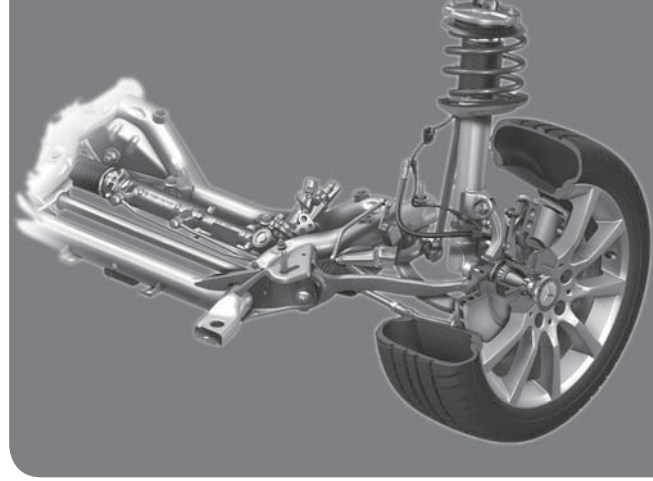


Chapter 7

Steering System Technology



Name _____

Date _____

Instructor _____

Score _____

Objective: After studying this chapter, you will be able to summarize the construction and operation of steering systems.

Basic Steering Systems

1. Today's sophisticated steering systems use mechanical mechanisms as well as _____ and _____ to improve steering precision.

Functions of a Steering System

2. List five functions of a steering system.

Basic Steering Systems

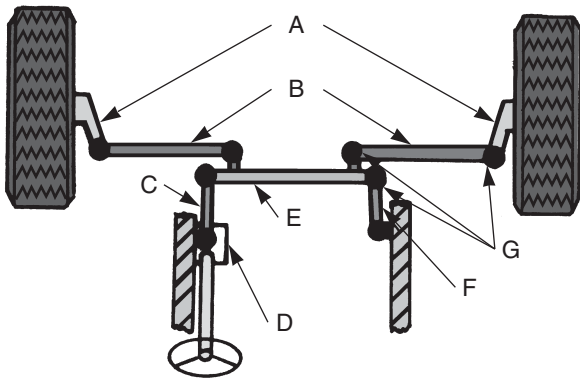
3. What are the two basic types of steering systems?

For questions 4–9, match the following terms and identifying phrases.

- | | |
|---|----------------------|
| _____ 4. Connects steering gearbox to steering knuckles and wheels. | (A) Steering wheel |
| _____ 5. Supports steering wheel and steering shaft. | (B) Steering shaft |
| _____ 6. Transfers turning motion from steering wheel to steering gearbox. | (C) Steering column |
| _____ 7. Allow linkage arms to swivel up and down for suspension action and from left to right for turning. | (D) Steering gearbox |
| _____ 8. Changes turning motion into a straight-line motion to the left or right. | (E) Steering linkage |
| _____ 9. Used by driver to rotate steering shaft, which passes through steering column. | (F) Ball sockets |

10. Describe a rack-and-pinion steering system.

11. Label the parts of the linkage steering system.



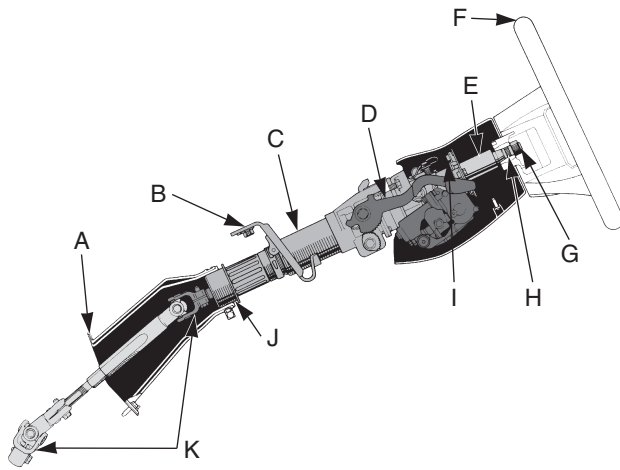
- (A) _____
- (B) _____
- (C) _____
- (D) _____
- (E) _____
- (F) _____
- (G) _____

Steering Column Assembly

- _____ 12. The steering column assembly consists of a ____.
- (A) column and an ignition key mechanism
- (B) steering wheel and steering shaft
- (C) flexible coupling and universal joint
- (D) All of the above.

Name _____

13. Label the steering column components.



- (A) _____
- (B) _____
- (C) _____
- (D) _____
- (E) _____
- (F) _____
- (G) _____
- (H) _____
- (I) _____
- (J) _____
- (K) _____

_____ 14. The ignition lock mechanism is normally on the _____-hand side of the column.
 (A) top, right
 (B) bottom, right
 (C) top, left
 (D) bottom, left

_____ 15. The ignition switch is usually bolted _____ the steering column.
 (A) to the right of
 (B) to the left of
 (C) inside
 (D) on top of

16. A(n) _____ steering wheel commonly uses a steel pin _____ and a slotted disc to prevent the steering wheel from being turned.

17. List the three types of collapsible steering columns in use today.

For questions 18–20, match the following terms and identifying phrases.

- _____ 18. Uses a lever on the steering wheel to unlock the flex joint. (A) Tilt steering column
 - _____ 19. Uses a flex joint that allows the top of the column and steering wheel to be positioned at different angles. (B) Manual tilt column
 - _____ 20. Uses a small electric motor, a control switch, and a gear mechanism to change steering wheel angle. (C) Power tilt column
21. _____ tilt wheels use a tilt control module (computer) _____ to “remember” more than one steering wheel position.

Steering Gear Principles

22. The ____ gearbox is normally used with a linkage-type system. _____
23. *True or False?* The sector shaft is the input gear connected to the steering column shaft. _____
24. A(n) ____ nut rides on the ball bearings and the worm gear. _____
25. A bearing ____ is usually provided to set worm shaft bearing preload. _____
26. What is *gearbox ratio*?

27. A manual gearbox will have a ____ (high/low) gearbox ratio to reduce the amount of effort needed to turn the steering wheel. _____
28. A(n) ____ gearbox changes the internal gear ratio as the front wheels are turned from the center position. _____
29. *True or False?* A constant-ratio gearbox has the same gear reduction from full left to full right. _____
30. Describe a worm-and-roller steering gearbox.

Steering Linkage (Worm-Type Gearbox)

31. What is steering linkage?

32. The ____ transfers gearbox motion to the steering linkage. _____
33. ____ provide for motion in all directions between two connected parts. _____
34. The steel bar that connects the right and left sides of the steering linkage is called the _____. _____

Name _____

35. What purpose does the idler arm serve?

36. What is used to fasten the center link to the steering knuckles?

37. The _____ is provided for changing the length of the tie-rod assembly during wheel alignment.

Manual Rack-and-Pinion Steering

38. What function does the flexible coupling serve?

39. A(n) _____ joint allows for a change in the angle between the steering column and steering shaft.

40. Name the components of a manual rack-and-pinion steering gear.

41. What preloads the rack-and-pinion gear teeth to prevent excessive gear backlash (play)?

_____ 42. Power steering systems may use a(n) _____ to assist steering action.

- (A) hydraulic system
- (B) engine-driven pump
- (C) electric motor
- (D) All of the above.

43. Name the three major types of power steering systems used on modern automobiles.

44. The _____ is engine driven and produces the hydraulic pressure for steering system operation.

45. A(n) _____ is used in a power steering system to control maximum oil pressure.

Linkage-Type Power Steering Systems

46. Explain the difference between integral and external cylinder power steering.

Power Rack-and-Pinion Steering

47. Explain these four basic parts of a power rack-and-pinion system.

Power cylinder:

Power piston:

Hydraulic lines:

Control valve:

48. The (rotary/spool) ____ control valve is operated by a torsion shaft connected to the pinion gear.

49. The thrust action of the pinion shaft shifts the (rotary/spool) ____ control valve.

50. What is a power steering oil cooler?

Name _____

Electronic Steering Assist

51. How can a steering system intentionally affect engine idle speed?

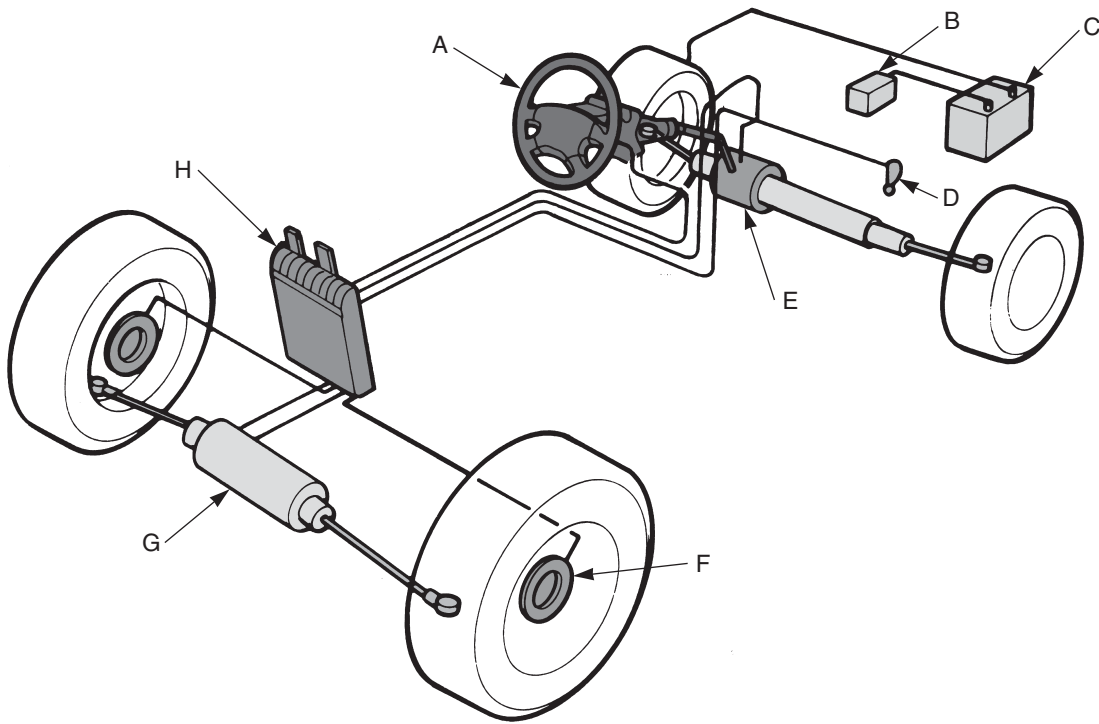
_____ 52. To keep the power assist motor away from road debris, it may be mounted _____.

- (A) in the dashboard
- (B) at the bottom of the steering shaft
- (C) at the top of the steering shaft
- (D) under the driver's side seat

53. What is road feel?

54. _____ steering systems alter steering wheel effort as _____ road speed changes.

55. Label the parts of the four-wheel steering system.



- | | |
|-----------|-----------|
| (A) _____ | (E) _____ |
| (B) _____ | (F) _____ |
| (C) _____ | (G) _____ |
| (D) _____ | (H) _____ |

Four-Wheel Steering Systems

For questions 56–58, match the following terms and identifying phrases.

- | | |
|--|---|
| _____ 56. Electric-motor-driven power rack that acts upon the rear wheels via its own recirculating-ball drive and mechanical links. | (A) Mechanical four-wheel steering system |
| _____ 57. Uses a special front rack-and-pinion gearbox with a transfer box. | (B) Hydraulic four-wheel steering system |
| _____ 58. Uses a conventional power rack-and-pinion steering system up front. | (C) Electronic four-wheel steering system |