

SECTION 6D5

ENGINE WIRING

When it is necessary to move any of the wiring, whether to lift wires away from their harnesses or move harnesses to reach some component, take care that all wiring is replaced in its original position and all harnesses are routed correctly. If clips or retainers break, replace them. Electrical problems can result from wiring or harnesses becoming loose and moving from their original positions or from being rerouted. Refer to figures 1 through 23 for the correct routing of the engine wiring.

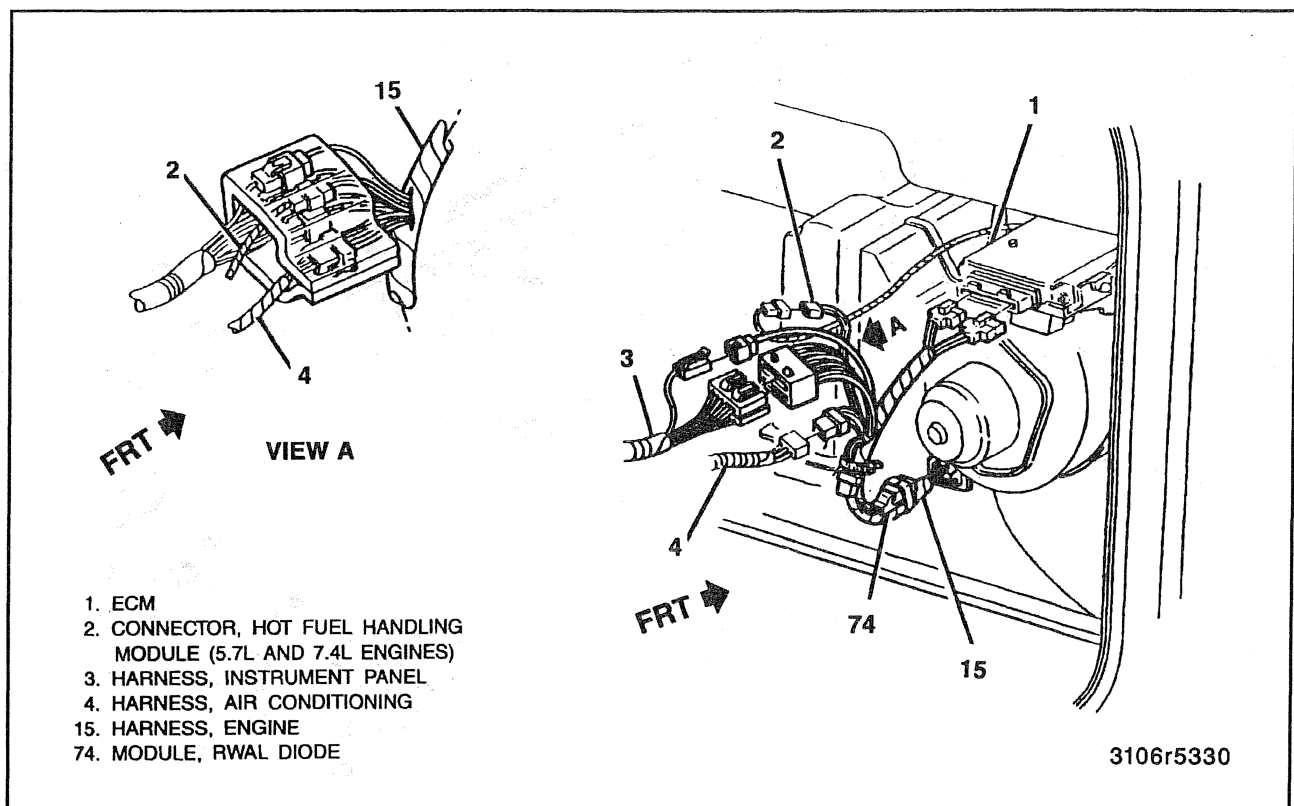


Figure 1—Engine Wiring to the Control Module (Gas Engines)

6D5-2 ENGINE WIRING

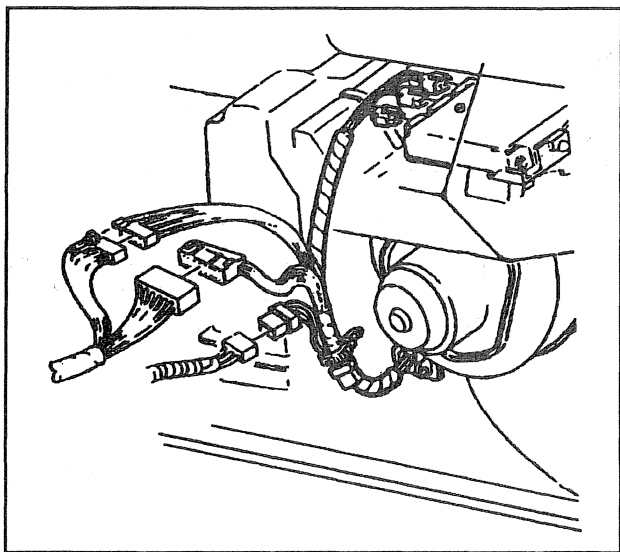


Figure 2—Engine Wiring to the Control Module
(Diesel Engines)

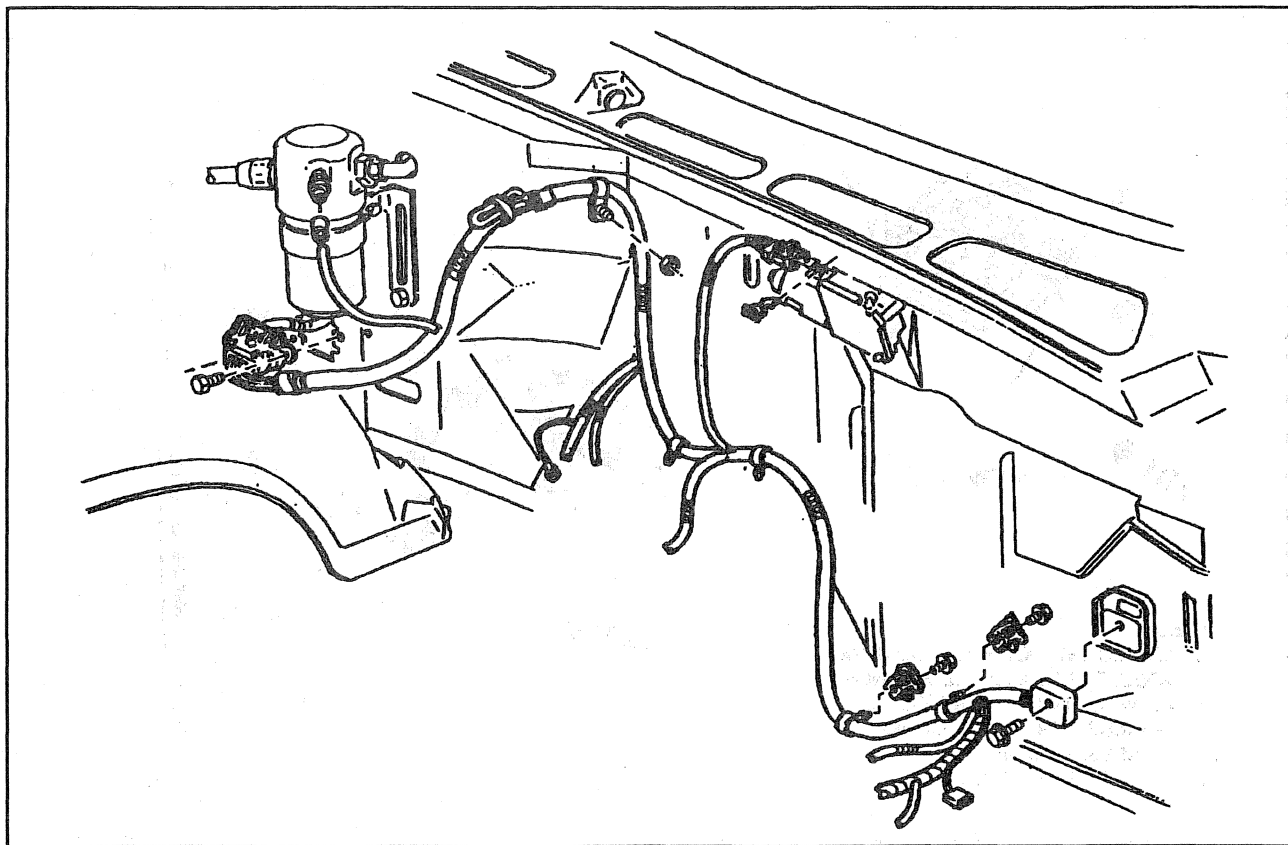


Figure 3—Engine Wiring at the Cowl

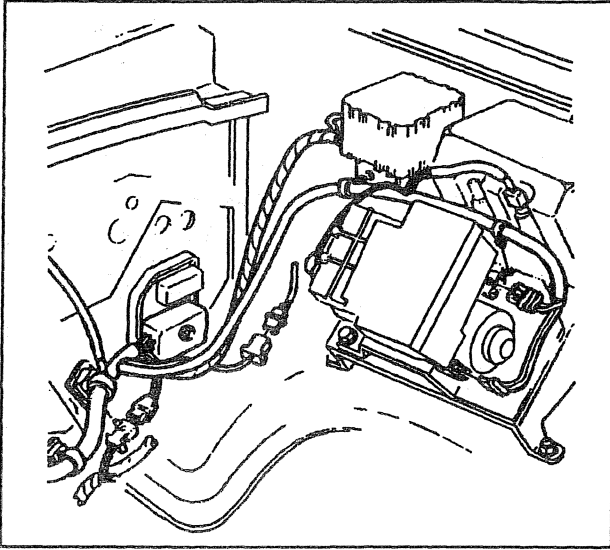


Figure 4—Engine Wiring from Junction Block (Diesel Engine)

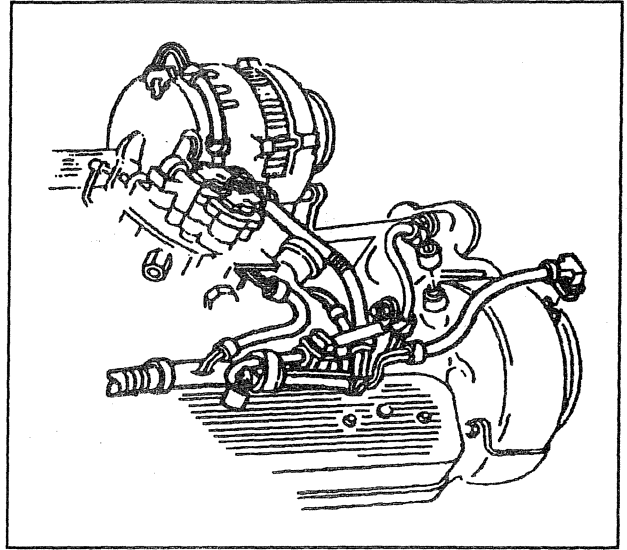


Figure 7—Engine Wiring to A/C Compressor (4.3L)

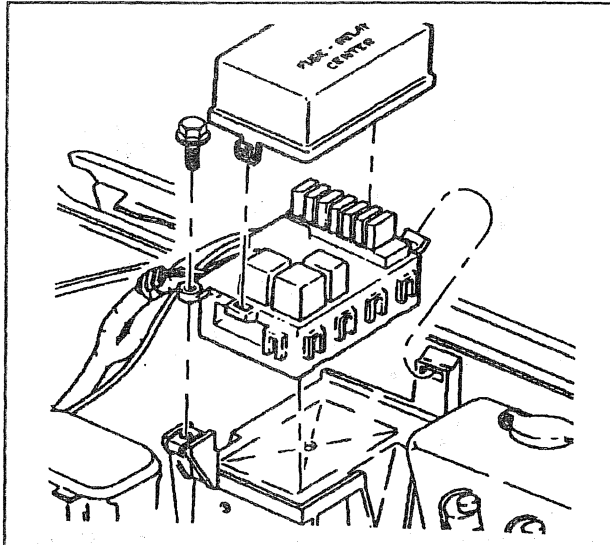


Figure 5—Engine Wiring to the Fuse Relay Center

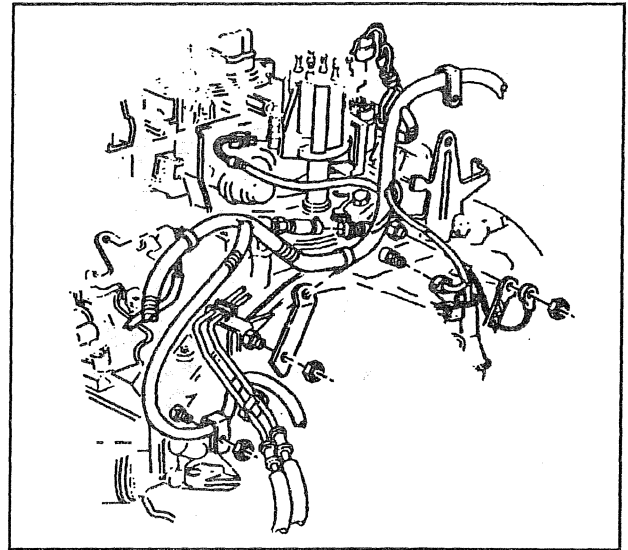


Figure 8—Engine Wiring Views - Rear (4.3L)

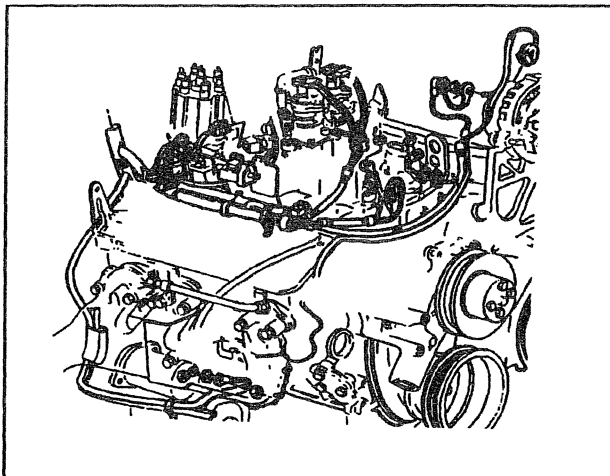


Figure 6—Engine Wiring (4.3L)

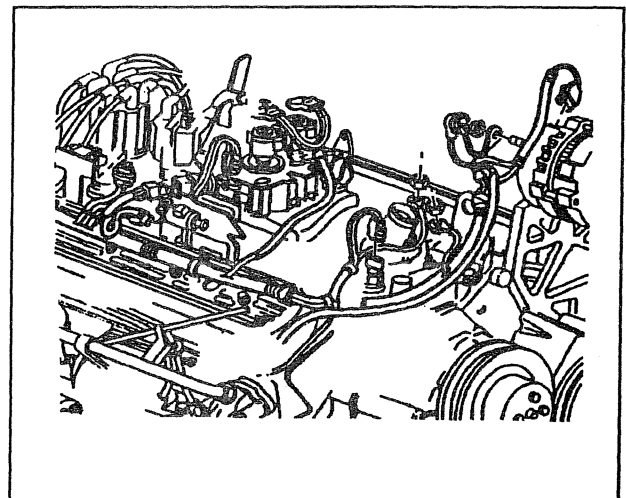


Figure 9—Engine Wiring Views - Top (5.0L - 5.7L)

6D5-4 ENGINE WIRING

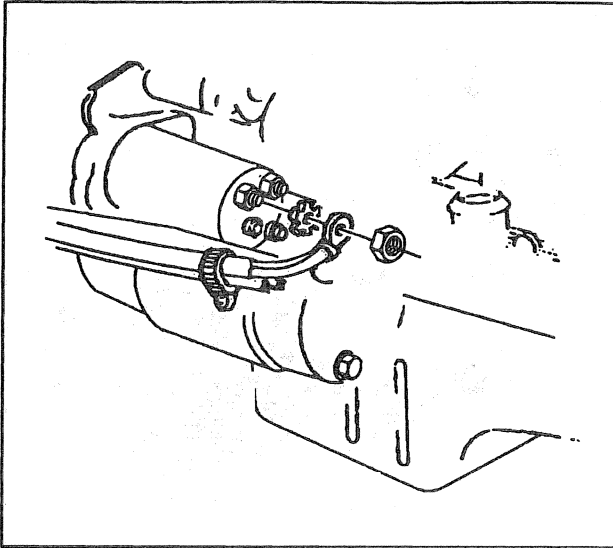


Figure 10—Starter Connections (5.0L - 5.7L)

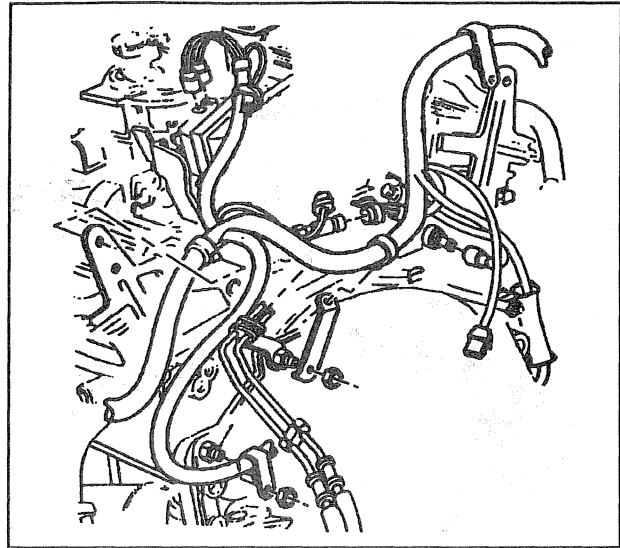


Figure 12—Engine Wiring - Rear (5.0L - 5.7L)

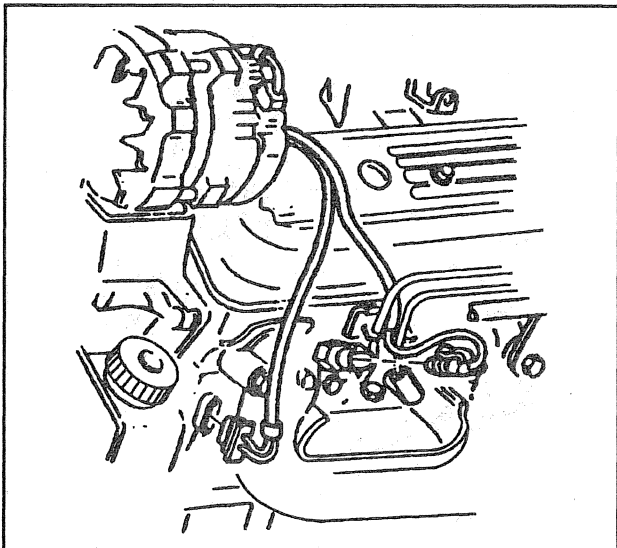


Figure 11—Engine Wiring Views - Left Side (5.0L - 5.7L)

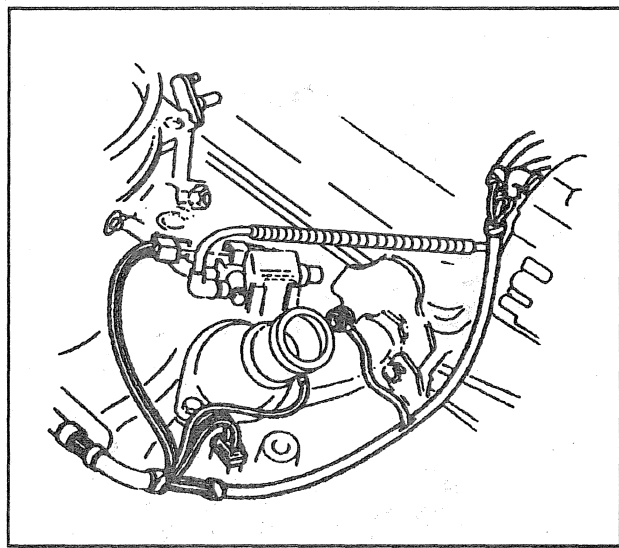


Figure 13—Engine Wiring to the Canister Purge Solenoid

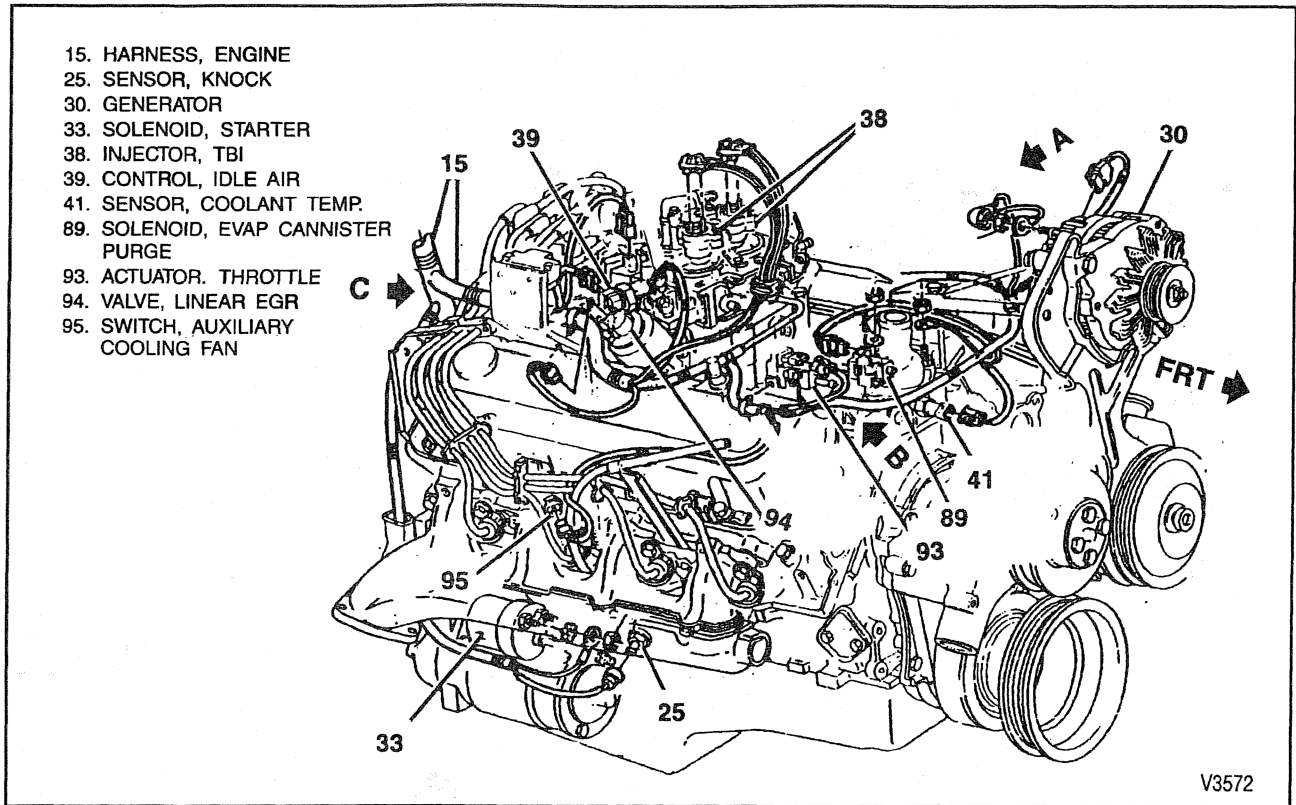


Figure 14—Engine Wiring - Right and Left Sides (7.4L)

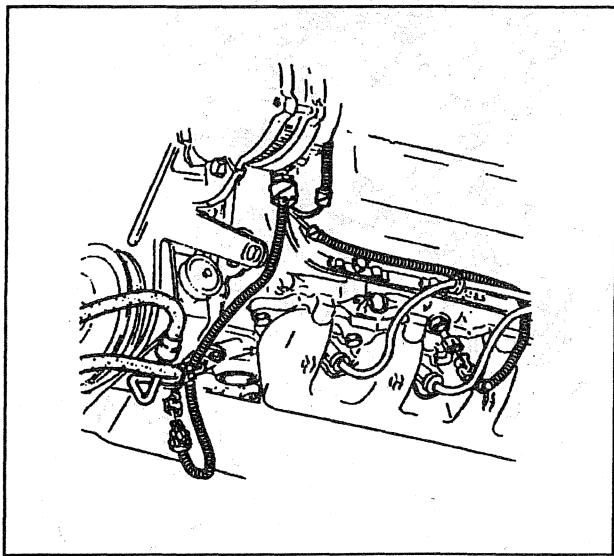


Figure 15—Engine Wiring - Left Side (7.4L)

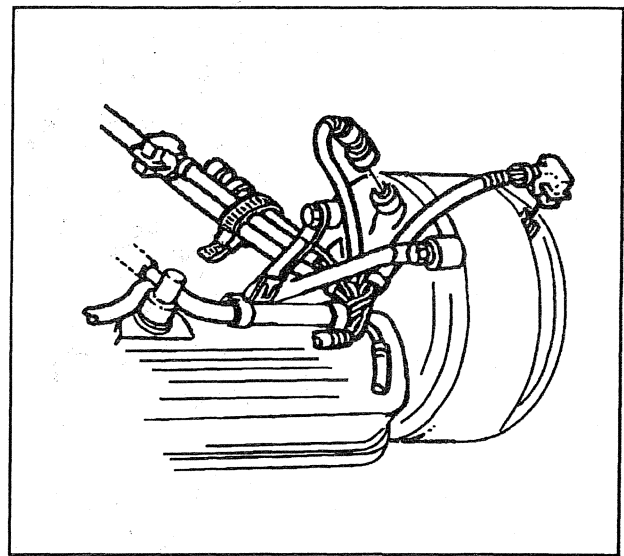


Figure 16—Engine Wiring to A/C Compressor (7.4L)

6D5-6 ENGINE WIRING

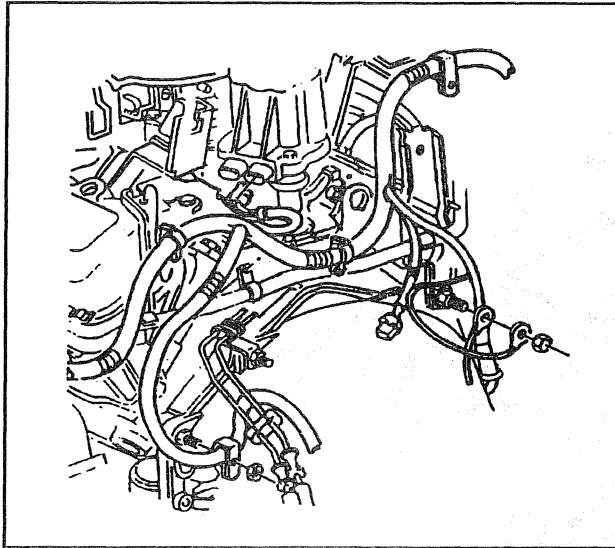
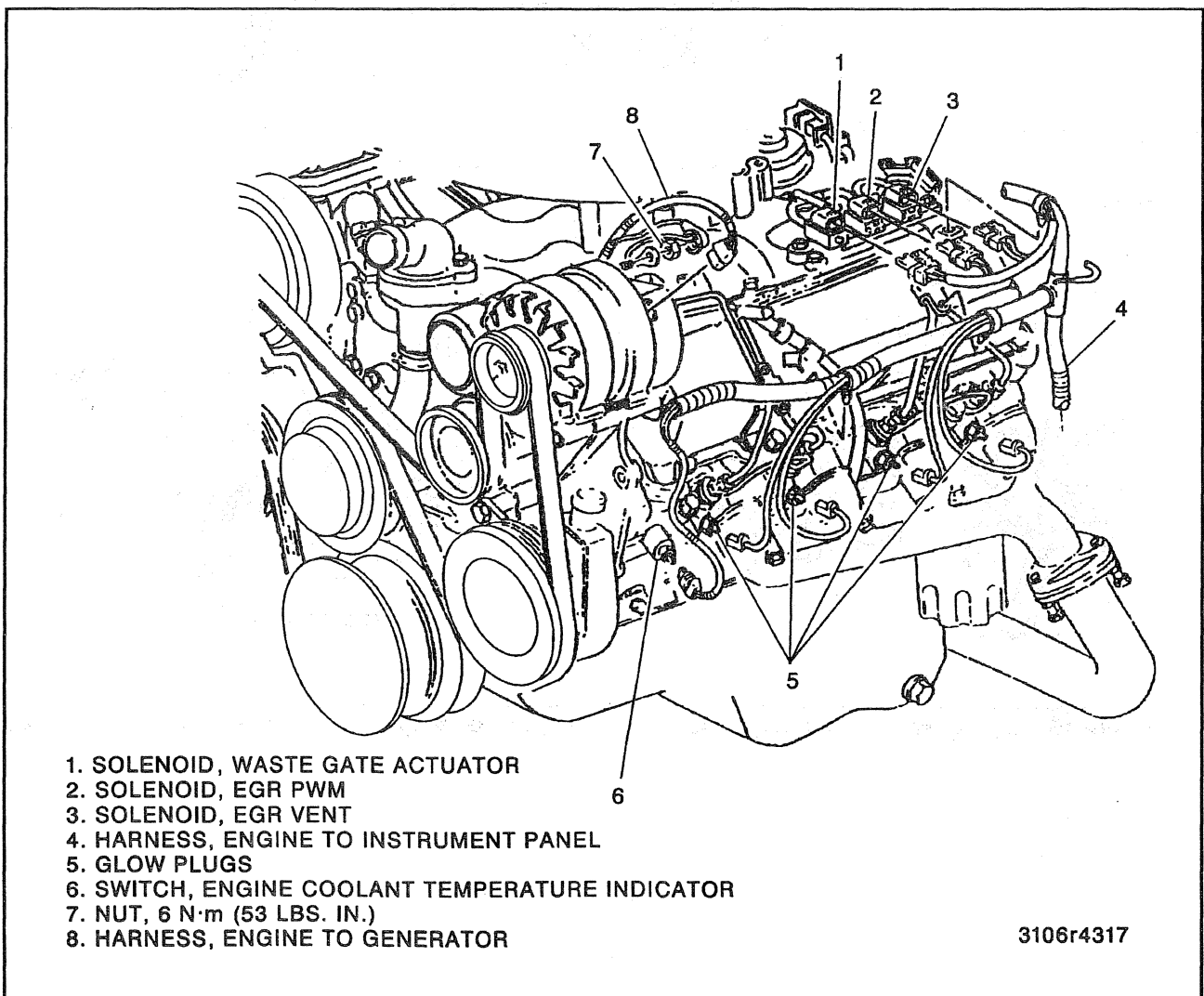


Figure 17—Engine Wiring - Rear (7.4L)



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Figure 18—Engine Wiring - Left Side (6.5L Diesel Engines)

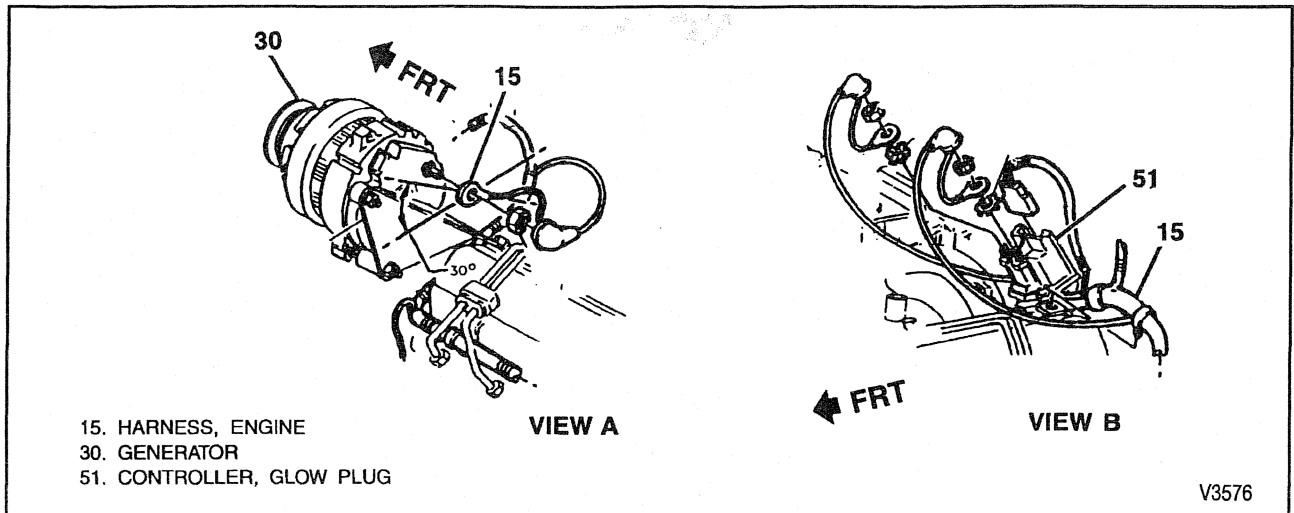


Figure 19—Engine Wiring - Left Side Views (6.5L Diesel Engines)

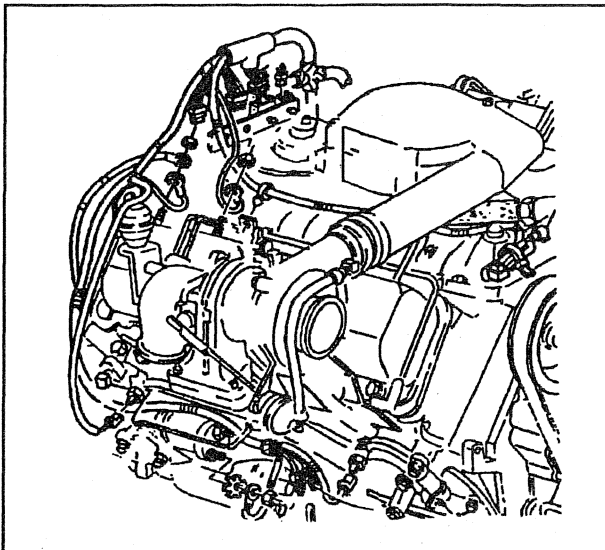


Figure 20—Engine Wiring - Right Side (6.5L)

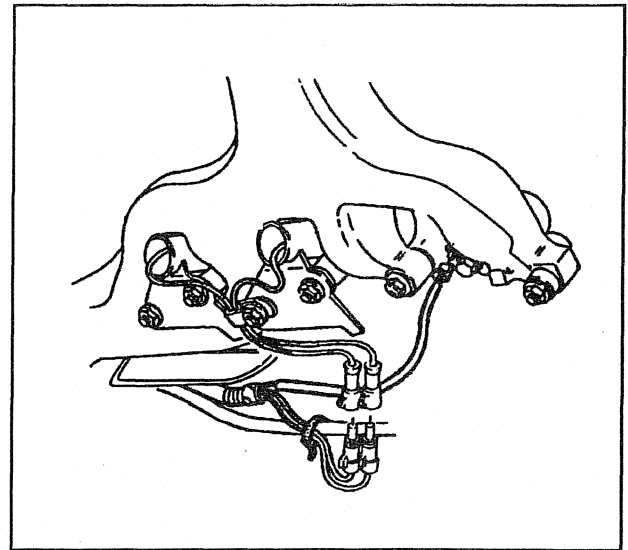


Figure 22—Glow Plug Connections (6.5L)

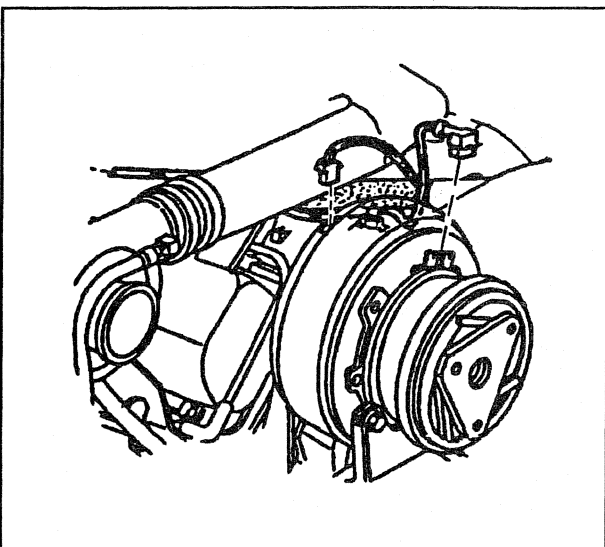


Figure 21—Engine Wiring to A/C Compressor (6.5L)

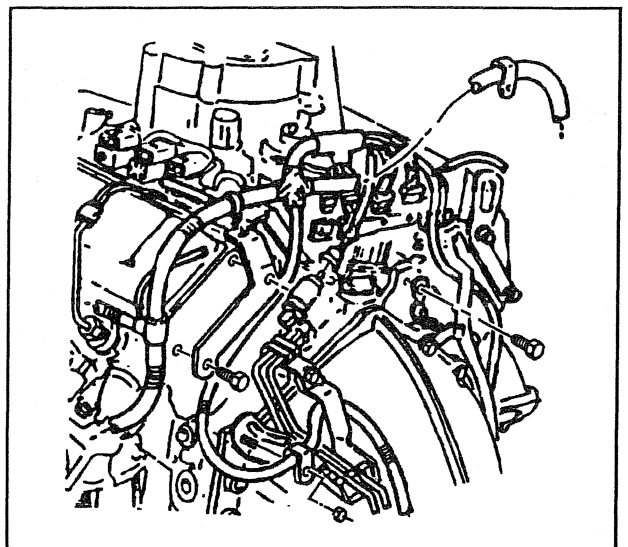


Figure 23—Engine Wiring - Rear (6.5L)

NOTES

SECTION 6D6

**DIESEL GLOW PLUG ELECTRICAL
SYSTEM**

There are three versions of the 6.5L diesel available with these vehicles. Included are: the naturally aspirated (RPO L49, VIN P), the turbocharged light duty (RPO L56, VIN S), and the turbocharged heavy duty (RPO L65, VIN F). These engines use an electronically-controlled injector pump and glow plug electrical system. For diagnosis, refer to the Fuel and Emission Section of GMT/95-CK-2.

6D6-2 DIESEL GLOW PLUG ELECTRICAL SYSTEM

NOTES

1. The glow plug system is used to pre-heat the combustion chamber.

2. The glow plug system is controlled by the engine control unit.

3. The glow plug system is used to pre-heat the combustion chamber. The glow plug system is controlled by the engine control unit. The glow plug system is used to pre-heat the combustion chamber. The glow plug system is controlled by the engine control unit.

SECTION 6E

EMISSIONS

The gasoline engines used in these vehicles use a throttle body fuel injection (TBI) unit. For information about throttle body fuel injection and engine emission systems, refer to the Driveability, Emissions, and Electrical Diagnosis Manual.

6E-2 EMISSIONS

NOTES

SECTION 6E2

DIESEL EMISSIONS

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: Always use the correct fastener in the correct location. Use the correct fastener part number to replace a fastener. If the correct fastener part number is not available, a fastener of equal size and strength may be used. Do not use a fastener that is stronger when the correct fastener part number is not available in the following applications:

- Some bolts are designed to permanently stretch, and if a stronger fastener is used, the part will not be tightened correctly. These permanently stretching bolts will be called out. The correct part number fasteners must be used to replace this type of fastener because there is no available equivalent.
- Other bolts are designed to break if over tightened to prevent part damage. If a stronger fastener is used part damage may occur.

Fasteners that need to be replaced when removed will be called out. Fasteners that require thread lockers or thread sealant will be called out. The correct tightening specification and sequence must be used when installing fasteners. Part or system damage may occur if the above instructions are not followed.

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GENERAL DESCRIPTION

The 6.5L diesel engine has controls to reduce emissions while maintaining good driveability and fuel economy. The light duty naturally aspirated engine (L49, VIN P) comes equipped with the following controls:

- A. Crankcase ventilation system.
- B. Powertrain control module.
- C. Vacuum pump.
- D. Exhaust gas recirculation (EGR).
- E. Cold advance and glow plug control.
- F. Automatic transmission control.

CRANKCASE VENTILATION
SYSTEM

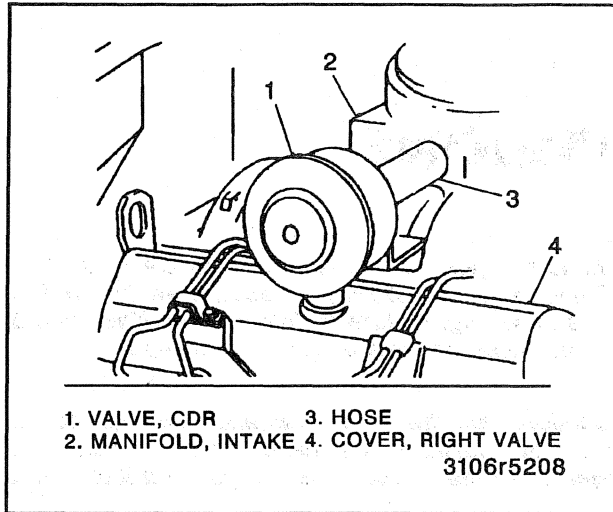
The crankcase ventilation system is designed to reduce the crankcase pressure at idle. This lower pressure reduces engine oil leaks. The system consists of a

crankcase depression regulator valve located on the right valve cover (figure 1).

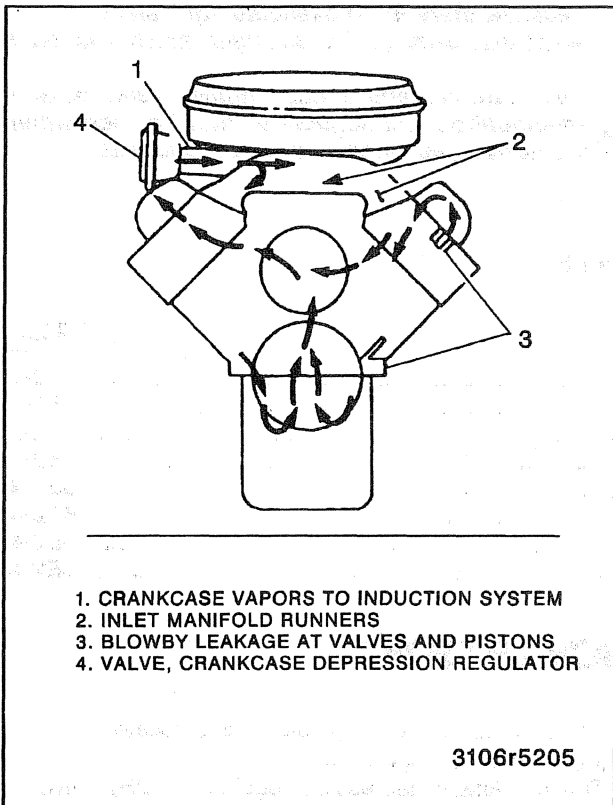
The crankcase depression regulator (CDR) valve is used to regulate the flow of crankcase gases back into the engine. The valve is designed to limit vacuum in the crankcase as the gases are drawn from the right valve cover, through the valve, and into the intake manifold (figure 2).

The intake manifold vacuum acts against a spring loaded diaphragm to control the flow of crankcase gases. Higher intake vacuum levels pull the diaphragm closer to the top of the outlet tube. This reduces the amount of gases being drawn from the crankcase and decreases the vacuum level in the crankcase. As the intake vacuum decreases, the spring pushes the diaphragm away from the top of the outlet tube allowing more gases to flow to the intake manifold (figure 3). For

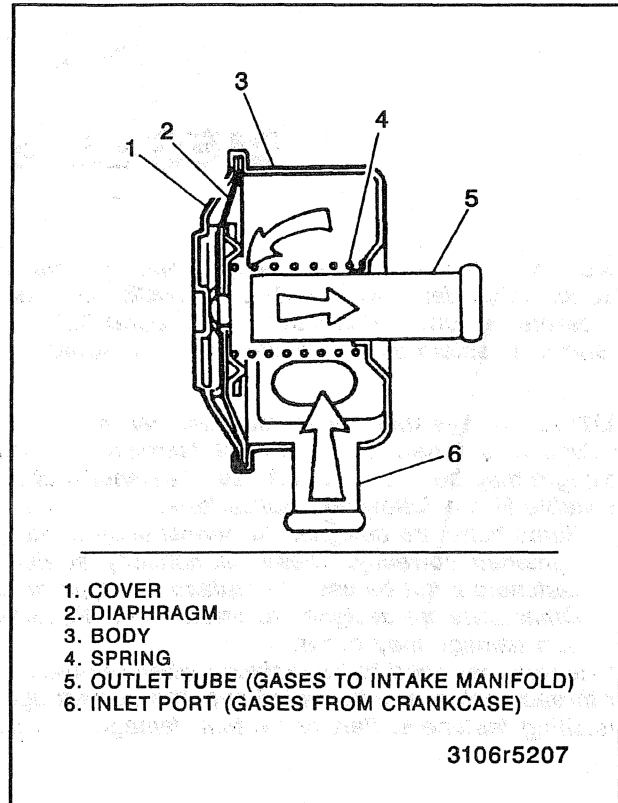
6E2-2 DIESEL EMISSIONS



Figure—1 CDR Valve



Figure—2 Crankcase Vapor Flow

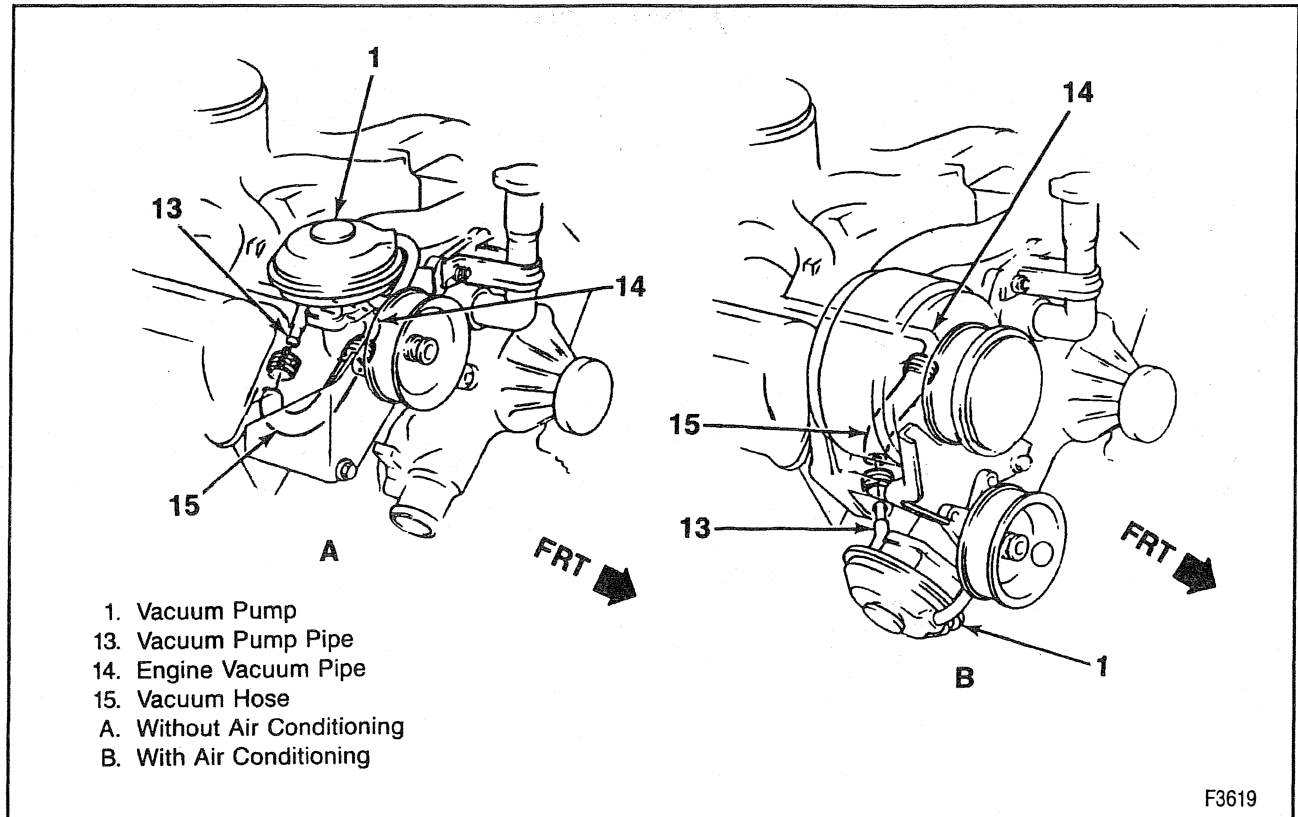


Figure—3 CDR Valve Operation

information about the Diagnostic Trouble Codes (DTC), refer to the Driveability, Emissions and Electrical Diagnosis Manual, GMT/95-CK-2.

VACUUM PUMP

A vacuum pump is located on the front right side of the engine and provides a vacuum source to operate the EGR system for the light duty naturally aspirated engine (L49, VIN P) and air conditioning servos (if equipped) (figure 4).



Figure—4 Vacuum Pump and Components

DIAGNOSIS

The purpose of the CDR valve is to maintain 0.75 to 1.0 kPa (3 to 4 hg - inches of mercury) vacuum in the crankcase. Too little vacuum will tend to force oil leaks. Too much vacuum will pull oil into the air crossover.

The CDR valve is checked with a water manometer. The U-tube manometer (figure 5) indicates pressure or vacuum by the difference in the height of two columns of fluid.

CDR VALVE TEST

1. Connect one end of the manometer to the engine oil dipstick hole. The other end of the manometer is vented to atmosphere.
2. Install the air cleaner.
3. Start the engine and observe the manometer reading. It should read one inch of water pressure at idle to approximately 3 to 4 inches of water vacuum at full load. Add the amount that the manometer column travels up, to amount column travels down to obtain total psi/vacuum. An example of a manometer reading is as follows: One-half inch above zero plus one-half inch below zero equals one inch vacuum reading ($1/2'' + 1/2'' = 1''$) (figure 5).

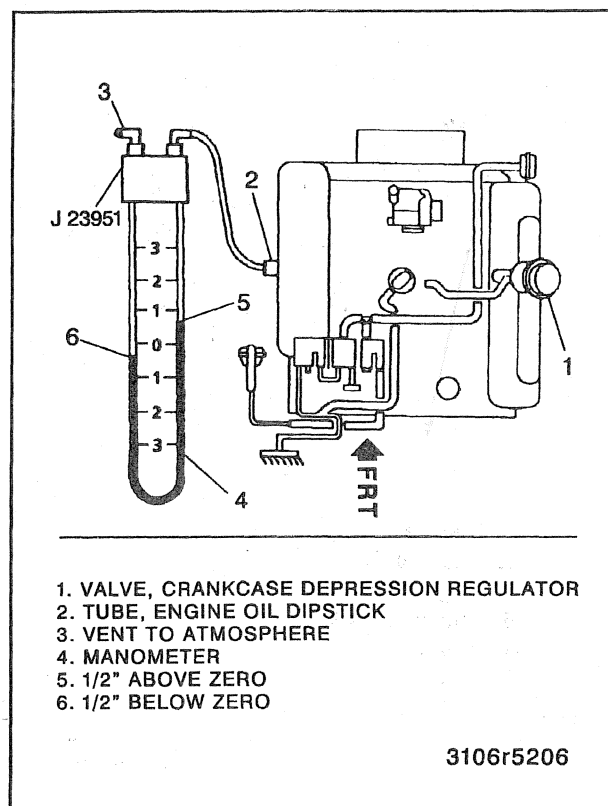


Figure 5—CDR Valve Test

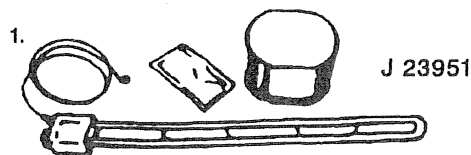
ON-VEHICLE SERVICE

CDR VALVE AND HOSES

NOTICE: Do not allow any solvent to come in contact with the diaphragm of the crankcase depression regulator valve because the diaphragm will fail.

The crankcase depression regulator valve is replaced as an assembly. Replace hoses as required, if inspection indicates cracks or decay. Refer to SECTION 0B for diesel crankcase ventilation system maintenance requirements.

SPECIAL TOOLS



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SECTION 6F

EXHAUST SYSTEM

CAUTION: On vehicles equipped with Supplemental Inflatable Restraint (SIR), refer to **CAUTIONS** in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow **CAUTIONS** could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: Always use the correct fastener in the correct location. Use the correct fastener part number to replace a fastener. If the correct fastener part number is not available, a fastener of equal size and strength may be used. Do not use a fastener that is stronger when the correct fastener part number is not available in the following applications:

- Some bolts are designed to permanently stretch, and if a stronger fastener is used, the part will not be tightened correctly. These permanently stretching bolts will be called out. The correct part number fasteners must be used to replace this type of fastener because there is no available equivalent.
- Other bolts are designed to break if over tightened to prevent part damage. If a stronger fastener is used part damage may occur.

Fasteners that need to be replaced when removed will be called out. Fasteners that require thread lockers or thread sealant will be called out. The correct tightening specification and sequence must be used when installing fasteners. Part or system damage may occur if the above instructions are not followed.

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GENERAL DESCRIPTION

Exhaust system designs vary according to the engine designation and intended use of the vehicle.

The exhaust pipe(s), muffler(s), and tailpipe(s) are standard equipment. The exhaust system uses a ball joint coupling to secure the exhaust pipe to the engine manifold. The ball joint allows angular movement for alignment purposes. The other connections use a slip joint coupling design with a clamp and U-bolt.

The exhaust system is suspended by hangers attached to the frame members. These allow some movement of the exhaust system, but should not allow the transfer of noise and vibration into the vehicle.

Heat shields are used to protect the vehicle and the environment from the high temperatures developed from the exhaust system, especially the three-way catalytic converter.

A close-couple catalytic converter operates the same as a three-way catalytic converter to reduce exhaust emissions. The converter and (Y-pipe) assembly are a one-piece unit. The catalyst in the close-couple converter is not serviceable.

The three-way catalytic converter is an emission control device added to the gasoline engine exhaust system to reduce hydrocarbon, carbon monoxide, and nitrogen oxide pollutants from the exhaust gases. The catalyst in the three-way converter is not serviceable.

NOTICE: The three-way catalytic converter requires the use of unleaded fuel only. Using leaded fuel will damage the catalytic converter and other emission system components.

6F-2 EXHAUST SYSTEM

Several diesel engines use an oxidizing catalytic converter. It's an emission control device added to the exhaust system to reduce smoke (particulates). The oxidizing catalytic converter operates at normal exhaust

system temperature as there is no significant temperature increase as a result of oxidation of particulates.

The catalyst in the oxidizing converter is not serviceable.

DIAGNOSIS OF EXHAUST SYSTEM

NOTICE: Replacement of exhaust system parts **MUST** be OEM standard.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Vibrating or Rattling From Exhaust System	Loose and/or misaligned components.	Align, then tighten connections. Check for damaged hanger or mounting brackets and clamps.
Restricted Exhaust System (Gasoline Engines)	<ol style="list-style-type: none">1. "Kinked" exhaust tubing.2. Restriction within the muffler. Refer to "Restricted Exhaust System Check" in the Driveability, Emissions, and Electrical Diagnosis Manual, GMT/95-CK-2.3. End of tail pipe obstruction.4. Plugged catalytic converter (may result from serious engine malfunction). Refer to "Restricted Exhaust System Check" in the Driveability, Emissions, and Electrical Diagnosis Manual, GMT/95-CK-2.	<ol style="list-style-type: none">1. If possible, repair the damaged condition, otherwise replace the component.2. If restriction is suspected, remove the muffler and visually check it. Replace muffler if condition is doubtful.3. Remove the obstruction, or if end is crimped, straighten outlet.4. Replace the catalytic converter. Correct engine malfunction.
Restricted Exhaust System (Diesel Engines)	<ol style="list-style-type: none">1. "Kinked" exhaust tubing.2. Restriction within the muffler. Refer to "Restricted Exhaust System Check" in the Driveability, Emissions, and Electrical Diagnosis Manual, GMT/95-CK-2.3. End of tail pipe obstruction.	<ol style="list-style-type: none">1. If possible, repair the damaged condition, otherwise replace the component.2. If restriction is suspected, remove the muffler and visually check it. Replace muffler if condition is doubtful.3. Remove the obstruction, or if end is crimped, straighten outlet.
Exhaust Leakage and/or Noise	<ol style="list-style-type: none">1. Leakage at exhaust component joints and couplings.2. Improperly installed or misaligned.3. Exhaust manifold cracked or broken.4. Leak between exhaust manifold and cylinder head.5. Damaged or worn seals or packing.6. Burned or rusted out exhaust pipe heat tube extension.7. Burned or rusted out exhaust pipe.8. Burned or blown out muffler.9. Broken or loose clamps and/or brackets.	<ol style="list-style-type: none">1. Tighten clamps or couplings to specified torque.2. Align, then tighten connections.3. Replace the manifold.4. Tighten the manifold to cylinder head nuts and bolts to specifications.5. Replace the seals or packing as necessary.6. Replace the heat tube extensions as required.7. Replace the exhaust pipe.8. Replace the muffler assembly.9. Repair or replace as necessary.

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ON-VEHICLE SERVICE

INSPECTION

Inspect exhaust pipes, catalytic converters (if equipped), mufflers, and tailpipes for cracked joints, broken welds, and corrosion damage that could result in a leaking exhaust system. Inspect the clamps, brackets, and insulators for cracks and stripped or corroded bolt threads.

The exhaust system, including heat shield, must be free of leaks, binding, grounding, and excessive vibration. These conditions are usually caused by damaged or loose flange bolts, heat shields, brackets, or pipes. If any of these conditions exist, check the exhaust system alignment. Align and replace the components as necessary.

REMOVING EXHAUST PARTS

CAUTION: Always wear protective goggles and gloves when removing exhaust parts as falling rust and sharp edges from worn exhaust components could result in serious personal injury.

When removing exhaust components an accumulation of dirt and corrosion can make work difficult. Using a penetrating oil on the threads of U-bolts can assist in the removal of these components.

INSTALLING EXHAUST PARTS

When installing a new exhaust pipe, or muffler, or tailpipe, on any model, check for proper alignment. Rattles and noise vibrations in the exhaust system are usually caused by the misalignment of parts. When aligning the system, leave all bolts and nuts loose until all parts are properly aligned, then tighten, working from the front to the rear.

Damaged exhaust system hangers, hanger brackets, and clamps should be replaced to maintain exhaust system alignment.

Important

- When jacking or lifting the vehicle from the frame side rails, make sure the lift pads do not contact the three-way catalytic converter as damage to the catalytic converter will result.
- Apply sealer (GM P/N 9985020) or equivalent to all slip joint connections.
- When installing the exhaust pipe to the engine manifold, always use new seal and nuts. Clean the engine manifold stud threads with a wire brush before installing the new nuts.

To view exhaust system layouts for C/K vehicles, refer to figures 1 through 27.

Refer to figure 1 for the various exhaust system hanger support types.

CLOSE-COUPLE CATALYTIC CONVERTER REPLACEMENT

Remove or Disconnect (Figures 2, 12 and 16)

- Raise the vehicle.
 - Support intermediate exhaust pipe.
1. Oxygen sensor electrical connection (if equipped).
 2. Nuts, springs, and flange gasket from exhaust manifold pipe.
 3. Nuts and washers from rear exhaust pipe flange to intermediate pipe flange.
 4. Catalytic converter assembly.

Install or Connect

- Position catalytic converter to intermediate pipe.
1. Washers and nuts onto rear exhaust pipe flange studs.

Tighten

- Nuts to 43 N·m (32 lbs. ft.)
2. Flange gasket, springs, and nuts to exhaust manifold.

Tighten

- Nuts to 29 N·m (22 lbs. ft.).
3. Oxygen sensor electrical connection (if equipped).
 - Check for clearance and alignment.
 - Remove support from intermediate exhaust pipe.
 - Lower the vehicle.

THREE-WAY CATALYTIC CONVERTER REPLACEMENT

Remove or Disconnect (Figures 3, 7, 13, 19, 21 and 27)

- Raise the vehicle.
1. Clamps at the front and rear of the three-way catalytic converter.
 2. Three-way catalytic converter to front exhaust pipe and three-way catalytic converter to intermediate exhaust pipe.
 3. Three-way catalytic converter.

Install or Connect

1. Three-way catalytic converter into the exhaust pipe.
2. New U-bolts and clamps at the front and rear of the three-way catalytic converter.


Tighten

- Bolts to specifications, refer to "Specifications."

6F-4 EXHAUST SYSTEM

- Check for clearance and alignment.
- Lower the vehicle.

OXIDATION CATALYTIC CONVERTER REPLACEMENT

 Remove or Disconnect (Figures 4, 5, 8, 9, 11, 15, 17, 18, 24 and 25)

- Raise the vehicle.
1. Fasteners at the front and rear of the oxidation catalytic converter.

2. Oxidation catalytic converter from front exhaust pipe and to intermediate exhaust pipe.
3. Oxidation catalytic converter.



Install or Connect

1. New oxidation catalytic converter into the exhaust pipe.
2. New seals and fasteners at the front and rear of the converter.



Tighten

- Nuts to 40 N.m (30 lbs. ft).
- Check for clearance and alignment.
- Lower the vehicle.

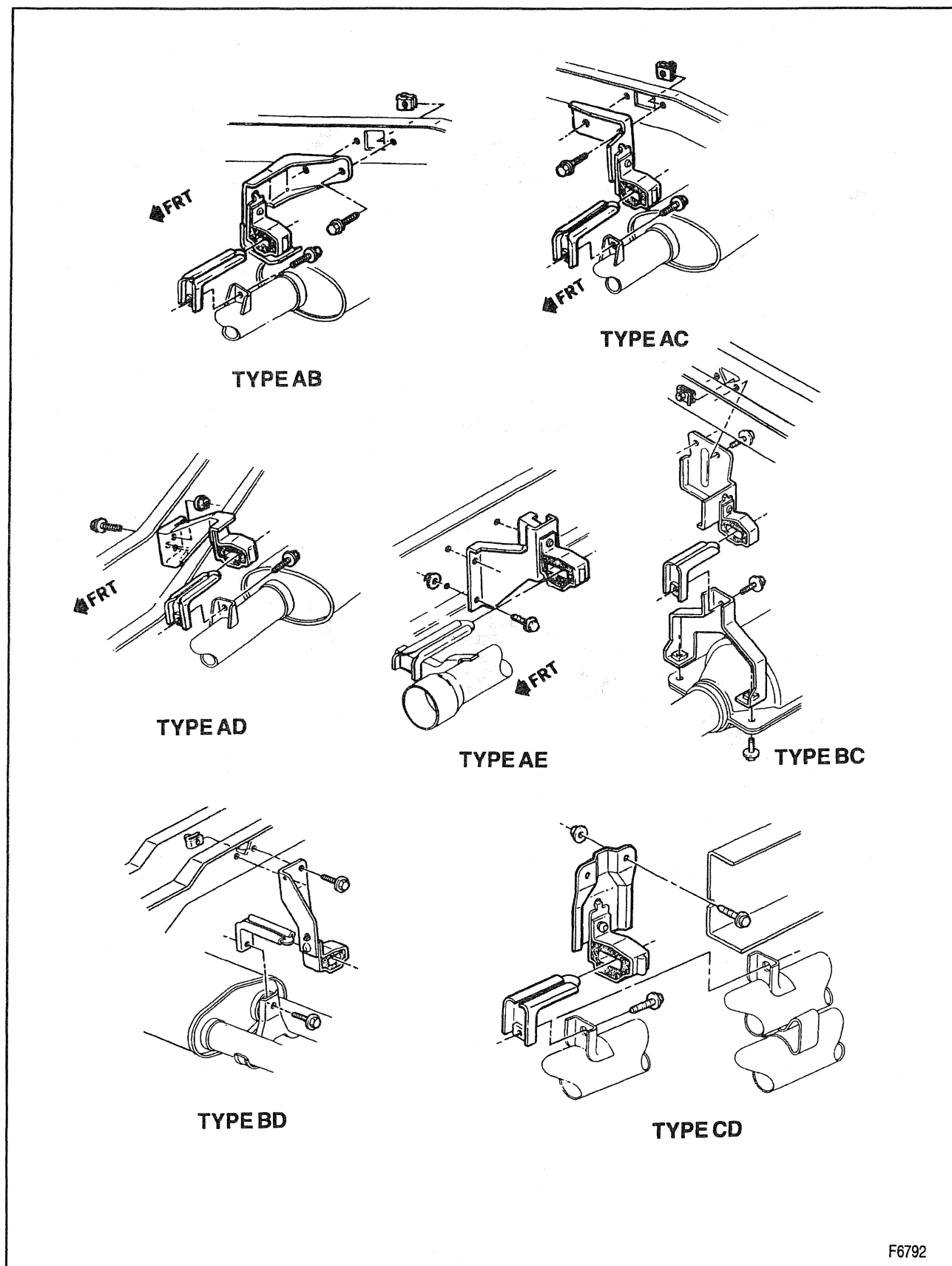


Figure 1—Support Types, C/K Pickup (Except Crewcab)

6F-6 EXHAUST SYSTEM

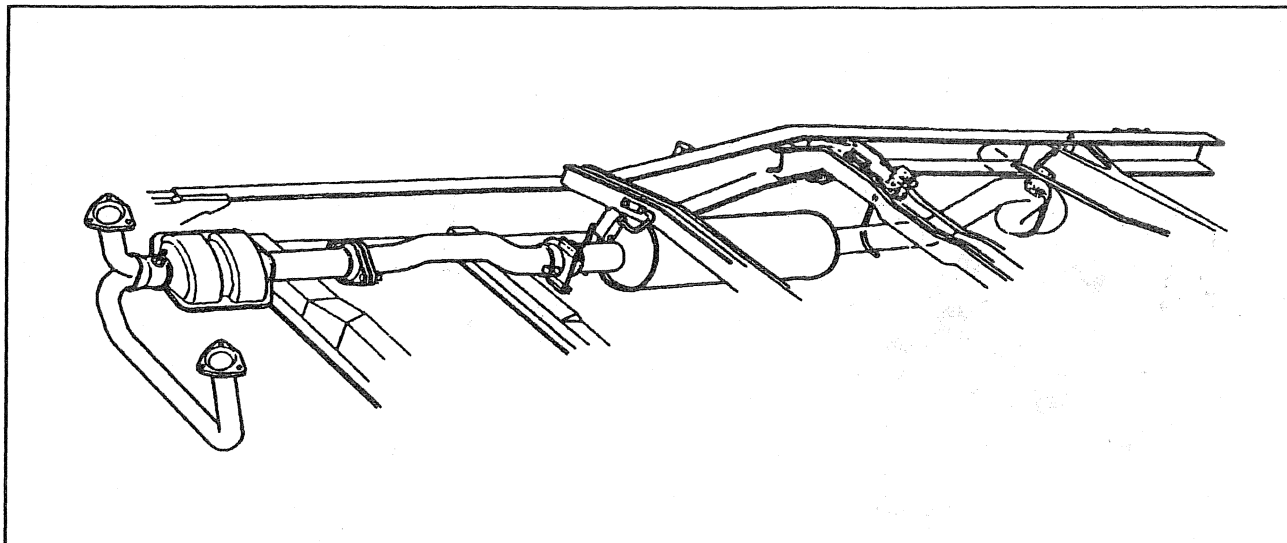


Figure 2—Exhaust System - C/K 1, 2 -Pickup, Extended Cab w/LB4 and L05

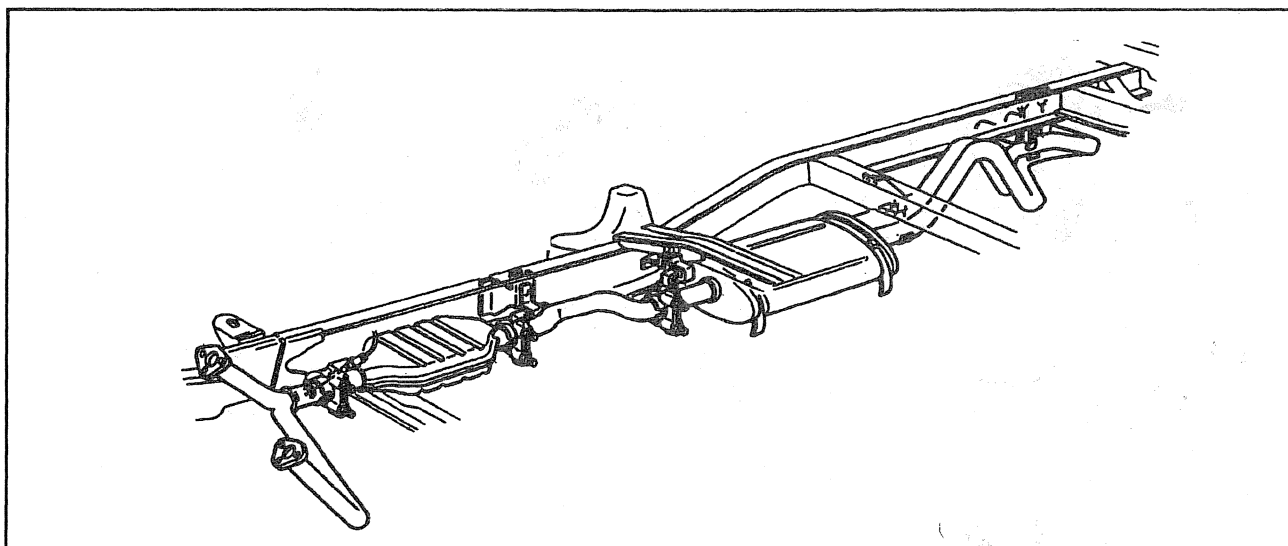


Figure 3—Exhaust System - C/K 2, 3 -Pickup, Extended Cab w/LB4 and L05 & C6P

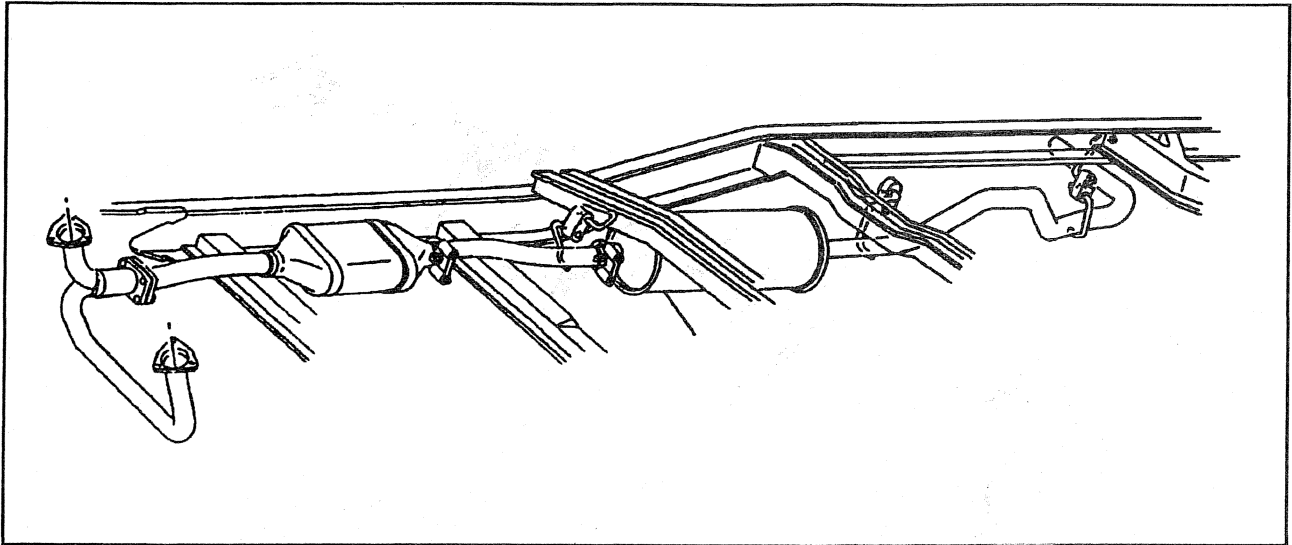


Figure 4—Exhaust System - C/K 1, 2 -Pickup, Extended Cab w/E63 & L49

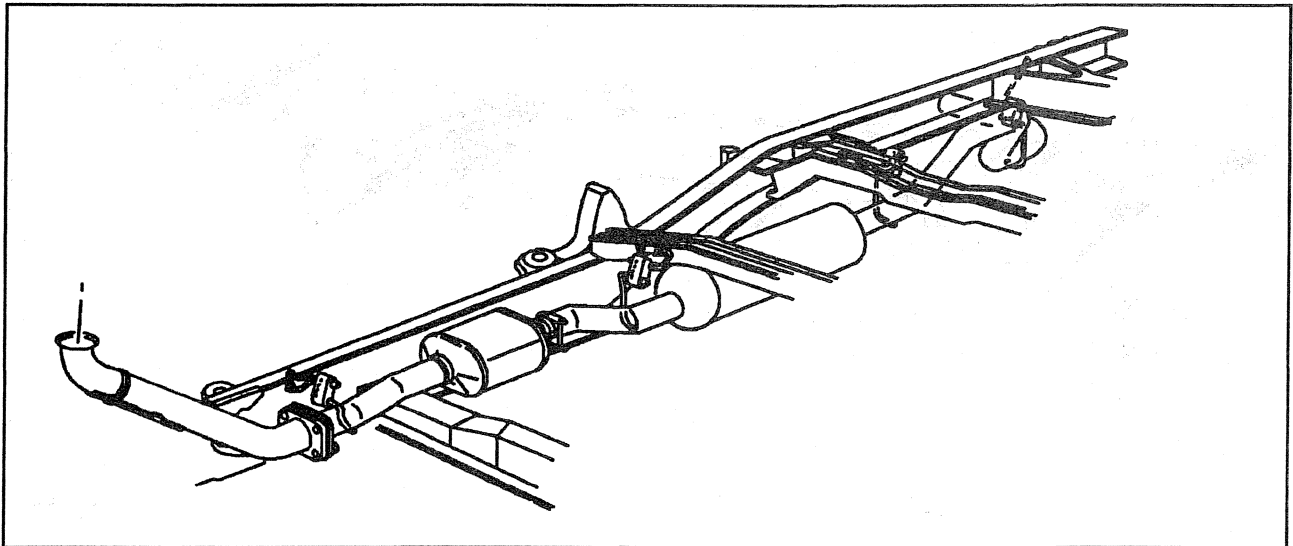


Figure 5—Exhaust System - C/K 1, 2 -Pickup w/L56

6F-8 EXHAUST SYSTEM

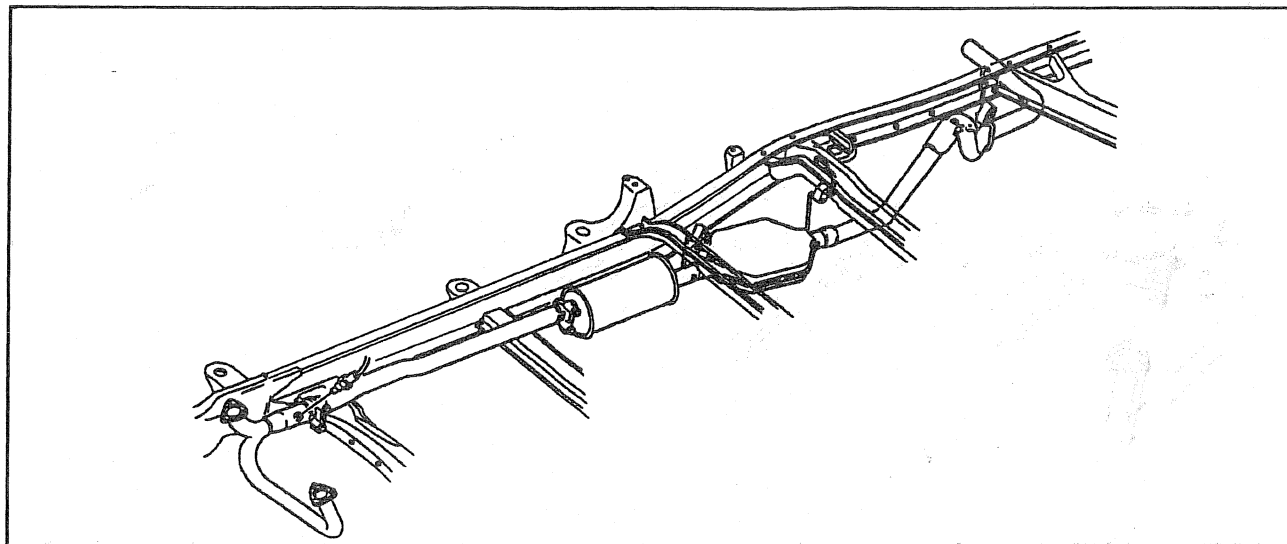


Figure 6—Exhaust System - C/K 2, 3 -Pickup, Extended Cab w/L19

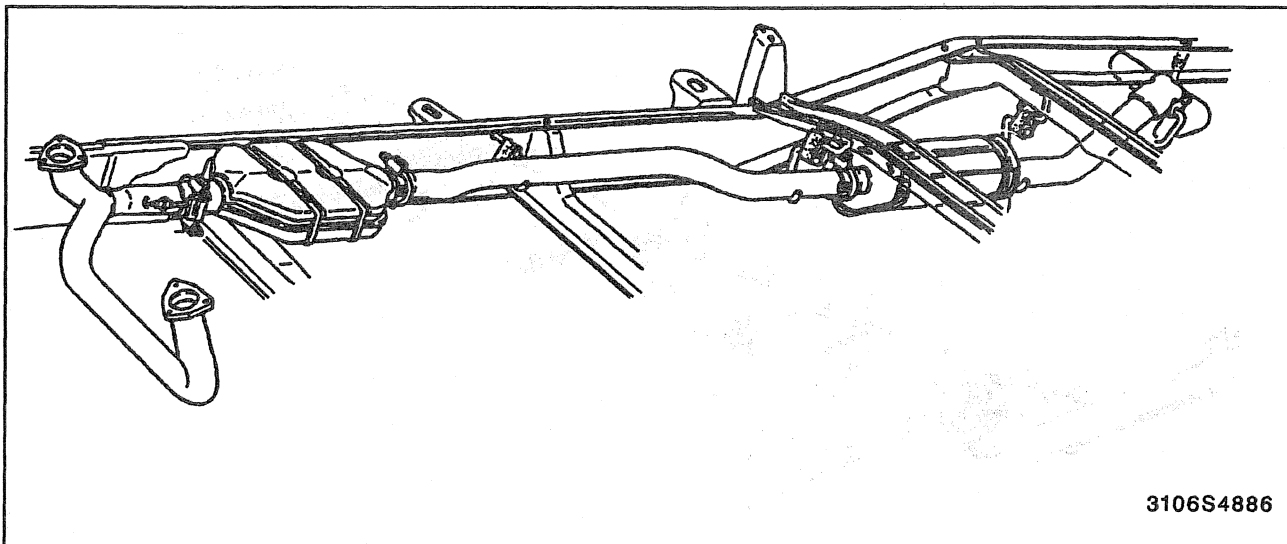


Figure 7—Exhaust System - C/K 3 - Extended Cab w/L05

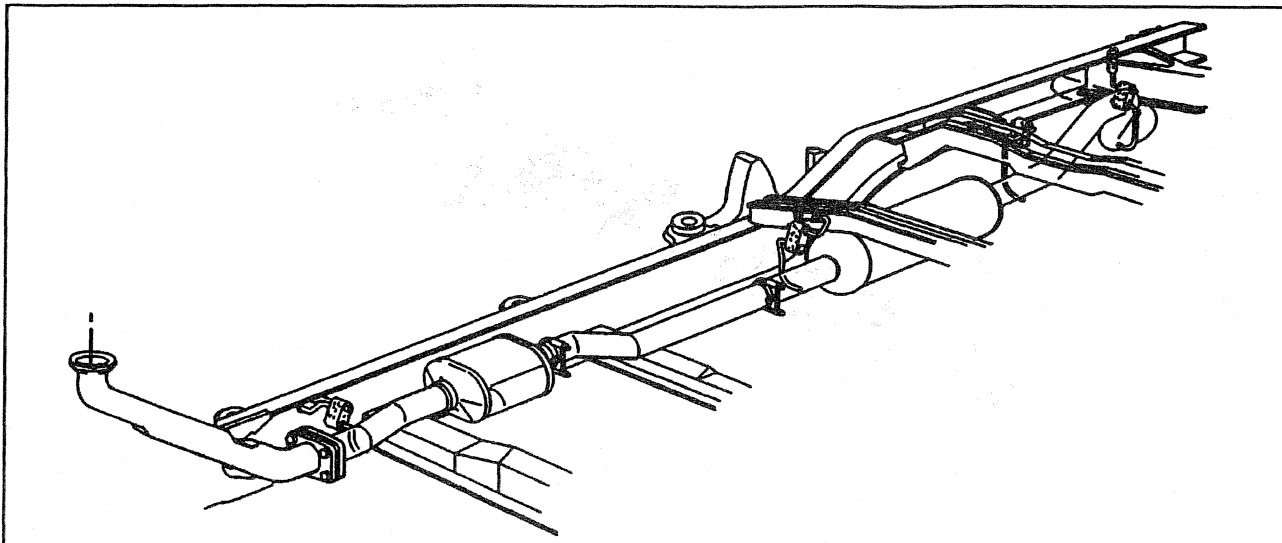


Figure 8—Exhaust System - C/K 1, 2, 3 -Extended Cab w/L56 or L65

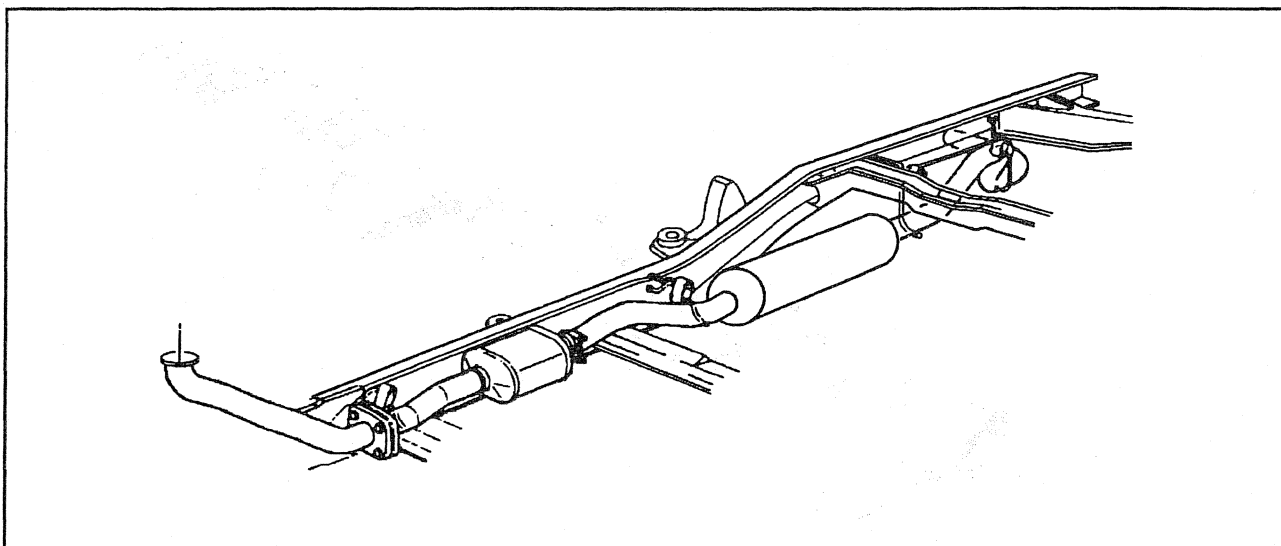


Figure 9—Exhaust System - C/K 1, 2 -Extended Cab w/L56 & Short Box

6F-10 EXHAUST SYSTEM

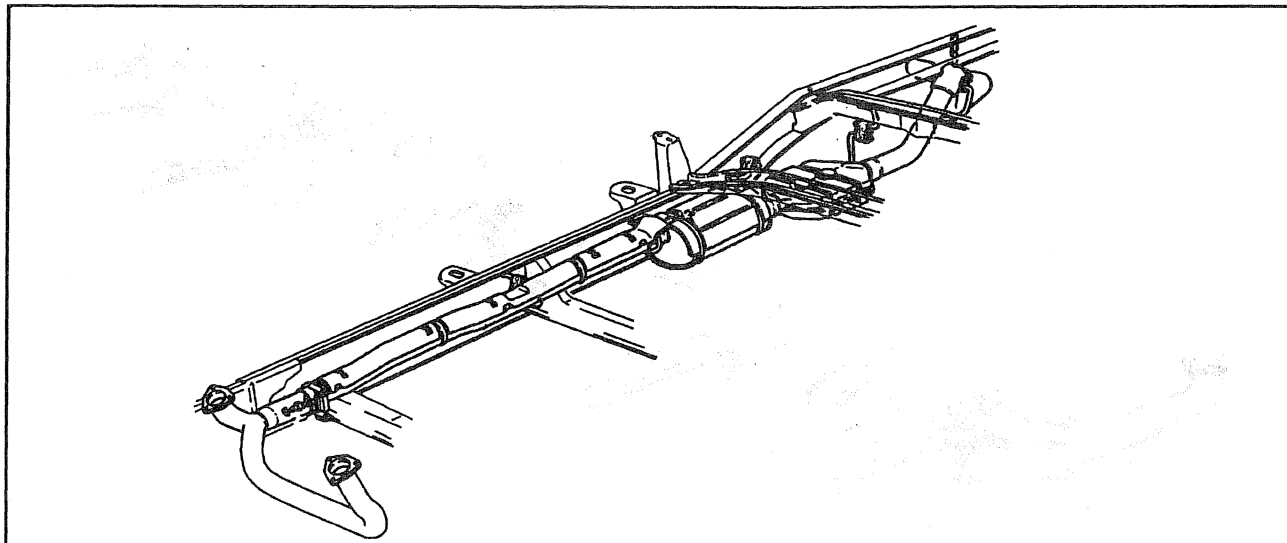


Figure 10—Exhaust System - C/K 3 - Crew Cab w/L19

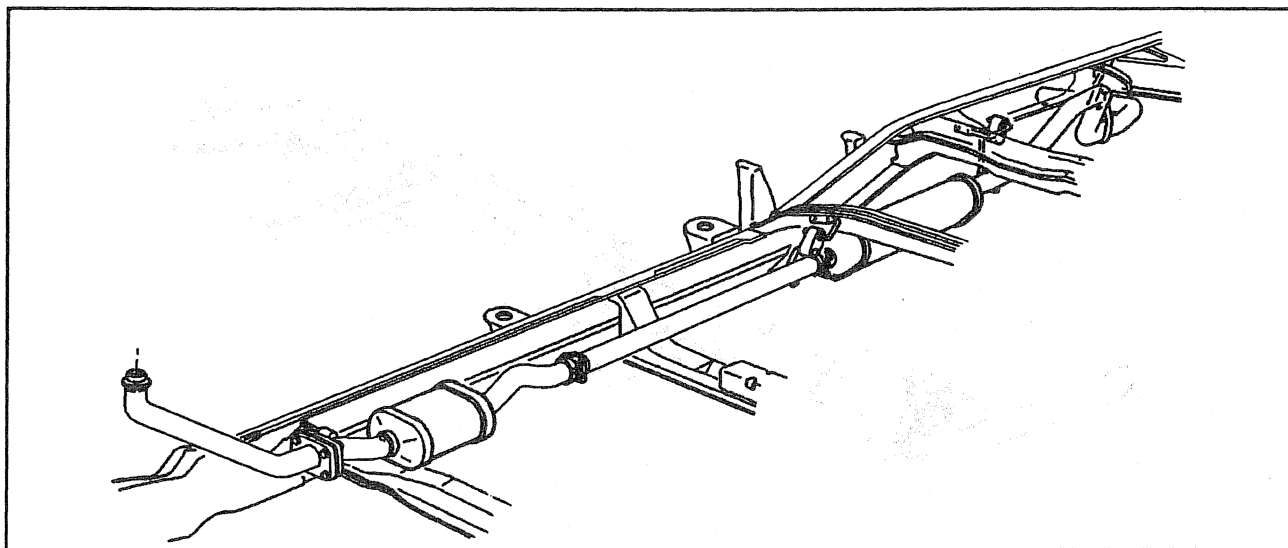


Figure 11—Exhaust System - C/K 3 - Crew Cab w/L65

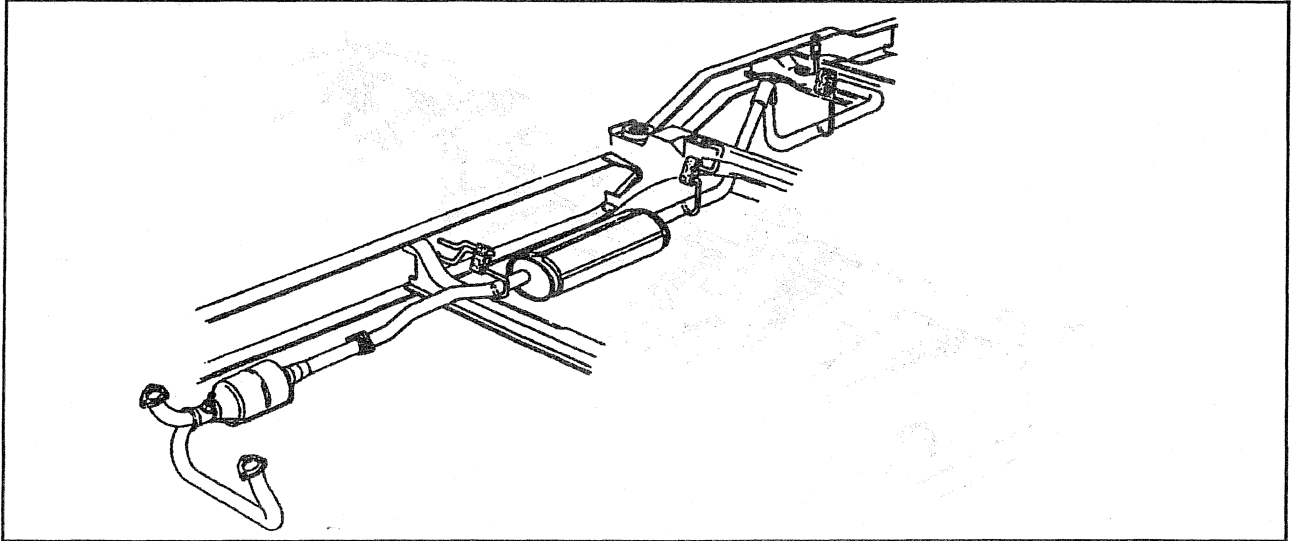


Figure 12—Exhaust System - C/K 1, 2 -Suburban w/L05 (Under 8600 GVW)

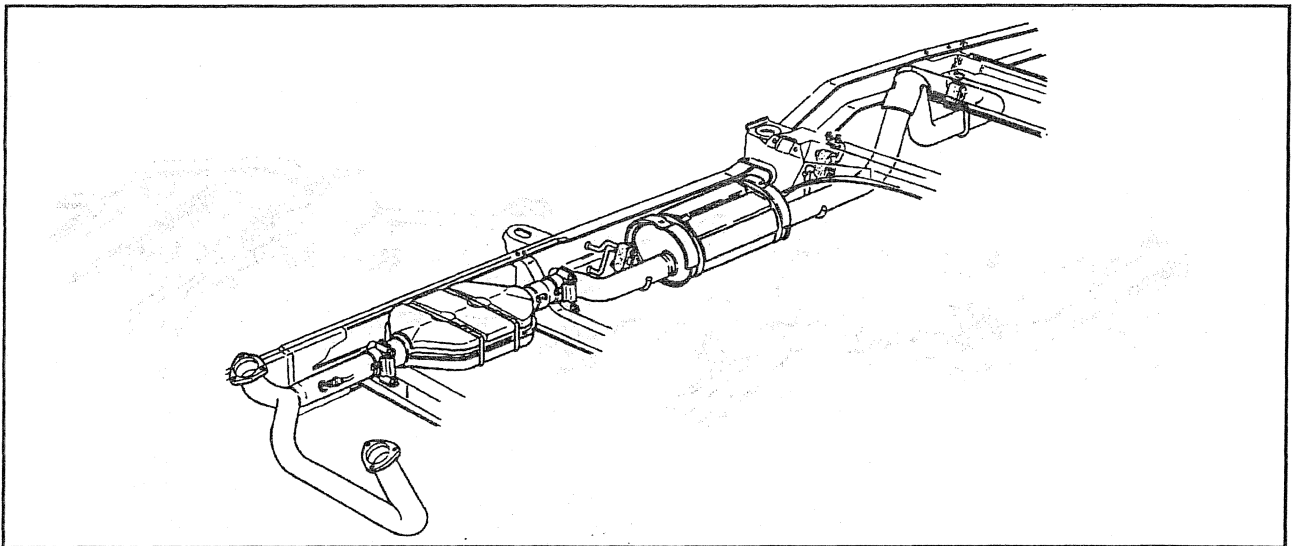


Figure 13—Exhaust System - C/K 2 - Suburban w/L05 (Over 8600 GVW)

6F-12 EXHAUST SYSTEM

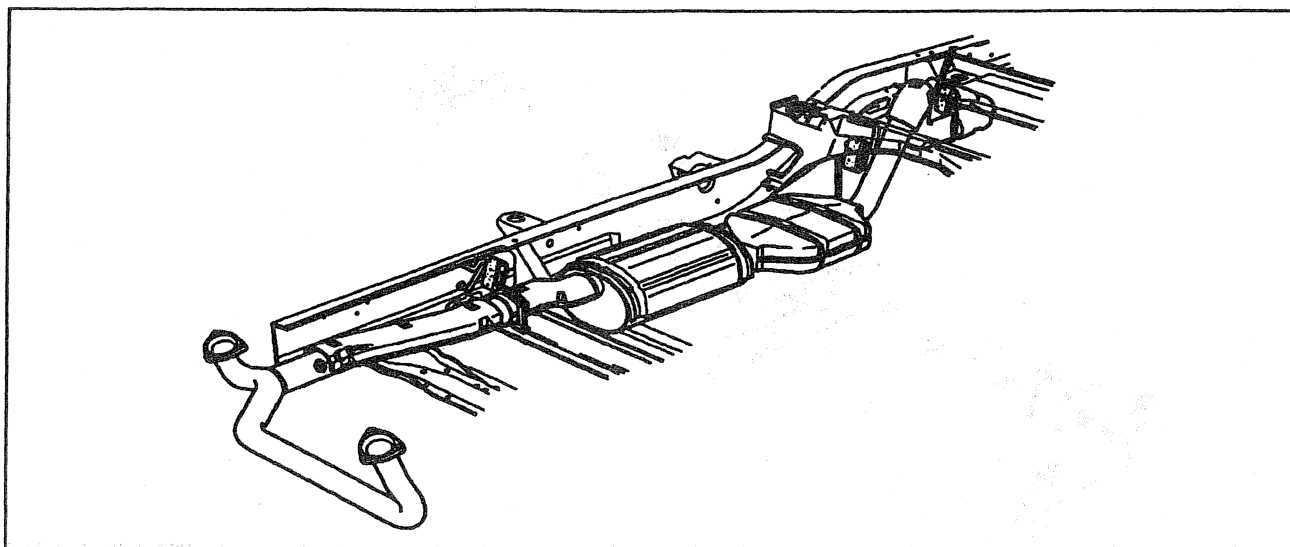


Figure 14—Exhaust System - C/K 2 - Suburban w/L19

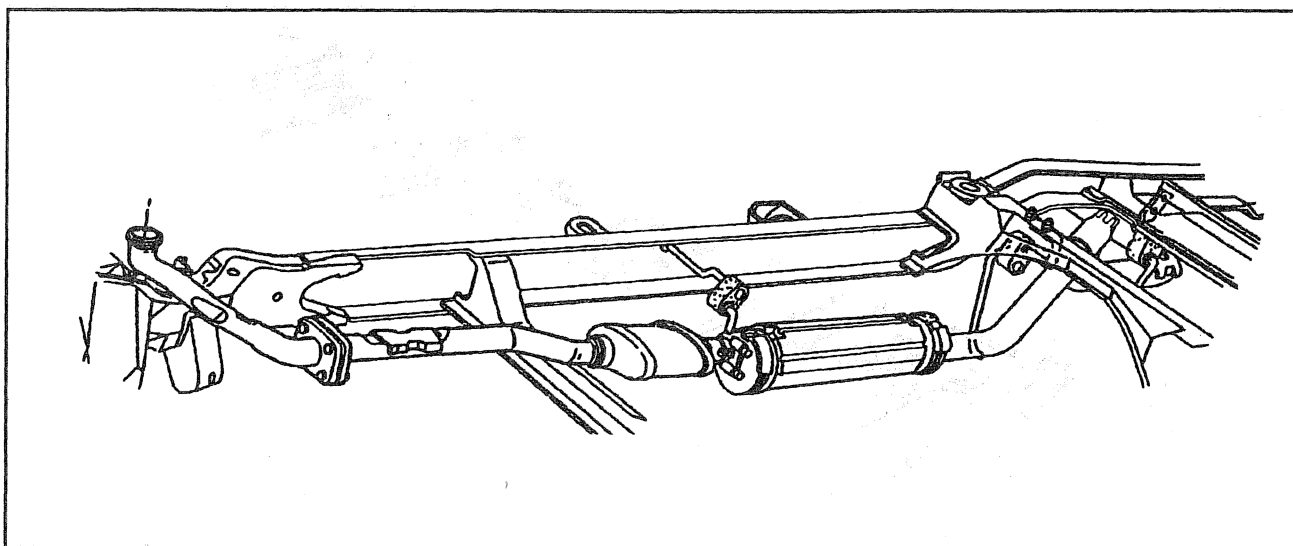


Figure 15—Exhaust System - C/K 1, 2 -Suburban w/L65

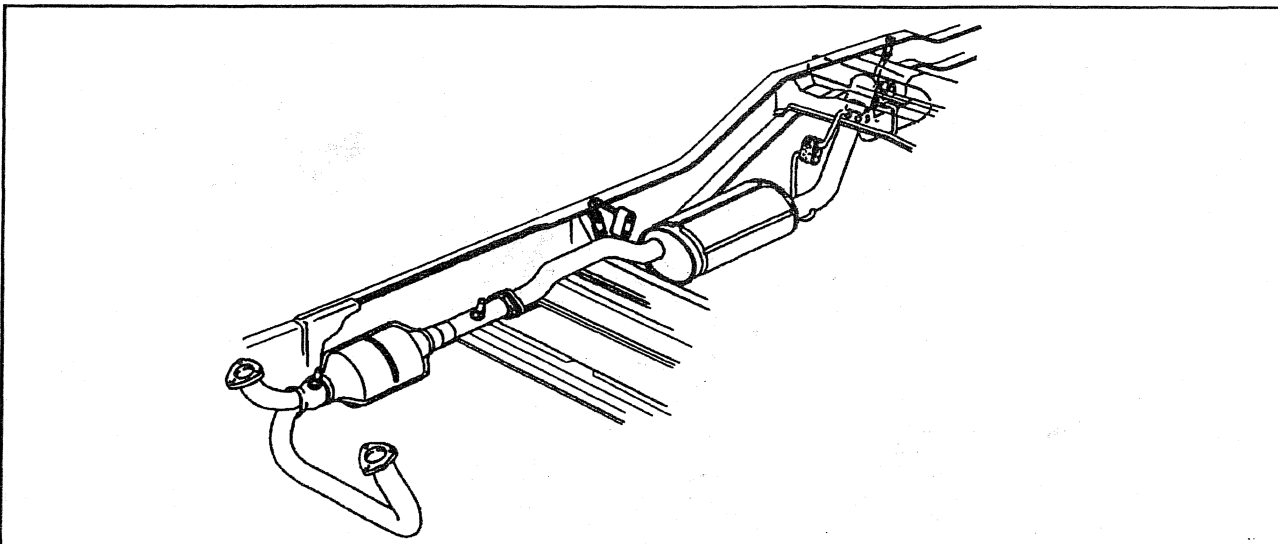


Figure 16—Exhaust System - Utility Models w/L05

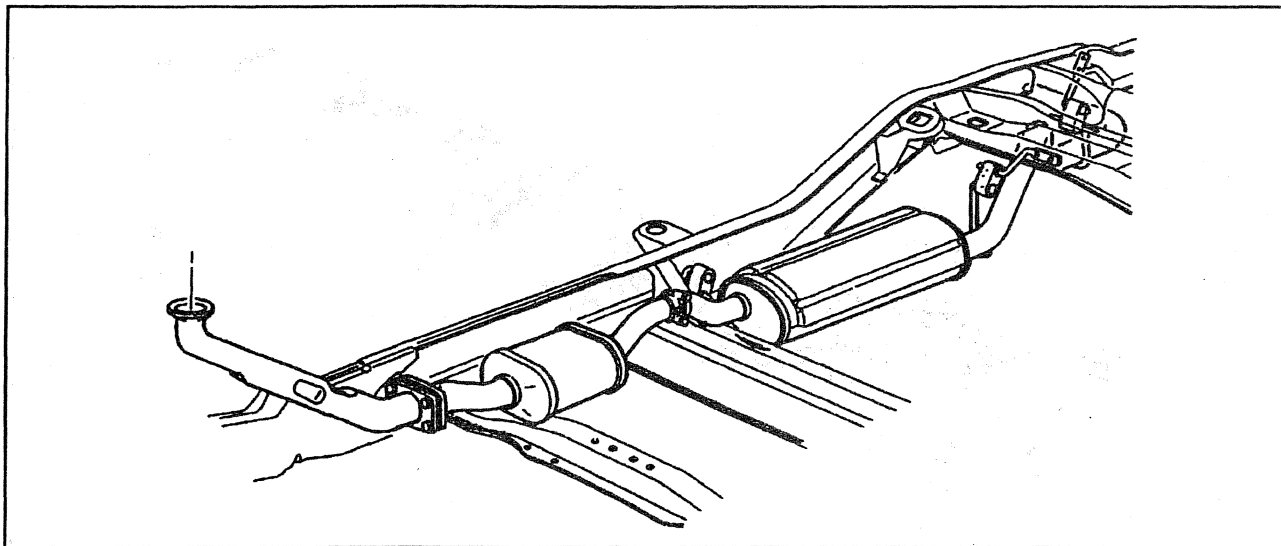


Figure 17—Exhaust System - K Utility Models w/L56

6F-14 EXHAUST SYSTEM

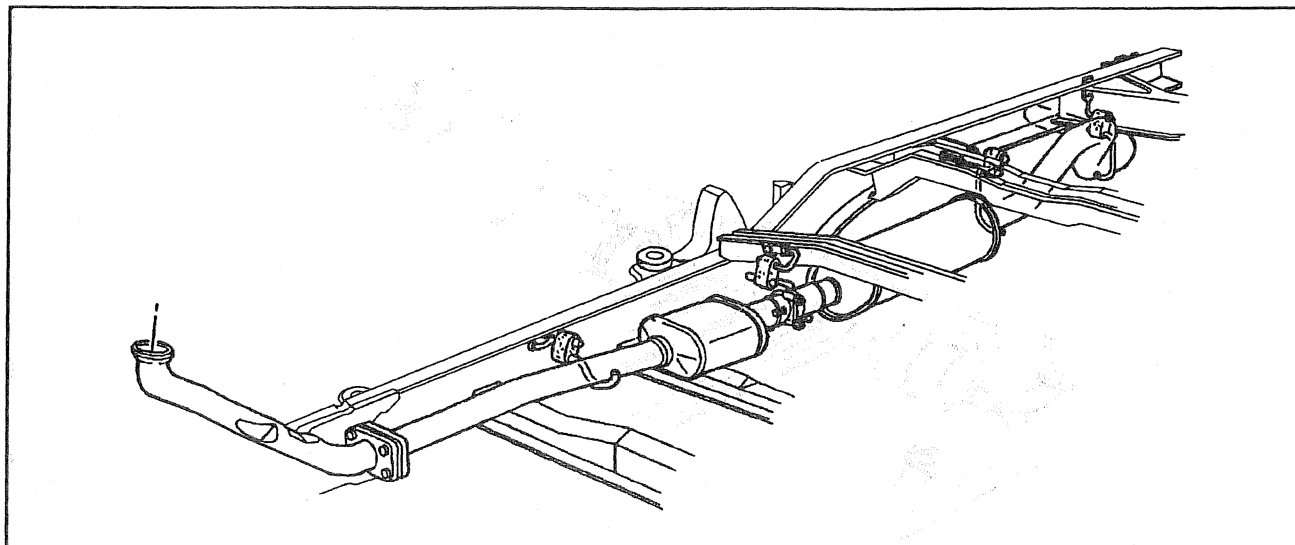


Figure 18—Exhaust System - C/K 2, 3 Pickup and Cab Chassis (Model 310 w/L65)

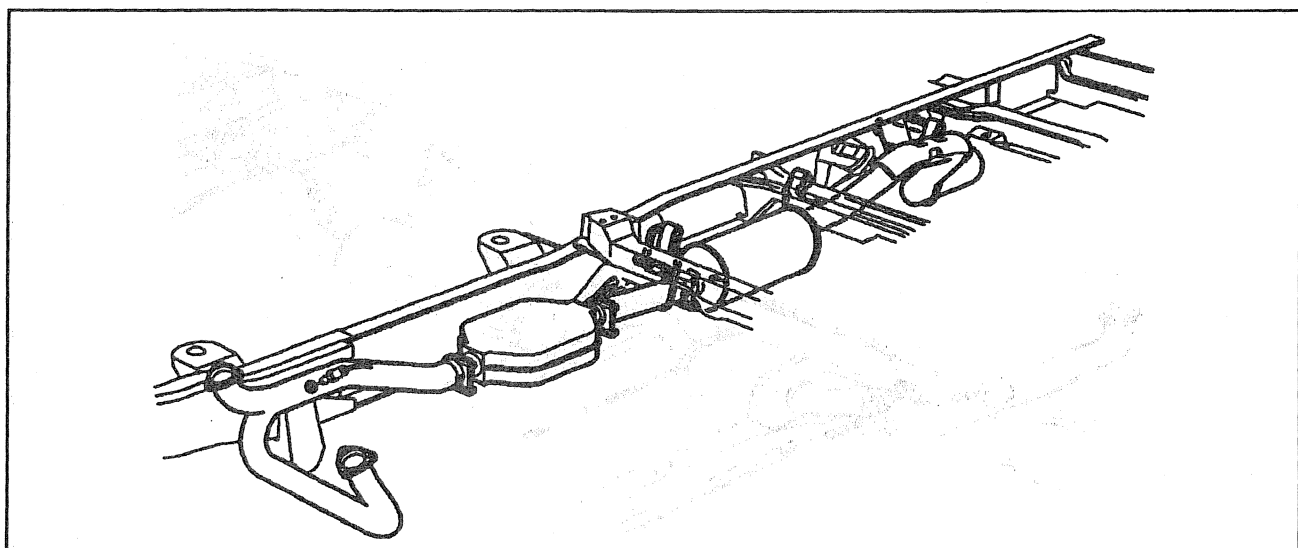


Figure 19—Exhaust System - C 3 Cab Chassis (Model 310 w/L05 & 15,000 GVW)

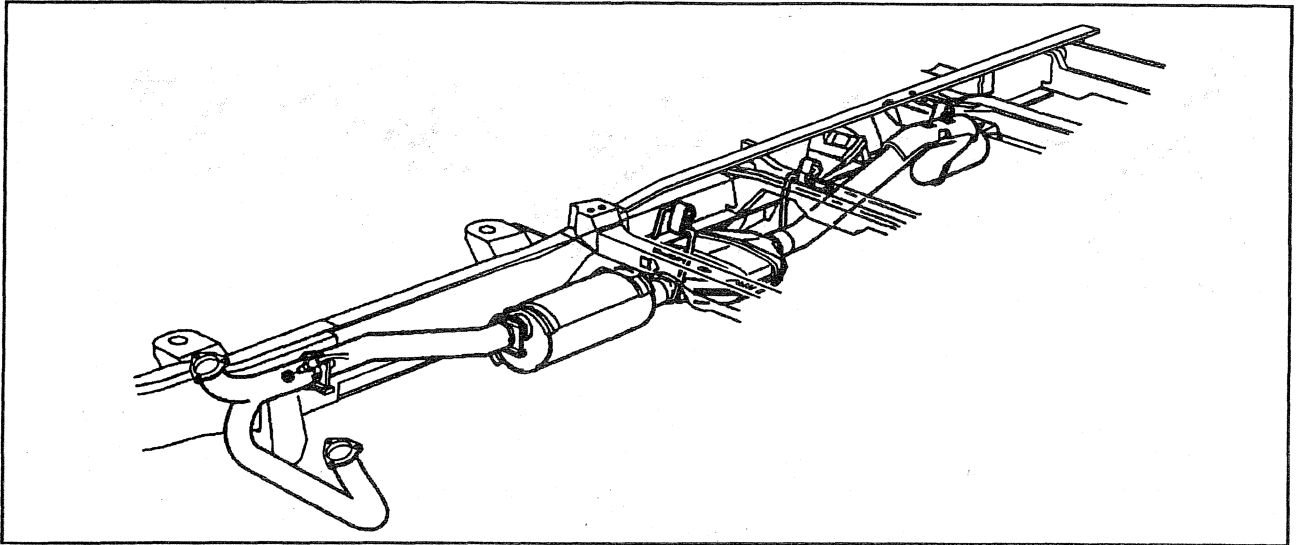


Figure 20—Exhaust System - C 3 Cab Chassis (Model 310 w/L19 & 15,000 GVW)

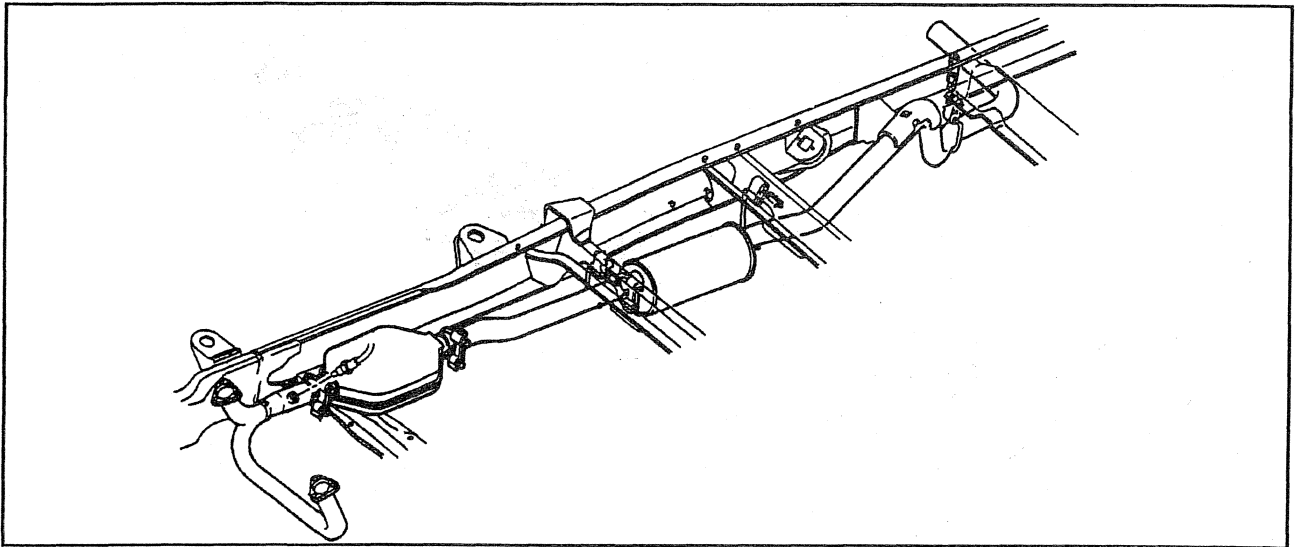


Figure 21—Exhaust System - C/K Cab Chassis (Model 310 w/L05 below 15,000 GVW)

6F-16 EXHAUST SYSTEM

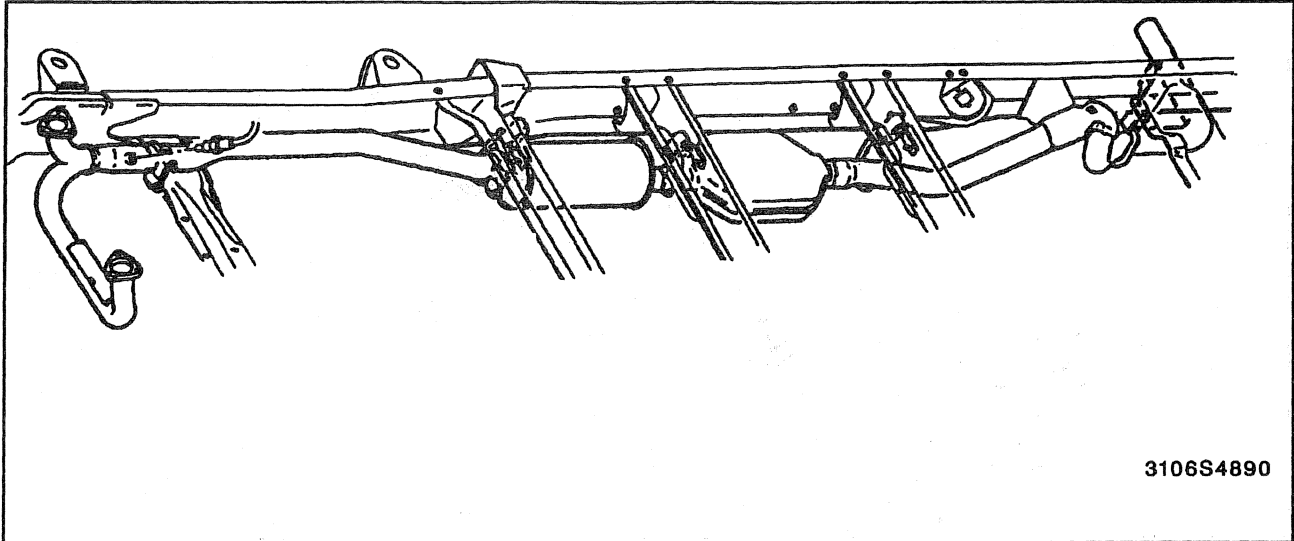


Figure 22—Exhaust System - C/K 3 Cab Chassis with L19

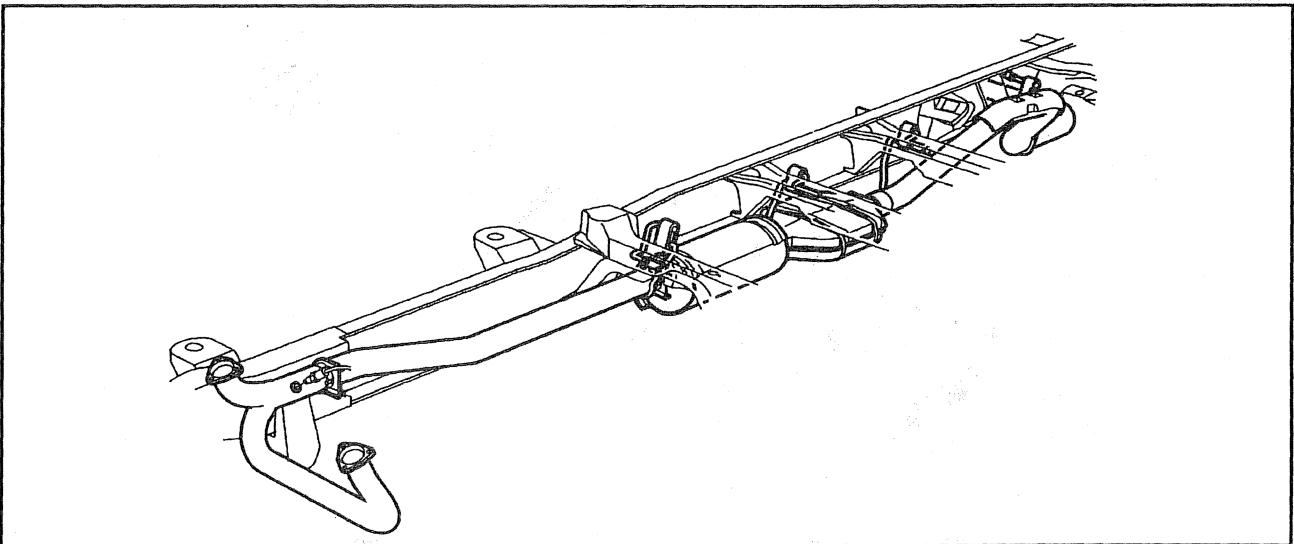


Figure 23—Exhaust System - C 3 Cab Chassis (Model 314 w/L19 & 15,000 GVW)

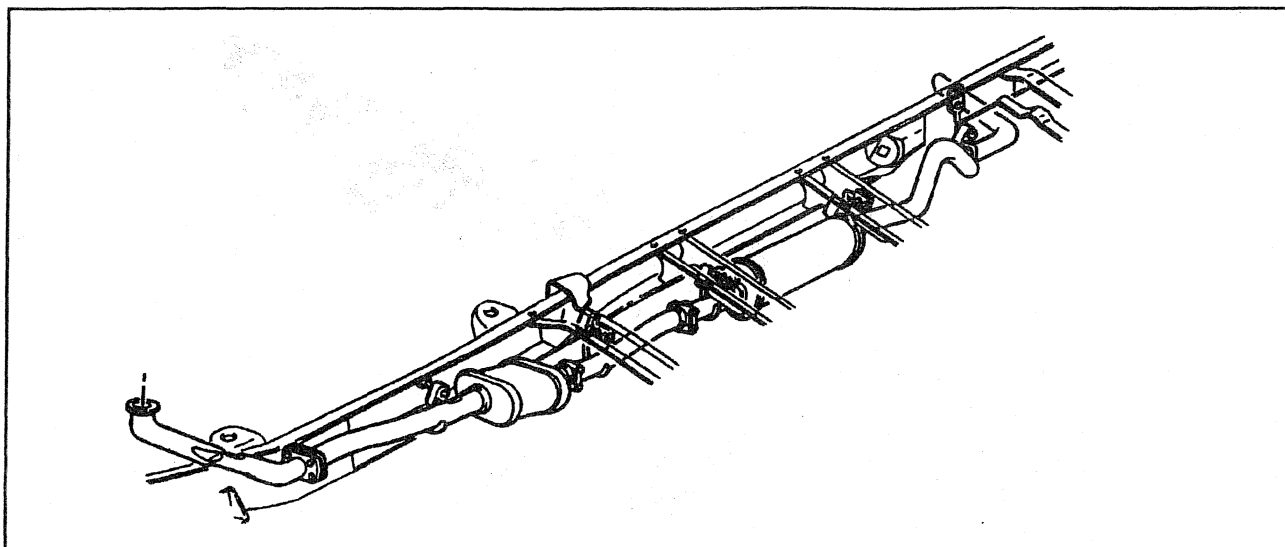


Figure 24—Exhaust System - C/K Cab Chassis (Model 314 w/L65 & 10,000 - 12,000 GVW)

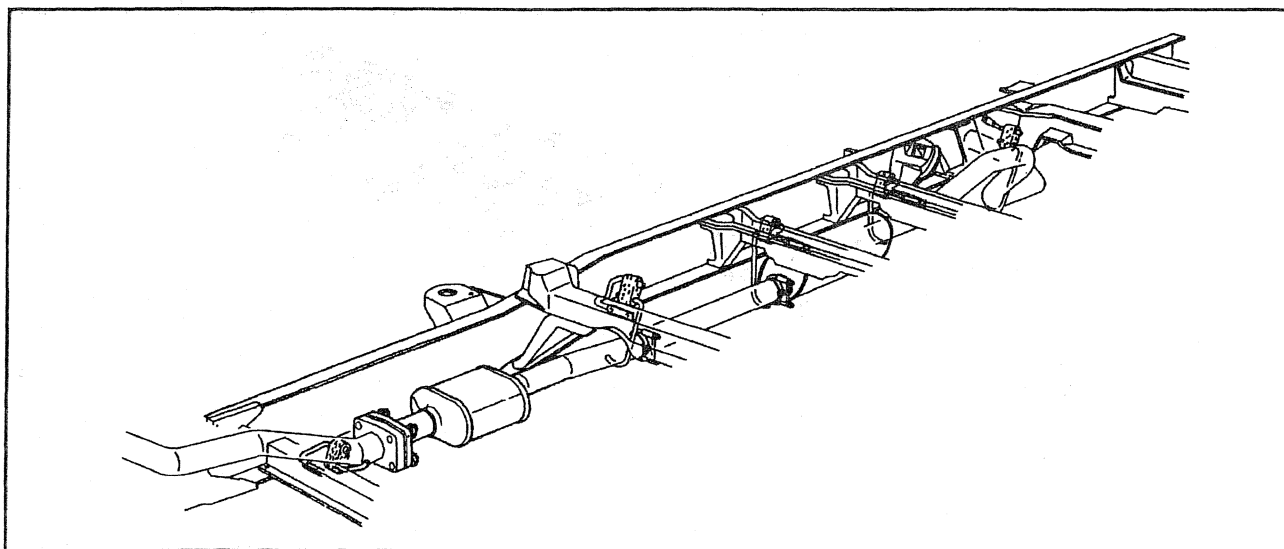


Figure 25—Exhaust System - C 3 Cab Chassis (Models 314 & 318 w/L65 & 15,000 GVW)

6F-18 EXHAUST SYSTEM

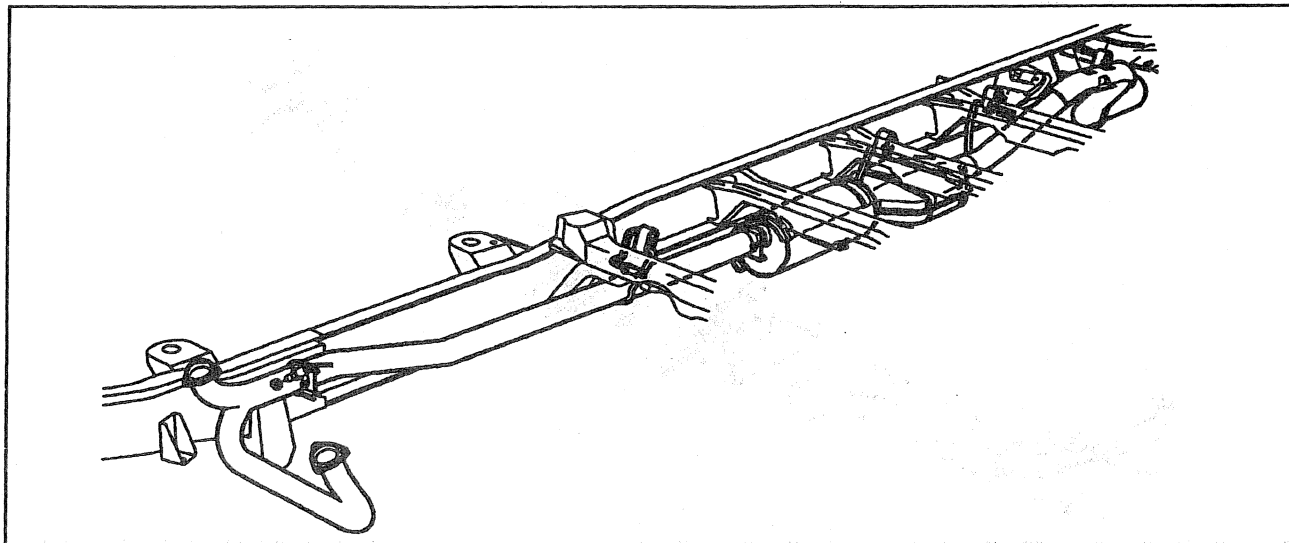


Figure 26—Exhaust System - C 3 Cab Chassis (3500 HD w/L19)

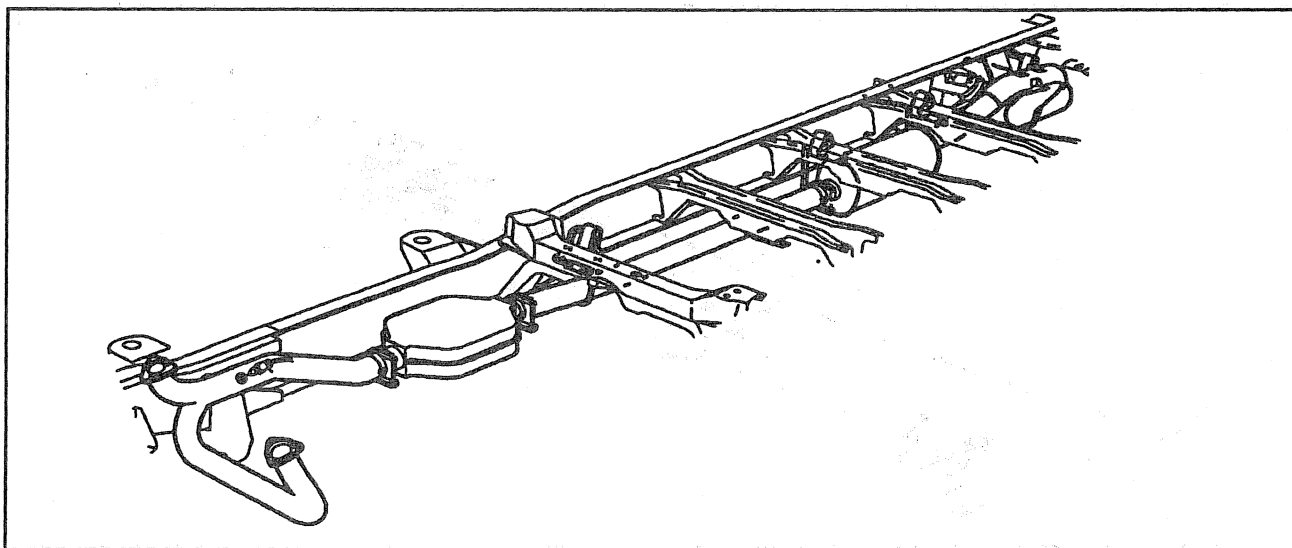


Figure 27—Exhaust System - C 3 Cab Chassis (3500 HD w/L05)

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

	N·m	Lbs. Ft.	Lbs. In.
Catalytic Converter Hanger Bolt.....	45	33	—
Catalytic Converter to Exhaust Pipe Bolts.....	60	44	—
Catalytic Converter U-Bolt Nuts.....	60	44	—
Exhaust Pipe Hanger Bracket to Frame Bolts	45	33	—
Exhaust Pipe to Flange Nuts (Diesel Engines).....	40	30	—
Exhaust Pipe to Manifold Bolts (Diesel Engines).....	29	22	—
Exhaust Pipe to Manifold Bolts (Gasoline Engines).....	20	15	—
Exhaust V-Band Clamp.....	8	—	71
Hanger to Frame Bolt (Rod Type).....	35	26	—
Hanger to Frame Nut (Rod Type)	34	25	—
Muffler Hanger Clamp Nuts.....	41	30	—
Muffler Hanger to Frame Bolt.....	45	33	—
Tail Pipe Bracket to Frame Bolt.....	45	33	—
Tail Pipe Hanger Clamp Nut.....	41	30	—

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NOTES

SECTION 6H**VACUUM PUMPS**

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: Always use the correct fastener in the correct location. Use the correct fastener part number to replace a fastener. If the correct fastener part number is not available, a fastener of equal size and strength may be used. Do not use a fastener that is stronger when the correct fastener part number is not available in the following applications:

- Some bolts are designed to permanently stretch, and if a stronger fastener is used, the part will not be tightened correctly. These permanently stretching bolts will be called out. The correct part number fasteners must be used to replace this type of fastener because there is no available equivalent.
- Other bolts are designed to break if over tightened to prevent part damage. If a stronger fastener is used part damage may occur.

Fasteners that need to be replaced when removed will be called out. Fasteners that require thread lockers or thread sealant will be called out. The correct tightening specification and sequence must be used when installing fasteners. Part or system damage may occur if the above instructions are not followed.

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Vacuum Pump Applications	6H-6
Fastener Tightening Specifications	6H-6
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GENERAL DESCRIPTION

The vacuum pump is used on the light duty naturally aspirated (L49, VIN P), light duty turbocharged (L56, VIN S), and heavy duty turbocharged (L65, VIN F) 6.5L diesel engines to operate emission controls. The diaphragm pump does not require periodic maintenance.

The pump is bracket mounted at the right front of the engine. It has a pulley attached that is driven by a multiple ribbed belt. With the exception of the pulley, the vacuum pump is replaced as an assembly. Refer to "Specifications" at the end of this section for vacuum pump applications.

DIAGNOSIS

Refer to figures 1 and 2 for diagnosis of the vacuum pump.

6H-2 VACUUM PUMPS

VACUUM PUMP DIAGNOSIS

BLOCK WHEELS, APPLY PARKING BRAKE, AND PLACE TRANSMISSION SELECTOR LEVER IN "PARK" OR "NEUTRAL" BEFORE STARTING ENGINE.

STEP 1

SEE "VACUUM PUMP DIAGNOSIS" ILLUSTRATION BELOW.
CONNECT A VACUUM GAGE TO THE VACUUM PUMP INLET.
WITH THE ENGINE IDLING, VACUUM SHOULD REACH—70 kPa (21 INCHES Hg)
MINIMUM AT SEA LEVEL WITHIN 30 SECONDS (REFER TO GRAPH FOR
VACUUM AT OTHER ELEVATIONS).

CHECKS OKAY. LEAK IN
SYSTEM OTHER THAN
VACUUM PUMP

GO TO STEP 2
ON NEXT PAGE

LOW VACUUM OR
FLUCTUATING GAGE
READING

1. CHECK GAGES AND CONNECTIONS FOR LEAKS.
2. CHECK BELT TENSION AND PULLEY FIT TO SHAFT ON DRIVE BELT MODELS.
3. CHECK IDLE RPM.

RECHECK VACUUM GAGE

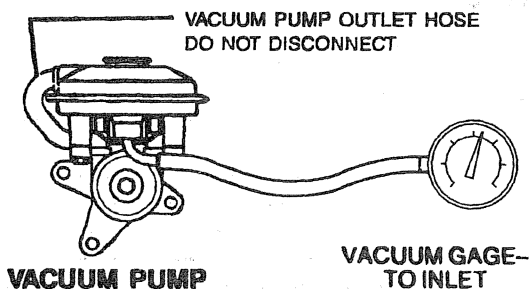
VACUUM O.K.

GO TO STEP 2

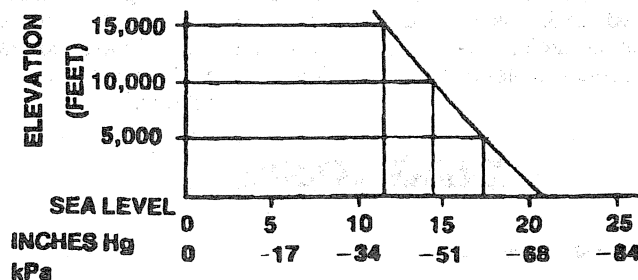
LOW VACUUM.
REPLACE
PUMP.

GO TO STEP 2
ON NEXT PAGE

VACUUM PUMP DIAGNOSIS



MINIMUM ACCEPTABLE vs ALTITUDE



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Figure 1—Vacuum Pump Diagnosis

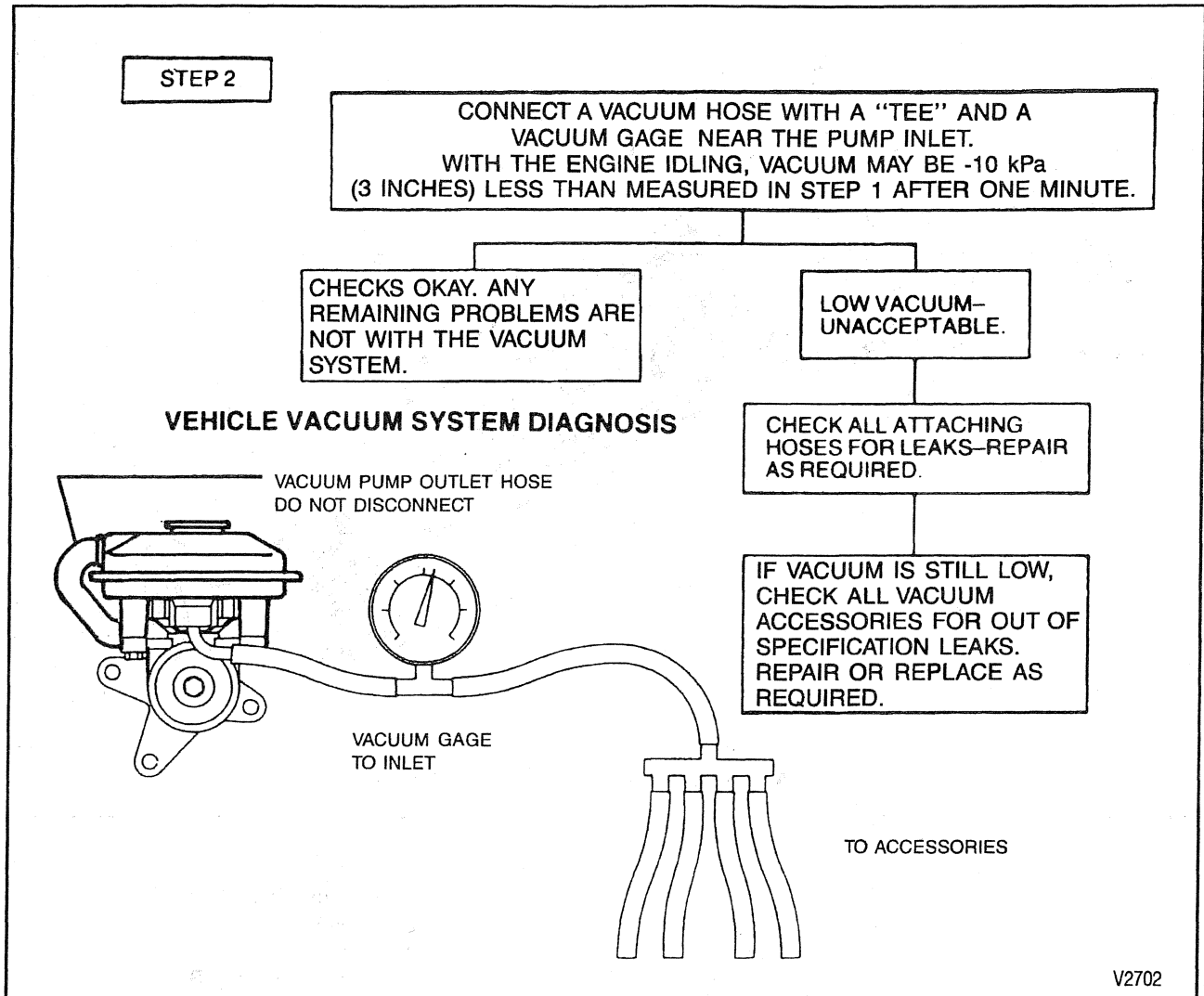


Figure 2—Diagnosis of Vacuum Pump

ON-VEHICLE SERVICE

VACUUM PUMP REPLACEMENT

Remove or Disconnect (Figures 3, 4, and 5)

- Make sure the engine control switch is off.
- 1. Drive belt. **(Vehicles with Air Conditioning)**
- 2. Electrical connector at the A/C compressor.
- 3. Three through bolts (7) holding the A/C compressor (9) to the bracket (10) (figure 3).
 - Do not remove the A/C lines.
- 4. A/C compressor out of the bracket and set it off to the right side.
- 5. Vacuum hose (15) off the vacuum pipe (14), leaving the hose attached to the pump (figure 5).
- 6. One through bolt (12) and two nuts (3) holding the bracket (10) to the stud on the engine (figure 3).
 - Access the lower nut through the hole in the vacuum pump pulley.
- 7. Vacuum pump (1) and bracket (10) assembly from the vehicle. **(Vehicles without Air Conditioning)**

- 8. Bolts holding the mounting bracket (10) to the engine (figure 4).
- 9. Nut holding the bracket to the stud on the engine.
- 10. Vacuum pump and the bracket from the engine.

Disassemble (Figure 6)

Tool Required:

J 25034-B Pump Pulley Remover

- Clamp the vacuum pump bracket in a vise.

- 1. Vacuum pump hose (15) from the vacuum pump pipe.
- 2. Pulley (2) from the pump using tool J 25034-B.

NOTICE: Do not pry from the back of the pulley. Damage could occur to the pulley or pump.

- 3. Three bolts (11) from the back of the bracket.
- 4. Vacuum pump.

6H-4 VACUUM PUMPS

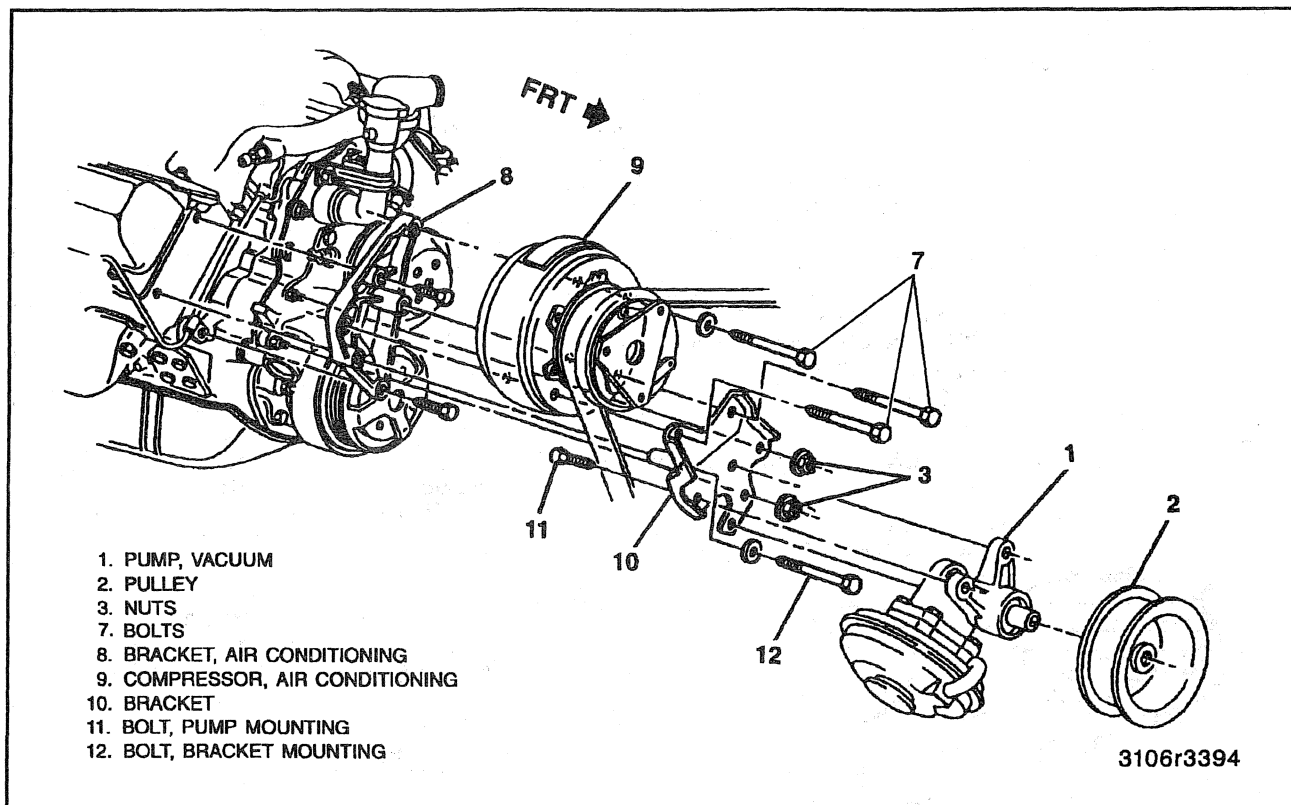


Figure 3—Vacuum Pump with Air Conditioning

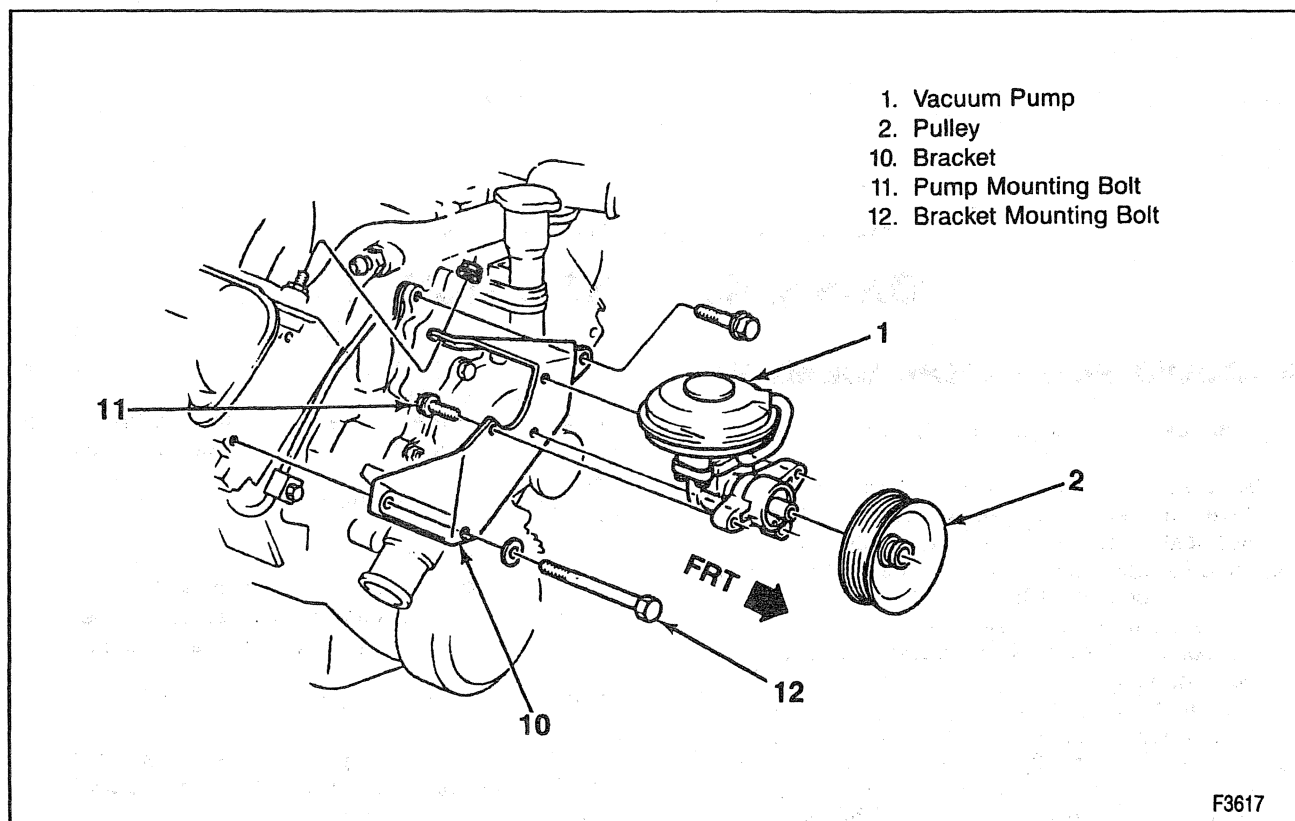


Figure 4—Vacuum Pump without Air Conditioning

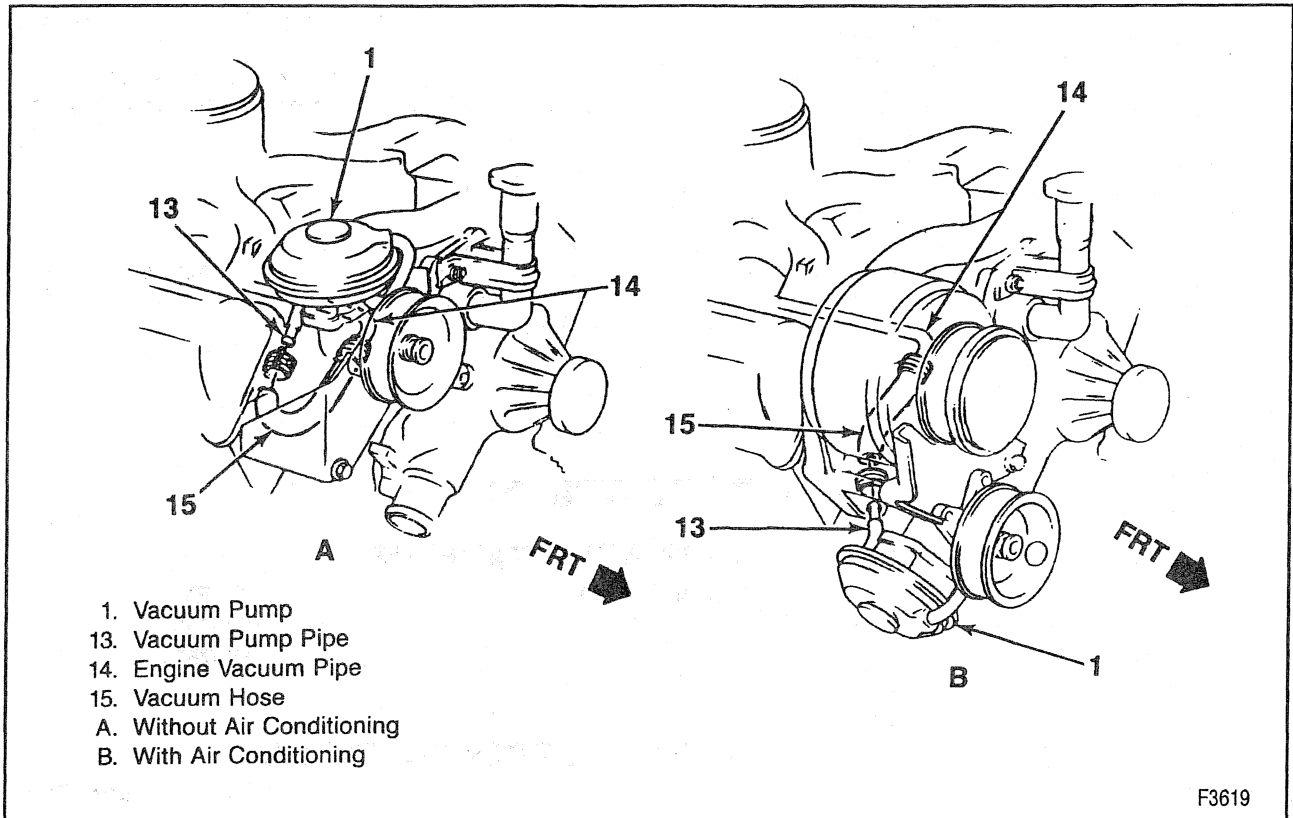


Figure 5—Vacuum Pump Hose

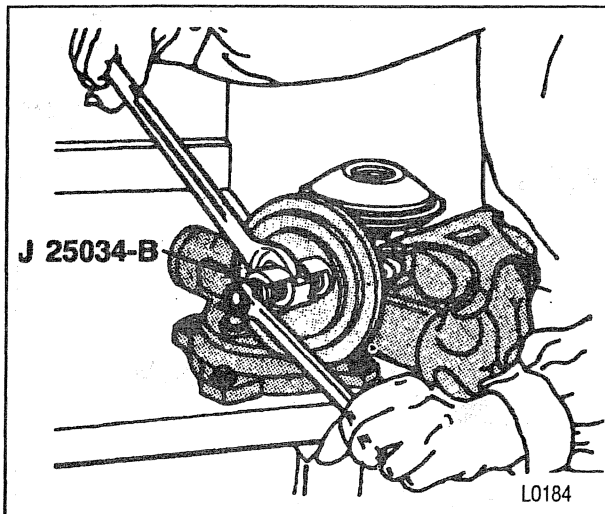


Figure 6—Removing Pulley



Assemble (Figure 7)

Tool Required:

J 25033-B Pump Installer

1. Vacuum pump to the bracket with bolts (11).



Tighten

- Bolts to 27 N·m (20 lbs. ft.).
2. Pulley to the pump using tool J 25033-B until the pulley is flush with the end of the shaft (figure 7).

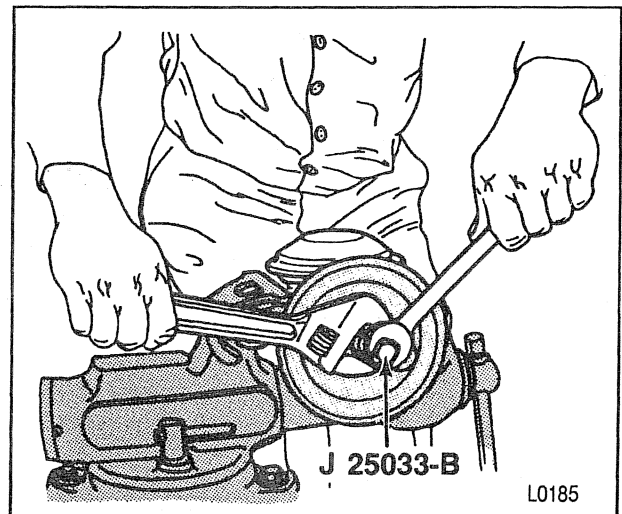


Figure 7—Installing Pulley

NOTICE: Do not tap the pulley back onto the pump shaft. The pump could be damaged.

3. Vacuum hose (15) to the vacuum pump pipe (13).



Install or Connect

1. Vacuum pump (1) to the bracket (10) with bolts (11) (figure 4). (Vehicles without Air Conditioning)



Tighten

- Bolts to 27 N·m (20 lbs. ft.).

6H-6 VACUUM PUMPS

2. Bracket and the pump to the engine with bolts (12) and nut.



Tighten

- Bolts to 40 N.m (30 lbs. ft.).
- Nut to 40 N.m (30 lbs. ft.).

3. Vacuum hose (15) (figure 5). **(Vehicles with Air Conditioning)**

4. Vacuum pump and bracket assembly to the engine with bolt (12) and nuts (3).



Tighten

- Bolt to 40 N.m (30 lbs. ft.).
- Nuts to 30 N.m (22 lbs. ft.).

5. Vacuum hose (15) to the engine vacuum pipe (14) (figure 5).

6. A/C compressor into position on the engine.

7. Bolts holding the compressor and bracket to the engine.



Tighten

- Bolts to 40 N.m (30 lbs. ft.).

8. Electrical connector to the compressor clutch. **(Both Models)**

9. Drive belt.

SPECIFICATIONS

VACUUM PUMP APPLICATIONS

ENGINE
6.5L without A/C
6.5L with A/C

VACUUM PUMP
26036642
7849209

PULLEY
15589758
15589757

T2142

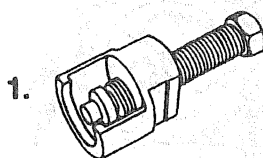
FASTENER TIGHTENING SPECIFICATIONS

Fasteners

	N·m	Lbs. Ft.
Bracket to Engine Bolts	40	30
Bracket to Engine Nut (with A/C)	30	22
Bracket to Engine Nut (without A/C)	40	30
Pump to Bracket Bolts (with A/C)	27	20
Pump to Bracket Bolts (without A/C)	27	20

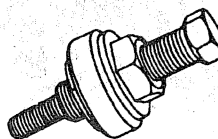
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SPECIAL TOOLS



1.

J 25034-B



2.

J 25033-B

1. Pump Pulley Remover
2. Pump Pulley Installer

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SECTION 6J

TURBOCHARGER

CAUTION: On vehicles equipped with Supplemental Inflatable Restraint (SIR), refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location view in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

CAUTION: Turbochargers operate at high speeds and temperature. Do not operate the engine and/or turbocharger without all normally installed inlet piping and filters, along with all exhaust piping. Failure to install the above components could result in personal injury and damage to the vehicle.

NOTICE: Always use the correct fastener in the correct location. Use the correct fastener part number to replace a fastener. If the correct fastener part number is not available, a fastener of equal size and strength may be used. Do not use a fastener that is stronger when the correct fastener part number is not available in the following applications:

- Some bolts are designed to permanently stretch, and if a stronger fastener is used, the part will not be tightened correctly. These permanently stretching bolts will be called out. The correct part number fasteners must be used to replace this type of fastener because there is no available equivalent.
- Other bolts are designed to break if over tightened to prevent part damage. If a stronger fastener is used part damage may occur.

Fasteners that need to be replaced when removed will be called out. Fasteners that require thread lockers or thread sealant will be called out. The correct tightening specification and sequence must be used when installing fasteners. Part or system damage may occur if the above instructions are not followed.

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Waste-Gate Actuator Replacement	6J-10
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GENERAL DESCRIPTION

The turbocharger is used to increase the amount of air that enters the engine's cylinders. This increase allows a proportional increase in fuel to be injected into the cylinders resulting in increased power output, more complete combustion of fuel, and cooling of the cylinder heads, pistons, valves, and exhaust gas. This cooling effect helps extend engine life.

Heat energy and pressures in the engine exhaust gas are utilized to drive the turbine wheel (figure 1). Exhaust gas is directed to the turbine housing. The turbine housing acts as a nozzle to direct the exhaust gas flow to the turbine wheel blades which drive the shaft wheel assembly. Since the compressor wheel is attached directly to the shaft, it rotates at the same speed as the

turbine wheel. Clean air from the air cleaner and crankcase vapors are drawn into the compressor housing and where it is compressed and delivered through a crossover pipe to the engine air intake manifold and then into the cylinders (figure 2). The inside of the turbocharger compressor housing, compressor wheel, and the inside of intake manifold can be quite oily due to the ingestion of the crankcase vapors. The amount of air pressure rise and air volume delivered to the engine from the compressor outlet is regulated by a waste-gate valve in the exhaust housing.

The position of the waste-gate valve is controlled by the vehicle PCM which monitors turbo boost pressure. If increased boost is needed, more vacuum is applied to

6J-2 TURBOCHARGER

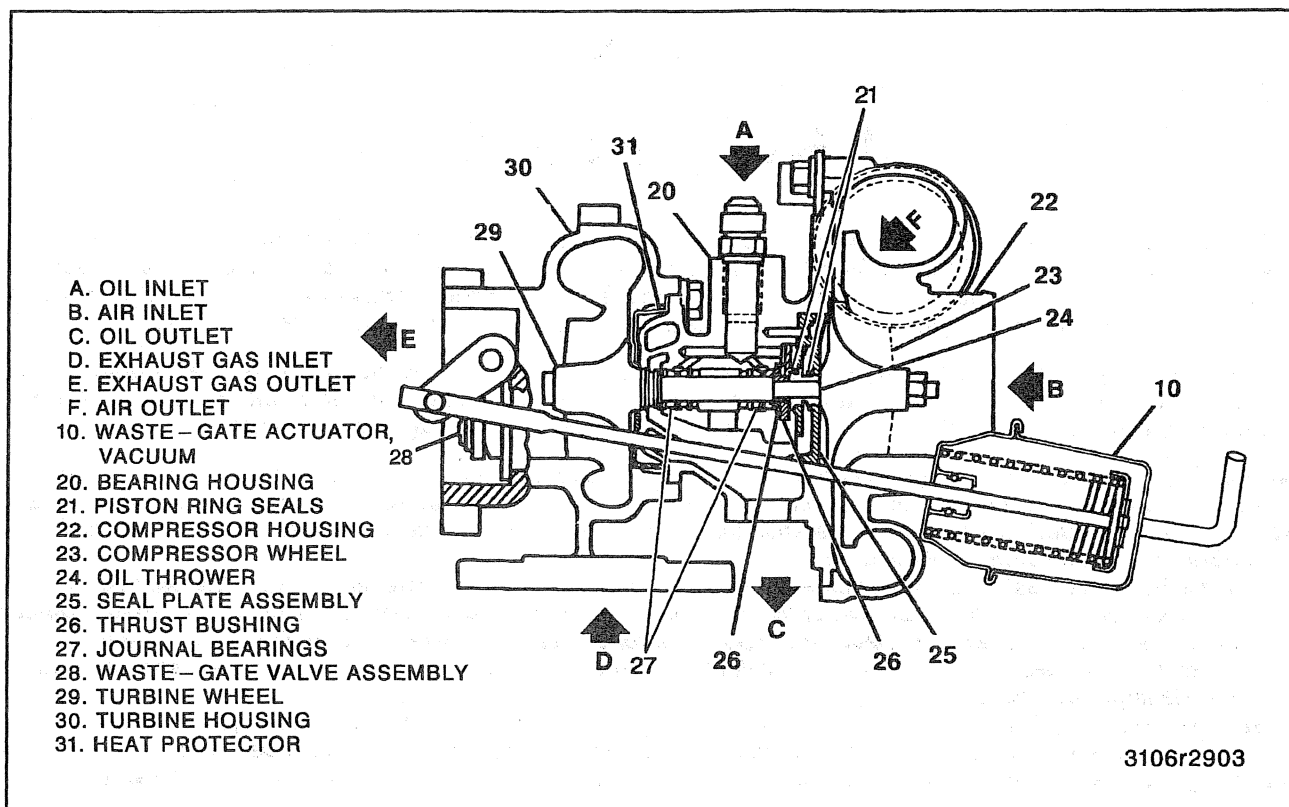
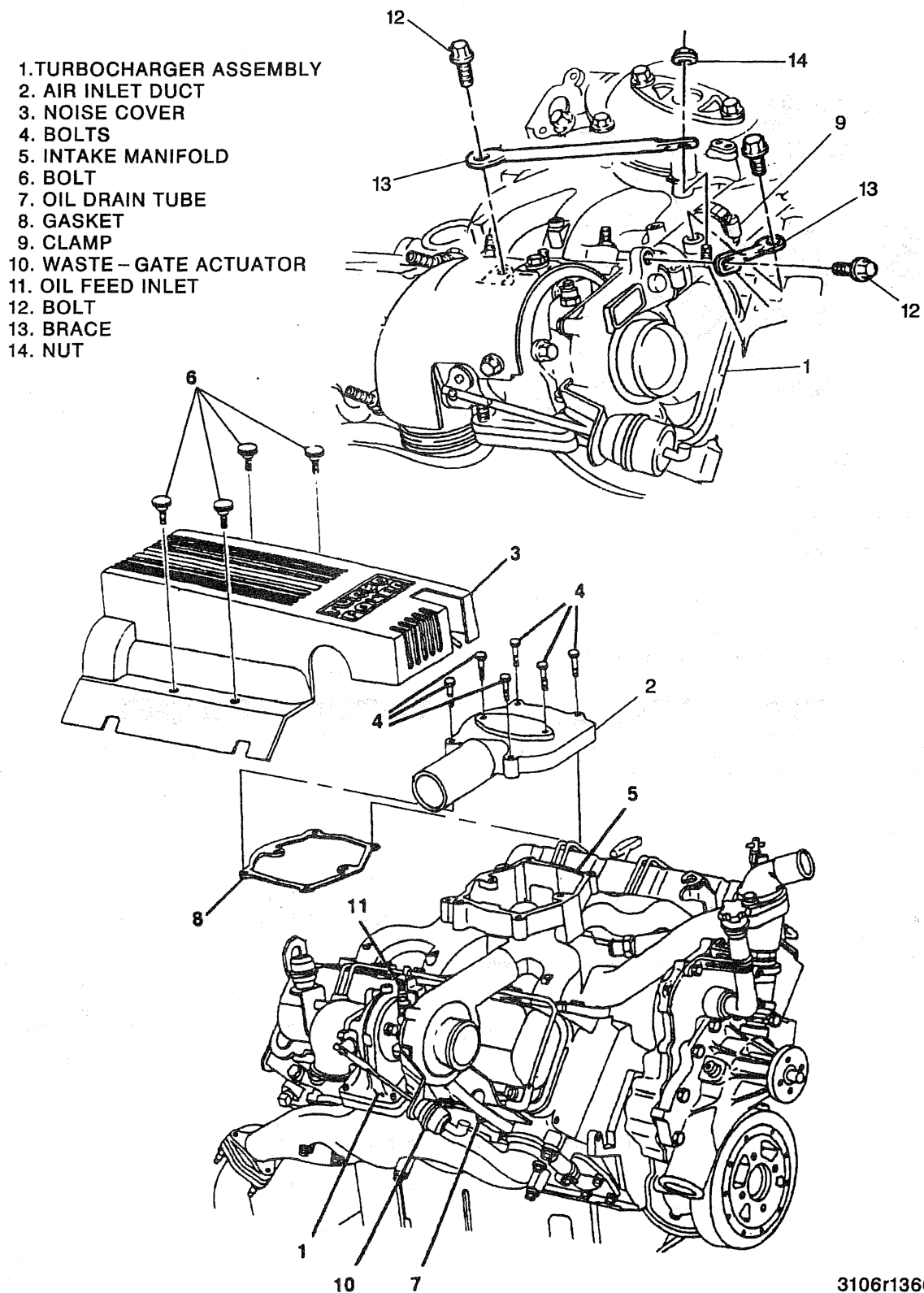


Figure 1—Turbocharger Component View

the actuator to close the waste-gate. If less turbo boost is needed, the vacuum applied to the actuator will be reduced allowing the waste-gate valve to open, resulting in additional exhaust bypassing the turbine wheel (figure 3).

For more information about vacuum operated wastegates controlled by the PCM, refer to the Driveability, Emissions, and Electrical Diagnosis Manual, GMT/95-CK-2.



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Figure 2—Turbocharger and Cover Assembly

6J-4 TURBOCHARGER

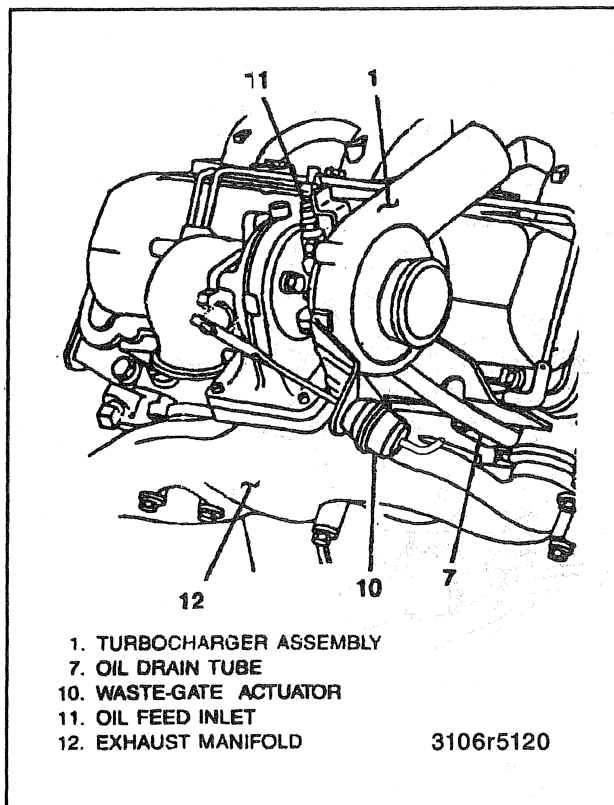


Figure 3—Turbocharger Assembly

DIAGNOSIS OF THE TURBOCHARGER

PROBLEM	POSSIBLE CAUSE	CORRECTION
Engine Lacks Power And Has No Black Smoke At Wide Open Throttle	1. Insufficient fuel supply to injection pump.	1. Refer to SECTION 6C and 6C2.
Engine Lacks Power And Has Black Smoke At Wide Open Throttle	1. Restricted air filter. 2. Obstructed air intake duct to turbo-charger compressor wheel. 3. Air leak in compressor wheel inlet/outlet duct. 4. No vacuum signal to wastegate actuator. 5. Ruptured wastegate actuator diaphragm. 6. Air leak between intake manifold and engine. 7. Exhaust gas leak between cylinder head exhaust ports and turbine inlet. 8. Damaged turbocharger (Refer to "Inspection.") 9. Fuel system problem.	1. Replace air filter. 2. Remove obstruction(s). 3. Inspect inlet/outlet ducts for loose connections. Tighten connections and/or replace damaged duct work. 4. Check for DTCs. Refer to Driveability, Emissions, and Electrical Diagnosis Manual, GMT/95-CK-2. 5. Refer to "Inspection of the Wastegate Actuator Assembly." 6. Refer to SECTION 6A6 and SECTION 6F. 7. Repair leaks. 8. Find and correct cause of damage. Replace turbocharger if necessary. 9. Refer to SECTION 6C and SECTION 6C2.

DIAGNOSIS OF THE TURBOCHARGER (cont'd)

PROBLEM	POSSIBLE CAUSE	CORRECTION
Turbocharger Noise	<ol style="list-style-type: none"> 1. Restriction and/or air leak in compressor inlet ducting and/or outlet ducting. 2. Rotating components of turbocharger out of balance. 3. Compressor and/or turbine wheel contacting housing. Refer to "Inspection." 	<ol style="list-style-type: none"> 1. Inspect compressor inlet/outlet ducting. Remove any restrictions. Tighten connections and/or replace any damaged duct work. 2. Replace turbocharger. 3. Locate reason for damage and replace turbocharger.
Blue Exhaust Smoke—Warm Engine Only	<ol style="list-style-type: none"> 1. Lack of intake air. 2. Restricted oil drain tube. 3. Oil leakage past turbo seals. (Refer to "Inspection.") 	<ol style="list-style-type: none"> 1. Refer to SECTION 6C. 2. Clean or replace oil drain tube. 3. Replace turbocharger.

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INSPECTION

Turbochargers are extremely reliable units. The majority of inoperative turbochargers are caused by dirt in the oil, oil lag (lack of oil flow), foreign objects or debris entering the turbocharger, and plugged or restricted air cleaner systems.

Lack of power, black smoke, blue smoke (excess oil consumption), or other engine performance problems are frequently blamed on the turbocharger when the actual cause is really another engine component. This is why a complete inspection of the turbocharger and all other engine components that may cause similar conditions must be examined before replacing the turbocharger. Refer to SECTION 6A for diagnosing engine problems other than those caused by the turbocharger. The following steps and the preceding diagnostic chart will aid in diagnosing problems caused by the turbocharger. If it is determined that the turbocharger is the cause of the problem it must be replaced. **Service of the turbocharger is not recommended.**

Inspect

- A high pitched whine may indicate an exhaust leak or a leak in the air induction system.
- A cycling up and down in pitch often indicates a blockage in the air inlet duct, a restricted air cleaner, or a build up of dirt on the compressor wheel of the turbocharger (oil film is normal).
- A sharp, high pitched scream may indicate that the bearings have deteriorated and one (or both) of the wheels is rubbing on its housing (this results in blue exhaust smoke).
- At the compressor wheel blades (figures 4 through 7). There should not be any bent, broken, eroded, or cracked wheel blades.
- At the housing for signs of rubbing.
- At the compressor wheel for a build-up of dirt.

Important

- With this engine application, the inside of the air intake duct (rubber inlet elbow), turbocharger compressor wheel and housing can be quite

oily, due to the venting of the crankcase vapors into the air intake system. This is considered normal.

- The CDR valve does not prevent oil vapors from getting into the turbocharger compressor inlet system.

CAUTION: Do not feel any components of the turbocharger while the engine is running. Make sure that the turbocharger has stopped rotating and the turbocharger and engine have cooled down before handling. Rotating parts and extreme heat may cause serious personal injury if handled.

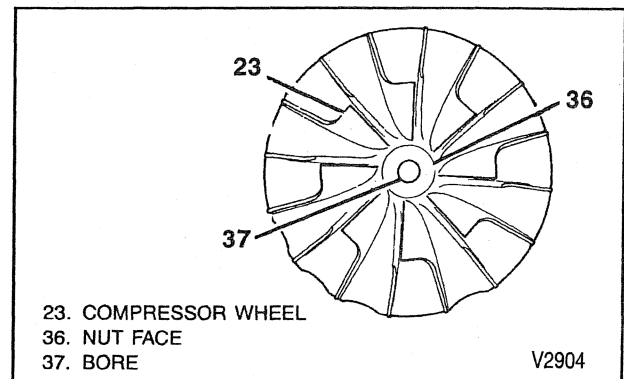


Figure 4—Normal Compressor Wheel

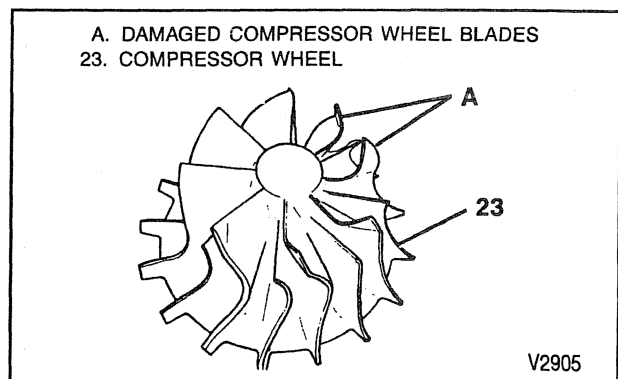


Figure 5—Damage by a Soft Object

6J-6 TURBOCHARGER

- Carefully grasp the compressor wheel nut with fingers and rotate the wheel in a clockwise direction. It should turn freely with no signs of binding or scraping (housing contact).
- How the turbocharger rotates while pushing in and pulling out on the compressor wheel; it should rotate freely with no contact with the housing.
- Carefully grasp the compressor wheel nut with fingers and while rotating move the wheel up and down (radially). There should be no compressor wheel to housing contact. **Note: axial and radial play is normal even on a new turbocharger.** If compressor wheel to housing contact exists, it will be very evident when rotating the wheel. The wheel will drag or scrape on the housing surface and visual damage will be evident on the wheel blades and housing surface.



Important

If the turbocharger does not pass any one of the above inspections that indicate damage to the turbocharger, with the exception of the waste-gate actuator, then the turbocharger must be replaced. See "Inspection of the Waste-Gate Actuator."

INSPECTION OF THE WASTE-GATE ACTUATOR ASSEMBLY

The waste-gate actuator assembly can be replaced separately from the turbocharger assembly. To check operation of the waste-gate actuator (figures 1 and 2):

Tool Required:

J 23738 Hand Operated Vacuum Pump

1. With the engine off, inspect actuator rod and lever. The actuator rod and lever should move back and forth without any tension.
2. Apply 5 inches HG vacuum to actuator, actuator rod and lever should close the waste-gate. Look for the rod to move toward the front of the engine.

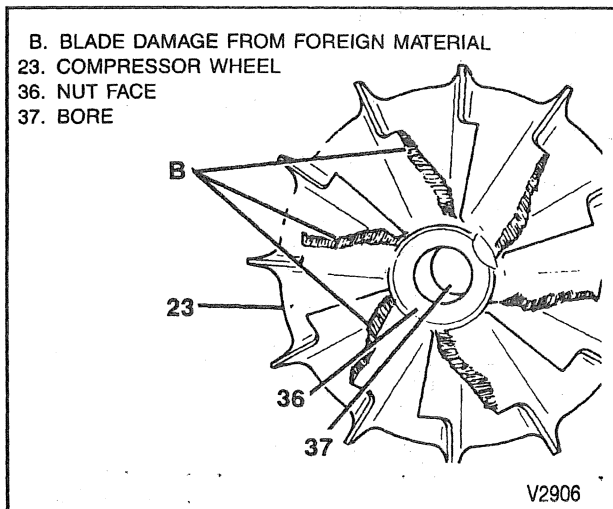


Figure 6—Damage by a Hard Object

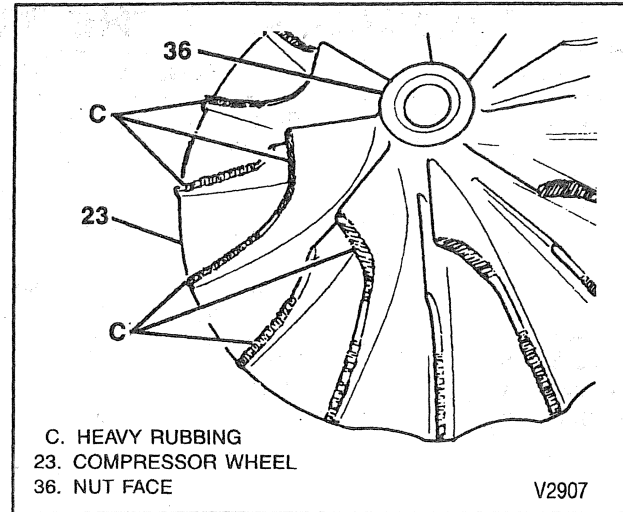


Figure 7—Compressor Blades Show Heavy Rubbing

If the rod does not snap back to a closed position, the waste-gate actuator is defective and should be replaced. For removal of the waste-gate actuator, refer to "Waste-Gate Actuator Replacement."

BOOST PRESSURE TEST

Tools Required:

J 39307 Adapter J 28474 Turbo Compound Gage

CAUTION: Do not perform this test with anyone in the area around the vehicle. The wheels of the vehicle should be blocked to prevent the vehicle from moving forward. Failure to take proper precautions may result in personal injury and damage to the vehicle.

1. Remove the front center mounting bolt from air inlet and install tool J 39307 adapter with a 6 to 7 foot length of 3/16 inch I.D. rubber line. Then route the rubber line into the cab and connect tool J 28474 pressure gage to the end of the line.
2. Test drive the vehicle with a passenger watching the gage. Allow the vehicle to coast at engine idle speed in first gear. Then press the accelerator pedal to the floor while the passenger notes the boost pressure reading. A boost reading of 14 kPa (2 psi) or more indicates the turbocharger is operating properly.

NOTICE: The 14 kPa (2 psi) reading is for quick accelerations only. The pressure reading can climb above 14 kPa (2 psi) under heavy loads. During deceleration, the pressure reading may even go down.

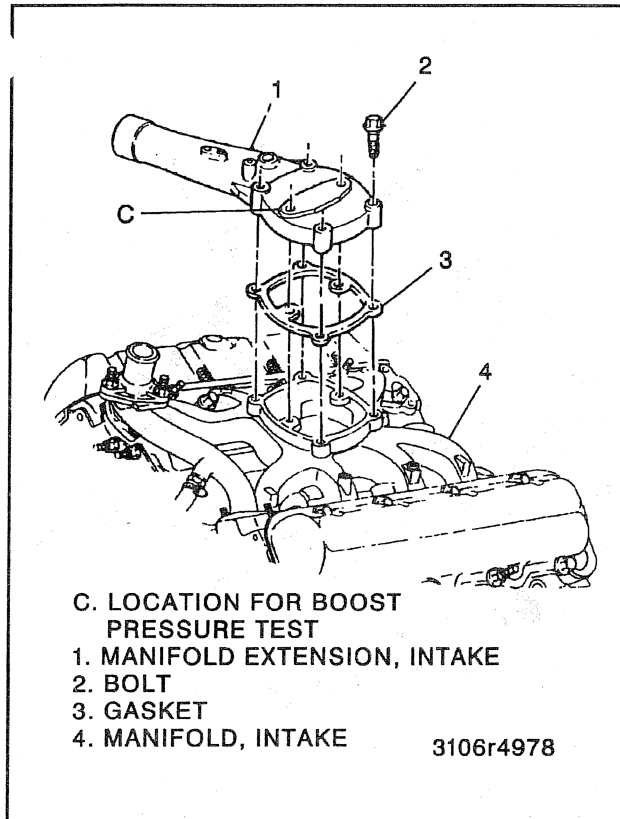


Figure 8—Boost Pressure Test Location

ON-VEHICLE SERVICE

TURBOCHARGER REPLACEMENT

The turbocharger assembly consists of the turbocharger housing, internal components, the waste-gate actuator, exhaust elbow, and heat shield.

↔ Remove or Disconnect (Figures 2, 9, 10, and 11)

1. Negative battery cables. Refer to SECTION 0A.
2. Upper intake manifold cover.
3. Self tapping screw holding CDR valve tube on top of turbocharger.
4. CDR valve and tube assembly from the air cleaner extension and right rocker cover. Refer to SECTION 6A6.

! Important

- Usually some quantity of oil will exist inside the vent system. The crankcase vapor consists of vaporized oil that condenses within the vent and intake system. The inside of the air intake duct (rubber inlet elbow) and compressor wheel housing can be quite oily due to the venting of the crankcase vapors.
- 5. Air cleaner extension (rubber elbow) from air cleaner and compressor inlet.

6. Two bolts retaining the air cleaner to the wheel well and lift the air cleaner assembly off the front air intake duct.

- This will allow easier access to the turbocharger flange nuts and exhaust clamp.

NOTICE: The right front wheel and inner splash shield can be removed for easier access to the turbocharger back flange nut. Refer to SECTION 3E.

7. Vacuum hose to the waste-gate actuator.
8. Long and short turbocharger braces (figure 2).
9. Hose clamps at intake extension/turbocharger compressor connector hose.


NOTICE: Silicone sealant is used between the connector hose, the intake extension, and turbocharger compressor outlet.

- Use a thin flat blade screwdriver to break the seal between the connector hose, turbocharger compressor outlet, and the intake extension.
- Slide connector hose over intake extension.

10. Exhaust clamp at turbocharger (figure 9).
11. Oil feed hose.
12. Oil return pipe (figure 11).
13. Turbocharger flange nuts (figure 10).

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14. Turbocharger assembly from exhaust manifold.

 **Install or Connect** (Figures 9, 10, 11, and 12)

 **Important**

Before the turbocharger is installed, perform the following steps:

- A. Check the intake and exhaust systems leading to and from the turbocharger to ensure that there is no foreign debris. Even small debris can cause severe wheel damage if inducted during high speed operation.
- B. Make sure the turbocharger and exhaust manifold flanges are clean and free of any foreign material. Use a high temperature anti-seize compound (GM P/N 1052771) or equivalent on all threaded fasteners connected to the turbocharger (figure 9).

1. Turbocharger assembly to the exhaust manifold (figure 10).
2. Nuts to exhaust manifold.

 **Tighten**

- Exhaust manifold mounting nuts to 58 N·m (43 lbs. ft.).

3. Gasket on oil return pipe. Then the oil return pipe to the bottom of the turbocharger (figure 11).

 **Tighten**

- Oil drain tube bolts to 26 N·m (19 lbs. ft.).

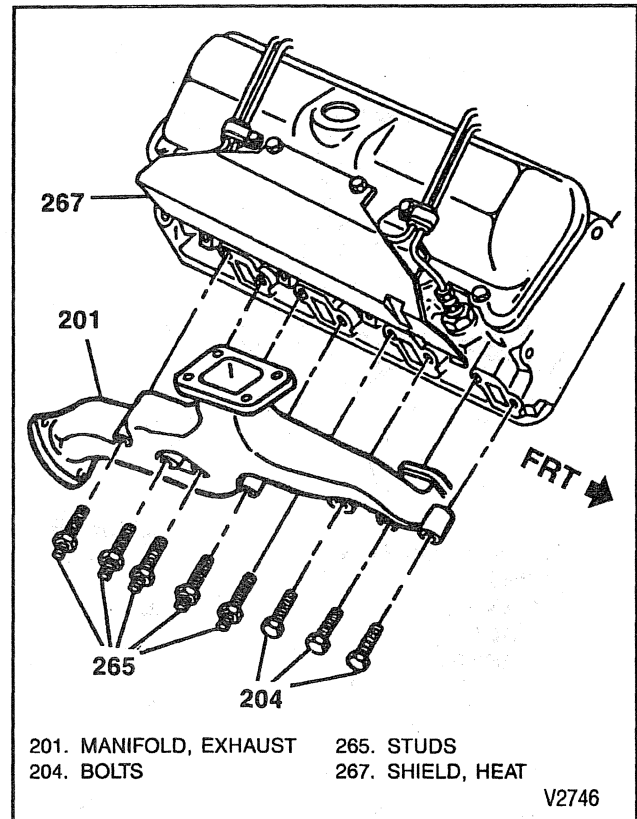


Figure 9—Exhaust Manifold and Heat Shield

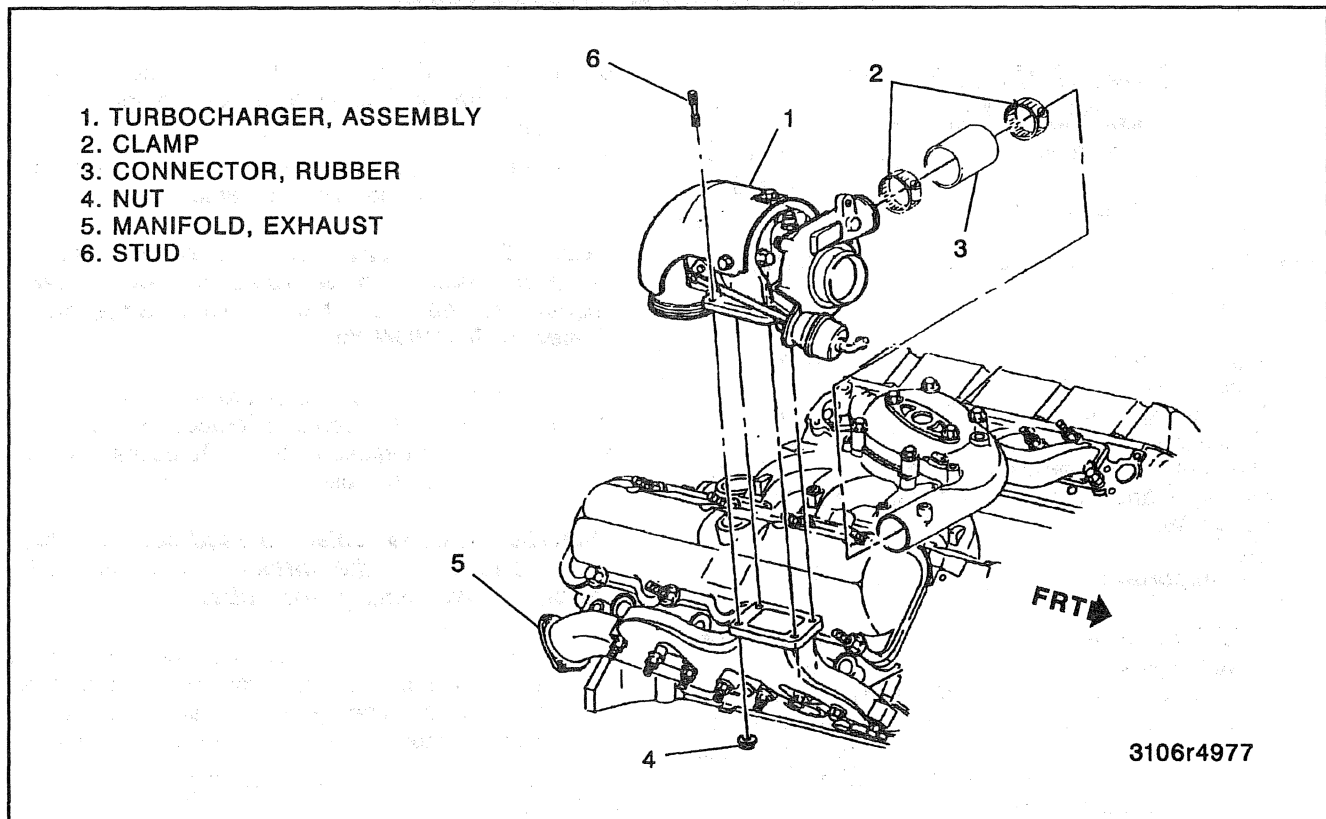


Figure 10—Turbocharger Mounting

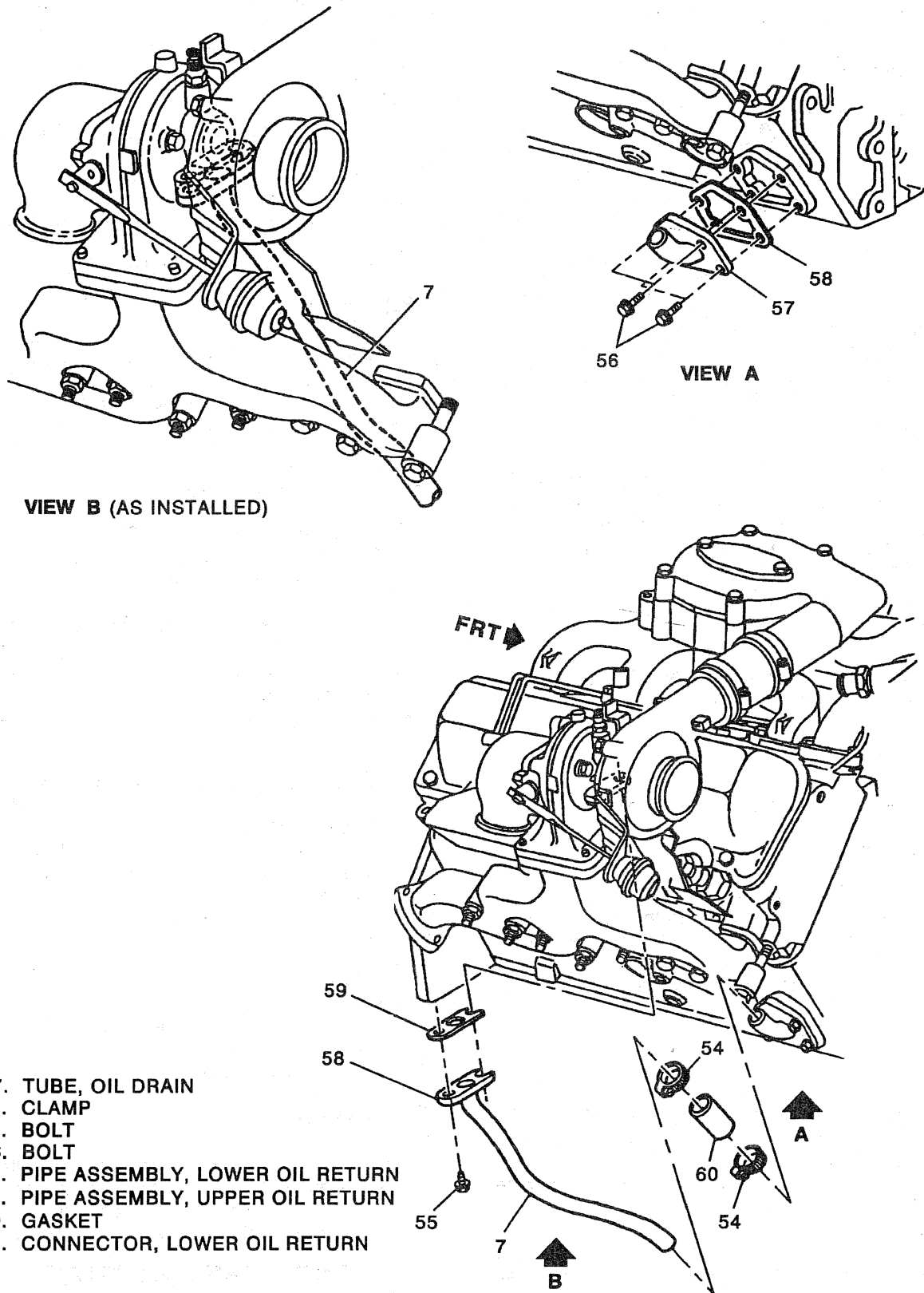


Figure 11—Oil Drain (Return) Tube

6J-10 TURBOCHARGER

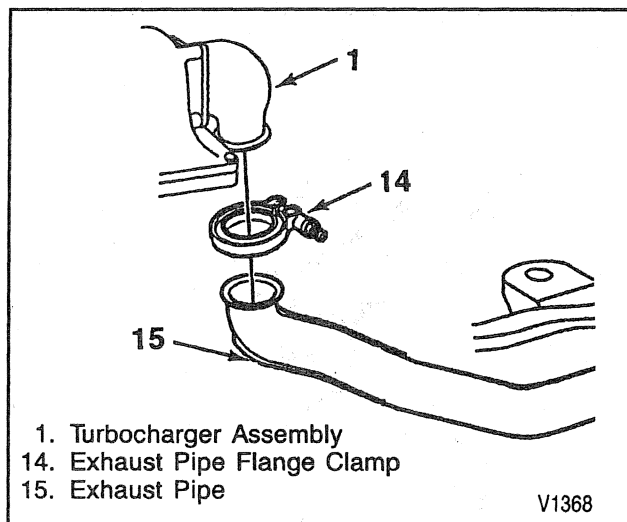


Figure 12—Exhaust Connection

! Important

- Fill the oil feed hole at the top of the turbocharger with a small amount of engine oil (1 to 2 cc) while hand rotating the compressor wheel. This action will lubricate the turbocharger shaft bearings.

4. Oil feed hose to top of turbocharger.

⌚ Tighten

- Oil feed hose fitting to 17 N.m (13 lbs. ft.).
5. Exhaust pipe to turbocharger with clamp (figure 12).

⌚ Tighten

- Exhaust pipe clamp to 8 N.m (71 lbs. in.).

! Important

- When starting the engine, allow it to idle for two minutes so oil can flow into the oil feed hose.
6. Inner splash shield and right front wheel (if removed).
 7. Clean surfaces of turbocharger compressor outlet and intake inlet extension housing where the connector hose is fastened.

! Important

- Apply silicone sealant (GM P/N 9985943) or equivalent to turbocharger compressor outlet hose (not the turbocharger or inlet extension) before installation to prevent oil leakage from the closed breather system.
8. Slide the connector hose over the compressor outlet and then slide the inlet extension into the other end of connector hose. Make sure the connector hose is centered between the compressor outlet and the inlet extension housing.

⌚ Tighten

- Connector hose clamps to N.m 5.6 (50 lbs. in.).

9. Long turbocharger brace by guiding the flat end of the brace under the heater inlet.
10. Nut onto the stud.
11. Bolt into the bent end of the brace.

⌚ Tighten

- Long turbocharger brace nut to 34 N.m (26 lbs. ft.).
 - Long turbocharger brace bolt to 50 N.m (37 lbs. ft.).
12. Short turbocharger brace to extension and compressor housing.
 13. Short turbocharger brace bolts.

⌚ Tighten

- Short turbocharger brace bolts to 25 N.m (19 lbs. ft.).
14. Vacuum hose to waste-gate actuator.
 15. Slide air cleaner onto the front air inlet duct and attach it to the fenderwell.
 16. Large diameter air cleaner bolt.
 17. Short diameter air cleaner bolt.

⌚ Tighten

- Larger diameter air cleaner bolt to 30 N.m (22 lbs. ft.).
 - Smaller diameter air cleaner bolt to 5 N.m (45 lbs. in.).
18. Air cleaner extension (rubber elbow) onto air cleaner and compressor inlet.

⌚ Tighten

- Extension clamps to 1.7 N.m (15 lbs. in.).
19. CDR valve and tube assembly on right rocker cover and extension.
 - Start self-tapping screw through CDR tube bracket and thread into bracket on turbocharger housing.
 20. Upper intake manifold cover.
 21. Intake manifold cover bolts.

⌚ Tighten

- Intake manifold cover bolts to 11 N.m (90 lbs. in.).
22. Negative battery cable.

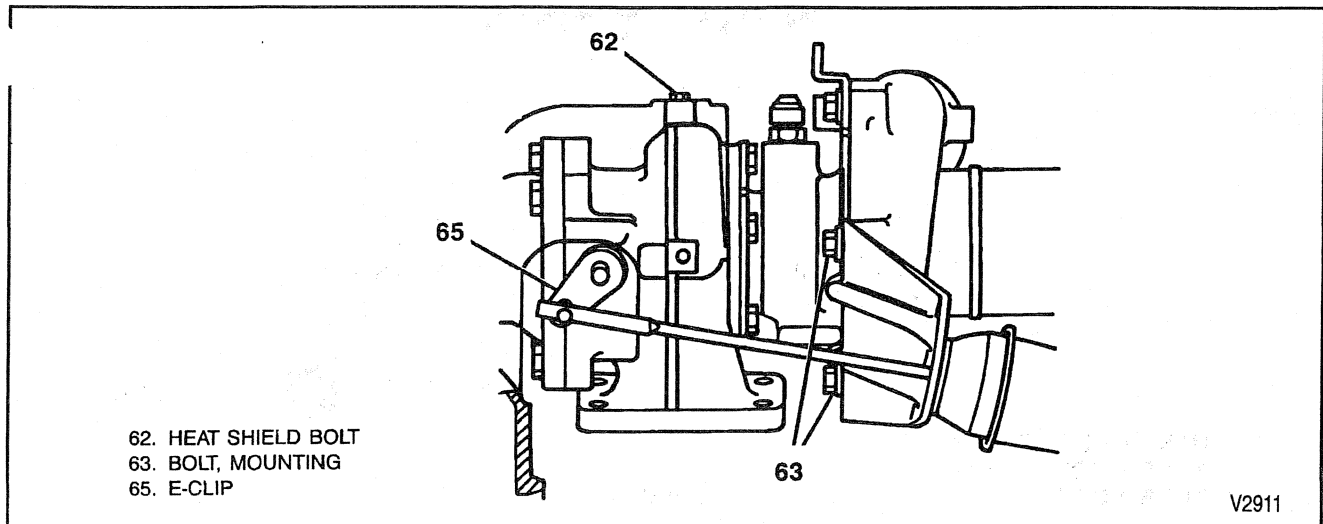
! Important

- Run engine at idle for at least 2 minutes after completing the installation of the turbocharger. While running the engine, check for any oil leaks at the oil supply and return hoses.

WASTE-GATE ACTUATOR REPLACEMENT

↔ Remove or Disconnect (Figure 13)

1. Vacuum hose.


Figure 13—Actuator Assembly Mounting

2. E-clip retainer from the waste-gate lever pin.
 - Access may be improved by removing the turbocharger heat shield.
3. Two waste-gate bracket mounting bolts.
4. Waste-gate actuator.


Install or Connect (Figure 13)

1. Waste-gate actuator assembly to turbocharger.
2. Shaft pin into lever hole.
3. Two mounting bolts through the waste-gate bracket. Use a sealant on the bolt threads.


Tighten

- Bolts to 23 N.m (17 lbs. ft.).
4. New E-clip on shaft pin.
 5. Heat shield (if removed). Use loctite on the heat shield bolts.


Tighten

- Bolts to 6 N.m (56 lbs. in.).
6. Vacuum line to wastegate actuator.

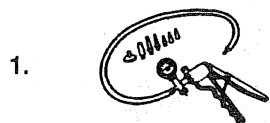
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener	N-m	Lbs. Ft.	Lbs. In.
Actuator Bracket Bolts	23	17	—
Air Cleaner			
Large Bolt.....	30	22	—
Smaller Bolt.....	5	—	45
Exhaust Clamp	8	—	71
Extension (Air Intake) Bolts	23	17	—
Heat Shield Bolts	6	—	56
Oil Drain Tube (Return) Flange Bolts	26	19	—
Oil Feed Line.....	17	13	—
Rubber Connector Hose Clamps.....	5.6	—	50
Rubber Inlet Elbow Clamps.....	1.7	—	15
Turbo Brace			
Long Type			
Bolt.....	50	37	—
Nut.....	34	26	—
Short Type			
Bolt.....	25	19	—
Turbocharger to Exhaust Manifold Nuts.....	58	43	—
Upper Intake Manifold Cover Bolts	11	—	90

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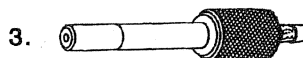
SPECIAL TOOLS



J 23738 - A



J 28474



J 39307 - 1

- 1. HAND OPERATED VACUUM PUMP
- 2. TURBO COMPOUND GAGE
- 3. TURBO BOOST PRESSURE GAGE ASSEMBLY

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