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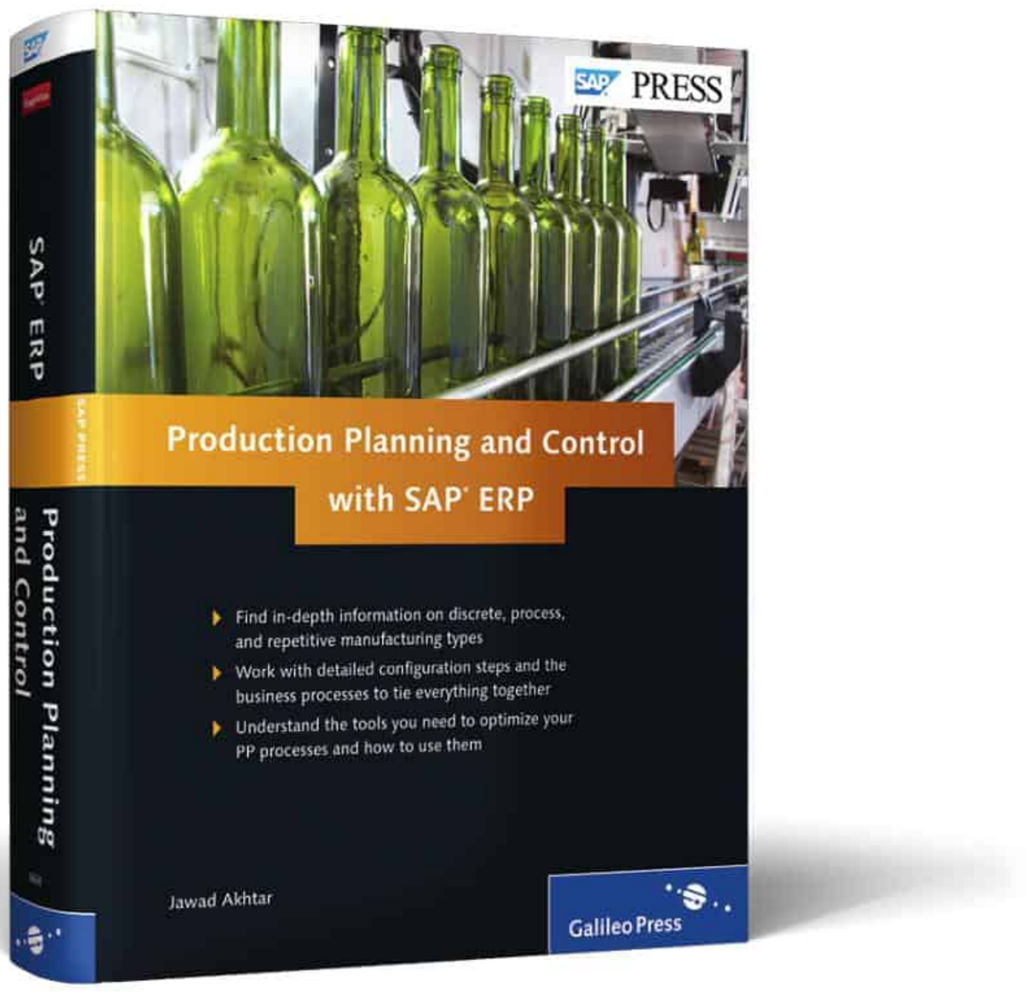
Production Planning and Control with SAP® ERP



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Contents at a Glance

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PART IV: Production Planning Workflow Tools

1 Introduction

A company that's in the business of manufacturing a product and selling it to customers goes through the rigor of production planning and then production execution. The Production Planning component (which we'll refer to as PP throughout the book) in the SAP ERP system plays a critical role in the logistics functions of the company to accomplish just this. This component enables the company to benefit from historical data to prepare a forecast, which can then be used in sales and production planning. From an initial sales plan or sales orders from customers, to the highly integrated and complex chain of interdependent activities in Logistics in the SAP system, the PP component reflects its strength, both in planning and execution. It seamlessly integrates with sales, procurement, quality, maintenance, projects, human capital, finance, and controlling functions of the company. It also integrates with the Manufacturing Execution System (MES), as well as with Manufacturing Integration and Intelligence (MII).

1.1 Goals of This book

The goals of this book are to provide you with the step-by-step approach to configure and implement three different production types in PP: discrete, process, and repetitive manufacturing.

The book will first lay the initial foundation in the form of configuration, and will then explain how the configuration impacts actual business processes. The configuration to business process approach is maintained throughout the book.

The next goal is to provide comprehensive coverage to the production planning workflow tools available. Further, there are significant "hidden", or lesser-used functionalities in PP that you can integrate even when (and long after) your SAP ERP system implementation is complete. These tools are covered to bring greater optimization to your business processes and greater return on your investment in the SAP ERP system.

The book offers several real-life examples and other modeling hints and tips to help you decide which option best meets the business needs of the company. Screenshots are used extensively and are duly supported by in-depth coverage of concepts and terminologies. SAP ERP 6.06 (Enhancement Package 6) is used in the screenshots. The menu paths or transaction codes are given to perform each step. Where possible, a deliberate attempt is made to use the SAP Internet Demonstration and Evaluation System (IDES), so you can configure and implement a solution in a training client. Where specific or unique data is used, all necessary prerequisites and hints are given to enable you to set up the data or meet the prerequisite before attempting to run a business process. While this book can only cover so much of a topic, we highly encourage you to explore and try out a large number of options, icons, menu paths, and other pointers available in order to continue the process of self-learning and eventually become an "expert" in the PP component of SAP ERP.

In this book, we also cover several cross-component functionalities that not only enable you to leverage their strengths in PP, but also in other Logistics components that are implemented in your company. For example, you can use the classification system, digital signature, Early Warning System (EWS), Flexible Planning standard analysis, Document Management System (DMS), shift notes and shift reports, Engineering Change Management (ECM), information systems, and reporting in many other Logistics components. In other words, this book goes beyond the PP component to help in optimizing business processes in other Logistics components.

1.2 Target Audience

This book is intended for all readers who use PP in the SAP ERP system. They may be the component's team leader, project team members in an SAP ERP system implementation, integration managers, production planners, or production controllers working in operational positions in the company. Because this book covers three different production types, namely, discrete, process, and repetitive manufacturing, it tends to benefit those readers who are either transitioning or intending to transition from companies using different production types. Additionally, if the company is embarking on production and capacity expansion, then this book can help by facilitating the creation of the new enterprise structure needed in the SAP ERP system to support the expansion. Finally, this book can be

an invaluable reference to SAP ERP system consultants and even business process owners who are considering the transition to a consulting career and need a comprehensive understanding of the required concepts and fundamentals.

1.3 Structure and Content

This book provides a deep-dive approach to deliver in-depth and comprehensive coverage to three different production types in the SAP ERP system: discrete, process, and repetitive manufacturing. It begins with covering the enterprise structure that you need to set up in the PP component, which also reflects the interdependencies of other components' enterprise structures. The configuration basics that you need to know for each production type are covered next. Similarities and differences in various production types are highlighted to enable you to comprehensively differentiate one from the other. The configuration of each production type is then put to actual use, in which we show the impact of the configuration on the business processes. The connecting point here is that a business process must be comprehensively understood first, before proceeding to model and configure it in the SAP ERP system.

The book then transitions to cover the production planning workflow tools available. You'll also learn how to optimize your production processes by making use of several latent features that are often not as frequently used to bring about business processes improvements. This book moves toward conclusion by covering the reporting capabilities, including the flexibility to create self-defined queries. Finally, the book concludes by broadly covering the integration aspects of the PP component with some of the other SAP ERP components.

In summary, the following structure is used:

In Part I of this book, starting in **Chapter 2**, we cover the broad outline of the entire book and why you should proceed to implement a specific functionality or how it will benefit your business processes. We'll discuss the enterprise structure that you'll need to set up in the PP component, which at the same time also depends on the enterprise structures of other components. The enterprise structure forms the backbone of the SAP ERP system, in which all the important business processes of the company are mapped. Eventually, reporting also takes important elements from the enterprise structure.

In Part II of this book, we move forward with covering the configuration basics that you need to set up for each production type. However, the primary focus of the three chapters in this part is on the configuration basics only, whereas the actual and practical use of configuration basics are covered with the business processes in Part III. **Chapter 3** covers the configuration basics of discrete manufacturing, whereas **Chapter 4** attends to the configuration basics of process manufacturing. **Chapter 5** covers the configuration details that you need to know for repetitive manufacturing.

Part III of this book discusses the production planning workflow by each production type, and here we make logical connections to the business processes of each production type for which we undertook the configuration in the relevant chapters of Part II. **Chapter 6** provides an in-depth coverage of the business processes of PP in discrete manufacturing. **Chapter 7** brings out the similarities and differences between discrete and process manufacturing, but remains primarily focused on the process industry-specific functionality known as Process Management. Process Management then matures to a user-friendly functionality known as XSteps. In the same chapter, we also cover how to use the Process Manufacturing Cockpit. The focus of **Chapter 8** is on the important business processes of repetitive manufacturing, in which, once again, we make consistent and logical links to the configuration chapter.

Part IV of this book covers the PP workflow tools. **Chapter 9** focuses on Sales and Operations Planning (SOP), in which we cover product group, flexible planning, and standard analysis in flexible planning. Forecasting as an invaluable planning tool is also covered in this chapter. **Chapter 10** is on SAP Demand Management, in which we cover planning strategies and production methods such as make-to-order (MTO) and make-to-stock (MTS). Material requirements planning (MRP) is covered in **Chapter 11**, in which we discuss the planning calendar and also MRP areas. In **Chapter 12**, you'll see how you can use MRP to successfully execute Long-Term Planning (LTP) to simulate what-if planning scenarios.

Part V is all about optimizing PP. **Chapter 13** covers special procurement types, such as subcontracting, phantom assembly, procurement or production at another plant, withdrawal from another plant, consignment, and pipeline materials. In **Chapter 14**, we show you how to manage the capacity requirements planning (CRP) in your SAP ERP system, including its evaluation and leveling. **Chapter 15** covers the versatile and dynamic functionality of the classification

system, which is cross-modular and finds several applications not just in the PP component but also in other Logistics components. In **Chapter 16**, we show you how you can leverage Engineering Change Management (ECM) to bring better control and visibility to your master data creation processes or the changes made to already-created master data, not just in the PP component but also in other Logistics components. The co-products and by-products that the actual production process generates find comprehensive coverage in **Chapter 17**. The option to record details specific to a shift or for various shifts in a day and then be able to generate a report is covered in **Chapter 18**, when shift notes and shift reports are discussed. A dedicated chapter on the Document Management System (DMS) in **Chapter 19** is to reflect upon the importance of having a plethora of a company's digital assets in a secure environment that is also easily accessible when needed. DMS is also a cross-modular component, and you can implement it not just in the PP component but in other Logistics components. Next, in **Chapter 20**, we show you the benefits of implementing the digital signature functionality in your business processes to eliminate or reduce the manual signature and approval process. Digital signature is also cross-modular.

The last part, Part VI, is all about monitoring and evaluating your PP component in SAP ERP. In **Chapter 21**, you'll learn how to quickly set up alerts in your SAP ERP system with the Early Warning System (EWS) to closely monitor important deviations to your business processes and take quick decisions and actions. You can also set up EWS in other Logistics functions, if needed. In **Chapter 22**, you'll learn the features, functionalities, menu paths, navigation tools, and many options available to run a large number of standard reports available in SAP ERP. The concepts that you'll develop here will enable you to expand your knowledge horizon to explore standard reports available in other Logistics components. In this chapter, we also cover how you can quickly create your own reports by using the SAP Query tools. Finally, in **Chapter 23** we give you some "flavors" to the complex and highly interconnected world of PP component integration with other Logistics functions. Here, we provide five examples in which the PP component integrates with Materials Management (MM), Quality Management (QM), Project Systems (PS), and Plant Maintenance (PM) components. We also provide a roadmap you can use to ensure effective planning and comprehensive monitoring of cross-components integration during your SAP ERP system implementation project.

In the appendices, you'll find a comparison table of the production types (discrete, process, and repetitive), and a glossary of some of the more important terms used in PP.

While this book is certainly a significant expansion to the areas and functionalities that the PP component offers, please note that we do not cover the following:

- Variant configuration
- Distribution resource planning
- Kanban

Implementing discrete manufacturing, also known as shop floor control, involves a series of logical and sequential configuration steps to ensure complete mapping of configuration with the business processes of the company.

3 Configuration Basics of Discrete Manufacturing

During an SAP ERP implementation project, when it's established that discrete manufacturing will most closely serve the business needs of the company, the next logical step is to have intensive discussions and several workshops to agree on the configuration objects of discrete manufacturing. Configuration of the specific production type (which in this case is discrete manufacturing) forms the basis on which the business processes of the company will run. For example, how should the system behaves when it comes across a material or capacity shortage during production order creation or release? How should it behave when the actual production exceeds the defined under-delivery or over-delivery of the material? What should the system do if it's unable to schedule production within the defined basic dates? For each of these (and many more) questions, you can set the controls on the degree of freedom or flexibility (or strictness) that you want the system to allow you to perform business functions. For example, you can configure the system to allow you to create a production order despite a component shortage, but to stop you from releasing it until the requisite components for production are available in stock.

In this chapter, we cover the configuration basics needed to set up the master data used in discrete manufacturing. Next, we follow a step-by-step process to create a new production order type PP10, including assigning it a new number range. All of the subsequent configuration steps covered for this order type and in this chapter are sufficient to enable you to run end-to-end business process in SAP ERP. In Chapter 6, we cover the business processes side of the configuration undertaken in this chapter.

If, as an SAP ERP system consultant or as a business process owner, this is the first time you're configuring and implementing the Production Planning (PP) component, then we suggest that you follow the step-by-step approach that we use in this chapter. Because the PP component integrates with several other components such as Materials Management, Quality Management, and most importantly with Controlling-Product Costing (CO-PC), we suggest that you maintain close coordination all along by consulting the resources of these components.

Note

The business processes of discrete and process manufacturing are also similar in a lot of ways. Where there is a difference, these are specifically covered in the relevant chapters (process manufacturing is covered in Chapter 4).

3.1 Material Master

The configuration of the material master is primarily managed within the Materials Management (MM) component of the SAP ERP system. During an SAP ERP system implementation, the MM team coordinates with the client to discuss and agree on a large number of MM-specific configuration objects, which also includes material types. A *material type* is a unique identification to distinguish materials used in various business processes. Some examples of material types are raw materials, semi-finished goods, trading materials, packing materials, non-valuated materials, spare parts, and consumables. However, the importance and involvement of PP can't be overemphasized here as the material requirements planning (MRP) and work scheduling views of the material master are very important to PP, both from a planning and execution perspective.

Apart from the option for quantity and value updates, you can also control the views that the system makes available to the end user during material master creation. For example, normally the purchasing view isn't available for finished goods because the company doesn't purchase finished goods. Similarly, for raw materials, the sales views aren't available because the company normally doesn't sell its raw materials.

To set up the attributes of material types, follow the configuration (Transaction SPRO) menu path Logistics – General • Material Master • Basic Settings • Material Types • Define Attributes of Material Types.

Figure 3.1 shows the configuration view of Material Type FERT (Finished product). On the lower-right side of the screen, you can control the views that you want the system to make available during material master creation. At the bottom of the screen is the Price control field, which enables you to select whether the material will have a moving average or standard price.

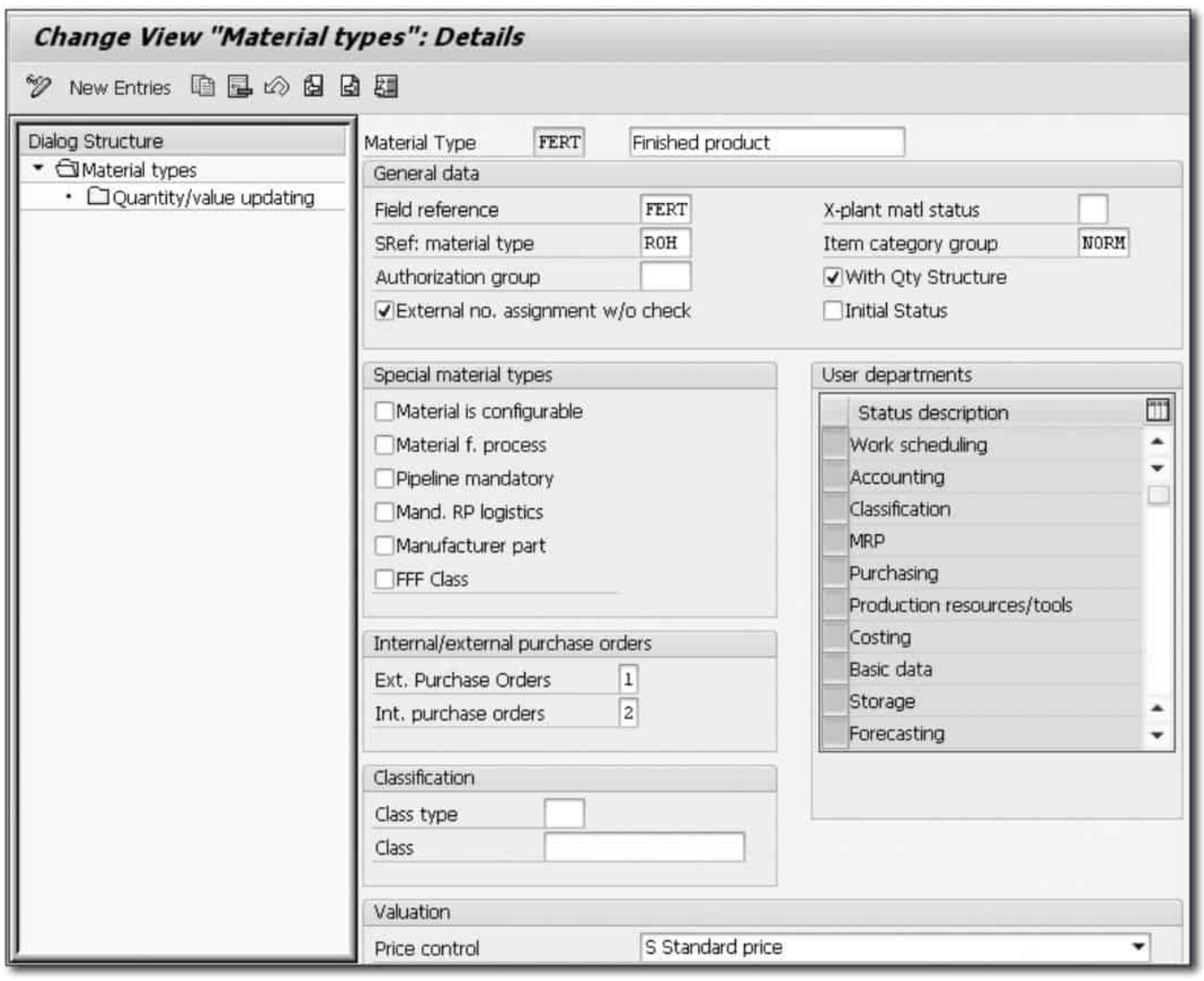


Figure 3.1 Material Types

3.2 Bill of Materials (BOM)

Similar to the material master, a material's BOM is used extensively in various areas of the supply chain, including planning and costing. A BOM is a formally structured list of components that you need to use to produce a material. These components may be raw materials or packing materials procured directly from vendors or subassemblies produced in-house.

The BOM has a large number of functions. You can have a BOM that is specific to engineering/design only, whereas you can have another BOM of the same material

that you can use for costing purposes. You can have a production BOM and also a sales BOM. In a sales BOM, the system explodes the components and makes them an integral part of sales processing. For example, when a company sells a new car, it also includes the accessories such as a spare tire, the tire changing tool-kit, and the owner's manual, among other things. These accessories are, in fact, components in a sales BOM.

A material BOM is a central component in MRP. When the system runs the MRP on a material, it looks for its BOM to plan not just at the finished goods level but also at the components' and raw materials' levels. The material BOM is always single-level, and you can explode and display the cascade of BOMs as a multilevel structure. The system displays a single-level BOM by showing its immediate next component or assembly. It's in a multilevel BOM that the system reflects comprehensive details of all of the assemblies, components, the associated quantities of assemblies and components, and their logical relationship to each other.

3.2.1 Define BOM Usages

A BOM usage controls the activities and functions that the system can perform in business processes. To create a new BOM usage, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • GENERAL DATA • BOM USAGE • DEFINE BOM USAGES, or use Transaction OS20.

Here you'll find several standard BOM usages. You can create a new BOM usage by choosing NEW ENTRIES, and selecting the control functions to allow or disallow the business processes in which the BOM usage is applicable (see Figure 3.2).

Change View "BOM Usage - Item Statuses": Overview

New Entries

BOM ...	Prod.	Eng/des.	Spare	PM	Sales	CostRel	Usage text
1	+	.	.	-	-	.	Production
2	.	+	.	-	-	.	Engineering/design
3	.	.	.	-	.	.	Universal
4	-	-	-	+	-	.	Plant maintenance
5	.	.	.	-	+	.	Sales and distribution
6	.	.	.	-	.	+	Costing
7	.	-	-	-	.	.	Returnable Packaging
8	-	.	-	-	-	-	Stability Study

Figure 3.2 BOM Usages

3.2.2 Allowed Material Types in the BOM Header

You can control the material types that the system allows for creation of a material BOM. For example, you normally don't create a material BOM for spare parts or consumable material types. This control on material types for BOM creation also helps prevent the creation of unnecessary or unwanted material BOMs. If a company has several company-specific material types, then you need to specifically identify and perform the necessary configuration for all of the material types that will have any BOM usage.

To specify the material types for a material BOM creation, follow the configuration (Transaction SPRO) menu path Production • Basic Data • Bill of Material • General Data • Define Material Types Allowed for BOM Header, or use Transaction OS24.

Figure 3.3 shows that you can also specify the BOM usage for the material type at the header level. The * symbol denotes that a BOM can have all usage types and can also be used in all material types at the header level.

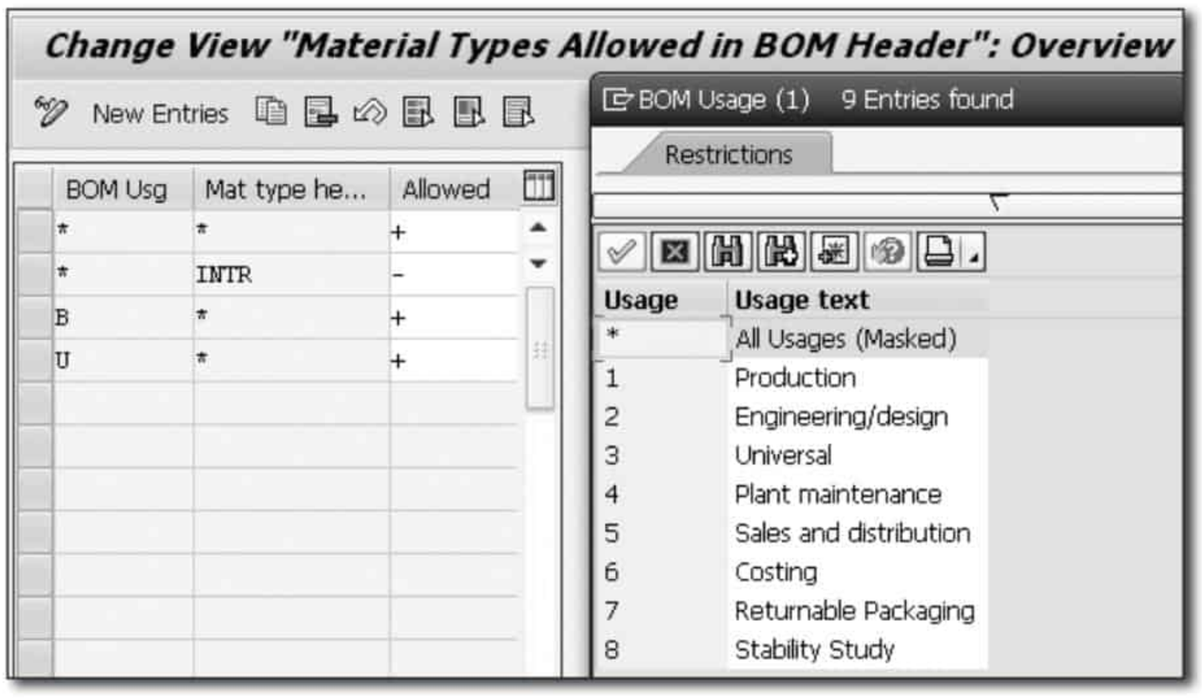


Figure 3.3 Allowed Material Types in the BOM Header

Note

In addition to maintaining the control function of the material type at the BOM header level, you can also do the same for a material at the BOM item level. To do so, follow the configuration (Transaction SPRO) menu path Production • Basic Data • Bill of Material • Item Data • Define Material Types Allowed for BOM Items, or use Transaction OS14.

3.2.3 BOM Status

You can control the different applications of a material BOM from its status. For example, during new product development, a material has a BOM status as *Engineering/design*. When the Engineering/design departments approve it, the next status can be *Costing* to enable the Product Costing team to calculate the cost of the material. Finally, when the costing department also approves the material BOM, it can attain the status of *Production*. This status enables the production team to begin producing the material. When the BOM has a *Production* status, it becomes available during the production order creation, whereas when its status is either *Engineering/design* or *Costing*, it isn't available in production order creation. You can also set the status in which all functions are possible.

To create or set the BOM status, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • GENERAL DATA • DEFINE BOM STATUS, or use Transaction OS23. As shown in Figure 3.4, you can control whether the BOM status should allow business functions such as being available during MRP explosion, for costing, or for work scheduling (production).

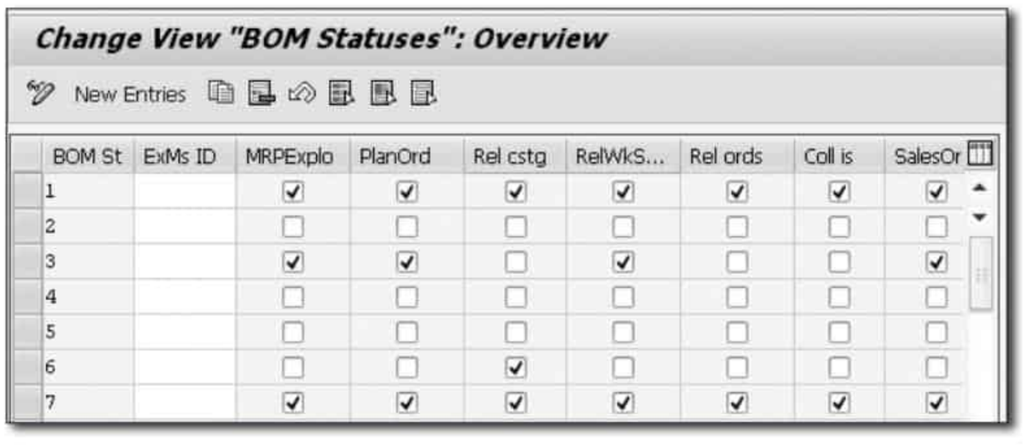


Figure 3.4 BOM Statuses

3.2.4 BOM with History Requirement

You can control whether changes made to the material BOM are with reference to a change number or Engineering Change Management (ECM). With a history requirement or change number, the system requires you to enter the change number before it allows you to makes the desired changes, which adds a level of security.

Note

See Chapter 16 for more on Engineering Change Management (ECM).

To select the BOM usage and status combination for which you want to set the history requirements, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • GENERAL DATA • CONFIGURE HISTORY REQUIREMENT FOR BOMs, or use Transaction OS25. You can mark the required BOMs with a history requirement by selecting the checkbox.

3.2.5 Item Category in BOM

The item category provides further divisions to the different BOM classes. While some item categories are relevant for production or for planning, others are merely to provide information.

Following are some of the most important predefined item categories:

- **L: stock item**
  Stock items contain components that you store in your warehouse and include as a part of Inventory Management.
- **N: nonstock item**
  A nonstock item is a material that isn't available in stock but is procured directly for the given production order. A nonstock item has direct relation to the procurement process. There is also no need to have a material master (item code) for nonstock material. If you use nonstock material, you also have to fill in the procurement details, such as cost element, purchasing group, material group, and price.
- **R: variable-size item**
  In this item category, you can use the formula and also define the variables' sizes to enable the system to perform calculations and suggest the component's quantity.
- **T: text item**
  The text item has a descriptive character.
- **M: intra material**
  This item category is commonly used in master recipes (process industry). Materials that are temporarily used in process engineering are recorded as components with this item category.

The material input parameter (MATINPT) indicates whether a material reference to the item exists. This isn't the case with document items or nonstock items. The inventory-management parameter (INVMG) allows you to set that you can only use those materials whose quantities are managed in inventory management.

To maintain a new item category or make changes to the existing ones, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • ITEM DATA • DEFINE MATERIAL TYPES ALLOWED FOR BOM HEADER, or use Transaction OS24. Select or deselect the checkboxes to meet your business needs.

3.2.6 Variable Size Item Formulas

In the fabrication industry, it's common that component issuance to produce an assembly is often based on a formula. For example, to produce the fuel tank of a motorcycle, the warehouse issues the steel sheet based on the formula, which calculates the requirement. When you assign the variable-size item in the BOM of the material, and with item category R, the system enables you to enter the variable-size details in the relevant area of the BOM's item details area.

Notes

Before you proceed to create a formula for a variable size item, you can also self-define a unique unit of measure to denote the formula via Transaction CUNI.

To create a variable size item formula, follow the SAP ERP system configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • ITEM DATA • DEFINE VARIABLE-SIZE ITEM FORMULA, or use Transaction OS15. Figure 3.5 shows the list of available formulas that you can use, or you can create a new one.

Change View "Variable-Size Item Formulas": Overview

New Entries

Formula	Formula	DimRes	Formula text
F1	ROMS1 * ROMS2	SURFAC	Area of a rectangle
F2	ROMS1 * ROMS1 * PI	SURFAC	Area of a circle
U1	ROMS1 + ROMS2 + ROMS3	LENGTH	Perimeter of a triangle
U2	2 * ROMS1 + 2 * ROMS2	LENGTH	Perimeter of a rectangle
V1	ROMS1 * ROMS2 * ROMS3	VOLUME	Volume of a rectangular parallelepiped

Figure 3.5 Variable-Size Item Formulas

3.2.7 BOM Explosion Types

You can control how the system takes a specific component's explosion into account in the BASIC DATA view of the BOM creation screen. You can control whether direct production, a phantom assembly, or even Long-Term Planning

(LTP) is deactivated. For example, if you don't want the system to plan a particular component in LTP, you can set its explosion type status in the BASIC DATA view of the material's component. If you don't find the desired configuration settings, then you can configure using the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • ITEM DATA • DEFINE EXPLOSION TYPES.

3.2.8 BOM Selection (Order of Priority)

You can control how the system makes an automatic selection of a BOM to incorporate it; for example, in a planned order during an MRP run. For example, during the MRP run, if the system is unable to find a material's BOM for production (BOM usage 1), then you can define the next BOM selection priority as universal (BOM usage 3).

To configure the BOM selection and its order of selection priority, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • BILL OF MATERIAL • ALTERNATIVE DETERMINATION • DEFINE ORDER OF PRIORITY FOR BOM USAGES, or use Transaction OS31. Here you define the selection ID to combine all BOMs with one unique ID. Then you define the selection priority of each BOM and finally assign the BOM usage, such as production or universal.

3.3 Work Center

A *work center* is a machine or a group of machines, a person or a group of persons, or a group of person(s) and machine(s) that adds value to the manufacturing process. During an SAP ERP system implementation, the production and the product costing teams discuss and mutually agree on the number of work centers that needs to be available. The decision is primarily focused on ensuring that the production department is able to schedule and plan work centers and machines capacities, whereas the product costing team ensures that the activities-wise and cost centers-wise reporting is available. For example, if Packaging as a work center entails significant cost that the product costing team needs to monitor its cost and activities, then it makes sense to create a work center and assign a separate cost center and associated activities to it. If it doesn't require monitoring, then the production line cost center is sufficient.

In the following sections, we explain how to make field selections in the work center so that during creation of the work center, the system either makes a field

entry as mandatory or optional. We also discuss how you can use a standard value key (SVK) to define which activities for an operation are important from a business perspective. You can define formulas for the work center that you can use in capacity requirements planning (CRP), scheduling, and costing. You can use the location groups to account for the time it takes to move a product from one work center to another, and the system corresponding considers this during scheduling. Finally, you can use a control key for operations as a control function to decide if, for example, scheduling or printing for an operation is allowed.

3.3.1 Work Center Category

A *work center category* is a control function that ensures the master data applications and business processes of discrete manufacturing in which you can use the work center. For example, work center category 0007 is available for rate routing in repetitive manufacturing, or work center category 0008 is available and used for process manufacturing. For work center category 0007, you'll find the available application option for repetitive manufacturing. Similarly for work center category 0008, you'll find the application for master recipe.

To create a work center category, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • WORK CENTER • GENERAL DATA • DEFINE WORK CENTER CATEGORY, or use Transaction OP40. Select the work center category 0001 used in discrete manufacturing, and double-click on the APPLICATION folder. You can see the available applications in the resulting screen in Figure 3.6 for CAT. (category) 0001.

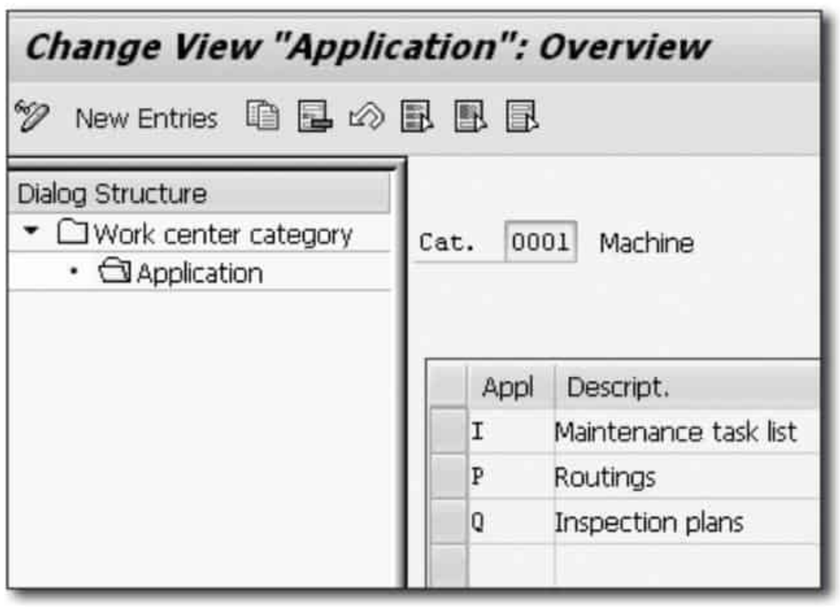


Figure 3.6 Application of Work Center Category

3.3.2 Field Selection in the Work Center

You can control the fields in the SAP ERP system for which entry is mandatory, optional, an input option, or is hidden from display. For example, during the work center creation, if you want the user to enter information in a specific field, you can select the REQ. radio button. You can also control that when the user enters information in one field, how the system prompts the user to perform any dependent function. This option works when one modifiable field relates to the influencing fields. For our example, you select the work center category as 0001 as an influencing field, and make the BACKFLUSH field indicator (a modifiable field) as a mandatory entry. So, whenever a user is going to create a work center with category 0001, it will become a mandatory requirement to select the BACKFLUSH field also.

Note

The field selection option isn't just restricted to work centers; you can also use it in BOM, routing, and confirmation.

To define field selection in a work center, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • WORK CENTER • GENERAL DATA • DEFINE FIELD SELECTION, or use Transaction OPFA. Figure 3.7 shows that the SCREEN GROUP BASIC DATA has several modifiable fields, such as BACKFLUSH or PERSON RESPONSIBLE. Notice that you have five options available in the modifiable fields:

- INPUT
  The entry in this field is optional.
- REQ. (required)
  The entry in this field is mandatory.
- DISP. (display)
  No entry because it's available for display only.
- HIDE
  The system hides this field, and it isn't displayed
- HILI (highlight)
  Any specific field can be highlighted if you want the user to pay attention. For example, when making a field entry as REQ., you can also select the checkbox HILI to enable the user to quickly see the fields requiring entries.

Field Selection: Modifiable Fields

Modified | Influencing | Screen groups | Influences

Screen group: Basic data

Modifiable fields

Modifiable field	Field name	Input	Req.	Disp.	Hide	HiLi
Backflush	P3000-RGEKZ	●	○	○	○	☐
Efficiency rate	RC68A-ZGRXX	●	○	○	○	☐
Location	P3000-STAND	●	○	○	○	☐
Mix. matl. allowed	P3000-MIXMAT	○	○	○	●	☐
Person responsible	P3000-VERAN	●	○	○	○	☐
Prodn Supply Area	P3000-PRVBE	●	○	○	○	☐
QDR system	P3000-SUBSYS	●	○	○	○	☐
Rule for maintenance	RC68A-VGMXX	●	○	○	○	☐
Standard Value Maintenance	BLOCK_VGWTS	●	○	○	○	☐
Standard value key	P3000-VGWTS	●	○	○	○	☐
Stor. loc. resource	P3000-LGORT_RES	○	○	○	●	☐
Transition matrix	P3000-RESGR	●	○	○	○	☐
Usage	P3000-PLANV	●	○	○	○	☐

Figure 3.7 Modifiable Fields of the Basic Data Screen Group

Double-click on the BACKFLUSH field or click on the MODIFIED button. In the screen that appears as shown in Figure 3.8, click on the NEW VALUES button. In the popup that appears, enter the work center category as "0001" and choose CONTINUE. Select the REQ. radio button to ensure that whenever a user creates a work center of category 0001, selecting the BACKFLUSH indicator will become mandatory.

Field Selection: Modified Field

New values ... | Delete value | Influencing | Modifiable | Screen groups | Influences | View

Screen group: Basic data

Modifiable field: Backflush

Influencing fields

Influencing field	Contents	Input	Req.	Disp.	Hide	HiLi
Field selection	0001	○	●	○	○	☐
Field selection	0008	○	○	○	●	☐
Field selection	0015	○	○	○	●	☐
Field selection		●	○	○	○	☐

Figure 3.8 Modifiable Field with Influences

Repeat the same with the work center categories 0008 and 0015, but this time select the HIDE radio button. The system won't show the BACKFLUSH field whenever the user proceeds to create a work center with work center categories 0008 and 0015. Save your entries.

3.3.3 Standard Value Key (SVK)

During the course of an SAP ERP system implementation, one of the main areas where the production and the product costing teams collaborate is in defining the standard value key (SVK). A SVK consists of individual parameters that are then grouped together as one SVK. You assign the SVK in the BASIC DATA view of the work center and also enter the formula that the system will use for each of the parameters. The sequence of steps is used to define a SVK:

1. Define the parameters.
2. Assign the parameters to the SVK.
3. Create a formula for the work center.
4. Assign a formula against each parameter.

We explain this with an example. Suppose that in addition to monitoring and recording standard durations such as setup, machine, or labor, your product costing department also wants you to record the electricity and steam consumed in producing a product. The reason to record these two unique parameter values is that significant highly cost is associated with these values. For example, in the caustic soda industry, electricity consumption is excessive and is closely monitored, so it's a critical cost component that the company wants to monitor and control.

When the user uses a specific work center (or resource) consisting of the SVK in the routing (or master recipe), the system requires the user to enter the standard consumptions. For our example, in the master recipe, the system prompts the user to define the standard electricity consumption in producing 1 metric ton of caustic soda. The product costing team will also have an associated cost (in the form of an activity type) assigned to this parameter (electricity). When the user performs the confirmation against the process order and enters the actual electricity consumed, the production and product costing teams can monitor the variances between standard consumption and actual consumption.

You can assign up to six parameters to a SVK. In other words, you can monitor and record up to six important parameters that have direct cost implications on a given work center. You can also use SVK in scheduling and capacity calculations.

To define a parameter, use configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • WORK CENTER • GENERAL DATA • STANDARD VALUE • DEFINE PARAMETERS, or use Transaction OP7B. You'll see the initial screen consisting of standard and user-defined parameters. Double-click on SAP_02, and the screen shown in Figure 3.9 appears. You can see the standard parameter with TIME as a DIMENSION and STANDARD VALUE UNIT in MIN (minutes). If you've created a self-defined parameter such as Steam or Electricity, then you can give the dimension and the unit of measure in which you want to record the consumption value.

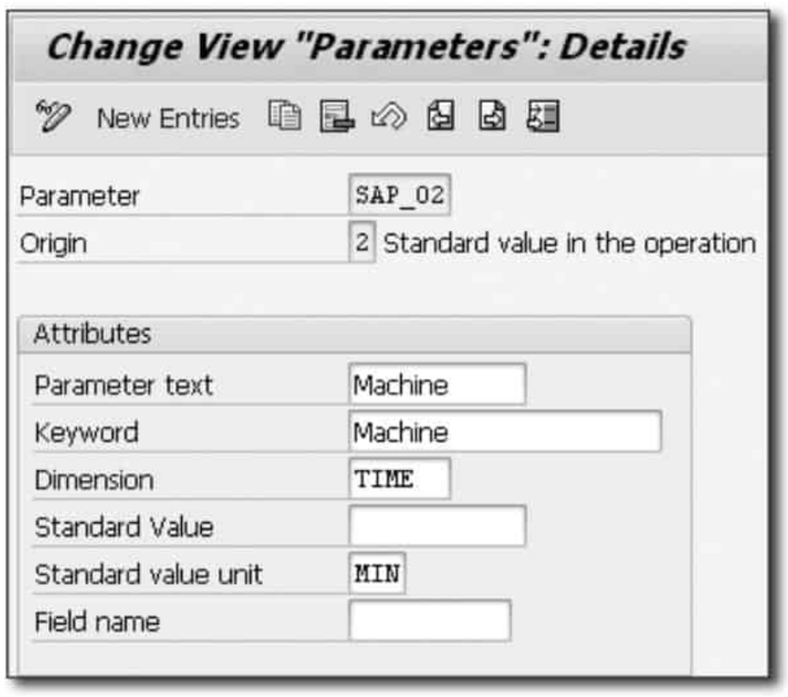


Figure 3.9 Machine Standard Parameter with Unit of Measure

Next, to create the SVK follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • WORK CENTER • GENERAL DATA • STANDARD VALUE • DEFINE STANDARD VALUE KEY, or use Transaction OP19 or Transaction OPCM.

Figure 3.10 shows the STD VAL. KEY SAP1, which consists of the standard parameters SAP_01, SAP_02, and SAP_03. If you have any self-defined parameter that you want to be part of the SVK, you can enter them here. As noted previously, you can enter up to six parameters in SVK. Make sure to select the GENERATE checkbox when defining SVK because then the system automatically performs the calculations defined in the formulas. If not selected, then it does the calculation for scheduling and capacity planning during production order creation, which often leads to system performance issues.

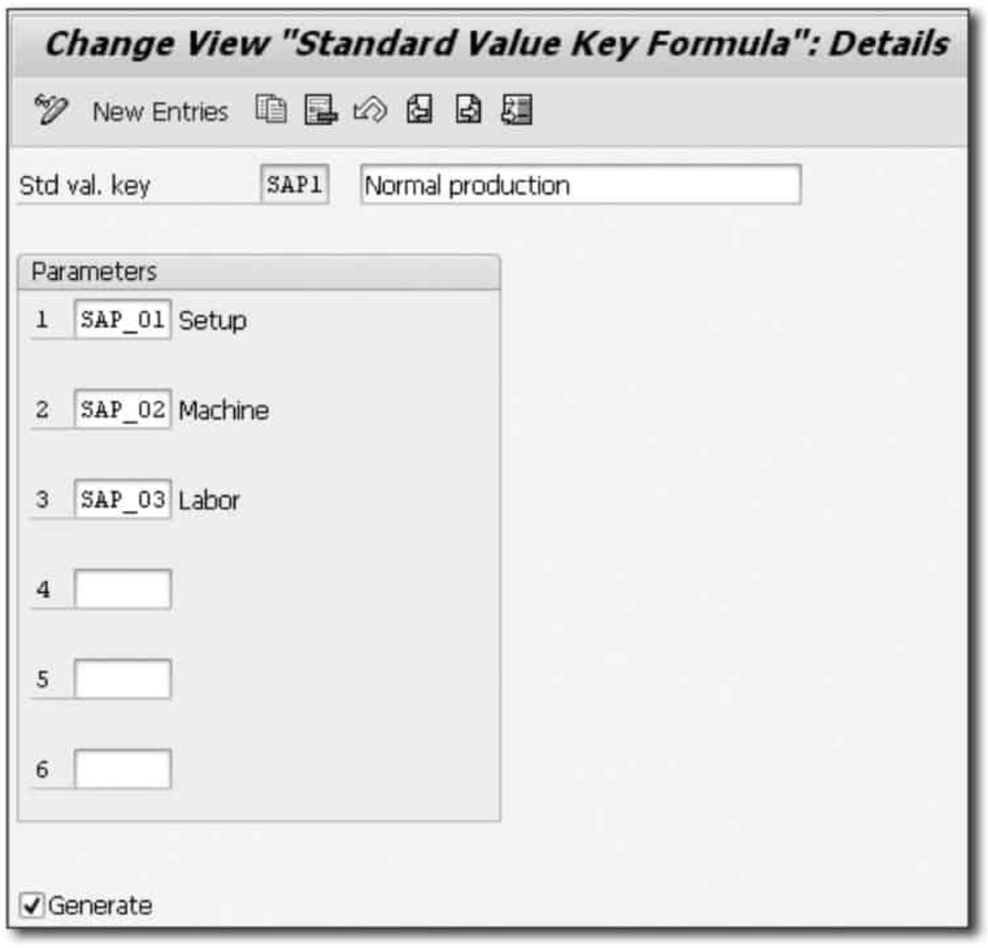


Figure 3.10 Standard Value Key Formula

3.3.4 Formulas for the Work Center

The system uses previously defined parameters to define formulas, which you can then use in CRP or scheduling. You can use parameters such as the following:

- SAP_08: Base quantity
- SAP_09: Operation quantity
- SAP_11: Number of operation splits

A formula definition also holds the control for the following applications:

- CRP
- Scheduling
- Costing

To define the formula parameter, if it's different from the ones already available, use the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • WORK CENTER • COSTING • WORK CENTER FORMULAS • DEFINE FORMULA PARAMETERS FOR WORK CENTERS, or use Transaction OP51.

To define the formula that you can use in the work center for costing, CRP, and scheduling, follow the configuration (Transaction SPRO) menu path PRODUCTION • BASIC DATA • WORK CENTER • COSTING • WORK CENTER FORMULAS • DEFINE FORMULA FOR WORK CENTERS, or use Transaction OP54.

In Figure 3.11, notice the formulas for calculating the production processing duration. The system calculates the capacity requirement as:

Capacity requirement = Standard value × Order quantity / Base quantity

You can reduce the processing duration if the operation is processed simultaneously at several work centers, per the following formula:

Duration = Standard value × Order quantity / Base quantity / Number of splits

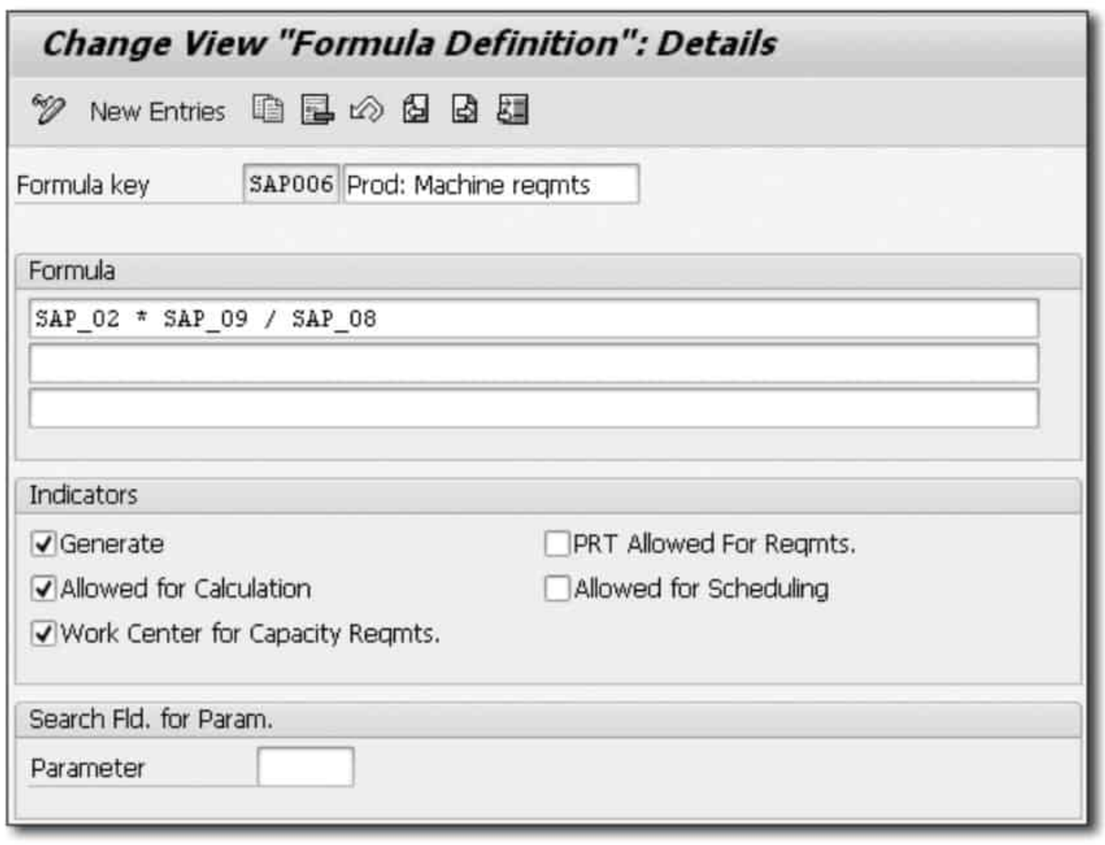


Figure 3.11 Formula Definition in the Work Center

In Chapter 6, you'll assign these formulas to scheduling, capacities, and costing views of the work center.

3.3.5 Location Groups

A *location group* consists of a physical location where each work center is located. You can combine several work centers into one location group if they are in close proximity to one another. You can use the move time matrix to provide standardized values to different transitions times (also known as interoperation times)

Building on the important configuration of process manufacturing that you undertook in Chapter 4, this chapter covers the important business processes and functions and also provides the vital and logical links of configuration with business processes. Greater focus is placed on Process Management in the master recipe, which is unique to process industries only.

7 Production Planning for Process Industries

Production Planning for Process Industries (PP-PI) is characterized by product complexity. There are also additional requirements to integrate Batch Management (BM) and Quality Management (QM) in process manufacturing in PP-PI. Some of the industries in which process manufacturing finds extensive implementation include chemicals, edible oil refining, pharmaceuticals, fertilizers, beverages, food, and food processing. Any manufacturing industry that deals with liquids, where the product flows in a liquid or semi-solid form, or where the processed material cannot be brought back to its original state or disassembled, characterizes process manufacturing.

The chapter begins with an overview of process manufacturing and how it fits into the planning and production perspectives. The process manufacturing process flow provides a comprehensive and step-by-step explanation of each stage involved. Important process manufacturing master data is covered next, with extensive focus on the master recipe, in which the system not only facilitates material quantity calculation but also Process Management. We cover some of the standard features available in Process Management such as input and calculated values, integration with the Document Management System (DMS), and digital signature. We then cover the end-to-end business processes involved from the creation of the process order to how Process Management integrates with it.

Next, we cover the highly versatile and intuitive functionality of Execution Steps (XSteps) when you either want to implement it or simply transition from process

instructions to XSteps. More features and functionalities of XSteps are shown, as well at their correlations to the configuration made in Chapter 4.

We then cover the process manufacturing cockpit that you've already configured in Chapter 4 to see how it helps and facilitates the business processes. We also cover process messages evaluation.

Finally, the remaining chapter provides brief coverage of the rest of the standard processes of PP-PI, such as goods issuance, confirmation, and goods receipt. Because these processes are all similar in discrete manufacturing, we suggest that you visit the relevant sections of those chapters (Chapter 3 and Chapter 6). Efforts have also been made to provide maximum links to the configuration made in Chapter 4. If deemed necessary, the pointers to necessary configurations are given in this chapter.

7.1 Process Manufacturing Overview

Figure 7.1 shows an overview of the end-to-end process involved in process manufacturing. The business processes involved can broadly be divided into the following areas:

- Process planning
- Process order execution
- Process Management
- Order closure

The production planning in PP-PI begins when you convert the output of material requirements planning (MRP), which in this case is a planned order, into a process order. This is then followed by a material availability check to ensure that the required quantities of components needed to produce the material are available. If you've enabled material quantity calculation in master recipe of the material, the system calculates the components' quantities. If not, it reads off the information from material BOM. At this stage, you can also enable the system to perform batch determination of the components that you want to use in production.

You proceed with releasing the process order as well as printing the process order. With a released process order, you can generate a control recipe. A generated control recipe takes the form of a process instruction (PI) sheet. You can run

several of these process order management activities automatically or in the background to minimize managing them manually. For example, you can determine that on creation of the process order, the system can automatically release it too. If not, you have to manually release the process order. Alternatively, you can use a separate transaction to release a large number of process orders (mass processing), which again can be carried out as a manual task.

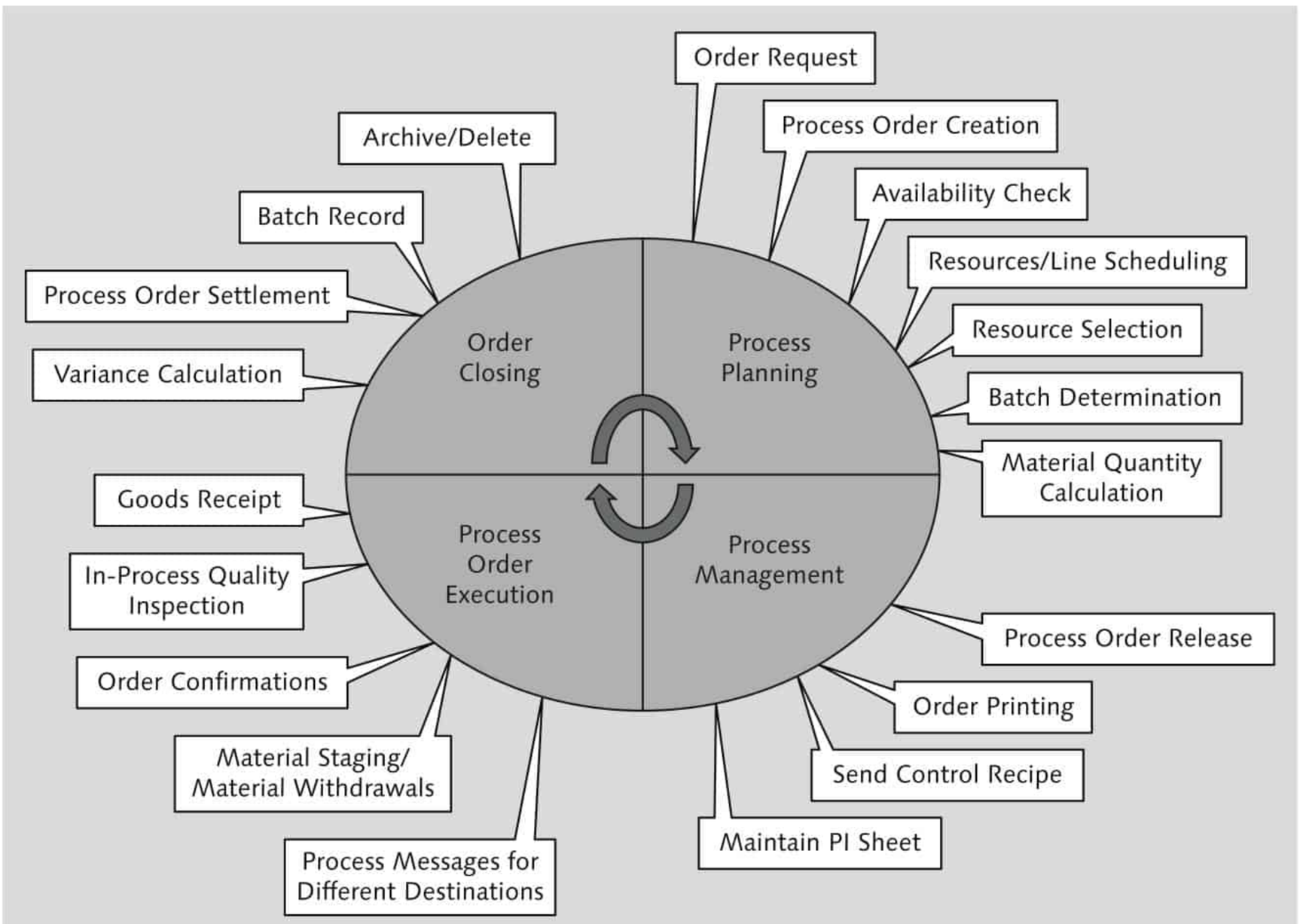


Figure 7.1 Production Planning and Execution in Process Industries

The Materials Management (MM) component plays an important role when you want to issue raw materials and components against a process order. The QM component (if integrated with the PP component) enables extensive in-process (during production) quality inspection checks. During this time, you also maintain the PI sheet and assign it a *Complete* status. You then perform confirmation of the process order, either at the individual phase level or at the entire process order level. When goods are produced, you can again engage the MM component

for ensuring goods receipt against the process order. You can now send the process messages back to the SAP ERP system.

The Cost Object Controlling activities such as work in process (WIP) determination, variance calculation, and settlement are order-specific in nature and are usually processed in the background. The PP component completely integrates with Cost Object Controlling in the SAP ERP system, so it's imperative that extensive coordination is ensured for comprehensive business processes mapping.

To optimize and bring greater visibility to your business processes, you can implement and integrate several additional processes and functionalities, such as digital signature, Engineering Change Management (ECM), Document Management System (DMS), co-products and by-products, shift notes, and shift reports. You can also integrate QM during production (in-process quality inspection) or at the time of goods receipt.

7.2 Master Data in Process Manufacturing

Process manufacturing has its own unique and often overlapping master data with other production types, such as discrete manufacturing or repetitive manufacturing. If you set up master data in the right sequence, it's much easier and logical to interconnect them because you've already taken care of the predecessor-successor relationship.

The creation of master data for process manufacturing begins with the material master of the product (a finished good or an assembly). You create the bill of materials (BOM) of the product that you want to produce and assign components, together with the quantities needed to produce the product. If needed, you can also define the scrap percentage at the operation or component levels.

You then create the resource and then create the master recipe for the material, in which you also assign the previously created resource.

Finally, you create the production version for the material and assign the material's BOM; that is, the master recipe.

When all of the logistical master data is in place, your CO team can create a product cost estimate of the material and also release it.

Note

You need to maintain a close coordination and liaison with the CO team to ensure that when working in the PP component, you're completely aligned with their working and reporting needs.

For example, for each resource, you need to assign a cost center, which your CO team should provide you with. They may provide you with one cost center for multiple resources or one cost center for an individual resource, depending on how they want to see the cost center reporting and evaluation.

The following make up the important master data in PP-PI:

- Material master
- BOM
- Resource
- Master recipe
- Production version

We'll discuss each in detail in the following subsections.

7.2.1 Material Master

The material master is the central master record in Logistics and the supply chain. The system defines a *material* as a substance or commodity that you can buy or sell on commercial basis. You can also relate a material to either being consumed or produced. A few examples of material are raw material, packing material, consumables, semi-finished goods, and finished goods. The material is not just restricted to production-based processes but all those for which the company wants to maintain inventory (stock items). So, you may also have materials that are used in Plant Maintenance (PM) processes, or you can even have non-valuated materials.

For PP-PI, there is an extensive use of *Batch Management (BM)*. A *batch* is a uniquely identifiable partial quantity of a material. The batches of a material are managed in separate stocks. In a production process, a batch is a quantity of a specific material produced during a standardized production run. This quantity therefore represents a non-reproducible unit with unique specifications. The key properties of a batch are homogeneity and non-reproducibility.

A batch can be traced across the entire supply chain; that is, from the receipt of the raw material to processing in production and the creation of the final product, all of the way to sales and delivery to the customer. There are complete batch traceability, batch determination, and batch derivation functionalities available. You can use the batch information cockpit (Transaction BMBC) for complete top-down or bottom-up evaluation of batches of materials.

The system creates batches for a material, and the data of the material master is valid for all batches assigned to it. In contrast to the material master, a batch master record contains data that uniquely identifies the corresponding batch and characterizes the unit as one that cannot be reproduced. The characteristic batch specifications are assigned using characteristics from the classification system in the material master and are inherited by the corresponding batch master records.

Note

Refer to Chapter 15 on the classification system, in which you'll learn how to create classes and characteristics that you can eventually use in BM. We suggest that you extensively coordinate with the MM consultant for activation as well as complete business process mapping of BM in production processes.

7.2.2 Bill of Materials (BOM)

The bill of materials (BOM) in PP-PI is the same as in discrete manufacturing. Refer to Chapter 3 and Chapter 6 for a detailed understanding of the configuration and business processes involved in BOMs.

The material quantity calculation is unique only to the PP-PI and uses components of the material defined in its BOM. When calculating the components' quantities that the system should use in reference to each other, it refers to the information in the BOM. See Section 7.2.5 concerning the master recipe for a detailed understanding of material quantity calculation.

To create a BOM, use Transaction CS01.

7.2.3 Resource

The resource in process manufacturing is the same as the work center is in discrete manufacturing. Refer to Chapter 3 and Chapter 6 for a detailed understanding

of the configuration and business processes involved in work centers (resource in PP-PI).

To create a resource, use Transaction CRC1.

The system offers and makes available standard configuration for PP-PI, which you can use if your business processes are not too complex. For example, you can set usage as "008" (for Master Recipe + Process Order) and standard value key as "SAP4" (Process Manufacturing), in which only DURATION is listed as an activity. The available control key that you can use is PI01 (Master Recipe/Process Order).

7.2.4 Production Version

A production version determines which alternative BOM the system should use in combination with the master recipe for process manufacturing. In PP-PI, it's mandatory to define a production version. The system uses the production version during the creation of a master recipe to identify the BOM for the material and pull the BOM details from the master recipe.

When you create the master recipe for a material and plant combination, we suggest that you also enter the production version for the material on the initial screen. The production version should be created prior to the creation of the master recipe and then be used for creation of the master recipe.

To create a new production version, use Transaction C223. You can also create a production version in the MRP 4 view of the material master or even in the work scheduling view. In this view (Transaction MM02), make sure that SELECTION METHOD is set as either "2" (SELECTION BY PRODUCTION VERSION), or "3" (SELECTION ONLY BY PRODUCTION VERSION). Refer to Chapter 6 for a detailed understanding of the business process of a production version and how to create one in the SAP ERP system. It's mandatory to create a production version for process manufacturing (and also in repetitive manufacturing), but it's optional in discrete manufacturing.

Note

Creating a production version directly from Transaction MM02 should be an exception because there may still be some incomplete data at this stage. We recommend using Transaction C223 to achieve this objective.

7.2.5 Master Recipe Creation

Before you create the master recipe, you can create a production version and include BOM details only (and not the master recipe details because you don't have them at that time). Next, you'll create the master recipe and give reference to the production version because it's a mandatory requirement to enter a production version during master recipe creation. You can then go back to the production version and incorporate the master recipe details, including group number and group counter that the system generated, when you saved the master recipe. The system suggests the master recipe group number and the group counter when you again go back to production version. This approach in creating the master recipe helps in having a materials list (BOM) in the master recipe, which you can then also use in material quantity calculation.

A second approach that you can use in creating the master recipe is to first create a master recipe group, without reference to a material and plant combination. When the system generates the recipe group number, create a production version of the material, and enter the BOM and master recipe details. Finally, when you assign the header material number in the change master recipe option for the master recipe group, the system prompts you to enter a production version to enable it to explode the BOM.

To create a master recipe for which the production version already exists, follow the SAP menu path Logistics • Production – Process • Master Data • Master Recipes • Recipe and Material List • Create, or use Transaction C201. On the initial screen of the master recipe, enter the material, the plant, and the production version, and the header screen appears. We'll discuss the different screen elements of this screen in the following subsections.

Recipe Header

Figure 7.2 shows the header details screen of the master recipe.

The Charge quantity range area is valid as the lot size quantities in the master recipe. It contains the default values for the operation, phase, and secondary resources. A proportional relationship exists between the default values for operation quantities and their unit of measure, versus the recipe quantities and their unit of measure. Compared with master recipes, you enter this relationship directly in the operation details in routing and rate routings.

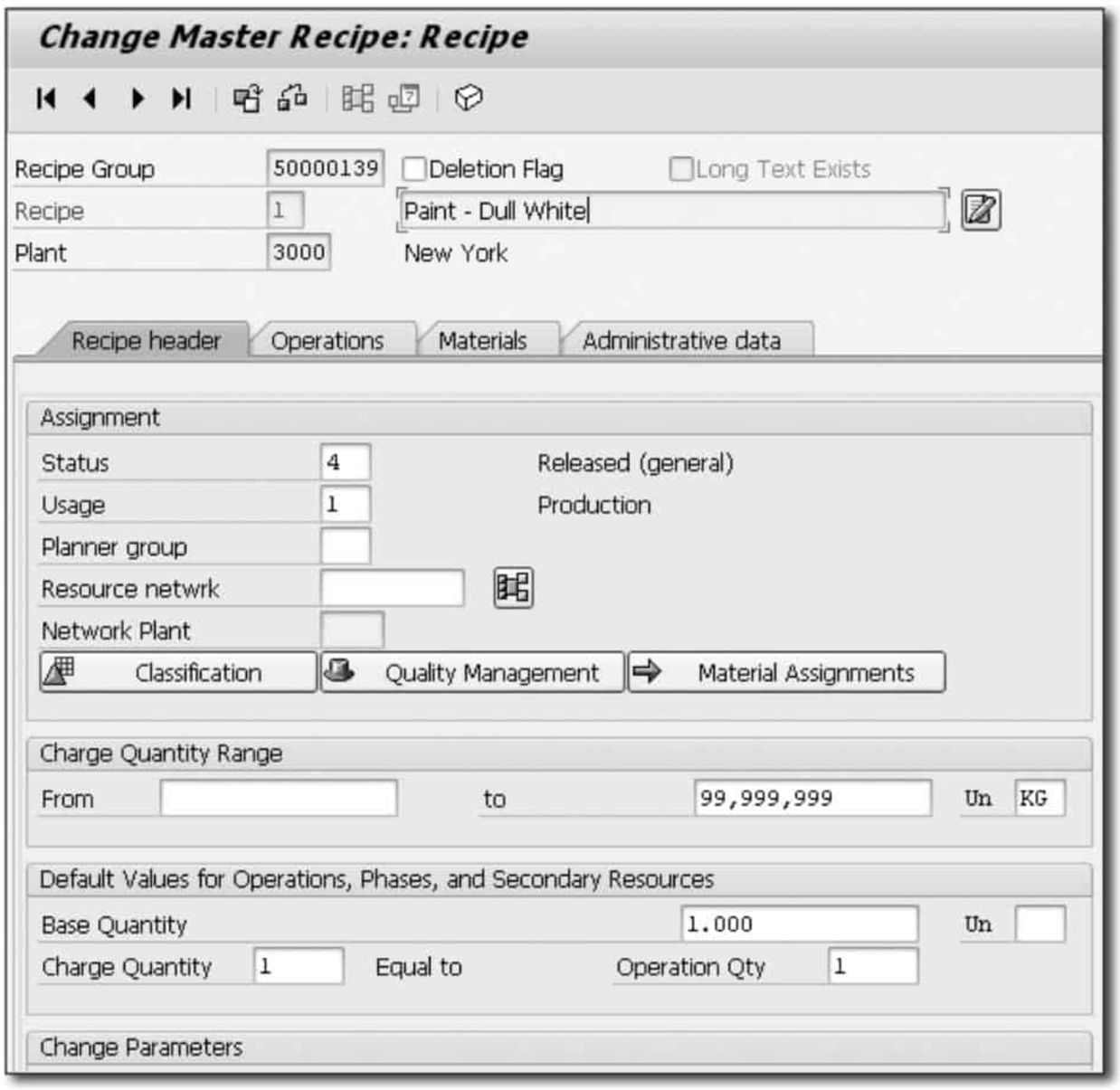


Figure 7.2 Master Recipe Header Screen

As an example, when the master recipe unit of measure is pieces and the operation unit of measure is kilogram (KG), then for every 7KG of the operation, there are 4 pieces (PC) of the master recipe, the quotient is 4/7. The charge quantity is 4 PC, and the operation quantity is 7KG. The system also provides the option to maintain a base quantity for detailed working.

Materials

The master recipe integrates the details of the operations and BOM together as one master data by using the production version. The system explodes the BOM in the master recipe to bring up the details of the material BOM. The material BOM details in the task list (master recipe) help enable a unique feature to process manufacturing known as *material quantity calculation*.

Note

You need to adopt one of the two approaches mentioned previously for the creation of a production version in relation to the master recipe to ensure the master recipe contains the materials (BOM).

Material Quantity Calculation

In a process order, the system calculates the components quantities directly from the BOM and takes the material quantity calculation into account.

With the material quantity calculation, you can do the following:

- Change the header product quantity with reference to components' quantities or even with respect to the active ingredient proportions.
- Calculate the planned scrap at the phase level, and also include it in the planned production cost.
- Change components' quantities with reference to each other, the header product, or the active ingredient proportions (batch characteristics and their values).
- Change operation or phase quantities when these are not in proportion to the product quantity.

For material quantity calculation to work effectively, you need to make sure that you create the master recipe with reference to the BOM and consisting of components and quantities.

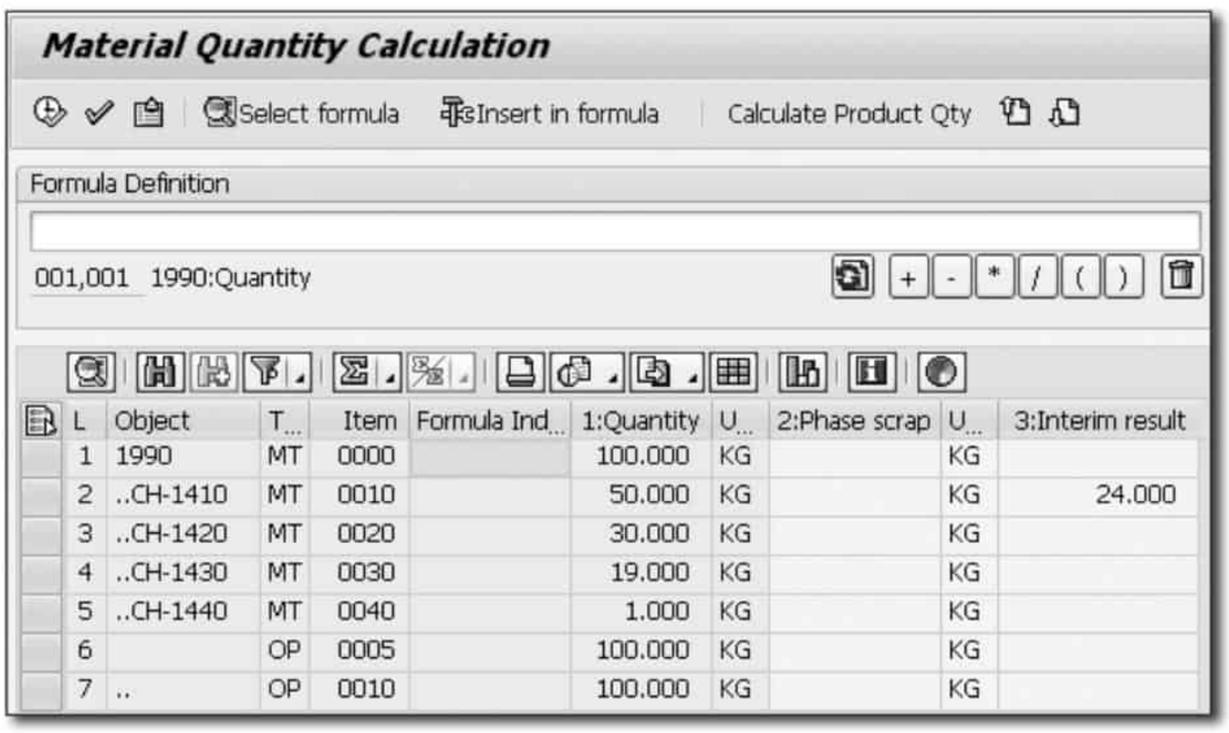
Because the planned scrap of the component is entered either in the material master or in the BOM, the system automatically increases the component quantity during planned order or process order creation. You can use the planned scrap of a component as a variable to calculate the other component's quantity using the material quantity calculation formula.

When you create the process order, the system automatically calculates the quantities based on the formulas. For a formula that is processed at the batch level and also uses active ingredient proportions (batch characteristics values), you need to manually trigger the material quantity calculation in the process order and after batch determination.

Note

Note that the system only considers batch characteristics with numeric values.

When the system explodes the BOM in the master recipe, you can go to the MATERIAL QUANTITY CALCULATION screen shown in Figure 7.3 by choosing GOTO • MATERIAL QUANTITY CALCULATION or by clicking on the MATERIAL QUANTITY CALC. (calculation) icon ( ) in the MATERIALS tab of master recipe.



L	Object	T...	Item	Formula Ind...	1:Quantity	U...	2:Phase scrap	U...	3:Interim result
1	1990	MT	0000		100.000	KG		KG	
2	..CH-1410	MT	0010		50.000	KG		KG	24.000
3	..CH-1420	MT	0020		30.000	KG		KG	
4	..CH-1430	MT	0030		19.000	KG		KG	
5	..CH-1440	MT	0040		1.000	KG		KG	
6		OP	0005		100.000	KG		KG	
7	..	OP	0010		100.000	KG		KG	

Figure 7.3 Material Quantity Calculation in the Master Recipe

Generally, the following steps are involved in entering the formula for the material quantity calculation:

1. In the screen shown in Figure 7.3, place the cursor on the field for which you want to change the quantity using a formula, and click on the SELECT FORMULA button in the menu bar.
2. In the FORMULA DEFINITION box, enter the formula or equation, which derives the output field value.
3. While creating a formula, you can also double-click on the variables that you want to include in the formula or place the cursor on the variable and click on the INSERT IN FORMULA button in the menu bar.

You can use formula operators such as +, −, *, /, DIV, and MOD. You can also use exponential, rounding (ROUND), absolute values (ABS), truncation

(TRUNC), EXP, LOG, SIN, COS, TAN, square root (SQRT), IF THEN ELSE conditions, and IF THEN NOT conditions.

We now show two examples to demonstrate how you can use the material quantity calculation to calculate product quantity and to show the interdependency of one component on another in calculations.

Example 1

In our first example, enter a formula using the following steps (refer to Figure 7.3):

1. For the header material quantity (1990) formula, place the cursor on the FORMULA INDICATOR field, and click on the SELECT FORMULA button in the menu bar. This shows up as 001,001 1990:QUANTITY just below the FORMULA DEFINITION bar.
2. Place the cursor on the field with the quantity 50.000 KG for MATERIAL CH-1410, and click on the INSERT IN FORMULA button in the menu bar. This automatically brings up [002, 001] in the FORMULA DEFINITION bar, in which you then enter "* 1.9". This means that the material quantity for the material 1900 will be 1.9 times the quantity of the material CH-1410.
3. Click on the REFRESH icon (), and the system denotes the row containing the material 1990 with the FORMULA icon ().
4. If you then click on the CALCULATE PRODUCT QTY button, the system updates the product quantity of material 1990 from 100KG to 95KG (50KG for material CH-1410 * 1.90 = 95KG).
5. Figure 7.4 shows the updated product quantity for material 1990. This compares with 100 KG as shown in Figure 7.3.

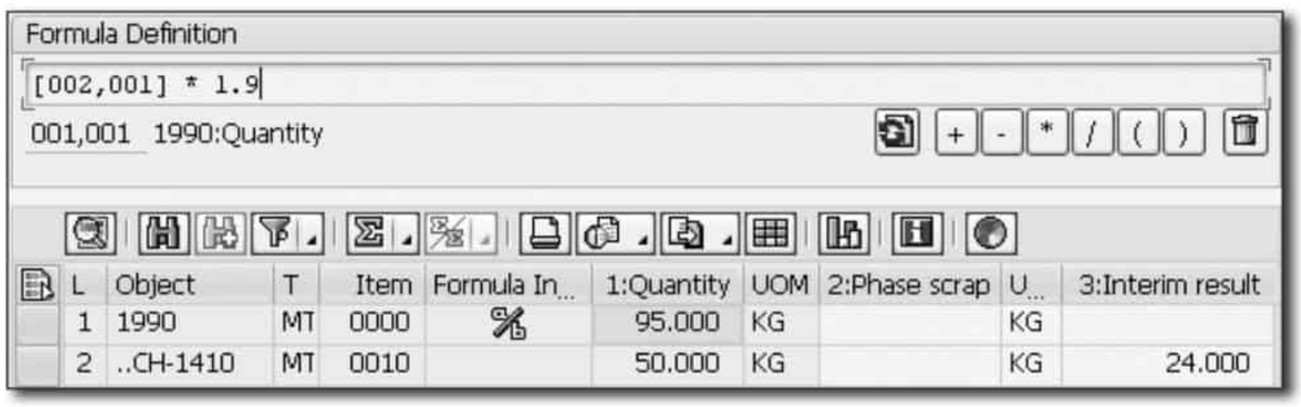


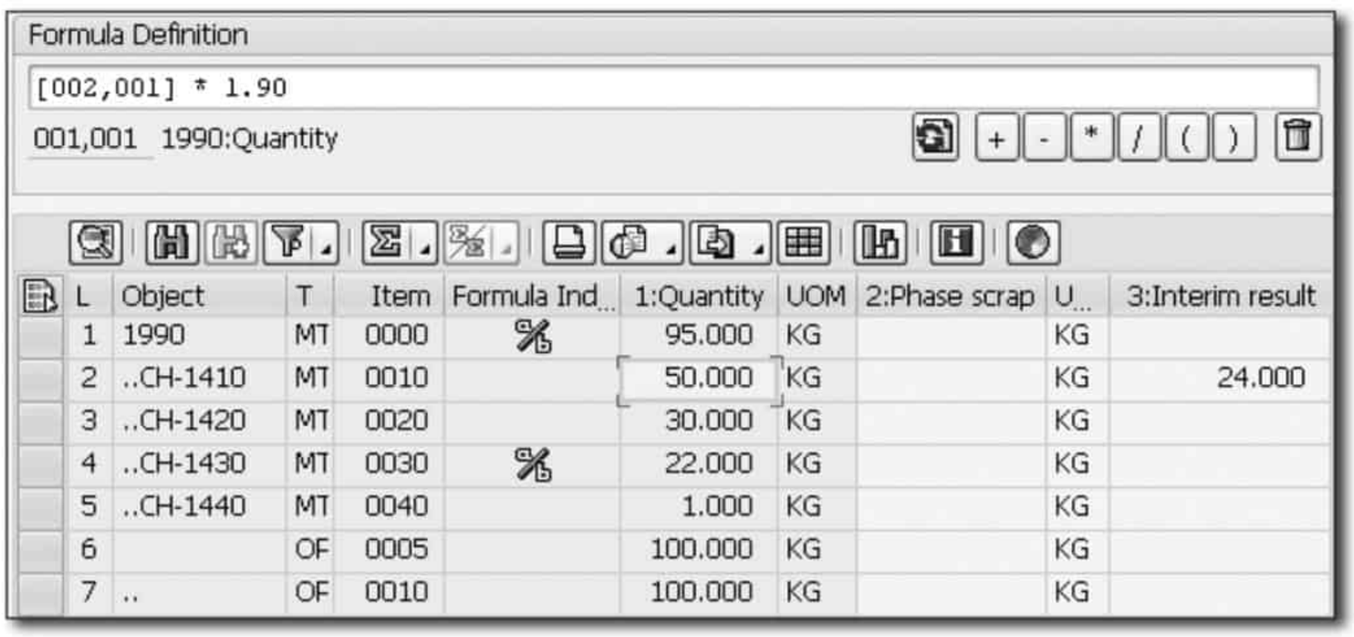
Figure 7.4 Updated Product Quantity after the Material Quantity Calculation

Example 2

In the second example of material quantity calculation, the system calculates one component's quantity based on the calculation that is associated with another component. Perform the following steps (refer to Figure 7.3 again):

1. To enter the formula for the component quantity (CH-1430), place the cursor on the FORMULA INDICATOR field, and choose the SELECT FORMULA button in the menu bar. This shows up as 004,001 CH-1430:QUANTITY just below the FORMULA DEFINITION bar.
2. Place the cursor on the field with quantity 30 KG for MATERIAL CH-1430, and choose the INSERT IN FORMULA button. This automatically brings up [002, 003] in the FORMULA DEFINITION bar, in which you then manually enter "– 8". This means that the material quantity for the material CH-1430 will be subtracted by 8KG from the quantity of material CH-1420.
3. Click on the REFRESH icon, and the system denotes the row containing the material 1430 with the FORMULA icon.
4. Because the quantity for material CH-1420 is 30KG, the system subtracts it by 8KG to update the quantity for material CH-1430 as 22KG. If you refer to Figure 7.3, the original quantity (before the material quantity calculation) for this material, CH-1430, was 19KG.

Figure 7.5 shows the updated product quantity for material CH-1430.



L	Object	T	Item	Formula Ind...	1:Quantity	UOM	2:Phase scrap	U...	3:Interim result
1	1990	MT	0000	%	95.000	KG		KG	
2	..CH-1410	MT	0010		50.000	KG		KG	24.000
3	..CH-1420	MT	0020		30.000	KG		KG	
4	..CH-1430	MT	0030	%	22.000	KG		KG	
5	..CH-1440	MT	0040		1.000	KG		KG	
6		OF	0005		100.000	KG		KG	
7	..	OF	0010		100.000	KG		KG	

Figure 7.5 Component Quantity Calculation for Material CH-1430

Figure 7.6 appears when you click on the FORMULA OVERVIEW icon ( ) and contains comprehensive details of all of the formulas and calculations involved.

Material 000000000000001990 Plant 3000 Prod. Version 0001

Line	Object: OP = Operation / Phase MT ...	+	Value	Unit	Formula (According To Column Descr...
1	MT 1990	-	95.000	KG	Quantity
	MT 0010 CH-1410		50.000	KG	Quantity
					* 1.90
2	MT 0010 CH-1410		50.000	KG	Quantity
3	MT 0020 CH-1420		30.000	KG	Quantity
4	MT 0030 CH-1430		22.000	KG	Quantity
	MT 0020 CH-1420		30.000	KG	Quantity
					- 8
5	MT 0040 CH-1440		1.000	KG	Quantity
6	OP 0005		100.000	KG	Quantity
7	OP 0010		100.000	KG	Quantity
2	MT 0010 CH-1410		24.000		Interim result
	MT 0020 CH-1420		30.000	KG	Quantity
					* 0.8

Figure 7.6 Overview of the Material Quantity Calculation

When you click on the BACK icon twice, the system takes you to the screen shown in Figure 7.7, which now has updated quantity details of all components, including base quantity of 95KG for material 1990.

If you create a process order for material 1990 for a quantity of 100KG, the system will divide the components' quantities by 95KG (the new base quantity) and then multiply each quantity with 100KG (the process order quantity) to arrive at the individual component quantity. For example, for component CH-1410, the quantity calculation for 100KG of process order is the following: 50KG / 95KG * 100KG = 52.63KG.

Recipe header | Operations | Materials | Administrative data

Material 1990 Plant 3000 BOM

Prod. Version 0001 Paint-Dull White

Base quantity 95 KG

Material Component Assignments

Material	Oper...	P	S...	Operation Desc.	Quantity	Co...	B	Item Text	Item ...
CH-1410					50	KG		Acrylic Resin	0010
CH-1420					30	KG		Additive BG99	0020
CH-1430					22	KG		Solvent Mix A	0030
CH-1440					1	KG		Pigment, blue	0040

Figure 7.7 Updated Material Quantities in the Master Recipe

Operations and Phases Tab

Master recipes use something called a *phase*, which work in the same manner as operations do in routing for discrete manufacturing. It's easier to maintain

detailed levels working at the phase level in the master recipe because you can manage and incorporate more production details, including Process Management.

In the master recipe, you assign activities such as production duration or labor hours at the phase level and not at the operation level. Hence, the confirmation of a process order is recorded for a phase and not an operation. You also assign a resource (work center) at the operation level. The phases below the operation then adopt the resource that you assigned at the operation level. The system assigns the standard values and activities (controlled by a control key in the resource) as active at the phase level and not at the operation level. The sum total of standard values at a phase is in fact the total time required to process the operation. The system assigns the components of the BOM (materials list) to phases and not to operations. You can, however, integrate in-process quality inspections of QM either at the operation level or the phase level.

To create a phase below an operation, you need to select the PHASE checkbox in the OPERATIONS tab, which then automatically copies the resource from the operation. At the same time, when defining a phase, you also have to assign the *superior* operation so that the system knows which specific phase relates to which operation.

You can maintain the relationships among various phases as start-finish, finish-start, finish-finish, or start-start. The phases can either work in parallel or in overlapping sequences. In the OPERATIONS tab of the master recipe, you can access the phase relationship screen for phases by selecting the phases and choosing GOTO • RELATIONSHIPS.

You assign individual control recipe destinations at the phase level and assign the process instructions in the respective phases of the master recipe. If you've defined the scope of generation in the configuration of the process instructions, it reduces the data maintenance efforts at the master recipe level. Alternatively, you can maintain the desired process instruction details either in the master recipe or in the process order. For process instructions that have characteristic values based on a material, you need to assign them at the master recipe level. To assign process instructions to the phases in the OPERATIONS tab of the master recipe, use the menu path GOTO • PROCESS MANAGEMENT • PROCESS INSTRUCTIONS.

Figure 7.8 shows the OPERATIONS tab of the master recipe, in which the operation is 0005. Enter the RESOURCE "CH_BLEND" at the operation level, and the system

automatically copies it in all of the phase below it. The phase is 0010 and is denoted by the PHASE checkbox. When you define an operation as a phase, you also have to define the SUPERIOR OPERATION, which, for our example, is 0005 (the operation).

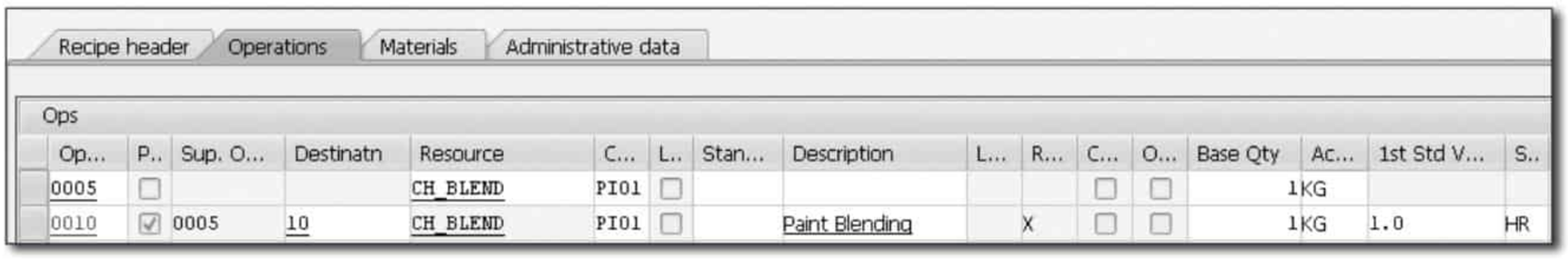


Figure 7.8 Operations Overview in the Master Recipe

The control recipe destination is 10. This is the same control recipe destination that you configured in Chapter 4.

Notice that the system automatically copies the control key, PI01, from the resource CH_BLEND. Select the phase 0010, and double-click the line item 0010 (the operation), and the system takes you to the screen shown in Figure 7.9.

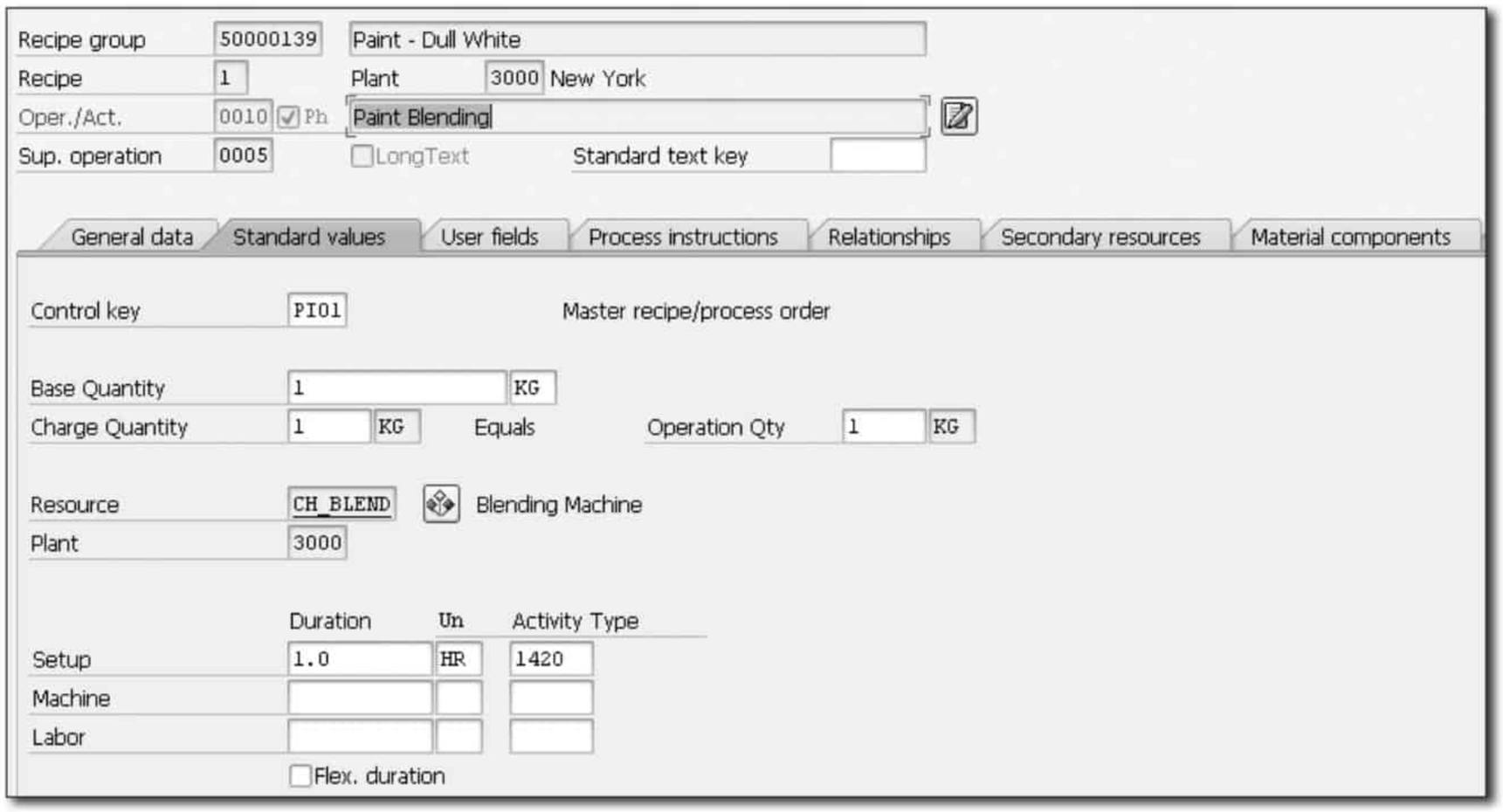


Figure 7.9 Standard Values in the Master Recipe

This shows the STANDARD VALUES tab of the master recipe in which you can enter the duration of the activities, such as SETUP, MACHINE, or LABOR hours required to

produce the material at each operation. From here you can click on the PROCESS INSTRUCTIONS tab to configure the process instructions which are an integral part of process management. We'll visit this screen a bit later in the upcoming section.

7.3 Process Management

Because a large number of features and functionalities of process instructions exist within an operation's phase of the master recipe, it warrants a separate section in this chapter. This section deals with process instructions (which is a part of process management) that you need to define in the PROCESS INSTRUCTIONS tab shown previously in Figure 7.9.

If you're working with a manufacturing organization, a permanent requirement is to monitor system performance and plant parameters. For example, when the production of a certain item is scheduled, the plant operator needs to have a series of clear and comprehensive instructions to follow. Similarly, the plant operator is required to record and report back data, such as steam temperature twice a shift or an abnormal vibration in the suction pump, so that it will be available for future reference or corrective action.

Therefore, there's a need of functionality in the SAP ERP system that is able to transfer and communicate all such information in a timely manner from plant operator back to the Process Control System (PCS). This has been made possible by the Process Management functionality.

Note

Transmitting information between an SAP ERP system and a PCS is possible by defining the type of the control recipe destination. We focus on the transfer to PI sheets to show you that implementing process management can still yield significant added value without integrating SAP with a PCS.

Process Management completely integrates with core SAP ERP system components such as MM, QM, and the cross-application DMS. It offers functionality such as goods issues and goods receipts, process order confirmations, and results recording of quality inspection data. All of this information helps in analysis and report generation functions, not to mention benefiting the business process owners who are directly using the information.

7.3.1 Functions in Process Management

The following summarizes the functions supported by Process Management in PP-PI:

- Receiving control recipes from released process orders
- Sending control recipes to process operators or PCSs
- Preparing process instructions as texts so that the process operators can display them on their computer screens
- Receiving, checking, and sending process messages with actual process data
- Monitoring process messages and control recipes
- Manually creating process messages

7.3.2 Elements in Process Management

Figure 7.10 shows an illustration of the various elements involved in process management for data flow. Starting from the top left, creating a process order forms the basis for the generation of the control recipe. The system sends the control recipe in the form of a PI sheet to the predefined control recipe destinations. The process operator follows the instructions given in the PI sheet and also fills the PI sheet with relevant plant parameters and other important data, and then returns it as a process message either back to the SAP ERP system or to an external system.

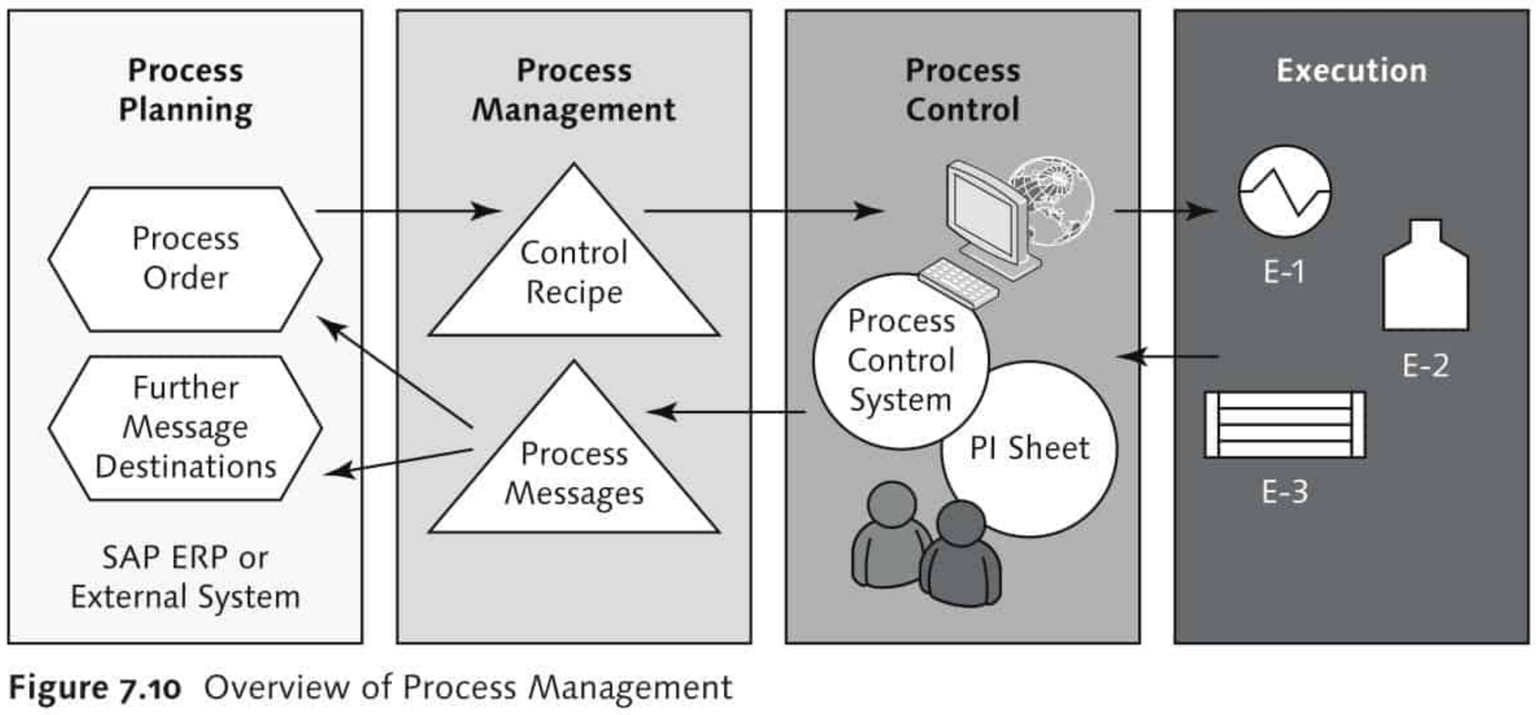


Figure 7.10 Overview of Process Management

7.3.3 Integrating Process Management with External Systems

In an automated environment, OLE for Process Control (OPC), and OPC Data Access (ODA) enables the system to read and write data points and events using the OPC server for the SAP ERP system. This function is also available in production orders (discrete manufacturing).

Note

The OPC is a standard that uses COM/DCOM technology to define interfaces independent of the manufacturer for use in an industry. The SAP ERP system designed the OPC standard especially for the process control level. OPC servers allow access to various data sources, such as PCSs, programmable logic controllers, and temperature sensors, and thus provide process data that can be requested by OPC clients.

7.3.4 Process Management and Manufacturing Integration and Intelligence

With Manufacturing Integration and Intelligence (MII), the SAP ERP system offers an adaptive manufacturing solution for production. MII provides manufacturing companies increased flexibility through improved linking of the SAP ERP system to the production process level and by making real-time information available. You can use MII both in the process order and production order environment. MII provides standardized, preconfigured connectors to enable real-time data integration in the Manufacturing Execution Systems (MES) and Supervisory Control and Data Acquisition (SCADA) systems

Note

You can find more information on MII/MES in Chapter 23.

You can run real-time analyses and display the results in browser- and role-based dashboards. These analyses provide important information for checking and supporting decision making such as warnings, job lists, analyses, reports, and real-time messages about production variance.

7.3.5 Process Instructions

An operation in the master recipe may have several phases, and each phase requires a control recipe destination. After a control recipe destination is defined

for an operation, it automatically applies to all of the phases of that operation. It's within each phase that process management-related information is incorporated, including process message categories, process instruction characteristics, and control recipe destinations.

You can assign process instructions to the phases in the OPERATIONS tab of the master recipe. To do this, select the specific phase, and use the following path in the OPERATIONS tab: MASTER RECIPE – GOTO • PROCESS MANAGEMENT • PROCESS INSTRUCTIONS.

In the resulting screen shown in Figure 7.11, there are two process instruction categories, AREAD1 and PP10. AREAD1 relates to the request to the shop floor to get the measured value of the process parameter. The second process instruction category, PP10, is the same that you configured in Chapter 4.

Also, the CONTROL RECIPE DESTINATION 10 (PRODUCTION FLOOR) is the same that you configured in Chapter 4.

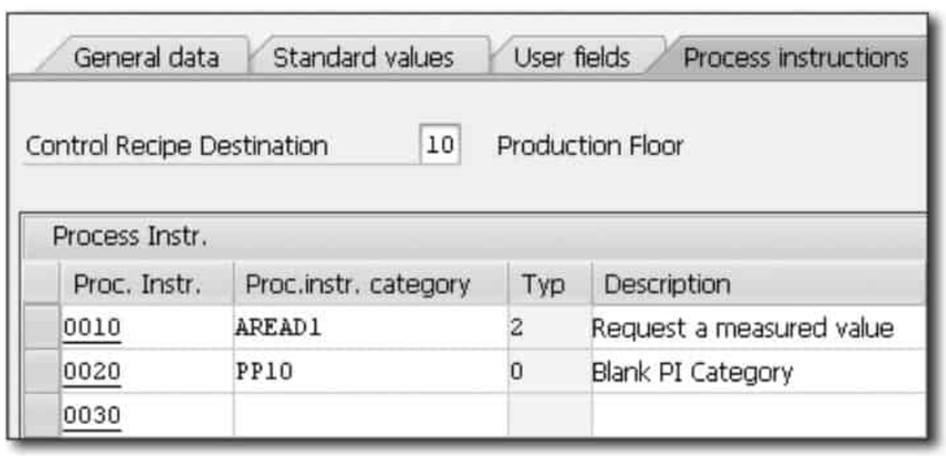


Figure 7.11 Process Instructions for Control Recipe Destination PP10

Double-click on the process instruction 0010 (with process instruction category AREAD1) to go to the screen shown in Figure 7.12.

A major benefit that Process Management offers is that its results can be checked for consistency and simulated to ensure completeness and correctness. Click the CHECK PROCESS INSTRUCTION icon ( ) in Figure 7.12 to check the consistency of the sequence of process instruction characteristics and the value of each characteristic defined. Then click the SIMULATE PI SHEET icon ( ) to show the simulated version of what the field and other information will eventually look like in a PI sheet.

Figure 7.12 contains the Message Category PP10 that you configured in Chapter 4. It also contains the process instruction characteristic ZPI_CREATION_DATE that you created earlier in Chapter 4. In the PI sheet, this field should show the Basic Finish Date of the process order. The output characteristic also have the same value (ZPI_CREATION_DATE) assigned.

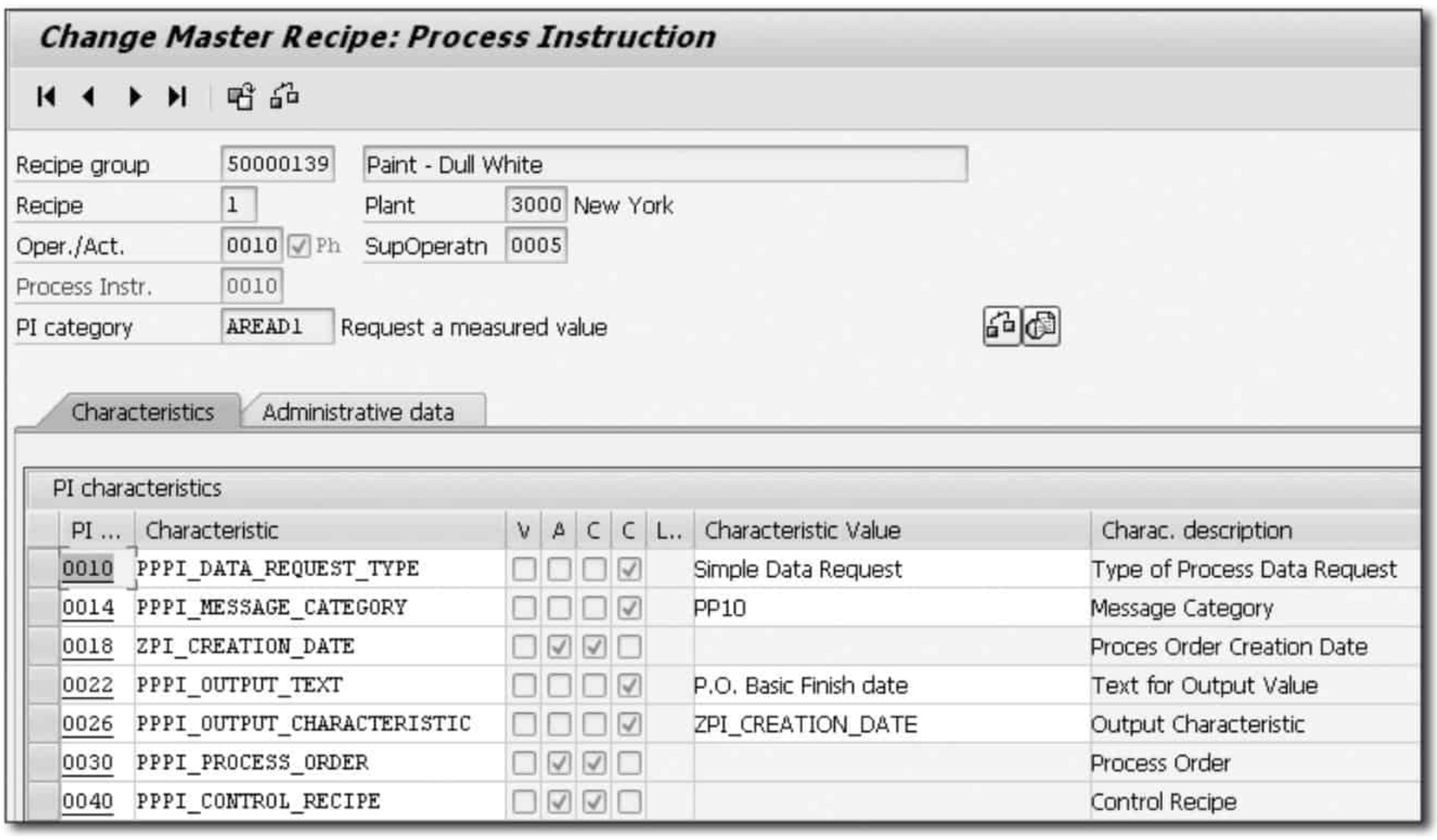


Figure 7.12 Process Instruction Characteristics for PI Category AREAD1

7.3.6 Process Instruction Sheet

Figure 7.13 shows a general example of a PI sheet.

The following subsections explain some of the options available in the PI sheet and the data or other information that you need to maintain for using a specific function/option.

Input Value

Table 7.1 contains the PPPI characteristics needed for input field functionality in the PI sheet.

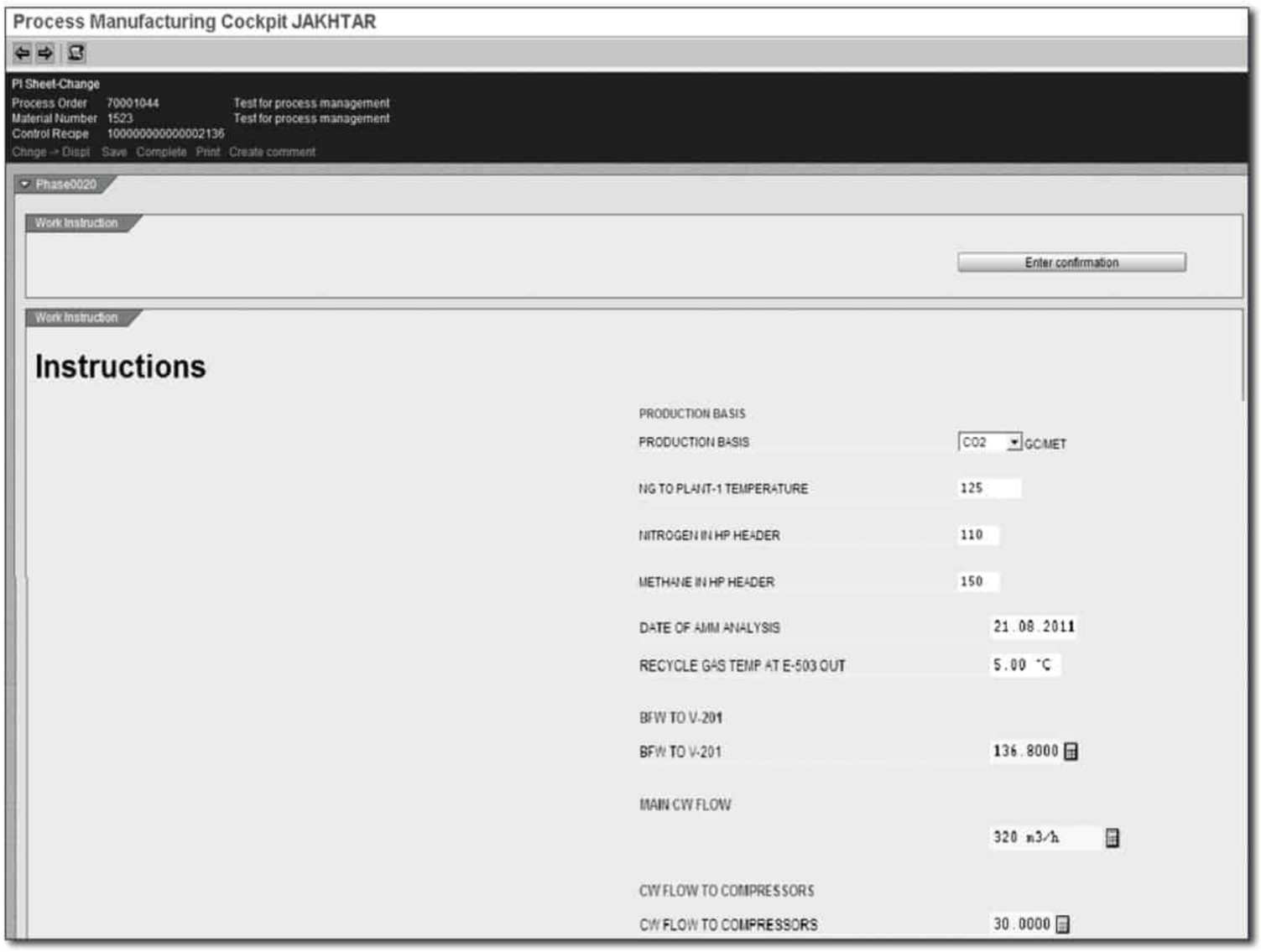


Figure 7.13 Example of a PI Sheet

Characteristic	Characteristic Value	Description
PPPI_INPUT_REQUEST	CARBON DI OXIDE IN HP HEADER	This is the standard PPPI characteristic whenever it's required that a field has an input value. The field value corresponding to this characteristic given as CARBON DI OXIDE IN HP HEADER will be the display name of the field in the PI sheet.
PPPI_VARIABLE	F	Each field can be tagged as a variable whose value can subsequently be used in calculations, if needed. For our example, give the variable tag as "F" as defined in characteristic value.
PPPI_REQUESTED_VALUE	NH3_CO2_HPH	This PPPI characteristic is the output value of a field. However, what governs the format and other details actually comes from characteristic value NH3_CO2_HPH.

Table 7.1 PPPI Characteristics and Their Values as Defined in Process Management

Figure 7.14 shows the simulation of the CARBON DI OXIDE IN HP HEADER field and how it will look in the PI sheet. Hence, the PPPI characteristic PPPI_INPUT_REQUEST is the display field in the PI sheet. The value (any numeric value) will be given a tag of PPPI_VARIABLE as "F", and the output format of the numeric value will be governed by characteristic NH3_CO2_HPH. For example, characteristic NH3_CO2_HPH stipulates having a field length of 5 with two decimal places and no negative values. In such a case, values such as 45.35 or 15.88 are acceptable but –15.88 isn't acceptable in the PI sheet.

Figure 7.14 Input Value in the PI Sheet

Note

See Chapter 15 on the classification system, including classes and characteristics, for further information on creating characteristics that you can use in process management.

Tips & Tricks

If you're not going to use the PPPI characteristic in any subsequent calculation and if you're using it only for data entry purposes, you can eliminate the entire row PPPI_VARIABLE and its value F.

Calculated Value

You can extensively use the PI sheet for all kinds of calculations, as long as all of the relevant parameters required for calculation are available in the same PI sheet.

Table 7.2 contains the PPPI characteristics needed for the calculation field functionality in the PI sheet. It also shows that if the calculation formula is too long for a single line, it can be continued on the next line (up to eight lines can be used for the calculation formula). Also, for the calculation formula, the variables AA1, AA2, and AA3 must previously be defined in the same PI sheet.

Characteristic	Characteristic Value
PPPI_INPUT_REQUEST	KS PRODUCTION
PPPI_VARIABLE	AA
PPPI_EVENT	PARAMETER_CHANGED
PPPI_CALCULATED_VALUE	NH3_02_FR_9
PPPI_CALCULATION_FORMULA	AA1*SQRT(((AA2+1.03*783)/((
PPPI_CALCULATION_FORMULA	AA3+273)*106))*3*24)

Table 7.2 Example of PPPI Characteristics and Their Values for Calculated Fields

The simulated version of the calculated field will appear as shown in Figure 7.15.

Figure 7.15 Calculation Field in a PI Sheet

Input Group and Dropdown Selection

Table 7.3 contains the PPPI characteristics needed for the input field functionality in the PI sheet.

Characteristic	Characteristic Value
PPPI_INPUT_GROUP	PRODUCTION BASIS
PPPI_INPUT_REQUEST	PRODUCTION BASIS
PPPI_VARIABLE	A
PPPI_REQUESTED_VALUE	NH3_PR_201
PPPI_UNIT_OF_MEASURE	GC/MET

Table 7.3 PPPI Characteristics and Their Values as Defined in Process Management

They will result in a display as shown in the screen in Figure 7.16.

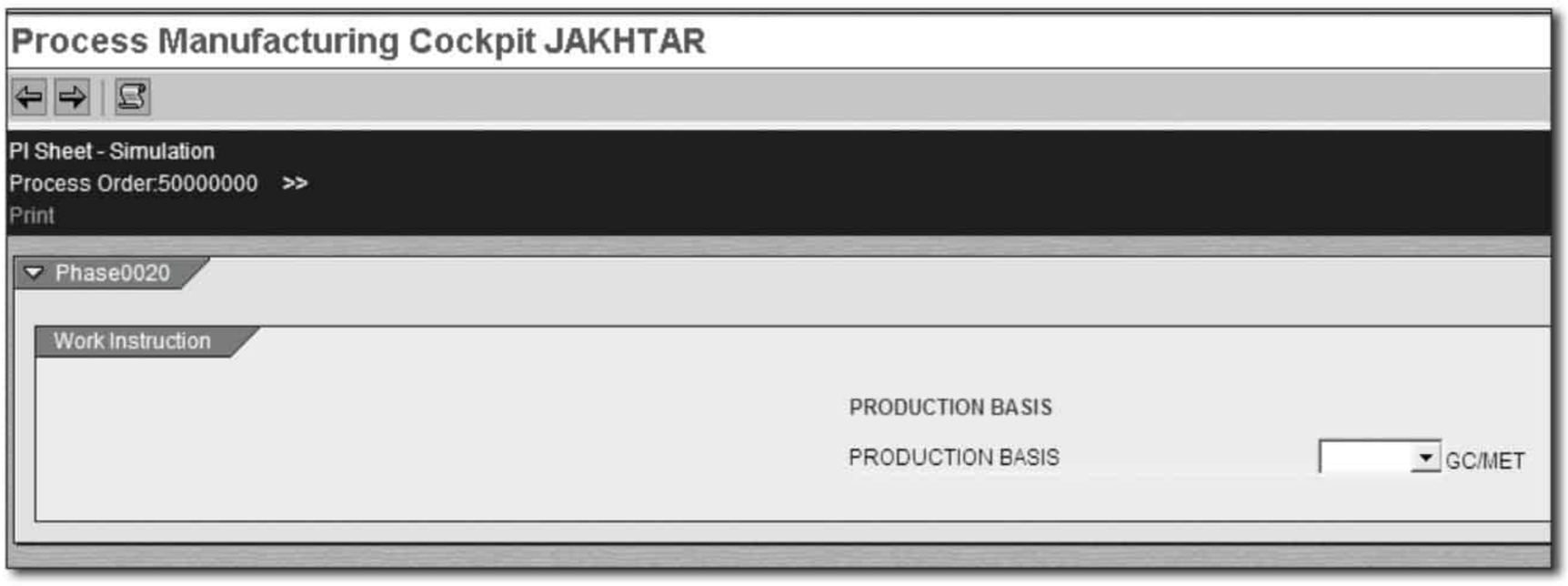


Figure 7.16 PPPI Characteristics for the Input Field Functionality in a PI Sheet

Call Function

As explained in Table 7.4, you can use the PI sheet to call up a transaction, while remaining on the PI sheet screen. The process instruction characteristics together with their values call up the DISPLAY PROCESS ORDER transaction while remaining in the PI sheet. The PPPI_BUTTON_TEXT enables you to define a meaningful description of the icon while remaining in the PI sheet. Set the icon text as DISPLAY PROCESS ORDER and set PPPI_TRANSACTION_CODE as COR3 for this example, but these fields are flexible and can be set to whatever you need.

Characteristic	Characteristic Value
PPPI_FUNCTION_NAME	COPF_CALL_TRANSACTION
PPPI_BUTTON_TEXT	Display Process Order
PPPI_FUNCTION_DURING_DISPLAY	Allowed
PPPI_EXPORT_PARAMETER	New_Session
PPPI_INSTRUCTION	
PPPI_EXPORT_PARAMETER	TCODE
PPPI_TRANSACTION_CODE	COR3

Table 7.4 PPPI Characteristics and Their Values as Defined in Process Management

The simulated version of the characteristics is shown in Figure 7.17. Here you see the DISPLAY PROCESS ORDER icon, which when clicked, brings up the Transaction COR3 (Display Process Order).

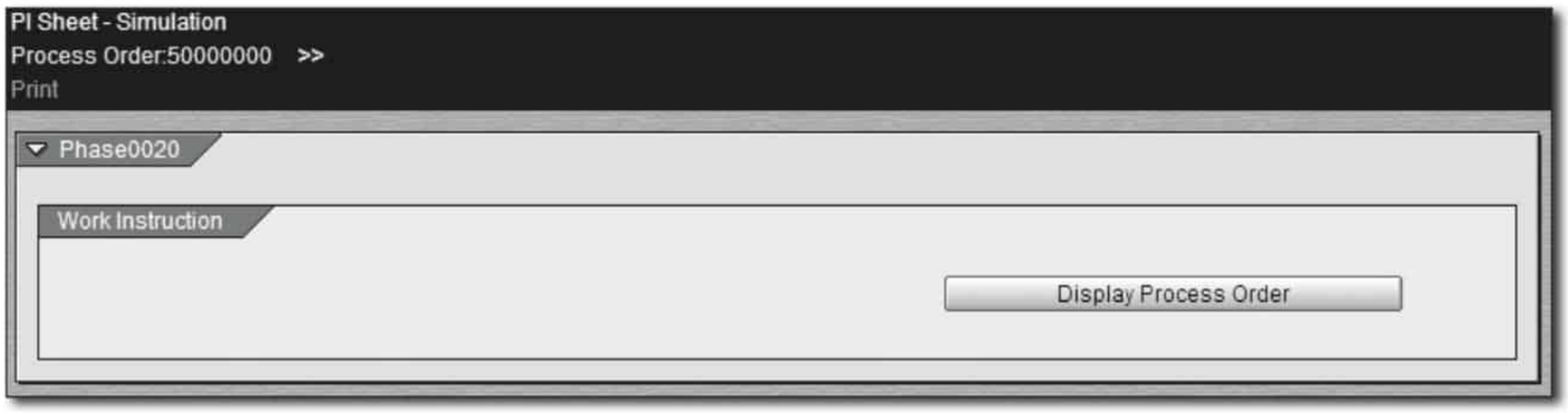


Figure 7.17 Call Function in the PI Sheet

Table Entry

Often there is a business need to enter multiple values in a tabular form for a single value or multiple values of parameter(s). Table 7.5 lists all of the PPPI characteristics needed to use the table-entry format in the PI sheet. Notice that you can control the table size (minimum four values, maximum six values in our example).

Characteristic	Characteristic Value
PPPI_DATA_REQUEST_TYPE	Repeated Data Request
PPPI_MINIMUM_TABLE_SIZE	4
PPPI_MAXIMUM_TABLE_SIZE	6
PPPI_INPUT_REQUEST	Hourly Flow Meter Readings
PPPI_VARIABLE	ABC
PPPI_REQUESTED_VALUE	NH3_02_FR_9

Table 7.5 PPPI Characteristics for Activating the Table Format with Multiple Values

Figure 7.18 illustrates the simulated version table entry format and shows six values being entered. Also note that up to four decimal places are allowed for each value (this is controlled via characteristic NH3_02_FR_9).

Sales and Operations Planning (SOP) strives to maintain a balance between SAP Demand Planning and Operations Planning, which takes initial stocks, machine capacities, and constraints into account to finalize a realistic production plan. You can use standard SOP to come up with a feasible production plan or use flexible planning if you have complex and diverse planning needs.

9 Sales and Operations Planning

Sales and Operations Planning (which we'll refer to as SOP) is an iterative form of business process management, in which you use several planning scenarios and versions until you arrive at a production plan. You can then confidently use it in production, procurement, and capital investment processes.

With the complexities involved in global supply chain management processes, there has never been a greater appreciation for ensuring effective and efficient use of SOP. SOP is mainly about sales-driven forecasting and consolidating forecasts and uses only neutral key figures (numbers) for that. In contrast to this, production planning (MRP, CRP) is all about production and takes into account requirements instead of key figures. Still, material requirements planning (MRP) in the SAP ERP system does not consider capacities, but capacity requirements planning (CRP) does. For a value-based plan, you need to transfer the sales or production figures to Controlling-Profitability Analysis (CO-PA) in SAP.

Example

Consider the following business scenario: Before each financial year begins, the sales and production teams spend countless hours working on planning figures that are acceptable to both. The sales team uses forecasting tools to arrive at next year's sale figures (targets) based on historical data. The production team looks at things differently. They evaluate whether they are able to meet the demand of sales with the existing production capacities or not. The procurement planner needs a better understanding of how the production figures will impact the procurement process; that is, do the vendors even have the capabilities to meet the supply requirements of the company? The inventory controller (warehouse) is concerned whether there is enough space in the

warehouse to manage and store the produced quantities. The management of the company is interested in not only increasing profitability on the product (and at the same time reducing cost) but also gaining a broader understanding of the capital tie-up involved and whether new investment (such as capacity enhancement or increasing the number of working shifts) is warranted. Further, knowing which product (or group of products), regions, or markets can bring in greater revenue for the company also helps the decision-making process.

This is where SOP can help. In general, the entire "planning" exercise entails the creation of various planning versions in the system, adjusting sales or production figures until there is a mutual consensus. The "finalized" planning figures, which usually reflect a production plan, are sent forward to SAP Demand Management where they appear as Planned Independent Requirements (PIR) with an "active" version. When the system runs the MRP, it considers the active PIR to arrive at procurement proposals (in-house production and external procurement).

In the planning process, there is a general need to have a planning table in the SAP ERP system that can take all of the important planning considerations into account and at the same time account for dependencies of one factor on another.

The biggest incentive for implementing SOP in a company comes from the ability of a planner to evaluate various what-if models and to perform scenario planning in simulative modes, before passing on the finalized operations plan to SAP Demand Management in the form of PIRs. Forecasting plays a major role in helping the planner arrive at a plausible operations plan.

Note

At the same time, the Long-Term Planning (LTP) option is also available in SAP ERP as a planning and simulation tool. LTP offers several planning options, including simulating the components' requirements quantities, inventory controlling, and capacity requirements. LTP has its limitations, however. For example, LTP can't take into account a product's demand fluctuation (which is possible in flexible planning) or the effect of changes in one key figure such as sales quantity or production quantity (possible in flexible planning). Refer to Chapter 12 for more information on LTP.

In this chapter, we'll start with an overview of what SOP is and also introduce flexible planning, which you can use as an alternative. You'll find an explanation of all functions and tools that are a part of these planning types, and learn how to work with them and interpret their results. Let's get started with an overview.

9.1 Sales and Operations Planning: An Overview

In standard SOP, you can plan individual materials or a group of materials (known as a product group). The product group consists of individual materials or other product groups and enables you to define the proportion factor (percentage) for each material in the overall product group. It also offers the option to aggregate and disaggregate at various planning levels. If the planning processes in your company are relatively simple and straightforward; that is, if they are restricted to individual materials or a group of materials, then standard SOP can fulfill your business needs.

The flexible planning functionality, while very sophisticated, is also a slightly complex tool to manage. With better comprehension, the dividends that flexible planning offers are far higher and bring forth much more realistic planning figures, which the company can use to reap greater financial benefits. For example, with flexible planning, you can configure your own planning layout (known as a planning table) of important key figures, include self-defined macros to manage complex calculations, perform forecasting (also possible in standard SOP), take special events such as trade shows or Olympics into account for increases in sales or natural calamities such as drought or flood to factor in decreases in sales (can also be an increase, if your company manufactures relevant products), and have a broader understanding of "commitments" (known as pegged requirements) such as capacities, materials, or production resources/tools (PRT).

When deciding which SOP options (standard SOP or flexible planning) to use, it makes sense to evaluate the business requirements and at the same time strive to maintain simplicity and a straightforward approach to business processes. As mentioned already, standard SOP offers a very limited set of functions, but being almost completely predefined, it enables you to immediately start taking advantage of the functionalities without any configuration. A general recommendation is to first try and cover the business process with standard SOP, and if important functions are still missing, then consider using the rather complex and sophisticated flexible planning tool instead. Flexible planning offers full functionality but requires many pre-settings and definitions

This chapter begins by covering the important objects and steps involved in two types of planning; namely, standard SOP and flexible planning. While covering flexible planning, we also cover a lesser-known and used application of flexible planning known as standard analysis reporting. The standard analysis in flexible

planning makes use of all the concepts and fundamentals that you will learn in this chapter.

SAP ERP offers several standard analyses reports in all Logistics components, consisting of characteristics and key figures for a period. A characteristic values combination (CVC) is the combination of characteristic values with which you want to plan. Characteristics can be materials, plants, sales organizations, distribution channels, or purchase organizations. Key figures (values or quantities) can be quantity produced, quantity procured, operations quantity confirmed, production scrap (quantity), invoiced value, or purchasing value. The period can be an interval, for example, six months. So, for example, standard analyses bring forth information such as the purchase and invoiced values (key figures) of all of the materials (characteristics) during the past six months (period). The standard analyses reports that SAP ERP offers for each logistic component has its predefined information structures with no option to add new key figures. However, when you create your own self-defined information structure in flexible planning, you can choose your desired key figures from several available catalogs. A catalog consists of a large number of characteristics and key figures of the specific application area, such as Production Planning (PP) or Quality Management (QM). You can even define how frequently you want to update the values of key figures in flexible planning standard analysis. Hence, standard analysis in flexible planning isn't just applicable to the PP component, but concepts and details covered in this chapter are equally applicable to other logistics components such as QM, Plant Maintenance (PM), Materials Management (MM), Sales and Distribution (SD), or Logistics (LO).

Note

See Chapter 22 in which we cover reporting, including standard analyses in the PP component.

Our example of flexible planning from both perspectives (flexible planning and standard analysis in flexible planning) in this chapter remains primarily focused on the Sales & Distribution (SD) component and its integral correlation with the PP component.

Note

Regardless of whether you implement standard SOP or flexible planning, we encourage you to read the entire chapter, as several features and functionalities are applicable to both planning types and are eventually covered (not necessarily in the same section).

For example, we cover the forecasting functionality within flexible planning, but it's also available and can be used in standard SOP for a material or material group. We have also dedicated a separate section on forecasting. This is also true for events and rough-cut planning. An event tends to have an impact on planning figures. A rough-cut planning profile provides better visibility on capacity, material, or PRT situations. Similarly, we cover aggregation/disaggregation in standard SOP, but not in flexible planning, although the option is available in both planning types.

In this section, we'll cover the important concepts and fundamentals you need to understand SOP. While the focus will remain primarily on covering standard SOP in this section, we'll also provide a comparison of standard SOP with flexible planning, as the next section will then be on flexible planning. Additionally, the concepts that you'll learn in this section of standard SOP will also be applicable to flexible planning.

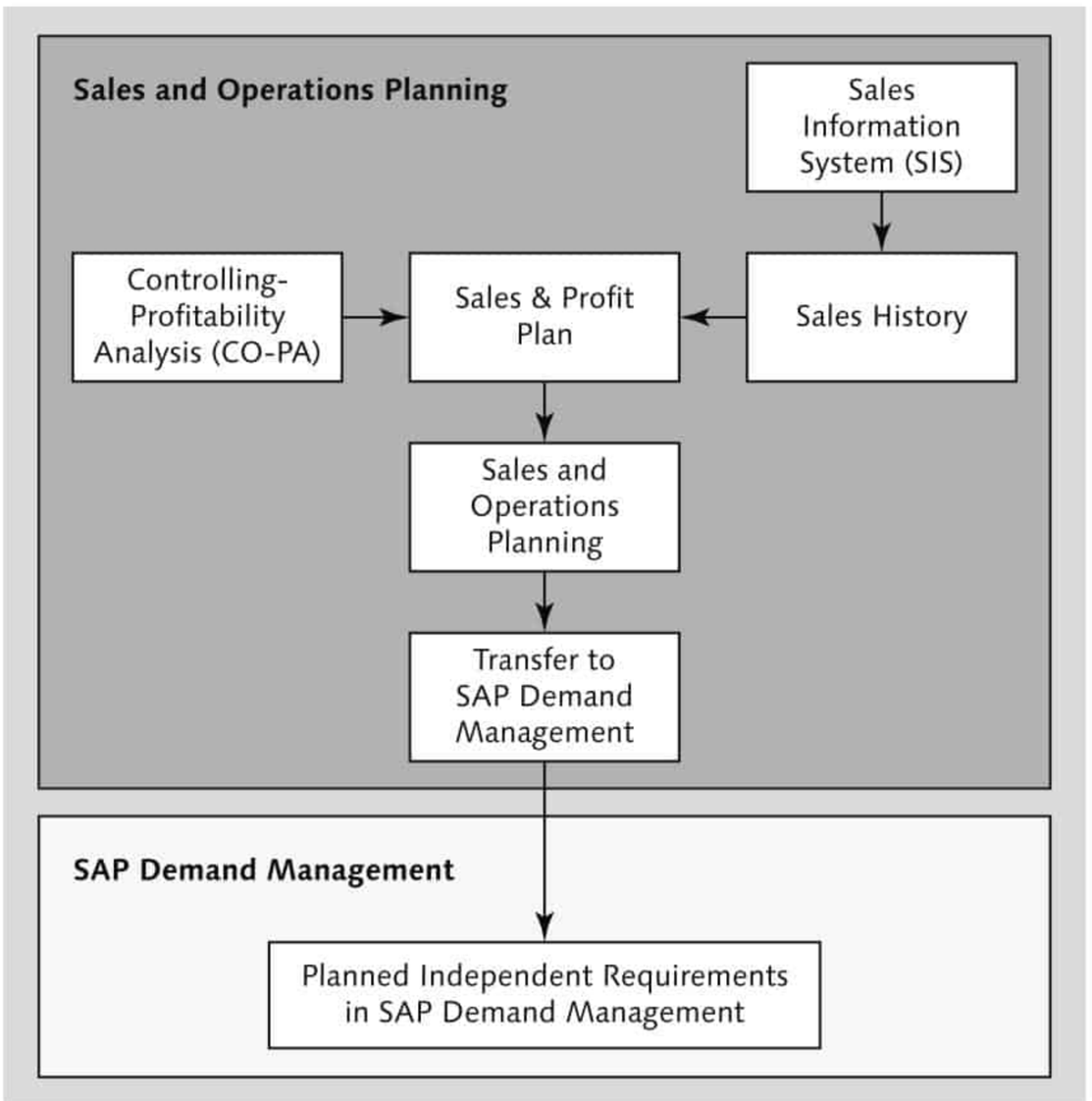


Figure 9.1 Process Overview of Sales and Operations Planning

Figure 9.1 shows that SOP can have key figures from one of the following three available options:

- **Sales Information System (SIS)**
  SIS takes information from sales history to propose a sales plan.
- **Profitability Analysis (CO-PA)**
  Information from the Profitability Analysis (PA) area of the Controlling (CO) component is used to help the planner makes a sales plan. The system derives this information from Sales and Profit Planning.
- **Forecasting**
  Historical data is used to come up with a sales plan. Forecasting is covered in Section 9.4.

The figures from SOP are eventually transferred to SAP Demand Management in the form of PIRs, which form the basis of MRP.

We list the objects used in SOP (standard SOP and flexible planning) and provide their logical relationship in Figure 9.2. The objects in SOP form an integral part in the planning process, so it's important to have a comprehensive understanding about them.

- **Information structure (info structure)**
  Data structure that stores the important planning parameters. The planning data is stored in key figures for the combinations of characteristic values. As previously explained, characteristics can be selection criterion based on which the system brings up relevant key figures. Key figures can be quantities or values, for example, number of quality inspection lots, total purchase value of raw materials, operation quantities, or production quantities.
- **Planning method**
  The storage, aggregation, and disaggregation of data with regard to the planning level occur either as consistent planning or as level-by-level planning. In SOP, the system looks for the planning method that is defined in the info structure.
- **Planning hierarchy**
  The planning hierarchy contains the CVCs for the characteristics of the info structure.
- **Planning table**
  This is where the planner carries out the actual and interactive planning.
- **Planning type**
  The planning type defines the layout or format of the planning table.

See Figure 9.2 to see how each of the objects is linked in SOP.

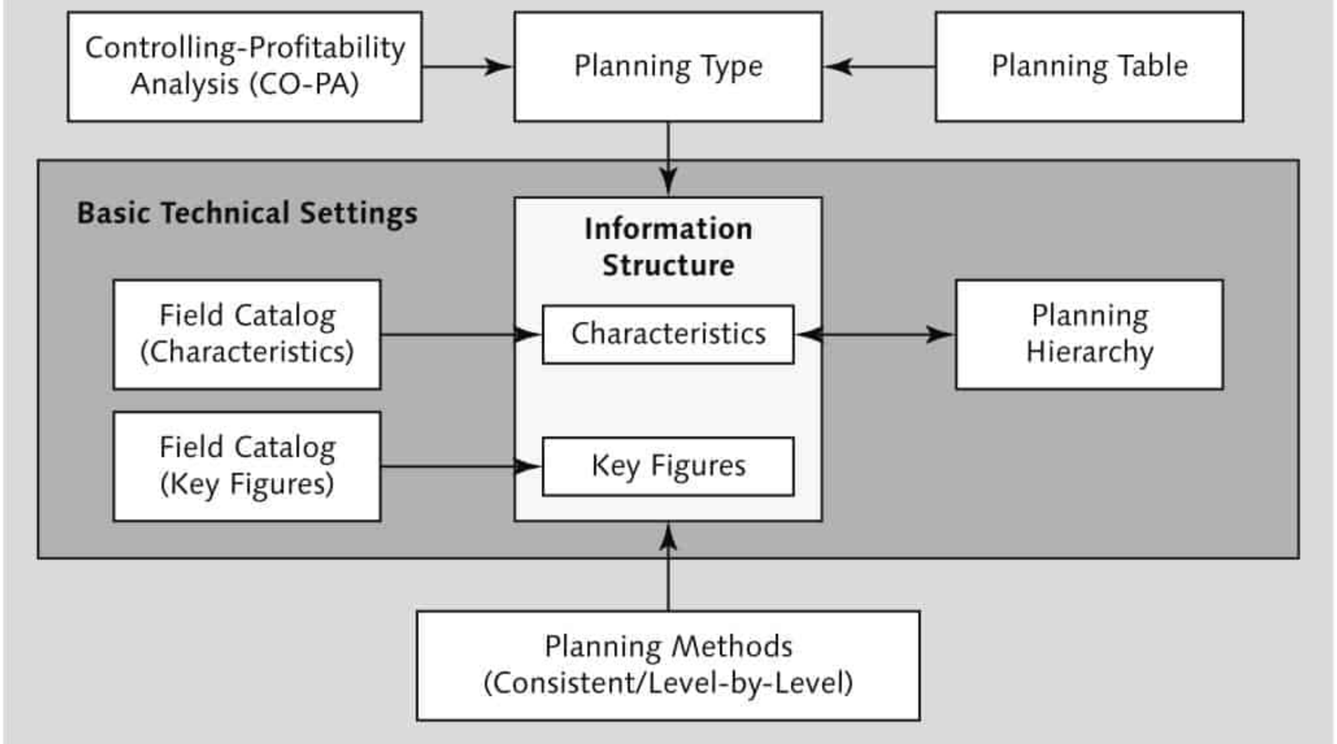


Figure 9.2 Objects of Sales and Operations Planning

Figure 9.3 provides a graphical comparison between the planning methods available for standard SOP and flexible planning.

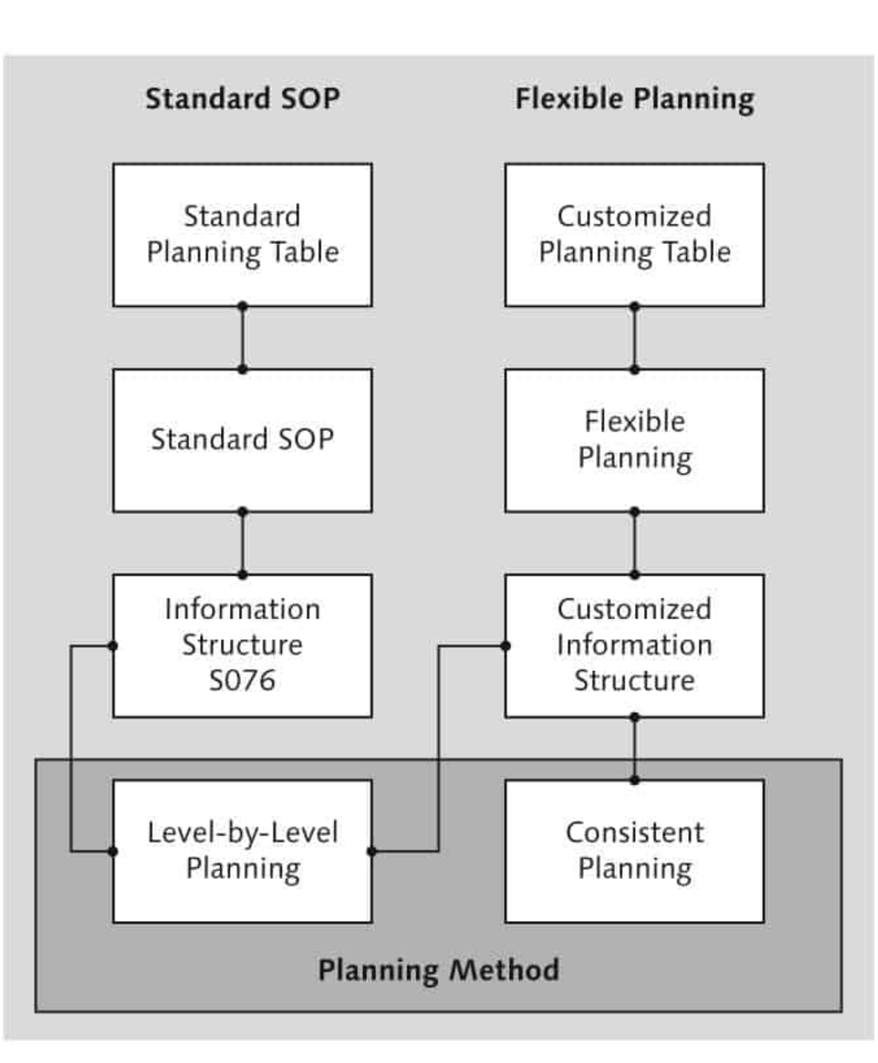


Figure 9.3 Standard SOP, Flexible Planning, Level-by-Level Planning, and Consistent Planning

Now let's dive into the details concerning the objects used in standard SOP and in flexible planning.

9.1.1 Information Structures

You can create and change the information (info) structures with the configuration (Transaction SPRO) menu path Logistics General • LIS • Logistics Data Warehouse • Data Basis • Information Structures • Maintain Custom Information Structures, or by using Transaction MC21 to create info structures and Transaction MC22 to change them.

Figure 9.4 shows info structure S076, which is used in standard SOP.

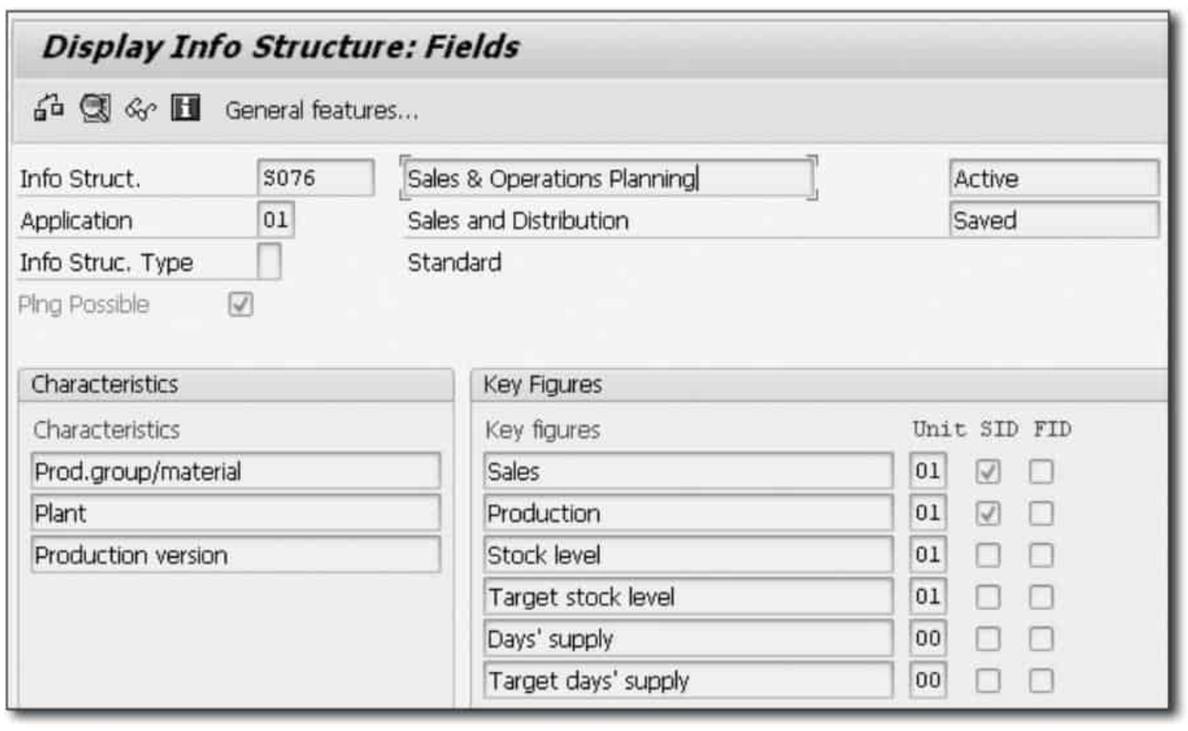


Figure 9.4 Standard SAP Info Structure S076

The planning result is stored for each CVC among the six key figures listed in the figure. Values for other key figures, such as special production or sales order; for example, can't be stored in this (standard) info structure.

Set Parameters for Info Structures and Key Figures

In standard SOP, you can't change many settings, but we'll review those you can to provide better comprehension of the parameters used in standard SOP for info structures and key figures.

To view or set parameters for info structure and key figures, follow the configuration (Transaction SPRO) menu path Logistics • Production • Sales & Operations

Planning (SOP) • Master Data • Set Parameters for Info Structures and Key Figures, or use Transaction MC7F.

In Figure 9.5 ❶, double-click on the info structure (Table) S076, or select the same and choose the Details (magnifying glass) icon, which takes you to the Change View "Info structure planning parameters": Details screen ❷. This area stipulates that the planning method used in standard SOP is level-by-level planning (denoted by I in the Planning method field).

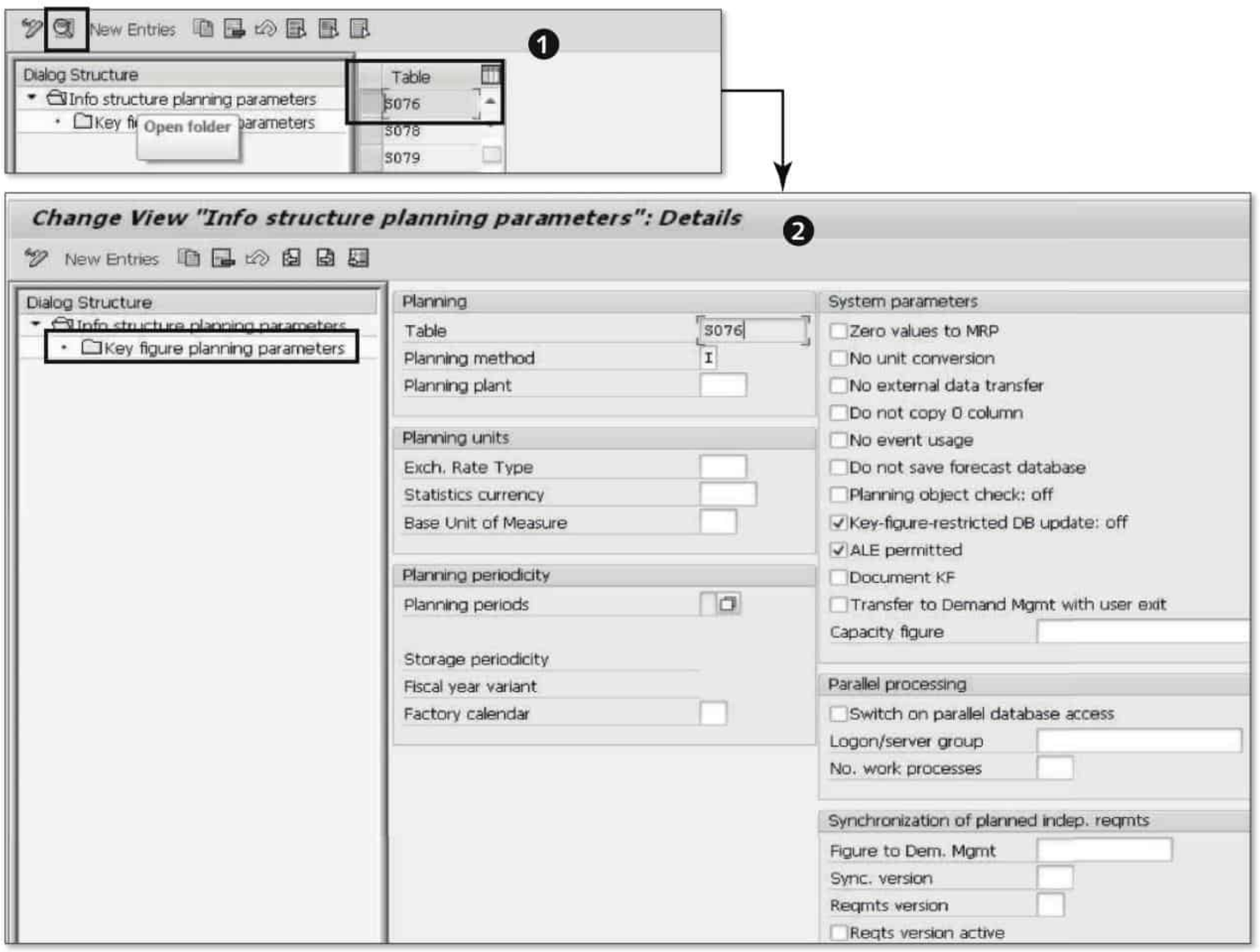


Figure 9.5 Planning Parameters of the Info Structure

Choose the Key figure planning parameters folder on the left-hand side of the screen, which takes you to the screen shown in Figure 9.6 ❶. The lower half lists the key figures available for standard info structure S076. When you double-click on the ABSAT field, a popup screen appears ❷. Here, you control whether the key figure can be used for forecasting and determine the type of aggregation (summation) of the entered data in the planning table.

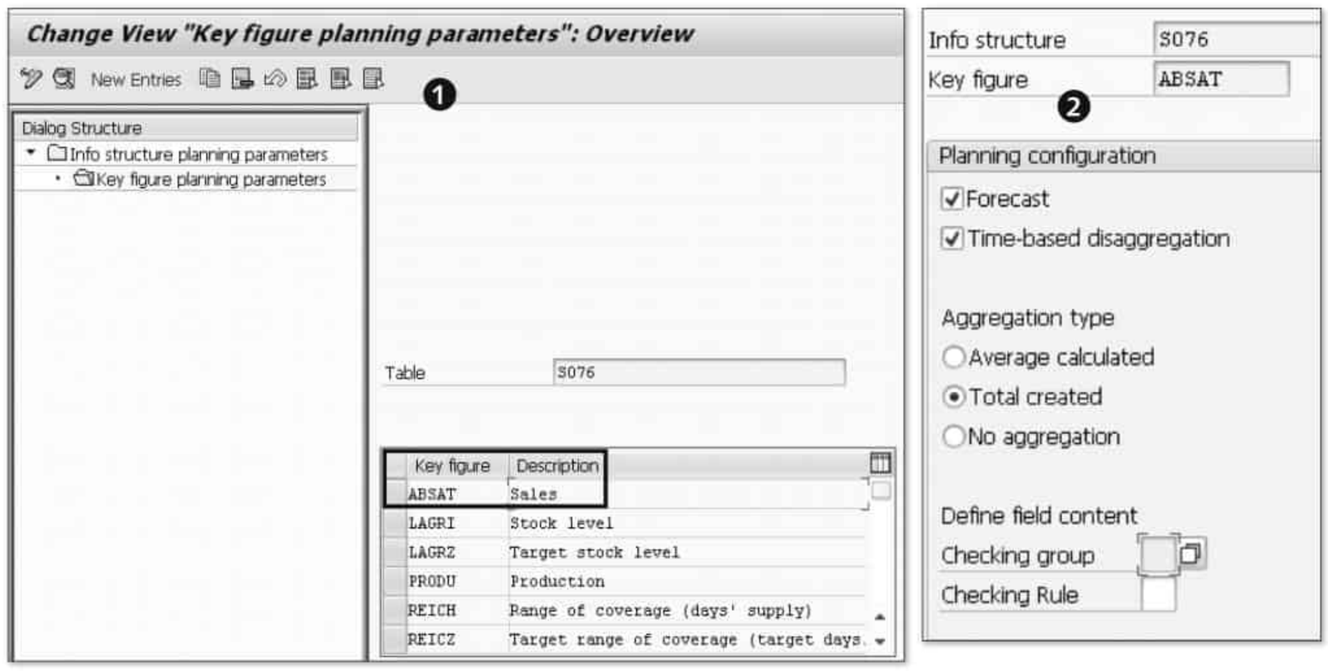


Figure 9.6 Parameters for Key Figures in the Info Structure

9.1.2 Planning Methods

In the beginning of this chapter, we mentioned that with standard SOP, the configuration and other settings are predefined, with limited options to customize parameters to meet your business requirements. For example, in standard SOP, the configuration for info structure S076 is preset with characteristics and key figures, as well as the planning table in which you enter the planning figures. The planning is either based on individual materials or group of materials (known as product groups) in which you can define proportional factors.

On the other hand, with flexible planning, you can set up self-defined info structures with desired characteristics and key figures, and the planning is based on planning hierarchies. You can set up self-defined planning tables as well, and you can perform either level-by-level planning or consistent planning.

Table 9.1 provides a comparison of planning methods available in standard SOP and in flexible planning.

Standard SOP	Flexible Planning
Preset configuration	Individual configuration based on business processes
Planning based on product groups/proportional factors	Planning based on planning hierarchies

Table 9.1 Features of Standard SOP and Flexible Planning

Standard SOP	Flexible Planning
Standard planning table for key figures entry	Customized planning tables
Level-by-level planning	Consistent planning or level-by-level planning

Table 9.1 Features of Standard SOP and Flexible Planning (Cont.)

With standard SOP, you can only plan using level-by-level planning (see Table 9.2), whereas flexible planning can use both level-by-level as well as consistent planning. In the level-by-level planning, the planning data is maintained at the specified level only. It doesn't automatically aggregate or disaggregate planning data. You have to manually perform these functions.

Table 9.2 provides a comparison of consistent planning and level-by-level planning in detail. To use consistent planning, you have to define planning hierarchies in the system. A planning hierarchy enables you to define proportional factors for each characteristic. For example, if there are three sales organizations, you can define how much (percentage) each sales organization (a characteristic) will contribute in the overall planning hierarchy. Similarly, changes made to any planning level automatically updates and accounts for changes in other planning levels. For example, initially you defined 10 materials each having a 10 % proportion to the planning results. Now, if you add a new material, the system automatically updates the proportional factor (100 % / 11 materials = 9.09 % for each material). The system also automatically aggregates (adds up) and disaggregates (divides up) the planning data to present a consistent planning position in the planning table.

Consistent Planning	Level-by-Level Planning
Planning hierarchy	Product group
Storage at the lowest level; planning data at all levels	Storage at each level; planning data only at maintained level
Automatic aggregation and disaggregation	Aggregation and disaggregation as a planning step

Table 9.2 Features of Consistent Planning and Level-by-Level Planning

9.1.3 Planning Types in Standard SOP

The *planning type* defines the layout or the format of the planning table and thus represents the link between the planning table, where the actual planning is carried out, and the info structure in which the planning is stored. You can create several planning types for one info structure. For example, two different planning types may contain planning data for two seasons (autumn and winter). As the data is stored in the info structure, the different planning types depend on each other as they use the same set of data. If you use level-by-level planning, you must create a separate planning type for each planning level.

Standard SOP has been configured with three planning types, which are used automatically in standard SOP planning:

- **SOPKAPA**
  Planning type for the planning of individual product groups.
- **SOPKAPAM**
  Planning type for the planning of individual materials.
- **SOPDIS**
  Planning type for the dual-level planning of product group hierarchies.

In the following subsections, we'll go through the steps you need to follow to create a product group that you can use in standard SOP. We also show how you can transfer the planning results of a product group to SAP Demand Management as PIRs.

Create a Product Group

Figure 9.7 shows that in our example, we're making use of info structure S076 in standard SOP to create a product group called Pump_SOP for plant 3000. This product group has two materials, 1729 and 1731, with a proportional factor of 60 % and 40 %, respectively. While we explained aggregation and disaggregation earlier, the proportional factor is specific to level-by-level planning only, and you can either maintain the proportional factor manually or allow the system to propose the proportional factor.

We now need to create the product group in the system for our example. To create a product group, follow the SAP menu path Logistics • Production • SOP • Product Group • Create, or use Transaction MC84. Figure 9.8 shows the initial screen ❶ to define the product group Pump_SOP for plant 3000. Enter the materials, "1729" and "1731" and their proportional factors of 60 % and 40 % ❷.

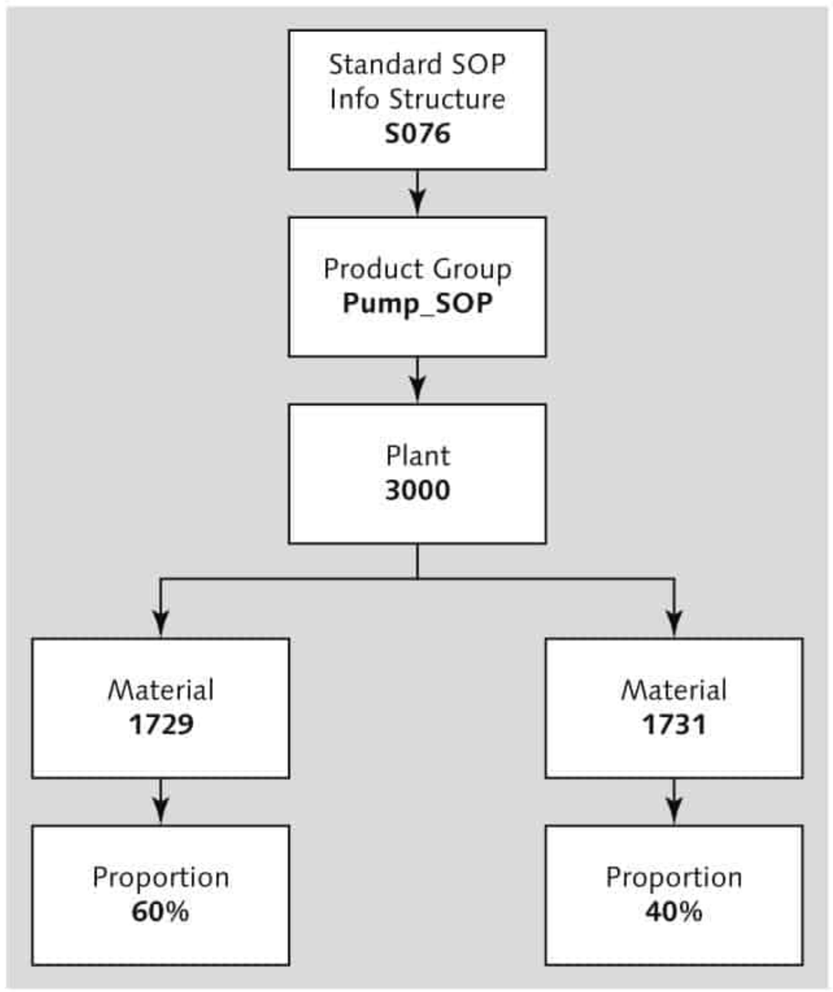


Figure 9.7 Product Group Pump_SOP

Choose the PRODUCT GRP. GRAPHIC icon to view the product group graphically ❸.

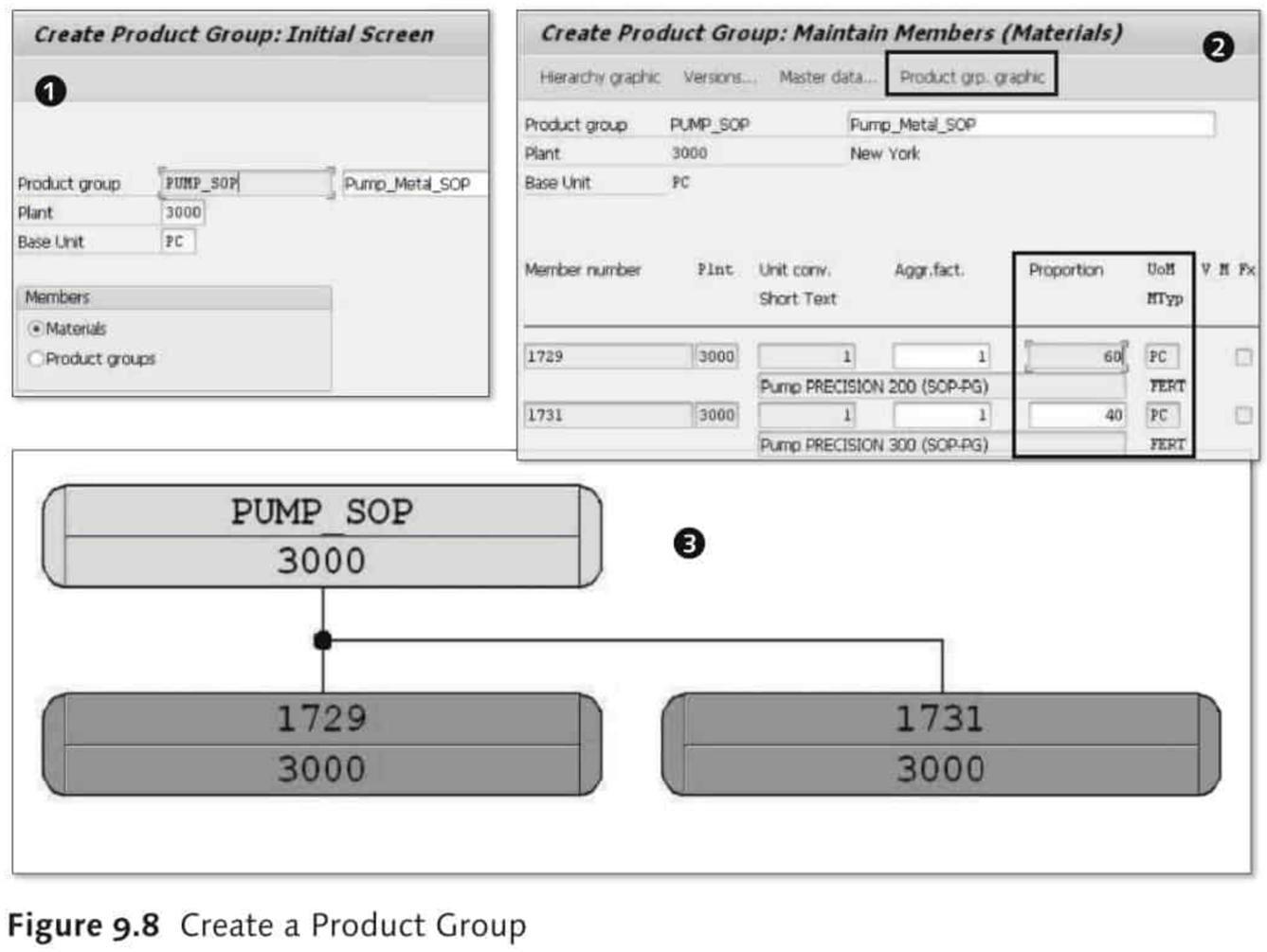


Figure 9.8 Create a Product Group

In addition to the interactive entry, you can also calculate proportional factors on the basis of historical data via the menu path Edit • Calculate Proportional Factors. You can use this option to see how well your self-defined (manual) proportional factors compare with what the system proposes and may enable you to prepare a realistic plan. Moreover, you can equally distribute the proportional factors via Edit • Distribute Proportional Factors. Save the product group.

Create a Plan for the Product Group

To proceed with planning the product group in standard SOP, use the menu path Logistics • Production • SOP • Planning • For Product Group • Create, or use Transaction MC81.

Figure 9.9 shows the initial screen ❶ of the rough-cut plan for the product. Enter the product group "Pump_SOP" and plant "3000" and then press Enter to go to the Define Version dialog box ❷. In this screen, enter the planning version "001" and the version description as "Pump_SOP_PG", and again press Enter to go to the Create Rough-Cut Plan screen ❸.

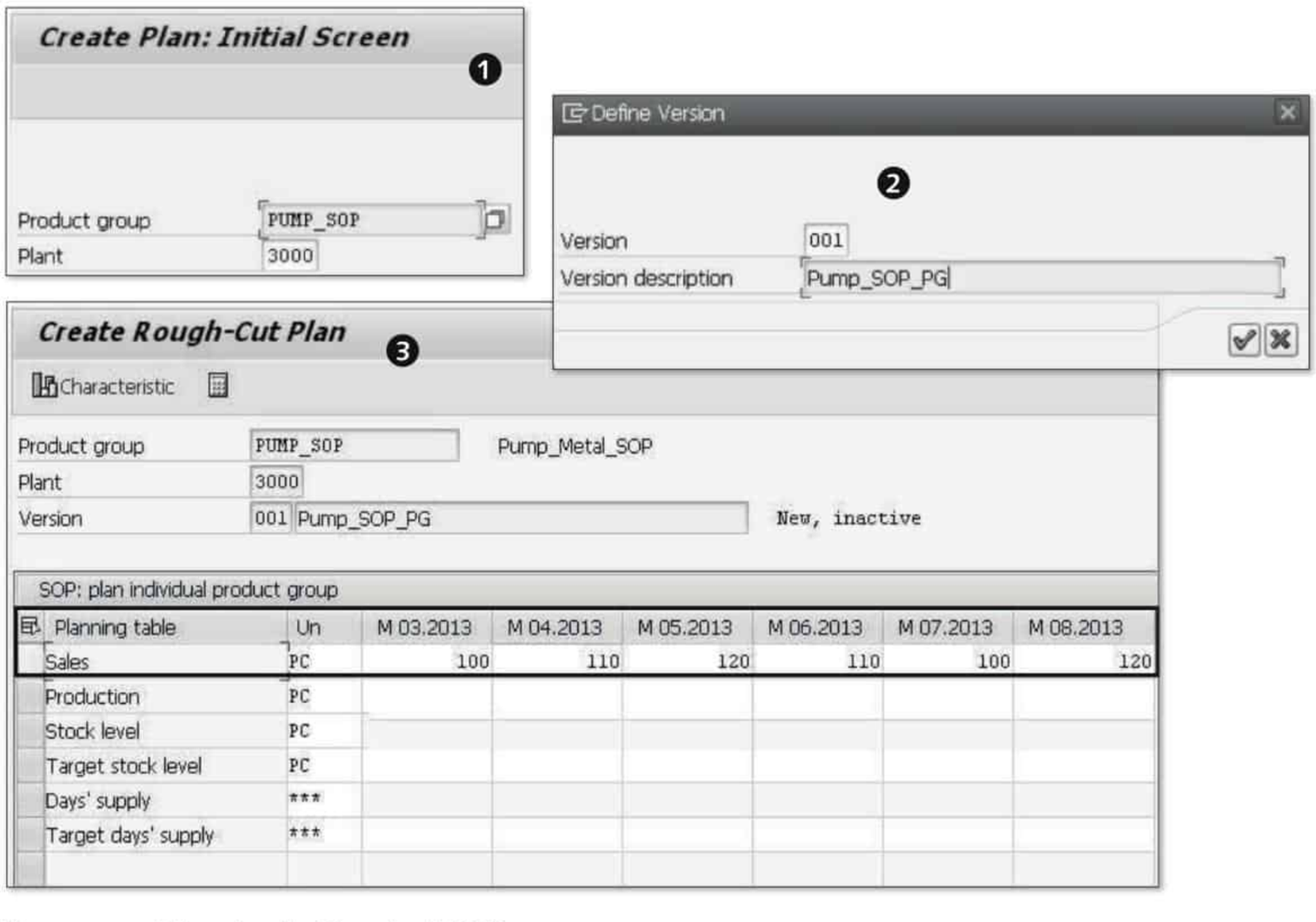


Figure 9.9 Planning in Standard SOP

If the historical key figure data is already available in the system, you can import it to create a sales plan. Alternatively, you can manually enter the SALES quantities in the PLANNING TABLE, as we've done in our example, by entering sales data for the next six months. Figure 9.10 shows that you have several options to create a sales plan for the product group (or for an individual material, where applicable):

- Transfer plan from SIS
- Transfer CO-PA plan
- Forecast
- Transfer product group (PG) proportional from production or from sales

The prerequisite for using any of the options entail that the system has significant historical data to help in effective and reliable planning.

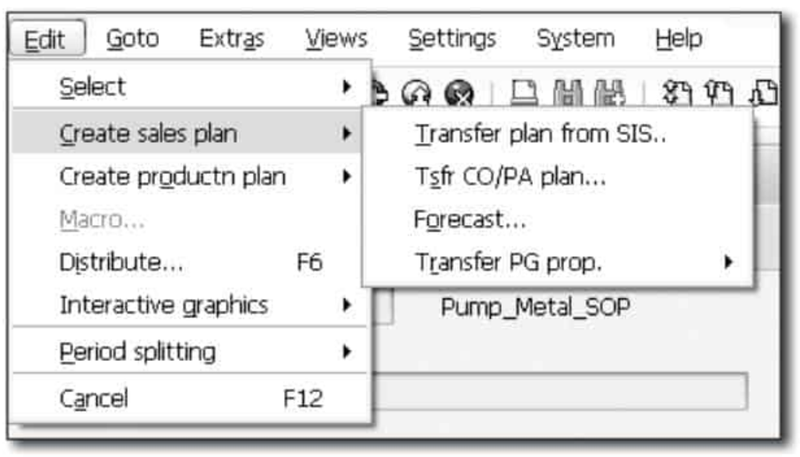


Figure 9.10 Options to Create a Sales Plan in Standard SOP

Options to Create a Production Plan Automatically

While remaining in the planning table (Transaction MC81), Figure 9.11 shows how you can create a production plan with the following options:

- SYNCHRONOUS TO SALES
  Sales figures are used as operations plans.
- TARGET STOCK LEVEL
  The operations plan is configured in such a way that the target stock level is reached in each period.
- TARGET DAYS' SUPPLY

The SAP ERP system provides special procurement types that you can use to attend to unique business scenarios. This might be where the production of assembly and procurement of components are nontraditional in nature and involves complex and diverse logistics processes.

13 Special Procurement Types

A traditional production process involves procuring components from suppliers and vendors, producing them in-house, and eventually selling them to customers. However, in a truly globalized economy, both small companies and companies with giant production setups across many countries and locations must deal with diverse, challenging, and complex logistics and supply chain processes. The same processes also need to be mapped in the SAP ERP system for effective planning of procurement and production processes.

Consider the following actual and real-time business processes and the complexities involved:

- You have a vendor who keeps its material's stock in your warehouse, but you only pay the vendor when your company actually consumes the material.
- You have a product in which few of the components become part of the assembly, yet are part of the overall product offering. During the packing process, you want all of these components available at the same time and place.
- You have a product in which some of the production steps are performed in-house, while the others are performed by external vendors/service providers.

These business scenarios and more are catered to with *special procurement types* in the SAP ERP system. These business processes vary from handling phantom assembly during production, subcontracting consignment to material production at another plant, to direct production or procurement.

When any special procurement is involved, you must ensure that you assign the relevant special procurement type key, either in the MRP 2 view of the material master or in the detailed view of the component in the material BOM. In this

chapter, we'll first give you an overview of special procurement types in the SAP ERP system, and then we'll discuss each type of special procurement.

13.1 Overview

A *special procurement type key* is the control function that the system looks for during the planning of the material to bring forth the relevant results (after planning) for immediate execution. The special procurement type key is plant-specific and you can assign this key at two levels, depending on the business processes:

- Material master (in the MRP 2 view)
- Bill of materials (BOM) in the detailed view of the component

Note

While we cover the maximum details of each of the business processes of special procurement types in this chapter, we suggest that you engage a Materials Management (MM) resource/consultant to have end-to-end comprehension of the processes involved.

Figure 13.1 shows the MRP 2 view of material P-100 and plant 3000. Assign the special procurement type key in the SPECIAL PROCUREMENT field by placing your cursor on the field and pressing F4 or clicking on the dropdown menu. This leads to the popup that contains the list of several standard procurement types delivered by SAP ERP system in its standard offering, as well as additional special procurement types created to fulfill the specific business needs.

Note

You define the special procurement key using the configuration (Transaction SPRO) path PRODUCTION • MATERIAL REQUIREMENTS PLANNING • MASTER DATA • DEFINE SPECIAL PROCUREMENT TYPE (see Figure 13.2).

Tips & Tricks

In a nonproduction SAP ERP system, whenever you assign a special procurement type key in the MRP 2 view of the material master or to a component in the BOM and then perform the necessary business transaction such as creating a production order or purchase requisition, you can always run material requirements planning (MRP) on that

material/component (Transaction MD02) to test how the system reflects the planning results of that specific special procurement type key. The same testing logic applies when you create a new special procurement key to cater to a business requirement.

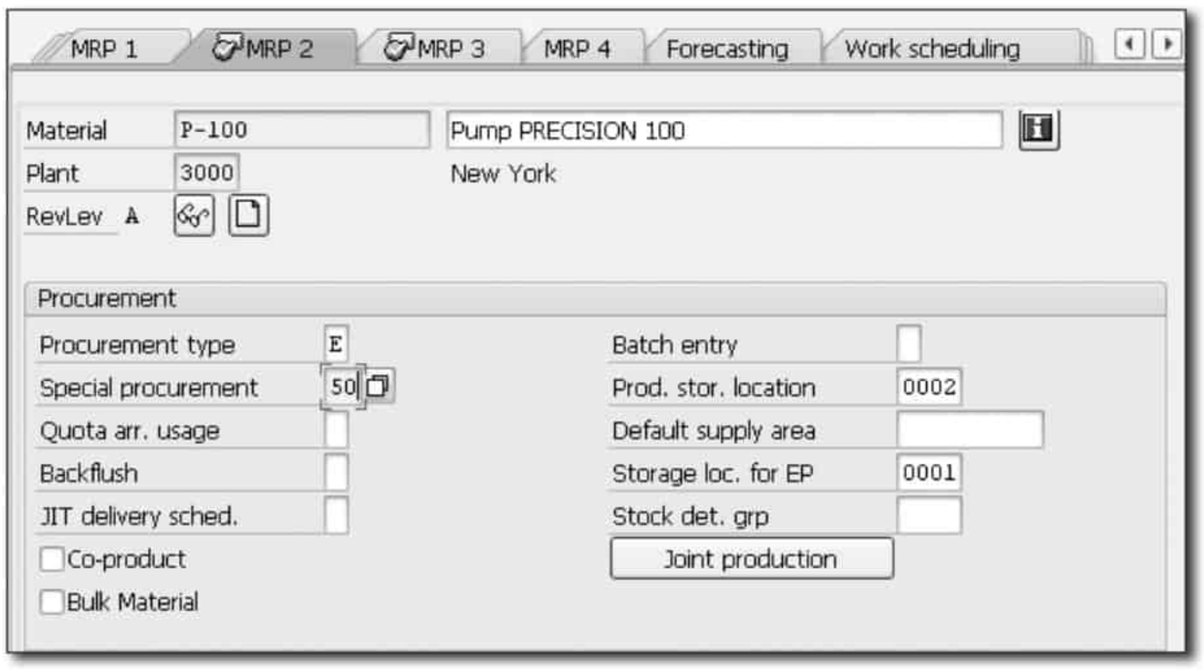
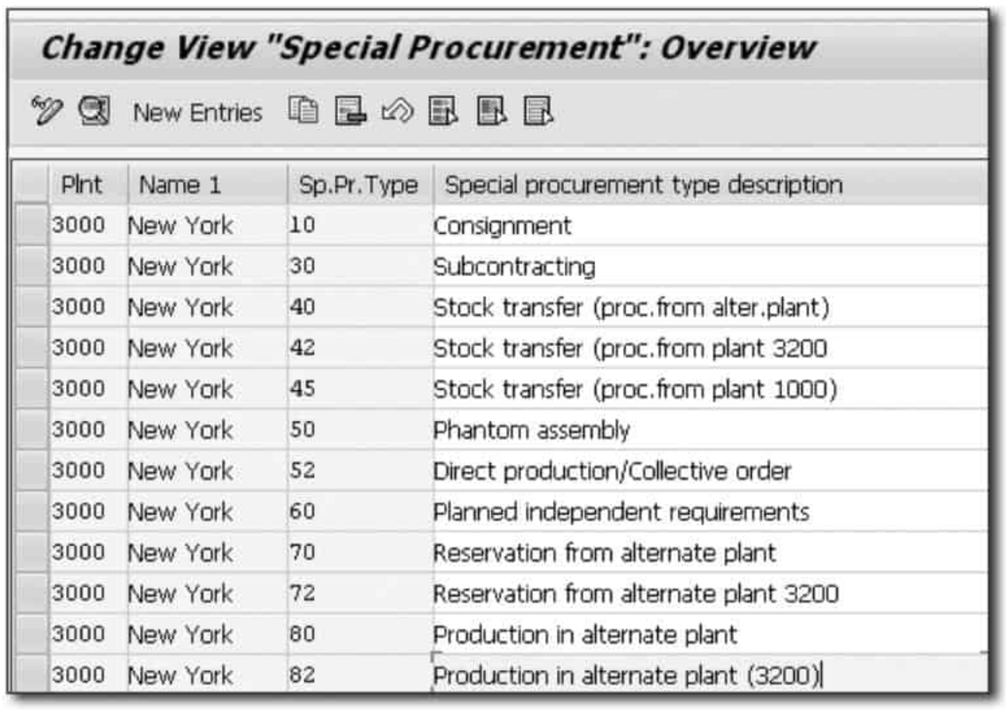


Figure 13.1 Special Procurement Type Field in the Material Master



Plnt	Name 1	Sp.Pr.Type	Special procurement type description
3000	New York	10	Consignment
3000	New York	30	Subcontracting
3000	New York	40	Stock transfer (proc.from alter.plant)
3000	New York	42	Stock transfer (proc.from plant 3200
3000	New York	45	Stock transfer (proc.from plant 1000)
3000	New York	50	Phantom assembly
3000	New York	52	Direct production/Collective order
3000	New York	60	Planned independent requirements
3000	New York	70	Reservation from alternate plant
3000	New York	72	Reservation from alternate plant 3200
3000	New York	80	Production in alternate plant
3000	New York	82	Production in alternate plant (3200)

Figure 13.2 Configuration of the Special Procurement Type Key for Plant 3000

You should now have a general understanding of the special procurement type processes. In the actual business processes of the company, preference should be given to making better and effective use of MRP results, so that the predecessor-successor relationship of the entire chain of events is available. Now let's consider each of the special procurement types in detail.

13.2 Phantom Assembly

The special procurement type key for phantom assembly is 50. A *phantom assembly* is the logical grouping of one or many different components, which forms an integral part of a final or superior product's offering. Examples of phantom assembly are the accompanying speakers, connecting wires, and so on when you buy a stereo system that you can install as and when needed. All of the components of phantom assembly are mandatorily required for the production process. Due to similarity to the production processes, it makes sense to group the components for availability. Hence, these logical grouping are purely organizational in nature to better manage the production processes. Also, note that the components in phantom assembly are never combined with each other, but are made available at the same time for an efficient production.

You don't have to maintain routing for phantom assembly because it's not produced, but you have to define the BOM, which is then eventually entered as a component in the material's BOM. Phantom assembly doesn't have stock of its own but that of components which make up the phantom assembly. Also, because no routing is available for phantom assembly, you can't record the machine or the labor duration to reflect the same in cost accounting (Controlling–Product Costing). The superior product's routing should account for the machine or labor hours involved in phantom assembly.

Figure 13.3 shows the configuration screen for phantom assembly for plant 3000 and special procurement key (SP.PR. TYPE) 50. The PHANTOM ITEM checkbox is also selected here.

With the special procurement type key 50 assigned to the material master, Figure 13.4 shows the COMPONENT OVERVIEW screen of the production order for material 1300-120, which contains the phantom assembly 1300-100. Phantom assembly 1300-100 has a grayed out line item and PHANTOM ITEM is checked. The phantom assembly explodes and individual components are listed directly below it. Any changes made to the quantity of phantom assembly 1300-100 automatically enable the system to calculate the components' quantities accordingly (as defined in the BOM of the phantom assembly).

Figure 13.3 Special Procurement Type Key 50 for Phantom Assembly

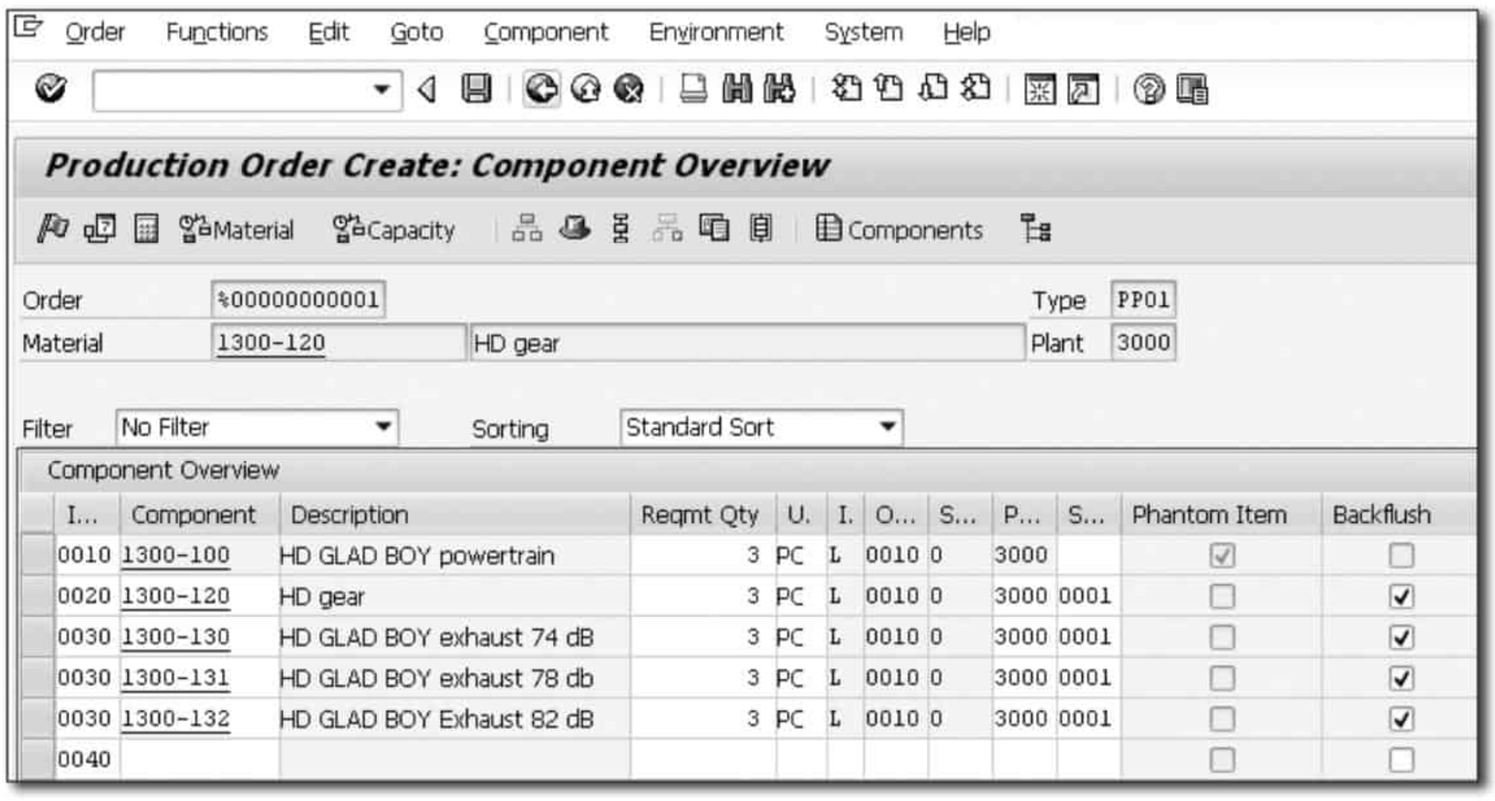


Figure 13.4 Phantom Assembly of Component 1300-100

13.3 Direct Production

The special procurement type key for direct production is 52. *Direct production* means that there is no stock posting among the various stages of the production processes. An example of direct production is that during the textile make-up of

a garment, the production process starts with the spinning of raw cotton into weft material, which in turn is converted into weaving product (after going through several intermediate production steps), and finally into a grading material for onward production into a garment product for the customer. Instead of repeatedly performing goods issuance and goods receipt at each step of the production process, direct production serves the desired purpose of eliminating these steps.

Note

Direct production is alternatively referred to as *collective order*, in which the parent–child or superior–subordinate relationship of various orders in the production processes exists. The network of orders in the collective order, across different production levels, such as finished product, assembly, or component, is established that supports synchronized actions in the network of orders.

Some of the other functions available in direct production are listed here:

- Quantity changes in the leading order applied to the entire collective order
- Collective scheduling (optional)
- Collective opening of the production orders
- No goods postings required between production orders

You can't create or use collective orders if one of its components has the following, however:

- Co-product
- By-product
- Discontinued material
- Inter-material

Note

Refer to Chapter 17 on handling co-products and by-products for more information.

The highest material of the direct production doesn't contain the special procurement type key 52, whereas all of the subordinate materials do (the components defined in the material BOM of the finished/highest material). All subordinate materials of the collective order have their independent BOMs and routings.

With a collective order, you get to see an integrated view of the entire production process. Each order within the collective order offers its own comprehensive visibility, including the assignment of a separate order number. Further, it saves time and effort because you don't have to remove and place produced components during various production processes. The confirmation process at each individual order level is enough to move the produced component to the next (higher) order level. Finally, if you make changes to the collective order; for example, in quantity, the system automatically makes the necessary quantity adjustments in all of the subordinate orders. In a collective order, you just have to perform goods receipt of the topmost order and not for all of the subordinate orders.

Tips & Tricks

To view a collective order, use Transaction CO02 and choose COLLECTIVE ORDER.

Figure 13.5 shows the configuration screen for direct production/collective order for plant 3000 with a SP.PR. TYPE of 52. The DIRECT PRODUCTION checkbox has also been selected here.

Figure 13.5 Special Procurement Type Key 52 for Direct Production

Note

You also need to ensure that in Transaction OPJH, the COLL. (COLLECTIVE) ORDER WITH GOODS MOVEMENT checkbox is checked on for the relevant order type.

With special procurement type key 52 assigned to the material masters undergoing direct production, Figure 13.6 shows the header screen of the production order for material 400-100. Notice the DATES IN COLLECTIVE ORDER area in the GENERAL tab to denote that it's a collective order (direct production). Choosing the COMPONENT OVERVIEW icon opens the PRODUCTION ORDER CREATE: COMPONENT OVERVIEW screen shown in Figure 13.7.

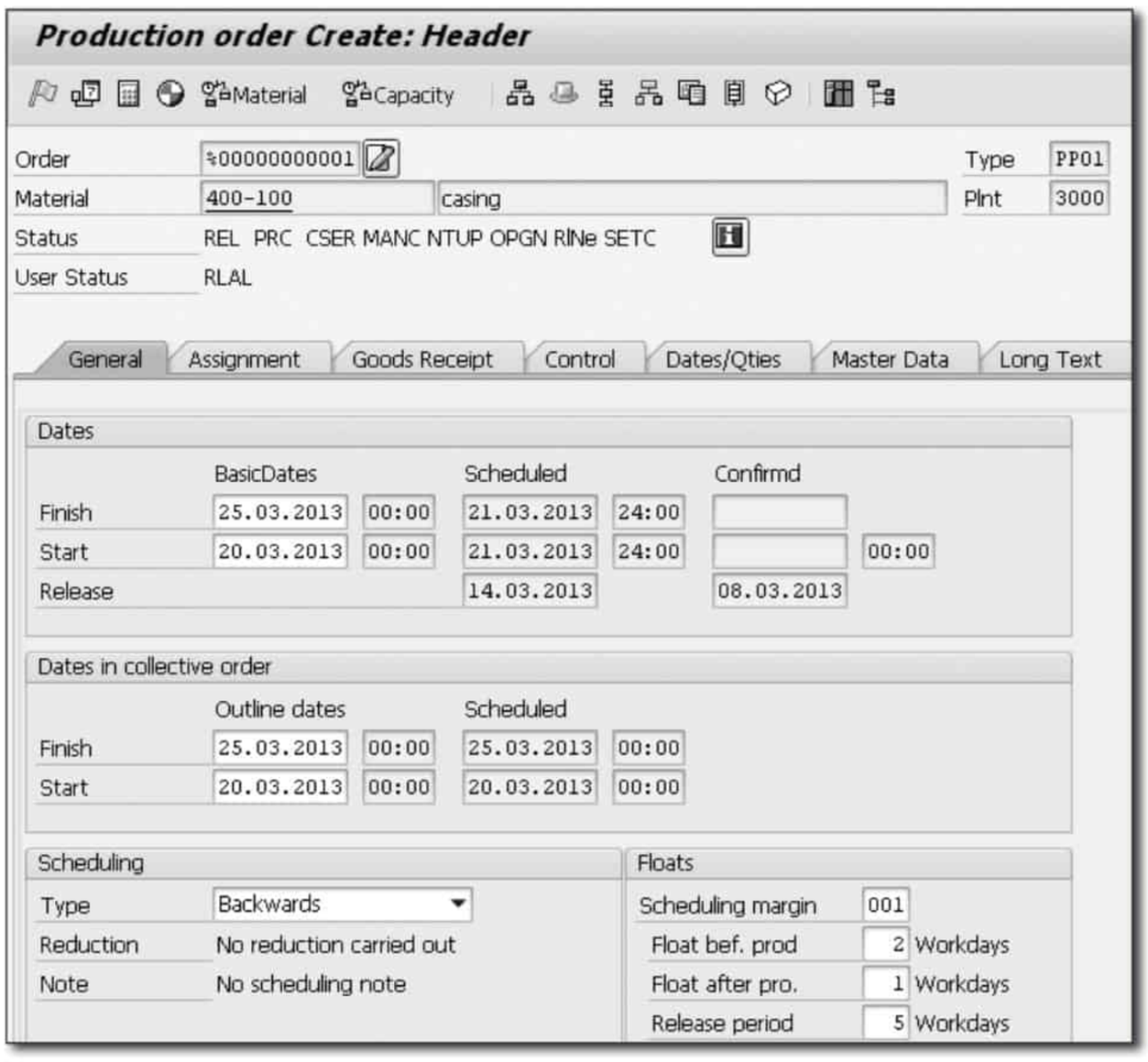


Figure 13.6 Collective Order Dates (Scheduling) in a Production Order

The last two components shown in Figure 13.7, 400-140 and 400-150, are grayed out, and the DIRECT PROCUREMENT column reflects 2, denoting direct production.

Save the production order and it will generate a production order number. In the change mode of the production order (Transaction CO02), shown in Figure 13.8, the system shows the collective order for the main material 400-100 as 60003529, whereas individual production orders were created for each of the direct production materials, production order 60003527 for material 400-140, and production order 60003528 for material 400-150, respectively.

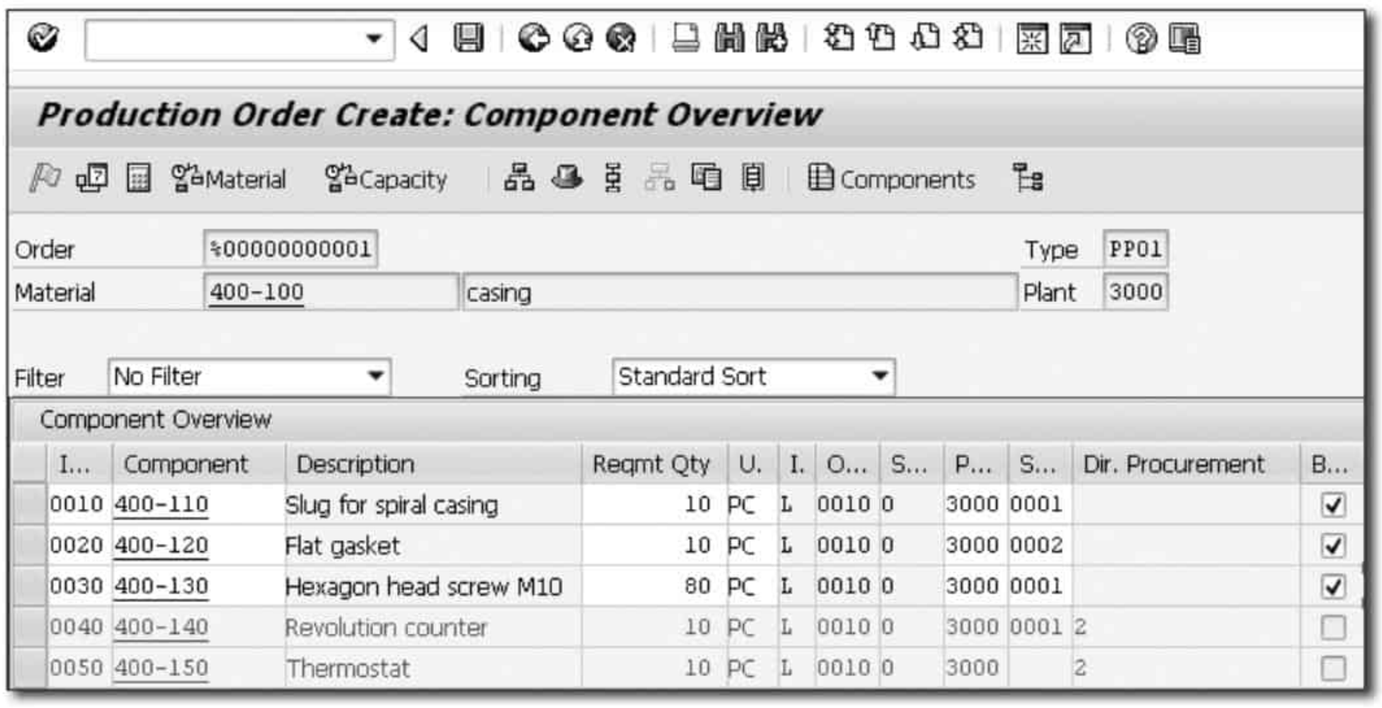


Figure 13.7 Components of Direct Production

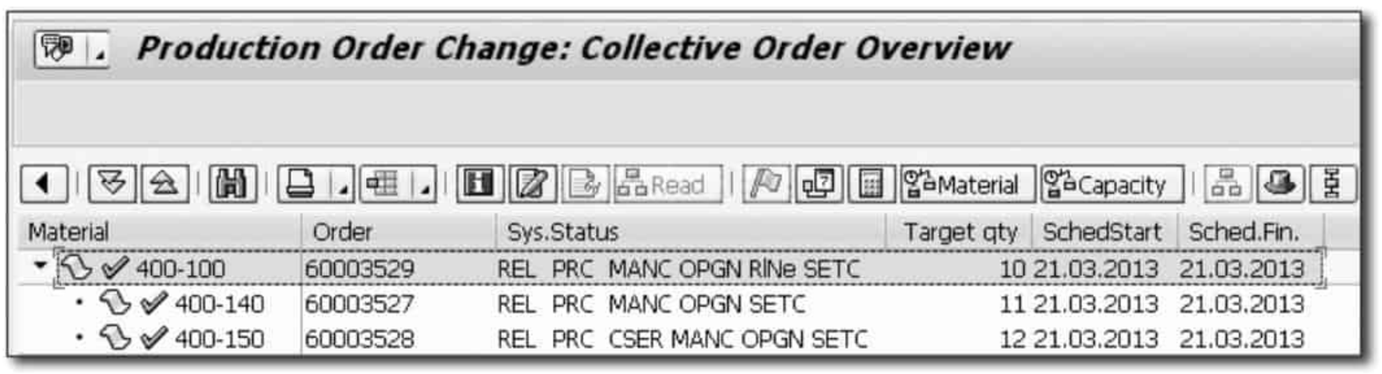


Figure 13.8 Direct Production of Components 400-140 and 400-150

Alternatively, if a component is generally not a part of a collective order, you have the option to assign the special procurement key for direct production directly in the BOM item and not in the material master. For example, in one production process the component is part of the collective order, whereas in another production process it's not. If you assign the special procurement type key 52 in the material master of the component, the system will make it a part of all of the collective orders in which this component is used. However, if you assign the special procurement type key to the component's detailed view of the material BOM (and not in the material master), the system will only consider it for collective order/direct production where it finds the assigned key. This way, you can maintain better control of the material, which is only specific to certain production processes by virtue of its collective order status.

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