

Chapter 17

The Milling Machine

Name: _____ Date: _____

Score: _____ Text pages 285–316

LEARNING OBJECTIVES

After studying this chapter, you will be able to:

- Describe how milling machines operate.
- Identify the various types of milling machines.
- Select the proper cutter for the job to be done.
- Calculate cutting speeds and feeds.

■ Carefully read the chapter, then answer the questions in the spaces provided.

1. The milling machine is a very versatile machine tool. It can be used to _____.
 - a. drill, bore, and cut gears
 - b. machine irregularly shaped surfaces
 - c. machine flat surfaces
 - d. None of the above.
 - e. All of the above.
 2. On a fixed-bed milling machine, *vertical* and *cross* movements are obtained by moving the _____.
 3. Rapid traverse feed _____.
 - a. permits work to be positioned at several times the fastest rate indicated on the feed chart
 - b. should only be activated while the cutter is positioned in a cut
 - c. allows fast power movement only when work is parallel with the periphery of the cutter
 - d. All of the above.
 - e. None of the above.
1. _____
2. _____
3. _____

4. Spindle speeds and table feeds on a milling machine may be changed ____.
- by shifting V-belts or by adjusting variable speed pulley
 - electronically
 - by using quick change gears
 - All of the above.
 - None of the above.
4. _____
5. List at least *five* safety precautions that must be observed when operating a milling machine.
- _____
- _____
- _____
- _____
- _____
- _____
6. Define the term *cutting speed*. _____
- _____
7. Cutting speed is expressed in ____ per minute or ____ per minute.
7. _____
- _____
8. The ideal milling cutter should have ____.
- edge toughness
 - red hardness
 - high abrasion resistance
 - All of the above.
 - None of the above.
8. _____
9. HSS milling cutters can be improved by the application of ____.
- coatings such as chromium or tungsten
 - lubricating treatments
 - surface hardening treatments
 - All of the above.
 - None of the above.
9. _____
10. Cemented tungsten carbides can be operated at speeds ____ than conventional HSS cutting tools.
- much slower
 - 3–10 times faster
 - 10–14 times faster
 - up to 20 times faster
 - None of the above.
10. _____

11. The term HAND is used to describe _____.
 a. cutter rotation
 b. helix direction of the flutes
 c. Both of the above.
 d. Neither of the above.

11. _____

12. What is a *fly cutter*? _____

13. Two-flute end mills can be _____ into the work like a(n) _____.

13. _____

14. Multiflute end mill is recommended for _____ milling where _____ milling is not necessary.

14. _____

15. Shell end mills have teeth similar to the multiflute end mills but are mounted on a(n) _____ arbor. It is designed for both face and _____ milling.

15. _____

■ Match the milling cutters with their descriptions.

- a. metal slitting saw
 b. side milling
 c. plain milling
 d. staggered-tooth side
 e. slab mill

16. A _____ cutter mounts on an arbor and has cutting teeth only on its circumference.

16. _____

17. A _____ cutter has helical teeth designed to cut with a shearing action.

17. _____

18. A _____ cutter has cutting teeth on the circumference and on both sides.

18. _____

19. A _____ cutter has alternate right-hand and left-hand helical teeth.

19. _____

20. A _____ cutter is a thin milling cutter designed to machine narrow slots and for cutoff operations.

20. _____

21. Define the term *feed*. _____

22. Formed milling cutters _____.
 a. include corner rounding cutters

22. _____

- b. include concave and convex cutters
 c. can be used to duplicate a contour
 d. All of the above.

- e. None of the above. 23. _____
23. The Woodruff key seat cutter is used to mill _____.
 a. the bottom of T-slots
 b. semicircular keyseats
 c. dovetail-type ways
 d. All of the above.
 e. None of the above. 24. _____
24. Climb milling should not be performed on machines _____.
 a. without play in the table
 b. that are not in top condition
 c. not fitted with an antibacklash device
 d. All of the above.
 e. None of the above. 25. _____
25. In general, use the _____ arbor possible which permits adequate clearance between the arbor support and the work.
26. How is feed expressed? _____

27. Spacing _____ allow the cutter to be positioned on the arbor. 27. _____
28. _____ fit into slots on the arbor, collet, or collet holder to provide nonslip drive. 28. _____
29. Briefly describe how you should remove an arbor or adaptor from the machine. _____

■ Using the formulas given below, solve problems 30–35. Use the space provided for your work. Round cutting speeds off to the nearest 50 rpm.

Formulas:

$$\text{rpm} = \frac{\text{fpm} \times 12}{\pi D}$$

$$F = \text{ftr} \times T \times \text{rpm}$$

Where:

rpm = Revolutions per minute

D = Cutter diameter

ftr = Feed per tooth per revolution

T = Teeth in cutter

30. Calculate the machine speed (rpm) recommended for a 3" diameter (8 teeth) side cutter (HSS) cutting free cutting steel. Recommended cutting speed is 200 fpm. Feed per tooth is 0.008". 30. _____
31. Determine the machine speed (rpm) for a 2.5" diameter side cutter (HSS) with 8 teeth, milling brass. Recommended cutting speed is 300 fpm. Feed per tooth is 0.011". 31. _____
32. Calculate the machine speed (rpm) for a 6" diameter side cutter (HSS) with 16 teeth, milling aluminum. Recommended cutting speed is 550 fpm. 32. _____
33. Calculate the machine speed (rpm) for a 3/4" diameter end mill (tungsten carbide) with 4 teeth, milling aluminum. Recommended cutting speed is 3500 fpm. 33. _____

34. What will be the feed rate (F) for the job in Problem 30? 34. _____

35. What will be the feed rate (F) for the job in Problem 31? 35. _____

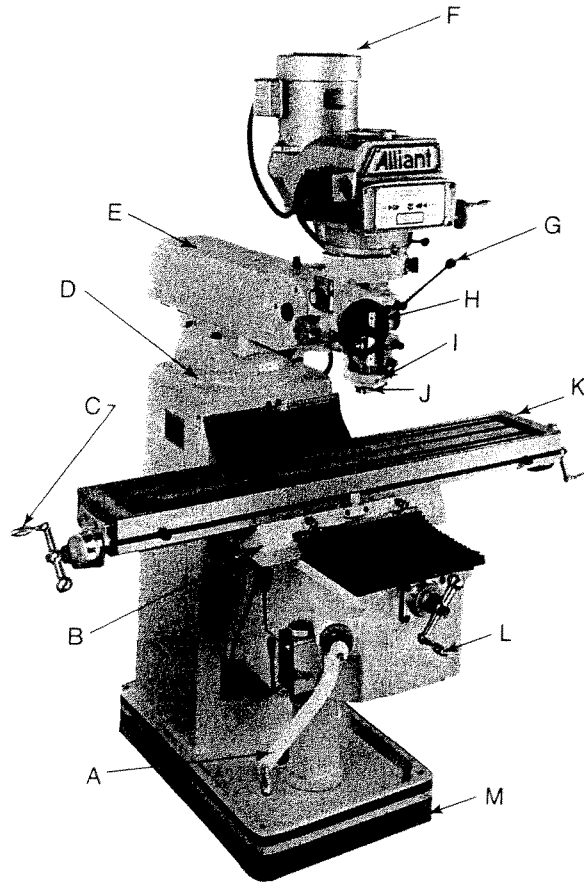
36. When indexing, it _____ (is/is not) necessary to count holes each time the work is repositioned after a tooth has been cut. 36. _____

37. Briefly describe the indexing operation. _____

38. The rotary table can be used to cut _____. 38. _____
a. irregular shaped objects
b. segments of circles
c. circular slots
d. All of the above.
e. None of the above.

39. A(n) _____ can be used to measure the circumference of circular work into equally spaced units. 39. _____

40. Identify the parts of the vertical milling machine illustrated below.



- | | |
|----------|----------|
| A. _____ | H. _____ |
| B. _____ | I. _____ |
| C. _____ | J. _____ |
| D. _____ | K. _____ |
| E. _____ | L. _____ |
| F. _____ | M. _____ |
| G. _____ | |

