

FUEL AND EXHAUST SYSTEMS

Automotive Technology

Module 3: Engine Performance

Section B: Fuel and Exhaust Systems

Student Workbook

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FUEL AND EXHAUST SYSTEMS

**MODULE 3: ENGINE PERFORMANCE
SECTION B: FUEL AND EXHAUST SYSTEMS
STUDENT WORKBOOK TRACKING SHEET**

Assignment Sheet	Title of Assignment Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
AS1-L1-UI	Fuel and Its Properties	FES 17-20	W 1-2		
AS1-L1-UII	Fuel Supply System Components	FES 55-58	W 3-4		
AS1-L1-UIII	Carburetor Fundamentals	FES 149-152	W 31-32		
AS1-L1-UIV	The Terms, History, and Advantages of Electronic Fuel Injection (EFI) Systems	FES 207-210	W 49-50		
AS1-L2-UIV	Types of Electronic Fuel Injection (EFI) Systems	FES 219-222	W 51-52		
AS1-L3-UIV	Components of Electronic Fuel Injection (EFI) Systems	FES 231-234	W 53-54		
AS1-L1-UV	Exhaust Systems	FES 403-406	W 107-108		
Job Sheet	Title of Job Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
JS1-L2-UII	Inspect and Diagnose a Carbureted Fuel Supply System	FES 83-88	W 5-10		
JS2-L2-UII	Inspect and Diagnose an Electronic Fuel-Injected Fuel Supply System	FES 89-92	W 11-14		
JS3-L2-UII	Service a Fuel Tank	FES 93-96	W 15-18		
JS4-L2-UII	Replace a Fuel Filter	FES 97-98	W 19-20		
JS5-L2-UII	Remove and Install a Mechanical Fuel Pump	FES 99-100	W 21-22		
JS6-L2-UII	Remove and Install an Electrical Fuel Pump	FES 101-102	W 23-24		
JS7-L2-UII	Test and Service a Fuel Pressure Regulator	FES 103-106	W 25-28		
JS8-L2-UII	Test the Fuel Quality	FES 107-108	W 29-30		
JS1-L2-UIII	Inspect and Test a Carbureted Fuel System	FES 163-166	W 33-36		
JS2-L2-UIII	Remove, Disassemble, Perform Bench Adjustments, Assemble, and Install a Carburetor	FES 167-170	W 37-40		
JS3-L2-UIII	Adjust the Idle Speed on a Nonemission-controlled Vehicle	FES 171-172	W 41-42		

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Job Sheet	Title of Job Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
JS4-L2-UIII	Adjust the Idle Mixture Using the Propane Enrichment Method on an Emission-controlled Vehicle	FES 173-174	W 43-44		
JS5-L2-UIII	Remove, Inspect, Clean, and Install the Intake Manifold	FES 175-178	W 45-48		
JS1-L4-UIV	Diagnose and Service Computerized Engine Control Systems	FES 279-280	W 55-56		
JS2-L4-UIV	Diagnose and Service Fuel-Related Sensors Using a Digital Multimeter	FES 281-282	W 57-58		
JS3-L4-UIV	Diagnose and Service Fuel-Related Sensors Using a Scan Tool	FES 283-284	W 59-60		
JS4-L4-UIV	Diagnose and Service Fuel-Related Sensors Using a Lab Scope	FES 285-286	W 61-62		
JS5-L4-UIV	Test and Service the Electronic Fuel Injectors	FES 287-290	W 63-66		
JS6-L4-UIV	Test and Service the Idle Air Control System	FES 291-292	W 67-68		
JS7-L4-UIV	Adjust or Reset the Minimum Idle Speed	FES 293-294	W 69-70		
JS8-L4-UIV	Service a Throttle Body Fuel Injector	FES 295-296	W 71-72		
JS9-L4-UIV	Service a Multiport Fuel Injection System Fuel Rail and Fuel Injector(s)	FES 297-298	W 73-74		
JS10-L4-UIV	Service the Throttle Body on a Multiport Fuel Injection System	FES 299-304	W 75-80		
JS1-L5-UIV	Test and Service the Intake Air Control System	FES 323-326	W 81-84		
JS2-L5-UIV	Test the Turbocharger	FES 327-330	W 85-88		
JS3-L5-UIV	Service the Turbocharger	FES 331-334	W 89-92		
JS4-L5-UIV	Test the Supercharger	FES 335-336	W 93-94		
JS5-L5-UIV	Service the Supercharger	FES 337-338	W 95-96		

FUEL AND EXHAUST SYSTEMS

STUDENT WORKBOOK TRACKING SHEET *PAGE 3*

Job Sheet	Title of Job Sheet	Instructor Guide Page #	Student Workbook Page #	Date	Instructor's Initials
JS1-L6-UIV	Diagnose Electronic Fuel Injection System Driveability Concerns/Symptoms	FES 355-358	W 97-100		
JS2-L6-UIV	Diagnose Driveability Concerns/Symptoms Using On-board Diagnostics	FES 359-360	W 101-102		
JS3-L6-UIV	Diagnose Driveability Concerns/Symptoms Using and Exhaust Gas Analyzer	FES 361-364	W 103-106		
JS1-L2-UV	Inspect the Exhaust System	FES 415-416	W 109-110		
JS2-L2-UV	Test the Exhaust System Back Pressure	FES 417-418	W 111-112		
JS3-L2-UV	Service the Exhaust System Components	FES 419-420	W 113-114		
JS4-L2-UV	Service the Exhaust Manifold	FES 421-424	W 115-118		

FUEL AND EXHAUST SYSTEMS

AS1-L1-UI

NAME:

FUEL AND ITS PROPERTIES

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. Define the following terms.

Ethanol —

MTBE —

Octane rating —

TAP —

Volatility —

2. How is gasoline rated? What are RON and MON the acronyms for?
3. Name three problems that can occur if volatility is too low.

Name three problems that can occur if volatility is too high.

FUEL AND EXHAUST SYSTEMS

AS1-L1-UII

NAME:

FUEL SUPPLY SYSTEM COMPONENTS

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. Define the following terms.

Fuel filter —

Fuel pump —

Fuel tank —

Residual fuel pressure —

Vapor lock —

2. What is the purpose of the fuel supply system?

3. What are the four main components of the fuel supply system?

What is sometimes a fifth main component of the fuel supply system?

4. What are fuel lines made of?

5. What is the main purpose of the fuel pressure regulator?

What are the two types of fuel pressure regulators?

The student must obtain a minimum score of _____ on AS1-L1-UII in order to receive an evaluation for Competency K2.

FUEL AND EXHAUST SYSTEMS

JS1-L2-UII

INSPECT AND DIAGNOSE A CARBURETED FUEL SUPPLY SYSTEM

Equipment:

Battery-powered light (drop light)
Graduated container
Hand tools
Protective eyewear
Vacuum pressure gauge

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Confirm the vehicle owner's complaint. Determine if the complaint could be caused by a problem in the fuel supply system.
3. Have the instructor review your findings and check the following box to indicate approval.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

NOTE: The components of the fuel supply system can be a source of engine performance problems that include hard starting, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, and/or poor fuel economy.

4. Inspect the carbureted fuel supply system and complete the following chart.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

	OK	Not OK
Fuel fill cap		
Fit		
Seat		
Gasket		
Fuel filler tube assembly		
Fuel filler restriction		
Fuel tank (Make sure the vehicle is securely raised and use a battery-powered light.)		
Rust		
Dents		
Leaks		
Loose retaining straps		
Fuel lines (supply and return)		
Rust		
Dents		
Leaks		
Proper routing		
Fuel hoses		
Cracking		
Hard or soft areas		
Collapsing		
Pinched		
Loose clamps		
Fuel filter(s)		
Rust		
Leaks		
Fuel quality		
Particles		
Water		
Alcohol		
Correct fuel		

FUEL AND EXHAUST SYSTEMS

5. Inspect the fuel pump for fuel leaks. Inspect the condition of the fuel hoses and lines. Record observations in the following space. _____

NOTE: If necessary, lift the vehicle with a hoist or place securely on safety stands.

6. Connect the exhaust ventilation equipment. _____

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine and listen for unusual or excessive noise from the fuel pump. Shut the engine off. Record observations in the following space. _____

8. Using a service manual or other information source, locate a procedure for testing the fuel pump pressure. Include the necessary pressure specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, test the fuel pump pressure. Record the pressure in the following chart.

Noted Pressure	
Specified Pressure (from the appropriate service manual)	

9. Using a service manual or other information source, locate a procedure for testing the fuel pump vacuum. Include the necessary vacuum specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, test the fuel pump vacuum. Record the vacuum in the following chart.

Noted Vacuum	
Specified Vacuum (from the appropriate service manual)	

10. Using a service manual or other information source, locate a procedure for testing the fuel pump volume. Include the necessary volume specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, test the fuel pump volume. Record the volume in the following chart.

Noted Volume	
Specified Volume (from the appropriate service manual)	

FUEL AND EXHAUST SYSTEMS

11. Based on the various tests, what is the condition of the fuel pump? Record observations in the following space. _____

12. Shut the engine off and disconnect the test equipment. _____

13. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks. _____

14. Disconnect the exhaust ventilation equipment. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS2-L2-U11

INSPECT AND DIAGNOSE AN ELECTRONIC FUEL-INJECTED FUEL SUPPLY SYSTEM

Equipment:

Battery-powered light (drop light)
Graduated container
Hand tools
Pressure gauge and adapters
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Confirm the vehicle owner's complaint. Determine if the complaint could be caused by a problem in the fuel supply system.
3. Have the instructor review your findings and check the following box to indicate approval.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

NOTE: The components of the fuel supply system can be a source of engine performance problems that include hard starting, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling and/or poor fuel economy.

4. Inspect the electronic fuel-injected fuel supply system and complete the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

		OK	Not OK
Fuel fill cap			
	Fit		
	Seat		
	Gasket		
Fuel filler tube assembly			
	Fuel filler restriction		
Fuel tank (Make sure the vehicle is securely raised and use a battery-powered light.)			
	Rust		
	Dents		
	Leaks		
	Loose retaining straps		
Fuel lines (supply and return)			
	Rust		
	Dents		
	Leaks		
	Proper routing		
Fuel hoses			
	Cracking		
	Hard or soft areas		
	Collapsing		
	Pinched		
	Loose clamps		
Fuel filter(s)			
	Rust		
	Leaks		
Fuel quality			
	Particles		
	Water		
	Alcohol		
	Correct fuel		

FUEL AND EXHAUST SYSTEMS

5. If the vehicle has an external-mounted fuel pump, inspect the condition of the fuel pump and attaching fuel hoses. Record observations in the following space.

6. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating the vehicle in an enclosed area.

7. Using a service manual or other information source, locate a procedure for testing the electrical fuel pump pressure. Include the necessary pressure specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, test the electrical fuel pump pressure. Record the pressure in the following chart.

Noted Pressure	
Specified Pressure (from the appropriate service manual)	

8. Shut the engine off and relieve the fuel pressure. Disconnect the test equipment.

9. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks.

10. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS3-L2-U11

SERVICE A FUEL TANK

Equipment:

Fuel gauge sending unit wrench
Fuel storage tank
Hand tools
Protective eyewear
Siphoning equipment

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Lift the vehicle with a hoist or place securely on safety stands.
3. Disconnect the negative battery cable.
4. Using a service manual or other information source, locate a procedure for removing the fuel tank. Include the necessary specifications and safety information. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the fuel tank.

CAUTION: Fuel is highly flammable. Do not service the fuel system in the presence of sparks or open flame.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

5. Using a service manual or other information source, locate a procedure for removing the fuel gauge sending unit from the fuel tank. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, remove the fuel gauge sending unit from the fuel tank.

NOTE: To prevent contaminants from entering the fuel tank, clean dirt or debris from the fuel tank before removing the fuel gauge sending unit.

6. Inspect the fuel tank for rust, dents, holes, etc. Inspect the condition of the fuel cap, fuel filler neck, and fuel gauge sending unit. Record observations in the following space.

7. Using a service manual or other information source, locate a procedure for installing the fuel tank and the fuel gauge sending unit. Include the necessary specifications and safety information. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, install the fuel tank and fuel gauge sending unit.

8. Lower the vehicle and refill the fuel tank. Reconnect the negative battery cable.

FUEL AND EXHAUST SYSTEMS

9. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

10. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks.

11. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

ENGINE PERFORMANCE



FUEL AND EXHAUST SYSTEMS

JS4-L2-U11

REPLACE A FUEL FILTER

Equipment:

Hand tools
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Lift the vehicle with a hoist or place securely on safety stands.
3. Using a service manual or other information source, locate a procedure for removing and replacing the fuel filter. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, remove and replace the fuel filter.

CAUTION: Fuel is highly flammable. Do not service the fuel system in the presence of sparks or open flame.

4. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

5. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

6. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

FUEL AND EXHAUST SYSTEMS

JS5-L2-U11

REMOVE AND INSTALL A MECHANICAL FUEL PUMP

Equipment:

Hand tools
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Lift the vehicle with a hoist or place securely on safety stands.
3. Using a service manual or other information source, locate a procedure for removing the mechanical fuel pump. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the mechanical fuel pump.

CAUTION: Fuel is highly flammable. Do not service the fuel system in the presence of sparks or open flame.

4. Thoroughly clean the fuel pump mating surface.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

5. Inspect the fuel lines and hoses that are attached to the fuel pump. Replace any defective fuel lines and hoses. Record the parts that need to be replaced in the following space.

6. Using a service manual or other information source, locate a procedure for installing a mechanical fuel pump. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, install the mechanical fuel pump.

NOTE: Be certain the fuel pump lever is installed correctly or fuel pump and/or engine damage can occur when the engine is started.

7. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

8. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks.

9. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

FUEL AND EXHAUST SYSTEMS

JS6-L2-U11

REMOVE AND INSTALL AN ELECTRICAL FUEL PUMP

Equipment:

Hand tools
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Lift the vehicle with a hoist or place securely on safety stands.
3. Using a service manual or other information source, locate a procedure for removing the electrical fuel pump. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the electrical fuel pump.

CAUTION: Fuel is highly flammable. Do not service the fuel system in the presence of sparks or open flame.

4. Compare the removed electrical fuel pump to the one that will be installed to make sure that the two are interchangeable.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

5. Using a service manual or other information source, locate a procedure for installing the electrical fuel pump. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, install the electrical fuel pump.

6. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks.
8. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

FUEL AND EXHAUST SYSTEMS

JS7-L2-U11

TEST AND SERVICE A FUEL PRESSURE REGULATOR

Equipment:

Fuel connector tools
Hand tools
Pressure gauge
Protective eyewear
Vacuum gauge

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using the following procedure, inspect the fuel pressure regulator.
 - a. Inspect the fuel pressure regulator and fuel rail for leaks.
 - b. Inspect the vacuum lines connected to the fuel pressure regulator.
 - c. Record observations in the following space.
3. Using the following procedure, test the fuel pressure regulator.
 - a. Connect the fuel pressure gauge.
 - b. Remove the vacuum lines from the fuel pressure regulator and connect the vacuum gauge.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

- c. Turn the ignition on and check the fuel pressure. Record the fuel pressure in the following space.

- d. Start the engine and check the vacuum reading. Record the vacuum in the following space.

- e. Reconnect the vacuum hose to the fuel pressure regulator. Check the fuel pressure. Fuel pressure will decrease when the vacuum is installed. Record the fuel pressure in the following space.

NOTE: If fuel pressure readings are not within the specified range for the fuel pump, replace the fuel filter and fuel return lines.

- 4. Determine if the fuel pressure regulator needs to be replaced. Record observations in the following space. _____

- 5. Using a service manual or other information source, locate a procedure for replacing the fuel pressure regulator. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, replace the fuel pressure regulator.

FUEL AND EXHAUST SYSTEMS

6. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine and check for fuel leaks. Shut the engine off. Repair any leaks.

8. Start the engine again. Test the fuel pressure regulator performance. Shut the engine off.

9. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 is at the end of JS8-L2-UII.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS8-L2-U11

TEST THE FUEL QUALITY

Equipment:

Appropriate fuel containers
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for testing the fuel quality. Include the procedures for testing for alcohol, water, dirt, and metal particles. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, test the fuel quality. Record the results in the following space.

Average of the above evaluations

This average is a partial evaluation for Competency K2. The final evaluation for K2 follows.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

FINAL EVALUATION INSTRUCTIONS

- I. Determine the student's final evaluation for Competency K2 by averaging the evaluations of JS1-L2-U11, JS2-L2-U11, JS3-L2-U11, JS4-L2-U11, JS5-L2-U11, JS6-L2-U11, JS7-L2-U11, and JS8-L2-U11.

JS1-L2-U11 _____

JS2-L2-U11 _____

JS3-L2-U11 _____

JS4-L2-U11 _____

JS5-L2-U11 _____

JS6-L2-U11 _____

JS7-L2-U11 _____

JS8-L2-U11 _____

Final evaluation for Competency K2 _____

FUEL AND EXHAUST SYSTEMS

AS1-L1-UIII

NAME:

CARBURETOR FUNDAMENTALS

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. Define the following terms.

Atomization —

Flooding —

Jet —

Vaporization —

Venturi effect —

2. What are the six basic components of a carburetor?

3. What are the six basic circuits in a carburetor?

4. What are the four carburetor systems and controls?

5. What are the two types of mixture control solenoids?

The student must obtain a minimum score of _____ on AS1-L1-UIII in order to receive an evaluation for Competencies K1-K4.

FUEL AND EXHAUST SYSTEMS

JS1-L2-UIII

INSPECT AND TEST A CARBURETED FUEL SYSTEM

Equipment:

Compression gauge
 Engine analyzer
 Hand tools
 Hand vacuum pump
 Protective eyewear
 Timing light

Procedure:

NOTE: The test should begin with a cold engine (one that has not been run for eight or more hours).

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Complete the following chart.

	OK	NOT OK
Inspect the air filter, filter housing, and ducts.		
Inspect the choke and answer the following three questions.		
a. Does the choke close as it should?		
b. Does the choke operate smoothly by hand?		
c. Does the choke unloader work?		
Test the choke pull-off operation.		
Test the accelerator pump operation.		
Inspect for external fuel leakage.		

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

3. Complete the following chart.

	Yes	No
<i>Are any of the following a concern/symptom?</i>		
Hard or no start	<input type="checkbox"/>	<input type="checkbox"/>
Poor idle	<input type="checkbox"/>	<input type="checkbox"/>
Engine flood	<input type="checkbox"/>	<input type="checkbox"/>
Engine hesitation or surge	<input type="checkbox"/>	<input type="checkbox"/>
Engine stall	<input type="checkbox"/>	<input type="checkbox"/>
Engine misfire	<input type="checkbox"/>	<input type="checkbox"/>
Engine diesel	<input type="checkbox"/>	<input type="checkbox"/>
Power loss	<input type="checkbox"/>	<input type="checkbox"/>
Poor fuel economy	<input type="checkbox"/>	<input type="checkbox"/>
Emission problems	<input type="checkbox"/>	<input type="checkbox"/>

4. Using a service manual or other information source, locate a procedure for testing the components or systems (the air induction system, the carburetor and circuits, the fuel supply system, the ignition system, the exhaust system, and the emission system) that could be causing the above concerns/symptoms. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

FUEL AND EXHAUST SYSTEMS

Using the procedure, test the components or systems. Record the results in the following space. List the components or systems that need to be serviced.

5. Connect the exhaust ventilation equipment. _____

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

6. Start the engine and allow it to reach normal operating temperature. Complete the following chart. _____

	OK	NOT OK
Does the choke open as it should?		
Check the carburetor for flooding.		

7. Shut the engine off. Disconnect the exhaust ventilation equipment. Complete the following chart. _____

	OK	NOT OK
Check the accelerator linkage for adjustment and smoothness of operation.		

8. Record any problems that were found during the tests in the following space. Indicate the possible cause(s) of the problem(s). _____

Average of the above evaluations _____

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS2-L2-UIII

REMOVE, DISASSEMBLE, PERFORM BENCH ADJUSTMENTS, ASSEMBLE, AND INSTALL A CARBURETOR

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing a carburetor. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

NOTE: Before beginning the removal procedure, disconnect the negative battery cable to prevent engine cranking. Place a towel over the intake manifold to prevent any debris from falling into the engine.

Using the procedure, remove the carburetor.

CAUTION: Fuel is highly flammable. Do not service a fuel system in the presence of sparks or open flame. Store fuel in approved sealed containers. Clean up any fuel spills.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

3. Using a service manual or other information source, locate a procedure for disassembling a carburetor. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, disassemble the carburetor.

4. Inspect the carburetor components. Complete the following chart. _____

	OK	NOT OK
Inspect the float.		
Inspect the choke shaft and valve for wear or binding.		
Inspect the throttle shaft and plates for wear and binding.		
Inspect for signs of dirt and/or water contamination.		
Inspect for signs of cracking or other damage to the carburetor.		

NOTE: If any evidence of dirt and/or water contamination is found, the fuel tank and lines should be drained and flushed with clean fuel before installing the carburetor.

5. Separate the carburetor parts for cleaning in an immersion-type carburetor cleaner. Clean the components using the appropriate instructions provided by the manufacturers of the carburetor and cleaner. _____

CAUTION: Immersion-type carburetor cleaner will burn the skin and eyes. Wear protective eyewear and do not allow the cleaner to come in contact with the skin.

6. Remove the parts from the cleaner. Rinse in hot water and dry with compressed air. _____

FUEL AND EXHAUST SYSTEMS

7. Using a service manual or other information source, locate a procedure for performing bench adjustments and assembling the carburetor. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, perform bench adjustments and assemble the carburetor.

8. Using a service manual or other information source, locate a procedure for installing the carburetor. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, install the carburetor.

9. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

10. Start the engine and allow it to reach normal operating temperature.
11. Check for fuel leaks. Repair any leaks.
12. Adjust the idle mixture and speed.
13. Shut the engine off. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competencies K3, K4, and K7. The final evaluations for K3 and K4 are at the end of JS5-L2-UIII. The final evaluation for K7 is at the end of JS7-L4-UIV.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS3-L2-UIII

ADJUST THE IDLE SPEED ON A NONEMISSION-CONTROLLED VEHICLE

Equipment:

Hand tools
Protective eyewear
Special tools as needed
Tachometer

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for adjusting the slow, curb, and fast idle speeds. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, set the slow, curb, and fast idle speeds.

Average of the above evaluations

This average is a partial evaluation for Competency K4. The final evaluation for K4 is at the end of JS5-L2-UIII.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS4-L2-UIII

ADJUST THE IDLE MIXTURE USING THE PROPANE ENRICHMENT METHOD ON AN EMISSION-CONTROLLED VEHICLE

Equipment:

Hand tools
Propane enrichment equipment
Protective eyewear
Tachometer

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the idle mixture concealment plugs. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the idle mixture concealment plugs.

3. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

4. Start the engine and allow it to reach normal operating temperature.
5. Check for fuel leaks. Repair any leaks.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

6. Using a service manual or other information source, locate a procedure for performing a propane enrichment method procedure. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, adjust the idle mixture using the propane enrichment method.

7. Shut the engine off. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K7. The final evaluation for K7 is at the end of JS7-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS5-L2-UIII

REMOVE, INSPECT, CLEAN, AND INSTALL THE INTAKE MANIFOLD

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the intake manifold. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, remove the intake manifold.

3. Using a service manual or other information source, locate a procedure for inspecting and cleaning an intake manifold. Include the warpage tolerances. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Using the procedure, inspect and clean the intake manifold. Complete the following chart.

	YES	NO
Are there any cracks in the manifold?	<input type="checkbox"/>	<input type="checkbox"/>
Are the mating surfaces within the proper tolerances?	<input type="checkbox"/>	<input type="checkbox"/>
Are there any problems with the intake manifold?	<input type="checkbox"/>	<input type="checkbox"/>
Describe any problems found during the inspection.		

4. Using a service manual or other information source, locate a procedure for installing the intake manifold. Determine and include the intake manifold fastener torque and tightening sequence in the procedure. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, install the intake manifold.

FUEL AND EXHAUST SYSTEMS

5. Fill the radiator with coolant.

6. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine and allow it to reach normal operating temperature.

8. Inspect for coolant, fuel, or oil leaks. Repair any leaks.

9. Shut the engine off. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competencies K3 and K4. The final evaluations for K3 and K4 follow.

FINAL EVALUATION INSTRUCTIONS

I. Determine the student's final evaluation for Competency K3 by averaging the evaluations of JS2-L2-UIII and JS5-L2-UIII.

JS2-L2-UIII _____

JS5-L2-UIII _____

Final evaluation for Competency K3 _____

II. Determine the student's final evaluation for Competency K4 by averaging the evaluations of JS2-L2-UIII, JS3-L2-UIII, and JS5-L2-UIII.

JS2-L2-UIII _____

JS3-L2-UIII _____

JS5-L2-UIII _____

Final evaluation for Competency K4 _____

FUEL AND EXHAUST SYSTEMS

AS1-L1-UIV

NAME:

THE TERMS, HISTORY, AND ADVANTAGES OF ELECTRONIC FUEL INJECTION (EFI) SYSTEMS

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. Define the following terms.

Adaptive control —

Driveability —

Pintle —

2. What company began development of fuel injection technology?

When did domestic manufacturers such as Ford and General Motors begin introducing fuel injection systems?

3. List three advantages of electronic fuel injection systems.

The student must obtain a minimum score of ____ on AS1-L1-UIV in order to receive an evaluation for Competencies K1, K5, K6, and K7.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

AS1-L2-UIV

NAME:

TYPES OF ELECTRONIC FUEL INJECTION (EFI) SYSTEMS

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. What are the two major electronic fuel injection (EFI) groups?
2. List all the components of a throttle body injection system.
3. List the four ways that multiport fuel injection systems are classified.
4. What are the advantages of the airflow meter/mass airflow system?
5. In a continuous injection system, how is the air/fuel mixture controlled?

The student must obtain a minimum score of ____ on AS1-L2-UIV in order to receive an evaluation for Competencies K1, K5, K6, and K7.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

AS1-L3-UIV

NAME:

COMPONENTS OF ELECTRONIC FUEL INJECTION (EFI) SYSTEMS

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. Describe the purpose/function of each of the following.

Air filter —

CKP —

ECM —

Fuel accumulator —

Fuel injector —

Knock sensor —

Output actuators —

Oxygen sensor —

Supercharger/turbocharger —

Throttle body —

The student must obtain a minimum score of ____ on AS1-L3-UIV in order to receive an evaluation for Competencies K1, K5, K6, and K7.

FUEL AND EXHAUST SYSTEMS

JS1-L4-UIV

DIAGNOSE AND SERVICE COMPUTERIZED ENGINE CONTROL SYSTEMS

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for accessing diagnostic trouble codes. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, access the diagnostic trouble codes. Record the results in the following chart.

If no codes are present, give some examples of codes and their meanings.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

Diagnostic Trouble Code	Meaning

3. Using a service manual or other information source, locate the procedures for testing the components that are indicated by the diagnostic trouble codes. Include the procedures and specifications for testing the wiring continuity related to the components. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedures, perform the tests and record the results on a separate sheet of paper.

4. After testing is complete, use a separate sheet of paper to describe necessary repairs and/or replacements. Using a service manual or other information source, locate the procedures to perform the necessary repairs and/or replacements. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedures, perform the repairs and/or replacements.

Average of the above evaluations

This average is a partial evaluation for Competencies K5, K6, and K7. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV. The final evaluation for K7 is at the end of JS7-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS2-L4-UIV

DIAGNOSE AND SERVICE FUEL-RELATED SENSORS USING A DIGITAL MULTIMETER

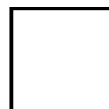
Equipment:

Digital multimeter
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the sensors on the following chart with a digital multimeter. Include the specifications for hertz, volts, ohms, etc. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedures, test the sensors with a digital multimeter. Record the results in the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

	Specification	Reading	Working Correctly? (Yes/No)	Initials
Crankshaft Position Sensor				
Hall Effect Sensor				
Engine Coolant Temperature Sensor				
Intake Air Temperature Sensor				
Throttle Position Sensor				
Frequency-Signal Type Manifold Absolute Pressure Sensor				
Simple-Voltage Type Manifold Absolute Pressure Sensor				
Frequency-Signal Type Mass Airflow Sensor				
Simple-Voltage Type Mass Airflow Sensor				
Knock Sensor				

3. Service malfunctioning sensors. After the service is complete, have the instructor check the following box to indicate approval of the service.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Average of the above evaluations

This average is a partial evaluation for Competencies K5, K6, and K7. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV. The final evaluation for K7 is at the end of JS7-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS3-L4-UIV

DIAGNOSE AND SERVICE FUEL-RELATED SENSORS USING A SCAN TOOL

Equipment:

Protective eyewear
Scan tool

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the sensors on the following chart using a scan tool. Include the specifications for hertz, volts, ohms, etc. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedures, test the sensors with a scan tool. Record the results in the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

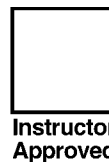
EVALUATION

ENGINE PERFORMANCE

	Specification	Reading	Working Correctly? (Yes/No)	Initials
Crankshaft Position Sensor				
Hall Effect Sensor				
Engine Coolant Temperature Sensor				
Intake Air Temperature Sensor				
Throttle Position Sensor				
Frequency-Signal Type Manifold Absolute Pressure Sensor				
Simple-Voltage Type Manifold Absolute Pressure Sensor				
Frequency-Signal Type Mass Airflow Sensor				
Simple-Voltage Type Mass Airflow Sensor				
Knock Sensor				

3. Service malfunctioning sensors. After the service is complete, have the instructor check the following box to indicate approval of the service.

Be certain that the instructor approves the procedure and checks this box.



Average of the above evaluations

This average is a partial evaluation for Competencies K5, K6, and K7. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV. The final evaluation for K7 is at the end of JS7-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS4-L4-UIV

DIAGNOSE AND SERVICE FUEL-RELATED SENSORS USING A LAB SCOPE

Equipment:

Lab scope
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the sensors on the following chart using a lab scope. Include the specifications for hertz, volts, ohms, etc. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedures, test the sensors with a lab scope. Record the results in the following chart.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

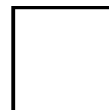
EVALUATION

ENGINE PERFORMANCE

	Specification	Reading	Working Correctly? (Yes/No)	Initials
Crankshaft Position Sensor				
Hall Effect Sensor				
Engine Coolant Temperature Sensor				
Intake Air Temperature Sensor				
Throttle Position Sensor				
Frequency-Signal Type Manifold Absolute Pressure Sensor				
Simple-Voltage Type Manifold Absolute Pressure Sensor				
Frequency-Signal Type Mass Airflow Sensor				
Simple-Voltage Type Mass Airflow Sensor				
Knock Sensor				

3. Service malfunctioning sensors. After the service is complete, have the instructor check the following box to indicate approval of the service. _____

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Average of the above evaluations _____

This average is a partial evaluation for Competencies K5, K6, and K7. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV. The final evaluation for K7 is at the end of JS7-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS5-L4-UIV

TEST AND SERVICE THE ELECTRONIC FUEL INJECTORS

Equipment:

Cleaner for electronic fuel injectors
Digital multimeter or noid
Hand tools
Lab scope or amperage probe
Ohmmeter
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for testing the voltage at each electronic fuel injector using a digital multimeter or noid. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, test the voltage at each electronic fuel injector using a digital multimeter or noid. Record the results in the following space.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

3. Using a service manual or other information source, locate a procedure for testing the electronic fuel injectors for short circuits, opens, and grounds using an ohmmeter. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, test the electronic fuel injectors for short circuits, open, and grounds using an ohmmeter. Record the results in the following space.

4. Using a service manual or other information source, locate a procedure for testing the operation of the electronic fuel injectors using a lab scope or amperage probe. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, test the operation of the electronic fuel injectors using a lab scope or amperage probe. Record the results in the following space.

FUEL AND EXHAUST SYSTEMS

5. Using a service manual or other information source, locate a procedure for testing electronic fuel injector balance on multiport fuel injection (MFI) systems. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

NOTE: This test can only be performed on MFI systems, but it will not work on all MFI systems. Consult the proper service manual before performing this test.

Using the procedure, test electronic fuel injection balance on MFI systems. Record the results in the following space.

6. Using a service manual or other information source, locate a procedure for cleaning the electronic fuel injectors. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, clean the electronic fuel injectors.

Average of the above evaluations

This average is a partial evaluation for Competencies K5 and K6. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS6-L4-UIV

TEST AND SERVICE THE IDLE AIR CONTROL SYSTEM

Equipment:

Hand tools
Protective eyewear
Scan tool
Test light

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate the procedures for testing the idle air control (IAC) components. Include the procedures for testing the electrical circuits and motor operation. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedures, test the IAC components. Record the results in the following space.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

3. Using a service manual or other information source, locate the procedures for servicing the IAC components. Include the procedures for testing the electrical circuits and motor operation. Make sure the procedures are appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedures.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedures, service the IAC components.

Average of the above evaluations

This average is a partial evaluation for Competencies K5 and K6. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS7-L4-UIV

ADJUST OR RESET THE MINIMUM IDLE SPEED

Equipment:

- Hand tools
- Protective eyewear
- Tachometer

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for adjusting or resetting the minimum idle speed. Include the minimum idle speed specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor Approved

Using the procedure, adjust or reset the minimum idle speed. Complete the following chart.

What is the proper minimum idle speed specification?	
Did the minimum idle speed meet the specification after adjusting or resetting?	

Average of the above evaluations

This average is a partial evaluation for Competencies K5 and K7. The final evaluation for K5 is at the end of JS10-L4-UIV. The final evaluation for K7 follows.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

FINAL EVALUATION INSTRUCTIONS

- I. Determine the student's final evaluation for Competency K7 by averaging the evaluations of JS2-L2-UIII, JS4-L2-UIII, JS1-L4-UIV, JS2-L4-UIV, JS3-L4-UIV, JS4-L4-UIV, and JS7-L4-UIV.

JS2-L2-UIII _____

JS4-L2-UIII _____

JS1-L4-UIV _____

JS2-L4-UIV _____

JS3-L4-UIV _____

JS4-L4-UIV _____

JS7-L4-UIV _____

Final evaluation for Competency K3 _____

FUEL AND EXHAUST SYSTEMS

JS8-L4-UIV

SERVICE A THROTTLE BODY FUEL INJECTOR

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the throttle body fuel injector. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the throttle body fuel injector.

CAUTION: Fuel-injected vehicles with electrical fuel pumps retain high pressure in the fuel system for long periods of time after the engine is shut off. Relieve the pressure before removing the fuel hoses.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

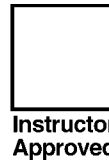
EVALUATION

3. Complete the following chart.

	OK	Not OK
Inspect the throttle body fuel injector for dirt or other contamination.		
Inspect the fuel meter cover and throttle body for damage or warpage.		

4. Using a service manual or other information source, locate a procedure for installing the throttle body fuel injector. Include the fastener torque specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Using the procedure, install the throttle body fuel injector.

- 5. With the key on and engine off, run the fuel pump to pressurize the fuel system.
- 6. Check the throttle body and fuel injector for fuel leaks. Repair any leaks.
- 7. Connect the exhaust ventilation equipment to the vehicle.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

- 8. Start the engine and check for the proper operation of the throttle body fuel injector.
- 9. Shut the engine off and disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competencies K5 and K6. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS9-L4-UIV

SERVICE A MULTIPOINT FUEL INJECTION SYSTEM FUEL RAIL AND FUEL INJECTOR(S)

Equipment:

Hand tools
Protective Eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the fuel rail and fuel injector(s) on a multipoint fuel injection (MFI) system. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the fuel rail and fuel injector(s) on a MFI system.

CAUTION: Fuel-injected vehicles with electrical fuel pumps retain high pressure in the fuel system for long periods of time after the engine is shut off. Relieve the pressure before removing the fuel hoses.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

3. Complete the following chart.

	OK	Not OK
Inspect the condition of the o-rings.		
Inspect the electrical connector for damage.		
Inspect the protective cap covering the nozzle and pintle valve.		

4. Using a service manual or other information source, locate a procedure for installing the fuel rail and fuel injector(s) on a MFI system. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, install the fuel rail and fuel injector(s) on a MFI system.

- 5. With the key on and engine off, run the fuel pump to pressurize the fuel system.
- 6. Start the engine. Check for fuel leaks. Repair any leaks.
- 7. Connect the exhaust ventilation equipment to the vehicle.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

- 8. Start the engine and check for proper operation of the fuel rail and fuel injector(s).
- 9. Shut the engine off and disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competencies K5 and K6. The final evaluations for K5 and K6 are at the end of JS10-L4-UIV.

FUEL AND EXHAUST SYSTEMS

JS10-L4-UIV

SERVICE THE THROTTLE BODY ON A MULTIPOINT FUEL INJECTION SYSTEM

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the throttle body on a multipoint fuel injection (MFI) system. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Instructor
Approved

Using the procedure, remove the throttle body on a MFI system.

CAUTION: Fuel-injected vehicles with electrical fuel pumps retain high pressure in the fuel system for long periods of time after the engine is shut off. Relieve the pressure before removing the fuel hoses.

3. Remove the old gasket. Clean the mating surfaces.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

- | | |
|---|-------|
| 4. Inspect the intake manifold bore for any loose parts or debris that may have fallen into the intake manifold. Record the results in the following space. | _____ |
| 5. Inspect the throttle body and throttle valve assembly for coking. Remove the idle air control and check for coking. Record the results in the following space. | _____ |
| 6. Test the throttle valve for binding. Record the results in the following space. | _____ |
| 7. Using the following procedure, clean the throttle body.

a. Using solvent and a small brush, clean both the front and behind areas of the throttle valve.

b. Clean the throttle valve and shaft.

c. Clean the idle air control (IAC) pintle and spring.

CAUTION: Do not submerge the IAC assembly in the solvent.

d. Using a small brush, clean the IAC passages.

e. Using compressed air, remove the particles and dry the throttle body. | _____ |

FUEL AND EXHAUST SYSTEMS

8. Using a service manual or other information source, locate a procedure for installing the throttle body. Include the necessary specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, install the throttle body.

9. With the key and engine off, press the accelerator to the floor and then release to check for binding in the accelerator.

10. Connect the exhaust ventilation equipment.

CAUTION: Use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

11. Start the engine and check engine operation.

12. Shut the engine off and disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competencies K5 and K6. The final evaluations for K5 and K6 follow.

FINAL EVALUATION INSTRUCTIONS

- I. Determine the student's final evaluation for Competency K5 by averaging the evaluations of JS1-L4-UIV, JS2-L4-UIV, JS3-L4-UIV, JS4-L4-UIV, JS5-L4-UIV, JS6-L4-UIV, JS7-L4-UIV, JS8-L4-UIV, JS9-L4-UIV, and JS10-L4-UIV.

JS1-L4-UIV _____

JS2-L4-UIV _____

JS3-L4-UIV _____

JS4-L4-UIV _____

JS5-L4-UIV _____

JS6-L4-UIV _____

JS7-L4-UIV _____

JS8-L4-UIV _____

JS9-L4-UIV _____

JS10-L4-UIV _____

Final evaluation for Competency K5 _____

FUEL AND EXHAUST SYSTEMS

- II. Determine the student's final evaluation for Competency K6 by averaging the evaluations of JS1-L4-UIV, JS2-L4-UIV, JS3-L4-UIV, JS4-L4-UIV, JS5-L4-UIV, JS6-L4-UIV, JS8-L4-UIV, JS9-L4-UIV, and JS10-L4-UIV.

JS1-L4-UIV _____

JS2-L4-UIV _____

JS3-L4-UIV _____

JS4-L4-UIV _____

JS5-L4-UIV _____

JS6-L4-UIV _____

JS8-L4-UIV _____

JS9-L4-UIV _____

JS10-L4-UIV _____

Final evaluation for Competency K6 _____

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS1-L5-UIV

TEST AND SERVICE THE INTAKE AIR CONTROL SYSTEM

Equipment:

Digital multimeter
Hand tools
Protective eyewear
Special tools as needed
Vacuum pump/gauge and adapters

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.

NOTE: Go to 2 to test the intake air control system vacuum-operated actuators. Go to 6 to test the intake air control system electrical actuators.

2. Using a service manual or other information source, locate a procedure for testing the intake air control system vacuum-operated actuators. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, test the intake air control system vacuum-operated actuators. Record the results in the following space.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

3. Using a service manual or other information source, locate a procedure for testing the intake air control system electrical actuators using a digital multimeter. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, test the intake air control system electrical actuators using a digital multimeter. Complete the following chart.

	OK	Not OK
Measure for the correct resistance.		
Test for the correct signal to each actuator with the engine running.		
Check the electrical connector for fit and/or corrosion.		

4. Inspect the intake air control valves. Complete the following chart.

	OK	Not OK
Inspect the movement. <i>*It may be necessary to remove the actuator or disassemble the intake manifold.</i>		
Inspect for buildup of carbon or fuel residue.		
Inspect the linkage between the actuators and the valves.		

FUEL AND EXHAUST SYSTEMS

5. Using a service manual or other information source, locate the procedures for servicing the components — the actuators, valves, and linkages — of the intake air control system. Include the fastener torque specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, service the components of the intake air control system.

6. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine and allow it to reach normal operating temperature.
8. Check the operation of the vehicle. Make sure engine performance is correct.
9. Shut the engine off and disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS2-L5-UIV

TEST THE TURBOCHARGER

Equipment:

Boost gauge
 Hoist
 Protective eyewear
 Vacuum/pressure gauge

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Visually inspect the turbocharger. Complete the following chart.

	OK	Not OK
Engine oil		
Air filter		
Hose between the air filter and center housing		
Hose between the center housing and throttle body		

3. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

4. Start the engine. Check for exhaust leaks. Record any leaks in the following space. _____
5. Using the following procedure, inspect and test the wastegate operation. _____
- a. Inspect the condition of the hose leading to the wastegate actuator. Record the results in the following space.

 - b. Test the wastegate operation. Record in the following space the pressure required to activate the wastegate. Compare the results to the proper specification.

 - c. Apply pressure to the wastegate actuator. Record the results in the following space. Compare the results to the proper specification.
6. Using the following procedure, perform a turbocharger boost test. _____
- a. Determine and record in the following space the maximum boost for the vehicle.

 - b. If the vehicle is not equipped with a boost gauge, connect a vacuum/pressure gauge.

FUEL AND EXHAUST SYSTEMS

c. Record in the following space whether a chassis dynamometer or road test is being used to test the boost.

d. Perform a boost test. Record the boost in the following space. Compare the results with the proper specification.

7. Based on the tests, record the condition of the turbocharger in the following space. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

ENGINE PERFORMANCE



FUEL AND EXHAUST SYSTEMS

JS3-L5-UIV

SERVICE THE TURBOCHARGER

Equipment:

Hand tools
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.

CAUTION: A turbocharger can become extremely hot. Take extra precaution to prevent burns.

2. Using a service manual or other information source, locate a procedure for removing the turbocharger. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, remove the turbocharger.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

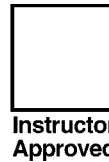
3. Inspect the turbocharger. Complete the following chart.

	Yes	No
Is the turbine wheel rubbing on the center housing?		
Is the wastegate arm moving freely?		
Is the wastegate valve closing properly?		
Is the discharge tube to the throttle body cracked? Does it have holes?		

4. Clean the gasket surfaces on the engine and turbocharger.

5. Using a service manual or other information source, locate a procedure for installing the turbocharger. Include the torque specifications. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Using the procedure, install the turbocharger. Tighten the fasteners to the specified torque.

6. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use the approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

7. Start the engine and allow it to reach normal operating temperature.

8. Top off the coolant level.

9. Check for exhaust leaks. Repair any exhaust leaks.

10. Test the turbocharger operation using the boost test procedure. See JS2-L5-UIV, 6 for the proper procedures.

FUEL AND EXHAUST SYSTEMS

11. Shut the engine off and disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS4-L5-UIV

TEST THE SUPERCHARGER

Equipment:

Boost pressure gauge
Hand tools
Protective eyewear
Scan tool
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for measuring boost pressure on a supercharger. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box before continuing.



**Instructor
Approved**

Using the procedure, measure the boost pressure on a supercharger. Record the results in the following space.

3. Check the operation of the bypass actuator. Record the results in the following space.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

4. Test the supercharger operation using a scan tool.
- a. Connect the scan tool.
 - b. Check for diagnostic trouble codes (DTCs). Record any DTCs in the following space.

 - c. Test the operation of the sensors and actuators. Record the results in the following space.

5. Based on the tests, record the condition of the supercharger in the following space.

Average of the above evaluations

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

FUEL AND EXHAUST SYSTEMS

JS5-L5-UIV

SERVICE THE SUPERCHARGER

Equipment:

Boost pressure gauge
Hand tools
Protective eyewear
Scan tool
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the supercharger. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box before continuing.

Instructor
Approved

Using the procedure, remove the supercharger.

3. Using a service manual or other information source, locate a procedure for repairing the supercharger. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, repair the supercharger.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

4. Using a service manual or other information source, locate a procedure for installing the supercharger. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

**Instructor
Approved**

Using the procedure, install the supercharger.

Average of the above evaluations

This average is a partial evaluation for Competency K1. The final evaluation for Competency K1 is at the end of JS3-L6-UIV.

FUEL AND EXHAUST SYSTEMS

JS1-L6-UIV

DIAGNOSE ELECTRONIC FUEL INJECTION SYSTEM DRIVEABILITY CONCERNS/SYMPTOMS

Equipment:

Hand tools
Protective eyewear
Testing equipment

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using the standard terms, determine the concern/symptom by communicating with the vehicle owner or service personnel. Record the concern/symptom and the possible condition and cause in the following space.
3. Duplicate the circumstances that cause the concern/symptom.
4. Identify the condition. Consider all the possible causes of each concern/symptom. Record the condition in the following space.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

5. Using the following procedure, perform a visual inspection of the electronic fuel injection (EFI) system.
- a. Inspect the fuel lines and hoses for leaks, crimping, deterioration, etc.
 - b. Check the wire connectors for a snug fit.
 - c. Check the condition of the vacuum hoses.
 - d. Inspect the air filter by placing a light on one side of the air filter element. Check to see if light is coming through the air filter.
 - e. Check the condition of the air induction system.
 - f. Inspect the emission control system devices for proper installation and operation.
 - g. Check the coolant condition and level.
 - h. Record the results of the visual inspection of the EFI system in the following space.
6. Using the visual inspection information, identify the symptoms related to the condition. Determine what diagnostic tests are needed. Record the symptoms and diagnostic tests in the following space.

FUEL AND EXHAUST SYSTEMS

7. Using a service manual or other information source, locate the procedures for performing the necessary diagnostic tests listed in 6. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedures, perform the necessary diagnostic tests. Record the results in the following space.

8. Interpret the test results. Record the interpretations in the following space.

9. Isolate the root cause of the symptom. Record the root cause in the following space.

10. Using a service manual or other information source, locate a procedure for servicing the root cause of the symptom listed in 9. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, service the root cause of the symptom.

11. Test for the original concern/symptom.

NOTE: Be sure to look for any new symptoms that could have been caused by secondary malfunctions or mistakes during service.

Average of the above evaluations

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

FUEL AND EXHAUST SYSTEMS

JS2-L6-UIV

DIAGNOSE DRIVEABILITY CONCERNS/SYMPTOMS USING ON-BOARD DIAGNOSTICS

Equipment:

Hand tools
Protective eyewear
Scan tool

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Determine if the system uses on-board diagnostics generation one (OBD I) or on-board diagnostics generation two (OBD II).
3. Connect the scan tool to the data link connector (DLC).
4. Check the digital reading for stored diagnostic trouble codes (DTC). Record any DTCs in the following space.

NOTE: On an OBD II system, check for stored snap shot information.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

5. Use the data stream to check the sensor output and actuator operation that relates to the DTCs or driveability concerns. Record in the following space abnormal readings that could be related to the concerns.

a. Check the fuel trim. Record the reading in the following space.

b. Check the oxygen sensor. Record the reading in the following space.

6. Using a service manual or other information source, locate the procedures for performing the necessary repair(s) to solve the driveability concern/symptom. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, perform the necessary repair(s).

7. Connect the scan tool to the DLC.

8. Check that the repair(s) has fixed the concern/symptom. Check to see if any new problems were created.

Average of the above evaluations

This average is a partial evaluation for Competency K1. The final evaluation for K1 is at the end of JS3-L6-UIV.

FUEL AND EXHAUST SYSTEMS

JS3-L6-UIV

DIAGNOSE DRIVEABILITY CONCERNS/SYMPTOMS USING AN EXHAUST GAS ANALYZER

Equipment:

Exhaust gas analyzer
Hand tools
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Connect the exhaust gas analyzer by sliding the probe into the tail pipe. Turn on the exhaust gas analyzer.

NOTE: Some exhaust gas analyzers require a few minutes to warm-up before the vehicle can be started and the reading taken.

NOTE: It may be necessary to block the source of air to the catalytic converter.

3. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use the approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

4. Start the engine and allow it to reach normal operating temperature.
5. Check the exhaust gas analyzer reading. Compare the reading to the proper specification. Record the results in the following space.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

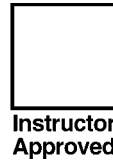
6. Shut the engine off and disconnect the exhaust gas analyzer. _____

7. Determine and record in the following space any possible causes for an abnormal reading. _____

8. Conduct any necessary additional tests to locate the source of the concern/symptom. _____

9. Using a service manual or other information source, locate the procedures for servicing the components or systems that are causing the concern/symptom. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure. _____

Be certain that the instructor approves the procedure and checks this box.



Using the procedures, service the components or systems that are causing the concern/symptom.

10. Repeat steps 2 through 6 to be sure the concern/symptom has been fixed. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency K1. The final evaluation for K1 follows.

FUEL AND EXHAUST SYSTEMS

FINAL EVALUATION INSTRUCTIONS

- I. Determine the student's final evaluation for Competency K1 by averaging the evaluations of JS1-L2-UIII, JS1-L5-UIV, JS2-L5-UIV, JS3-L5-UIV, JS4-L5-UIV, JS5-L5-UIV, JS1-L6-UIV, JS2-L6-UIV, and JS3-L6-UIV.

JS1-L2-UIII _____

JS1-L5-UIV _____

JS2-L5-UIV _____

JS3-L5-UIV _____

JS4-L5-UIV _____

JS5-L5-UIV _____

JS1-L6-UIV _____

JS2-L6-UIV _____

JS3-L6-UIV _____

Final evaluation for Competency K1 _____

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

AS1-L1-UV

NAME:

EXHAUST SYSTEMS

DATE:

Directions — Answer the following questions by writing all responses on this sheet.

1. What is the purpose of the exhaust system?

2. Describe the function of the following exhaust system components.

Catalytic converter —

Exhaust pipe —

Resonator —

Tail pipe —

The student must obtain a minimum score of ____ on AS1-L1-UV in order to receive an evaluation for Competency K8.

ENGINE PERFORMANCE

FUEL AND EXHAUST SYSTEMS

JS1-L2-UV

INSPECT THE EXHAUST SYSTEM

Equipment:

Hoist
Protective eyewear

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Place the vehicle securely on safety stands or lift with a hoist.
3. Inspect the condition of the exhaust system. Complete the following chart.

	OK	Not OK
Exhaust pipe		
Intermediate pipe		
Tail pipe		
Muffler		
Catalytic converter		
Resonator		

4. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

ENGINE PERFORMANCE

5. Start the engine. Check for exhaust leaks. In the following space, note any exhaust leaks. _____

6. Shut the engine off. Disconnect the exhaust ventilation equipment. _____

7. In the following space, describe the condition of the vehicle based on the inspection. _____

8. Lower the vehicle. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency K8. The final evaluation for K8 is at the end of JS4-L2-UV.

FUEL AND EXHAUST SYSTEMS

JS2-L2-UV

TEST THE EXHAUST SYSTEM BACK PRESSURE

Equipment:

Back pressure gauge
Hand tools
Protective eyewear
Tachometer
Vacuum gauge

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Determine if the vehicle has a loss of power, poor fuel economy, an overheating engine, or engine knock.
3. Using the following procedure, test the exhaust system back pressure using a vacuum gauge.
 - a. Connect a vacuum gauge and tachometer.
 - b. Start the engine and allow it to stabilize.
 - c. Check and record in the following space the vacuum reading.
 - d. Increase the engine speed to 2500 rpm and allow it to stabilize.
 - e. Check and record in the following space the vacuum reading.
 - f. Compare the vacuum reading to the proper specification.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

4. Using the following procedure, test the exhaust system using a back pressure gauge. _____
- a. Remove the oxygen sensor.
NOTE: On systems with more than one oxygen sensor, remove the one that is closest to the engine.
 - b. Connect the exhaust back pressure gauge and a tachometer.
 - c. Start the engine and allow it to stabilize.
 - d. Check and record in the following space the back pressure readings.

 - e. Increase the engine speed to 2500 rpm and allow it to stabilize.
 - f. Check and record in the following space the back pressure readings.

 - g. Compare the readings to the proper specification.
5. Based on the exhaust system back pressure tests, is the exhaust system restricted? If the exhaust system is restricted, identify the supporting reasons and/or signs. _____

Average of the above evaluations _____

This average is a partial evaluation for Competency K8. The final evaluation for K8 is at the end of JS4-L2-UV.

FUEL AND EXHAUST SYSTEMS

JS3-L2-UV

SERVICE THE EXHAUST SYSTEM COMPONENTS

Equipment:

Hand tools
Hoist
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Place the vehicle securely on safety stands or lift with a hoist.
3. Using a service manual or other information source, locate a procedure for removing the defective exhaust component(s). Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, remove the defective exhaust system component(s).

4. Inspect the condition of the hangers, heat shields, and other components. List the defective parts in the following space.
5. Replace the defective hangers, heat shields, and other components.

NAME(s):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

VIN:

EVALUATION

6. Using a service manual or other information source, locate a procedure for installing the exhaust component(s). Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



**Instructor
Approved**

Using the procedure, install the exhaust system component(s).

NOTE: Check the exhaust system for proper alignment. Make sure that no components are misaligned and/or making contact with the vehicle frame or body.

7. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

8. Start the engine. Check for exhaust leaks. Repair any exhaust leaks.
9. Shut the engine off. Disconnect the exhaust ventilation equipment.
10. Lower the vehicle.

Average of the above evaluations

This average is a partial evaluation for Competency K8. The final evaluation for K8 is at the end of JS4-L2-UV.

FUEL AND EXHAUST SYSTEMS

JS4-L2-UV

SERVICE THE EXHAUST MANIFOLD

Equipment:

Hand tools
Hoist
Protective eyewear
Special tools as needed

Procedure:

1. Wear protective eyewear while performing the procedures on this job sheet.
2. Using a service manual or other information source, locate a procedure for removing the exhaust manifold. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, remove the exhaust manifold

3. Using a service manual or other information source, locate a procedure for inspecting and cleaning the exhaust manifold. Include the procedure for checking the exhaust manifold for warpage. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.

Instructor
Approved

Using the procedure, inspect and clean the exhaust manifold.

NAME(S):

DATE:

MODEL OF CAR:

MAKE OF CAR:

YEAR OF CAR:

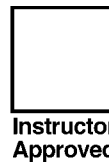
VIN:

EVALUATION

Record the observations from the inspection in the following space. Make sure to include if the exhaust manifold is cracked or warped.

4. Using a service manual or other information source, locate a procedure for installing the exhaust manifold. Include the proper tightening sequence and fastener torque. Make sure the procedure is appropriate for the make and model of the vehicle. Have the instructor check the following box to indicate approval of the procedure.

Be certain that the instructor approves the procedure and checks this box.



Using the procedure, install the exhaust manifold. Tighten the fasteners in the proper sequence and to the specified torque.

5. Connect the exhaust ventilation equipment.

CAUTION: Be sure to use approved exhaust ventilation equipment when operating a vehicle in an enclosed area.

6. Start the engine. Check for exhaust leaks. Repair any exhaust leaks.
7. Shut the engine off. Disconnect the exhaust ventilation equipment.

Average of the above evaluations

This average is a partial evaluation for Competency K8. The final evaluation for K8 follows.

FUEL AND EXHAUST SYSTEMS

FINAL EVALUATION INSTRUCTIONS

- I. Determine the student's final evaluation for Competency K8 by averaging the evaluations of JS1-L2-UV, JS2-L2-UV, JS3-L2-UV, and JS4-L2-UV.

JS1-L2-UV _____

JS2-L2-UV _____

JS3-L2-UV _____

JS4-L2-UV _____

Final evaluation for Competency K8 _____

ENGINE PERFORMANCE
