

Cooling System 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
• Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.	C399	8A15	P-1
• Verify engine operating temperature; determine necessary action.	C398	8A14	P-1
• Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.	C450	8F4	P-1
• Remove and replace thermostat and gasket/seal.	C845	8F3	P-1

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
- Cooling system pressure tester
- Anti-freeze hydrometer (or refractometer)
- ph test strip or ph tester
- Infrared temperature gun
- DVOM
- Drain pan
- Gasket scraper

Some Safety Issues to Consider

- Open the radiator cap (or any other part of the cooling system) only with the engine cold. Opening a radiator cap on a warm or hot engine could cause severe burns.
- Electric fans can turn on at any time. Keep your hands and fingers away.
- 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 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

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Total time _____

Time on _____

Time off _____

▶ TASK Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.

C399 8A15

1. Research the following specifications for this vehicle in the appropriate service manual.
 - a. Radiator cap pressure rating: _____ psi/kPa
 - b. Cooling system capacity: _____ qt/l
 - c. Type of anti-freeze _____
2. Cooling system pressure test
 - a. If the vehicle is cold or cool, and the engine is not running, remove the radiator cap. Top off the radiator with the correct type of anti-freeze/water mix if it is not already full. Install the proper adapter on the cooling system access point. Pressurize the cooling system only to the specified radiator cap pressure listed above. Make sure you leave the system pressurized for a minimum of 10 minutes while you inspect for coolant leaks.

NOTE ▶ Don't forget to check the heater core and the core plugs.

- b. List any leaks found and any necessary actions:
 - c. Remove the pressure tester from the radiator. Fit the proper adapter on the tester so you can check the radiator cap. Pressure test the cap and check it for the following:
 - i. At what pressure does it vent? _____ psi/kPa
 - ii. What pressure does it hold? _____ psi/kPa
 - iii. Determine any necessary action/s:
3. Check coolant condition
 - a. Use an anti-freeze hydrometer or refractometer to test the coolant's freezing and boiling points:
 - i. Freezing point: _____ °F/°C
 - ii. Boiling point: _____ °F/°C
 - b. Use a ph test strip or a ph tester to determine the ph balance of the anti-freeze:
 - i. ph reading: _____
 - ii. Determine any necessary action/s:
4. Inspect the radiator, recovery tank, and hoses.
 - a. Inspect all of these parts for damage, broken, or missing pieces and list your findings and any necessary action/s:
5. Test the radiator (on a vehicle where the radiator core is accessible).
 - a. Reinstall the radiator cap on the radiator. Place the exhaust hose over the vehicle's exhaust pipe/s. Start the vehicle and allow the engine to warm up.

- b. Use the infrared temperature gun to measure the temperature across the radiator core. The temperature should show a steady cooling reading as you trace the core tubes from the hot side of the radiator to the cool side. Any tubes that are significantly cooler than the others indicate a plugged tube in the radiator.
- c. List your observations and 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: C399

2008 NATEF Reference Number: 8A15



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Supervisor/instructor signature _____ Date _____

TASK Verify engine operating temperature; determine necessary action.

C398 8A14

1. Research the following specifications in either the service manual or a parts manual.
 - a. Thermostat opening temperature: _____ °F/°C
 - b. Temperature at which the electric fan comes on (if equipped): _____ °F/°C
 - c. Temperature at which the fan clutch engages (on) (if equipped): _____ °F/°C
2. Apply the vehicle's parking brake and secure the vehicle with wheel chocks to prevent the vehicle from rolling.
3. Start the vehicle. Allow the vehicle to warm up while monitoring the engine temperature with the temp gun. Find the spot where the highest temperature reading is found on the engine side of the thermostat housing (on most engines). Monitor the temperature at that spot.

Time off _____

Time on _____

Total time _____

NOTE ▶ The temperature should rise to between the thermostat opening temperature and the electric (or clutch) fan "on" temperature (if equipped). If this happens, continue to the next step. If this doesn't happen, diagnose the problem and go to step 5 below.

- a. If the engine is equipped with an **electric fan**, the temperature should vary between the electric fan "on" temperature and the electric fan "off" temperature. Record these temperatures:
 - i. Electric fan "on" temp: _____ °F/°C
 - ii. Electric fan "off" temp: _____ °F/°C
- b. If the engine is equipped with a **clutch fan**, the temperature should rise above the thermostat opening temperature but not above the clutch fan engagement temperature. Record these two temperatures:
 - i. Clutch fan "engaged" temp: _____ °F/°C
 - ii. Clutch fan "disengaged" temp: _____ °F/°C
- c. If the engine is equipped with a **mechanical fan without a clutch**, the temperature should rise to, or slightly above, the thermostat opening temperature and should remain fairly steady. Record this operating temperature:
 - i. Engine operating temperature: _____ °F/°C
4. If the engine did not reach the thermostat opening temperature, list the temperature that it did reach: _____ °F/°C
5. Determine any necessary action/s:

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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: C398

2008 NATEF Reference Number: 8A14



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Supervisor/instructor signature _____ Date _____

TASK Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

C450 8F4

1. Mechanical fans

- a. Research the fan inspection and testing procedure for this vehicle in the appropriate service manual.
- b. List the inspection and testing procedure for the fan system (or print out the procedure and attach it to this worksheet):

- c. Visually inspect the fan and fan clutch for damage or wear and list your observations:

- d. Test the fan clutch according to the service manual procedure and list your observations:

- e. Determine any necessary action/s:

2. Electric fans

- a. Research the fan inspection and testing procedure for this vehicle in the appropriate service manual.
- b. List the inspection and testing procedure for the fan system (or print out the procedure and attach it to this worksheet):

- c. List the temperature at which the electric fan should turn on: _____ °F/°C

- d. Visually inspect the fan for damage or wear and list your observations:

- e. Test the fan system according to the service manual procedure and list your observations:

f. Determine any necessary action/s:

3. Fan shroud/ducting and air dam

a. Visually inspect the fan shroud/ducting and air dam for any damage, missing parts, or wear and list your observations:

b. Determine any necessary action/s:

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

Performance Rating

CDX Tasksheet Number: C450

2008 NATEF Reference Number: 8F4



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Supervisor/instructor signature _____ Date _____

TASK Remove and replace thermostat and gasket/seal.

C845 8F3

1. Research the thermostat replacement procedure for this vehicle in the appropriate service manual.
 - a. List any special procedures and/or tools to perform this task:

2. Look up the flat rate time for this task in a flat rate manual.
 - a. Flat rate time for this task: _____ hr
3. Drain enough coolant out of the radiator to lower the level below the thermostat. Save this to put back in the radiator when the task is finished. Keep it free of dirt and debris.
4. Follow the manufacturer's procedure to remove the thermostat.
 - a. Have your supervisor/instructor verify removal and initial here: _____
5. Carefully scrape off the entire old gasket and residue from the thermostat housing and mating surface, being careful not to gouge it.
6. Install a new thermostat and gasket (or reinstall the old one if your supervisor/instructor directed you to do so).

Time off _____
Time on _____
Total time _____

NOTE ▶ Be careful when bolting down the thermostat housing. Make sure the thermostat is still in its recessed groove. Failure to do so will result in a broken housing and damaged thermostat. If in doubt, ask your supervisor/instructor.

7. Once the thermostat is installed, return the drained anti-freeze to the radiator.
8. Apply the vehicle's parking brake and secure the vehicle with wheel chocks to prevent the vehicle from rolling. Place the exhaust hose over the exhaust pipe/s.

9. Start the vehicle and check for any leaks or overheating. Immediately shut off the vehicle if a leak or overheating is found. Repair any leaks, or determine reason for overheating, if present.

NOTE ▶ Ask your supervisor/instructor whether or not to perform the next action before proceeding.

10. Test the old thermostat in a pan of boiling water to see when it opens. Suspend the thermostat in a pan of heating water using a piece of wire. Do not allow the thermostat to touch the side or bottom of the pan, but fully immerse it in water.
- List the temperature at which the thermostat started to open: _____ °F/°C
 - List the temperature at which the thermostat was fully open: _____ °F/°C
 - How far did the thermostat open? _____ in/mm
 - Did the thermostat operate according to specifications? **Yes/No** (Circle one)
11. Return the vehicle to its beginning condition and return any tools you used to their proper locations.
12. Have your supervisor/instructor verify satisfactory completion of this procedure, any observations found, and any necessary action/s recommended.

Performance Rating

CDX Tasksheet Number: C845

2008 NATEF Reference Number: 8F3



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Supervisor/instructor signature _____ Date _____