Table: Max Milling Rate Video Results

Machine: Cinn. Mil. 7VC
Tool: 5/16 in 2 flute, high speed steel end mill

Aluminum trials: 6061 – T6, d = 0.2 in, Ω = 4000 rpm for all 6 trials

1. v = 30 in/min, no coolant
   MRR = 1.9 in^3/min (0.5 cm^3/sec) Result: small chips

2. no coolant
   MRR = 2.8 in^3/min (0.8 cm^3/sec) Result: small chips

3. no coolant
   MRR = 3.8in^3/min (1.0 cm^3/sec) Result: melting/welding of chips, bad surface finish

4. with coolant (water soluble oil)
   MRR = 1.9in^3/min (0.5 cm^3/sec) Result: small chips

5. with coolant
   MRR = 2.8 in^3/min (0.8 cm^3/sec) Result: small chips

6. with coolant
   MRR = 3.8 in^3/min (1.0 cm^3/sec) Result: melting/welding, not as severe

Steel trials: Mild Steel (1018)
Tool: 5/16 in, 2 flute, high speed steel end mill
d =0.2in , all with coolant (Ω = 857 RPM for trials 1 & 2)

1. MRR = 0.4 in^3/min (0.1 cm^3/sec) Result: small chips

2. MRR = 0.6 in^3/min (0.16 cm^3/sec) Result: broken end mill

3. d = 0.2 in, Ω = 1714
   MRR = 0.4 in^3/min (0.1 cm^3/sec) Result: small chips

4. d = 0.2 in, Ω = 1714
   MRR = 0.6 in^3/min (0.16 cm^3/sec) Result: small chips rougher surface but no break

5. d = 0.2 in, Ω = 1714
   MRR = 0.9 in^3/min (0.35 cm^3/sec) Result: broken end mill

Problem 5

Consider the table providing data from the Max Milling Rate Video shown in class.
a) Assuming the yield stress for 6061–T6 aluminum is 35,500 psi compare this with the values given in the textbook for the specific cutting energy for aluminum. How do these numbers compare?

b) Estimate the power required in the aluminum trial # 3. Give your answer in horsepower. If the spindle for this machine is 7 hp how close are we to stalling the spindle?

c) Consider the 2 machining trials for steel: # 2 and # 4. Assuming that the specific energy for steel is 0.7 hp min/in3, Estimate the horsepower required for both of these trials.

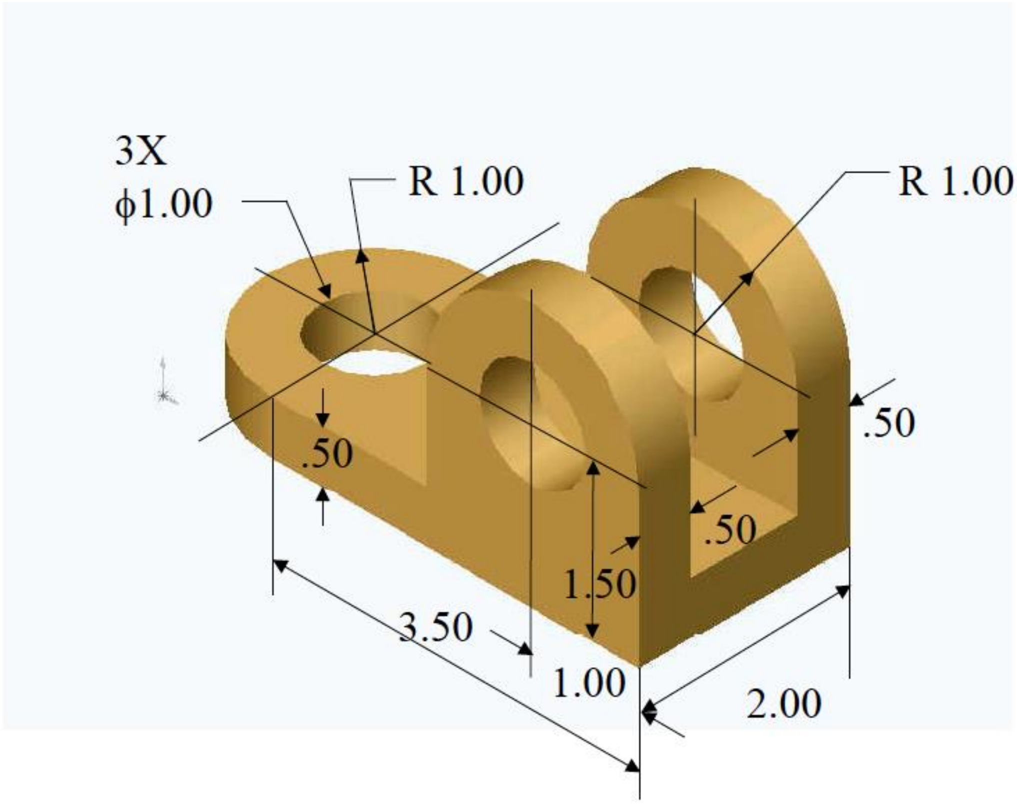
d) Now please provide a hypothesis, using a numerical example, why the cutting tool broke for steel trial #2 but did not break for trial #4.

Problem 6

Consider the drawing of a part called a rocker arm shown below. The tolerance on the three 1 inch diameter holes is ± 0.001 in. For all other dimensions the tolerance is ± 0.007 in. The material is 1018 steel with a density of 0.3 lb/in3 (8.9 g/cm3).

a) Assuming you start with bar stock with the nominal dimensions of the cross-section for this part (you may adjust this slightly if you like), please write down a process plan to make this part by manual machining, and by CNC machining using a band saw and a single milling machine. Please use the *Simplified Time Estimation Booklet for Basic Machining Operations* to estimate the times for the manual machining operation.

b) Now consider higher volume production suggest alternatives to increase the production rate and decrease the cycle time.



Isometric drawing of a Rocker Arm part. See text for material and tolerances