

# Memo

Date: 11/29/2006  
To: Matt Ford  
From: Tricia Austing and Kiley Black  
RE: Positrol Workholding Job Shop Sequencing

---

## Introduction

As requested, the calculations to compare the scheduling effectiveness of the current sequencing rule to two new ones have been calculated. The current sequencing rule is first come, first served (FCFS) basis and the other two alternatives are the shortest processing time (SPT) and the earliest due date (EDD). Our focal point was on six specific jobs and their operating time and due date.

## Findings

**Rule Results.** In comparing Positrol Workholding's current sequencing rule of FCFS to the two new rules, SPT and EDD, it was found that the current rule did not have the best average flow time (total flow time/ number of jobs), the optimal average lateness number (total lateness/number of jobs), nor the lowest number of late jobs. SPT, average flow and average lateness was 11.12 days and -6.05 days respectively, while EDD, the third rule, had the lowest number of late jobs at 2. This is a key finding because the lowest number of late jobs will result in an increase in the number of happy customers. This will in turn increase revenue and profits.

**Implementation.** Because EDD has the lowest number of late jobs in comparison to the other two rules, the rule for shortest processing time should be chosen and implemented into Positrol Workholding's scheduling system.

**Regulation.** Once it is implemented the EDD rule should be monitored and a regular comparison of rules should also be implemented to ensure an optimal scheduling system.

## Discussion

**Method.** Operating time and due date information was obtained from six different jobs from Positrol Workholding. Using three different rules, FCFS, SPT, and EDD, individual job flow time and lateness is used to figure out the average flow time (total flow time/ number of jobs) and average lateness (total lateness/number of jobs). FCFS means jobs are processed in the order in which they arrive at a machine or work center. SPT means jobs are processed

Memo: Positrol Workholding Job Shop Sequencing

according to processing time at a machine or work center, shortest jobs first. EDD means jobs are processed according to due dates, earliest due date first. The flow time for the first job in the sequence is just the operating time. Each subsequent flow time is calculated by adding the current job's operating time to the previous job's flow time. When taking the average flow time, the lower number the better. A job's lateness is calculated by subtracting the due date from the operating time. A negative number means the job is finished early, zero is on time, and a positive number results in a late job. The number of late jobs was also determined through the analysis. The lower the number of late jobs, the better. This is the ultimate determinant because late jobs mean angry customers. Angry customers take their business else where which means lower revenue and profits for Positrol Workholdings.

**Rule Results.** Each rule calculation is shown below. Refer to table one for FCFS, table two for SPT, and table three for EDD. It was found that rule two, PST, have both the best average flow time with 11.12 days and the average lateness time of -6.05 days. The current rule, FCFS had the next best averages for flow time and lateness 15.25 days and -1.92 days, while the final rule's, EDD, flow and lateness respectively averaged out to be 15.6 days and -1.57 days. However, when comparing number of late jobs, EDD has 2 days while the other two have 3 jobs.

Table 1: First Come, First Serve

\* 3 late days

Job	Operating Time (days)	Flow Time= previous ft+current ft	Due Date	Lateness= flow time-due date
A	4.5	4.5	10	-5.5
B	6.0	10.5	17	-6.5
C	5.2	15.7	12	3.7*
D	1.6	17.3	27	-9.7
E	2.8	20.1	18	2.1*
F	3.3	23.4	19	4.4*
Total		91.50		-11.50
Average		15.25		-1.92

\*3 late jobs

Table 2: Shortest Processing Time

Job	Operating Time (days)	Flow Time= previous ft+current ft	Due Date	Lateness= flow time- due date
				* 3 late jobs
D	1.6	1.6	27	-25.4
E	2.8	4.4	18	-13.6
F	3.3	7.7	19	-11.3
A	4.5	12.2	10	2.2*
C	5.2	17.4	12	5.4*
B	6.0	23.4	17	6.4*
Total		66.70		-36.30
Average		11.12		-6.05

Table 3: Earliest Due Date

Job	Operating Time (days)	Flow Time= previous ft+current ft	Due Date	Lateness= flow time-due date
				* 2 late jobs
A	4.5	4.5	10	-5.5
C	5.2	9.7	12	-2.3
B	6.0	15.7	17	-1.3
E	2.8	18.5	18	0.5*
F	3.3	21.8	19	2.8*
D	1.6	23.4	27	-3.6
Total		93.60		-9.4
Average		15.60		-1.57

**Implementation.** The rule EDD should replace the current scheduling rule of FCFS because it has the fewest number of late jobs. Although it does not have the lowest average flow time or lowest average lateness, it had the best number in the category that matters. A table summarizing this data is shown below in Table 4. Lower average flow time and a lower average lateness number of days mean nothing if there are more late orders. The company wasn't able to use the lower average flow time to lower the number of late jobs because of how the due date fell in the sequencing order. Also, the even lower average number of late days just mean the jobs were finished extremely early. Problems arise with this when customer can't take finished products early or expect all products early. Therefore, the lowest number of late jobs should be the determinant. By implementing this rule, Positrol Workholdings will ensure the best scheduling results overall because it will have the most on time jobs. Late jobs not only may force customers to go somewhere else, but it can cause the company to reduce the price on the product to make up for the lateness. These two factors lower the profitability of the company.

Table 4: Summary Table

	SPT	EDD	FCFS
Average Flow Time	11.12	15.60	15.25
Average Lateness	-6.05	-1.57	-1.92
# of Late Orders	3	2	3

**Regulation.** Once the rule is implemented it should be monitored to ensure that jobs are running smoothly and completed as calculated. Positrol Workholdings should also do a periodic analysis of the current rule (EDD) and other possible rules to ensure that EDD is benefiting the company at that specific period. Internal changes as well as job changes and customer changes could cause a different rule to better fit the company's scheduling needs.

**Limitations.** The analysis only consisted of six current jobs. In the future more jobs could be added or the current job's due date or operating time could change. For example, the rule decision does not take into consideration a customer changing their minds about when they need the product or a break down of certain machines causing operating time to fluctuate. When these instances happen, another comparative analysis should take place to determine the best schedule.