Master Recipes

Introduction

The master recipe describes the production of one or several materials in a production run. It contains master data and details the plant-specific use of a process. It is used in MRP runs and in campaign planning, as well as in process planning and control.

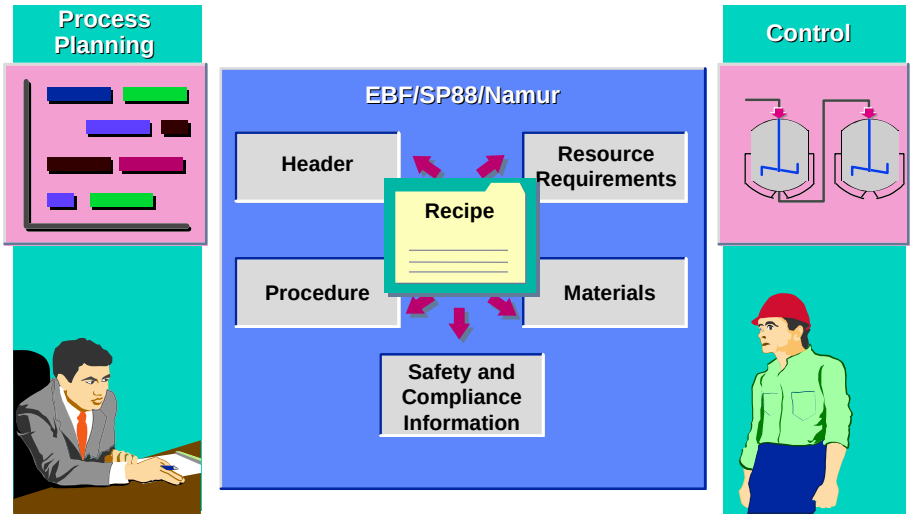

Fig. 5-1: Master recipes in PP-PI

Conformity to Norms

The master recipe was designed in close conformity with the norms and guidelines of the following institutions:

- ISA (Instrument Society of America) with the Norm SP88
- NAMUR (Norms working committee for measuring and control techniques in the chemical industry): For the requirements of process planning, PP-PI has included some enhancements over and above the NAMUR requirements.
- European Batch Forum: coordinates the work of national European committees such as NAMUR with ISA.

FDA/GMP Guidelines

Recipes contain all the information required by the FDA (Food and Drug Administration) in their GMP (Good Manufacturing Practice) guidelines for the documentation of process specifications. For each recipe and recipe object (for example, operations / phases, material components, or process

instructions) involved, changes are documented separately. If a change number is entered, it is possible to have changes with a validity period.

The authorizations for changing recipes ensure that only authorized changes are made, as required in the GMP guidelines.

Links to R/3-PP

At the same time, the development of PP-PI placed emphasis on keeping full integration with the data flows represented in the classical R/3 PP module. There are many relationships between PP-PI and PP, since discrete and non-discrete production flows contain common functionality such as scheduling and product costing. In this way, manufacturers can use the functionality of discrete and process flow production simultaneously.

Master Recipe Functions

A master recipe describes the steps (operations and phases) involved in a production process, allocates resources and materials to the process, and contains process instructions and their characteristics for purposes of process control.

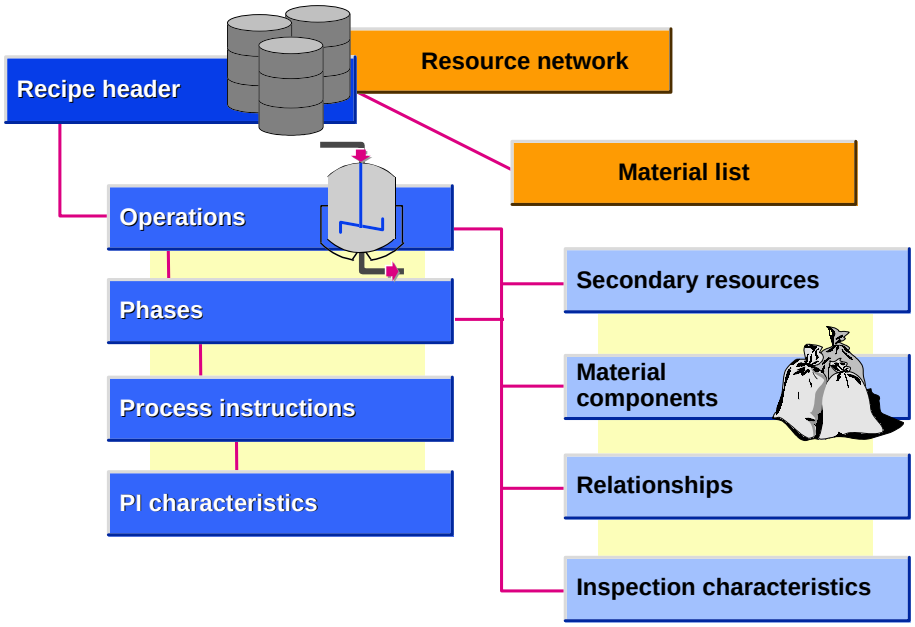

Fig. 5-2: Structure of the master recipe

In the R/3 System, master recipes have the same basic structure as routings, inspection plans, maintenance task lists, and library networks.

Seen from the perspective of process planning, it is important to consider the time sequence in which a batch is produced. This information is stored in the **operations** and **phases** of a recipe.

Allocation of Resources to Operations/Phases

An operation is an independent part of a recipe carried out at a processing unit (primary resource). An operation can be subdivided into phases. Operations as well as phases can have resources and materials allocated to them.

If operations are allocated to a particular processing unit, their execution time corresponds to the duration that the substances remain at the processing unit. For each operation, additional resources (secondary resources) can be defined, which can be allocated using a time offset. This could be labor resources, energy, transport, etc.

In the master recipe, it is possible to first store only requirements for the resource to be used, without specifying exactly which one. At the time a process order is released, the user can then select a particular resource. For this, resources need to be classified via the R/3 classification system. From the resources which correspond to the requirements of the operation, the user can then select an appropriate one.

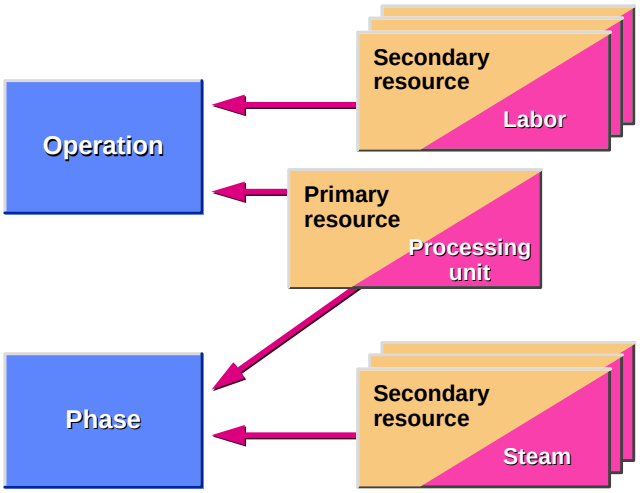

Fig. 5-3: Allocation of resources

Relationships

Phases can have relationships with other operations and phases. Relationships specify the type of time sequence for operations/ phases. A simple example is the synchronization of phases belonging to different operations. Another example involves the mixing and heating of substances in one vessel, but where the duration of mixing is longer than that of heating. The two phases “mixing” and “heating” have different durations, and their start is linked by a relationship.

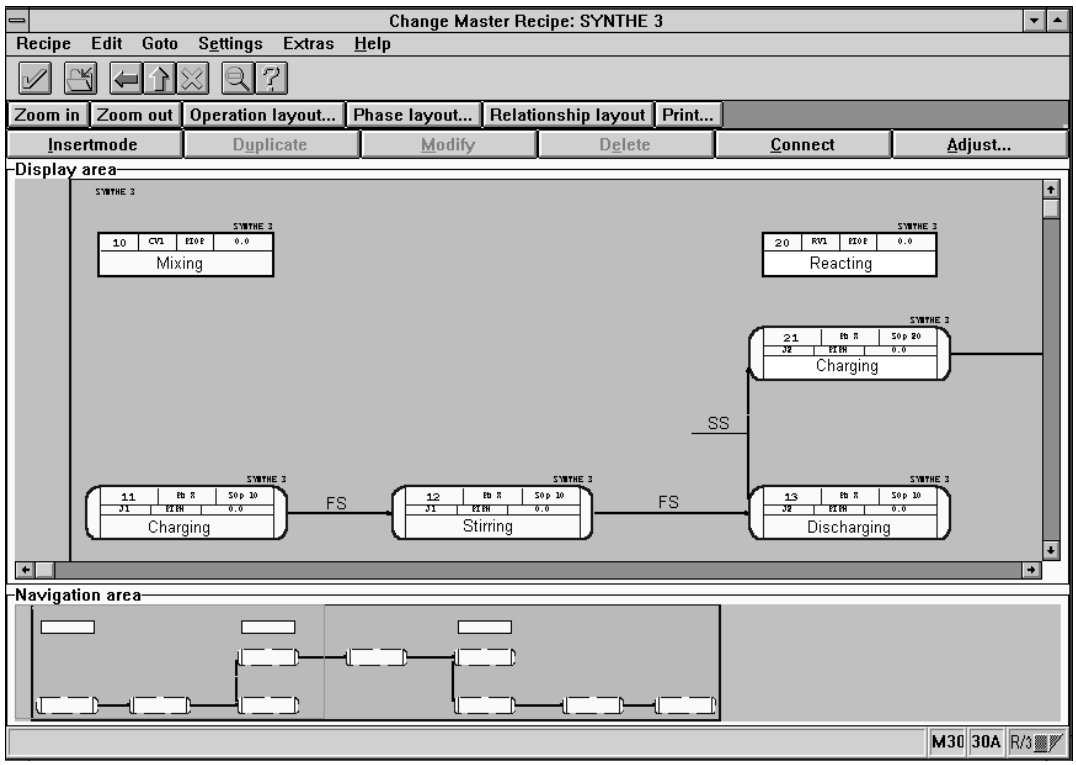

Fig. 5-4: Relationships of operations and phases

Process Instructions

Information for the process control level is stored in process instructions in the master recipe. A process instruction is a structure with which data or instructions are transferred from process planning to process control. Process instructions are allocated to the phases of a recipe. After a process order containing this recipe is released for production, the operations and phases in it are combined to form control recipes.

Control Recipe Destination

The process instructions to be combined in a control recipe are specified in the master recipe using the so-called control recipe destination. This can be a process control system or a line operator, to which the control recipe is transferred for further processing. Via the control recipe destination, you can specify the technical address to which a control recipe is to be sent and how the data transfer is to take place (for example, triggered by the R/3 System or by process control).

You can get further information on process instructions and control recipes in Chapter 8 *Process Management*.

Material List

An important part of the master recipe is formed by the material list/BOM linked to it, which contains all input and output materials. It serves to represent all the material flows involved in a process. The material list is designed for process flows in which input materials are consumed and valuable/remaining materials are produced. In contrast to the classical bill of material (BOM), which is created for a finished product, the material list is created for the process and can also contain, for example, catalysts. The material list becomes "process-specific" when a BOM alternative of a multiple BOM is allocated to a master recipe in a 1:1 fashion.

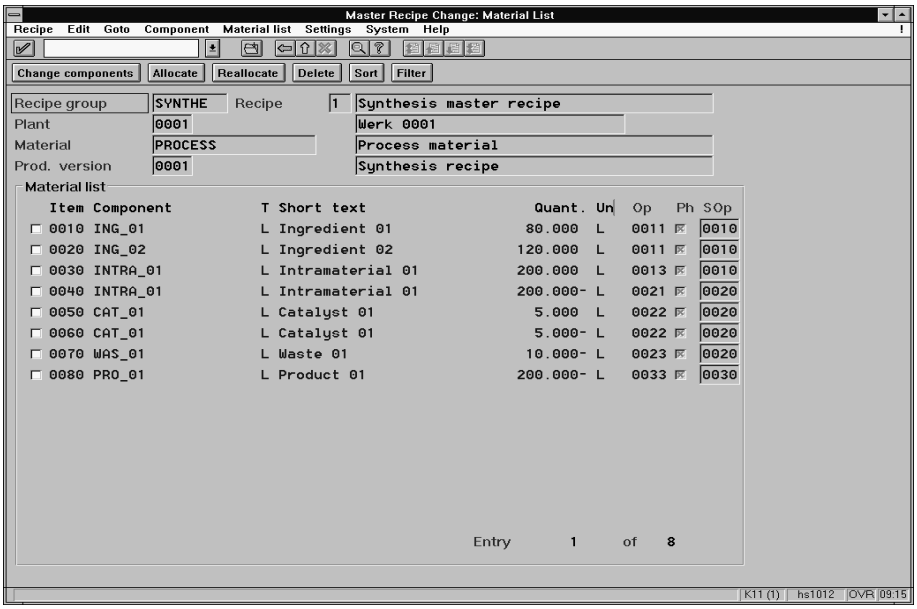

Fig. 5-5: Material list for a master recipe

The material list contains planned values for the input materials, their mixing ratios as well as the yields and remaining substances (by-products, wastes) to be produced. The user has to define the finished products, the input materials and all other produced materials in the form of material master records (MM). For intra materials, however, this is not the case.

Intra Materials

An intra material is a material without a master record, which only appears temporarily between two processing units. This can be, for example, a charge quantity which is flowing from one vessel into another. The charged substance needs, for example, to be distilled before it comes out as a finished product.

It is necessary to define intra materials in orders, for example, to calculate material quantities or carry out in-process inspections for them.

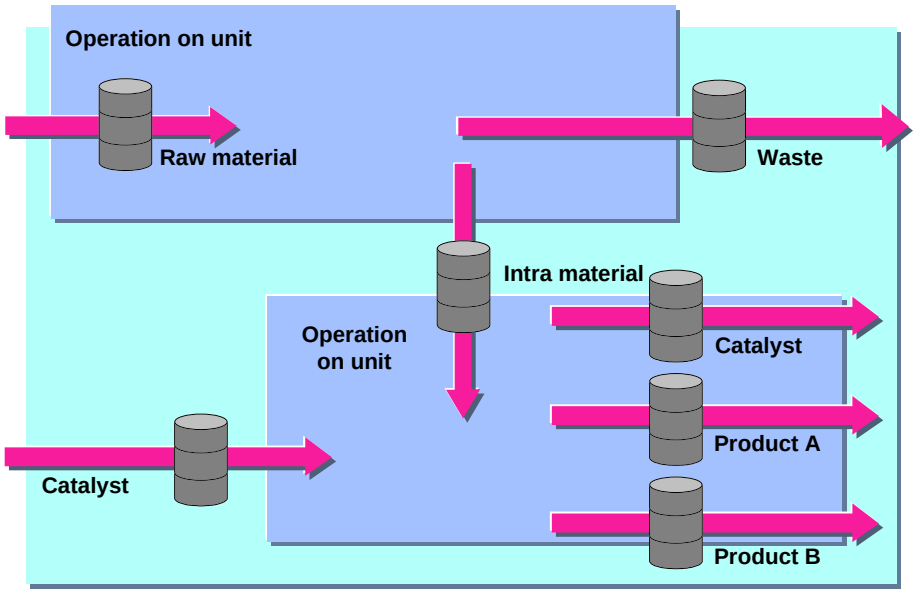

Fig. 5-6: Material flow - example with intra material

Material Flows

A material can be included in the list more than once. It can appear as an input material, as well as an output material (finished product or by-product).

The materials are grouped into a material list, which has the following advantages:

- It enables the adequate description of co-products, if more than one product per process is to be manufactured.
- It makes it possible to represent circular material flows in a plant.
- It enables you to plan the production of products as well as wastes.

Allocation of Finished Products to Recipes

When materials for finished products are allocated to recipes, there are the following possibilities:

- A material is allocated to a single recipe or recipe group.
- A material is allocated to several recipes, or to several recipe groups. In this way, you can create different production versions for each material.
- Several materials can be allocated to a single recipe. In this way it is possible to represent the production of co-products.

Allocation of Material Components to Operations/Phases

In order to detail the above allocations for planning purposes, you can allocate material components, i.e. items in the material list, to operations or phases (see Fig. 5-7).

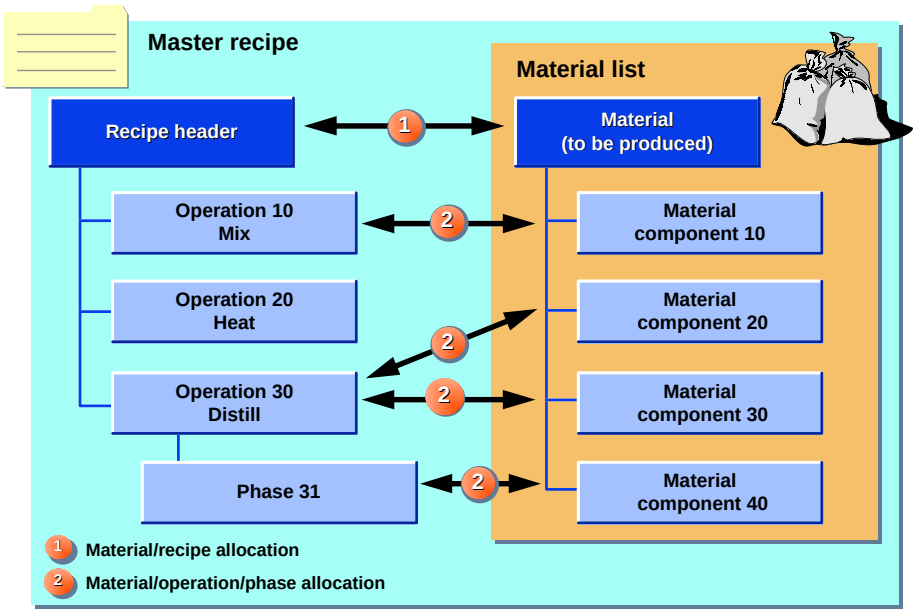

Fig. 5-7: Allocation of materials to a recipe

Copying Function

The user has the possibility of copying a master recipe. In this way, planners can take a frequently used master recipe as the basis of planning, in order to adjust it to various processes and / or plant lines.

The copying function can also be used for the transfer of already existing standard routings. The header data, the main sequence and the operations are taken over as is, sub-operations are transformed into secondary resources. This means that you can use routings existing in your firm for the purposes of PP-PI.

Simulation

In normal operation, the effect process instructions and their characteristics (created for the master recipe) have on the layout and the structure of the PI sheet are only clear after the control recipe has been created. As this happens much later, it is useful if one is able to check the layout and the structure of the PI sheet via simulation in advance.

Production Versions

The production version defines a unique combination of a material list / BOM and a master recipe for the production of a material on a key date.

The production version can be maintained in the material master as well as in the master recipe for detailed planning, for rate-based or campaign planning and for rough-cut planning. In the case of period-based manufacturing, the production version is a prerequisite for a period-based cost accounting per version.

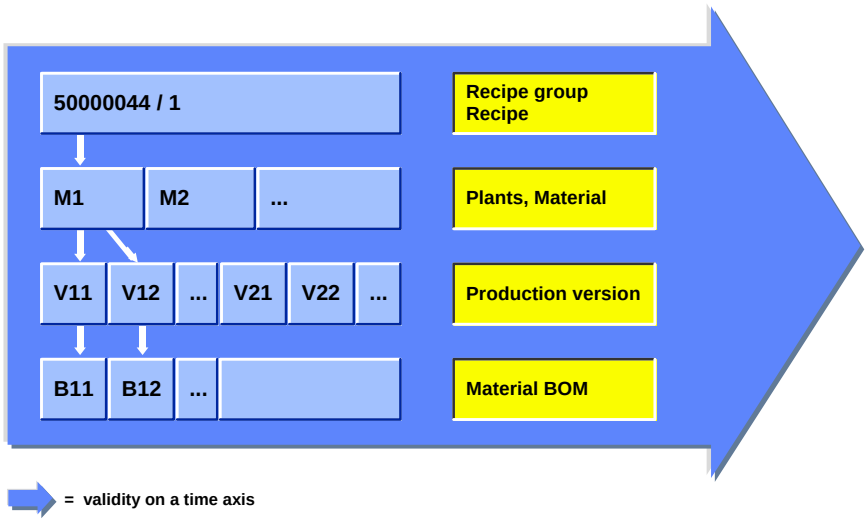

Fig. 5-8: Production versions for a recipe

Production versions are used to represent various production techniques for one product. They specify the following:

- The material list / BOM used
- The task list type (in this case, master recipes), the recipe group and the specific recipe to be used
- Existing lot-size restrictions and periods of validity

Calculation of Material Quantities

The material quantity calculation determines how much of each substance used in production is necessary, taking into consideration the mixing ratios of the input materials as well as the yield ratios of the products and by- or co-products. The material quantity calculation includes:

- all quantities of materials in the material list
- the characteristics and their values

The prerequisite of a material quantity calculation is the creation of characteristics and characteristic values, in order to classify the materials and their properties.

When a material is included in the material list of the master recipe, the characteristics of the classified materials are used. In the material list / BOM, it is

possible to classify the individual material items again. In this way, it is possible to adjust the material to the process.

Material quantity calculation uses these characteristics and their values. The valuation of these characteristics in the master recipe provides planned values for the calculation, as well as providing actual values for the selection of batches from the warehouse after production.

When a process order is created, the characteristics and their values are transferred from the master recipe. After a batch has been allocated to a material in the process order, the actual values of the warehouse batch are used instead of the planned values of the material list.

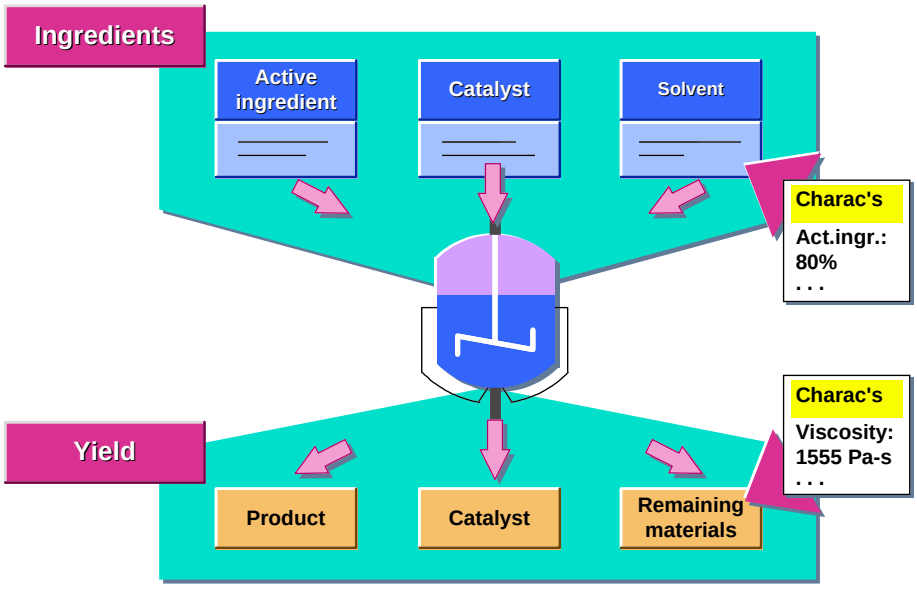

Fig. 5-9: Calculation of quantities for input materials and yields

The quantities of materials or substances used in a recipe can be put in relation to one another via formulas. Formulas can also incorporate the characteristics of the materials.

When you change the quantity of a material or the value of one of its characteristics, you can recalculate all dependent quantities.

Evaluations

You can carry out the following evaluations for your recipes:

- Evaluations on recipe changes: all changes in recipe objects are displayed over the time axis
- Where-used list of a master recipe in resources, process instruction categories, materials, documents and classes
- Mass changes: replacement of process instruction categories and resources in the master recipe, and of materials in material lists / BOMs.
- Material list evaluations as well as evaluations on the structure of and changes to a material list

Change Management Functions

Besides the functionality for mass changes in the material list, you can use the integrated change management functionality to obtain a full change history of materials, recipes, material list items, etc.

Further Uses of the Master Recipe

Besides the recipes which serve to produce a batch, there are also non-manufacturing recipes in PP-PI:

- **Cleanout recipes** can be inserted between two operations, if the product sequence requires a cleanout operation.
- **Changeover recipes** describe the requirements of particular resources, the materials or substances required, as well as the changeover activities to be carried out between two production campaigns.
- **Equipment-testing recipes** contain process instructions that are used to carry out and document periodic functional testing of a plant line.

The master recipe describes the steps of a process including the materials and resources used.

Which information is contained in the master recipe?

The master recipe contains materials, the description of the process from the planning as well as the control view, all resources as well as information for quality control.

How are materials and their attributes represented during the calculation of input and output quantities?

The material quantity calculation determines the required and generated material quantities, taking into consideration the mixing ratios of the input materials as well as the yield ratios of the products and by-products.