Date 1-1-89

MC-9 MAINTENANCE MANUAL

SECTION 12
SUSPENSION

MC-9 MAINTENANCE MANUAL

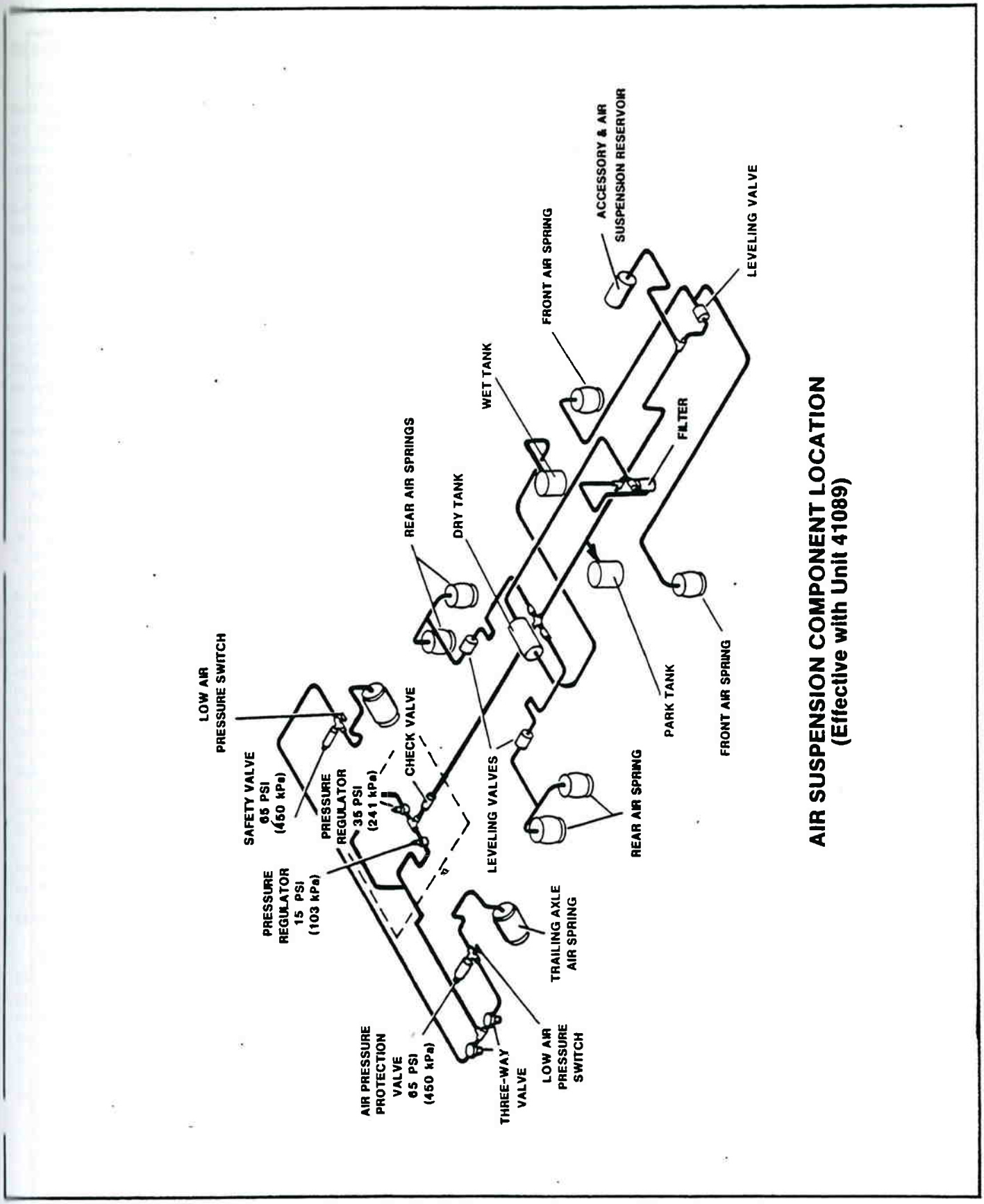


Figure 12-1A. Air Suspension Component Locations.
(Effective with Unit 41089)

MC-9 MAINTENANCE MANUAL

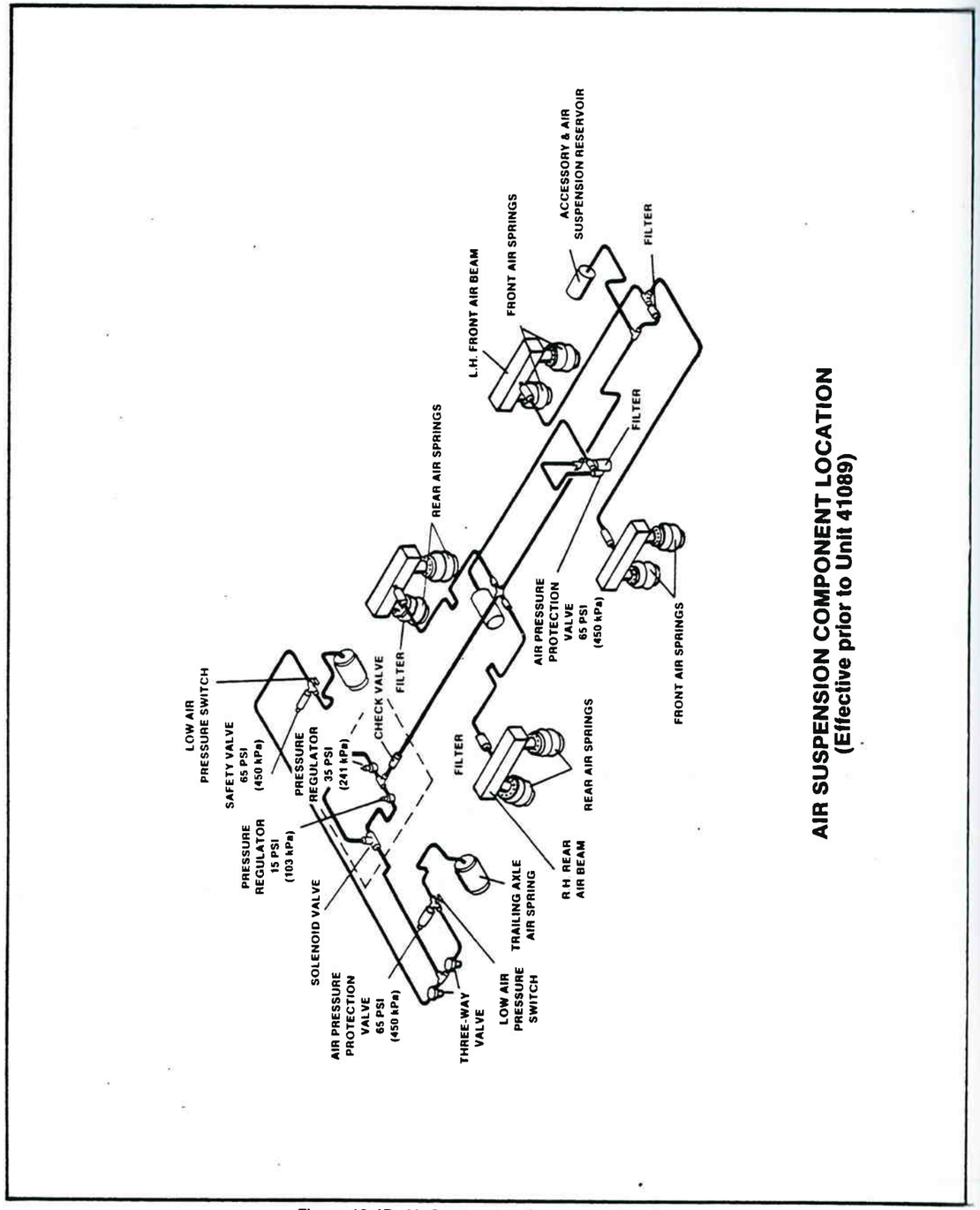


Figure 12-1B. Air Suspension Component Locations. (Effective prior to Unit 41089)

MC-9 MAINTENANCE MANUAL

SUSPENSION

DESCRIPTION

The coach rides on an air suspension system. Air springs (bellows) are installed above both the front and rear axles. They are fastened between the axle support strucures and the bogies. Air is supplied to the air springs from the coach air reservoirs.

Prior to unit 41089, the air reservoirs are in the bogie air beams (see figure 12-1A). Effective with that unit, air is stored in air tanks (see figure 12-1B).

Other suspension components are height control valves, radius rods and shock absorbers. The system is entirely automatic in operation and is designed to maintain a constant vehicle height regardless of load. A pressure regulating valve maintains constant pressure in the air springs and uniform loading of the rear trailing wheels regardless of total vehicle load. Refer to Section 4, Brakes and Air System, for regulating valve pressure setting.

The air springs are made from a special compound rubber molded to the proper contour and dimensions. The entire vertical load of the coach is taken by these air springs. See figures 12-1A and 12-1B.

Radius rods are used to hold the axles in the proper transverse and longitudinal position. Four radius rods are used at the rear axle and five at the front axle. These rods transmit both braking and driving forces from the axles to the coach body.

Delay-type height control valves increase or decrease the air pressure as required. Two height control valves are located at the rear axle, and one at the front axle. The valves are mounted on the coach body and are connected to the axles by rubber-bushed links. Because of the delay mechanism in each height control valve, the valves respond only to sustained variations in the height of the axles in relationship to the coach body. Thus no change in air pressure takes place during normal driving. However, the valves automatically regulate air pressure to compensate for changes in the load carried by the coach, or due to changes in the location of the coach load.

Double-acting shock absorbers are used to enhance ride characteristics. Two shock absorbers are used at the front axle, four at the rear and two at the rear trailing wheels.

An auxiliary air system is provided to supply compressed air for the operation of the system. Compressed air from the main system is fed to an auxiliary tank.

MAINTENANCE

The suspension system requires periodic lubrication only at the rear trailing axle trunnions. Refer to Lubrication (Section 10) of this manual. Routine maintenance should also include visual inspection procedures and occasional tests to determine that the correct coach body height is maintained. The suspension air filter should also be replaced periodically.

To remove axles, refer to Section 1, Front Axle, and to Section 2, Rear Axle.

NOTE: When installing major components of the suspension system, refer to the torque recommendations shown in the figures at the end of this section.

TRAILING AXLE UNLOADING SYSTEM - OPTIONAL

A switch mounted on the switch panel will allow the driver to partially unload the trailing wheels to add weight to the drive wheels on icy conditions (figure 12-2).

A buzzer and a low air tell-tale light will remind the driver to return the system to normal as soon as conditions permit. The trailing axle bellow air pressure is controlled from 35 psi to 15 psi (241 kPa to 104 kPa) in the unloaded position. This will increase the load on the drive wheels by approximately 2,000 lbs. (907 kg). See figures 12-3 and 12-4.

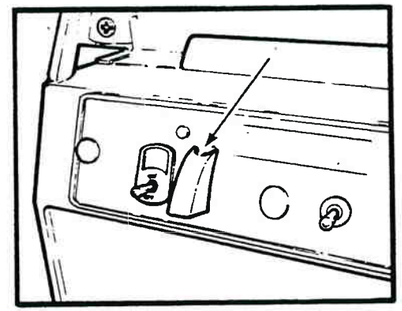


Figure 12-2. Unloading Switch on Instrument Panel.

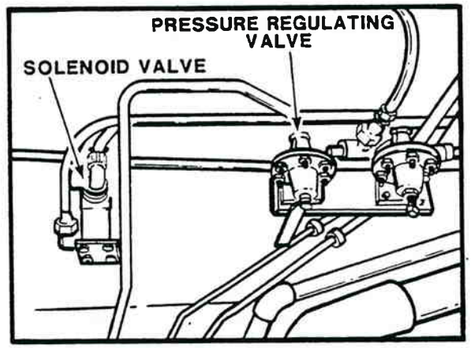


Figure 12-3. Axle Unload Solenoid Valve and Pressure Regulator.

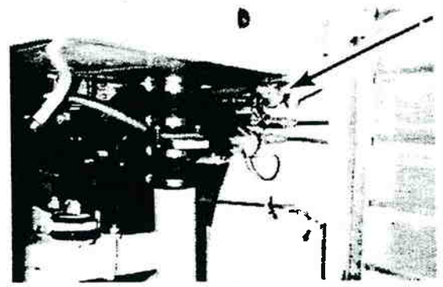


Figure 12-4. Trailing Axle Low Air Pressure Switch.

MC-9 MAINTENANCE MANUAL

AIR SPRINGS

Effective with unit 41089, the air springs are all of the rolling lobe (involute) type. The spring is made of molded rubber and consists of an outer section and a smaller inner, or piston, section which moves vertically.

Prior to unit 41089 the air springs used at the front and rear driving axles are of the double-convolution type, having beads reinforced at top and bottom with wire. Bead rings are specially formed and use special bolts. The surfaces of the bead ring and bolts are so designed as to prevent any chafing of the bellows. A girdle ring is molded in the center section of the bellows for reinforcement. The trailing axle air springs on the earlier suspension system are the rolling lobe style just as in the later system.

1. Raise and block the coach body as outlined under Front Axle Removal, Section 2.
2. Disconnect height control valve links and pull down on valve arm to exhaust air from the air spring.
3. On the front suspension, after air is exhausted, remove the air line to the air spring.
4. Remove nuts and washers from studs at top of air spring.
5. Remove the mounting bolts from the air spring mounting plate to the bottom of the air spring. The air spring may then be removed from coach.
6. On the rear suspension, after air is exhausted, remove the line to the air spring.
7. Remove the nuts and washers at top of the air spring.
8. Remove bolt from bottom and remove air spring.

Reverse procedure to replace air spring.

RADIUS RODS

The following instructions apply to radius rods used at the front and the rear driving axles.

Radius rods are mounted at both ends by means of bushings. The condition of these bushings should be checked periodically and any defective parts replaced. Radius rods should be checked for distortion and cracks. The Magnaflux process is recommended for detecting cracks in the radius rods. New bushings should be used when rods are replaced.

To remove radius rods, follow this procedure:

1. Flatten attaching nut locking plate and remove nuts.
2. Remove radius rod end plates from anchor pins.
3. Withdraw radius rod.

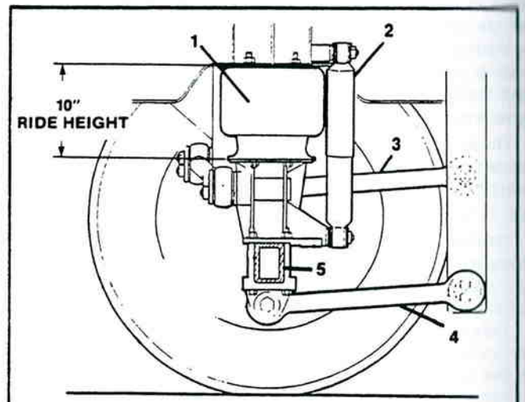
Installation of the radius rods is the reverse of removal. Apply Never-Seize or equivalent lubricant to the bushing inner race and radius rod pin.

It is extremely important upon reconnection of the rods that the proper clearance height between the axle and body is maintained; otherwise, the rubber bushings in radius rod ends will become preloaded, shortening the life of these parts. Refer to figures 12-5 and 12-6.

CAUTION: When reinstalling radius rods, make sure that the rod is centered on the bushing before tightening retaining nuts.

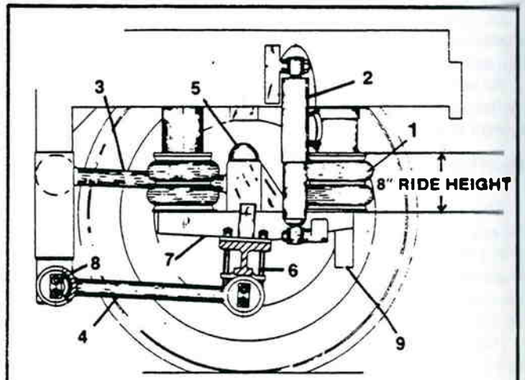
The radius rod should be held in a centered position with a pry bar against the coach body or axle while the stud nuts are tightened. See specifications at end of section for proper torque.

It is strongly recommended that periodic checks, depending upon operation conditions, be made on all radius rods and bushings. Due to the difficulty in checking the radius rod bushings at the anchor pin above the rear axle, they tend to be overlooked. Therefore, special emphasis should be placed on the checking of this area. If all worn bushings are not replaced, excessive wear to suspension components and tires will result.



1. Air Spring
2. Shock Absorber
3. Upper Radius Rod
4. Lower Radius Rod
5. Axle

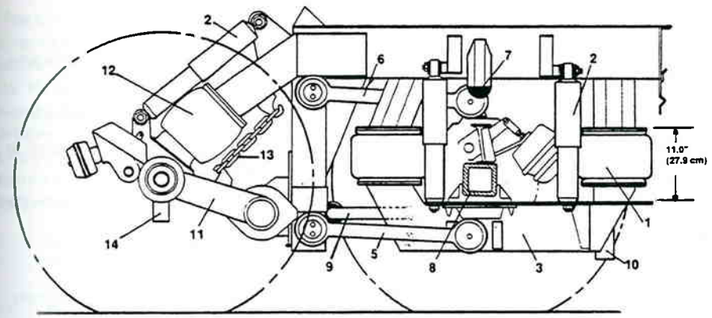
Figure 12-5A. Front Suspension Effective With Unit 41089.



1. Air Spring
2. Shock Absorber
3. Upper Radius Rod
4. Lower Radius Rod
5. Axle Bumper
6. U-Bolt
7. Suspension Support
8. Radius Rod Bushing
9. Jacking Point

Figure 12-5B. Front Suspension Effective Prior to Unit 41089.

MC-9 MAINTENANCE MANUAL



1. Air Spring
2. Shock Absorbers
3. Suspension Support
4. Lower Radius Rod
5. Upper Radius Rod
6. Axle Bumper
7. Axle
8. Anti-Sway Bar
9. Jacking Point
10. Trailing Axle Arm
11. Air Spring
12. Hold-Up Chain
13. Jacking Point

Figure 12-6A. Rear Suspension Effective With Unit 41089.

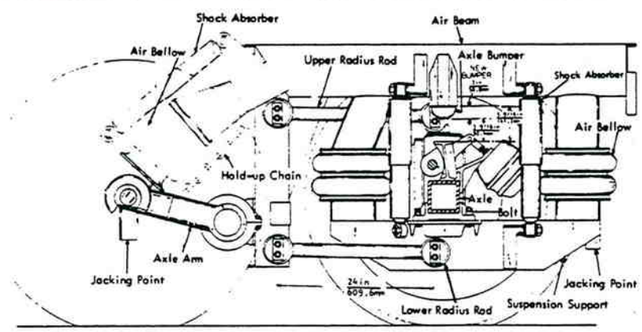


Figure 12-6B. Rear Suspension Effective Prior to Unit 41089.

HEIGHT CONTROL VALVES

The operation of the height control valves and the general design is detailed in Figure 12-7. The height control valves require no periodic maintenance. Height control valve linkage operates on rubber bushings and no lubrication at these points should be attempted.

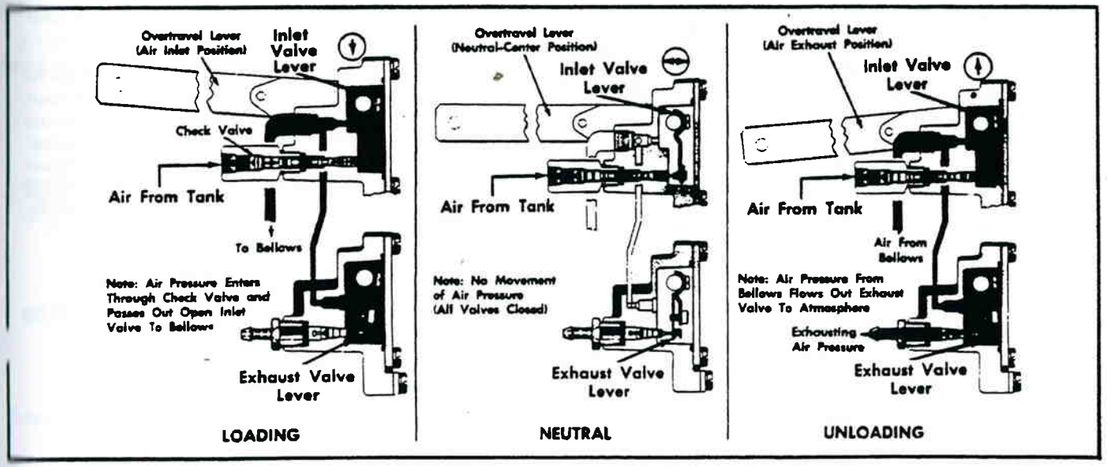


Figure 12-7. Height Control Valve Operation.

MC-9 MAINTENANCE MANUAL

LOADING OPERATION

When loaded, the body of the coach settles. Since the height control valve is linked to the suspension, and the valve is mounted to the vehicle body, the valve moves downward with the body during loading. As the overtravel lever and control shaft turns, the intake valve lever presses against the pin of the valve core. As the pin is depressed, air pressure flows through the height control valve into the air springs. Increased the air pressure expands the air springs and raises the body of vehicle. The intake valve is protected by a check valve which permits air to travel in one direction only.

NEUTRAL POSITION

Increased pressure expands the air springs lifting the vehicle body and height control valve. The overtravel lever returns to "neutral" as vehicle body approaches normal ride height. The intake valve lever also moves the closing valve. The exhaust valve remains closed and the check valve in intake adapter prevents air from escaping from the valve body and air springs. This condition remains static until coach load is altered, moving the overtravel lever from "neutral" for one or more seconds actuating the intake or exhaust valves.

UNLOADING OPERATION

When the load is lightened, pressure in the air springs raises the coach body. Overtravel lever is pulled downward from "neutral." This applies a force that slowly moves the delay piston and opens the exhaust valve when the lever moves beyond free travel range. The intake valve remains closed allowing air from the air springs to exhaust to atmosphere. As air is exhausted from air springs, the vehicle body is lowered until the overtravel lever returns to neutral position.

When the coach is in motion with body at normal ride height, the overtravel lever is in neutral position. Small movements of the lever may occur without activating the control valve as it must move in excess of 3/16" (4.7 mm) before either the inlet or exhaust valve is opened.

The delay piston, connecting through a pin to overtravel shaft is contained in a cylinder of silicone fluid. The slowing action of this fluid delays by 1 to 6 seconds the closing of one valve to the opening of the other. The flapper valves allow both valves to close from full-open position within 1 second.

The overtravel piston is held against the shaft by two springs (one inside the other) and keeps the shaft in proper position relative to the overtravel lever. The purpose of the piston is to prevent damage of parts inside the control valve if the lever exceeds normal travel, and to allow the lever to move without moving parts inside the valve.

REMOVAL

1. Support coach by placing blocks under body at jacking points.

2. Open drain cock in air filter and vent all air from system.

3. Disconnect overtravel lever from link and pull down to exhaust remaining air from air beams.

4. Disconnect both lines from control valve and cover the ends with tape to prevent contamination.

5. Detach height control valve from mounting bracket.

Replacement is the reverse of removal. After assembly, check for leakage using soap and water solution.

LEAKAGE TEST

The following procedure is a leakage test when the valve assembly is removed from vehicle.

1. Clean the exterior of the valve assembly.

2. Connect air pressure line to air valve inlet port, then open the air pressure (70-100 psi; 483-690 kPa).

3. Dip the valve assembly in a container of water and watch for air bubbles when the overtravel lever is in the center position. No air should escape from any point of the valve assembly.

4. If bubbles appear from the bellows port, this is an indication that the air inlet valve assembly is defective and must be replaced.

5. Remove the air pressure line from the air inlet port and connect it to the bellows port. If bubbles appear at the air inlet check valve port, this is an indication that check valve unit is defective and must be replaced.

6. If bubbles appear at the exhaust port, it is an indication that the exhaust valve assembly is defective and must be replaced.

7. If bubbles appear around edge of the valve cover plate, the cover plate gasket should be replaced.

8. If no leaks are found, remove the valve assembly from the water, then with air pressure still connected to the bellows port, actuate the overtravel lever to remove any excessive amount of water which may have entered the exhaust valve chamber. Remove the air line and connect it to the air inlet port to remove water from the air inlet valve chamber.

MC-9 MAINTENANCE MANUAL

HEIGHT ADJUSTMENT

The correct coach body-to-axle clearance which should be maintained is shown in Figures 12-5 and 12-6. It should not be necessary to make an adjustment under normal service conditions. However, if an adjustment is necessary, it is made by changing the position of the overtravel lever in relation to the overtravel control body. The lever should be moved up to raise the level of the coach body, and down to lower it. Check that air pressure is above 100 psi (690 kPa) and raise coach to the specified height.

CAUTION: Always adjust on "fill cycle." If it is necessary to lower coach height, release sufficient air to be well below clearance and adjust to specified clearance.

NOTE: Ride height should be rechecked after road testing.

When it is found that the coach is falling below the correct level after being parked for a period of time, the following procedure should be carried out:

1. Support coach by placing blocks under body at jacking points.

2. Open drain cock in air filter and vent all air from system.

3. Locate the suspension system height control valve which is applicable to the side of the coach which is low. One height control valve controls both front air beams or springs; the rear air beams or springs are controlled by two height control valves — one left hand side and one right hand side.

4. Disconnect the air line (inlet from air tank) and remove the adapter assembly (figure 12-8) and discard.

5. Remove the two small filter screens located behind the adapter assembly.

6. Clean with solvent and compressed air.

7. Replace the two small screens and install a new adapter and reconnect air line.

8. Charge the air system, remove the blocks and check the height control valve for leaks.

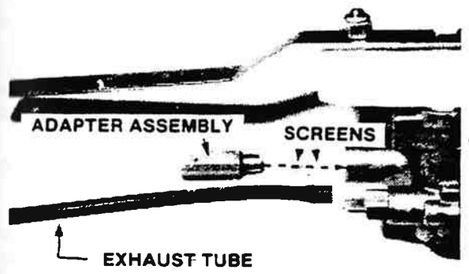


Figure 12-8. Height Control Valve Adapter and Screens.

OVERTRAVEL LEVER CENTER POSITION ADJUSTMENT

The following procedure is to adjust the overtravel lever:

1. Clean the exterior of the height control valve.

2. Remove delay piston retaining ring, cover, and O-ring from control valve assembly, then drain off the silicone fluid.

3. Remove exhaust fitting and exhaust screen from control valve.

4. Referring to figure 12-9, scribe a line 1-3/8" (34.9 mm) from plug end of overtravel lever control body.

5. Place valve assembly in vise as shown in figure 12-9.

6. If vacuum source is available, attach supply hose to valve exhaust port using Sun Tester fitting No. 115-3 or equivalent. Do not apply vacuum at this time.

7. Attach air pressure supply hose to air inlet port. Do not apply pressure at this time.

8. Locate dial indicator in position as shown in figure 12-9. Move overtravel lever to full air exhaust position — top of delay piston flush with top of bore — without overtraveling (position "C" Figure 12-10). Relocate indicator push rod to just contact 1-3/8" (34.9 mm) mark on control body and reset indicator dial to zero at this point (position C).

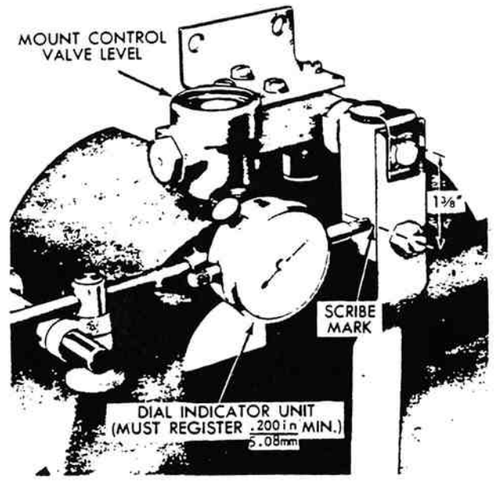


Figure 12-9. Dial Indicator Locations.

9. Move overtravel lever to full air intake position without overtraveling (position "A" Figure 12-10)(delay piston at bottom of bore). Take indicator reading which may vary 0.60" to 0.190" (1.52 mm - 4.82 mm).

10. Repeat steps 8 and 9 above to recheck this reading.

MC-9 MAINTENANCE MANUAL

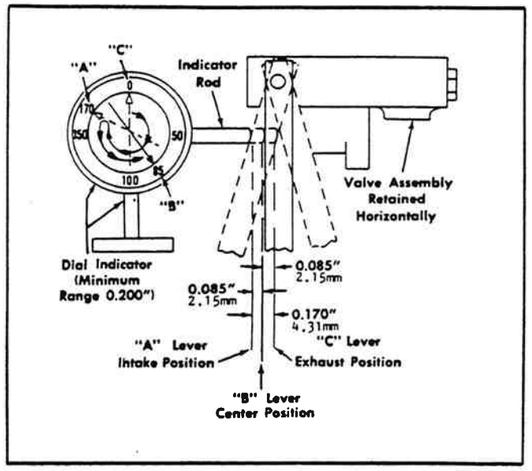


Figure 12-10. Locating Lever Center.

11. Divide the total travel dimension by two (example: 0.170" divided by 2 equals 0.085"; (4.31 mm divided by 2 equals 2.15 mm) to the center (position B).

12. Important: Without disturbing lever center position, reset indicator dial to zero, which actually is 0.100" (2.54 mm) on indicator of type registering 0.100" (2.54 mm) for each revolution of indicator needle, then proceed with valve lever gap adjustments following.

AIR INTAKE AND EXHAUST VALVE LEVER ADJUSTMENT

Two methods of adjustment are available:

1. Using both air pressure and vacuum — If vacuum source is available, this method will take less time to perform. Vacuum source is used to make the exhaust valve lever gap check only.

2. Using air pressure only — When this method is used, it will take longer to perform adjustments as the valve cover must be in place each time air pressure is applied and then removed to permit adjustment of exhaust valve lever.

Instructions covering lever adjustments are identical for front and rear valves. Rear valve lever and front valve lever must be bent to proper setting. In these valves both exhaust and intake levers are part of one unit which contains "score" marks to permit easy bending. Persons may accomplish this operation with lever in the valve body, or lever may be removed and bent on the bench.

NOTE: Before making these adjustments the overtravel lever must be centered as explained previously.

VACUUM METHOD

1. Apply available vacuum and regulate air pressure to approximately 95 psi (655 kPa).

2. Move overtravel lever fore and aft several times and then back to center position.

3. Starting at center position, slowly move lever to where air intake valve just begins to open. Listen for escaping air. Note reading on dial at this point. Reading should be 0.025-0.027" (.635-.685 mm) from lever center position. If necessary bend intake valve lever to correct setting, refer to figure 12-11.

4. Return overtravel lever to center position. Slowly move lever to exhaust side and at the same time note the vacuum gauge reading. When vacuum just begins to fall, the exhaust valve has opened. Valve should open when overtravel lever is moved 0.035" to 0.037" (.889-.940 mm) from center position. If necessary, bend exhaust valve lever to correct setting; refer to Figure 12-11.

AIR PRESSURE METHOD

This method may be performed when a vacuum source is not available.

1. Apply air pressure regulated to approximately 95 psi (655 kPa) to air inlet port.

2. To adjust air intake valve lever gap, move the overtravel lever slowly from center position to point where intake valve just begins to open. Listen for escaping air: Note reading on dial at this point which should register 0.025-0.027" (.635-.685 mm). If necessary, bend intake valve lever to correct setting. Refer to Figure 12-11.

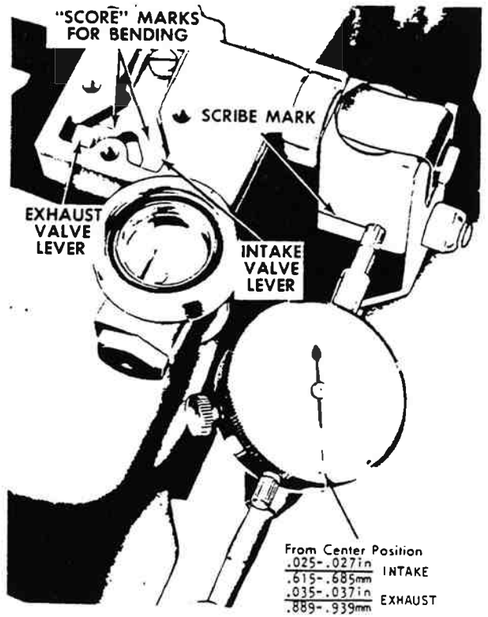


Figure 12-11. Adjusting Air Intake Valve Lever Gap.

MC-9 MAINTENANCE MANUAL

3. To adjust air exhaust valve lever gap, install valve cover on the valve using a new gasket and four attaching screws. Be careful not to disturb indicator setting.

4. Disconnect air supply from the air inlet port and connect it to the air springs port.

5. Move overtravel lever slowly to open exhaust port while observing the indicator dial. Air should start to escape from the exhaust port when indicator registers 0.035-0.037" (.889-.940 mm).

6. If adjustment is necessary, shut off air pressure supply and remove valve cover. Bend exhaust valve lever to correct setting. Then install cover and re-check valve opening dimension.

TIME DELAY CHECK

After adjusting valve gaps check time-delay for opening and closing of valves (1-6 seconds one valve to opening of the other is recommended). Valves should close from full-open position within one second.

1. Place new O-ring over delay plug and install plug. Tighten to 20-30 inch-pounds (2.2-3.4 Nm) torque.

2. Pour 5.5 CC + 0.25 CC of Silicone fluid (750 centistokes viscosity at 25°C) into delay piston chamber. With valve body tilted slightly as shown in Figure 12-12 carefully operate overtravel lever fore and aft to vent air from fluid. When all air has been expelled from piston pin cavity, check fluid level using depth gauge as shown in Figure 12-13.

NOTE: Use only No. S F96-1000 centistokes L-HF22 40 lbs. (5 gal.).

3. With valve assembly level take measurement from center of bore only. Add or remove fluid to bring fluid 13/64" (5.1 mm) from top of valve body. An eyedropper will serve this purpose.

4. Place new delay piston cover O-ring in groove of valve body. Install cover with retaining ring.

5. Place valve assembly vertically in holding vise. Refer to figure 12-14.

6. Move overtravel lever up and down for approximately one minute.

AIR INTAKE TIME DELAY CHECK

1. Connect pressure line to valve intake port (figure 12-15) and open air pressure to 95 psi (655 kPa).

2. Move the overtravel lever upward quickly approximately 2" (50.8 mm) and simultaneously start counting the number of seconds before air starts to escape from the bellows ports. A delay of 1-6 seconds should exist. Repeat this check.

AIR EXHAUST TIME DELAY CHECK

To time the delay for exhaust, two methods can be used; one using vacuum source and one using air pressure. If vacuum source is available, perform steps 1 thru 3. If not, proceed to steps 4 thru 6.

Method Using Vacuum:

1. Install cover plate on height control valve using gasket.

2. Connect pressure line to air exhaust port and open air pressure to 95 psi (655 kPa).

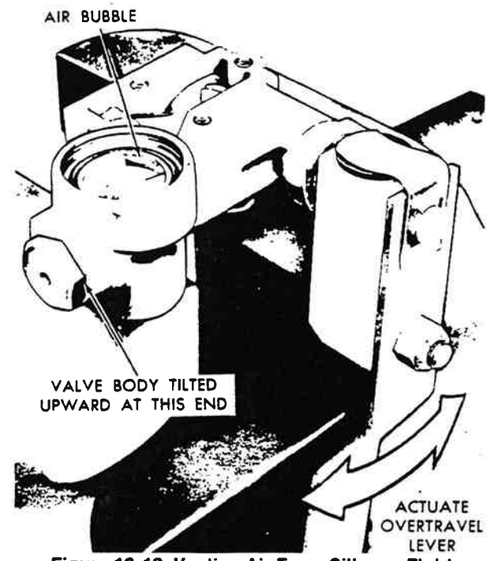


Figure 12-12. Venting Air From Silicone Fluid.

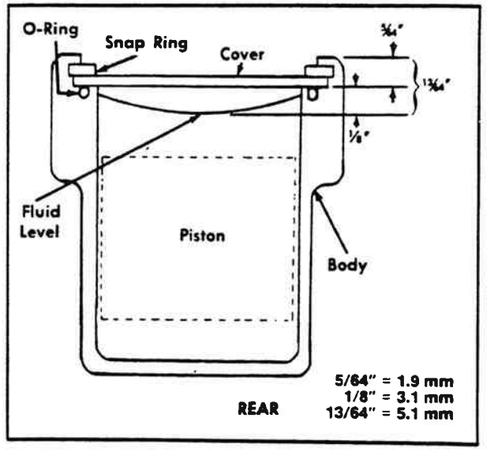


Figure 12-13. Measuring Silicone Fluid Level.

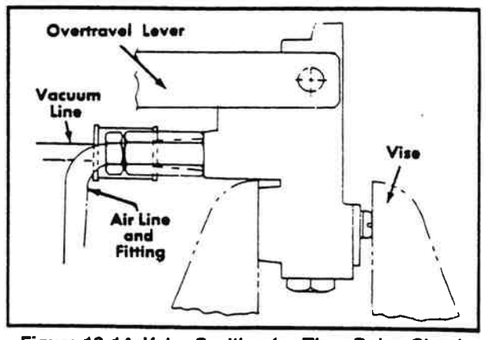


Figure 12-14. Valve Position for Time Delay Check.