Standard WIP

Overview

A few module ago we learned that Standard Work in Process, also referred to as Standard WIP, is the minimum amount of work in process necessary to keep the process flowing smoothly.

The idea is to not have too much or too little work in process, based on the timing and sequence required as well as taking into account limiting factors within the process such as batch size, distance or waiting time.

Standard WIP includes all in-process materials. These can be parts being worked on manually, parts on machine auto cycle, parts that are drying / curing / or used for setting things up.

Standard WIP can also be parts or material out to an external vendor for processing as we'll soon discuss in more detail.

Simplified Calculation

In its simplest form, Standard WIP is calculated as follows:

\[ \text{Standard WIP} = \frac{(\text{Manual CT} + \text{Auto CT})}{\text{Takt Time}} \]

(Manual Cycle Time + Auto Cycle Time) / Takt Time where manual cycle time describes the time a person is needed to perform a task such as to load and unload parts while automatic cycle time describes the time a machine or automatic operation takes to complete a task without needing operator intervention.

So, we may have a situation with 10 seconds of manual cycle time as an operator picks up a part and loads it into the machine followed by 30 seconds of automatic cycle time as the machine processes the part our total cycle time would be 40 seconds.

When a process is operating at, or slightly less than Takt Time Standard WIP will usually be 1 piece.

With this said, in many situations we're going to face slightly more complex situations... as such the way we calculate Standard WIP will vary.
Advanced Calculation

So let’s work through an example in order to see exactly how to go about this. Here we see a process that’s been arranged to produce product in a one piece flow manner.

We also see some machines with automatic cycles which are noted as white boxes. Additionally, we see one external operation in blue where parts are sent outside the facility for processing.

By following the time study process we learned about in the Gemba Academy Quick Changeover course that involves video taping the process and then carefully studying the manual and automatic cycle times this time observation table was created.

Additionally, using the Gemba Academy takt time calculator, this team was able to determine that their takt time was 245 seconds per piece. In other words, in order to satisfy customer demand a widget needs to be produced every 245 seconds.

This information is then noted on the Standard Work Sheet. Now, as a point of clarification, it’s not necessary to actually note the cycle times on the sheet but you can if you find it helps.

At this point we’re now ready to calculate the Standard WIP for this manufacturing process. The first component of Standard WIP is to ensure at least one piece of SWIP is available for each operator.
In our case this means 3 pieces of Standard WIP since this process has 3 operators working in it. Here is what the Standard Work Sheet looks like with these 3 pieces of SWIP added. And as a reminder from the Standard Work Sheet module the green ovals represent each operator.

1) In-hand parts (One part per operator)
   - Example: 3 operators = 3 pcs

2) Parts at machines with auto cycles
   - Formula: Auto Cycle Time/ Takt Time (always round up)
   In Our Example:
   
<table>
<thead>
<tr>
<th>Autocycle</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>41&quot; (drilling)</td>
<td>41&quot;/245&quot; = 0.16 = 1 pc</td>
<td></td>
</tr>
<tr>
<td>148&quot; (swaging)</td>
<td>148/245 = 0.6 = 1 pc</td>
<td></td>
</tr>
<tr>
<td>600&quot; (cure time)</td>
<td>600/245 = 2.44 = 3 pcs</td>
<td></td>
</tr>
</tbody>
</table>

3) Parts at batch processes
   - Formula: Process Lead Time / Takt Time x 2
   In Our Example:
   
   27,000" (vendor process) = 27,000/245 (= 110.2) x 2 = 220.4 pcs

Next, we focus on the parts at machines with auto cycles. To calculate SWIP at these machines we divide the automatic cycle time by the takt time. We always round up.

So, in our example where we have three processes we see the cure time step, which takes 600 seconds of auto time, requires 3 pieces of Standard WIP. Here is what these pieces of SWIP look like when added to the Standard Work Sheet.

Notice how we note the curing SWIP with a x3 notation instead of drawing 3 different symbols. We do this to keep things neat and readable.

Finally, the third component of SWIP calculation has us examining parts at batch processes such as our example where parts are sent to an external supplier for processing before coming back to our facility.

When this is the case, we calculate SVIP by dividing the lead time by takt time and then multiplying this by 2. So, in our example we divide the lead time of 27,000 seconds by the takt time of 245 seconds which gives us 110 pieces. We then multiply this by 2 since we'll need parts to work on while another batch is being processed by the vendor.

In total this batch process requires 220 pieces of SWIP to maintain smooth flow. So, when we add up the different types of Standard WIP we learn that a total of 228 pieces is required for this process. We note this on the Standard Work Sheet as shown here.
Now, depending on the process you may need to make some slight modifications to the way SWIP is calculated… but the principles you’ve learned here should suffice for most of the situations you face.