

MRP Logic Doesn't Work for Master Scheduling

By: **Dave Searle**

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In my last article, I explained the need to synchronize the Master Schedule to the S&OP Supply Plan. The key is to derive the MS Flow Rate directly from the S&OP Supply plan. This is easier said than done.

In most systems, MRP calculates the **supply (released, firm and planned orders)** for each SKU in the family based on the **requirements (Shipment Plan)** and **projected inventory position** compared to **safety stock**. In S&OP we manage the Shipment Plan and the Supply Plan, and the difference goes to inventory. In S&OP we use inventory as a buffer, while MRP always wants to hold inventory equal to the safety stock.

The crux of the problem is that MRP does not use inventory as a buffer!

A note on terminology. In S&OP we have a Shipment Plan, a Supply Plan and an Inventory Plan. The shipment plan at the family level is represented in MRP as requirements for the individual SKUs in the family. The Supply Plan in S&OP is represented as released, firm and planned orders for the individual SKUs in MRP. This is important:

- **S&OP Shipment Plan** = The Sum of Customer Orders, Dependent Requirements and Forecast Requirements for the family SKUs in MRP
- **S&OP Supply Plan** = The Sum of Released, Firm and Planned Orders for the family SKUs in MRP

Most ERP systems require manual intervention before MRP can produce a set of planned orders that match the S&OP Supply Plan. In the example shown below where we are comparing the two plans, you can see that the requirements in S&OP and MRP are the same, but the Master Schedule generated by MRP is not equal to the S&OP Supply Plan. This is because in S&OP we manage the Shipment Plan (requirements) and the Supply Plan, but MRP accepts the requirements and the inventory rules and then plans supply. In S&OP the difference goes to inventory, but in MRP the difference goes to supply, and typically they won't match.

MRP is a good tool, but at the master schedule level, it needs management to make sure that the sum of the master schedule equals the S&OP Supply Plan.

When you look at the family S&OP example, you can see that a shipment plan and a supply plan have been developed for the family. The inventory plan is the result of the difference between shipment and supply. Inventory is being used as a buffer.

Family	S&OP Plan	1	2	3	4	
	S&OP Shipment Plan	75	75	125	125	
	S&OP Supply Plan	100	100	100	100	
	S&OP Inventory Plan	300	325	350	325	300

We know MRP is going to net the on-hand inventory. It's standard logic for MRP to project the "available" into the future and determine the point in time that it will be consumed, and then plan an order to replenish. Bleeding this on-hand inventory is a rule that MRP strictly follows.

Comparison of S&OP Family Plan to MRP Plan

Family	S&OP Plan	1	2	3	4	
	S&OP Shipment Plan	75	75	125	125	
	S&OP Supply Plan	100	100	100	100	
	S&OP Inventory Plan	300	325	350	325	300

SKU1	MRP	1	2	3	4
Lotsize = 65 SS = 20	MRP Requirement	40	35	60	65
	MRP Master Schedule				65
	MRP Inventory Projection	200	160	125	65

SKU2	MRP	1	2	3	4
Lotsize = 40 SS = 10	MRP Requirement	20	10	35	40
	MRP Master Schedule			40	40
	MRP Inventory Projection	50	30	20	25

SKU3	MRP	1	2	3	4
Lotsize = 30 SS = 5	MRP Requirement	15	30	30	20
	MRP Master Schedule			30	30
	MRP Inventory Projection	50	35	5	5

Total MRP Requirement		75	75	125	125
Total MRP Supply Plan		0	0	70	135
MRP Inventory Projection		225	150	95	105

Differences between S&OP Family Plan and the MRP Plan

Requirements	1	2	3	4
S&OP Shipment Plan	75	75	125	125
MRP Requirements	75	75	125	125
Difference	0	0	0	0

Supply	1	2	3	4
S&OP Supply Plan	100	100	100	100
MRP Master Schedule	0	0	70	135
Difference	-100	-100	-30	35

Inventory	1	2	3	4
S&OP Inventory Projection	325	350	325	300
MRP Inventory Projection	225	150	95	105
Difference	-100	-200	-230	-195

In this example, the MRP Requirements at the SKU level sum up to equal the family S&OP Shipment Plan, yet the MRP Master Schedule is generating a completely different plan than the S&OP Supply Plan, and this also results in a significant difference between the Inventory Plans.

It's a simple problem that is not widely understood. MRP is designed to net available inventory and maintain safety stock, and therefore without intervention, these two plans will never equal. Fixing this problem will be the subject of my next article.