

STUDY GUIDE

Manual Machining Lab

Student Copy

Rev Spring 2019

1. A micrometer is more accurate than a caliper
2. To cut a slot of a certain width, for example .250, and to a certain length, you should use an endmill cutting tool on the milling machine fastened in the vise resting on parallels.
3. When drilling a hole with a drill bit, you should always first drill a starting hole with a Center Drill.
4. In order to maintain concentricity when turning two different diameters in a three jaw chuck on a rough piece of extra long bar stock, the smaller diameter should be machined to the right of the part.
5. When chamfering the outside corners of a part on the lathe, you should use a 45 degree lathe cutting tool.
6. When turning the small diameter of a part that extends 1 1/2" beyond the chuck jaws, you should use a Live Center to support the end of the part.
7. To produce an accurate hole to a precise inside diameter you should use a drill bit to drill undersize and then use a Reamer to drill the hole to an exact size
8. When parting off a part, you should touch off the parting tool to the right of the part, zero the travel dial and move the parting tool a distance of the length of the part plus the width of the parting tool and part off the part.
9. A Morse Taper arbor is normally used in a Lathe.
10. Calculate Taper per Foot of a Morse Taper 4 Arbor. The large diameter is 1.245" and the small diameter is 1.0372". The length of the taper is 4 inches. Large diameter minus small diameter, divided by length of taper and multiplied by 12. The taper per foot is _____.
11. The Taper per Inch of a Morse Taper 4 Arbor is _____.
12. Finding the center for the slot at the milling machine should be done with an edge finder.
13. When drilling a long hole in a part, the drill bit outside corners cutting edges should be lined up with the face or end of the part.
14. If a cutting tool chatters on a lathe or milling machine, you should slow the machine down.
15. Given the formula, # of teeth of pinion gear driven with motor, divided by # of teeth of larger gear, multiplied by motor RPM: if a gear is machined to have 30 teeth and is driven by a pinion gear having 15 teeth attached to a D.C motor with an output of 4 R.P.M.'s, the gear will rotate at _____ R.P.M.'s .
16. A counter bored hole is a flat bottom hole with the O.D. enlarged so as to allow sinking a bolt head below the surface of the part.
17. Chatter causes the tool to bounce off the part leaving a checkered appearance so reduce speed to stop it.
18. A tap drill is a drill that is smaller than the tap.

On a GEAR CUTTING Index Head, Simple Indexing is based on the ratio between the worm and the worm gear located inside it that is usually 40:1 on American made Indexing Heads. The numerator represents the number of holes to be moved on the circle of holes specified by the denominator. The Ratio of the Indexing Head, 40, over the number of divisions or gear teeth = the Indexing Circle of Holes to be used to machine a set number of gear teeth.

19. With a worm/worm gear ratio of 40:1, making 15 divisions requires the numerator 40, over the denominator 15, to be reduced to 8/3 of a turn of the indexing crank. To machine 15 gear teeth on a gear would require an indexing circle of holes of the numerator _____, over the denominator 36.
20. Pressure Angle of a gear tooth refers to angle of one side of an involute gear tooth.

Given 2 Spur Gears, each containing 12 (P) Diametral Pitch, 14.5 Degree Pressure Angle, 20 Tooth Pinion Gear (p) and a 100 Tooth Larger Gear (g), using the formulas below, calculate the following:

The Formulas for some calculation of Coarse Spur Gears are:

$$\begin{aligned} \text{Pitch Diameter (D)} &= N / P & \text{Circular Pitch (p)} &= 3.1416 D / N \\ \text{Center Distance (C)} &= D_p + D_g / 2 & \text{Outside Diameter (Do)} &= N + 2 / P \\ \text{Diametral Pitch (P)} &= N / D \end{aligned}$$

21. The Pitch Diameter (D) of a 20 Tooth Pinion Gear is _____.
22. The Pitch Diameter (D) of a 100 Tooth Gear is _____.
23. The Circular Pitch (p) of a 20 Tooth Pinion Gear is _____.
24. The Circular Pitch (p) of a 100 Tooth Gear is _____.
25. The Center Distance of a 20 Tooth Pinion Gear and a 100 Tooth Gear is _____.
26. The Outside Diameter (Do) of a 20 Tooth Pinion Gear is _____.
27. The Outside Diameter (Do) of a 100 Tooth Pinion Gear is _____.
28. Diametral Pitch refers to the number of teeth of a gear divided by the Pitch Diameter.
29. The formula for determining the height of a 5" Sine Bar = C X Sin D. Calculate what gage blocks would be needed for the height of a Sine Bar if the angle of Sine D is 20° 30'. The first gage block is 1.0". The second gage block is .101". The third gage block is _____.
30. To drill the two holes for the shafts of both 20 and 100 tooth gears on a milling machine, use the calculated Center Distance of the two gears, side "C" = 1.5". Side "B" = 1.125". Use the formula $\sqrt{C^2 - B^2}$ to find Side "A". _____.
31. Milling of a slot or groove in a milling machine fixture should be done in a horizontal index head.
32. A counter bored hole is a hole that the O.D. is enlarged so as to permit sinking a bolt head below the top surface.
33. The best tool to use to counter bore a flat bottom hole on a milling machine is an Endmill.
34. The operator should not remove the metal stock from the chuck until all machining operations have been completed.
35. A Thread Pitch Gage is used to determine the # of threads per inch on a bolt.
36. The depth of a thread and the relief groove depth formula is .866 divided by the # of threads per inch.

37. A square thread form is called an Acme Thread.
38. A Boring Bar is a cutting tool used on the lathe to enlarge an existing hole to an exact size in .001 increments of an inch.
39. A Taper Attachment is an optional device used on a lathe to cut an angle on the part.
40. The 4 types of drill bit sizes are Fractions, Letters A to Z, Numbers 1 to 80, and Metric.
41. Milling of a slot in a milling machine should be done in a horizontal index head with an endmill cutting tool.
42. To produce an accurate hole to a precise inside diameter you should use a drill bit to drill an undersized hole than use a reamer to enlarge the hole to an exact standard size.