Chapter 11
Scheduling the Production Obtained by Production Processes where Several Operations Are Performed and Repeated at Time Intervals Previously Set Forth for Various Products

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ABSTRACT

Programming the production obtained by processing the raw materials in several operations that are repeated at certain time intervals previously set forth for various products aims the serial production organised by manufacturing batches. The size of the manufacturing series implies determining the optimal level of the manufacturing series that takes into account the correlation of the number of products that will be manufactured with the unitary expenses, which are in turn based on total expenses established according to the expenses incurred by the immobilisations of means and those related to the time to prepare-complete the manufacturing batch. The optimal size of the series influences the level of the manufacturing batch next to the size of the preparation-completion time, operative time, and manufacturing conditions. Based on the two previously established sizes, the duration of the manufacturing cycle is calculated, separately emphasising the duration of processing and of interruptions. Once the manufacturing cycle duration is established, the possible calendar moves forward and the size of the half-finished stocks necessary for the smooth operation of the flow manufacturing line is established. Balancing the scheduled production is to be done on that manufacturing line and takes into account its correlation with the production capacity for every workplace and each machine-operation during the period of repeatability of manufacturing batches and of the transport batches.

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DETERMINING THE SIZE OF THE SERIES

The production series includes a certain number of items, which should be set at such a level, so that the amount of expenses reported per piece, resulting from the share of time for preparation and completion, from the value of the noncurrent assets and other expenses related to the production of a batch of parts should be minimum.

The size of the series (Courtois, Pillet, & Martin, 2000) obtained may be explained by means of Figure 1.

The need to determine the size of the series occurs in the low serial production, where there is a wide nomenclature of products, and where the manufacture of the same products is repeated at certain time intervals.

When approximately an equal number of same type products are manufactured for one month and there is no possibility to organise their production in successive series, it is no longer necessary to determine the size of the series.

Under the conditions of low serial production, the size of the series is a very important regulation, based on which the other calendar scheduling regulations are determined (batches, cycles, etc.) and the entire operative scheduling of production is organised (Bicheno & Elliott, 1997).

The size of the series must provide an as high as possible decrease of types of products scheduled monthly by each department, based on concentrating the production of some identical or similar products during one month.

In order to determine the size of the series, there is no rigorous method and this is why a selective method must be applied.

Usually, the relations (1), (2), and (3) are also used:

\[
\begin{align*}
n_{opt} &= \frac{\sum_{i=1}^{J} t_{pi}}{K_f \sum_{i=1}^{J} t_{bac_i}} \\
\end{align*}
\]

where:

- \( n_{opt} \): Represents the number of pieces in the optimum series;
- \( J \): Number of operations;
- \( \sum t_{pi} \): The amount of times of preparation and completion for the operations of that respective product, in min.;
- \( \sum t_{bac_i} \): The amount of time norms per product, for these operations, in min.;
- \( K_f \): The coefficient determined by the manufacturing conditions.

Figure 1. Optimum size of the series