

SECTION 10-I WINDSHIELD WIPER AND WASHER ASSEMBLY

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10-52 DESCRIPTION AND OPERATION—SINGLE SPEED

a. General Description

The gear train consists of a helical gear at end of armature shaft. The helical gear drives an intermediate gear and pinion assembly, the pinion of which drives an output gear and shaft assembly. See Figure 10-72. The crank arm is attached to the shaft of the output gear and drives the two wiper transmissions through connecting link arms.

There is no circuit breaker in this model wiper motor.

b. Principle of Operation

Two switches, a dash switch and a park switch control the starting

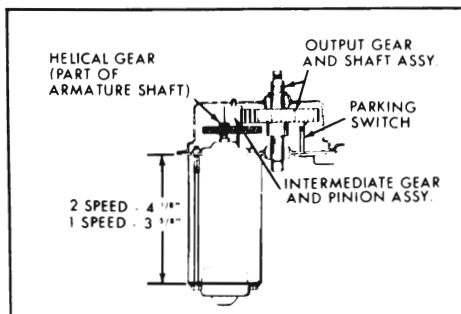


Figure 10-72—Typical View of Gear Train

and stopping of the wiper. The switch mounted on the dash controls starting the wiper. The park switch, which is located in the wiper gear box (Figure 10-72), controls stopping the wiper. The operation of the park switch is explained in the following paragraph. (Refer to the wiring diagram in Figure 10-74).

When the car owner shuts the wiper “off” at the dash switch, the motor circuit to ground is opened at the dash. However, the parking switch contacts, which are normally closed, maintain the motor circuit to ground at the wiper. This allows the wiper to keep operating until the blades or wiper crank arm reach the park position (Blades approx. 2" above windshield molding). (Figure 10-73 shows the crank arm in park position.) At the same time the blades reach the park position, a cam on the output gear opens the park switch contacts. This opens the motor circuit to ground, stopping the motor. Thus, the park switch actually controls wiper operation only during that short period of time, after the owner turns the wiper “off” at the dash switch but before the wiper has completely stopped.

Turning the wiper “on” at the dash switch overrides the open park switch contacts and closes the wiper motor circuit to ground,

starting the wiper. (NOTE: Although the park switch contacts are opened once during each revolution of the output gear, the park switch has no control over the wiper until the dash switch is turned “off”.)

c. Connections to Operate Wiper

Figure 10-75 shows the proper method of connecting jumper leads to the wiper so that it can be operated independently of the dash switch or car wiring for test purposes. (NOTE: Specification table at end of this section lists current draw data.)

10-53 TROUBLE-SHOOTING—SINGLE SPEED

a. Description

Trouble-shooting procedures are divided into two categories: Wiper in car; wiper out of car.

Typical Trouble Conditions:

1. Inoperative.
2. Will not shut off.
3. Intermittent or slow operation.
4. Wiper will not park.



Figure 10-73—Park Position of Crank Arm

b. Wiper in Car

1. Wiper Inoperative - **IMPORTANT:** Ignition switch must be on to make electrical tests.

(a) Check the following:

(1) Make sure wiring harness is properly attached to wiper terminals and dash switch. See Figure 10-74.

(2) Make sure wiper ground strap is properly connected to wiper and car body.

(3) Make sure switch is mounted securely in dash.

(4) Check fuse.

(b) If everything checks out in Step (a) but wiper still fails to

operate, disconnect wiring harness from wiper and check for 12 volts at harness terminal that connects to wiper terminal No. 2, Figure 10-75. No voltage indicates defective car wiring. **CAUTION: DO NOT** connect hot line to No. 1 terminal.

(c) Connect 12 volt supply to No. 2 wiper terminal and connect a jumper wire from terminal No. 1 to ground (Figure 10-75). If wiper operates, the dash switch or wiring between dash switch and wiper is defective.

(d) If wiper still fails to operate with jumper wires, remove body parts as required to disconnect wiper transmission from wiper crank arm. Recheck wiper operation with jumper wires. If wiper operates correctly a defective transmission or binding condition exists. If wiper still fails to operate, remove wiper from car and follow instructions under "Trouble-Shooting Wiper Out-of-Car".

2. Wiper Will Not Shut Off

(a) Disconnect wiring from dash switch. If wiper shuts off, a defective dash switch is indicated.

(b) If wiper still operates, disconnect wiring from wiper and connect 12 volt supply direct to wiper terminal No. 2 (Figure 10-75). **DO NOT** connect any jumper wire to terminal No. 1.

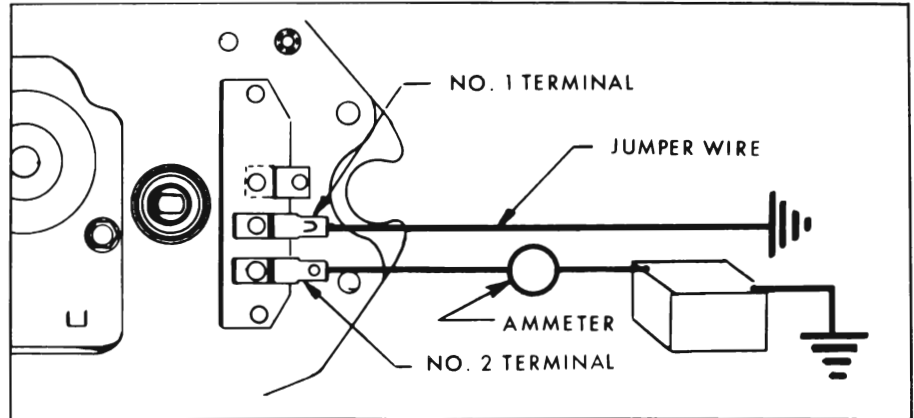


Figure 10-75—Connections to Operate Wiper out of Car

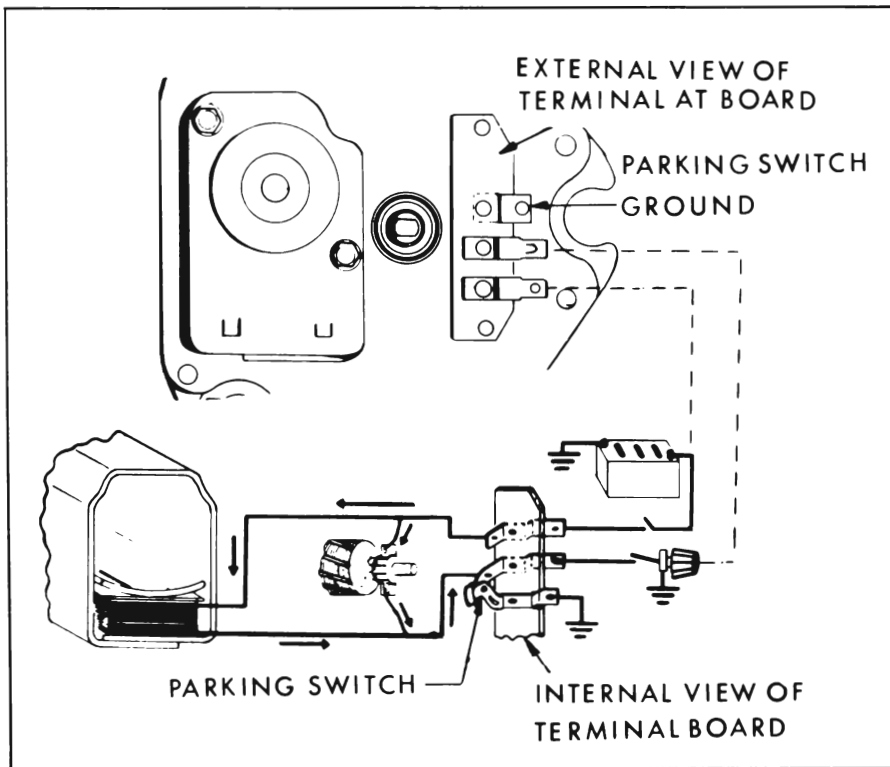


Figure 10-74—Single Speed Wiper Wiring Diagram

If wiper now shuts off correctly, check for a ground in lead that extends between wiper terminal No. 1 and dash switch.

If wiper still fails to shut off—remove wiper from car and follow instructions under “Trouble-Shooting Wiper Out-of-Car”

3. Intermittent or Slow Operation

(a) Check the following: Loose ground strap, loose dash switch mounting, loose connection.

4. Wiper Will Not Park

(a) Remove wiper from car and check for a dirty or broken park switch.

c. Wiper Out of Car

Connect a 12 volt supply and an ammeter to wiper as shown in Figure 10-75 and observe current draw and wiper operation.

1. Wiper Inoperative

(a) Current Draw - 0.

(1) Check solder connection at terminal board.

(2) Disassemble motor section and check all splice connections (Figure 10-76).

(b) Current Draw-1-1.5 amps.—Disassemble motor and check for the following items:

(1) Open armature.

(2) Brushes sticking.

(3) Brush springs improperly positioned (see Figure 10-77).

(4) Brush pigtail connections at splice joints (Figure 10-76).

(c) Current Draw-10-12 amps.

(1) Check for open shunt field circuit.

(2) Check for broken gear.

2. Wiper Will Not Shut Off.

Wiper crank arm fails to stop in park position when jumper wire

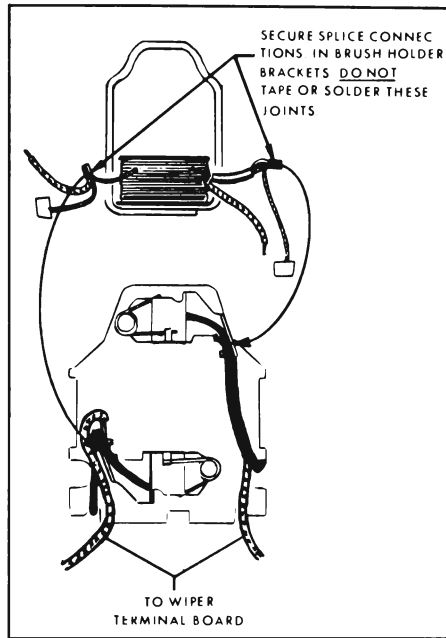


Figure 10-76—Motor Wiring

is removed from wiper terminal No. 1 (Figure 10-75).

(a) Check that park switch contacts are opening.

(b) Check for grounded condition in the internal motor lead that connects to terminal No. 1, Figure 10-75.

3. Intermittent or Slow Operation

(a) Current Draw-7-9 amps.

(1) Check for binds in gear train.

(2) Check for shorted armature. (Armature may be checked on a growler).

4. Wiper Will Not Park.

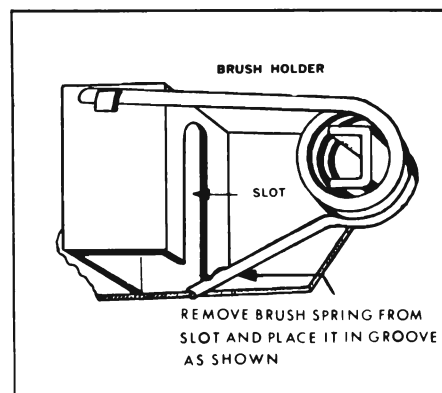


Figure 10-77—Releasing Brush Holder Spring Pressure

Wiper crank arm stops rotating immediately when jumper wire is disconnected from wiper terminal No. 1 (Figure 10-75). NOTE: Crank arm should continue to rotate until park position is reached (Figure 10-73).

10-54 DISASSEMBLY AND ASSEMBLY—SINGLE SPEED

a. Gear Box Disassembly

1. Remove washer pump drive cam as required. The cam is pressed on the shaft but can be wedged off by using two screwdrivers between cam and plate.

2. Clamp crank arm in a vise and loosen crank arm retaining nut.

3. Remove seal cap, retaining ring and end-play washers. NOTE: Seal cap should be cleaned and repacked with a water proof type grease before reassembly.

4. Drill out the gear box cover retaining rivets and remove cover from gear train. CAUTION: Mark ground strap location for reassembly purposes.

5. Remove output gear and shaft assembly, then slide intermediate gear and pinion assembly off shaft. (Figure 10-79).

6. Remove terminal board and park switch assembly as follows:

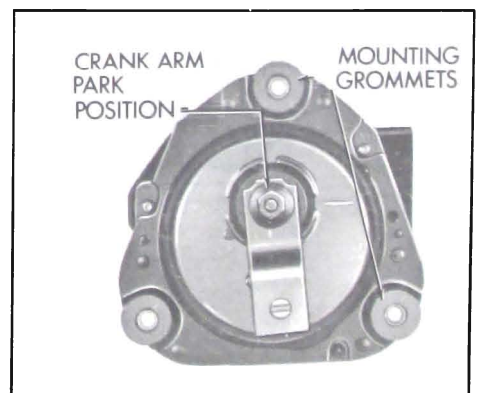


Figure 10-78—Single and Two Speed Wiper Mounting Grommets

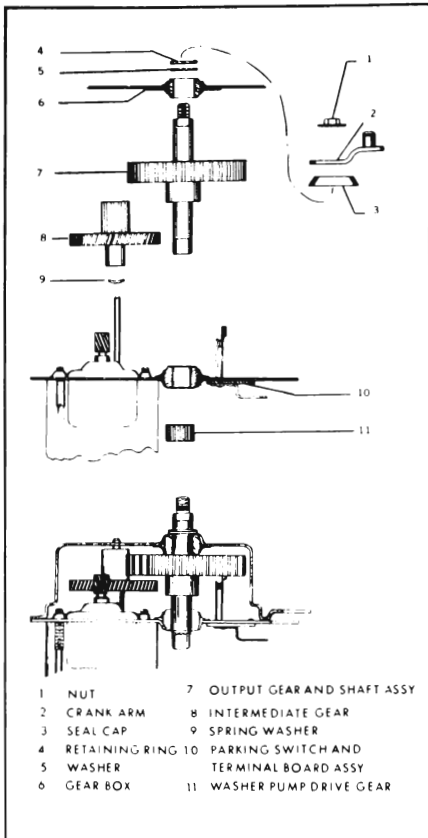


Figure 10-79—Gear Box Assembly

- (a) Unsolder motor leads from terminals.
- (b) Drill out rivets that secure terminal board and park switch ground strap to plate. NOTE:

Screws, nuts and washers for attaching a replacement terminal board-park switch assembly are included with the replacement assembly.

b. Gear Box Assembly

Reverse Steps 1 thru 7 except as noted:

1. Reassembly of Gear Box Cover - Be sure cover is located properly over locating dowel pins and be sure to reinstall ground strap.
2. Reassembly of Crank Arm Operate wiper to park position (Figure 10-75) and install crank arm on output shaft in the position shown in Figure 10-73. Clamp crank in vise before securing the retaining nut.

c. Motor Disassembly and Assembly

1. Follow Steps 1 thru 7(a) under gear box disassembly.
2. Release brush spring pressure against brushes as shown in Figure 10-77.
3. Move brushes away from armature and slide armature out of frame and field assembly. Pull end cap assembly off armature. See Figure 10-81.

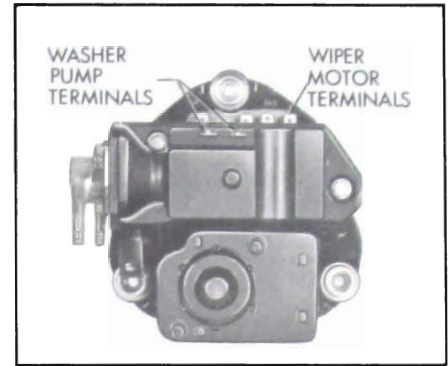


Figure 10-81—Windshield Wiper Motor—Two Speed

- 4. Remove end play adjusting washers.

To reassemble motor, reverse Steps 1 thru 4.

NOTE: Lubrication of armature shafts and bearings should be with light grade machine oil. Gear teeth and cam should be lubricated with Delco gear and cam lubricant.

d. Wiper Specifications

- Operating Test Voltage 12
- Crank Arm Rotation (looking at arm) CCW
- Current Draw (Amps.)
- No load 3 Max.

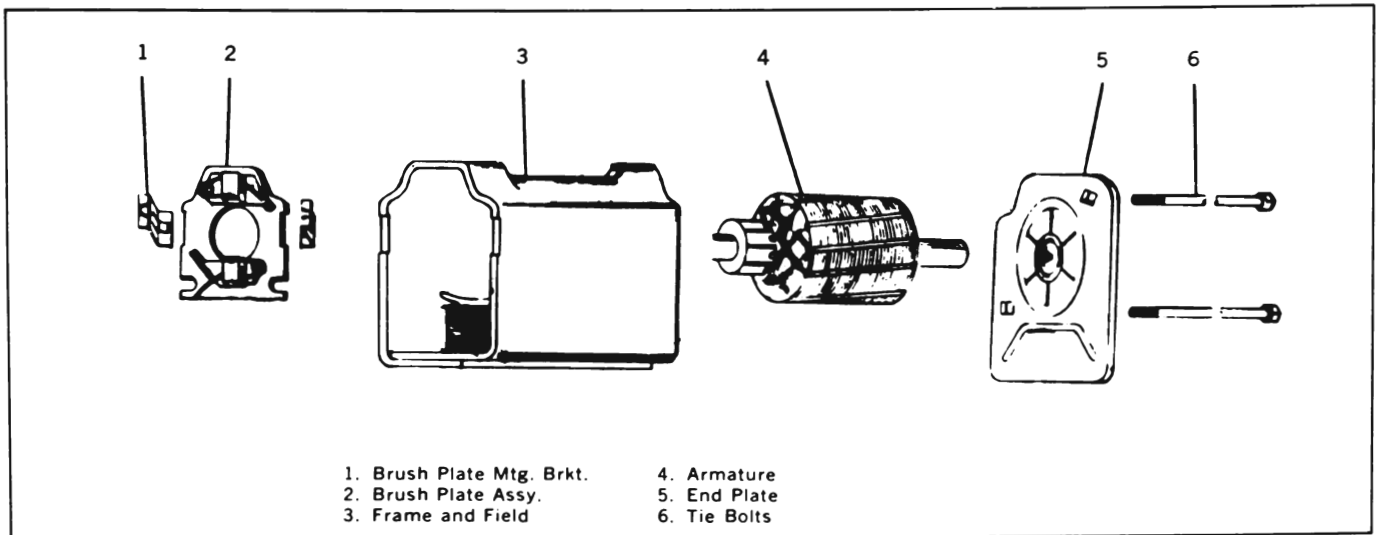


Figure 10-80—Motor Assembly

Dry windshield 3.5 Max.
 Stall 11.0 Max.

10-55 DESCRIPTION AND OPERATION—TWO SPEED

a. General Description

The two-speed non-depressed park wiper consists of a rectangular shaped compound wound motor (series and shunt field) adapted to the same type gear train as that used with the single speed wiper (See Figure 10-72). The two-speed wipers have a 36:1 gear ratio.

b. Operation

The principle of operation is very similar to that of the single speed wiper as explained under "Principle of Operation" in paragraph 10-52. A combination pictorial and schematic circuit is shown in Figure 10-82. An explanation of "LO", "HI" and parking circuits follows:

1. Lo Speed

When the wiper switch is moved to the "LO" speed position (Ign. Sw. On) current from the battery flows through the series field coil and divides; part passing through the shunt field coil to ground at the dash switch, the other part passing through the armature to ground at the dash switch. See Figure 10-83.

2. Hi Speed

Moving the wiper switch to the "HI" speed position opens the shunt field circuit to ground at the dash switch and keeps the armature circuit closed to ground. The shunt field current must then pass through a 20 ohm resistor located on the back of the wiper terminal board, and then through the same lead that connects the armature circuit to ground through the dash switch. See Figure 10-84.

3. Parking Circuit

Moving the dash switch to the "off" position opens both the armature and shunt field circuits to ground at the dash switch. However, both of these circuits are

still closed to ground through the parking switch. NOTE: The shunt field circuit actually flows via the dash switch back to the wiper parking switch direct to ground which means that wiper is actually operating in "LO" speed during the parking cycle.

When the cam on the wiper output gear opens the park switch contacts, the wiper is "off" and the blades and/or wiper crank arm should be in the park position. See Figure 10-73 which shows a typical crank arm in park position. See Figure 10-85.

4. Connections to Operate Wiper

Figure 10-86 illustrates the method of connecting leads to the wiper for either bench operation or to run wiper independently of dash switch and car wiring when installed in car.

10-56 TROUBLE-SHOOTING AND TESTING

a. Trouble-Shooting—Wiper in-Car

1. Wiper Inoperative

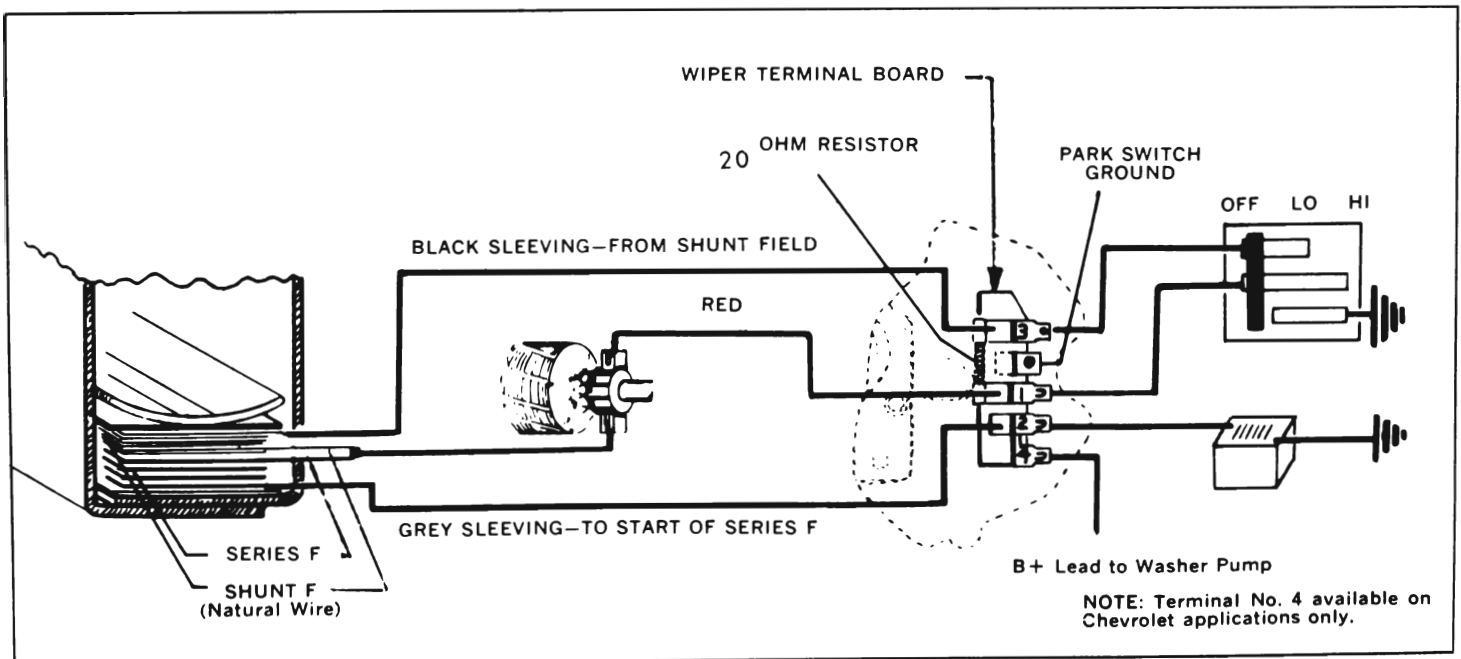


Figure 10-82—Two Speed Wiper Motor Wiring

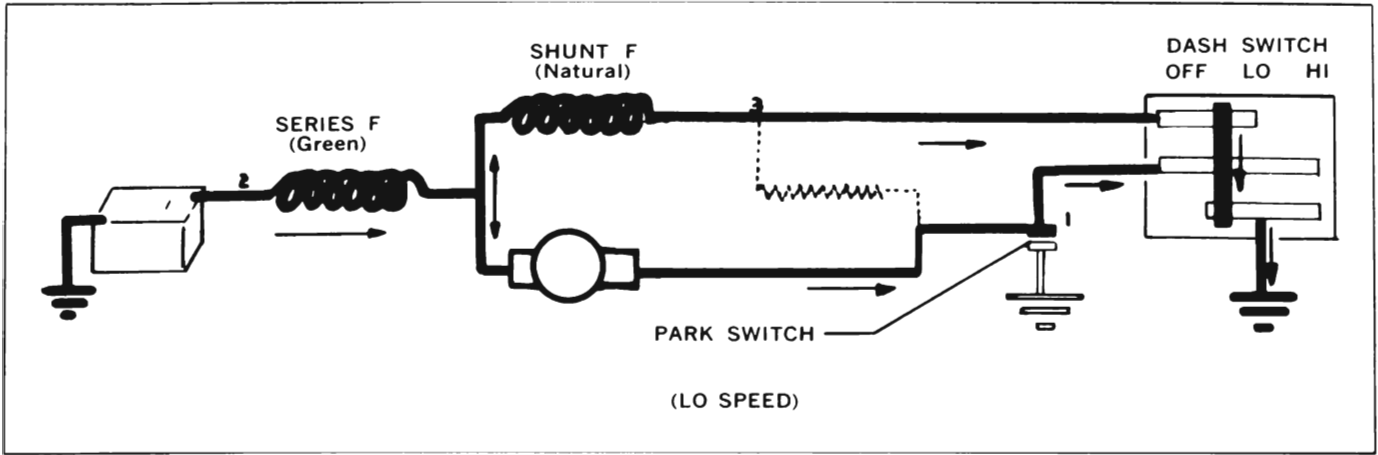


Figure 10-83—Lo Speed Circuit

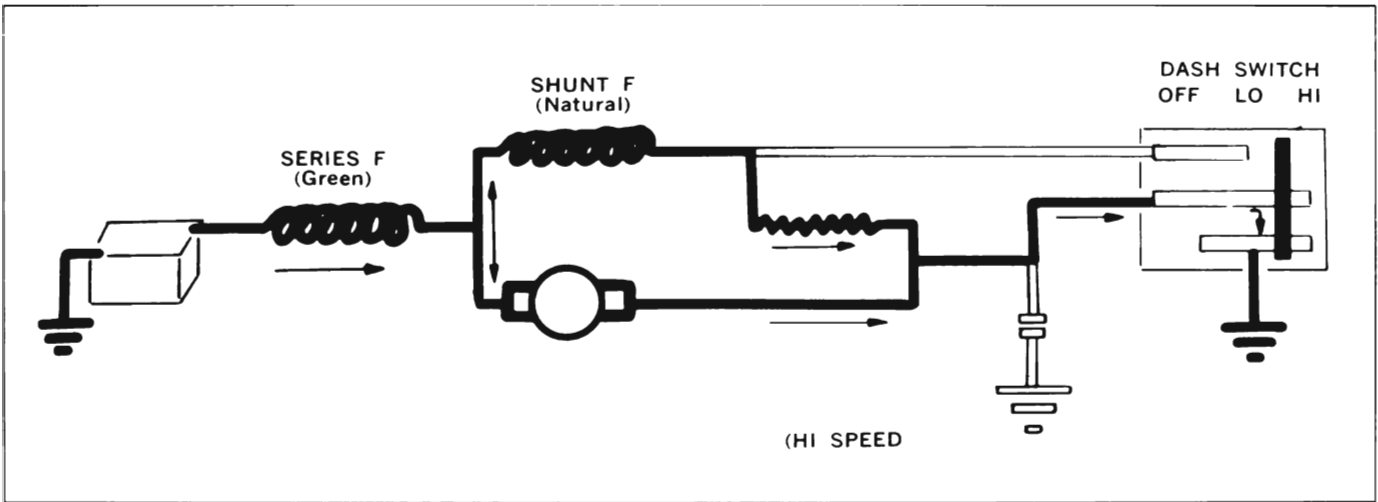


Figure 10-84—Hi Speed Circuit

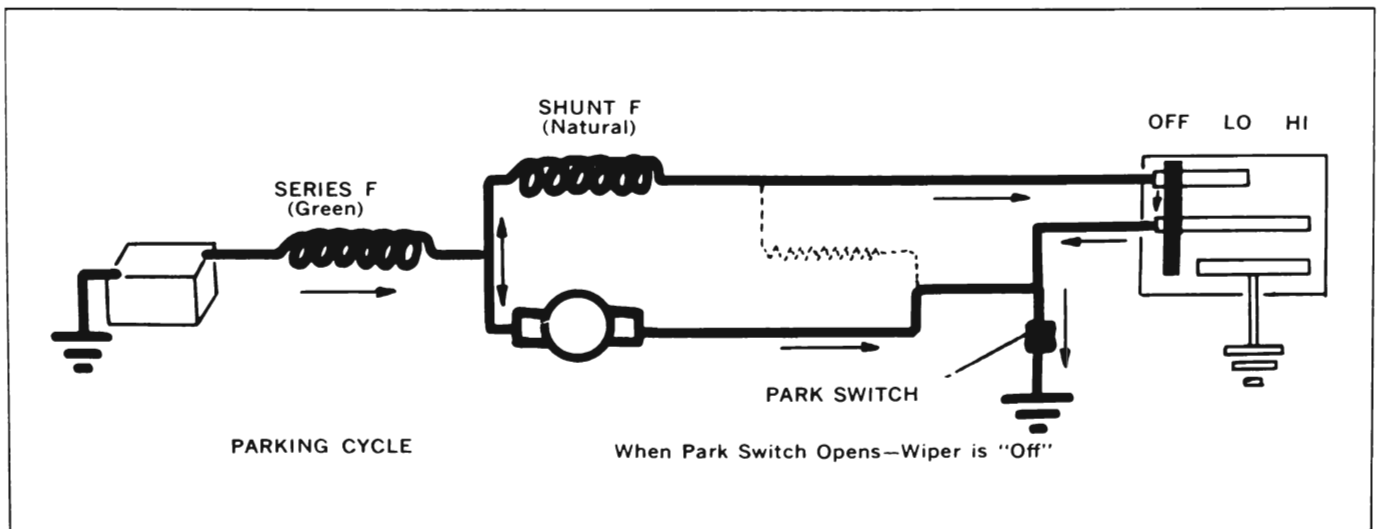


Figure 10-85—Parking Circuit

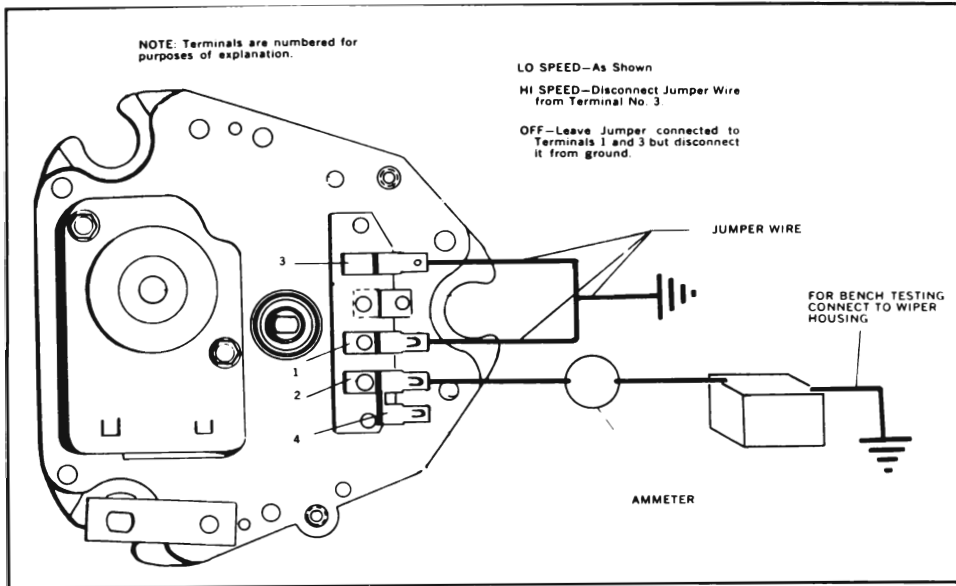


Figure 10-86—Connections to Operate Wipers

(a) Check that wiring harness is properly connected to wiper and dash switch; wiper ground strap is connected securely to car body; and dash switch is securely mounted.

(b) With ignition switch on, check for 12 volts at harness terminal that connects to number (2) terminal (Figure 10-86).

(c) To determine if dash switch or car wiring are at fault, disconnect harness from wiper motor and try operating wiper as shown in Figure 10-86. If wiper fails to operate, remove body parts as required, disconnect transmission from wiper crank arm and recheck wiper operation. If wiper still fails to perform correctly, remove wiper from car and check wiper according to procedure under Trouble-Shooting Wiper Out-of-Car.

2. Wiper Will Not Shut Off

(a) Determine if wiper has both "Lo" and "Hi" speeds, "Lo" speed only, or "Hi" speed only. (Important - wiper must operate in "Lo" speed during parking cycle).

(b) Disconnect wiring harness from wiper motor and try operating wiper independently of dash switch as shown in Figure 10-86.

If wiper operates correctly independently of the dash switch, (i.e. shuts off correctly with crank arm in park position) refer to the table below for possible trouble location -

If wiper still fails to operate correctly in Step (b), remove it from car and check it per instructions under Trouble-Shooting Wiper Out-of-Car.

Wiper Will Not Shut Off And:	Possible Trouble
Wiper has both speeds.	(1) Lead between wiper terminal No. 1 and dash switch grounded. (2) Defective dash switch.
Wiper has "Lo" speed only.	(1) Lead between wiper terminal No. 3 and dash switch grounded. (2) Defective dash switch.
Wiper has "Hi" speed only.	(1) Lead between wiper terminal and dash switch open. (2) Defective dash switch.

3. Wiper Has One Speed - Fast

Check for a defective dash switch or open lead between terminal Number 3 and dash switch.

4. Wiper Has One Speed (Slow) and Shuts "Off" With Dash Switch In "Hi" Speed Position

Reverse harness leads that connect to wiper terminal 1 and 3.

5. Blades Do Not Return to Park Position When Wiper is Turned "Off"

(a) Check wiper ground strap connection to car body.

(b) Remove wiper from car and check for dirty, bent or broken park switch contacts.

6. Wiper Speed Normal In "Lo" But Too Fast In "Hi"

Remove wiper from car and check for an open terminal board resistor.

7. Intermittent Operation

Check for loose wiper ground connections and/or loose dash switch mounting.

**b. Trouble Diagnosis—
Wiper Out-of-Car**

It is assumed that in many cases there is no information available to the repairman about the original wiper complaint. It is necessary, therefore, that wiper operation be checked according to the instructions shown in Figure 10-86. **IMPORTANT - Be sure and use an ammeter capable of reading at least 30 amperes in the feed wire circuit.**

1. Wiper Inoperative

Connect wiper to operate in "Lo" speed and observe current draw. Current draw ratings shown below will provide a hint as to the possible source of trouble.

Ammeter Reading (Amps)	Possible Trouble
0	(1) Loose solder connection at wiper terminal No. 2. (2) Loose splice joints or brush lead connections.
1-1.5	(1) Open armature. (2) Brushes sticking. (3) Loose splice joint.
11.0	(1) Broken gear or some other condition that will stall the wiper.
2. Wiper will not shut off and:	Possible Trouble
Wiper has both speeds.	(1) Park switch contacts not opening. (2) Internal wiper motor lead that connects to wiper terminal No. 1 grounded.
Wiper has "Lo" speed only.	(1) Internal wiper motor lead that connects to wiper terminal No. 3 grounded. (2) Shunt field coil grounded.
Wiper has "Hi" speed only.	(1) Internal wiper motor lead that connects to wiper terminal No. 3 open. (2) Shunt field open.

3. Wiper Has "Hi" Speed Only

See Possible Trouble under 2.

4. Wiper Has "Lo" Speed Only

See Possible Trouble under 2.

5. Wiper Crank Arm Does Not Return To Park Position When Wiper Is Turned Off. Park Position is shown in Figure 10-87. Check for dirty, bent or broken park switch contacts.

6. Wiper Speed Normal In "Lo" But Too Fast In "Hi"

Check for open 20 ohm resistor on back of wiper terminal board.

7. Intermittent Operation

Check for sticking brushes, loose splice joints, etc.

10-57 DISASSEMBLY AND ASSEMBLY

Except for the internal wiring to the wiper terminal board, the disassembly and assembly procedures for the two speed wipers covered in this section are the same as those outlined for the single speed wipers in paragraph 10-56 of this manual. See Figure 10-87 for internal wiring.

a. Specifications

Operating Volts 12 VDC

Gear Ratio 36:1

Crank Arm Rotation
(looking at Crank Arm) . . CCW

Crank Arm Speed:
(RPMs) (No Load)
Lo 34 Min.
Hi 65 Min.

Current Draw: (Amps)
No Load (Lo Speed) . . 3.6 Max.
Installed in Car -
(Dry Glass) 4.5 Max.
Stall 12 Max.

Shunt Field Resistor. . 20 OHMS

10-58 WINDSHIELD WASHER DESCRIPTION AND OPERATION

a. General Description

The washer pump used on the two speed non-depressed park wiper is a positive displacement type pump employing a small bellows, bellows spring and valve arrangement. The pumping mechanism is actuated by a 4 lobe cam driven by the wiper. See Figure 10-89. The programming (starting and

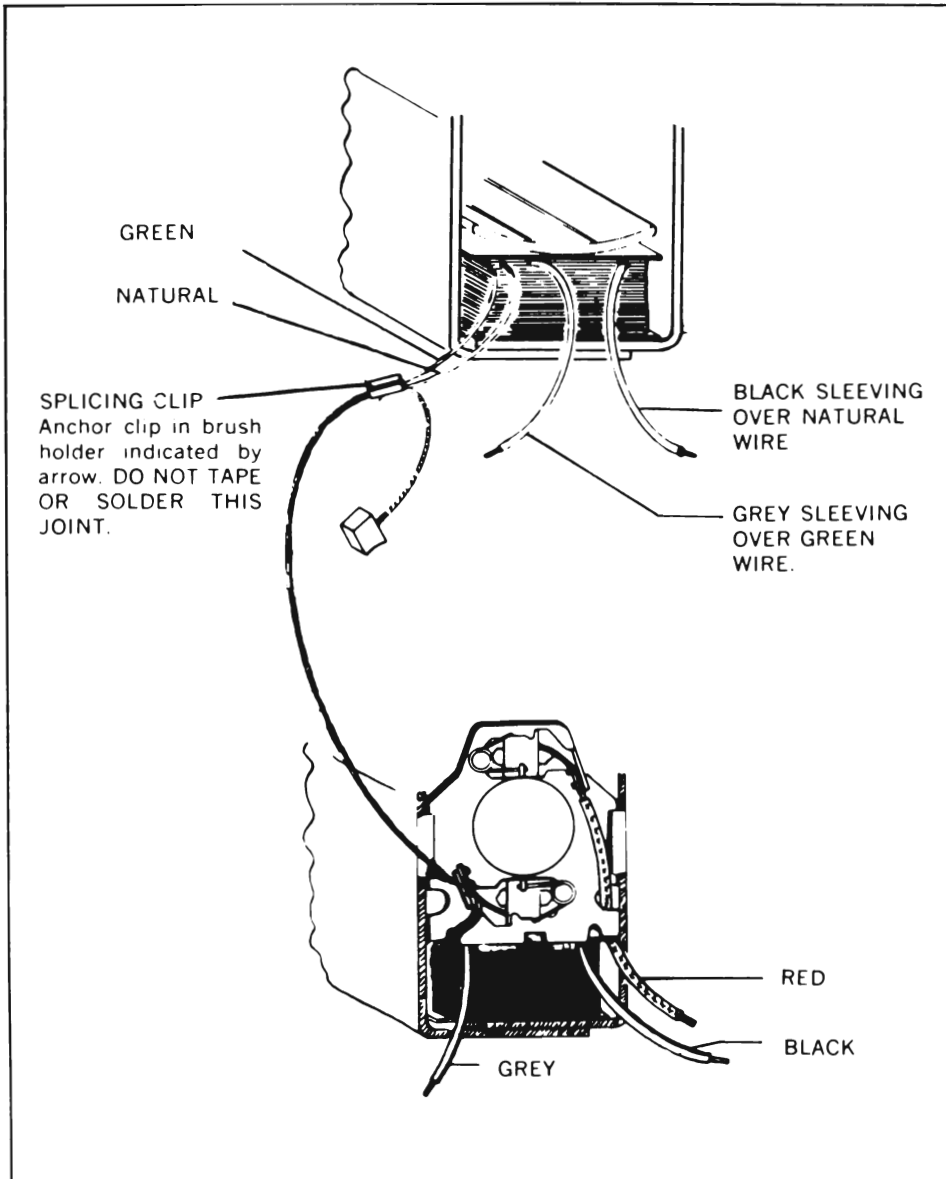


Figure 10-87—Two Speed Motor Wiring

completion of a wash cycle) is accomplished electrically and mechanically by a relay assembly and ratchet wheel arrangement. See Figure 10-88.

Explanation of pump operation follows:

b. Washer Operation

1. Wiper On - Washer Off

When the washer pump is mounted on the wiper correctly, a pin and roller assembly on the washer pump engages a 4 lobe cam on

the output shaft of the wiper output gear. (Figure 10-89). The pin and roller assembly is attached to the spring loaded plate and ratchet pawl assembly. See Figure 10-88. Thus, with the wiper running, the 4 lobe cam rotates continuously and actuates the plate and ratchet pawl assembly back and forth in a horizontal plane. A second pin, attached to the plate and ratchet pawl assembly, extends through a slot in the bellows plunger arm. This pin moves freely back and forth in the slot while the pumping mechanism is in the "lock-out" position and no pumping action occurs.

The pump is in the "lock-out" position when the relay holding contacts are open and a tang on the plunger arm rests against the widest part of an eccentric ramp located on the lower surface of the ratchet wheel. The tang holds the bellows plunger arm in a retracted position (bellows spring compressed) allowing the plunger arm actuator pin on the plate and ratchet pawl assembly (Figure 10-88) to move freely back and forth in the plunger arm slot and thus no pumping action occurs.

The ratchet pawl is spring loaded to hold it away from engaging the ratchet wheel teeth until such time as the washer pump relay is energized by the dash switch washer button.

2. Turning The Washer On

Depressing the dash switch washer button closes the washer pump relay circuit to ground. (Refer to Figure 10-90). NOTE: If wiper was 'off' the wiper switch is mechanically turned to the 'on' position by the washer button.

With the washer relay coil energized, the ratchet pawl, which is normally held away from the ratchet wheel by a spring, is pulled toward the coil pole and engages the ratchet wheel teeth. The ratchet pawl and plate assembly, which moves back and forth continuously when the wiper is on, now starts to rotate the ratchet wheel (Figure 10-91).

When the ratchet wheel has been rotated one tooth, two simultaneous functions occur (1) the eccentric ramp on the ratchet wheel is moved away from the plunger arm tang, releasing the pumping mechanism from its lock-out position and (2) a set of holding contacts close, maintaining the coil circuit to ground. The contacts will stay closed until the ratchet wheel has

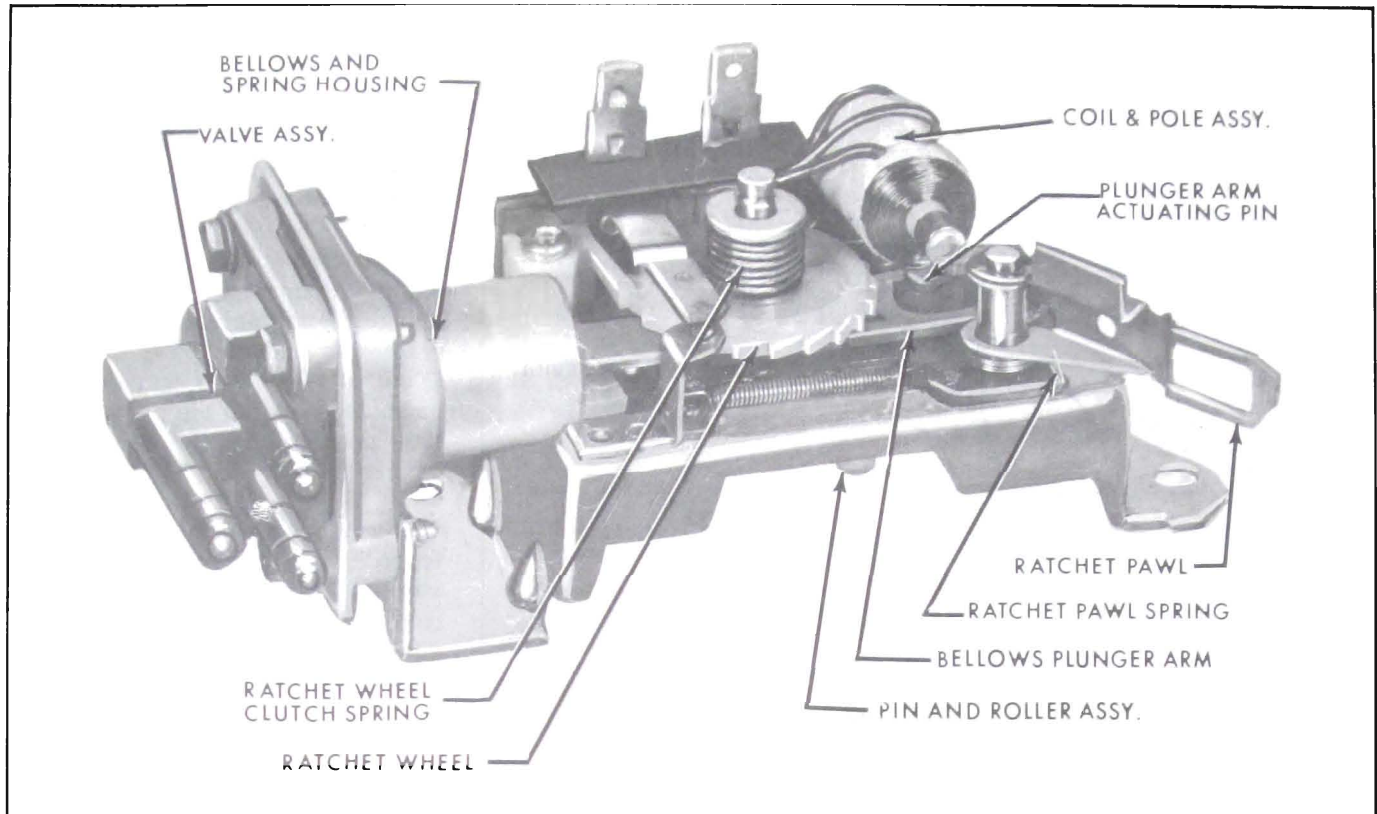


Figure 10-88—Washer Pump with Cover Removed

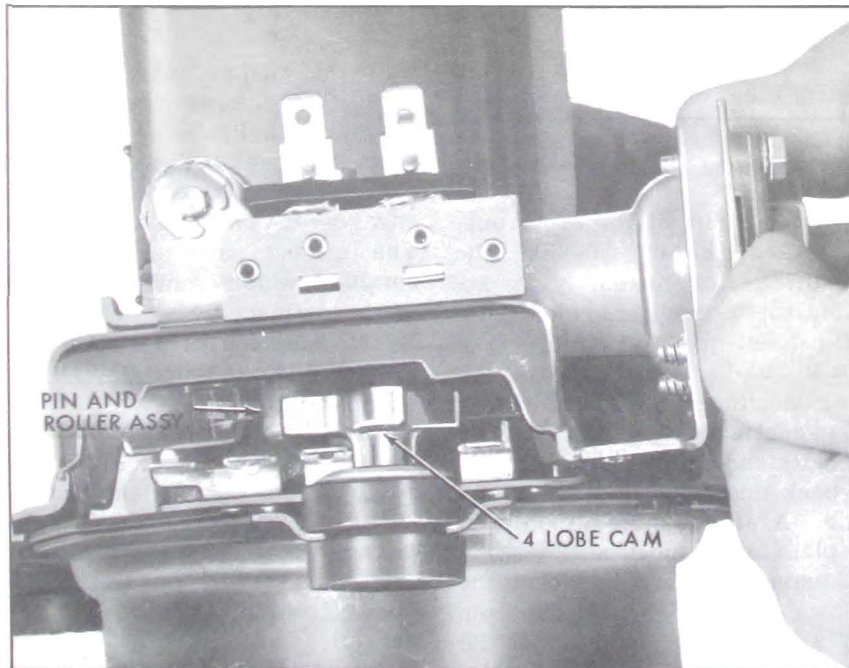


Figure 10-89—Washer Pump Drive

been turned through 360° or 21 teeth, at which time the ratchet wheel will again open the contacts.

3. Pumping Cycle

(a) (Exhaust half of pump stroke:)

With the pumping mechanism released from its "lock-out" position, the bellows spring expands and collapses the bellows forcing water out two outlet valves. (Figure 10-92). The plunger arm, which is attached to the bellows, is pulled forward with the bellows and the back edge of the plunger arm slot moves up tight against the plunger arm actuator pin. The actuator pin, which was previously moving back and forth freely in the plunger arm slot, will now pull the plunger arm back and compress the bellows spring each time a lobe of the 4 lobe cam actuates the plate and ratchet pawl assembly.

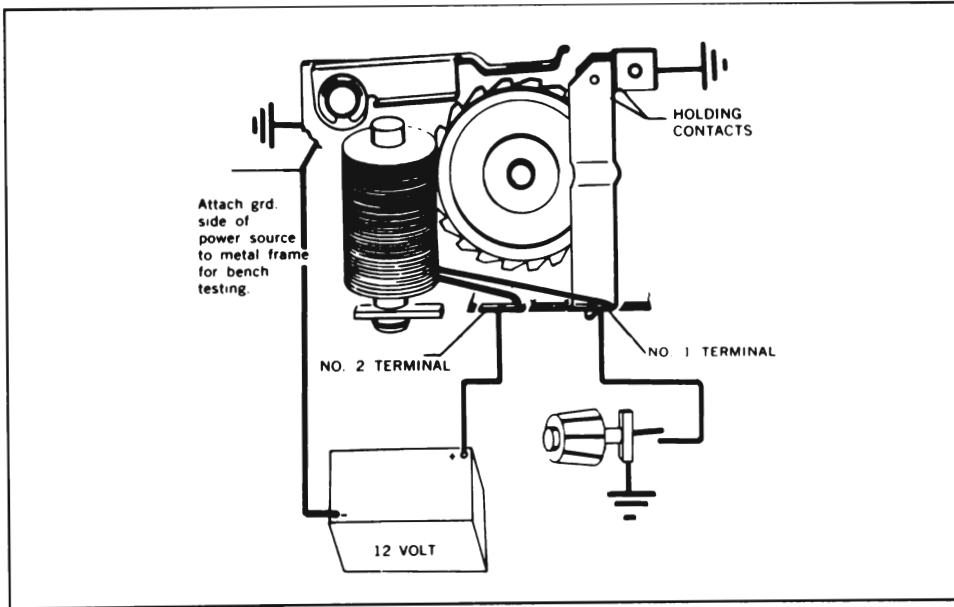


Figure 10-90—Washer Pump Wiring Diagram

(b) (Intake half of pump stroke:)

Pulling the plunger arm back compresses the bellows spring (Figure 10-93) and water is drawn into the bellows through the intake valve. During the intake of water, the exhaust or outlet valves are drawn tight against their seats. During each intake stroke of the pumping mechanism, the ratchet wheel is rotated one tooth.

4. Completion Of Wash Cycle

The wash cycle is completed when the electrical circuit to the relay coil is opened and the pumping

mechanism reaches its "lock-out" position. This is accomplished as follows:

When the ratchet wheel has been rotated through 360° or 21 teeth, the relay coil holding contacts are pushed open by a "hump" on the ratchet wheel. This opens the coil circuit and the spring loaded ratchet pawl moves away from the ratchet wheel preventing further rotation of the ratchet wheel.

As the ratchet wheel rotates, the tang on the bellows plunger arm starts to ride up the eccentric

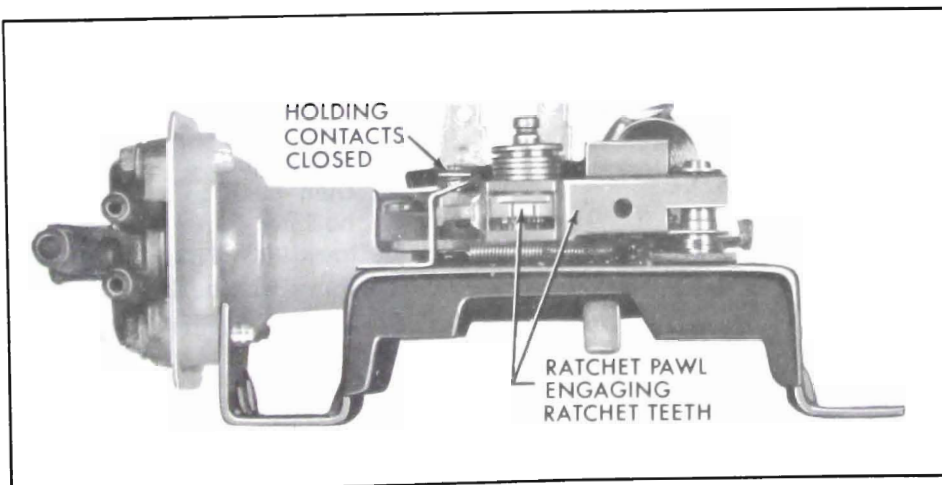


Figure 10-91—Ratchet Pawl Engaging Ratchet Wheel

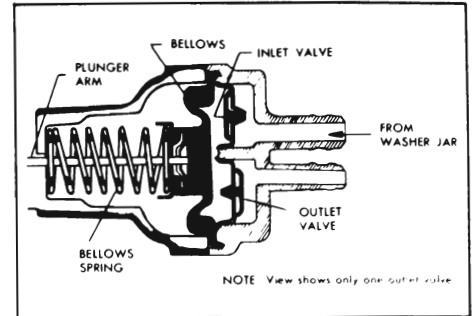


Figure 10-92—Pump Stroke (Exhaust)

ramp on the lower surface of the ratchet wheel. The full "lock-out" position of the pumping mechanism is reached when the tang is up on the widest part of the ramp. The tang reaches the "lock-out" position at the same time the relay coil holding contacts open.

10-59 WINDSHIELD WASHER TROUBLE SHOOTING

a. Washer Inoperative

1. Check the following items:
 - (a) Jar has adequate quantity of water solution.
 - (b) Hoses are not damaged and hose connections are tight.
 - (c) Screen at end of jar cover hose is not plugged.
 - (d) Electrical connections to washer pump and dash switch.
 - (e) Nozzles are not plugged.

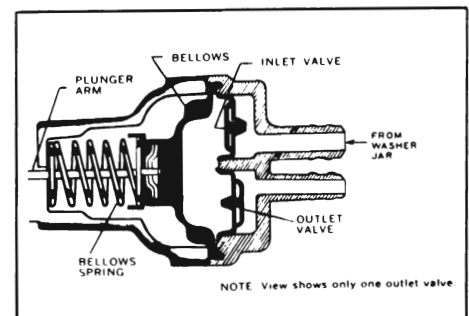


Figure 10-93—Pump Stroke (Intake)

2. If all items in Step 1 check out, start wiper motor only, then push washer button and listen for "click" as washer relay pulls in. If no "click" is heard, check for 12 volts at terminal without tab. No voltage indicates defective wiring. If "click" is heard, proceed to Step 4.

3. If correct voltage was found in Step No. 2, connect a jumper wire from terminal with tab to ground and operate wiper. If washer relay "click" is heard and pump functions correctly, a defective dash switch or an open circuit between washer pump and dash switch is indicated - "No Click" indicates an open relay coil.

4. If relay "click" is heard in Step 2, listen for the soft clicking as the pump ratchet wheel is rotated.

If "soft clicking" is not heard, the pump mechanism is faulty and should be removed from the wiper motor and checked.

If soft clicking is heard but no pumping action occurs, replace the valve assembly and recheck pump.

b. Checking Pump Operation With Washer Pump Detached

1. Remove washer pump cover and connect 12 volt power supply to washer pump as shown in Figure 10-90. Connect jumper wire from terminal No. 1 to ground. Turn ratchet pawl to the position shown in Figure 10-90. Ratchet

pawl should be pulled toward relay pole and engage ratchet teeth. Failure to do as described above indicates an open relay coil.

2. If relay and ratchet pawl perform correctly in Step 1, manually rotate the 3 lobe cam 1 lobe in a clockwise direction (looking at the cam). Observe if relay holding contacts close (Figure 10-91) and the pump plunger arm is released from its lock-out position.

3. Disconnect jumper wire from terminal No. 1. Relay coil should remain energized and hold ratchet pawl against ratchet wheel. Failure to do so indicates open or dirty holding contacts.

4. If pump performs correctly in Step 3, manually operate pin and roller assembly until the ratchet wheel has been turned through 360° or 21 teeth. After the ratchet wheel has been rotated 21 teeth, the holding contacts should be opened by a "hump" on the wheel and the pump plunger arm should be in the "lock-out" position.

c. Checking Valve Assembly

1. Attach a hose to the large or intake pipe. You should be able to blow through it but not draw through it.

2. Attach a hose individually to each of the small or exhaust pipes. You should be able to draw through them but not blow through them.

If any of three valves allow air to pass in both directions, the valve assembly is defective.

10-60 WINDSHIELD WASHER DIS-ASSEMBLY AND ASSEMBLY

a. Removal and Installation of Relay

1. Remove washer pump cover.
2. Unsolder coil leads from terminals. (NOTE: No coil polarity is necessary when resoldering coil leads).
3. Remove coil retainer clip and slip coil assembly out of mounting bracket.
4. To install reverse removal procedure.

b. Removal and Installation of Ratchet Pawl

1. Remove washer pump cover.
2. Disengage spring from ratchet pawl. (CAUTION: Be sure spring is properly assembled before replacing washer pump cover.)
3. Remove "E" ring and slide ratchet pawl off shaft.
4. To install reverse removal procedure.

c. Removal and Installation of Valve Assembly

1. Remove the four screws that secure the valve assembly to the bellows housing. (CAUTION: It is sometimes necessary to carefully pry the bellows lip out of the valve body groove.)
2. Manually operate pump to release pump from "lock-out" position (See "Checking Washer Pump Detached").
3. Hold bellows plunger arm from moving, then push in against bottom of bellows with thumb and twist bellows 90°. This should release bellows and bellows spring.
4. To install reverse removal procedure.

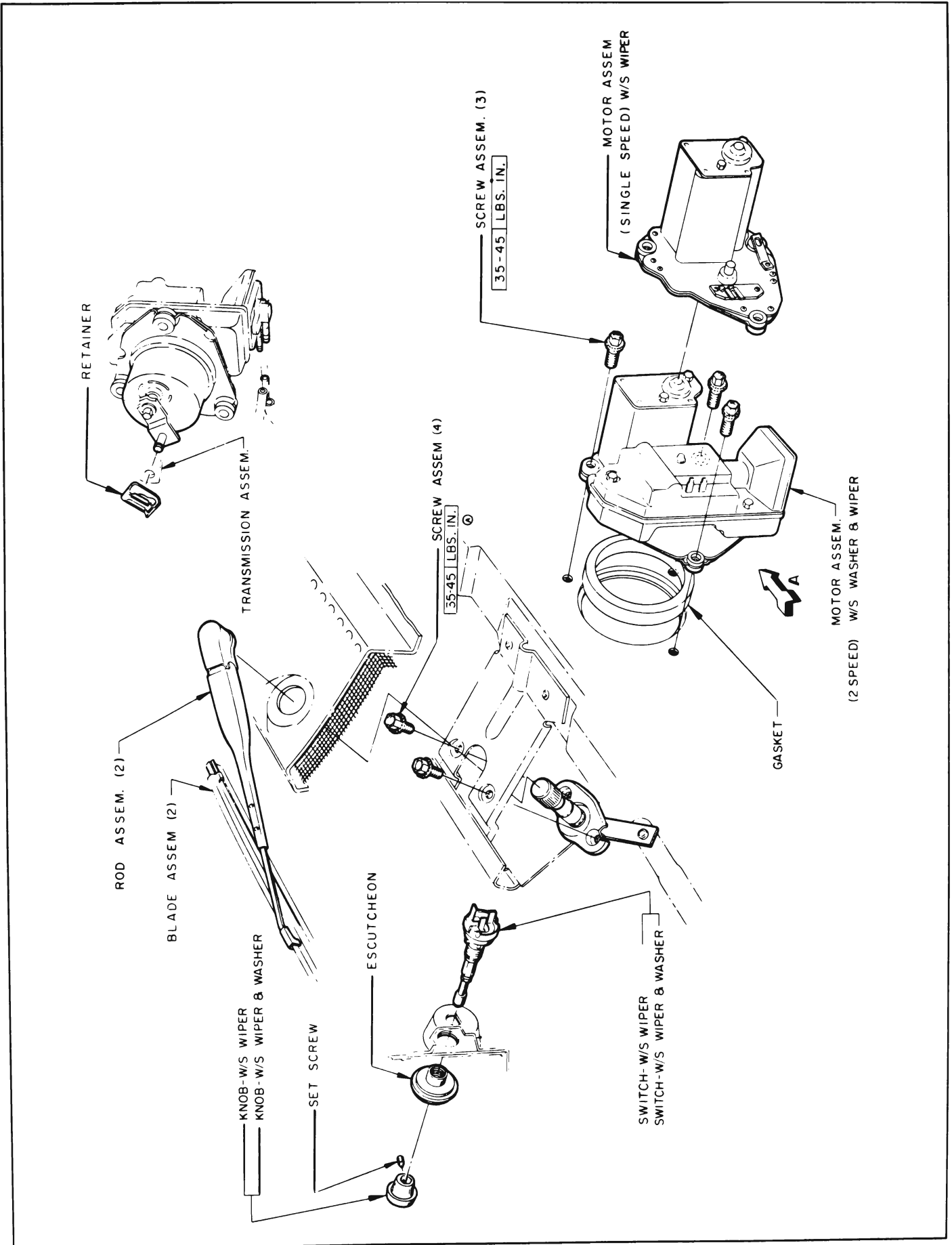


Figure 10-94—Windshield Wiper Installation

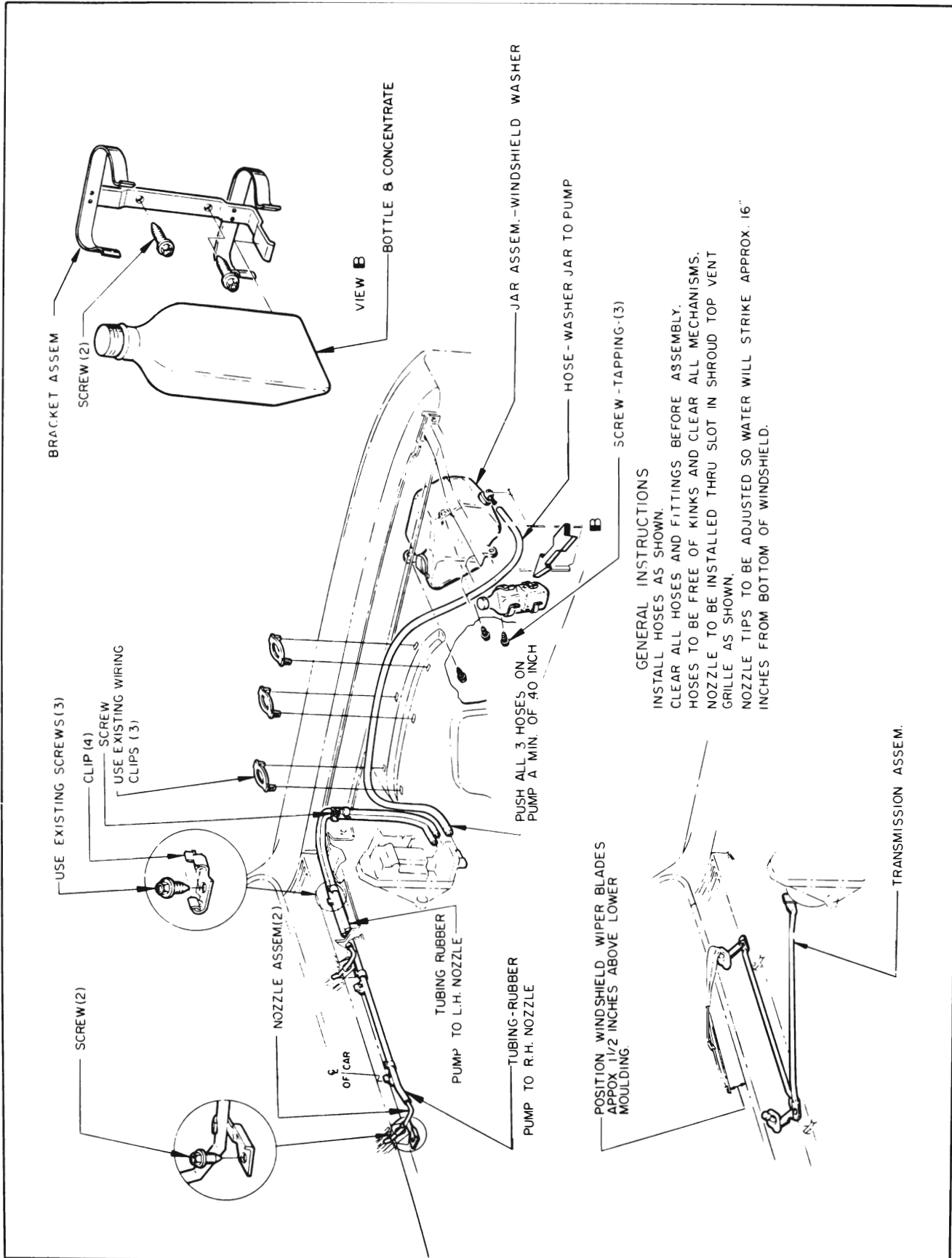


Figure 10-95—Windshield Washer Hose Installation

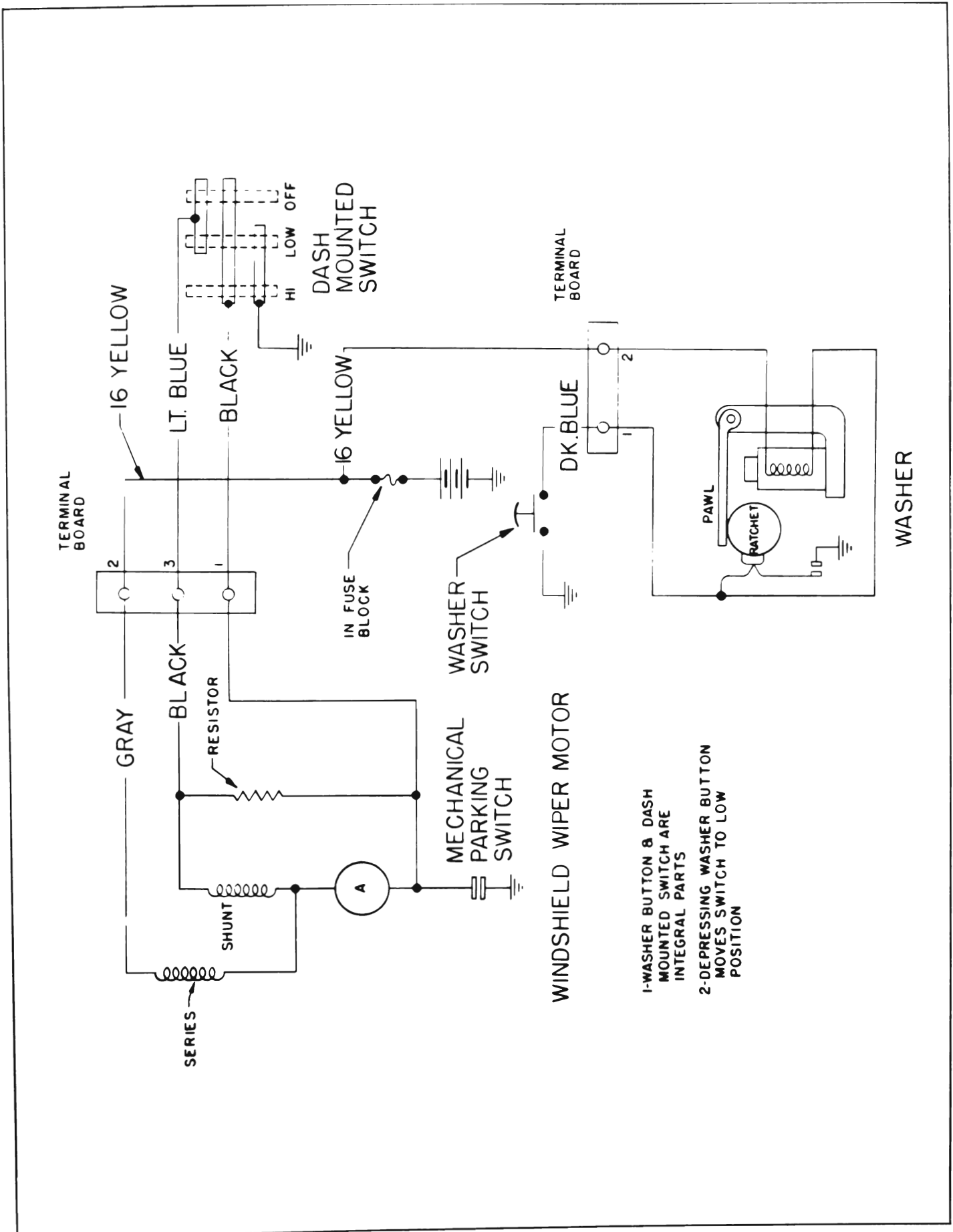


Figure 10-96—Windshield Wiper and Washer Wiring Circuit Diagram (Two Speed Wiper)