Asprova's "Pocket manual" series No.4

Multiple assignment to the same equipment

We frequently see in the fabrication of semiconductors, the use of an Asprova APS to make multiple assignments on the same machine. The assignment of simple parameters leads to empty time and that leads to a poor plan. Here we will show you methods of assigning parameters that will prevent that from happening.

With data

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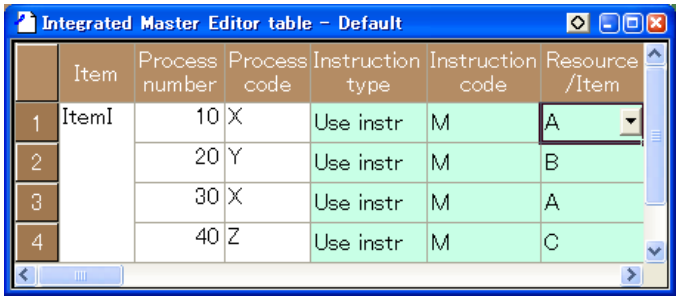
Problems using the same machine more than once

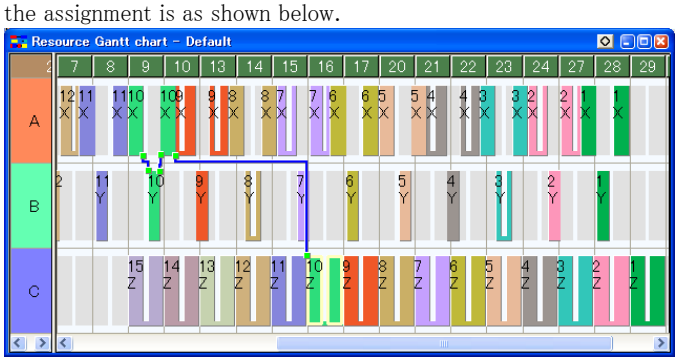
Fig. 1 shows an example of an integrated master used for making several passes on the same machine. In this example, processes 10 and 30 are the same.



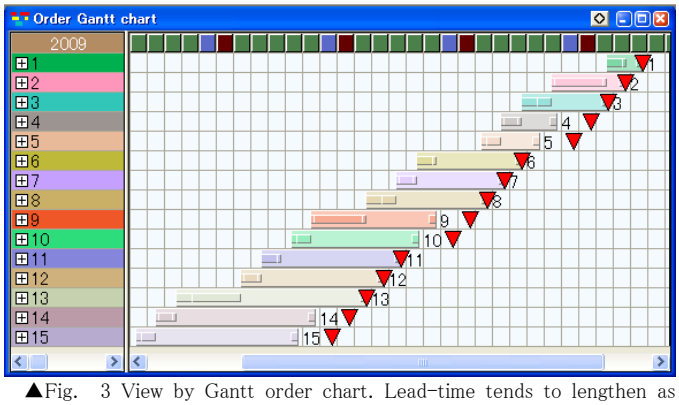
	Item	Process number	Process code	Instruction type	Instruction code	Resource /Item
1	ItemI	10	X	Use instr	M	A
2		20	Y	Use instr	M	B
3		30	X	Use instr	M	A
4		40	Z	Use instr	M	C

▲Fig. 1 Integrated master table Processes 10 and 30 are the same.

And, they are using the same resource [A]. Several of the orders for product I passing through this process line are registered and when the default planning parameters assign "backward," to these orders the assignment is as shown below.

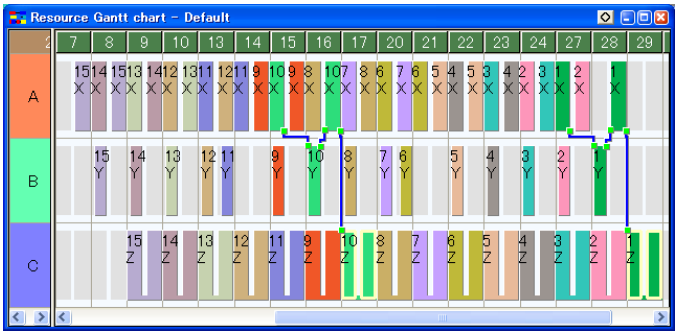


▲Fig. 2 Assignment of "backward" by default planning parameters

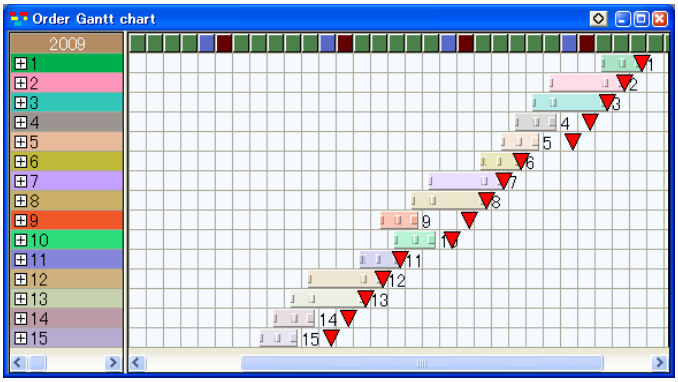


▲Fig. 3 View by Gantt order chart. Lead-time tends to lengthen as dispatch sequence order goes up.

At first glance this seems good, but lead-time tends to lengthen the older the order is (orders to the left, those with higher numbers). A look at the Gantt order chart (Fig. 3) shows this more clearly. It becomes clear. The reason that this happens must be the assignments shown in Fig. 4. That is, machine A is using process lines 10 and 30, and if one order is done on line 20, then all other orders must be processed. It is a lot like how a comb must go through the hair, it has to be at the right angle, or you won't be combed properly. The assignments must match in alternation with each other. Achieve this kind of assignment; lead-time is uniform as shown in Fig. 5's Gantt order chart.



▲Fig. 4 Assignment originally expected. Each order meshes with all the others.

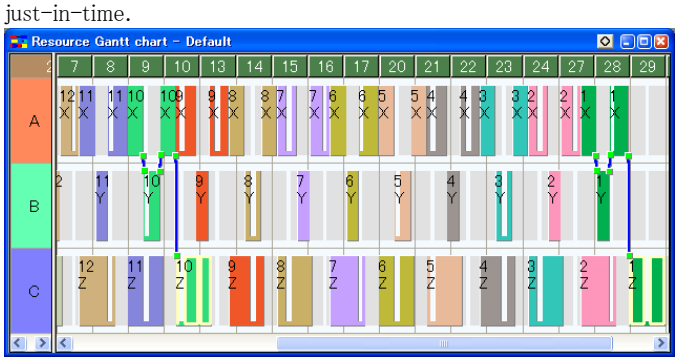


▲Fig. 5 A Gantt order chart when the assignment originally expected is obtained. Lead-time is uniform and moreover, assignment is just-in-time.

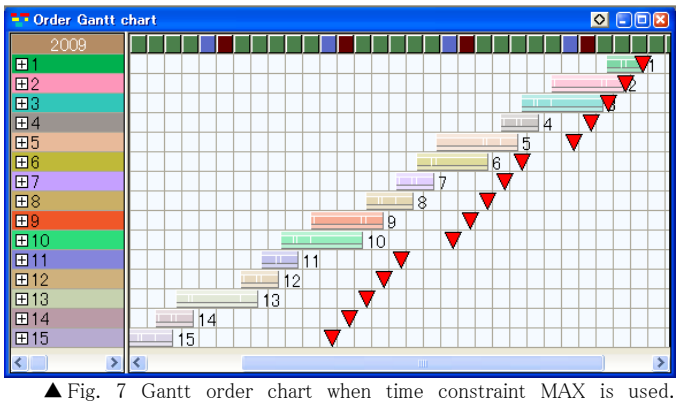
How to use time constraint MAX

Constraints like these are frequently seen in which simple solutions cannot be obtained and some scheme is needed to achieve the ideal results shown in Fig 4. Just because lead-times are long we attempt a coping method using time constraint MAX. However, time constraint MAX does not work well. An attempt to assign using time

constraint MAX turns out like Fig. 6 and Fig. 7. The Gantt order chart in Fig. 7 clearly shows the essence of the problem, but although lead time itself uniformly decreases, the more the dispatching sequence is delayed, the more that the assignment position gets farther from the delivery date and eliminates just-in-time.

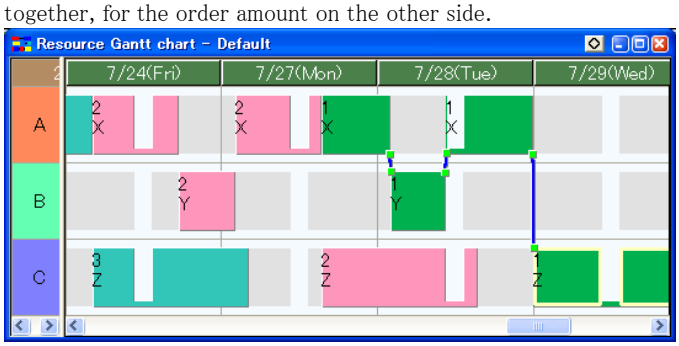


▲Fig. 6 Gantt resource chart when time constraint MAX is used.

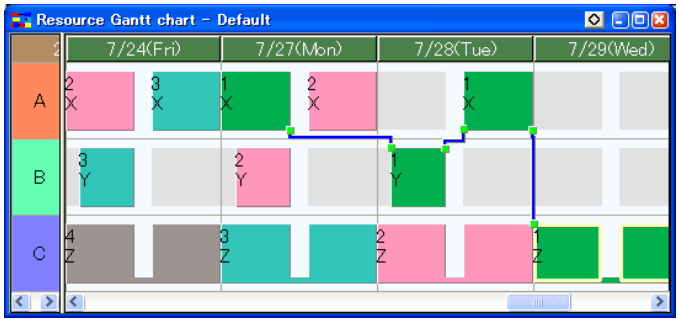


▲Fig. 7 Gantt order chart when time constraint MAX is used. Lead-time is uniform but just-in-time has been eliminated.

That is because when time constraint MAX is used, each order searches for a location that satisfies the requirements of time constraint MAX, and determines an assignment position for each order, but will not provide free time, like gear-teeth meshing together, for the order amount on the other side.



▲Fig. 8 Gantt resource chart when time constraint MAX is used.



▲Fig. 9 Ideal assignment

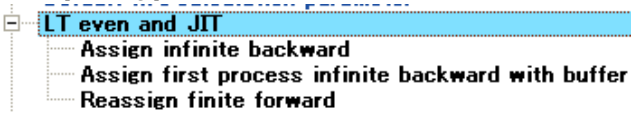
Look at the example of results for assigning orders [1] and [2] shown in Fig. 8in which the two are not meshing and if the lead process for order [1] is not assigned more toward the past, then process 30 for order [2] will not fit in.

Help "Time constraint MAX option" (Help No. 754010)

What's the best planning parameter?

We will now explain the best methods for achieving short, uniform lead times and just-in-time with this data.

First, they cannot be achieved in just one assignment if consideration is given to orders (operations) on the opposite side. The graphic in Fig. 10 shows an example of the planning parameter in the planning parameter combo box.

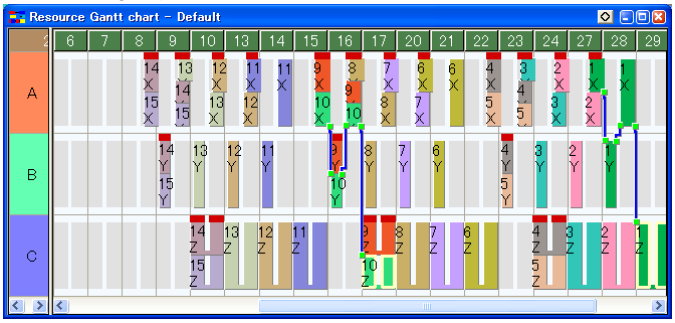


▲Fig. 10 An example of a planning parameter for minimizing lead-time (LT) and assigning in just-in-time (JIT)

A planning parameter can be divided into three stages.

■ Assign infinite backward

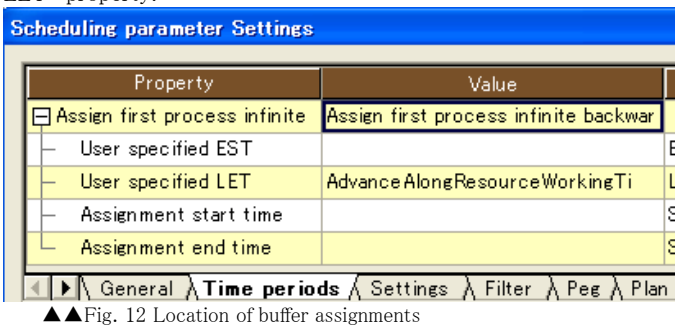
First assign by infinite backward.



▲Fig. 11 Gantt resource chart when assigning by infinite backward

■ Assign first process infinite backward with buffer

Then attach a buffer to the initial process and assign by infinite backward. That is because we want to pass order [1], the initial process, which is assigned in front of order [2] in process 30. Buffer assignment uses the planning parameter's "User specified LET" property.



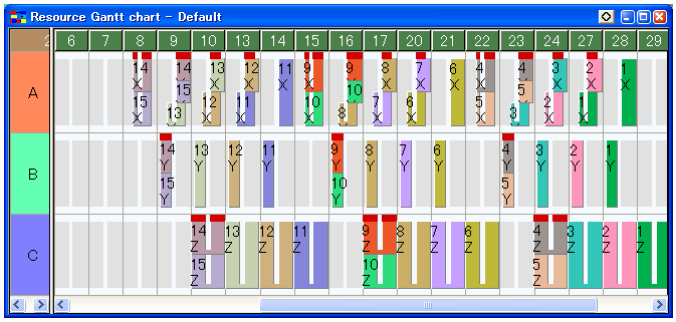
▲▲Fig. 12 Location of buffer assignments

This:

AdvanceAlongResourceWorkingTime(ME.'Main resource', ME.'Production end time',-2h)

is assigned in the expression and the buffer is attached for just two hours as determined by operating time. This assignment gives the situation shown in Fig. 13, in which operation assignment location has been passed.

※ Factually speaking, the "**Assign first process infinite backward with buffer**" parameter is incorporated within the "**Assign infinite backward**" parameter and although this is done in two stages, rather than three, the division here is in three stages for easier understanding.



▲Fig. 12 After attaching buffer and reassigning only the initial process

■ Reassign finite forward

Then finally, make assignments using the theory of constraints and based on this assignment status. Doing that provides assignments like those in Fig. 4. The dispatching rule for these parameters is "**Operation production start time**"+"**Descending**" and they are reassigned, based on previous assignment results, from the side toward the future. There are no particular settings other than those.

Q&A

How do you derive the two hours that are assigned to **User specified LET** for attaching the buffer?

That will depends on what the data and the conditions are at that particular time so the decision has to be made in line with the circumstances of the moment.

When products having different manufacturing times are mixed together things may not work out well at fixed times. This is one of the hurdles of difficulty at such a time, but it is also when some sort of scheme for solution must be devised. We have to clarify what the ideal assignment is and we have to very carefully discern what the logic will be for it. I will save that explanation for another time after having seen some specific examples.

For more information

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