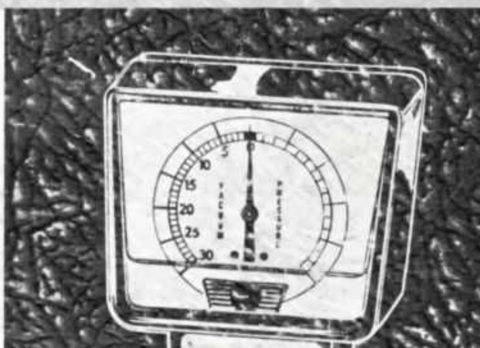
TRAINING HANDBOOK 1760

DIAGNOSIS OF VACUUM-OPERATED COMPONENTS



Ford

REGISTERED TECHNICIAN

VOL. 67 S6 L2

FOREWORD

This handbook is to assist you in the proper diagnosis of vacuum-operated component problems.

Most of the time, the customer can supply you information which will pinpoint the problem condition. This complaint should be noted on the repair order.

For example, the complaint "speed control switch is broken" will pinpoint the problem to the switch. However, if the repair order simply says that "the speed control doesn't work" you will have to determine specifically which part of the system does not work.

In either case, there is a definite procedure to follow:

- Verify the customer complaint
- Isolate the system
- Isolate the component in the system
- Repair or replace the component

To assist the Service Technician to develop these skills, this handbook contains:

- Description of operation for each system
- Adjustment procedures for the system components
- Procedures for component tests
- Page references for each system in the Vacuum Diagram and Wiring Diagram books
- Diagnosis "Road Maps" that indicate specific customer problems and the checks, tests, adjustments and repairs necessary for correction. These specific customer problems are all listed on the CONTENTS page.

The diagnosis procedures for the vacuum controlled air conditioner systems are included in the Air Conditioning Diagnosis, Adjustment and Repair Course 19001.1 and 19002.1 handbook.

DIAGNOSIS OF VACUUM-OPERATED COMPONENTS

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TABLE OF CONTENTS

NATIONAL SERVICE ACTIVITY

FORD DIVISION

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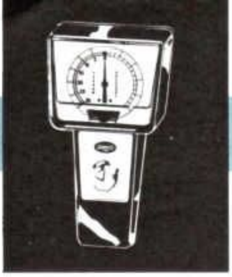
FIRST PRINTING—APRIL, 1967

Page



GENERAL DIAGNOSIS AND CORRECTION

GENERAL VACUUM DIAGNOSIS

Diagnosis of vacuum controlled systems is basically similar to electrical diagnosis. That is, the vacuum system must be complete from the source to the vacuum components. Any leaks, like a bad connection, will make the system inoperative. If a leak develops in one of the vacuum systems, one or all of the vacuum components may become inoperative. This would be dependent on the location of the vacuum leak. If the leak is in the components side of the vacuum control for the specific system, all other systems will operate when the leaking system is off.

When testing a vacuum control system, a minimum of 14 inches of mercury vacuum should be available at all points where vacuum is applied.

Failure to maintain 14 inches of mercury vacuum during vacuum system tests could be caused by a bad hose connection, resulting in a vacuum leak. When checking for vacuum between two points, trace the hose along the entire routing to be sure it is not pinched, cracked or crossed with another hose and connected to the wrong connection.

Leaking or disconnected hoses can usually be discovered by listening for a hissing sound along the hose routings. All of the vacuum system checks should be performed with the engine running. **Do not apply air pressure to the vacuum system, because the actuator diaphragms may be damaged.**

VACUUM GAUGE TESTER FABRICATION

A vacuum gauge is required to diagnose and test a vacuum control system. The Rotunda Fuel Pump Tester Gauge (ARE345) is recommended. It is also recommended that the vacuum gauge be used, from time to time, as a part of a vacuum probe tester. Ordinarily, a vacuum gauge used alone is used to measure the vacuum from a vacuum system hose or nipple back to the primary vacuum source, the reservoir, or the engine intake manifold. A vacuum probe tester, on the other hand, supplies vacuum to a particular point of the vacuum system and is used to supply a definite amount of vacuum to a particular point in the system. It tests the system from this point to the component.

A vacuum probe tester is not commercially supplied, but it is easily made:

1. Cut or splice a length of 3/16-inch hose long enough to reach from the engine intake manifold to the remotest component in the vacuum system. Let's call the ends of the hose the manifold end and the working end.
2. Insert a 4-way connector into the working end of the hose.
3. Attach a vacuum gauge to one of the 4-way connector nipples (Fig. 1).

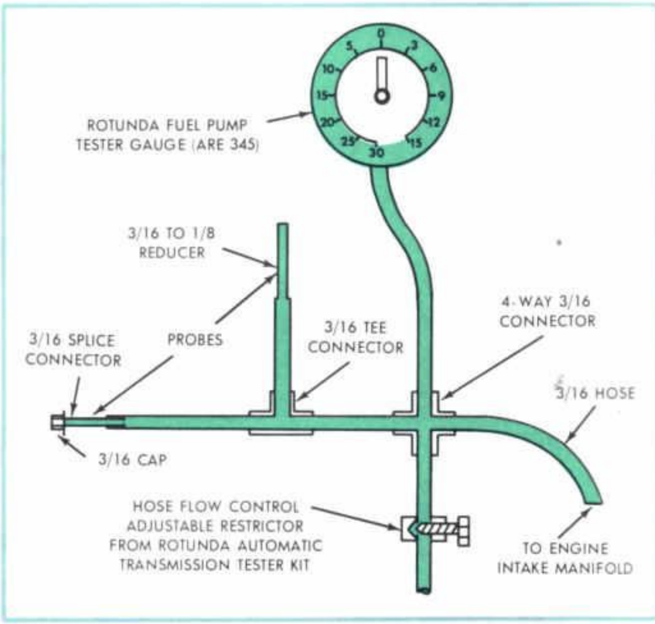


Fig. 1 — Vacuum Gauge Tester

4. Install a short length of 3/16 hose with an adjustable hose restrictor on another nipple of the 4-way connectors.
5. Install a short length of hose on the last nipple of the 4-way connector. Insert a Tee connector into this hose.
6. Install a short length of hose to the two open ends of the Tee connector (Fig. 1). Install a 3/16-1/8 reducer in one hose and a 3/16 splice connector in the other hose. By adding or removing connectors (splices) to these test probe hoses, these hoses can be connected to any one 3/16 or any one 1/8 hose, nipple, or connector, while the other test hose is plugged, or both the 3/16 and 1/8 tester probes can be used at the same time.

To adjust the probe to the required 14 inches of vacuum, plug the test probe hoses and adjust the hose restrictor until the vacuum gauge reads 14 inches. The vacuum supply at the end of the test probe hoses should be checked often, because the engine warms up, loads up, etc.

Let's see how the vacuum gauge and the vacuum probe tester might be used on the vacuum controlled door lock system.

In a vacuum door lock diagnosis and testing situation, we might use only the vacuum gauge to measure the reservoir vacuum available for the door lock system at the dash panel right junction block (passenger side) nipple. The gauge reading here will tell us whether enough vacuum supply is available at the junction block to operate the door lock system. To connect the gauge here, we will usually disconnect the 3/16 red hose from the junction block (Fig. 2), and

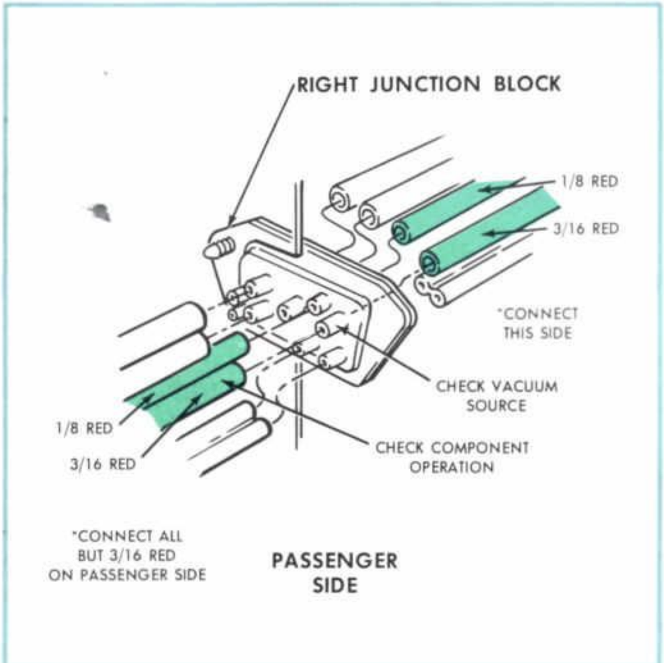


Fig. 2 — **Vacuum Test**

attach the gauge with a short length of hose. Should we find that the vacuum supply at the junction block is not adequate, we know that we must repair the system between the junction block, the reservoir, the other connected systems, and the engine intake manifold. Since removal of the 3/16 red hose at the dash panel right junction block disconnected the system within the passenger compartment, we can adjust the probe vacuum supply to 14 inches, plug the 1/8 tester probe hose, and insert the 3/16 tester probe hoses and connector into the 3/16 red hose. The total door lock system within the passenger compartment is now supplied with adequate vacuum, and the doors should lock and unlock by the manual switch.

The vacuum supply capacity in the probe is not as great as the regular supply, since the hose is smaller. In the car, a 1/4-inch hose is used in the engine compartment, plus a reservoir in this 1/4-inch line. This means that it may take longer (in time) for the doors to lock and unlock with the probe applied than with the normal car reservoir system applied. The probe, however, has an advantage in that we can see, on the probe gauge, the vacuum reading at which the locking and unlocking occurs. The gauge will also tell us whether there are leaks in the system or whether that part of the system works or not.

GENERAL ELECTRICAL DIAGNOSIS

A definite plan or procedure must be followed in order to perform tests efficiently and quickly. With all the different types of electrical circuits found in an automotive vehicle, it is impossible to establish one set procedure which would apply in all cases. The following procedures will provide a systematic approach to any testing problem.

- If the fault is in a single-unit in a multiple-unit circuit, start the test at the unit (Fig. 3).
- If the fault affects all the units in a multiple-unit circuit, start the test at the point where the circuit gets its power (Fig. 4).

An example of this procedure is found in the light circuit. If only one bulb in the circuit will not operate (Fig. 4), start checking at the light bulb and check back along each part of the circuit until the defective element is found. If all the lights in a circuit do not operate, start checking at the point where the power is first intro-

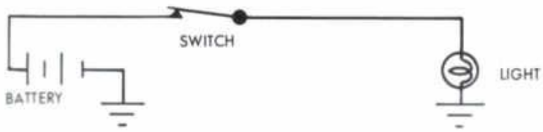


Fig. 3 — **Single Unit Circuit**

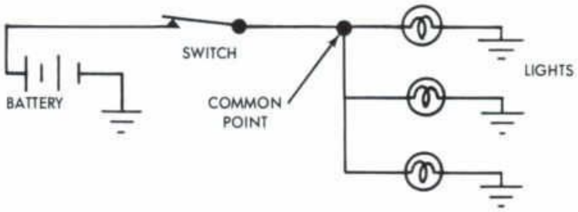


Fig. 4 — Multiple Unit Circuit

duced into the circuit and check each connection in sequence until the defective part is found. The term "common point of the circuit" will be referred to as that point farthest from the power source where more than one component receives its power.

TEST FOR COMPLETE CIRCUITS

All electrical circuits must be complete from the source of power (battery), to the unit where the power is used, and back to the source of power again. A check at each connection in a circuit, starting at the battery, will locate an open circuit or will show that the circuit is complete.

A self-powered test light connected at any two points of a circuit with the power removed from the circuit, will show if the circuit between the two connections is open or complete. If the bulb does not light, the circuit is open. If the bulb lights, the circuit is complete.

VISUAL INSPECTION

The most common problems revealed by visual inspection are defective connections or damaged wires. A loose connection can cause intermittent operation of the circuit or can cause the circuit to be open. Corrosion can appear as high resistance or as an open circuit. A damaged wire is obvious by noting sharp kinks or frayed insulation.

Move the wires around by hand when making this test. A wire may be rubbing against a sharp sheet metal edge or on the point of a screw which can cause the insulation to be cut or worn through to the wire. If the bare wire comes in contact with the sheet metal or screw, the circuit will be grounded.

The visual inspection should be made quickly, but cautiously, of exposed easy-to-get-at parts. A visual inspection does not mean a disassembly of body parts to check the wiring harness completely through the entire circuit.

ELECTRICAL TESTS

There are two types of electrical testers that will be used. Each tester is both effective and inexpensive.

A. JUMPER WIRE

Although the jumper wire is not a true instrument, it is a very effective testing device when properly used. Care must be exercised in using a jumper wire. A jumper wire is nothing more than a piece of stranded, insulated electrical wire, of sufficient length and current capacity, with suitable connectors attached to each end (Fig. 5).

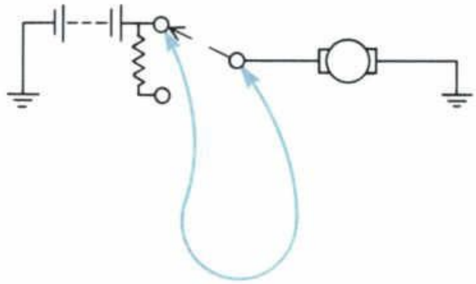


Fig. 5 — Jumper Wire

The jumper wire is used as a substitute for a part in the circuit. To use it in a test, disconnect the leads going to the part and connect the jumper wire between the leads. If the circuit operates properly with the jumper wire used in place of the part, the part which was removed from the circuit is defective. A defective switch, fuse, circuit breaker, relay or similar part may be quickly found by substituting a jumper wire for the hot circuit and ground, or a fire may result.

In many cases when an electrical component stops operating, the trouble can be a blown fuse; and by replacing with a good fuse, the trouble may be eliminated. However, it will generally be found that something caused the fuse to blow other than just a bad fuse. If the second fuse blows soon after replacement, this is a sure sign of some other trouble.

B. TEST LIGHTS

When reference is made to "Test for Power" or "Check for Power," it is understood that the test will be performed using a 12-volt test light. When one test light is connected to a good ground and the other lead is connected to a

point in the circuit, there is power from the battery to that point if the test lamp lights (Fig. 6).

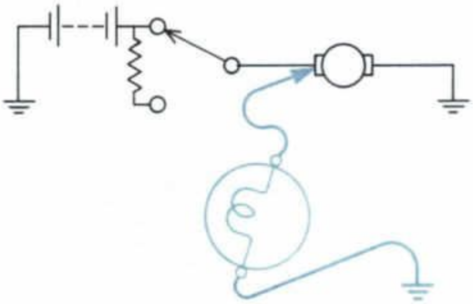


Fig. 6 — Test Light

If the test lamp does not light, there is no power to the point being checked. When making this test, always start at a convenient midpoint (terminal or connection) in the circuit. If power is available, the battery and wires to this point are good. Check for power again at a convenient point in the middle of the unknown section. If the test lamp lights (indicating power) at one point, but does not light (indicating no power) at another point, the trouble is in the circuit between these two points. This test also can be made using a voltmeter in place of the test light, if it is desirable to know the amount of voltage to any given point in a circuit.

There are two basic types of test lights. These are the probe light and the self-powered test light. A probe test light does not have a power supply built into it. It uses the circuit power supply. It tests for power and continuity. A self-powered test light is used as a continuity tester only (Fig. 7). Because of the built-in power supply, it cannot be used as a tester for power.

Tests for power can be made at the electrical terminals by loosening the wire connector enough to touch the metal terminal with the test light.

Internal circuits of a relay or switch can be tested with a self-powered test light. Be sure to disconnect the unit from the wiring harness before hooking up the light. The solenoid of a relay can be checked by connecting a jumper wire from the battery terminal of the starter relay to the solenoid terminal of the relay under test. Listen for the relay to click when the connection is made. If there is no click, the solenoid may be burned out or the circuit open.

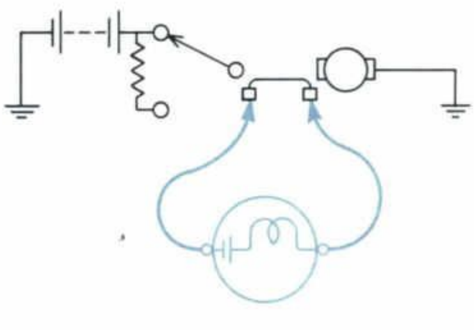


Fig. 7 — Self-Powered Test Light

TILT-AWAY STEERING COLUMN — MUSTANG

OPERATION

The tilt-away steering column features nine driving positions (four up and four down from a center position). A tilt-away position is automatically accomplished when the ignition key is turned to the OFF position and the left door is opened. This completes an electrical circuit through a switch in the left door jamb and an electrically operated vacuum release valve (Fig. 8). The vacuum release valve is connected to a vacuum reservoir and to a vacuum motor. When the vacuum release valve is energized electrically, it opens a valve and allows reservoir vacuum to act on the vacuum motor diaphragm to pull the parking pawl out of the lower flange at the upper end of the column. Spring tension then moves the steering wheel upward and to the right at approximately a 45° angle (tilt-away position). The column will remain in the tilt-away position until the driver manually moves the column to the drive position after the left door has been closed.

A starter safety switch prevents the engine from being started while the steering wheel is in the tilt-away position. The starter safety switch is actuated by the locking pawl rod. A tap provided on the rod depresses the switch to open the starter motor circuit when the wheel is in the tilt position. When the steering wheel is placed in the drive position, the tab moves upward and allows the switch plunger to move outward and close the circuit.

The vacuum reservoir has a capacity to operate (cycle) the steering column approximately three times after the engine has been shut down.

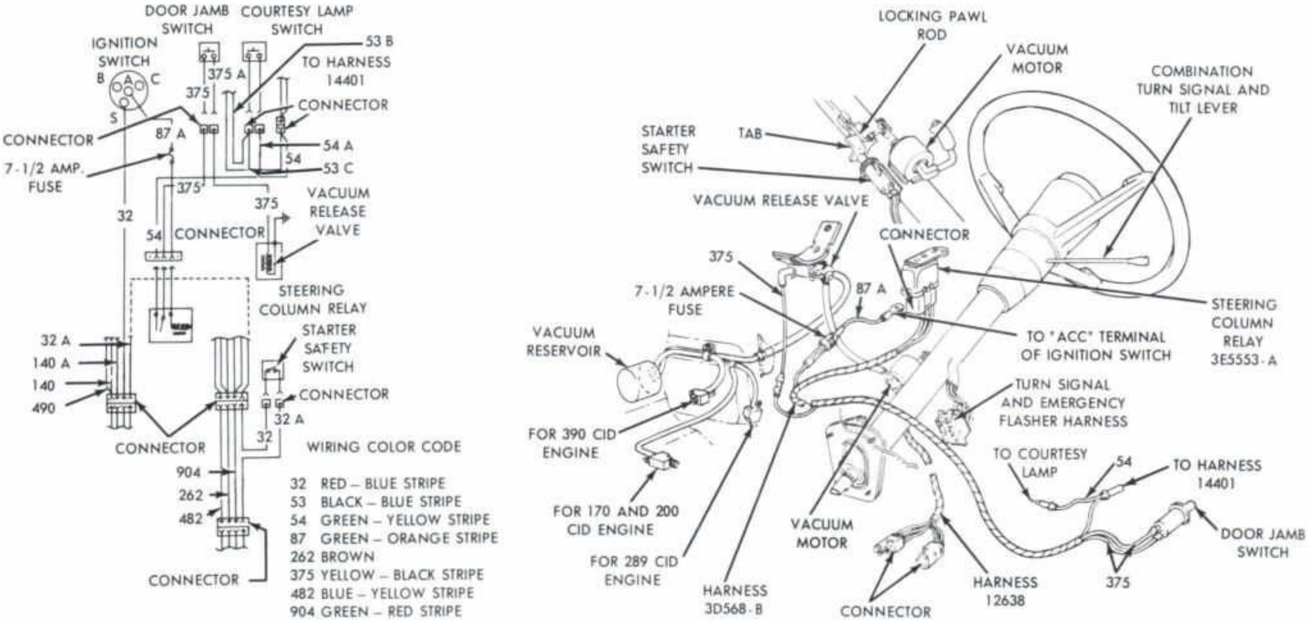


Fig. 8 — Tilt-Away Steering Column Vacuum and Electrical Systems — Mustang

TESTS AND ADJUSTMENTS

VACUUM MOTOR TEST

Apply vacuum directly to the vacuum motor. Vacuum can be obtained by attaching a hose directly to the engine manifold and running the engine. If the motor has a tendency to operate but cannot pull the pawl free of the flange, disconnect the motor from the locking pawl rod when checking with a pull scale. Attach a pull scale to the vacuum motor and apply a minimum of 14 inches of vacuum. If the motor registers 16-18 pounds of pull, it is satisfactory. The scale reading will be proportionally higher than the amount of vacuum applied. Then, check locking pawl rod for binding or other damage.

Vacuum Release Valve Test

Disconnect the wiring harness from the vacuum release valve solenoid. Check for current. Connect the 12-volt leads to the bayonet terminal of the vacuum release valve (Fig. 9). If the vacuum release valve solenoid clicks or movement is detected by feeling the magnetic cylinder, the valve is satisfactory.

STARTER SAFETY SWITCH TEST

Disconnect the wires from the safety switch and connect a self-powered test light to the switch. The test light should glow with the steering wheel in the drive position or the starter safety switch is defective. Place the steering wheel in the tilt-away position. If the engine will not start and there is no vacuum reserve, pull downward on locking pawl rod manually to release the wheel. The test light should not glow.

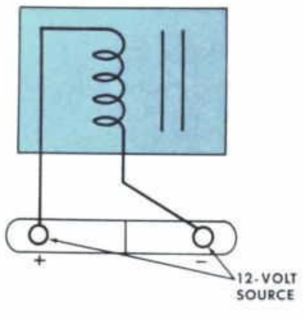


Fig. 9 — Vacuum Release Valve Test

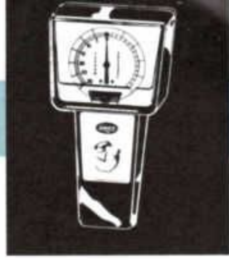
TILT COLUMN LOCKING PAWL ADJUSTMENT

Remove the two fastening screws which secure the locking pawl motor to the steering column.

Slide the motor up the column in approximately 1/16" increments holding in position with body tape.

At each increment, actuate the tilt mechanism and check for freedom of movement and positive locking in all nine positions.

When the properly adjusted position is reached, disconnect and remove the motor from the column, at the bench, file the upper slots in



the bracket to gain sufficient width for permanently fastening the motor in that position.

If the motor cannot be adjusted by this procedure, the tilt column mechanism will have to be removed for adjustment.

1. Remove the steering wheel and install the spring, shipping spacer and nut on the steering shaft. Remove the steering column from the car.
2. Remove the combination turn signal and tilt mechanism control lever. Remove the emergency flasher control knob. Remove the upper cover.
3. Slide the lower cover downward on the steering column tube.
4. Remove the turn signal wire retaining clip from the steering column tube.
5. Remove the turn signal switch attaching screws. Work the switch wires upward enough to permit removing the switch over the end of the shaft.
6. Remove the lower flange from the steering column tube.
7. Remove the steering shaft and tilt mechanism as an assembly.
8. Lift the hub from the steering tube just enough to permit access to the locking pawl.
9. Rotate the pawl as required to obtain a distance of 1-3/32 inches from the top of the pawl to the upper end of the tube.
10. Position the hub on the tube.
11. Install the steering shaft and tilt mechanism in the column.
12. Secure the lower flange to the tube.
13. Install the turn signal switch on the flange and secure it in place with two attaching screws.
14. Position the turn signal wires properly and install the retaining clip.
15. Slide the lower cover into place making sure that the three retaining clips engage the slots in the hub.
16. Install the upper cover on the pivot cover.
17. Install the combination turn signal switch and tilt mechanism control lever.
18. Install the emergency flasher control knob.
19. Install the steering column in the car.
20. Remove the shipping spacer and install the steering wheel and hub.

STARTER SAFETY SWITCH ADJUSTMENT

Loosen the safety switch bracket attaching screws. Place the steering wheel in the drive position and slide the switch forward or back on the steering column tube to establish a clearance of a 0.080-inch gap between the tab on the locking pawl rod and the switch plunger, then tighten the two attaching screws.

Starter Relay Test

Connect a jumper from the battery terminal of the relay to the "S" terminal of the relay. If the engine does not crank and the relay does not click, the relay is defective.

Starter Drive and Starter Test

Operate the ignition switch and listen for starter noise. If the starter rotates or makes a distinct clunk but will not crank the engine, the starter drive is defective.

Temporarily connect a heavy jumper from the battery positive terminal to the starter terminal of the starter relay. If the starter will not crank the engine, the starter is defective. Repair or replace the starter.

Starter Control Circuit Test

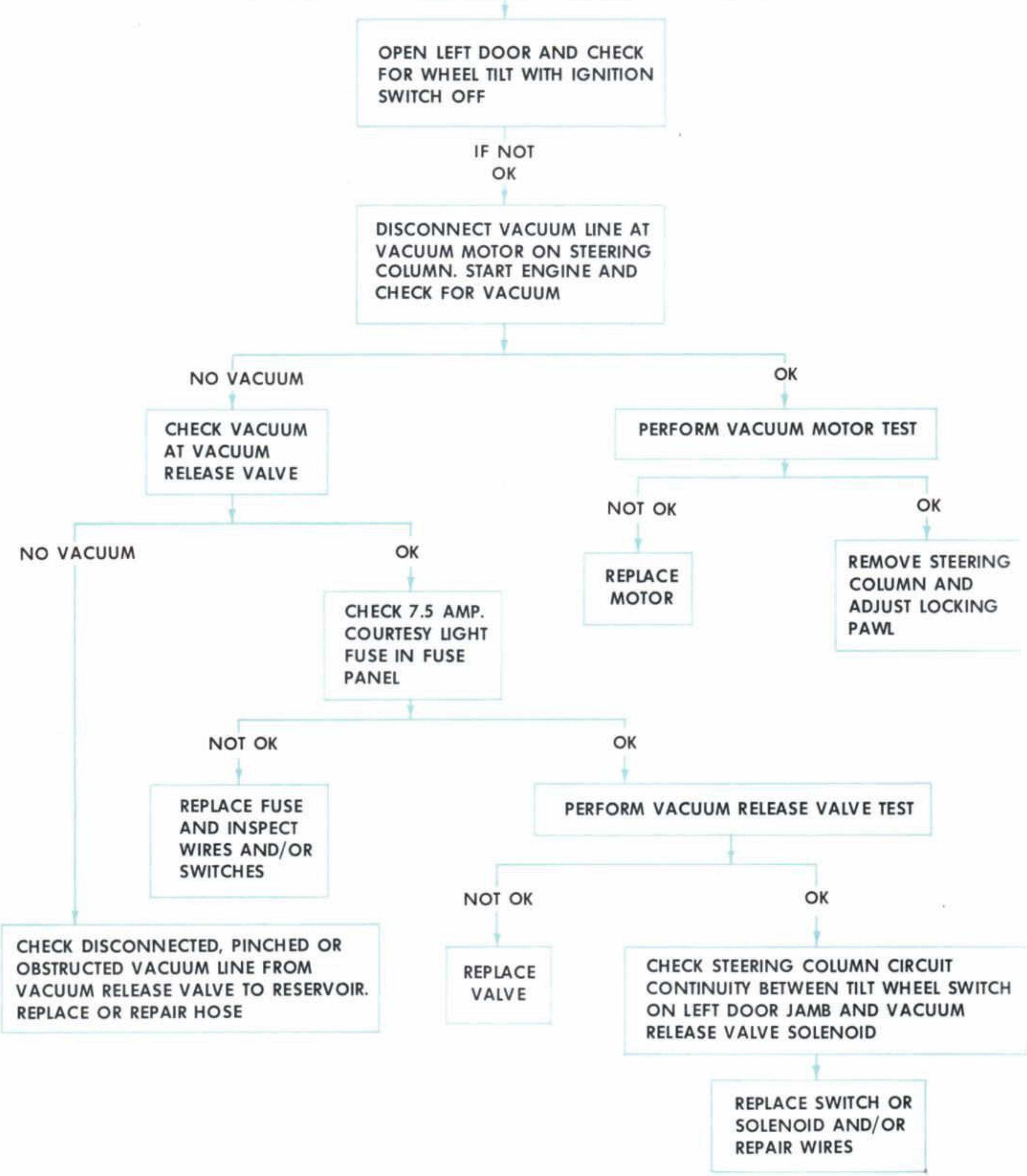
On vehicles equipped with an automatic transmission, if the engine cranks, connect a jumper from the battery terminal of the relay to the relay side of the neutral-start switch. If the engine does not crank, the wiring between the neutral-start switch and the relay is at fault. If the engine battery terminal of the relay to the starter (ignition) switch side of the neutral-start switch is at fault and if the engine does not crank, the neutral-start switch is out of adjustment or is defective. If the engine cranks, check for voltage at the battery terminal of the starter (ignition) switch wiring harness connector with a test light or a voltmeter. If voltage is not available, the wiring between the battery terminal of the starter relay and battery terminal of the starter (ignition) switch is at fault. If voltage is available, substitute an ignition switch from stock. If the engine cranks, replace the ignition switch. If the engine will not crank, the trouble is in the wiring or connections between the ignition switch and the starter-neutral switch.

REFERENCES

1967 Vacuum Diagram Book page 1-5.

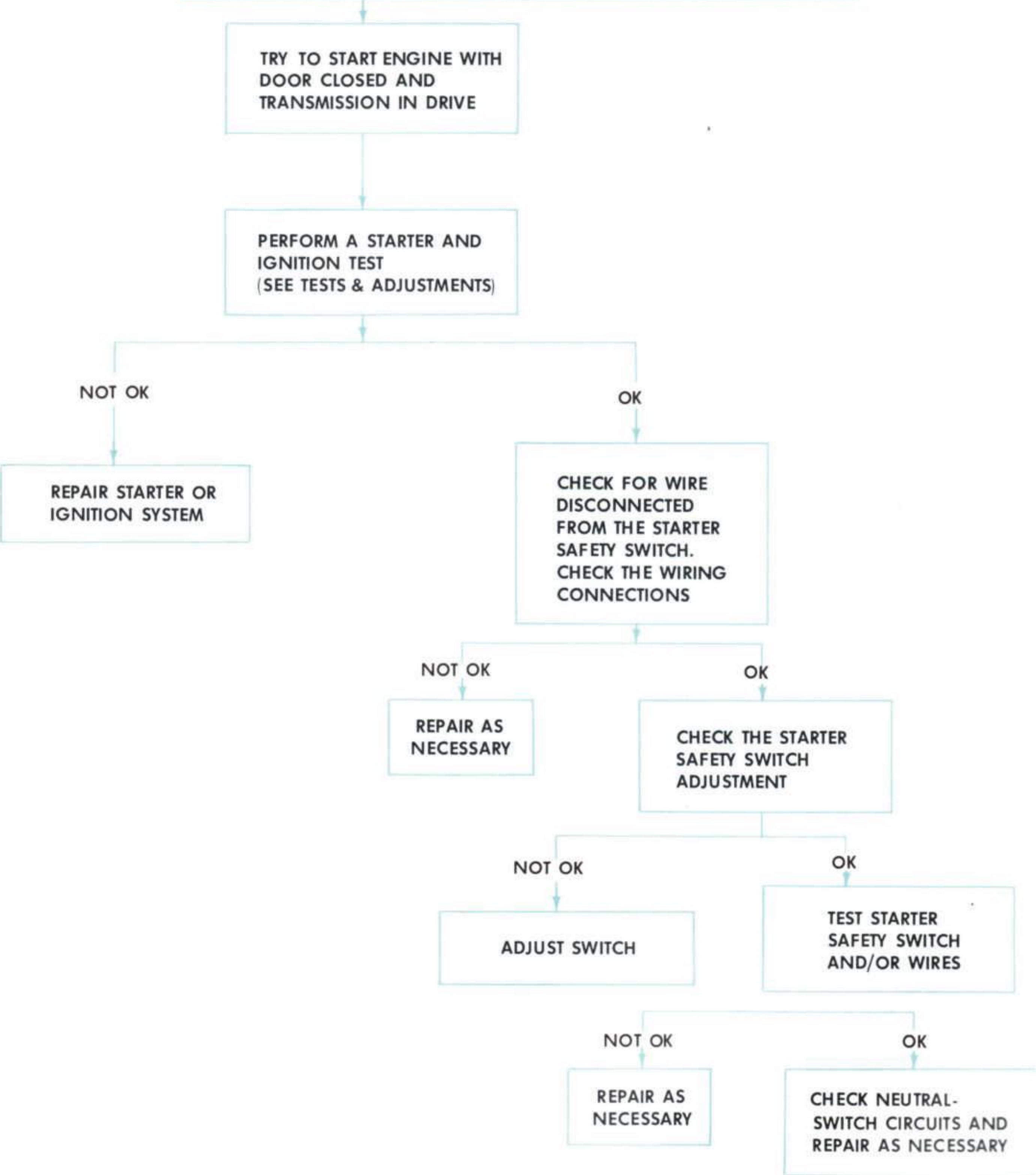
TROUBLE DIAGNOSIS GUIDE

STEERING WHEEL WILL NOT TILT AWAY



TROUBLE DIAGNOSIS GUIDE — Continued

ENGINE WILL NOT START WITH LEFT DOOR CLOSED



TROUBLE DIAGNOSIS GUIDE — Continued

STEERING WHEEL LOOSE

- PUSH AND PULL ON STEERING WHEEL TO TEST FOR LOOSENESS
- CHECK STEERING WHEEL ATTACHING NUT FOR LOOSENESS
  - LOOSE → APPLY LOCTITE AND TORQUE TO SPECIFICATION
  - OK → CHECK STEERING COLUMN LOWER FLANGE RETAINER SCREWS FOR LOOSENESS OR RETAINER NOT PROPERLY SEATED
    - LOOSE OR NOT SEATED → TIGHTEN SCREWS OR PROPERLY SEAT THE RETAINER
    - OK → CHECK FOR LOSS OF PRELOAD IN VACUUM MOTOR. DISCONNECT VACUUM MOTOR FROM LOCKING PAWL ROD. VACUUM MOTOR PUSH ROD SHOULD EXTEND 1/4-INCH BEYOND LOCKING PAWL ACTUATING ROD
      - NOT OK → REPLACE MOTOR
      - OK → CHECK FOR WORN UPPER STEERING COLUMN BALL BEARINGS OR TILT MECHANISM PIVOT PINS
        - WORN → REPLACE WORN PARTS
        - OK → ADJUST THE LOCKING PAWL

TROUBLE DIAGNOSIS GUIDE — Continued

STEERING WHEEL WILL NOT HOLD IN SET DRIVE POSITION

SET WHEEL IN ALL DRIVE POSITIONS TO SEE IF IT WORKS

WHEEL WILL NOT HOLD 9 POSITIONS OR WILL HOLD ONLY 4 POSITIONS

REMOVE STEERING WHEEL AND UPPER STEERING COLUMN COVER. CHECK FOR BROKEN LOCKING INDEX GROOVES, SEIZED LOCKING LEVER OR BROKEN LEVER RETURN SPRING. REPAIR OR REPLACE WORN OR BROKEN PARTS

WHEEL LOOSE IN SOME POSITIONS AND NOT IN OTHERS

REMOVE LOCKING INDEX AND CHECK SLOTS FOR WORN AND OVERSIZE CONDITION. REPAIR OR REPLACE AS NECESSARY

STEERING WHEEL TILTS AWAY WHEN LEFT DOOR IS OPENED WITH IGNITION SWITCH ON

OPEN DOOR WITH IGNITION SWITCH ON TO CHECK IF STEERING WHEEL TILTS

CHECK 7.5 AMP IN LINE FUSE LOCATED IN GREEN AND ORANGE STRIPE WIRE RUNNING BETWEEN THE IGNITION SWITCH AND THE STEERING COLUMN RELAY OR BROKEN WIRE IN SAME CIRCUIT

NOT OK

CHECK FUSE OR CONNECTING WIRES. REPAIR OR REPLACE AS REQUIRED

OK

CHECK STEERING COLUMN RELAY CONTINUITY WITH A SELF-POWERED TEST LIGHT. REPLACE RELAY IF DEFECTIVE

STEERING WHEEL TILTS AWAY WHEN ENGINE IS STARTED

SET WHEEL IN DRIVE POSITION, START ENGINE AND CHECK WHEEL OPERATION

VACUUM RESERVOIR HOSE CONNECTED DIRECTLY TO VACUUM MOTOR. DISCONNECT VACUUM HOSE FROM VACUUM MOTOR, PLACE STEERING WHEEL IN DRIVE POSITION, START ENGINE AND OBSERVE ACTION. CONNECT VACUUM HOSE TO PROPER CONNECTIONS.

STEERING WHEEL TILTS AWAY — WILL NOT STAY IN DRIVE POSITION

SET STEERING WHEEL IN DRIVE POSITION AND CHECK WHEEL OPERATION

REMOVE COURTESY LIGHT SWITCH AND CONNECT A SELF-POWERED TEST LIGHT TO SWITCH TERMINALS. THE TEST LIGHT SHOULD NOT GLOW WITH PLUNGER DEPRESSED. REPLACE SWITCH IF DEFECTIVE

TILT-AWAY STEERING COLUMN — THUNDERBIRD

OPERATION

The tilt-away steering column features nine driving positions (four up and four down from a center position). A tilt-away position is automatically accomplished when the transmission selector lever is in Park position and the left front door is opened. When the transmission selector lever is moved to Park position in addition to opening the left front door, an electrical circuit is completed through the courtesy light switch located in the left front door jamb and the neutral start switch (Fig. 10).

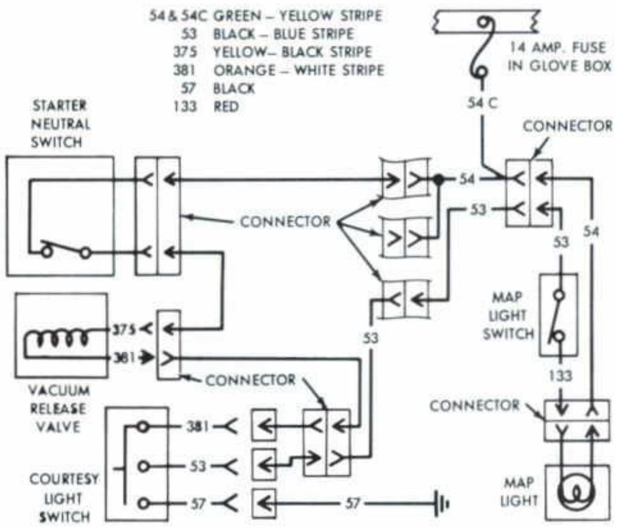


Fig. 10 — Tilt-Away Steering Column Wiring Diagram — Thunderbird

This actuates a vacuum release valve located on the left side of the steering column opposite the vacuum motor (Fig. 11). The vacuum release valve, when actuated, allows vacuum to react on the diaphragm in the vacuum motor to pull the parking pawl out of the lower flange at the upper end of the column. Spring tension then moves the steering wheel upward and to the right at approximately a 45° angle (tilt-away position).

The column will remain in this tilt-away position until the driver closes the door and manually moves the column to the drive position.

The vacuum reservoir has a capacity to operate (cycle) the steering column approximately three times after the engine has been shut down.

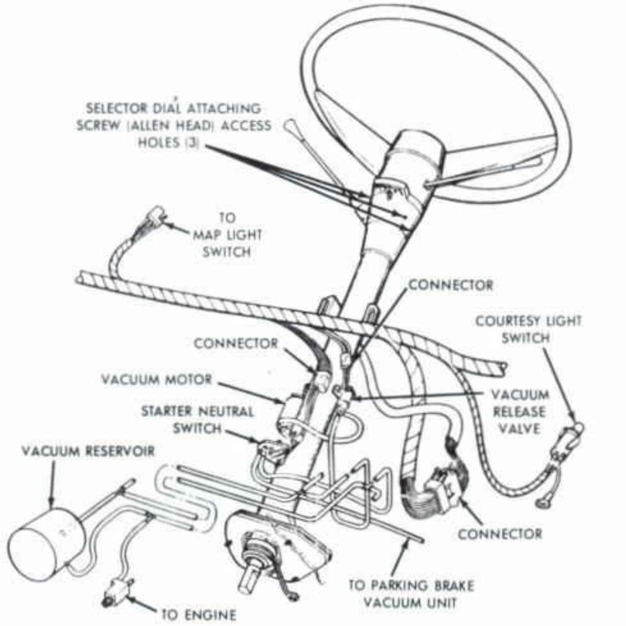


Fig. 11 — Tilt-Away Steering Column Vacuum and Electrical Systems — Thunderbird

TESTS AND ADJUSTMENTS

VACUUM MOTOR TEST

Apply vacuum directly to the vacuum motor. Vacuum can be obtained by attaching a hose directly to the engine manifold and running the engine. If the motor has a tendency to operate but cannot pull the pawl free of the flange, disconnect the motor from the locking pawl rod when checking with a pull scale.

Attach a pull scale to vacuum motor and apply minimum of 14 inches vacuum. If motor registers 16-18 pounds pull, it is satisfactory. The scale reading will be proportionally higher than the amount of vacuum applied. Then, check locking pawl rod for binding or other damage.

VACUUM RELEASE TEST

Disconnect wiring harness from vacuum release valve solenoid. Connect ground wire (-) to exposed terminal of solenoid harness. Connect the 12-volt leads to the insulated terminal of vacuum release valve (Fig. 12). If vacuum release valve solenoid clicks or movement is detected by feeling the magnetic cylinder, the valve is satisfactory.

STARTER RELAY TEST

Connect a jumper from the battery terminal of the relay to the "S" terminal of the relay. If the engine does not crank and the relay does not click, the relay is defective.

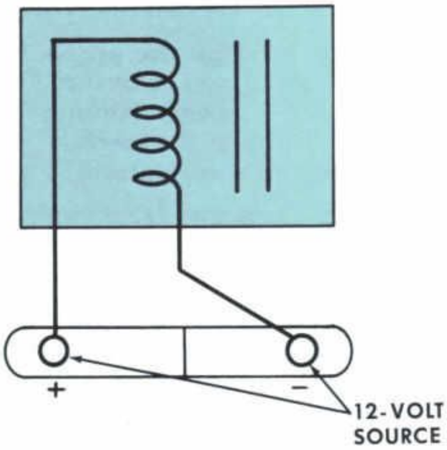


Fig. 12 — Vacuum Release Valve Test

STARTER DRIVE AND STARTER TEST

Operate the ignition switch and listen for starter noise. If the starter rotates or makes a distinct clunk but will not crank the engine, the drive is defective.

Temporarily connect a heavy jumper from the battery positive terminal to the starter terminal of the starter relay. If the starter will not crank the engine, the starter is defective. Repair or replace the starter.

CHECK STARTER CONTROL CIRCUIT

On vehicles equipped with an automatic transmission, if the engine cranks, connect a jumper from the battery terminal of the relay to the relay side of the neutral-start switch. If the engine does not crank, the wiring between the neutral-start switch and the relay is at fault. If the engine cranks, connect a jumper from the battery terminal of the relay to the starter (ignition) switch side of the neutral-start switch. If the engine does not crank, the neutral-start switch is out of adjustment or defective. If the engine cranks, check for voltage at the battery terminal of the starter (ignition) switch wiring harness connector with a test light or a voltmeter. If voltage is not available, the wiring between the battery terminal of the starter relay and the battery terminal of the starter (ignition) switch is at fault. If voltage is available, substitute an ignition switch from stock. If the engine cranks, replace the ignition switch. If the engine still will not crank, the trouble is in the wiring or connections between the ignition switch and the starter-neutral switch.

LOCKING PAWL ADJUSTMENT

Remove the two fastening screws which secure the locking pawl motor to the steering column.

Slide the motor up the column in approximately 1/16" increments holding in position with body tape.

At each increment, actuate the tilt mechanism and check for freedom of movement and positive locking in all nine positions.

When the properly adjusted position is reached, disconnect and remove the motor from the column, at the bench, file the upper slots in the bracket to gain sufficient width for permanently fastening the motor in that position.

If the motor cannot be adjusted by this procedure, the tilt column mechanism will have to be removed for adjustment.

1. Remove the steering column from the vehicle. (See the shop manual.)
2. Remove the roll pin that secures the selector lever to the hub. Remove the lever and insulator from the hub.
3. Slide the selector lever hub cover downward on the steering tube (Fig. 13).

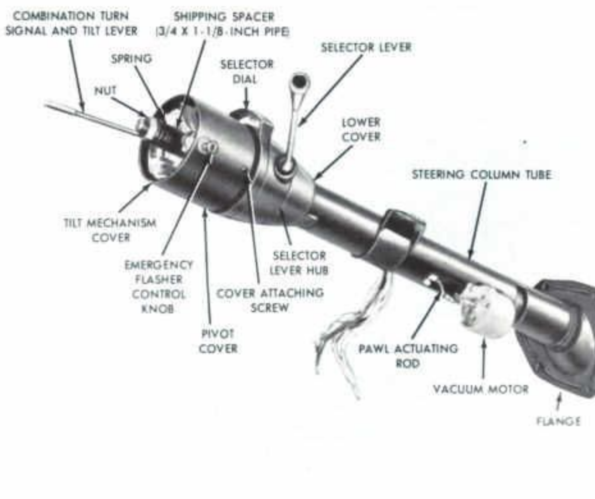


Fig. 13 — Tilt-Away Steering Column

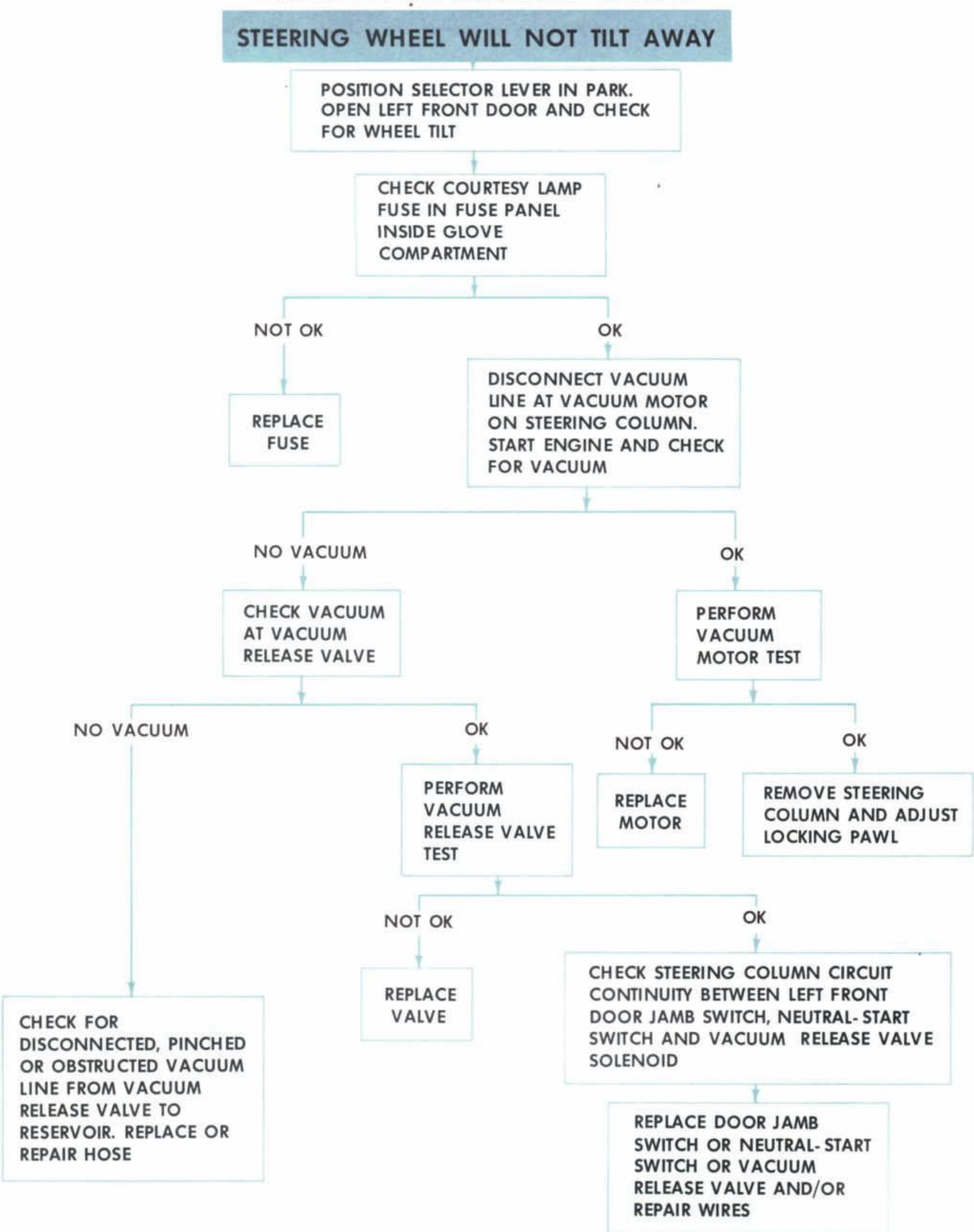
4. With the tilt mechanism centered in the driving position, rotate the selector lever hub as required to gain access to the steering column tube-to-lower flange attaching screws.
5. Working through the access holes in the lower end of the selector lever hub, remove the steering column tube from the lower flange.
6. Remove the tapered bushing from the lower end of the steering shaft.
7. Remove the screw and nylon clip that secures the turn signal wires to the steering column tube.
8. Carefully lift the steering wheel and shaft far enough out of the steering column to gain access to the locking pawl.
9. Turn the locking pawl counterclockwise to raise the height, or clockwise to lower height. Adjust the pawl height to 1-3/32 inches from the top of the steering column tube.
10. Carefully lower the steering shaft into the tube, making sure that the locking pawl is properly positioned in the steering column tube lower flange.
11. Position the turn signal wiring harness and install the nylon retaining clip.
12. If the tapered plastic bushing is in a serviceable condition, install it, or a new one, on the lower end of the steering shaft.
13. Working through the access holes in the lower end of the selector lever socket, install the steering column tube lower flange. Tighten the screws evenly and alternately to specification.
14. Slide the selector lever hub cover into place making sure that the retaining clips engage slots in the hub.
15. Position the selector lever and insulator in the selector lever hub. Secure the lever with the roll pin.
16. Install the steering column.

REFERENCE

1967 Vacuum Diagram Book, pages 4-3, 4-10, 4-12 and 4-14.

1967 Wiring Diagram Book, page 4-22.

TROUBLE DIAGNOSIS GUIDE



TROUBLE DIAGNOSIS GUIDE — Continued

STEERING WHEEL LOOSE

- PUSH AND PULL ON STEERING WHEEL TO TEST FOR LOOSENESS
- CHECK STEERING WHEEL ATTACHING NUT FOR LOOSENESS
  - LOOSE → APPLY LOCTITE AND TORQUE TO SPECIFICATION
  - OK → CHECK STEERING COLUMN LOWER FLANGE RETAINER SCREWS FOR LOOSENESS OR RETAINER NOT PROPERLY SEATED
    - LOOSE OR NOT SEATED → TIGHTEN SCREWS OR PROPERLY SEAT THE RETAINER
    - OK → CHECK FOR LOSS OF PRELOAD IN VACUUM MOTOR. DISCONNECT VACUUM MOTOR FROM LOCKING PAWL ROD. VACUUM MOTOR PUSH ROD SHOULD EXTEND 1/4 INCH BEYOND LOCKING PAWL ACTUATING ROD
      - NOT OK → REPLACE MOTOR
      - OK → CHECK FOR WORN UPPER STEERING COLUMN BALL BEARINGS OR TILT MECHANISM PIVOT PINS
        - WORN → REPLACE WORN PARTS
        - OK → REMOVE THE STEERING COLUMN AND ADJUST THE LOCKING PAWL

TROUBLE DIAGNOSIS GUIDE — Continued

STEERING WHEEL WILL NOT HOLD IN SET DRIVE POSITION

SET WHEEL IN ALL DRIVE POSITIONS TO SEE IF IT WORKS

WHEEL WILL NOT HOLD 9 POSITIONS OR WILL HOLD ONLY 4 POSITIONS

REMOVE STEERING WHEEL AND UPPER STEERING COLUMN COVER. CHECK FOR BROKEN LOCKING INDEX GROOVES, SEIZED LOCKING LEVER OR BROKEN LEVER RETURN SPRING. REPAIR OR REPLACE WORN OR BROKEN PARTS

WHEEL LOOSE IN SOME POSITIONS AND NOT IN OTHERS

REMOVE LOCKING INDEX AND CHECK SLOTS FOR WORN AND OVERSIZE CONDITION. REPAIR OR REPLACE AS NECESSARY

STEERING WHEEL TILTS AWAY WHEN ENGINE IS STARTED

SET WHEEL IN DRIVE POSITION. START ENGINE AND CHECK WHEEL OPERATION

VACUUM RESERVOIR HOSE CONNECTED DIRECTLY TO VACUUM MOTOR. DISCONNECT VACUUM HOSE FROM VACUUM MOTOR. PLACE STEERING WHEEL IN DRIVE POSITION. START ENGINE AND OBSERVE ACTION. CONNECT VACUUM HOSE TO PROPER CONNECTIONS.

STEERING WHEEL TILTS AWAY — WILL NOT STAY IN DRIVE POSITION

SET STEERING WHEEL IN DRIVE POSITION AND CHECK WHEEL OPERATION

REMOVE COURTESY LIGHT SWITCH FROM LEFT DOOR JAMB AND CONNECT A SELF-POWERED TEST LIGHT TO SWITCH TERMINALS. THE TEST LIGHT SHOULD NOT GLOW WITH PLUNGER DEPRESSED. REPLACE SWITCH IF DEFECTIVE

VACUUM–OPERATED HEADLIGHT COVERS – THUNDERBIRD

OPERATION

Retracting headlight doors are standard equipment on all Thunderbirds. With the lights OFF, the headlamp doors are closed.

When the headlights are turned ON, an electrical circuit activates a solenoid (Fig. 14) which operates a valve routing vacuum to the motors, pulling the doors into a retracted position, exposing the headlight.

As long as the headlight switch is ON, the headlight doors will stay open.

When the headlight switch is turned to the PARK or OFF position, the solenoid is deactivated, releasing the vacuum control valve, thus

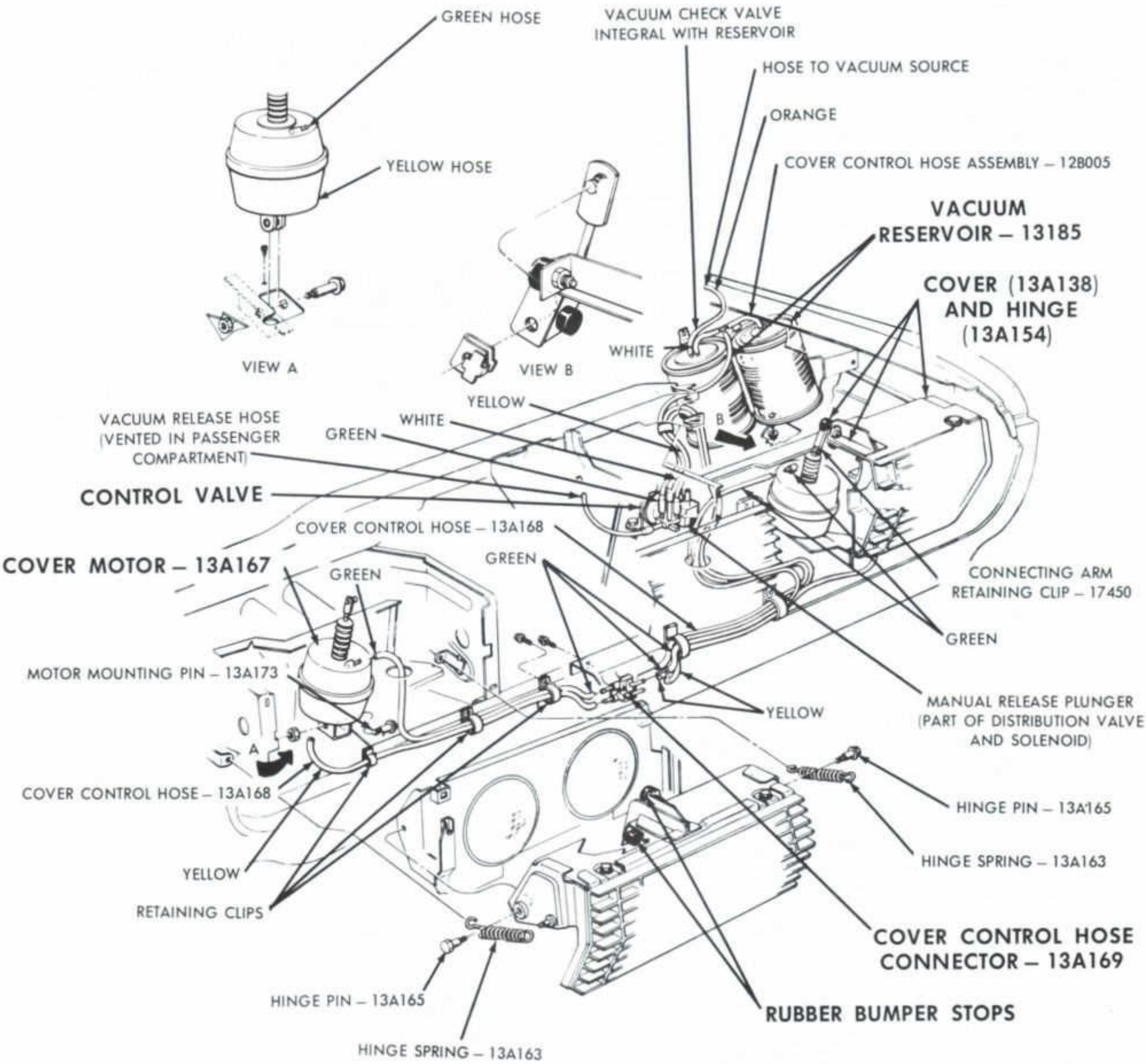
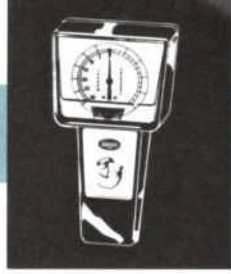


Fig. 14 — Headlight Cover Installation — Thunderbird

VACUUM-OPERATED HEADLIGHT COVERS–THUNDERBIRD



switching the vacuum to the closed side of the headlight door motors.

The door controls are not activated when the headlight switch is in the parking light position.

Provision is made to manually open the doors should a power failure occur.

To manually open the doors, press on the vacuum release control on the control valve until the catch is engaged. **The control vacuum is released and the doors can be opened by lifting the grille work or they will open automatically if vacuum is available.**

From the electrically operated control valve, two vacuum hoses connect to a distribution connector. One hose is for the door opening operation. The other hose is for the door closing operation.

The distribution connector is located on the front radiator support midway between the headlights. By equalizing the distance between the headlights, both doors will tend to operate simultaneously.

From the distribution connector, two hoses go to each headlight door operating motor. One hose is connected to the door open side of the motor. The other hose is connected to the door closed side of the motor.

The complete system is composed of a vacuum source, supply reservoirs, electrically operated control valve, distribution connector, door actuator motors, headlight doors and various lengths of connecting hoses.

All the hoses are black but are identified by a colored stripe. The colored stripe on the hose should correspond to the paint dab color of the connector.

An orange hose connects the intake manifold vacuum supply to the reservoirs.

From the supply reservoirs to the control valve, the hose is white. From the control valve to the distribution connector, the hose for the opening or retracting operation is green, and the hose for the closing operation is yellow.

HEADLIGHT COVER ADJUSTMENT

There are two adjustable rubber bumper stops on each headlight cover. **Adjust each stop with the engine running.**

Adjust each cover in the closed position by rotating the stop screw so that the cover edges are flush with the grille. Adjust each cover in the open position by rotating the stop screw so that the cover is fully open and has an approximate clearance of 1/4 inch with the cover edge of the hood at the outboard edge of the cover.

After the vehicle has set with the engine off for a period of time, and the vacuum reserve has partially escaped, the headlight covers will not align with the grille. This is normal. When the engine is started and vacuum is again in the system, the covers will return to a proper alignment with the grille.

REFERENCE

1967 Vacuum Diagram Book, pages 4-1, 4-2, 4-10, 4-12.
1967 Wiring Diagram Book, page 3-13.

VACUUM-OPERATED HEADLIGHT COVERS — THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE

HEADLIGHT COVERS WORK SLOWLY

- TURN ON HEADLIGHTS AND CHECK COVERS
- CHECK FOR VACUUM AT HEADLIGHT COVER MOTORS
  - NO VACUUM: INSPECT THE HOSES FROM THE CONTROL VALVE TO DISTRIBUTION CONNECTOR BEHIND GRILLE AND FROM CONNECTOR TO COVER MOTORS FOR KINKS, CRACKS AND TIGHT CONNECTIONS. REPAIR OR REPLACE HOSES
  - OK: CHECK COVER LINKAGE FOR BINDS
    - BINDS: REPAIR BIND. IF STILL BINDS, REPLACE MOTOR
    - OK: REPLACE VACUUM MOTOR

ONE HEADLIGHT COVER DOES NOT WORK

- TURN ON LIGHT SWITCH TO CHECK HEADLIGHT COVERS
- CHECK FOR VACUUM AT COVER MOTOR THAT DOES NOT WORK
  - NO VACUUM: CHECK HOSES FROM CONNECTOR TO MOTOR FOR KINKS, CRACKS AND TIGHT CONNECTIONS. REPAIR OR REPLACE HOSES
  - OK: CHECK COVER MECHANISM FOR BINDING AND/OR REPLACE MOTOR

TROUBLE DIAGNOSIS GUIDE — Continued

HEADLIGHT COVERS DO NOT WORK

TURN ON LIGHT SWITCH AND CHECK HEADLIGHT COVERS

START ENGINE. REMOVE CENTER WHITE VACUUM HOSE FROM HEADLIGHT COVER CONTROL VALVE AND CHECK FOR VACUUM

NO VACUUM

IF THERE IS NO VACUUM AT THE WHITE SUPPLY HOSE, INSPECT THE HOSES LEADING TO THE VACUUM RESERVOIRS FOR KINKS, CRACKS OR LOOSE CONNECTIONS, AND RESERVOIRS FOR LEAKS. REPLACE HOSE IF NECESSARY

OK

REMOVE OTHER TWO HOSES FROM VALVE. MOMENTARILY CONNECT EACH HOSE TO THE WHITE SUPPLY HOSE. MOMENTARILY CONNECT EACH HOSE TO THE WHITE HOSES. ONE SHOULD OPEN COVERS, THE OTHER CLOSES

NOT OK

REPAIR OR REPLACE HOSE TO CONNECTOR

OK

WITH HEADLIGHTS ON, CHECK FOR POWER AT CONTROL VALVE WITH TEST LIGHT

NO POWER

REPAIR OR REPLACE WIRING AND/OR CONNECTIONS FROM HEADLIGHT SWITCH TO CONTROL VALVE

OK

REPLACE CONTROL VALVE. CONNECT HOSE THAT CAUSED COVERS TO OPEN TO CONTROL VALVE NIPPLE NEAREST MOUNTING FLANGE. CONNECT HOSE THAT CAUSED COVERS TO CLOSE TO NIPPLE FARTHEST FROM MOUNTING FLANGE. CONNECT VACUUM SUPPLY HOSE TO CENTER NIPPLE

UNIFLOW VENT SYSTEM — THUNDERBIRD

OPERATION

A uniflow vent system is standard on all Thunderbirds. A switch on the dash panel controls vacuum which either opens or closes air vents located on the outside of the vehicle at the rear of the passenger compartment (Fig. 15).

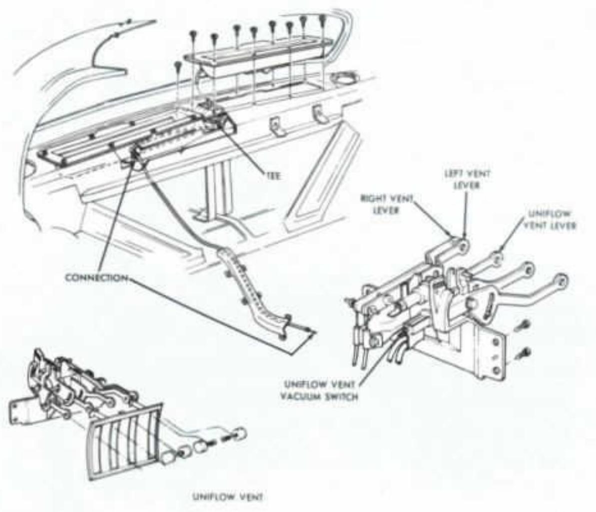


Fig. 15 — Uniflow Vent — Thunderbird

When the uniflow vent control switch is placed in the ON position, vacuum is routed from the engine supply source to one side of two vacuum motors situated on each side of the vents. Vacuum so routed causes these motors to actuate, opening the vents through mechanical linkage. When the control switch is placed in the OFF position, vacuum is routed to the opposite side of the two vacuum motors closing the vents.

ADJUSTMENT

The vacuum motor has elongated mounting holes, provided in the housing. To adjust the motor, loosen the bolts and reposition the motor (Fig. 16).

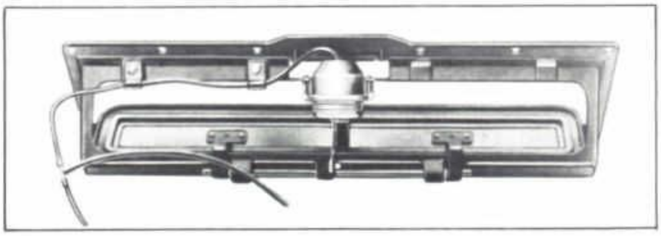
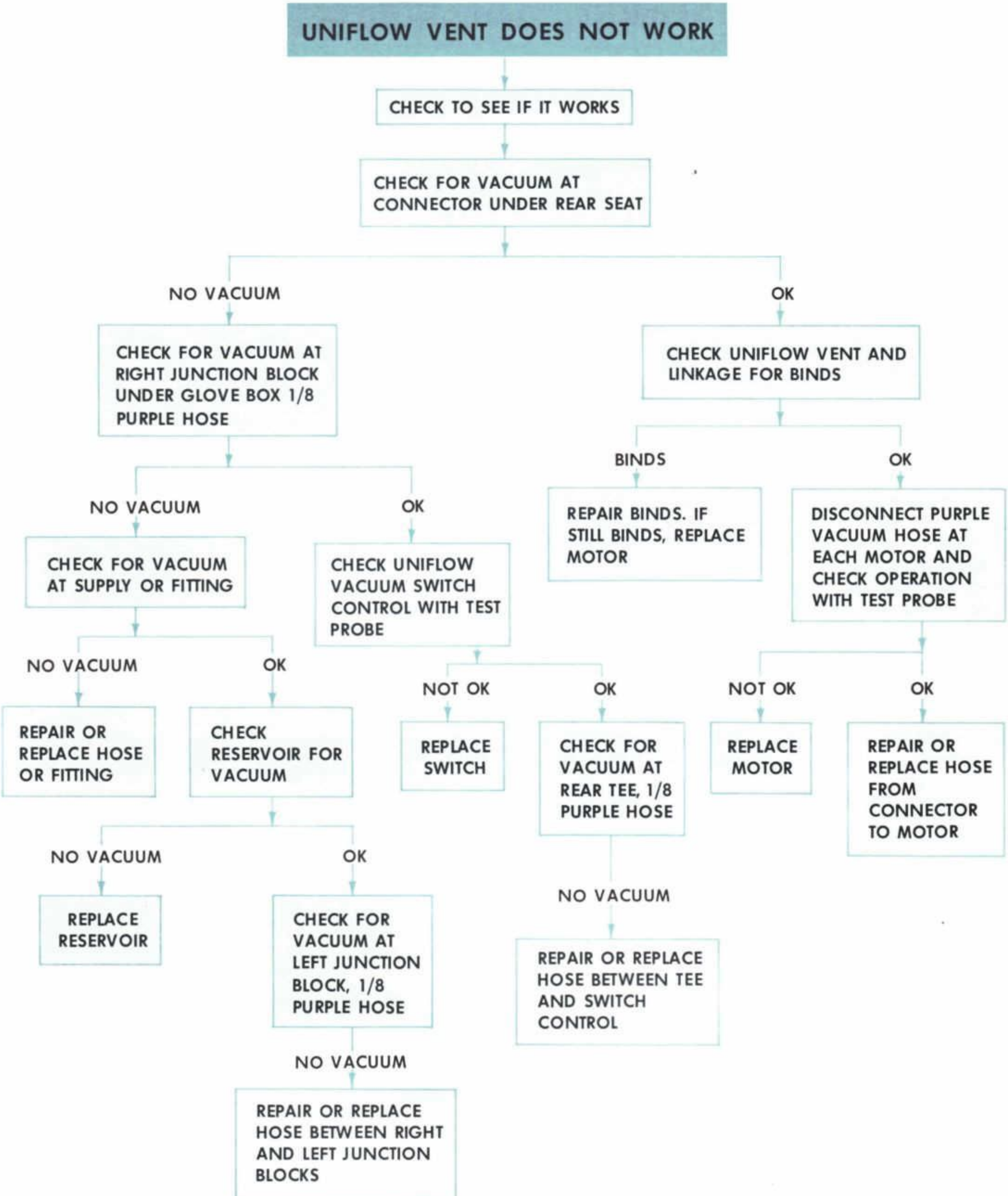


Fig. 16 — Rear Vent

REFERENCE

1967 Vacuum Diagram Book, pages 4-1, 4-3, 4-7, 4-10, 4-12 and 4-14.

TROUBLE DIAGNOSIS GUIDE



LUGGAGE COMPARTMENT DOOR VACUUM LOCK CONTROL — THUNDERBIRD

OPERATION

A vacuum control for unlocking the luggage compartment door is an available option. Vacuum for the system control is furnished by connecting into the vacuum control supply system in the engine compartment on units built before October 18, 1966. This is the same supply system that operates the air conditioning control doors, tilt-away wheel, speed control and the vacuum door locks; not the same system that operates the headlight doors. On units built after October 18, 1966, only the luggage compartment and door locks use the same reservoir. The vacuum reservoir is located in the right front fender cavity.

A T-connection in the supply system furnishes a location to tap into the supply and connect to the junction block on the dash panel. This vacuum is routed to a control valve mounted on the instrument panel (Fig. 17). The push button-type valve applies the vacuum to the vacuum motor supply hose which is routed to the luggage compartment along the tunnel area. In the forward area of the luggage compartment, the hose is routed to the left side of the compartment, along the side and to the motor inside the rear panel. The motor is attached to a lever on the latch assembly by means of a flexible cable.

When vacuum is supplied to the motor, movement of the actuator diaphragm moves the lever on the latch assembly which releases the latch allowing the door to open. When the control valve on the dash panel is released, the vacuum bleeds out of the motor system and the latch arm swings back into a normal locking position. Key unlocking action has not been changed.

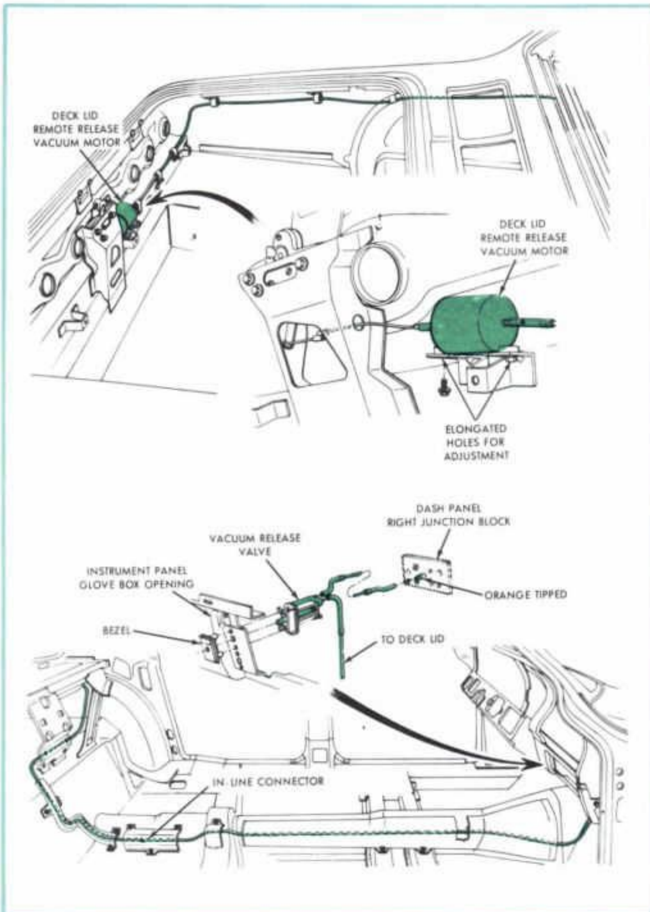


Fig. 17 — Luggage Door Vacuum Release

ADJUSTMENT

The vacuum motor has elongated mounting holes provided in the housing. To adjust the motor, loosen the bolts and reposition the motor.

REFERENCES

1967 Vacuum Diagram Book, pages 4-1, 4-3, 4-7, 4-10, 4-12, 4-13 and 4-14.

LUGGAGE COMPARTMENT DOOR VACUUM LOCK CONTROL — THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE

VACUUM CONTROLLED LUGGAGE COMPARTMENT DOOR LOCK DOES NOT WORK

- CHECK TO SEE IF IT WORKS
- START ENGINE AND CHECK FOR VACUUM AT LOCK MOTOR (OPEN COMPARTMENT WITH KEY)
  - **NO VACUUM** → CHECK FOR VACUUM AT RIGHT JUNCTION BLOCK UNDER GLOVE BOX — 1/8 ORANGE HOSE
    - **NO VACUUM** → CHECK VACUUM AT ENGINE SUPPLY HOSE OR FITTING
      - **NO VACUUM** → REPAIR OR REPLACE HOSE OR FITTING
      - **OK** → CHECK FOR VACUUM AT LEFT JUNCTION BLOCK — 1/8 ORANGE — UNITS BUILT BEFORE 10-16-67
        - **NO VACUUM** → REPAIR OR REPLACE HOSE
    - **OK** → CHECK VACUUM. RELEASE VALVE OPERATION WITH VACUUM PROBE
      - **NOT OK** → REPLACE VALVE
      - **OK** → CHECK FOR VACUUM AT CONNECTOR UNDER REAR SEAT
        - **NO VACUUM** → REPAIR OR REPLACE HOSE BETWEEN CONNECTOR AND RELEASE VALVE
  - **OK** → CHECK LOCK LINKAGE FOR BINDING AND ADJUSTMENT
    - **NOT OK** → CORRECT BIND/OR ADJUSTMENT
      - **STILL BINDS** → PULL ROD BENT, REPLACE MOTOR
    - **OK** → REPLACE VACUUM MOTOR

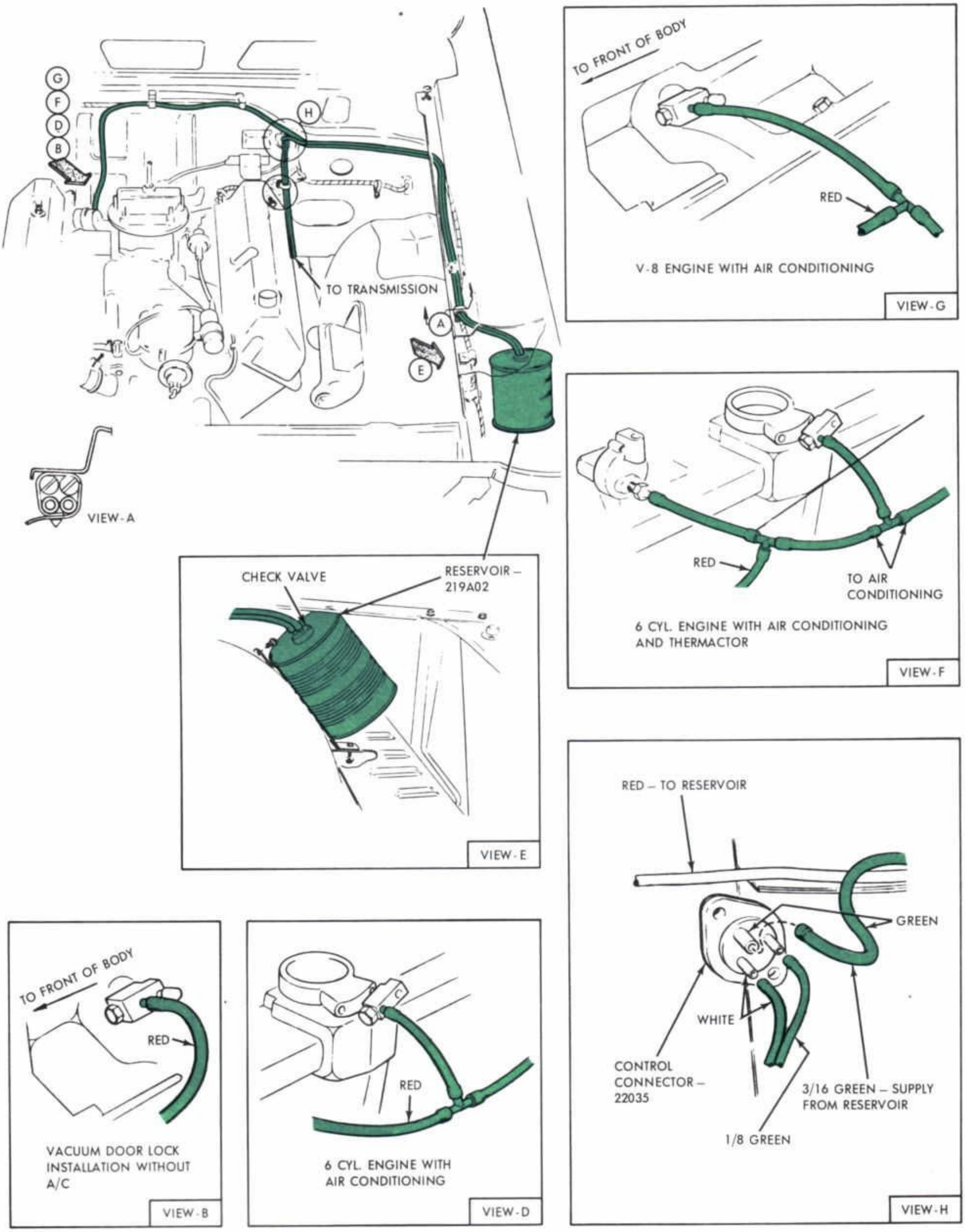


Fig. 18 — Door Lock Vacuum Supply Installation — Ford

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

DESCRIPTION AND OPERATION

This description and operation of the vacuum controlled door lock system applies to both the Ford and Thunderbird cars. Basically, the same system is used on both cars. The exact locations of the various components differ from the one car to the other, and, in a few cases, the hose color codes within the engine compartment differ. These differences do not present a problem in diagnosis and testing or repair, since the component locations and hose color coding on both cars are covered in several illustrations in this handbook and in the 1967 Vacuum Diagram Book.

The vacuum-operated door lock system is composed of vacuum hoses which connect the functioning elements of the system, a reservoir assembly, a control valve assembly, a control switch and the locking mechanism vacuum motors. All rubber vacuum hoses are black but are distinguished by a colored stripe. A hose not designated by a color will be black. Plastic vacuum hoses will be a solid color.

Vacuum from the engine manifold is routed to the vacuum reservoir which is located in the engine compartment (Figs. 18 and 19).

The reservoir contains a one-way check valve which will prevent the loss of vacuum back through the engine when it is not running. The supply of vacuum held in the system with the engine not running is enough for at least two complete cycles of operation.

Vacuum from the reservoir is routed to a junction block on the dash panel. From the passenger compartment side of the junction block, the reservoir vacuum is routed by red hoses to the manual control switch and to the lock and unlock sections of the control valve (Figs. 20, 21 and 22).

The manual control switch is a hold-down type rather than a throw type. When no pressure is applied to the switch, its spring centers it and vacuum supply dead ends at the switch. When the switch is held in the lock position, vacuum is routed through a green hose to the lock section of the control valve. When the switch is held in the unlock position, vacuum is routed through a white hose to the unlock section of the control valve (Fig. 23).

When the lock section of the control valve is actuated by vacuum from the control switch, a valve is actuated which routes the vacuum to the hoses connected to the locking side of the lock motors in the doors. Vacuum applied to the motor moves the connecting link and locks the doors.

When the control switch returns to its neutral position, vacuum is shut off between the control switch and the control valve. As soon as the vacuum from the control switch is shut off, the control valve shuts off its vacuum supply to the lock motor and the lock motor becomes neutral. The doors will remain locked until they are unlocked manually or the control switch is moved to the unlock position.

When the control switch is moved to the unlock position, vacuum is routed to the unlock side of the control valve. With the unlock section of the control valve energized, vacuum is routed to the unlock section of the door lock motors. With vacuum applied to the unlock section of the motor, the link connecting the motor to the door lock mechanism is moved upward thus unlocking the doors. Again, the control valve will shut off its vacuum supply to the lock motor, and the lock motor becomes neutral.

All door lock motors are interconnected to the system and will lock or unlock the doors simultaneously.

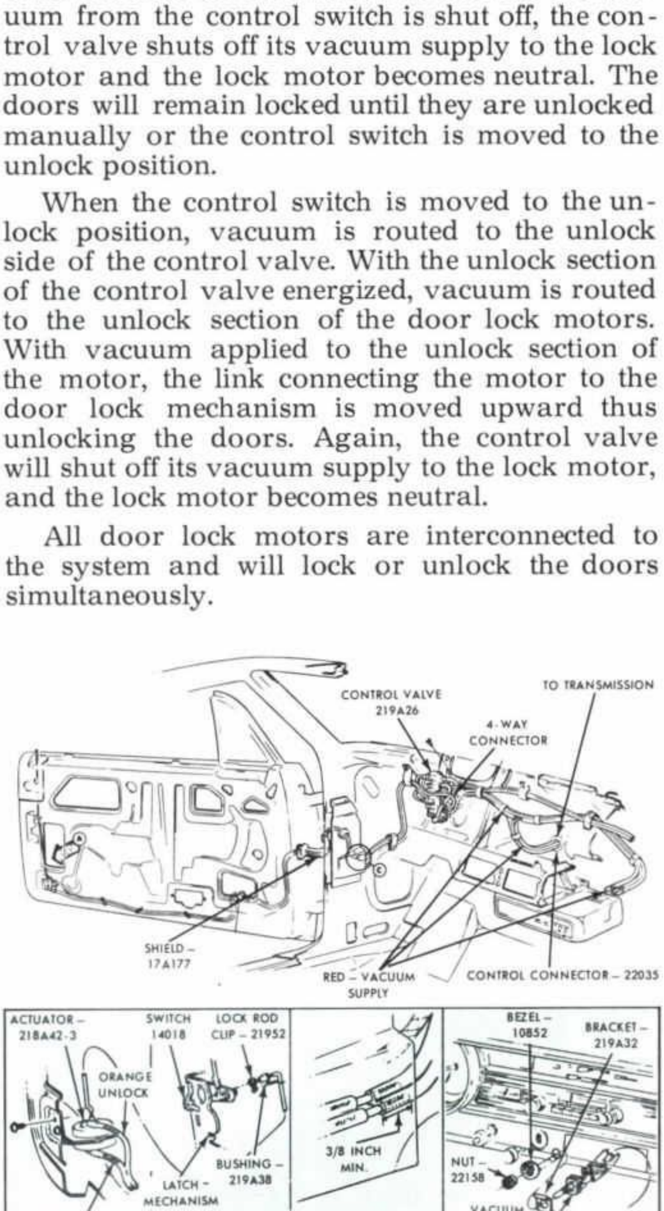


Fig. 21 — Vacuum Door Locks
Ford 2-Door Models

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

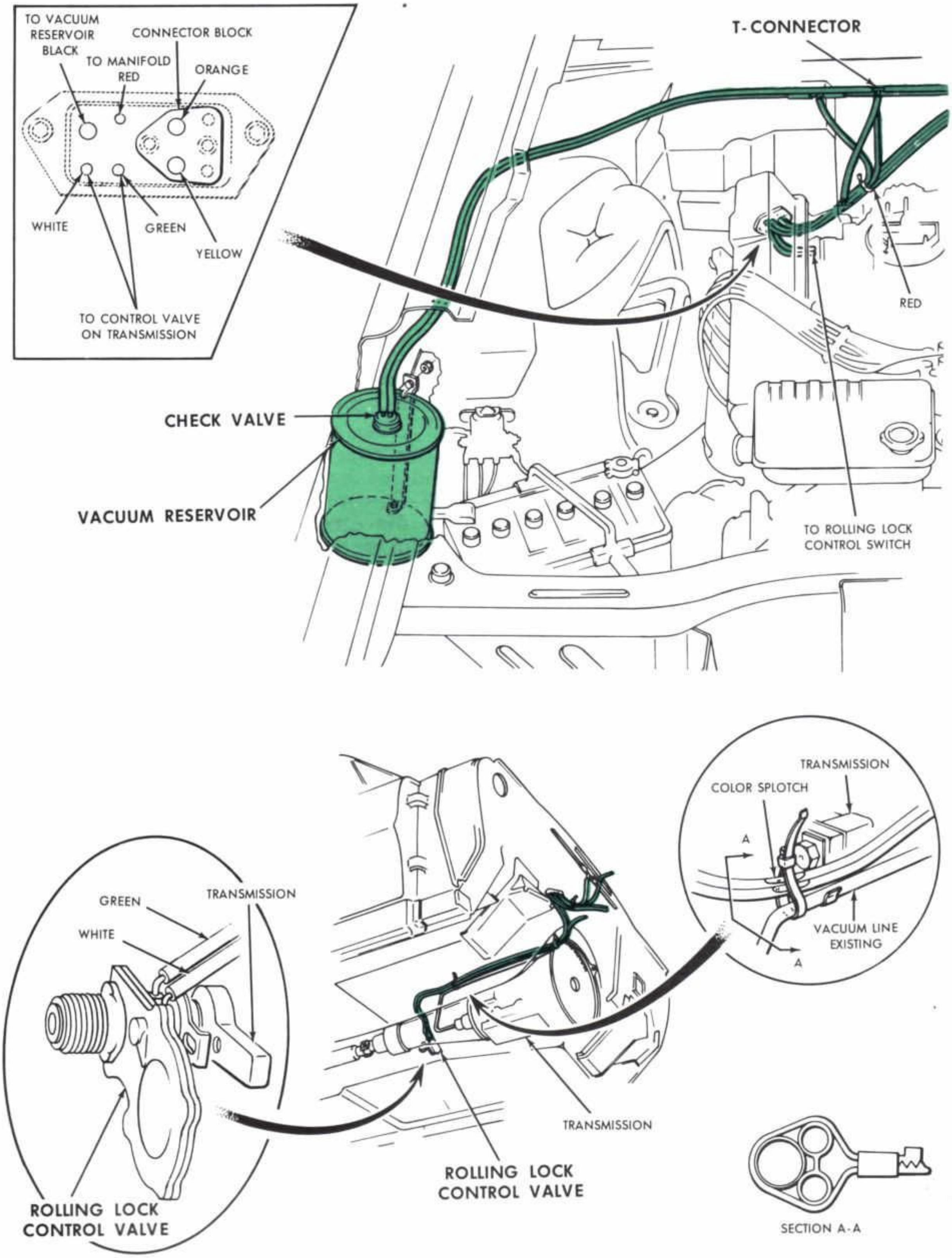


Fig. 19 — Door Lock Vacuum Supply Installation — Thunderbird

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

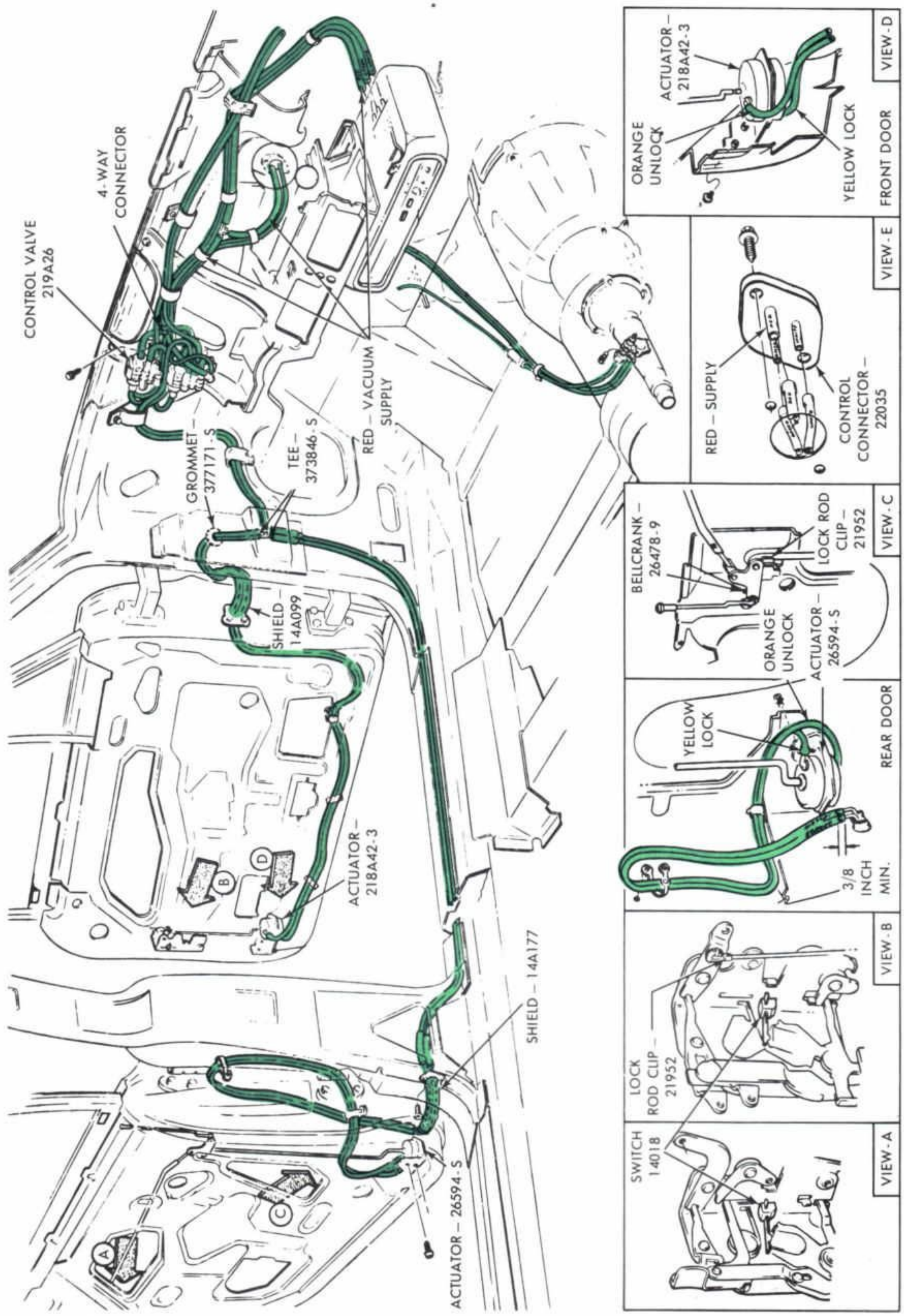


Fig. 20 — Vacuum Door Locks — Ford 4-Door Models

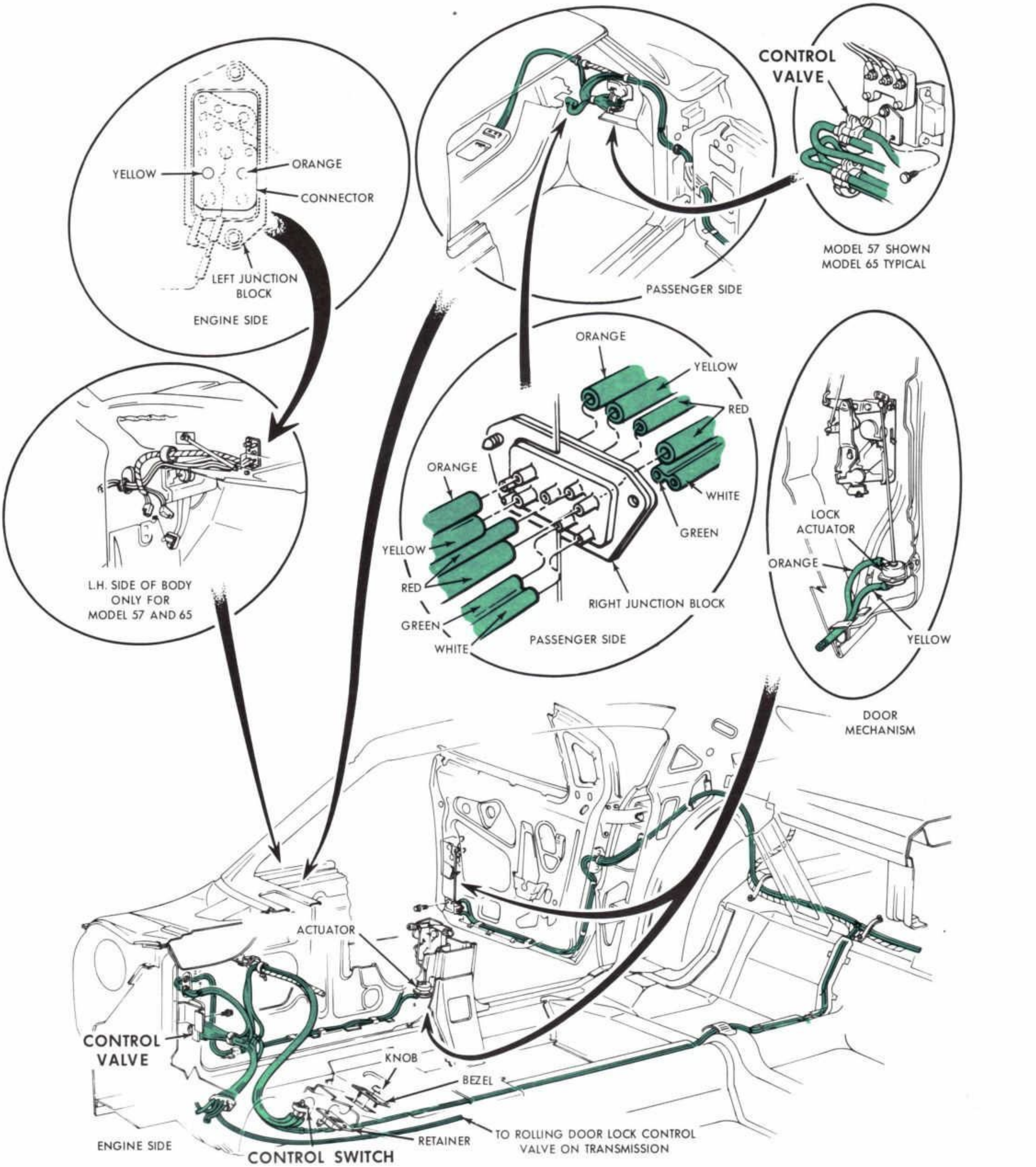


Fig. 22 — Door Lock Vacuum Component Location — Thunderbird

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

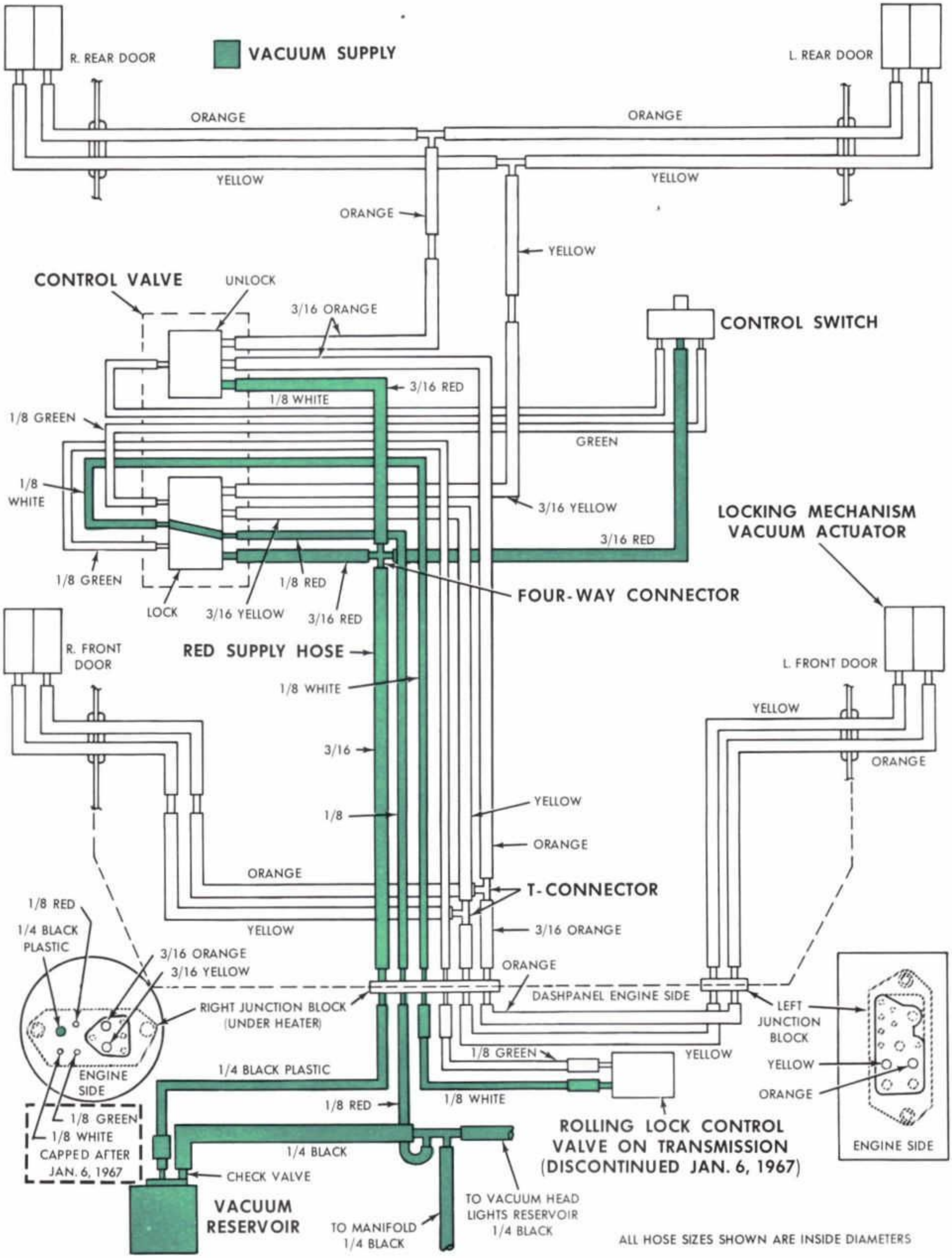


Fig. 23 — Vacuum Door Locks Circuit Diagram — Thunderbird

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

With the control switch in the normal or neutral position the doors may be locked or unlocked manually.

ROLLING DOOR LOCK SYSTEM

The rolling door lock system is an option which may have been added to the manually controlled system (units built before January 6, 1967). The rolling door lock system is controlled by an automatic switch, which is mounted on the transmission at the speedometer cable connection (Figs. 19 and 20). When the car moves at a speed greater than 5 to 9 mph, the switch opens and routes vacuum to the door lock section of the control valve. Once this switch is opened, vacuum routing to the lock section of the control valve is maintained as long as the car is in motion. This switch does not close until the car is stopped. This means that the door lock motors are energized at road speeds above 5 to 9 mph and once the switch is on, the door lock motors will remain energized until the car stops.

When the car stops, this switch closes and shuts off the vacuum supply to the lock side of the control valve. The control switch on the transmission is not connected into the unlock portion of the control valve. The doors will remain locked after the car stops until they are unlocked by either pressing the manual control switch or by lifting the individual lock buttons.

DIAGNOSIS AND TESTING

The vacuum supply from the manifold to the rolling door lock control switch passes through the control valve and bypasses the reservoir vacuum system. This makes the rolling door lock system active only if the engine is running, and forestalls the possibility of locking the doors while the vehicle is on a hoist and the rear wheels are turned. It is therefore important to leave the left door window open when the vehicle is on a hoist or with the rear wheels off the ground and the engine is left running for test purposes. Likewise the engine should be turned off when going through an automatic wash rack that uses rolls to run the wheels during cleaning.

Two problems can occur with the rolling door lock system:

1. Doors will not lock when the car is moving.
2. Doors lock immediately as soon as the engine is started.

Any other rolling door lock malfunction will occur with both the manually controlled vacuum door locks and the rolling door locks, since the two systems are integrated.

REFERENCE

1967 Vacuum Diagram Book —
Ford pages 3-9 through 3-13.
Thunderbird pages 4-4, 4-6, 4-10, 4-12 and 4-14.

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE

ALL VACUUM DOOR LOCKS DO NOT WORK — FORD

OPERATE VACUUM DOOR LOCKS TO SEE IF THEY WORK

NOT OK

START ENGINE AND CHECK FOR VACUUM AT DASH PANEL JUNCTION BLOCK 3/16 RED NIPPLE ON PASSENGER SIDE

NO VACUUM

REPAIR PLUGGED OR LEAKING HOSE BETWEEN JUNCTION BLOCK AND SOURCE

OK

APPLY VACUUM WITH PROBE TESTER TO YELLOW AND ORANGE HOSES TO DOOR LOCKS. REMOVE COWL SIDE TRIM PANELS

NOT OK

REPAIR VACUUM COMPONENTS AND LINKAGE WITHIN DOOR

OK

CHECK FOR VACUUM AT MANUAL CONTROL SWITCH RED HOSE

NO VACUUM

REMOVE RADIO, CHECK FOR VACUUM AT 4-WAY CONNECTOR

REPAIR OR REPLACE HOSE TO MANUAL CONTROL SWITCH

OK

CONNECT MANUAL CONTROL SWITCH RED HOSE TO GREEN HOSE AND THEN WHITE HOSE TO CHECK LOCKS

NOT OK

CHECK FOR VACUUM AT EACH HOSE FROM COWL CONNECTORS TO CONTROL VALVE. HOLD MANUAL CONTROL SWITCH ON

NO VACUUM

REPAIR OR REPLACE LEAKING OR PLUGGED HOSES. IF HOSE IS OK, REPLACE CONTROL VALVE

LOCKS OK

REPLACE MANUAL CONTROL SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE — Continued

DOOR LOCKING SYSTEM DOES NOT WORK, BUT UNLOCKING SYSTEM WORKS — FORD

- CHECK LOCKING AND UNLOCKING SYSTEMS TO SEE IF THEY WORK
  - **DOORS DO NOT LOCK** → REMOVE COWL SIDE TRIM PANELS. APPLY VACUUM WITH PROBE TESTER TO YELLOW HOSES TO DOOR LOCK MOTORS
    - **NOT OK** → REPAIR VACUUM COMPONENTS AND LINKAGE WITHIN DOOR
    - **OK** → CONNECT MANUAL CONTROL SWITCH RED HOSE TO GREEN HOSE TO CHECK LOCKS
      - **NOT OK** → REMOVE RADIO AND CHECK GREEN HOSE ROUTING FROM MANUAL SWITCH TO CONTROL VALVE. CHECK FOR VACUUM AT TEE ENDS OF YELLOW HOSES BETWEEN CONTROL VALVE AND COWL TEES
        - **NO VACUUM** → REPAIR OR REPLACE LEAKING OR PLUGGED HOSES. IF HOSES ARE OK, REPLACE CONTROL VALVE
      - **LOCKS OK** → REPLACE MANUAL CONTROL SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE — Continued

DOOR UNLOCKING SYSTEM DOES NOT WORK, BUT LOCKING SYSTEM WORKS — FORD

CHECK LOCKING AND UNLOCKING SYSTEMS TO SEE IF SYSTEM WORKS

DOORS DO NOT UNLOCK

REMOVE COWL SIDE TRIM PANELS. APPLY VACUUM WITH PROBE TESTER TO ORANGE HOSES TO DOOR LOCK MOTORS

NOT OK

REPAIR VACUUM COMPONENTS AND LINKAGE WITHIN DOOR

OK

CONNECT MANUAL CONTROL SWITCH RED HOSE TO WHITE HOSE TO CHECK LOCKS

NOT OK

REMOVE RADIO AND CHECK WHITE HOSE ROUTING FROM MANUAL SWITCH TO CONTROL VALVE. CHECK FOR VACUUM AT TEE ENDS OF ORANGE HOSES BETWEEN CONTROL VALVE AND COWL TEES

NO VACUUM

REPAIR OR REPLACE LEAKING OR PLUGGED HOSES. IF HOSES ARE OK, REPLACE CONTROL VALVE

LOCKS OK

REPLACE MANUAL CONTROL SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE — Continued

ONE DOOR LOCK DOES NOT WORK — FORD AND THUNDERBIRD

OPERATE CONTROL TO SEE IF VACUUM LOCK WORKS

↓

REMOVE THE LOCK PUSH BUTTON IN ORDER TO REMOVE ANY BINDING BETWEEN BUTTON AND TRIM PANEL. TEST THE LOCK BY WORKING MANUAL SWITCH

- DOES NOT WORK → REMOVE DOOR TRIM PANEL. APPLY VACUUM PROBE TESTER TO LOCK (YELLOW) AND UNLOCK (ORANGE) NIPPLES ON DOOR LOCK MOTOR
  - DOES NOT WORK → FROM PROBE TESTER GAUGE READINGS DETERMINE WHETHER THE PROBLEM IS IN THE VACUUM SYSTEM OR IN THE LOCKING MECHANISM. REPAIR OR REPLACE ACCORDINGLY
  - OK → REPAIR OR REPLACE ORANGE OR YELLOW HOSES FROM DOOR LOCK MOTOR BACK TO TEE CONNECTORS WITH OTHER DOOR OR DOORS
- OK → ADJUST LOCK LINKAGE

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

TROUBLE DIAGNOSIS GUIDE — Continued

DOORS DO NOT LOCK WHEN CAR SPEED GOES ABOVE 5-9 MPH — FORD AND THUNDERBIRD WITH ROLLING DOOR LOCKS

UNLOCK DOORS, LOWER DRIVER'S WINDOW, RAISE CAR, REMOVE WHITE AND GREEN HOSES FROM ROLLING DOOR LOCK SWITCH AND CONNECT REMOVED HOSES TOGETHER. START ENGINE AND SEE IF DOOR LOCKS WORK

- DOES NOT WORK → CHECK FOR VACUUM AT SWITCH END OF 1/8 WHITE HOSE
  - NO VACUUM → CORRECT HOSE LEAKAGE OR PLUGGING IN 1/8 RED HOSE BETWEEN ENGINE INTAKE MANIFOLD AND CONTROL VALVE
  - VACUUM → CORRECT HOSE LEAKAGE OR HOSE PLUGGING IN 1/8 GREEN HOSE BETWEEN ROLLING SWITCH AND CONTROL VALVE
- LOCKS WORK → REPLACE ROLLING DOOR LOCK SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

VACUUM CONTROLLED DOOR LOCKS — FORD AND THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE — Continued

DOORS LOCK AS SOON AS ENGINE STARTS — FORD AND THUNDERBIRD WITH ROLLING DOOR LOCKS

START ENGINE TO SEE IF DOORS LOCK

DISCONNECT AND PLUG 1/8 GREEN AND WHITE HOSES FROM PASSENGER SIDE OF DASH PANEL JUNCTION BLOCK. START ENGINE

- DOES NOT LOCK → REPLACE ROLLING LOCK SWITCH
- OK → DISCONNECT AND PLUG 3/16 RED HOSE AT MANUAL CONTROL SWITCH. START ENGINE
  - DOES NOT LOCK → REPLACE MANUAL CONTROL SWITCH
  - DOORS LOCK → CHECK 3/16 RED AND 3/16 YELLOW HOSE ROUTINGS TO LOCK SECTION OF CONTROL VALVE. IF HOSE ROUTINGS ARE OK, REPLACE CONTROL VALVE

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

TROUBLE DIAGNOSIS GUIDE — Continued

DOOR LOCKING SYSTEM DOES NOT WORK, BUT UNLOCKING SYSTEM WORKS — THUNDERBIRD

OPERATE SYSTEM TO SEE IF IT WORKS

DOORS DO NOT LOCK

APPLY VACUUM WITH PROBE TESTER TO TEE CONNECTORS IN YELLOW HOSES TO FRONT AND REAR DOOR LOCKS. FRONT DOOR TEE IS IN HOSES NEAR CONTROL VALVE. REAR DOOR TEE IS BEHIND REAR SEAT BACK

DOES NOT WORK

REPAIR VACUUM COMPONENTS AND LINKAGE WITHIN DOORS

OK

CONNECT MANUAL SWITCH RED HOSE TO GREEN HOSE TO CHECK LOCKS

DOES NOT LOCK

CHECK 1/8 GREEN HOSE ROUTING FROM MANUAL SWITCH TO CONTROL VALVE. THEN CHECK FOR VACUUM AT TEE OF YELLOW HOSES BETWEEN CONTROL VALVE AND TEES

NO VACUUM

REPAIR OR REPLACE LEAKING OR PLUGGED HOSES. IF HOSES ARE OK, REPLACE CONTROL VALVE

OK

REPLACE MANUAL CONTROL SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

VACUUM CONTROLLED DOOR LOCKS – FORD AND THUNDERBIRD

TROUBLE DIAGNOSIS GUIDE – Continued

DOOR UNLOCKING SYSTEM DOES NOT WORK, BUT LOCKING SYSTEM WORKS – THUNDERBIRD

OPERATE SYSTEM TO SEE IF IT WORKS

→ DOORS DO NOT UNLOCK

APPLY VACUUM WITH PROBE TESTER TO TEE CONNECTORS IN ORANGE HOSES TO FRONT AND REAR DOOR LOCKS. FRONT DOOR TEE IS IN HOSES NEAR CONTROL VALVE. REAR DOOR TEE IS BEHIND REAR SEAT BACK

→ NOT OK

REPAIR VACUUM COMPONENTS AND LINKAGE WITHIN DOORS

→ OK

CONNECT MANUAL SWITCH RED HOSE TO WHITE HOSE TO CHECK LOCKS

→ DOES NOT UNLOCK

CHECK WHITE HOSE ROUTING FROM MANUAL SWITCH TO CONTROL VALVE. THEN CHECK FOR VACUUM AT TEE NIPPLES OF ORANGE HOSES BETWEEN CONTROL VALVE AND TEES

→ NO VACUUM

REPAIR OR REPLACE LEAKING OR PLUGGED HOSES. IF HOSES ARE OK, REPLACE CONTROL VALVE

→ DOORS UNLOCK

REPLACE MANUAL CONTROL SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

TROUBLE DIAGNOSIS GUIDE — Continued

ALL VACUUM DOOR LOCKS DO NOT WORK — THUNDERBIRD

OPERATE VACUUM DOOR LOCKS TO SEE IF THEY WORK

NOT OK

START ENGINE AND CHECK FOR VACUUM AT DASH PANEL JUNCTION BLOCK 3/16 RED NIPPLE ON PASSENGER SIDE

NO VACUUM

REPAIR PLUGGED OR LEAKING HOSE BETWEEN JUNCTION BLOCK AND SOURCE

OK

APPLY VACUUM WITH PROBE TESTER TO TEE CONNECTORS IN YELLOW AND ORANGE HOSES TO FRONT AND REAR DOOR LOCKS. FRONT DOOR TEES ARE IN HOSES NEAR CONTROL VALVE. REAR DOOR TEES ARE BEHIND REAR SEAT BACK

NOT OK

REPAIR VACUUM COMPONENTS AND LINKAGE WITHIN DOOR

OK

CHECK FOR VACUUM AT MANUAL CONTROL SWITCH RED HOSE

NO VACUUM

CHECK FOR VACUUM AT 4-WAY CONNECTOR

REPAIR OR REPLACE HOSE TO MANUAL CONTROL SWITCH

OK

CONNECT MANUAL CONTROL SWITCH RED HOSE TO GREEN HOSE AND THEN WHITE HOSE TO CHECK LOCKS

NOT OK

CHECK FOR VACUUM AT EACH HOSE FROM TEE CONNECTORS TO CONTROL VALVE. HOLD MANUAL CONTROL SWITCH ON

NO VACUUM

REPAIR OR REPLACE LEAKING OR PLUGGED HOSES. IF HOSE IS OK, REPLACE CONTROL VALVE

LOCKS OK

REPLACE MANUAL CONTROL SWITCH

DO NOT REMOVE ANY OF THE VACUUM HOSES FROM EITHER CONTROL VALVE UNLESS THE CONTROL VALVE IS BEING REPLACED, AS THE BLACK PLASTIC NIPPLES ARE THIN AND VERY BRITTLE AND DAMAGE MAY RESULT

AUTOMATIC SPEED CONTROL — FORD

OPERATION

GENERAL DESCRIPTION

The automatic speed control is a driver controlled and operated mechanism for automatically regulating vehicle speeds on turnpikes, expressways and other open road driving conditions.

The system can be set to operate at a desired speed. It can be canceled, or reset for vehicle speeds ranging from 30 to 80 mph. The entire system is controlled by vehicle speed which will maintain the selected speed up and down grades and on level terrain.

The system consists of an ON-OFF switch mounted on the instrument panel lower flange (Fig. 24) a set speed switch located in the end of the turn signal lever, a resume switch manually operated by a sleeve on the turn signal lever shaft, a speed control assembly mounted on the left front fender apron, a vacuum operated servo mounted in the engine compartment to automatically control the throttle, an air valve and holding relay, a brake disconnect relay, two speedometer cables and associated vacuum hoses and electrical wiring harnesses.

OPERATING CONTROLS

The ON-OFF switch is used to activate the speed control system by supplying electrical power from the accessory terminal of the ignition switch through a 7.5-amp fuse to the speed control system (Fig. 24).

The set-speed electrical control switch is used to set and hold the desired vehicle speed automatically.

The resume electrical switch, assembled slightly inward from the outer end of the turn signal lever, is used to return the vehicle to the previously selected speed after slowing down because brakes were applied.

The main wire connectors for the speed control are shown in Figure 24. These connectors are also identified in the circuit schematic (Fig. 26).

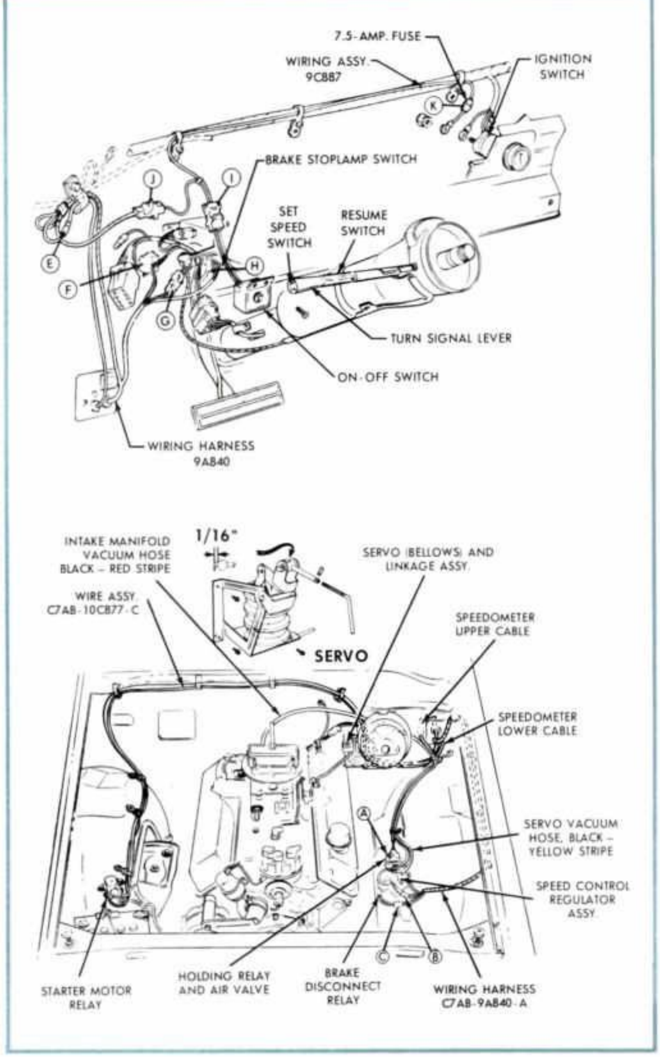


Fig. 24 — Speed Control Installation — Ford

SYSTEM OPERATION

The automatic speed control system is activated by pulling the ON-OFF switch out to the ON position. The button will stay out. Refer to Figure 24. The vehicle is manually accelerated to the desired speed and held until the vehicle speed becomes stabilized. The set speed switch button is then quickly depressed and released. The vehicle then automatically controls the throttle to maintain the selected road speed without manually holding the accelerator pedal with the normally required foot pressure.

Vehicle speed can be increased above the selected speed by applying normal foot pressure on the accelerator pedal. When the accelerator pedal is released the vehicle will slow down and resume the previously selected vehicle speed.

When a higher automatically controlled speed is desired, the vehicle is manually accelerated to the higher speed and the set speed switch button is depressed and released. A higher automatically controlled vehicle speed can also be achieved by depressing and holding the set speed switch button. The vehicle speed will continue to increase until the set speed button is released. The vehicle may continue to accelerate approximately 2 to 3 miles per hour while the system stabilizes and then locks at the higher selected speed.

To disengage the set speed, push on the brake pedal. This does not change the memory of the last set speed. When the resume switch is turned on, the vehicle automatically accelerates to, and maintains the previously selected road speed. Refer to Figure 25.

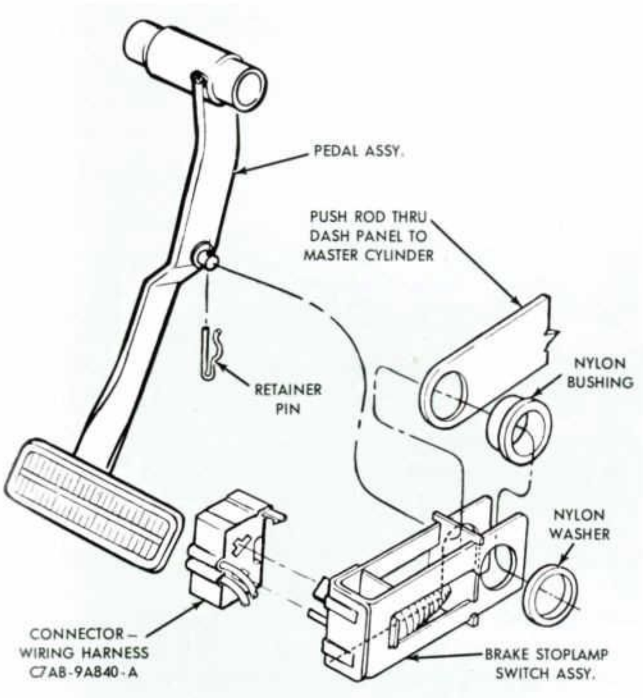


Fig. 25 — Brake Stoplight Switch — Ford

The automatic control system can be disengaged by applying the brakes to retard the vehicle speed, by pushing the ON-OFF switch button into the OFF position or by turning the ignition switch off cutting the electrical power supply to the speed control system.

SYSTEM COMPONENT OPERATION

The electrical power supply for the speed control system is obtained from the accessory terminal of the ignition switch (ignition ON) through a 7.5-amp fuse to the power supply open contact point of the ON-OFF switch. When the switch button is pulled out to the ON position, the switch holding coil is energized to hold the switch points closed. Electrical power is supplied to the contact points, (normally open) of the set speed and resume switches and through the normally closed contact points of the brake disconnect relay to the holding relay. Refer to Figure 26.

As the vehicle is accelerated, the speedometer cable drives the speed control regulator assembly (Fig. 27).

At approximately 25 miles per hour the speed control regulator inhibit switch closes the electrical circuit to the holding relay field coil. This makes the speed control system electrically ready.

To set a speed, the vehicle is accelerated manually to the desired speed. When the set speed switch button is depressed and released, the regulator metering valve meters vacuum to maintain the set speed. This metering valve is centered magnetically by the clutch coil each time a new speed is selected.

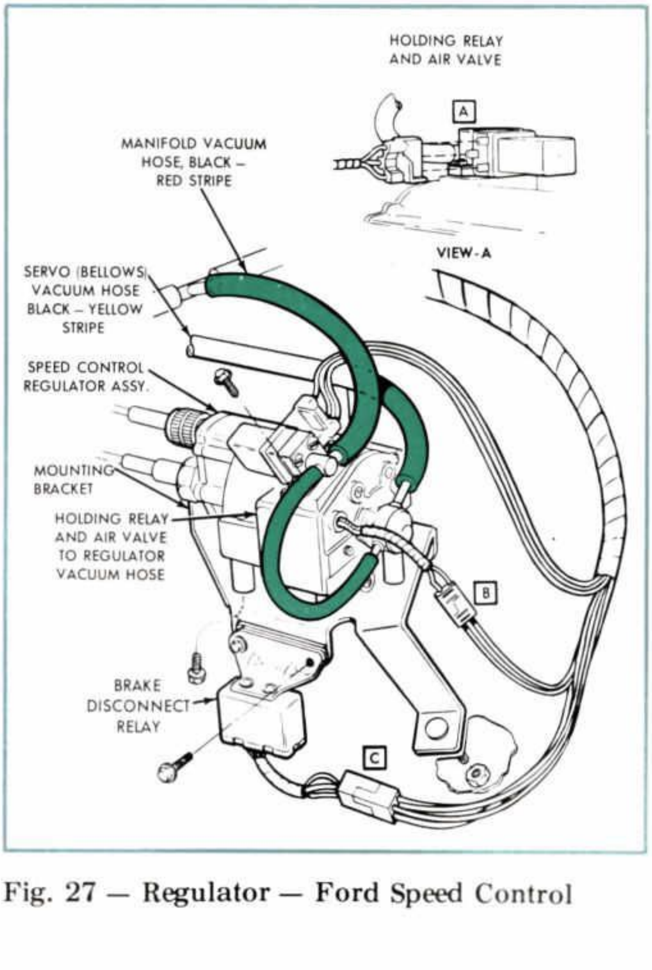


Fig. 27 — Regulator — Ford Speed Control

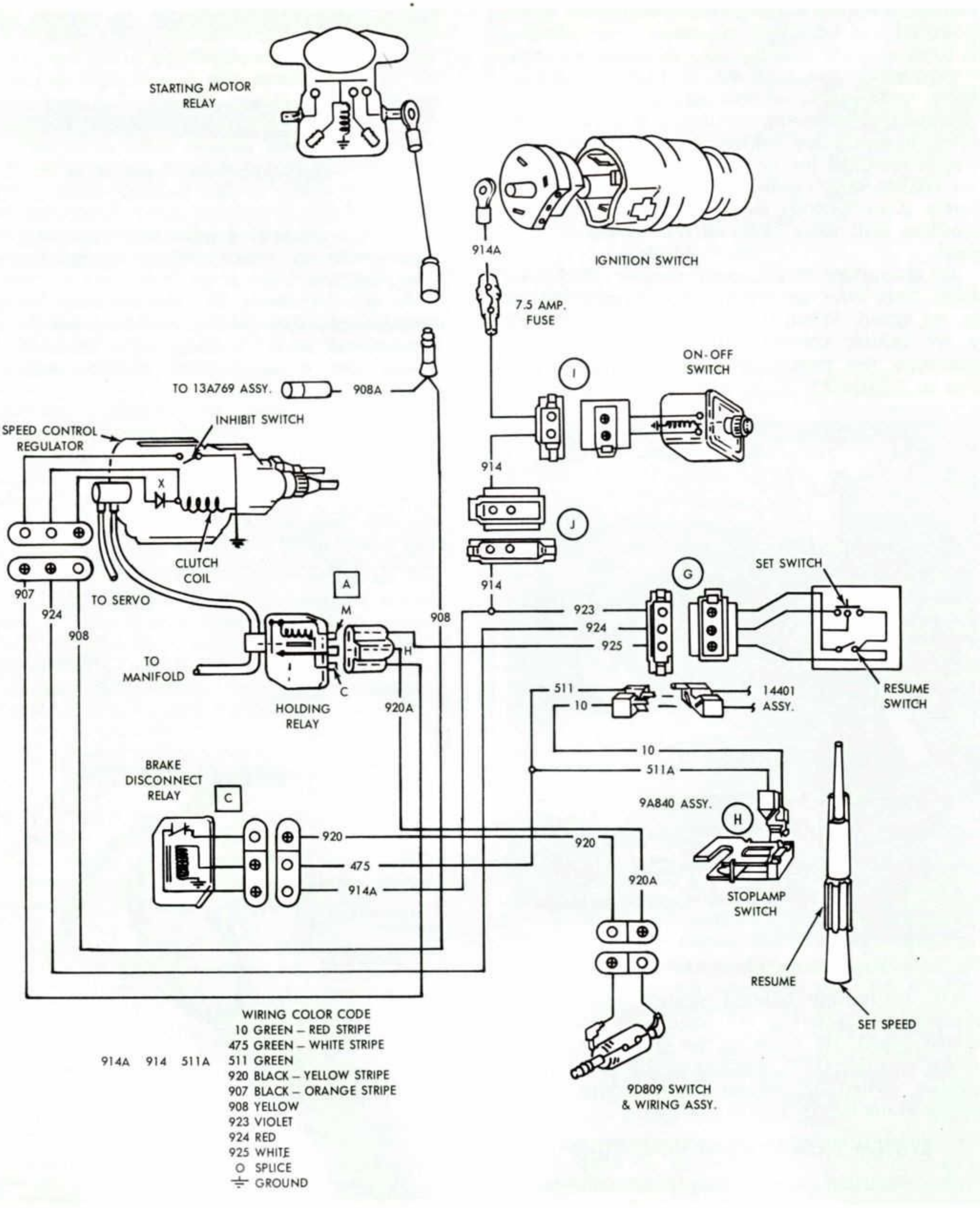


Fig. 26 — Ford Speed Control Wiring Diagram

AUTOMATIC SPEED CONTROL — FORD

Automatic control of the vehicle selected speed on grades is achieved by the increased or decreased vacuum metered to the servo motor. On an upgrade, as the vehicle speed begins to decrease, the speedometer cable drives the regulator assembly at a reduced speed, this moves the regulator metering valve to meter increased vacuum to the servo motor to open the throttle and increase the vehicle speed.

On a downgrade, as the vehicle speed begins to increase, the speedometer cable drives the regulator assembly at an increased speed. This moves the regulator metering valve to meter decreased vacuum to the servo motor to reduce the throttle opening to maintain the selected vehicle speed.

ADJUSTMENT AND TEST PROCEDURES

SERVO ADJUSTMENT

The servo linkage should be adjusted so that a 1/16" measurement is obtained (Fig. 24).

SIMULATED ROAD TEST

The road test may be simulated by raising the vehicle on a hoist enough to have the rear wheels clear the floor. Remove the vacuum hose from the servo and install a vacuum gauge so that it can be read from the driver's seat.

Start engine, place transmission into Drive and raise speed over 25 mph. The system is now ready to test.

HOLDING RELAY TEST

Disconnect the wire connector from the holding relay. Connect a 12-volt battery across the holding relay H (+) and C (-) terminals (Fig. 28). Connect a jumper wire temporarily between the H terminal and the M terminal. The relay should click. Remove the jumper wire. The relay should hold the air valve open. Blow through the T-connector on the end of the relay to see that the valve is open.

BRAKE DISCONNECT RELAY TEST

Disconnect the relay from the circuit. Connect a self-powered test light across the connector outside terminals (Fig. 29). Since this is a normally closed relay, the light should glow. Apply a 12-volt lead to the relay center terminal. Be sure the ground wire is properly connected. This should energize the relay coil through the ground wire, open the contact points and the light should go out.

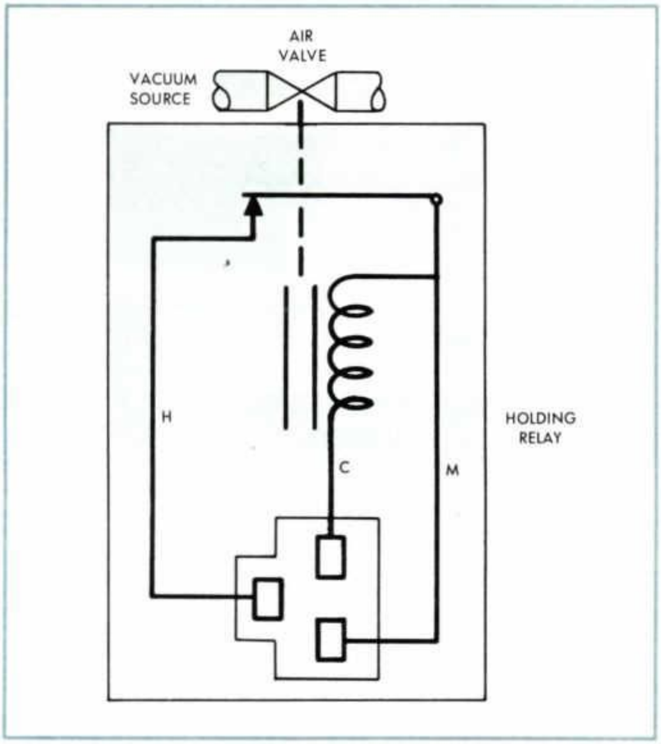


Fig. 28 — Holding Relay and Air Valve

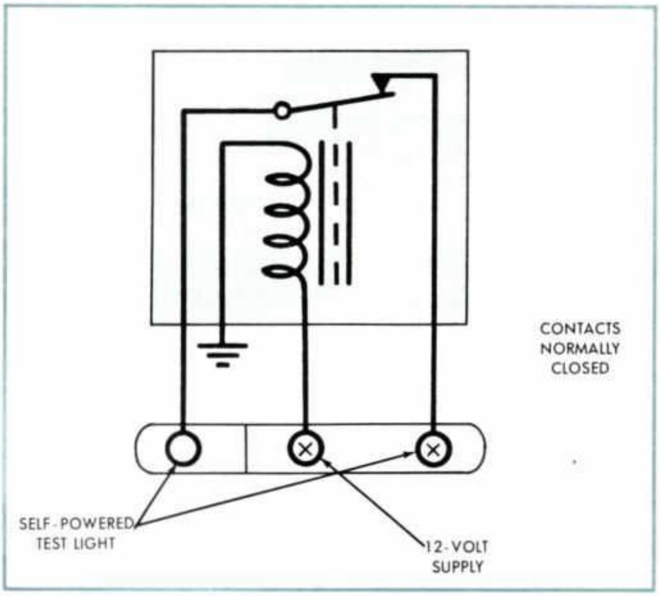


Fig. 29 — Brake Disconnect Relay

REFERENCES

1967 Vacuum Diagram Book page 3-8.
1967 Wiring Diagram Book page 5-18.

TROUBLE DIAGNOSIS GUIDE

ON-OFF SWITCH DOES NOT STAY ON

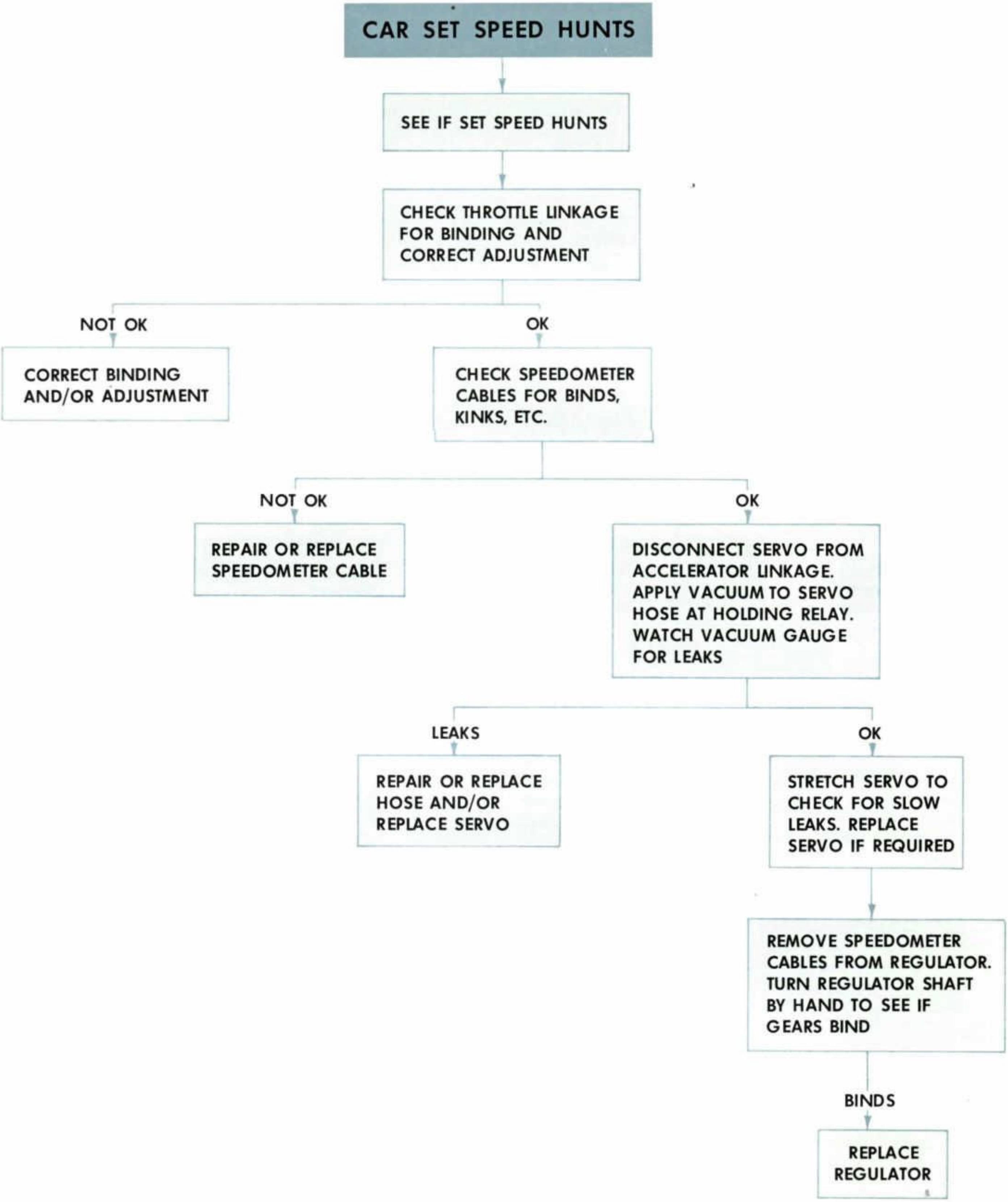
- TURN IGNITION SWITCH AND ON-OFF SWITCH ON TO SEE IF IT WORKS. KNOB SHOULD STAY OUT
  - CHECK FOR POWER AT CONNECTOR (I) WIRE 914A (FIG. 26)
    - NO POWER → CHECK FUSE
      - NOT OK → REPLACE FUSE
      - OK → CHECK WIRE 914A AND CONNECTIONS BETWEEN IGNITION SWITCH AND ON-OFF SWITCH
        - REPAIR OR REPLACE AS NECESSARY
    - OK → CHECK FOR POWER AT CONNECTOR (I) WIRE 914 (FIG. 26) WITH ON-OFF KNOB PULLED
      - NO POWER → REPAIR WIRE OR REPLACE SWITCH
      - OK → WITH SELF-POWERED TEST LIGHT CHECK BETWEEN GROUND AND 914 TERMINAL OF ON-OFF SWITCH

TROUBLE DIAGNOSIS GUIDE — Continued

SPEED CONTROL DOES NOT WORK

- PERFORM SIMULATED ROAD TEST. ACCELERATE ENGINE TO 30 MPH AND PUSH SET SPEED BUTTON. CHECK GAUGE FOR VACUUM TO SEE IF SYSTEM WORKS
  - NO VACUUM → CHECK FOR POWER AT CONNECTOR [C] WIRE 914A (FIG. 26)
    - NO POWER → CHECK 914 WIRE FOR CONTINUITY THROUGH CONNECTORS (J) AND (I)
      - REPAIR OR REPLACE WIRE
    - OK → CHECK BRAKE LIGHTS. SHOULD BE OUT
      - NOT OK → REPAIR STOPLAMP SWITCH WIRES OR SWITCH
      - OK → CHECK 920 WIRE AT CONNECTOR [A] FOR POWER (FIG. 26)
        - NO POWER → CHECK BRAKE RELEASE RELAY, BRAKE PEDAL SWITCH, WIRES OR CONNECTORS. REPAIR OR REPLACE AS REQUIRED
        - OK → CHECK HOLDING RELAY
          - NOT OK → REPLACE RELAY
          - OK → CHECK FOR VACUUM AT HOLDING RELAY FROM MANIFOLD
            - NO VACUUM → INSPECT, REPAIR OR REPLACE HOSE TO MANIFOLD
            - OK → PUSH AND HOLD SET BUTTON TEST FOR POWER AT CONNECTOR [B] 924 AND THEN 907
              - NO POWER → REPAIR OR REPLACE WIRES BETWEEN CONNECTORS [B] (G) AND OR SET SPEED SWITCH
              - OK → CHECK REGULATOR. REPLACE IF NECESSARY
  - VACUUM → CHECK SERVO FOR LEAKS. REPLACE IF NECESSARY

TROUBLE DIAGNOSIS GUIDE — Continued



TROUBLE DIAGNOSIS GUIDE — Continued

CAR DOES NOT HOLD SET SPEED ON HILL

SEE IF CAR WILL HOLD SPEED ON HILL

- NOT HOLD → CHECK THROTTLE LINKAGE FOR BINDING AND CORRECT ADJUSTMENT
  - NOT OK → CORRECT BINDING AND/OR ADJUSTMENT
  - OK → CHECK FOR VACUUM AT SERVO
    - LOW VACUUM → CHECK FOR PLUGGED VACUUM HOSE FROM SOURCE TO SERVO
    - OK → CHECK SERVO FOR BINDING
- OK → CHECK SPEED CONTROL FOR CORRECT OPERATION

RESUME SWITCH DOES NOT WORK

PERFORM SIMULATED ROAD TEST. START ENGINE AND SET SPEED AT 40 MPH. DEPRESS BRAKE PEDAL THEN AT 30 MPH TURN RESUME SWITCH ON. VACUUM SHOULD DECREASE WHEN BRAKES ARE APPLIED AND INCREASE WHEN RESUME SWITCH IS TURNED ON IF THE SYSTEM WORKS

↓

TURN RESUME SWITCH ON AND HOLD. CHECK FOR POWER AT TERMINAL M WIRE 925 OF HOLDING RELAY (FIG. 30)

- NO POWER → PRESS SET SPEED BUTTON. AGAIN CHECK FOR POWER AT TERMINAL M
  - NO POWER → CHECK WIRE 925 FROM HOLDING RELAY TO RESUME SWITCH. REPAIR WIRE OR REPLACE SWITCH
  - OK → RESUME SWITCH DEFECTIVE. REPLACE SWITCH

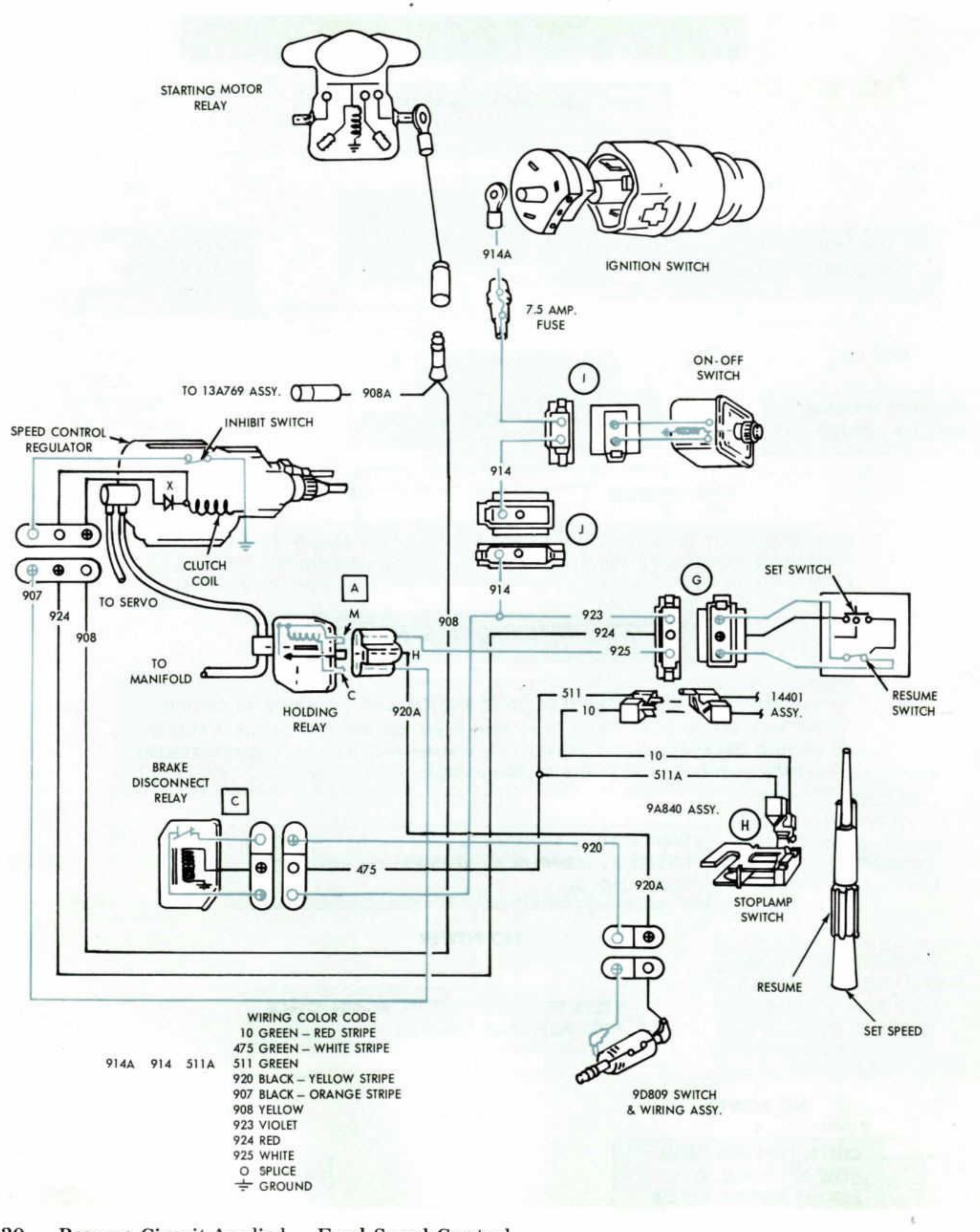


Fig. 30 — Resume Circuit Applied — Ford Speed Control

AUTOMATIC SPEED CONTROL — THUNDERBIRD

INTRODUCTION

GENERAL SYSTEM OPERATION

The 1967 Thunderbird speed control system is a driver-operated system. It is capable of holding a speed between 30 and 80 mph regardless of hills and curves. The driver controls (Fig. 31) are an ON-OFF switch marked SPEED CONTROL and located on the console panel, a set speed switch on the steering wheel left spoke, and a resume-retard switch on the steering wheel right spoke.

To operate the system while the car is in motion, the speed control switch is pushed forward to apply power to the system and then released. The car then is accelerated and held at the desired speed by the driver. The set speed

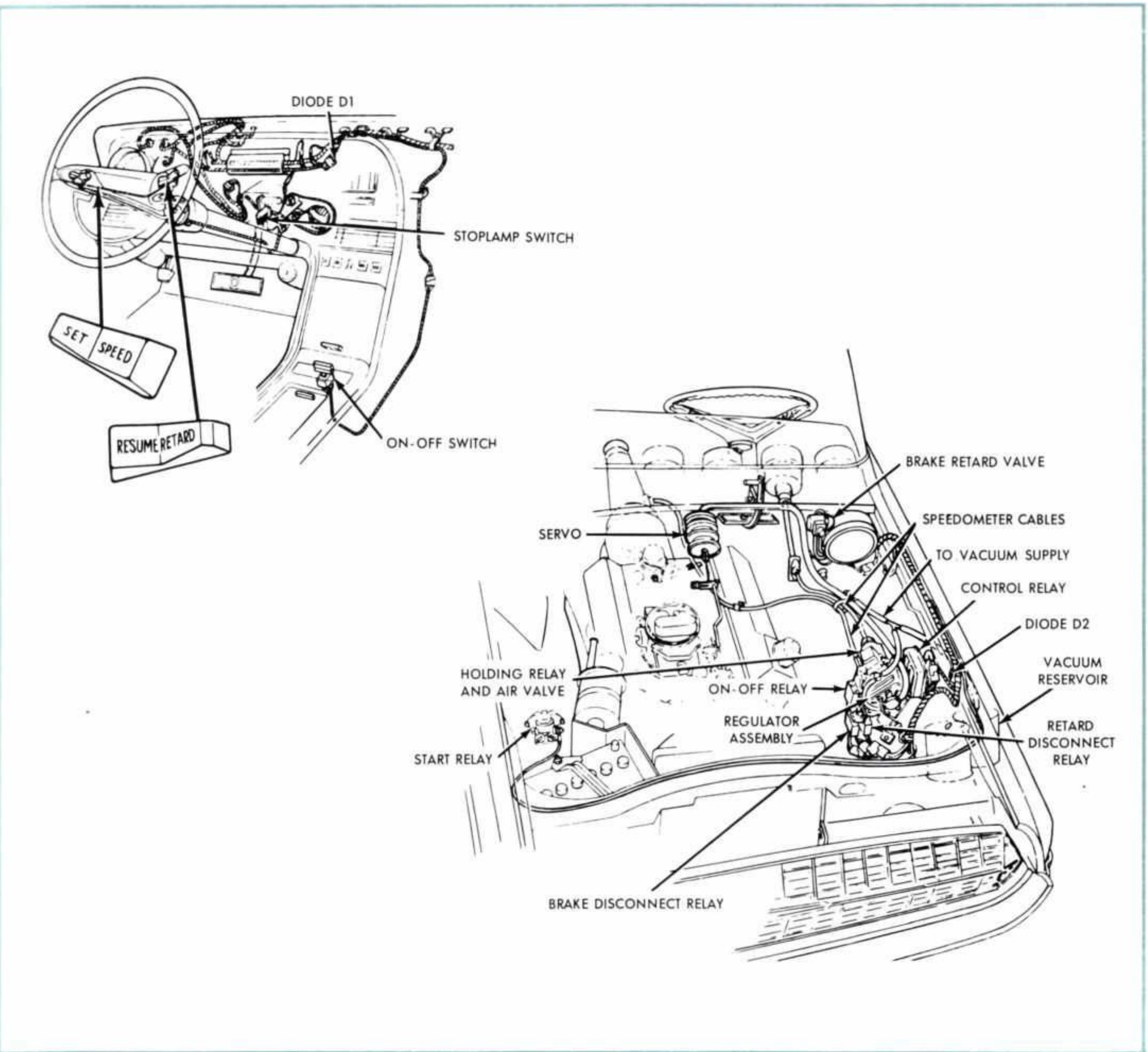


Fig. 31 — Thunderbird Speed Control Component Location

AUTOMATIC SPEED CONTROL — THUNDERBIRD

switch is then pushed and released. The speed control system is now in operation. The car will maintain its set speed normally within 2 or 3 miles-per-hour up and down hills as long as the system is in control under average driving conditions.

If a higher speed is desired, hold the set speed button down and the car speed will continue to increase. When the desired speed is reached release the set speed button. The car will continue at the speed established when the button was released.

To set in a lower speed, push the retard button. This disengages the speed control system and the vehicle slows down normally. When you hold down the retard button the brakes are applied lightly to slow the car. When the new, lower speed is reached, push the set speed button momentarily and the new speed is set in the system.

The speed control system is disengaged whenever the foot brake is pushed. Pushing the retard button or pulling back on the speed control switch also disengages the automatic speed control.

If the car has been slowed down by using the brakes or the retard button and the resume button is pushed, the car automatically adjusts its speed to the last set speed. Whenever the car motor has been stopped, and then restarted, the set speed is cancelled and returned to zero. A new control speed must be established.

SYSTEM COMPONENTS

Figure 31 shows the location of all the components. Figure 32 shows the location of the electrical connections for connecting the circuits between the components.

SYSTEM CIRCUITS

The speed control system may be divided into a number of different functions. The system is made up of a series of electrical relays and vacuum valves. Engine vacuum actually does the work to control the speed.

The engine start circuit automatically cancels any previously established speed settings. Every time the engine is started a new controlled speed must be set by the driver.

The ON-OFF circuit controls the power to the system.

The control circuit is made up of the various driver operated controls which tell the system what to do.

The disconnect circuit contains the relays and switches which remove automatic control.

The regulator circuit contains the regulator assembly which controls the car speed. The speedometer cable from the transmission is connected to the regulator assembly. This is the speed input. The inhibit switch in the regulator prevents the system from engaging below 20 mph. The clutch coils allow the speed to be set into the regulator. A regulator valve controls the vacuum to a collapsible bellows, the servo. The more sent to the servo, the more it collapses and pulls on the throttle linkage. When the regulator assembly senses that the car is at the set speed, the regulator valve is set so that just enough vacuum goes to the servo to hold the set speed. When the car starts up a hill, the speed input indicates the car is slowing down and more vacuum is sent to the servo. The servo pulls on the throttle linkage just enough to keep the speed constant even though the car is climbing a hill.

A speedometer cable from the control regulator drives the speedometer.

When the disconnect circuit operates, all vacuum is shut off to the regulator valve and servo. The driver must then control the speed with the accelerator.

GENERAL INFORMATION

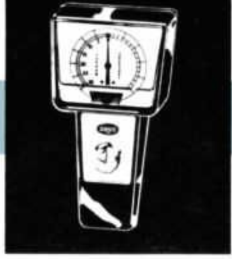
A number of plugs and connectors and wiring harnesses are used to interconnect the various parts of the speed control system. A complete electrical schematic of the system shows all the connections and slip rings used in the speed control system (Fig. 33). The schematic shows the system in an OFF condition.

Note the symbols for the connections. They are end views making the pin or jack connecting to a particular wire easy to locate. All the wires are color coded which gives a double check on finding the desired wire.

Location of the plugs and connectors in the vehicle is shown in Figure 32.

ENGINE START CIRCUIT

When the ignition switch is turned to start, the starter relay is actuated and power is applied to



terminal 11 of control relay K3 (Fig. 34). From terminal 11, the power is sent through the closed relay contact to terminal 2, then through the wiring harness to the clutch coil in the regulator assembly, K7, which will be energized. When the clutch coil is energized the car speed, which is zero, is set in to the regulator assembly. Any previous set speed is automatically cancelled. This will happen each time the engine is started. As soon as the engine starts, the starter relay is released and power is removed from the clutch coil K7.

ON-OFF SWITCH "ON"-CIRCUIT

To operate the speed control system the speed control switch is pushed forward to the on position, applying power to the on-off relay, K1 (Fig. 35). The relay contacts close and stay closed since the relay coil now gets its power through these contacts even after the ON-OFF switch is released.

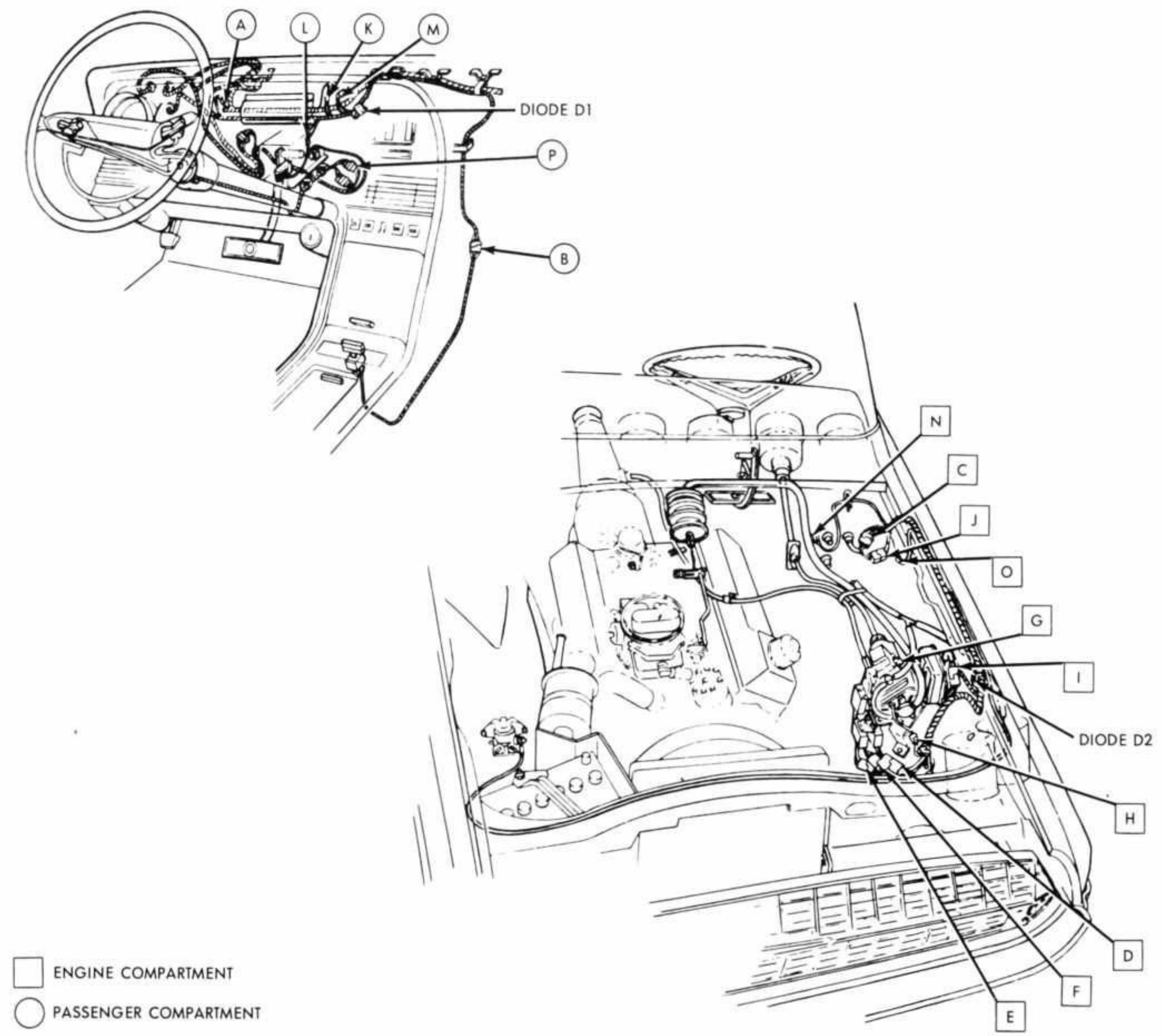
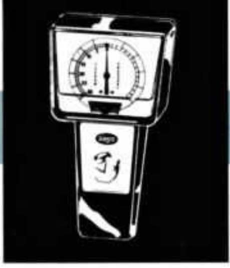


Fig. 32 — Thunderbird Speed Control Connector Location



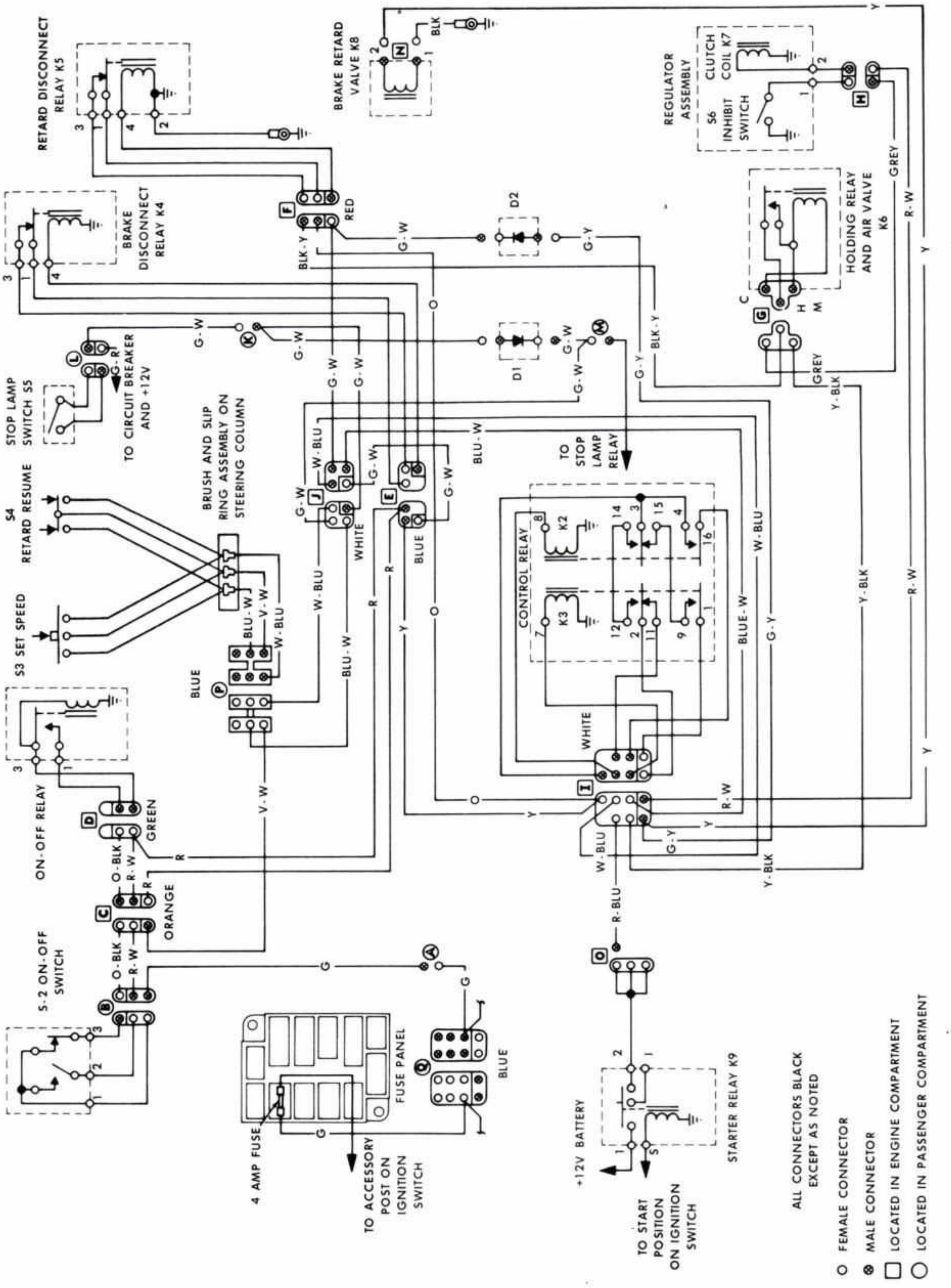
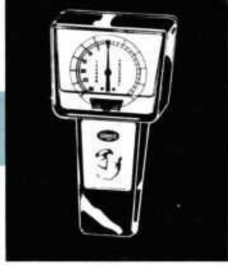


Fig. 33 — Wiring Connectors — Thunderbird Speed Control



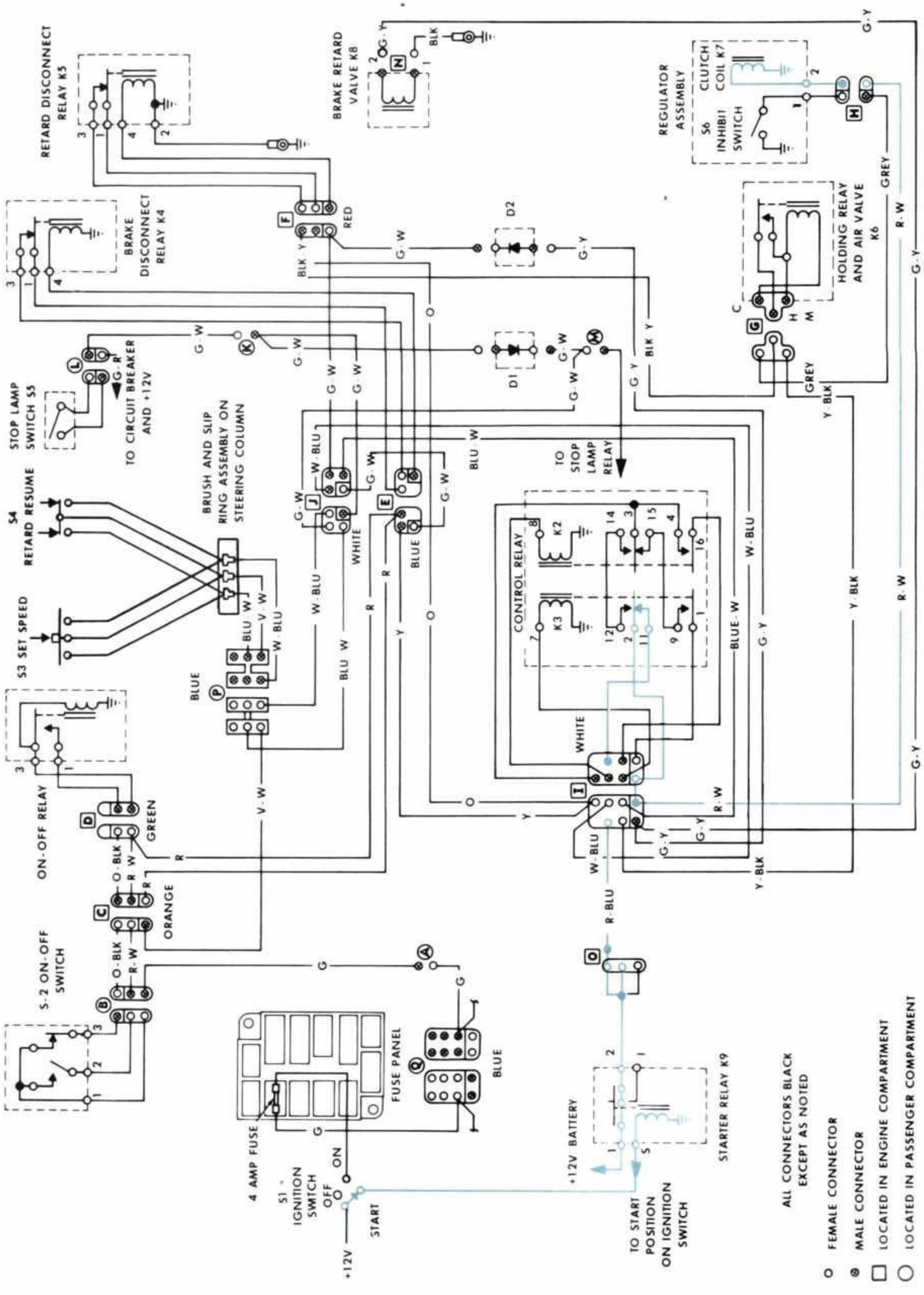


Fig. 34 — Start Circuit — Thunderbird Speed Control

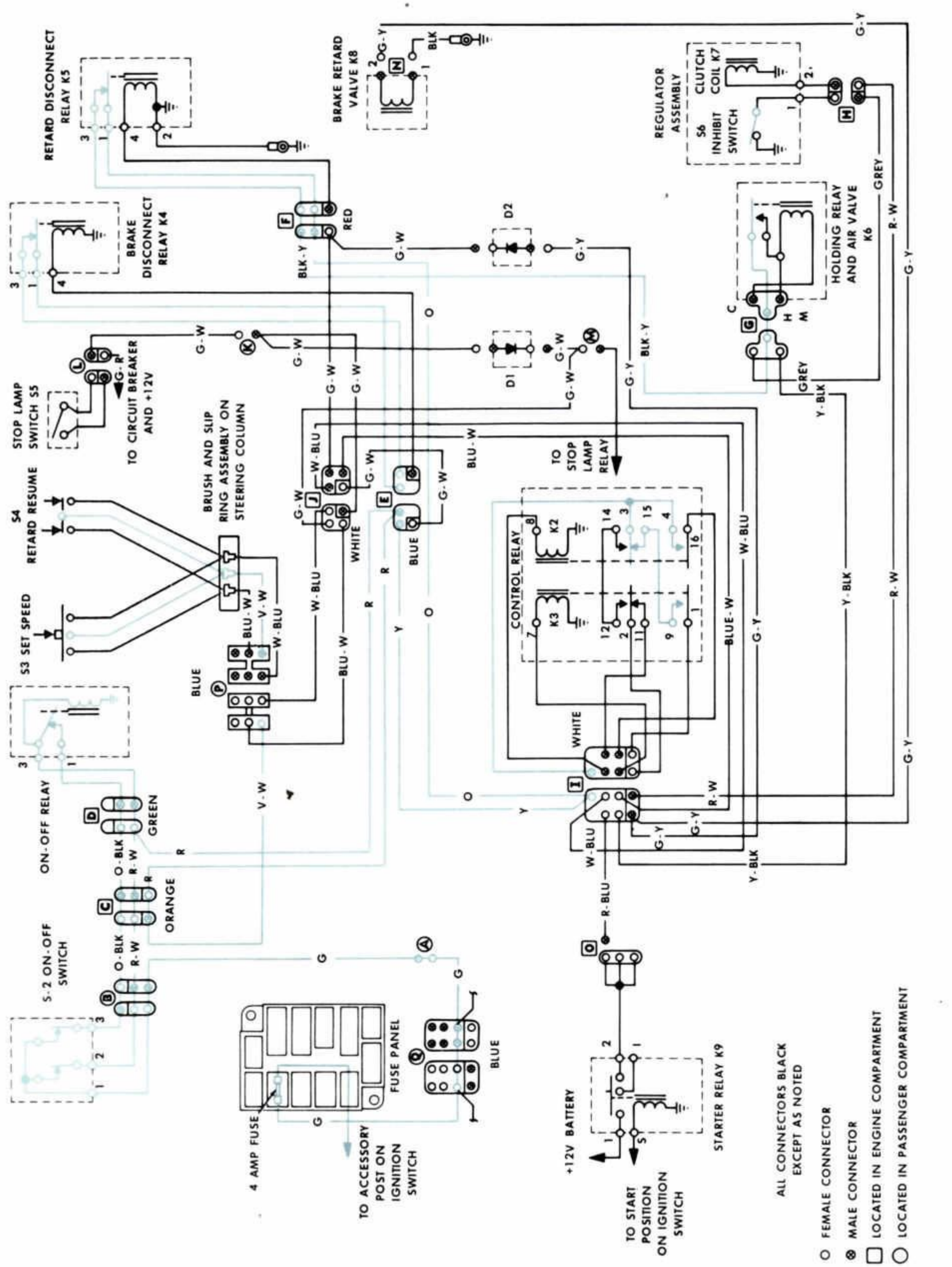


Fig. 35 — ON Circuit — Thunderbird Speed Control

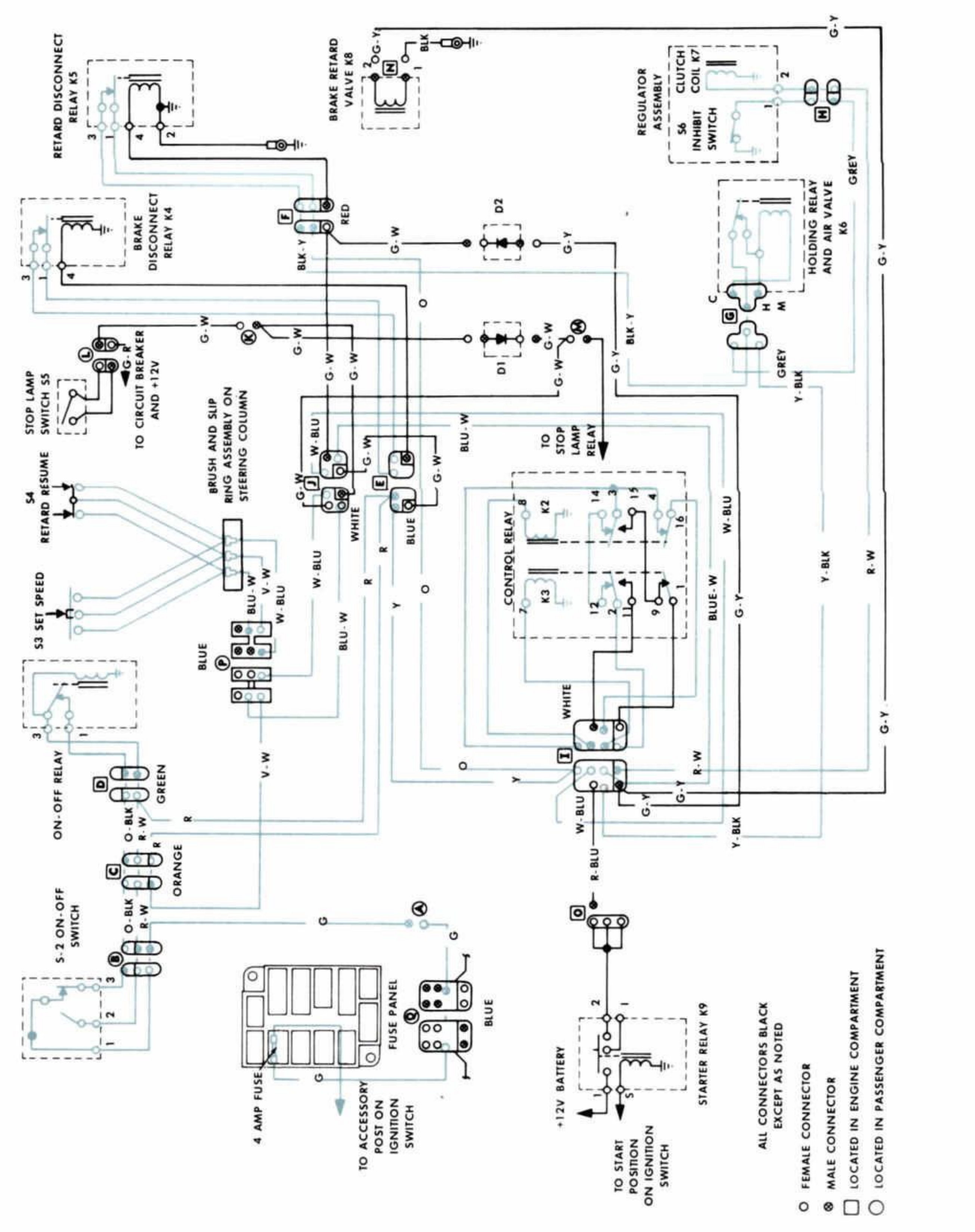


Fig. 36 — Set Speed Circuit — Thunderbird

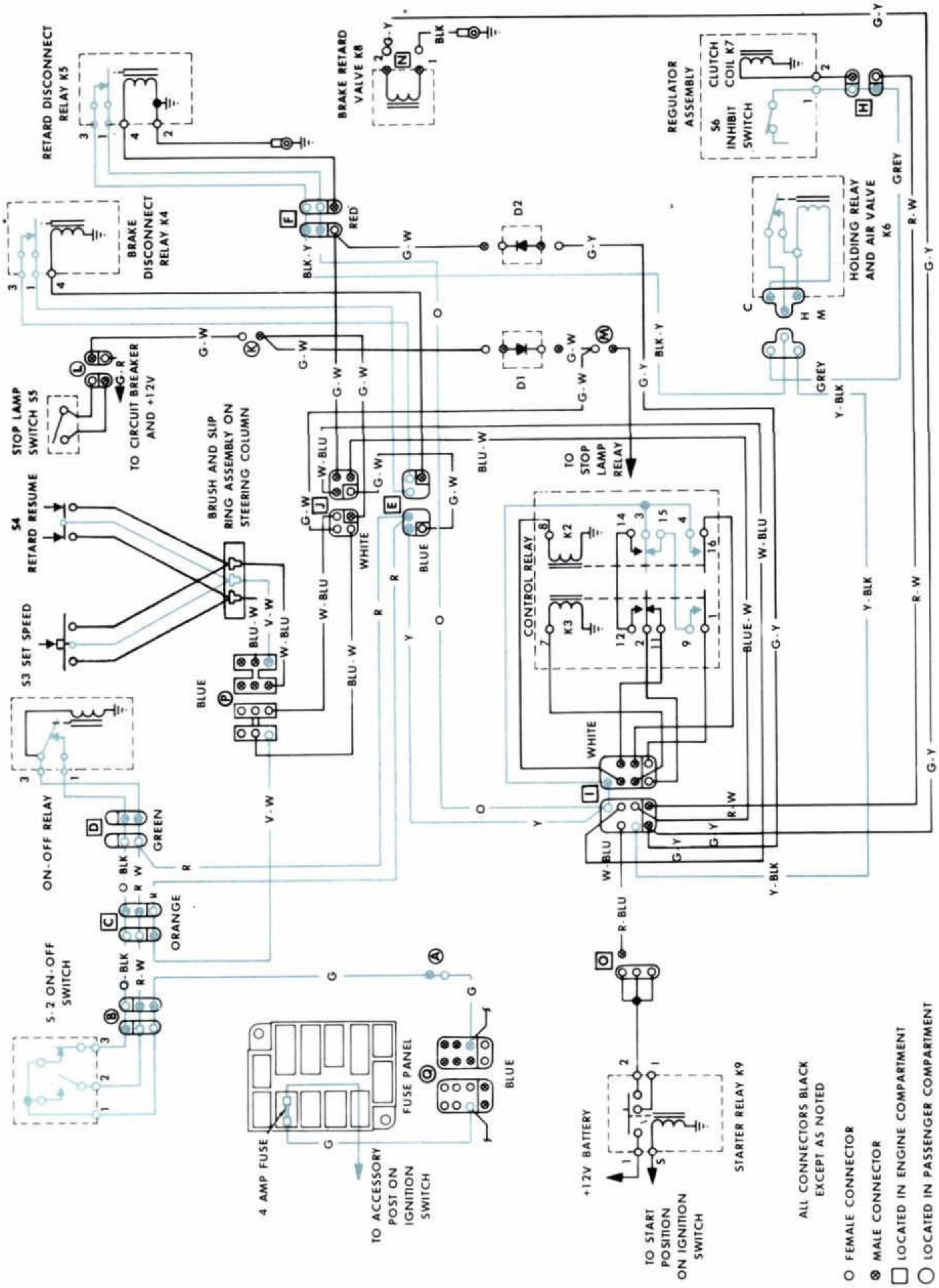


Fig. 37 — Cruise Circuit — Thunderbird

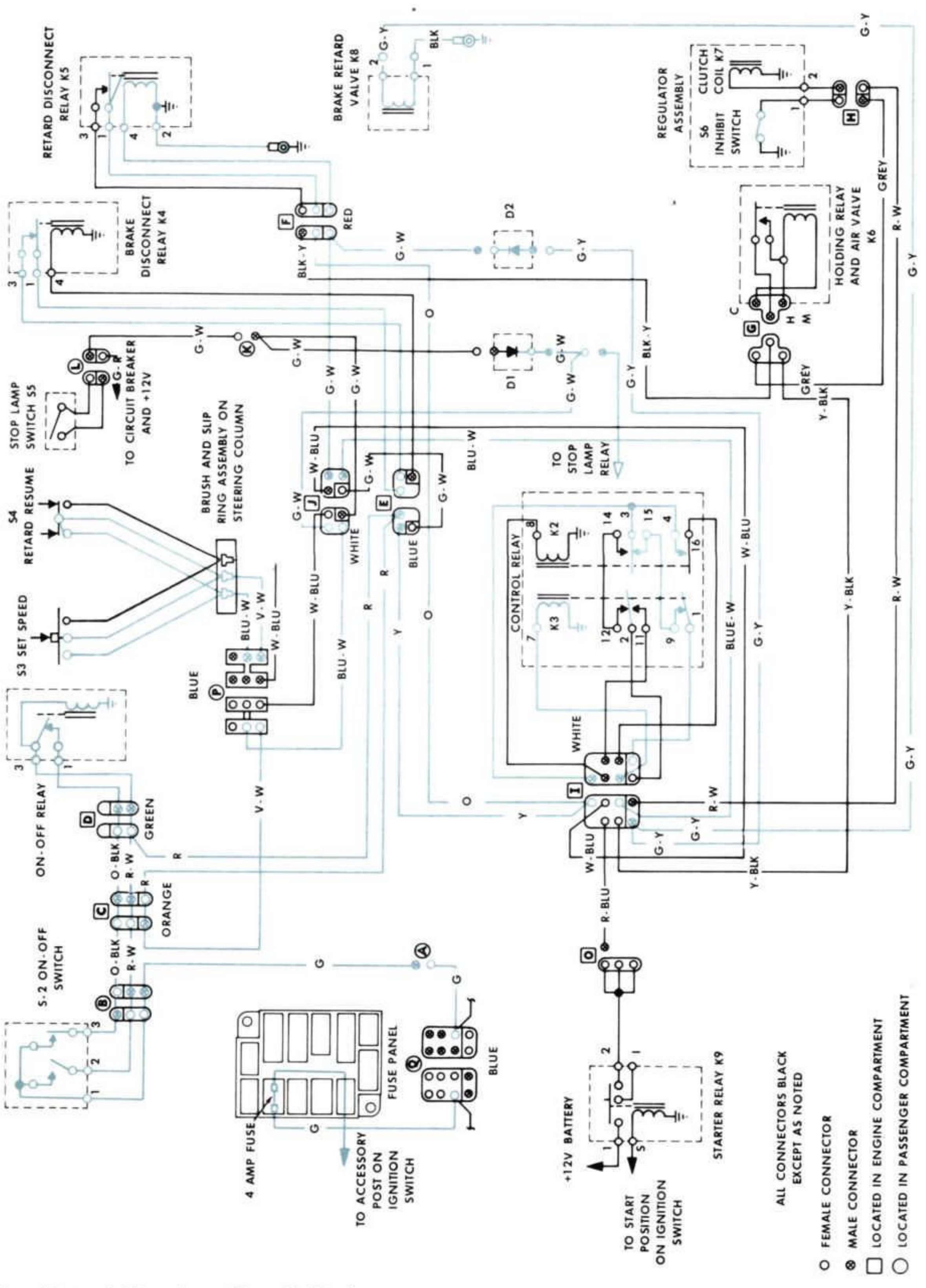


Fig. 38 — Retard Circuit — Thunderbird

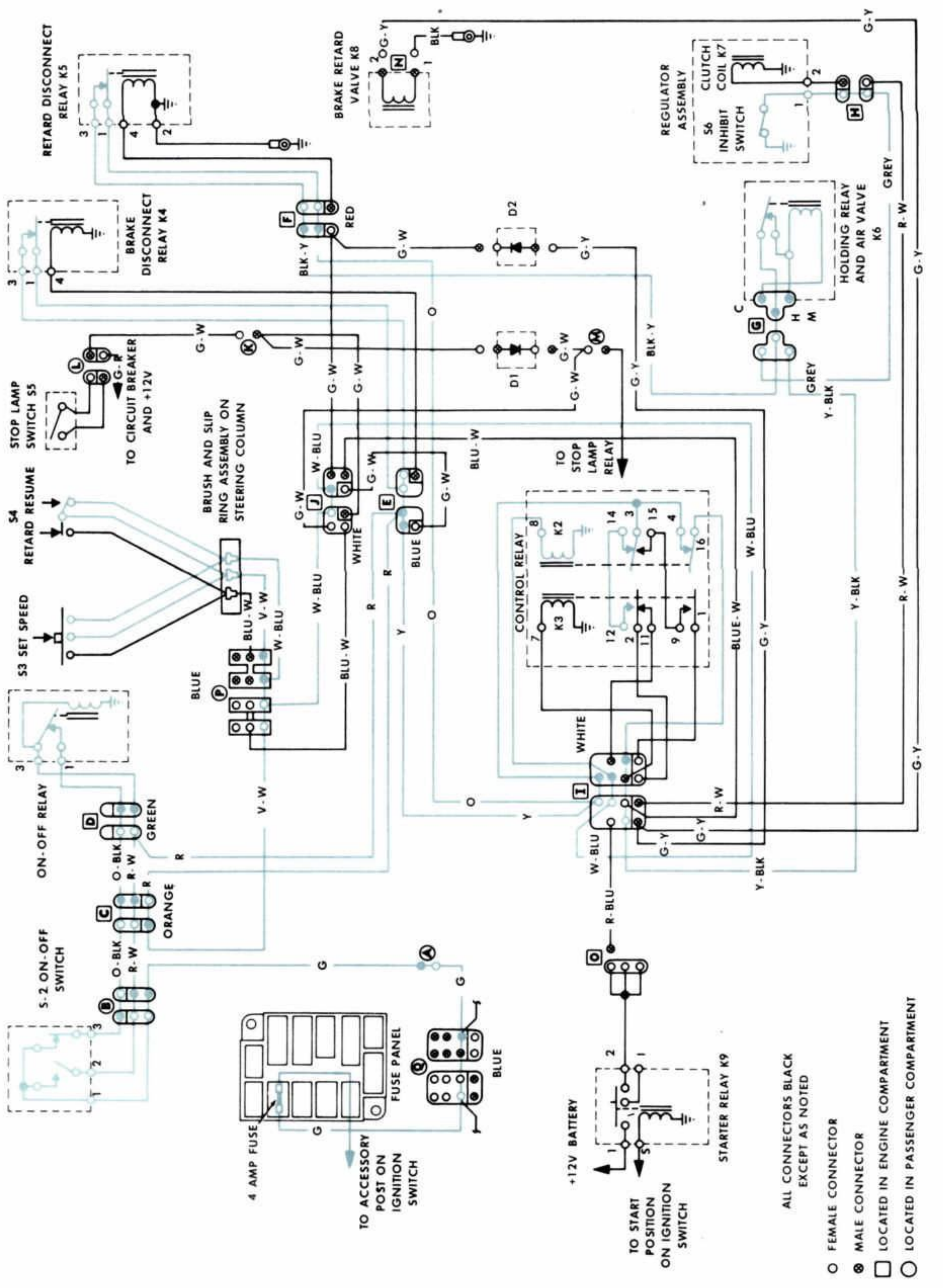


Fig. 39 — Resume Circuit — Thunderbird

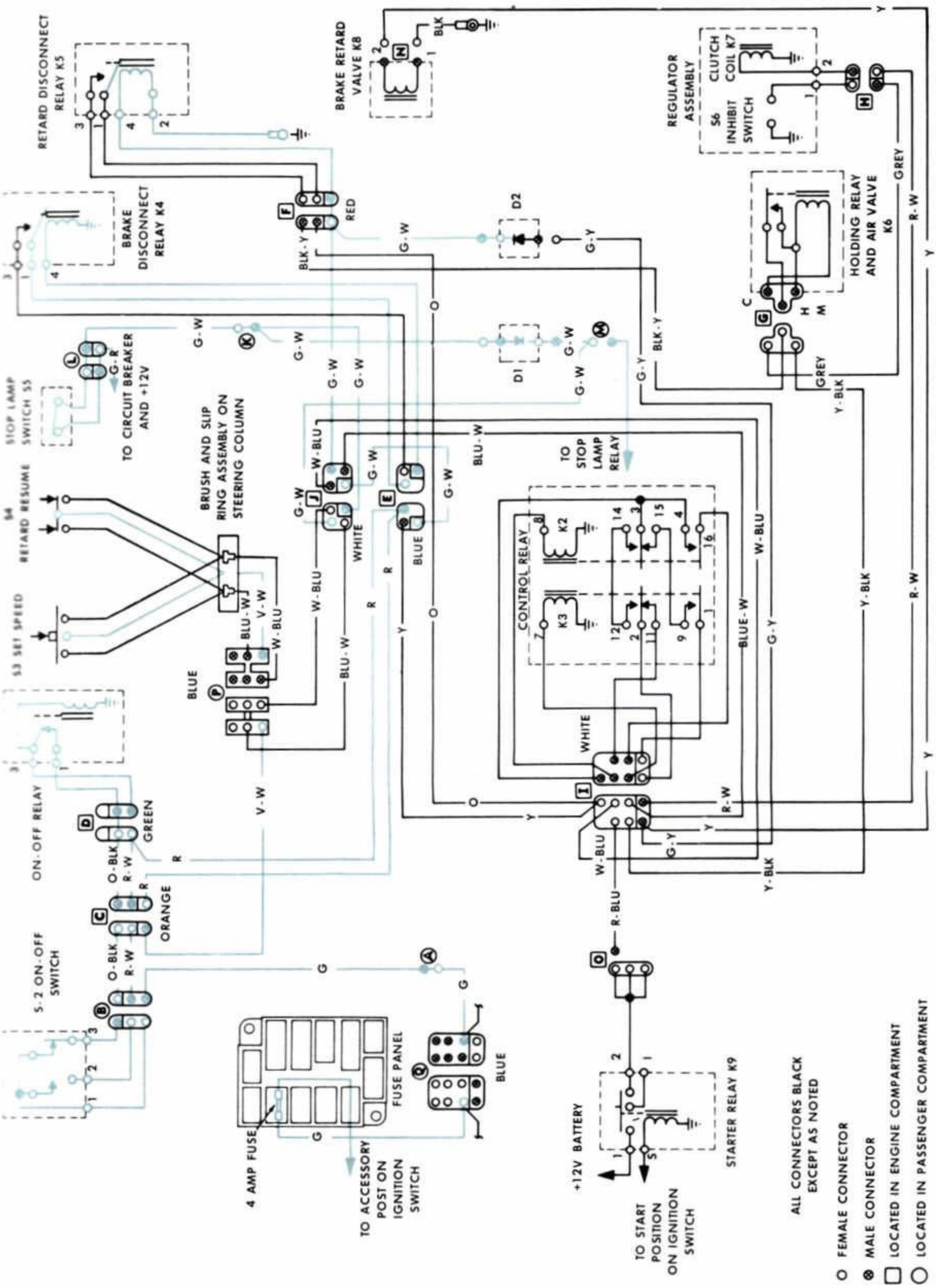


Fig. 40 — Brake Circuit — Thunderbird

Power is now available through the normally closed contacts of the brake and retard disconnect relays, K4 and K5, to terminals 3 and 4 on control relay K2, to the set speed and retard-resume switches on the steering wheel, and to the holding relay terminal H located on the regulator assembly.

SET SPEED CIRCUIT

When the desired speed has been reached, the set speed switch is pushed and power is then supplied to both coils of the control relay, terminals 7 and 8 (Fig. 36). This changes the position of all four sets of points. Power now flows through terminals 3, 14, 12 and 2 to the clutch coil which sets the speed into the regulator assembly. Power also flows through terminal 4 and 16 to terminal M on the holding relay and air valve. The circuit is completed through the inhibit switch which provides the ground at speeds over 25 mph. This opens the vacuum line to the regulator valve and also closes the relay contacts, which stay together even after the set speed switch is released. The relay now gets hold-in power through the retard disconnect relay contacts and its own closed contacts.

CRUISE CIRCUIT

With the set speed button released the control relay switches return to their normal position (Fig. 37). The clutch coil in the regulator assembly is de-energized.

The holding relay remains energized so long as the inhibit switch is closed and the air valve remains open.

RETARD SWITCH OPERATION – RETARD CIRCUIT

When the retard switch, S4, is pushed, power is supplied to terminal 7 of the control relay and coil K3 operates (Fig. 38). Power is now supplied from terminal 3 through normally closed contacts to 15 and 9 then through now closed contacts to terminal 1 which supplies the retard signal power to actuate the brake retard valve, K8. This same power lights the car's stop lamps and operates the retard disconnect relay, K5. The normally closed contacts of relay K5 open, and break the hold signal power to the holding relay and air valve, K6. K6 opens and the vacuum valve closes. Vacuum to the regulator assembly is cut off.

The brake retard valve meters a small amount of air to the power brake booster which applies a light pressure on the brakes as long as the retard switch is held. When the switch is released, the brakes are released but the automatic speed control system stays off. The resume switch must be pushed to put the system back into operation.

RESUME CIRCUIT

When the resume switch, S4, is pushed, power is supplied to terminal 8 of the control relay and coil K2 operates (Fig. 39). Power is now supplied from terminal 4 through the now closed contacts to terminal 16, which supplies the signal power to the holding relay and air valve, K6. The valve opens and the points close. Closed relay contacts supply power to hold the relay points closed and the valve open after the resume switch is released. The system now is on automatic control again and the car speed is automatically adjusted to the speed previously set into the regulator assembly.

FOOT BRAKE APPLICATION – BRAKE RETARD CIRCUIT

When the foot brake is pushed, the stop lamp switch, S5, closes and supplies power to both the brake and retard disconnect relays, K4 and K5 (Fig. 40). The stop lamp also is lit. The two relays remove the hold signal and the ready signal and the car speed is under driver control.

TESTS AND ADJUSTMENTS

ACCELERATOR LINKAGE ADJUSTMENT

Check the accelerator linkage adjustment for free operation and proper adjustment as shown in Figure 41.

SIMULATED ROAD TEST

The road test may be simulated by raising the vehicle on a hoist enough to have the rear wheels clear the floor. Remove the vacuum hose from the servo, install a vacuum gauge so that it can be read from the driver's seat.

Start engine, place transmission into Drive and raise speed over 25 mph. System is now ready to test.

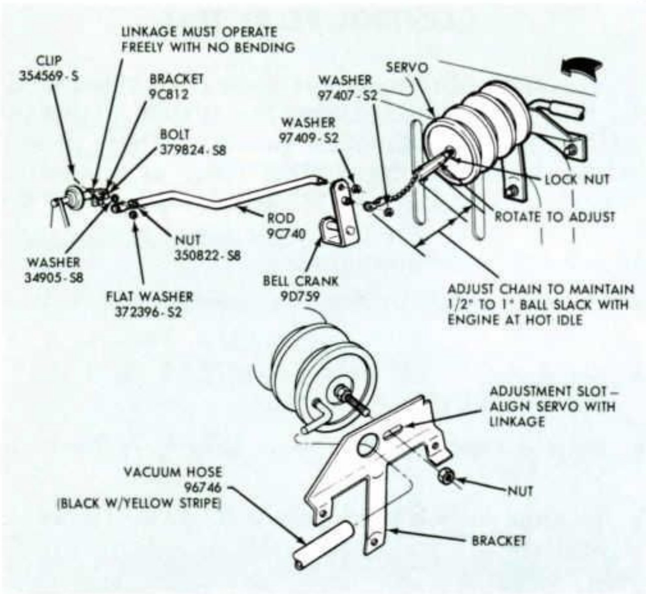


Fig. 41 — Servo Assembly and Accelerator Linkage

NOTE: Vacuum reading on gauge indicates system is engaged. No reading indicates system is not engaged.

VACUUM TEST

Remove vacuum source hose at the holding relay and air valve. Install vacuum gauge, the hose and start engine. Reading should be the same as engine vacuum.

ON-OFF SWITCH TEST

Disconnect switch from circuit. Connect a self-powered test light across the connector outside terminals (Fig. 42). The light should glow. Now push the switch to the OFF position, the light should go out. Move one end of the test light to the center terminal. The light should not glow. Now push the switch to the ON position and the light should glow.

SET SPEED SWITCH TEST

Remove switch from the steering wheel and disconnect from circuit. Connect a self-powered test light across one of the center terminals and one of the outside terminals (Fig. 43), the light should not glow. Hold the button down and the light should glow. Repeat test between center terminal and other outside terminal.

RESUME — RETARD SWITCH TEST

Remove switch from the steering wheel and disconnect from circuit. Connect a self-powered test light between the left and center terminal (Fig. 44), the light should not glow. Hold down resume portion of switch, light should glow. Move test light from left to right connector. Light should not glow. Hold retard portion of switch down, light should glow.

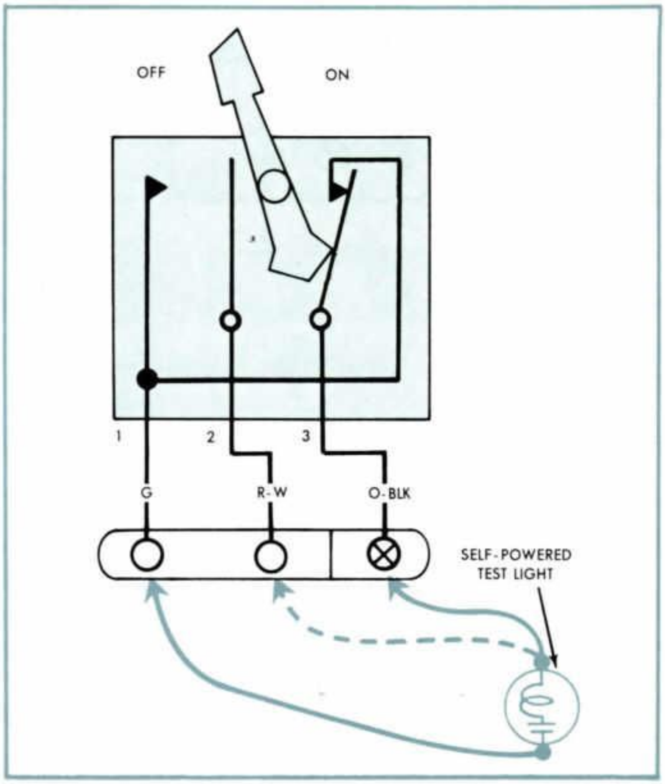


Fig. 42 — ON-OFF Switch Test

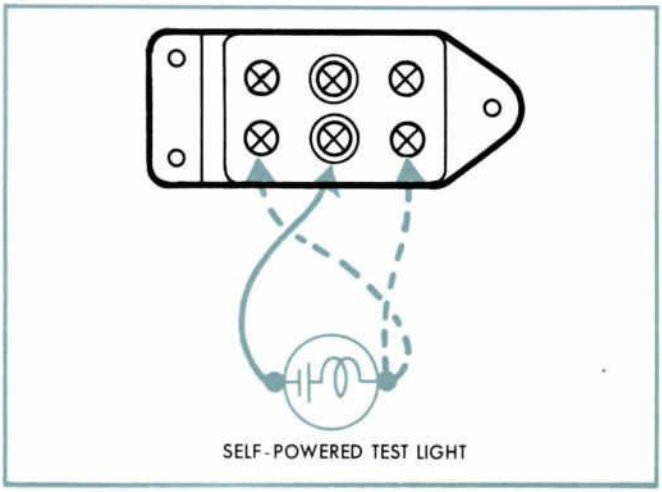


Fig. 43 — Set Speed Switch Test

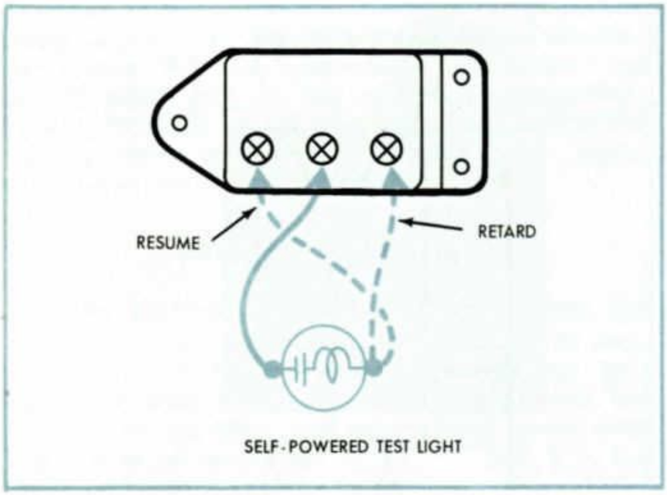


Fig. 44 — Resume — Retard Switch Test

SLIP RINGS AND BRUSHES TEST

Remove the switches from the steering wheel and disconnect from circuit. Disconnect connector P (Figs. 39 and 40) at lower end of steering column. Using a self-powered test light check for continuity from the connectors in the steering wheel through the slip rings and brushes to connector P at the lower end of the steering column (Fig. 45). The light should glow in each test. If the light does not glow, remove the steering wheel and repair or replace slip rings or brushes.

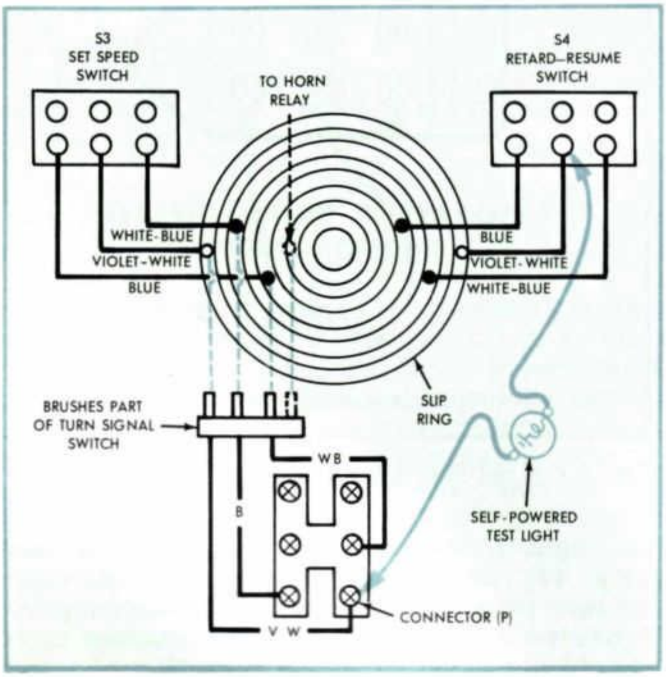


Fig. 45 — Slip Rings and Brushes Test

CONTROL RELAY TEST

The control relay test is to be performed while the relay is connected into the system. Turn the ignition switch to the ACC position. There should not be power to the control relay at this point. Check all terminals (Fig. 46) for power in the following tests. The terminals listed are the only ones that should have power.

- On-Off switch in the ON position: 3, 4, 9 and 15.
- Set speed switch held down: 2, 3, 4, 7, 8, 12, 14 and 16.
- Retard switch held down: 1, 3, 4, 7, 9 and 15.
- Resume switch held down: 3, 4, 8, 12, 14 and 16.
- Brakes applied, switch on: No power to control relay.
- Engine cranking: 2 and 11.

ON-OFF RELAY TEST

Disconnect the relay from the circuit. Perform a continuity test by connecting a self-powered test light across the two connectors (Fig. 47). This being a normally open relay, the light should not glow.

To perform an operation test, connect a test light to the terminal in the middle of the connector (Fig. 47). Apply a 12-volt supply lead to the other connector. (Be sure relay is properly grounded.) This should energize the relay coil, close the normally open points and the test light should glow.

BRAKE AND RETARD DISCONNECT RELAY TEST

Disconnect the relay from the circuit. Connect a self-powered test light across the two female connectors (Figs. 48 and 49). Since this is a normally closed relay, the light should glow. Apply a 12-volt lead to the relay male terminal. (Be sure relay is properly grounded.) This should energize the relay coil, open the contact points and the light should go out.

HOLDING RELAY TEST

Disconnect the wire connector from the holding relay. Connect a 12-volt battery across the

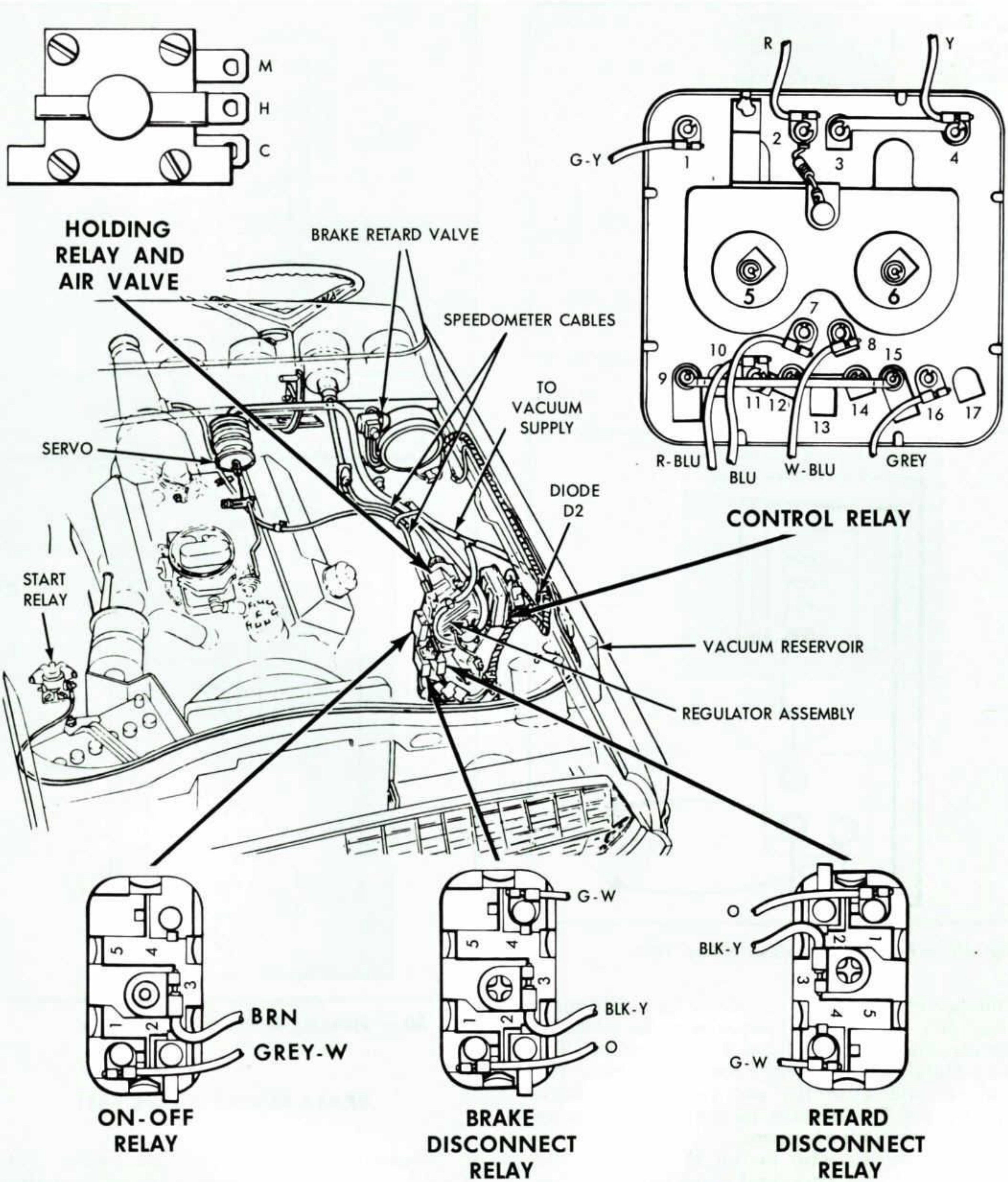


Fig. 46 — Component Location Diagram — Engine Compartment

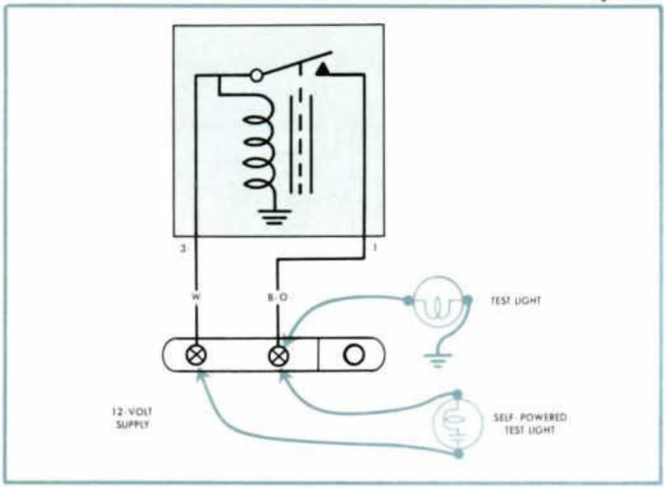


Fig. 47 — ON-OFF Relay Test

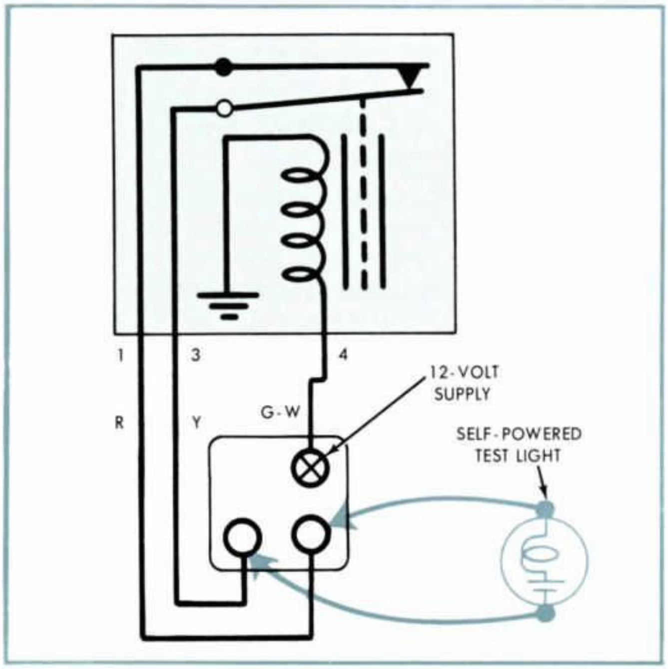


Fig. 48 — Brake Disconnect Relay Test

holding relay H (+) and C (-) terminals (Fig. 50). Connect a jumper wire temporarily between the H terminal and the M terminal. The relay should click. Remove the jumper wire. The relay should hold the air valve open. Blow through the T-connector on the end of the relay to see that the valve is open.

Disconnect the wire to the H terminal. The relay should now click and close the air valve. You should not be able to blow through the T-connector on the end of the relay.

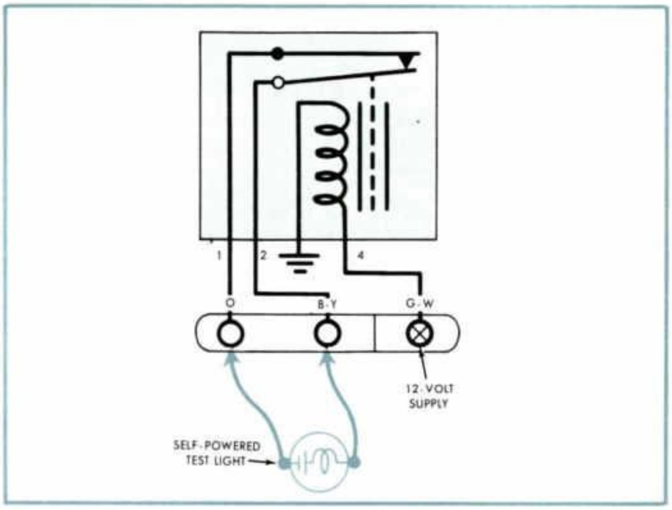


Fig. 49 — Retard Disconnect Relay Test

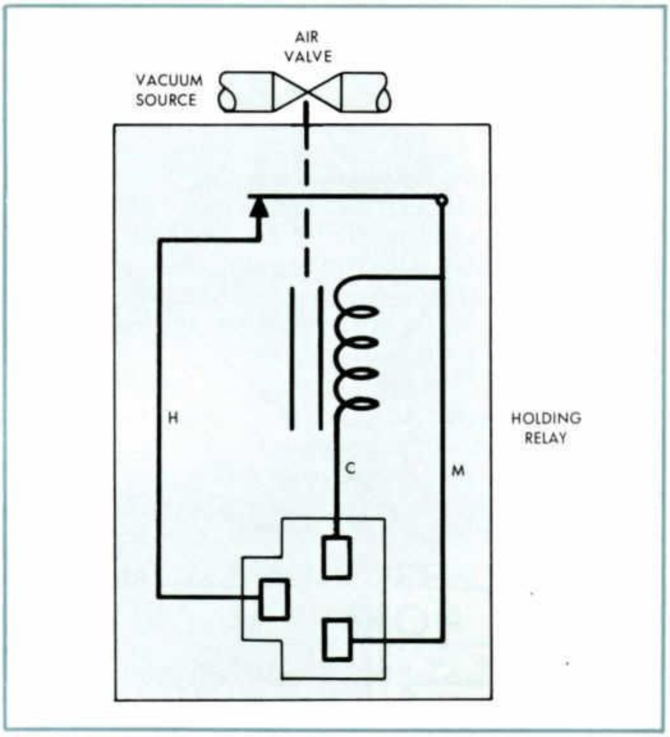
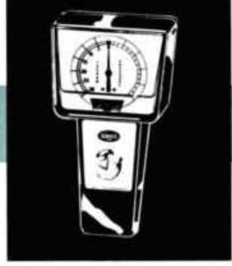


Fig. 50 — Holding Relay and Air Valve

BRAKE RETARD VALVE TEST

Disconnect wiring connects from valve. Ground one of the terminals. Start the engine to provide vacuum to the brake booster. Observe brake pedal when 12-volt supply is connected



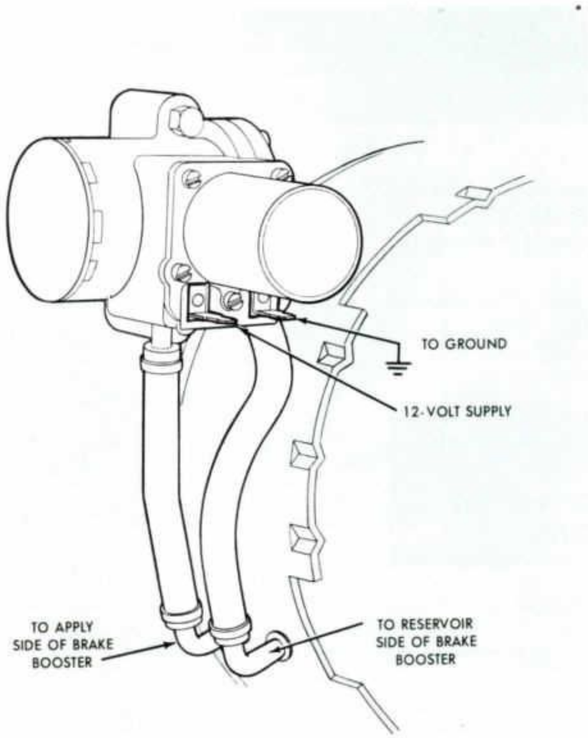


Fig. 51 — Brake Retard Valve Test

to other terminals on brake retard valve. Pedal should go down as the booster applies the brake lightly. If the pedal does not go down the valve is not working.

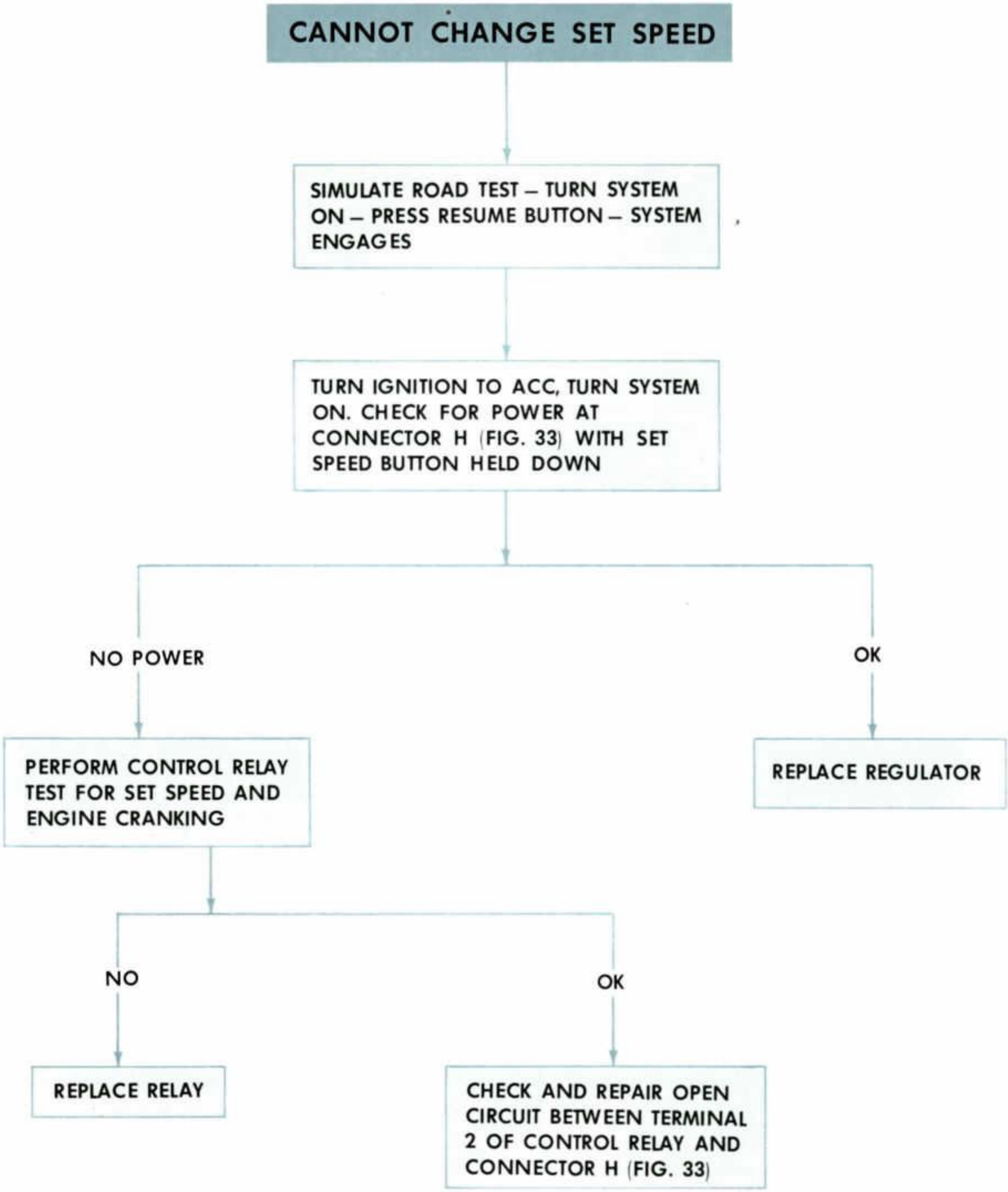
SERVO TEST

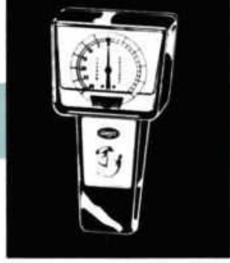
Disconnect servo from linkage and servo vacuum hose at regulator. Collapse servo and seal end of hose. If servo remains collapsed, servo and hose do not have a leak. If servo expands, there is a leak in the servo or hose.

REFERENCES

1967 Vacuum Diagram Book pages 4-1, 4-3, 4-10, 4-12 and 4-14.
1967 Wiring Diagram Book page 5-43.

TROUBLE DIAGNOSIS GUIDE





TROUBLE DIAGNOSIS GUIDE — Continued

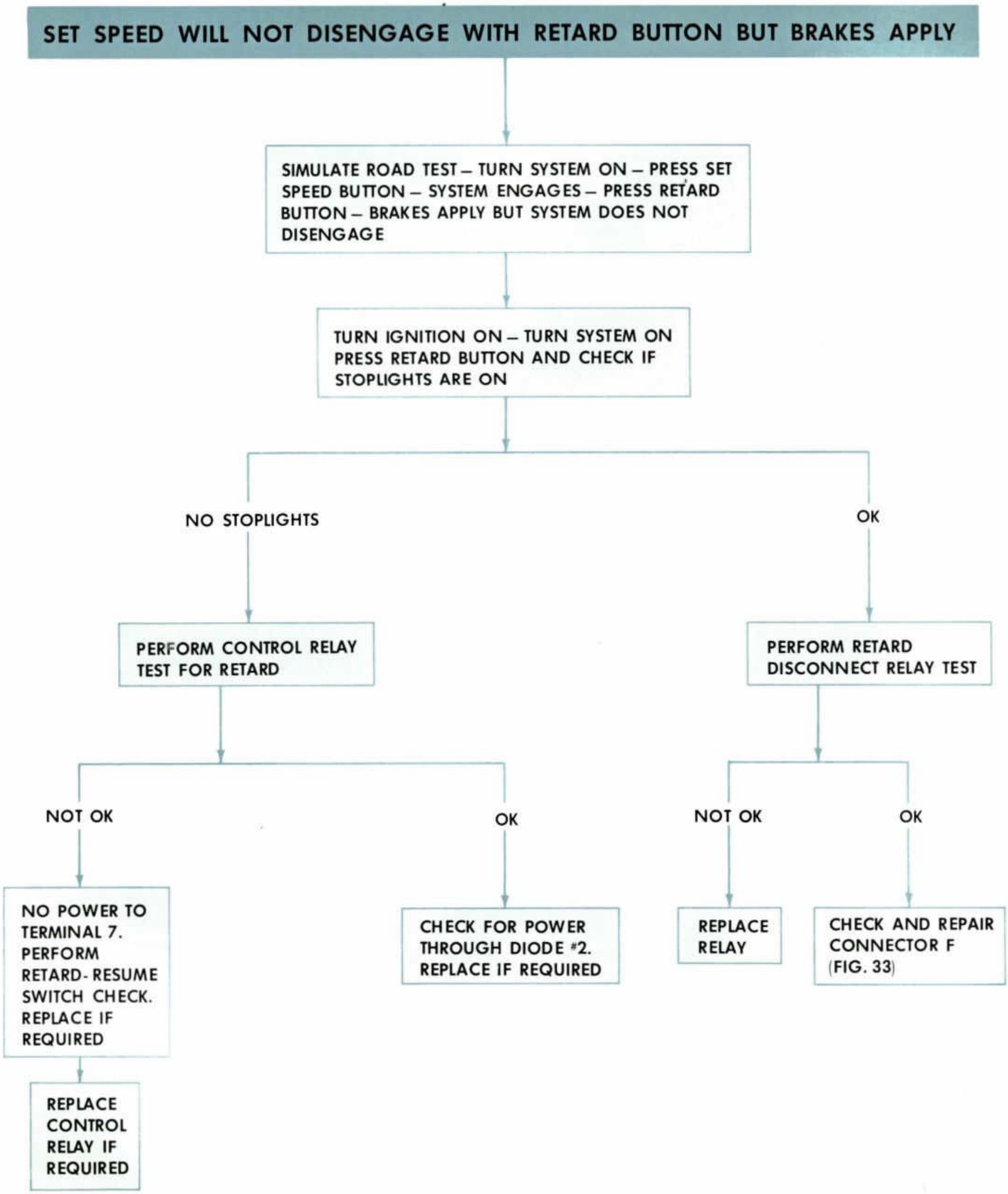
ENGINE SPEED DOES NOT INCREASE WHEN SET SPEED BUTTON IS HELD DOWN

ROAD TEST — TURN SYSTEM ON. SET SPEED AT 30 MPH THEN HOLD SET SPEED BUTTON DOWN. SPEED DOES NOT INCREASE

PERFORM VACUUM TEST

- NO
  - CHECK VACUUM HOSES FOR LEAKS, KINKS OR SHARP BENDS
  - REPLACE, REROUTE OR REPAIR VACUUM HOSES
- OK
  - PERFORM SERVO TEST
    - NO
      - REPLACE SERVO OR HOSE
    - OK
      - CHECK LINKAGE FOR SMOOTH OPERATION AND PROPER ADJUSTMENT
      - REGULATOR MAY HAVE TO BE REPLACED IF SPEED WILL NOT INCREASE SLOWLY IN THE DESIGNED SPEED RANGE

TROUBLE DIAGNOSIS GUIDE — Continued



TROUBLE DIAGNOSIS GUIDE — Continued

SET SPEED WILL NOT DISENGAGE WITH RETARD BUTTON BUT IT WILL RESUME

SIMULATE ROAD TEST — TURN SYSTEM ON — PRESS SET SPEED BUTTON — SYSTEM ENGAGES — PRESS RETARD BUTTON — SYSTEM DOES NOT DISENGAGE — BRAKES DO NOT APPLY — STOPLIGHTS DO NOT LIGHT. SYSTEM DISENGAGES AND STOPLIGHTS WORK WITH BRAKE APPLICATION. SYSTEM WILL RESUME TO SET SPEED

TURN IGN. ON — TURN SYSTEM ON — PRESS RETARD BUTTON AND CHECK FOR POWER AT TERMINAL #7 ON CONTROL RELAY

- NO POWER → PERFORM RETARD SWITCH TEST
  - NO POWER → REPLACE RETARD SWITCH
  - OK → CHECK FOR OPEN CIRCUIT IN WIRE FROM SWITCH TO SLIP RING
- OK → PERFORM CONTROL RELAY TEST FOR RETARD
  - NO POWER → REPLACE RELAY
  - OK → CHECK FOR OPEN CIRCUIT IN CONNECTOR I OR HARNESS

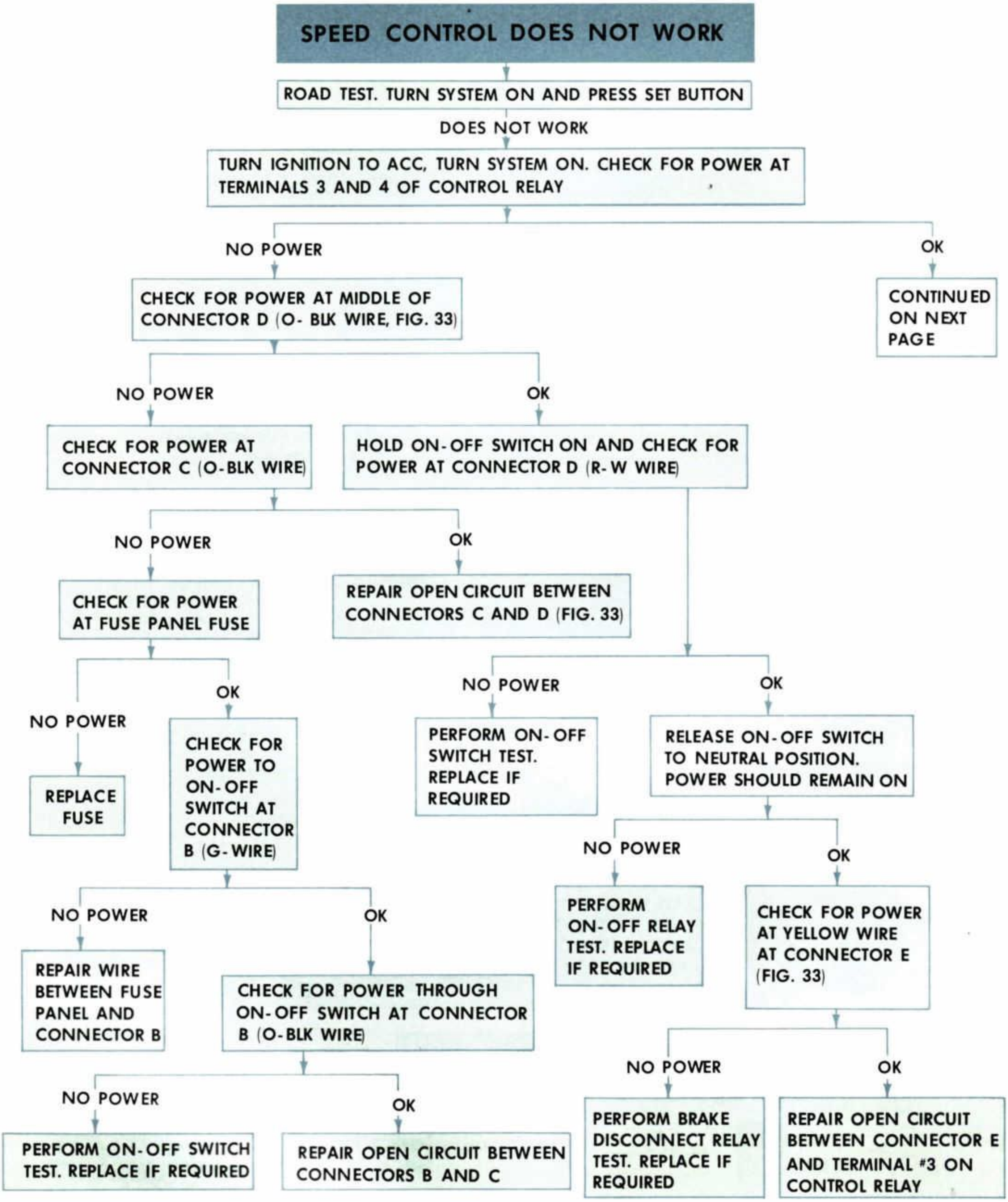
SET SPEED WILL NOT RESUME

SIMULATE ROAD TEST — TURN SYSTEM ON AND PRESS SET SPEED BUTTON — SYSTEM ENGAGES — PRESS RETARD BUTTON — SYSTEM DISENGAGES AND RETARDS — PRESS RESUME BUTTON — SYSTEM DOES NOT ENGAGE

PERFORM RESUME SWITCH TEST

- NO → REPLACE SWITCH
- OK → CHECK FOR OPEN CIRCUIT IN WIRE FROM SWITCH TO SLIP RING

TROUBLE DIAGNOSIS GUIDE — Continued



TROUBLE DIAGNOSIS GUIDE — Continued

SPEED CONTROL DOES NOT WORK — Continued

- POWER OK — CONTINUED FROM PRECEDING PAGE
  - CHECK TERMINAL H (FIG. 33) ON HOLDING RELAY AND AIR VALVE FOR POWER
    - NO POWER → CHECK FOR POWER TO RETARD DISCONNECT RELAY — CONNECTOR F (FIG. 33) CENTER WIRE — ORANGE
      - NO POWER → CHECK FOR OPEN CIRCUIT BETWEEN CONNECTORS F AND I (FIG. 33)
      - OK → CHECK FOR POWER THROUGH RETARD DISCONNECT RELAY CONNECTOR F (BLK-Y WIRE FIG. 33)
        - NO POWER → PERFORM RETARD DISCONNECT RELAY TEST. REPLACE RELAY IF REQUIRED
        - OK → REPAIR OPEN CIRCUIT BETWEEN CONNECTORS F AND G (FIG. 33)
    - OK → HOLD SET SPEED BUTTON DOWN AND CHECK FOR POWER AT TERMINAL M OF HOLDING RELAY
      - NO POWER → HOLD SET SPEED BUTTON DOWN AND CHECK FOR POWER AT TERMINALS 7 AND 8 OF THE CONTROL RELAY
        - NO POWER → HOLD RETARD BUTTON DOWN — CHECK FOR POWER AT TERMINAL #7 OF CONTROL RELAY — HOLD RESUME BUTTON DOWN — CHECK FOR POWER AT TERMINAL #8
          - NO POWER → CHECK FOR POWER AT CONNECTOR P (FIG. 33)
            - NO POWER → REPAIR OPEN CIRCUIT BETWEEN CONNECTORS P, C AND E
            - OK → PERFORM SLIP RING AND BRUSHES TEST. REPAIR AS REQUIRED
          - OK → TEST SET SPEED SWITCH — REPAIR OR REPLACE
        - OK → PERFORM CONTROL RELAY TEST — SET SPEED
          - NOT OK → REPLACE CONTROL RELAY
          - OK → REPAIR OPEN CIRCUIT BETWEEN TERMINAL #16 CONTROL RELAY AND TERMINAL M ON HOLDING RELAY AND AIR VALVE
      - OK → PERFORM VACUUM TEST
        - NOT OK → REPAIR VACUUM SUPPLY HOSES
        - OK → PERFORM HOLDING RELAY TEST
          - NOT OK → REPLACE RELAY
          - OK → CHECK INHIBIT SWITCH
            - NOT OK → REPLACE REGULATOR

TROUBLE DIAGNOSIS GUIDE — Continued

SPEED WILL NOT HOLD WHEN SET SPEED BUTTON IS RELEASED

- SIMULATE ROAD TEST AT 30 MPH. HOLD SET SPEED BUTTON DOWN. SYSTEM ENGAGES. RELEASE BUTTON. SYSTEM DISENGAGES
  - IGNITION ON AND SYSTEM TURNED ON, CHECK FOR POWER AT TERMINAL H (FIG. 33) OF HOLDING RELAY AND AIR VALVE. DO NOT DISCONNECT CONNECTOR FROM RELAY
    - NOT OK → CHECK FOR POWER AT RETARD DISCONNECT RELAY CONNECTOR F (FIG. 33) CENTER WIRE (ORANGE)
      - NO POWER → REPAIR OPEN CIRCUIT BETWEEN CONNECTOR I AND F
      - OK → CHECK FOR POWER AT RETARD DISCONNECT RELAY CONNECTOR F (FIG. 33) WIRE BLACK-Y
        - NO POWER → PERFORM RETARD DISCONNECT RELAY TEST. REPLACE IF REQUIRED
        - OK → REPAIR OPEN CIRCUIT BETWEEN CONNECTOR F AND G (FIG. 33)
    - OK → PERFORM HOLDING RELAY AND AIR VALVE TEST. REPLACE IF REQUIRED

TROUBLE DIAGNOSIS GUIDE — Continued

SYSTEM HUNTS

- CHECK ACCELERATOR LINKAGE FOR SMOOTH OPERATION AND PROPER ADJUSTMENT (FIG. 41)
  - NOT OK → FREE UP LINKAGE AND SET PER ADJUSTMENT PROCEDURE
  - OK → CHECK THE VACUUM HOSES AND SERVO FOR LEAKS, KINKS OR SHARP BENDS
    - LEAKS → REPAIR OR REPLACE HOSES OR SERVO AS REQUIRED
    - OK → CHECK SPEEDOMETER CABLES FOR SMOOTH OPERATION
      - NOT OK → LUBE CABLES AND REROUTE HOUSING TO OBTAIN SMOOTH OPERATION
      - OK → CHECK REGULATOR DRIVE FOR SMOOTH OPERATION
        - REPLACE REGULATOR IF IT BINDS

SYSTEM SLUGGISH, WILL NOT HOLD SET SPEED ON HILL

- PERFORM VACUUM TEST
  - NOT OK → CHECK THE VACUUM HOSES AND SERVO FOR LEAKS, KINKS OR SHARP BENDS
    - REPLACE, REROUTE OR REPAIR VACUUM HOSES AND/OR SERVO
  - OK → CHECK LINKAGE FOR SMOOTH OPERATION AND PROPER ADJUSTMENT. CORRECT AS REQUIRED

TROUBLE DIAGNOSIS GUIDE – Continued

SYSTEM WILL NOT DISENGAGE WITH BRAKE PEDAL, BUT RETARD BUTTON WORKS

SIMULATE ROAD TEST – TURN SYSTEM ON – PRESS SET SPEED BUTTON – SYSTEM ENGAGES – APPLY BRAKES – SYSTEM DOES NOT DISENGAGE – PRESS RETARD BUTTON – SYSTEM DISENGAGES

↓

WITH BRAKES APPLIED – CHECK STOPLIGHTS

- **NO STOPLIGHTS** → CHECK FOR POWER TO STOPLIGHT SWITCH
  - **NO POWER** → CHECK CIRCUIT BREAKER AND WIRES. REPAIR OR REPLACE
  - **OK** → REPAIR OR REPLACE STOPLIGHT SWITCH
- **OK** → CHECK POWER TO BRAKE DISCONNECT RELAY – CONNECTOR E (FIG. 33) GREEN-WHITE WIRE
  - **NO POWER** → CHECK AND REPAIR OPEN CIRCUIT TO OR IN CONNECTOR J (FIG. 33) OR IN WIRE TO CONNECTOR K
  - **OK** → PERFORM BRAKE DISCONNECT RELAY TEST. REPAIR OR REPLACE AS REQUIRED

RETARD BUTTON WILL NOT DISENGAGE SYSTEM NOR WILL RESUME BUTTON WORK AFTER BRAKE APPLICATION

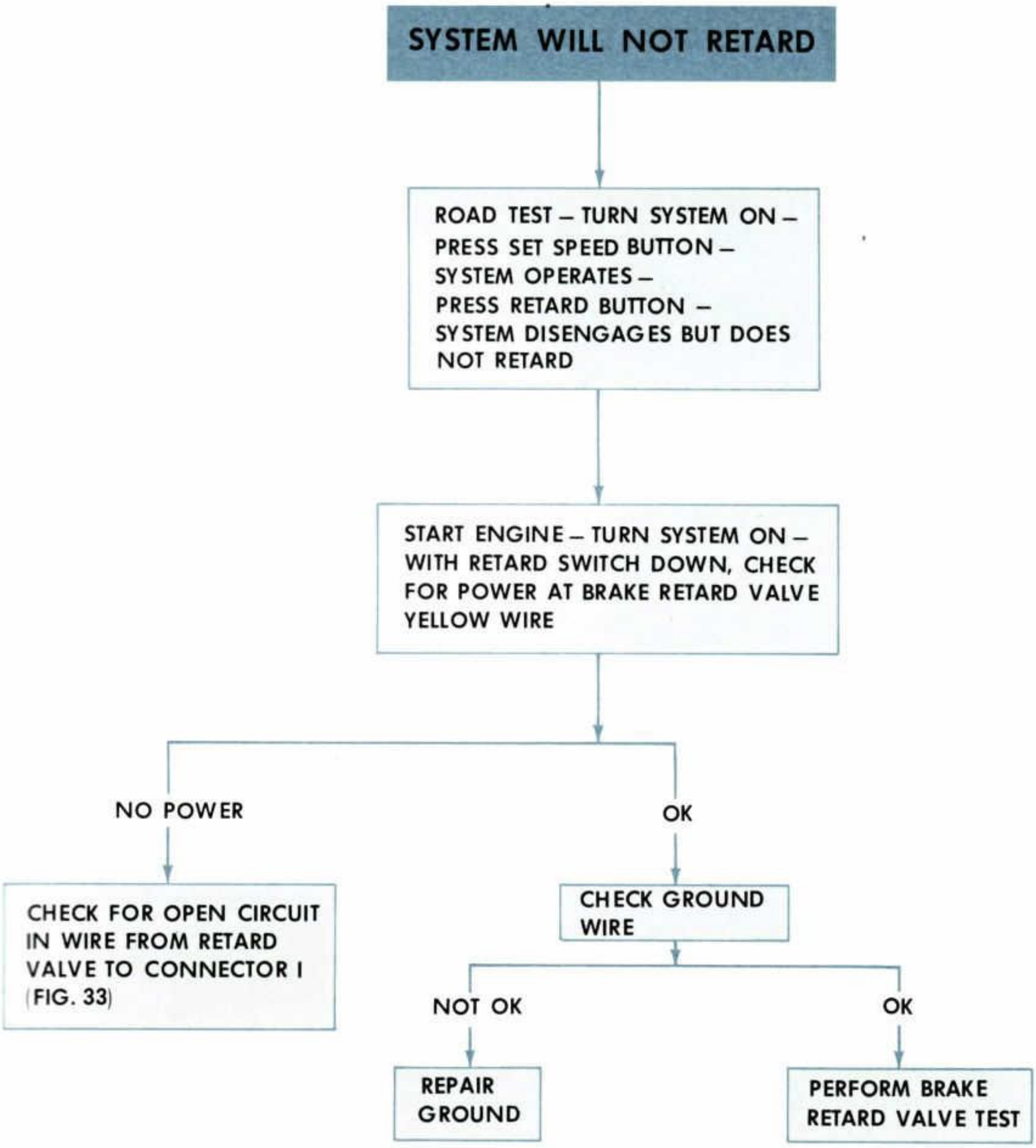
SIMULATE ROAD TEST – TURN SYSTEM ON – PRESS SET SPEED BUTTON – SYSTEM ENGAGES – PRESS RETARD BUTTON – SYSTEM DOES NOT DISENGAGE – BRAKES DO NOT APPLY – STOPLIGHTS DO NOT LIGHT. SYSTEM DISENGAGES AND STOPLIGHTS WORK WITH BRAKE APPLICATION. PRESS RESUME BUTTON SYSTEM WILL NOT RESUME

↓

TURN IGN. TO ACC. TURN SYSTEM ON. CHECK FOR POWER FROM SLIP RING TO RETARD-RESUME SWITCH

- **NO POWER** → REPAIR OPEN CIRCUIT BETWEEN SLIP RING AND SWITCH
- **OK** → PERFORM RESUME-RETARD SWITCH TEST – REPLACE SWITCH IF REQUIRED

TROUBLE DIAGNOSIS GUIDE — Continued



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