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# Takt Time: A Guide to the Very Basic Lean Calculation

## Second Edition

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Mohammed Hamed Ahmed Soliman

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TAKT TIME: A GUIDE TO THE VERY BASIC LEAN CALCULATION

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# Takt Time

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## Takt Time

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**W**hat is takt? Takt is a German word for pace or beat. Takt time is a reference number that is used to help match the rate of Production in a pacemaker process to the rate of Sales.

One of lean manufacturing's most important calculations is takt time, or the rate of customer demand for a group or family of products produced by one process. Takt time is calculated by dividing the effective operating time of a process (be it a shift, a day, etc.) by the quantity of items that the customer requires from the process in that time period. For example, the operating time for a process is 28,800 seconds per shift. But the effective operating time is the operating time minus allowances, which can include planned downtime, lunches, breaks, team meetings, cleanup and planned maintenance. Assuming 1 hour for allowances, unplanned downtimes, changeovers (signify waiting waste) and other internal problems are those variables that need to be improved to have the best effective operating time. If the customer demands 420 pieces of a product during an eight-hour shift, the takt time will be 25,200 divided by 420, or 60 seconds. This means that based on the available time, on average, the customer is buying one unit every 60 seconds.

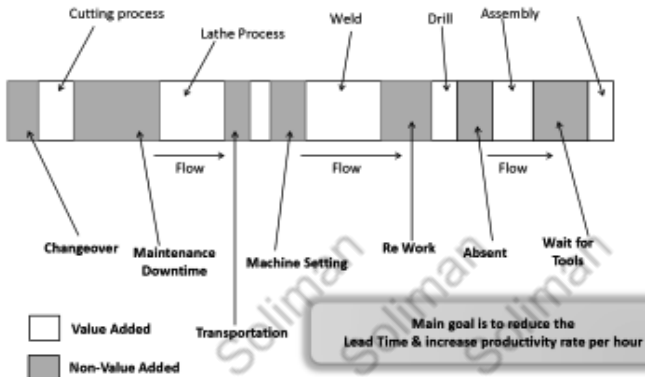
Obviously, the intended cycle time of an assembly process, called planned cycle time, is usually less than the takt time. So in less than one hour, we expect this machine on this shift to produce 60 pieces of product. Any interference such as unplanned downtimes would reduce the operating time thus reduce the productivity rate of this machine and delay the product for the customer.

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$$\text{takt time} = \frac{\text{(your effective operating time per shift)}}{\text{(quantity customer require per shift)}}$$

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Because the takt time must represent the actual customer demand rate do not subtract time for unplanned downtimes, changeovers, or other internal problems.



Too many unplanned downtimes presented by the non-value added activities that need to be removed/minimized.

### What if the long-term average demand and day-to-day actual demand are different?

You should check the range of daily customer demand variation by reviewing actual shipments (not orders) over the past twelve months. You cell should be able to handle sustained demand.

For occasional spikes in demand it is generally better to operate at a steady takt time. (Based on average long-term demand) and either hold a buffer stock of finished goods (small buffer) or run some daily overtime (only per need) to ensure ability to serve customer demand.

Changing takt time from day to day is inefficient, disrupt the work pace, and increase potential for quality problems.

### Regarding future demand

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It can be difficult to make accurate forecast far in advance. When future demand is uncertain it may be wiser to add capacity in steps as increased demand actually materializes rather than designing your pacemaker process now on peak demand that may not appear.

### **Levelling the product volume, mix and sequence**

Since customers don't order in a stable or predictable way, producing in a leveled schedule has been the foundation of Toyota production system. The Heijinka method is covered later in this book. In real life, customers don't order the same mix and quantity of parts every day. Changing the demand every day (as a try to follow customer demand in order hourly or daily) can create many wastes and issues in the value stream.

## Cycle Time

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To complete the picture you need to know the cycle time – the rate at which the products are produced. What you are trying to do is to get the cycle time to match the takt time.

Making comparison between cycle time and takt time is the approach that will allow you to start to be able to see and understand the waste that exists in your business.

The takt time or planned cycle time can be a good target to strive for. If the operator walks away from the line to get a tray for parts and the machine shuts down, this prevents the shift from achieving the desired cycle time. Thus, more resources or overtime will be required to complete the job and deliver the product to the customer on time. For example, in one factory an operator often left the machine to find tools or spare parts. Although the machine's uptime or availability was the full eight-hour shift, the operator's absence reduced the machine's actual use by 10 percent each shift. This company was subtracting the operator's absence from its calculation of effective operating time, thereby losing the opportunity to improve that process by better training and a better system for making sure that the operator had the right tools and parts.

When the work elements assigned to the operator contain wastes such as undesired movements, this will make the cycle time less efficient and it will be difficult to meet the takt with the current resources. More operators will be required to do the job.

Figure (1) below present 7 different departments involved in making the same product A. We can go from one operation to another timing how long each step takes, and then comparing

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total cycle time to takt. You have to pay attention that I said (timing), it means you have now the waste-free (after kaizen) total cycle time.

Adding up the cycle time of all operations gives us a total cycle time of 165 seconds to make product A, compared to a takt time of 60 seconds. For efficiency, each operator cycle time should be equal to takt time so divide the cycle time by takt time to see that 2.75 operators are needed to have the cycle time equal to takt time.

By introducing a one piece flow of product, and connect the processes to one single production cell, you have now eliminated the waiting and delays and the difficulties for the operator to handle multiply tasks due to transportation and inventories problems.

Figure (2) below show the different after the improvement is made. This is almost 61 percent productivity gain. All you did was compare the cycle time to the rate of customer demand (takt). Operator 1 is now given enough work to 60 second cycle, can operator 2, operator 3 will have to do the remaining work and still have 15 seconds to spare.

Work element or work content is the minimum amount of work necessary to produce a good part. In the previous example, if the work element of the operator has some wastes such as delays and waiting (refer to waiting and motion wastes) it will increase the total cycle time that is required to make one piece. Thus increasing the resources needed to meet the takt or causing delay in customer order.

It is important to measure the operator cycle time and eliminate the waste from the work elements assigned to the