LAB #4 MACHINING EXPERIMENT II

MILLING

Purpose: To study the operation of milling.

Machine: Milling machines

Tools: sine bar, gage blocks, 6 inch dial caliper, steel ruler, fly-cutter (3'' diameter) high-speed end mill (1/2"), edge-finder (0.2'').

Material: Aluminum block (approximately 2"x3")

Operations:

A. Secure the workpiece in the table of the milling machine using the vice.

1. Clean milling machine vise thoroughly.
2. Place parallels under the workpiece to raise the surface to be milled above the level of the vise jaws.
3. After the workpiece is in place, tighten the vise securely, then tap the workpiece lightly with a dead blow hammer to seat it. Do not tighten the vise again because this would alter the position of the workpiece and tightness of the parallels.

B. Machine Setup

1. Check the diameter of the cutter with a vernier calipers.
2. Calculate RPM for cutting speed = 140 ft/min (end milling), 350 ft/min (fly cutting)

$$RPM = \frac{V(ft/\min) \times 12}{\pi D(in)}$$

3. <u>When using the White Chevalier Mills</u>.
   Set the speed of mill by adjusting the RPM knob and reading the speed on the analog meter. "H" and "L" scales represent high and low gear ranges.
   Note: do not cut at a speed lower than 500 rpm while in the high gear range.
   (Check with the lab instructor to verify your setup before you continue).

4. Calculate feed (in inch/min) for a feed per tooth = 0.003".

   Feed= feed per tooth x no. of cutter teeth x RPM

   Note*: Power feed: speed is displayed on the digital readout. Adjust with the dial while moving away from your part.*
   If power feed is not available, use handles for manual feed.

Note*: The direction of feed is optional on a vertical milling machine.*

C. Milling the top surface using fly (facemilling) cutting

1. Before starting the machine, be sure the cutting tool is clear of the workpiece. If not, lower the workpiece by lowering the knee.
2. Move the table with the x and y axis handles to position the workpiece under the cutter.
3. Lower the cutting tool or raise the table using the crank until it touches the top surface of the workpiece gently.
4. Set the micrometer dial on the knee to zero.
5. Lower the table by 0.020", by turning the knee handwheel counter clockwise.
6. Move the table longitudinally so that the cutter is clear of the workpiece at either end.
7. Turn the machine on.
8. Raise the table (or lower the cutter) 0.030" (1 graduation is 0.001") from zero so that the final thickness of the workpiece is 0.970"±0.002". Use multiple cuts and monitor the thickness of the workpiece.
9. Engage the power feed with the lever. Note: Table travels in the direction of the feed engagement lever.
10. After workpiece has been milled on the top surface, disengage power feed and turn spindle off.

D. Endmilling of slots

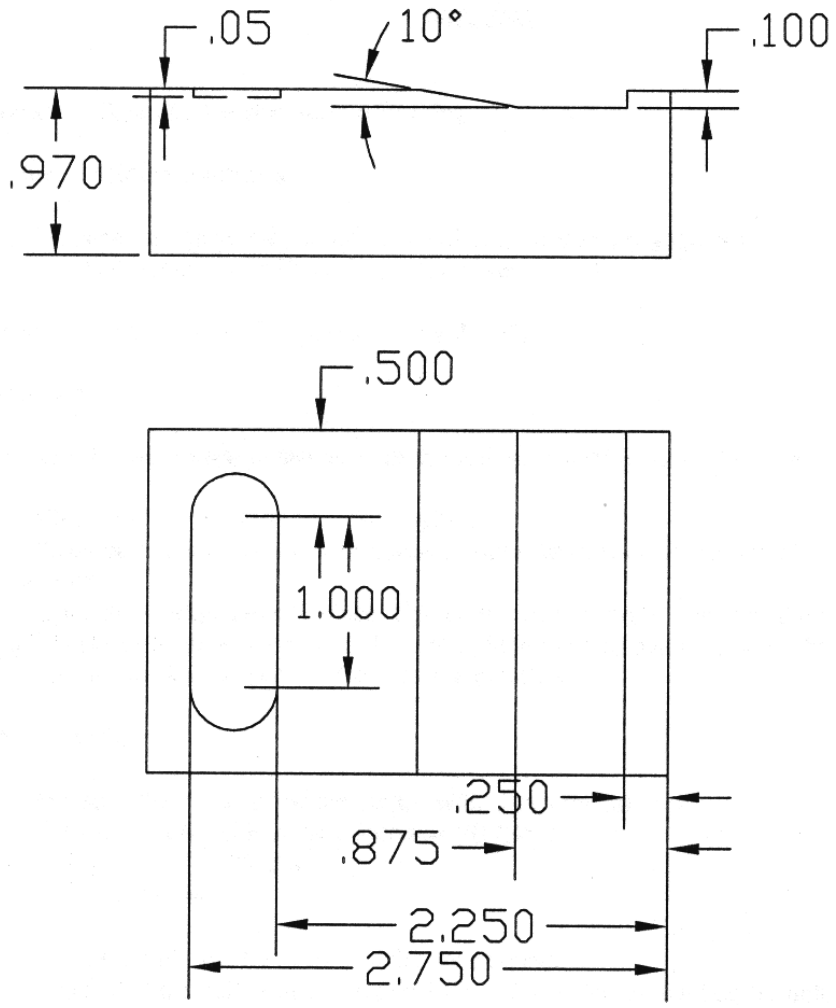
1. Replace the face mill cutter with an edge finder (run the edge finder above 1K rpm)
2. Touch the corners of the workpiece to set the origin of the workpiece (the lab instructor will demonstrate the procedure). Consider the diameter of the edge finder and offset the zero point accordingly.
3. Replace the edge finder with a 1/2" end mill.
4. Make a slot 1 (through slot) as shown in Figure using the same procedure in C.2-C.10. The cutting speed should be 50 ft/min and depth of the slot should be 0.10". You will need multiple cuts.
5. Make the slot 2 as shown in Figure using the same procedure in C.2-C.10. The depth of slot should be 0.050".

E. Slope machining

1. Use a sine bar to set up the workpiece to be tilted at 10^0.
2. Use the 1/2" endmill or a fly cutter to generate the slope using multiple path cuts.

Items to be included in the report

1. Measured dimensions of the finished part (all the dimensions shown on the drawing)
2. Cutting conditions used for each feature



All dimensions must be within tolerance of 0.002". The angle of the slope should be within tolerance of 0.1 degrees.

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