SUSPENSION - AIR

1987 Lincoln Mark VII

1987 SUSPENSION
Ford Motor Co. Air Suspension System

Lincoln; Continental, Mark VII

DESCRIPTION

The air suspension system is an air-operated, microprocessor controlled suspension system. This system replaces the conventional coil spring suspension and provides automatic front and rear load leveling. The 4 air springs, made of rubber and plastic, support the vehicle load at the front and rear wheels.

OPERATION

Air suspension leveling system operates by adding or removing air in the springs to maintain level of vehicle at a predetermined front and rear suspension height. Suspension height is controlled by 3 height sensors (2 front and one rear).

Airflow to the entire system is controlled by the interaction of the air compressor, solenoids, height sensors and control module. The air suspension is equipped with a diagnostic system. An air fill routine is preprogrammed into the control module memory. A warning light located in overhead console is used as a diagnostic aid and malfunction indicator.

WARNING: Carefully read instructions to prevent damage to suspension system and possible personal injury due to automatic air filling procedure.

AIR COMPRESSOR

A single cylinder piston-type air compressor is mounted on left fender apron. Compressor is electrically operated and supplies air pressure to system. A regenerative type drier is attached to compressor manifold. All air flow during compression or venting passes through drier. A vent solenoid, located on compressor manifold, controls air exhaustion. Air compressor is replaced as a unit.

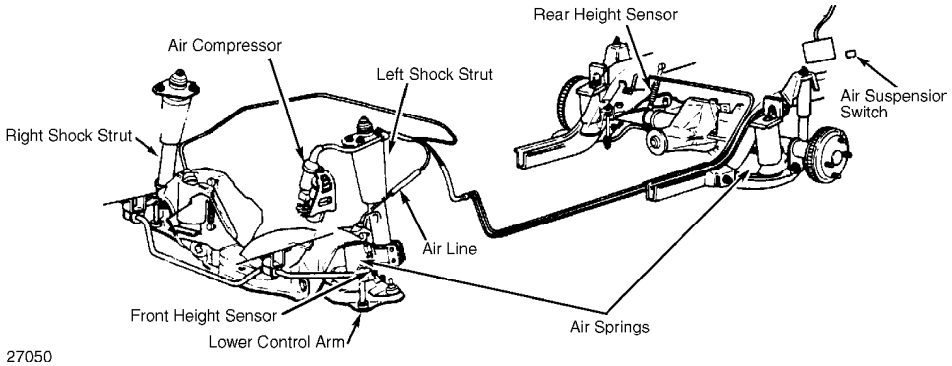

Fig. 1: Exploded View of Air Suspension System
Courtesy of Ford Motor Co.

CONTROL MODULE

A mirocomputer-based module controls the air compressor motor, vent solenoid and 4 air spring solenoids. The control module, located on left side of trunk, continuously monitors air suspension system through a pre-programmed test sequence. The system operates with ignition switch in both "OFF" and "RUN" positions.

DIAGNOSTIC SYSTEM

The air suspension system control module is equipped with an amber "CHECK SUSPENSION" warning light. The warning light, located in the overhead console, has the following functions:

Observation of warning light during normal operation with ignition on, can aid in detecting system problems. The warning light is lit by the control module whenever a malfunction is noted in suspension system. The warning light is also used as a diagnostic aid during the pre-programmed test cycle.

HEIGHT SENSORS

The air suspension leveling system operates by adding or removing air to maintain vehicle (trim) height. Trim height is controlled by 3 height sensors. The height sensors are located at left and right front and one at rear. The sensors operate as follows:

As weight is added to vehicle, the body will settle under load. As vehicle lowers, height sensors shorten (low out-of-trim), sending a signal to control module which activates air compressor and opens air spring solenoid valves. When preset trim height is reached, air compressor and solenoid valves shut off.

Height sensors are attached to body and suspension arms, and will lengthen or shorten with suspension travel. When weight is removed, vehicle rises, which causes height sensors to lengthen (high out-of-trim), sending a signal to the control module. Which opens air compressor vent solenoid and air spring solenoid valves. As vehicle lowers, height sensors shorten, and when preset trim height is reached, air compressor vent and spring solenoid valves close.

ADJUSTMENTS

CASTER & CAMBER

See CASTER, CAMBER & TOE-IN ADJUSTMENTS article in WHEEL ALIGNMENT section

RIDE HEIGHT ADJUSTMENT

NOTE: Adjustment procedure must be performed before alignment or ride height is checked so air suspension system will vent to trim. If vehicle is more than 20°F (6°C) colder or warmer than alignment area, time must be allowed for vehicle to match alignment area temperature.

Pre-Alignment Procedure

1) Drive onto alignment rack and position vehicle. Turn ignition off and exit vehicle. Level rack as necessary. Re-enter vehicle and turn ignition switch to the "RUN" position (DO NOT start).

2) Allow one minute for vehicle to level. Push trunk release, turn ignition off and exit vehicle. Allow 20 seconds for vehicle to vent to trim height (all doors closed).

3) Turn off air suspension system switch in trunk on left front side panel. Check for proper ride height. If necessary, adjust front ride height by moving front left and/or right lower sensor attaching stud.

4) There are 3 adjustment positions provided on bracket. Loosen attaching bolt and adjust as necessary. A one position change to sensor attachment point will result in 1/2" (12.7 mm) change up or down.

5) Rear suspension ride height is adjusted by moving rear sensor attaching bracket up or down relative to right rear arm (slot adjustment is provided on bracket). Loosen attaching nut and adjust up or down as required. One index mark change to sensor attachment point will result in 1/4" (6.4 mm) change up or down.

CAUTION: The electrical power supply to the air suspension system must be shut off prior to hoisting, jacking or towing vehicle. Turn off air suspension switch located on left hand side of vehicle trunk or disconnect battery. See Fig. 2.

CAUTION: The following hoist restrictions must be observed: Use only a "body hoist". Lift vehicle using standard procedures and place jack stands at each corner as a safety precaution. If "body hoist" is not available, use standard hydraulic floor jack. Raise front of vehicle at No. 2 crossmember and place jack stands at front corners of body. For rear, use same procedure, but use rear jacking location.

FRONT WHEEL BEARINGS

1) Turn air suspension switch off. See Fig. 2. Raise vehicle as previously outlined and remove wheel cover and grease cap. Remove cotter pin and locking nut. Loosen adjusting nut 3 turns and rock wheel to relieve brake pad pressure from hub and rotor assembly.

2) Tighten adjusting nut to 17-25 ft. lbs. (23-34 N.m) while rotating wheel assembly. Loosen lock nut 1/2 turn and tighten to 10-15 INCH. lbs. (1-2 N.m). Reinstall locking nut on adjusting nut and insert new cotter pin.

BALL JOINT CHECKING

1) Turn off air suspension switch. See Fig. 2. Support vehicle in normal driving position with vehicle weight on ball joints. Wipe off wear indicator and ball joint cover checking surface, so they are free of dirt and grease.

2) Checking surface should project outside cover. If checking surface is in cover, replace lower arm assembly.

NOTE: Lower control arm, including both end bushings, are replaceable as assemblies. Replace in pairs only.

DIAGNOSIS & TESTING

TEST EQUIPMENT

The following test equipment is recommended to perform all tests on air suspension system. Do not attempt to test this system without proper equipment. Damage to vehicle components may result if improper equipment is used.

* Automotive type volt/ohmmeter.
* Fabricate a test light. Attach 2 test leads with pointed probes to a No. 194 bulb. Using any other bulb may damage air suspension system.
* 0-150 psi (0-70 kg/cm^2) pressure gauge.

PREPARATION

Check Vehicle Load

Unload the passenger and luggage compartments, as necessary. Allow vehicle to sit with ignition switch in "RUN" position for minimum of 5 minutes (door closed, brake off). Level vehicle.

Initialize System

Turn ignition switch to "OFF" position, then turn ignition switch to "RUN" position. Observe air suspension warning light. If warning light does not blink or glow, proceed to TEST A. If air suspension system is suspected of leakage, standard soap solution check procedure is acceptable.

DIAGNOSTIC ROUTINE

System is operable for one hour after ignition is turned off. During this period, system will lower or raise vehicle if required. (System priority is rear up, front up, rear down and front down.) System will not lower vehicle if any height sensor indicates "high" vehicle prior to turning ignition off.

If ignition switch is in "RUN" position for less than 45 seconds, system will raise vehicle if required, but will not lower vehicle. If ignition switch is in "RUN" position longer than 45 seconds, system will raise or lower vehicle using a 45-second averaging method, with doors closed and no pressure applied to brake pedal.

If door is open and no brake pressure applied, system will raise vehicle but will not lower vehicle until door is closed. If brake is depressed and door is open, system will raise vehicle but will not lower vehicle. If brake is depressed and doors are closed, system will not raise or lower vehicle, except to complete a rear raise procedure.

When ignition switch is turned from "OFF" to "RUN" position, warning light will glow for about one second and go out. If light glows continuously, there is no battery power to control module. Lamp does not operate when ignition switch is in "OFF" or in "START" positions.

If light glows for about 1/2 second, goes out, and then glows continuously after 5-8 seconds when ignition is turned from "OFF" to "RUN" position, a height sensor or harness problem is indicated.

After ignition switch is turned from "OFF" to "RUN" position, if light comes on and glows continuously at any time after 8 seconds, a system problem is indicated.

Once warning light comes on during ignition "RUN" cycle, it will glow continuously for that cycle. Erratic operation of warning light (blinking or flashing) during an ignition "RUN" cycle indicates a system problem.

During diagnostic testing, the light will blink at a rate of 2 blinks per second, to indicate that diagnostic routine (in module) has been entered. The light blinks the test number that is being run during that test sequence.

If light blinks at a rate of one blink every 2 seconds, this indicates that air fill routine has been entered.

NOTE: The following diagnostic charts and illustrations are supplied courtesy of Ford Motor Co.

Entering Diagnostics

CAUTION: The air fill routine and diagnostic routine are both activated in a similar manner. DO NOT open and close driver’s door unless specifically instructed to do so by

routine.

1) Turn on air suspension switch. Unground diagnostic pigtail located at rear of on/off switch in trunk. See Fig. 2. Connect battery charger to battery to reduce drain.

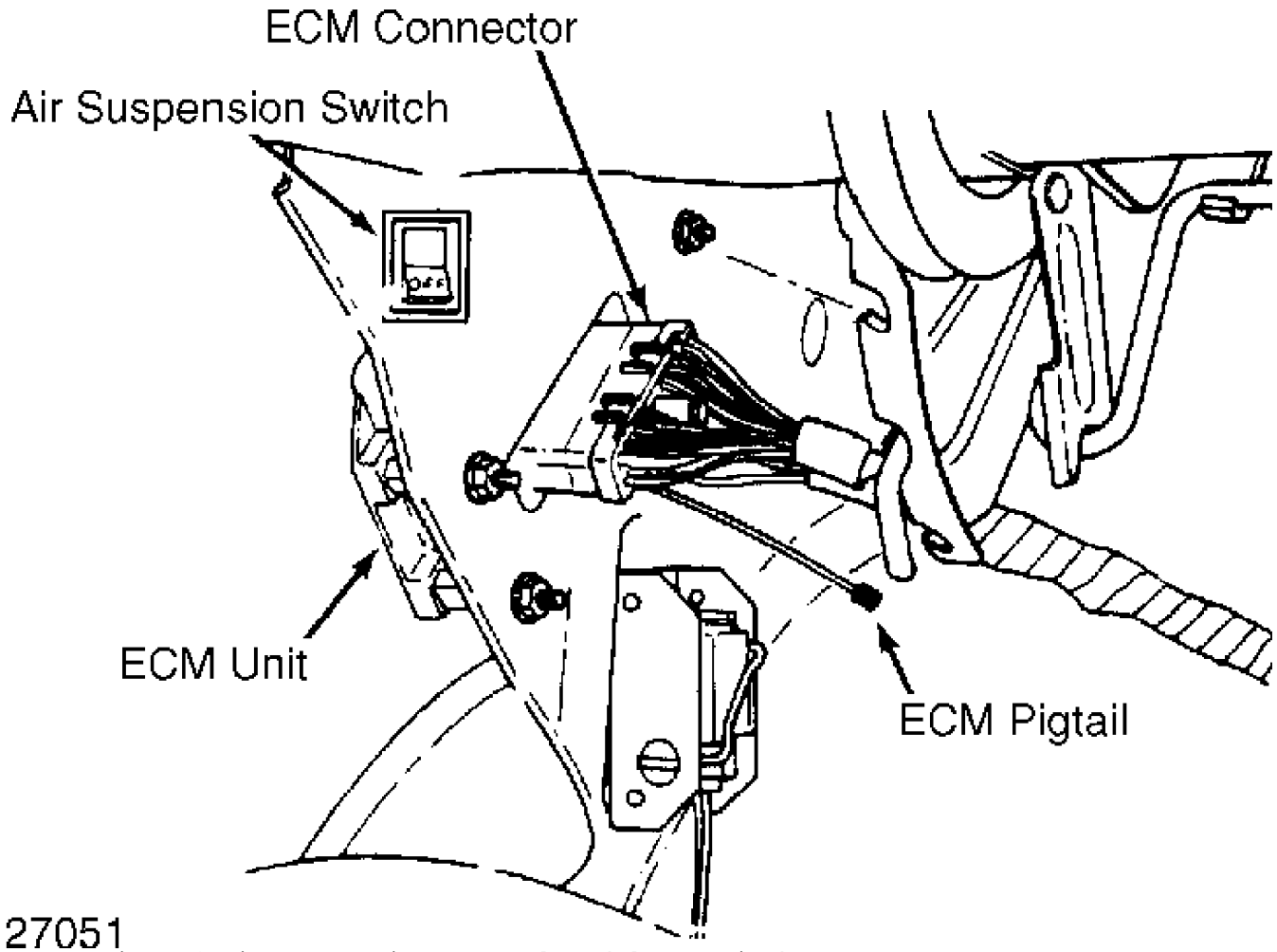

Fig. 2: Location of Air Suspension Control Module & Switch
Courtesy of Ford Motor Co.

2) Open driver's door. Close all other doors. Leave driver's door open. Cycle ignition switch from "OFF" to "RUN" position, hold switch in "RUN" position for a minimum of 5 seconds, and turn ignition off.

3) Change diagnostic pigtail from ungrounded to grounded by attaching a lead from pigtail to vehicle ground. Pigtail must remain grounded during diagnostic sequence.

4) Turn ignition switch to "RUN" position. Do not start vehicle. Warning light will blink continuously at a rate of about 2 blinks per second to indicate diagnostics routine has been entered and is ready. During diagnostics, warning light will continuously blink or give current test number.

5) During diagnostic testing, if light blinks at a rate of 2 blinks per second, it indicates that a diagnostic routine (in module) has been entered. The light then blinks test number that is being run during test sequence.

6) If light blinks at a rate one blink every 2 seconds, this

indicates that air fill routine has been entered.

7) If warning light blinks only once, proceed to TEST A, step 10). If warning light stays on, proceed to TEST A, step 13).

8) Terminate diagnostics by either ungrounding pigtail, activating brake pedal or cycling ignition switch. This returns control module to operating mode.

Self-Test

The Self-Test is a series of 10 individual tests which are conducted by the control module in a specific sequence.

Tests 1-3 are complete cycles of suspension operation (raising and lowering; front first, then rear). Each successive transition from door closed to door open will cause control module to advance to next test.

In tests 4-9, the following components will cycle in sequence: air compressor, vent solenoid, left front solenoid, right front solenoid, right rear solenoid and left rear solenoid.

Test 10 checks brake circuit system and completes test sequence. Test is terminated either by brake actuation, turning ignition switch to "OFF" position, or disconnecting pigtail from control module. System returns to normal operating mode.

During test sequence, the warning light operation is an indication of a system malfunction. The warning light will flash test number at a constant rate during all tests.

During tests 1-3, the warning light will glow and remain on continuously if appropriate signal is not received within 30 seconds. If an illegal signal is received, the warning light will flash rapidly. Either of these would indicate a failure. To repeat test, close and open door. To proceed to next test, close and open door within 15-second period.

During tests 4-10, the warning light is not required for pass/fail determination. These tests will cycle various components and pass/fail determination can be made by observing vehicle for automatic lowering, or listening to compressor and vent solenoid for operation. To advance to next test, close and open door.

NOTE: Do not perform any pin point test until Self-Test is completed.

SELF-TEST

1) Test 1 (Rear). To start test, open and close door. System raises rear evenly for 15-30 seconds, then lowers rear for 30 seconds (maximum). When a rear low signal is received by the control module, the rear of the vehicle will raise for a maximum of 30 seconds or until a rear trim signal is received at the control module. Warning light will blink Test No. 1 at a constant rate for a maximum test time of 90 seconds. After 90 seconds, observe warning light. If warning light flashes about 4 times per second or stays on, record Test 1 as a failure and proceed to next step. If warning light flashes Test No. 1, proceed to next step. If warning light does not flash Test No. 1, flashes rapidly or remains on, proceed to Test A, step 19).

2) Test 2 (Right Front). To start test, open and close door once. If Test No. 1 failed, open and close door twice. System raises right front for 15-30 seconds, then lowers for 30 seconds (maximum). When a right front low signal is received by the control module, the right front of the vehicle will raise for a maximum of 30 seconds or until a right front trim signal is received by the control module. Warning light will blink Test No. 2 at a constant rate for a maximum test time of 90 seconds. After 90 seconds, observe warning light. If warning light flashes about 4 times per second or stays on, record Test No. 2 as a failure and proceed to step 3). If warning light

flashes Test No. 2, proceed to step 3).

3) Test 3 (Left Front). To start test, open and close door once. If Test No. 2 failed, open and close door twice. System raises left front for 15-30 seconds, then lowers for 30 seconds (maximum). When a vehicle high signal is received from the left front sensor, the left front of the vehicle will raise for a maximum of 30 seconds or until a left front trim signal is received at the control module. Warning light will blink Test No. 3 at a constant rate for a maximum test time of 90 seconds. After 90 seconds, observe warning light. If warning light flashes about 4 times per second or stays on, record Test No. 3 as a failure and proceed to step 4). If warning light flashes Test No. 3, system passed test. Proceed to step 4).

4) Test 4 (Compressor). To start test, open and close door once. If Test No. 3 failed, open and close door twice. System cycles compressor on and off. Warning light will blink Test No. 4 continuously. Compressor will only cycle 50 times during test. Rear of vehicle may raise during test. If compressor does not cycle, runs continuously or doesn't run, system failed test. Record Test No. 4 as a failure, and proceed to step 5). If compressor cycles, system passed test. Proceed to step 5).

5) Test 5 (Vent Solenoid). To start test, open and close door. System cycles vent solenoid on and off. Warning light will blink Test No. 5 continuously during test. If solenoid doesn't cycle, system failed test. Record Test No. 5 as a failure, and proceed to step 6). If solenoid cycles, system passed test. Proceed to step 6).

6) Test 6 (Left Front Air Spring Solenoid). To start test, open and close door. Listen for air escaping from vent solenoid and for left front spring solenoid to cycle. Left front of vehicle will drop during test. If spring solenoid doesn't cycle or air is not venting, system has failed test. Record Test No. 6 as a failure and proceed to step 7). If spring solenoid cycles and air is escaping from vent solenoid, system passed test. Proceed to step 7).

7) Test 7 (Right Front Air Spring Solenoid). To start test, open and close door. Listen for air escaping from vent solenoid and for right front spring solenoid to cycle. Right front of vehicle will drop during test. If spring solenoid doesn't cycle or air is not venting, system has failed test. Record Test No. 7 as a failure and proceed to step 8). If spring solenoid cycles and air is escaping from vent solenoid, system has passed test. Proceed to step 8).

8) Test 8 (Right Rear Air Spring Solenoid). To start test, open and close door. Listen for air escaping from vent solenoid and for right rear spring solenoid to cycle. Right rear of vehicle will drop during test. If spring solenoid doesn't cycle or air is not venting, system has failed test. Record Test No. 8 as a failure, and proceed to step 9). If spring solenoid cycles and air is venting, system has passed test. Proceed to step 9).

9) Test 9 (Left Rear Air Spring Solenoid). To start test, open and close door. Listen for air escaping from vent solenoid and for left rear spring solenoid to cycle. Left rear of vehicle will drop during test. If spring solenoid doesn't cycle or air is not venting, system has failed test. Record Test No. 9 as a failure and proceed to step 10). If spring solenoid cycles and air is escaping, system has passed test. Proceed to step 10).

10) Test 10 (Brake Circuit). To start test, open door. DO NOT close door. Sit in driver's seat and depress brake pedal. If warning light continues to blink, system has failed test. Proceed to Test A, step 20). If warning light stops blinking, system has passed test. This completes diagnostic sequence. If system passed Self-Test, disconnect ground from pigtail.

11) Review notes and use the following sequence to correct faults: If warning light flashed rapidly for any of the first 3 tests, proceed to Test B, step 1).

12) If warning light stayed on after completion of Test 1,

proceed to Test C, step 1).

13) If warning light stayed on after completion of Test 2, proceed to Test D, step 1).

14) If warning light stayed on after completion of Test 3, proceed to Test E, step 1).

15) If left front solenoid did not cycle during Test 6, proceed to Test E, step 1).

16) If right front solenoid did not cycle during Test 7, proceed to Test D, step 1).

17) If right rear solenoids did not cycle or air did not escape from vent solenoid during Test 8, proceed to Test C, step 1).

18) If left rear solenoids did not cycle or air did not escape from vent solenoid during Test 9, proceed to Test C, step 1).

TEST A

SYSTEM CONTROL TEST

NOTE: See Fig. 13 for Control Module Connector numbers.

1) Check air suspension warning light bulb, and replace if defective. Repeat Self-Test. If bulb is not defective, proceed to step 2). Make a test light out of a No. 194 bulb and 2 leads. Any other bulb will damage system.

2) Check ignition circuit. Turn ignition and air suspension switch off. If warning light is off, proceed to step 3). If warning light stays on, repair short between battery to ignition in circuit No. 687. Turn air suspension switch on. Repeat Self-Test.

3) Check ignition circuit using test light, connect one lead to ignition circuit No. 640 at warning light and other lead to ground. Turn ignition switch to "RUN" position. If test light is on, proceed to step 5). If test light remains off, proceed to step 4).

4) Check fuse in ignition circuit No. 640. If fuse is okay, repair open in circuit No. 640. Repeat Self-Test. If fuse is blown, repair short in ignition circuit No. 640, and replace fuse. If second fuse fails, repeat Self-Test.

5) Check ignition circuit. Using test light, connect one lead to pin No. 7 (circuit No. 687) of control module connector and other lead to ground. Turn ignition switch to "RUN" position. If test light is on, proceed to step 6). If test light is off, repair short in ignition circuit No. 687. Turn air suspension switch on, and repeat Self-Test.

6) Check control module ground circuit (pins No. 1 and 24). Connect one test light lead to pin No. 7 (circuit No. 687) of control module connector. Turn ignition switch to "RUN" position. Connect other test light lead to pin No. 1 (circuit No. 430) of control module connector. Move lead on pin No. 1 of control module connector to pin No. 24 on control module connector. If test light is on, proceed to step 7). If test light does not light, repair open in circuit No. 430 and repeat Self-Test.

7) Check warning light circuit. Using volt/ohmmeter, connect negative test lead to ground and positive lead to pin No. 21 (circuit No. 419) of control module connector. Turn ignition switch to "RUN" position. If voltage is more than 5 volts, proceed to step 8). If voltage is 5 volts or less, repair short in warning light circuit No. 419 from control module connector to warning light connector. Turn air suspension switch on and repeat Self-Test.

8) Check battery voltage. Connect negative lead to pin No. 24 (circuit No. 430) of control module connector and positive lead to pin No. 20 (circuit No. 418) of control module connector. Turn ignition switch to "RUN" position. If voltage is less than 11 volts, check battery or faulty connection. Turn air suspension switch on and

repeat Self-Test. If voltage is more than 11 volts, replace air suspension control module and repeat Self-Test.

9) Check for proper ground at pigtail. If warning light blinks only once, proceed to step 10). If warning light blinks more than once, repeat Self-Test.

10) Check pigtail. Using test light, connect one lead to pin No. 2 (circuit No. 606) of control module connector and other lead to pin No. 7 (circuit No. 687) of control module connector. Turn ignition to "RUN" position. Ground and then unground the diagnostic pigtail. If test light is on, then off, pigtail circuit is good. Proceed to step 9). If test light is off, repair short in circuit No. 606 and repeat Self-Test.

11) Check for system in diagnostic mode. Open and close door. If compressor starts running, proceed to step 17). If compressor is off or already running, proceed to step 12).

12) Check battery circuit. Using test light, connect one lead to circuit No. 418 at control module connector and other lead to ground. If test light illuminates, proceed to step 18). If test light is off, proceed to step 13).

13) Check fuse link in battery circuit No. 175. If fuse link is good, proceed to step 14). If fuse link is blown, replace fuse link and repeat Self-Test.

14) Check that air suspension switch is on and proceed to step 15). If switch is off, turn air suspension switch on and repeat Self-Test.

15) Check battery circuit. Using test light, connect one lead to circuit No. 175 at air suspension switch pin No. 2 and the other lead to ground. If test light is on, proceed to step 16). If test light is off, repair short in battery circuit No. 175 from air suspension switch to battery and repeat Self-Test.

16) Check air suspension switch. Using test light, connect one lead to pin No. 1 (circuit No. 418) of switch (control module side) and other lead to ground. If test light is on, repair short in battery circuit No. 418 from pin No. 1 to battery and repeat Self-Test. If test light is off, replace switch. Repeat Self-Test.

17) Check warning light circuit. Disconnect control module connector. If warning light is on, repair short in ground circuit No. 419 from control module connector to warning light and repeat Self-Test. If warning light is off, proceed to step 18).

18) Check battery voltage. Using volt/ohmmeter, connect negative lead to pin No. 24 (circuit No. 430) of control module connector and positive lead to pin No. 20 (circuit No. 418) of control module connector. If voltage is less than 11 volts, check for low battery or faulty connections at battery and repeat Self-Test. If voltage is more than 11 volts, replace control module. Reconnect connectors and repeat Self-Test.

19) Check door circuit. Using test light, connect one lead to pin No. 19 (circuit No. 24) at control module connector and other lead to ground. Close door. If test light is on, repair short in circuit No. 24 or replace faulty door switch. Repeat Self-Test. If test light is off, open door. If test light comes on, circuit is good. Repeat Self-Test. If test light is off, replace defective door switch or repair open or short circuit No. 24.

20) Check brake circuit. Depress and release brake pedal. If brake lights operate properly, proceed to step 21). If brake lights do not operate properly, repair as necessary and repeat Self-Test.

21) Check compressor circuit. Disconnect compressor relay connector and observe warning light. If light flashes rapidly, flashes test number or stays on, proceed to step 22). If not, proceed to step 18).

22) Check compressor circuit. DO NOT reconnect the compressor relay connector. Using volt/ohmmeter, connect negative lead to ground and positive lead to pin No. 2 (circuit No. 417) on

harness side of connector. Measure resistance. If reading is greater than 1,000 ohms, proceed to step 23). If reading less than 1,000 ohms, repair short to ground on circuit No. 417 and repeat Self-Test.

23) Check compressor current. Disconnect compressor connector and connect a jumper (14 ga. minimum) between compressor connector (compressor side) pin No. 3 and a good ground. Using ammeter, (40 amps minimum) connect negative lead to pin No. 3 and positive lead to positive side of battery. Measure amperage after compressor has run for 10 seconds. Do not allow compressor to run more than 60 seconds. If amperage is greater than 35 amps, replace compressor assembly and repeat Self-Test. If less than 35 amps, proceed to step 24).

24) Check compressor voltage. Perform step 23), except measure battery voltage with compressor running. If more than 11 volts, replace control module. Reconnect connectors and repeat Self-Test. If less than 11 volts, check battery and charge if necessary. Repeat Self-Test.

25) Check brake circuit. Depress and release brake pedal. If brake lights operate properly, proceed to step 26). If brake lights do not operate properly, repair as necessary and repeat Self-Test.

26) Check brake circuit. Using test light, connect one lead to pin No. 15 (circuit No. 511) at control module connector and other lead to ground. Depress brake pedal. If test light is on, replace control module and repeat Self-Test. If light is off, repair short in brake circuit No. 511. and repeat Self-Test.

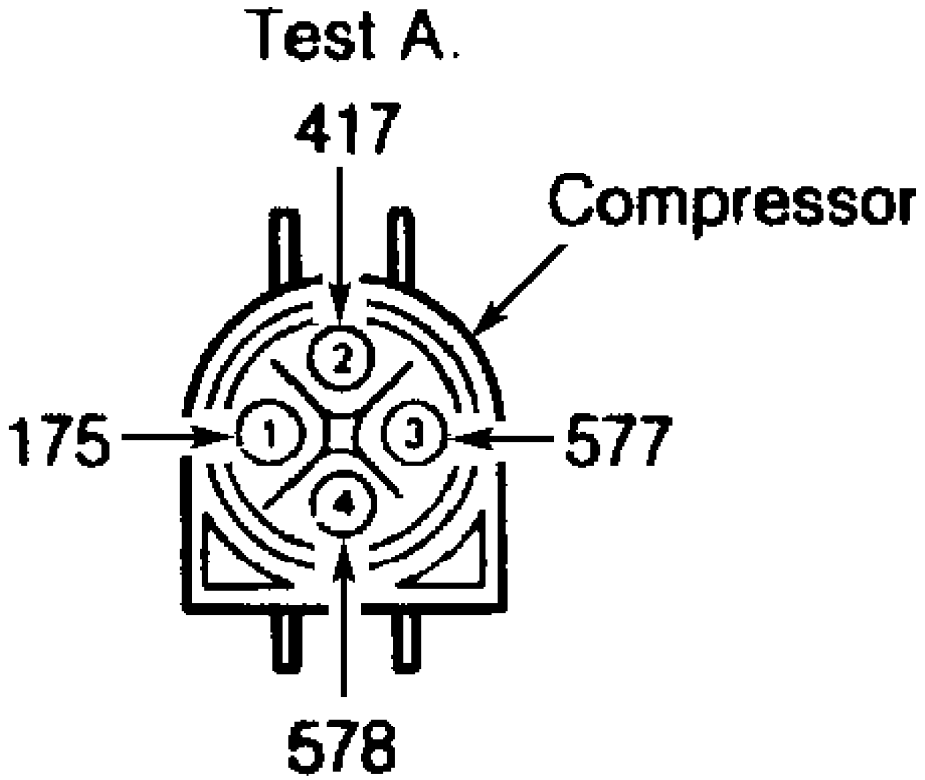

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Fig. 3: Compressor Circuit Numbers

TEST B

SENSOR TESTS

1) If warning light flashed for all 3 tests, proceed to step 2). If not proceed to step 11).

2) Check sensor ground circuit. Using test light, connect one lead to pin No. 1 (circuit No. 432) at left front sensor connector and connect other lead to the positive battery terminal. If test light is on, ground circuit is good. Proceed to step 5). If light is off, proceed to step 3).

3) Check sensor ground circuit. Using test light, connect one lead to pin No. 14 (circuit No. 432) at control module connector (do not disconnect control module) and other lead to pin No. 20. If test light is on, repair open in ground circuit No. 432 and repeat Self-Test. If light is off, proceed to step 4).

4) Disconnect control module connector and check sensor ground pin No. 14, and control module ground pins No. 1 and No. 24 for corrosion or damage. If damage or corrosion is found, repair or clean pins and repeat Self-Test. If pins are good, replace control module and repeat Self-Test.

5) Set volt/ohmmeter to read 3 volts. Connect negative lead to pin No. 14 (circuit No. 432) at control module connector and positive lead to pin No. 4 (circuit No. 431) of control module connector. Turn ignition switch to "RUN" position. If reading is less than one volt and steady, proceed to step 6). If readings are erratic or greater than one volt, but less than 5 volts, repair open in sensor power circuits No. 426 or No. 431, between control module and sensors. Repeat Self-Test. If reading is more than 5 volts, replace control module and repeat Self-Test.

6) Check left front sensor. Disconnect harness at left front sensor and read volt/ohmmeter. If reading is less than one volt and steady, sensor is good. Proceed to step 7). If reading erratic or more than one volt, replace left front sensor and repeat Self-Test.

7) Check right front sensor. Do not reconnect left front sensor. Disconnect harness at right front sensor and read volt/ohmmeter. If reading is less than one volt and steady, sensor is good. Proceed to step 8). If reading is erratic or more than one volt, replace sensor and repeat Self-Test.

8) Check rear sensor. Do not reconnect left or right front sensor. Disconnect harness at rear sensor and read volt/ohmmeter. If reading is less than one volt and steady, sensor is good. Proceed to step 9). If reading is erratic or more than one volt, replace sensor. Reconnect all sensors (except rear) and repeat Self-Test.

9) Check sensor power circuit. Do not reconnect rear sensor. Disconnect control module. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) of control module connector and positive lead to pin No. 3 (circuit No.426) at control module connector. Measure resistance. If more than 1,000 ohms, proceed to step 10). If less than 1,000 ohms, repair short in circuit No. 426. Reconnect all sensors and control module and repeat Self-Test.

10) Check sensor power circuit. Move positive lead to pin No. 4 (circuit No. 431) at control module connector and measure resistance. If more than 1,000 ohms, replace control module and repeat Self-Test. If less than 1,000 ohms, repair short to ground in circuit No. 431. Reconnect all sensors and control module and repeat Self-Test.

11) If warning light flashed rapidly on Test 1 proceed to step 12). If not, proceed to step 23).

12) Check sensor ground circuit. Turn air suspension switch off. Using volt/ohmmeter, connect positive lead to pin No. 1 (circuit No. 432) at rear sensor. Connect negative lead to ground. Measure resistance. If more than 5 ohms, repair open in circuit No. 432 between control module connector and rear sensor and repeat

Self-Test. If less than 5 ohms, proceed to step 13).

13) Check sensor power circuit. Turn air suspension switch on. Using volt/ohmmeter, connect negative test lead to pin No. 1 (circuit No. 432) at rear sensor connector and positive lead to pin No. 2 (circuit No. 426). Turn ignition switch to "RUN" position and read voltage. If less than one volt and steady, repair open in circuit No. 426 from sensor to control module and repeat Self-Test. If voltage is more than one volt or erratic, power circuit is good. Proceed to step 14).

14) Check rear sensor A circuit. Move positive lead to pin No. 4 (circuit No. 427) at rear sensor connector and read voltage. If more than 1.5 volts, rear sensor circuit is good. Proceed to step 18). If less than 1.5 volts, proceed to step 15).

15) Check rear sensor. Disconnect rear sensor connector and read voltage. If more than 1.5 volts, replace rear sensor and repeat Self-Test. If less than 1.5 volts, proceed to step 16).

16) Check rear sensor A circuit. Do not connect rear sensor. Using a volt/ohmmeter, connect negative lead to pin No. 14 (circuit No. 432) and positive lead to pin No. 13 (circuit No. 427). Read voltage. If more than 1.5 volts, repair open in circuit No. 427 between control module and sensor. Connect sensor lead and repeat Self-Test. If less than 1.5 volts, proceed to step 17).

17) Check rear sensor A circuit. Disconnect control module. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) at control module connector and positive lead to pin No. 13 (circuit No. 427). Read resistance. If more than 1,000 ohms, replace control module unit. Connect rear sensor and repeat Self-Test. If less than 1,000 ohms, repair short to ground on circuit No. 427, between control module and rear sensor. Connect rear sensor and repeat Self-Test.

18) Check rear sensor B circuit. Move positive lead to pin No. 3 (circuit No. 428) at rear sensor connector and read voltage. If more than 1.5 volts, rear sensor circuit is good. Proceed to step 19). If less than 1.5 volts, proceed to step 20).

19) Check control module for damage. Repeat Self-Test, step 1). If warning light flashes rapidly, replace control module and repeat Self-Test, step 1). If warning light is not flashing rapidly, repeat Self-Test.

20) Check rear sensor. Disconnect rear sensor and read voltage. If more than 1.5 volts, replace rear sensor and repeat Self-Test. If less than 1.5 volts, rear sensor is good. Proceed to step 21).

21) Check rear sensor B circuit. Do not connect rear sensor. Connect negative lead to pin No. 14 (circuit No. 432) at control module connector and positive lead to pin No. 18 (circuit No. 428) at module connector. Read voltage. If more than 1.5 volts, repair short in circuit No. 428 between control module and sensor. Connect rear sensor and repeat Self-Test. If less than 1.5 volts, proceed to step 22).

22) Check rear sensor B circuit. Disconnect control module connector. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) and positive lead to pin No. 18 (circuit No. 428). Read resistance. If more than 1,000 ohms, replace control module. Connect rear sensor and repeat Self-Test. If less 1,000 ohms, repair short in circuit No. 428 between control module and rear sensor. Connect control module and repeat Self-Test.

23) If warning light flashed rapidly during Self-Test, step 2), proceed to step 24). If not, proceed to step 35).

24) Check sensor ground circuit. Using test light, connect one lead to pin No. 1 (circuit No. 432) at right front sensor and other lead to positive side of battery. If test light is on, sensor ground circuit is good. Proceed to step 25). If test light is off, repair short in circuit No. 432 between control module and right

front sensor. Connect sensor and repeat Self-Test.

25) Check sensor power circuit. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 432) at right front sensor connector and positive lead to pin No. 2 (circuit No. 431) at right front sensor. Turn ignition switch to "RUN" position and read voltage. If less than one volt and steady, repair short in circuit No. 431 from right front sensor to control module. Connect sensor and repeat Self-Test. If voltage is more than one volt and erratic, sensor power is good. Proceed to step 26).

26) Check right front sensor A circuit. Move positive lead to pin No. 4 (circuit No. 424) at right front sensor and read voltage. If more than 1.5 volts, right front sensor is good. Proceed to step 30). If less than 1.5 volts, proceed to step 27).

27) Check right front sensor. Disconnect right front sensor and read voltage. If more than 1.5 volts, replace right front sensor and repeat Self-Test. If less than 1.5 volts, right front sensor is good. Proceed to step 28).

28) Check right front sensor A circuit. Do not connect right front sensor. Using volt/ohmmeter, connect negative lead to pin No. 14 (circuit No. 432) at control module connector and positive lead to pin No. 5 (circuit 424) at module connector. Read voltage. If more than 1.5 volts, repair short in sensor circuit No. 424 between control module and sensor. Connect sensor and repeat Self-Test. If less than 1.5 volts, proceed to step 29).

29) Check right front sensor A circuit. Do not connect control module. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) at control module connector and positive lead to pin No. 5 (circuit No. 424) at control module connector. Read resistance. If more than 1,000 ohms, replace control module. Connect right front sensor and repeat Self-Test. If less than 1,000 ohms, repair short in circuit No. 424 between control module and right front sensor. Connect sensor and repeat Self-Test.

30) Check right front sensor B circuit. Move positive lead to right front sensor connector pin No. 3 (circuit No. 425) at right front sensor connector and read voltage. If more than 1.5 volts, replace right front sensor and proceed to step 31). If less than 1.5 volts, proceed to step 32).

31) Check control module for damage. Repeat Self-Test, step 2). If warning light flashes rapidly during test, replace control module. If warning light is not flashing rapidly, repeat Self-Test.

32) Check right front sensor. Disconnect right front sensor and read voltage. If more than 1.5 volts, replace sensor and repeat Self-Test. If less than 1.5 volts, proceed to step 33).

33) Check right front sensor B circuit. Do not connect right front sensor. Using volt/ohmmeter, connect negative lead to pin No. 14 (circuit No. 432) at control module connector and positive lead to pin No. 16 (circuit No. 425) at control module connector. Read voltage. If more than 1.5 volts, repair short in sensor B circuit No. 425 between control module and sensor. Connect sensor and repeat Self-Test. If less than 1.5 volts, proceed to step 34).

34) Check right front sensor B circuit. Disconnect control module. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) at control module connector and positive lead to pin No. 16 (circuit No. 425). Read resistance. If more than 1,000 ohms, replace control module. Reconnect sensor and repeat Self-Test. If less than 1,000 ohms, repair short in circuit No. 425 between control module and right front sensor. Repeat Self-Test.

35) Check sensor ground circuit. Using test light, connect one lead to pin No. 1 (circuit No. 432) at left front sensor and other lead to positive battery terminal. If test light is on, sensor ground is good. Proceed to step 36). If test light is off, repair short in circuit No. 432 between control module and left front sensor. Connect sensor and repeat Self-Test.

36) Check sensor power circuit. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 432) at left front sensor connector and positive lead to pin No. 2 (circuit No. 431) at left front sensor. Turn ignition switch to "RUN" position and read voltage. If voltage is less than one volt, repair short in circuit No. 431 from left front sensor and control module. Connect sensor and repeat Self-Test. If voltage is more than one volt, sensor circuit is good. Proceed to step 37).

37) Check left front sensor A circuit. Move positive lead to pin No. 4 (circuit No. 422) at left front sensor connector and read voltage. If more than 1.5 volts or erratic, left front sensor is good. Proceed to step 41). If less than 1.5 volts, proceed to step 38).

38) Check left front sensor. Disconnect left front sensor connector and read voltage. If more 1.5 volts, replace sensor. If less than 1.5 volts, proceed to step 39).

39) Check left front sensor A circuit. Do not connect left front sensor. Using volt/ohmmeter, connect negative lead to pin No. 14 (circuit No. 432) at control module connector and positive lead to pin No. 6 (circuit No. 422) at control module connector. Read voltage. If more than 1.5 volts, repair short in circuit No. 422 between control module and sensor. Connect sensor and repeat Self-Test. If voltage is less than 1.5 volts, proceed to step 40).

40) Check left front sensor A circuit. Disconnect control module. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) at control module connector and positive lead to Pin No. 6 (circuit No. 422) at control module connector. Read resistance. If more than 1,000 ohms, replace control module. Connect left sensor and repeat Self-Test. If less than 1,000 ohms, repair short in circuit No. 422 between control module and left sensor. Connect left front sensor and repeat Self-Test.

41) Check left front sensor B circuit. Move positive lead to pin No. 3 (circuit No. 423) at left front sensor connector and read voltage. If more than 1.5 volts, replace sensor and proceed to step 42). If less than 1.5 volts, proceed to step 43).

42) Check control module for damage. Rerun Self-Test, step 3). If warning light flashes rapidly during test 3, replace control module. If warning light is not flashing rapidly during test 3, repeat Self-Test.

43) Check left front sensor. Disconnect left front sensor connector. Using volt/ohmmeter, check voltage. If more than 1.5 volts or erratic, install new sensor and repeat Self-Test. If less than 1.5 volts, left front sensor is good. Proceed to step 44).

44) Check left front sensor B circuit. Do not connect left front sensor. Using volt/ohmmeter, connect negative lead to pin No. 14 (circuit No. 432) at control module connector and positive lead to pin No. 17 (circuit No. 423). Read voltage. If more than 1.5 volts, repair short in circuit No. 423 between control module and sensor. Connect sensor and repeat Self-Test. If less than 1.5 volts, sensor is good. Proceed to step 45).

45) Check left front sensor B circuit. Disconnect control module. Using volt/ohmmeter, connect negative lead to pin No. 1 (circuit No. 430) at control module connector and positive lead to pin No. 17 (circuit No. 423) at control module connector. Read resistance. If more than 1,000 ohms, replace control module. Connect sensor and repeat Self-Test. If less than 1,000 ohms, repair short in circuit No. 423 between control module and sensor. Connect sensor and repeat Self-Test.

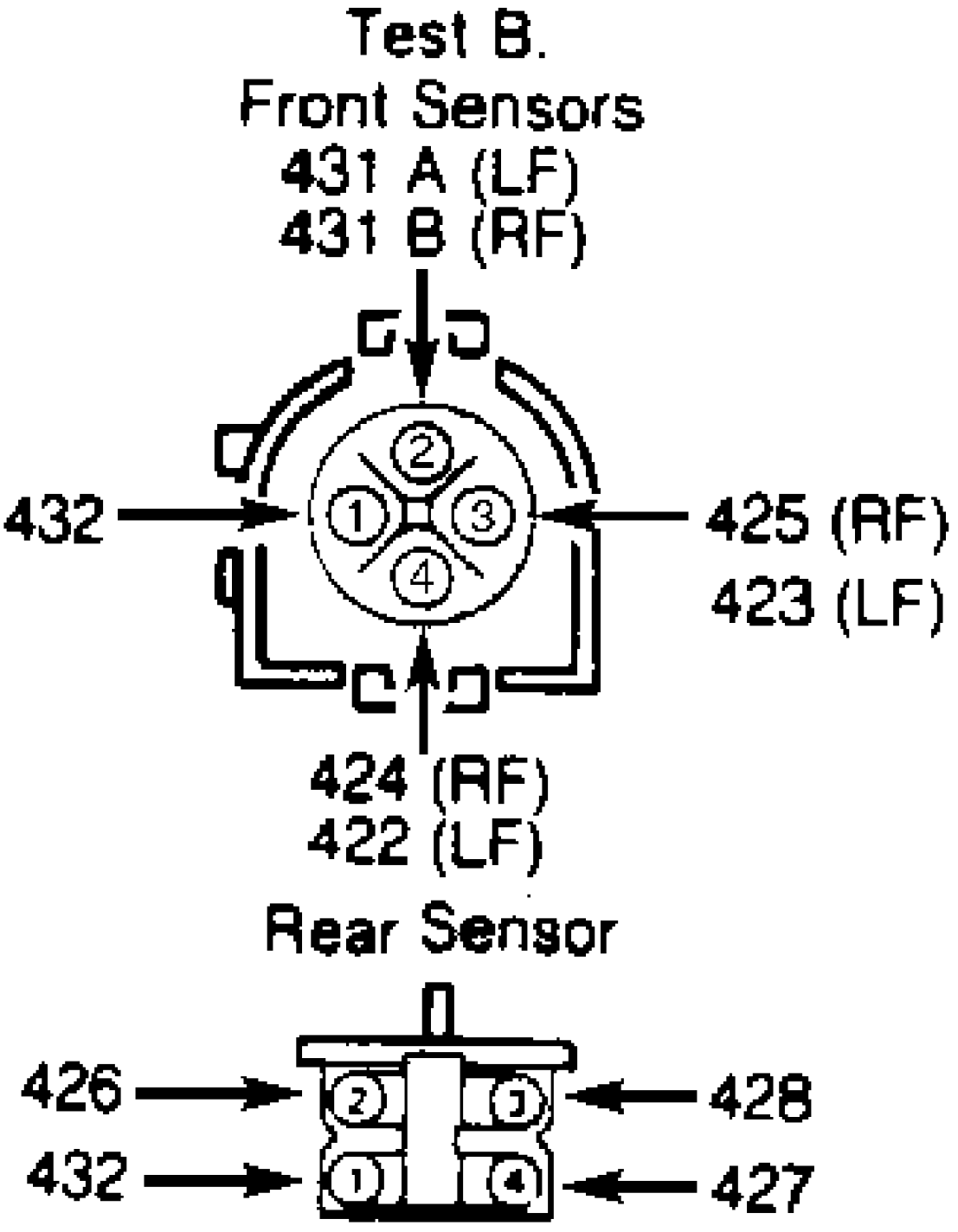

Fig. 4: Height Sensor Circuit Numbers

TEST C

REAR SUSPENSION TEST

NOTE: See Fig. 13 for control module connector numbers.

1) If compressor did not cycle during Self-Test No. 4, proceed to Test F, step 1). If compressor did cycle, proceed to step 2).

2) If right rear solenoid did not cycle during test No. 8, proceed to step 12). If right rear solenoid did cycle, proceed to step 3).

3) If left front solenoid did not cycle during test No. 9, proceed to step 23). If left front solenoid did cycle, proceed to step 4) .

4) If vent solenoid did not cycle during test No. 5, proceed to Test G, step 5) 1). If vent solenoid did cycle, proceed to step 5).

5) Check compressor. Perform Self-Test steps 2) and 3). Disconnect all air lines at compressor. Plug 3 of the 4 air line fittings at compressor. Using a 0-150 psi (0-70 kg/cm^2) pressure gauge, connect gauge to remaining open fitting on air compressor. Open and close door and observe pressure gauge. If pressure is more than 120 psi (70 kg/cm^2), compressor is good. Proceed to step 6). If pressure is less than 120 psi (70 kg/cm^2), replace compressor. Connect all air lines and repeat Self-Test.

6) Check rear sensor connection. Check rear sensor, ball studs and bracket for secure mechanical connection. If all fittings are tight, proceed to step 7). If all fittings are not tight, tighten as necessary and repeat Self-Test.

7) Check rear air system. Disconnect air lines going to rear suspension at compressor. Repeat Self-Test steps 2) and 3). Open and close door and verify that air is escaping from air lines. If air is escaping from both air lines, proceed to step 8). If air is not escaping from one rear air line, proceed to step 10). If air is not escaping from either air line because of no air in air springs, proceed to step 8).

8) If vehicle failed Self-Test steps 2) and 3), proceed to step 9). If vehicle passed both tests, locate and repair air leaks in either spring or solenoid assembly.

9) If rear of vehicle is at rebound (high), replace compressor assembly and repeat Self-Test. If vehicle is not at rebound, check all air lines and fittings. Repair air leaks and repeat Self-Test.

10) Check for air restrictions at rear air spring solenoids. Connect air lines at compressor and remove air line from suspected rear solenoid. Perform Self-Test steps 2) and 3). If air is not escaping from rear solenoid air line, proceed to step 11). If air is escaping from solenoid, repair leak and repeat Self-Test.

11) Check suspected air spring solenoid. If there are no air leaks, replace solenoid. If leaks are found, repair or replace as necessary and repeat Self-Test.

12) Cycle right rear solenoid. Perform Self-Test steps 2) and 3). Open and close door until warning light blinks Test No. 8, then proceed to step 13).

13) Check right rear solenoid circuit. Using test light, connect one lead to solenoid circuit No. 416 at right rear solenoid connector and other lead to battery circuit No. 175 at right rear solenoid connector. If test light is blinking, replace right rear solenoid and repeat Self-Test. If test light is on, proceed to step 21). If test light is off, proceed to step 14).

14) Check connector polarity. Move test lead to pin No. 2 at right rear solenoid connector. Connect other test lead to ground. If test light is on, proceed to step 17). If test light is off, proceed to step 15).

15) Check connector polarity. Connect test lead to pin No. 1

on right rear solenoid connector. Connect other lead to ground, if light is off, proceed to step 17). If light is on, repair crossed wires in solenoid connector and proceed to step 16).

16) Check battery circuit. Move test lead connected to circuit No. 416 at right rear solenoid to ground. If test light is on battery circuit is good. Proceed to step 17). If light is off, repair short in circuit No. 175 between right rear solenoid and fuse link, repeat Self-Test.

17) Check control module. Using test light, connect one lead to pin No. 10 (circuit No. 416) at control module connector and other lead to pin No. 20 (circuit No. 418) at control module connector. Do not disconnect control module connector. If test light is blinking, repair short in circuit No. 416 between control module and right rear solenoid. Repeat Self-Test. If test light is off, proceed to step 18).

18) If warning light is blinking Test No. 8, proceed to step 19). If light is off, proceed to step 12).

19) Check control module connector pins. Disconnect control module connector and inspect pins. If pins are good. Proceed to step 20). If pins are bad, repair and repeat Self-Test.

20) Check right rear solenoid. Using volt/ohmmeter, connect negative lead to pin No. 1 at right rear solenoid connector and positive lead to pin No. 2 of right rear solenoid connector. Read resistance. If more than 13 ohms, replace control module unit and repeat Self-Test. If less than 13 ohms, replace solenoid and control module unit. Repeat Self-Test.

21) If warning light is blinking Test No. 8, proceed to step 22). If not, proceed to step 12).

22) Check right rear solenoid circuit. Disconnect control module connector. If test light is on, repair short in circuit No. 416 between control module and solenoid. Repeat Self-Test. If test light is off, replace control module and repeat Self-Test.

23) Cycle left rear solenoid. Perform Self-Test steps 2) and 3). Open and close door until warning light blinks Test No. 9, proceed to step 24).

24) Check left rear solenoid circuit. Using test light, connect one lead to circuit No. 429 at left rear solenoid connector and other lead to battery circuit No. 175 at left rear solenoid connector. If test light is blinking, replace solenoid and repeat Self-Test. If test light is off, proceed to step 25). If test light is on, proceed to step 32).

25) Check connector polarity. Connect test lead to connector pin No. 2 at left rear solenoid. Connect other lead to ground. If test light is on, proceed to step 28). If test light is off, proceed to step 26).

26) Check connector polarity. Connect test lead to pin No. 1 at left rear solenoid. Connect other lead to ground. If test light is off, proceed to step 28). If test light is on, repair crossed wires in solenoid connector and proceed to step 27).

27) Check battery circuit. Move test lead connected to circuit No. 429 to ground. If test light is on, battery circuit is good. Proceed to step 28). If test light is off, repair short in circuit No. 418 between air suspension switch and right rear solenoid. Repeat Self-Test.

28) Check control module unit. Using test light, connect one lead to pin No. 9 (circuit No. 429) at control module connector and other lead to pin No. 20 (circuit No. 418). Do not disconnect control module connector. If test light is blinking, repair short in circuit No. 429 between control module and left rear solenoid. Repeat Self-Test. If test light is off, proceed to step 29).

29) If warning light is blinking Test No. 9, proceed to step 30). If warning light is off, proceed to step 23).

30) Check control module connector pins. If pins are good,

proceed to step 31). If pins are bad, repair as necessary and repeat Self-Test.

31) Check left rear solenoid. Using volt/ohmmeter, connect negative lead to pin No. 1 at left rear solenoid connector. Connect positive lead to pin No. 2 at left rear solenoid connector. Read resistance. If more than 13 ohms, replace control module unit and repeat Self-Test. If less than 13 ohms, replace solenoid and control module unit. Repeat Self-Test.

32) If warning light is blinking Test No. 9, proceed to step 33). If warning light is off, proceed to step 23).

33) Check left rear solenoid circuit. Disconnect control module connector. If test light is on, repair short to circuit No. 429 between control module connector and left rear solenoid. Repeat Self-Test. If light is off, replace control module and repeat Self-Test.

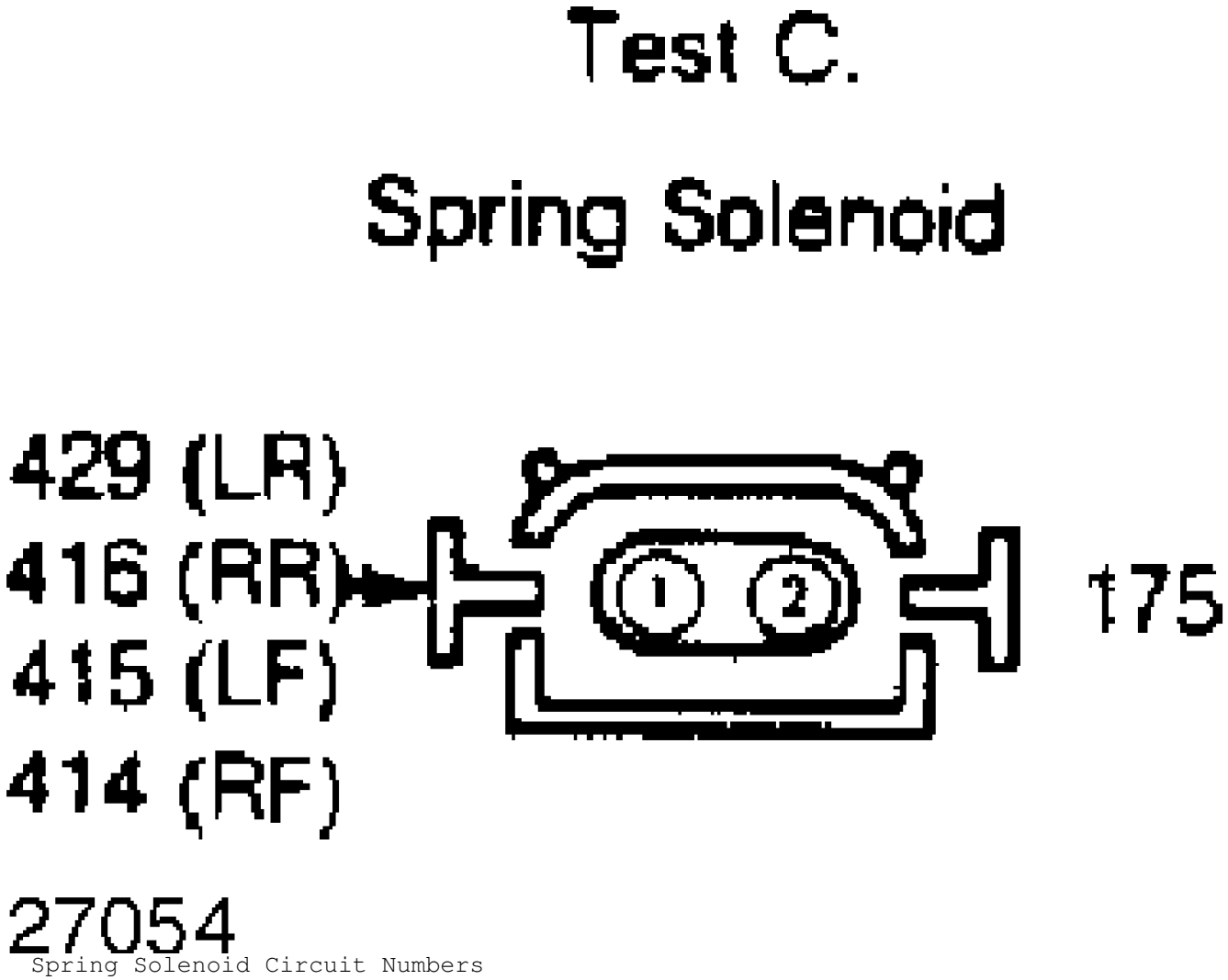

Fig. 5: Spring Solenoid Circuit Numbers

TEST D

RIGHT FRONT

NOTE: See Fig. 13 for control module connector numbers.

1) If vehicle passed Self-Test step 1), proceed to step 2). If not, proceed to Test C, step 1).

2) If right front solenoid passed Self-Test No. 7, proceed to step 3). If system did not pass, proceed to step 4). If system passes air but did not click, proceed to step 16).

3) Check right front sensor. Check sensor and ball studs for a tight mechanical connection. If connections are tight, proceed to step 6). If loose, tighten and repeat Self-Test.

4) Check right front solenoid circuit. Perform Self-Test steps 2) and 3). Open and close door until warning light blinks Test No. 7. Using test light, connect one lead to circuit No. 414 at solenoid connector and other lead to battery circuit No. 175 at solenoid connector. If test light blinks, system is good. Proceed to step 5). If test light is off, proceed to step 7). If test light is on, proceed to step 14).

5) Check for restriction in right front air line. Perform Self-Test steps 2) and 3). Right front of vehicle will drop during this test. Disconnect air lines at air spring solenoid. Open and close door twice and verify that air is escaping from spring solenoid line. If air is escaping, repair air line as necessary and repeat Self-Test. If air is not escaping, proceed to step 6).

6) Check for solenoid or air spring leaks. Connect air lines and perform Self-Test steps 2) and 3). Open and close door twice and verify that air is not leaking from air spring or solenoid. If air is not leaking, repair or replace air spring solenoid due to obstruction. If air is leaking, repair or replace leaky spring or solenoid. Repeat Self-Test.

7) Check connector polarity. Connect test light to right front solenoid connector pin No. 2 and ground. If test light is on, proceed to step 10). If test light is off, proceed to step 8).

8) Connect test light to the solenoid connector pin No. 1 and ground. If test light is off, proceed to step 10). If test light is on, repair crossed wires in solenoid connector and proceed to step 9).

9) Check battery circuit. Move test lead from solenoid circuit No. 414 to ground. If test light is on, battery circuit is good. Proceed to step 10). If test light is off, repair short in battery circuit No. 175 between battery and solenoid. Repeat Self-Test.

10) Check control module unit. Using test light, connect one lead to pin No. 12 at control module connector and other lead to pin No. 20. Do not disconnect control module connector. If test light is blinking, repair short in circuit No. 414 between control module and right front solenoid. Repeat Self-Test. If test light is off, proceed to step 11).

11) If warning light is blinking Test No. 7, proceed to step 12). If test light is not blinking, proceed to step 4).

12) Check control module unit. Disconnect control module connector and inspect pins. If pins are good, proceed to step 13). If pins are bad, repair as necessary and repeat Self-Test.

13) Check right front solenoid. Disconnect solenoid connector. Using volt/ohmmeter, connect negative test lead to pin No. 1 at solenoid connector and positive test lead to pin No. 2. Read resistance. If more than 13 ohms, replace control module unit and repeat Self-Test. If less than 13 ohms, replace solenoid and control module unit and repeat Self-Test.

14) If warning light is blinking, proceed to step 15). If warning light is not blinking, proceed to step 4).

15) Disconnect control module connector, leaving test light connected between circuits No. 414 and No. 175. If test light is on, repair short to ground in circuit No. 414 between control module connector and right front solenoid and repeat Self-Test. If test

light is off, replace control module unit and repeat Self-Test.

16) Disconnect right front solenoid connector. Connect one test light lead to circuit No. 414 on harness side of connector. Connect other lead to battery circuit No. 175 on harness side of connector. If test light is on, repair short to ground in circuit No. 414 between control module connector and solenoid. Repeat Self-Test. If solenoid is off, replace solenoid. Repeat Self-Test.

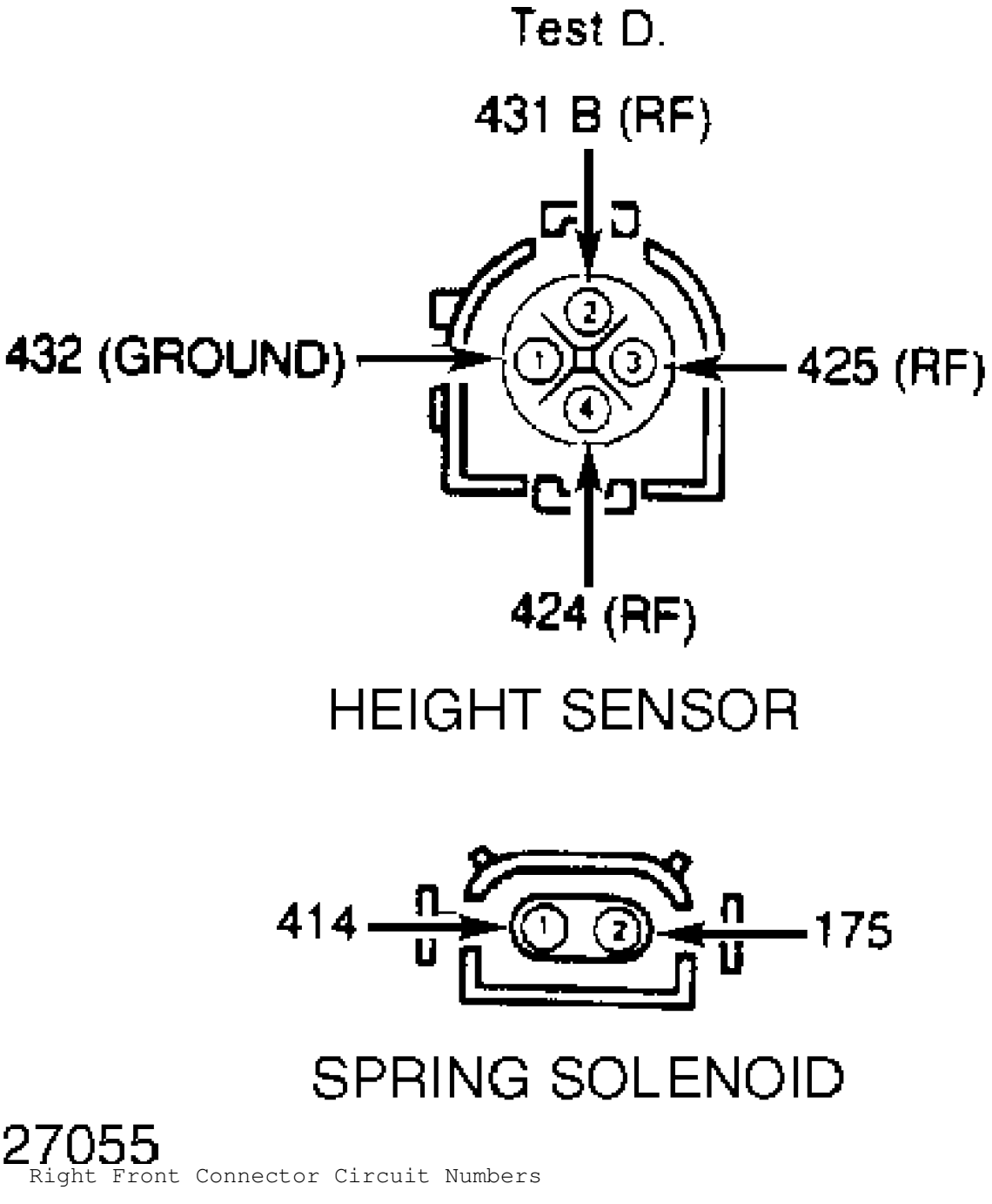

Fig. 6: Right Front Connector Circuit Numbers

TEST E

LEFT FRONT

NOTE: See Fig. 13 for control module connector numbers.

1) If vehicle passed Self-Test step 1), proceed to step 2). If vehicle did not pass test, proceed to Test C, step 1).

2) If left front solenoid passed Self-Test step 6), proceed to step 3). If solenoid did not pass air, proceed to step 4). If solenoid passes air but does not click, proceed to step 16).

3) Check left front sensor. Check sensor and ball stud for tight mechanical connection. If loose, tighten sensor and repeat Self-Test. If sensor is good, proceed to step 6).

4) Check left front solenoid circuit. Perform Self-Test steps 2) and 3). Open and close door until warning light blinks Test No. 6. Using test light, connect one lead to solenoid circuit No. 415 at left front solenoid connector and other lead to battery circuit No. 175 at left front solenoid connector. If test light is blinking, system is good. Proceed to step 5). If test light is off, proceed to step 7). If test light is on, proceed to step 14).

5) Check for restrictions in left front air line. Perform Self-Test steps 2) and 3). Left front of vehicle will drop during this test. Disconnect air lines at left front air spring solenoid. Open and close door 3 times and verify that air is escaping spring solenoid. If air is escaping from solenoid, repair air lines as necessary. Reconnect air lines and repeat Self-Test. If air is not escaping, proceed to step 6).

6) Check for solenoid or air spring leaks. Connect air lines. Perform Self-Test steps 2) and 3). Open and close door 3 times and verify that air is not leaking from left front spring or solenoid. If air is not leaking, repair or replace air spring solenoid due to obstruction. Repeat Self-Test. If air is leaking, repair or replace air spring or solenoid and repeat Self-Test.

7) Check for connector polarity, connect test light lead to pin No. 2 at left front solenoid connector. Connect other test lead to ground. If test light is on, proceed to step 10). If test light is off, proceed to step 8).

8) Check for connector polarity. Connect test light lead to right front solenoid connector pin No. 1. Connect other test lead to ground. If test light is off, proceed to step 10). If test light is on, repair or service crossed wires at solenoid connector and proceed to step 9).

9) Check battery circuit. Move test lead from circuit No. 415 to ground. If test light is on, battery circuit is good. Proceed to step 10). If light is off, repair short in circuit No. 175 between the control module and solenoid. Repeat Self-Test.

10) Check control module. Do not disconnect control module connector. Using test light, connect one lead to pin No. 11 (circuit No. 415) at control module connector and the other lead to circuit pin No. 20 (circuit No. 418). If test light is blinking, repair short in circuit No. 415 between control module and left front solenoid. Repeat Self-Test. If test light is off, proceed to step 11).

11) If warning light is blinking Test No. 6, proceed to step 12). If warning light is not blinking, proceed to step 4).

12) Check control module connector. Disconnect control module connector and inspect pins. If pins are good, proceed to step 13). If pins are bad, repair as necessary and repeat Self-Test.

13) Check left front solenoid. Disconnect left front solenoid connector. Using a volt/ohmmeter, connect negative lead to pin No. 1 at left front solenoid connector and positive lead to pin No. 2 at left front solenoid connector. Read resistance. If more than 13 ohms, replace control module and repeat Self-Test. If less than 13 ohms, replace left front solenoid and control module. Repeat Self-Test.

14) If warning light is blinking Test No. 6, proceed to step 15). If warning light is not blinking, proceed to step 4).

15) Disconnect control module connector and leave test light connected to circuits No. 415 and No. 175. If test light is on, repair short in circuit No. 415 between control module connector and left front solenoid. Repeat Self-Test. If test light is off, replace control module and repeat Self-Test.

16) Disconnect left front solenoid connector. Using test light, connect one lead to circuit No. 415 on harness side of connector and connect other lead to circuit No. 175 on harness side. If test light is on, repair short to ground in circuit No. 415 and repeat Self-Test. If test light is off, replace solenoid and repeat Self-Test.

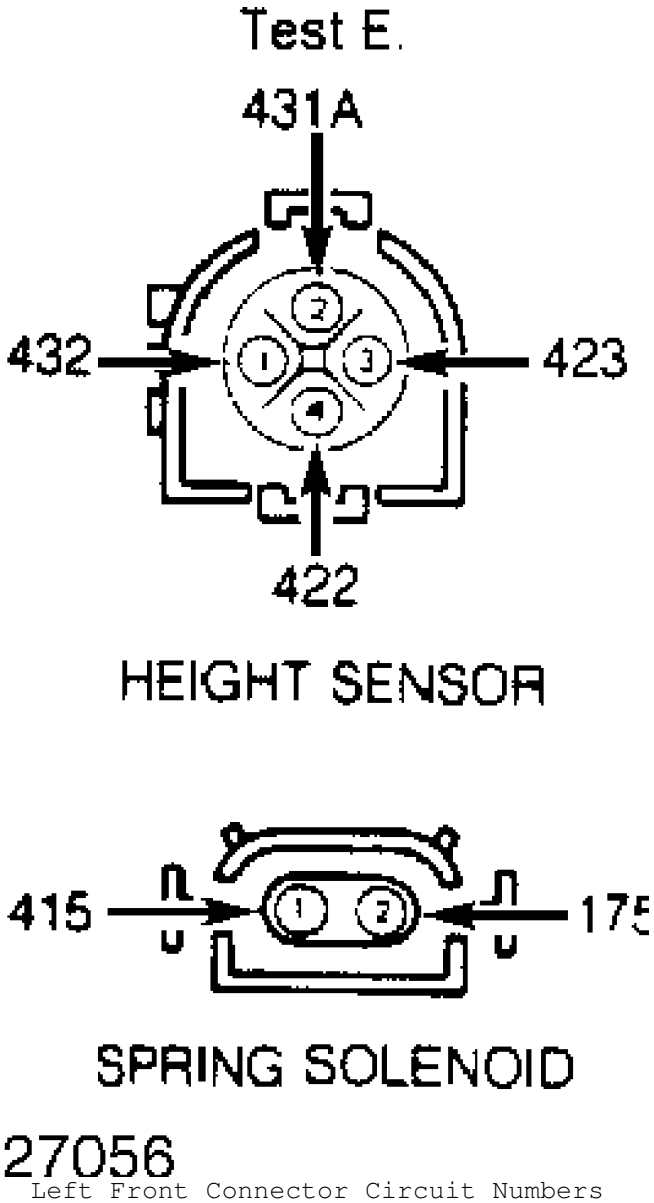

Fig. 7: Left Front Connector Circuit Numbers

TEST F

AIR SPRING FILL

NOTE: See Fig. 13 for control module connector numbers.

1) Check compressor relay. Perform Self-Test steps 2) and 3). Open and close door until warning light blinks Test No. 4. Rear of vehicle may raise during this test. Compressor will cycle 50 times or about 3 minutes then shut off and will not restart until Test No. 4 is reentered. If relay is cycling, proceed to step 2). If relay is not cycling, proceed to step 5).

2) Check compressor circuit. Disconnect compressor connector. Using test light, connect one lead to circuit No. 417 at harness side of compressor connector and connect other lead to ground. If test light is blinking, compressor circuit is good. Proceed to step 3). If test light is on, replace compressor relay and repeat Self-Test. If test light is off, proceed to step 4).

3) Check compressor ground circuit. Move ground lead of test light to circuit No. 430 at harness side of compressor connector. If light is blinking, install new compressor and repeat Self-Test. If test light is off, repair short in circuit No. 430 between compressor and battery. Repeat Self-Test.

4) Check compressor circuit. Reconnect compressor connector and repeat step 1). Using test light, connect one lead to circuit No. 417 at compressor relay. Connect other lead to ground. If test light is blinking, repair short to ground in circuit No. 417 between compressor and compressor relay. Repeat Self-Test. If test light is off, replace compressor relay and repeat Self-Test.

5) Check compressor relay circuit. Using test light, connect one lead to compressor relay circuit No. 420 at relay and connect other lead to positive side of battery. If test light blinks, module relay circuit is good. Proceed to step 6). If test light is on, proceed to step 8). If test light is off, proceed to step 9).

6) Check jumper circuit. Using test light, connect one lead of jumper to pin No. 2 (circuit No. 175A) at compressor relay. Connect other lead to ground. If test light is on, replace compressor relay and repeat Self-Test. If test light is off, proceed to step 7).

7) Check battery circuit. Using test light, connect one lead to pin No. 3 (circuit No. 175) at compressor relay and other lead to ground. If test light is on, repair short in circuit No. 175A and repeat Self-Test. If test light is off, repair short in circuit No. 175 between relay and battery. Repeat Self-Test.

8) Check control module unit. Disconnect control module connector. If test light is on, repair short to ground in circuit No. 420 at compressor relay. Repeat Self-Test. If test light is off, replace control module unit and repeat Self-Test.

9) Check compressor relay. Disconnect compressor relay. Using volt/ohmmeter, connect negative lead to pin No. 2 at compressor relay connector. Connect other lead to pin No. 1 at compressor relay connector. Read resistance. If more than 54 ohms, compressor relay is good. Proceed to step 10). If less than 54 ohms, replace compressor relay and repeat Self-Test.

10) Check control module. Perform step 1). Do not disconnect control module connector. Using test light, connect one lead to pin No. 22 (circuit No. 420) at control module connector and the other lead to pin No. 20 (circuit No. 418). If test light is blinking, repair short in circuit No. 420 between compressor relay and control module. Repeat Self-Test. If test light is off, replace control module unit. Repeat Self-Test.

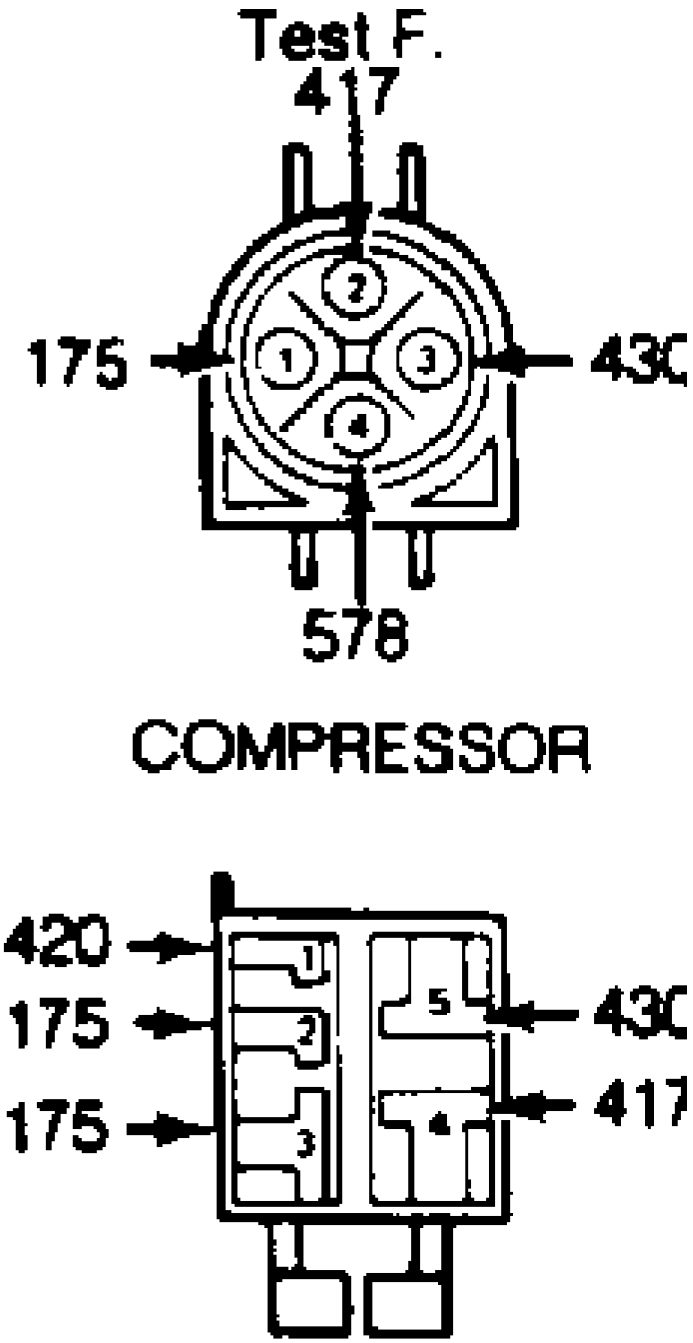

Fig. 8: Compressor & Relay Circuit Numbers

TEST G

VENT SYSTEM

NOTE: See Fig. 13 for control module connector numbers.

1) Check vent solenoid circuit. Perform Self-Test steps 2) and 3). Open and close door until warning light blinks Test No. 5. Disconnect air compressor connector. Using test light, connect one lead to pin No. 4 (circuit No. 578) at harness side of connector. Connect other lead to pin No. 1 (circuit No. 175) at harness side of connector. If test light blinks, replace compressor assembly and repeat Self-Test. If test light is off, proceed to step 3). If test light is on, proceed to step 2).

2) Check control module. Disconnect control module connector. If test light is on, repair short in vent solenoid circuit No. 421 between compressor and control module. Repeat Self-Test. If test light is off, replace control module and repeat Self-Test.

3) Check battery circuit. Move test light lead at vent solenoid circuit No. 578 to ground. If test light is on, battery circuit is good. Proceed to step 4). If test light is off, repair short in circuit No. 175 between vent solenoid and battery. Repeat Self-Test.

4) Check control module. Do not disconnect control module connector. Using test light, connect one lead to pin No. 23 (circuit No. 421) at control module connector and other lead to pin No. 20 (circuit No. 418). If test light is blinking, repair short in circuit No. 421 between control module and compressor relay. If test light is off, proceed to step 5).

5) Check warning light. If warning light blinks Test No. 5, proceed to step 6). If warning light did not blink Test No. 5, proceed to step 1).

6) Check vent solenoid. Disconnect connector at compressor. Using volt/ohmmeter, connect negative lead to pin No. 4 at compressor assembly and positive lead to pin No. 1 at compressor assembly. Read resistance. If more than 27 ohms, replace control module and repeat Self-Test. If less than 27 ohms, replace compressor unit and control module. Repeat Self-Test.

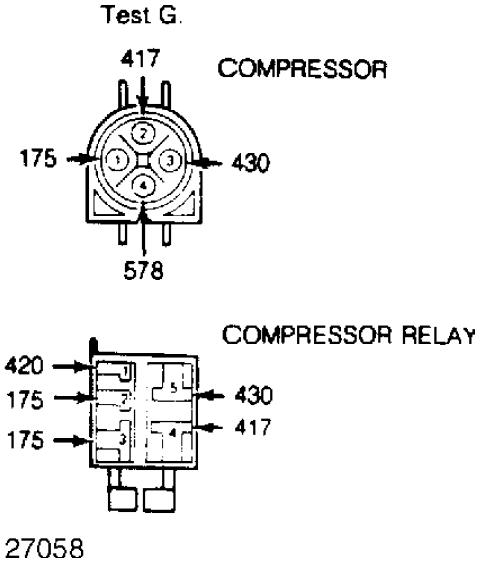

Fig. 9: Compressor & Relay Circuit Numbers

REMOVAL & INSTALLATION

BALL JOINTS

Ball joints and lower suspension arm bushings are not serviced separately and must be replaced as an assembly.

STABILIZER BAR BUSHING & INSULATORS

Removal (Front & Rear)

Turn air suspension switch to "OFF" position. See Fig. 2. Raise vehicle as previously outlined. Remove nut, washer and insulator from end of stabilizer bar link attaching bolts. Remove remaining hardware. Remove adapter brackets and "U" clamps. Cut worn bushings from stabilizer bar.

Installation

To install, reverse removal procedure. Lubricate bushings and insulators with silicone rubber lubricant. Tighten all nuts and bolts to specifications.

AIR SPRING FILL PROCEDURE

NOTE: This routine is used only to add air to front or rear air springs. Do not perform this routine unless a mechanical problem is verified as a cause of air loss (hole in spring, defective solenoid, etc.) and leak has been corrected.

1) Raise vehicle as previously outlined. Do not apply a load to suspension. Disconnect ground from diagnostic pigtail and turn air suspension switch to "ON" position. See Fig. 2.

2) Install battery charger to reduce drain. Open driver's door. Turn ignition switch to "RUN" position. Hold in "RUN" position for 5 seconds, then turn ignition off.

3) Connect a jumper lead between diagnostic pigtail and ground. Leave in grounded position during the entire test procedure. Apply brake pedal and turn ignition switch to "RUN" position. Leave driver's door open. Warning light will blink continuously every 2 seconds indicating spring fill sequence has been entered.

4) To fill rear springs, close and open door once. After 6 seconds, rear springs will fill for 60 seconds. To fill front springs, close and open door twice. To fill front and rear springs, wait until rear springs are finished, then close and open door once.

5) After completion of air spring fill sequence, turn air suspension switch to "OFF" position. Inspect all air springs for proper inflation. Remove ground from pigtail. Any further leveling will done automatically when vehicle is on the ground, if the air suspension is on.

AIR SPRING SOLENOID

NOTE: Follow all cautions as previously outlined.

Removal

1) Turn air suspension switch to "OFF" position. See Fig. 2. Raise vehicle as previously outlined. With suspension at full rebound, remove wheel and tire assembly. Disconnect electrical connector and remove air line.

2) The air spring solenoid has a 2-stage pressure relief fitting. First remove clip and rotate solenoid counterclockwise to first stop. Slowly pull solenoid straight out and release air out of air spring.

3) After air is fully bled from air spring, rotate solenoid to third stop. Remove solenoid from spring. Remove "O" ring

from solenoid housing.

Installation

1) Check "O" ring for cuts or abrasions. Replace as necessary. Lubricate and install "O" ring into housing. Insert solenoid into end cap and rotate clockwise to the third stop. Push solenoid in until it reaches the second stop. Then rotate clockwise to the first stop.

2) Inspect the wiring harness connector and ensure rubber gasket is in place at the bottom of the connector cavity. Connect air line and electrical connector. Refill air springs. Install wheel and tire assembly.

AIR SPRING

NOTE: Check vehicle for properly folded air springs. If any air springs are found to be improperly folded, replace unit. Check height sensors and replace if damaged. See Fig. 10.

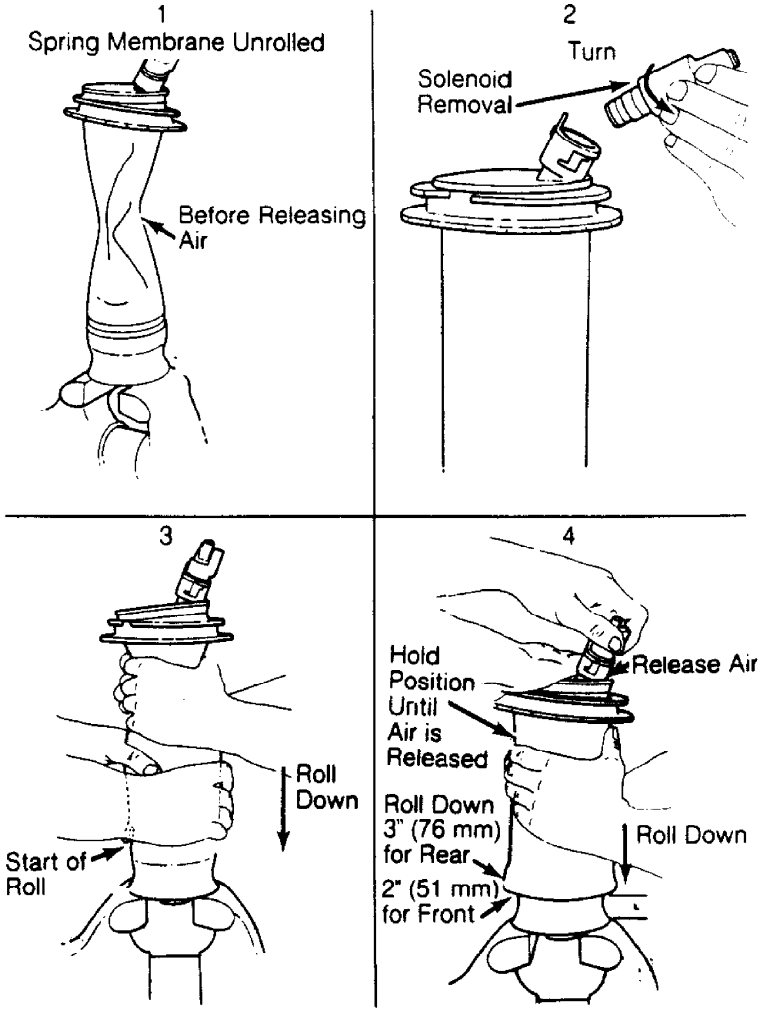

Fig. 10: Air Spring & Solenoid
Courtesy of Ford Motor Co.

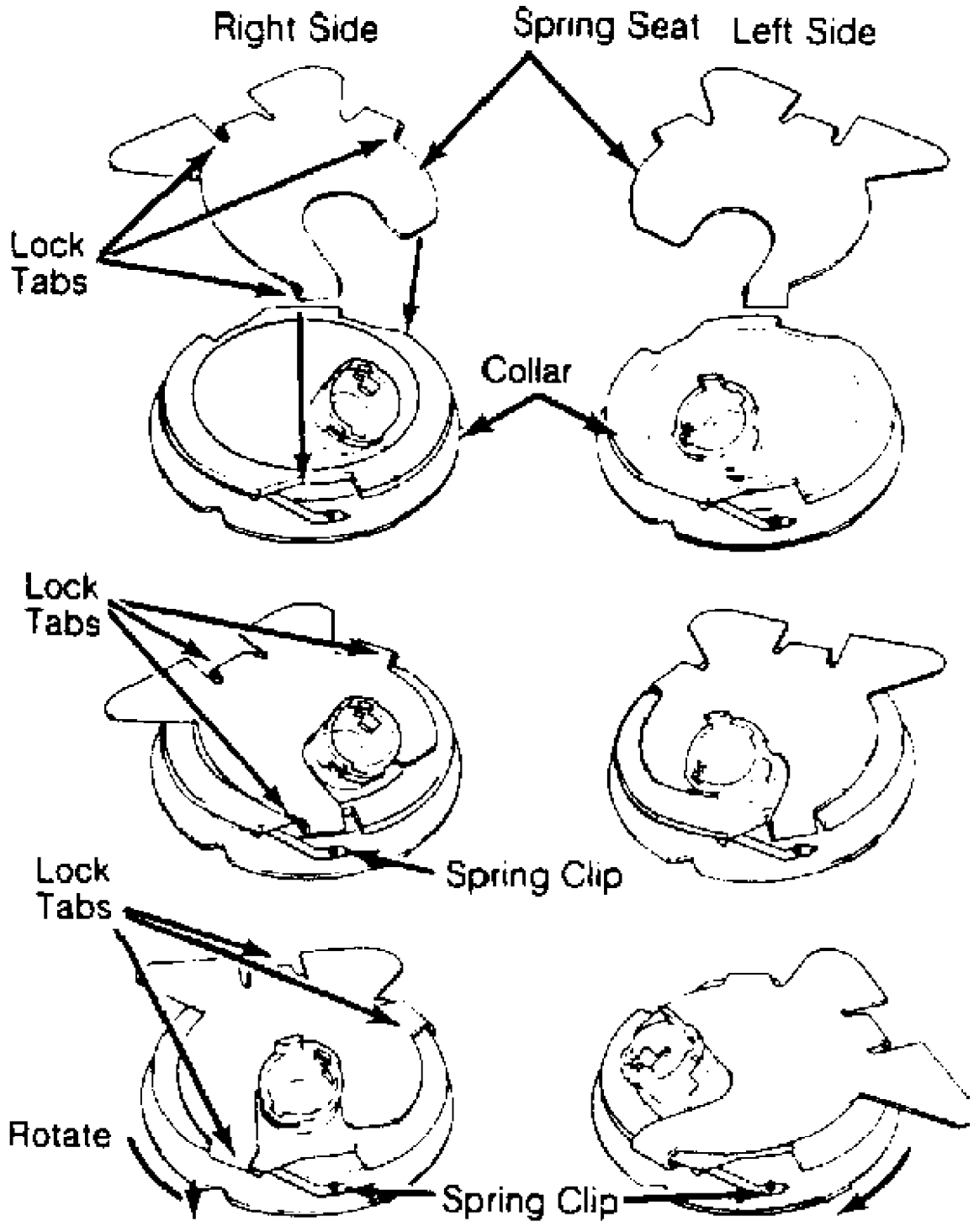

Fig. 11: Air Spring Upper Attachments
Courtesy of Ford Motor Co.

Removal (Front & Rear)
1) Turn air suspension switch to "OFF" position. See Fig. 2.

Raise vehicle as previously outlined. With suspension at full rebound, remove wheel and tire assembly. Remove air solenoid, as previously described.

2) Remove spring clips for front or rear. Push down spring clip on collar of air spring and rotate counterclockwise to release spring from body spring seat. Remove spring.

Installation

1) Install air spring solenoid as previously described. Ensure air springs are installed properly. See Figs. 10 and 11 Install air spring into body spring seat, being careful not to damage solenoid or electrical connections

2) Rotate air spring collar until spring snaps into place. Ensure that collar is retained by 3 roll tabs on the body spring seat. Attach air line and electrical connector to solenoid.

3) With suspension at full rebound and supported by shock absorbers, align and secure lower arm to spring attachment. Do not allow vehicle suspension to compress before air springs are filled or damage may result.

4) Replace wheel. Lower vehicle to 3" (76 mm) above floor. Refill springs as previously outlined.

HEIGHT SENSOR

Removal (Front & Rear)

1) Turn suspension switch to "OFF" position. See Fig. 2. Disconnect electrical connector located in engine compartment behind shock tower. Push connector through access hole in shock tower.

2) For rear sensor, electrical connector is located in the luggage compartment in front of forward trim panel. Pull luggage compartment carpet back for access to sensor sealing grommet located on floor pan.

3) Raise vehicle as previously outlined until suspension is at full rebound. Disconnect bottom and then top end of sensor from attaching studs. Disconnect sensor wiring harness from plastic clips on shock tower and remove sensor.

4) For rear sensor, push upward on sealing grommet to unseat sensor. Push sensor through floor pan hole into luggage compartment.

Installation

To install, reverse removal procedure. Turn air suspension switch to "ON" position after installation.

ELECTRONIC CONTROL MODULE

Removal & Installation

Turn air suspension and ignition switches to the "OFF" position. See Fig. 2. Remove left luggage compartment trim panel and disconnect harness connector. Remove 3 attaching nuts and remove unit. To install, reverse removal procedure.

COMPRESSOR RELAY

Removal & Installation

Disconnect electrical connector. Remove relay retaining screw at left front shock tower. Remove relay. To install, reverse removal procedure.

AIR COMPRESSOR & DRIER ASSEMBLY

Removal

1) Turn air suspension switch to "OFF" position. See Fig. 2.

Disconnect electrical connection at compressor. Remove air line protector cap from drier by releasing 2 latching pins located at the bottom of cap, 180 degrees apart. Disconnect 4 air lines from drier. Remove 3 compressor bracket retaining screws and compressor.

2) To remove drier assembly, remove retainer clip and screw. Separate drier from head of compressor.

Installation

To install, reverse removal procedure. Replace "O" ring when installing new drier assembly.

UPPER MOUNT ASSEMBLY

NOTE: Upper mounts use a one-piece design and cannot be disassembled.

Removal

1) Turn air suspension switch to "OFF" position. See Fig. 2. Turn ignition switch to the "UNLOCKED" position. From engine compartment, loosen but do not remove, 3 upper mount retaining nuts. Do not remove pop rivet holding camber plate. Loosen strut rod nut.

2) Raise vehicle as previously outlined. Place jack stands under lower control arms, as far outboard as possible. Be careful not to damage lower sensor bracket. Lower vehicle until weight is supported by lower control arms.

3) Remove wheel. Remove brake caliper and wire out of way. Remove upper and lower retaining nuts. Be careful removing last nut as gas pressurized strut will extend fully at this point. Lift strut up from spindle to compress rod, remove strut. Remove upper mount from strut. See Fig. 12.

Installation

Install new upper mount on strut and hand tighten nut. Position upper mount studs and tighten nuts. Compress strut and position onto spindle. To complete installation, reverse removal procedure. Turn air suspension switch to the "ON" position.

SPINDLE ASSEMBLY

Removal

1) Turn air suspension switch to "OFF" position. See Fig. 2. Raise vehicle as previously outlined. Remove wheel, brake caliper, rotor and dust shield. Remove stabilizer link from lower arm assembly. Using Tie Rod Remover (3290-C), remove tie rod end from spindle. Remove cotter pin from ball joint stud nut.

2) Loosen but do not remove nut. Tap spindle boss to relieve stud pressure. Place floor jack under lower control arm. Compress air spring and remove stud nut. Remove 2 bolts and nuts attaching spindle to shock strut. Compress shock strut until clearance is obtained. Remove spindle assembly. See Fig. 12.

Installation

1) Using new hardware, place spindle on ball joint stud, but do not tighten at this time. Lower shock strut until attaching holes are aligned with holes in spindle. Install 2 bolts and nuts.

2) Tighten ball joint stud nut and install cotter pin. To complete installation, reverse removal procedure.

SHOCK STRUT REPLACEMENT

Removal

1) Turn air suspension switch to "OFF" position. See Fig. 2. Turn ignition to the "UNLOCKED" position. From engine compartment,

loosen but do not remove strut-to-upper mount attaching nut. Raise vehicle as previously outlined.

2) Place jack stands as far outboard as possible under control arms, clearing lower sensor mounting brackets. Remove wheel. Remove brake caliper and wire out of way. Remove strut-to-upper mount attaching nuts and bolts.

3) Be careful removing last nut and bolt as strut is gas charged and will extend fully when removed. Lift strut up from spindle to compress rod and remove strut. Remove jounce bumper. See Fig. 12.

Installation

To Install, reverse removal procedure. Prime new strut by compressing 5 times before installing. Use new hardware when reassembling. Turn air suspension switch to "ON" position when installation is complete.

SUSPENSION CONTROL ARM

Removal

1) Turn air suspension switch to "OFF" position. Raise vehicle as previously described. Using Tie Rod Remover (3290-C), remove tie rod end from spindle assembly. If necessary, remove steering gear bolts. Position gear so that suspension arm bolt may be removed. Disconnect lower stabilizer bar link.

2) Disconnect lower end of height sensor from mounting stud. Remove sensor mounting screw and stud from lower arm bracket. Mark for alignment in original position during installation. Loosen ball joint nut, but do not remove. Tap spindle boss to relieve pressure. Vent air spring. See Removal under AIR SPRING SOLENOID in this article. Reinstall solenoid.

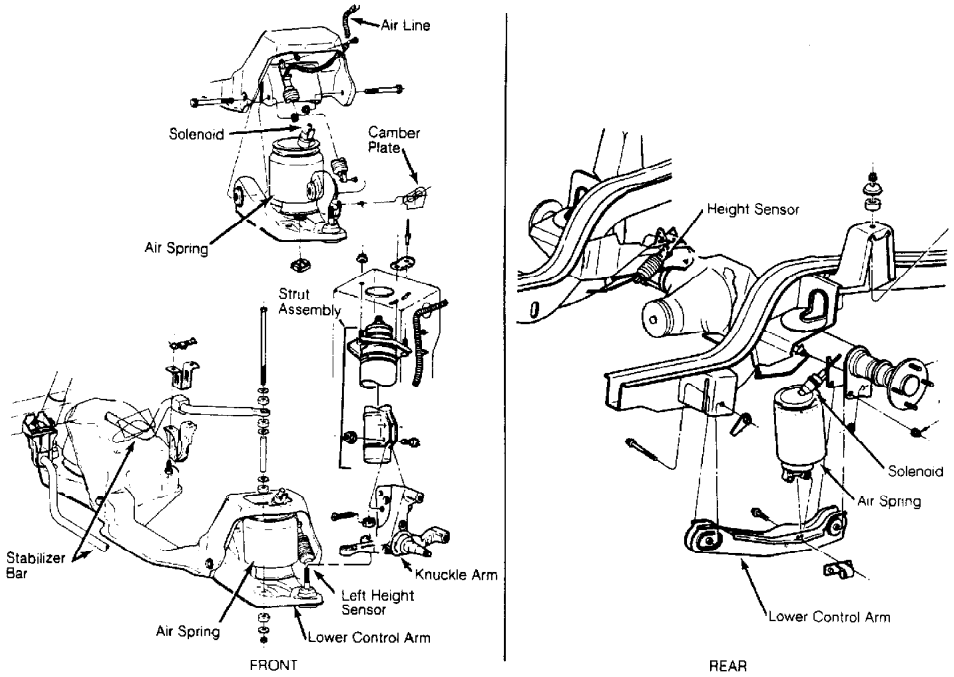

Fig. 12: Exploded View of Front & Rear Suspension Components Courtesy of Ford Motor Co.

3) Remove air spring-to-lower arm fastener clip. Remove ball joint nut. Raise entire strut and spindle and wire out of way. Remove

suspension arm-to-crossmember nuts and bolts. Remove arm from spindle. See Fig. 12.

Installation

1) Using new hardware, position arm into crossmember, but do not tighten. Attach ball joint to spindle, but do not tighten. Position air spring and install fastener.

2) Install sensor in original position. Connect lower end of sensor to lower mounting stud. Using floor jack, raise suspension arm high enough to tighten lower arm-to-crossmember nut. Tighten ball joint stud nut and install cotter pin. Remove floor jack.

3) If removed, install steering gear bolts. Position tie rod assembly into steering spindle. Tighten nut and install cotter pin. Connect stabilizer bar link to lower suspension and tighten nut

4) Install wheel. Lower vehicle, but do not allow wheels to touch floor. Refill air springs as previously outlined. If necessary, check front wheel alignment.

REAR SHOCK ABSORBERS

NOTE: Shocks are gas-pressurized and will extend when removed.

Removal

1) Turn air suspension switch to "OFF" position. Remove inside trim panels from luggage compartment. Loosen, but do not remove shock rod attaching nut. Raise vehicle as previously outlined. Place jack stands in position and lower vehicle until weight is supported by rear axle.

2) Remove upper attaching nut, washer and insulator. Remove right lower shock protective cover. Remove lower shock absorber cross bolt and nut. From beneath vehicle, compress shock absorber until clear from hole in upper shock tower.

Installation

To install, reverse removal procedure. Prime new shocks by compressing 5 times before installation. Turn air suspension switch to "ON" position after installation is completed.

REAR LOWER CONTROL ARM

NOTE: Replace lower control arm in sets only.

Removal

Turn air suspension switch to "OFF" position. See Fig. 2. Raise vehicle until suspension is at full rebound. Remove wheel. Vent air spring. See Removal under AIR SPRING SOLENOID in this article. Reinstall solenoid. Remove 2 air spring-to-lower arm bolts. Remove air spring. Remove frame-to-arm bolts. Remove frame-to-axle bolts. Remove arm from vehicle. See Fig. 12.

Installation

1) Using new hardware, position lower control into assembly into front arm brackets. Install arm-to-frame pivot bolt and nut so it is facing outward, do not tighten. Position rear bushing in axle bracket. Install arm-to-axle pivot bolt and nut facing outward. See Fig. 10. Carefully reinstall air spring. Do not tighten bolts at this time.

2) Using floor jack, raise axle making sure air spring is flat. Tighten all attaching bolts. Replace wheel and lower jack. Using previously outlined air spring fill sequence, fill air springs.

UPPER CONTROL ARM & AXLE BUSHING

NOTE: Upper control arms are replaced in sets only.

Removal

1) Turn air suspension switch to "OFF" position. See Fig. 2. Raise vehicle to full rebound. Detach height sensor from right side arm. Note position of sensor adjustment bracket on upper arm for reinstallation reference.

2) Remove upper arm-to-axle and upper arm-to-frame bolts and nuts. Remove upper arm from vehicle. If necessary, use Remover (T78P-5638-A) to replace axle bushings.

Installation

To Install, reverse removal procedure. When attaching right rear height sensor, place adjusting bracket in its original position. Turn air suspension switch to "ON" position.

TORQUE SPECIFICATIONS

TIGHTENING SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Air Spring-to-Lower Arm Bolt	30-35 (41-47)
Ball Joint-to-Spindle Nut	100-120 (136-163)
Lower Arm-to-Axle Bolt	90-100 (122-136)
Lower Arm-to-Crossmember Nut	150-180 (203-244)
Lower Arm-to-Frame Bolt	100-105 (136-142)
Shock Absorber-to-Frame Nut	17-27 (23-27)
Shock Strut-to-Upper Mount Nut	55-92 (75-125)
Shock Upper Mount-to-Body Nut	62-75 (84-102)
Spindle-to-Shock Strut Nut	150-180 (203-244)
Stab. Bar Mntg. Clamp-to-Brckt. Bolt	20-25 (27-34)
Stabilizer Bar-to-Axle Bolt	30-35 (41-47)
Stabilizer Bar-to-Body Nut	13-18 (18-24)
Strng. Gear-to-Crossmember Nut	90-100 (122-136)
Tie Rod End-to-Spindle Nut	35-47 (47-64)
Upper Arm-to-Axle Bolt	90-100 (122-136)
Upper Arm-to-Frame Bolt	100-105 (136-142)
	INCH Lbs. (N.m.)
Sensor-to-Arm Mounting Nut	84-120 (9-16)
Sensor-to-Frame Mounting Nut	110-150 (12-17)
Stabilizer Bar-to-Lower Arm Nut	108-144 (12-16)

WIRING DIAGRAM

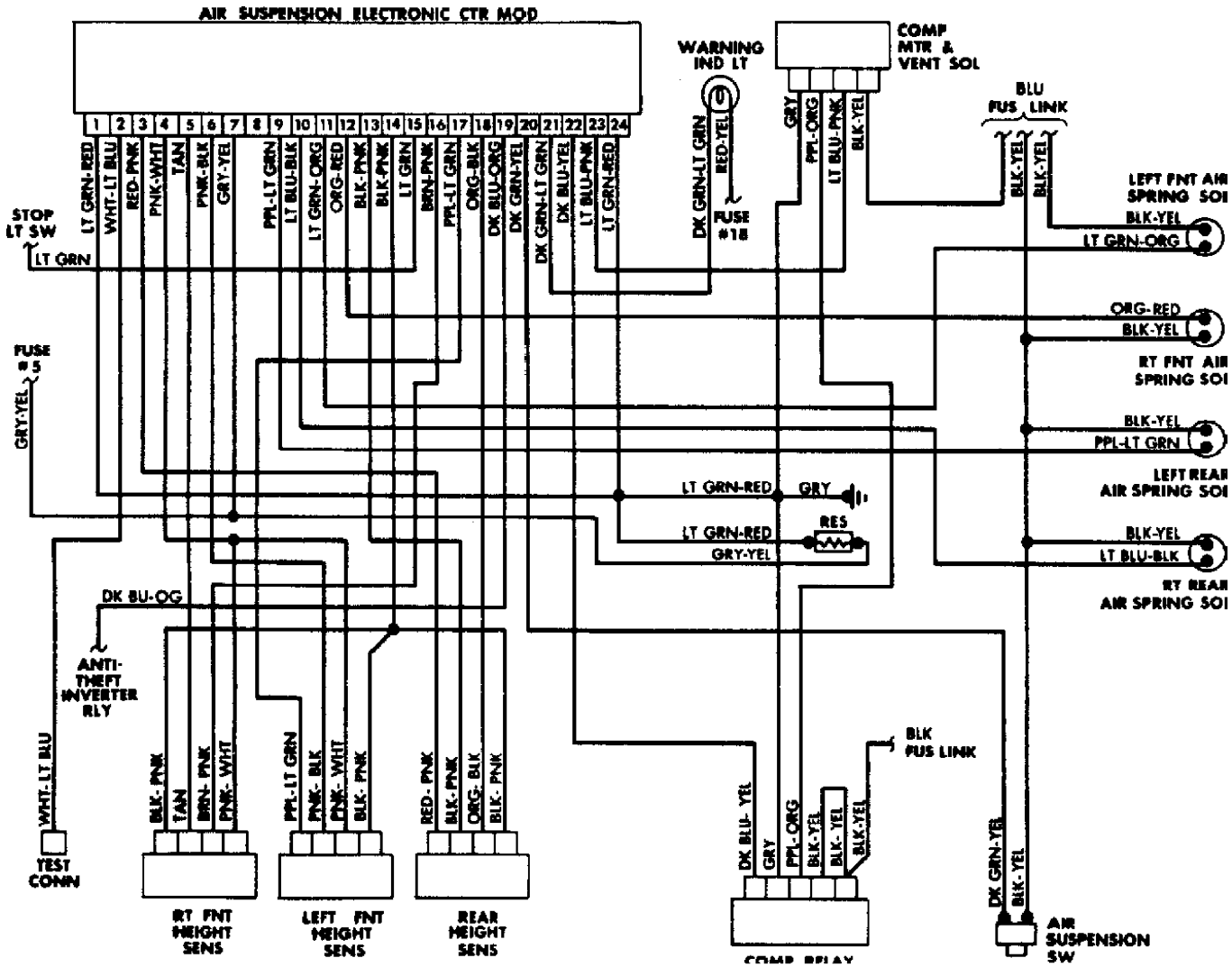

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Fig. 13: Air Suspension Wiring Diagram