SECTION 6

Exhaust Gas Recirculation (EGR) Systems

Contents

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 five basic types of EGR valves:

- The Back Pressure Variable Transducer (9J431)
- The Integral Back Pressure Transducer EGR Valve (9D448)
- The Ported EGR Valve (9D475)
- The Electronic EGR Valve (9F483)
- The Valve and Transducer Assembly EGR Valve (9H495)

NOTE: Refer to Section 3 for valve description and function.

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 back pressure, 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.

Typical Pressure Feedback Electronic EGR System

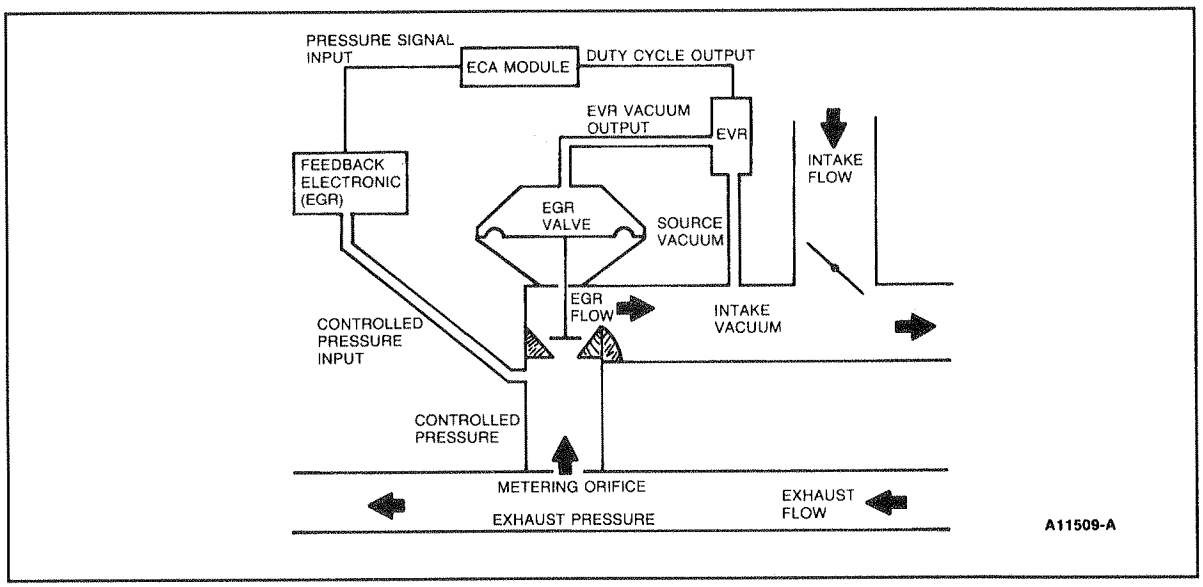


Figure 1 Typical Pressure Feedback Electronic EGR System

System Descriptions

Typical Back Pressure 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 back pressure inputs. One input is the standard vehicle back pressure and the other is the back pressure 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.

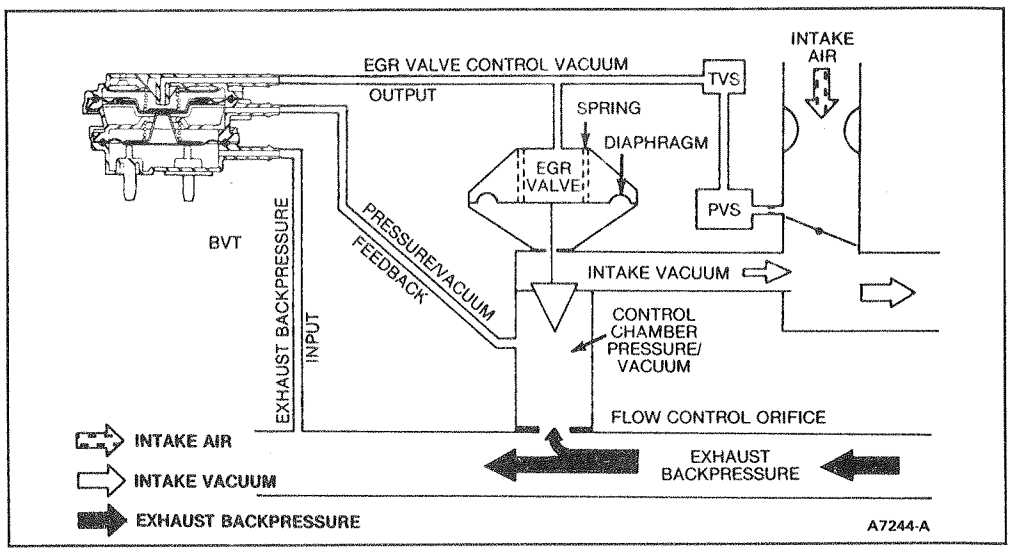


Figure 2 Back Pressure Variable Transducer (BVT) Schematic Diagram

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Rough idle-cold	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
• Rough idle hot	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Rough running, surge, hesitation, poor part throttle performance — cold	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Ignition timing too low.	• Reset to specification shown on emission decal.
• Rough running, surge, hesitation, poor part throttle performance — hot	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Insufficient exhaust back pressure to activate valve.	• Check exhaust system for leaks.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine stalls on deceleration — hot and cold	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT functional test.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Blocked or restricted EGR passage in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine spark knock or ping	• EGR malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Blocked or restricted passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Insufficient exhaust back pressure to actuate valve.	• Check exhaust system for leaks.
	• Ignition timing too high.	• Reset to specification shown on emission decal.
	• Air cleaner temperature vacuum switch (TVS) malfunction.	• Perform air cleaner temperature switch (TVS) diagnosis, refer to Section 3.
• Engine stalls at idle — cold	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, PVS or TVS malfunction.	• Perform EGR, PVS or TVS diagnosis, refer to Section 3.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

Diagnosis By Symptom

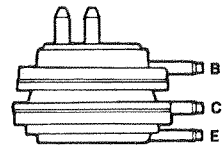
SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine stalls at idle — hot	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
	• Ignition timing too low.	• Reset to specification shown on emission decal.
• Low power at wide-open throttle	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine starts but will not run — engine hard to start or will not start	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
• Poor fuel economy.	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten attaching nuts or bolts to specification.
	• EGR, PVS or TVS malfunction.	• Perform EGR, PVS or TVS diagnosis, refer to Section 3.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Insufficient exhaust back pressure to activate valve.	• Check exhaust system for leaks.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

Functional Diagnosis

BACK PRESSURE VARIABLE TRANSDUCER (BVT) SYSTEM

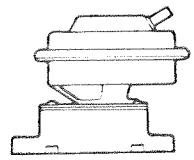


9J431

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, Rotunda 059-00010 or equivalent.
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 according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
8. When vacuum is fully applied to the EGR valve:
   - If idle speed drops more than 100 rpm or if engine stalls, perform the next step. Otherwise, replace the EGR valve.
   - Remove the vacuum from the EGR valve. If idle speed does not return to normal (±25 rpm), replace the EGR valve.
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 Back Pressure 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

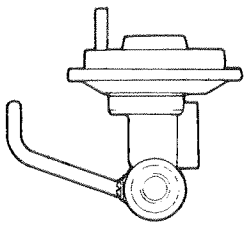
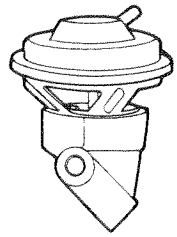
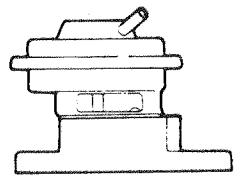
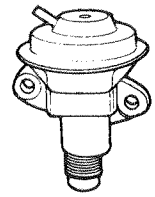
INTEGRAL BACK PRESSURE (IBP) TRANSDUCER EGR VALVE



9D448

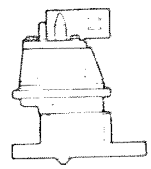
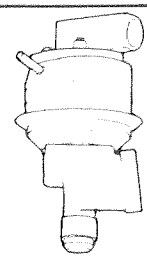
1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Plug the tailpipe(s) to increase the exhaust system back pressure, leaving a 1/2-inch diameter opening to allow exhaust gases to escape.
5. Remove the vacuum supply hose from the EGR valve nipple. Plug the hose.
6. Start engine, idle with transmission in NEUTRAL, and observe idle speed. If necessary, adjust idle speed according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
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. If the EGR valve is not replaced, reconnect the idle air bypass valve electrical connector.
10. Unplug and reconnect the EGR vacuum supply hose.
11. Remove the tailpipe plug(s).
12. 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, Rotunda 059-00010 or equivalent.
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 according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
8. When vacuum is fully applied to the EGR valve:
   - If idle speed drops more than 100 rpm or if engine stalls, perform the next step. Otherwise, replace the EGR valve.
   - Remove the vacuum from the EGR valve. If idle speed does not return to normal (±25 rpm), replace the EGR valve.
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.

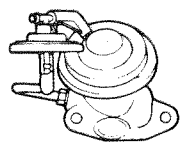
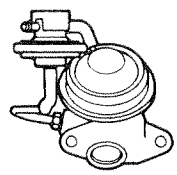
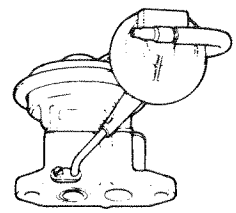
Functional Diagnosis

ELECTRONIC EGR (EEGR) 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.

   NOTE: The EVR solenoid has a constant internal leak. You will notice a small vacuum signal. This signal should be less than 2 1/2 in-Hg at idle.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (1.9L 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 according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
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

VALVE AND TRANSDUCER ASSEMBLY	 9H495	 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, Rotunda 059-00010 or equivalent.
4. Plug the tailpipe(s) to increase the exhaust system back pressure, leaving a 1/2-inch diameter opening to allow exhaust gases to escape.
5. Remove the vacuum supply hose from the exhaust back pressure 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 according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the Back Pressure Transducer vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
8. When vacuum is applied to the Back Pressure 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 back pressure transducer.
10. Remove the tailpipe plug(s).
11. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

ROTUNDA EQUIPMENT

Model	Description
021-00014	Vacuum Pump
059-00010	Tachometer