SECTION H

EXHAUST EMISSION CONTROL SYSTEM (CALIFORNIA)

CONTENTS

DIVISION I SPECIFICATIONS AND ADJUSTMENTS

64-39 EXHAUST EMISSION CONTROL SYSTEM SPECIFICATIONS

Tune-Up Specifications	Identical with Standard Car Tune-Up Specs.
Air Pump Belt Tension	60 Lbs.
Rotor Ring Screw Torque	37 Lb. In.
Housing Cover Bolt Torque	10 Lb. Ft.
Vane and Rear Bearing Grease	SSG Code #5124
Speed Ratio, Air Pump to Engine	1-1/4 to 1

DIVISION II DESCRIPTION AND OPERATION

64-40 DESCRIPTION AND OPERATION OF EXHAUST EMISSION CONTROL SYSTEM

Most cars manufactured for registration in California must be capable of passing certain tests which measure the quantity of unburned impurities in the exhaust gases. California law places a limit on the amount of hydrocarbon and carbon monoxide emissions from the exhaust system. The purpose of this law is to keep the atmosphere cleaner, particularly in populous areas where these impurities add to the smog problem.

The exhaust emission control system, which is known as the "Air Injection Reactor System", consists basically of an air pump which forces a constant flow of air into each exhaust port immediately after the exhaust valve. Since exhaust gases at this point are above kindling temperature, infusion with an excess of oxygen is all that is required to start a burning action. This action burns the excess hydrocarbons and also changes most of the carbon monoxide to harmless carbon dixoide.

The air injection system draws clean air from the air cleaner, through an inlet hose, into the air pump and from the pump through two outlets (one for each cylinder head). The system to each cylinder head consists of an outlet hose, a check valve, a pipe,

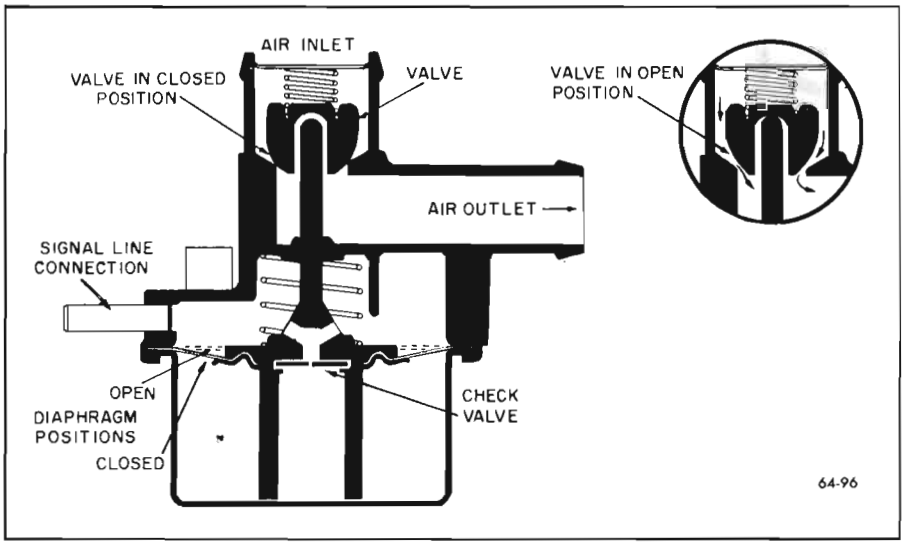

Figure 64-96—Intake Air Bleed Valve Operation

a distribution tee, an air manifold and a lower air feed pipe (stainless steel nozzle) which projects into each exhaust port.

Since the air pump is a positive displacement pump, air is constantly flowing into the exhaust ports. The quantity of air flow and the pressure both increase with pump speed. However, since high air flow at high speed causes a higher exhaust temperature, a pressure relief valve is used to release air directly from the pump whenever the pressure exceeds a certain setting. Three different settings are used: one for V-6's, one for V-8 single exhaust and one for V-8 dual exhaust.

In addition to the air injection system, the exhaust emission control system uses a special carburetor which is slightly leaner. All California carburetors are vented inside the air cleaner; the one external vent opens only when the carburetor is in curb idle position.

The action of the exhaust control system makes it necessary for all engines to have an air valve which opens into the intake manifold. When the throttle is closed suddenly after a hard acceleration, the carburetor air is shut off instantly but the fuel continues to flow momentarily. The resulting excessively rich mixture would burn after air was injected in the exhaust system, resulting in a "back-fire". To prevent this, an intake air bleed (anti-backfire) valve opens to let air into the intake manifold whenever the throttle is closed suddenly. The opening of this valve is "triggered" whenever there is a rapid rise in intake manifold vacuum. The valve then opens momentarily (for about one second) to allow clean air from the air pump into the intake manifold. The air bleed greatly reduces the possibility of a backfire. Since the opening of the air bleed valve also prevents rapid reduction of engine RPM, a dash pot is not required; any car with an exhaust emission control system will not require a dash pot to prevent engine stalling. See Figure 64-96.

All California cars must also be equipped with the closed positive crankcase ventilation system (same as used in 1965) in addition to the exhaust emission control system.

While the A.I.R. system will result in an exhaust emission level below the California requirements when it is properly installed and maintained, it will not provide the desired reduction in exhaust emissions if some of the engine components malfunction. In order to obtain maximum benefits from the Air Injection Reactor System, it is desirable that our normal tune-up items receive careful thorough attention.

A high quality level of performance in conducting our tune-up operations is essential if the citizens of California are to receive the full benefit of the air pollution reduction which has been built into their 1966 General Motors vehicles.

64-41 DESCRIPTION AND OPERATION OF AIR PUMP

a. Description of Air Pump

The major components of the air pump are enclosed in a die cast aluminum housing. A rotor shaft, drive hub, relief valve, and intake and exhaust tubes are visible on the pump exterior. See Figure 64-97. A rotor, vanes, carbon shoes, and shoe springs make up the rotating unit of the pump.

The aluminum housing has cavities for air intake, compression,

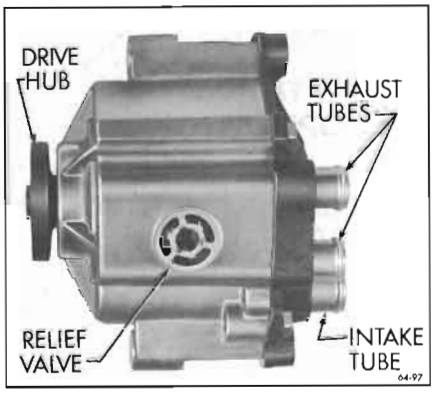

Figure 64-97—Air Pump for Exhaust Emission Control System - California

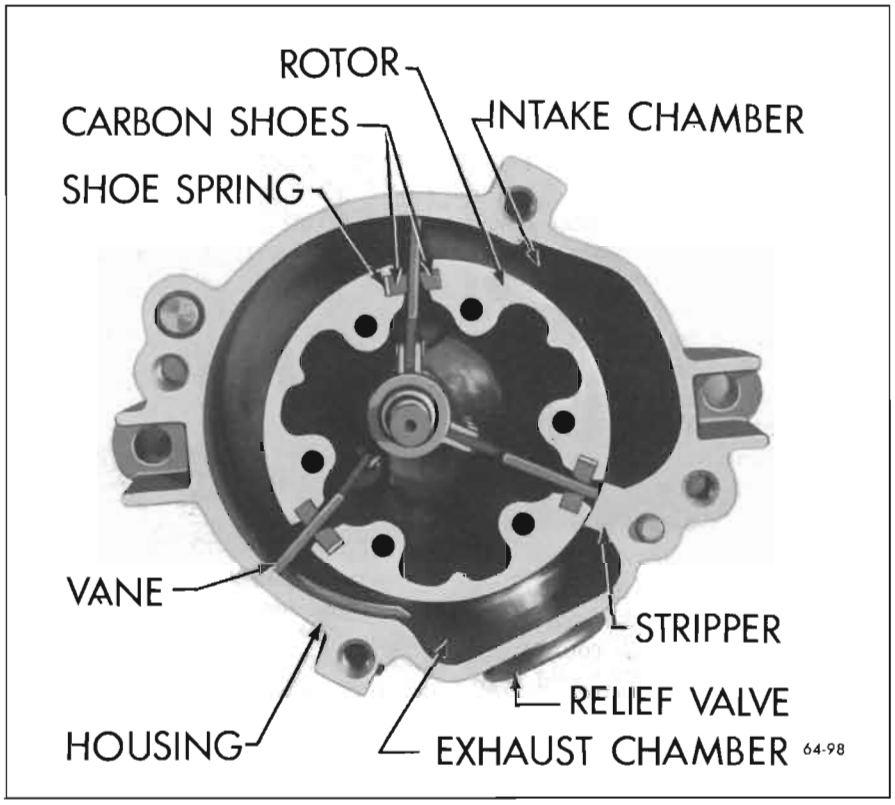

Figure 64-98—Air Pump Interior

and exhaust and a bore for mounting the front bearing. See Figure 64-98. The housing also includes grooves that reduce the noise of intake and compression, a seat for a carbon seal, and a relief valve hole. Mounting bosses are on the housing exterior.

The front seal, a carbon plate, prevents the passage of air from the pump chambers. The relief valve assembly is pressed into the hole provided in the housing. See Figure 64-99. The valve relieves the air flow when the pump pressure reaches a predetermined value. The front bearing supports the rotor shaft; the bearing is secured by a snap ring.

The cast iron end cover supports the vane pivot pin, rear bearing inner race, and intake and exhaust tubes. See Figure 64-99. Dowel pins pressed into the housing correctly position the end cover, and the cover is fastened by four bolts.

The rotor positions and drives the three vanes; it supports the carbon seals, carbon shoes, and shoe springs. See Figure 64-98. Each of the three plastic vanes is riveted to hubs. The vane hubs have bearings that rotate on the pivot pin. The pulley drive hub is pressed on the rotor shaft, and bolt holes in the hub provide for attachment of a pulley.

b. Operation of Air Pump

The rotor is located in the center of the pump and is belt driven. The vanes rotate freely about the

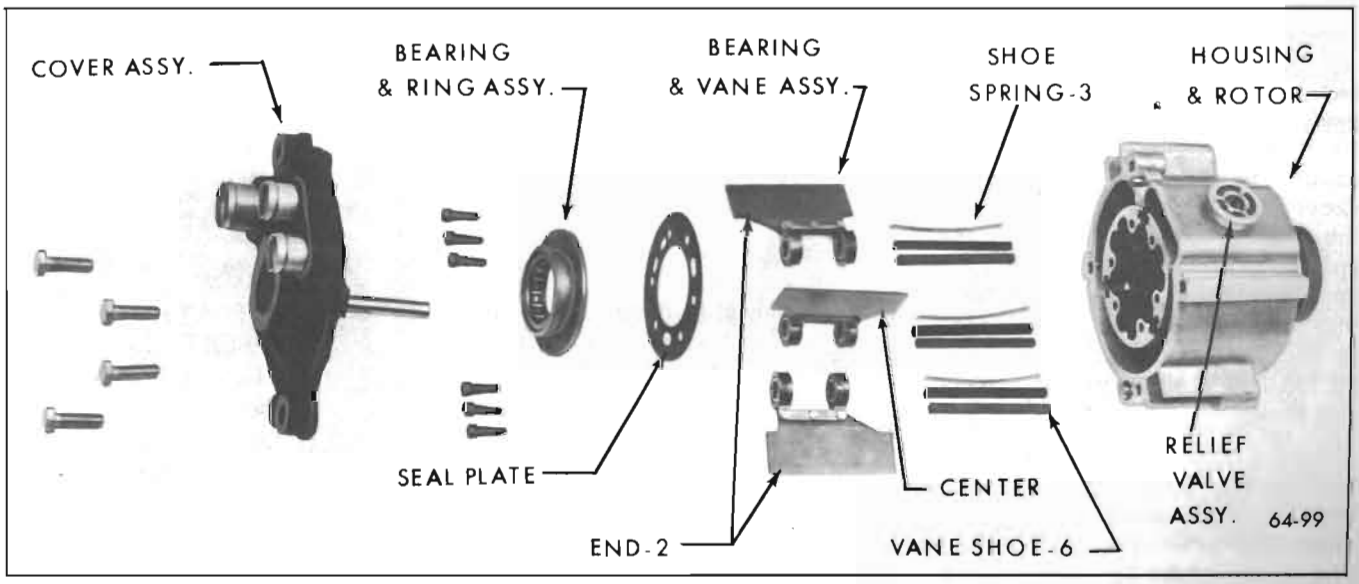

Figure 64-99—Air Pump Disassembled for Service

off-center pivot pin, and follow the circular-shaped pump bore. The vanes produce three chambers in the housing - intake, compression, and exhaust. Each vane completes a pumping cycle in every revolution of the rotor. The vane tips make no contact with the housing walls, but pass extremely close, by virtue of wearing away to conform to the housing during break-in running.

Air is drawn into the intake cavity through a tube connected to the air cleaner. The air is sealed between the vanes and moved into a smaller cavity - the compression area. After compression, the vanes pass the exhaust cavity where air exits through tubes connected to the engine exhaust ports. The vane next passes the stripper, a part of the housing that separates the exhaust and intake cavities. See Figure 64-98. The rotor outside diameter passes close to the stripper. Continuing the cycle, the vane again enters the intake cavity to repeat its pumping cycle.

Explanation of the vane rotation and pump cavities, however, does not completely describe air pump operation. The relief valve, metering grooves, and seals also influence the cycle. The relief valve is located in the exhaust cavity and has been pressed into the housing wall. The valve body encloses a preloaded spring, a seat, and a pressure-setting plug. Its function is to relieve the exhaust air flow if the pressure exceeds a pre-set value. Should the air pressure increase, the spring-loaded valve seat is forced up, opening the orifice and relieving the pressure. The pressure at which it opens is determined by the length of the pressure setting plug.

Metering grooves, machined into the housing wall, are located in both the intake and exhaust cavities. They provide a quiet transition from intake to compression to exhaust.

Carbon shoes support the vanes from slots in the rotor. See Figure 64-98. The shoes are designed to permit sliding of the vanes and seal the rotor interior from the air cavities. Leaf springs behind the follower-side shoes compensate for shoe wear. Air leaking into the rotor is exhausted through two small holes in the end cover. The rotor is further sealed by flexible carbon seals attached to each end. The plates also seal off the housing and end cover to confine the air to the pump cavities. Air that leaks by the front carbon seal is exhausted through a small hole in the housing.

Completing the rotating unit is a steel ring bolted to the rotor end. This ring prevents the rotor from spreading at high RPM and also positions and holds the rear bearing and the carbon seal.

The front and rear bearings, which support the rotor, are of two types. The front uses ball and the rear, needle bearings; needles are also used for the vane bearings. All bearings have been greased at the factory and no periodic lubrication is required.

DIVISION III SERVICE PROCEDURES

64-42 DISASSEMBLY AND ASSEMBLY OF AIR PUMP

a. Disassembly of Air Pump

1. Mount air pump for disassembly by clamping drive hub in a vise. See Figure 64-100.

CAUTION: Never clamp vise on the aluminum housing or it may become distorted.

2. Remove four housing cover bolts.

Figure 64-100—Air Pump Correctly Mounted for Disassembly

3. Remove housing end cover by tapping protruding edge with a soft hammer while pulling straight up on cover. See Figure 64-101.

4. Remove six rotor ring screws with allen wrench and remove rotor ring along with carbon seal. See Figure 64-102.

5. Remove three vanes from rotor. See Figure 64-103. Clean vane bearings with solvent and blow out with air hose. Inspect bearings for wear or damage;

Figure 64-101—Removing Housing End Cover

Figure 64-102—Removing Rotor Ring Screws

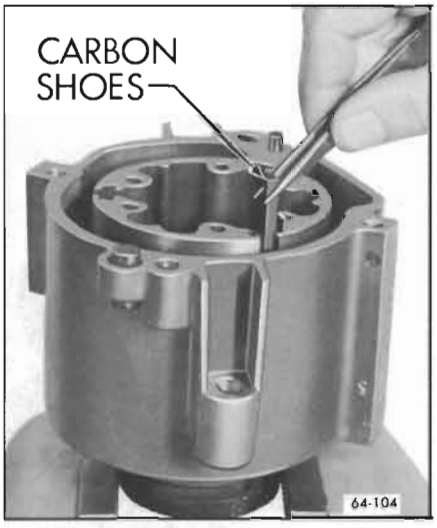

Figure 64-104—Removing Shoes

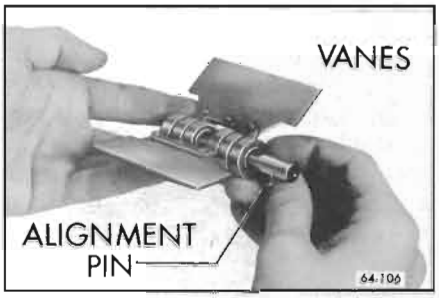

Figure 64-106—Assembling Vanes on Alignment Pin

if a bearing is defective, vane must be replaced.

6. Remove six carbon shoes with tweezers. See Figure 64-104. Remove three shoe springs.

7. Clean rear bearing in solvent and blow out with air hose. Inspect bearing for wear or damage. If bearing is defective, press from rear rotor ring using an arbor press. See Figure 64-105. Be sure to adequately support rotor ring to avoid distortion. Press new bearing into ring until bearing is 1/32 inch below ring surface. Press on lettered end of bearing only.

8. Remove a defective relief valve by prying under opposite sides at the same time. Install new relief valve by starting valve in housing hole; then hold a flat plate over valve and tap plate with a hammer until valve shoulder seats on housing.

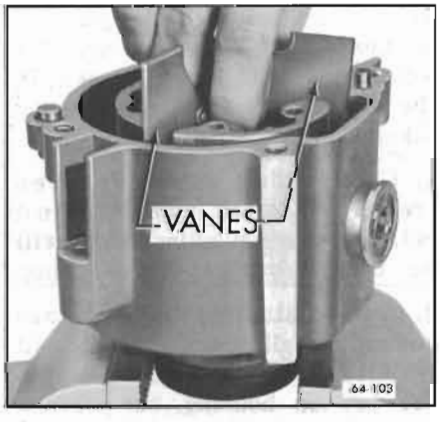

Figure 64-103—Removing Vanes

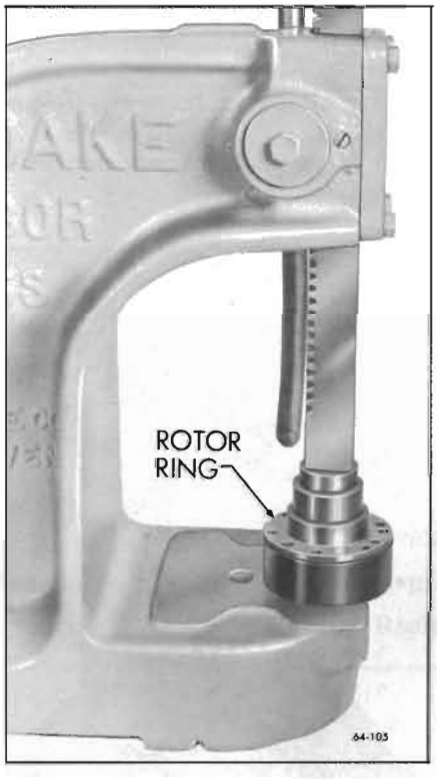

Figure 64-105—Pressing Rear Bearing from Rotor Ring

9. Thoroughly pack each vane bearing with SSG code #5124 grease. Assemble vanes on an alignment pin 3/8 inch in diameter by approximately 3-1/2 inches long. See Figure 64-106.

10. Install vane and pin assembly in rotor. Insert with one vane against housing stripper (dividing wall between intake and exhaust chambers) as shown in Figure 64-107. Leave alignment pin in until later.

11. Insert one carbon shoe on each side of every vane. Notice that shoes are square except for one slanting side. Each shoe must be installed with slanting side toward vane and with sharpest corner outward. See Figure 64-108.

12. Insert three shoe springs in

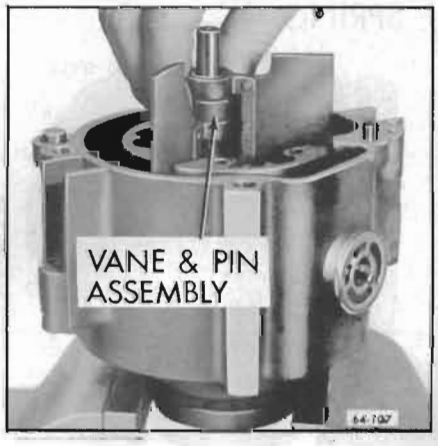

Figure 64-107—Installing Vane and Pin Assembly in Rotor

Figure 64-108—Installing Carbon Shoes

back of shoes in three deeper shoe slots. Curved center of spring must contact shoe. See Figure 64-109.

13. Thoroughly pack rear bearing with SSG code #5124 grease. Place new carbon seal on rotor. Install rotor ring on rotor; holes will align with ring in one position only. Apply "Loctite" thread lock or equivalent on allen screw

Figure 64-110—Installing Carbon Seal and Rotor Ring

threads and torque screws to 37 lbs. in. See Figure 64-110.

14. Remove alignment pin from vane bearings. Start housing cover into position; jockey cover as necessary to insert pivot pin through all vane bearings. See Figure 64-111.

15. Install cover bolts and torque to 10 lb. ft. See Figure 64-112. Hold housing from rotating with other hand.

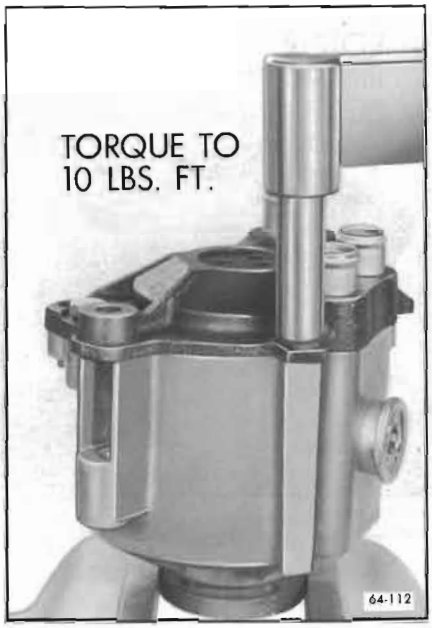

Figure 64-112—Torquing Housing Cover Bolts

Figure 64-109—Installing Shoe Springs

Figure 64-111—Installing Housing Cover

DIVISION IV

TROUBLE DIAGNOSIS

64-43 AIR PUMP TROUBLE DIAGNOSIS

a. Pump Noise Diagnosis—On Car

The air pump is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases. Air pump noise can be confused with other engine noise. If excessive noise is heard, remove the pump drive belt to determine if the pump is at fault. If it is determined that excessive pump noise is present, the following steps should be taken in the order given:

1. Check that pump rotates freely. A seized pump will not rotate and a squealing noise will be caused by the belt slipping.

2. If squealing noise is heard during acceleration, check belt tightness. In tightening belt, do not pry on housing, but position pump by hand. Correct belt tension is 60 lbs. on Gage J-7316.

3. Check entire system for leaks in hoses and around clamps. With engine running, leaks can be detected by feeling along entire length of each line.

4. Check air cleaner wing nut. If air cleaner is not fastened down securely, normal pump intake noise will be much more noticeable.

5. Check relief valve. Relief valve leakage will cause excessive noise. Run engine at a fast idle (1500 RPM); if any air escapes from the valve, valve must be replaced.

6. An intermittent chirping or squeaking noise which is most noticeable at low speeds is most likely caused by the vanes rubbing in the housing bore. To achieve the best possible fit, these vanes are designed to lightly contact the bore when new, but to just clear the bore when worn-in. Generally vane chirp will be gone after the air pump is thoroughly broken in at high speeds.

b. Pump Noise Diagnosis—On Bench

If the cause of the noise cannot be corrected on the car, it will be necessary to remove the pump from the car and disassemble it, following the steps outlined under Disassembly and Assembly of Air Pump.

1. With pump removed, rotate pulley in jerks three-quarters of a turn forward and one-quarter backward. Roughness or bumps may indicate vane bearing failure.

2. Check inside of housing cover for vane and rotor wear. Excessive rotor wear means assembly must be replaced.

3. Check rear bearing for failure. Extensive failure of this bearing may necessitate replacing assembly if failure has permitted rotor to score housing extensively. Minor failure of this bearing must be followed by a check of vane bearings and pivot pin.

4. Check rear carbon seal for damage or excessive wear.

5. Remove the vane assemblies and check vanes and bearings for damage or excessive wear.

6. Check carbon shoes for chipping. Damaged or excessively worn shoes must be replaced.

7. Generally carbon dust will be present on the vanes and in the housing. This is not an indication of failure, but of normal wear. Remove carbon dust by blowing with an air hose.

TROUBLE SHOOTING PUMP NOISE—QUICK REFERENCE CHART

CAUSE	REMEDY
1. Inoperative	Replace Pump
2. Loose Belt	Tighten Belt to 60 lbs.
3. Leak in Hose	Locate Source of Leak and Correct
4. Loose hose	Re-assemble and Tighten Clamp
5. Leak at Air Cleaner	Tighten Air Cleaner
6. Leak at Relief Valve	Replace Valve
7. Vane Bearing Failure	Replace Vane Assemblies
8. Vane Wear	Replace Vane Assemblies
9. Rear Bearing Failure	Replace Rear Bearing
10. Carbon Seal Failure	Replace Carbon Seal
11. Carbon Shoe Failure	Replace Carbon Shoes

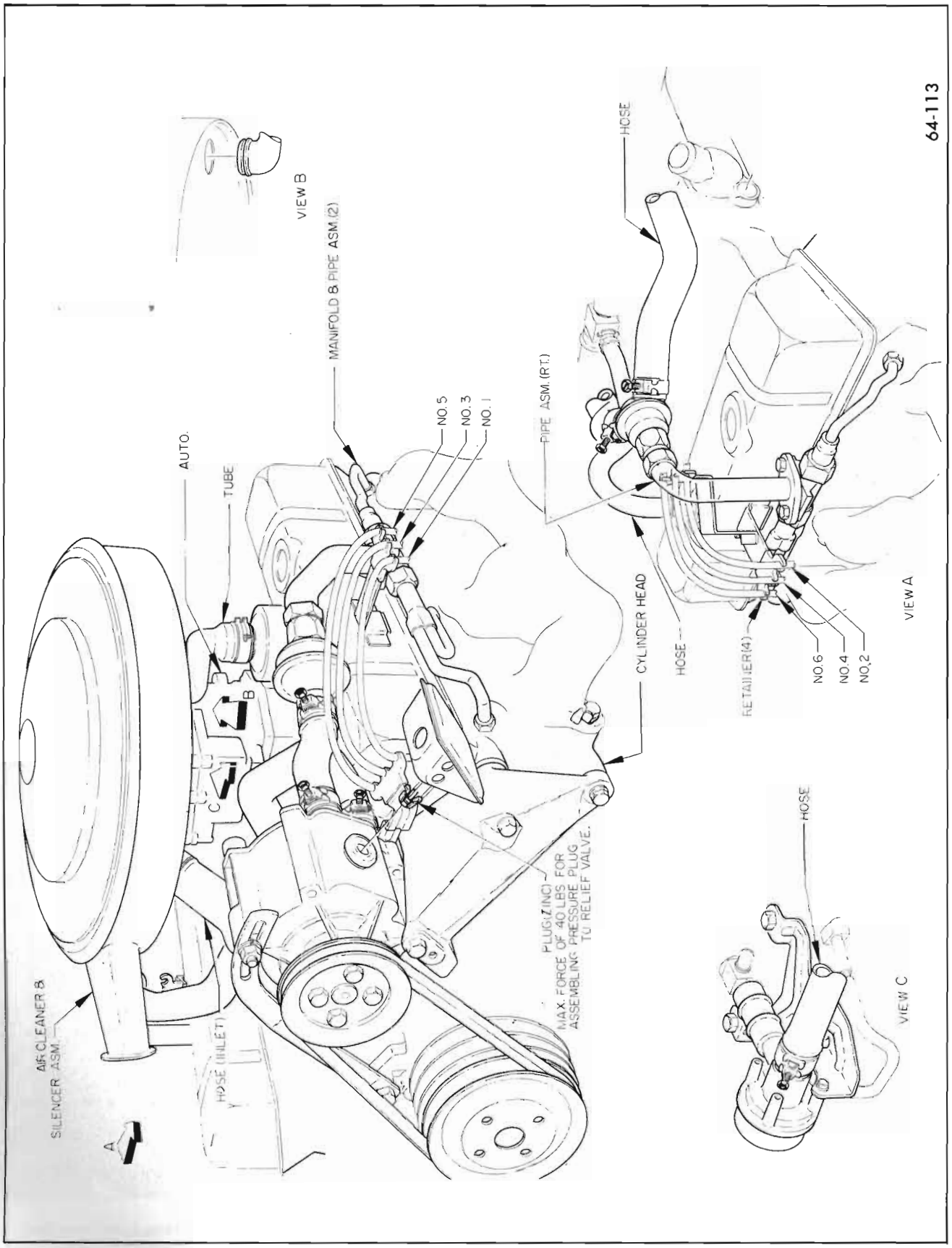

Figure 64-113—Exhaust Emission Control System - 225 Engine Less Power Steering

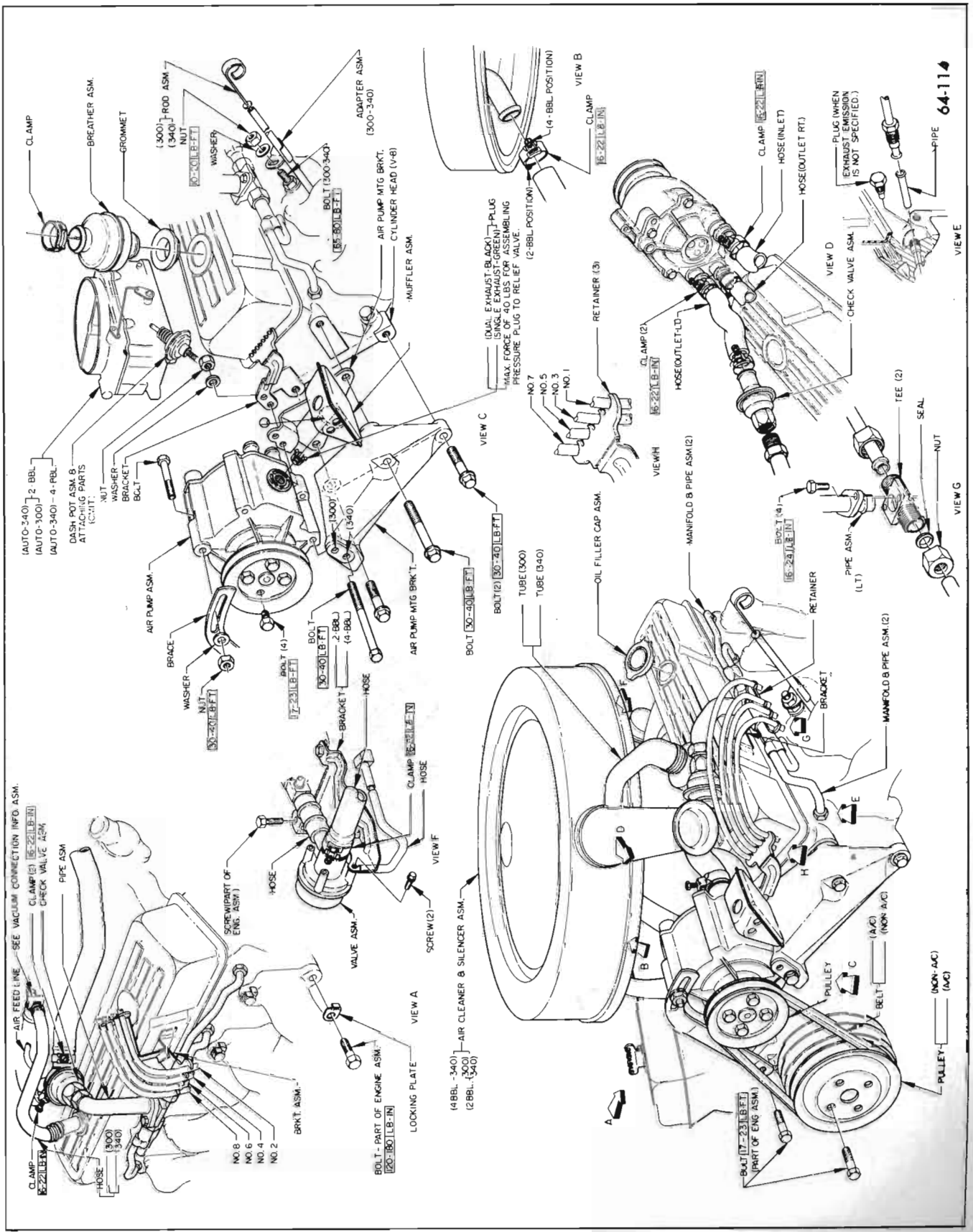

Figure 64-114—Exhaust Emission Control System - 300 and 340 Engine Less Power Steering

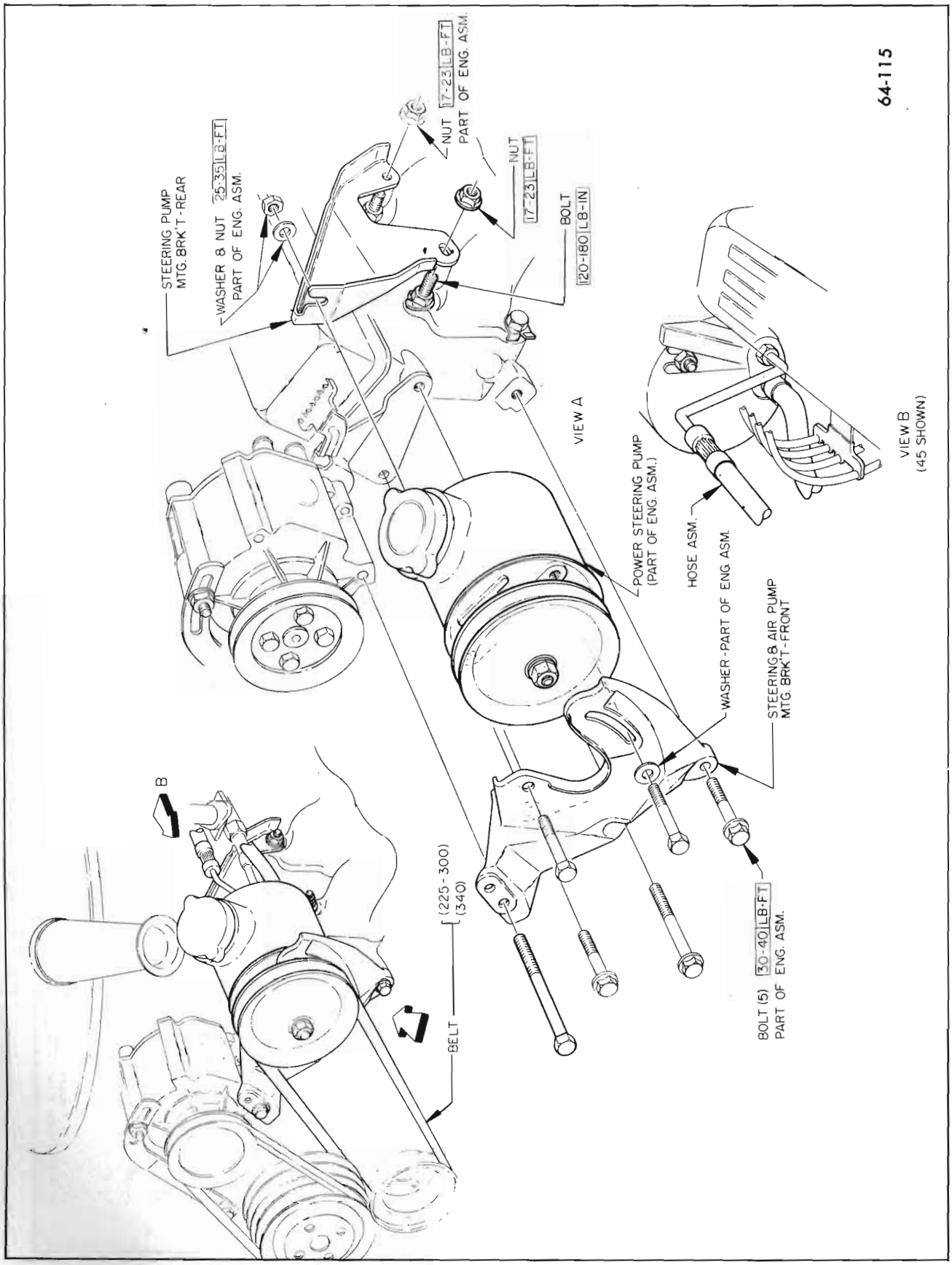

Figure 64-115—Exhaust Emission Control Parts - 225, 300 and 340 Engine With Power Steering

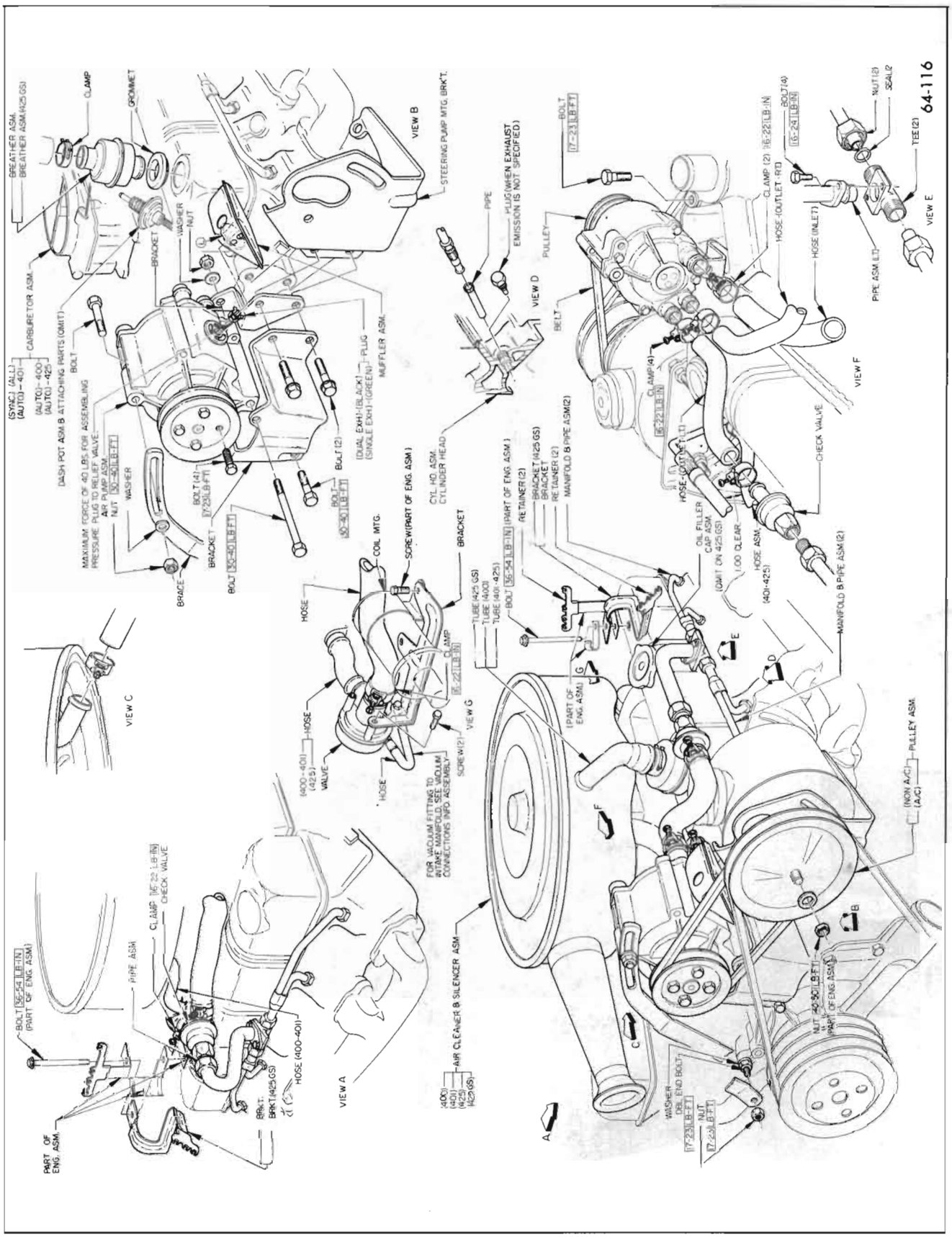

Figure 64-116—Exhaust Emission Control System - 400, 401 and 425 Engine

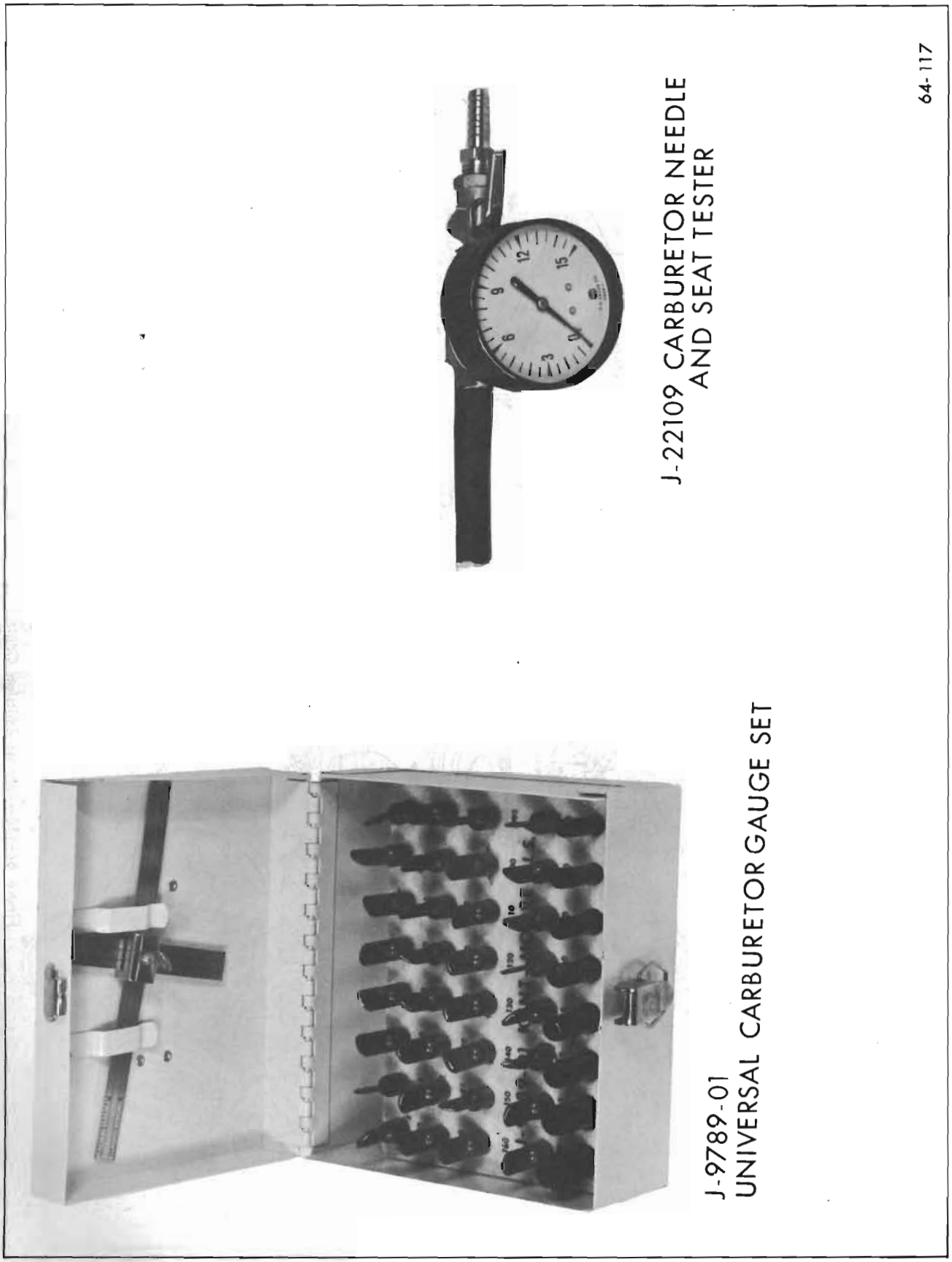

Figure 64-117