

## Engine Mechanical Testing

### Student/intern information:

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

### Vehicle used for this activity:

Year \_\_\_\_\_ Make \_\_\_\_\_ Model \_\_\_\_\_

Odometer \_\_\_\_\_ VIN \_\_\_\_\_

Learning Objective/Task	CDX Tasksheet Number	2008 NATEF Reference Number	2008 NATEF Priority Level
• Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.	C004	1A5	P-1
• Perform cranking sound diagnosis.	N/A	N/A	N/A
• Perform engine vacuum tests; determine necessary action.	C007	1A8	P-1
• Perform cylinder power balance tests; determine necessary action.	C715	1A9	P-2
• Perform cylinder cranking and running compression tests; determine necessary action.	C716	1A10	P-1
• Perform cylinder leakage tests; determine necessary action.	C717	1A11	P-1
• Diagnose engine noises and vibrations; determine necessary action.	C005	1A6	P-2
• Diagnose the cause of excessive oil consumption, coolant consumption, and unusual engine exhaust color and odor; determine necessary action.	C670	1A7	P-2

Time off \_\_\_\_\_

Time on \_\_\_\_\_

Total time \_\_\_\_\_

### Recommended Resource Materials

- CDX Automotive program
- Technical service bulletins, shop manuals, and any other information applicable to the specific vehicle or components you are working on
- Class notes

### Materials Required

- Vehicle or simulator
- Vacuum gauge
- Tachometer (hand-held if the vehicle is not equipped with an in-dash tachometer)
- Insulated spark plug wire pliers (if using this method to disable the cylinders)
- Scan tool (if using this method to disable the cylinders)
- Compression tester
- Cylinder leakage tester
- Stethoscope
- Flashlight

### Some Safety Issues to Consider

- You will be working under the hood of a running vehicle. Keep your hands and fingers away from moving belts, fans, and other parts.
- Be sure to only disconnect the proper vacuum hose. Many other hoses look alike but could carry gasoline or hot coolant under high pressure.
- During this test, you may be disabling the ignition or fuel systems. Be sure you only do so for the minimum amount of time to get your readings. Operating the engine with cylinders disabled may lead to damage of the catalytic converter or other parts. If in doubt, ask your supervisor/instructor.
- If you disable the cylinders by disconnecting the spark plug wires, you may expose yourself to extremely high voltage (up to 100,000 volts). Reduce the possibility of electrical shock by using appropriate insulated spark plug wire pliers.

- When running any vehicles in the shop, make sure you use the shop's exhaust ventilation system to discharge all exhaust gas safely outside.
- Always follow your supervisor/instructor's directions on how to get the piston to top dead center. Failure to do so could cause injury or damage to the vehicle.
- Use caution when turning the engine to top dead center. If you do this by hand, be sure your fingers, hands, etc. stay clear of belts and pulleys that could cause severe pinching.
- Make sure the ignition switch is in the "off" position and the key is removed from the ignition switch during this job to prevent someone from inadvertently cranking the engine over while you are working on it.
- Always wear the correct protective eyewear and clothing and use the appropriate safety equipment, as well as fender covers, seat protectors, and floor mat protectors.
- Make sure you understand and observe all legislative and personal safety procedures when carrying out practical assignments. If you are unsure of what these are, ask your supervisor/instructor.

### Performance Standard

**0–No exposure:** No information or practice provided during the program; complete training required

**1–Exposure only:** General information provided with no practice time; close supervision needed; additional training required

**2–Limited practice:** Has practiced job during training program; additional training required to develop skill

**3–Moderately skilled:** Has performed job independently during training program; limited additional training may be required

**4–Skilled:** Can perform job independently with no additional training

**▶ TASK** Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

C004 1A5

**NOTE ▶** If the vehicle's engine assembly is coated with leaking fluids and road dirt, you may need to pressure wash the engine before inspecting it for leaks. Some very small leaks, or leaks on engines that have a lot of accumulated residue, may be diagnosed with the use of a fluorescent dye and ultraviolet light. Check with your supervisor/instructor about which procedure to perform. Follow the dye check equipment manufacturer's instructions if you are performing this test.

1. Check for leaks under the hood and under the vehicle.
2. Safely raise the vehicle onto a hoist.
3. Inspect the engine, cooling system, fuel system, transmission/transaxle, and any differentials for leaks.

**NOTE ▶** Fluid leaks can be hard to locate. Remember that gravity tends to pull any leaking fluid down. You will need to identify the highest point of the leak to locate its source. Fluids can also be flung from rotating parts, sprayed under pressure from pin hole leaks, or blown by airflow far from the source. Investigate carefully.

4. Identify the type of fluid leaking and the source of the leak for the following items.
  - a. Engine:

- b. Fuel system:

c. Cooling system:

d. Transmission/transaxle:

e. Steering system:

f. Differentials:

5. Determine any necessary action/s:

6. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**

**CDX Tasksheet Number: C004**

**2008 NATEF Reference Number: 1A5**



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

Total time \_\_\_\_\_  
 Time on \_\_\_\_\_  
 Time off \_\_\_\_\_

**▶ TASK** Perform cranking sound diagnosis.

1. Disable the ignition or fuel system so that the engine will crank, but not start.

**NOTE ▶** Some vehicles can be put into “clear flood” mode by depressing the throttle to the floor before turning the ignition key to the “run” position. This prevents the fuel injectors from being activated. If your vehicle is equipped with this mode, hold the throttle down to the floor and try cranking the engine over (make sure you are prepared to turn off the ignition switch if the engine starts).

2. Crank the engine over for approximately 5 seconds and listen to the cranking sound.

**NOTE ▶** The engine should crank over at a normal speed. Too fast could mean low compression caused by bent valves or a slipped timing belt or chain. Too slow could mean a seized piston or bearing, or a faulty starting system. An uneven cranking sound may indicate grossly uneven compression pressures in the cylinders.

3. List your observation/s:

4. Determine any necessary action/s:

5. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

Total time \_\_\_\_\_  
 Time on \_\_\_\_\_  
 Time off \_\_\_\_\_

**▶ TASK** Perform engine vacuum tests; determine necessary action.

**C007 1A8**

1. Find an appropriate vacuum hose to connect into.

**NOTE ▶** Make sure the vacuum hose is connected to the intake manifold vacuum and you are not disconnecting anything that will affect the operation of the engine. If possible, the use of a vacuum tee will allow you to take the reading while allowing the vacuum to get to its intended device.

**Running vacuum test:**

2. Describe the purpose of this test, the components or functions this test checks, and what the results might indicate:
  
3. Start the engine, allow it to idle, and note the vacuum reading: \_\_\_\_\_
  - a. Is the vacuum gauge needle relatively steady? **Yes/No** (Circle one)
4. Carefully raise the engine RPM to 2,000 RPM and note the vacuum reading: \_\_\_\_\_
  - a. Is the vacuum gauge needle relatively steady? **Yes/No** (Circle one)
5. Determine any necessary action/s:
  
6. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**

CDX Tasksheet Number: C007

2008 NATEF Reference Number: 1A8



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

**▶ TASK** Perform cylinder power balance tests; determine necessary action.

C715 1A9

1. Research the best option for disabling the cylinders on this vehicle in the appropriate service manual. The following list contains the most common methods. Circle the one that you plan on using.
  - a. Disconnect individual spark plug wires or ignition coils.
  - b. Disconnect individual fuel injectors (multi-port fuel injection only).
  - c. Use a diagnostic scope to disable cylinders through the ignition primary circuit.
  - d. Use a scan tool on vehicles with power balance capabilities.
  - e. Use a vacuum hose and test light (option for waste spark ignition systems).
2. Determine from the service manual if this vehicle has an idle control system. If it does, list how to best disable the system during this test:

Time off \_\_\_\_\_

Time on \_\_\_\_\_

Total time \_\_\_\_\_

3. Have your supervisor/instructor check the above answers and initial below if correct.
  - a. Supervisor/instructor's initials: \_\_\_\_\_
4. If this vehicle is equipped with an idle control system, disable it and set the idle speed to an appropriate RPM.
  - a. List the RPM here: \_\_\_\_\_

5. Disable the cylinders one at a time and record the RPM drop (not the RPM) of each cylinder.
  - a. RPM drop: \_\_\_\_\_
6. Determine any necessary action/s:

7. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**

CDX Tasksheet Number: C715

2008 NATEF Reference Number: 1A9



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

**► TASK** Perform cylinder cranking and running compression tests; determine necessary action.

C716 1A10

1. Research the procedure and specifications for performing both a cranking compression test and a running compression test on this vehicle in the appropriate service manual.
2. List the conditions that must be met for the tests to be accurate (you may paraphrase):

3. Specifications
  - a. Minimum compression pressure: \_\_\_\_\_ psi/kPa or %
  - b. Maximum variation: \_\_\_\_\_ %

**Cranking compression test:**

4. Perform the cranking compression test following the service manual procedure. The top row in the table below is a standard test and the bottom row is a wet test using a small amount of clean engine oil. List the readings obtained for each cylinder in the table.

Cylinder	#1	#2	#3	#4	#5	#6	#7	#8
Standard test (psi/kPa)								
Wet test (psi/kPa)								

- a. Calculate the difference between the highest and lowest cylinders (dry test): \_\_\_\_\_ %

**Running compression test:**

- Perform the running compression test following the service manual procedure. List the readings obtained for each cylinder:

**NOTE** ▶ Make sure the person snapping the throttle open is ready to turn off the ignition switch if the throttle sticks open.

Cylinder	#1	#2	#3	#4	#5	#6	#7	#8
Idle (psi/kPa)								
Snap throttle (psi/kPa)								

- Determine any necessary action/s:

- Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**

CDX Tasksheet Number: C716

2008 NATEF Reference Number: 1A10



Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

**▶ TASK** Perform cylinder leakage tests; determine necessary action.

C717 1A11

- List all of the possible places where compression can leak out of a cylinder:

Time off \_\_\_\_\_

Time on \_\_\_\_\_

Total time \_\_\_\_\_

- Remove the appropriate spark plugs to test the cylinder with the lowest compression pressure.
- Bring that piston up to top dead center on the compression stroke and install the cylinder leakage tester. List the reading you obtained.
  - Cylinder #: \_\_\_\_\_
  - Cylinder leakage: \_\_\_\_\_ %
  - Leaking from: \_\_\_\_\_

4. Perform this test on one other cylinder. List the reading you obtained. Before removing the cylinder leakage tester, call your supervisor/instructor over to verify the reading.
  - a. Cylinder #: \_\_\_\_\_
  - b. Cylinder leakage: \_\_\_\_\_ %
  - c. Leaking from: \_\_\_\_\_
5. Determine any necessary action/s: \_\_\_\_\_
  
6. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

Performance Rating

CDX Tasksheet Number: C717

2008 NATEF Reference Number: 1A11



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

Total time

Time on

Time off

**TASK** Diagnose engine noises and vibrations; determine necessary action.

C005 1A6

Vehicle used for this activity:

Year \_\_\_\_\_ Make \_\_\_\_\_ Model \_\_\_\_\_

Odometer \_\_\_\_\_ VIN \_\_\_\_\_

1. Ask your instructor to assign you a vehicle with an engine noise or vibration concern. List the customer concern:
2. Research possible causes of the concern for this vehicle in the appropriate service manual.
  - a. List any possible causes:



b. List any specified tests to pinpoint the problem:

3. With your supervisor/instructor's permission, operate the vehicle to verify the concern. List your observations:

4. Follow the service manual procedure to diagnose the concern. List your tests and results here:

5. Determine any necessary action/s:

6. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**

**CDX Tasksheet Number: C005**

**2008 NATEF Reference Number: 1A6**



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

Total time \_\_\_\_\_

Time on \_\_\_\_\_

Time off \_\_\_\_\_

► **TASK** Diagnose the cause of excessive oil consumption, coolant consumption, and unusual engine exhaust color and odor; determine necessary action.

C670 1A7

**Vehicle used for this activity:**

Year \_\_\_\_\_ Make \_\_\_\_\_ Model \_\_\_\_\_

Odometer \_\_\_\_\_ VIN \_\_\_\_\_

1. Ask your instructor to assign you a vehicle with an excessive oil consumption, coolant consumption, or unusual exhaust color/odor concern. List the customer concern:
  - a. List any possible causes:
  
  
  
  
  
  
  
  
  
  
  - b. List any specified tests to pinpoint the problem:
  
  
  
  
  
  
  
  
  
  
3. With your supervisor/instructor's permission, operate the vehicle to verify the concern. List your observations:
  
  
  
  
  
  
  
  
  
  
4. Follow the service manual procedure to diagnose the concern. List your tests and results here:

5. Determine any necessary action/s:

6. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

**Performance Rating**

**CDX Tasksheet Number: C670**

**2008 NATEF Reference Number: 1A7**



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Supervisor/instructor signature \_\_\_\_\_ Date \_\_\_\_\_

