Bendix® MC-11™ Tractor AntiLock

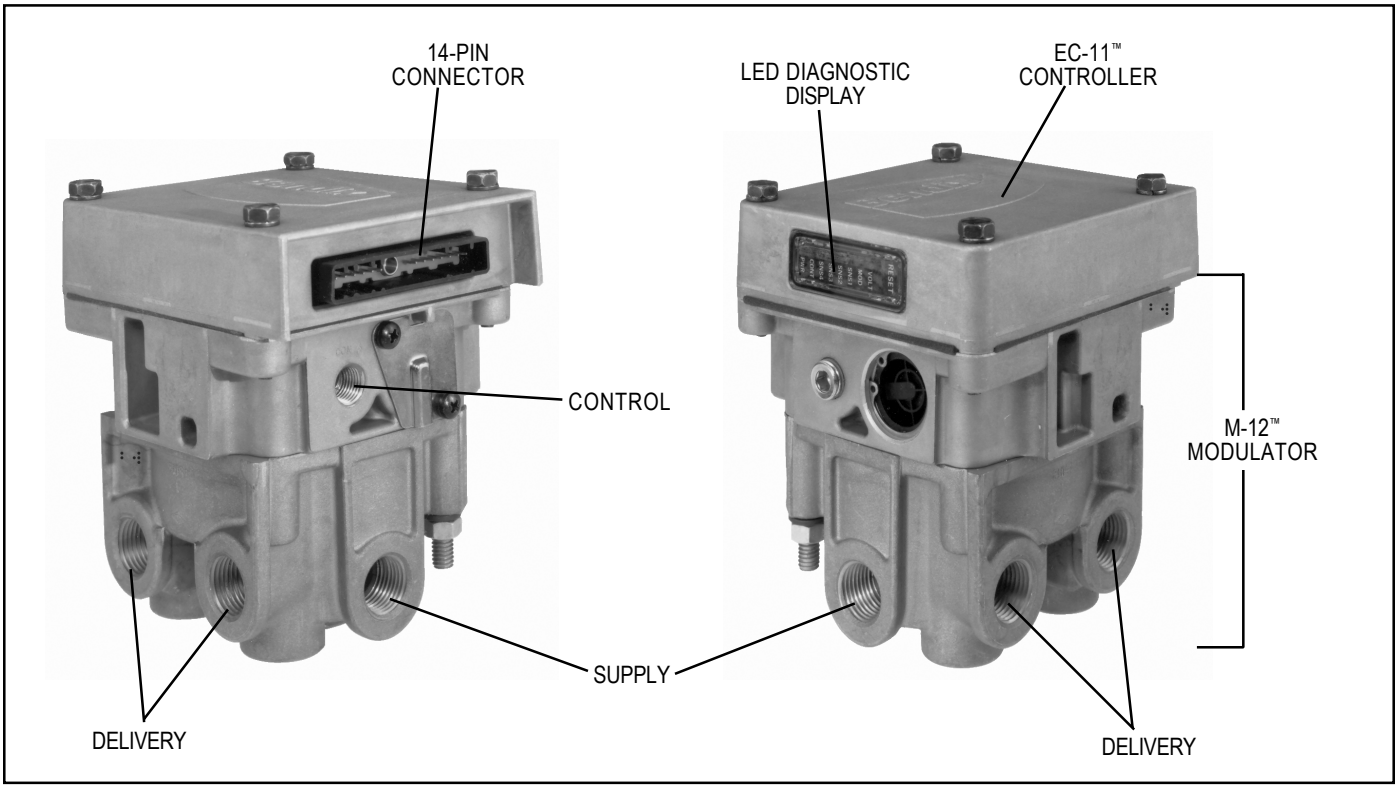


FIGURE 1

DESCRIPTION

The Bendix® MC-11™ tractor antilock assembly is designed to improve vehicle stability by reducing wheel lock-up during aggressive braking. Like the MC-10™ antilock assembly that it replaces, the MC-11™ tractor antilock assembly is a one-channel system–it uses one modulator. And the system can control single or tandem axles. The antilock assembly mounts to the vehicle frame and usually replaces the drive axle service relay valve.

The MC-11™ tractor antilock assembly consists of an EC-11™ electronic controller and an M-12™ modulator. The EC-11™ controller houses the electronics that regulate the antilock system. The electronics are protected by a self-healing silicone compound. The EC-11™ controller contains a diagnostic window and reset switch, and its 14 pin connector is the electrical link to the rest of the antilock system. (See Figure 2.) The controller mounts to the modulator with four cap screws, and it is electrically connected to the modulator with a four-pin connector. The M-12™ modulator has two components: solenoids, which rapidly apply and exhaust air during an antilock stop, and a standard relay valve. (See SD-13-4772 for more information on the M-12™ modulator.)

The air connections for the MC-11™ tractor antilock assembly are as follows:

AIR CONNECTION	EMBOSSED IDENTIFICATION
Supply (to reservoir)	SUP
Delivery (to brake actuator)	DEL
Control (to rear service brake valve delivery)	CON

14 PIN CONNECTOR CALLOUTS

PIN	CONNECTION
A	"+" POWER
B	RETARDER DISABLE
C	"-" GROUND
D	DASH LIGHT
E	SERIAL LINK
F	SERIAL LINK
G	UNUSED
H	UNUSED
J	UNUSED
K	UNUSED
L	SENSOR
M	SENSOR
N	SENSOR
P	SENSOR

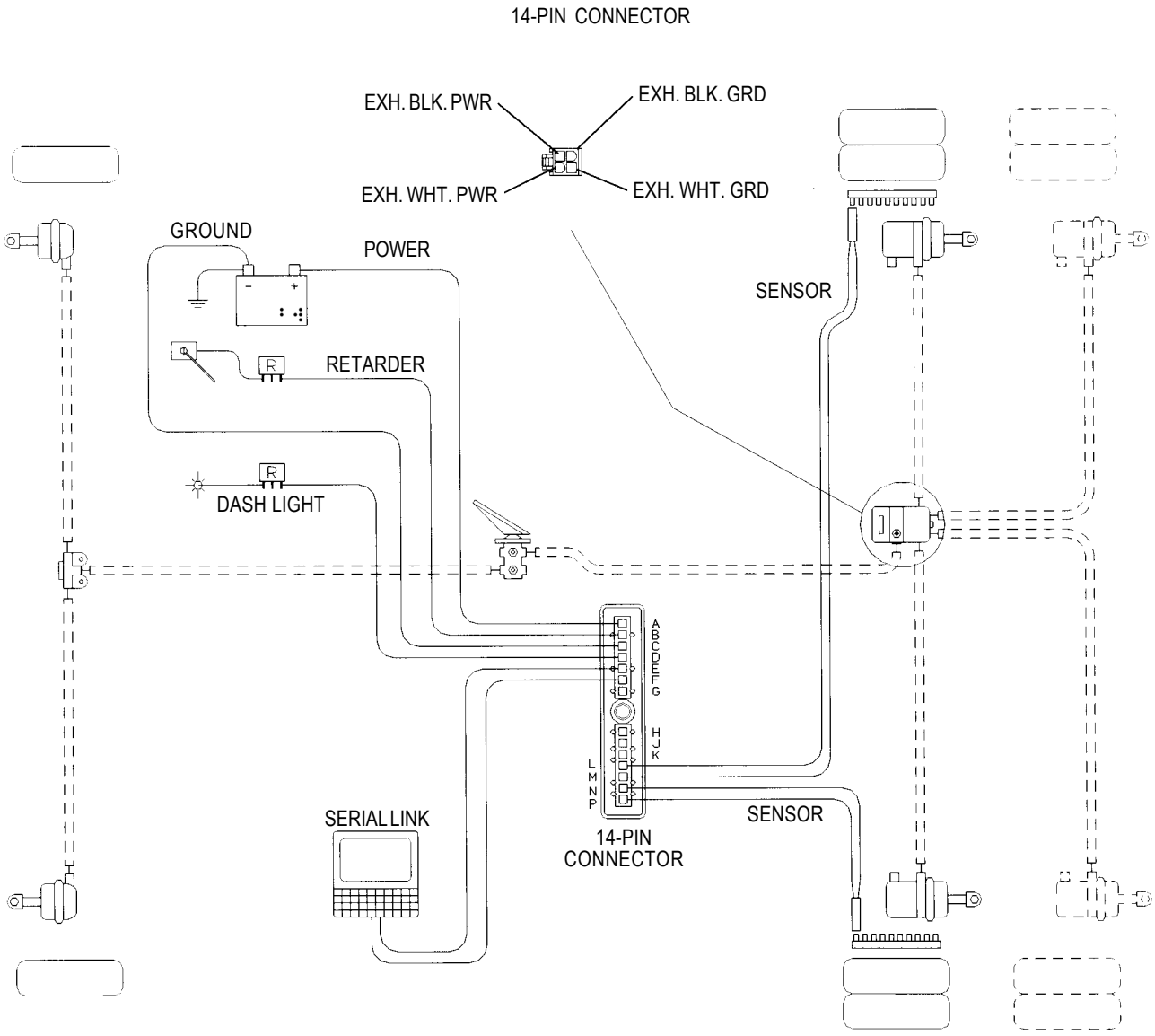


FIGURE 2 - TYPICAL MC-11™ TRACTOR ANTILOCK WIRING SCHEMATIC

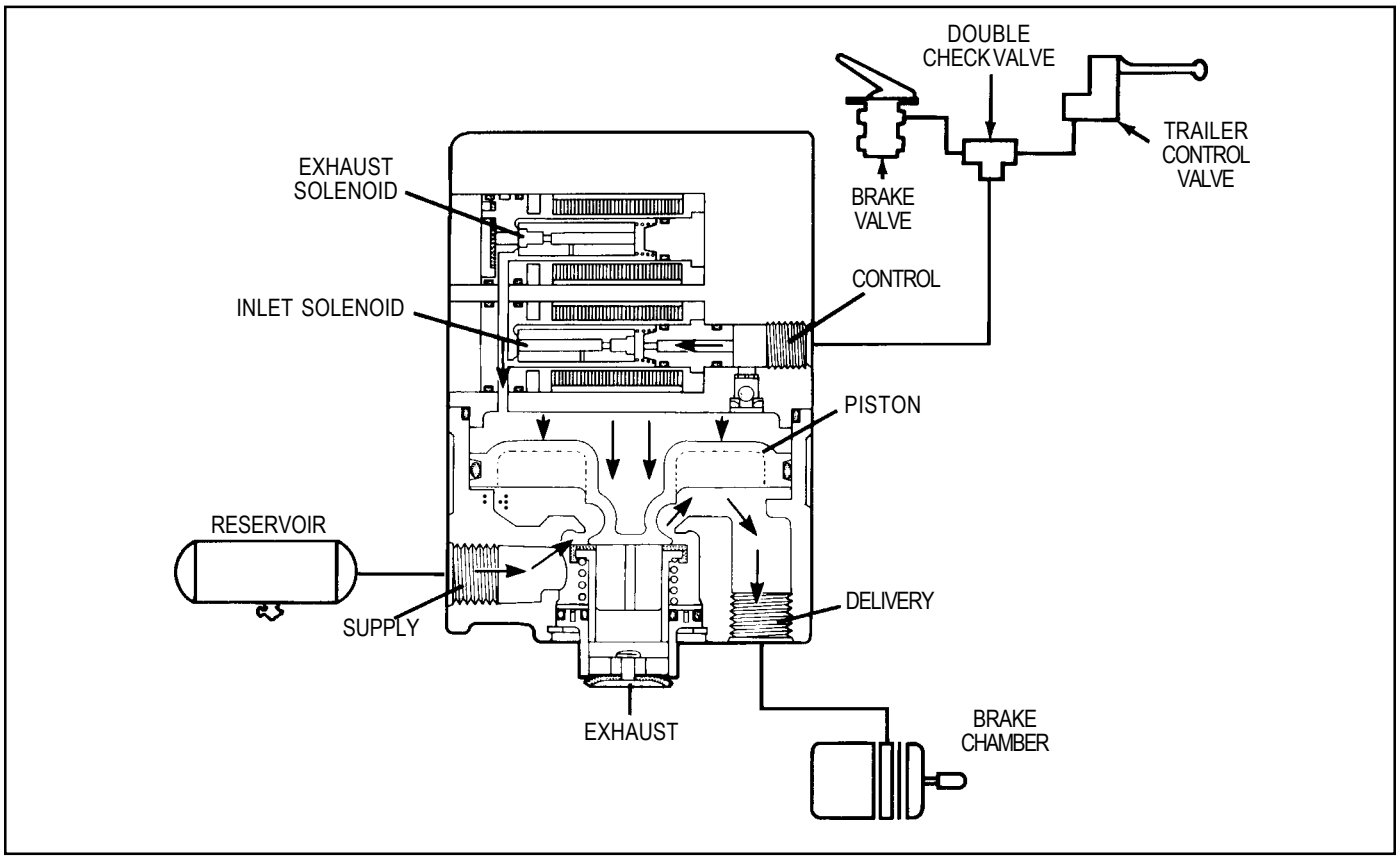


FIGURE 3 - APPLYING: NORMAL SERVICE APPLICATION

The wiring connections on the 14 pin connector are as follows:

PIN A - Power	PIN IF - Serial Link
PIN B - Retarder Disable	PIN L - Sensor
PIN C - Ground	PIN M - Sensor
PIN D - Dash Light	PIN N - Sensor
PIN E - Serial Link	PIN P - Sensor

PIN A - Vehicle power is supplied to the EC-11™ controller from the ignition switch, through a fuse, to pin A on the 14 pin connector.

PIN B - The EC-11™ controller is equipped with a retarder disable circuit, which, when coupled with an electrical relay, will disable the vehicle retarder (engine or transmission) during an antilock stop. The retarder disable function is not essential but is highly recommended for vehicles equipped with a retarder. Connection to pin B on the EC-11™ controller provides this function.

PIN C - Pin C connects directly to negative vehicle ground.

PIN D - A dash light and its electrical relay are controlled by the EC-11™ controller through pin D. The light advises the driver of the antilock system condition.

PIN E - The serial link allows the EC-11™ controller to "report" its operating PIN IF condition to a specialized external computer in response to certain commands it receives. The serial link configuration conforms to S.A.E. standard J1708. Pins E and F provide serial link connections to the EC-11™ controller, but the function is not essential for MC-11™ tractor antilock assembly operation.

PIN L - Sensors mounted at the wheel end send wheel speed information PIN M to the EC-11™ controller through pins L-M and N-P. The EC-11™ controller receives the information at (PIN N) 100 pulses per wheel revolution.

The MC-11™ tractor antilock assembly "knows" what's happening at the wheel ends because of the signals it receives from the wheel speed sensors. The sensors are actually A.C. generators. They create a magnetic field; and when the field is interrupted by an irregular surface, like a tone ring, A.C. voltage is produced. The frequency of voltage increases or decreases as wheel speed increases or decreases.

During normal, non-antilock operation, the M-12™ modulator inlet solenoid is open, and the exhaust solenoid is closed. In this condition, the M-12™ modulator is a regular R-12™ relay valve. It receives a control signal from the foot valve,

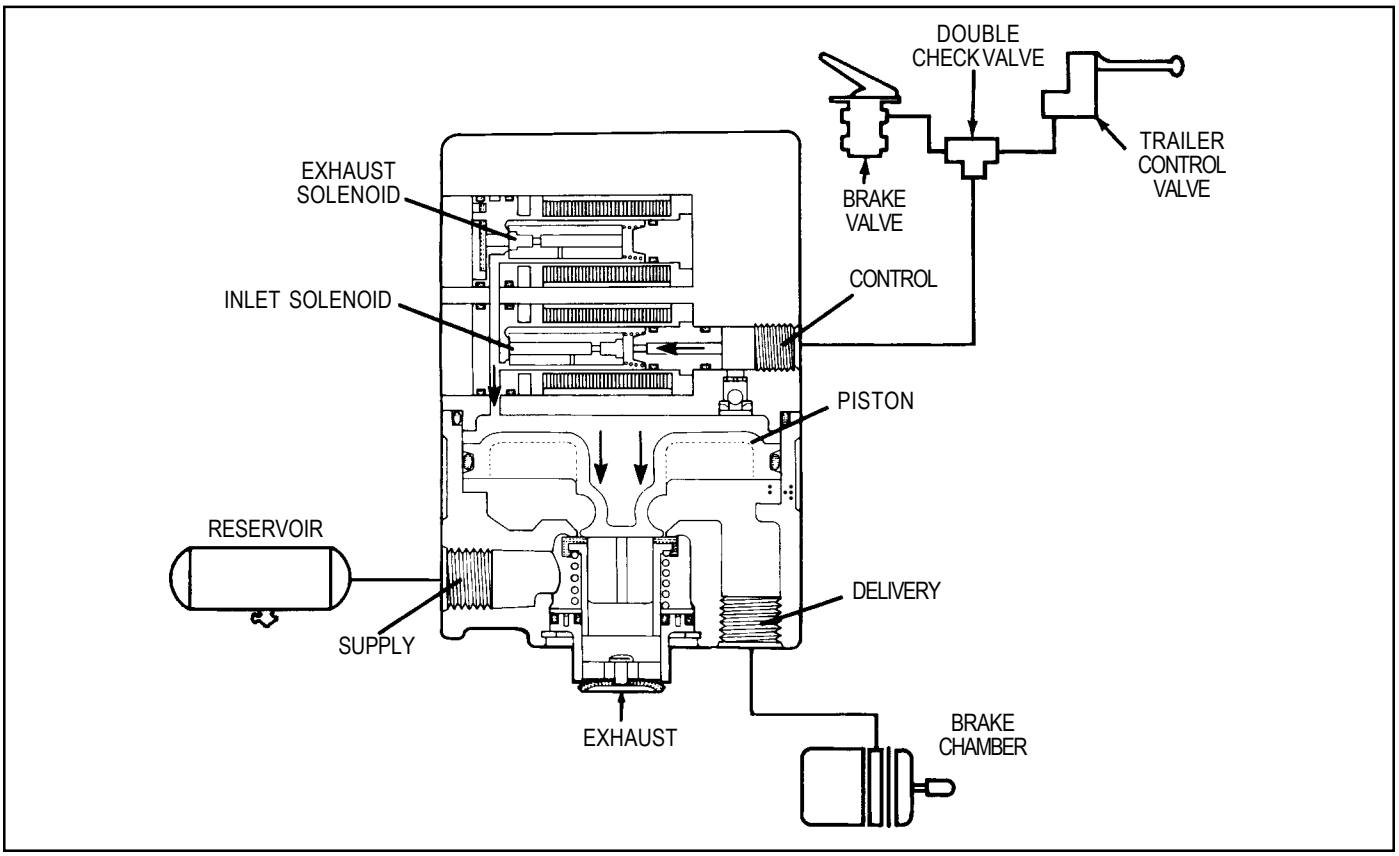


FIGURE 4 - BALANCED POSITION

which passes through the open inlet solenoid and into the control cavity of the relay valve. The valve then applies air to the service brake chambers in proportion to the control signal.

If wheel lock is impending, the EC-11™ electronic controller commands the solenoids to modulate brake chamber pressure on the axles in which the system is installed.

OPERATION

APPLYING: Normal Service Application

When a normal service brake application is made, control air pressure from the brake valve enters the modulator control port. The air passes through the supply solenoid and acts on the modulator's piston. The piston closes the modulator exhaust and opens the inlet, delivering supply air out the delivery ports.

BALANCED POSITION: Normal Service Application

The modulator reaches a balanced position when control pressure acting upon the topside of the piston approaches that of the air acting upon the underside of the piston. The piston moves upward and closes the inlet valve, while the exhaust remains closed. This prevents the modulator from delivering or exhausting air.

EXHAUSTING: Normal Service Application

When the brake valve is released, control pressure exhausts through the supply solenoid and the check valve in the solenoid housing and out the exhaust port of the brake valve. As the piston moves upward, the modulator's exhaust opens, allowing air from the piston's underside to exhaust through the modulator exhaust port.

ANTILOCK MODE: Solenoids Activated

If a service brake application is made and the EC-11™ controller senses impending wheel lockup, it will command the antilock system to alter the service brake application automatically.

When activated, shuttles within the solenoids alter the application and exhaust of control air pressure. The supply solenoid closes, preventing control line pressure from entering the modulator. Then the exhaust solenoid opens, allowing control pressure to exhaust from the top side of the piston through the exhaust port of the solenoid assembly. This activity occurs in a pulsating manner, simulating "pumping of the brakes."

PREVENTIVE MAINTENANCE

GENERAL

Perform the inspections and tests at the prescribed intervals. If the MC-11™ tractor antilock assembly fails to function as described, repair or replace the unit.

EVERY 3 MONTHS; 25,000 MILES; 900 OPERATING HOURS; OR DURING THE VEHICLE CHASSIS LUBRICATION INTERVAL

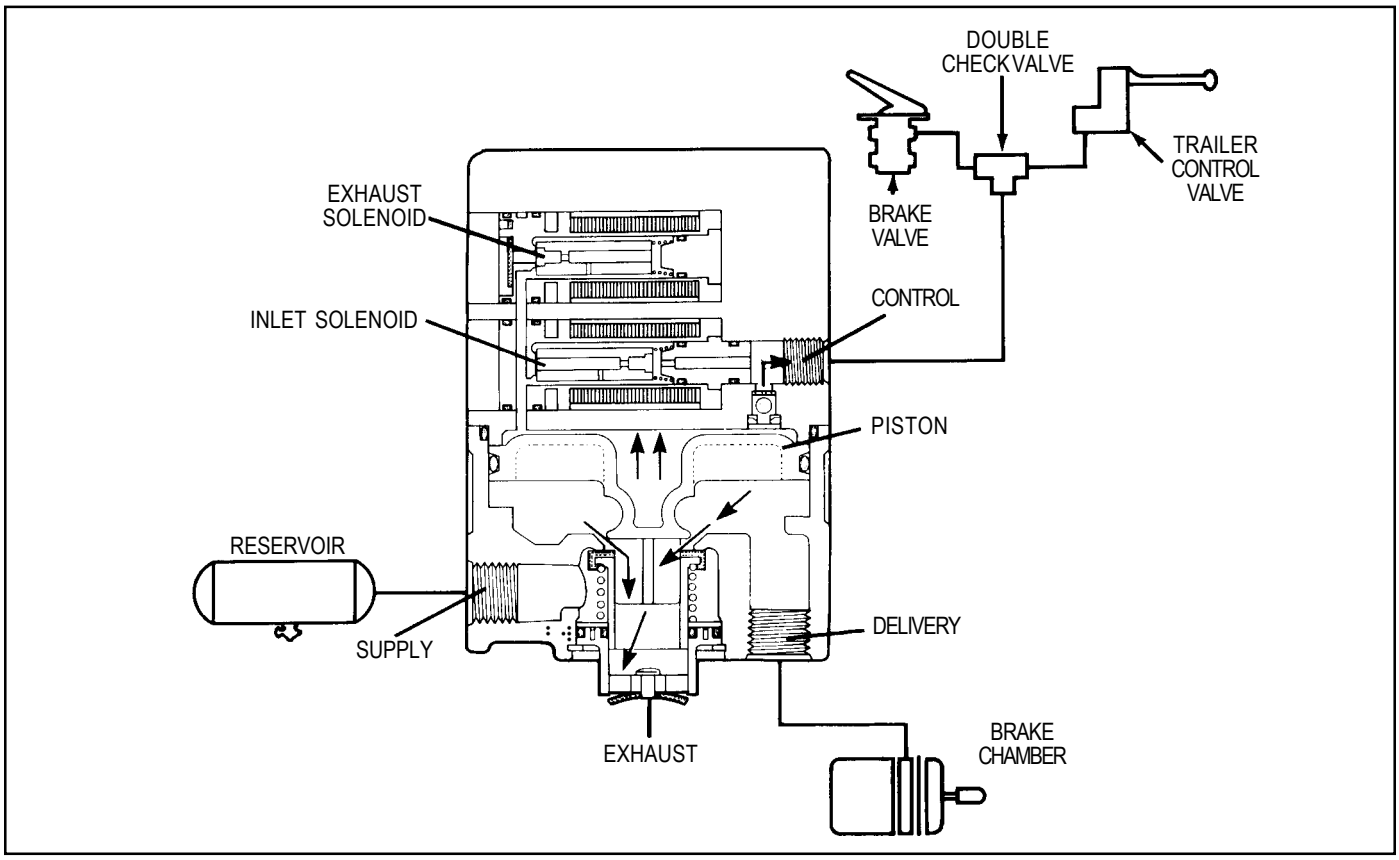


FIGURE 5 - EXHAUSTING: NORMAL SERVICE APPLICATION

1. Remove any accumulated contaminants and visually inspect the exterior of the unit for excessive corrosion or physical damage.
2. Inspect all air lines and wiring connected to the MC-11™ tractor antilock assembly for signs of wear or physical damage. Replace as necessary.
3. Perform "LEAKAGE TEST."

EVERY YEAR; 100,000 MILES; OR 3,600 OPERATING HOURS

1. Perform "OPERATIONAL AND LEAKAGE TESTS."

OPERATIONAL AND LEAKAGE TESTS

LEAKAGE TEST

1. Park the vehicle on a level surface and block the wheels. Release the parking brakes and build the air system to full pressure.
2. Turn the engine OFF and make 4 or 5 brake applications. Note that the service brakes apply and release promptly.
3. Build system pressure to governor cut-out and turn engine OFF.
4. Make and hold a full service brake application.
   A. Apply a soap solution to the relay valve exhaust port. A 1" bubble in 3 seconds is permitted.
   B. Apply a soap solution to the outside of the modulator body where the relay valve joins the solenoid assembly. A 1" bubble in 3 seconds is permitted.
5. If leakage is excessive around the supply and exhaust solenoids, replace the M-12™ modulator.

OPERATIONAL TEST

LED Operation

Although the MC-11™ assembly has self-check diagnostics, the LEDs (Light Emitting Diodes) should be inspected to ensure that they are functioning properly. With the vehicle ignition on, hold a magnet (capable of picking up 3 ounces) to the RESET position on the diagnostic window. All LEDs should illuminate. If one or more of the LEDs do not illuminate, and the dash light indicates proper system function, note the nonilluminated LEDs for future reference. Diagnostic capabilities will be limited, but the system will continue to function as designed.

Solenoid Operation

The MC-11™ assembly monitors the system electronics upon vehicle start-up. However, the vehicle should be tested to verify proper solenoid function. Two technicians will be required to properly test the solenoids.

1. Park the vehicle on a level surface and block the wheels. Release the parking brakes and build the air system to full pressure.
2. Turn the engine ignition key to the OFF position. Then make and hold a full brake application.

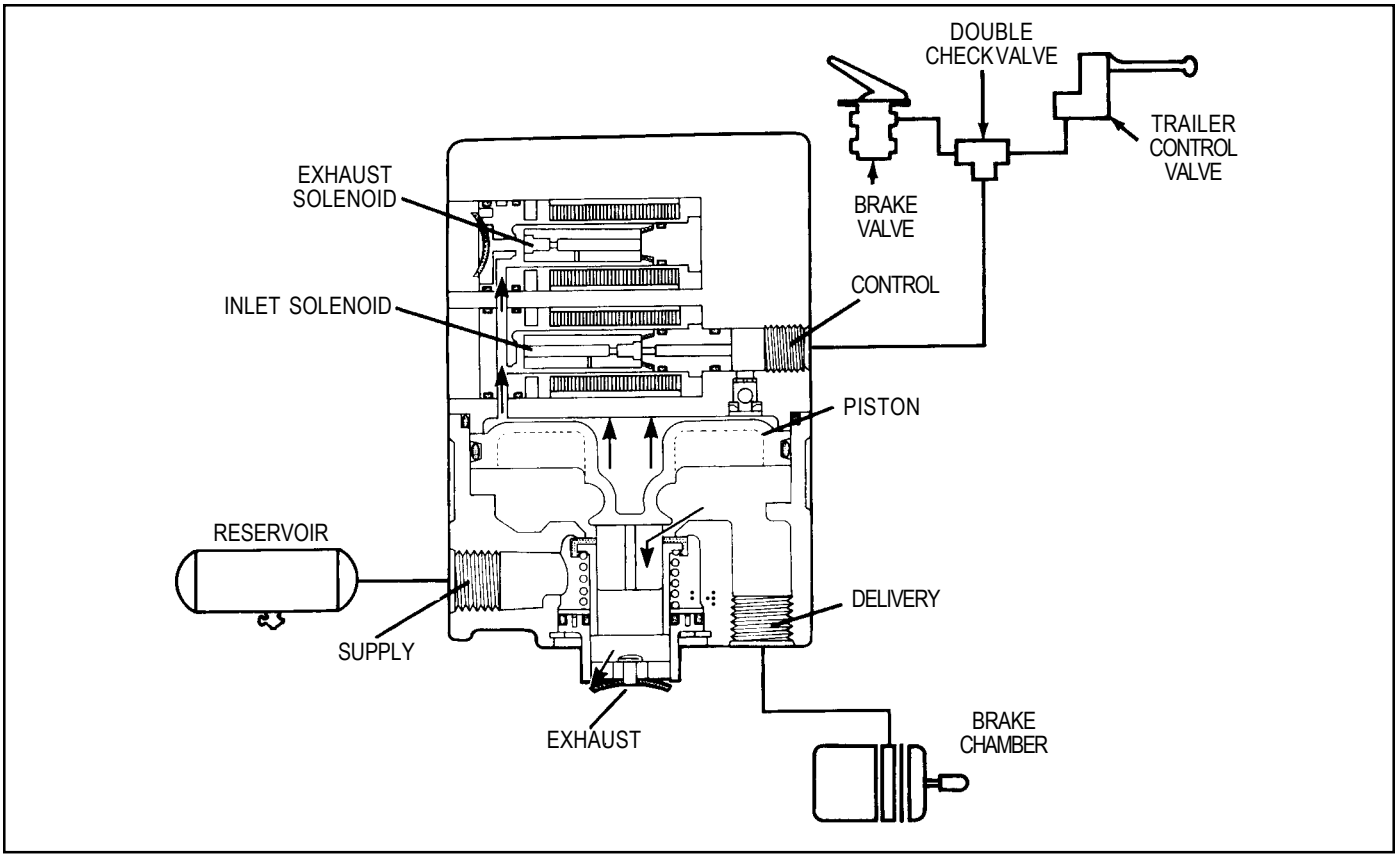


FIGURE 6 - ANTILOCK MODE: SOLENOIDS ACTIVATED

3. With the brake application held and a technician near the modulator, turn the vehicle ignition key to the ON position. One short burst of air should be noted from the modulator exhaust. If one short burst of air is not noted, or if the exhaust is prolonged and not short, sharp and well-defined, refer to the troubleshooting section.

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.**
2. **Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.**
3. **Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.**
4. **If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with an AD-IS™ air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**

REMOVAL OF THE MC-11™ ASSEMBLY

1. Prior to disassembly, remove as much contamination as possible from the exterior of the assembly. Be sure to keep the contamination away from the open ports.
2. Remove and identify all air lines connected to the unit.
3. Disconnect the 14-pin connector from the unit by unscrewing its hex screw and pulling the connector away from its socket.
4. Remove and save the mounting hardware connecting the MC-11™ assembly to the vehicle.

INSTALLATION OF THE MC-11™ ASSEMBLY

1. Replace the MC-11™ assembly on the vehicle using the hardware saved during removal. Connect the air lines to the proper ports, as identified during removal. Connect the 14-pin connector into the controller and tighten the hex screw.
2. Perform "OPERATIONAL AND LEAKAGE TESTS" before placing vehicle back into service.

DISASSEMBLY

The following disassembly and assembly procedure is presented for reference purposes and presupposes that a major rebuild of the antilock valve is being undertaken. Several replacement parts and maintenance kits are available which do not require full disassembly. The instructions provided with these parts and kits should be followed in lieu of the instructions presented here. Refer to Figure 7 throughout the procedure.

CAUTION: The MC-11™ assembly may be lightly clamped in a bench vise during disassembly. However, overclamping will result in damage, leakage, and/or malfunction. If a vise is to be used, position the MC-11™ assembly so the jaws bear on the flat area of the supply port and its opposing side of the body.

1. Remove the EC-11™ controller(1) from the M-12™ modulator by removing the controller's four mounting bolts.
2. Lift the controller off the M-12™ modulator and detach the wire harness from the base of the controller. To detach the harness, depress the tab on the side of the 4-pin connector and pull the connector from its socket in the controller. Remove the gasket(7) from the recess in the EC-11™ controller body. NOTE: If replacement of the controller only is required, proceed to Step 8 of assembly.
3. Remove the four 1/2" bolts that secure the solenoid assembly(2) to the valve body(3). Separate the solenoid assembly and valve body.
4. Remove sealing ring(4) from the protrusion on the bottom of the solenoid assembly.
5. Using a pair of snap ring pliers, remove retaining ring(14). Remove the exhaust assembly(13). Remove o-ring(12) and o-ring(11) from the I.D. and O.D., respectively, of the exhaust assembly.
6. Remove spring(10). Remove the inlet/exhaust assembly(8). Remove the spring seat(9) from the inlet/exhaust assembly.
7. Using your thumb, press the piston stem and push the piston(6) out the opposite end of the body. Remove o-ring(5) from the piston.
8. Discard all items that have replacement parts in the maintenance kit.

CLEANING AND INSPECTION

1. Using mineral spirits or an equivalent solvent, clean and thoroughly dry all parts to be reused. Do not allow mineral spirits to come into contact with the ECU connector or solenoids.
2. Inspect the interior and exterior of all parts that will be reused for severe corrosion, pitting and cracks. Superficial corrosion and/or pitting on the exterior portion of the body is acceptable.
3. Inspect the bores for deep scuffing or gouges.
4. Inspect the pipe threads in the body. Make certain they are clean and free of thread sealant.
5. Inspect all air line fittings and plugs for corrosion. Clean all old thread sealant from the pipe threads. Any component exhibiting a condition described in inspection steps 2 to 5 should be discarded and replaced before proceeding.

ASSEMBLY

1. Using a lubricant (Bendix Pc. No. 291126) lightly coat all o-rings and the bores of the valve body.
2. Install spring seat(9) onto the inlet/exhaust valve(8) so that it covers the rubber seat of the inlet/exhaust valve. Place the inlet/exhaust valve, large diameter first, into the M-12™ modulator's bottom bore.
3. Install spring(10) over the barrel of the inlet/exhaust valve(8) so that one end of the spring rests on the spring seat(9).
4. Install the o-rings(11 & 12) into the respective grooves of the O.D. and I.D. of the exhaust assembly(13). Place the large diameter of the exhaust assembly against the spring(10) and compress the spring until the exhaust assembly enters the bore of the body and the o-ring(11) seals against the wall of the bore.
5. Depress the exhaust assembly into the bore until it exposes the groove for the snap ring(14). Install snap ring(14) into its groove. Make sure it is fully seated.

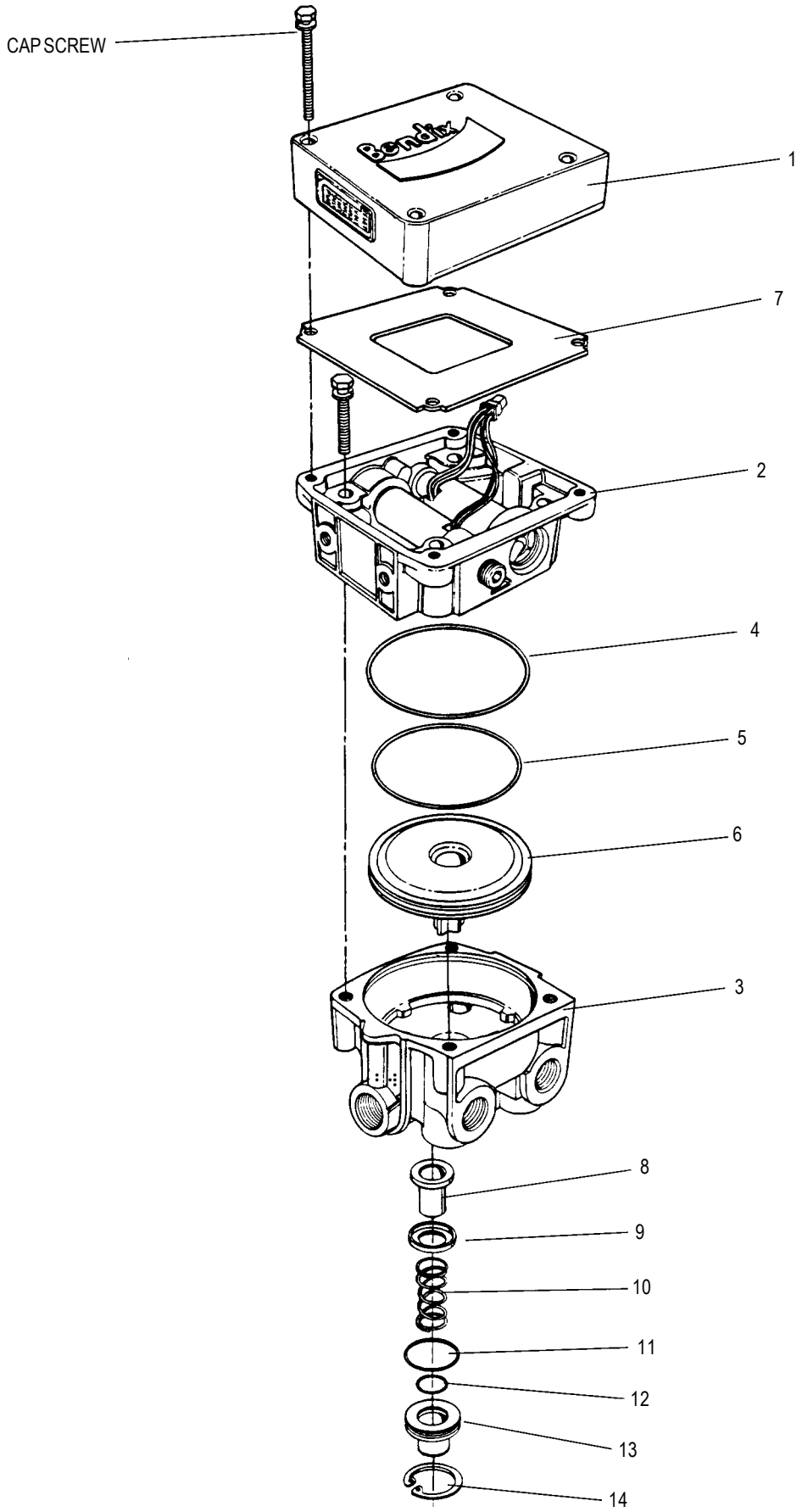
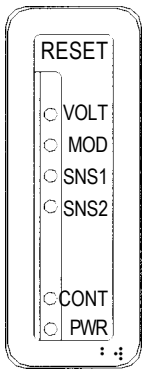


FIGURE 7 - EXPLODED VIEW

6. Install o-ring(5) into its groove in the piston(6). Install piston(6) into the M-12™ modulator body. The piston stem fits into the small hole in the center of the body.
7. Install o-ring(4) onto the protrusion on the bottom of the M-12™ modulator solenoid assembly(2). Install the solenoid assembly onto the valve body(3). The solenoid assembly will fit on the M-12™ modulator body in any of four orientations, 90 degrees apart. Secure the solenoid assembly to the valve body with the four 1/2" bolts. Torque the bolts to 120-150 in. lbs.
8. Install gasket(7) onto the EC-11™ controller. Install the EC-11™ controller(1), as shown in Figure 9, by plugging the 4-pin electrical connector from the solenoid assembly into the socket in the bottom of the controller. Press in until lock tab engages. Ensure engagement by pulling the connector lightly. Place the controller on to the solenoid assembly and secure with the four 1/2" bolts and lockwashers. Torque to 30-60 in. lbs.



DIAGNOSING AND LOCATING A SYSTEM PROBLEM

GENERAL

The EC-11™ controller contains self-test and diagnostic circuitry that continuously checks for proper operation of the entire antilock system, including wiring continuity. A dash light, controlled by the EC-11™ controller, advises the driver of the antilock system condition. Specific component condition is provided by a series of Light Emitting Diodes (LEDs) displayed through a "window" in the EC-11™ controller housing.

The dash light's separation from the EC-11™ controller diagnostic window allows the driver to be aware of any problems that occur but not to be confused by diagnostic information.

A special feature of the MC-11™ antilock system is failure latching. When the controller senses an error, it stores the condition in memory, disables antilock, and illuminates the dash light and the appropriate LEDs on the EC-11™ controller. The condition is truly stored–it is not cleared by loss of power to the EC-11™ controller. The LEDs will re-light when power is restored and will remain illuminated until the problem is corrected. After the actual problem is discovered and corrected, maintenance personnel can clear the EC-11™ controller diagnostics by passing a small magnet over the RESET area in the "window."

DIAGNOSTIC LEDs

There are six LEDs and a magnetic reset switch on the EC-11™ controller diagnostic window.

"VOLT" LED

This red LED illuminates when power to the EC-11™ controller falls outside the acceptable range of 9-18 volts. If the voltage returns to within the acceptable range, the VOLT LED will go off. This is the only LED that will reset itself when the failure condition no longer exists.

"MOD" LED

This red LED illuminates AND LATCHES ON when solenoid resistance is not within the acceptable range of 9.5-11.5 ohms. It can also illuminate if excessive electrical spikes are present in the power line.

"SNS 1" AND "SNS 2"

The red SNS LEDs illuminate AND LATCH ON to indicate any one of a number of permanent or intermittent failures. (For example, open or shorted wheel speed sensor, open or shorted sensor wiring, no wheel speed signal.)

"CONT" LED

This red LED illuminates AND LATCHES ON if the EC-11™ controller is malfunctioning, or if excessive electrical spikes are present in the power line.

"PWR" LED

This green LED illuminates and remains on during vehicle operation to indicate that vehicle power is reaching the EC-11™ controller.

TROUBLESHOOTING

GENERAL

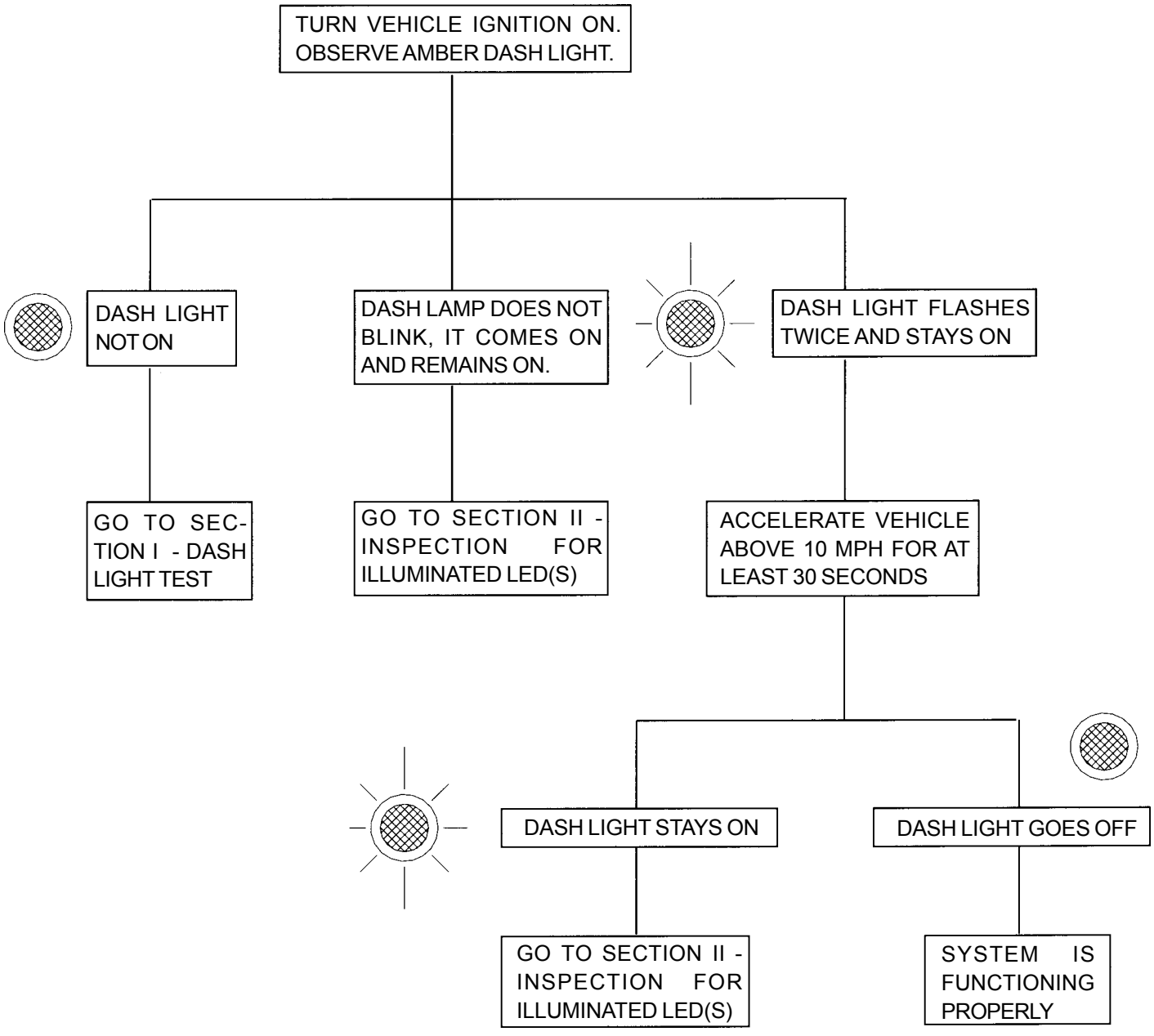
While the EC-11™ controller diagnostic display locates a specific problem area, it is still necessary to determine whether the problem resides in the component itself or the wiring. Basically, the troubleshooting procedure that follows is devoted to narrowing down the problem to either the wiring or a specific antilock component.

TIPS

1. All troubleshooting should begin by performing the "STARTUP," which focuses on observing the antilock status light on the dash.
2. The troubleshooting technician should record all findings and the action taken during the troubleshooting process.
3. No voltage or resistance tests are performed into the EC-11™ controller. All electrical tests begin at the wire-harness end of the connector and move AWAY from the EC-11™ controller toward and antilock system component (modulator, wheel speed sensor, etc.).

TROUBLESHOOTING

INITIAL START-UP PROCEDURE



TROUBLESHOOTING

SECTION I - DASH LIGHT TESTING

DISCONNECT 14 PIN CONNECTOR FROM EC-11™ CONTROLLER OBSERVE DASH LIGHT

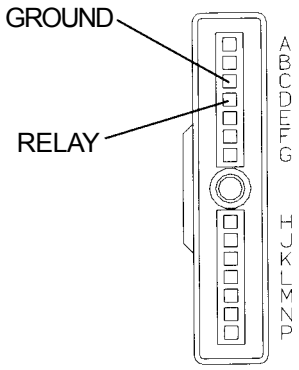
DASH LIGHT ON

REPLACE EC-11™ CONTROLLER

REPEAT STARTUP

DASH LIGHT OFF

WITH IGNITION ON, MEASURE VOLTAGE BETWEEN DASH LIGHT RELAY (PIN D) AND GROUND (PIN C). VOLTAGE SHOULD BE SAME AS BATTERY VOLTAGE.



IS VOLTAGE CORRECT?

NO

REPAIR/REPLACE WIRE HARNESS

REPEAT STARTUP

YES

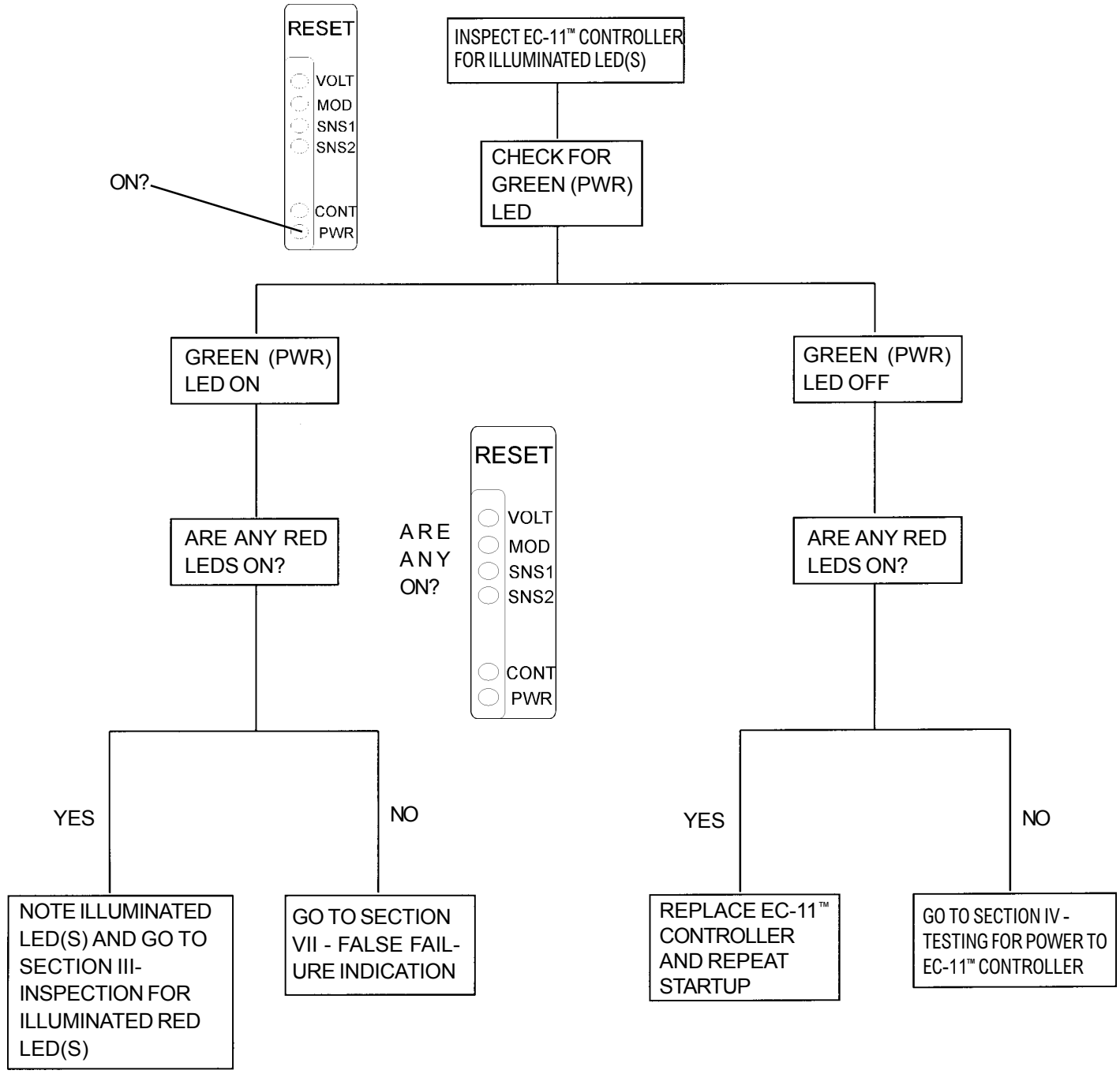
CHECK WIRING HARNESS AND RELAY FOR SHORTS TO GROUND. RECONNECT AND CHECK/REPLACE THE FOLLOWING:

1. DASH LIGHT BULB
2. FUSE
3. RELAY POWER WIRE
4. RELAY

AFTER REPLACING A COMPONENT TEST THE DASH LIGHT.

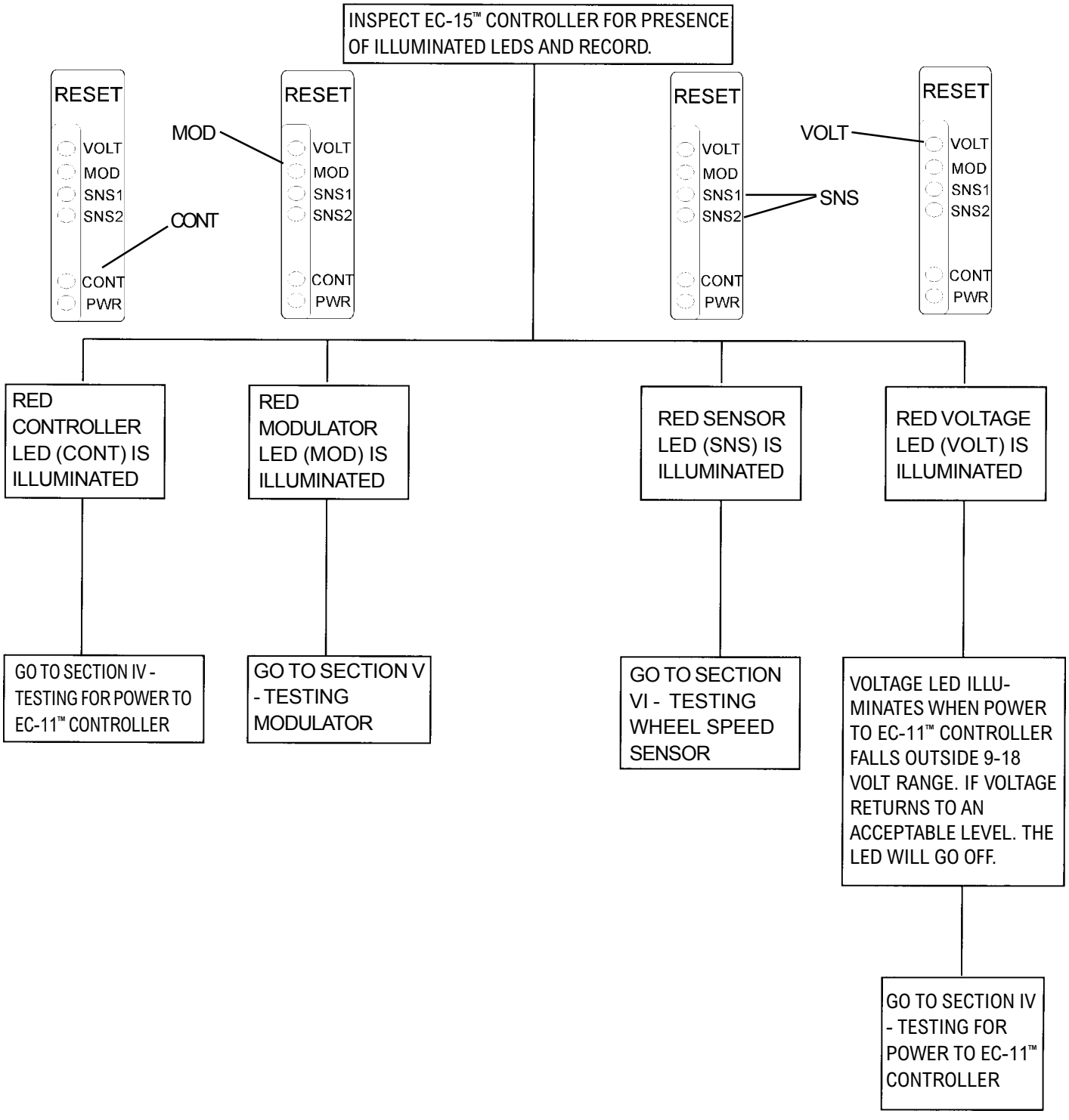
TROUBLESHOOTING

SECTION II INSPECTION FOR ILLUMINATED LEDS



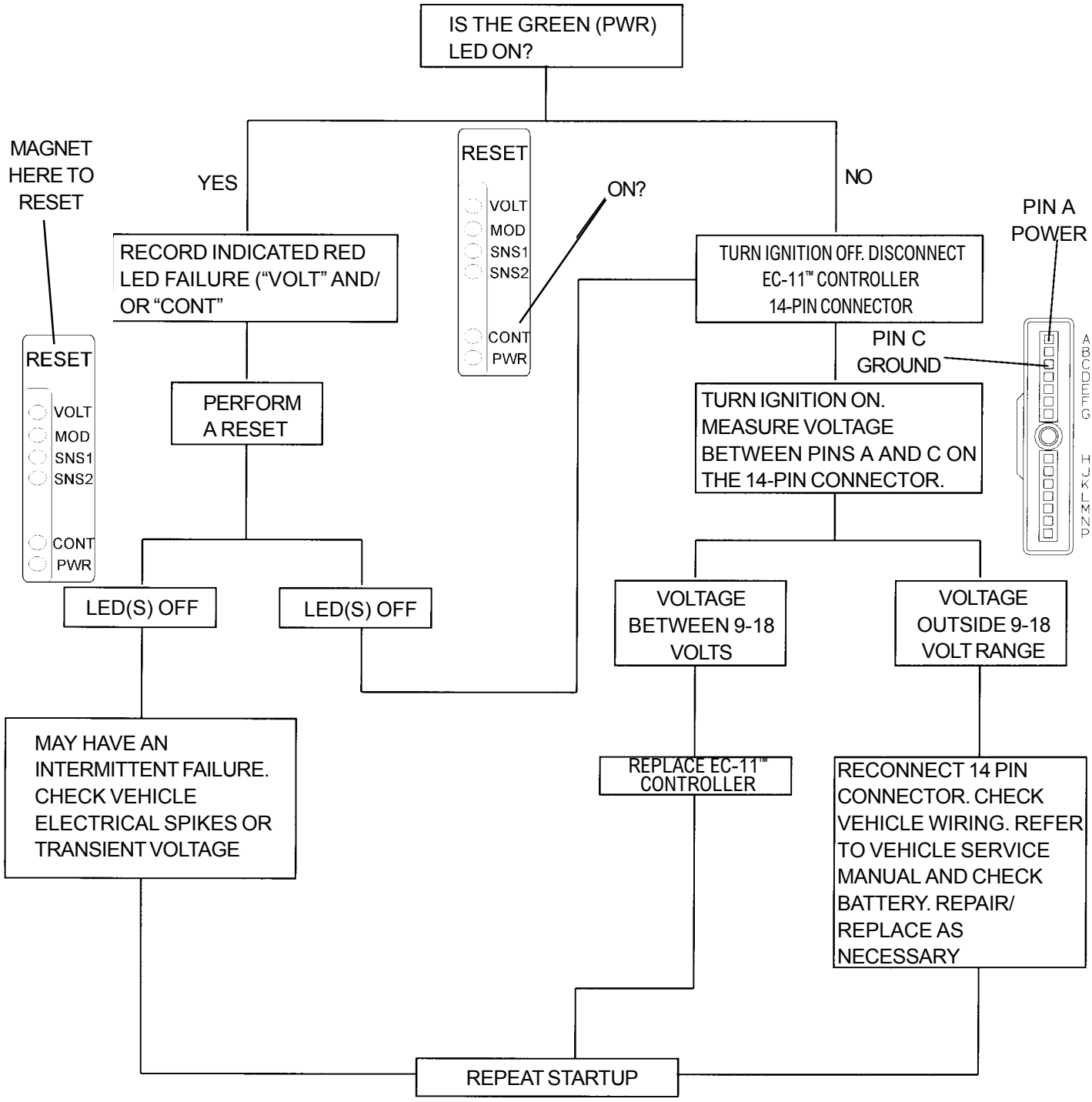
TROUBLESHOOTING

SECTION III - INSPECTION FOR ILLUMINATED RED LEDS



TROUBLESHOOTING

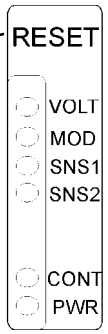
SECTION IV - INSPECTION FOR ILLUMINATED LEDS



TROUBLESHOOTING

SECTION V - TESTING MODULATOR

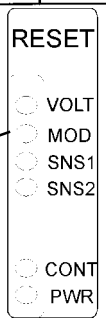
MAGNET HERE TO RESET



RECORD INDICATED FAILURE. PERFORM A RESET.

"MOD" LED STAYS ON

STILL ON?



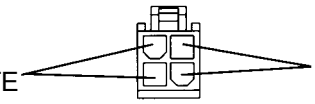
"MOD" LED GOES OFF

DISCONNECT THE 4-PIN CONNECTOR BETWEEN THE EC-11™ CONTROLLER AND THE M-12™ MODULATOR SOLENOID ASSEMBLY. CHECK RESISTANCE ACROSS BOTH PAIRS OF WIRES. (WHITE-WHITE, BLACK-BLACK)

INTERMITTENT CONNECTION BETWEEN EC-11™ CONTROLLER AND M-12™ MODULATOR. CHECK 4-PIN CONNECTOR

REPEAT STARTUP

WHITE



BLACK

RESISTANCE WITHIN 9.5-11.5 OHMS

RESISTANCE OUTSIDE 9.5-11.5 OHMS

CHECK FOR SHORT-BLACK TO CASE GROUND AND WHITE TO CASE GROUND

REPLACE M-12™ MODULATOR

CONTINUITY

NO CONTINUITY

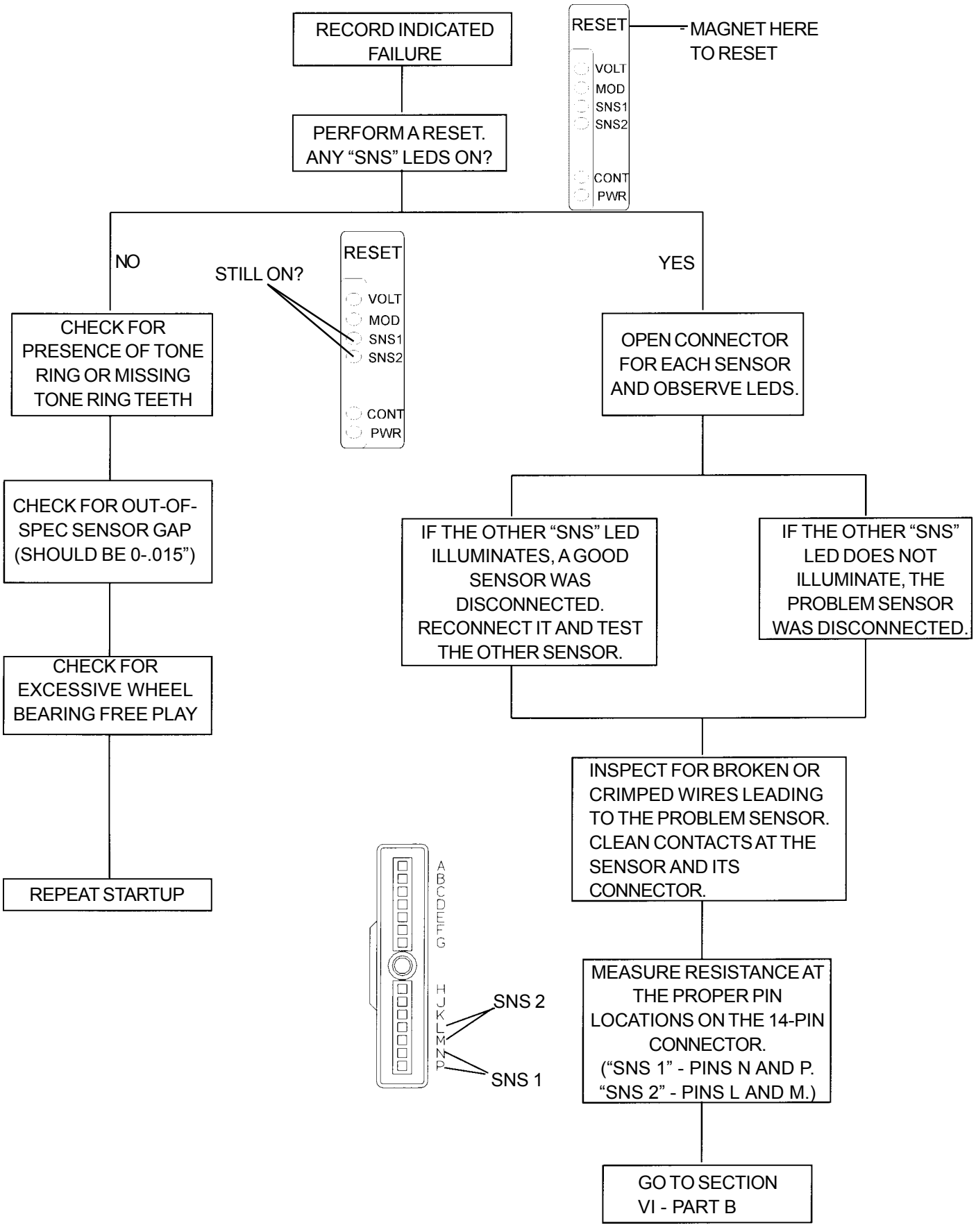
REPLACE M-12™ MODULATOR

REPLACE EC-11™ CONTROLLER

REPEAT STARTUP

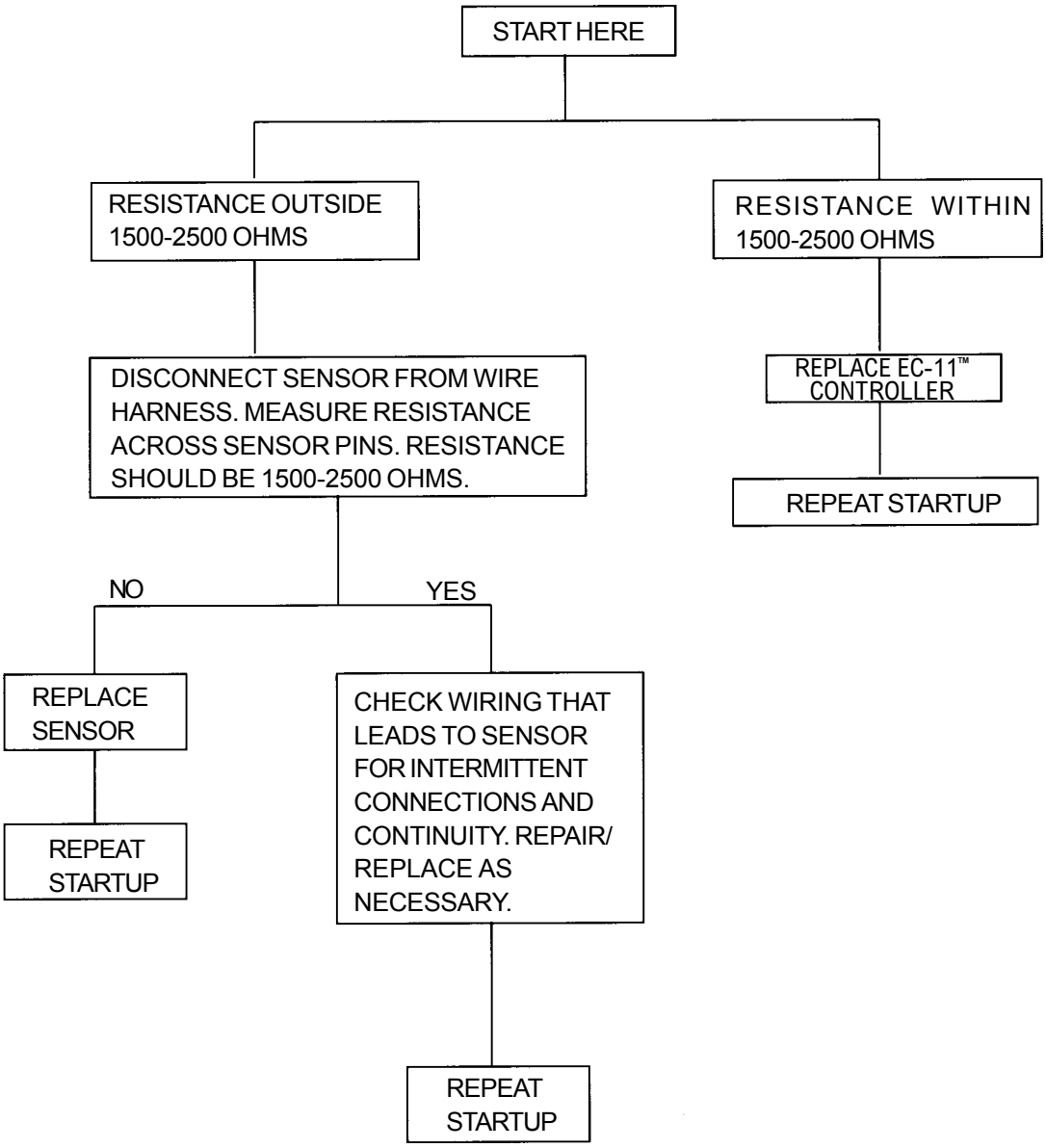
TROUBLESHOOTING

SECTION VI PART A - TESTING WHEEL SPEED SENSOR



TROUBLESHOOTING

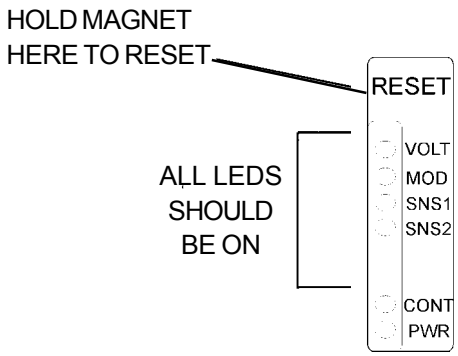
SECTION VI PART B - TESTING THE MODULATOR



TROUBLESHOOTING

SECTION VII - FALSE FAILURE INDICATION

NOTE: IF DURING STARTUP, THE DASH LIGHT ILLUMINATED WITHOUT BLINKING, GO TO SECTION VII PART B - TESTING FOR FALSE FAILURE CAUSED BY DASH LIGHT RELAY. I F THE DASH LIGHT BLINKED DURING STARTUP BUT ILLUMINATED AFTER THE VEHICLE REACHED 10 MPH, GO TO SECTION VII PART A - TESTING FOR FALSE FAILURE CAUSED BY WHEEL SPEED COMPONENTS.



HOLD A MAGNET TO THE RESET SWITCH AND MAKE SURE ALL LEDS ILLUMINATE WHEN MAGNET IS PRESENT

LEDS ILLUMINATED?

YES

NO

REMOVE MAGNET

BOTH SENSORS MAY NOT BE RECEIVING SIGNALS.

CHECK FOR PRESENCE OF TONE RINGS.

TONE RINGS PRESENT AND IN GOOD CONDITION

CHECK FOR OUT-OF-SPEC SENSOR GAPS (SHOULD BE 0-.015")

GAP OK

REPEAT STARTUP, IF TESTING RETURNS TO THIS PLACE TWICE, REPLACE THE EC-11™ CONTROLLER

GAP OUT OF SPEC

ADJUST AS NECESSARY

TONE RINGS NOT PRESENT OR DAMAGED

REPAIR/REPLACE AS NECESSARY.

REPEAT STARTUP

REMOVE MAGNET

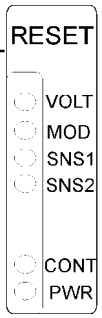
REPLACE EC-11™ CONTROLLER

REPEAT STARTUP

TROUBLESHOOTING

SECTION VII PART B - TESTING FOR FALSE FAILURE CAUSED BY DASH LIGHT RELAY

HOLD MAGNET HERE TO RESET



ALL LEDS SHOULD BE ON

HOLD A MAGNET TO THE RESET SWITCH AND MAKE SURE ALL LEDS ILLUMINATE WHEN MAGNET IS PRESENT

LEDS ILLUMINATED?

YES

NO

REMOVE MAGNET

REMOVE MAGNET

TURN IGNITION OFF. CHECK FOR CONTINUITY BETWEEN PIN D AND ITS TERMINAL ON THE DASH LIGHT RELAY.

REPLACE EC-11™ CONTROLLER

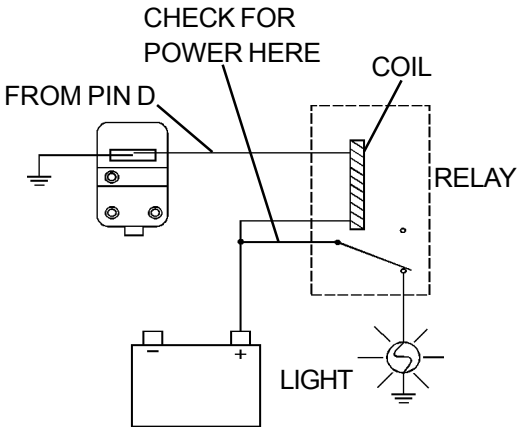
REPEAT STARTUP

NO CONTINUITY

CONTINUITY

REPAIR/REPLACE WIRE HARNESS. RECONNECT 14 PIN CONNECTOR AND REPEAT STARTUP.

RECONNECT 14 PIN CONNECTOR. TURN IGNITION ON AND CHECK FOR POWER AT THE DASH LIGHT RELAY COIL.

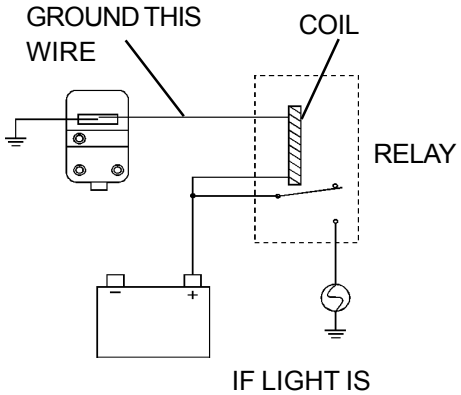


NO POWER

POWER

CHECK DASH WIRING AND CONNECTORS. CONSULT VEHICLE MANUAL FOR FURTHER TROUBLE-SHOOTING INFORMATION. REPAIR/REPLACE AS NECESSARY AND REPEAT STARTUP.

CONNECT OPPOSITE END OF RELAY COIL TO GROUND AND NOTE REACTION OF DASH LIGHT.



DASH LIGHT OFF

DASH LIGHT ON

REPEAT STARTUP, IF TESTING RETURNS TO THIS PLACE TWICE, REPLACE THE EC-11™ CONTROLLER

REPLACE RELAY

REPEAT STARTUP

IF LIGHT IS ON - BAD RELAY