

SECTION 6

Exhaust Gas Recirculation (EGR) Systems

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System Descriptions

Typical Vacuum Operated EGR System

The Exhaust Gas Recirculation System (EGR) is designed to reintroduce exhaust gas into the combustion cycle lowering combustion temperatures and reducing the formation of Nitrous Oxide.

There are four basic types of EGR valves:

- The Integral Backpressure Transducer EGR Valve (9D448)
- The Ported EGR Valve (9D475)
- The Electronic EGR Valve (9F483)
- The Valve and Transducer Assembly EGR Valve (9H495)

Refer to Section 3 for valve description and function.

Typical components connected within the system are:

- EGR Valve.
- PVS and or TVS.
- Carburetor EGR port.

The amount of exhaust gas reintroduced and the timing of the cycle varies by calibration and is controlled by various factors such as engine speed, engine vacuum, exhaust system backpressure, coolant temperature and throttle angle depending on the calibration. All EGR valves are vacuum actuated. The vacuum diagram is shown on the emission decal for each calibration.

Figure 1 shows a typical EGR valve installation.

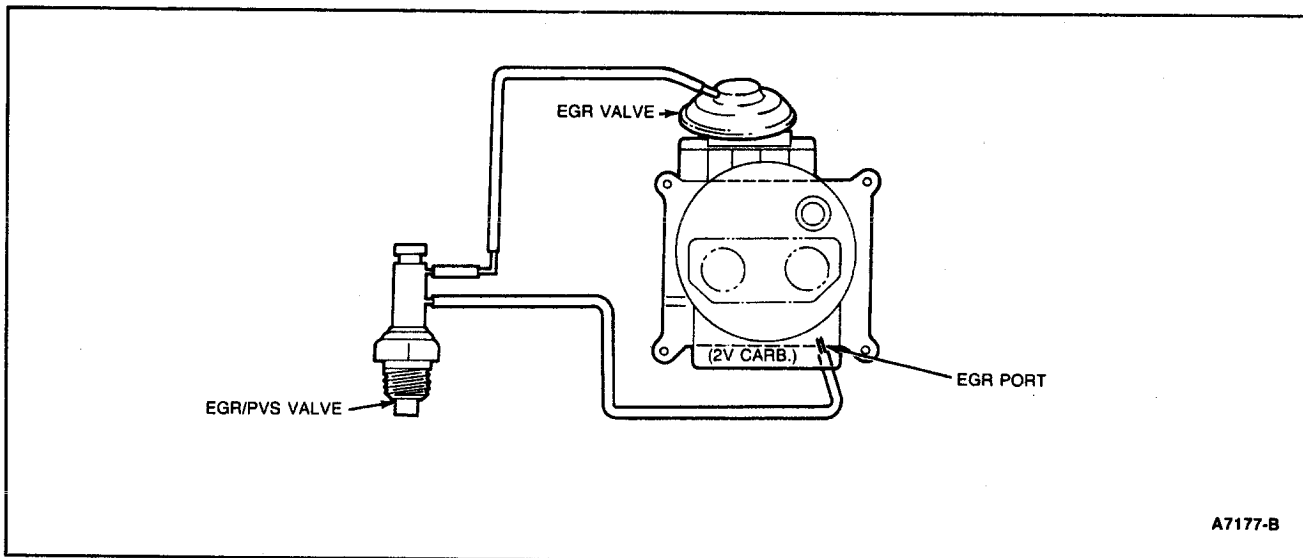


Figure 1 Typical EGR Vacuum System

System Descriptions

Typical Backpressure Variable Transducer (BVT) System

The BVT system is used on most 1.9L and 2.3L passenger car applications. A typical BVT control system is shown in Figure 2. It consists of three components; a vacuum regulator (9J431), EGR valve (9D475) and a flow control orifice.

The regulator modulates the vacuum signal to the EGR valve using two backpressure inputs. One input is the standard vehicle backpressure and the other is the backpressure downstream of the flow control orifice. The control chamber pickup is in the EGR tube and the flow control orifice is integral with the upstream EGR tube connector.

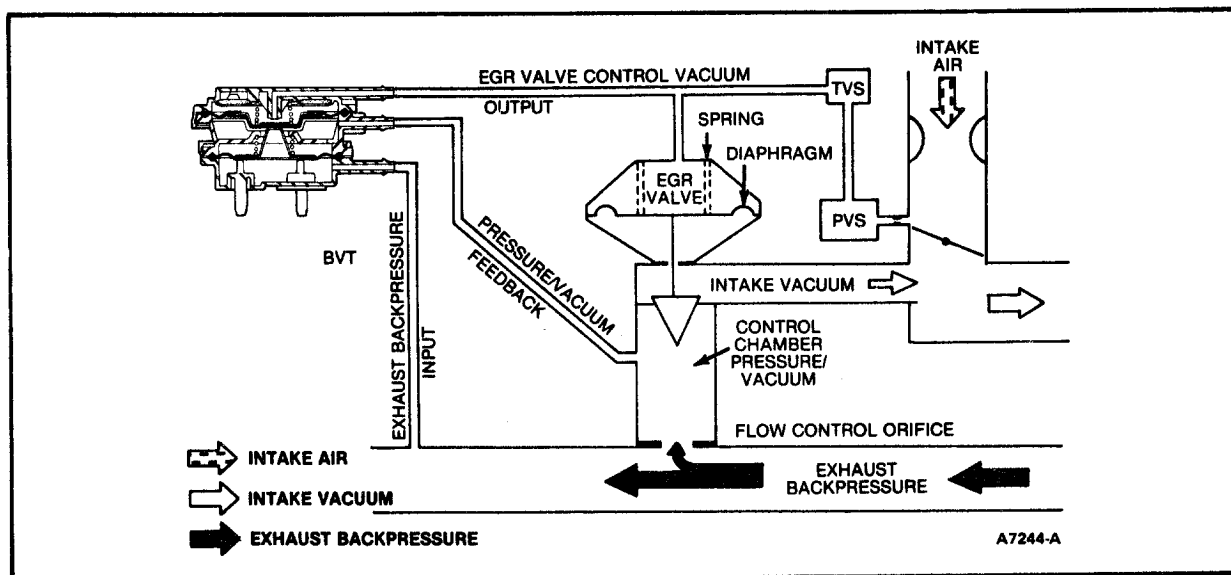


Figure 2 Backpressure Variable Transducer (BVT) Schematic Diagram

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
<ul style="list-style-type: none"> ● Rough idle-cold 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, VCV or TVS malfunction. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Curb idle speed too high or low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, VCV or TVS diagnosis, refer to section 3. ● Perform load control (WOT) valve diagnosis. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal.
<ul style="list-style-type: none"> ● Rough idle hot 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Curb idle speed too high or low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
<ul style="list-style-type: none"> ● Rough running, surge, hesitation, poor part throttle performance — cold 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, VCV or TVS malfunction. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, VCV or TVS diagnosis, refer to Section 3. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal.
<ul style="list-style-type: none"> ● Rough running, surge, hesitation, poor part throttle performance — hot 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, VCV or TVS malfunction. ● Blocked or restricted EGR passages in valve or spacer. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Insufficient exhaust backpressure to activate valve. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, VCV or TVS diagnosis, refer to Section 3. ● Clean passages in EGR spacer and if necessary, replace EGR valve. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Check exhaust system for leaks. ● Reset to specification shown on emission decal.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
<ul style="list-style-type: none"> ● Engine stalls on deceleration — hot and cold 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, VCV or TVS malfunction. ● Blocked or restricted EGR passage in valve or spacer. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Curb idle speed too high or low. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT functional test. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, VCV or TVS diagnosis, refer to Section 3. ● Clean passages in EGR spacer and if necessary, replace EGR valve. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal. ● Reset to specification shown on emission decal.

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Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
<ul style="list-style-type: none"> ● Engine spark knock or ping 	<ul style="list-style-type: none"> ● EGR malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, VCV or TVS malfunction. ● Blocked or restricted passages in valve or spacer. ● Vacuum leak at EVP sensor. ● Insufficient exhaust backpressure to actuate valve. ● Ignition timing too high. ● Air cleaner temperature vacuum switch (TVS) malfunction. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, VCV or TVS diagnosis, refer to Section 3. ● Clean passages in EGR spacer and if necessary, replace EGR valve. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Check exhaust system for leaks. ● Reset to specification shown on emission decal. ● Perform air cleaner temperature switch (TVS) diagnosis, refer to Section 3.
<ul style="list-style-type: none"> ● Engine stalls at idle — cold 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, PVS or TVS malfunction. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Curb idle speed too high or low. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, PVS or TVS diagnosis, refer to Section 3. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal. ● Reset to specification shown on emission decal.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
<ul style="list-style-type: none"> ● Engine stalls at idle — hot 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● Blocked or restricted EGR passages in valve or spacer. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Curb idle speed too high or low. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Clean passages in EGR spacer and if necessary, replace EGR valve. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal. ● Reset to specification shown on emission decal.
<ul style="list-style-type: none"> ● Low power at wide open throttle 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● Blocked or restricted EGR passages in valve or spacer. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Clean passages in EGR spacer and if necessary, replace EGR valve. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Reset to specification shown on emission decal.

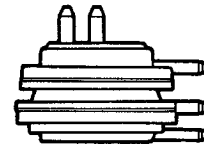
Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
<ul style="list-style-type: none"> ● Engine starts but will not run — engine hard to start or will not start 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, VCV or TVS malfunction. ● Vacuum leak at EVP sensor. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Perform EGR, VCV or TVS diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
<ul style="list-style-type: none"> ● Poor fuel economy 	<ul style="list-style-type: none"> ● EGR valve malfunction. ● BVT malfunction. ● EGR flange gasket leaking. ● EGR valve attaching nuts or bolts loose or missing. ● EGR, PVS or TVS malfunction. ● Blocked or restricted EGR passages in valve or spacer. ● Load control (WOT) valve malfunction. ● Vacuum leak at EVP sensor. ● Insufficient exhaust backpressure to activate valve. ● Ignition timing too low. 	<ul style="list-style-type: none"> ● Perform EGR valve diagnosis. ● Perform BVT diagnosis. ● Replace flange gasket and tighten valve attaching nuts or bolts to specification. ● Replace flange gasket and tighten attaching nuts or bolts to specification. ● Perform EGR, PVS or TVS diagnosis, refer to Section 3. ● Clean passages in EGR spacer and if necessary, replace EGR valve. ● Perform load control (WOT) valve diagnosis, refer to Section 3. ● Replace O-ring seal and tighten EVP sensor attaching nuts to specification. ● Check exhaust system for leaks. ● Reset to specification shown on emission decal.

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Functional Diagnosis

BACKPRESSURE VARIABLE TRANSDUCER (BVT) SYSTEM

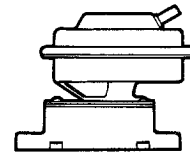


9J431

1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
5. Remove vacuum supply hose from the EGR valve nipple. Plug the hose.
6. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed to the emission decal specification.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump.
8. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
 - Engine does not install.
 - Idle speed does not drop more than 100 rpm.
 - Idle speed does not return to normal (± 25 rpm) after the vacuum is removed.
9. Reconnect the idle air bypass valve electrical connector.
10. Unplug and reconnect the EGR vacuum supply hose.
11. Disconnect the vacuum connection at the 9J431 Backpressure Variable Transducer (BVT).
12. Gently blow into the hose to Port C until the relief valve closes and at the same time apply 5-10 inches of mercury vacuum to Port E with a hand vacuum pump. Port E should hold vacuum as long as there is pressure on Port C.
13. Apply a minimum of 5-10 inches of mercury vacuum to Ports B and C using a hand vacuum pump. Ports B and C should hold vacuum.
14. Replace the BVT if any of the Ports do not hold vacuum.
15. Reconnect the vacuum at the BVT.
16. If neither the EGR valve nor the BVT were replaced, the system is OK. Refer to the Diagnostic Routine in Section 2.

Functional Diagnosis

INTERGRAL BACKPRESSURE TRANSDUCER EGR VALVE

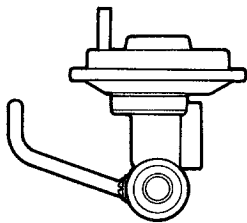
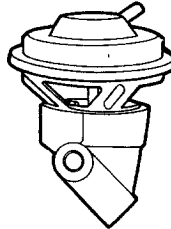
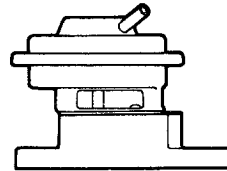
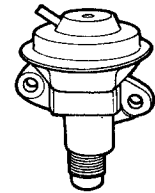


9D448

1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer.
4. Plug the tailpipe (s) to increase the exhaust system backpressure, leaving a 1/2-inch diameter opening to allow exhaust gases to escape.
5. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
6. Remove the vacuum supply hose from the EGR valve nipple. Plug the hose.
7. Start engine, idle with transmission in NEUTRAL, and observe idle speed. If necessary, adjust idle speed to the emission decal specification.
8. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump.
9. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
 - Engine does not stall.
 - Idle speed does not drop more than 100 rpm.
 - Idle speed does not return to normal (± 25 rpm) after the vacuum is removed.
10. If the EGR valve is not replaced, reconnect the idle air bypass valve electrical connector.
11. Unplug and reconnect the EGR vacuum supply hose.
12. Remove the tailpipe plug (s).
13. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

Functional Diagnosis

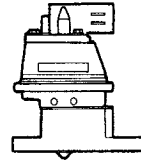
PORTED EGR VALVE

**9D460****9D475****9D475****9D475**

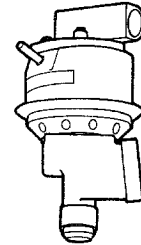
1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
5. Remove the vacuum supply hose from the EGR valve nipple, Plug the hose.
6. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed to the emission decal specification.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump.
8. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
 - Engine does not stall.
 - Idle speed does not drop more than 100 rpm.
 - Idle speed does not return to normal (± 25 rpm) after the vacuum is removed.
9. Reconnect the idle air bypass valve electrical connector.
10. Unplug and reconnect the EGR vacuum supply hose.
11. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

Functional Diagnosis

ELECTRONIC VALVE



9F483

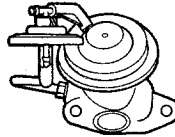


9F483

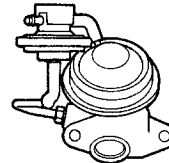
1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
5. Remove the vacuum supply hose from the EGR valve nipple. Plug the hose.
6. Disconnect the 9G428 EVP sensor electrical connector mounted on top of the 9H473 valve.
7. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed to the emission decal specification.
8. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump.
9. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
 - Engine does not stall.
 - Idle speed does not drop more than 100 rpm.
 - Idle speed does not return to normal (± 25 rpm) after the vacuum is removed.
10. Reconnect the idle air bypass valve electrical connector.
11. Unplug and reconnect the EGR vacuum supply hose.
12. Reconnect the EVP sensor electrical connector.
13. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

Functional Diagnosis

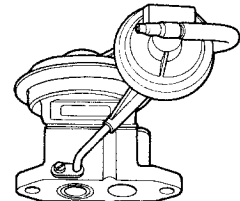
VALVE AND TRANSDUCER ASSEMBLY



9H495



E3BE-9H495



9H495

1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer.
4. Plug the tailpipe (s) to increase the exhaust system backpressure, leaving a 1/2-inch diameter opening to allow exhaust gases to escape.
5. Remove the vacuum supply hose from the exhaust backpressure transducer nipple and plug the hose. Do not disconnect the transducer from the EGR valve.
6. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed to the emission decal specification.
7. Slowly apply 5-10 inches of mercury vacuum to the Backpressure Transducer vacuum nipple using a hand vacuum pump.
8. When vacuum is applied to the Backpressure Transducer and any of the following occur, replace the valve:
 - Engine does not stall.
 - Idle speed does not drop more than 100 rpm.
 - Idle speed does not return to normal (± 25 rpm) after the vacuum is removed.
9. Unplug and reconnect the vacuum supply hose to the exhaust backpressure transducer.
10. Remove the tailpipe plug (s).
11. The EGR system is OK, refer to the Diagnostic Routines in Section 2.