HWK # 6b SOLUTION Manufacturing systems 2.810 Fall 2013

Please read the four-page handout entitled " the monumental of monuments" from the book Lean Thinking by Womack & Jones.

1. Estimate the production rate (parts/hr) for the automated Blohm grinder, and the Chaku-Chaku cell. State any assumptions, and justify why you think this assumption might be reasonable.

A. Using Little's Law, we know that $\lambda = L/W$. From table 8.1 the production rate for the Chuka-Chuka cell is 15 parts/75 min or 15 parts/1.25 hrs = 12 parts/hr. The production rate for the Blohm grinder is more difficult to estimate because we do not know how many shifts are being worked at the factory. Because the cell is highly automated, one might assume it would be possible to operate for 3 shifts a day. Furthermore, since the encapsulation process is clearly the bottleneck you probably would want to operate 3 shifts so the expensive Blohm is not idle. On the other hand, we learn that it is the encapsulation process that paces production for the cell and this process is temperamental and only has a yield of 80%. In this case, one might conclude that the encapsulation process requires close attention and therefore may only be operated for one shift the day. Ultimately, the production rate will be chosen to meet demand. The resulting production rates for the Blohm cell for 1, 2, and 3 (8hr) shifts a day would be 20.4 parts/ hr, 13.7 parts/hr, and 6.8 parts/hr respectively. If the reduction due to yield losses is also included these production rates would fall to; 16.3, 11, and 5.4 parts/hr.

2. How many Chuka-Chuka cells are needed to replace one automated Blohm grinder?

A. The answer to this question depends on the previous answer. If only one shift is used for the Bholm grinder then you will need more than one, and less than 2 C-C cells to have an equivalent production rate. If there are 3 shifts, then the C-C cell is about twice as fast as the Bholm.

3. What actions would you consider to improve the time performance of the Blohm grinding cells?

A. While the Blohm grinder is maligned in this article because it is large, expensive and immovable, it seems that the biggest problem by far, is the requirement for encapsulation. This process is not only temperamental, but is also the reason for the 10 day throughput time. On the other hand, the Chuka-Chuka cell takes advantage of an" ingenious quick change fixture". An obvious question is why can't the same fixture be used for the Blohm grinders. In addition, we are told that the reason we need to use encapsulation in the first place, is because the large grinding forces will cause the blades to break. There are however, several ways in which the grinding forces can be reduced. Each of them has a consequence. These are listed below:

a) Reduce depth of cut (this is almost surely exploited on the C-C cell); consequence-lower production rate, but what does this matter we could not take advantage of the 3 min. process time on the Blohm.

b) Add lubrication; consequence- additional cleaning step
c) Single point machining versus grinding; consequence- different machines and slower production rate; You can see this by comparing the specific energies given for grinding and cutting in Kalpakjian and Schmid. E.g. for Ti alloy, grinding gives 16-55 W·s/mm3 and cutting gives 2-5 W·s/mm3.

Given the overwhelming degradation in time performance caused by the encapsulation process, the consequences of the above actions, such as lower production rate, do not at first glance rule these actions out, further investigation would be needed.