ASE 1 - Engine Repair

Module 7
General Engine Diagnosis

Instructor Guide

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Introduction

After completing this unit, the technician will demonstrate an understanding of general engine diagnosis. The technician will also demonstrate the skills required to troubleshoot general engine diagnosis and general engine customer concerns.

Objectives

NATEF Area A1

A. General Engine Diagnosis; Removal and Reinstallation (R & R)

1. Identify and interpret engine concern; determine necessary action.
2. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins.
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
5. Diagnose engine noises and vibrations; determine necessary action.
6. Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action.
7. Perform engine vacuum tests; determine necessary action.
8. Perform cylinder power balance tests; determine necessary action.
9. Perform cylinder compression tests; determine necessary action.
10. Perform cylinder leakage tests; determine necessary action.

Engine Repair

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform oil pressure tests; determine necessary action.

STC Tasks:

A. Engine Mechanical Diagnosis and Testing

1. Describe the process for conducting a compression test
2. Describe the process for conducting an engine vacuum test
3. Describe the cylinder leakage test
4. Describe the fluid leak diagnosis process
5. Describe the oil pressure test procedure
6. Describe camshaft timing and related diagnostics
8. Describe engine mechanical diagnostic procedures
9. Verify driver's complaint, perform visual inspection and/or road test vehicle; determine needed action
10. Research applicable vehicle information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.
11. Diagnose the cause of unusual engine noise and/or vibration problems; determine needed action
12. Diagnose the cause of unusual exhaust color, odor, and sound
13. Perform engine manifold vacuum or pressure tests
14. Perform cylinder power balance test
15. Perform cylinder cranking compression test
16. Perform cylinder leakage test
18. Verify correct camshaft timing
19. Verify proper engine operating temperature, check coolant level and condition
22. Diagnose the cause of excessive oil consumption
23. Diagnose the cause of excessive coolant consumption

I. Verify customer concerns, make quick checks and perform a system diagnostic check related to engine mechanical system faults.

1. Describe how to perform a system diagnostic check.

J. Perform engine valve timing component service procedures.

1. Remove and install the engine valve timing components.

L. Perform engine diagnostic procedures.

1. Perform engine vacuum gauge diagnostic check.
2. Perform an engine external oil leak diagnostic check.

O. Perform an engine compression test.

1. Perform an engine compression test.

R. Perform an engine cylinder leakage test.

1. Perform an engine cylinder leakage test.

Exercise 7-1

Read each question carefully and choose the correct response.

1. A compression test is performed on an engine. Technician A states that the lowest cylinder should NOT be les than 70% of the highest reading. Technician B states that you should consult service information for the correct pressure specifications. Which technician is correct? (3)
   a. Technician A
   b. Technician B
   c. Both technicians are correct
   d. Neither technician is correct.

2. For a properly running engine, a good vacuum reading should be _____.
   a. 10-14 inches of mercury
   b. Steady needle, 17-20 inches of water
   c. Steady needle, 17-20 inches of mercury
   d. Fluctuating gauge between 15-17 inches of water

3. A diagram shows a vacuum hose connected to “ported vacuum.” This means the hose should be connected _____.
   a. To the vacuum reservoir tank
   b. To the intake manifold
   c. Below the throttle plate
   d. Above the throttle plate

4. All of the following engine mechanical conditions can be diagnosed with a leakage test EXCEPT:
   a. Burned exhaust valve
   b. Cracked or warped head
   c. Worn cam lobes
   d. Worn piston rings

5. During a cylinder leakage test you find air coming out around the cylinder head valve cover. All of the following could be the cause EXCEPT:
   a. Blown head gasket
   b. Cracked block
   c. Warped head
   d. Worn piston rings

6. A leakage test on cylinder 3 shows air coming from cylinder 5, and vice versa. These results mean which of the following?
   a. Leaking head gasket
   b. Hole in piston 3
   c. Leaky exhaust valve
   d. Leaky intake valve

7. A customer is concerned because oil is leaking from the middle of their vehicle engine compartment. The source of the leak cannot be determined visually. How should the source of the leak be pinpointed?
   a. Overfill all the fluids
   b. Inspect seals
   c. Replace all the seals
   d. Use fluorescent dye

8. Which of the following devices is used with dye to help find leaks?
   a. Fluorescent light
   b. Infrared camera
   c. Ultraviolet light
   d. Neon light

9. When using the black light and dye method to perform oil leak detection, the dye will appear _____ under the light.
   a. Red
   b. Yellow
   c. Blue
   d. Black

10. The purpose of the oil pump is to _____.
    a. clean the oil
    b. cool the oil
    c. pressurize the oil
    d. control oil pressure

11. Which of the following is NOT a cause of low or no oil pressure?
    a. Improper oil viscosity
    b. Low oil level
    c. Low cylinder compression
    d. Slow idle speed

12. Which of the following can NOT be the cause of low engine oil pressure?
    a. Loose crankshaft balancer bolt
    b. Loose oil pump mounting bolts
    c. Missing pickup o-ring
    d. Broken valve lifters

13. On a V-type engine with dual overhead cams, compression is found to be low on all cylinders in one bank only. The most likely cause would be _____.
    a. jumped timing chain
    b. incorrect ignition timing
    c. leaking head gasket
    d. broken crank gear

14. If camshaft timing were incorrect, all of the following might be the result EXCEPT _____.
    a. no start
    b. lack of power
    c. possible damage to valves or pistons (depending on the application)
    d. worn camshaft lobes

15. When verifying camshaft timing, the timing marks should be at which of the following positions?
    a. All at 12 o'clock
    b. Pointing at each other
    c. Lined up according to service information
    d. Ignored, as they are only for use in ignition timing

16. Valve train noises occur at _____ speed of the engine.
    a. 1/4
    b. 1/2
    c. 3/4
    d. the same

17. When checking the Camshaft position actuator movement, approximately how much movement should there be?
    a. 5-8 mm
    b. 10-11 mm
    c. 14-15 mm
    d. 17-18 mm

18. A customer brings in a 1996 Oldsmobile Aurora with a 4.0L V8. The customer is concerned because oil is leaking from the middle of the engine compartment. Which of the following processes should be used to solve the concern?
    a. System verification process
    b. Strategy-based diagnostics
    c. Testing based diagnostics
    d. Strategy verification process

19. A customer brings in a 1996 Oldsmobile Aurora with a 4.0L V8. The customer is concerned because oil is leaking from he middle of the engine compartment. Which of the following is the first step?
    a. Check bulletins
    b. Verify the customer concern
    c. Check vehicle history
    d. Start OBD system check

20. A customer brings in a vehicle with an intermittent misfire concern. The MIL is illuminated. Which of the following is the first step in diagnosing this concern using a strategy based diagnostic process?

    a. Verify concern

    b. Check service diagnostics

    c. Verify bulletins

    d. Conduct preliminary checks

21. A customer brings in a 1999 Cadillac Eldorado with a 4.6L V8 VIN Y ROP Code LD8, concerned because it misfires at all times. The MIL is illuminated. All of the following are quick checks EXCEPT:

    a. Checking for loose or missing plug wire

    b. Looking for damaged coil

    c. Listening for engine noises

    d. Checking for vehicle history

22. After performing an engine vacuum and a compression test, the test results are reviewed and oil is added to cylinders 3 and 5. If the compression remains the same, which of the following tests is performed next?

    a. Compression test

    b. Cylinder leakage test

    c. Fuel pressure test

    d. Oil pressure test

23. A compression test shows that one cylinder is too low. A cylinder leakage test shows that there is too much leakage. During the test, air could be heard coming from the tailpipe. Which of the following could be the cause?

    a. Broken piston ring

    b. Blown head gasket

    c. Leaking exhaust gasket

    d. Leaking exhaust valve

24. An irregular thud or click loudest on deceleration is most likely related to the _____.
    a. main bearings
    b. flywheel
    c. valve train
    d. harmonic balancer

25. In engine noise diagnosis, noises synchronized to one-half the engine speed are normally associated with the _____.
    a. main bearings
    b. connecting rod bearings
    c. pistons
    d. valve train

26. A high frequency light-knocking sound occurring at the same intensity regardless of engine load is related to the _____.
    a. flywheel
    b. connecting rod bearings
    c. main bearings
    d. timing chain and sprocket

27. Top engine cleaner is the recommended GM cleaner for which of the following conditions:
    a. Leaking oil seals
    b. Carbon build up
    c. Coolant system leaks
    d. Defective head gasket

28. When removing carbon build up, the top engine cleaner should be allowed to work inside the engine for at least _____ minutes, before starting the engine to remove the cleaner:
    a. 5
    b. 10
    c. 15
    d. 20

29. The injector test lamp tests which of the following:
    a. The mechanical side of the injector
    b. The fuel pump
    c. The PCM and harness
    d. The fuel pressure regulator

30. A customer is concerned about a knocking noise in the front of their vehicle on start up. The first step of the SBD process is _____.
    a. verify the concern
    b. preliminary checks
    c. check vehicle history
    d. check bulletins

31. In reference to low or no oil pressure, Technician A says that it could be caused by worn main bearings. Technician B says that worn rings will cause the same. Which technician is correct?
    a. Technician A
    b. Technician B
    c. Both technicians are correct
    d. Neither technician is correct

32. During which of the following engine operating conditions will carbon build up cause a noise concern?
    a. Cold engine operation
    b. Engine overheating condition
    c. Normal operating conditions
    d. All engine operating conditions

33. Which of the following noises would usually be associated with a balance shaft concern?
    a. Rattle noise
    b. Whine
    c. Knock
    d. Growl

34. A damaged flywheel will usually create a knocking noise during which of the following conditions:
    a. acceleration
    b. deceleration
    c. idle
    d. part throttle cruise

35. Which of the following is a cause of low oil pressure?
    a. Too much oil
    b. Broken piston oil ring
    c. Plugged oil pump pickup screen
    d. Oil pan leak

36. A technician is measuring engine vacuum on an engine. The readings are 20 inches of vacuum at idle and 10 inches of vacuum at 2000 RPM. This would indicate _____.
    a. late valve timing
    b. restricted exhaust
    c. restriction in air intake system
    d. a vacuum leak at the intake manifold

37. A plugged catalytic converter will cause a vacuum gauge to _____.
    a. read a steady 16 inches at idle
    b. fluctuate between 16 and 21 inches at idle
    c. read a steady 25 inches at idle
    d. read a gradual loss of vacuum

38. When checking engine vacuum, idle has 15 inches and when increasing RPM's, vacuum steadily drops off and engine stalls. This means the _____.
    a. catalytic converter is restricted
    b. muffler has been replaced with test pipe
    c. vacuum reading is normal
    d. engine timing is retarded

39. A vacuum test shows low, but steady vacuum. Which of the following is the least likely cause?

    a. Weak valve springs

    b. Leakage around piston rings

    c. Late ignition timing

    d. Vacuum leak

40. For most engines, normal engine vacuum at idle should be _____ inches Hg.

    a. 25-29

    b. 15-22

    c. 7-12

    d. 5-7

41. When performing an engine vacuum test, the test shows the needle fluctuating between 12 and 17 inches Hg. Which of the following tests should be performed next?

    a. Compression test

    b. Engine vacuum test

    c. Fuel pressure test

    d. Leakage test

42. For every _____ feet of altitude above sea level, vacuum will be lowered by 1 in-Hg.

    a. 500

    b. 1,000

    c. 5,000

    d. 10,000

43. While doing a cylinder leakage test, the technician finds air escaping out the dipstick tube. The most likely cause would be _____.

    a. worn piston rings

    b. burned intake valve

    c. blown head gasket

    d. burned exhaust valve

44. A car runs rough and backfires through the throttle body. Compression is checked and one cylinder is low. The most likely cause of the problem is a/an:

    a. faulty intake valve

    b. burned exhaust valve

    c. EGR valve failure

    d. blown head gasket

45. During a compression test, you get a reading of 80 PSI dry and 140 PSI wet on the #4 cylinder. All other cylinders are about 145 PSI wet and dry. Which of these readings most likely indicate a/an:

    a. blown head gasket between cylinder #3 and cylinder #4

    b. bad intake valve on cylinder #4

    c. bad exhaust valve on cylinder #4

    d. worn piston ring on cylinder #4

46. During an engine compression test, how many compression strokes are needed to obtain an accurate reading on the gauge?

    a. Four

    b. Three

    c. Two

    d. One

47. An engine compression test indicates compression is low on the first stroke, and does NOT build up, even with the addition of oil. Which of the following parts could be the cause of this concern?

    a. Valve stem seals

    b. Piston rings

    c. Valves

    d. Intake manifold

48. An engine compression test indicates compression is low on the first stroke, but builds with successive strokes, especially when oil is added. Which of the following parts is most likely the cause of this concern?

    a. Valve stem seals

    b. Piston rings

    c. Valves

    d. Head gasket

49. When performing an engine compression test, if the compression is low on the first stroke, does NOT build on successive strokes, and does NOT increase with oil added, the most likely problem is/are the:

    a. Valves

    b. Piston rings

    c. Intake manifold

    d. Valve stem seals

50. During a cylinder leakage test, you notice air escaping past the throttle plate. This means there is a leak at the _____.

    a. Piston rings

    b. Intake valve

    c. Intake manifold gasket

    d. Head gasket

51. During the leakage test, listen for air leakage in all of the following locations EXCEPT the:

    a. Throttle body

    b. Tailpipe

    c. Crankcase or valve cover

    d. Transmission

52. Which of the following is the MOST likely symptom of a leaky valve when performing a cylinder leak down test?
    a. Hissing in crankcase
    b. Bubbles in radiator
    c. Hissing in intake or exhaust
    d. Hissing at the spark plug hole

53. When doing a compression test, all cylinders are found to be low. Which of the following would be the most likely cause?
    a. Advanced ignition timing
    b. Burned intake valves
    c. Late valve timing
    d. Carbon build up in the cylinder

54. A leak in the hose on the bottom radiator tank to the water pump will allow coolant to leak and:
    a. Air to enter
    b. The thermostat to fail
    c. Increase pressure in cap
    d. The hose to fail

55. Technician A says that too high an oil level could cause seepage and foaming. Technician B says it could cause low crankcase pressure. Which technician is correct?
    a. Technician A
    b. Technician B
    c. Both technicians are correct
    d. Neither technican is correct

56. A common cause for excessive oil burning is a/an _____.
    a. stuck piston rings
    b. leaking crankshaft seal
    c. clogged engine air cleaner
    d. external leak

57. You are performing a cylinder leakage test. Bubbles in the radiator would indicate _____.
    a. defective piston rings
    b. burned intake valve
    c. a leaking intake manifold gasket
    d. a blown head gasket

58. The primary cause of an overheating problem is _____.
    a. thermostats
    b. **loss of coolant**
    c. defective water pumps
    d. incorrect coolant mixture

59. When using an outside micrometer with a Vernier scale, the most precise measurement is obtained from the Vernier. To read the scale, identify the Vernier number that is most perfectly _____.
    a. aligned with any scale mark on the barrel
    b. aligned with the Vernier pointer on the thimble
    c. aligned with any scale mark on the thimble
    d. between any two scale marks on the thimble

60. Which of the following must be reset on the torque angle meter before tightening each fastener?
    a. Angle zero pad
    b. Reset angle pad
    c. Operate/set alarm pad
    d. Torque/angle pad

61. Which of the following tools is used to measure crankshaft endplay?
    a. Torque angle meter
    b. Dial indicator
    c. Micrometer
    d. Telescoping gauge

62. One of the reasons that piston rings wear a deeper groove at the top of the cylinder than at the bottom is that the _____.
    a. connecting rod angle is greater
    b. combustion pressure is higher at the top
    c. heat softens the upper wall
    d. cooling system is less effective there

63. The thrust surfaces of a cylinder are _____ to the piston pin.
    a. parallel
    b. vertical
    c. horizontal
    d. perpendicular

64. When removing valve springs, which of the following should be done to prevent the valve from dropping into the cylinder?
    a. Grasp valve with valve stem key
    b. Compress valve locks using valve lock compressor
    c. Insert valve stem retaining pin
    d. Apply air pressure to the cylinder

65. Which of the following is a thread-locking compound and is applied to the insert OD threads?
    a. General Motors P/N 1052864
    b. Loctite® 277
    c. General Motors Cleaner P/N 12346139
    d. WD-40®

66. Engine blocks may be distorted if head bolts are tightened without the use of a _____ wrench.
    a. box
    b. rachet
    c. socket
    d. torque

67. With the camshaft and crankshaft gears aligned correctly, the piston on Number 1 cylinder is located _____.
    a. on valve overlap
    b. BDC on exhaust stroke
    c. TDC on compression stroke
    d. BDC on power stroke

68. Push rods should be checked for _____.
    a. straightness
    b. adjustment
    c. clearance
    d. rotatability

69. Excessive valve guide clearance can be corrected by all of the following EXCEPT _____.
    a. by knurlizing
    b. with valve guide installation
    c. with an oversized valve stem
    d. with an undersized valve stem

70. The crankshaft is held in the engine block by the _____.
    a. rod caps
    b. main bearing caps
    c. main bearing journals
    d. harmonic balance

71. Two types of rear main-bearing oil seal materials are _____.
    a. neoprene and leather
    b. neoprene and rope
    c. #2 Permatex and RTV
    d. rubber and anaerobic

72. In which groove(s) is the oil ring located?
    a. **Bottom**
    b. Middle
    c. Top
    d. All grooves

73. Which one of the following cleaning methods uses live microbes to clean components?
    a. **Bio-remediating**
    b. Sand blasting
    c. Acid bath
    d. Sonic vibration

74. If a bio-remediating aqueous parts washer is NOT used for more than two weeks, it may be necessary to change the filter pad in order to _____.
    a. provide a fresh supply of microbes
    b. remove excess oil and grease
    c. provide fresh supply of rust inhibitor
    d. prevent sediment from clogging the circulating pump

75. An engine failure has caused metal contamination of the oil. Which of the following must be replaced?
    a. Regulating valve
    b. Oil cooler
    c. Relief valve
    d. Nothing needs to be replaced

76. The proper way to clean a cylinder head is to use _____.
    a. aluminum oxide disks
    b. solvent
    c. a plastic scraper
    d. air pressure

77. A common difficulty when diagnosing a problem reported by a customer is the _____.

    a. customer's misconception of results to be expected from the services to be performed

    b. communication of the malfunction from the customer to the service manager

    c. customer's insistence for the use of nonfactory replacement parts

    d. service manager's inability to quickly recognize the malfunction

78. The engine vacuum reading is low but steady. Which of the following is the most likely cause of this problem?

    a. A sticky valve

    b. Leaky fuel injectors

    c. Retarded timing

    d. Fouled spark plugs

79. A technician is measuring engine vacuum. The needle is normal at idle but fluctuates rapidly as engine speed is increased. This would indicate _____.

    a. improper valve timing

    b. blown head gasket

    c. weak valve spring

    d. burned or warped valve

80. When doing a vacuum test on an engine, the needle occasionally makes a sharp, fast drop. This would be caused by a/an _____.

    a. improper valve timing

    b. vacuum leak

    c. weak valve spring

    d. sticking valve

82. Which of the following will assist in determining which cylinders are misfiring?
    a. DTC P0201 - P0208
    b. DTC P0301 - P0308
    c. DTC P0401 - P0408
    d. DTC P0501 - P0508

83. When cleaning the external battery case terminals, use _____.
    a. a solution of water and baking powder
    b. clean mineral spirits
    c. a solution of water and baking soda
    d. clean water

84. When replacing electrical components, _____.
    a. disconnect the battery ground cable
    b. disable the ignition system
    c. use only insulated wrenches
    d. isolate the alternator to prevent damage

85. All of the following will clear DTCs EXCEPT _____.
    a. disconnect the battery
    b. Tech 2
    c. grounding the Data Link Connector (DLC)
    d. 40 consecutive warm-up cycles