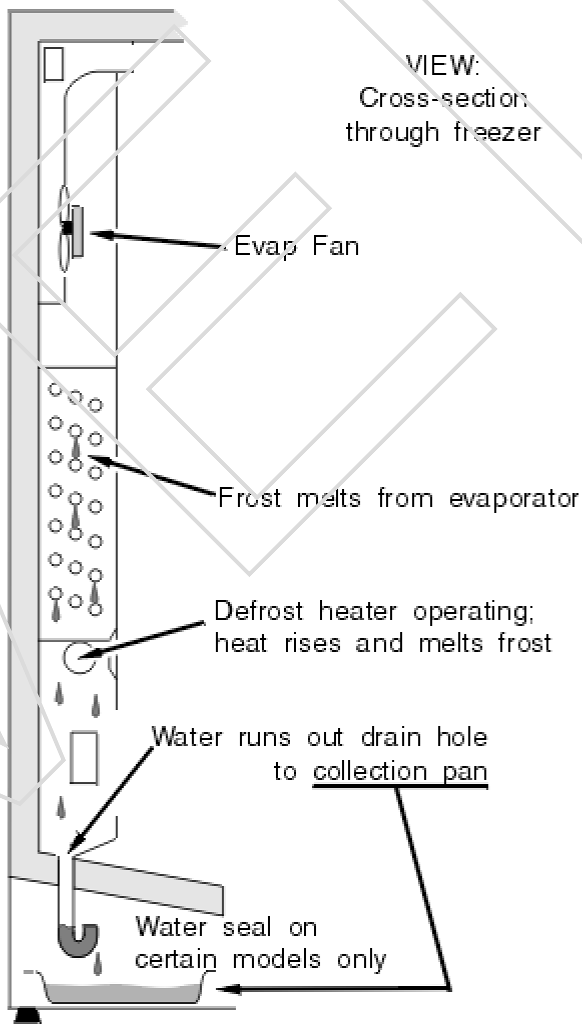
If the cause of it not starting was that the compressor motor is getting worn out, the "3-in-1" will prolong the life of your compressor for somewhere between a few hours and a year or two.

REFRIGERATOR DEFROST DRAIN SYSTEM

Directly beneath the evaporator will be a water collection pan with a drain hole. Leading from that drain hole to the drain pan beneath your refrigerator is a drain tube.

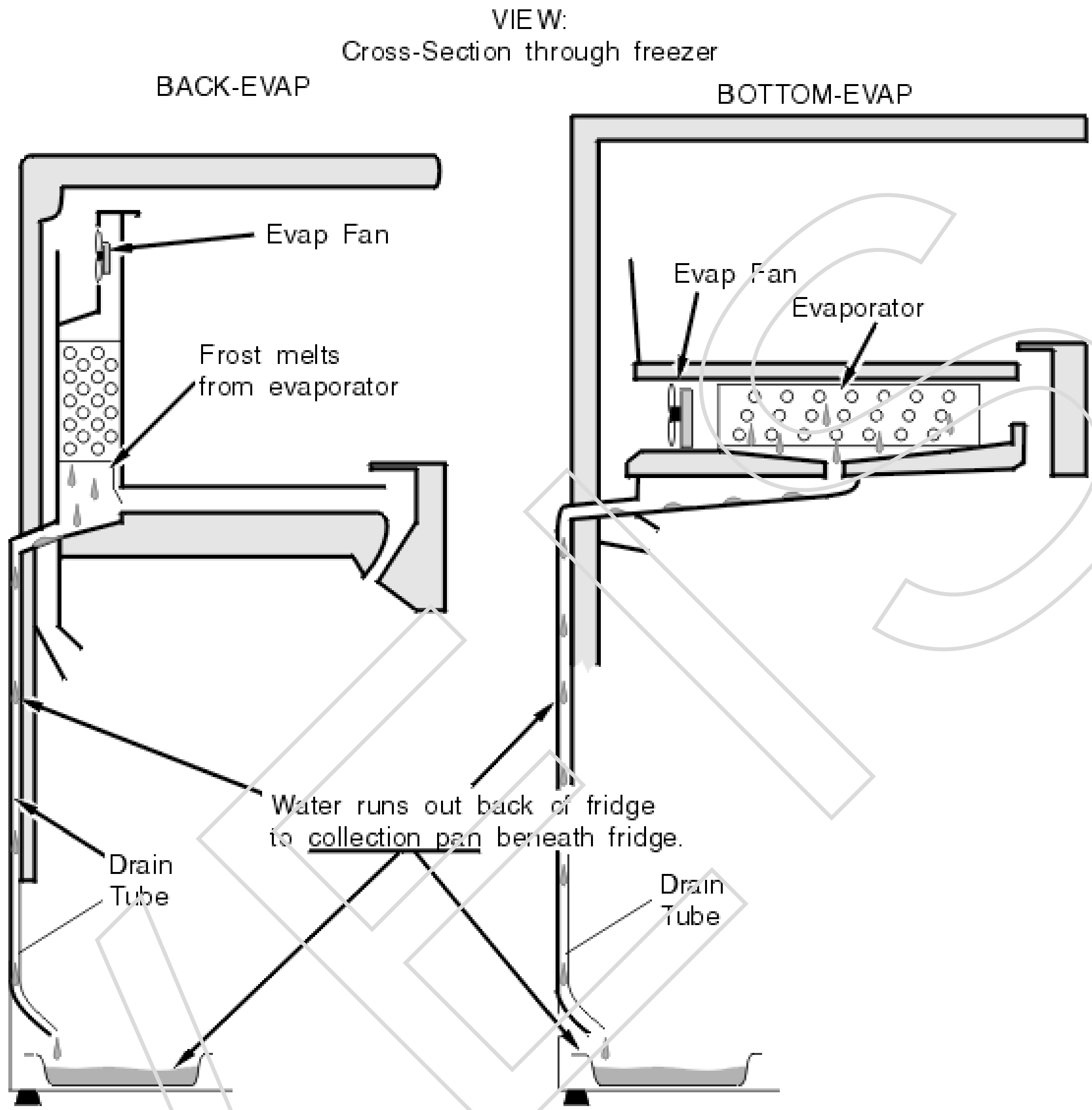
Side-by-side defrost drain tubes usually go straight down through the freezer floor to the drain pan. (Figure)

Figure: Typical Side-by-Side Defrost Drain System



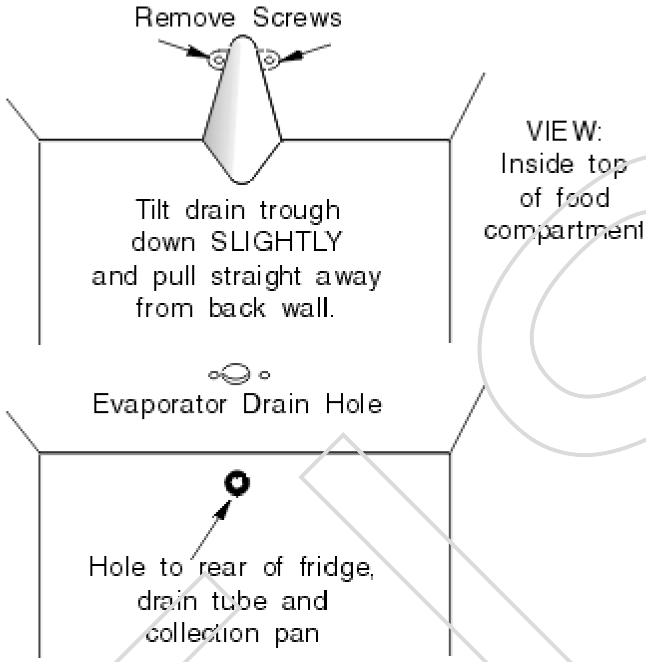
Top-freezer models usually drain through a drain tube out the back of the refrigerator and down to the drain pan beneath the fridge (Figure).

Figure: Typical Top-Freezer Defrost Drain System



Some top-freezer models have a removable drain tube or trough inside the food compartment. (See Figure)

Figure: Removable Defrost Drain Trough (Certain Top-Freezer Bottom-Evap Models Only)



DIAGNOSIS AND REPAIR

On back-evap models, if the drain backs up, it will not freeze the evaporator. You will see the collection pan full and frozen over.

On bottom-evap models, the evaporator will be frozen into one solid block of ice.

In either case, when the collection pan fills up with ice, the defrost water will generally start showing up on the inside floor of your fridge; either as water in a top freezer model or as a thick ice accretion in a side-by-side. Any ice or water must be removed and/ or melted and the drains cleared. The fastest way to do this is to melt the ice with a blow dryer and to blow the drains clear with a pan of hot water and a syringe-type turkey baster. (Figure)

COOKING APPLIANCE SYSTEM BASICS

. BASIC FUNCTIONS

In their most basic forms, ovens and cook tops are pretty simple devices. Technically, all they do is develop high, controlled temperatures in specific places, in order to transfer heat to food and cook it.

The important words here are "high" and "controlled." These two requirements present specific challenges to the folks who design and service ovens. And consumers demand gadgets that might make life easier for them, but they sure make the life of a serviceman tougher.

ELECTRIC COOKTOPS AND OVENS

Most electric cooking equipment uses two different electrical circuits. The heating elements usually run on 220 volts, and accessories such as lights, timers and rotisserie motors run on 110 volts. In most cooktops, the heating element is simply a big resistor wire, with enough resistance to generate a high heat. Usually these are nichrome wire, surrounded in ceramic insulation, with a steel sheath around the ceramic. On higher settings, the element glows red when operating. Heating occurs mainly by conduction; that is, the direct contact of the heating element to the cookware. Since the surface unit coil is flat, flat-bottomed cookware provides the best contact with these units and thus the most efficient operation.

A fairly recent development is the radiant heat cooktop. These have a radiant element (something like a very intense sunlamp) underneath a glass surface. These units do not heat the pot or pan by direct contact (conduction) like coil surface units. They heat by radiation, much like a sunlamp heats your skin.

To maintain a set temperature, the element is cycled on and off, usually by a switch called an ***infinite switch***,

GAS COOKTOPS AND OVENS

Gas ovens use the burning of a fuel such as natural gas, LPG or propane to generate heat. These gases are obviously highly flammable and are heavier than air; they must be closely controlled to prevent explosion hazards.

The different fuels require valves and burners with different orifice sizes, so when buying parts, make sure you get the right ones for the fuel you are using.

A pressure regulator keeps the gas entering the stove at a constant pressure of about 1/6 PSI, regardless of fluctuations in the supply pressure. In a cooktop or stove, this pressure regulator feeds a main gas header, or *manifold*, located under the cooktop. The surface burner gas valves are mounted directly to the gas header. Gas is piped from the header to the various burners, pilots and safety valves, and in some systems, the oven thermostat.

Temperature control in cooktops is very different from that in ovens. In cooktops, a gas valve varies the flow of gas to the burner. In ovens, the gas is either on or off; the burner cycles on and off to maintain temperature.

Another major difference is that when you turn on a gas cooktop, you can immediately see if it ignites. If it doesn't, you turn off the burner and figure out why. In ovens, since the burner is inside the oven, you cannot immediately see whether the burner has ignited. If it does not ignite, you certainly do not want the gas valve to stay open. This would dump raw unburned gas into the oven and create an explosion hazard.

This creates different ignition and safety needs for cooktops versus ovens. Cooktops use a standing pilot or spark ignition system. Ovens use a standing pilot, spark or glow bar ignition system, and gas safety valves that will not open unless ignition is assured.

CONVECTION OVENS

In order to understand convection ovens, there are a few principles you need to understand first:

1) Ovens ***don't*** make things hot. They ***add heat*** to whatever you put into them.

2) Heat will always flow ***from*** something of a ***higher*** temperature ***to*** something of a ***lower*** temperature. The farther apart the temperatures are, the faster the heat flow.

3) Heat will continue to flow from one object to another until the temperatures of the two objects are equal.

4) Air is really a poor conductor of heat. It is actually a pretty good insulator.

Lets talk about chill factor for a minute. Chill factor? Isn't that *weather* stuff? In an oven manual? Yeah, because the concepts are the same. Stick with me here.

All ovens have *some* air moving around inside, due to natural convection (warm air rises, cooler air falls.) In a ***convection*** oven, a fan is used to force the air to move around inside the oven, speeding up the cooking process.

The fan also has two other functions in the oven. Oven temperatures are pretty extreme conditions in which to operate an electric motor. If the oven is also self-cleaning the temperatures are even higher. So

PARTS ACCESS

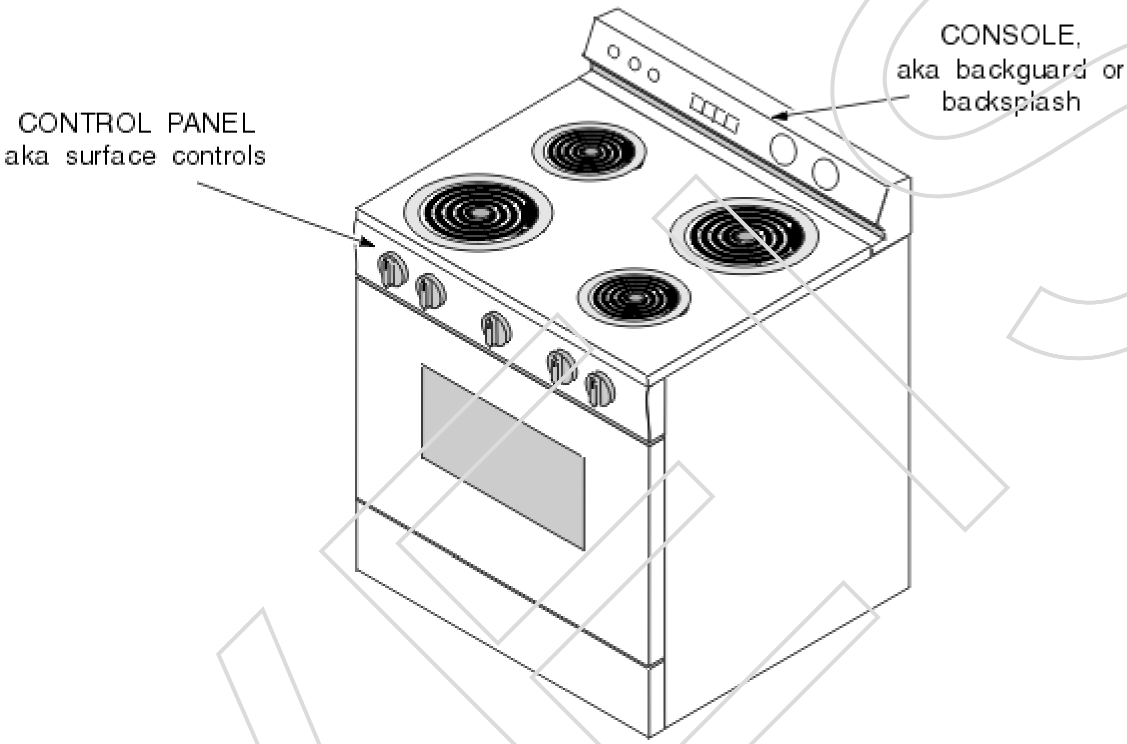
Just for your info and future reference, an *electric* cooktop and oven combined into one unit is called a ***range***.
A *gas* cooktop and oven combined into one unit is called a ***stove***.

This manual covers both ranges and stoves, in addition to freestanding cooktops and wall ovens. The systems in freestanding cooktops and wall ovens are the same as in ranges and stoves. So when this service manual refers to a particular aspect or function of a cooktop or an oven, the same thing will be true of a range or a stove.

CONTROL PANEL

Typically clocks, timers and other manual oven controls are located in the control panel. In ranges and stoves, there may be two control panel areas. The main burner or surface unit controls and oven thermostat are usually located at the front of the cooktop area, and selector switches or lighting controls may be located in the console area, at the rear of the cooktop. In some models, the wiring diagram may be contained in an envelope inside the console.

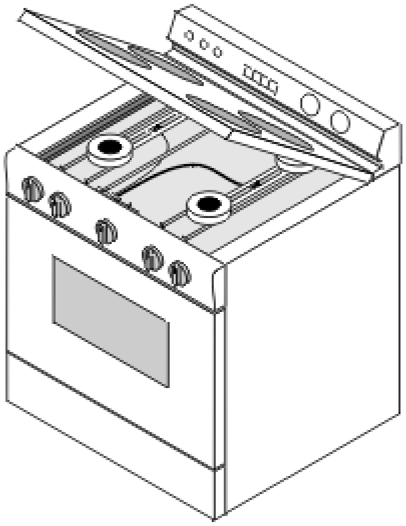
Control Panel Nomenclature

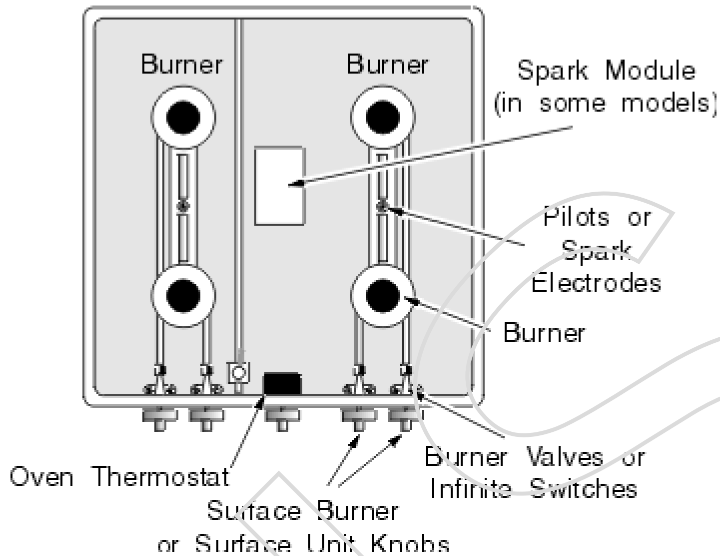


UNDER COOKTOP

In most stoves, ranges and cooktops, the cooktop just lifts up to provide access to gas inlet piping, burners and burner valves, pilots, oven thermostats, infinite switches and surface unit wiring. This, of course, makes the burners easier to clean, too. In gas models with spark ignition, the spark module may be located inside a metal box inside the cooktop compartment. Do not forget to remove power from an electric cooktop before lifting it.

Under Cooktop Access

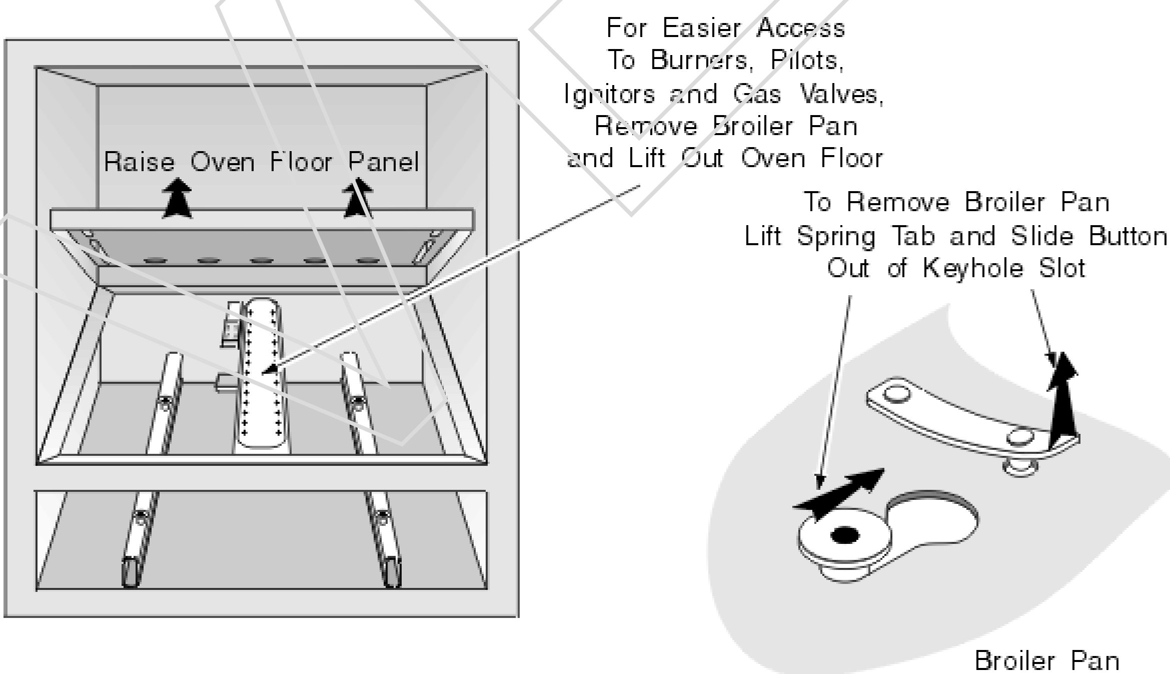




BROILER PAN OR STORAGE

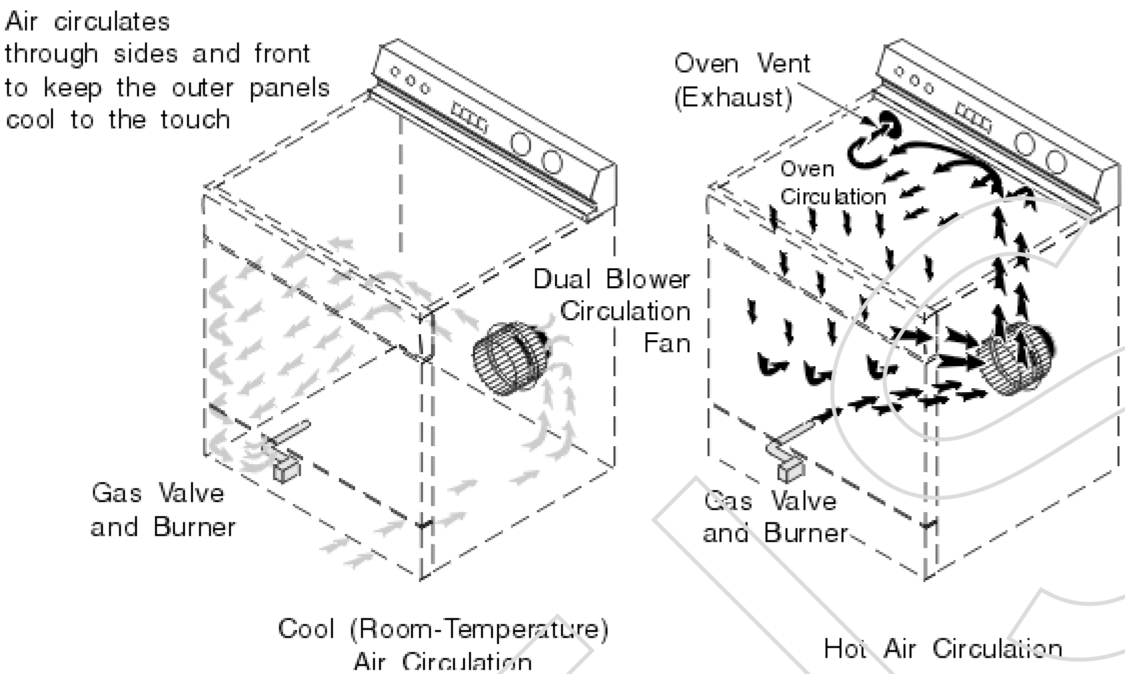
Since a gas oven burner is underneath the oven, the space below it is usually dedicated to a broiler compartment. Beneath the oven, at the back of the broiler compartment is usually where the gas oven ignitor or pilot and safety valve are located.

Broiler Pan and Oven Floor Access and Removal



This may be different in a convection oven. The oven floor usually just lifts out for easier access to work on the burner, ignitor or gas valve. There will also be holes in the oven floor to facilitate airflow within the oven while it is operating.

Typical Convection Oven Arrangement and Air Circulation



***NOTE:** Do not block these holes in the oven floor with aluminum foil. It will definitely block proper airflow in your oven, and it will probably disturb burner operation, too!*

Electric ovens are somewhat different. They have separate broil and bake elements at the top and bottom of the oven, respectively. So the bottom compartment is just for storage of pans, and the oven floor is not removable.

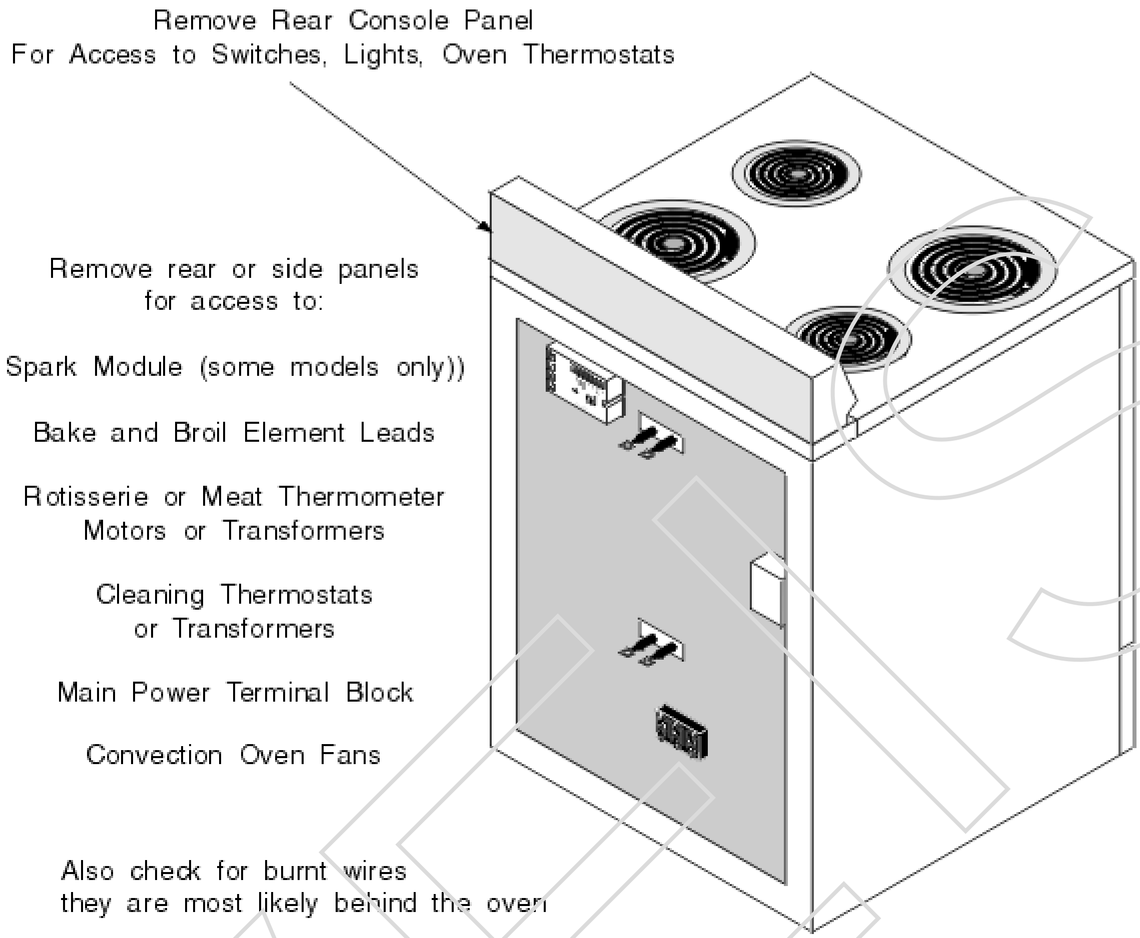
The broiler or storage pan may be removed as. In some models, the wiring diagram may be found inside the front leg of the oven after removing the broiler pan or storage drawer.

REAR ACCESS

In some models, high-limit thermostats, cleaning limit thermostats, oven thermostat probes, convection fans and sail switches, rotisserie motors, and oven spark modules are accessed by removing side or rear access panels as shown in figure 3-E. If you have a problem with burned leads to an electric oven element, sometimes you need to go in through the back to find a lost wire lead.

To access these panels, the oven obviously must first be pulled away from the wall. This can be tricky. Be careful that there is enough excess flexible gas piping and electrical power cord. If not, you must first disconnect gas and/or power from the oven.

Oven Rear Access



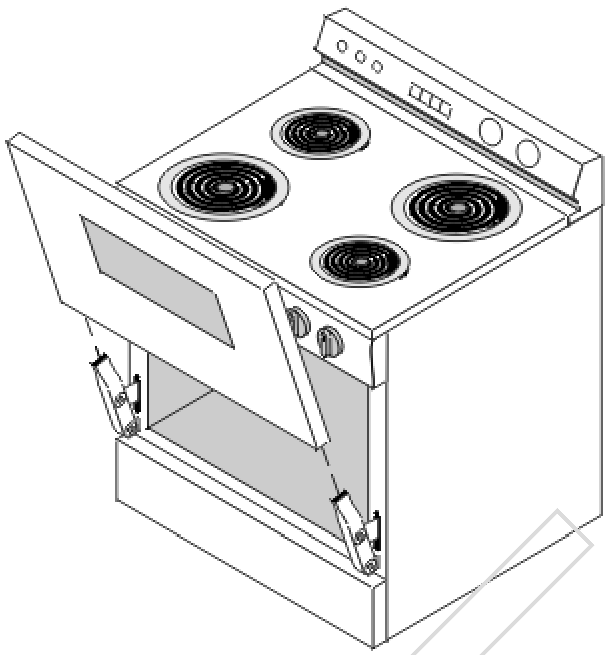
DOOR REMOVAL, DOOR SEAL AND OVEN GLASS SERVICE

In most models the door just lifts off . If so, open the oven door to the first notch (nearly fully closed) and lift the door straight off its' hinges. In some ovens, you must first remove one or two screws that hold the door to the hinge. Be careful and do NOT put your fingers under the hinges; the springs are strong and you might just end up wishing you hadn't.

Working on oven hinges and springs in some models requires access through the broiler/storage pan or side panels. It is a typical oven door hinge and spring arrangement.

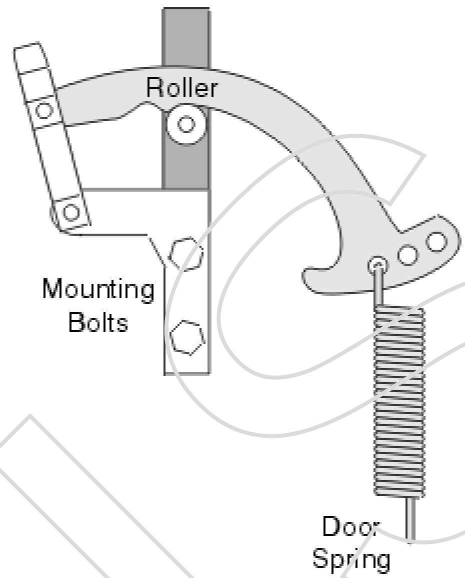
Oven Door Removal and Disassembly

Remove retaining screw(s) (if any)
Lift door straight off hinges as shown



Hinges may be accessed by removing
broiler / storage pan (in stoves and ranges)
or side panels (in wall ovens)

Typical Hinge Assembly



Once you get the door off, remove any door edge trim and the screws that hold the door together. If you are replacing the oven glass or door seal, disassemble the door carefully and note how everything comes apart so you can get it back together. Often there are layers of stuff inside the door; insulation, oven glass (cleaning cycle) heat shields, door locking mechanisms, switches and other gadgets.

In some ovens, the door seal is attached to the oven opening instead of the door. To replace the door seal in these ovens, you sometimes have to open up the back panel of the oven and loosen the whole oven inner liner.

ELECTRIC COOKTOPS AND OVENS

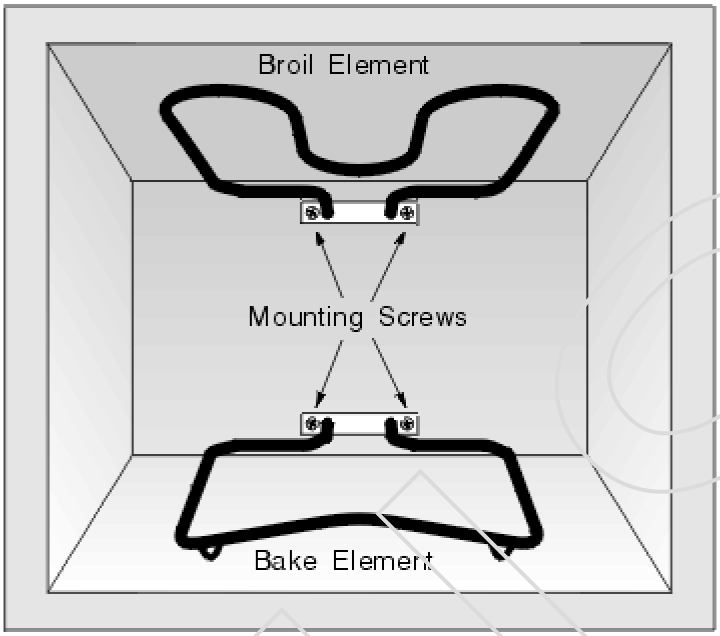
NORMAL OPERATION

The heating element is simply a big resistor wire, with enough resistance to generate a high heat. Usually these are nichrome wire, surrounded in ceramic insulation, with a steel sheath around the ceramic.

Inside the oven, the heating element is called a "bake" or "broil" element. A "bake" element is located below the oven it affects. A "broil" element is located above the oven it affects.

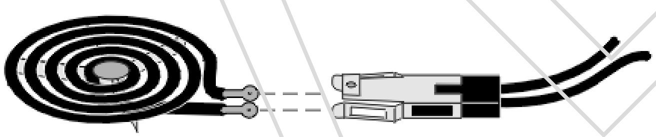
: Oven Elements

View: Inside Oven



In a electric cooktop, the heater elements are coiled into a round thing called a "surface unit." A single surface unit might contain two or even three different elements all mounted together, with different resistance ratings. Sometimes the wiring is screwed directly to terminals on the ends of the surface unit. Some surface units plug into a receptacle mounted under the cooktop, which makes them more easily removable for cleaning, but also more susceptible to burned connections.

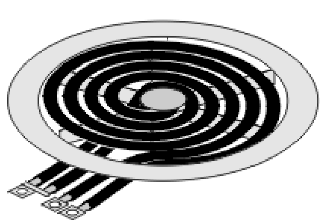
Typical Surface Units



Typical Plug-In Surface Unit

Typical Receptacle
(Styles May Vary)

Typical Two-Element
Wire-In Surface Unit



Note that each separate element is separately grounded to the cabinet!

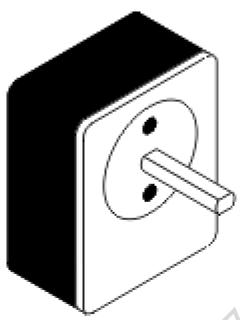
TEMPERATURE CONTROL

To maintain a set temperature in an electric ***cooktop***, the element is cycled on and off, usually by a switch called an infinite switch, so named because it theoretically provides an infinite number of heat settings. This switch has its own little heater inside, which heats a bimetal switch. (see figure 4-C) A cam attached to the control knob changes spring tension on the bimetal, which changes the amount of heat needed to open the switch.

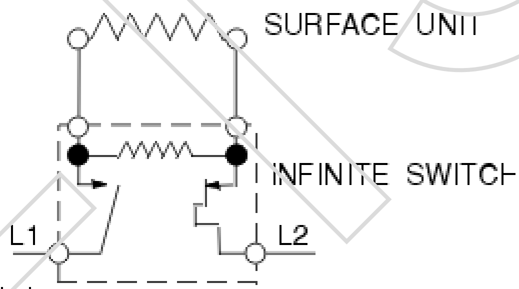
When the heating element is on, the heater inside the switch is on. The bimetal heats (along with the element) until the contacts open. Then the bimetal cools (along with the elements) until the contacts close again.

In an oven, the temperature is controlled by a thermostat. Using a liquid-filled bulb and capillary, the thermostat senses temperature inside the oven and cycles the heating system on and off to maintain oven temperature within a certain range.

Temperature Control Switches

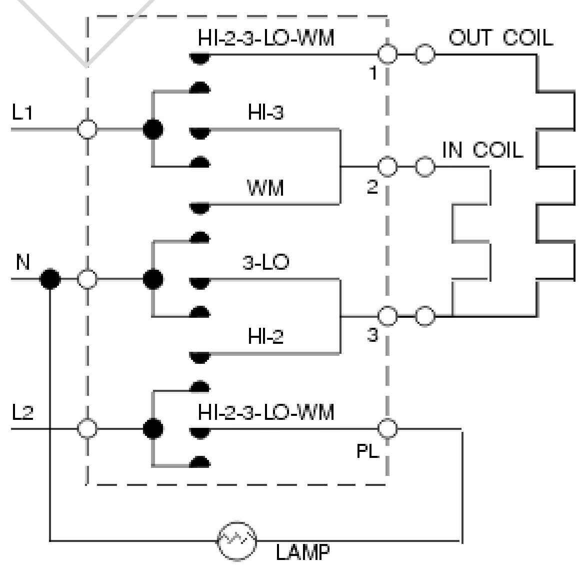


Typical Infinite Switch

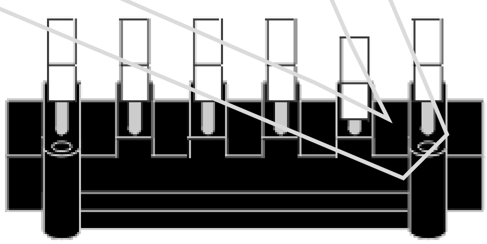


Typical Infinite Switch
Wiring Diagram

Typical Wiring Diagram
For Fixed-Temperature Switch
With Two-Element Surface Unit



Typical Pushbutton
Fixed-Temperature Switch



CLEANING HEATING ELEMENTS

Do not put any cleaning agents or solvents directly on heater elements or surface units. The steel sheath is semi-porous; cleaning solvents can penetrate the steel and damage the ceramic insulation or electrically short the element. Think about it... when these elements are in operation, they glow red-hot. They will eventually incinerate anything that contacts them. If there is any carbon or other crusty residue left after that, just scrape it off as best you can.

TROUBLESHOOTING

When troubleshooting electrical cooking equipment, the very first thing to do is stand back and observe the big picture. What's really going on? If *nothing* is operating, you probably have a breaker, fuse or other power source problem. Do the surface units heat, but not the oven elements? Does the bake element heat, but not the broil element? Does the oven cleaning only work on Tuesdays in July during a snowstorm? Knowing what's operating and what isn't, in conjunction with a wiring diagram, can point you towards the failed component.

Electric oven or cooktop repairs can be broken down into 3 categories:

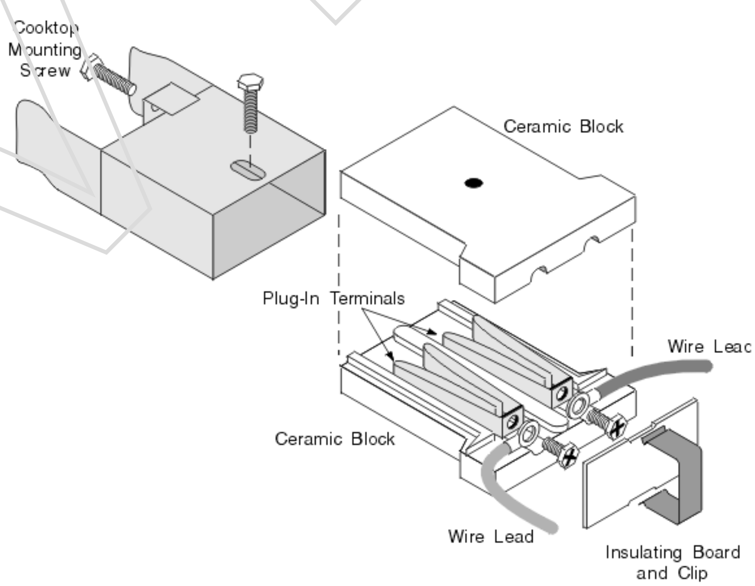
ONE ELEMENT NOT HEATING

In surface units, this is usually caused by a burned out element, terminal, or receptacle. It may also be an infinite switch or fixed-temperature selector switch. Turn the breaker off or pull the fuse, and inspect the element, terminals and receptacle.

Most receptacles are mounted to the cooktop by one or two screws. Some receptacles can be disassembled inspect and replace the internal terminals.

Usually the burned or melted area of terminals or elements will be visible, but test for continuity, even if it appears to be OK. A bad element will show no continuity. A good element will show some continuity, even though there is a lot of resistance.

Receptacle Repair



A switch will show no continuity when off and good continuity when turned on. You should also see continuity through the bimetal heater inside an infinite switch.

Replace a burned or bad receptacle, terminal, element or switch; repair a broken wire end terminal. When replacing elements, make sure you get a replacement element of the right wattage; the element is matched to the control switch.

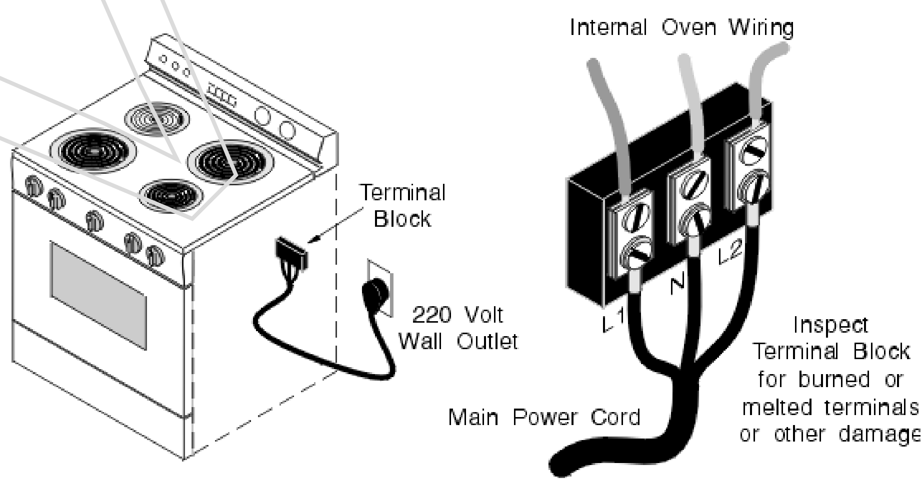
If an oven element isn't working, check the automatic baking cycle (timer) controls first! If those are OK, the break is usually where the wire attaches to the element, inside the back wall of the oven. Turn the breaker off or pull the fuse, remove the screws holding the element into the oven, and pull the element away from the back wall a little. There is a little bit of extra wire in there to allow you to access it from the front, but do not pull out any more wire than you need to work on it. You may need to tilt the element upwards to get the terminals through the holes. If the wire is broken or burnt completely off the terminal, you may be able to fish the wire out of the hole with needlenose pliers, as long as the power is off.

Replace a burned or bad element; repair a broken wire end terminal using special high-temp terminals, available at your appliance parts dealer.

NO POWER TO OVEN

First, make absolutely sure you have no power. Check all heating elements, on all settings. Check the clock, timers, and the oven light if any. If at least one component is operating properly, you have power. Keep in mind that if one leg of the circuit is out due to a house wiring problem, you might have 110 volts but not 220. This might mean the oven light and clock and even some of the heating elements operate on low power, but the high-heat circuits do not work. It also means you still have power, and you can still get zapped.
If you're sure you have no power, we need to figure out if the problem is in the house wiring or inside the oven or cooktop. First, of course, check the house breaker or fuse. Next we need to test for power where it enters the oven. You need to follow the steps as described above, but while the power is off, locate the 3-wire terminal block as shown

Main Power Terminal Block



Center (neutral) lead must be grounded to the cabinet!

In some mobile home and apartment installations, there are four wires in the main power cord. The fourth wire provides the necessary cabinet ground connection.

Inspect the terminal block for any signs of damage; overheating, melted terminals, etc.

Make sure all wiring is clear and make sure you don't touch any bare wires or terminals, turn the breaker or fuse back on briefly, and check the terminal block for power across all three legs. Then remove power again at the breaker or fuse.
If power is not getting to the terminal block, the problem is in your house wiring. During the 70's some houses were built with aluminum wiring, which is notorious for not being able to handle oven currents. House wiring repairs are beyond the scope of this manual. There are plenty of good books on house wiring; get one of those, or call an electrician.
If power is getting to the terminal block, the problem is obviously somewhere within the oven. There may be a main fuse, or a main switch that everything is routed through.

COMPONENT PROBLEMS

One fairly common failure with confusing symptoms occurs when an infinite switch or a fixed-temperature switch shorts internally to ground. The symptom will be that with the switch off, the indicator light remains on dimly. If this occurs, replace the defective switch.

Replace the bad component, or repair damaged wires with special high-temp wire and connections, available at your appliance parts dealer.