EMISSION CONTROL SYSTEMS
ALL SERIES

CONTENTS

Subject	Page No.
DESCRIPTION AND OPERATION:	
Distributor Vacuum Advance Spark Delay System	6F-243
Positive Crankcase Ventilator System (P.C.V.)	6F-243
Transmission Controlled Vacuum Spark Advance (T.C.S.) 455 Stage I	6F-243
Transmission Controlled Vacuum Spark Advance (T.C.S.) L-6 Engine	6F-244
Controlled Combustion System (C.C.S.)	6F-247
Air Injection Reactor System (A.I.R.)	6F-247
Exhaust Gas Recirculation System (E.G.R.)	6F-248
DIAGNOSIS:	
Testing Thermal Check and Delay Valve	6F-250
Testing Thermo Air Cleaner Operation	6F-250
Testing Transmission Controlled Vacuum Spark Advance System	6F-251
455 Stage I Engine	6F-251
L-6 Engine	6F-251
A.I.R. System Diagnosis	6F-255
Checking E.G.R. Valve Operation	6F-256
EGR System Diagnosis	6F-256
P.C.V. Valve Trouble Diagnosis	6F-257
MAINTENANCE AND ADJUSTMENTS:	
P.C.V. Valve Filter	6F-257
EGR System Inspection and Cleaning	6F-257
MAJOR REPAIR:	
Removal and Installation of C.C.S. Units	6F-258
Removing and Installing A.I.R. System Units	6F-258
V-8 Engines	6F-259
L-6 Engine	6F-259
Removing and Installing E.G.R. Valve	6F-260
SPECIFICATIONS:	
Emission Control System Specifications	6F-260

DESCRIPTION AND OPERATION

DISTRIBUTOR VACUUM ADVANCE SPARK DELAY SYSTEM

Thermal Check and Delay Valve

A thermal check and delay valve is in the vacuum advance circuit on all 455-2 Bbl. and 350-4 Bbl. engines. It is located in the hose between the carburetor ported spark port and the T.V.S. "C" port.

Below 50 degrees underhood temperature the valve is open, and the vacuum advance receives full "distributor ported vacuum" from the carburetor.

Above 50 degrees underhood temperature the valve is in the restricting position. Distributor ported vacuum must then be metered through a .005" orifice in the valve. It takes up to 40 seconds for full vacuum advance after distributor ported vacuum has been dropped to zero.

When the valve is in the restricting position and ported vacuum drops, there is a pressure differential within the valve; the valve momentarily opens equalizing the vacuum between the vacuum advance and the distributor, retarding the distributor vacuum advance. When vacuum increases at the carburetor port the valve goes to the restricting position so vacuum to the advance will have to be metered to increase the distributor vacuum advance.

The valve is by-passed above 226 degrees coolant temperature when the T.V.S. valve switches. Vacuum for the advance then comes from an intake manifold vacuum source.

The Thermal Check and Delay Valve functional checks are not a part of the emission control maintenance. If not operating properly, it could cause the engine to operate on retarded distributor advance causing an overheating condition.

CLOSED POSITIVE CRANKCASE VENTILATOR SYSTEM

All cars have a closed Positive Crankcase Ventilating System to provide more complete scavenging of crankcase vapors. Ventilation air is drawn through a filter assembly located in the air cleaner, through a hose, into the left rocker arm cover, down into the crankcase, across and up into the rear of the intake manifold, up through the ventilator valve, through a hose and into the intake manifold. Intake manifold vacuum draws any fumes from the crankcase to be burned in the engine.

When air flow through the carburetor is high, added air from the Positive Crankcase Ventilating System

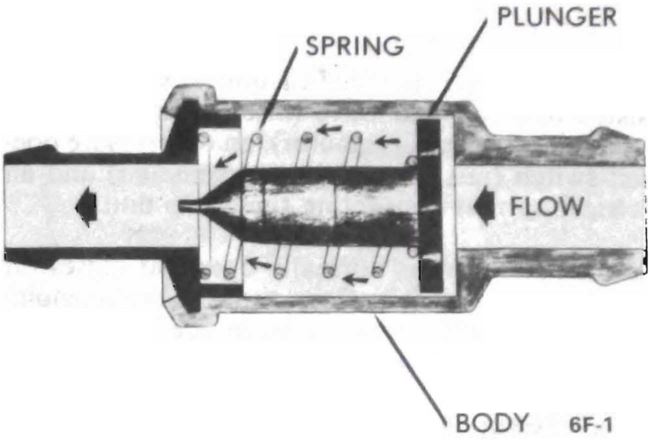


Figure 6F-1 Positive Crankcase Ventilator Valve

has no noticeable effect on engine operation; however, at idle speed, air flow through the carburetor is so low that any large amount added by the ventilating system would upset the air-fuel mixture, causing rough idle. For this reason, a flow control valve is used which restricts the ventilating system flow whenever intake manifold vacuum is high. See Figure 6F-1.

An engine which is operated without any crankcase ventilation can be damaged seriously. Therefore, it is important to replace the ventilator valve periodically.

> **CAUTION:** *If an engine is idling too slow or rough, this may be caused by a clogged ventilator valve or plugged hose; therefore, never adjust the carburetor idle without first checking the crankcase ventilator check valve and hose.*

After installing a new ventilator valve, readjust engine idle if necessary.

All cars have a closed P.C.V. System. With this system, any blow-by in excess of the system capacity (from a badly-worn engine, sustained heavy load, etc.) is exhausted into the air cleaner and is drawn into the engine.

TRANSMISSION CONTROLLED VACUUM SPARK ADVANCE SYSTEM

Automatic Transmission (TCS) 455 Stage I Engine ("A" Series Only)

The Transmission Controlled Vacuum Spark Advance (T.C.S.) System is used with engines designed for no spark advance at lower engine speeds, plus leaner carburetor and choke calibrations. With retarded idle timing, the throttle must be opened slightly more to maintain the same idle speed. This gives better mixture distribution and less exhaust dilution, resulting in much more complete combustion.

The transmission controlled vacuum advance system consists of a solenoid valve (inserted in the ported vacuum hose to the distributor), an oil pressure operated switch (installed in the transmission) and an electrical harness connecting these two units.

The solenoid valve is normally open but closes off vacuum when electricity flows through the solenoid. A vent bleeds off any vacuum in the hose to the distributor advance unit when the valve closes.

The oil pressure switch is located internally in the direct clutch circuit and is pressurized when the transmission upshifts into third gear.

The oil pressure switch is normally closed but opens to stop electrical flow to ground when there is oil pressure to the switch. The switch is controlled by direct clutch apply pressure.

An electrical harness connects the ignition switch to one terminal of the solenoid valve, through the solenoid, out the other solenoid terminal and to ground thru the oil pressure switch (when closed).

Operation of the transmission controlled vacuum advance system is as follows:

1. When operating in P, N, L2, or L1 positions; there is no oil pressure in the direct clutch circuit to the transmission switch, so there can be no vacuum advance.

2. When operating in D, there is no oil pressure to the transmission switch until the transmission upshifts to third gear, at which time vacuum advance starts to operate normally.

3. When operating in R, there is always oil pressure in the direct clutch circuit to the transmission switch, so there is normal vacuum advance.

Because of the greater heat rejection to the coolant during idle without vacuum spark advance, the engine is liable to overheat if allowed to idle for an extended period. For this reason, a thermo vacuum switch is located in the coolant passage at the left front corner of the intake manifold. This vacuum switch has three nipples:

1. The nipple marked "MT" has a hose either directly to the intake manifold or to a tee which connects to the manifold.

2. The nipple marked "C" is connected to the carburetor for a "ported" vacuum source.

3. The nipple marked "D" is connected to the distributor vacuum advance unit.

When engine coolant is at normal temperatures, the thermo vacuum switch is positioned internally to supply "ported" vacuum to the distributor. However, if coolant temperature should ever rise above 220 degrees, the thermo vacuum switch will supply full intake manifold vacuum to the distributor, even at closed throttle. This will improve idle quality and will cause an idling engine to speed-up, resulting in improved fan and water pump action, besides reducing heat rejection to the coolant because of the 14 to 20 degrees spark advance.

Transmission Controlled Spark System (TCS) (L-6 Engine Only)

The transmission controlled spark system is used on the L-6 Engine with manual transmission (only).

The TCS system permits vacuum advance only when the vehicle is being operated in high gear.

Vacuum advance is controlled by a solenoid-operated value, which is energized by grounding a normally open switch at the transmission. When the solenoid is in the non- energized position, vacuum to the distributor advance unit is shut off and the distributor is vented to atmosphere through a filter at the opposite end of the solenoid (venting the distributor advance unit prevents it from becoming locked at an advanced position). When the solenoid is energized, the vacuum port is uncovered and the plunger is seated at the opposite end, shutting off the clean air vent.

The vacuum advance solenoid is controlled by two switches and a time relay. The solenoid is energized in the high forward gear by a transmission operated switch. A thermostatic coolant temperature switch is used to provide a thermal override below 93°F. The time relay is incorporated in the circuit to energize the vacuum advance solenoid for approximately 20 seconds after the ignition switch is turned on, but the solenoid will remain energized as long as coolant temperature is below 93°F.

Wider throttle blade openings at idle are required to compensate for the retarded spark condition produced by the design of the emission reduction system. To prevent engine dieseling at engine shut down, an idle stop solenoid is provided. The ignition activated idle stop solenoid eliminates dieseling tendencies by allowing the throttle valve to close beyond normal idle position when the ignition is turned off.

SYSTEM THEORY

The TCS system components are shown in their normal at rest position with the engine off and cold. The temperature switch points are closed, making contact with the cold terminal; the time relay points are

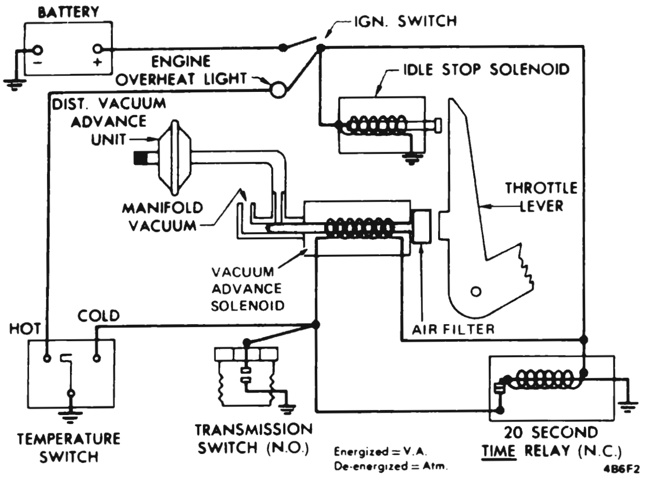


Figure 6F-2 TCS System (Engine Off)

closed, transmission switch points are open; vacuum advance solenoid is de-energized, plunger retracted and blocking distributor vacuum advance and opening the distributor vacuum advance unit to atmosphere; idle stop solenoid is de-energized with plunger retracted. See Figure 6F-2.

When the ignition switch is turned on the idle stop solenoid is energized, extending the plunger to contact the throttle lever. A circuit is completed from the ignition switch through the vacuum advance solenoid and through the temperature switch cold terminal to ground. At the same time another circuit is energized – this is from the ignition switch through the time relay coil and to ground, also as long as the relay points are closed it provides a path to ground for the vacuum advance solenoid. With either one or both of the above circuits complete, the vacuum advance solenoid is energized; permitting vacuum advance to distributor. See Figure 6F-3.

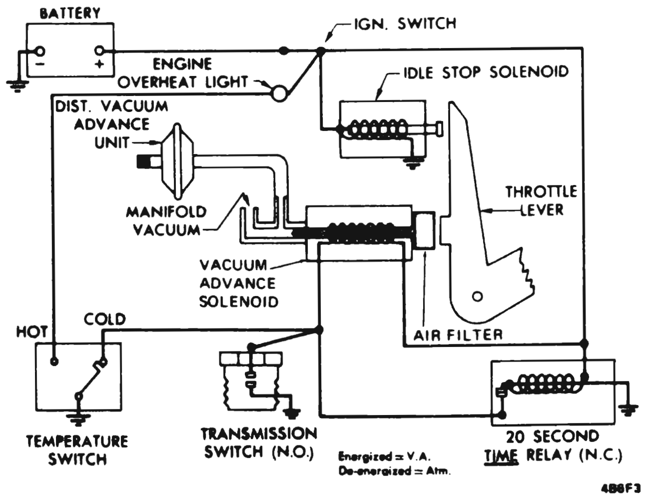


Figure 6F-3 TCS System (Ignition Switch Turned on)

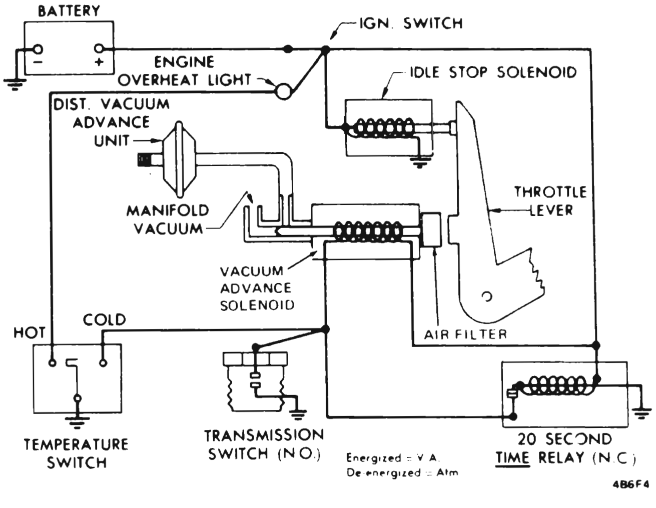


Figure 6F-4 TCS System (Low Gear Operation)

In low gear operation, with engine temperature above 93 degrees, the temperature switch cold override points are open. If 20 seconds have elapsed the time relay points are open also. This breaks the circuit(s) de-energizing the vacuum advance solenoid, allowing the plunger to block vacuum and open advance unit to atmosphere. See Figure 6F-4.

When the transmission is shifted into high forward gear the transmission switch points are closed by shift action. This completes the circuit from the ignition switch through the vacuum advance solenoid and through the closed transmission switch points to ground the vacuum advance solenoid is energized. See Figure 6F-5.

COMPONENT DESCRIPTION

Idle Stop Solenoid

The idle stop solenoid is a two position electrically operated control, used to provide a predetermined

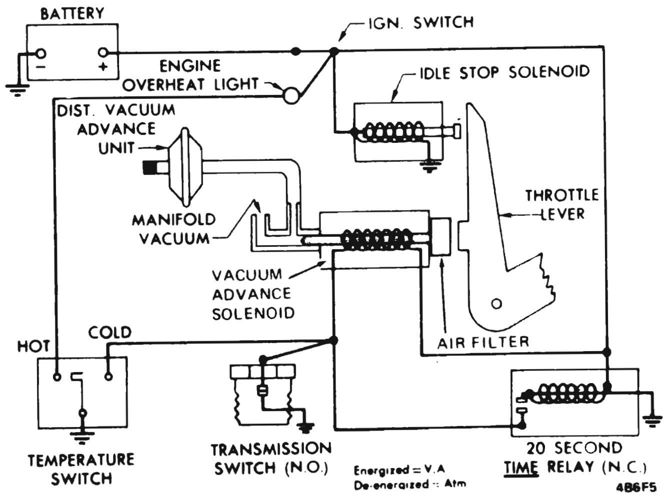


Figure 6F-5 TCS System (High Gear Operation) throttle setting. In the energized position (plunger extended) the plunger contacts the carburetor throttle lever and prevents full closing of the carburetor throttle plates. This fast idle control when de-energized (plunger retracted) allows throttle plates to close beyond the normal idle position; thereby shutting off air supply and in essence starving the engine so that it will shut down without dieseling. The idle stop solenoid is bracket-attached to the carburetor so that the plunger, when extended, contacts the throttle lever.

Vacuum Advance Solenoid

The vacuum advance solenoid is bracket-attached to the ignition coil retaining screw. See Figure 6F-6. This electrically operated two-position plunger controlled valve serves to supply or deny vacuum to the distributor vacuum advance unit. In the energized position, the plunger opens the vacuum port from the carburetor to the vacuum advance unit. In opening the vacuum port the plunger simultaneously closes the clean air port at the opposite end. In the de-energized position the spring loaded plunger seats against the vacuum inlet and opens the distributor advance unit to the clean air vent.

Time Relay

The time relay is an electrically operated on-off type switch. When the coil is energized it begins to heat the bi-metal strip to open the normally closed relay points in approximately 20 seconds after the ignition is turned on.

If for some reason the vehicle is not started within 20 seconds and the time relay has completed its "countdown", it denies vacuum advance until the relay has cooled. In other words, once the relay has run one cycle after the key has been turned on, it must cool

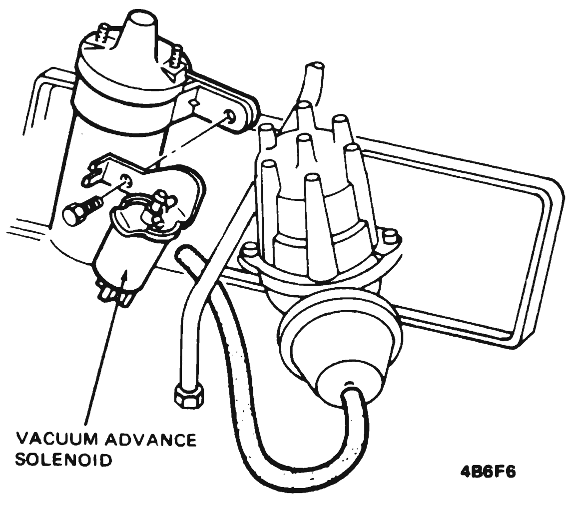


Figure 6F-6 Vacuum Advance Solenoid

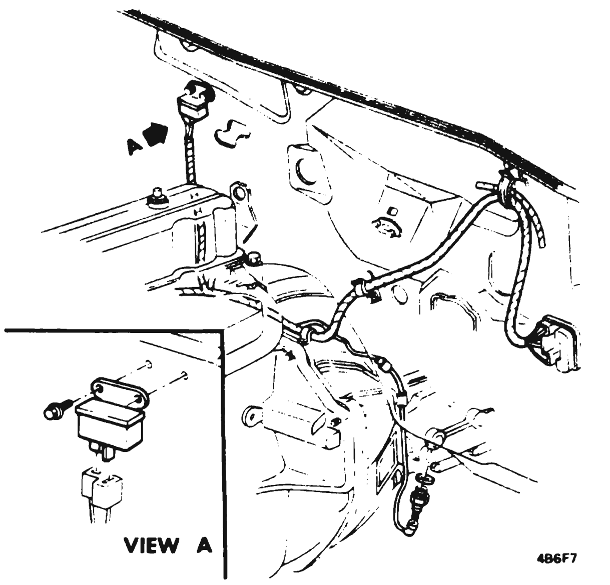


Figure 6F-7 Time Relay Location

off before it will reactivate, even if the ignition key is switched off and turned on.

A ground path is provided through the relay housing and mounting bracket. Two self-tapping screws attach the relay to the vertical wall of the cowl to the right of centerline. See Figure 6F-7.

Temperature Switch

The TCS, engine-coolant, temperature switch is located in the coolant outlet (thermostat) housing. This switch is a three-position double terminal unit with a neutral position. At coolant temperatures below 93 ($\pm$5) degrees, the cold terminal is contacted by the bi-metallic strip to ground and completes the circuit to the vacuum advance solenoid. In the neutral position, no contact is made; therefore the circuit is broken. When the engine starts to overheat, the bi-metallic strip contacts the hot terminal grounding and activating the circuit to the "hot" light in the instrument panel.

Transmission Switch

The transmission switch is located on the outside of the transmission case in an area adjacent to the 2-3 shifter shaft. The mechanically operated switch is spring loaded to provide continuity between the switch terminal and the switch housing. When installed in the transmission, the plunger contacts the shifter shaft, which causes the plunger to retract in low forward gears. Thereby opening the circuit to ground. When the transmission is shifted into high forward gear, the plunger drops into a recess or flat on the shifter shaft, causing the plunger to rest internally on the switch housing. A circuit is completed to ground, from the transmission through the switch housing to the cup contact and through the spring to the electrical terminal.

CONTROLLED COMBUSTION SYSTEM (C.C.S.)

The C.C.S. package includes leaner carburetor calibration at idle and part throttle plus leaner choke calibration. Since past model carburetion was as lean as possible consistent with good driveability with inlet air temperatures as low as minus 20 degrees, this still leaner carburetion is only possible because of the heated air system that is also a part of the C.C.S. package. With the heated air system operating, inlet air temperature is around 115 degrees after the first few minutes of operation; this makes use of leaner (hot weather) calibration possible, and the car still responds and drives well in cold weather.

The heated air part of the C.C.S. consists of a heat stove, a heated-air pipe, a nylon adapter elbow, where necessary, and an air cleaner containing a temperature controlled door operated by vacuum through a temperature sensor (located on the bottom side of the air cleaner).

The heat stove is a sheet metal cover, shaped to and bolted on the left exhaust manifold. Air drawn in along the lower edge of the stove passes across the manifold surface, picking-up heat. The heated air is drawn out from the upper center of the manifold, through the heated air pipe into the snorkel of the air cleaner.

The temperature control air cleaner is designed to mix this heated air with cold air from under the hood so that carburetor inlet air temperature averages about 115 degrees. This mixing is done by a damper door.

The damper door is moved by a diaphragm type vacuum motor. When there is no vacuum present in the motor, the diaphragm spring forces the damper door downward, opening the snorkel passage. Whenever the engine is running, the amount of vacuum present in the vacuum motor depends on the temperature sensor in the air cleaner which is located in the vacuum line between the intake manifold and the vacuum motor. In the sensor, a bi-metal temperature sensing spring starts to open a valve to bleed more air into the vacuum line whenever the temperature in the air cleaner rises above about 115°. Whenever the temperature falls below about 115° the sensing spring starts to close the air bleed into the vacuum line, allowing more manifold vacuum to reach the vacuum motor. Whenever there is 7 inches or more of vacuum in the vacuum motor, the diaphragm spring is compressed, raising the damper door to close snorkel passage.

When the engine is not running, the diaphragm spring will always hold the damper door to wide open snorkel passage position. However, when the engine is running, the position of the damper door depends on the air temperature in the air cleaner.

When starting a cold engine (air cleaner temperature under 85°), the damper door will close off snorkel passage. As soon as the air cleaner starts receiving hot air from the heat stove, the sensor will cause the damper door to partially open snorkel passage, mixing cold air with hot air as necessary to regulate air cleaner temperature within 20° of the ideal 115° air inlet temperature.

If underhood air temperature rises to 135°, the air bleed valve in the sensor will be wide open so that vacuum to the vacuum motor approaches zero. The diaphragm spring in the vacuum motor will hold the damper door to wide open snorkel position. If underhood temperature rises above 135°, carburetor inlet air temperature will also rise above 135°.

While air cleaner temperature is being regulated, accelerating the engine hard will cause the vacuum level in the intake manifold and in the vacuum motor to drop. Whenever vacuum drops below 5 inches, the diaphragm spring will move the damper door downward opening the snorkel passage in order to get the maximum air flow required for maximum acceleration.

Since failure of the thermo air cleaner will generally result in damper door staying in the downward position (snorkel passage open) failure will probably go unnoticed in warm weather. In cold weather, however, owners will complain of leanness, hesitation, sag, surge or stalling. When any type of lean operation complaint is received, always test the thermo air cleaner for proper functioning before doing any work on the carburetor.

AIR INJECTION REACTOR SYSTEM (A.I.R.)

General

The A.I.R. System reduces the hydrocarbon and carbon monoxide content of the exhaust gases by injecting air into the exhaust port of each cylinder. The oxygen in the air reacts with the hot exhaust gas, causing further combustion in the exhaust manifold before the gas enters the exhaust pipe.

The A.I.R. System is used on all 1974 Buicks.

The system consists of a belt-driven air pump, diverter valve, check valve, special intake manifold and cylinder head assemblies and hoses connecting the various components.

Air Pump

The air injection pump is a positive displacement vane type which is permanently lubricated and requires no periodic maintenance.

The belt-driven air pump is located at the upper left front of the engine. The pump mounting bracket is attached to the front of the engine. Power take-off for the pump is at the water pump pulley. Intake air passes through a centrifugal fan at the front of the pump, where foreign materials are separated from the air by centrifugal force. Air is delivered to the intake manifold galleries by a formed flexible hose of 3/4" inside diameter fitted to a 3/4" exhaust tube on the diverter valve at the back of the pump.

The only serviceable component of the pump is the centrifugal filter fan. Do not assume pump is malfunctioning if it squeaks when turned by hand. Do not lubricate the pump in any way.

If engine or underhood compartment is to be cleaned with steam or high pressure detergent, the centrifugal filter fan should be masked off to prevent liquids from entering the pump.

Do not attempt to operate vehicle with the drive belt disconnected.

Diverter Valve and Silencer Assembly

The diverter valve is attached to the back of the pump. It senses manifold vacuum through a 3/16" fitting at the carburetor. During sudden deceleration, vacuum increases cause the valve to open, allowing air from the air-injection pump to pass through the valve and silencer to the atmosphere. Approximate duration of the valve opening is five seconds. This valve also controls pressure within the system by diverting excessive pump output to the atmosphere through an internal muffler.

Check Valve

The check valve has a one-way diaphragm which prevents hot exhaust gases from backing up into the hose and pump and causing damage. This will protect the system in the event of pump belt failure, abnormally high exhaust system pressure or air delivery hose ruptures.

Intake Manifold and Cylinder Heads Assemblies

All engines have special intake manifolds and cylinder heads to distribute air from the pump to the exhaust port of each cylinder. Figure 6F-10 shows an intake manifold for A.I.R. with the air intake on the left side of the manifold (V-8 engine). Air is pumped in the left side and across to the right side by a cast passage crossover just in front and below the carburetor bores. Openings on each side of the manifold are drilled to match passages in the cylinder heads drilled directly into each exhaust port.

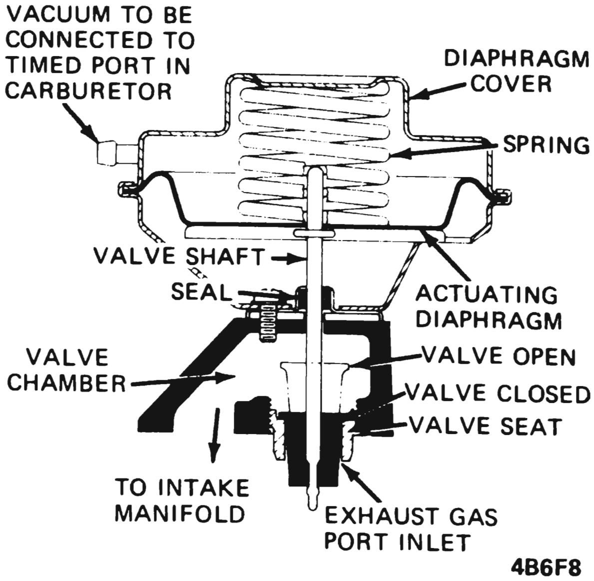
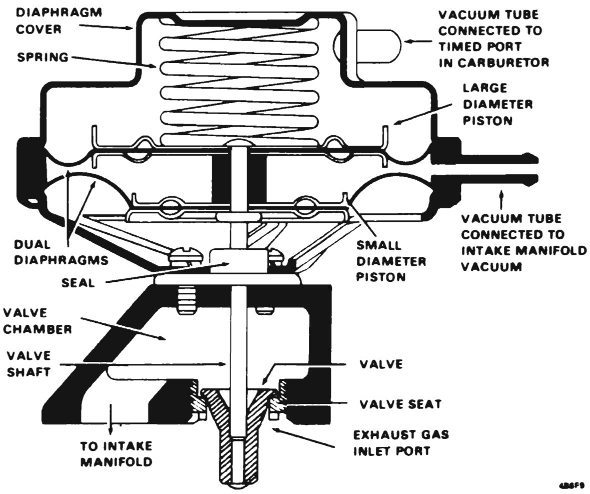


Figure 6F-8 E.G.R. Valve Cross-Section View (Single Diaphragm Type)

EXHAUST GAS RECIRCULATION SYSTEM (E.G.R.)

The Exhaust Gas Recirculation System is used on all 1974 Buicks. California 350 engines will use a dual diaphragm EGR valve and non California models will continue to use the single diaphragm valve. See Figures 6F-8 and 6F9.

The Exhaust Gas Recirculation System is used to reduce oxides of nitrogen emissions from the engine exhaust. During the combustion process, nitrogen which makes up 80 percent of the air will tend to mix with oxygen at temperatures above 2500° F. During the combustion process, temperatures in the engine's cylinders will go well above 2500° F. which forms nitrogen oxides.



DUAL DIAPHRAGM
EXHAUST GAS RECIRCULATION VALVE
(CLOSED POSITION)

Figure 6F-9 E.G.R. Valve Cross Section View (Dual Diaphragm Type)

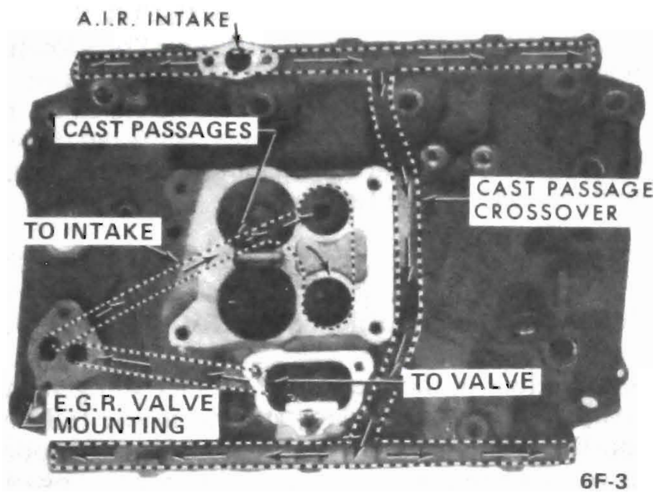


Figure 6F-10 Intake Manifold E.G.R. System (V-8)

To lower the formations of nitrogen oxides, it is necessary to reduce combustion temperatures. This is accomplished by introducing exhaust gases into the engine intake manifold, which will enter the engine cylinders with the air fuel mixture for combustion.

The exhaust gas intake port of the E.G.R. valve is connected to the intake manifold exhaust crossover channel (V-8 engines) and on the exhaust manifold on (L-6 engines) where it can pick up exhaust gases. See Figure 6F-10 for exhaust passages in intake manifold.

The E.G.R. Valve is operated by vacuum through a thermal vacuum switch located just behind the thermostat housing. See Figures 6F-14, 6F-26 and 6F-27. The thermal vacuum switch blocks the vacuum signal to the E.G.R. Valve any time engine coolant temperatures are below 67-1/2° $\pm$ 7-1/2°F.

SINGLE DIAPHRAGM TYPE

The vacuum to the E.G.R. Valve is supplied by the carburetor.

Two punched ports, one just above the throttle valve and one mid-way between the throttle valve and upper surface of the throttle body are located in the primary bore.

As the primary throttle valve is opened beyond the idle position, the first vacuum port for the E.G.R. system is exposed to manifold vacuum to supply a vacuum signal to the E.G.R. valve. To control the vacuum signal at the lower port, the upper port bleeds air into the vacuum channel and modulates the amount of vacuum signal supplied by the lower E.G.R. port. In this manner, the E.G.R. valve can be timed for precise metering of exhaust gases to the intake manifold dependent upon location of the ports in the carburetor bore and by the degree of throttle valve opening.

As the primary throttle valve is opened further in the part throttle range at higher air flows the vacuum signal decreases at the lower port. At this time the upper port ceases to function as an air bleed and is gradually exposed to manifold vacuum to supplement the vacuum signal at the lower port and helps maintain correct E.G.R. valve position.

The upper and lower vacuum ports connect to a cavity in the throttle body which, in turn, through a passage supply the vacuum signal to an E.G.R. tube pressed into the front of the throttle body.

The E.G.R. valve remains closed during periods of engine idle and deceleration to prevent rough idle from excessive exhaust gas contamination in the idle air/fuel mixtures.

DUAL DIAPHRAGM TYPE

The operating principle of the dual diaphragm valve is similar to the single diaphragm valve, in that the upper diaphragm receives a vacuum signal from a timed signal port in the carburetor bore. However, a second diaphragm is added below the upper diaphragm and is rigidly attached to the same shaft, which forms a vacuum chamber between the two diaphragms. This chamber is connected by a tube and hose direct to engine intake manifold vacuum. The force generated by the second (lower) vacuum chamber controls opening of the EGR valve with respect to engine load.

The E.G.R. valve cannot be disassembled and no actual service is required, except that it should be checked for proper operation, as outlined under MAINTENANCE AND ADJUSTMENTS of this section.

DIAGNOSIS

FUNCTIONAL CHECK OF THE THERMAL CHECK AND DELAY VALVE

VALVE AT ROOM TEMPERATURE

(Above 50 Degrees F.)

Connect a vacuum gauge to the "T.V.S." side of the valve and the Hand Operated Vacuum Pump (with a vacuum gauge) to the carburetor side of the valve.)

2. Draw a vacuum, there should be a slight hesitation on the gauge reading at the "T.V.S." side. The Hand Operated vacuum pump gauge should drop slightly and balance with the gauge reading at the "T.V.S." side. This should take 3 to 4 seconds to balance the readings.

3. If there is not a slight hesitation in readings the valve should be replaced.

4. Remove the gauge hose from the "T.V.S." side of the valve. Cover the port with a finger, draw a vacuum, .5". The hand operated vacuum gauge pump reading should hold steady. If the vacuum reading should show a leak, replace the valve.

5. Remove the finger and the gauge reading should drop slowly, if the reading drops quickly to zero, replace the valve.

COLD CHECK

(Temperature Approximately 40 Degrees F.)

1. Cool the valve to approximately 40 degrees F. to unseat the disc.

2. Connect a vacuum gauge to the "T.V.S." side of the valve and the Hand Operated Vacuum Pump to the "CARB" port of the valve.

3. Draw a vacuum, there should be no delay in readings between the two gauges. If there is, replace the valve.

A leak in the valve housing or the disc remaining on its seat will effect cold driveability of the car.

The carburetor center port "C" of the T.V.S. Switch is vented to the carburetor air horn. The only time manifold vacuum is obtained at idle is when the coolant temperatures exceed 226 degrees F. At this time full intake manifold vacuum is directed through the T.V.S. Switch to the distributor vacuum advance unit, advancing the timing.

TESTING THERMO AIR CLEANER OPERATION

Since failure of the thermo air cleaner will generally result in the damper door staying in the full open snorkel position, failure will probably go unnoticed in warm or hot weather. In cold weather, however, owners will complain of leaness, hesitation, sag, surge or stalling. When any type of lean operation complaint is received, always test the thermo air cleaner for proper functioning before doing any work on the carburetor.

Always perform checks in the same order as listed below.

Vacuum Motor Check

1. Check all hoses for proper hook-up. Check for kinked, plugged or damaged hoses.

2. With the engine "OFF", observe damper door position through snorkel opening. If position of snorkel makes observation difficult use the aid of a mirror. At this point damper door should be in such a position that the heat stove passage is covered (snorkel passage open). If not, check for binds in linkage.

3. Apply at least 7 in. Hg. of vacuum to the diaphragm assembly through hose disconnected at sensor unit. Damper door should completely close snorkel passage when vacuum is applied. If not check to see if linkage is hooked up correctly and for a vacuum leak.

4. With vacuum applied, bend or clamp hose to trap vacuum in diaphragm assembly. Damper door should remain in position (closed snorkel passage). If it does not, there is a vacuum leak in diaphragm assembly. Replace diaphragm assembly.

Sensor Check (Quick Check of System)

1. Start test with engine cold, air cleaner at a temperature below 85 degrees. If the engine has been in recent use, allow it to cool. (Removing the air cleaner

from the engine and placing it on the bench will aid in quickly cooling the sensor).

2. Observe the damper door before starting the engine: it should be in the open snorkel position.

3. Start the engine and allow it to idle. Immediately after starting the engine, the damper door should be in the closed snorkel passage position.

4. As the engine warms up, the damper door should start to allow outside air and heated air to enter the carburetor inlet.

5. The system is operating normally as described above. If the air cleaner fails to operate as above or if correct operation of the air cleaner is still in doubt, proceed to the thermometer check (of sensor).

Thermometer Check of Sensor:

1. Start test with air cleaner temperature below 85 degrees. If engine has been run recently, remove air cleaner and place on bench (this will help quickly cool the air cleaner). Remove air cleaner cover and place Tool J-22973 (Thermac Thermometer) as close as possible to the sensor. Let air cleaner cool until thermometer reads below 85°F. about 5 to 10 minutes. Reinstall air cleaner on engine and continue to step 2 below.

2. Start and idle engine. Damper door should move to close the snorkel passage immediately if engine is cool enough. When damper door starts to open the snorkel passage (in a few minutes), remove air cleaner cover and read temperature gage. It must read 115 degrees plus or minus 20 degrees.

3. If the damper door does not start to open up the snorkel passage at temperature indicated, temperature sensor is malfunctioning and must be replaced.

TESTING TRANSMISSION CONTROLLED VACUUM ADVANCE (Stage I Engine Only)

A failure in the transmission controlled vacuum advance spark system could result in either of two troubles:

1. Continuous vacuum advance in first and second gears which would prevent the car from passing the Federal emissions standards.

2. No vacuum advance in third gear which would result in lower gas mileage and overheating.

Check for proper operation of the Transmission Controlled Vacuum Spark Advance System as a part of each engine tune-up, as follows:

WARNING: MAKE SURE PARKING BRAKE IS APPLIED FIRMLY AND THAT A WHEEL IS BLOCKED IN FRONT AND BACK.

1. Connect a vacuum gauge to the distributor vacuum advance line at the distributor. Position the gauge so it can be observed from the drivers seat. With transmission in neutral, increase engine speed to about 1000 RPM's.

2. At this point, note vacuum gauge reading, it should be zero.

3. Shift transmission into reverse.

4. Again note vacuum gauge reading, there should be vacuum present at this time. If no vacuum is present, proceed with the following.

5. Connect a jumper with a test light (1893 bulb or smaller) between the two connector terminals of the T.C.S. solenoid. Start engine and place transmission in reverse. The test light should be off.

6. If the test light is on, check for a grounded wire between solonoid connector and transmission, if wire is not grounded, replace transmission switch.

7. Shift transmission to neutral. Test light should come on, if test light does not come on, check for an open circuit. If circuit is not open, replace transmission switch.

8. If Steps 6 and 7 above check out correctly and there is still no vacuum present as required in Step 4 above, replace T.C.S. solenoid.

TCS Diagnosis Chart L-6 Engine (Only)

Condition	Possible Cause	Correction
Engine stalls at idle. Excessive creep at idle. High idle speed dieseling.	1. Malfunction in idle stop solenoid.	1. Check for free movement of plunger. 2. Check for incorrectly adjusted plunger (out too far). 3. Solenoid should de-energize with ignition off. If idle stop solenoid does not operate correctly it must be replaced.
Vacuum at all times.	1. Malfunction in TCS system component. Check for: Blown fuse - Loose connections - Broken wire - Broken or disconnected hoses - Proper ground at all components - Proper routing of hoses.	1. Correct as necessary.
	2. Inoperative vacuum advance solenoid.	1. Check vacuum at source. Then connect vacuum gauge to advance unit port. With 12 volts applied to solenoid. Solenoid should be energized (vacuum to distributor), proceed to inoperative time relay if solenoid is not at fault.
	3. Inoperative time relay.	1. Remove temperature switch connector. 2. Check relay to make sure that it is cool, then turn ignition on. 3. Solenoid should energize for 20 seconds and then de-energize. If it does not de-energize, remove blue lead from time relay. Solenoid will de-energize if relay is at fault. Proceed to inoperative temperature switch if relay is not at fault.
	4. Inoperative temperature switch.	1. On a cold engine the vacuum advance solenoid should be energized, if not - ground the wire from the cold terminal of the temperature switch. If solenoid energized, replace the temperature sending unit. Proceed to inoperative transmission switch if temperature switch is not at fault.
	5. Inoperative transmission switch.	1. With engine warm and running, put transmission in high. Solenoid should be energized. If not remove and ground connector at switch replace switch if solenoid energizes.

Condition	Possible Cause	Correction
Poor high gear performance Stumble - Stall on cold start - Excessive fuel consumption Deceleration exhaust "Pop".	1. Malfunction in TCS system component. Check for Blown fuse - Loose connections - Broken wire - Broken or disconnected hoses - Proper ground at all components - Proper routing of hoses.	1. Correct as necessary.
	2. Inoperative vacuum advance solenoid.	1. Check vacuum at source, then connect vacuum gauge to advance unit port. With 12 volts applied to solenoid, solenoid should be energized (vacuum to distributor). Proceed to inoperative time relay if solenoid is not at fault.
	3. Inoperative time relay.	1. Remove temperature switch connector. 2. Check relay to make sure that it is cool, then turn ignition on. 3. Solenoid should energize for 20 seconds and then de-energize. If it does not de-energize, remove blue lead from time relay. Solenoid will de-energize if relay is at fault. Proceed to inoperative temperature switch if relay is not at fault.
	4. Inoperative temperature switch.	1. On a cold engine the vacuum advance solenoid should be energized, if not - ground the wire from the cold terminal of the temperature switch. If solenoid energizes, replace the temperature sending unit. Proceed to inoperative transmission switch, if temperature switch is not at fault.
	5. Inoperative transmission switch.	1. With engine warm and running, put transmission in high. Soldnoid should be energized. If not remove and ground connector at switch, replace switch if solenoid energizes.

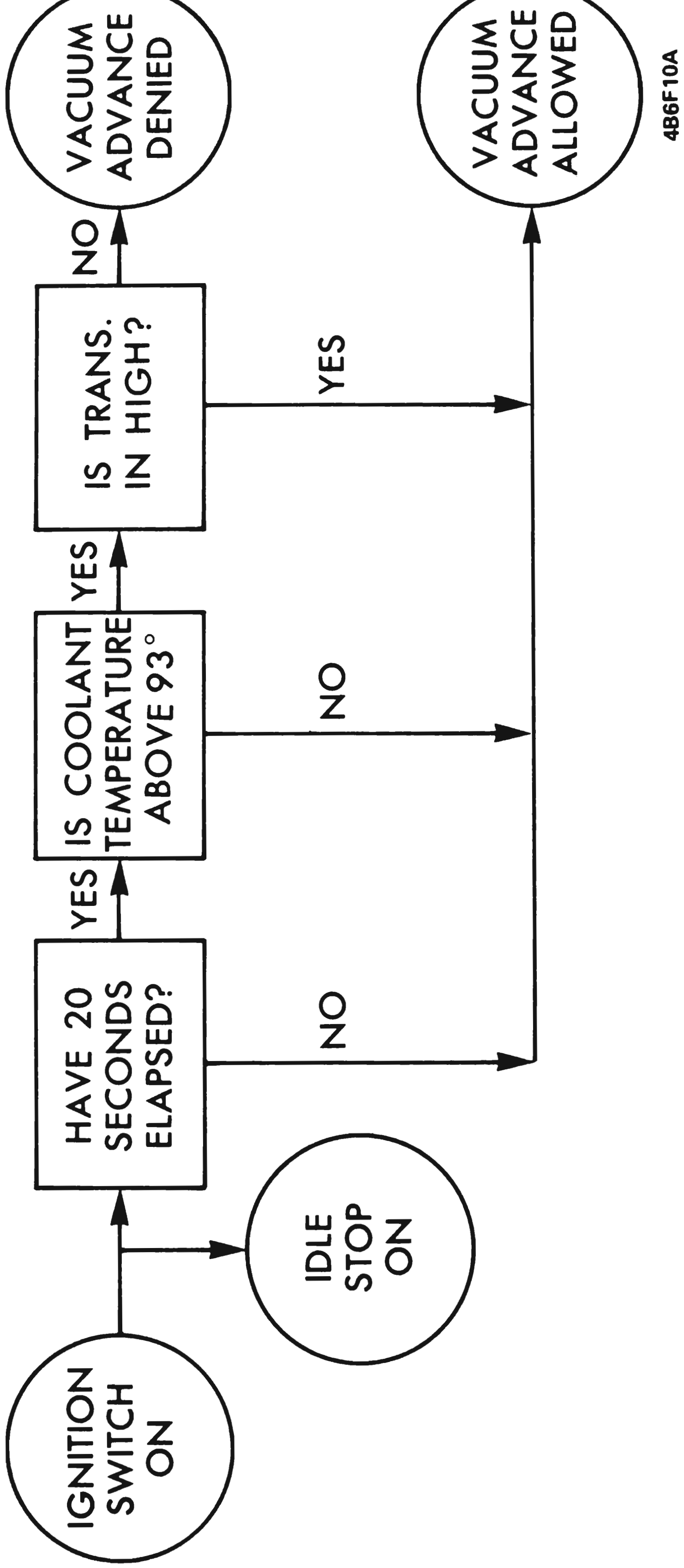


Figure 6F-10A Vacuum Advance Diagram (L-6 with Manual Transmission)

A.I.R. PUMP DIAGNOSIS CHART

Condition	Possible Cause	Correction
Excessive Belt Noise	1. Loose belt.	1. Tighten belt.
	2. Seized pump.	1. Replace pump.
Excessive Pump Noise, Chirping, Rumbling Or Knocking	1. Leak in hose.	1. Locate source of leak and correct.
	2. Loose hose.	1. Reassemble and replace or tighten hose clamp.
	3. Hose touching other engine parts.	1. Adjust hose position.
	4. Malfunctioning diverter valve.	1. Replace valve.
	5. Malfunctioning check valve.	1. Replace valve.
	6. Pump mounting fasteners loose.	1. Re-torque all mounting screws.
	7. Centrifugal filter fan damaged.	1. Replace centrifugal filter fan.
	8. Malfunctioning pump.	1. Replace pump.
	9. Malfunctioning Max-Trac solenoid.	1. Full connector off of solenoid. Diverter valve should stop diverting. If not replace solenoid.
No Air Supply	1. Loose belt.	1. Tighten belt.
	2. Leak in hose.	1. Locate source of leak and correct.
	3. Leak at hose fitting.	1. Reassemble and replace or tighten hose clamps.
	4. Malfunctioning diverter valve.	1. Replace valve.
	5. Malfunctioning check valve.	1. Replace valve.
	6. Malfunctioning pump.	1. Replace pump.

CHECKING E.G.R. VALVE OPERATION

The E.G.R. valve cannot be disassembled and no actual service is required, except that it should be checked for proper operation.

> **WARNING: IF ENGINE HAS BEEN OPERATED, CAUTION SHOULD BE USED WHEN CHECKING MOVEMENT OF VALVE STEM AS VALVE WILL BE HOT.**

Checking E.G.R. Valve (Engine at Operating Temperature)

NOTE: *A cold override or thermal delay system is used on all models. Disconnect the system prior to performing the on-the-car check of the EGR valve.*

An outside vacuum source can be applied to the vacuum supply tube at the top of the vacuum diaphragm. The diaphragm should not leak down and can be checked for freedom of movement by applying a 5" vacuum signal to the diaphragm and observing shaft movement.

NOTE: *Cars equipped with dual diaphragm EGR valves, the lower diaphragm can be checked as follows:*

With engine off remove the vacuum hose from lower tube connection on EGR valve. Use a hand vacuum pump with a dial gauge and connect with hose to lower vacuum tube on EGR valve. Pump enough to apply approximately 14" vacuum and observe for "leak down". If no drop in vacuum on gauge occurs in 30 seconds both upper and lower diaphragms have no leakage and are O.K. If vacuum drop occurs, either the upper or lower diaphragm are leaking, and the EGR valve must be replaced.

Checking EGR Thermal Vacuum Switch

1. Start engine cold, (engine coolant temperatures below 67°F.) and raise engine speed to about 1500 RPM and feel for movement of the E.G.R. Valve stem.

NOTE: *This test should be done immediately after engine is started as it does not take long for engine coolant temperatures to rise above 67°F.*

If E.G.R. VALVE STEM MOVES, replace the temperature control valve. If the stem does not move, the temperature control valve is operating correctly.

EGR SYSTEM

Condition	Possible Cause	Correction
Engine runs rough on light throttle acceleration, poor part load performance and mileage.	1. Rough operation (including severe surge and misfire) can be caused by many different engine problems. Before checking the EGR system, perform recommended ignition system maintenance.	1. Check EGR system operation. Remove EGR valve & inspect. Clean, if needed.
	2. EGR flow unbalanced side-to-side due to deposit accumulation in EGR passage between discharge orifices. 2 Bbl. models only.	1. Using flexible cleaning tool J-24841, clean passage between EGR discharge orifice by running tool down orifice repeatedly until deposits are loose. Use shop AIR to blow all passages clear of deposits.
Engine idles rough and/or stalls.	1. Leaking EGR valve.	1. Replace valve.
	2. Idle speed misadjusted.	1. Set idle RPM per shop manual specification if condition is not corrected, remove EGR vacuum hose from valve and observe effect on engine RPM. If speed is affected, reset RPM to specification and reconnect hose.
	3. EGR valve vacuum hose misrouted.	1. Reroute EGR vacuum hose correctly.

Condition	Possible Cause	Correction
Engine stalls on deceleration.	1. Restriction in EGR vacuum line.	1. Check line for kinks, restriction in hose, EGR temperature control. Replace hose and/or valve as required.

P.C.V. VALVE TROUBLE DIAGNOSIS

Condition	Possible Cause	Correction
Slow, Unstable Idle, Frequent Stalling	1. Valve completely plugged or stuck.	Replace valve.

MAINTENANCE AND ADJUSTMENTS

P.C.V. FILTER

Replace positive crankcase ventilator or filter every twelve months or 12,000 miles. Remove filter from inside air cleaner by removing breather hose clamp, breather hose and filter retainer clip.

EGR SYSTEM INSPECTION AND CLEANING

At 12 month/12,000 mile intervals inspect and clean EGR system if deposits exist.

INSPECTION PROCEDURE

EGR Valve

1. Remove vacuum line to EGR valve.

2. Remove EGR valve – discard gasket.

3. Visually inspect EGR valve and valve seat area for deposits.

4. If deposits exist, follow EGR valve cleaning procedure.

Intake Manifold Discharge Hole(s)

1. Remove air cleaner.

2. Open throttle to wide open throttle position.

> **NOTE:** *Most models will have to have the carburetor removed to inspect the discharge hole(s).*

3. Using adequate lighting to be able to see the EGR discharge hole(s) visually inspect discharge holes in manifold under throttle valve area for deposits.

a. If adequate lighting is not available, or if physically impossible to properly inspect discharge hole(s) – carburetor must be removed for hole(s) inspection.

b. For carburetor reinstallation see Cleaning Procedure – intake manifold discharge hole(s).

4. If visible deposits exist follow intake manifold discharge hole cleaning procedure.

CLEANING PROCEDURE

EGR Valve

1. With wire brush remove deposits from EGR valve and valve seat.

2. Intake manifold and EGR valve gasket surfaces should be cleaned thoroughly.

INTAKE MANIFOLD DISCHARGE HOLE(S)

(Cleaning)

1. Remove carburetor – discard gasket (carburetor to manifold).

2. Manually insert flexible cleaning Tool J-24841 into orifice(s).

3. Rotate tool, moving the top back and forth in passage until deposits are loose.

4. Holding shop cloth tightly over orifice(s) use shop air to blow all passages clear of loose deposits (majority of loose deposits will blow out the rear hole in EGR pad). Then remove shop cloth and blow shop air through orifice(s) to be sure all loose deposits have been removed.

5. Clean and install EGR valve (see EGR valve cleaning procedure).

6. Reinstall carburetor (and manifold riser baffles if equipped) using new gasket, carburetor to manifold, torque bolts to 15 lb. ft. (Reinstall heat baffles between manifold and gasket if equipped).

7. Check and reset idle stop solenoid to specified RPM.

8. Check and reset choke coil rod per gauge slot - reinstall in standard hole (if engine equipped with altitude kit or factory-ordered altitude option - install choke coil rod in altitude hole).

9. Reinstall air cleaner assembly.

MAJOR REPAIR

REMOVAL AND REPLACEMENT OF C.C.S. UNITS

The damper door is not serviceable. The air cleaner assembly must be replaced if the damper door is malfunctioning.

R and R Vacuum Motor

1. Drill center of two spot welds using a 1/16 inch drill. Do not center punch.

2. Enlarge two holes using a 5/32 inch drill.

Use extreme care not to damage the air cleaner snorkel.

3. Remove vacuum motor retainer strap. See Figure 6F- 11.

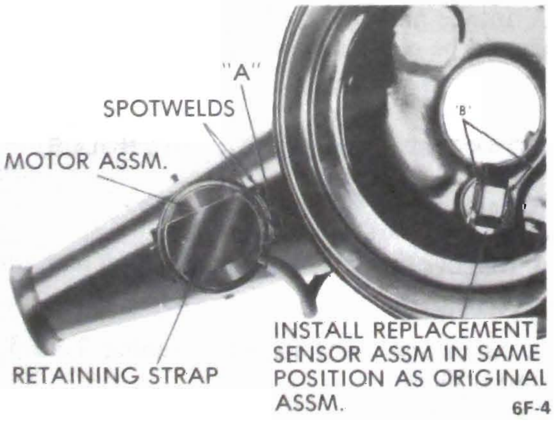


Figure 6F-11 - Replacing Vacuum Motor Assembly

4. Lift vacuum motor, cocking it to one side to unhook motor linkage at the control door.

5. Drill a 7/64" hole in snorkel tube at point "A" as shown in Figure 6F-11.

6. Use the motor strap retainer and the sheet metal screw provided in the motor service package to secure the retainer and motor to the snorkel tube.

7. Make sure the screw does not interfere with the operation of the damper assembly. Shorten screw if required.

R and R Air Cleaner Sensor

1. Remove two sensor retaining clips by prying. See Figure 6F-12.

2. Pull vacuum hoses from sensor.

3. Note carefully the installed position of the sensor so that you can install new sensor in same position. Then remove sensor.

4. Install sensor and gasket assembly in air cleaner in same position as noted in Step 3. This is to eliminate the possibility of interference with the air filter element. See Figure 6F-12.

5. Install sensor retaining clip. Meanwhile supporting sensor at "B" around the outside rim to prevent damage to the temperature sensing spring. See Figure 6F-11.

6. Reinstall vacuum hoses.

AIR PUMP

Removal

1. Disconnect hoses from pump and valve.

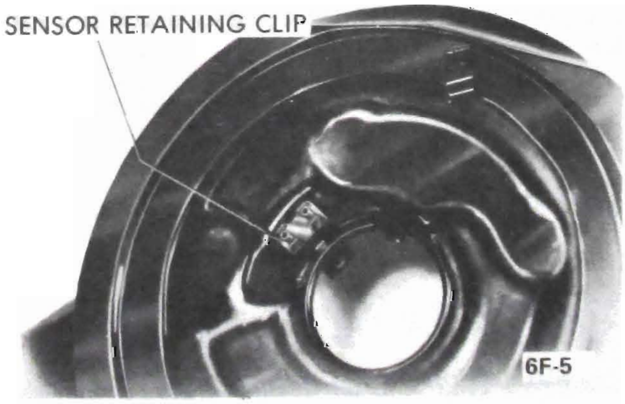


Figure 6F-12 - Replacing Sensor Assembly

2. Loosen bracket to pump mounting bolts.

3. Remove pump belt.

4. Remove pulley to hub bolts and remove pulley.

5. Remove pump.

6. Remove valve from pump if pump is to be replaced.

Installation

1. Replace valve on back of pump.

2. Position pump assembly on mounting bracket with holes lined up and install bolts loosely.

3. Place pulley on hub and tighten pulley to hub bolts to 72-108 lb.in.

4. Install pump belt over pulley.

5. Move pump until belt is tightened to 60-85 lbs. and tighten bracket bolts.

6. Connect all hoses to valve and pump.

CENTRIFUGAL FILTER FAN

Removal

1. Remove pump.

2. Insert needle nose pliers and pull fan from hub, as shown in Figure 6F-13. It is seldom possible to remove fan without damaging it. Care should be taken to prevent fragments from entering the air intake hole.

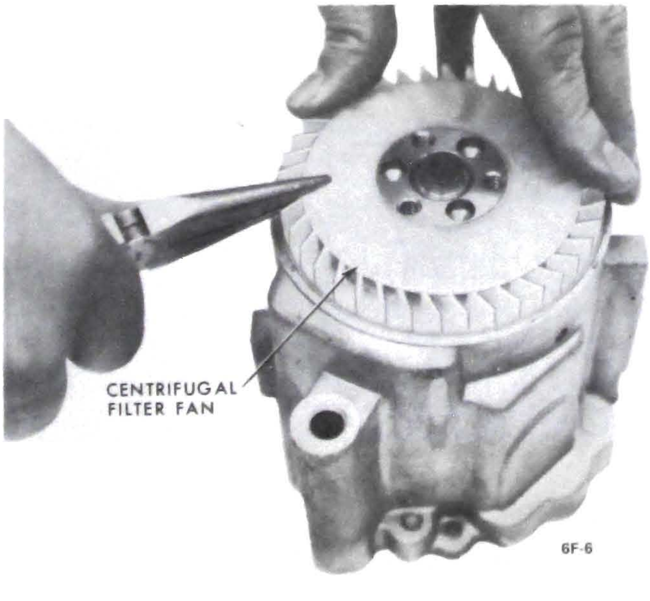


Figure 6F-13 Removing Centrifugal Fan From Hub

Installation

1. Install filter fan by drawing it into position, using pulley and bolts as tools. Draw the fan down evenly by alternately torquing the bolts, making certain that the outer edge of the fan slips into the housing.

2. Install pump.

A new fan may be noisy for about 20-30 miles of operation, until the outer diameter sealing lip has worn in.

DIVERTER VALVE

Removal

1. Remove hoses on valve.

2. Remove two screws holding valve to pump and remove valve.

3. Remove gasket material from valve and pump.

Installation

1. Do not use a gasket when replacing the diverter valve.

2. Install valve and secure with two screws. Torque to 120-160 lb.in.

3. Connect hoses to valve assembly.

CHECK VALVE

Removal

1. Release clamp and disconnect air hose from check valve.

2. Unscrew check valve.

Installation

1. Reinstall check valve.

2. Install air hose to check valve.

A.I.R. INJECTION TUBES REPLACEMENT (L6-only)

There is no periodic service or inspection for the air injection tubes, yet, whenever the cylinder head is removed inspect the air injection tubes for carbon build up and warped or burned tubes.

Remove any carbon build up with a wire brush.

Warped or burned tubes must be replaced.

Replacement

On in-line engines, remove carbon from tubes and using penetrating oil, work tubes out of cylinder head.

E.G.R. VALVE REMOVAL AND INSTALLATION

Removal

1. Disconnect vacuum hose or hoses from valve.

2. Remove bolt or bolts holding valve to manifold and remove valve.

Installation

1. Install gasket and valve in manifold and tighten bolts.

2. Connect vacuum hose or hoses to valve.

SPECIFICATIONS

EMISSION CONTROL SYSTEM SPECIFICATIONS

Positive Crankcase Ventilator Valve Type	CV-768C
PCV Valve Location	Intake Manifold
Carburetor Inlet Air Regulated Temperature	115° ± 20°
Air Injection Pump Belt Tension	65-80 Lbs.

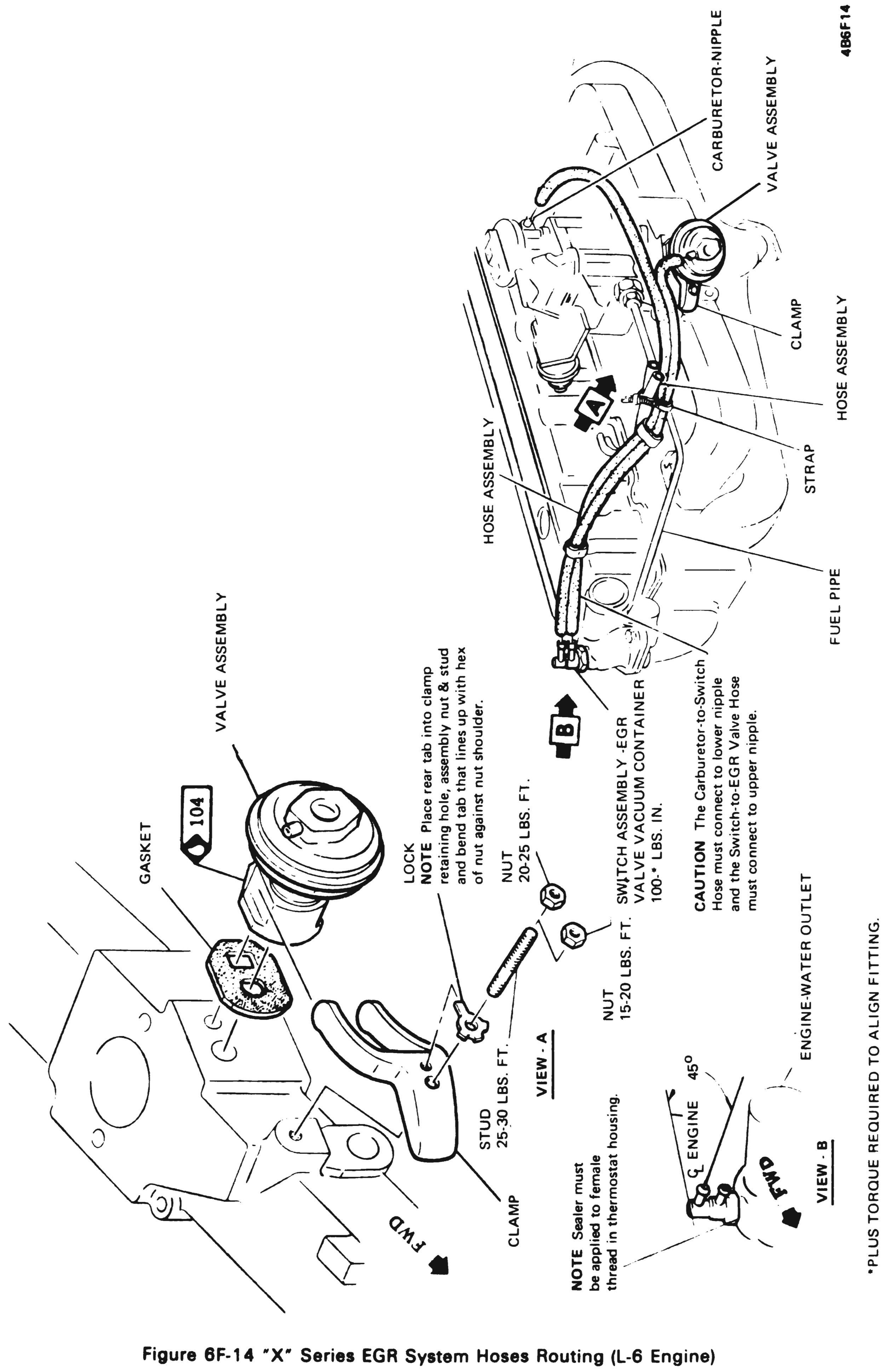


Figure 6F-14 "X" Series EGR System Hoses Routing (L-6 Engine)

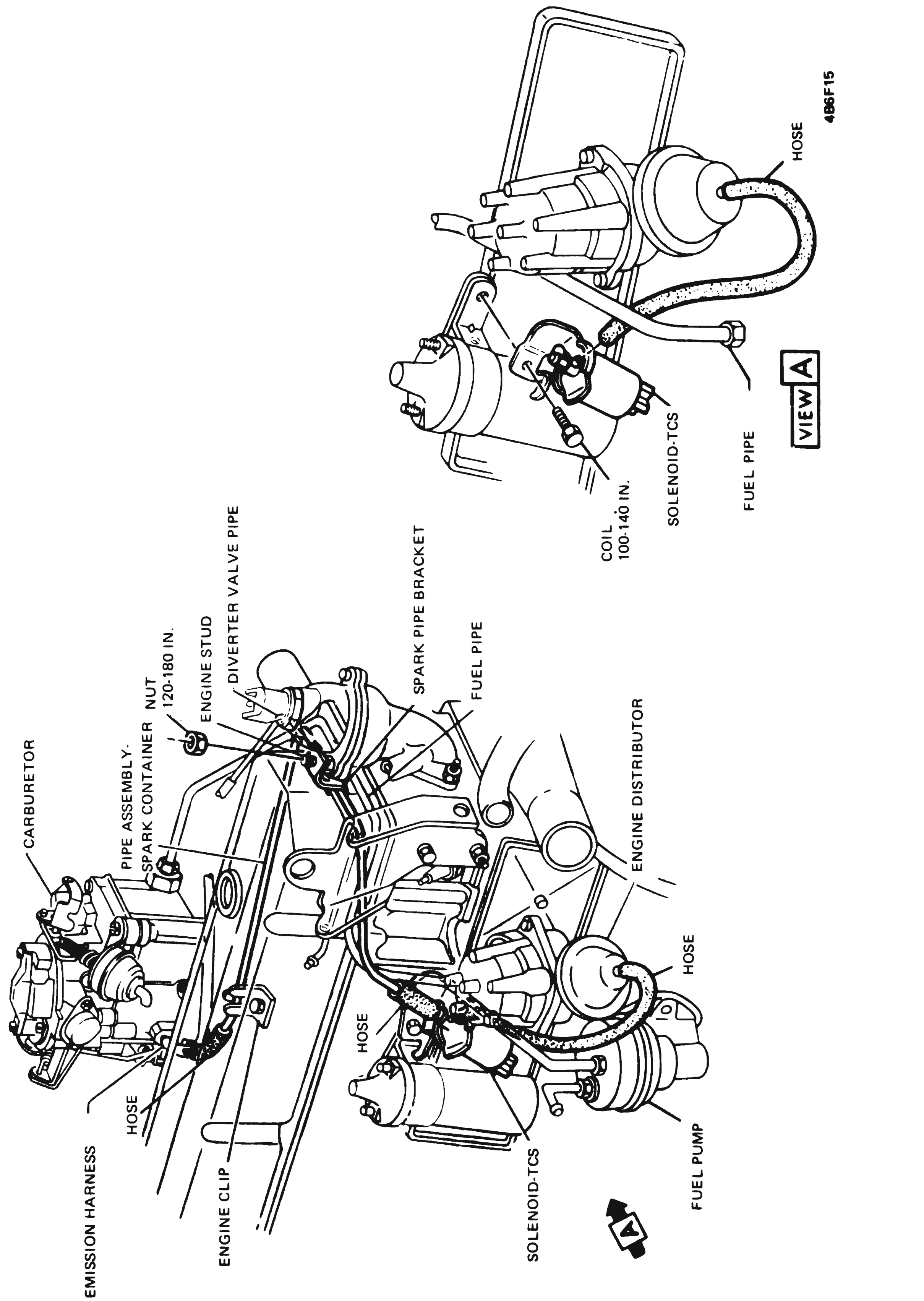


Figure 6F-15 "X" Series TCS System Hose Routing (Manual Trans.) L-6 Engine

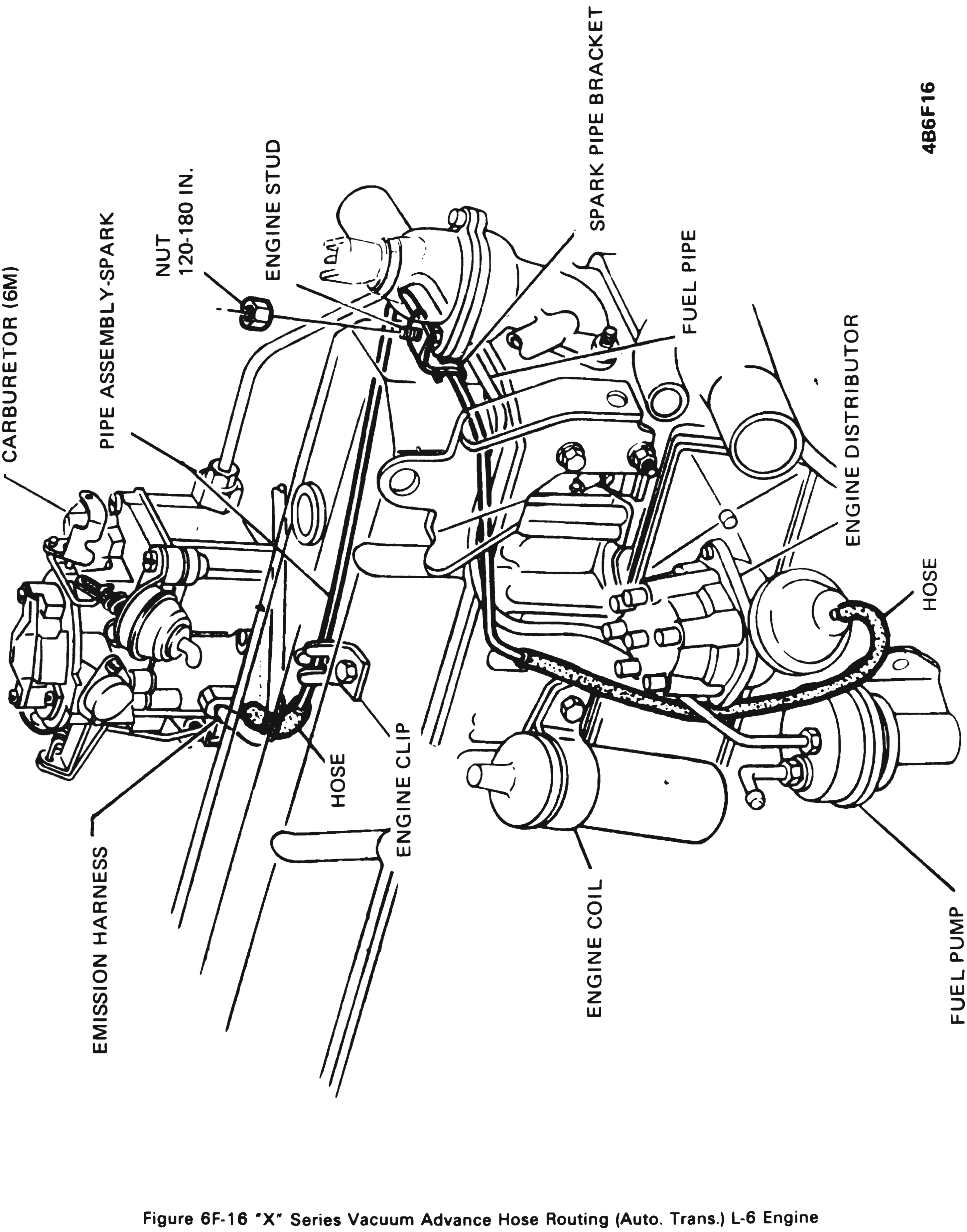


Figure 6F-16 "X" Series Vacuum Advance Hose Routing (Auto. Trans.) L-6 Engine

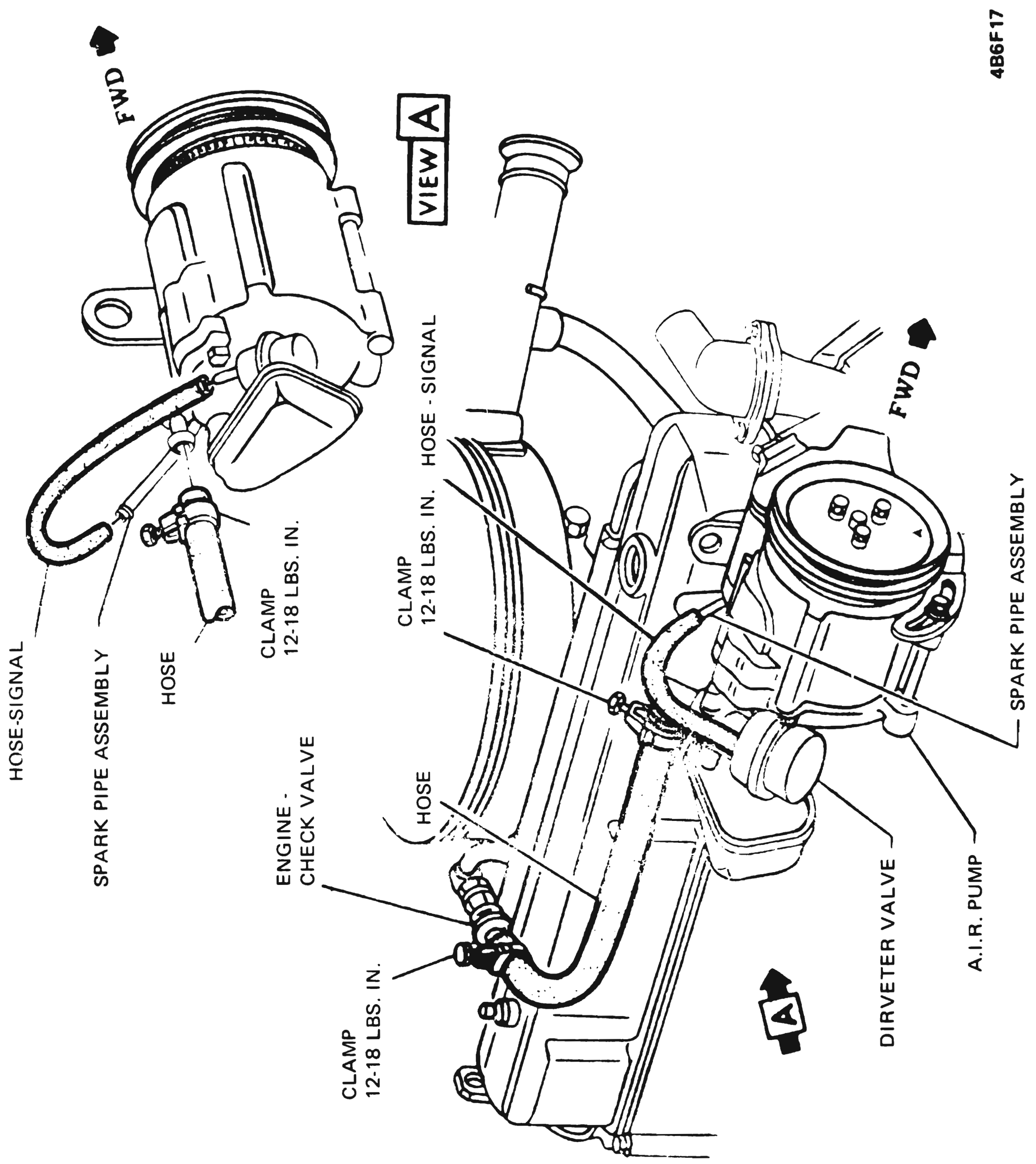


Figure 6F-17 "X" Series A.I.R. System Hose Routing (L-6 Engine)

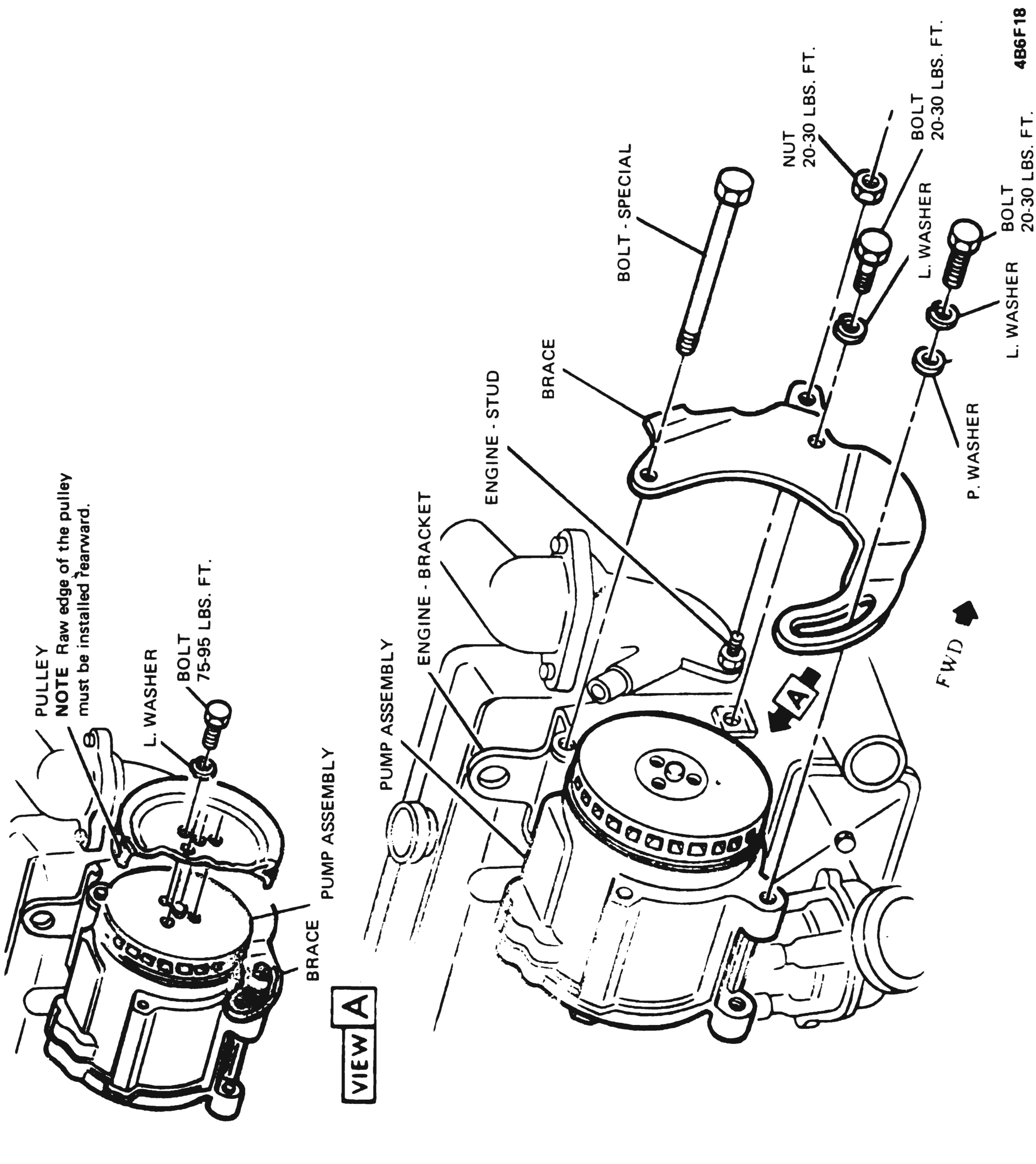


Figure 6F-18 "X" Series A.I.R. Pump Mounting (L-6 Engine)

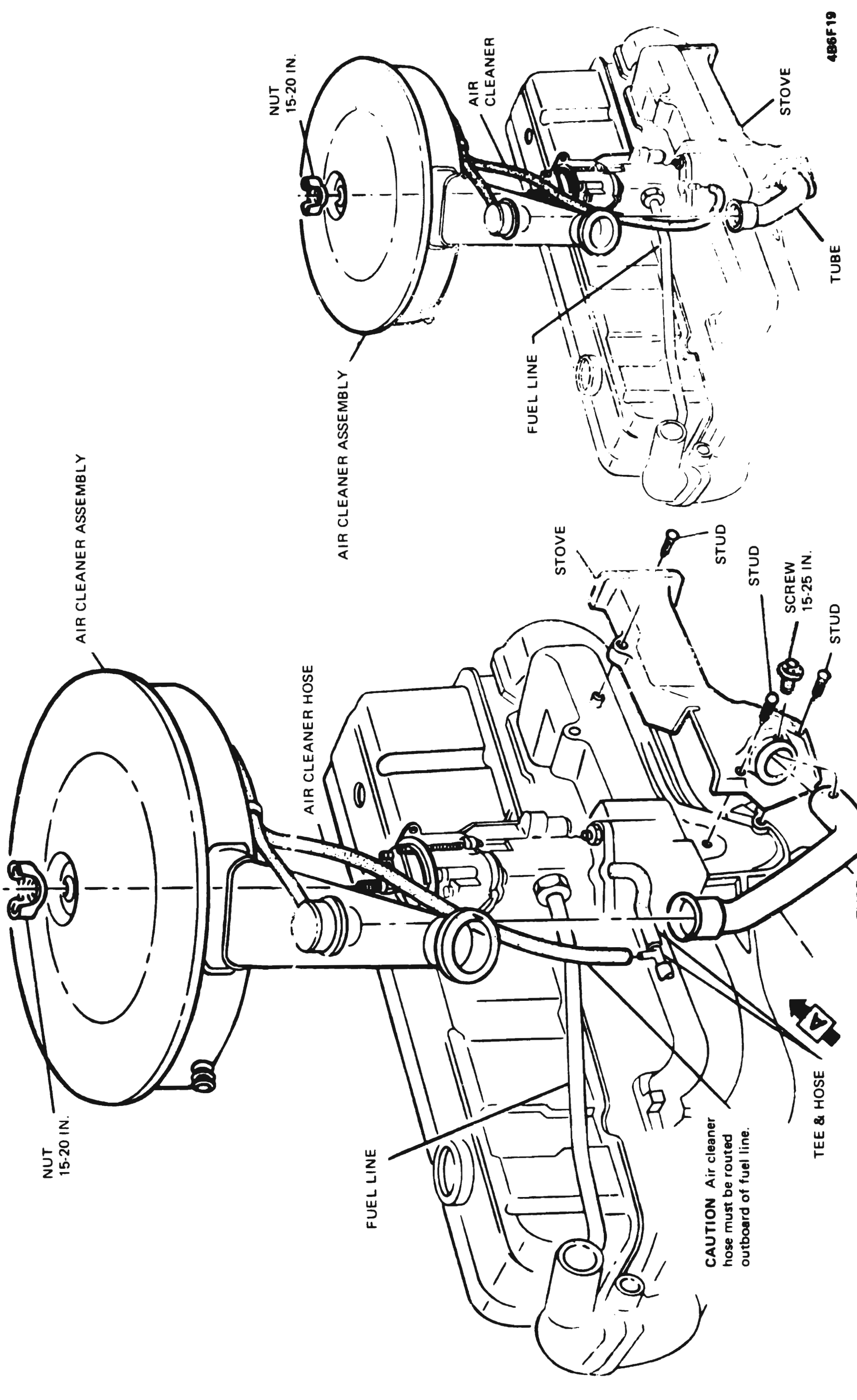


Figure 6F-19 "X" Series Air Cleaner Hose Routing (L-6 Engine)

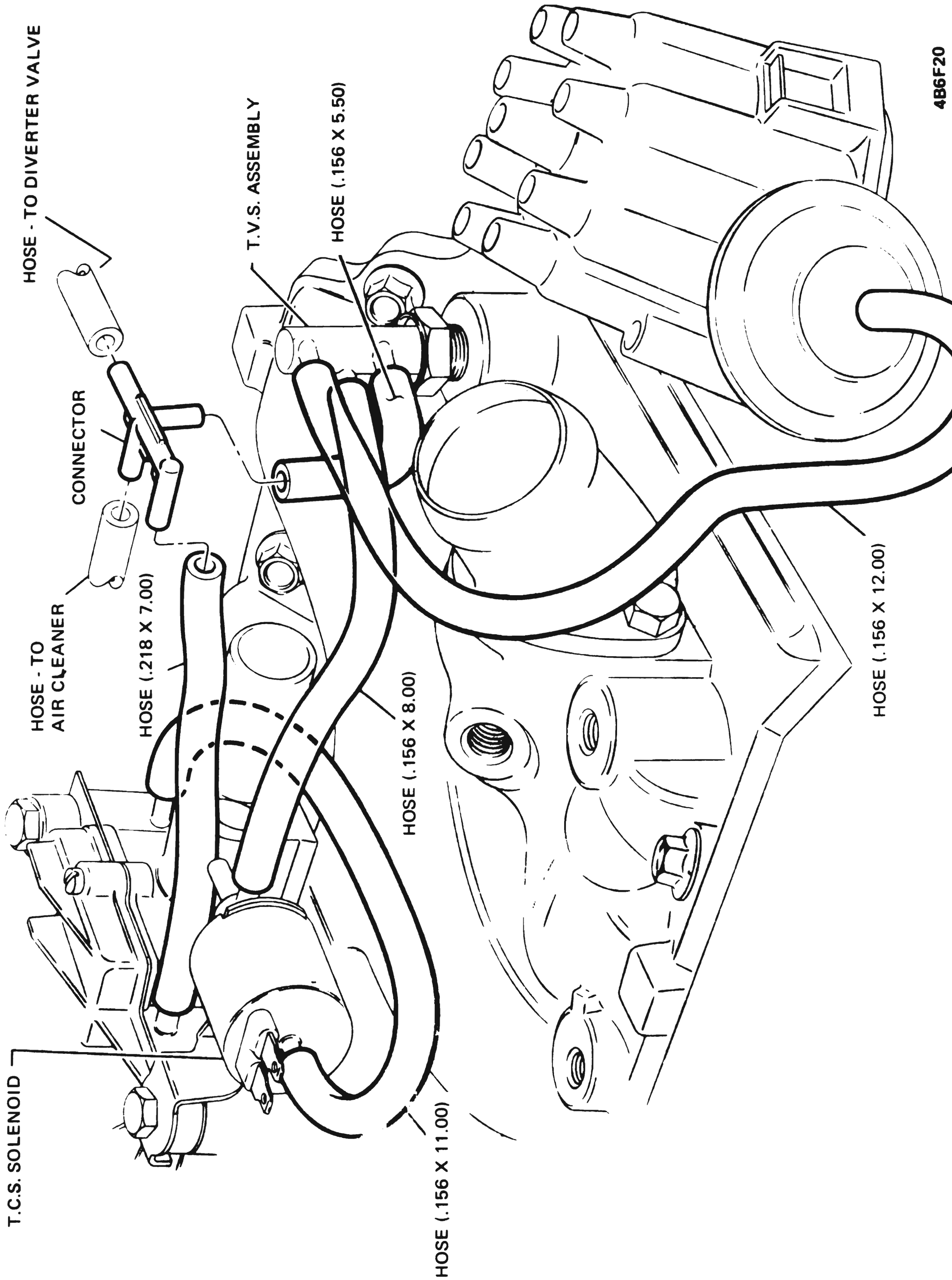


Figure 6F-20 "A" Series Vacuum Hose Routing (Stage I Engine)

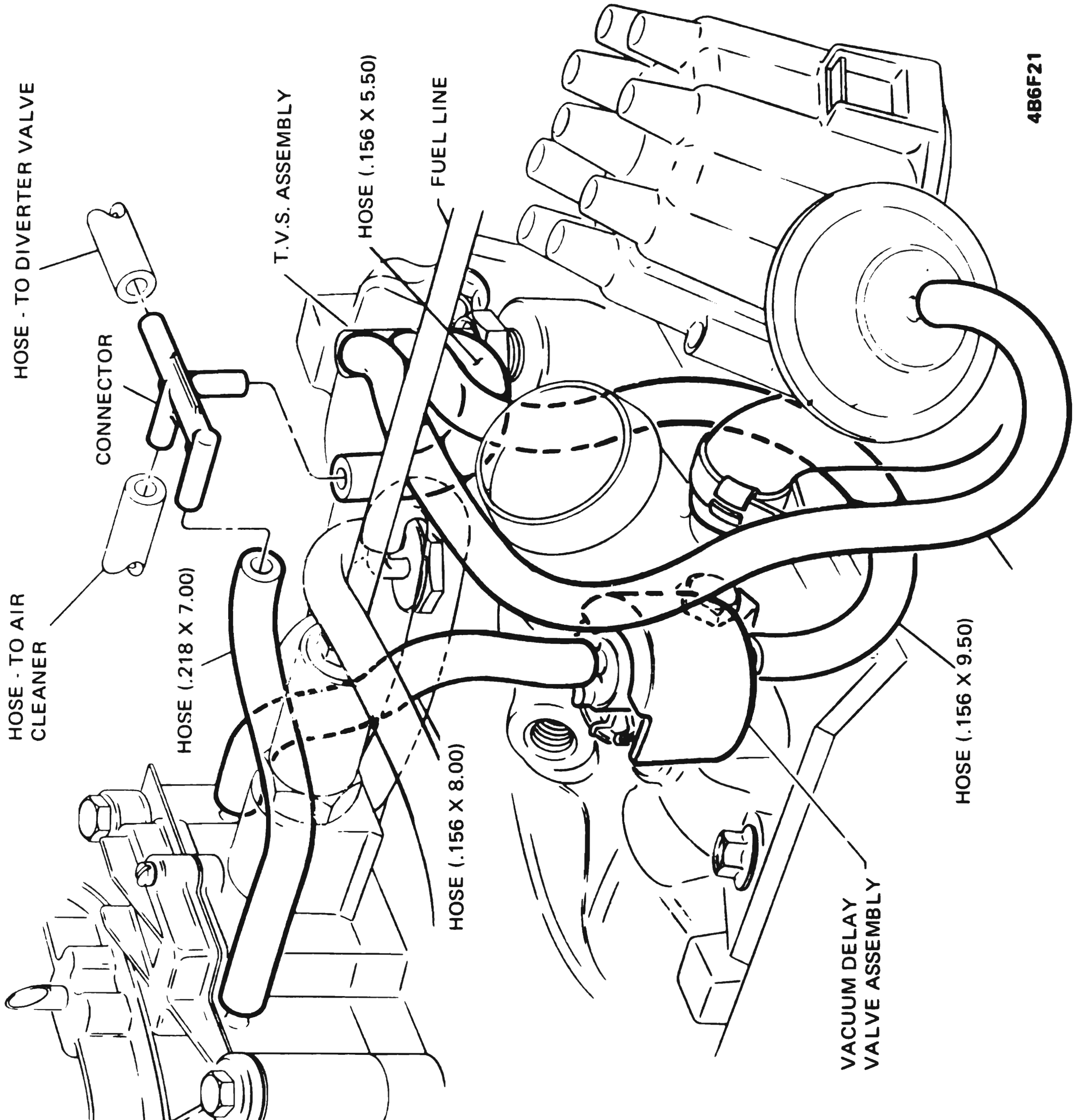


Figure 6F-21 All Series Vacuum Hose Routing (All 350-4 Bbl. Engines)

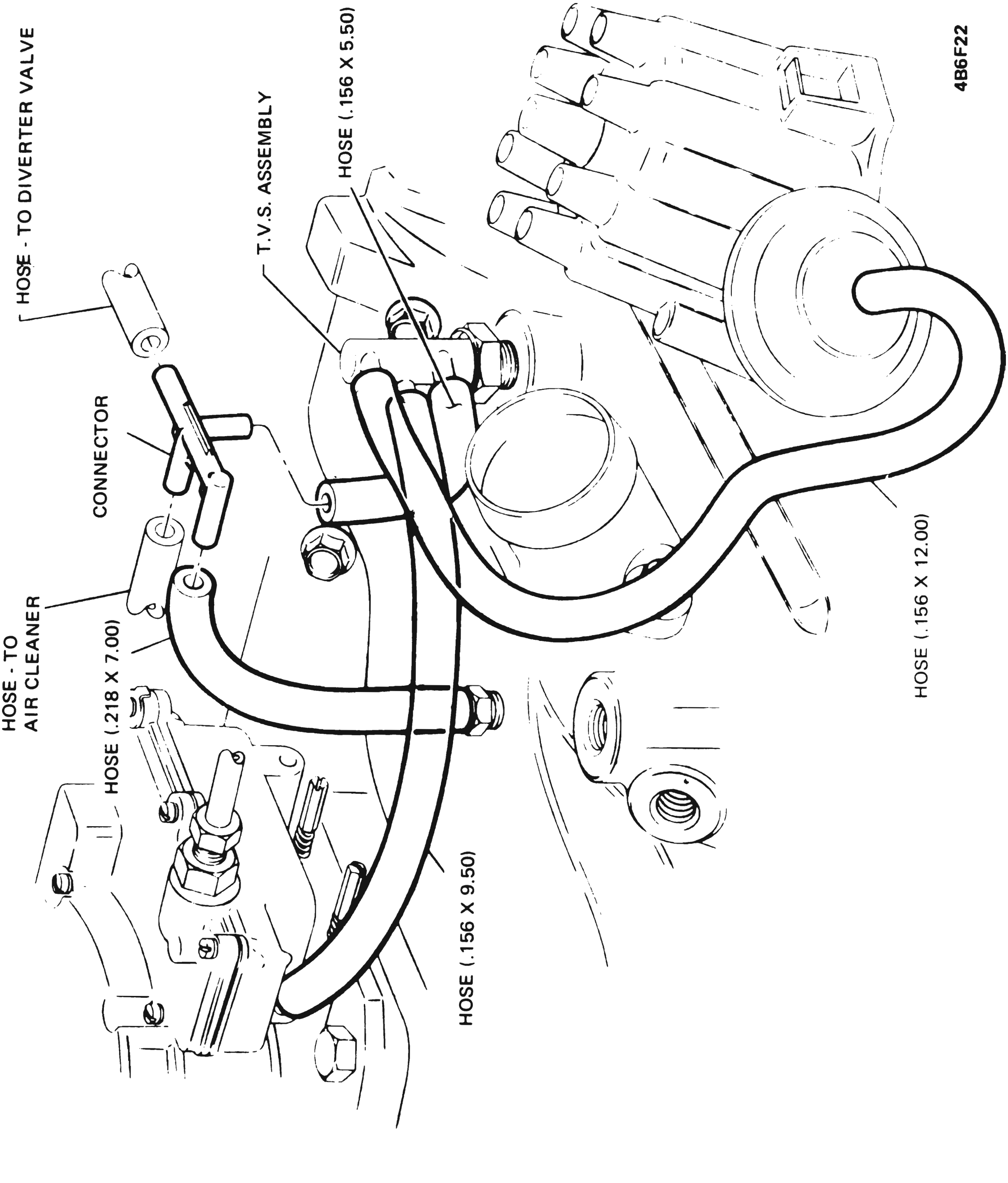


Figure 6F-22 All Series Vacuum Hose Routing (All 350-2 Bbl. Engines with A/C and/or H-D-C)

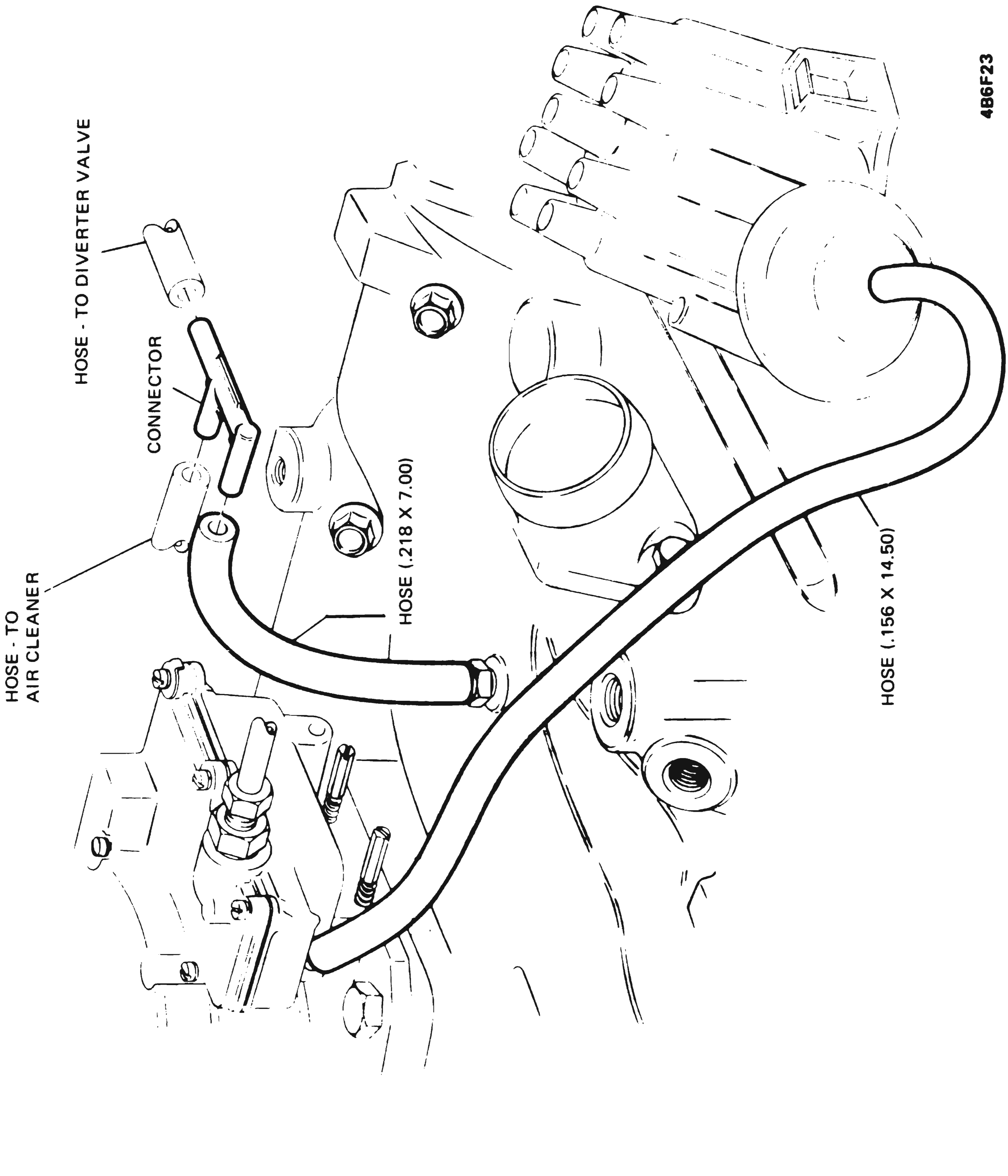


Figure 6F-23 All Series Vacuum Hose Routing (All 350-2 Bbl. Engines without A/C and H-D-C)

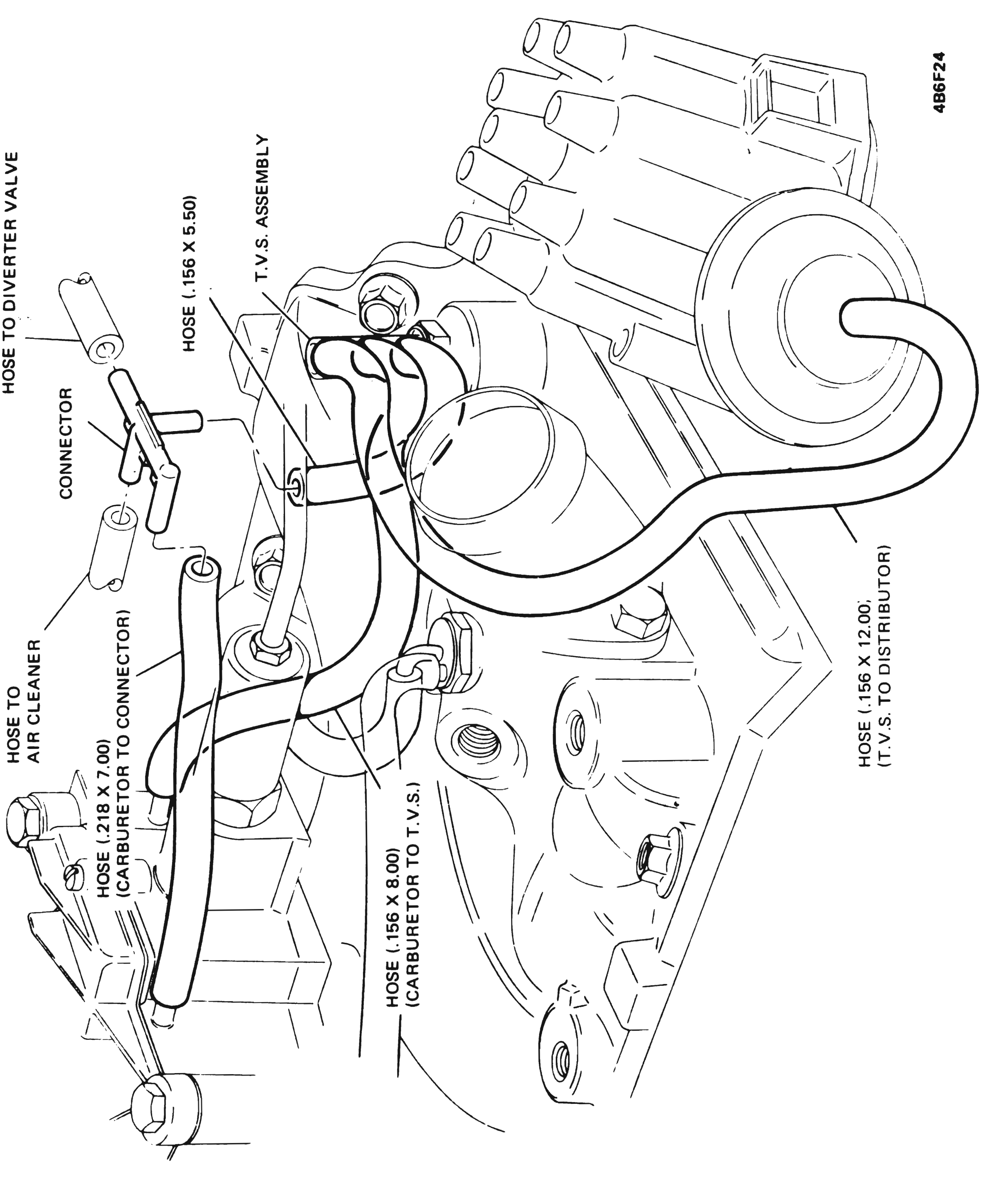


Figure 6F-24 A-B-C-E Series Vacuum Hose Routing (All 455-4 Bbl. Engines, except "A" Series Stage I)

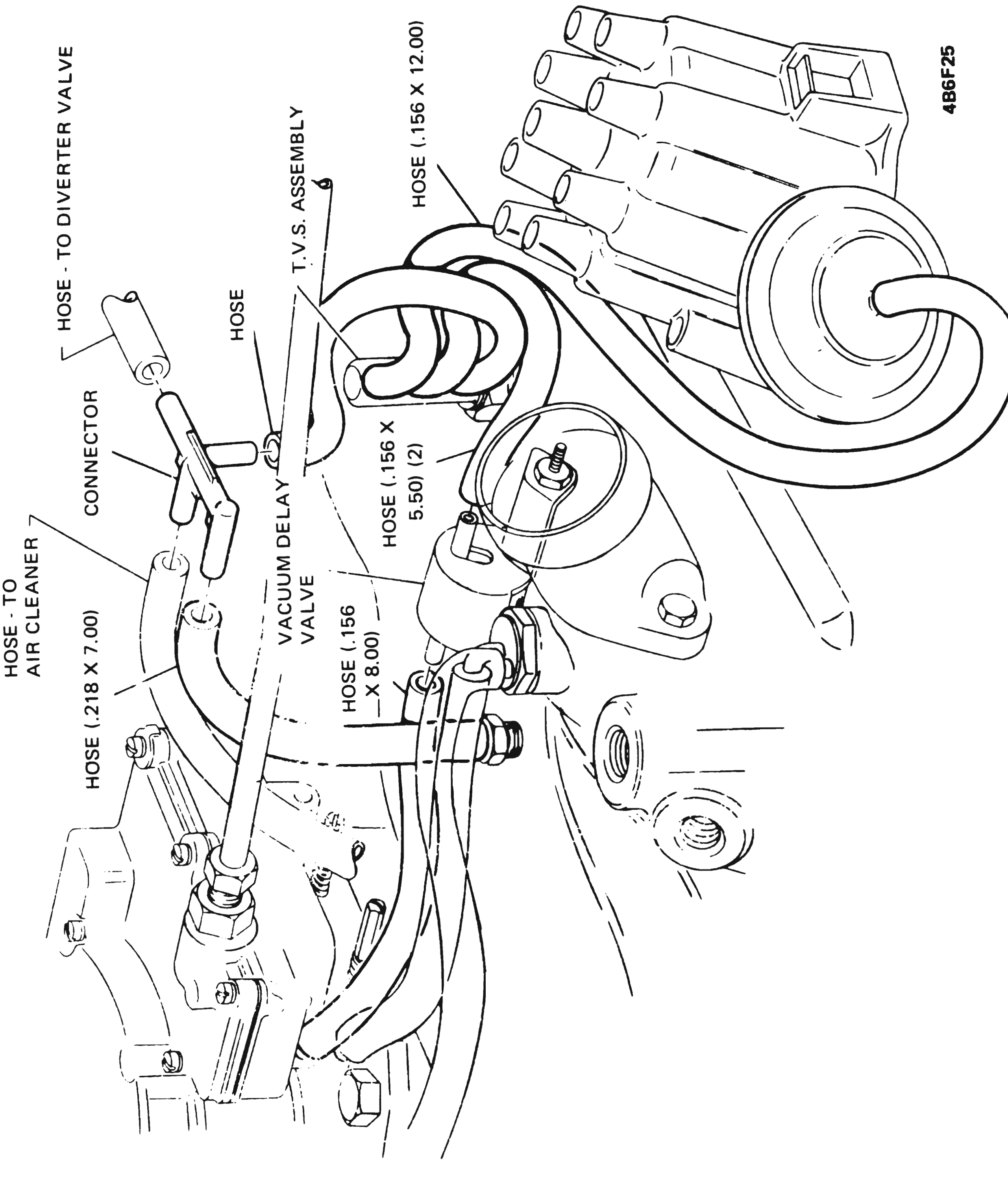


Figure 6F-25 A-B Series Vacuum Hose Routing (All 455-2 Bbl. Engines)

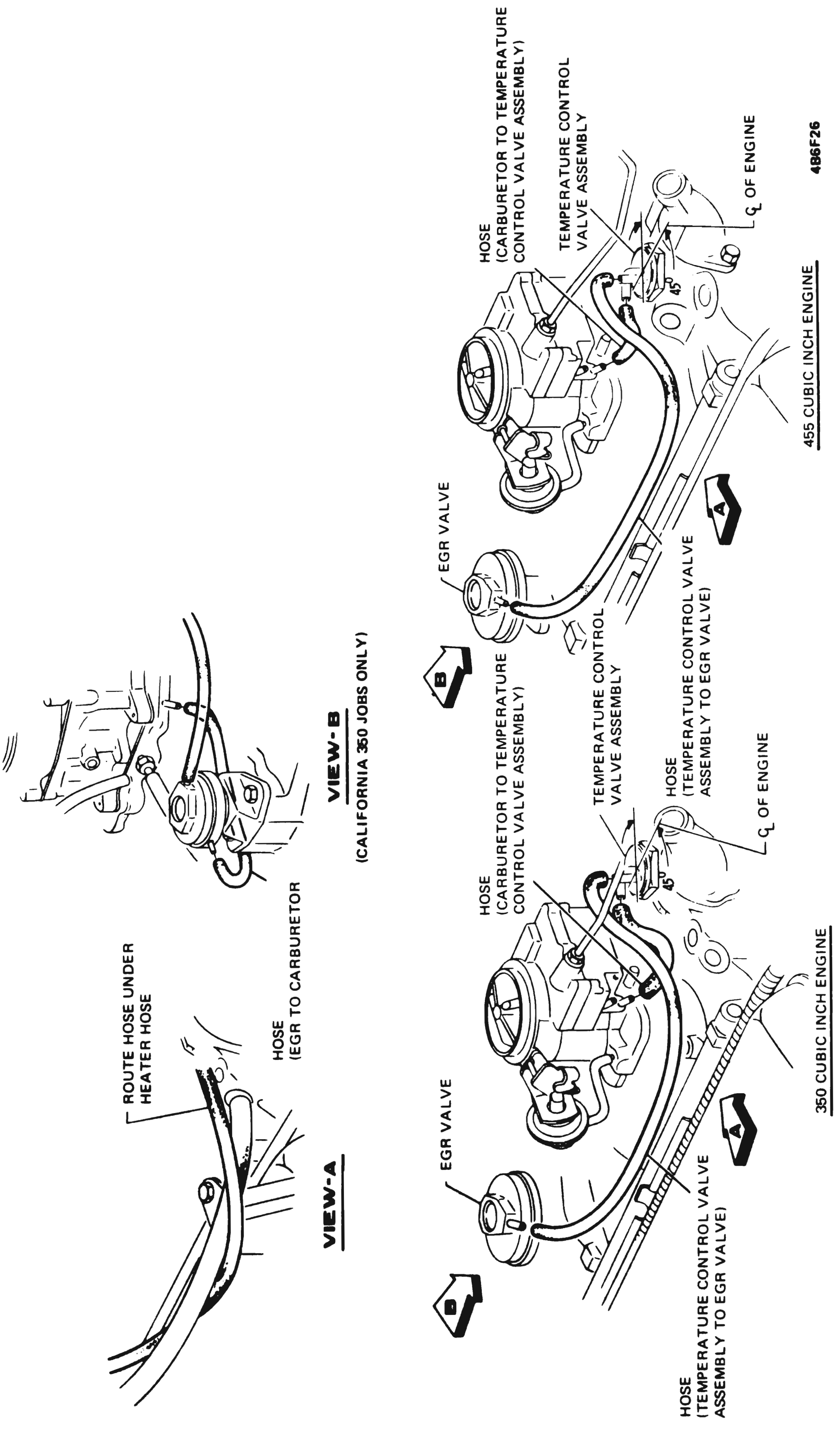


Figure 6F-26 EGR System Hose Routing (All 2 Bbl. Engines)

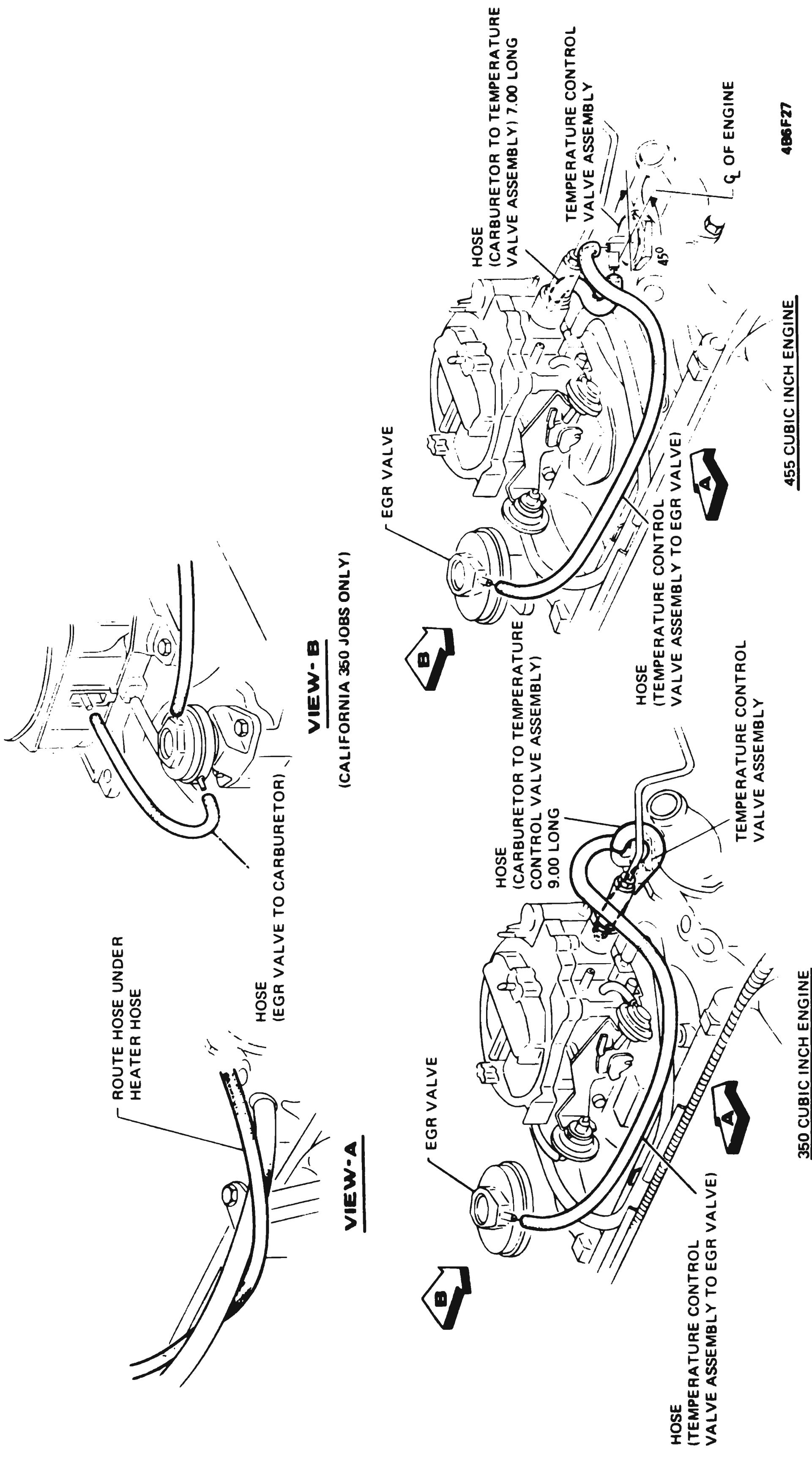


Figure 6F-27 EGR System Hose Routing (All 4 Bbl. Engines)

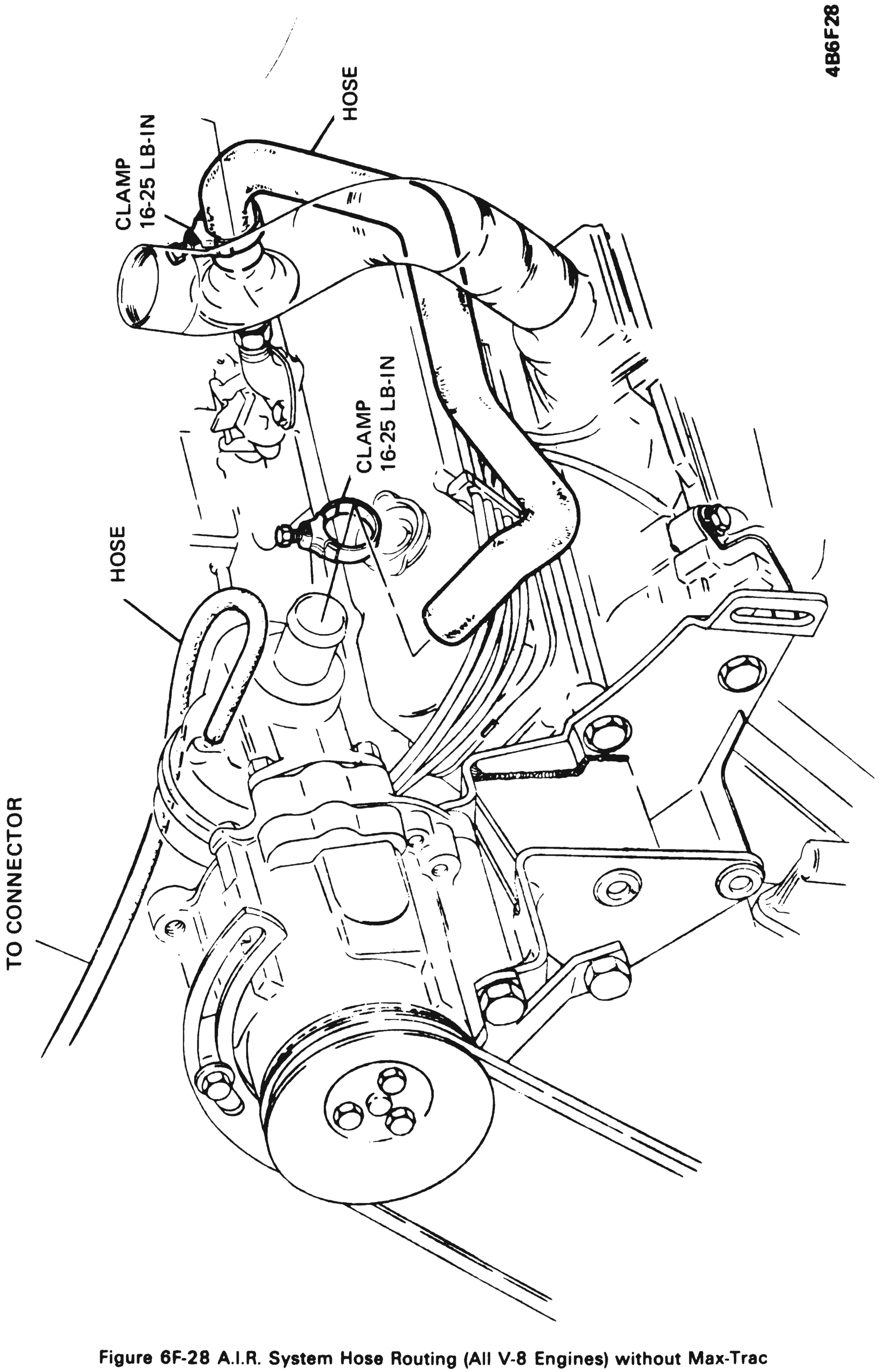


Figure 6F-28 A.I.R. System Hose Routing (All V-8 Engines) without Max-Trac

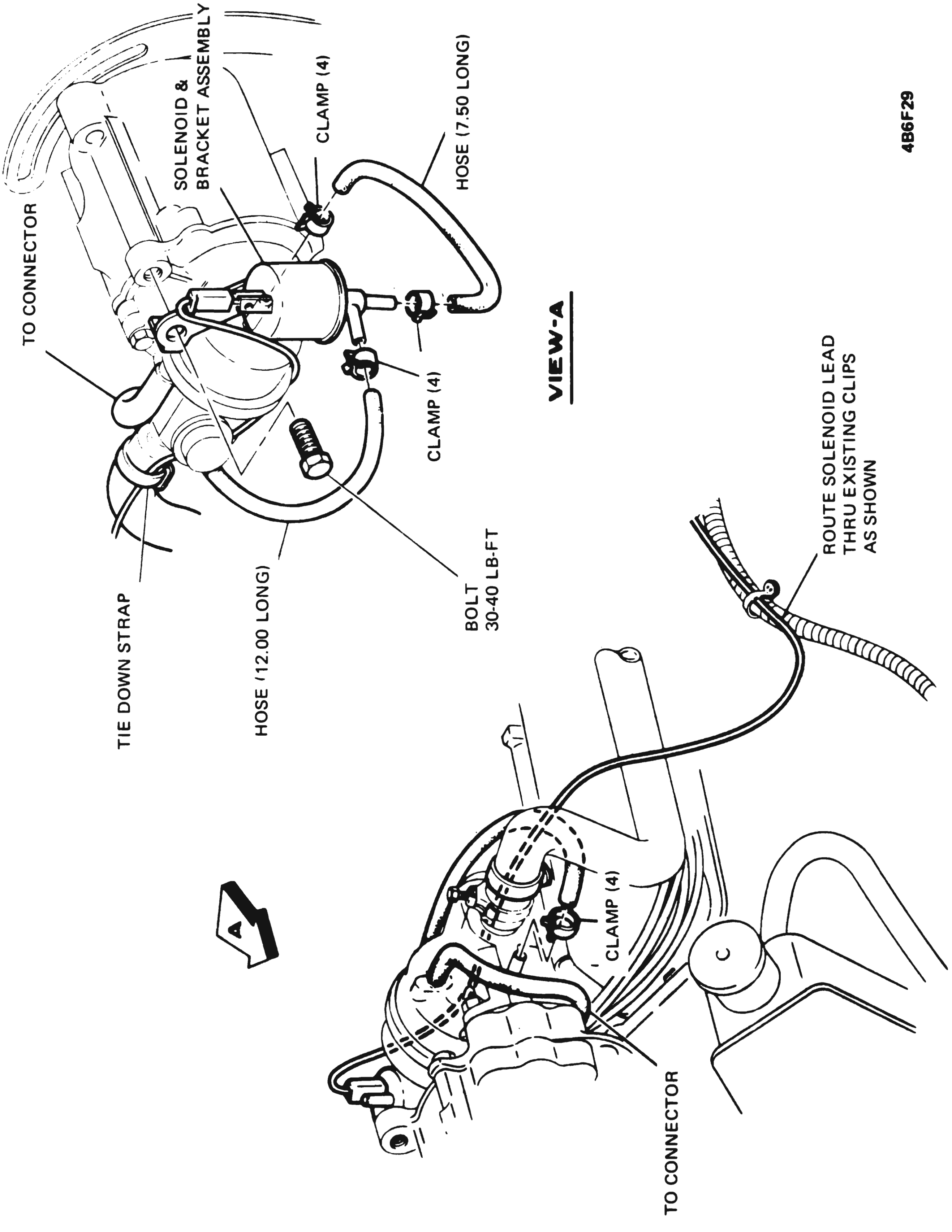


Figure 6F-29 A.I.R. System Hose Routing (All V-8 Engines) with Max-Trac

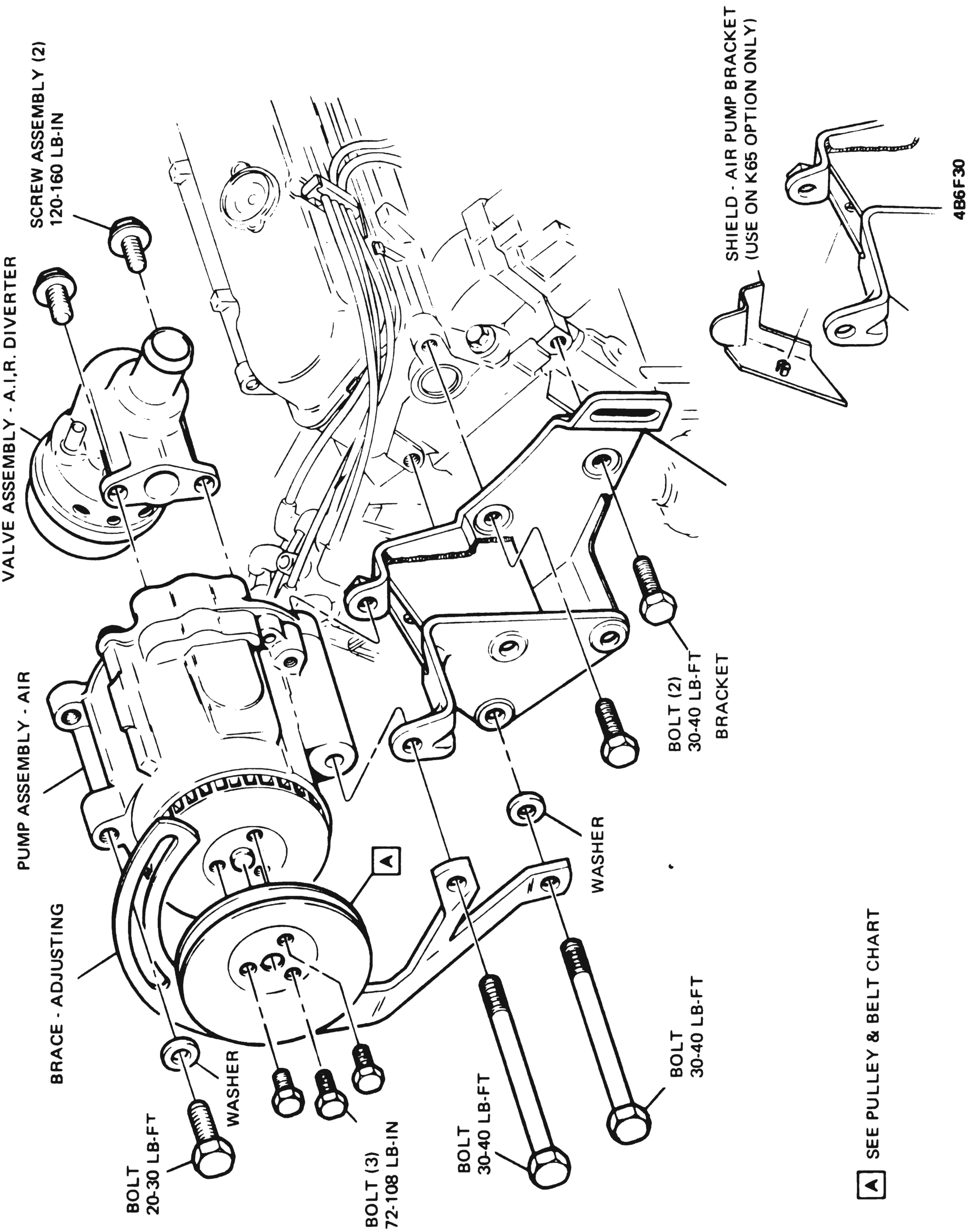


Figure 6F-30 All Series A.I.R. Pump Mounting (V-8 Engines)

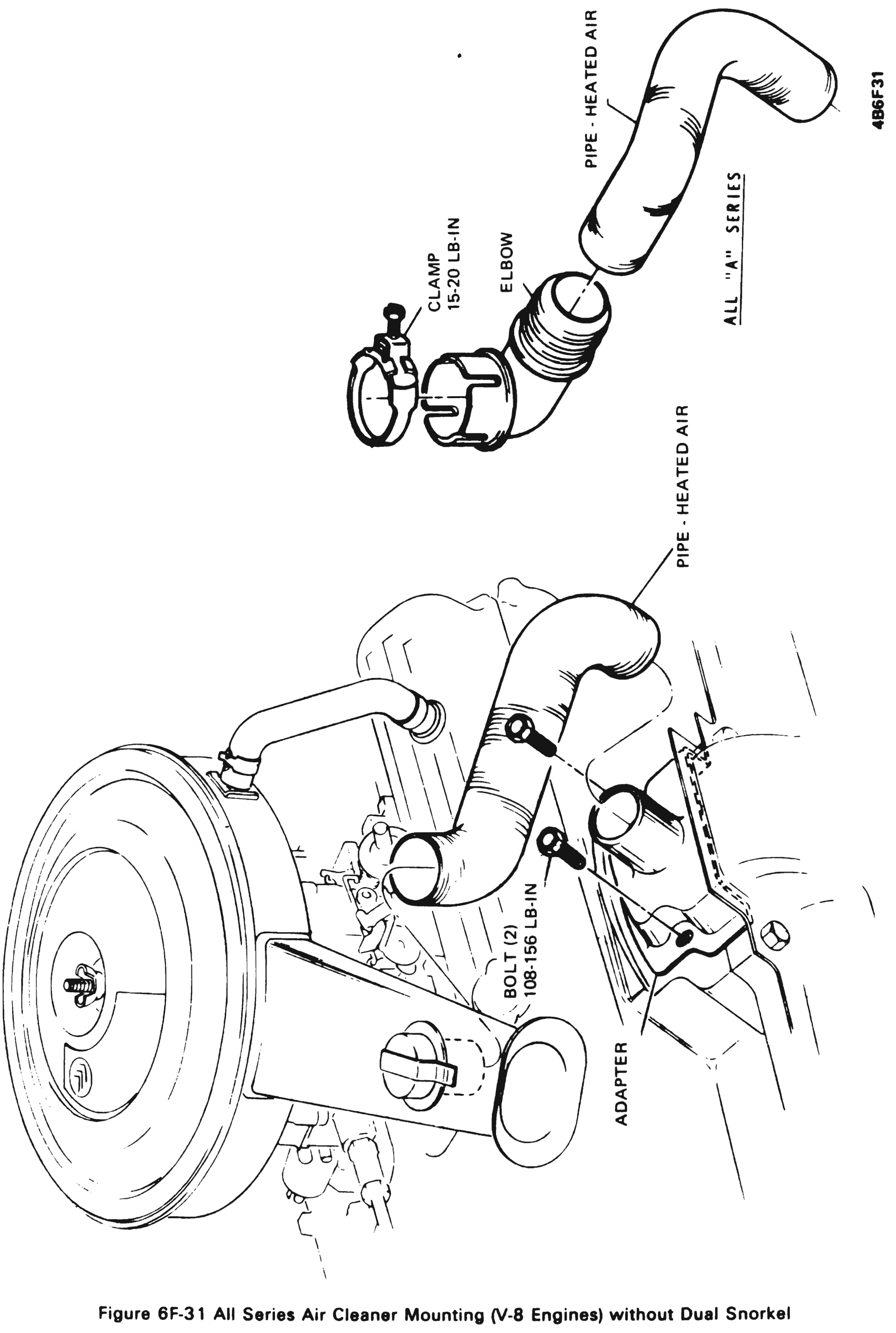


Figure 6F-31 All Series Air Cleaner Mounting (V-8 Engines) without Dual Snorkel

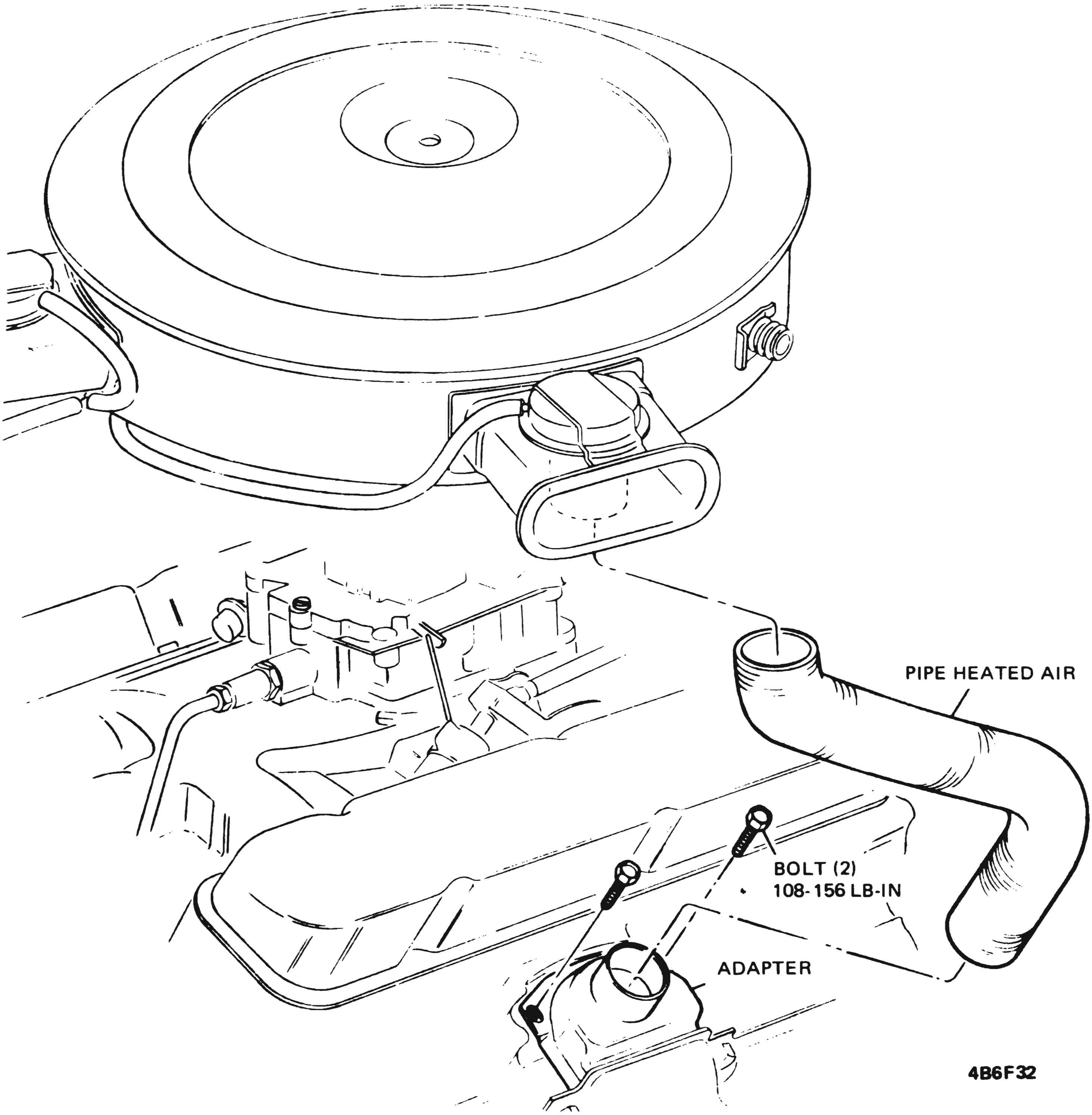


Figure 6F-32 "A" Series Air Cleaner Mounting (455 Stage I Engine) with Dual Snorkel

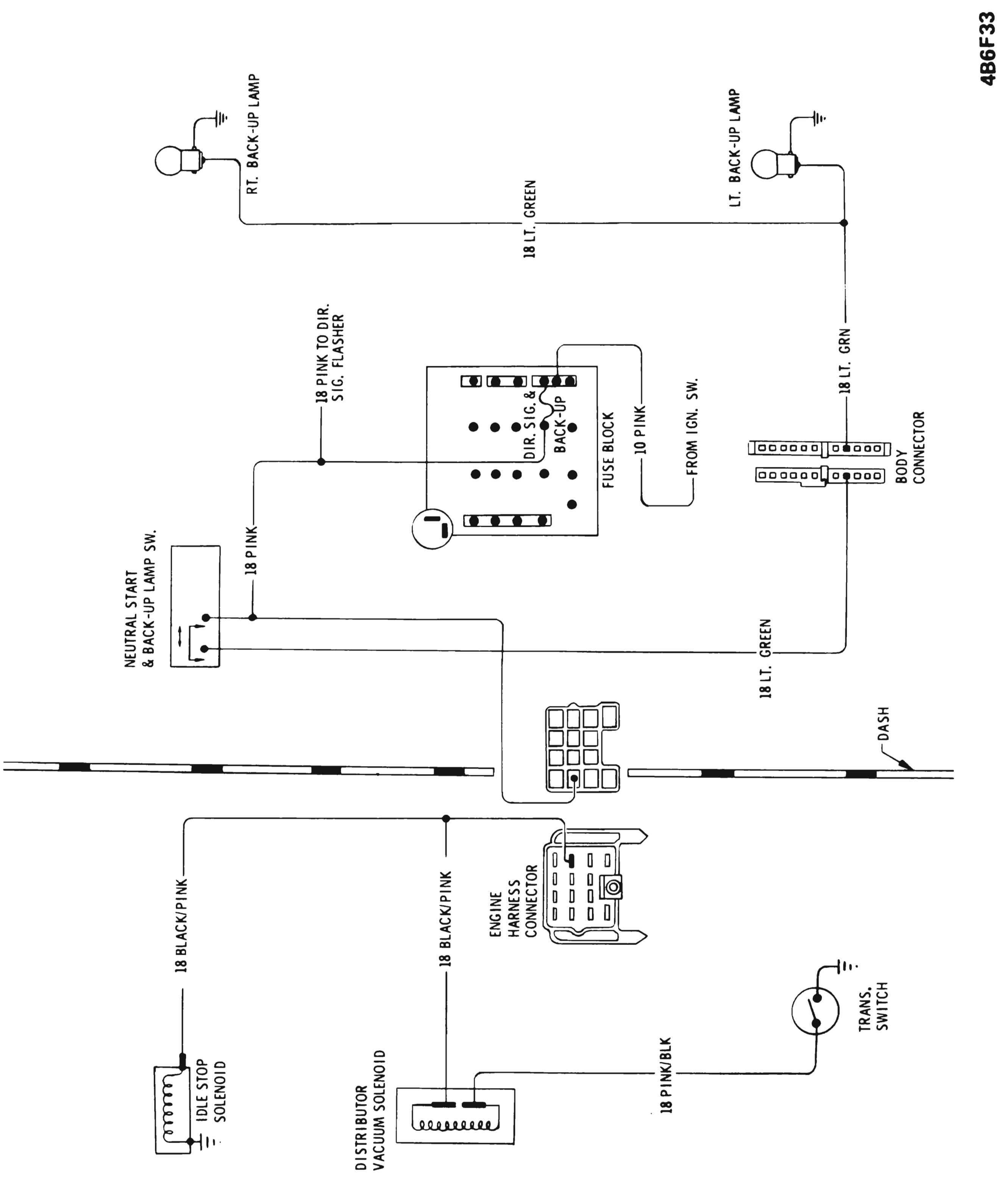


Figure 6F-33 TCS Wiring Diagram ("A" Series Stage I Engine Only)