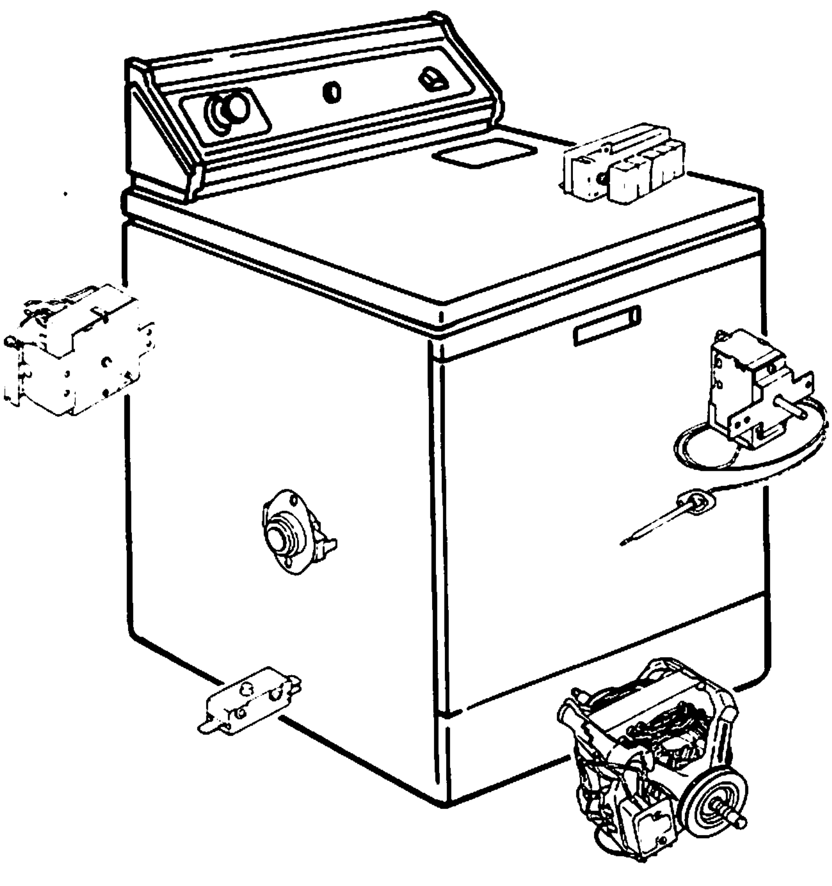
DRYER

STUDY COURSE

UNDERSTANDING DRYER:

- ELECTRICAL COMPONENTS
  and
  CHECKING PROCEDURES



MODULE 1

LIT787848 Rev. B

INTRODUCTION

The material presented in this module is intended to provide you with an understanding of the fundamentals of gas and electric dryer servicing.

Major appliances have become more sophisticated, taking them out of the screwdriver and pliers category. Their electrical circuits include several different types of automatic controls, switches, heaters, valves, etc.. Semiconductors, solid-state controls, and other components usually associated with radio and television electronic circuits are being engineered into automatic washers, dryers, dishwashers and refrigerators.

The appliance technician is emerging into a professional status of his own. He must prepare himself now to be able to perform his duties today as well as to retain his professionalism in the future.

No longer is on-the-job training sufficient to prepare technicians for the complicated procedures required for todays sophisticated appliances. This training can best be obtained through organized classroom study and application. However, much of the knowledge necessary to service todays appliances can be obtained through study courses. Completion of this and other courses will provide you with sufficient understanding of appliances and their operation to enable you to do minor service. It will also serve as a valuable stepping stone to more advanced study and on-the-job training to improve your servicing skills.

Information contained in this module is used on WHIRLPOOL® appliances.

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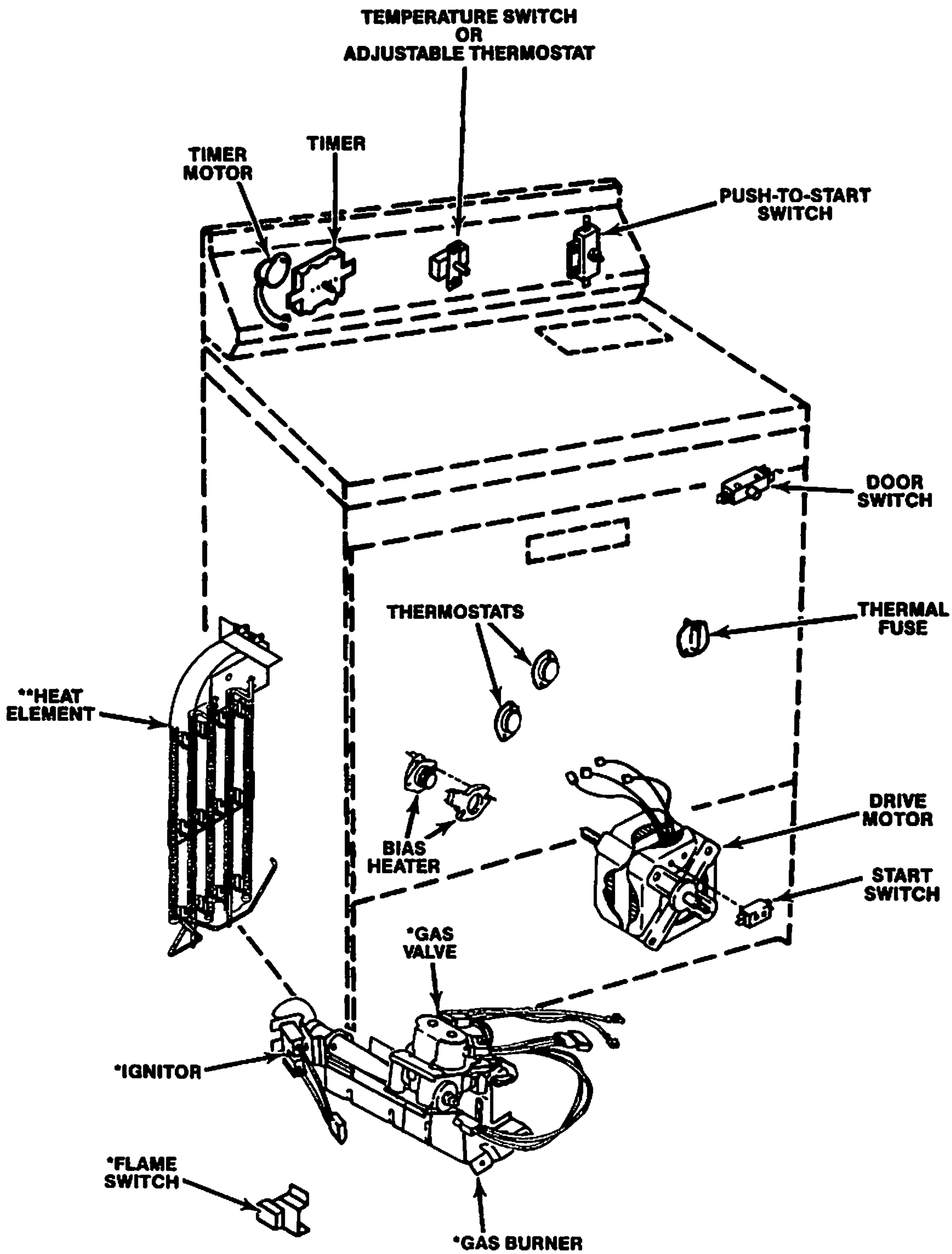
****NOTE:*** ***We recommend taking the TEST for MODULE 1, right after studying it.***

CHAPTER 1

ELECTRICAL COMPONENTS



*gas dryer models

**electric dryer models

THERMOSTATS

Thermostats used in both gas and electric dryers are devices which convert heat into mechanical motion. This mechanical action is used to open or close electrical circuits. Thus, thermostats are an essential component in regulating the operation of the electrical system.

Thermostats may be either adjustable or fixed.

There are three basic applications of thermostats in a dryer. These are: the operating thermostat, the high-limit thermostat and the cool-down thermostat.

ADJUSTABLE THERMOSTATS

The adjustable thermostat is composed of a bulb, a capillary tube, an expanding bellows, and a switch. It is shown on the wiring diagram by the symbol shown in Figure 1.

The arrow running through the symbol shows this to be an adjustable rather than fixed thermostat. The hat-like symbol indicates that it is a heat-sensitive switch. Since the contact arrow is under the symbol, this switch will open on heat rise.

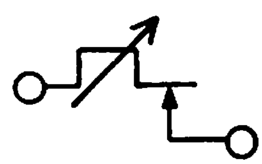


Fig. 1. Adjustable thermostat (spst) symbol.

The bulb and capillary tube of the adjustable thermostats are filled with a special liquid which expands when heated, creating a pressure which is transmitted to the bellows. The bellows expand or contract, depending on the temperature of the bulb, and opens or closes the thermostat switch contacts. The switch contacts are used to control the heat source. Figure 2 shows a picture of an adjustable thermostat and identifies some of its parts.

The temperature at which the adjustable thermostat's switch contacts will open is controlled by a temperature knob. It is mounted in such a way that it can increase or decrease the amount of expansion required for the bellows to operate the switch.

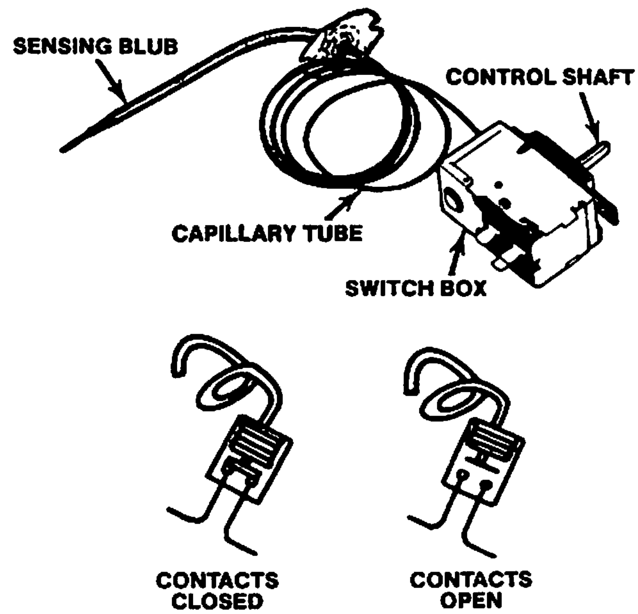


Fig. 2. Adjustable thermostat.

When the heat source is no longer heating the air, the thermostat bulb will cool, thus relieving pressure in the capillary tube and bellows. When the bellows contracts the switch contacts will again close. The adjustable thermostat will continue to cycle heat "ON" and "OFF" during the entire drying operation, thereby maintaining a specified drying temperature.

The bulb of the adjustable thermostat is positioned in the exhaust air stream of the dryer, as shown in Figure 3.

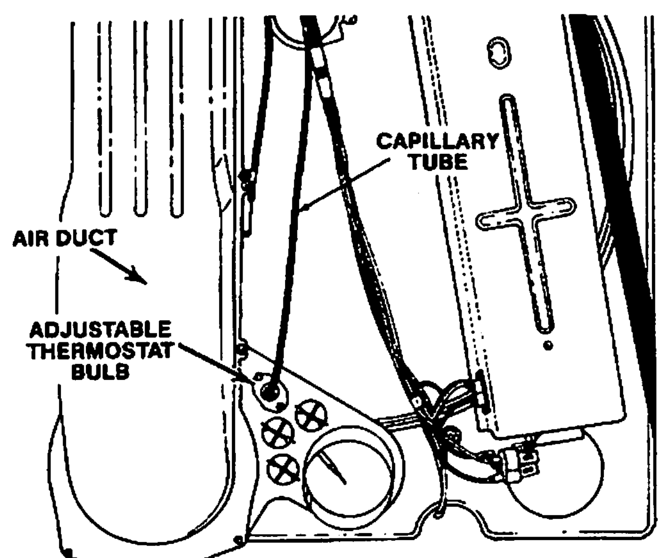


Fig. 3. Location of adjustable thermostat on an electric dryer.

CHECKING PROCEDURE

ADJUSTABLE THERMOSTAT

Check the wiring diagram on your model for the correct terminals to be tested.

STEP 1 EXAMPLE: Turn the temperature control knob to any setting other than air.

EXAMPLE

STEP 2 Touch one ohmmeter probe to terminal 2.

STEP 3 Touch the other ohmmeter probe to terminal 3.

STEP 4 The ohmmeter should show ZERO resistance (continuity). If not, the thermostat is bad and needs replacing.

STEP 5 Touch one ohmmeter probe to terminal 2.

STEP 6 Touch the other ohmmeter probe to terminal 1.

STEP 7 The ohmmeter should show an open circuit. If not, the thermostat is bad and needs replacing.

STEP 8 Place the bulb, and only the bulb of the thermostat, in water in the skillet.

STEP 9 Turn the electric skillet to 180° F.

STEP 10 When the electric skillet reaches this temperature, we can now test the thermostat to see if it is opening.

STEP 11 Touch one ohmmeter probe to terminal 2.

STEP 12 Touch the other ohmmeter probe to terminal 1.

STEP 13 The ohmmeter should show ZERO resistance (continuity). If not, the thermostat is bad and needs replacing.

STEP 14 Touch one ohmmeter probe to terminal 2.

STEP 15 Touch the other ohmmeter probe to terminal 3.

STEP 16 The ohmmeter should show an open circuit. If not, the thermostat is bad and needs replacing.

STEP 17 Reconnect the wires to the proper terminals as previously marked.

FIXED THERMOSTATS

A fixed thermostat has a bimetallic disc which will "snap" from its normal to the opposite position when sufficiently heated. This action controls a switch. The switch may be SPST (single-pole, single throw), or SPDT (single-pole, double-throw), and it may be N.O. (Normally Open) or N.C. (Normally Closed). See Figure 4.

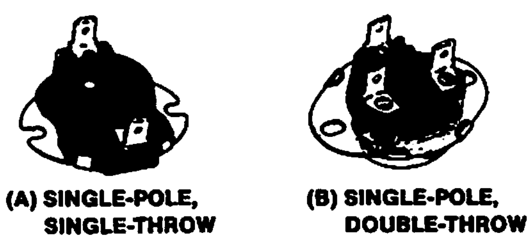


Fig. 4. Fixed thermostats.

The wiring diagram symbols for the SPST thermostat and the SPDT thermostat are shown in Figure 5.

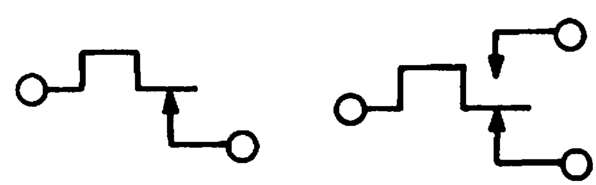


Fig. 5. Fixed thermostat symbols.

Like the adjustable thermostat, fixed thermostats may be used as operating thermostats. Thermostats regulate the air temperature in the dryer. Located in the exhaust air stream of the dryer, the thermostat contacts open with temperature rise and control gas burner or electric heat element circuitry. Fixed thermostats are also used as high-limit (safety) thermostats.

Thermostat location will vary by model. Some typical thermostat locations for electric dryers are shown in Figure 6.

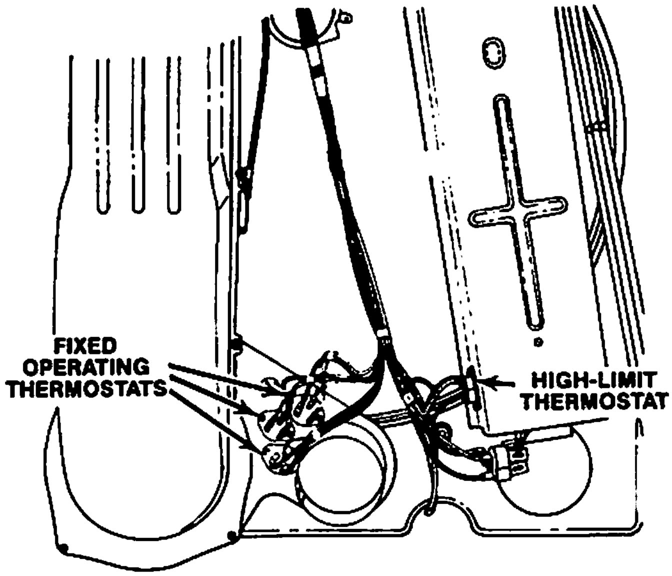


Fig. 6. Thermostat location, electric dryer.

The location and number of fixed thermostats in the gas dryer will also vary, depending on the model. Figure 7 shows typical fixed thermostat locations for the gas dryer.

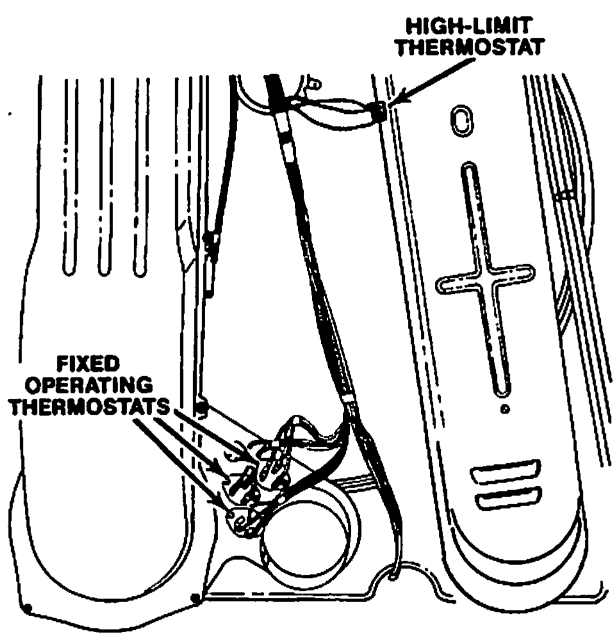


Fig. 7. Thermostat location, gas dryer.

The following descriptions of how operating thermostats, high-limit thermostats, and cool-down thermostats perform their assigned functions will give you a better understanding of the versatility and many uses of the fixed thermostat.

OPERATING THERMOSTATS

The fixed thermostat is used to control the temperature of the dryer, when used as an operating thermostat. Operating thermostats are located in the exhaust air stream of the dryer and have normally-closed contacts. The contacts open with temperature rise. They control electrical circuitry to the gas burner or electric heat element.

In some applications a second normally-open contact on the fixed thermostat is used to control timer operation. When the heat source is "ON", the timer is "OFF", and vice versa. However, recent production models use a voltage divider system to accomplish the same purpose, through a fixed thermostat that has only one normally-closed contact. The following wiring diagrams will show you how the voltage divider system works.

The timer is wired in a parallel circuit to the operating thermostats, as shown in Figure 8. Notice the resistor in the circuit between TM and RS. Notice also that all of the fixed thermostats are closed and the heater is ON. The timer motor is not running at this time even though there is a potential electrical circuit, because the current is taking the path of least resistance.

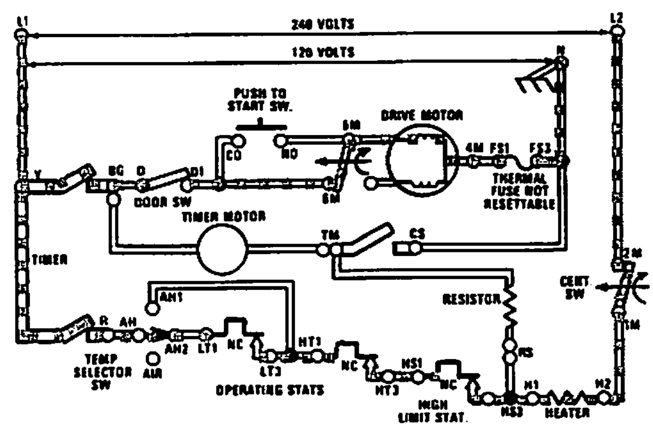


Fig. 8. Dryer heating—timer motor not running.

As long as the circuit is completed through the heat source, the timer motor will not run. When one of the operating thermostats opens, a circuit is completed through the timer motor, resistor and heater. The heater serves only as a conductor for the timer motor circuit. See Figure 9.

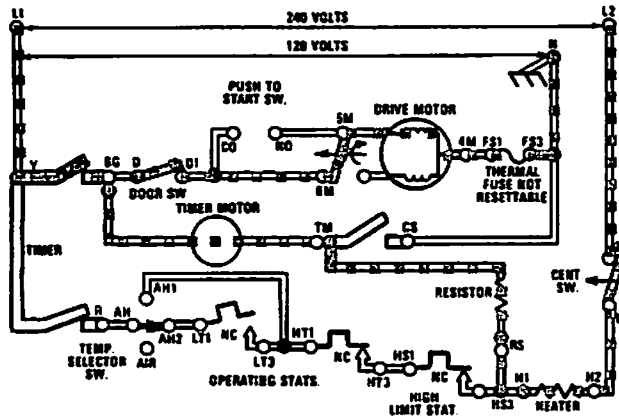


Fig. 9. Timer motor operating.

At the beginning of the cycle, the cold drum and the high moisture content in the clothes keeps the temperature down and the operating thermostat remains closed. The clothes absorb less heat as they heat up and become more dry, the thermostat opens, and the timer motor runs.

The timer motor will be off for long periods of time at the beginning of the cycle and then run for longer periods of time as the clothes get dryer. A good way to remember how this cycle works is "Heat On—Timer Off" and "Heat Off—Timer On."

Near the end of the cycle, timer switch TM to CS closes as shown in Figure 10. This circuit is programmed into the timer because switch Y to R opens and breaks the circuit to the heat source. The dryer runs for about ten minutes without heat, gradually cooling the clothes and advancing the timer to the OFF position. This "cool-down" portion of the cycle is needed to avoid wrinkling of permanent press clothes.

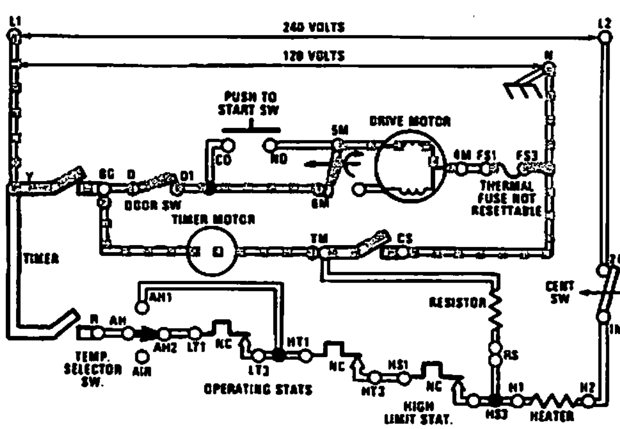


Fig. 10. The cool-down cycle.

Cool-down thermostats are used to provide motor operation during cool-down on some older production models.

After the heat-on phase of the cycle has ended, the dryer continues to run for some minutes. This "cool-down" phase is controlled by a cool-down thermostat on some models.

These thermostats have normally-open contacts which close during the heat-on phase of the cycle. When the heat-on phase ends, these contacts remain closed until exhaust temperatures cool to approximately 120°F. The motor continues to run until the cool-down thermostat contacts open.

HIGH-LIMIT (SAFETY) THERMOSTATS

High-Limit thermostats, or a thermal cutoff are sometimes called safety thermostats, and are used to prevent excessive temperatures within the dryer. These thermostats are always the fixed or nonadjustable type. They are located at strategic locations in the burner area, heater box or fan-scroll housing, depending on the requirements of the dryer model.

In most applications, high-limit thermostats have normally-closed contacts that open the circuit to the heat source in the event that some failure causes abnormal temperature rise. Some of the failures that will cause overheating are:

- Broken Belt
- Plugged Exhaust
- Leaking Drum Seals
- Improper Exhaust System
- Leaking Door Seals
- Overfiring (on gas dryers)

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the thermostat. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

HIGH-LIMIT (SAFETY), FIXED OR OPERATING THERMOSTAT

STEP 3 Touch one ohmmeter probe to one of the terminals on any thermostat.

STEP 4 Touch the other ohmmeter probe to the other terminal on the same thermostat.

STEP 5 The ohmmeter should show ZERO resistance (continuity). If not, the thermostat is bad and needs replacing.

STEP 6 Check each thermostat this way and replace them if you do not show ZERO resistance (continuity).

STEP 7 Remove the thermostat(s).

STEP 8 Place the thermostat(s) face down (terminals up) in an electric skillet.

STEP 9 Turn the electric skillet to 180°F. for operating thermostats or 225°F for a gas 300°F for an electric high-limit thermostat.

STEP 10 When the electric skillet reaches this temperature, we can test the thermostat(s) to see if it is opening.

STEP 11 Touch one ohmmeter probe to one of the terminals on any thermostat.

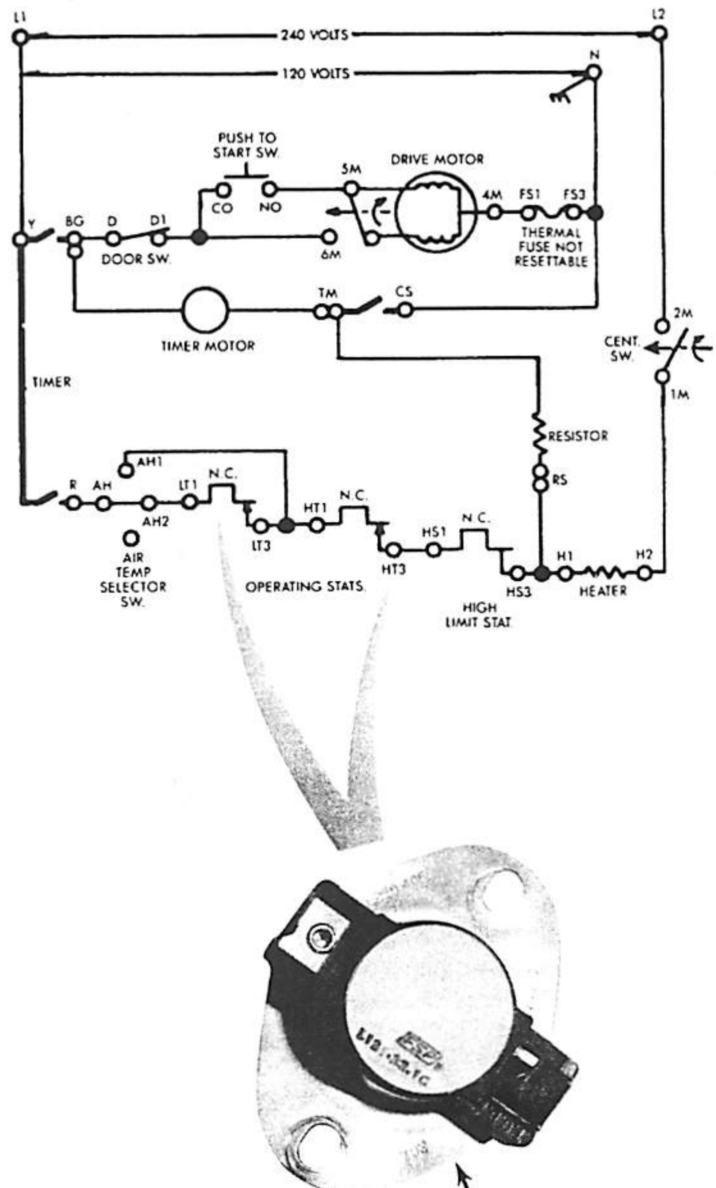
STEP 12 Touch the other ohmmeter probe to the other terminal on the same thermostat.

STEP 13 The ohmmeter should show an open circuit. If not, the thermostat is bad and needs replacing.

STEP 14 Check each thermostat this way and replace it if you do not show an open circuit.

STEP 15 Turn the electric skillet off.

STEP 16 Reconnect the wires to the proper terminals as previously marked.



ADJUSTABLE THERMOSTAT

THERMAL FUSE (NON-RESET)

A no-reset thermal fuse is now used in the blower housing instead of the high-limit thermostat. The purpose of the thermal fuse is to turn the drive motor OFF if one of the thermostats fail in the closed position causing the temperature to exceed approximately 195°. See Figure 11 for the thermal fuse location.

In the wiring diagram shown, the termal fuse opens causing the drive motor to shut OFF. The centrifugal switch contacts 1M to 2M open, causing the heater to shut Off. The timer motor is still running because contacts TM to CS are closed as well as timer contacts Y to BG. Depending on the model, the thermal fuse could be located before any other components shutting off the dryer completely.

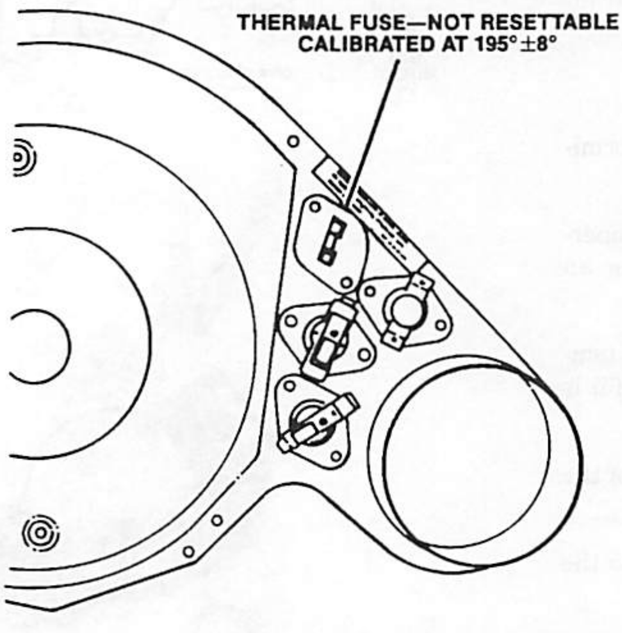


Fig. 11. Thermal fuse location.

The thermal fuse is located in the blower housing near the operating thermostats. It is calibrated to open at 195°±8°. If you find the fuse open, replace it, but first search for a defective operating thermostat.

When the thermal fuse is open, the dryer will be completely "dead," since the thermal fuse is located in the circuit ahead of all other components.

CHECKING PROCEDURE

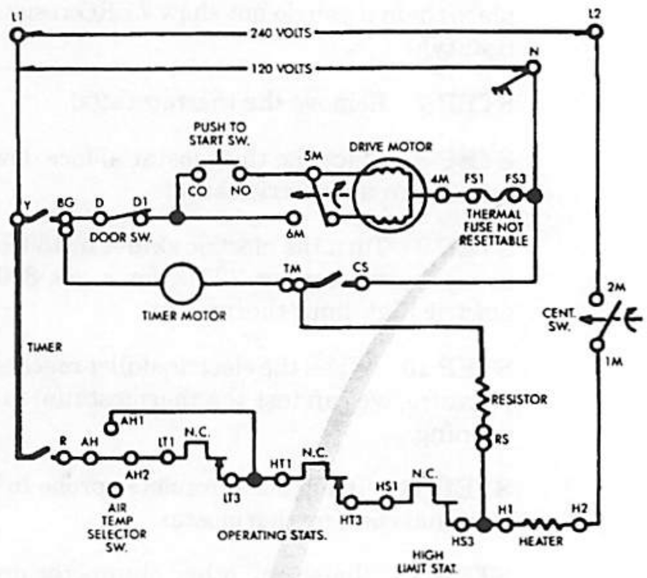
Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

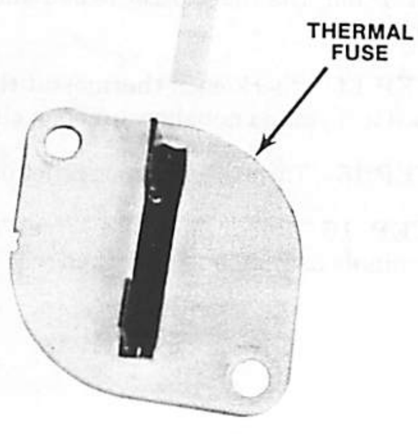
STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal markings on the thermal fuse. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

STEP 3 Touch one ohmmeter probe to one of the terminals.

STEP 4 Touch the other ohmmeter probe to the other terminal.





PUSH-TO-START SWITCH OR RELAY

Push-to-start switches are momentary "make" switches. This means that they create temporary circuits when pushed closed, and open the circuit when released.

NOTE: The push-to-start circuit cannot be completed until the timer is set.

When depressed, the push-to-start switch establishes a circuit through the motor windings. Within three seconds, the motor reaches about 2/3 of its running speed, causing the centrifugal switch contacts to open. This removes the start winding from the circuit and maintains the run winding circuit through contacts 5M to 6M.

Figure 12 shows two types of push-to-start switches and a wiring diagram of the motor circuit. The dryer stops when the door is opened. The only way the dryer can be restarted after closing the door is by depressing the start switch again.

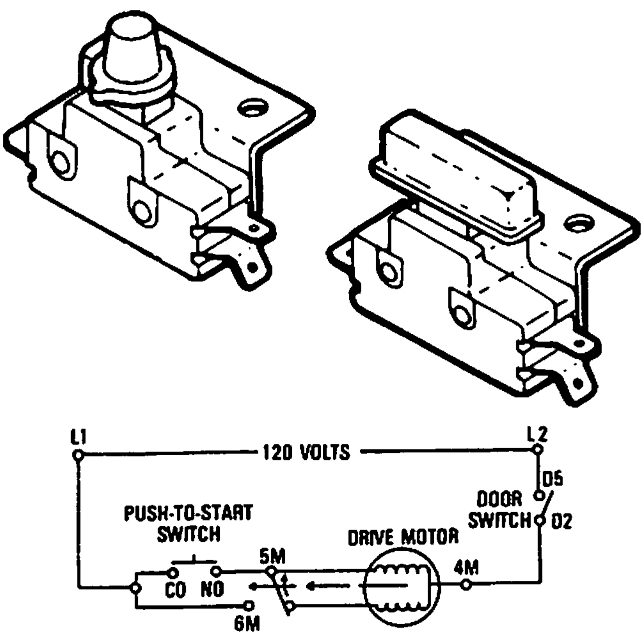


Fig. 12. Circuit with push-to-start switch.

Some dryers use a relay-operated switch as a push-to-start switch. The relay is a control device that uses a coil to hold the switch closed. When the switch button is depressed, a circuit is completed through the switch contacts and the coil. The current flowing through the coil sets up a magnetic field. The magnetic field holds the switch contacts closed. See Figure 13.

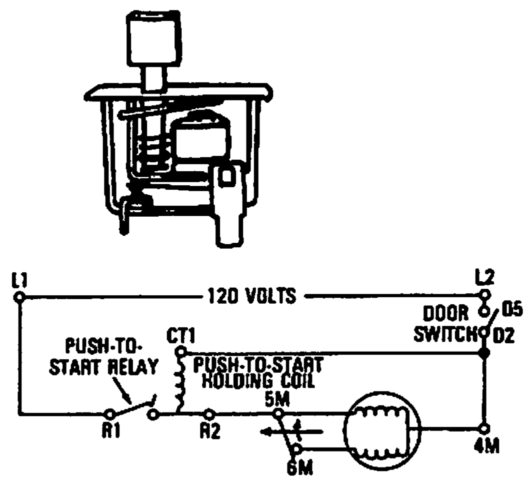


Fig. 13. Push-to-start relay and coil.

If the dryer door is opened at any time during a cycle, the relay coil is de-energized and the relay start contacts open. The cycle will not continue until the dryer door is closed and the push-to-start relay button is pressed.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal markings on the push-to-start switch or relay. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

STEP 3 Touch one ohmmeter probe to terminal CO (common) on the switch or R2 on the relay.

STEP 4 Touch the other ohmmeter probe to terminal NO (open) on the switch or R1 on the relay.

STEP 5 The ohmmeter should show an open circuit with the button up. If not, the push-to-start switch or relay is bad and needs replacing.

STEP 6 Now press the button.

STEP 7 The ohmmeter should show ZERO resistance (continuity) with the button in. If not, the push-to-start switch or relay is bad and needs replacing.

STEP 8 If your push-to-start switch or relay has three terminals, touch one of thee ohmmeter probes to terminal NC (closed) on the switch or CT1 on the relay.

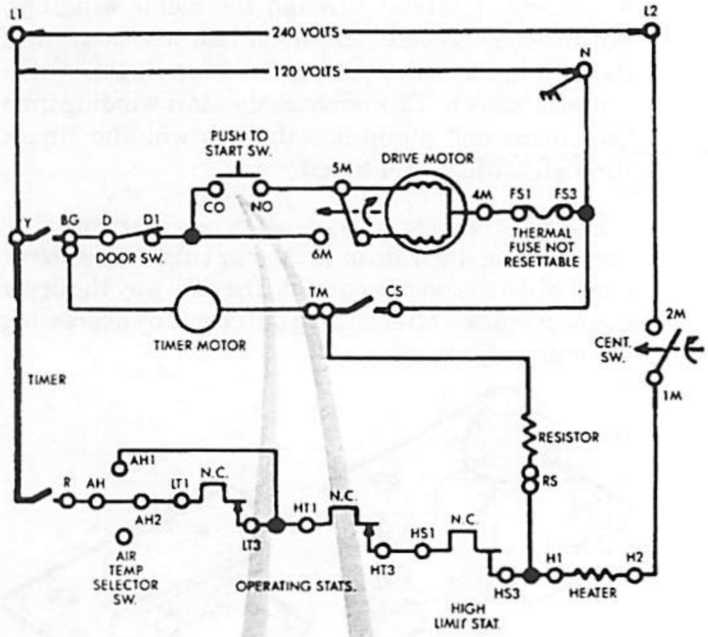
STEP 9 Touch the other ohmmeter probe to terminal CO (common) on the switch or R1 on the relay.

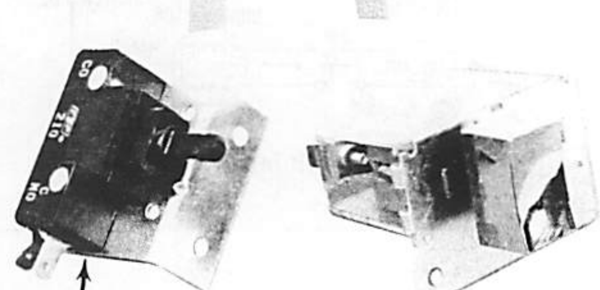
STEP 10 The ohmmeter should show ZERO resistance (continuity) on the switch, or an open circuit on the relay, with the button up. If not, the push-to-start switch or relay is bad and needs replacing.

STEP 11 Now press the button.

STEP 12 The ohmmeter should show an open circuit on the switch or 1,000-3,000 ohms on the relay with the button in. If not, the push-to-start switch or relay is bad and needs replacing.

STEP 13 Reconnect the wires to the proper terminals as previously marked.





SWITCH

RELAY

DOOR SWITCH

The door switch, Figure 14, breaks the dryer circuits, causing the machine to stop when the dryer door is opened. This is a safety feature which allows the user to open the door for inspection purposes during the drying cycle without risk of personal injury or damage to clothes. Some dryers use a door switch with as many as five terminals.

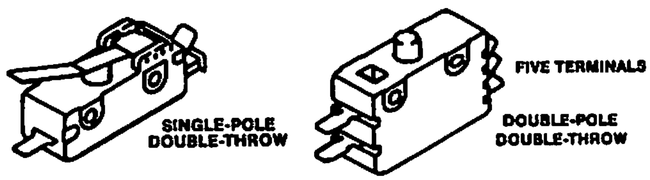


Fig. 14. Door switches.

On dryers that have a drum lamp, the door switch also closes a circuit to the lamp when the door is opened, allowing the drum lamp to remain lighted.

Figure 15 shows a typical door-switch circuit. Refer to the wiring diagram of the specific model when checking a door switch.

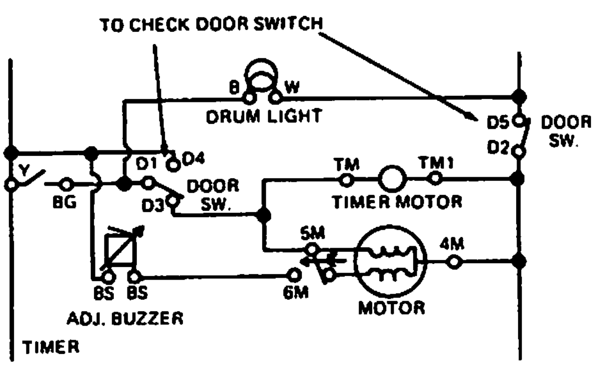


Fig. 15. Door-switch circuits.
(Shown with door shut)

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the door switch. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

SEE TYPE OF SWITCH:

Two-Terminal Switch, steps 3-9
Three-Terminal Switch, steps 10-22
Five-Terminal Switch, steps 23-41

TWO-TERMINAL SWITCH

STEP 3 With the door closed, touch one of the ohmmeter probes to terminal D (COM).

STEP 4 Touch the other ohmmeter probe to terminal D1 (NO).

STEP 5 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the door switch is bad and needs replacing.

STEP 6 With the door open touch one of the ohmmeter probes to terminal D (COM).

STEP 7 Touch the other ohmmeter probe to terminal D1 (NO).

STEP 8 The ohmmeter should show an open circuit with the door open. If not, the door switch is bad and needs replacing.

STEP 9 Reconnect the wires to the proper terminals as previously marked.

THREE-TERMINAL SWITCH

STEP 10 With the door closed, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 11 Touch the other ohmmeter probe to terminal D (NO).

STEP 12 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the door switch is bad and needs replacing.

STEP 13 With the door closed, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 14 Touch the other ohmmeter probe to terminal D2 (NC).

STEP 15 The ohmmeter should show an open circuit with the door closed. If not, the door switch is bad and needs replacing.

STEP 16 With the door open, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 17 Touch the other ohmmeter probe to terminal D (NO).

STEP 18 The ohmmeter should show an open circuit with the door open. If not, the door switch is bad and needs replacing.

STEP 19 With the door open, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 20 Touch the other ohmmeter probe to terminal D2 (NO).

STEP 21 The ohmmeter should show ZERO resistance (continuity) with the door open. If not, the door switch is bad and needs replacing.

STEP 22 Reconnect the wires to the proper terminals as previously marked.

FIVE-TERMINAL SWITCH

STEP 23 With the door closed, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 24 Touch the other ohmmeter probe to terminal D3 (NO).

STEP 25 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the door switch is bad and needs replacing.

STEP 26 With the door closed, touch one of the ohmmeter probes to terminal D2 (COM).

STEP 27 Touch the other ohmmeter probe to terminal D5 (NO).

STEP 28 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the door switch is bad and needs replacing.

STEP 29 With the door closed, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 30 Touch the other ohmmeter probe to terminal D4 (NC).

STEP 31 The ohmmeter should show an open circuit with the door closed. If not, the door switch is bad and needs replacing.

STEP 32 With the door open, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 33 Touch the other ohmmeter probe to terminal D3 (NO).

STEP 34 The ohmmeter should show and open circuit with the door open. If not, the door switch is bad and needs replacing.

STEP 35 With the door open, touch one of the ohmmeter probes to terminal D2 (COM).

STEP 36 Touch the other ohmmeter probe to terminal D5 (NO).

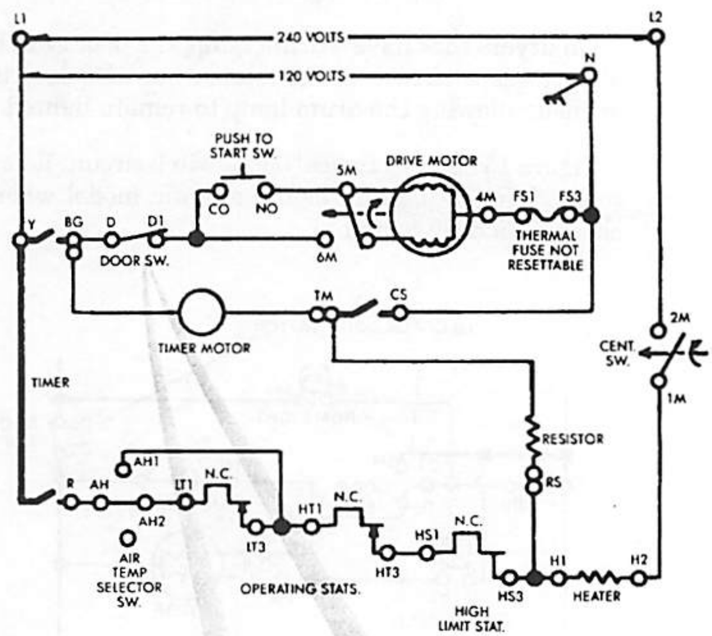
STEP 37 The ohmmeter should show an open circuit with the door open. If not, the door switch is bad and needs replacing.

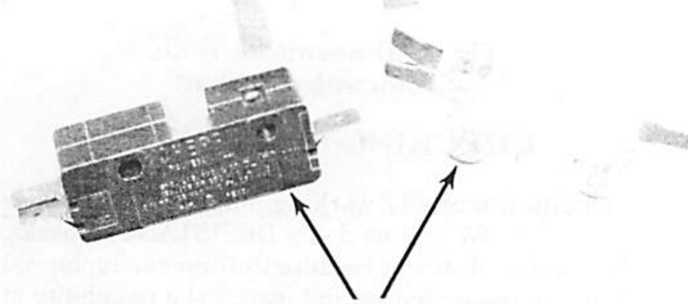
STEP 38 With the door open, touch one of the ohmmeter probes to terminal D1 (COM).

STEP 39 Touch the other ohmmeter probe to terminal D4 (NC).

STEP 40 The ohmmeter should show ZERO resistance (continuity) with the door open. If not, the door switch is bad and needs replacing.

STEP 41 Reconnect the wires to the proper terminals as previously marked.





DOOR SWITCH

TEMPERATURE SWITCH

Some dryer models have a temperature selection switch. It enables the user to select one of several fixed operating thermostats which then control drying temperatures. The air selection provides operation without heat. See Figure 16.

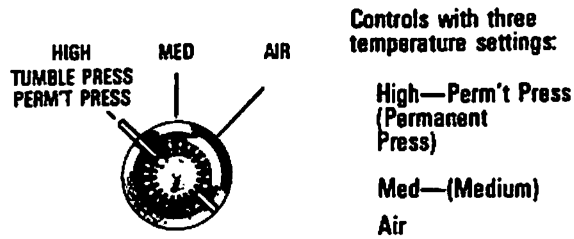


Fig. 16. Temperature selector switch.

Figure 17 shows the temperature selection switch placed in series between the "R" timer terminal and the thermostats. It is a three-position switch. When switched to the AIR setting, it opens the circuit to the heating components. When switched to MEDIUM (or LOW on some models) it will complete a circuit from AH to AH2, and the heating element or burner will be controlled by the low temperature thermostat (LT1 to LT2).

Dialing NORMAL heat (or HIGH on some models) on the selector switch will close the AH to AH1 selector switch contacts putting the high temperature thermostat (HT1-HT2) in series with the heating components.

Notice this heating circuit has two high-limit thermostat switches. The high-limit thermostat with the terminals marked "HS" is in the heater box. The second high-limit thermostat is in the fan scroll and its terminals are marked "FS." Excessive temperatures in either area will open the heater circuit and shut off the element or the burner.

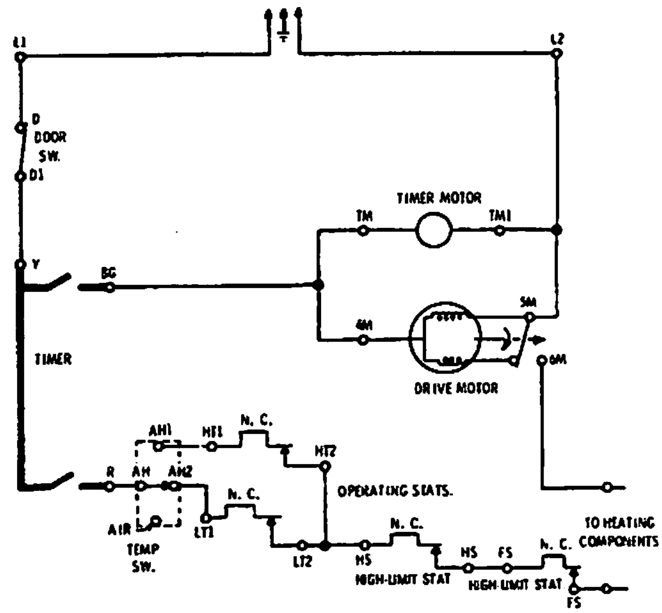


Fig. 17. Temperature selection circuit.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the temperature switch. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

STEP 3 Check each circuit by turning the rotary knob or pushing in on the push-button to each setting and check the proper terminals.

Use the following charts. Your switch may not have all the settings shown.

Terminals shown in each setting show ZERO resistance (continuity). All others should show an open circuit.

These are typical diagrams; refer to your own wiring diagram for proper terminal markings.

ROTARY

SWITCH SETTING	TERMINAL MARKING ON SWITCH
Air	
Low	AH to AH3
Medium	AH to AH2
High	AH to AH1

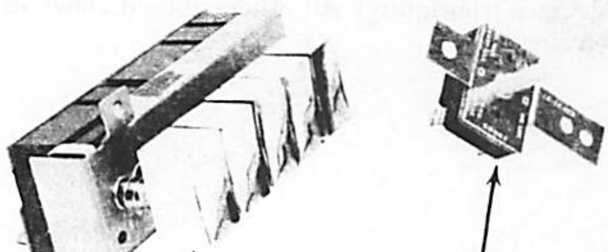
PUSHBUTTON

SWITCH SETTING	TERMINAL MARKING ON SWITCH
High	PB1 to PB2, PB5 to PB9, PB6 to PB8
Medium	PB1 to PB3, PB5 to PB9, PB6 to PB8
Tumble Press	PB1 to PB4, PB5 to PB9
Warm	PB1 to PB4, PB5 to PB9
Air	PB6 to PB8

STEP 4 EXAMPLE: Set the rotary or pushbutton temperature switch to medium. This closes contacts inside the switch, AH to AH2 or PB1 to PB3, PB5 to PB9 and PB6 to PB8.

STEP 5 Touch one ohmmeter probe to terminal PB1 or AH.

STEP 6 Touch the other ohmmeter probe to terminal PB3 or AH2.



PUSHBUTTON

ROTARY

STEP 7 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the temperature switch is bad and needs replacing.

STEP 8 Touch one ohmmeter probe to terminal PB5.

STEP 9 Touch the other ohmmeter probe to terminal PB9.

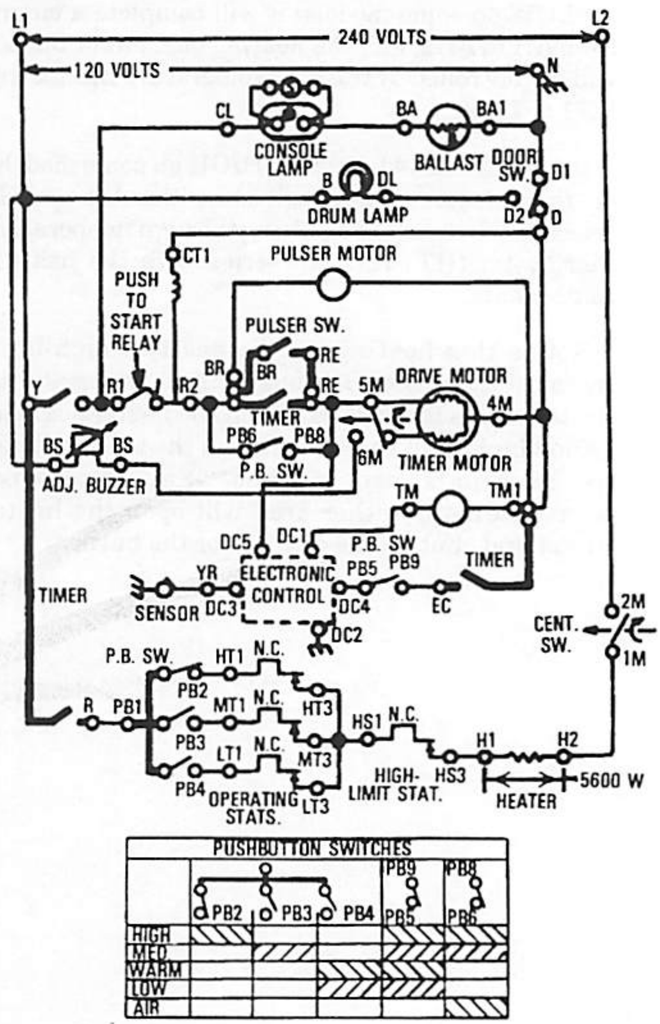
STEP 10 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the temperature switch is bad and needs replacing.

STEP 11 Touch one ohmmeter probe to terminal PB6.

STEP 12 Touch the other ohmmeter probe to terminal PB8.

STEP 13 The ohmmeter should show ZERO resistance (continuity) with the door closed. If not, the temperature switch is bad and needs replacing.

STEP 14 Reconnect the wires to the proper terminals, as previously marked.



BUZZER

The buzzer signals the end of the drying cycle. It alerts the user so that the clothing may be removed before wrinkles set in. On most models it is adjustable for loudness. An arrow through the symbol will indicate it is adjustable.

During dryer operation, a potential circuit between 5M and 6M is set up by the centrifugal switch in the drive motor. Having resistance, the buzzer will not operate because a line of least resistance from Y to BG to 5M is established. See Figure 18.

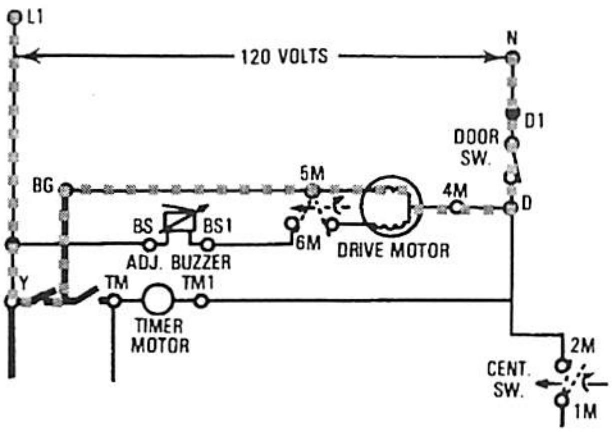


Fig. 18. Motor operation.

At the end of the cycle, however, when the Y to BG timer contact opens, the circuit to the buzzer becomes operable. See Figure 19. The buzzer will sound until the motor slows down enough for the centrifugal switch to break the 6M contact and snap back to the motor start position.

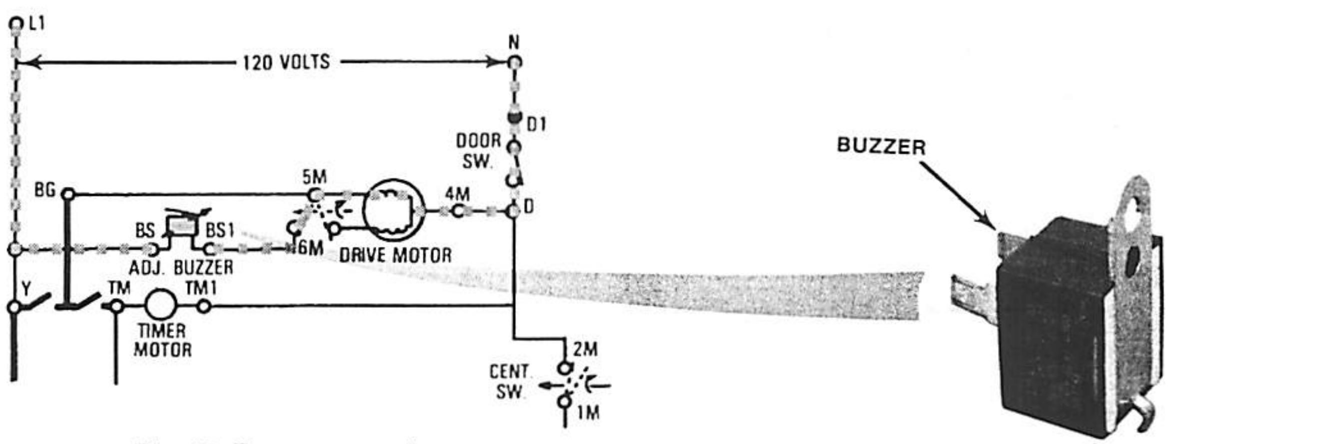


Fig. 19. Buzzer operation.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the signal (buzzer). This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Refer to the instructions that came with your ohmmeter to find the proper scale to measure 1,000-4,000 ohms. Set the ohmmeter scale and ZERO the meter.

STEP 3 Touch one ohmmeter probe to one of the terminals.

STEP 4 Touch the other ohmmeter probe to the other terminal.

STEP 5 The ohmmeter should show between 1,000-4,000 ohms on the ohms scale. If you do not get this reading, the cycle signal (buzzer) is bad and needs replacing.

STEP 6 Reconnect the wires to the proper terminals as previously marked.

DRIVE MOTOR

In this section you will learn about the dryer motor and its functions within the dryer. You will also learn about various changes that have taken place in motor construction. In addition, you will study the different types of motor centrifugal switches.

The dryer motor provides power to rotate the dryer drum and to drive the exhaust fan.

EARLY MOTORS

Most early-production dryers were equipped with 1/3 horsepower—1725-rpm drive motors. They have a built-in centrifugal switch and overload protector.

EXTERNAL MOUNTED CENTRIFUGAL SWITCH

An externally-mounted centrifugal switch was incorporated in the motor on later dryer models. This made the centrifugal switch replaceable in the field without disassembling the motor. The switch is mounted to the end bell. See Figure 20. It is completely enclosed to prevent any foreign particles from entering the switch mechanism. (Switch designs may vary slightly due to the different methods of switch activation).

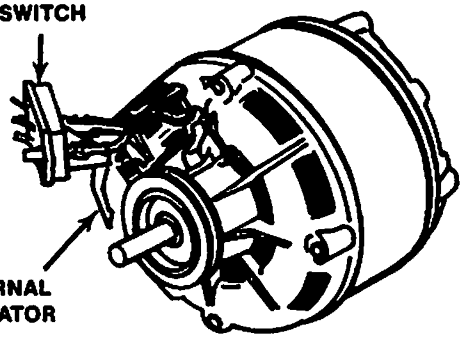


Fig. 20. External centrifugal switch.

Care should be exercised to be sure the actuating arm of the switch is located behind the motor shaft centrifugal spool, and also that wires do not interfere with the counterweights of the starting switch mechanism. See Figure 21.

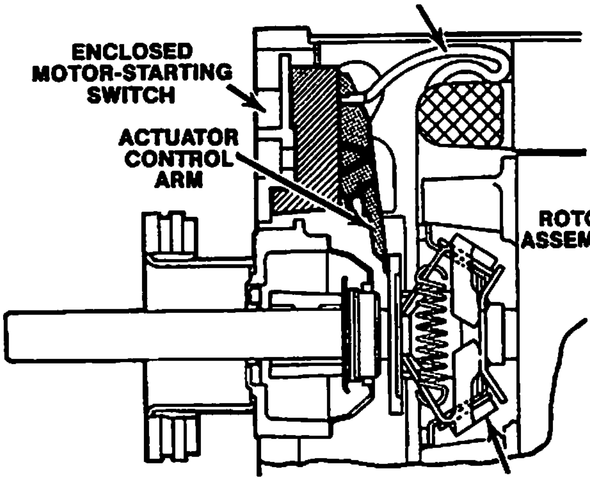


Fig. 21. Centrifugal switch in place.

DISPOSABLE MOTORS

Most of the motors used today are the non-repairable type with a serviceable, externally-mounted centrifugal switch. Depending on design, some of these motors are cemented together and others welded. In either case, the construction makes them non-repairable internally.

These 1/3-horsepower, 1750-rpm motors have a double-end threaded shaft which drives the drum belt from one end and drives the blower fan on the other. Motors rotate in a counterclockwise direction—looking at the switch end—they also are equipped with a built-in overload protector.

Looking at the other end of the disposable motor, you will see that the motor shaft on that end is threaded. These are left-hand threads for the blower. A left-hand thread is used to prevent the blower from loosening during operation. See Figure 22.

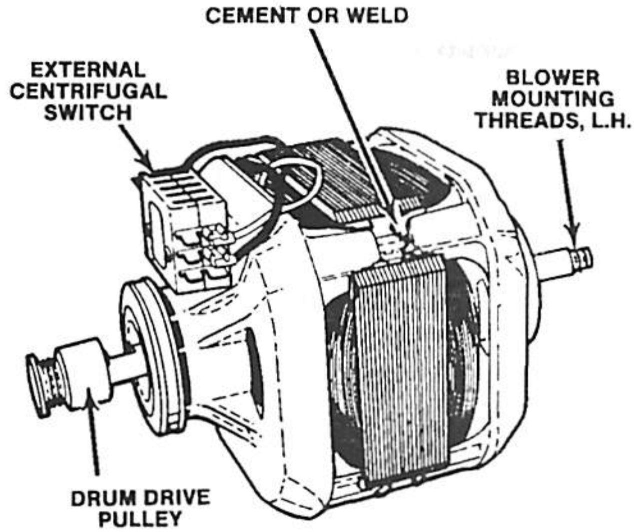


Fig. 22. Disposable motor.

There are several different kinds of disposable motors used on dryers, since each motor manufacturer has a different design. This will become more apparent when we study the motor centrifugal switches.

Recently, some motors have been used in production which have most of the motor housing removed. Figure 23 shows one example of this type of motor.

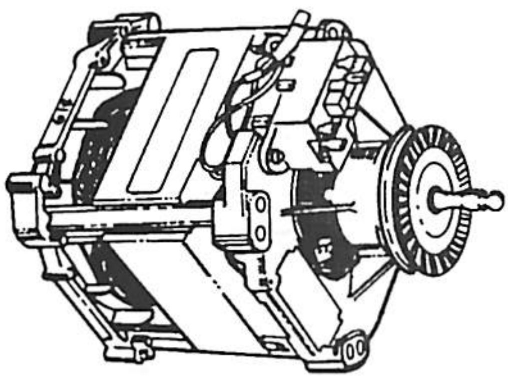


Fig. 23. Form 'V' motor.

The removal of most of the motor housing prevents lint from building up in the motor. The removal of lint buildup, in turn, helps to prevent the motor from overheating. Another example of a motor of this type, from a different manufacturer, is shown in Figure 24.

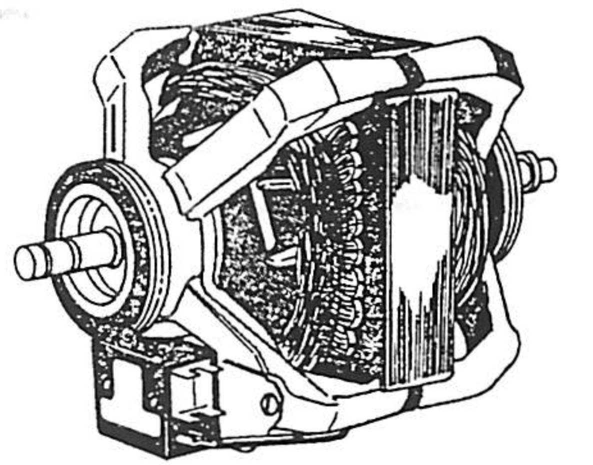


Fig. 24. Open type motor.

These motors are interchangeable with motors used previously on dryers. Always refer to your parts list for the model being serviced when ordering parts.

MOTOR MOUNTING

Methods of mounting the dryer motor have been revised many times over the years to reduce noise and vibration and to aid in servicing.

The basic motor mounting design shown in Figure 25 utilizes a saddle-type bracket, rubber cushions around the end bells of the motor, and retaining clamps to secure the motor to the bracket. The rubber cushions are sandwiched between the retainer clamps and the motor bracket to reduce noise levels and minimize vibration.

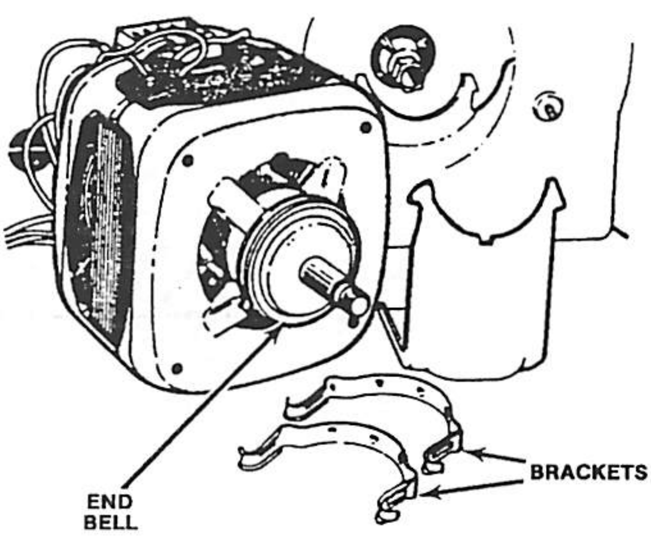


Fig. 25. Mounting Brackets.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time coming from the main wiring harness to the start switch, carefully labeling each wire according to the terminal marking on the start switch. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Remove the other wires one at a time from the drive motor to the start switch carefully, labeling each wire according to the terminal marking on the start switch. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 3 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

STEP 4 Touch one ohmmeter probe to the terminal on the yellow wire coming from the motor windings.

STEP 5 Touch the other ohmmeter probe to the terminal on the blue wire coming from the motor windings.

STEP 6 The ohmmeter should show about 1-5 ohms on the ohms scale.

STEP 7 If you do not get this reading, the drive motor is bad and needs replacing.

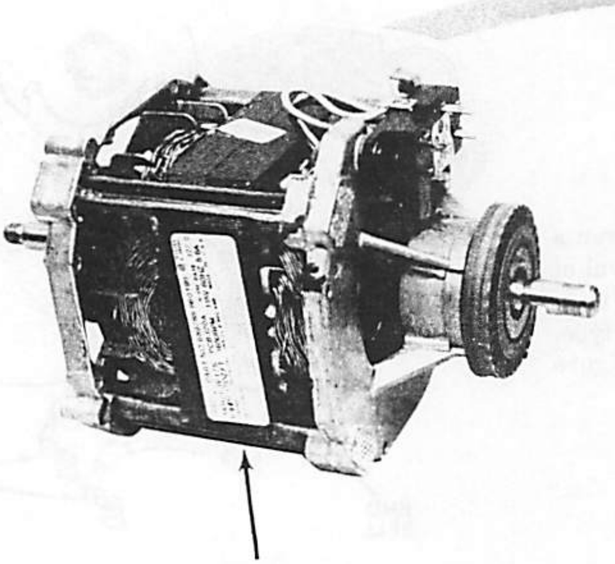
STEP 8 Touch one ohmmeter probe to the terminal on the black wire coming from the motor windings.

STEP 9 Touch the other ohmmeter probe to the terminal on the blue wire coming from the motor windings.

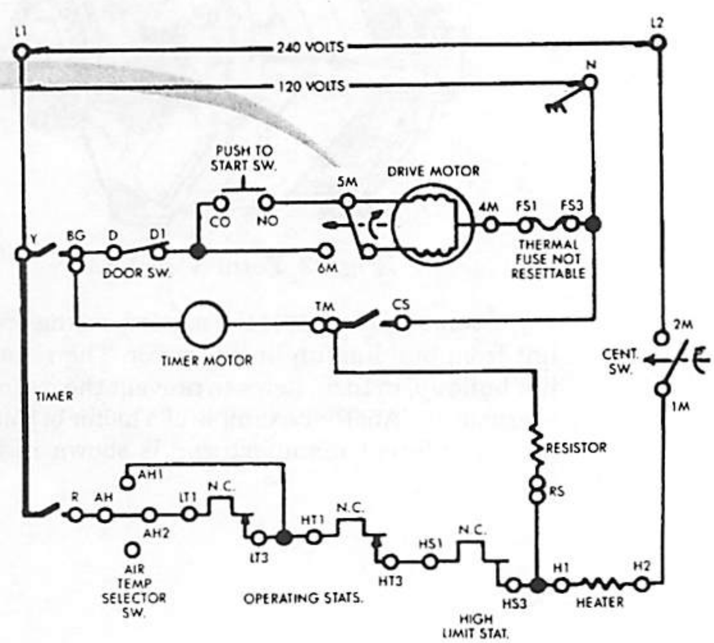
STEP 10 The ohmmeter should show about 1-5 ohms on the ohms scale.

STEP 11 If you do not get this reading, the drive motor is bad and needs replacing.

STEP 12 Reconnect the wires to the proper terminals as previously marked.



DRIVE MOTOR



CENTRIFUGAL SWITCH

The centrifugal switch is operated by the motor revolutions. When the motor reaches approximately 1100 rpm, the switch is activated. This action breaks the circuit to the motor start winding and, at the same time, completes a circuit to the heat source.

The action prevents the heater load and motor start circuit from being energized at the same time. Such an action would result in excessive current draw. It also provides a means of disconnecting the heater circuit should the motor stop or slow down.

The centrifugal switch symbol will have a straight and a curved arrow. The curved arrow signifies a centrifugally operated switch. The straight arrow indicates the direction the switch will throw when the motor is up to speed. Each complete dryer wiring diagram will display two centrifugal switch symbols even though there is only one centrifugal switch assembly, because the assembly has the two sets of contracts, each controlling a separate circuit.

The centrifugal switch contacts can also be checked with an ohmmeter. For example, to check the 5M to 6M contact in a dryer motor centrifugal switch, remove a lead from terminal number 6M and place the meter probes at the 5M and 6M terminals. You should read infinite resistance (no continuity) with the switch in the "at rest" position. See Figure 26.

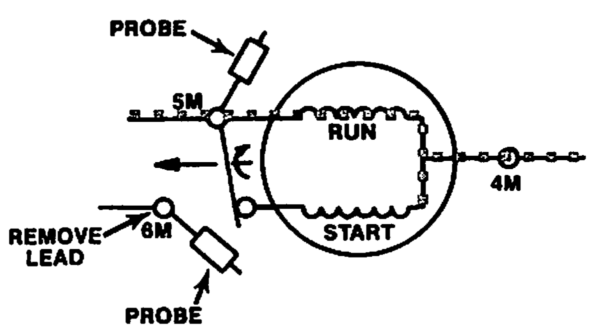


Fig. 26. Checking switch contacts.

Many motors are scrapped because the technician failed to make the simple checks which you have just studied. If the centrifugal switch is found to be defective, the externally mounted switch is replaceable as a service part. Instructions for replacement come with each switch. The instructions are simple. Basically, all that needs to be done is to disconnect the wiring harness; remove two screws securing the switch to the motor.

The design of the switch will vary due to the different motor designs. This is apparent when you look at the various switch configurations shown in Figure 27. As you look at the switches, you can also see that you should use extreme care to order the correct switch, and to install it so that the switch arm is not damaged. Follow the installation instructions carefully when reinstalling the wiring on the switch terminals, because the terminal locations may be different than the original.

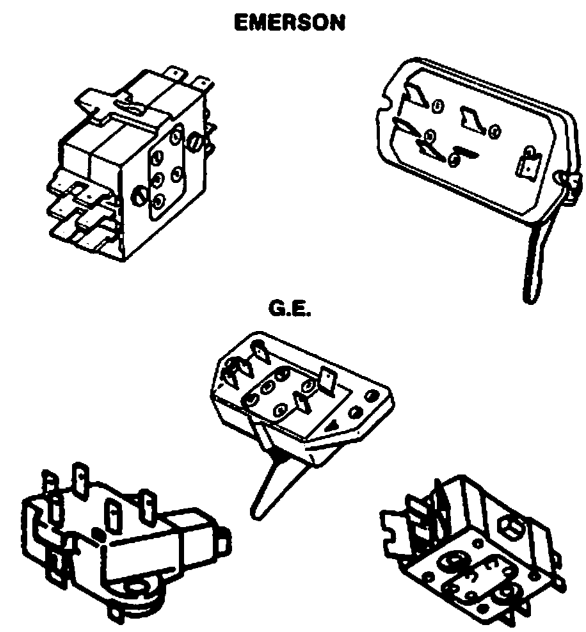
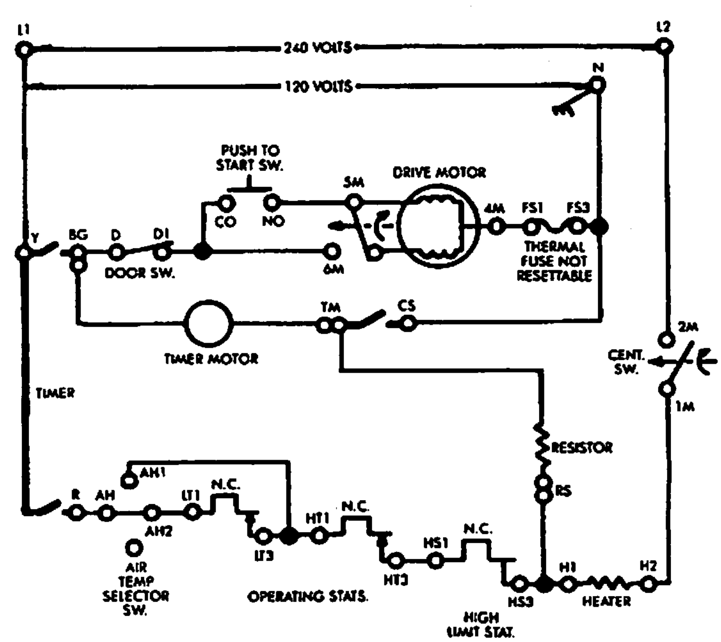


Fig. 27. Centrifugal switches.



TIMER

The timers on all dryers which use a mechanical timing control are similar in design and operation. Each timer consists of two basic components assembled into one unit. The components are the enclosure for the motor and the speed-reduction gear, and switch box. See Figure 28.

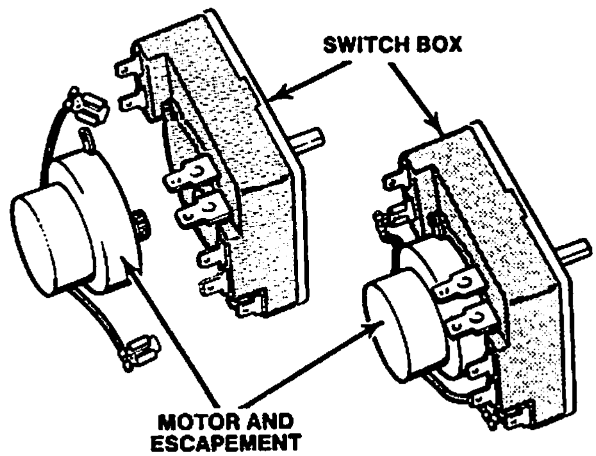


Fig. 28. Timer assembly.

Timer motors may vary slightly with different sources of manufacture, but all function in the same manner.

The switch box contains one or more cams, each of which is a circular piece of composition material fixed on a revolving shaft. The cam is shaped so that a cam follower, which rides on the outer contour of the cam, is forced alternately up or down, making or breaking contacts as the cam revolves. See Figure 29.

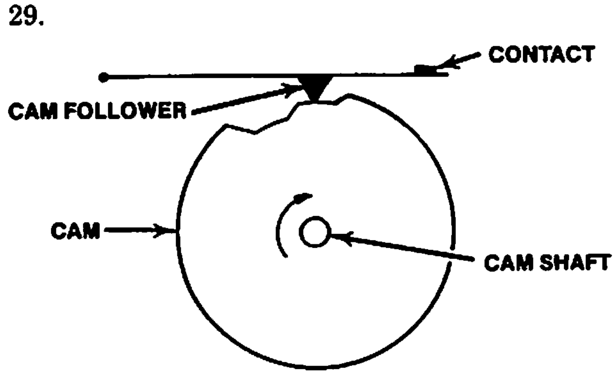


Fig. 29. Single-cycle timer cam.

The timer motor, through speed-reduction gears, rotates the timer cams. The amount of time for one revolution varies, depending on the timer design. In fact, the total time for one revolution of the timer is not important because most dryers have several cycles on the dial. You can find the time for each timed cycle listed on the chart titled "Timer Schedule in Minutes."

Dryer timers can be divided into four basic categories: one cycle, two cycle, three cycle and four cycle.

ONE AND TWO-CYCLE TIMERS

One and two-cycle timers are the most simple to explain. Usually, each horizontal bar on the timer schedule represents a separate cam. The cam is notched as shown in Figure 30. The cam is shown in different positions to show how one cam with dual switch contact points can control several dryer functions.

In the top view (A), the cam has forced the cam follower up so that the circuits to the heat element and the main motor are closed.

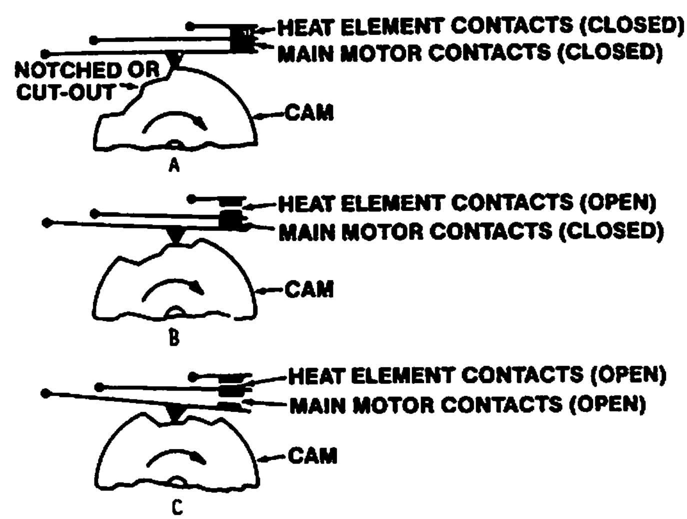


Fig. 30. Dual-cycle timer cam.

In the center view (B), the cam follower has been permitted to drop slightly, breaking the circuit to the heating component, but still permitting current to flow to the main motor. This happens during the last few minutes of the cycle permitting the clothes to tumble in unheated air (cool-down) so that they will be comfortable to handle and will not wrinkle at the end of the cycle.

View C shows the timer cam and contacts when the dryer has completed its cycle, and both the heat function and main motor circuits are open.

THREE- AND FOUR-CYCLE TIMERS

Three- and four-cycle timers are basically the same as the single- and dual-cycle timers. The major differences are the separate and distinct cycle cuts on the cams. Therefore, we will use the three-cycle cam as an example.

On some timers as many as four contacts are made or broken by the action of one cam. The third and fourth contacts may be used to control the console lights and cycle end signal. See Figure 31.

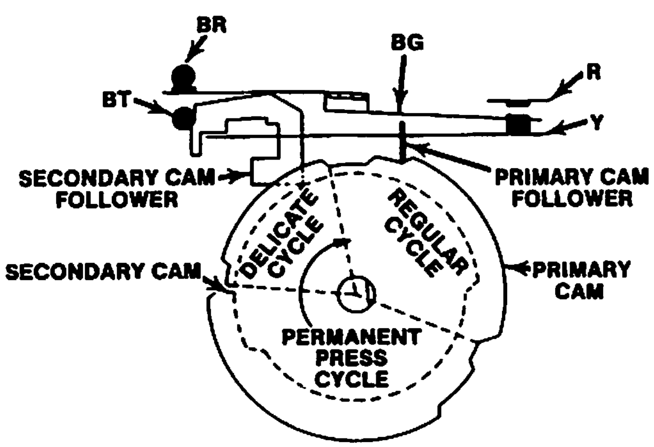


Fig. 31. Three-cycle timer cams.

TIMING THE DRYING FUNCTION

The timing of the drying function has been achieved by several different methods of timer motor control such as:

1. Timer motor started and terminated by timer cam operation.

2. Automatic timer termination by the temperature controls. The timer motor operates only when the temperature of the dryer air opens a thermostat.

The complete timer can be checked with a few simple tests. Timer failure is usually caused by one of three things.

a. The timer motor will not run.

b. Switch contacts do not "make."

c. The timer does not advance.

This basic wiring diagram will help you to understand the timer function. See Figure 32. Once you understand the basic timer circuitry, we will explain the simple steps necessary for checking the timer.

In this wiring diagram you can see that current is led to the timer motor from L1 through timer contacts Y to BG. These contacts also control the circuit to the dryer drive motor. Notice that the circuit to the motor is through the door switch D1 to D. Notice also that the push-to-start switch must make contact before the motor starts to run. Timer contact Y to R must close before the heater can be energized. Looking at the TIMER SCHEDULE IN MINUTES, you can see that Y to BG contacts are closed for the entire NORMAL cycle. The Y to R contacts are closed, except for the last five minutes of the normal cycle.

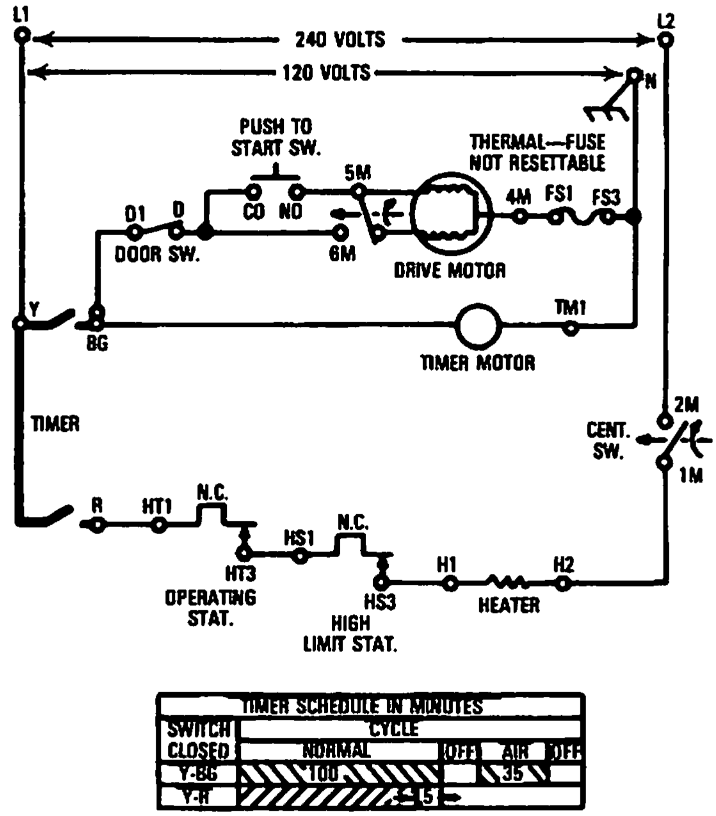


Fig. 32. Basic dryer wiring diagram.

Keep in mind that this is a wiring diagram for an electric dryer, but the wiring diagram for a gas dryer would be the same except that terminals H1 and H2 would be attached to the gas burner instead of the electric heating element.

The timer in this dryer is designed for two cycles, NORMAL and AIR. On the NORMAL cycle there are 100 minutes of time available. On the AIR cycle there are 35 minutes of time available. When AIR is selected, there is no heat because Y to R contacts are open, as you can see by looking at the bar chart.

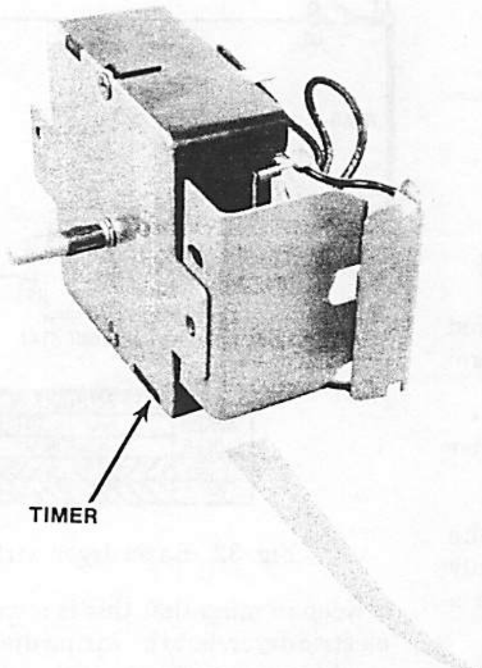
CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the timer. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 See example in steps 4-7. Turn the timer knob to the point in the cycle you suspect is bad.

STEP 3 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.



STEP 4 EXAMPLE: Move the timer dial to any heat cycle. PROBLEM—Clothes dryer does not heat.

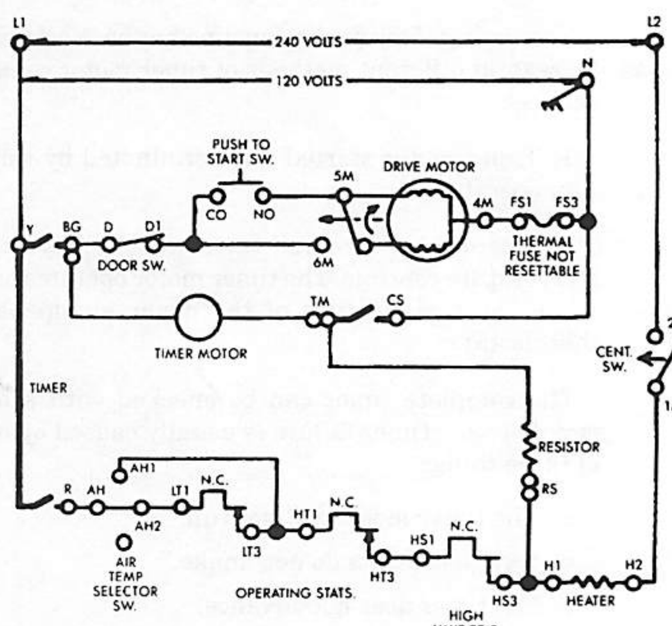
STEP 5 Touch one ohmmeter probe to terminal Y.

STEP 6 Touch the other ohmmeter probe to terminal R.

STEP 7 The ohmmeter should show ZERO resistance (continuity). If not, the timer is bad and needs replacing.

STEP 8 Reconnect the wires to the proper terminals as previously marked.

NOTE: It may be possible to install the timer upside down or sideways. Make note of its position on the bracket.

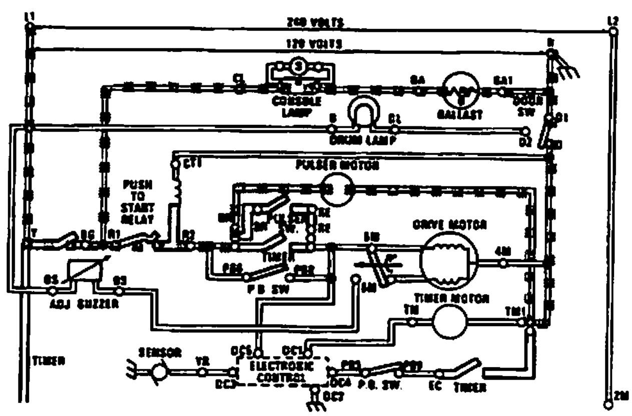


PULSER TIMER

Automatic dryers with a Wrinkle Guard or Finish Guard feature are equipped with a second timer called a pulser timer. The pulser timer assembly contains a timer motor and a cam-operated switch. On recent production models this is accomplished with only one motor.

The purpose of the pulser timer is to turn the dryer motor on periodically (after the dryer has cycled off) for 10 to 30 seconds (depending on your model) every 5 minutes and sound the buzzer approximately 3 seconds until the dryer is opened and the load removed. This reduces the setting of wrinkles in the fabric. The following wiring diagrams will demonstrate what happens at the end of the cycle, when the pulser timer controls the dryer operation.

Four minutes before the end of the cycle the main timer switch BR (P1) to RE (P2) opens and breaks the circuit to the drive motor and the main timer motor. The pulser timer is now in control. See Figure 33.



TIMER SCHEDULE IN MINUTES				
SWITCH CLOSED	CYCLE: AUTO	OFF	TIMED	OFF
Y-R	12		12	
EC-TM1				
Y-BG	45		63	
BR-RE	4		4	

PULSER SCHEDULE IN MINUTES		
BR-RE	1/2	4-1/2

Fig. 33. Pulser-timer switch open.

In Figure 33, the only active circuits are the console lamp, the relay and the pulser motor, because the pulser switch Y to RE is open.

Once every 5 minutes, Y to RE (P2) closes for about 30 seconds on this model. At the instant contact is made, the timer motor and the drive motor start to run. They will run for the thirty seconds that the pulser contact BR (P1) to RE (P2) is closed. See Figure 34. Notice that contacts 5M to 6M are closed at this time and there is a potential circuit through the buzzer. The buzzer does not sound off while the pulser switch is closed because the current is following the path of least resistance through the motor. When the pulser switch BR (P1) to RE (P2) opens, the buzzer sounds off because its circuit is through the motor centrifugal switch contacts for a few seconds while the motor is coasting to a stop. Since the pulser switch is closed only 30 seconds out of every five minutes, it will take the main timer 40 to 45 minutes to advance to the OFF position.

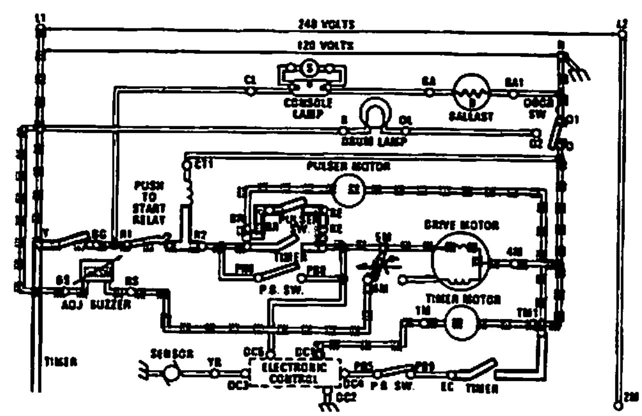


Fig. 34. Pusler-timer switch closed.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the timer. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

STEP 3 Touch one ohmmeter probe to terminal BR (P1).

STEP 4 Touch the other ohmmeter probe to terminal TM1 (P4).

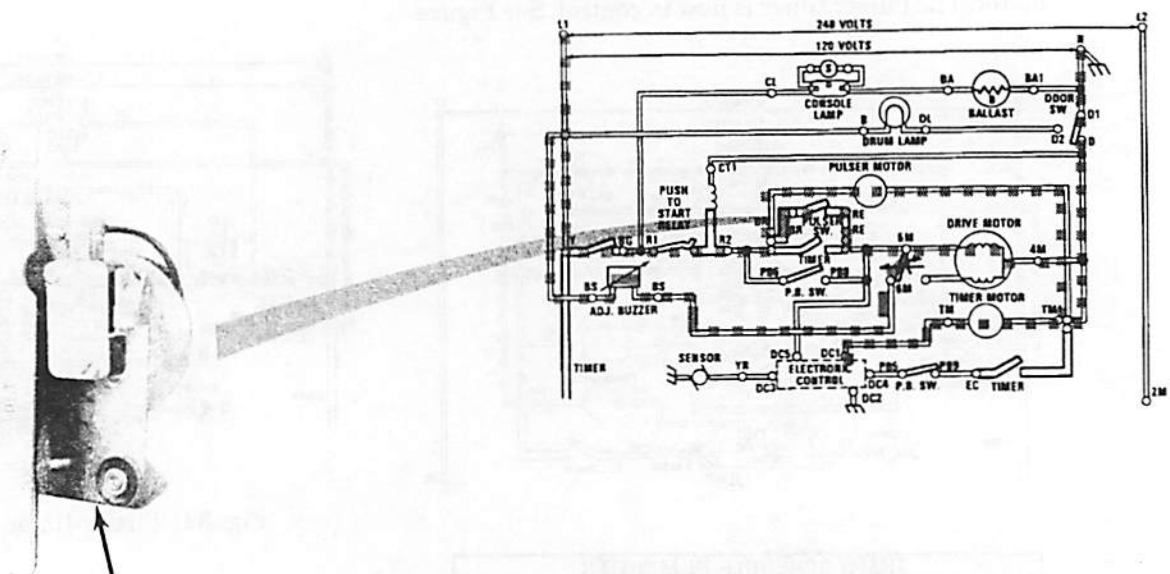
STEP 5 The ohmmeter should show between 2,000-3,000 ohms on the ohms scale. If not, the pulser timer is bad and needs replacing.

STEP 6 Touch one ohmmeter probe to terminal BR (P1).

STEP 7 Touch the other ohmmeter probe to terminal RE (P2).

STEP 8 The ohmmeter should show an open circuit. If not, the pulser timer is bad and needs replacing.

STEP 9 Reconnect the wires to the proper terminals as previously marked.



PULSER TIMER

TIMER MOTOR

Timer motors may vary slightly in appearance, but regardless of the differences each functions in the same manner as the others. It is a synchronous-type motor, similar to those used in electrical clocks, with a small pinion which drives a gear.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the timer motor. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

STEP 2 Refer to the instructions that came with your ohmmeter to find the proper scale to measure 2,000-3,000 ohms. Set the ohms scale and ZERO the meter.

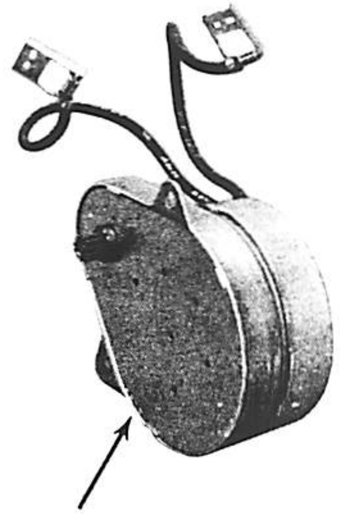
STEP 3 Touch one of the ohmmeter probes to one of the timer/pulser motor wire terminals.

STEP 4 Touch the other ohmmeter probe to the other timer/pulser motor wire terminals.

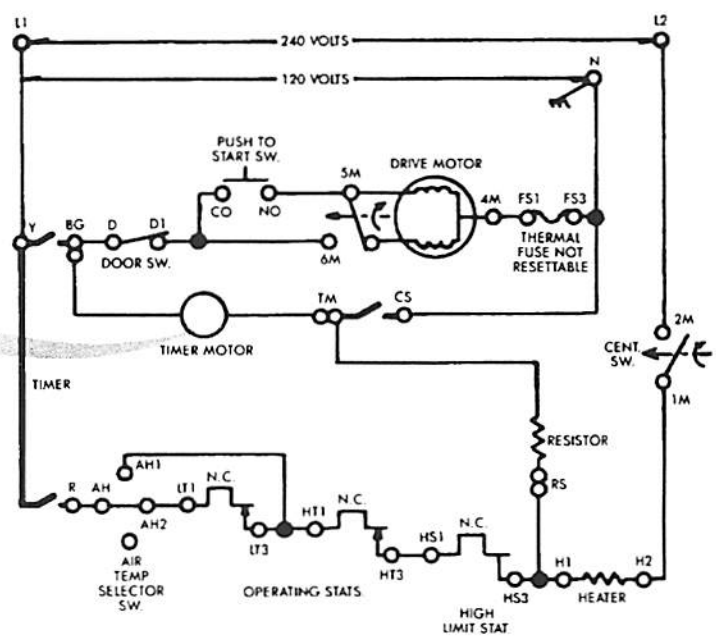
STEP 5 The ohmmeter should show between 2,000-3,000 ohms on the ohms scale. If you do not get this reading, the timer/pulser motor is bad and needs replacing, or replace the complete timer or pulser timer.

STEP 6 Reconnect the motor wires to the proper terminals or harness wire as previously marked.

NOTE: If you get this reading, the timer motor could still be bad from a mechanical problem inside the motor. This condition can only be checked by running a voltage check.



TIMER MOTOR



THERMAL CUT-OFF

This thermal cutoff located on the upper part of the heater box, is used as a backup for a failed hi-limit thermostat or overheated grounded heat element.

It is recommended that the hi-limit thermostat be checked for proper operation whenever the thermal cutoff is replaced.

The following checks should be made when the thermal cutoff is replaced.

A. Heat element.

B. Plugged lint screen.

C. Blocked, clogged or kinked exhaust duct.

D. Too long exhaust, too many elbows with less than 4" diameter pipe.

E. Exhaust hood flapper does not work.

F. Blower wheel not in place or not turning with motor.

G. Drive motor
 1M-2M contacts—should show an open circuit.

H. Timer
 Heat circuit contacts—should show an open circuit with the timer in the OFF position.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the thermal cutoff. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

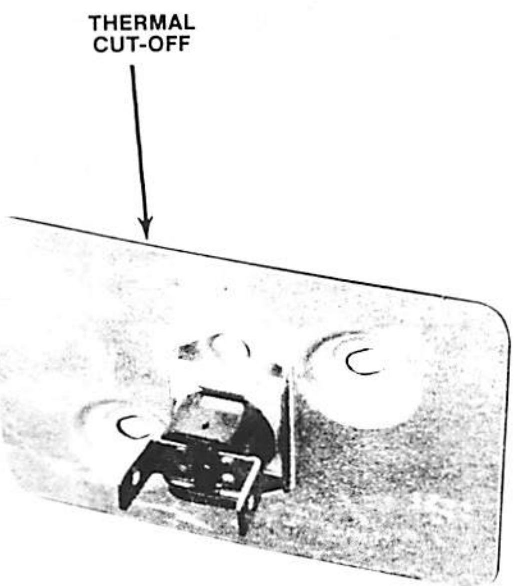
STEP 2 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

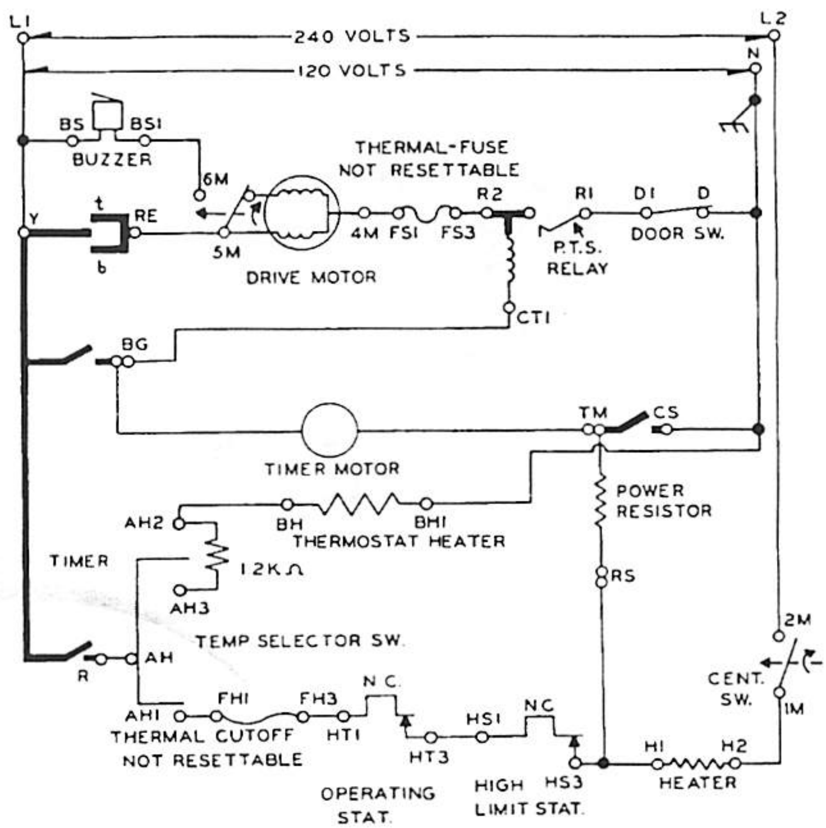
STEP 3 Touch one ohmmeter probe to one of the terminals on the thermal cutoff.

STEP 4 Touch the other ohmmeter probe to the other terminal on the thermal cut-off.

STEP 5 The ohmmeter should show ZERO resistance (continuity). If not, the thermal cut-off is bad and needs replacing.

STEP 6 Reconnect the wires to the proper terminals as previously marked.





BIAS HEATER

A new 4-watt thermostat heater is being phased into production on all bias system dryers.

This new 4-watt heater will improve the earlier bias system, especially at lower temperature settings.

This bias system eliminates the use of other operating thermostats to control different temperatures.

This type heater is used in conjunction with a temperature switch and a bias thermostat.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the dryer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the bias heater. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

NOTE: You will have to determine if you have a 3-watt or 4-watt heater. Any model built before August 1985 will have a 3-watt and any model built after this date will have a 4-watt.

STEP 2 Refer to the instructions that came with your ohmmeter to find the proper scale to measure 3,240-4,000 (4 watt) ohm or 4,200-5,300 (3 watt) ohms. Set the ohmmeter scale and ZERO the meter.

STEP 3 Touch one ohmmeter probe to one of the terminals.

STEP 4 Touch the other ohmmeter probe to the other terminal.

STEP 5 The ohmmeter should show between:

4 watt = 3,240-4,000
3 watt = 4,200-5,300

on the ohms scale. If you do not get this reading the bias heater is bad and needs replacing.

STEP 6 Reconnect the wires to the proper terminals as previously marked.

BIAS (THERMOSTAT) HEATER