

**FIGURE 33-1** A funnel is one way to visualize the diagnostic process. The purpose is to narrow the possible causes of a concern until the root cause is determined and corrected.




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**FIGURE 33-2** Step #1 is to verify the customer concern or problem. If the problem cannot be verified, then the repair cannot be verified.




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**FIGURE 33-3** A form that the customer should fill out if there is a driveability concern to help the service technician more quickly find the root cause.

ENGINE PERFORMANCE DIAGNOSIS WORKSHEET	
Please Describe The Step or Condition	
Step	Condition
1. When the engine starts	Engine starts - normal
2. When the engine is running	Engine runs - normal
3. When the engine is idling	Engine idles - normal
4. When the engine is under load	Engine runs - normal
5. When the engine is under load	Engine runs - normal
6. When the engine is under load	Engine runs - normal
7. When the engine is under load	Engine runs - normal
8. When the engine is under load	Engine runs - normal
9. When the engine is under load	Engine runs - normal
10. When the engine is under load	Engine runs - normal
11. When the engine is under load	Engine runs - normal
12. When the engine is under load	Engine runs - normal
13. When the engine is under load	Engine runs - normal
14. When the engine is under load	Engine runs - normal
15. When the engine is under load	Engine runs - normal
16. When the engine is under load	Engine runs - normal
17. When the engine is under load	Engine runs - normal
18. When the engine is under load	Engine runs - normal
19. When the engine is under load	Engine runs - normal
20. When the engine is under load	Engine runs - normal
21. When the engine is under load	Engine runs - normal
22. When the engine is under load	Engine runs - normal
23. When the engine is under load	Engine runs - normal
24. When the engine is under load	Engine runs - normal
25. When the engine is under load	Engine runs - normal
26. When the engine is under load	Engine runs - normal
27. When the engine is under load	Engine runs - normal
28. When the engine is under load	Engine runs - normal
29. When the engine is under load	Engine runs - normal
30. When the engine is under load	Engine runs - normal
31. When the engine is under load	Engine runs - normal
32. When the engine is under load	Engine runs - normal
33. When the engine is under load	Engine runs - normal
34. When the engine is under load	Engine runs - normal
35. When the engine is under load	Engine runs - normal
36. When the engine is under load	Engine runs - normal
37. When the engine is under load	Engine runs - normal
38. When the engine is under load	Engine runs - normal
39. When the engine is under load	Engine runs - normal
40. When the engine is under load	Engine runs - normal
41. When the engine is under load	Engine runs - normal
42. When the engine is under load	Engine runs - normal
43. When the engine is under load	Engine runs - normal
44. When the engine is under load	Engine runs - normal
45. When the engine is under load	Engine runs - normal
46. When the engine is under load	Engine runs - normal
47. When the engine is under load	Engine runs - normal
48. When the engine is under load	Engine runs - normal
49. When the engine is under load	Engine runs - normal
50. When the engine is under load	Engine runs - normal

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**FIGURE 33-4** This is what was found when removing an air filter from a vehicle that had a lack-of-power concern. Obviously the nuts were deposited by squirrels or some other animal, blocking a lot of the airflow into the engine.



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**FIGURE 33-5** Using a bright light makes seeing where the smoke is coming from easier. In this case, smoke was added to the intake manifold with the inlet blocked with a yellow plastic cap and smoke was seen escaping past a gasket at the idle air control.



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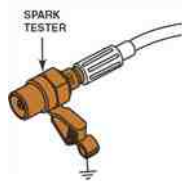
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**FIGURE 33-6** A spark tester connected to a spark plug wire or coil output. A typical spark tester will only fire if at least 25,000 volts is available from the coil, making a spark tester a very useful tool. Do not use one that just lights when a spark is present, because they do not require more than about 2,000 volts to light.



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**FIGURE 33-7** Step 3 in the diagnostic process is to retrieve any stored diagnostic trouble codes.




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**FIGURE 33-8** After checking for stored diagnostic trouble codes (DTCs), the wise technician checks service information for any technical service bulletins that may relate to the vehicle being serviced.




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**FIGURE 33-9** Looking carefully at the scan tool data is very helpful in locating the source of a problem.




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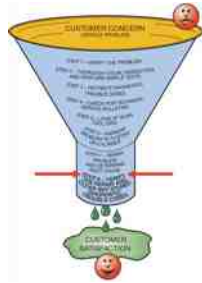
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FIGURE 33–10 Step 8 is very important. Be sure that the customer's concern has been corrected.



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FIGURE 33–11 A TECH 2 scan tool is the factory scan tool used on General Motors vehicles.



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FIGURE 33–12 Some scan tools use pocket PCS which make it very convenient to use.



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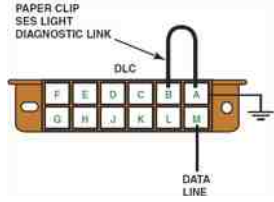
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**FIGURE 33-13** To retrieve flash codes from an OBD-I General Motors vehicle, connect terminals A and B with the ignition on-engine off. The M terminal is used to retrieve data from the sensors to a scan tool.




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**FIGURE 33-14** A Ford OBD-I self-test connector. The location of this connector can vary with model and year of vehicle.




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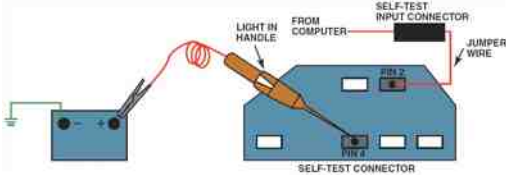
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**FIGURE 33-15** To retrieve Ford DTCs using a test light and a jumper wire, turn the ignition switch on (engine off) and make the connections shown. The test light will blink out the diagnostic trouble codes.




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**FIGURE 33-16** A typical OBD-II data link connector (DLC). The location varies with make and model and may even be covered, but a tool is not needed to gain access. Check service information for the exact location if needed.



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**FIGURE 33-17** The first step in the reprogramming procedure is to determine the current software installed using a scan tool. Not all scan tools can be used. In most cases using the factory scan tool is needed for reprogramming unless the scan tool is equipped to handle reprogramming.



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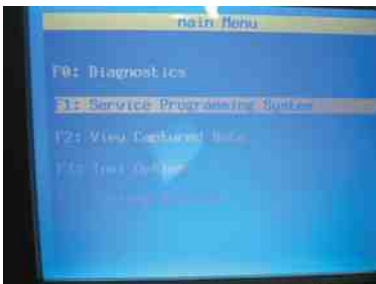
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**FIGURE 33-18** Follow the on-screen instructions.



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**FIGURE 33-19** An Internet connection is usually needed to perform updates although some vehicle manufacturers use CDs which are updated regularly at a cost to the shop.



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**FIGURE 33-20** Connecting cables and a computer to perform off-board programming.



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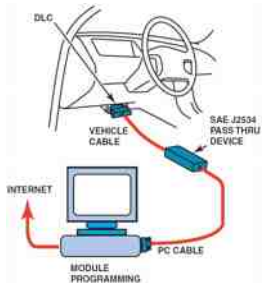
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**FIGURE 33-21** The J2534 pass-through reprogramming system does not need a scan tool to reflash the PCM on most 2004 and newer vehicles.



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FIGURE 33-22 A typical J2534 universal reprogrammer that uses the J2534 standards.



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