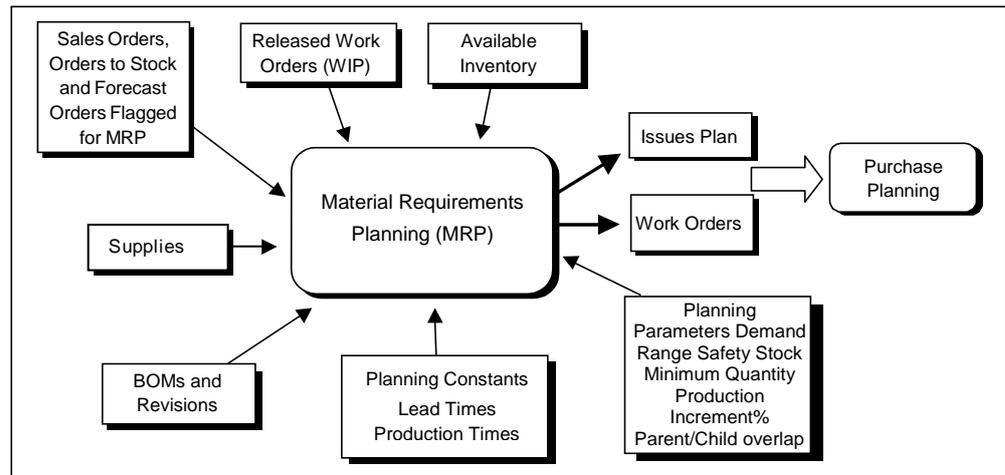


Material Requirements Planning (MRP)

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MRP – Introduction



Material requirements planning regulates production timing according to the demand for processed parts, and creates a timetable for the issue of raw materials required for their manufacture.

As opposed to production planning, MRP uses infinite-capacity planning, i.e., it does not take production limitations into account. Planning is generally carried out on the basis of sales orders, forecast orders and orders to stock that were flagged for MRP. In addition, MRP prepares sub-assembly work orders and can create a work plan as well as issue plans for open work orders.

Issues are calculated on the basis of demand for top-level parts and parent-child ratios recorded in the bill of materials (BOM), taking into account BOMs for sub-contracted work orders and upcoming BOM revisions. MRP addresses daily production requirements independent of any constraints arising from work hours, production capacity, set-ups and the like.

The module includes a mechanism for viewing plant-floor inventory balances, including open work orders (work-in-progress, or WIP), which can be taken into account by MRP.

Calculating Demand for Top-Level Parts

The MRP program calculates the demand for top-level parts until a designated date, called the planning horizon. The system divides parts into two categories, according to their replenishment type (i.e., the method used to calculate demand for the part). Demand for the first type is dynamic, that is, based on sales orders and forecast orders. Demand for the second type is static, that is, the same fixed quantity is required over a set interval of time.

For parts of the first type (dynamic demand), MRP calculates demand according to open sales orders or forecast orders over the period being planned. This calculation also takes into account the required safety stock defined for each part.

For parts of the second type (static demand), MRP calculates demand according to the part's required fixed quantity and safety stock. Even if orders are opened for parts of this type, MRP does not take them into account when calculating demand.

After calculating demand, MRP subtracts existing inventory in order to determine production demand. MRP can also be configured to subtract the quantity of WIP (i.e., open work orders) and the current floor inventory.

Calculating Demand for Sub-assemblies and Raw Materials

As with top-level parts, MRP calculates the required quantities of child parts and raw materials according to their replenishment type. Dynamic demand for child parts and raw materials is calculated by “expanding” the BOM of the required top-level part, while static demand is a known fixed quantity per interval. Here, too, MRP takes into account the safety stock required for each part and material.

In **Priority**, MRP can determine material requirements in the case of production by subcontractors (BOM for subcontractors), or when future revisions of the BOM are due to come into effect.

Running MRP Simulations

You can run the MRP program as a simulation. This enables you to view planning reports without opening any work orders or preparing issues plans. Simulations enable you to try out a variety of planning parameters and analyze results. When results are satisfactory, you can run the program as an actual plan using the chosen parameters.

Opening Work Orders

Usually, MRP opens work orders for the required top-level parts (and their sub-assemblies). However, it is possible to configure a part such that MRP will list any required issues in the issues plan (under a separate category) without opening a new work order. In this manner, work orders can easily be opened manually.

MRP opens work orders for sub-assemblies on the basis of the top-level part's BOM, coordinating the timing of these work orders with those of other sub-assemblies and of the top-level part.

You can configure MRP to open one work order for each part, which includes all demand for the part over a given time period, called the “demand range.” Thus, if the demand range defined for part A is one week, MRP will open one work order for all demands for part A that fall within the first week, a second work order for all demands that fall within the second week, and so forth. Alternatively, you can configure MRP to open one work order for all part demands that fall within a month (monthly range). In this case, one work order is opened at the beginning of the month for each required part.

MRP takes additional parameters into account when timing work orders and determining their size: permitted overlap percentage (when production of a parent part begins before production of the child part is completed), minimum and maximum allowed production quantities and the production increment, as defined for each required processed part. In addition, individual work orders that have already been released can be “frozen” in time, such that additional MRP runs cannot change their production dates.

Sales Orders and Forecast Orders

When MRP calculates dynamic demand for top-level parts, the program takes into account sales orders and forecast orders (flagged for MRP) whose due dates fall before the planning horizon. Forecast orders “compete” with their corresponding sales orders in this process, reducing the demand that they create; as a rule, MRP calculates demand on the basis of the larger of the two values.

A constant determines which forecast order items are used to reduce the demand generated by sales orders: either those forecast parts whose due date falls before the actual ordered item's due date (to ensure that sales orders are filled on time), or all forecast parts that are due in the same month as the corresponding sales order item (to prevent the accumulation of surplus inventory).

MRP can also be run in such a way that the forecast order is offset by existing inventory of the required part, in which case the competition with sales orders is limited to the offset value. For example, 100 units of a part exist in inventory, the forecast order for the next month is 200 units and actual sales orders for the next month require 150 units. After the forecast order is offset by inventory (200-100), sales orders become the larger value (150 > 100), resulting in a calculated demand of 150 units.

In any case, MRP always calculates *production* requirements by offsetting existing inventory. In other words, even if MRP calculates demand according to forecast orders without reference to inventory or sales orders, production requirements are still calculated as demand minus inventory.

WIP and Floor Inventory

MRP can also take into account WIP (open work orders). That is, it will subtract WIP (in addition to existing inventory in regular warehouses) from the calculated demand. Furthermore, MRP can take into account existing floor inventory. In such a case, MRP will automatically run the **Backflush** program, thus updating the system's floor inventory balances.

New Orders

You can run MRP solely for new orders. In this case, MRP opens work orders and create issues plans only for new orders of the required part (i.e., orders that were not included in the previous run of MRP). This option is useful when several new orders have been added at the end of the month, after work orders and issues plans have been prepared for all previous orders.

Alternate Parts

If an alternate part (general or relative to a parent part) has been defined for a certain child part, MRP generates demand against the inventory of the alternate part if the original part is not available.

Production by Subcontractors

You can create a list of subcontractors to produce a given part, based on order of precedence and production capacity. For example, three subcontractors capable of producing a certain part are assigned precedence values of 1, 2 and 3, and can produce 300, 200 and 100 units of the part, respectively. According to demand for the part, MRP opens separate work orders for each subcontractor, from the highest precedence down. Thus, if a total quantity of 200 units is required, MRP prepares one work order for 200 units for the first subcontractor (whose production capacity is 300 units). If 700 units are required, MRP prepares four work orders: the first for a quantity of 300 from the first subcontractor, the second for a quantity of 200 from the second subcontractor, the third for a quantity of 100 from the third subcontractor and the fourth for a quantity of 100, again from the first subcontractor.

Issues Plan and Bill of Materials

MRP prepares an issues plan for each work order that it opens, as well as for each open work order. If the child parts are themselves processed parts, MRP opens work orders for them when needed. MRP times these child work orders such that the parent work order will be ready on time (according to its demand range or to a monthly work order). The parameters taken into account by MRP are the

production times of the child parts and the parent, and the permitted overlap percentage (when production of a parent part begins before production of the child part is completed).

MRP plans child work orders and issues according to the BOM of the parent part (and the BOM of each processed child part). If different BOMs are defined for different subcontractors for the same part (for example, when one subcontractor purchases the necessary components, while another subcontractor is supplied components by your company), MRP takes this into account when planning issues.

If a new BOM revision has been defined for a part (i.e., a BOM in which one or more of the child parts have changed) and is due to come into effect before the planning horizon, MRP “expands” the new BOM revision on the correct date. In other words, the issues plan designates issues of the old child parts for work orders dated before the new revision comes into effect, and issues of the new child part for work orders dated afterwards.

When MRP prepares an issues plan for work orders that were opened manually, it prepares the issues according to the BOM defined in the work order itself. If the work order has a custom BOM, MRP makes the necessary adjustments.

Priority's MRP can aggregate issues per work order, parent part and month.

Analyzing MRP Results

MRP results can be analyzed in forms and through various reports. You can also produce a Gantt chart that not only displays the timing of work orders and child work orders in a graphic format, but also allows you to change the actual data from within the chart.