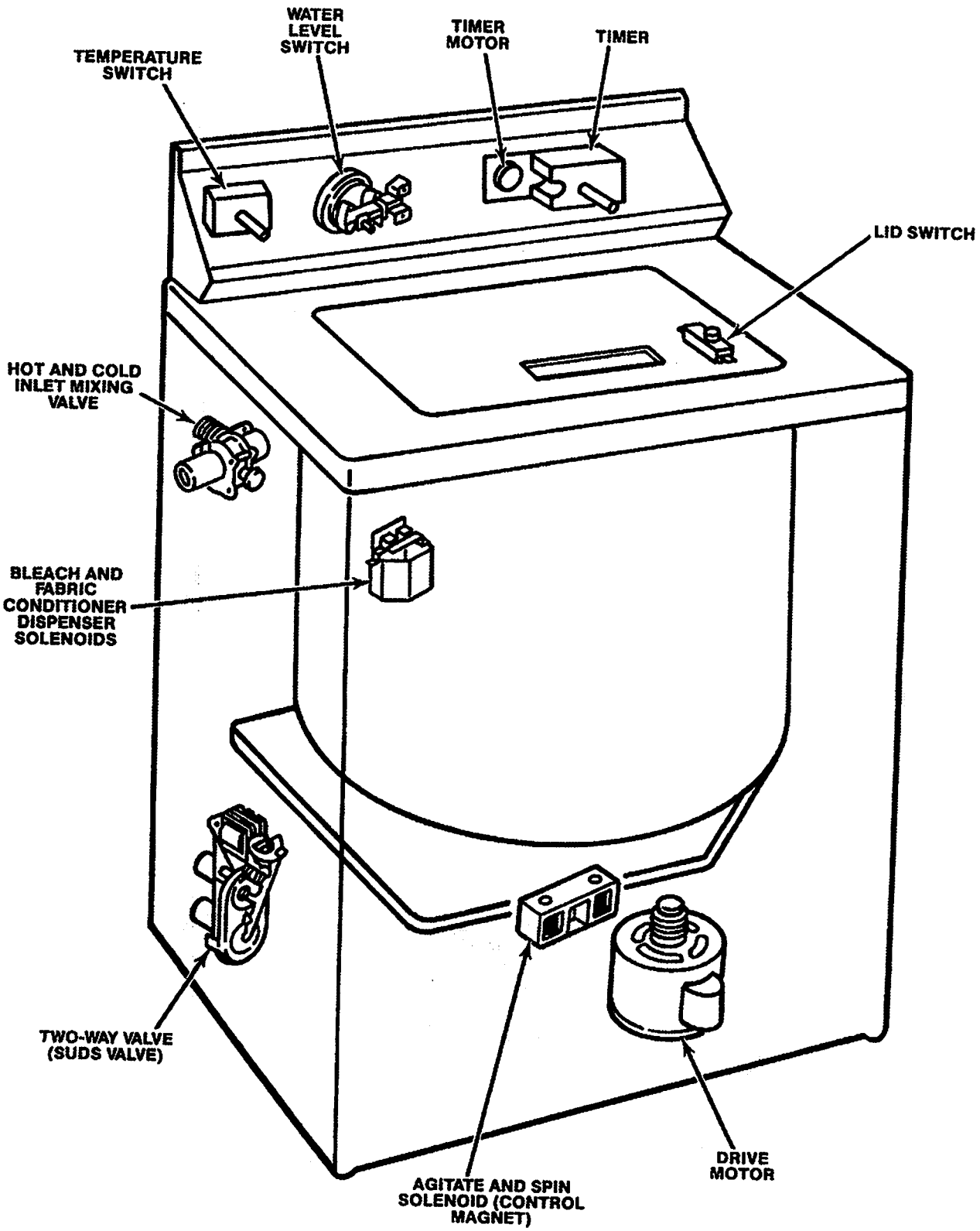
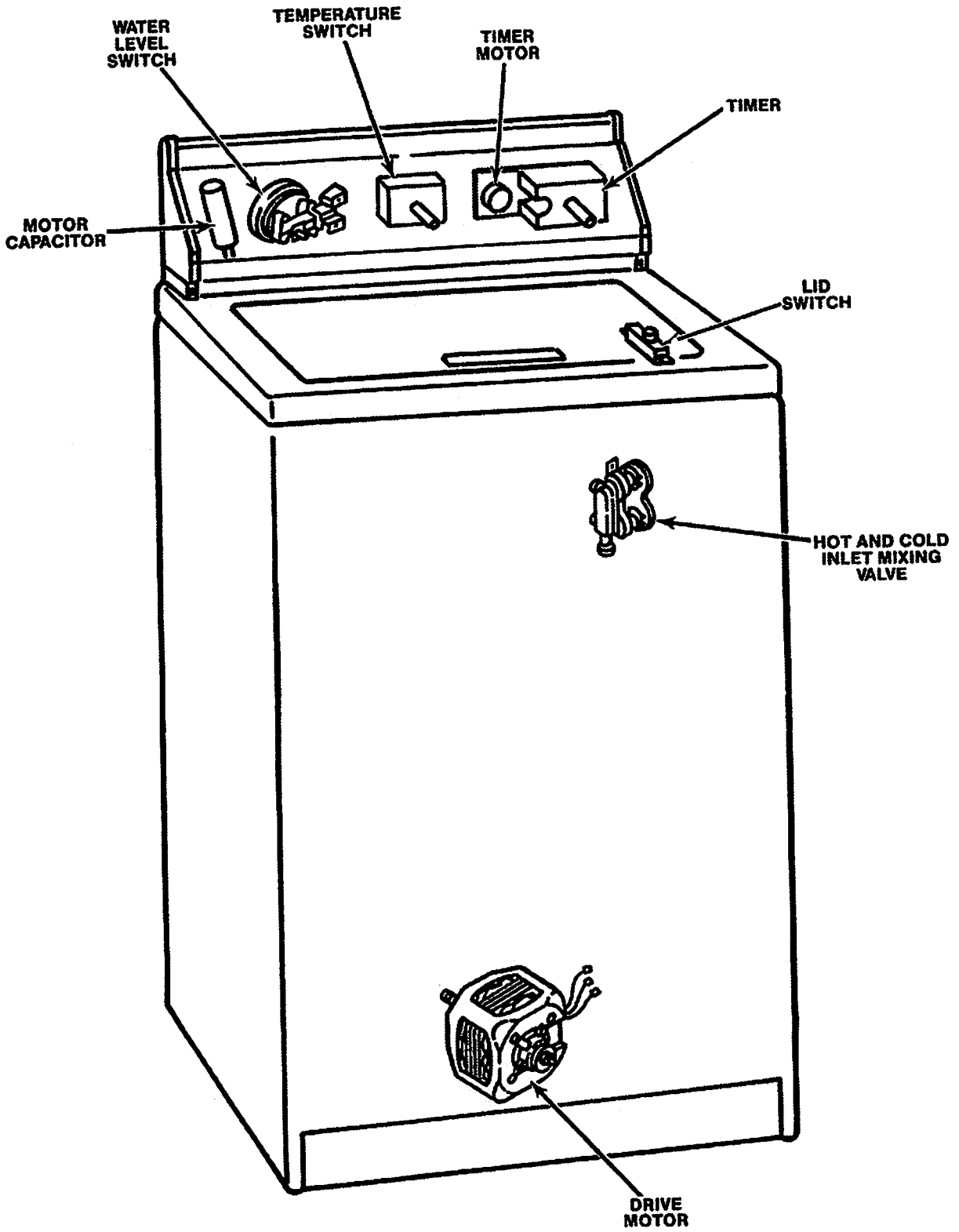
CHAPTER 1
ELECTRICAL COMPONENTS



VIEW OF BELT DRIVE AUTOMATIC WASHER SHOWING ELECTRICAL COMPONENTS (SOME OF THESE PARTS MAY NOT BE USED ON ALL MODELS)

Module 1



VIEW OF DIRECT DRIVE AUTOMATIC WASHER SHOWING ELECTRICAL COMPONENTS

CONDITIONER DISPENSER (BLEACH/RINSE OR FABRIC CONDITIONER SOLENOIDS)

These solenoids are used to electrically control the dispensing of liquid laundering additives at the proper time during the machine cycle.

The reservoir for holding the liquid laundering additives is divided into two cavities, bleach and fabric softener. Each dispenser is operated by an independent solenoid which raises a plunger-type plug, releasing additives into the water recirculating system.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 conditioner or solenoids. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

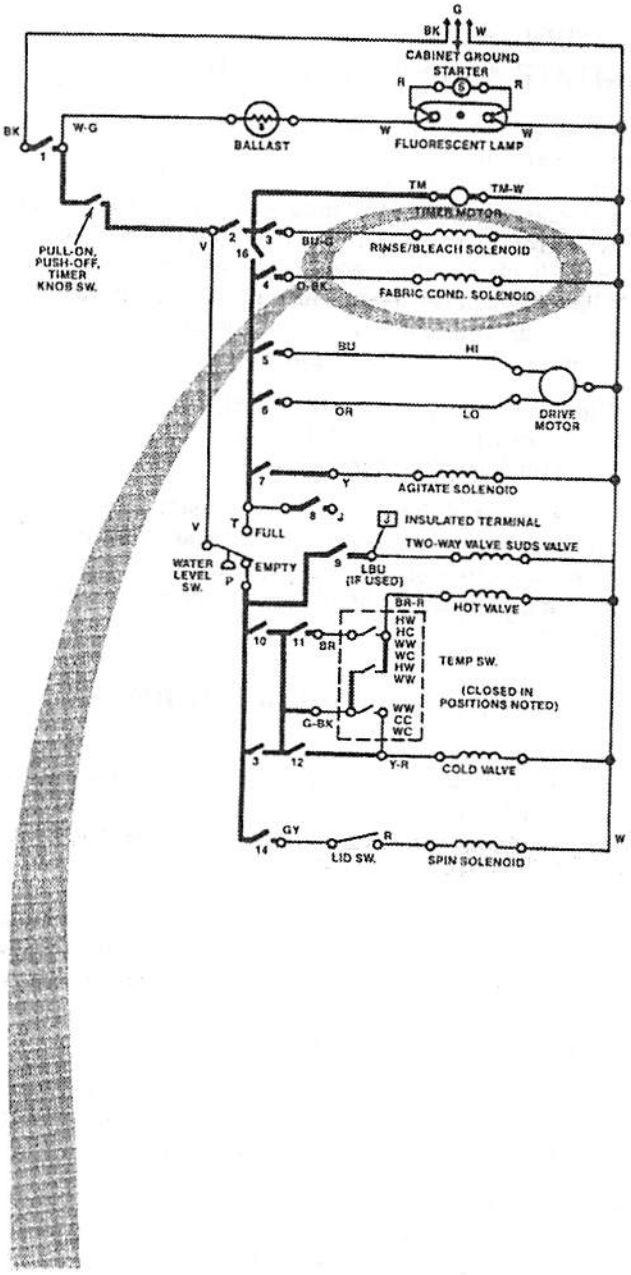
STEP 2 Refer to the instructions that came with your ohmmeter to find the proper scale to measure 200-500 ohms. Set the ohms scale and ZERO the meter.

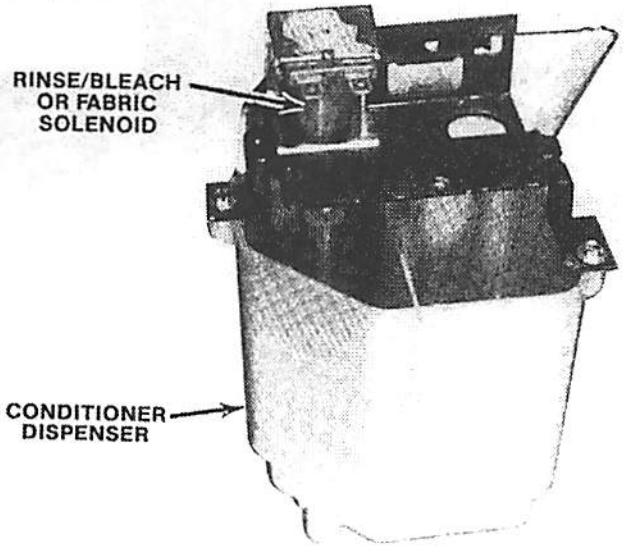
STEP 3 Touch one ohmmeter probe to one of the terminals on the solenoid and the other probe to the other terminal, on the same solenoid.

STEP 4 The ohmmeter should show between 200-500 ohms on the ohms scale. If not, the solenoid is bad and needs replacement.

STEP 5 Check the other solenoid the same way as in steps 2-4.

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





CONTROL MAGNET (AGITATE AND SPIN SOLENOIDS)

The agitate and extractor (spin) control solenoids are identical and are mounted parallel in a vertical position on the same bracket. This bracket, with the solenoids included, is called a control magnet assembly (wig wag). This control magnet assembly is mounted on the sector gear shaft of the gear case. It moves back and forth (oscillates) whenever the machine motor is running. The extractor or spin control solenoid is on the left with the agitate solenoid on the right.

When the spin solenoid is energized, it raises a plunger which moves the spin cam bar in such a manner as to cause the basket to spin.

The function of the agitate control solenoid is to raise a plunger which moves the agitate cam bar in such a manner as to engage the agitator and at the same time change the direction of the flow of water through the pump.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 control magnet or solenoids. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

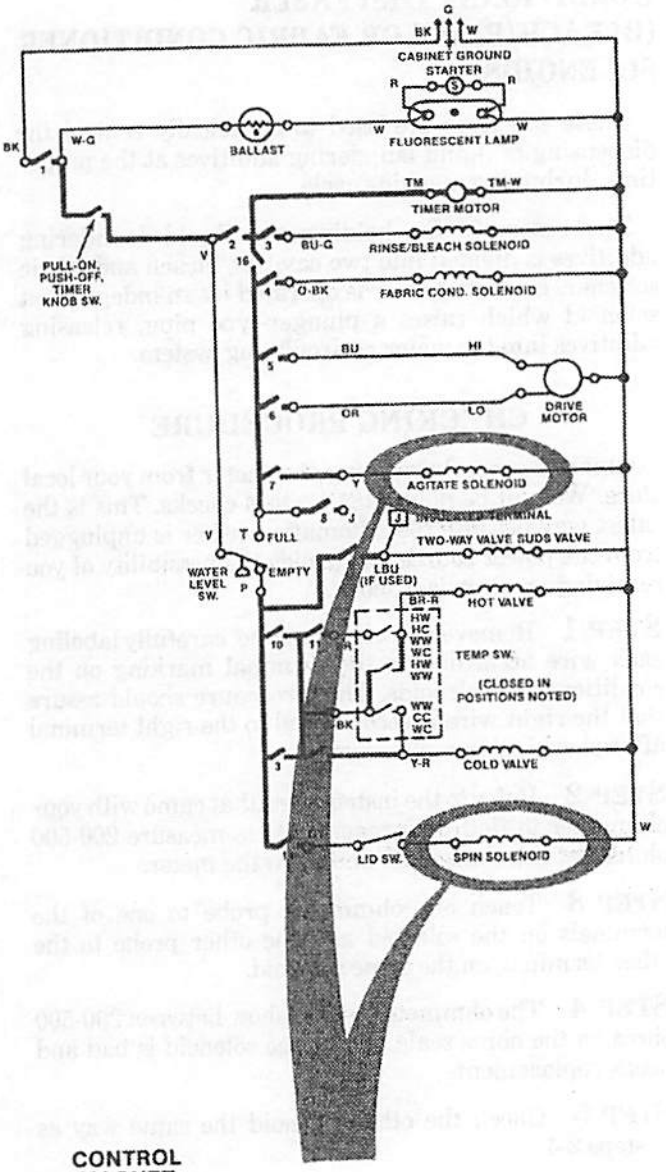
STEP 2 Refer to the instructions that came with your ohmmeter to find the proper scale to measure 200-700 ohms. Set the ohms scale and ZERO the meter.

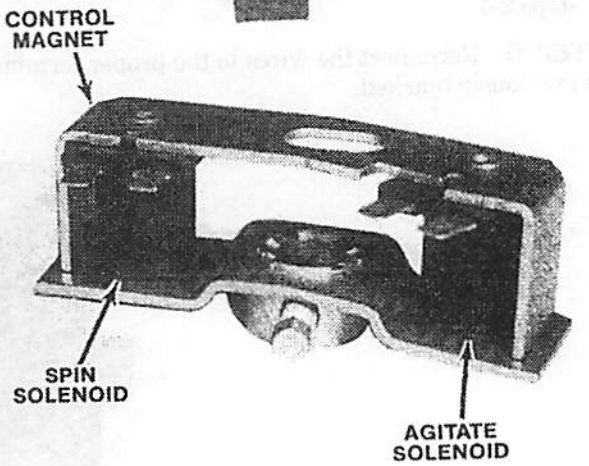
STEP 3 Touch one ohmmeter probe to one of the terminals on the solenoid and the other probe to the other terminal, on the same solenoid.

STEP 4 The ohmmeter should show between 200-700 ohms on the ohms scale. If not, the control magnet is bad and needs replacement.

STEP 5 Check the other solenoid the same way as in steps 2-4.

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





TWO-WAY VALVE (SUDS VALVE)

All washers equipped with the suds-saving feature require the use of a two-way valve solenoid. This solenoid is used to provide an automatic method for closing the drain port and opening the suds port on the two-way valve. Thus, the wash water can be directed into a suds storage tub or returned from the suds storage tub to the machine for reuse.

The bottom end of the two-way valve solenoid pivots on the valve body, while the top of the armature is anchored to the valve operating lever which is spring loaded. When the solenoid is de-energized this spring-loaded lever quickly pulls the armature out of the center of the solenoid coil, closing the suds port and opening the drain port of the valve. When the solenoid is energized, the suds port is opened and the drain port 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 automatic washer is unplugged from the power source and avoids the possibility of you receiving an electrical shock.

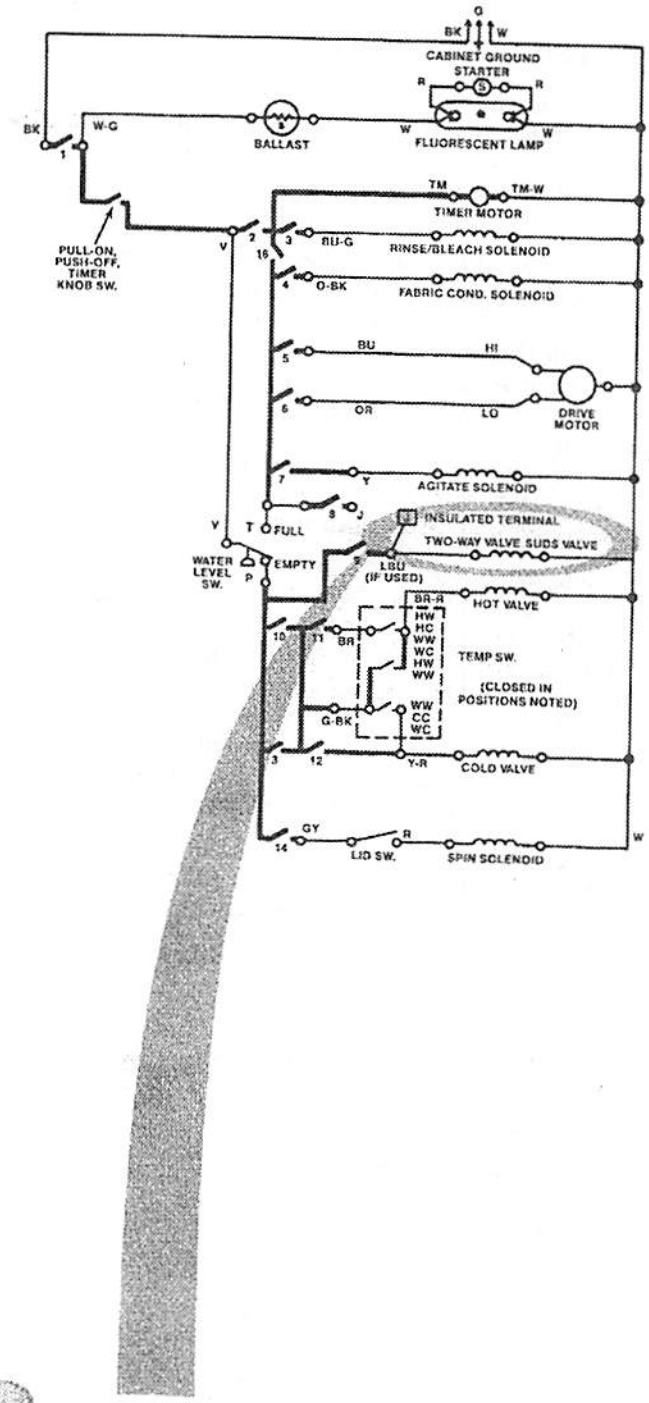
STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the two-way valve or solenoids. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

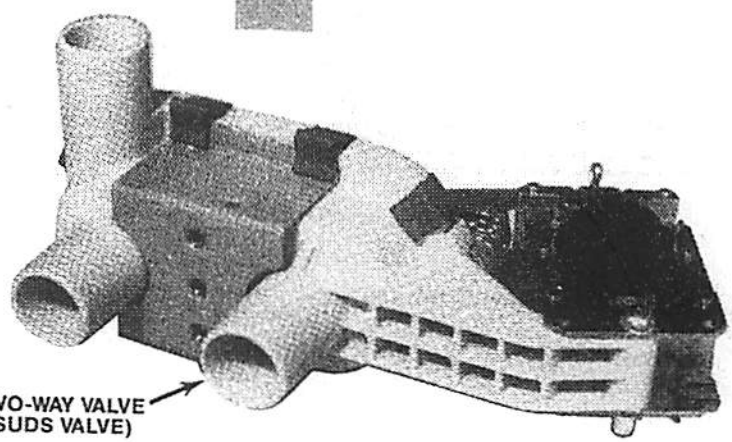
STEP 2 Refer to the instructions that came with your ohmmeter to find the proper scale to measure 10-15 ohms. Set the ohms scale and ZERO the meter.

STEP 3 Touch one ohmmeter probe to one of the terminals on the solenoid and the other probe to the other terminal, on the same solenoid.

STEP 4 The ohmmeter should show between 10-15 ohms on the ohms scale. If not, the two-way valve is bad and needs replacement.

STEP 5 Reconnect the wires to the proper terminals as previously marked.





WATER LEVEL SWITCH

The pressure-type, water-level control is a single-pole, double-throw switch activated by a diaphragm. A 3/16-inch plastic pressure tube connects this switch to the fill control pressure dome mounted on the side of the tub.

The main function of the water level switch is to control the amount of water that enters the tub. During the FILL portion of the cycle, a circuit is completed through the switch contacts of the water level switch and the timer to the water control solenoids on the water inlet valve, permitting water to enter the machine. As soon as the correct water level is reached in the tub, this circuit opens. At the same time the circuit to the timer motor, and through the timer switch contacts to the drive motor and agitate solenoid is completed.

Note the water level switch in Fig 1. As the tub fills with water, an air pocket is formed in the plastic tube. As the water rises in the tub, the air pressure in the tube increase until it is sufficient to cause the diaphragm to actuate the switch contacts; thus, opening the circuit to the water control solenoids and stopping the flow of water into the tub. As the water drains out of the tub, the air pressure in the tube decreases, gradually allowing the diaphragm to reset the switch contacts.

Four styles of pressure switches have been used—single-level, two-level, three-level, and the infinite-level switch. Do not try to adjust the factory set water levels.

The single-level pressure switches are factory set.

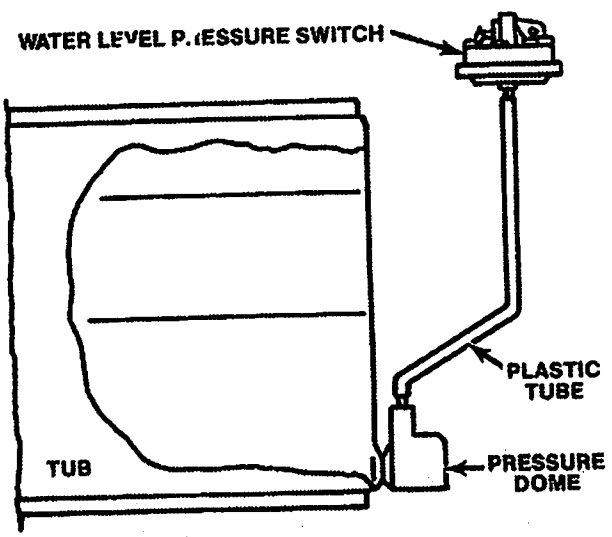


Fig. 1. Water level switch action.

The two, three, and infinite level switches have an adjustable setting that turns a cam. This increases or decreases the pressure on the diaphragm.

On machines using the infinite-type pressure switch, set the selector knob to a LOW setting, water will enter the tub to a low setting. When the switch is set at HIGH the tub will fill to the high setting. By setting the selector knob at any position between LOW and HIGH, the amount of water entering the tub will vary, depending on the setting.

Finally, the infinite-type water level switch also has a RESET position, so the user can add additional water if the first setting did not supply the desired water level. To do this the operator merely turns the selector knob to the RESET position; then to any position higher than the original setting.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 water level 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.

NO WATER IN TUB

STEP 3 Touch one ohmmeter probe to terminal V and the other probe to terminal P.

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

STEP 5 Touch one ohmmeter probe to terminal V and the other probe to terminal T.

STEP 6 The ohmmeter should show an open circuit. If not, the water level switch is bad and needs replacing.

TUB FULL OF WATER

STEP 7 Touch one ohmmeter probe to terminal V and the other probe to terminal T.

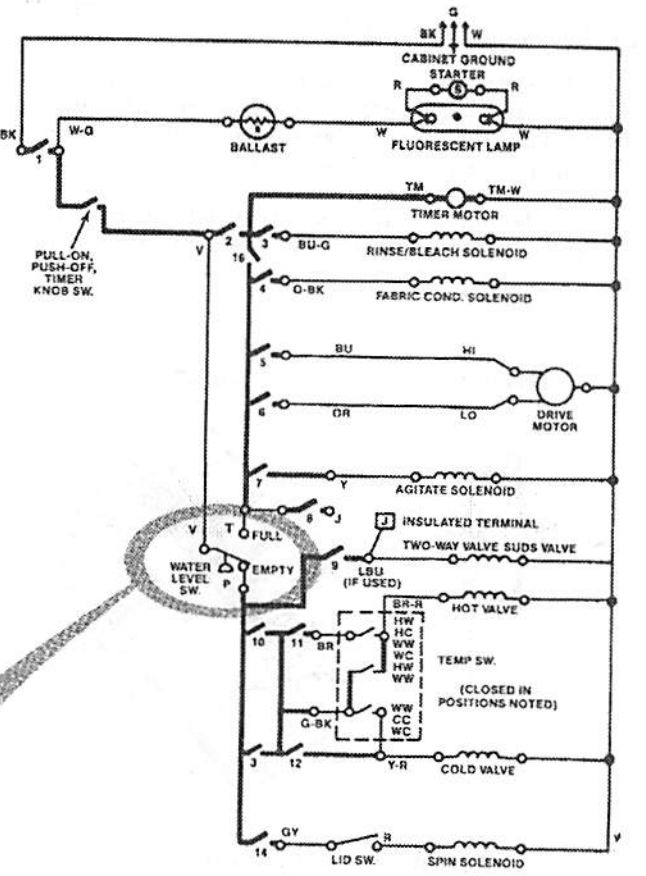
WATER LEVEL SWITCH

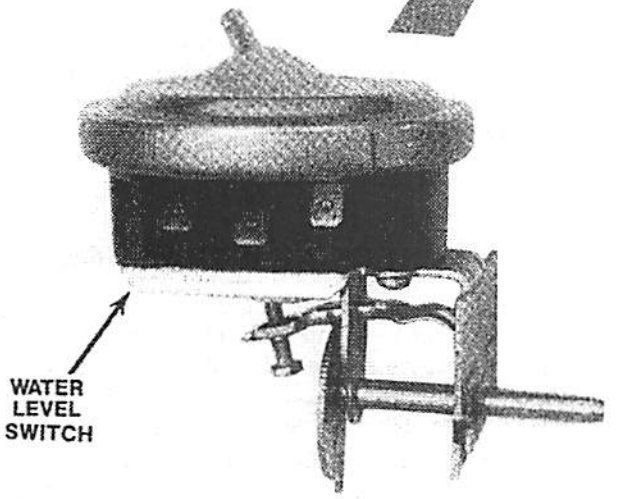
STEP 8 The ohmmeter should show ZERO resistance (continuity). If not, the water level switch is bad and needs replacing.

STEP 9 Touch one ohmmeter probe to terminal V and the other probe to terminal P.

STEP 10 The ohmmeter should show an open circuit. If not, the water level switch is bad and needs replacing.

STEP 11 Reconnect the wires to the proper terminals as previously marked.





TEMPERATURE SWITCH

Automatic washers equipped with a water mixing valve will also incorporate a water temperature control switch. Two types are shown in Fig. 2; the rotary-type is on the left, and the pushbutton type at the right.

The water temperature selections available on those washers equipped with rotary-type switches will vary

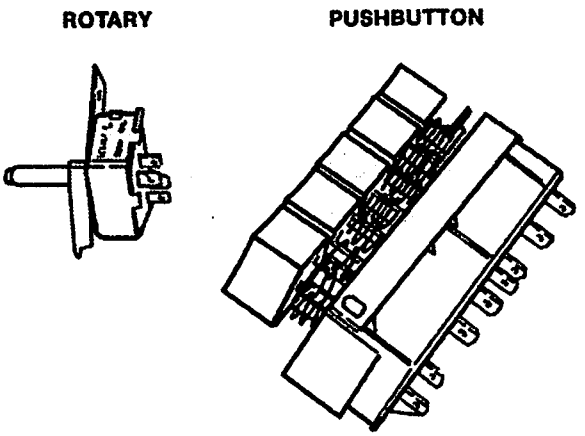


Fig. 2. Water temperature switches.

according to the particular model. Some models use rotary switches which offer a combination of three selections of wash and rinse temperature. Other models use rotary switches which offer a combination of five selections of wash and rinse temperature.

The rotary-switch wiring diagram in Fig. 3 shows a combination of selection of hot or warm wash and warm rinse temperature. When the upper switch contact is closed, the hot water solenoid will be energized. When the lower switch contact is closed, the cold water solenoid will be energized. When both switch contacts are closed, both the hot and cold water solenoids will be energized and warm water will result.

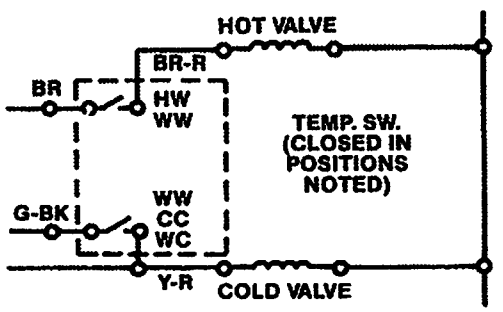


Fig 3. Water temperature switch wiring diagram.

The switch diagramed in Fig. 4 provides a combination of five selections of hot, warm, and cold for both the wash and rinse water temperature. The only difference lies in the additional contact, which provides more wash and rinse water selections. Note that the letters next to the switch contacts denote each switch function. The letters to the right of each contact denote the closing sequence by temperature selection—*H* for hot, *W* for warm, and *C* for cold. The first letter is the wash water temperature, and the second the rinse

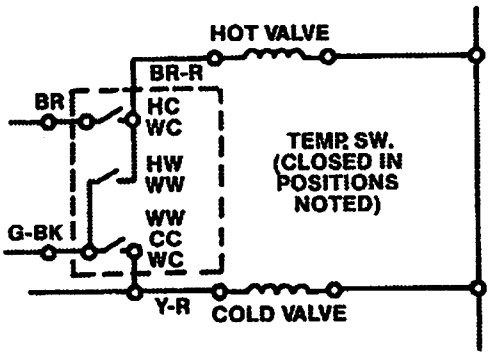


Fig 4. Five selection switch wiring diagram.

water temperature. For example, *HC* denotes hot water wash and cold water rinse. It should be pointed out that the timer is also utilized to control the water temperature at certain times during the cycle. The power to the temperature switch is supplied through the timer switch. Thus, in our previous example *(HC)*, no power is available at the brown lead during rinse so even with the upper switch closed, the hot water solenoid will not be energized.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 water 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 pushbutton to each setting and check the proper terminals.

Temperature Switch

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

SWITCH SETTING	TERMINAL MARKING ON SWITCH
Hot/Warm	G-BK to BR-R
Hot/Cold	BR to BR-R
Warm/Warm	BR to BR-R & G-BK to Y-R, G-BK to BR-R
Warm/Cold	BR to BR-R & G-BK to Y-R
Cold/Cold	G-BK to Y-R

Step 4 EXAMPLE: Set temperature switch to (warm/cold). This closes two contacts inside the switch, BR to BR-R and G-BK to Y-R.

Step 5 Touch one ohmmeter probe to terminal BR and the other probe to terminal BR-R.

Step 6 The ohmmeter should show ZERO resistance (continuity). If not, the temperature switch is bad and needs replacing.

Step 7 Touch one ohmmeter probe to terminal BR and the other probe to the rest of the terminals without touching terminal BR-R.

Step 8 The ohmmeter should show an open circuit when checking these other terminals. If not, the temperature switch is bad and needs replacing.

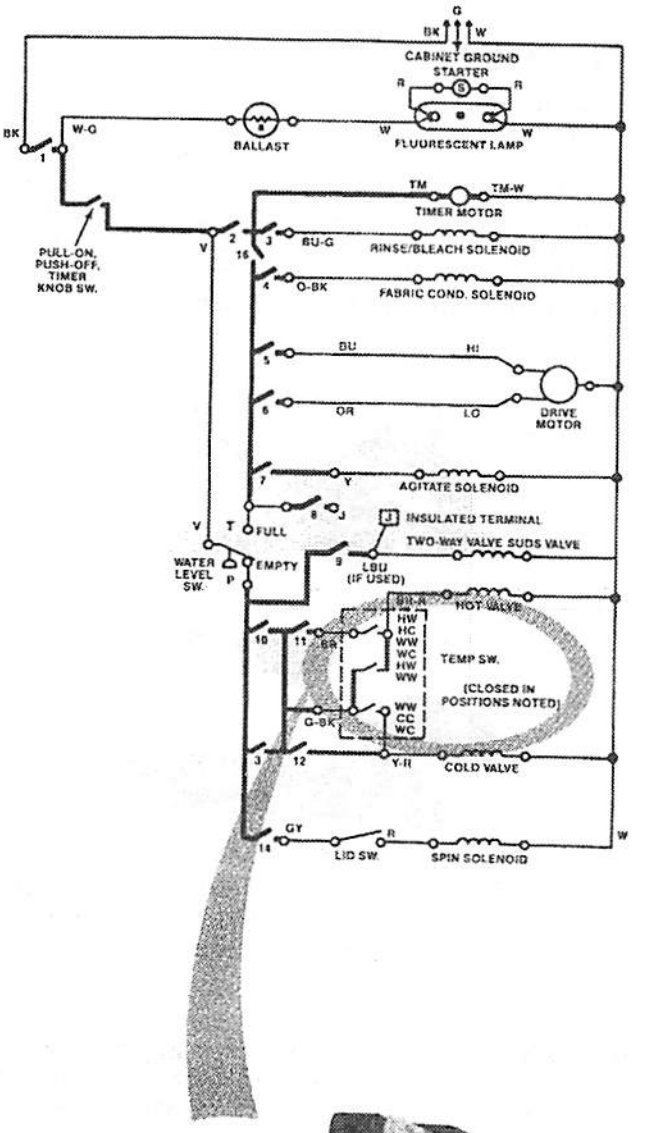
Step 9 Touch one ohmmeter probe to terminal G-BK and the other probe to terminal Y-R.

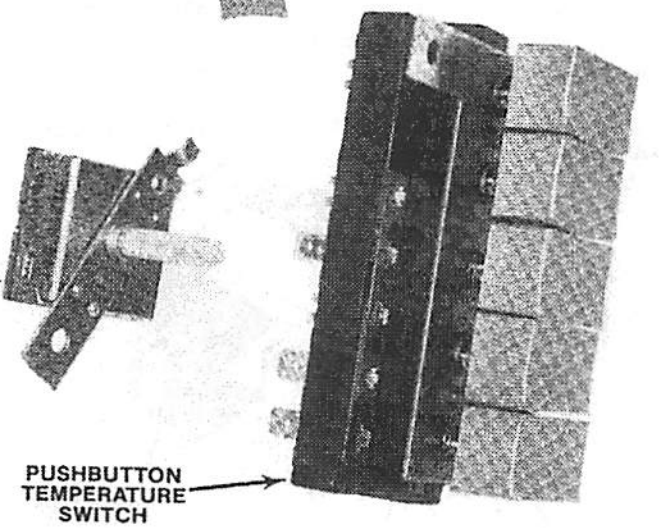
Step 10 The ohmmeter should show ZERO resistance (continuity). If not, the temperature switch is bad and needs replacing.

Step 11 Touch one ohmmeter probe to terminal G-BK and the other probe to the rest of the terminals without touching terminal Y-R.

Step 12 The ohmmeter should show an open circuit when checking these other terminals. If not, the temperature switch is bad and needs replacing.

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





LID SWITCH

This lid switch is mounted to the bottom of the washer top but has been repositioned as seen in Fig. 5. The lid switch on these models is a microswitch. As the lid is closed, a strike attached to the lid depresses a lever which in turn actuates the safety lid switch. In other words, when the lid is closed, the basket spins. When the lid is opened, it breaks the circuit in the lid switch contacts and the basket stops spinning.

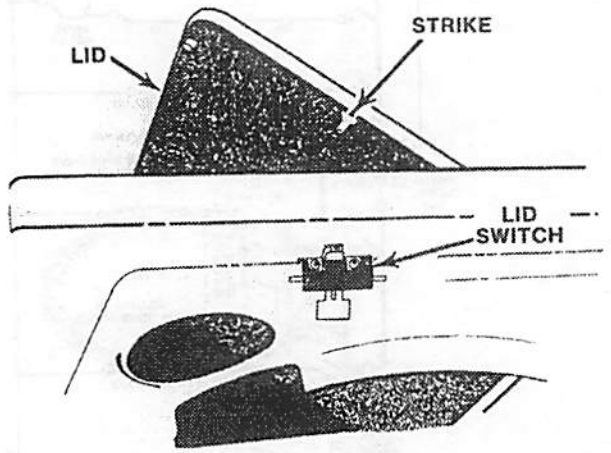


Fig. 5.

A revised and relocated safety lid switch assembly was phased into production. The new assembly is mounted to the rear center of the washer top, adjacent to the serial plate.

The revised assembly uses a mounting block that mounts to the washer top with two mounting screws. See Fig. 6. The safety lid switch (the current production microswitch) is mounted to the block with two screws and a retaining clip. A plastic water shield is fastened by the same screws to the mounting block.

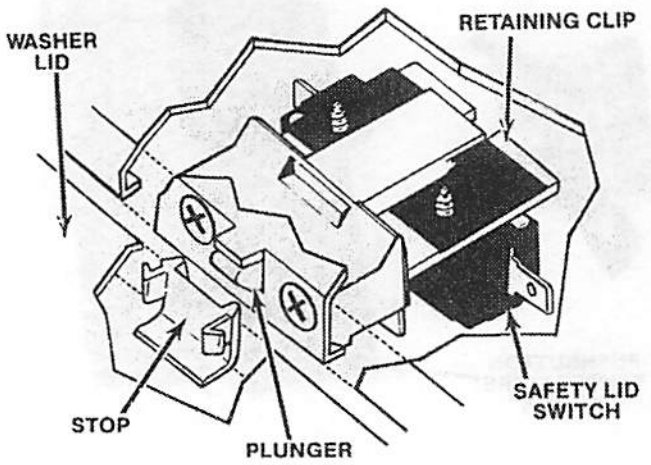


Fig. 6.

A plunger is located in the center of the mounting block. This plunger is actuated by a stop that snaps into the washer lid. As the lid is closed, the stop depresses the plunger, which closes the safety lid switch.

When servicing the new safety switch assembly, make sure that the microswitch is pushed as far forward as it will go before tightening the safety lid switch mounting screws. If the safety lid switch is not mounted properly, improper operation will result.

LID SWITCH ADJUSTMENT

An adjustment operation was added to manufacturing assembly operation as it is felt that over adjustment of switch is leading to switch bracket, actuator and lid pad failures.

After replacing any of these parts or the lid switch, the following adjustment MUST be made. First, with lid taped closed, loosen the two (2) screws which hold switch to bracket. Adjust by pushing switch toward actuator until switch button is completely depressed by actuator, then tighten screws to secure. See Fig. 7.

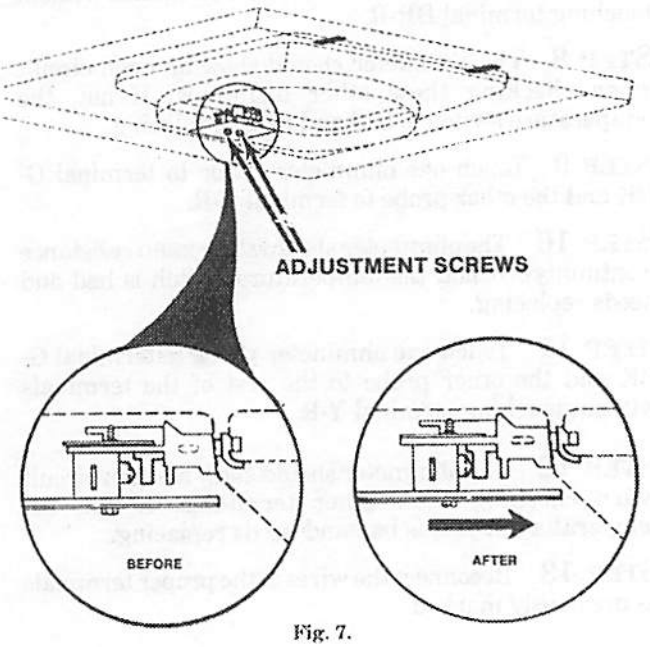


Fig. 7.

A revised and relocated safety lid switch assembly is being phased into production. The revised assembly is mounted to the bottom of the washer top (same as early production of "fast brake" models.) The safety lid switch bracket has been revised to a rigid plastic bracket. There is no adjustment in this assembly. A plastic shield is required and must be replaced when servicing to prevent water from splashing on the lid switch.

CHECKING PROCEDURE

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

Lid Switch

Step 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the lid 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 With the button up, touch one of the ohmmeter probes to one of the terminals.

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

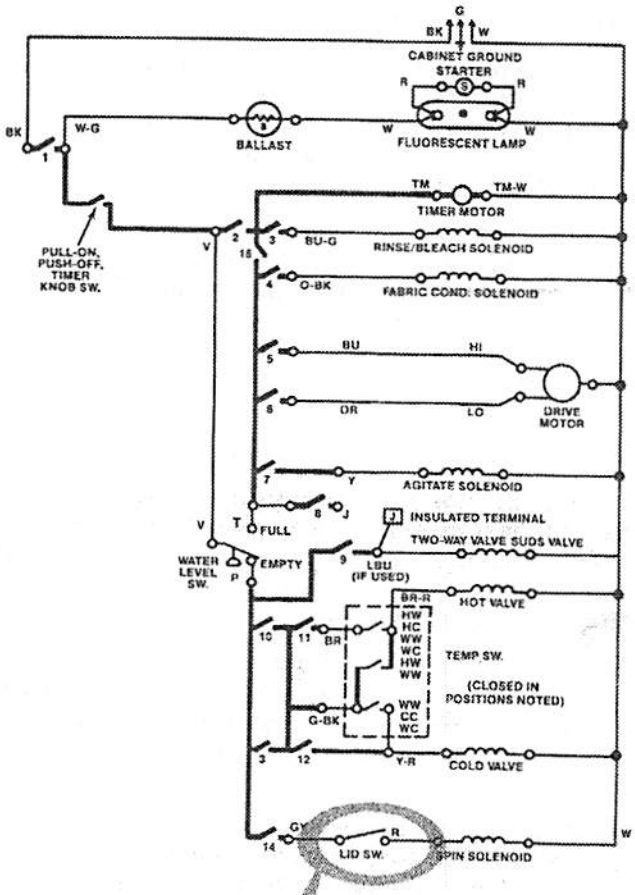
Step 5 The ohmmeter should show an open circuit when the button is up. If not, the lid switch is bad and needs replacing.

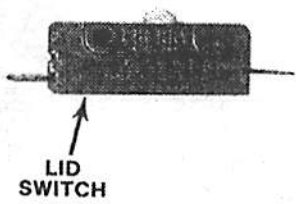
Step 6 With the button pressed in, touch one of the ohmmeter probes to one of the terminals.

Step 7 Touch the other ohmmeter probe to the other terminal.

Step 8 The ohmmeter should show ZERO resistance (continuity). If not, the lid switch is bad and needs replacing.

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





INLET MIXING VALVE

On water inlet valves, a sealed-type solenoid, is secured to the nylon valve body by screws. The solenoid coil is completely sealed to protect the wire from the corrosive effects of water and detergents. The spade terminals are mounted on the outer end of the solenoid.

Double-port mixing valves, require the use of two solenoids. When the hot water solenoid is energized only hot water is permitted to enter the machine. Energizing the cold water solenoid permits only cold water to enter the machine. To obtain warm water, both the hot and cold water solenoids are energized.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 inlet mixing valve. 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 500-2,000 ohms. Set the ohms scale and ZERO the meter.

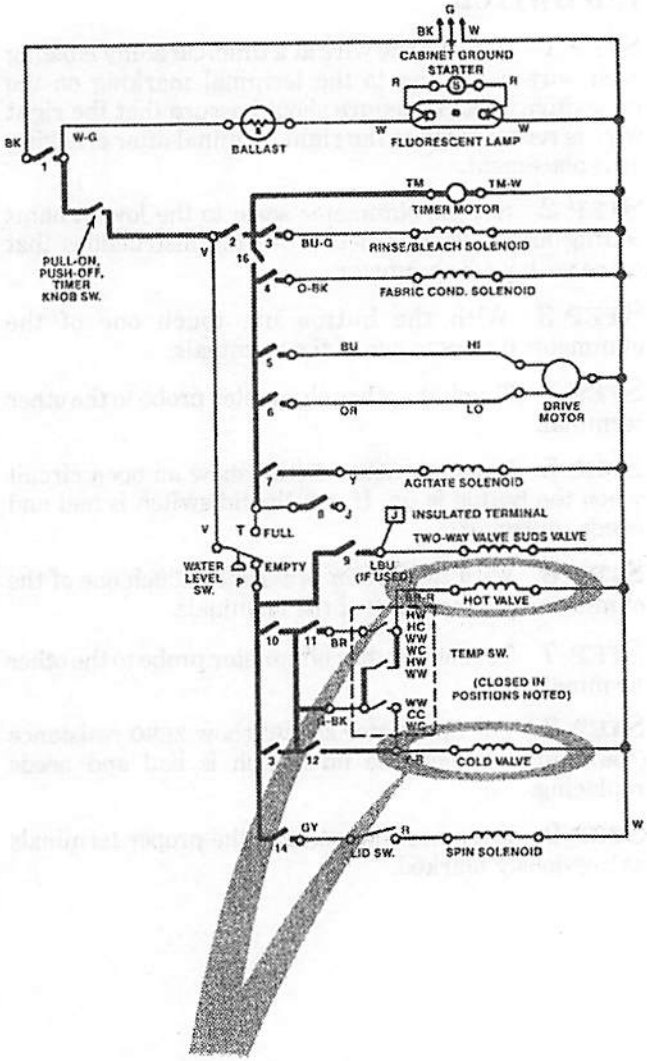
STEP 3 Touch one ohmmeter probe to one of the terminals on the solenoid and the other probe to the other terminal, on the same solenoid.

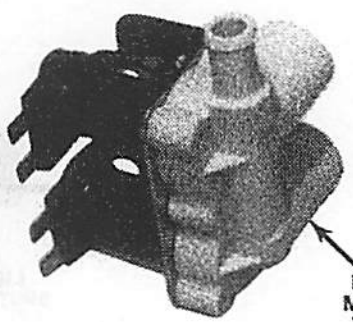
STEP 4 The ohmmeter should show between 500-2,000 ohms on the ohms scale. If not, the inlet mixing valve is bad and needs replacement.

STEP 5 Check the other solenoid the same way as in steps 2-4.

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

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

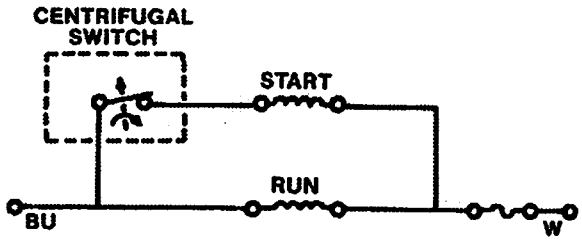




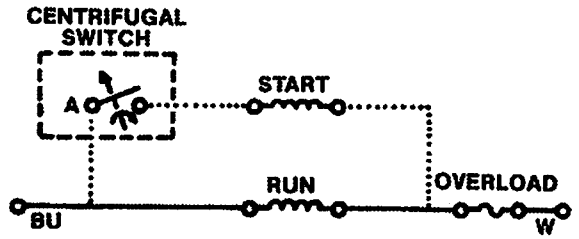
DRIVE MOTOR (BELT DRIVE)

Motors used on belt drive automatic washers may be one-, two-, or three-speed. The drive motor used on most automatic washers is a ½ H.P., 115-volt, 60-hertz, split-phase, single-extension shaft motor.

Most of these belt drive automatic washer motors are attached to the baseplate in a vertical position with the shaft end up. The wiring diagram in Fig. 8a illustrates the start position of the centrifugal switch.



(A) Start position.



(B) Run position.

Fig. 8. Wiring diagram of drive motor.

Starting the motor is accomplished by applying voltage to the parallel circuit consisting of the start and run windings. The purpose of the start winding is to give maximum torque during the critical start-up period of the motor. The start winding draws high amperage and, therefore, voltage must be removed from the starting circuit as quickly as the motor reaches speed to keep the winding from burning up. This is accomplished by the centrifugal switch, which opens the start circuit. The motor continues to operate at the designed motor speed on the run winding only as shown in Fig. 8b.

Certain automatic washers use a capacitor-type motor. The capacitor, located under a metal shield on the side of the motor, increases the starting torque of the motor, enabling it to operate at lower starting voltages and greater loads. When a starting capacitor is used, it is always wired in series with the start winding.

These motors are equipped with an automatic reset thermal overload. The overload may be built into the motor or mounted externally on the motor housing. If it opens, one side of the line to the motor is broken and the motor will stop. Overloads normally will automatically reset in about 60 seconds.

Motors which provide alternate speed selections are built with multiple contacts in the centrifugal switch and additional run windings designed to provide the desired speeds. For example, two speed motors like the one diagramed in Fig. 9, are equipped with three terminals. These motors are designed with a start winding, two sets of run windings, and a centrifugal switch.

When the normal cycle is selected, voltage is applied to terminals *BU* and *W*; the motor operates the same as a single-speed motor. When the centrifugal switch opens, the start winding is removed and the motor runs on the normal (1725 rpm) winding.

When the gentle cycle is selected, voltage is applied to motor terminals *OR* and *W*. The motor starts the same as for the normal cycle with voltage applied to both the start and normal speed windings. When centrifugal switching takes place, Contact A opens, and Contact B switches to the gentle-speed motor winding. This switching action opens the circuit to the start and normal speed windings and completes a circuit to the slow-speed (1,140 rpm) winding for continued operation.

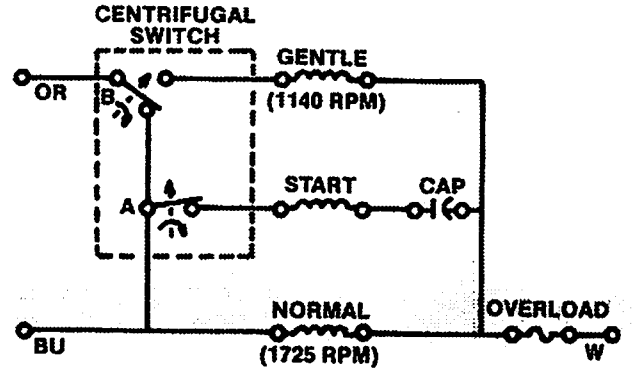


Fig. 9. Two-speed motor.

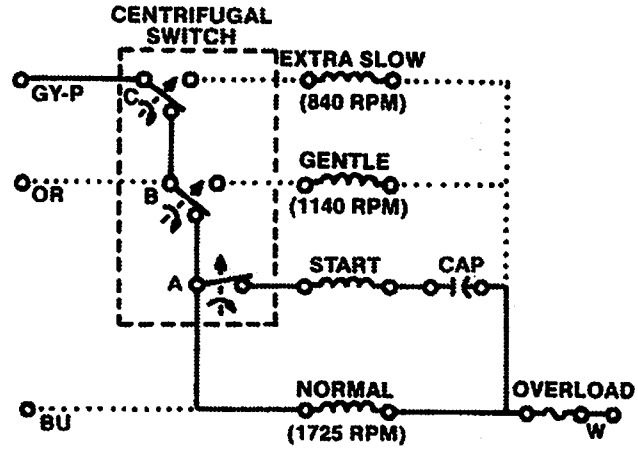


Fig. 10. Three-speed motor.

Three-speed motors are designed just like two-speed motors with the exception of an additional run winding (extra-low speed, 840 rpm). Three-speed motors (Fig. 10) are equipped with four terminals. When the extra-low speed is selected, voltage is applied to both motor

terminals *GY-P and W.* This causes the motor to start just as for the other type motors; that is, current flows through both the start and normal speed windings. When the centrifugal switch is actuated, Contact C closes the circuit to the extra slow speed winding and opens the circuit to the start and normal windings. The motor then continues operation through the extra slow speed run winding.

Understanding the operation of automatic washer electrical controls will make diagnosis of appliance failures a simple task. The components are not complex; therefore, diagnosis of electrical problems should be easy.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 motor start switch and from the motor to the start switch, carefully labeling each wire according to the terminal markings on the start switch. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

⚠WARNING

Electrical Shock Hazard

To avoid a possible shock:

- **Do not touch both terminals at the same time.**
- **Capacitors should always be discharged prior to handling. To discharge the capacitor, use a two-watt, 20,000-ohm resistor with insulated leads. Touch both capacitor terminals at the same time with the resistor.**

STEP 2 If your motor has a capacitor, remove the red or black wire from the capacitor to the motor.

STEP 3 Remove the black jumper wire from the capacitor to the start switch.

STEP 4 Refer to the instructions that came with your volt-ohmmeter to find the proper scale to measure 1-20 ohms. Set the ohms scale and ZERO the meter.

To tell what speed drive motor you have, look at the colored wires coming from the drive motor.

ONE-SPEED	TWO-SPEED	THREE-SPEED
White	White	White
Blue	Blue	Blue
Black	Black	Black
Follow Steps 5-12	Violet	Violet
	Follow Steps 5-16	Gray/Pink
		Follow Steps 5-20

The following test must be made on 1-, 2- and 3-speed motors

STEP 5 Touch one ohmmeter probe to the terminal on the white wire from the motor.

STEP 6 Touch the other ohmmeter probe to the terminal on the blue wire from the motor.

STEP 7 The ohmmeter should show between 1-4 ohms on the ohms scale.

STEP 8 If you do not get this reading, the drive motor is bad and needs replacing.

STEP 9 Touch one ohmmeter probe to the terminal on the white wire from the motor.

STEP 10 Touch the other ohmmeter probe to the terminal on the black wire from the motor.

STEP 11 The ohmmeter should show between 5-20 ohms on the ohms scale.

STEP 12 If you do not get this reading, the drive motor is bad and needs replacing.

NOTE: If you do get this reading, the start switch must be checked.

The following test must be made on 2- and 3-speed motors—plus steps 5-12

STEP 13 Touch one ohmmeter probe to the terminal on the white wire from the motor.

STEP 14 Touch the other ohmmeter probe to the terminal on the violet wire from the motor.

STEP 15 The ohmmeter should show between 1-4 ohms on the ohms scale.

STEP 16 If you do not get this reading, the drive motor is bad and needs replacing.

NOTE: If you do get this reading, the start switch must be checked.

The following test must be made on 3-speed motors—plus steps 5-16

STEP 17 Touch one ohmmeter probe to the terminal on the white wire from the motor.

STEP 18 Touch the other ohmmeter probe to the terminal on the gray-with-pink-stripe wire from the motor.

STEP 19 The ohmmeter should show between 1-4 ohms on the ohms scale.

STEP 20 If you do not get this reading, the drive motor is bad and needs replacing.

NOTE: If you do get this reading the start switch must be checked.

DRIVE MOTOR (BELT DRIVE)

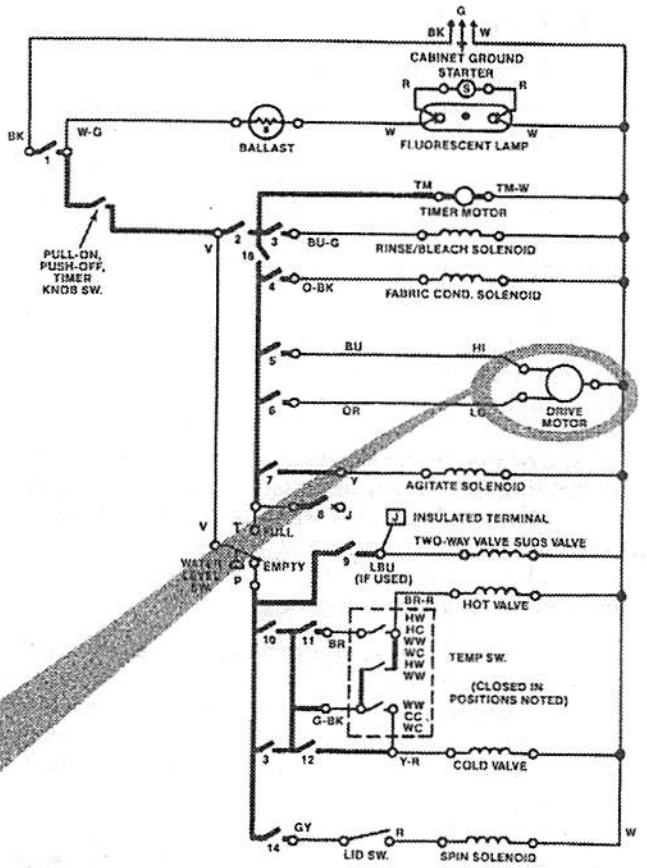
The following three checks must be made on all 1-, 2- and 3-speed motors to check for an internal failure (short)

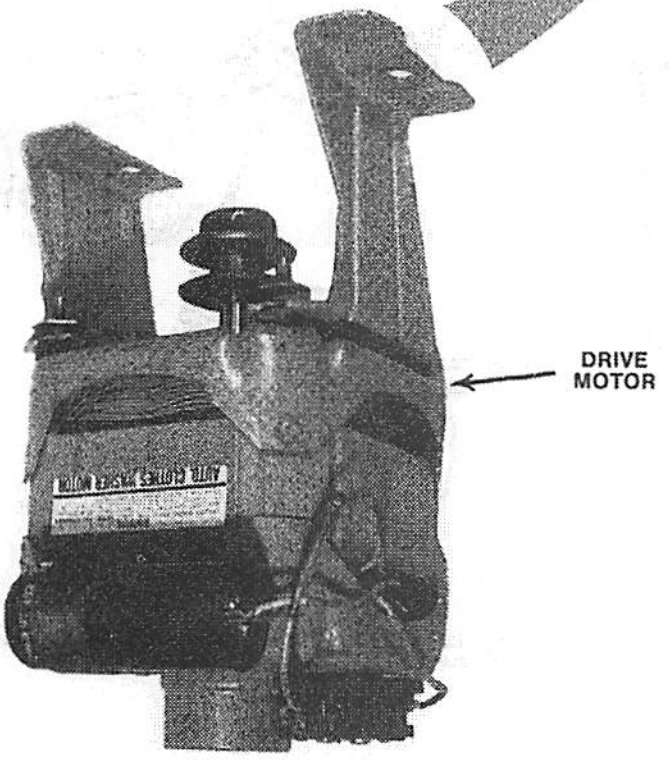
STEP 21 Touch one ohmmeter probe to the motor housing.

STEP 22 One at a time, touch the other ohmmeter probe to each of the wires (terminals) coming out of the motor.

STEP 23 The ohmmeter should show an open circuit when each of the wires (terminals) are checked. If not, the drive motor is bad and needs replacing.

STEP 24 Reconnect the wires to the proper terminals as previously marked.





DRIVE MOTOR (DIRECT DRIVE)

Motors used on direct drive automatic washers are one- or two-speed. These drive motors are ½ H.P., 115 volt, 60-hertz, double shaft, reversing type motors.

Direct drive automatic washer motors are attached to the gearcase in a horizontal position. One end of the motor shaft fits into the gearcase while the other end of the motor shaft fits into the pump.

Starting the motor is accomplished by applying voltage to the parallel circuit consisting of the start and run windings. The purpose of the start winding is to give maximum torque during the critical start-up period of the motor. The start winding draws high amperage and therefore, voltage must be removed from the starting circuit as quickly as the motor reaches speed to keep the winding from burning up. This is accomplished by the centrifugal switch, which opens the start circuit. The motor continues to operate at the designed motor speed on the run winding.

Some direct drive automatic washers used a capacitor-type motor. This capacitor located in the console assembly, increases the starting torque of the motor, enabling it to operate at lower starting voltages and greater loads. When a start capacitor is used, it is always wired in series with the start winding.

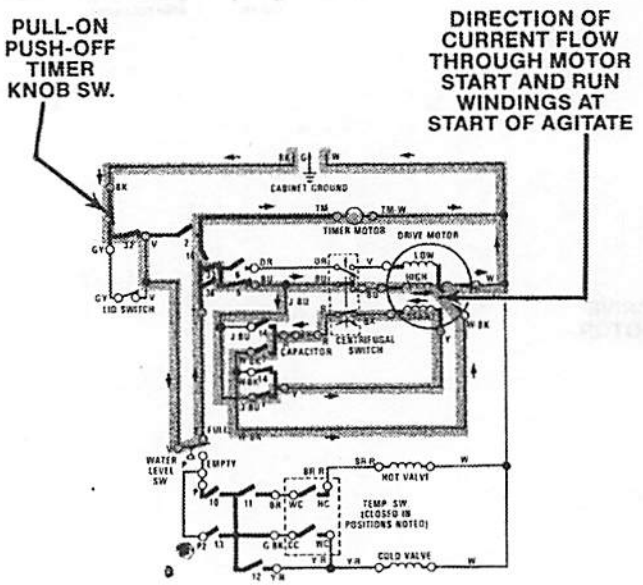


Fig. 11. Start of agitation.

Fig. 11 shows the circuit through the timer and drive motor start and run windings at the instant of start for agitation. Note the relationship between the direction of current flow through the start and run windings. This direction of current flow, controlled by the timer, will start the motor in the direction to put the machine into agitation.

As the drive motor comes up to speed, the centrifugal switch will open, breaking the circuit to the start windings.

NOTE: High-speed motor operation is shown; in low-speed, timer switch 6 is closed and timer switch 5 is open.

The drive motor shaft (looking at the front) rotates in a counter-clockwise direction during agitation and a clockwise direction during spin and pump-out. The drive motor is connected to the gearcase through a rubber isolation coupling (Fig. 12). This coupling compensates for any minor misalignment between the motor and the gearcase. In addition, the isolation coupling serves as a weak link between the gearcase and motor. Should the gearcase "lock up" the isolation coupling and motor couplings will shear, preventing the motor from being damaged.

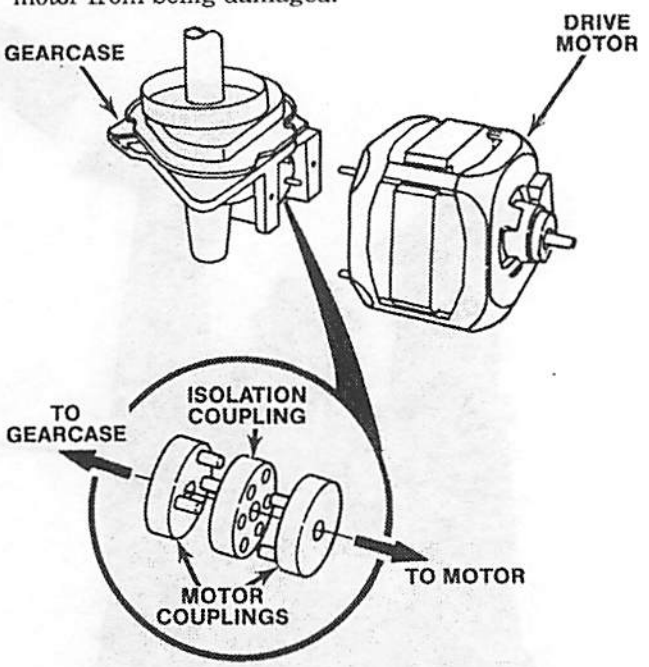


Fig. 12. Isolation coupling is connected between the gearcase and motor.

DRIVE MOTOR (DIRECT DRIVE)

Fig. 13 shows the circuit through the timer and drive motor start and run windings at the instant of start for spin/pumpout. Note the relationship between the direction of current flow through the start and run windings. This direction of current flow, controlled by the timer will start the motor in the direction to put the machine into spin/pumpout.

As the drive motor comes up to speed, the centrifugal switch will open, breaking the circuit to the start windings.

NOTE: High-speed motor operation is shown; in low-speed, timer switch 6 is closed and timer switch 5 is open.

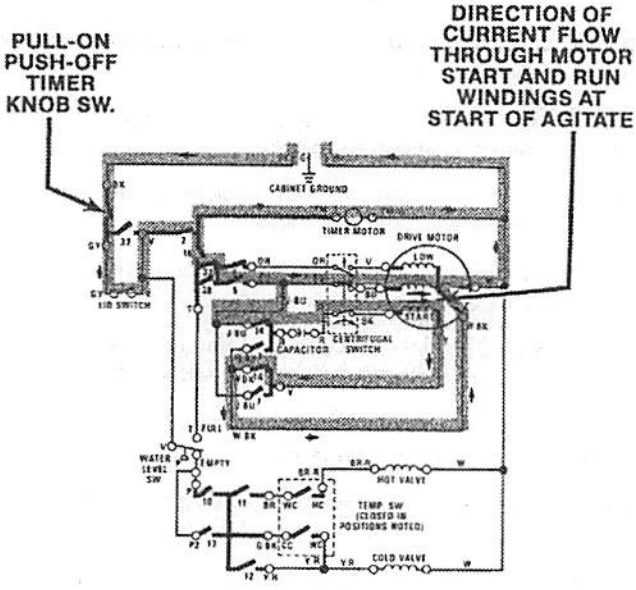


Fig. 13. Start of spin/pumpout.

CHECKING PROCEDURE

Obtain a properly working ohmmeter from your local store. We will be doing RESISTANCE checks. This is the safest way because the automatic washer 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 motor start switch and from the motor to the start switch, carefully labeling each wire according to the terminal markings on the start switch. This procedure should assure that the right wire is reconnected to the right terminal after checking or replacement.

⚠WARNING

Electrical Shock Hazard

To avoid a possible shock:

- **Do not touch both terminals at the same time.**
- **Capacitors should always be discharged prior to handling. To discharge the capacitor, use a two-watt, 20,000-ohm resistor with insulated leads. Touch both capacitor terminals at the same time with the resistor.**

STEP 2 If your motor has a capacitor, remove the red or black wire from the capacitor to the motor.

STEP 3 Refer to the instructions that came with your volt-ohmmeter to find the proper scale to measure 1-20 ohms. Set the ohms scale and ZERO the meter.

To tell what speed drive motor you have, look at the colored wires coming from the drive motor.

ONE-SPEED	TWO-SPEED
White	White
Blue	Blue
Black	Black
Yellow	Yellow
White/Black	White/Black
Follow Steps 4-24	Violet
	Follow Steps 4-34

The following test must be made on 1- and 2-speed motors

STEP 4 Touch one ohmmeter probe to the terminal on the white wire from the motor.

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

STEP 6 The ohmmeter should show between 1-4 ohms on the ohms scale.

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

DRIVE MOTOR (DIRECT DRIVE)

STEP 8 Touch one ohmmeter probe to the terminal on the white wire with black tracer from the motor protector.

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

STEP 10 The ohmmeter should show between 1-4 ohms on the ohms scale.

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

STEP 12 Touch one ohmmeter probe to the terminal on the white wire with black tracer from the motor protector.

STEP 13 Touch the other ohmmeter probe to the terminal on the white wire from the motor.

STEP 14 The ohmmeter should show ZERO resistance (continuity). If not, the drive motor is bad and needs replacing.

STEP 15 Touch one ohmmeter probe to the terminal on the yellow wire from the motor.

STEP 16 Touch the other ohmmeter probe to the terminal on the black wire from the motor.

STEP 17 The ohmmeter should show between 5-10 ohms on the ohms scale.

STEP 18 If you do not get this reading, the drive motor is bad and needs replacing.

STEP 19 Touch one ohmmeter probe to the terminal on the yellow wire from the motor.

STEP 20 Touch the other ohmmeter probe, one at a time, to the terminal on the white, blue, and white with black tracer wires.

STEP 21 The ohmmeter should show an open circuit when checking these other wires. If not, the drive motor is bad and needs replacing.

STEP 22 Touch one ohmmeter probe to the terminal on the black wire from the motor.

STEP 23 Touch the other ohmmeter probe, one at a time, to the terminal on the white, blue, and white with black tracer wires.

STEP 24 The ohmmeter should show an open circuit when checking these other wires. If not, the drive motor is bad and needs replacing.

The following test must be made on 2-speed motors—plus steps 4-24

STEP 25 Touch one ohmmeter probe to the terminal on the violet wire from the motor.

STEP 26 Touch the other ohmmeter probe, one at a time, to the terminals on the white, blue and white with black tracer wires.

STEP 27 The ohmmeter should show between 1-4 ohms on the ohms scale.

STEP 28 If you do not get this reading, the drive motor is bad and needs replacing.

STEP 29 Touch one ohmmeter probe to the terminal on the yellow wire from the motor.

STEP 30 Touch the other ohmmeter probe to the terminal on the violet wire from the motor.

STEP 31 The ohmmeter should show an open circuit. If not, the drive motor is bad and needs replacing.

STEP 32 Touch one ohmmeter probe to the terminal on the black wire from the motor.

STEP 33 Touch the other ohmmeter probe to the terminal on the violet wire from the motor.

STEP 34 The ohmmeter should show an open circuit. If not, the drive motor is bad and needs replacing.

DRIVE MOTOR
(DIRECT DRIVE)

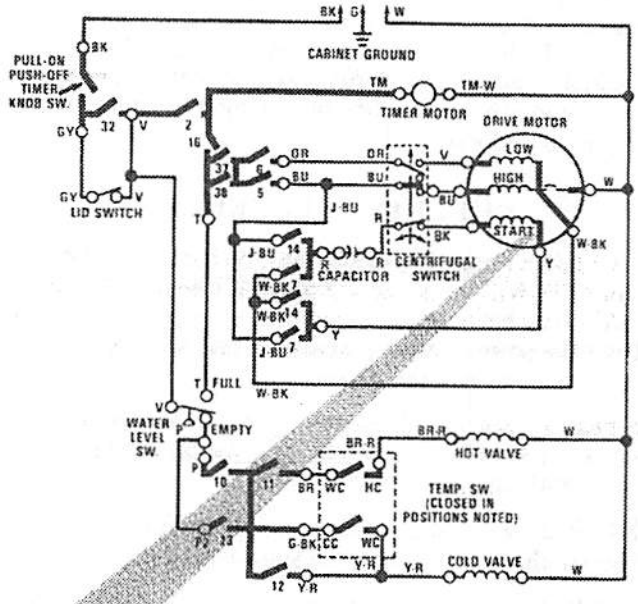
The following three checks must be made on all 1 and 2 speed motors to check for an internal failure (short)

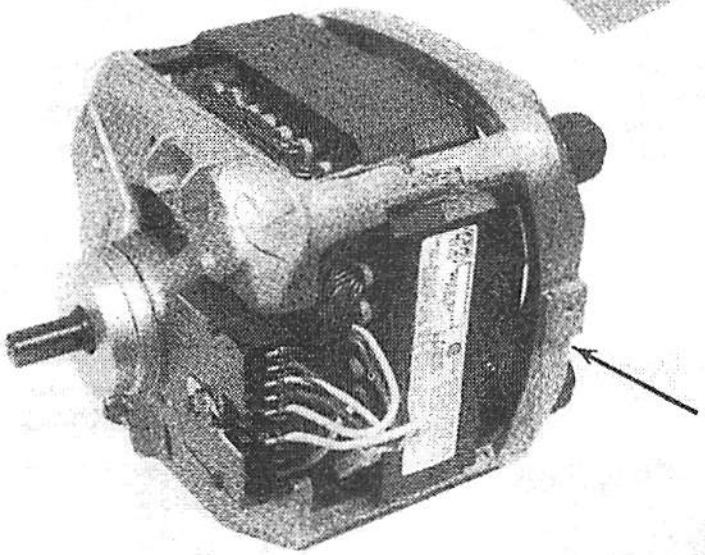
STEP 35 Touch one ohmmeter probe to the motor housing.

STEP 36 One at a time, touch the other ohmmeter probe to each of the wires (terminals) coming out of the motor.

STEP 37 The ohmmeter should show an open circuit when each of the wires (terminals) are checked. If not, the drive motor is bad and needs replacing.

STEP 38 Reconnect the wires to the proper terminals as previously marked.





TIMER

All timers used on automatic washers operate the same, but are somewhat different in looks. Due to functions or features of different models, some timers have more terminals and internal switches (contacts) than others.

On quick-disconnect timers, the different colored harness wires are placed inside either a black or white block which plugs into the timer. These blocks are colored to match the words black or white stamped on the timer. The possibility of wiring the timer wrong is greatly reduced.

CHECKING PROCEDURE

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

STEP 1 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

STEP 2 See example in steps 7-13. Turn the timer knob to the point in the cycle you suspect is bad.

STEP 3 Remove both the white and black disconnect blocks. Some models only have the one (black) disconnect block. The blocks have tabs on each end which must be pressed while pulling on the block.

Instead of coding timer terminals like the standard frame timers, a chart of each wiring block is printed on the back of the timer. The line through the chart separates the two blocks. Letters indicate active terminals while the black dots identify blank terminals.

STEP 4 Touch one ohmmeter probe to the timer terminal specified for this function.

STEP 5 Touch the other ohmmeter probe to the other timer terminal specified for this function.

STEP 6 The ohmmeter should show ZERO resistance (continuity). If not, the timer is bad and needs replacing.

STEP 7 EXAMPLE: Move the timer dial to the start of any WASH cycle. PROBLEM—Automatic washer does not fill.

STEP 8 Touch one ohmmeter probe to terminal P.

STEP 9 Touch the other ohmmeter probe to terminal G-BK.

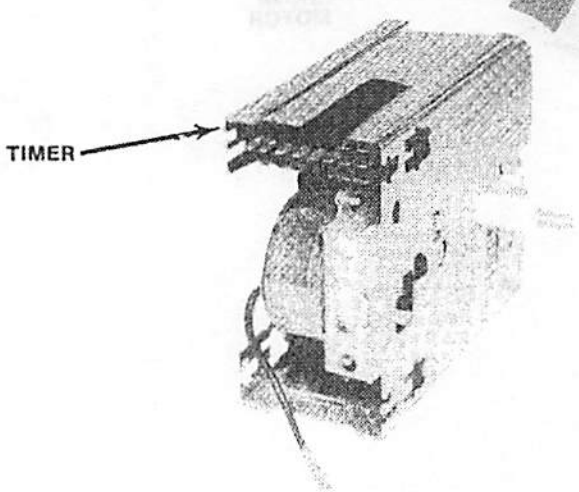
STEP 10 The ohmmeter should show ZERO resistance (continuity). If not, the timer is bad and needs replacing.

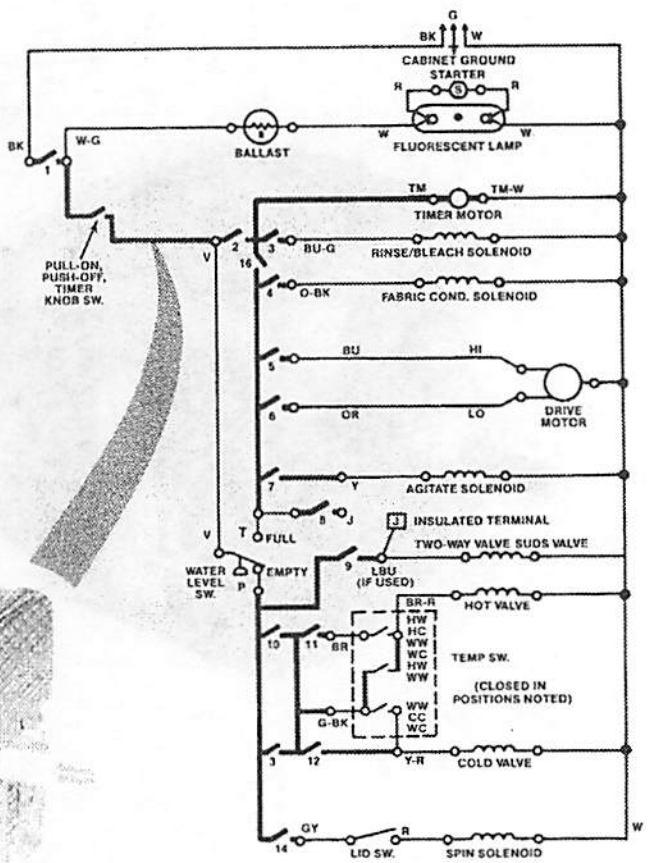
STEP 11 Touch one ohmmeter probe to terminal P.

STEP 12 Touch the other ohmmeter probe to terminal BR.

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

STEP 14 Replace the colored blocks in the proper end marked BLACK or WHITE on the 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 automatic washer 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.

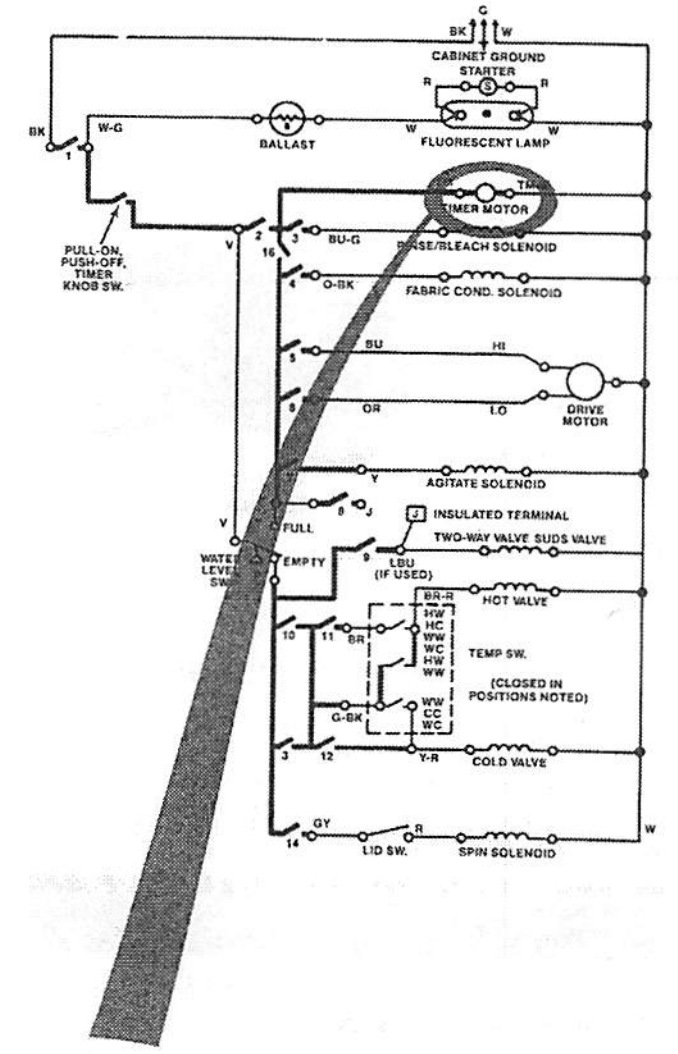
STEP 3 Touch one of the ohmmeter probes to one of the timer motor wire terminals.

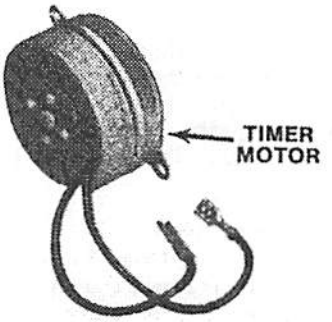
STEP 4 Touch the other ohmmeter probe to the other timer motor wire terminal.

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 motor is bad and needs replacing.

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

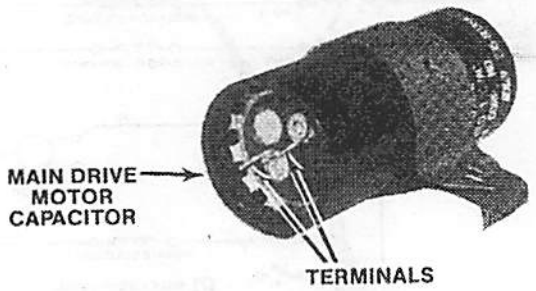
NOTE: If you get this reading, the timer motor could still be bad from a mechanical problem inside the motor. This condition can only be checked by running a voltage check.





Motor Capacitor

Starting capacitors increase the turning force of the rotor in the drive motor during start. Capcitors are located either on the main drive motor or in the console area.



CHECKING PROCEDURE

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

⚠WARNING

Electrical Shock Hazard

To avoid a possible shock:

- **Do not touch both terminals at the same time.**
- **Capacitors should always be discharged prior to handling. To discharge the capacitor, use a two-watt, 20,000-ohm resistor with insulated leads. Touch both capacitor terminals at the same time with the resistor.**

STEP 1 Remove one wire at a time, carefully labeling each wire according to the terminal marking on the capacitor. 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 highest 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 capacitor.

At the instant the other ohmmeter probe touches the other terminal on the capacitor, the ohmmeter needle should move instantly toward ZERO, then return slowly.

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

STEP 5 If the ohmmeter needle stays at or near ZERO or does not move at all, the capacitor is bad and needs replacing.

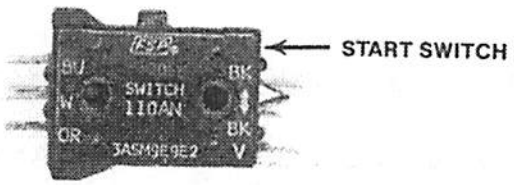
STEP 6 Now switch the ohmmeter probes on the capacitor terminals. The same thing should happen as in steps 3-5. If not, the capacitor is bad and needs replacing.

STEP 7 Reconnect the wires to the proper terminals as previously marked.

START SWITCH (DRIVE MOTOR) (BELT DRIVE)

This start switch is used in getting voltage to the motor start and run windings at the same time. As the motor increases in speed, an actuating arm inside the motor opens the switch and removes the voltage from the start windings. There are one-, two- or three-speed start switches used on automatic washers.

Because of different drive motor brands used, it is necessary when replacing the drive motor start switch that you use the same brand as your drive motor.



STEP 1 Remove one wire at a time, 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 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

To tell what speed start switch you have, look at the colored wires coming from the drive motor.

ONE-SPEED	TWO-SPEED	THREE-SPEED
White	White	White
Blue	Blue	Blue
Black	Black	Black
Follow Steps 3-7	Violet	Violet
	Follow Steps 3-17	Gray/Pink
		Follow Steps 3-27

The following test must be made on 1-, 2- and 3-speed start switches

STEP 3 Touch one ohmmeter probe to terminal BU.

STEP 4 Touch the other ohmmeter probe to terminal BK (7).

STEP 5 With the start switch button out, the ohmmeter should show an open circuit. If not, the start switch is bad and needs replacing.

STEP 6 With the ohmmeter probes still touching these terminals (BU and BK [7]), push in on the button.

STEP 7 With the start switch button in, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

The following test must be made on 2- and 3-speed start switches—plus steps 3-7

STEP 8 Touch one ohmmeter probe to terminal OR.

STEP 9 Touch the other ohmmeter probe to terminal BK (7).

STEP 10 With the start switch button out, the ohmmeter should show an open circuit. If not, the start switch is bad and needs replacing.

STEP 11 With the ohmmeter probes still touching these terminals (OR and BK[7]), push in on the button.

STEP 12 With the start switch button in, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

STEP 13 Touch one ohmmeter probe to terminal OR.

STEP 14 Touch the other ohmmeter probe to terminal V.

STEP 15 With the start switch button out, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

STEP 16 With the ohmmeter probes still touching these terminals (OR and V), push in on the button.

STEP 17 With the start switch button in, the ohmmeter should show an open circuit. If not, the start switch is bad and needs replacing.

The following test must be made on 3-speed start switches—plus steps 3-17

STEP 18 Touch one ohmmeter probe to terminal GY-P.

STEP 19 Touch the other ohmmeter probe to terminal BK (7).

STEP 20 With the start switch button out, the ohmmeter should show an open circuit. If not, the start switch is bad and needs replacing.

STEP 21 With the ohmmeter probes still touching these terminals (GY-P and BK[7]), push in on the button.

STEP 22 With the start switch button in, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

STEP 23 Touch one ohmmeter probe to terminal GY-P.

STEP 24 Touch the other ohmmeter probe to terminal G.

STEP 25 With the start switch button out, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

STEP 26 With the ohmmeter probes still touching these terminals (GY-P and G), push in on the button.

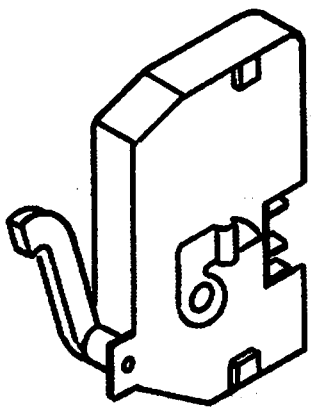
STEP 27 With the start switch button in, the ohmmeter should show an open circuit. If not, the start switch is bad and needs replacing.

STEP 28 Reconnect the wires to the proper terminals as previously marked.

START SWITCH (DRIVE MOTOR) (DIRECT DRIVE)

This start switch is used in getting voltage to the motor start and run windings at the same time. As the motor increases in speed, an actuating arm inside the motor opens the switch and removes the voltage from the start windings. There are one-, two- or three-speed start switches used on automatic washers.

Because of different drive motor brands used, it is necessary when replacing the drive motor start switch that you use the same brand as your drive motor.



STEP 1 Remove one wire at a time, 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 Set the ohmmeter scale to the lowest ohms setting and ZERO the meter. See the instructions that came with your ohmmeter.

To tell what speed start switch you have, look at the colored wires coming from the drive motor.

ONE-SPEED	TWO-SPEED	THREE-SPEED
White	White	White
Blue	Blue	Blue
Black	Black	Black
White/Black	White/Black	Yellow
Yellow	Yellow	White/Black
Follow Steps 3-8	Violet	
	Follow Steps 3-14	PLUG
		White/Orange
		White/Violet

The following test must be made on 1-, 2- and 3-speed start switches

START MODE

STEP 3 Touch one ohmmeter probe to terminal R.

STEP 4 Touch the other ohmmeter probe to terminal BK.

STEP 5 With the start lever pushed in, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

RUN MODE

STEP 6 Touch one ohmmeter probe to terminal R.

STEP 7 Touch the other ohmmeter probe to terminal BK.

STEP 8 With the start lever out, the ohmmeter should show an open circuit. If not, the start switch is bad and needs replacing.

The following test must be made on 2- and 3-speed start switches—plus steps 3-8

START MODE

STEP 9 Touch one ohmmeter probe to terminal BU.

STEP 10 Touch the other ohmmeter probe to terminal OR.

STEP 11 With the start lever pushed in, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

RUN MODE

STEP 12 Touch one ohmmeter probe to terminal V.

STEP 13 Touch the other ohmmeter probe to terminal OR.

STEP 14 With the start lever out, the ohmmeter should show ZERO resistance (continuity). If not, the start switch is bad and needs replacing.

STEP 15 Reconnect the wires to the proper terminals as previously marked.

NOTES