SAP PRESS

Production Planning with SAP S/4HANA®

- Implement production planning for discrete, process, and repetitive manufacturing with SAP S/4HANA
- Configure and run MRP, batch management, capacity planning, and more
- Analyze your data with standard analytics and SAP Fiori apps

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Production Planning with SAP S/4HANA®

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Preface

Logistics and supply chain management today are far more volatile, uncertain, complex, and ambiguous due to globalized sourcing, which causes longer lead times. Manufacturing complexities, including outsourced and subcontracted manufacturing, incessant and endless introduction of new products and features, and customers' shorter tolerance time to wait for the required products are causing companies to constantly try to stay a step ahead or risk being overtaken by their competition. But whatever happens in the real world in general and in a company in particular should also be correspondingly mapped in SAP S/4HANA so that the business processes of a company can run smoothly. This book, *Production Planning with SAP S/4HANA,* covers not only the standard manufacturing processes but also some of the newer and more innovative production planning and control tools as well as reporting features and functionalities introduced in SAP S/4HANA.

In this book, a four-step approach is adopted to ensure that a logical, step-by-step, sequential set of activities are performed in the SAP S/4HANA system that correspond to meeting the actual business needs of a company:

1. *Configuration* is a backend SAP system activity and must occur only once during an SAP implementation project.
2. *Master data* is a frontend input activity that also often happens only once or only occasionally. Master data remains largely unchanged for a much longer period of time and is used in routine business transactions.
3. *Transactions,* or business processes, such as creating a production order, goods issue (GI), or goods receipt (GR), are again input activities and take place as frequently as needed.
4. Finally, the *reporting and analysis*, for example, to determine the number of open production orders or production wastages, are *outputs* of all these previous input activities.

As an SAP consultant, you must always stay focused on the *output* (reporting) during the SAP implementation project. Doing so means you'll need to ensure the necessary data *inputs* are in place in the system to be able to produce the necessary outputs. (Remember, when data is incorrect or missing, data outputs will be incorrect or incomplete!)

Goals of This Book

The first goal of this book is to provide you with the step-by-step approach to configure and implement three different production types in production planning (PP): discrete manufacturing, process manufacturing, and repetitive manufacturing (REM).

The book lays the initial foundation in the form of configuration and then explains 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 PP 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 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 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 using SAP S/4HANA 1809 are used extensively and are duly supported by in-depth coverage of concepts and terminologies. The menu paths or transaction codes are given to perform each step. Where possible, a deliberate attempt is made to use SAP's 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 prerequisites 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 to continue the process of self-learning and eventually become an expert in PP.

In this book, we also cover several cross-component functionalities that enable you to leverage their strengths not only in PP but also in other logistics components that are implemented in your company. For example, you can use the classification system, Early Warning System (EWS), flexible planning standard analysis, information systems, reporting, and SAP Fiori apps in many other logistics components.

Target Audience

This book is intended for all readers who use PP in the SAP system, such as the team leader, project team members in an SAP system implementation, integration managers, production planners, or production controllers working in operational positions

in the company. Because this book covers three different production types—discrete manufacturing, process manufacturing, and REM—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 system to support the expansion. Finally, this book can be an invaluable reference to SAP 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.

Structure and Content

This book takes a deep-dive approach to deliver in-depth and comprehensive coverage of discrete manufacturing, process manufacturing, and REM in SAP. It begins by covering the enterprise structure that you need to set up in PP, which also reflects the interdependencies of the enterprise structures of other areas. 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 to show the impact of the configuration on the business processes. You must understand a business process in a comprehensive way before modeling and configuring it in the SAP system.

The book then transitions to cover the PP workflow tools available. You'll also learn how to optimize your production processes by using 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 of PP with some of the other SAP functionalities.

In summary, the following structure is used:

In Part I, which starts with **Chapter 1**, we'll discuss the various manufacturing types and their unique characteristics. We'll also explain how to decide which manufacturing type is suitable for a particular manufacturing process. In addition, we'll provide an overview of the five applications of SAP Integrated Business Planning (SAP IBP), which is the next-generation, SAP HANA-powered, cloud-based materials planning tool.

In **Chapter 2,** we'll discuss the enterprise structure that you'll need to set up in PP, which at the same time also depends on the enterprise structures of other areas, such as financials (FI), materials management (MM), or sales and distribution (SD). The enterprise structure forms the backbone of the SAP system to which all the important business processes of the

company are mapped. Eventually, reporting is often based on important elements from the enterprise structure.

In Part II, 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 only, whereas the actual and practical use of configuration is covered with the business processes in later chapters. **Chapter 3** covers the discrete manufacturing configuration, **Chapter 4** attends to the process manufacturing configuration, and **Chapter 5** covers the configuration details for REM.

In Part III, the book then transition to the PP workflow by each production type and makes logical connections to the business processes of each production type for which the configuration was undertaken in the relevant chapters earlier. **Chapter 6** provides an in-depth coverage of the PP business processes in discrete manufacturing. **Chapter 7** brings out the similarities and differences between discrete and process manufacturing, but it remains primarily focused on the process industry– specific functionality known as process management. Process management then matures into a user-friendly functionality known as Execution Steps (XSteps). XSteps can also be used in discrete manufacturing. 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 REM, in which, once again, we make consistent and logical links to the configuration chapter.

Note

As is always standard in testing, checking, and validating the configuration, the agreed-upon objects are first configured during SAP implementation projects. These configured objects are then assigned to the master data. The master data is then used in business processes or transactions. Finally, the configured objects are often used as selection criteria in various SAP standard reports. In other words, the relationship among these elements follows Configuration → Master Data → Transactions → Reports.

This book follows the same approach to show the logical, predecessor-successor relationships of the preceding four elements.

Next, in Part IV, are the PP workflow tools that start with batch management in **Chapter 9** and is extensively used in process manufacturing. **Chapter 10**focuses on sales and operations planning (S&OP), 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 11** is on demand management, in which we cover several planning strategies and production methods. The foundations of material requirements planning (MRP) are covered in **Chapter 12**, in which we discuss the planning calendar and also MRP areas. In **Chapter 13**, several next-generation MRP tools, such as MRP Live and demand-driven replenishment are covered. **Chapter 14** is on long-term planning (LTP) to simulate what-if planning scenarios. **Chapter 15** details how to manage the capacity requirements planning (CRP) in SAP S/4HANA systems, including its evaluation and leveling. **Chapter 16** covers the configuration, master data, business processes, and reporting in embedded production planning and detailed scheduling (PP-DS) in SAP S/4HANA.

Finally, in Part V, monitoring and evaluating in PP is discussed. **Chapter 17** shows how to quickly set up user-defined alerts in the SAP system with the Early Warning System (EWS) to closely monitor important deviations to your business processes and make quick decisions and actions. EWS can also be used in other logistics functions, if needed. In **Chapter 18**, 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. The concepts you'll develop here will enable you to expand your knowledge horizon to explore standard reports available in other logistics areas. In **Chapter 19**, several standard analyses for PP are discussed. Finally, **Chapter 20** covers SAP Fiori apps for PP.

While this book is certainly a significant expansion to the areas and functionalities that PP offers, note that we don't cover the following in detail:

Variant configuration

Distribution resource planning

Kanban

Note

Kanban is now covered in the E-Bite titled *Configuring Kanban in SAP ERP MM and PP* (SAP PRESS, 2015), which is available at *www.sap-press.com/4013*.

Throughout the book, we've also provided several elements that will help you access useful information:

Tips

Boxes with this symbol provide you with recommendations as to how you can simplify your work.

Notes

Boxes marked with this symbol contain additional information or important contents that you should keep in mind.

Examples

Boxes marked with this symbol provide practical scenarios and explain, in detail, how particular functions can be applied.

Warnings

Boxes with this symbol contain details worth considering. Moreover, it warns you of common errors or problems that might occur.

PART I Core Production Planning Concepts

Chapter 1

Introduction to Production Planning with SAP S/4HANA

While it's true that today's logistics and supply chain management is far more volatile, uncertain, complex, and ambiguous due to globalized supply chain and shorter product lifecycle, production planning in SAP S/4HANA offers several planning tools to help reduce volatility, uncertainty, complexity, and ambiguity.

A company that is in the business of manufacturing a product and selling it to customers goes through the rigor of production planning and then production execution. Production planning with SAP S/4HANA (referred to as PP throughout the book) plays a critical role in the logistics and supply chain functions of the company to accomplish just this. PP enables the company to benefit from historical data to prepare a forecast that can then be used in sales, operations, materials, 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, PP 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.

In this chapter, we'll provide an overview of the three manufacturing types: discrete, process, and repetitive. This will then be followed by an overview of some of the important production planning tools available in SAP S/4HANA. We'll also highlight the importance of production planning in the product costing business process. Finally, we'll provide a table that compares the different production types, and give you a brief overview of another planning tool offered by SAP: SAP Integrated Business Planning (SAP IBP).

1.1 Production Planning and Control

Production planning is the core of any manufacturing process. SAP helps you set up and streamline your specific process to maximize efficiency in the workplace when working with different types of manufacturing. In the following sections, we'll introduce PP, cover the features and characteristics of various production types, and discuss important business processes.

1.1.1 Production Planning Overview

You'll find that the SAP S/4HANA system is made up of several different functionalities in addition to PP, and they all work together to cover end-to-end business processes, such as procure-to-pay, plan-to-produce, order-to-cash, and hire-to retire, and do by ensuring seamless flows of material and information through the integration processes.

In general, the entire process of production planning and control starts when the company forecasts the demand of a product and prepares a sales plan. The sales plan is synchronized with a production plan to take the project realities into account, such as capacity or warehouse constraints. Various simulated models are considered, and a finalized production plan becomes the basis of material requirements planning (MRP). MRP helps the production and the procurement planners know when to procure and produce a material for its eventual availability and dispatch to the customer. The production execution accounts for and records each production detail, including scrap, co-products, or by-products generated during the production processes. Quality checks in the production processes ensure minimal customer returns or other in-process or line rejections. The produced product is sold to a customer, and the production plan continues to be a monitoring barometer against the sales plan.

Of course, this information is great for providing a bird's-eye view of the production planning process. We'll help you understand how the individual objects you have to work with in the SAP system help streamline and manage your business processes in the following sections.

PP includes the following production types and production planning tools:

Master data

This includes the material master, work centers, resources, production lines, routings, master recipe, rate routing, bill of materials (BOM), and production version.

Sales and operations planning (S&OP)

Standard S&OP as well as flexible planning tools are available to forecast sales and production plans to meet customers' requirements for products.

Production planning

This includes material forecasting, demand management, long-term planning (LTP), and master production scheduling (MPS). **Material requirements planning (MRP)**

This attends to standard and unique customers' requirements via various planning and production methods. **Demand-driven replenishment (DDR)**

This reduces the bullwhip effect so commonly found in the supply chain by timely adjustments of the supply plan due to a change in demand. **Production planning and detailed scheduling (PP-DS)**

This introduces the advanced capacity planning and heuristics for materials planning.

Discrete manufacturingor shop floor control (SFC)

Production orders processing, goods issues (GIs) and goods receipts (GRs), and confirmations are used for complex manufacturing processes in which there may be a need for intermediate or interim storage.

Process manufacturingor production planning for process industries (PP-PI)

Process orders processing, process management, material quantity calculation, GI/GR, and confirmations are used for production processes of liquid-based or flow-based materials.

Repetitive manufacturing (REM)

This adopts the lean manufacturing principle in which generally the production process is not only simple but also consistent over a considerable period of time. **Capacity requirements planning (CRP)**

This consists of capacity evaluation and capacity leveling. Capacity evaluation reflects the load and overload at work centers/resources, whereas capacity leveling helps the planner optimize the production processes.

Product cost controlling (CO-PC)

This completely integrates with PP and is responsible for ensuring all productionrelated costs are accounted for, including overheads, variances, and work in process (WIP).

Kanban

It replenishes stocks based on a pull system by using Kanban cards. Kanban works well for both in-house produced materials and outside procured materials.

Distribution resource planning (DRP)

This enables planning the demand of products at distribution centers.

Reporting

A large number of information systems and standard and flexible analysis reporting options are available in PP.

1.1.2 Characteristics of Production Types

A *production type* characterizes the frequency, complexity, or stability with which a product is produced in the production process. When implementing an SAP system, one of the first decisions a company makes is which production type to implement to reflect the complexity (or simplicity) of the production process. For example, if the production process is relatively simple with a linear production line involving one operation and one work center, then it makes sense to implement the REM production type to enable the company to benefit from lean manufacturing. Similarly, the process manufacturing production type is more suited to scenarios in which the product is generally in liquid form and flows or where the manufacturing process is generally continuous. The discrete manufacturing production type is used where the production process is order based, involves special procurement types, or when products are stored in interim storage locations between the production processes.

We discuss each of the three main production types in the following sections. While this book will primarily cover discrete, process, and repetitive production types, these sections also briefly covers engineer-to-order (ETO) and Kanban to provide a comprehensive look at production types.

Discrete Manufacturing

The *discrete manufacturing* production type, which is also known as shop floor control (SFC), describes the production of a product on the basis of production orders. Discrete manufacturing is implemented where the products change frequently, the demand pattern is irregular, and production is workshop oriented in character. A range of master data is required for discrete manufacturing; the most important are the material, BOM, work center, routing, and production version.

Example

In steel rerolling mills, the entire production process passes through five different production steps. However, customers can place orders based on a different level of the processed good. Hence, the company has to produce and also store a semifinished good at each production step to meet its customer's demand.

The production process in discrete manufacturing starts when a production order is created and processed. A production order can either be created manually or by converting a planned order that the system generated after an MRP run. A production order is a request to the production department to produce the product at a specific time and in a specific quantity. It specifies the work centers and material components that are required for production. The creation of a production order automatically creates reservations for the required material components. Purchase requisitions are created for externally procured material components and services, and capacity requirements are created for the work centers at which each operation of the order will be executed. The discrete manufacturing process is shown in Figure 1.1.

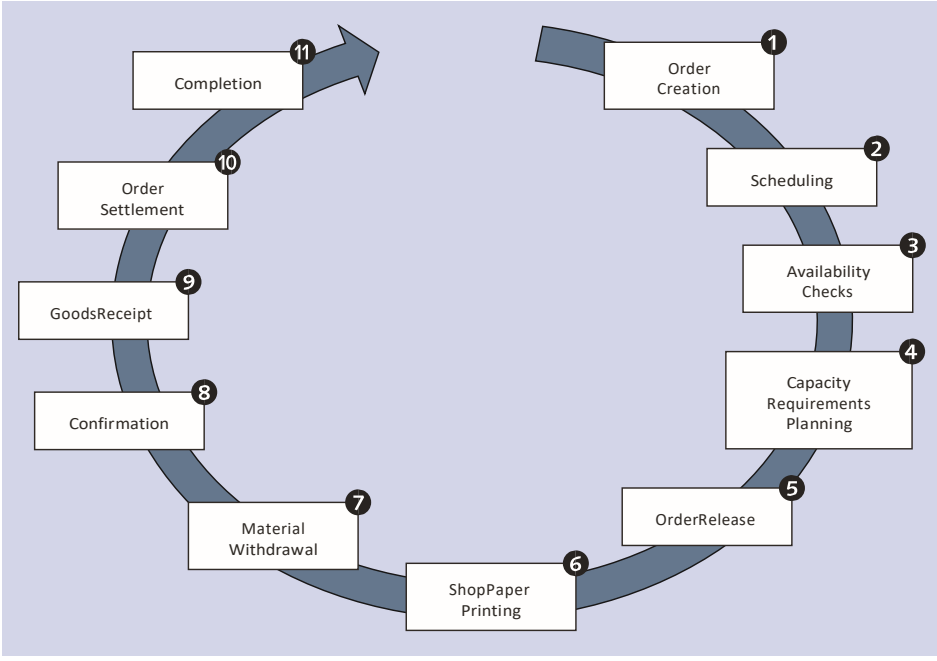


Figure 1.1 Discrete Manufacturing Process Flow

Production orders are released on the release date as long as the required materials and capacity are available. The production order-related documents (known as shop floor

papers) are printed to prepare for production execution. The capacity situation is evaluated, and any required capacity leveling is carried out in any phase of production order processing, although this is usually ensured before the actual production starts.

The components required to produce the products are issued with reference to the production order, the product is produced on the basis of the production order, and the finished quantity is confirmed with reference to the production order. The product is put into a storage location, and the GR is posted. Finally, the settlement of the production order is ensured.

Note

Chapter 3 covers discrete manufacturing configuration, and Chapter 6 details the business processes of discrete manufacturing.

Process Manufacturing

Process manufacturing is the batch-oriented and recipe-oriented production of main products or co-products in the process industry. Manufacturing can be in the form of continuous production, discontinuous production, or regulated production. In *continuous production*, the product is continuously produced, raw material is continuously supplied to the production line, and the plant and machinery are in continuous operation. An example of this is fertilizer manufacturing, where the production process is continuous, starting with production of ammonia from natural gas (methane) and continuing until the final urea/fertilizer is produced. The process may find an interim storage in the form of bulk urea being stored in the warehouse before the bagging process starts. Other examples are tablet, soft gel capsules, syrups, capsules, and injection vials produced in the pharmaceutical industry.

In *discontinuous production*, the products aren't produced in a continuous process. Instead, the material components are provided and weighed out as required for each step of the production process. Its greater application is found in industries such as food processing.

Regulated production is used if the product quality requirements are very stringent, and specific industry standards must be met. This type of production is generally followed in pharmaceutical or cosmetics manufacturing. In regulated production, orders can be created only with approved recipes. If changes need to be made to master recipes, these are subject to master data change administration procedures. The central master data elements in

process manufacturing are the material, the BOM, the resource, the master recipe, and the production version.

The business process in process manufacturing starts when a *process order* is created and processed in accordance with a master recipe. A process order is a request to the production department to produce a product at a specific time and in a specific quantity, and it specifies the resource and material components required for production.

A process order can be created either manually or when a planned order that was created in the PP process is converted. The creation of a process order automatically creates reservations for the required material components. The system automatically creates purchase requisitions for externally procured material components and services, and capacity requirements are created for the resources at which the order will be executed. Process orders are released on the release date, provided the required materials and capacity are available. At the time of release, you can run an automatic batch-determination process for components that are subject to a batch management requirement. The relevant documents in the process order can be printed to prepare for the execution of the process order. The process manufacturing flow is shown in Figure 1.2.

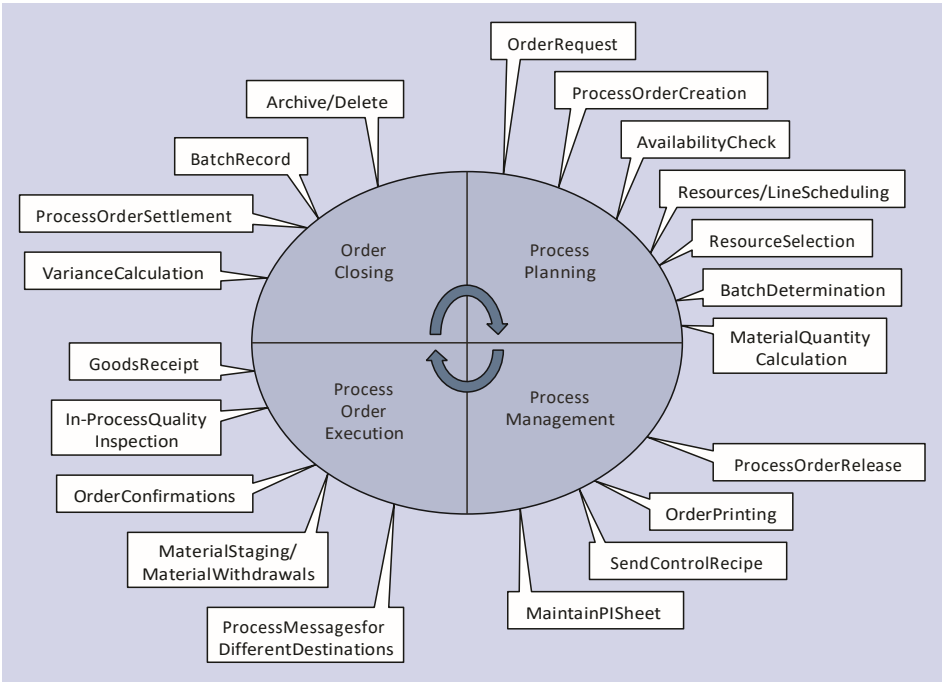


Figure 1.2 Process Manufacturing Process Flow

The capacity situation is evaluated, and any required capacity leveling can be carried out in any phase of the process order processing, although this is usually ensured before the actual production commences.

Note

Chapter 15 covers how to use capacity requirement planning (CRP) for evaluation and leveling.

The actual production can now begin, with or without the use of process management. If you implement process management to execute a process order, this serves as the interface between the SAP system and process control. The flexible structure of this interface makes it possible to connect automated, semiautomated, and manually controlled plants and equipment to the production process. Process management extensively uses the classification system, which works throughout the SAP S/4HANA functional areas.

Note

Chapter 4 and Chapter 7 cover the configuration and business processes of process manufacturing, respectively.

Repetitive Manufacturing

Repetitive manufacturing (REM) is the interval-based and quantity-based creation and processing of production plans. With REM, a certain quantity of a stable product is produced over a certain period of time. The product moves through a work center, which may be a group of machines, in a continual flow, and intermediate products aren't put into intermediate storage (e.g., motherboard assembly in computer manufacturing).

The data entry efforts involved in production control with REM are significantly reduced when compared with single-lot and order-based production control. REM can be used for the make-to-stock (MTS) production method. In this case, production has no direct connection to a sales order. The requirements are created in the demand management process, and the sales orders are supplied from stocks. Production based on sales orders (i.e., the make-to-order [MTO] production method) is also possible in REM. In this case,

production is directly related to a sales order or can even be directly triggered from a sales order. The most important master data elements in REM are material, BOM, production line, rate routing, and production version. The REM process flow is shown in Figure 1.3.

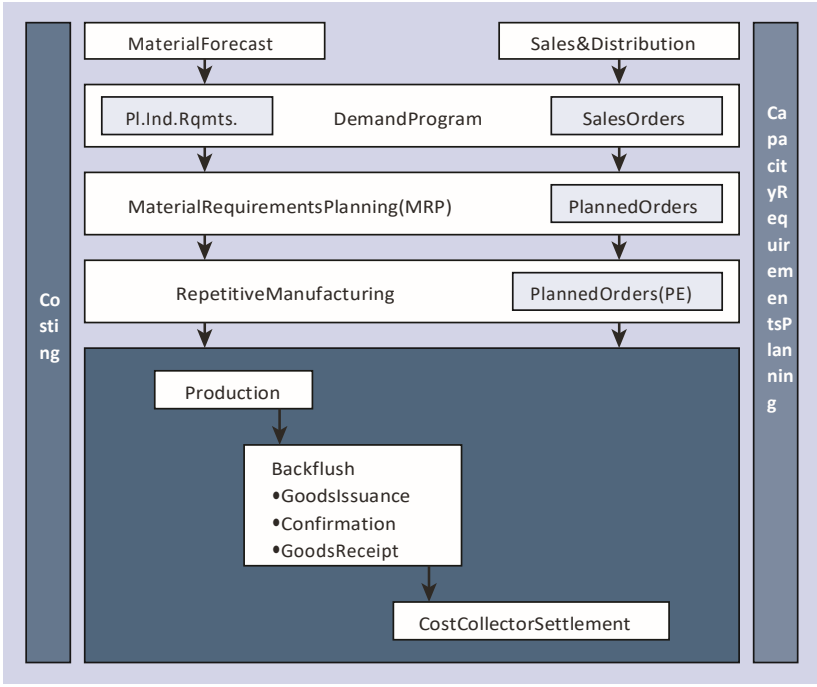


Figure 1.3 REM Process Flow

Note

Chapter 5 covers the configuration details of REM, and Chapter 8 details the business processes.

Engineer-to-Order

The *engineer-to-order* (ETO) production type attends to the complexities and challenges when a sales order-based MTO production method is unable to fulfill the requirements. In the MTO production method, the system is unable to make a distinction between the predecessor-successor relationships in the production process; for example, a material's production can't initiate (successor) until the production of the previous product (predecessor) is ensured. In ETO, the system uses work breakdown structure (WBS) and

networks for scheduling and coordinating the production processes and also managing cost accounting. All produced goods are specific to the project, and the system maintains project-based inventory.

Kanban

With *Kanban*, a material is produced or procured only when it's actually required. A specific quantity of the components required to produce a material are stored on-site and in containers. When a container is empty, this component is replenished according to a predefined replenishment strategy (in-house production, external procurement, or stock transfer). In the interval between the request for replenishment and the delivery of the refilled container, the other available containers simply do the work of the empty one.

The replenishment process is largely automatic in the Kanban procedure, thereby greatly reducing the amount of manual posting work required. The material isn't pushed through the production process as specified by an overall plan; rather, it's requested by one production level (consumer) from the previous production level (source) as and when needed. It adopts the "pull" strategy in the production process.

In Kanban processing, *production supply areas* (PSAs) divide the plant. The components required for production are stored in these PSAs, and various work centers take what they need from them. A Kanban control cycle is defined to specify how a material should be obtained within a PSA. The control cycle defines a replenishment strategy for the material that specifies, for example, whether the required material is to be produced in-house or procured externally. The control cycle also specifies the number of containers in circulation between the consumer and source, as well as the quantity per container.

Replenishment strategies specify how a material component should be replenished and which of the following replenishment elements should be created for this purpose:

In-house production

Manual Kanban

Replenishment with run schedule quantity

Replenishment with production order

Replenishment by purchase order

Replenishment with schedule agreement

Replenishment with reservation

Replenishment with direct transfer posting

Replenishment with summarized just-in-time (JIT) call

Stock transfer

Replenishment by transport requirements of a warehouse management-administered storage location

The replenishment process with Kanban entails that a material is produced at a machine. The components required to produce it are available on-site in containers and are ready for withdrawal. If one of these containers is empty, the source that is responsible for its replenishment has to be informed. If Kanban processing without SAP system support is being used, the consumer sends a card to the work center (source). The card contains the information about which material is required, in what quantity, and where it should be delivered to.

Note

The replenishment process gets its name from the Japanese word for these cards (*Kanban*).

The source can now produce or procure the material and then refill the container. If Kanban processing with SAP support is in place, the containers are managed in the system and have a specific status. After the last component is withdrawn from a container, the status of that container is simply changed from **Full** to **Empty**. This status change is the Kanban signal, and it can be set by passing a barcode reader over the card attached to the container. It's also possible to have the system display the containers in a production area in the form of a Kanban table and to make the status change there. The Kanban signal now triggers the replenishment process and creates, for example, a run schedule quantity in accordance with the replenishment strategy. The source then processes the run schedule quantity, and the finished material is sent to the container. The status of the container is set to **Full** again (through barcode or Kanban table), and the GR for the material is posted with reference to the procurement element.

1.1.3 Processes in Production Planning and Control

We discuss the main processes in PP in the following sections.

Sales and Operations Planning

The S&OP process is used to determine the quantities for production. Sales planning, which is also known as demand planning, covers future requirements without considering stocks and available capacities. The historical sales figures serve as a basis for sales planning. Operations planning uses the results of the sales planning process to plan the production quantities and takes initial stocks and capacities into account.

Note

Chapter 10 covers S&OP.

Demand management aligns sales planning with the customer requirements in accordance with the planning strategy and thus calculates the independent requirements for production.

The planning methods that demand management looks for are MTS, MTO, planning with final assembly, and several others.

Note

Chapter 11 covers demand management.

Material Requirements Planning

MRP is one of the most important functions of PP. The system performs net quantity calculations for component requirements while taking scrap and lot sizes into account. MRP

calculates requirement coverage elements for all MRP levels, such as plant, material, product group, and MRP areas, and it takes into account the lead times, lot sizes, and scrap quantities. MRP also enables capacity planning.

Note

Chapter 12 and Chapter 13 cover MRP.

Long-term planning (LTP) is a simulation tool for MRP that examines how a change in planned independent requirements (PIRs) will affect capacity utilization, stocks, and external procurement. LTP is also suitable for short-term simulations.

Note

Chapter 14 covers LTP.

Capacity Requirements Planning

For detailed production planning while taking available capacities into account, CRP schedules the worklist in detail, which usually consists of the processes for created or released production orders. CRP delivers a production sequence that is feasible from the capacity viewpoint. CRP consists of capacity evaluation and capacity leveling.

Note

Chapter 15 covers CRP.

Production Control

The central controlling and recording element—the production process—is the production order in discrete manufacturing, the process order in process manufacturing, and the run schedule quantity in REM. While the previous processes dealt with production planning, production execution is concerned with how the actual production as specified in the production order is recorded and controlled, from material withdrawal to order confirmation to storage and invoicing.

1.1.4 Product Cost Controlling

The product cost controlling (CO-PC) functionality is a subset of controlling (CO) and comprehensively integrates with PP. In fact, PP is unable to function completely until CO-PC is in place. CO-PC helps to ensure that the total cost of goods manufactured (COGM) and total cost of goods sold (COGS) are completely accounted for. To calculate the COGM, you need to have firsthand information of the cost of all raw materials and components used. Further, you also need to know the activity rates for each work center (resource). The material and activities costs are also known as *direct costs* and are individually assigned to

the order without any allocation. *Overhead cost* is determined by overhead charges. Examples of overhead costs are the electricity consumed in the production process and the salaries of employees involved in the production of goods.

There is also a method of assigning a *costing sheet* to an order type, which, for example, may contains details such as 2% of raw material cost will equal the electricity cost of producing a material. Before the actual business processes, such as order creation, in PP begins, the product costing team runs a *material cost estimate* in the SAP system. When running the material's standard cost estimate, the system refers to the complete master data information of PP, such as BOM, routing, work center, and production version. It draws information from CO, such as activity types and activity rates. The material cost estimate is first saved and then released. Then, when you create an order, the system performs planned cost calculations within the order. When you perform production execution activities, such as GI, confirmation, GR, and recording of co-products or by-products, the system continuously updates the actual cost and presents a comparison of planned costs with actual costs.

The WIP, overhead, variances, and finally settlement are some of the functions managed by the product costing team. When an individual order is settled, the system updates the material price based on the price control. If the price control in the material master (finished or semifinished good) is a standard price, the system reflects all differences and variances to the price difference account. If the price control in the material master is a moving average, the system updates the material price. Orderbased settlement in discrete and process manufacturing is a mandatory requirement.

The process differs slightly in REM, in which either the material's standard cost estimate is used or a product cost collector (PCC) is created with infinite validity. A PCC is preliminary costing, and all the product costs are summed up in the PCC for a material before the actual settlement takes place. In REM, the settlement process isn't order-based but period-based.

1.2 Comparison Table of Production Types

Table 1.1 provides a selective comparison among of three types of production that are highlighted in this book—discrete, process, and REM. Here you can find the typical properties of each production type. In a few cases, there might be exceptions that are very rare or special and aren't worth mentioning here.

Characteristics	Discrete Manufacturing (SFC)	Process Manufacturing (PP-PI)	Repetitive Manufacturing (REM)
General Characteristics			
Industry types	Automobiles, pumps, engines, computers, toys, and electronics, such as televisions and computers	Chemicals, paints, fertilizers, processed food, pharmaceutical, beverage, and so on	Consumer goods, mechanical, electronics, and so on

Table 1.1 Comparison between Discrete, Process, and Repetitive Manufacturing

Characteristics	Discrete Manufacturing (SFC)	Process Manufacturing (PP-PI)	Repetitive Manufacturing (REM)
Product stability/ complexity	Complex production process with intermediate storages	Complex production process and generally without or bulk intermediate storage (mostly continuous flow and liquid-based production)	High-volume (mass production), highly stable, and without any production complexities
Production flow	Order-based and complex	Order-based and mostly used in producing materials that flow (or can't disassemble)	Lean (simple) manufacturing without order types and only through planned orders
Changeover	Frequent	Frequent	Infrequent
MTS and MTO	Supported	Supported	Supported
Batch management	Yes	Yes (extensive utilization)	Yes
Active ingredient management	Not available	Available	Not available
Material quantity calculation	Not possible	Possible	Not possible
Components staging	With reference to production order	With reference to process order	Components staged periodically and anonymously (order reference is a typical reference in REM)
Planning strategies: MTO and MTS	Supported	Supported	Supported

Table 1.1 Comparison between Discrete, Process, and Repetitive Manufacturing (Cont.)

Characteristics	Discrete Manufacturing (SFC)	Process Manufacturing (PP-PI)	Repetitive Manufacturing (REM)
Completion confirmation (backflush)	For individual operations or orders	For individual phases or orders	Period-based confirmation with backflush
Order-related production	Yes (production order)	Yes (process order)	Period-based with planned orders
Productionbased	Lot size-based production	Lot sized-based production	Period and quantitybased production
Cost Object Controlling	Order-based costing	Order-based costing	Period-based costing (using PCC)
Settlement	Settlement at order level	Settlement at order level	Settlement at the material level; production versionspecific CO-PC is also possible for better evaluation
Process management	Process integration (= process control), control instruction (= control recipe), operational method sheet (= process instruction sheet [PI sheet])	Control recipe (sent as process instructions)	Operational methods sheet (OMS)
Master Data			
Material master	Yes	Yes	Yes (**REM** checkbox and REM profile maintenance in material master)
Work scheduling view activated	Yes	Yes	No (maintaining REM details in **MRP 4** view of material master is necessary/sufficient)

BOM	BOM (Transaction CS01)	List of materials (Transaction CS01)	BOM (Transaction CS01)

Table 1.1 Comparison between Discrete, Process, and Repetitive Manufacturing (Cont.)

Characteristics	Discrete Manufacturing (SFC)	Process Manufacturing (PP-PI)	Repetitive Manufacturing (REM)
Work center	Work center (Transaction CR01)	Resource (Transaction CRC1)	Production line (Transaction CR01)
Work center hierarchy	Work center hierarchy	Resource network	Possibility of work center hierarchy in REM planning to get a synchronous overview of several production lines (Transaction MF50); possibility of line hierarchies to monitor and plan the load on several capacities along a production line
Routing	Routing (Transaction CA01)	Master recipe (Transaction C201)	Rate routing (Transaction CS21); complete support from REM for standard routing (Transaction CA01)
Production version	Optional (Transaction C223)	Mandatory (Transaction C223)	Mandatory (Transaction C223)
Transactional Data			
Manufacturing order	Production order (Transaction CO01)	Process order (Transaction COR1)	Run schedule quantity (e.g., Transaction MF50)

Collective availability check	Production orders (Transaction COMAC)	Transaction COHVPI (on the **Mass Processing** tab, select **Material Availability Check** from the dropdown)	Planned orders (Transaction MDVP)
Process management	Execution Steps (XSteps)	Control instructions and XSteps	OMS (Transaction LDE1)

Table 1.1 Comparison between Discrete, Process, and Repetitive Manufacturing (Cont.)

Characteristics	Discrete Manufacturing (SFC)	Process Manufacturing (PP-PI)	Repetitive Manufacturing (REM)
Confirmation	At operation level (Transaction CO11N)	At phase level (Transaction COR6N)	Confirmation with or without reporting point backflush (Transaction MFBF)
Printing	Shop floor papers (Transaction CO04)	Shop floor papers (Transaction COPI)	Production list (Transaction MF51)
Order confirmation	For production order (Transaction CO15)	For process order (Transaction CORK)	For material or for planned orders of material (Transaction MFBF)
Mass processing	Transaction COHV	Transactions: COHVPI or CORM	Transactions: COHV and COHVPI; availability of several mass processing functions with the deselection of **Production** or **Process Order,** respectively, and the selection of **Planned Order**
Status management	Yes	Yes	No
Confirmation of activities	Yes	Yes	Yes

Separation of final confirmation and GR possible	Yes	Yes	No
In-process (during production) inspection	Possible at operation level only (inspection type: 03)	Possible at operational and phase level (inspection type: 03)	Possible (inspection type: 13)

Table 1.1 Comparison between Discrete, Process, and Repetitive Manufacturing (Cont.)

The next section covers core applications of SAP Integrated Business Planning (SAP IBP).

1.3 SAP Integrated Business Planning

SAP Integrated Business Planning (SAP IBP) is an SAP HANA-based cloud solution to manage the strategic, tactical, and operational objectives of the company—all in an integrated environment. Some of the key highlights of SAP IBP are real-time simulations of business scenarios to bring demand, supply, and financial models together; a collaborative approach to reaching consensus on important business decisions; and a user-friendly interface—all while using the enormous data processing prowess of SAP HANA.

SAP Advanced Planning and Optimization

SAP APO used to be the go-to planning tool for use with PP, but it has since been depreciated in favor of SAP IBP. The core components of SAP APO are as follows:

Demand Planning

Supply Network Planning

Production Planning and Detailed Scheduling (now part of SAP S/4HANA)

Global Available-to-Promise (GATP)

Transportation Planning/Vehicle Scheduling

The five applications of SAP IBP are as follows:

SAP IBP for sales and operations

SAP IBP for sales and operations is often the first application companies implement because they almost always start out the long-term and mid-term sales planning that then

needs to synchronize with operations (production, procurement, logistics) planning. The ability to use different forecasting models coupled with the ability to simulate various demand, supply, and financial models provides a holistic view of the entire supply chain network, which includes customers, suppliers, manufacturing units, and distribution units. To ensure a quick and steep learning and adoption curve, this SAP IBP application uses the all-familiar Microsoft Excel interface.

SAP IBP for demand

The ability to predict demand of products is perhaps one of the most critical success factors in the whole planning process because it impacts the entire upstream planning of procurement, production, and inventory. Even the best forecasting tools can only predict the demand to a certain degree of accuracy; the key to better demand planning lies in a collaborative and consensus approach to predicting demand and working backward to ensure timely supplies. However, with this SAP IBP application, the possibility to adopt a demand-driven approach to material planning becomes a reality in the short- to medium term when verifiable demand signals, such as confirmed sales orders, help the supply chain planners quickly adapt the supplies.

SAP IBP for response and supply

Like SAP IBP for demand, this SAP IBP application also takes advantage of the demand-driven materials planning to account for the demand variability or supply disruptions that can't be planned for in advance. Starting with the rough-cut capacity planning, the SAP IBP for response and supply planning application simulates and evaluates different planning scenarios to strike a balance among demand, supply, and capacity constraints while taking into account the procurement, production, inventory, and warehousing costs. The output from this SAP IBP application forms the basis for input into the SAP IBP for sales and operations application. The response planning takes into account the demand variability and how best to allocate constrained supplies to meet the highest service level and fill rate while keeping all costs to a minimum.

SAP IBP for inventory

SAP IBP for inventory enables complete modeling of the inventory network, that is, from raw material supplier to the end customer and all the logical supply chain links involved in between. This SAP IBP application uses an advanced algorithm to balance inventory investment with service levels at each supply chain link to come up with optimum inventory and service levels for each product and physical location combination. For example, in a multisourcing environment, where one product can be sourced or distributed from multiple sources, this SAP IBP application strikes the right balance by considering transportation costs, replenishment lead time, targeted service level, and fill rate to suggest where and how much of a product's inventory should be available at a specific location.

SAP Supply Chain Control Tower

This SAP IBP application is a dashboard and analytics tool to provide real-time, end-to-end visibility of the entire supply chain of the company. Apart from the ability to set up user-defined alerts when there's a potential disruption to the supply chain, this SAP IBP application also can drill down to the lowest level to evaluate the root cause leading to supply chain issues or disruptions. Further, this SAP IBP application can integrate with different SAP logistics and supply chain solutions such as SAP Extended Warehouse Management (SAP EWM) and SAP Transportation Management (SAP TM), as well as non-SAP systems.

1.4 Summary

This chapter provided an overview of various manufacturing types available in SAP S/4HANA, and the corresponding comparison table will make it easier for a PP consultant or even a production planner to choose which manufacturing type best suits their business needs. An overview of various production planning tools available in SAP S/4HANA should convince a production planner to use as many of them as possible or practical to bring some degree of stability and sanity to today's complex logistics and supply chain management.

Let's now move on to Chapter 2, where we'll discuss the internal organizational structure of SAP from a PP perspective.

Chapter 2

Organizational Structure in SAP

Production planning with SAP S/4HANA is a direct and in-depth reflection and mapping of the business processes that a company either currently follows as a part of industrial operations or will transition to when the implementation of the SAP system is complete. We'll start your journey with a discussion of the organizational structure of all the core units.

This chapter provides an overall understanding of how business functions and the SAP system interact and work together. After you understand the basics, we'll slowly move into some specific details on how production planning (PP) works in the SAP system.

From a PP perspective, the important organizational units are company code, plant, and storage location. In the following sections, we'll review the structure as it applies to PP. We'll discuss the importance of the organizational units and explain how they work together to accomplish the organizational, legal, and reporting requirements of the company. We'll also explain the SAP calendar, which is an essential part of maintaining your entire system schedule.

2.1 Breaking Down the Structure into Units

During an SAP system implementation, one of the first and highly intensive activities undertaken is the finalization of the organizational structure. This involves having inter-modular and intra-modular discussions and deliberations to ensure that SAP can cover the legal aspect of the company's organizational structure, as well as attend to specific reporting needs. In other words, the business process owners, business analysts, and SAP system consultants review the existing organizational structure of the company and then simultaneously begin mapping it in the SAP system.

A practical approach to adopt while finalizing the organizational structure in the SAP system is to ensure that the organizational structure isn't so generic that it loses its significance and prevents the business process owner from extracting the required information from the

system, nor is it so minute or detailed that it becomes cumbersome to collate and consolidate the information. You should also keep a forwardthinking view of your organizational structure. If you foresee that you'll need certain organizational elements in your SAP system in the future, for example, it's better to have them available in the system than to add them at a later point.

The organizational structure in the SAP system is equally applicable to all manufacturing types—discrete, process, or repetitive. Take a look at Figure 2.1, which shows the client as the highest level of the organizational structure in the SAP system. The profitability analysis of the company is performed at the *controlling area* level, and the cost center and profit center accountings are performed at that level as well.

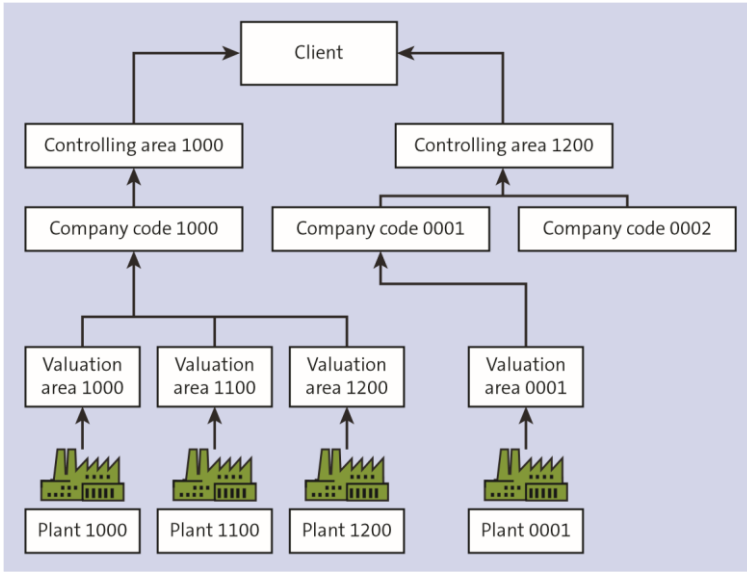


Figure 2.1 Organizational Structure in SAP

A company can consist of several legal entities, each including separate, individual financial statements that must be prepared at the end of the financial year. This is reflected as a separate *company code* for each legal entity.

The *valuation area* represents the level at which the company values its material stock consistently. It's part of the logistics area of the SAP system. A one-to-one relationship exists between the valuation area and the plant. For example, a material at one plant may have a different standard price than at another plant.

The diagram shown in Figure 2.2 represents the o*rganizational unit* of PP, wherein the company code attains the highest level. Within each company code, there can be one or multiple *plants*. Within each plant, there can be one or multiple physical and virtual *storage locations*.

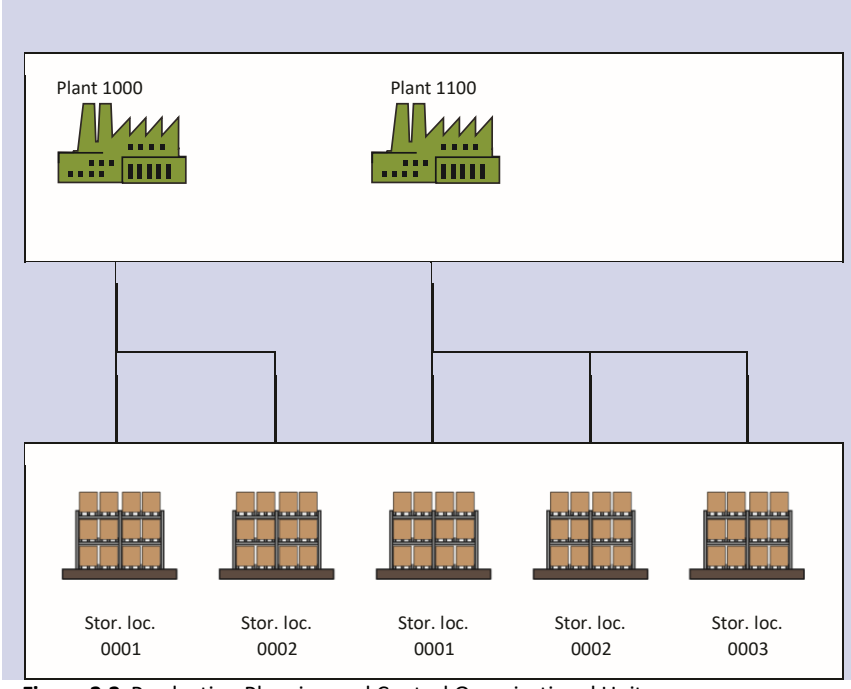


Figure 2.2 Production Planning and Control Organizational Unit

In the next sections, we'll explain each unit in greater detail.

2.1.1 Client

A *client* represents the highest element of the SAP system's organizational structure. Often, the client represents a company or a group of companies, within which there are several independent company units. An SAP system can contain several clients in logical units. The additional organizational elements and the master and transaction data are created and managed within a client.

From the SAP system's landscape perspective, normally there are three clients (systems): development (DEV), quality assurance (QAS), and production (PRD). The actual configuration of the SAP system takes place in the DEV system, which is then transported to the QAS system for testing and training. The final configuration eventually moves to

PRD, which is the final and live system on which the business process owners of the company make real-time live entries.

Note

In an SAP system, the word *client* has a specific meaning, and a clear understanding of what this word means in this context is important. In general speech, a "client" is a customer to whom you're providing services. In an SAP system, however, it refers to a corporate group, which is the highest organizational element. Clients in an SAP system are also used to differentiate among real-time data, test data, and development data

2.1.2 Company Code

The company code is the level below the client in the SAP system, and it reflects the level at which the company legally reports income statements and balance sheets. It's an organizational element (unit) of SAP S/4HANA Finance. You can have a separate company code for each line of business—for example, textile and chemicals—as long as the two are legally separate entities. Similarly, separate company codes can exist if the company has operations in foreign countries.

To create a company code or to make changes to an existing one, follow the configuration menu path, **SAP IMGEnterprise StructureDefinitionFinancial AccountingEdit, Copy, Delete, Check Company CodeEdit Company Code Data** (see Figure 2.3).

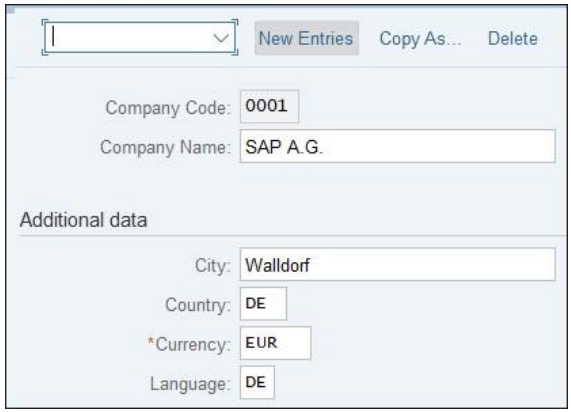


Figure 2.3 Company Code

Tips & Tricks

The configuration menu paths in this book each begin with **SAP Menu Tools Customizing IMG SPRO** followed by clicking on **Display Reference IMG** or pressing (F5).

For the sake of brevity, each menu path won't include that repetitive section of the path but rather only begin the configuration menu path with **SAP IMG**.

Wherever possible or available, the relevant configuration transaction code is also shared to facilitate the configuration efforts.

Tips & Tricks

In general, we *always* recommend that when creating a company code, you copy one from an existing company code. In a standard system, company code 0001 is provided by SAP for this purpose. When you copy company codes, the system also copies parameters specific to company codes. If necessary, you can then change the specific data in the relevant application, which is less time consuming than creating a new company code and also reduces the chance of error when maintaining the settings for a new company code.

Note

During the SAP implementation project, the financials (FI) team decides with the client and works on the creation of company codes in the SAP system.

2.1.3 Plant

A *plant* is an organizational unit within logistics. You can classify a plant from the point of view of production, procurement, maintenance, warehouse, and planning. For example, the plant can be a manufacturing site, a head office, or a distribution center within a company. It organizes the tasks for the production logistics, and it can be a physical production site or the logical grouping of several sites in which materials are produced or goods and services are provided. Different production locations are mapped with the plant in the SAP system. At the plant level, you can perform the following tasks:

Managing inventory

Evaluating and performing physical inventory of stocks

Managing demand

Planning production

Executing and controlling production

Performing material requirements planning (MRP)

In the organizational structure of the SAP system, you can assign only one company code to a plant. However, you can assign multiple plants to the same company code.

To create a new plant or to make changes to the existing plant, follow the configuration menu path, **SAP IMGEnterprise StructureDefinitionLogistics–GeneralDefine**, **Copy**, **Delete**, **CheckPlant**, or use Transaction OX10.

Note

During the SAP implementation project, the materials management (MM) team decides and works on the creation of plants in the SAP system.

Figure 2.4 shows the change transaction screen of plant 1000, with the provision to enter the complete address and other details. It's important to use the **Factory Calendar** field to assign a factory calendar to a plant so that the system can plan out all the working and nonworking days of the plant.

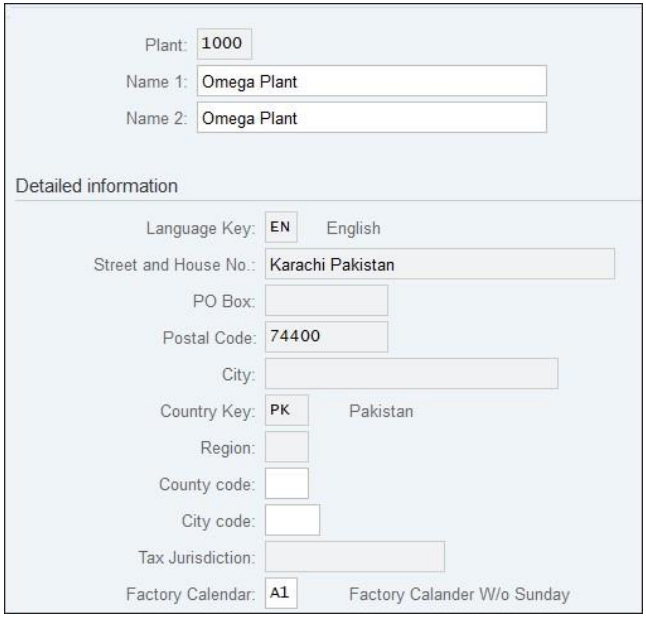


Figure 2.4 Plant: Change Transaction Screen

Note

We cover the creation of the factory calendar in Section 2.2.

After the creation of the plant, the next step is to assign the plant to the company code. A plant can only be assigned to one company code, and you can assign multiple plants to the same company code. It's mandatory to assign a plant to a company code.

To make a plant-company code assignment, follow the configuration menu path, **Enterprise StructureAssignmentLogistics–GeneralAssign Plant to Company Code**, or use Transaction OX18 (see Figure 2.5). Choose the **New Entries** icon to create a new plant-company code assignment.

Assignment Plant - Company Code

CoCd	Plnt	Name of Plant	Company Name
0001	0001	Werk 0001	SAP A.G.

Figure 2.5 Assignment of Plant to Company Code

Note

The MM team creates the plant-company code assignment in the system.

2.1.4 Storage Location

A *storage location* is the physical or virtual storage site for the materials. Examples of physical storage locations include raw materials store, components store, returned goods store, finished goods store, and so on, whereas the virtual storage location can be self-defined and may be a scrap yard or a production shop floor in which semifinished goods are temporarily stored.

You can even treat storage tanks or silos for storing bulk chemicals, oils, or grains as storage locations in the system. However, the limitation is that a storage location in the SAP system doesn't have the provision to define the maximum storage capacity of an individual tank or silo. This provision is available in embedded Extended Warehouse Management (EWM) in SAP S/4HANA.

You can create as many storage locations as needed within a plant, but you can assign a storage location to one plant only.

To create a new storage location or to make changes to the existing storage location, follow the configuration menu path, **SAP IMGEnterprise StructureDefinitionMaterials ManagementMaintain Storage Location**, or use Transaction OX09. Figure 2.6 shows the **Plant** "1000" and several storage locations with this plant. You add both the storage location code and **Addresses of storage locations**.

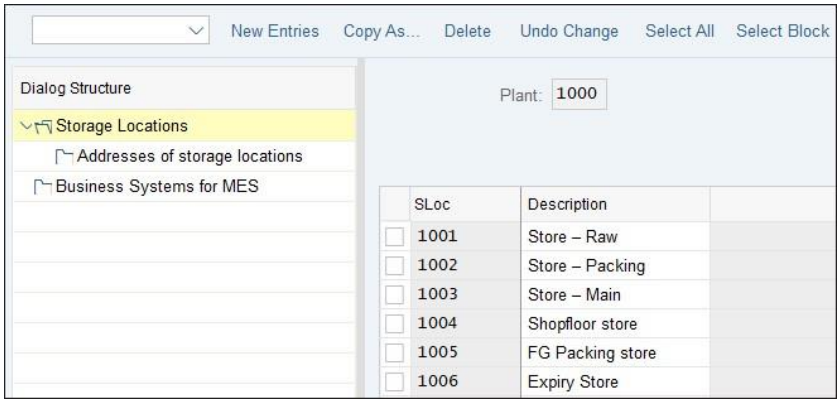


Figure 2.6 Storage Location

Note

The MM team creates storage locations and assigns them to the plants.

2.1.5 Material Requirements Planning Controllers

An *MRP controller* can be an individual role or group of roles performing the same task. For example, if three people in a company manage the packaging materials procurement, then it makes sense to define one MRP controller for this. The MRP controller is primarily responsible for attending to the requirements of materials. When defining the MRP controller, focus must remain on making sure it's defined based on responsibility, role, or area of working, instead of individuals. For example, you may have one MRP controller who is responsible for raw materials only, while another one may be responsible for packaging material. You may have an MRP controller who is only responsible for managing consumables.

The MRP controller is assigned in the **MRP 1** view of the material master. When you select the relevant MRP type in the material master by indicating that planning will be done on the material, the system prompts you to enter the MRP controller. Again, the MRP controller should be based on the position or responsibility rather than on the person. Later, when you run several reports, you'll be able to use the MRP controller as one of the selection criteria, among others.

To configure the MRP controller in SAP, follow the configuration menu path, **SAP IMGProductionMaterial Requirements PlanningMaster DataDefine MRP Controllers**.

Note

MRP controllers are extensively used by both production and procurement departments and the corresponding PP and MM areas, respectively. MRP controllers for procurement may be raw materials, packaging materials, consumables, or spare parts. MRP controllers for production may be finished goods, semifinished goods, or assemblies.

The two teams (PP and MM) must coordinate in finalizing production and procurement MRP controllers because the bifurcation of PP and MM MRP controllers (including its transaction code) isn't obvious. It's best to mutually agree and make them available in the system.

2.1.6 Capacity Planners

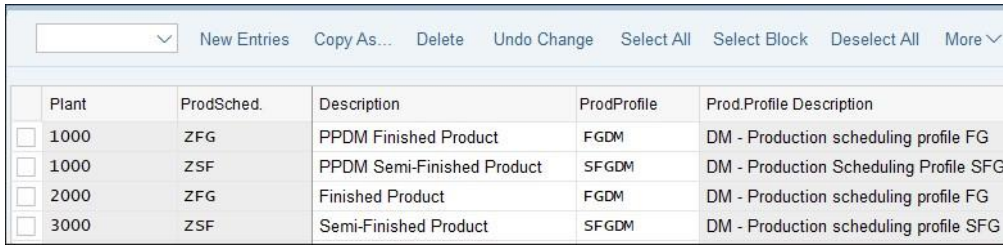
A *capacity planner* or *capacity planner group* is responsible for evaluating the current work center's or resource's capacity and, if needed, also for performing the capacity leveling. When you create a new work center, you also have to assign the person responsible in a specific field. The capacity planner can handle the role of person responsible for the work center as well. For example, it may make sense to combine all of the packing units of similar products as one capacity planner if the same person is responsible for it. If a company produces 10 different sizes of tomato ketchup— from a packet to a gallon size— and the same capacity planner is responsible for ensuring that various machines' capacities for each packing size are available, then you can simply agree to have one capacity planner in the SAP system, together with its code.

The capacity planners are assigned in the capacity header data of the work center (resource). Then, in all the capacity evaluation and leveling reports, the capacity planner is available as the selection criterion for the planner to choose from and enables the system to display only relevant information.

To create a capacity planner, follow the configuration menu path, **SAP IMGProductionCapacity PlanningMaster DataCapacity DataSet up Capacity Planner**.

2.1.7 Production Schedulers

A production scheduler is responsible for ensuring that production execution and operation takes place per the production plan. The production scheduler immediately attends to or takes remedial action, where necessary. To define a production scheduler, follow the configuration menu path, **SAP IMGProductionShop Floor ControlDefine Production Scheduler**, or use Transaction OPJ9 (see Figure 2.7). You assign production schedulers in the **Work Scheduling** view of the material master.



Plant	ProdSched.	Description	ProdProfile	Prod.Profile Description
1000	ZFG	PPDM Finished Product	FGDM	DM - Production scheduling profile FG
1000	ZSF	PPDM Semi-Finished Product	SFGDM	DM - Production Scheduling Profile SFG
2000	ZFG	Finished Product	FGDM	DM - Production scheduling profile FG
3000	ZSF	Semi-Finished Product	SFGDM	DM - Production scheduling profile SFG

Figure 2.7 Production Scheduler with Production Profile Assignment

The next section discusses the SAP calendar, which is alternatively referred to as a factory calendar in the SAP system.

2.2 SAP Calendar

For all of the planning and scheduling to effectively take place, it's imperative that a calendar exists in the system. This calendar is then assigned to the plant. You first have to define all of the national holidays, followed by combining all of the individual holidays in the holiday calendar. This holiday calendar then gets assigned to the factory calendar.

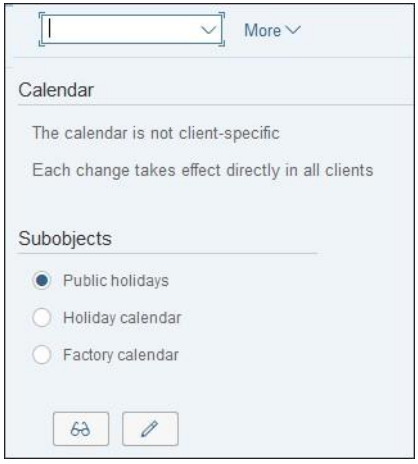


Figure 2.8 SAP Calendar

The SAP calendar creation function includes three individual steps:

Defining holidays

Creating a holiday calendar

Defining a factory calendar and assigning a holiday calendar to it

To create a new calendar, follow the configuration menu path, **SAP IMGSAP NetWeaverGeneral SettingsMaintain Calendar**, or use Transaction SCAL (see Figure 2.8). Here you have the options you need to maintain the requisite details, such as **Public holidays**, **Holiday calendar**, and **Factory calendar**, in the same sequence.

In the following sections, we'll go into more detail about the different calendar steps.

2.2.1 Public Holidays

Select the **Public holidays** radio button shown previously in Figure 2.8, and then choose the **Change** icon. Select the **New Holiday** icon, so you can then select whether it's a fixed date or a floating public holiday. A floating public holiday depends on factors such as moon sighting to decide the holiday. In Figure 2.9, selecting **Floating Public Holiday** leads to the **Floating Public Holidays** dialog box, in which you can choose the holiday to be any specific date, day, or even religious denomination, such as Buddhist, Christian, Islamic, or Jewish calendars.

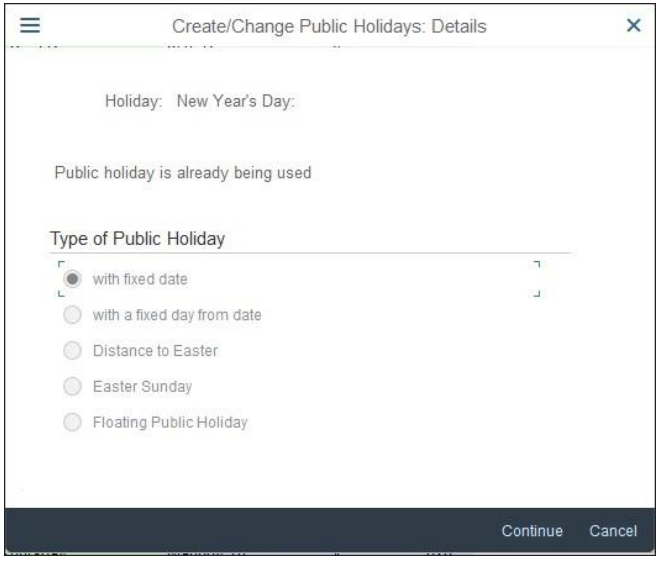


Figure 2.9 Public Holidays

2.2.2 Holiday Calendar

After defining and saving a public holiday, you'll again come back to the screen shown previously in Figure 2.8, where you select the **Holiday calendar** radio button, which consists of a list of all of the holidays defined so far. Choose the **New Entry**, which leads to the screen shown in Figure 2.10. After you provide the identification code (**Calendar ID**) and a short text for the holiday calendar in this screen, you define the validity (**From**/**To**) of the holiday calendar. Next, select the **Assign Holiday** button, which leads to the popup in which you can select all of the relevant public holidays by choosing the relevant checkboxes, pressing (Enter) to confirm, and finally saving the holiday calendar. This takes you back to the original **Calendar** screen shown earlier in Figure 2.8.

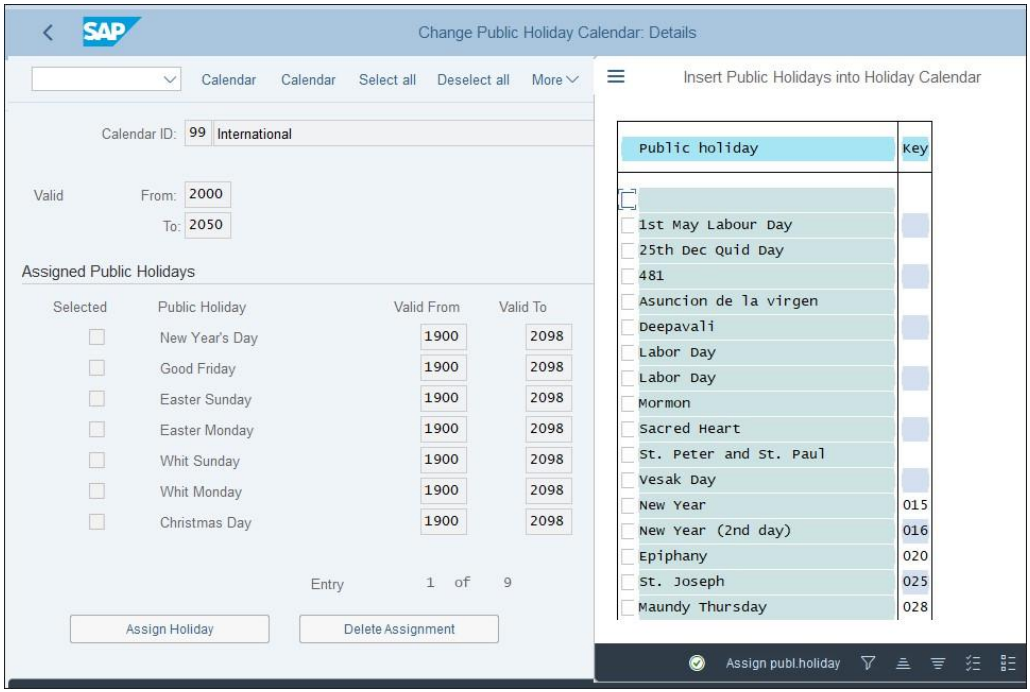


Figure 2.10 Public Holiday Calendar

2.2.3 Factory Calendar

Finally, in the screen shown earlier in Figure 2.8, select the **Factory calendar** radio button, which leads to the screen shown in Figure 2.11, where you can enter the validity

date of the factory calendar, assign a **Holiday Calendar ID**, and define **Workdays**. You can also define **Special Rules** to denote any holiday (off day) as a workday.

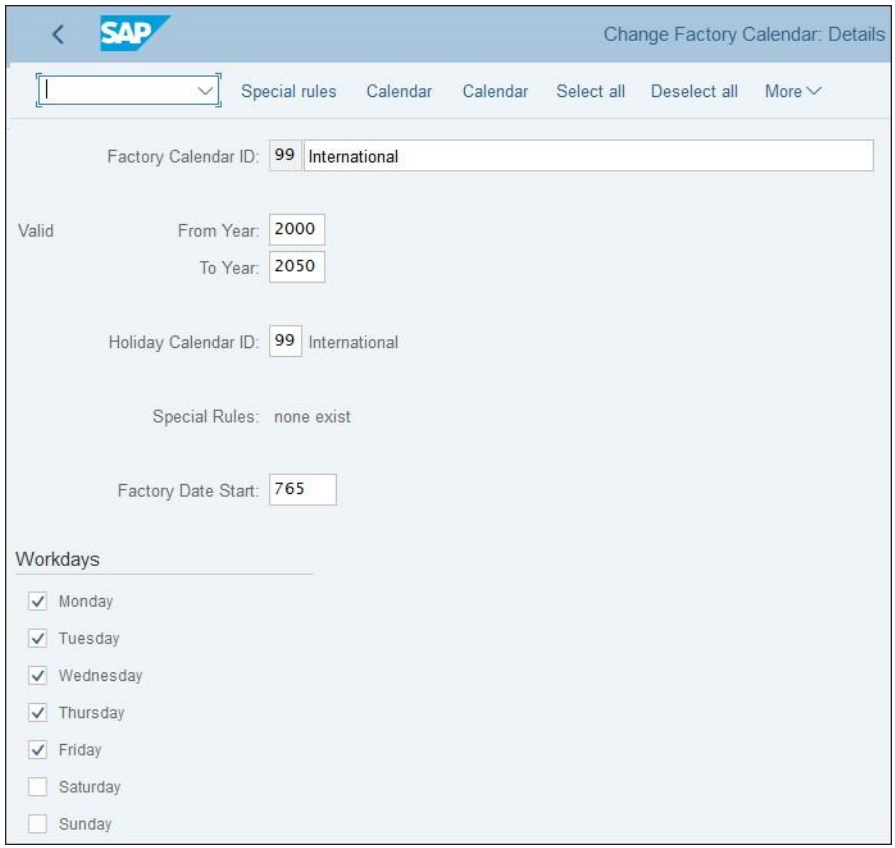


Figure 2.11 Factory Calendar

Note

With the necessary configuration of the factory calendar in place, you can proceed to assign the same in the plant (refer to Figure 2.4 in Section 2.1.3).

2.3 Summary

This chapter explained the importance of mapping most, if not all, of the important actual business processes of the company in SAP during its implementation. We also highlighted

the importance of the enterprise structure of not just PP but of the entire organization, along with their interdependencies. The reference table acts as an invaluable guide in helping understand the importance of several PP-specific configuration elements, such as MRP controllers, production schedulers, and capacity planners.

The next chapter covers the configuration details of PP for discrete manufacturing.

PART II Production Planning Configuration

Chapter 3

Discrete Manufacturing Configuration

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.

During an SAP S/4HANA 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 discrete manufacturing production type forms the basis on which the business processes of the company will run. For example, how should the system behave 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 underdelivery or overdelivery 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 when performing 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 begin by covering 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. The subsequent configuration steps covered for this order type and in this chapter are sufficient to enable you to run end-to-end business processes in SAP. In Chapter 6, we cover the business processes side of the configuration undertaken in this chapter.

If, as an SAP consultant or as a business process owner, this is the first time you're configuring and implementing production planning (PP), we suggest that you follow the step-by-step approach in this chapter. Because PP integrates with several other functional areas, such as materials management (MM), quality management (QM), and most importantly with product cost controlling (CO-PC), we suggest that you maintain close coordination all along by consulting the resources of these functionalities.

Note

The business processes of discrete manufacturing and process manufacturing are also similar in a lot of ways. Any differences are specifically covered in the relevant chapters (process manufacturing is covered in Chapter 4).

Note

Refer to Chapter 1 for features comparison among discrete manufacturing, process manufacturing, and repetitive manufacturing (REM), as well as how to decide which manufacturing type is most relevant for a given industry.

3.1 Material Master

The configuration of the material master is primarily managed within MM. During an SAP 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, semifinished goods, trading materials, packing materials, nonvaluated materials, spare parts, and consumables. However, the importance and involvement of PP can't be overemphasized here because the material requirements planning (MRP) and work scheduling views of the material master are very important to PP, both from a planning and an execution perspective. The PP information is maintained in the MRP views of the material master to enable the system to perform reliable material planning. The work scheduling view controls how production execution should take place.

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, the purchasing view isn't normally 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 material type attributes, follow the configuration menu path, **SAP IMG 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 (not shown) is the **Price Control** field, which enables you to select whether the material will have a moving average price or standard price.

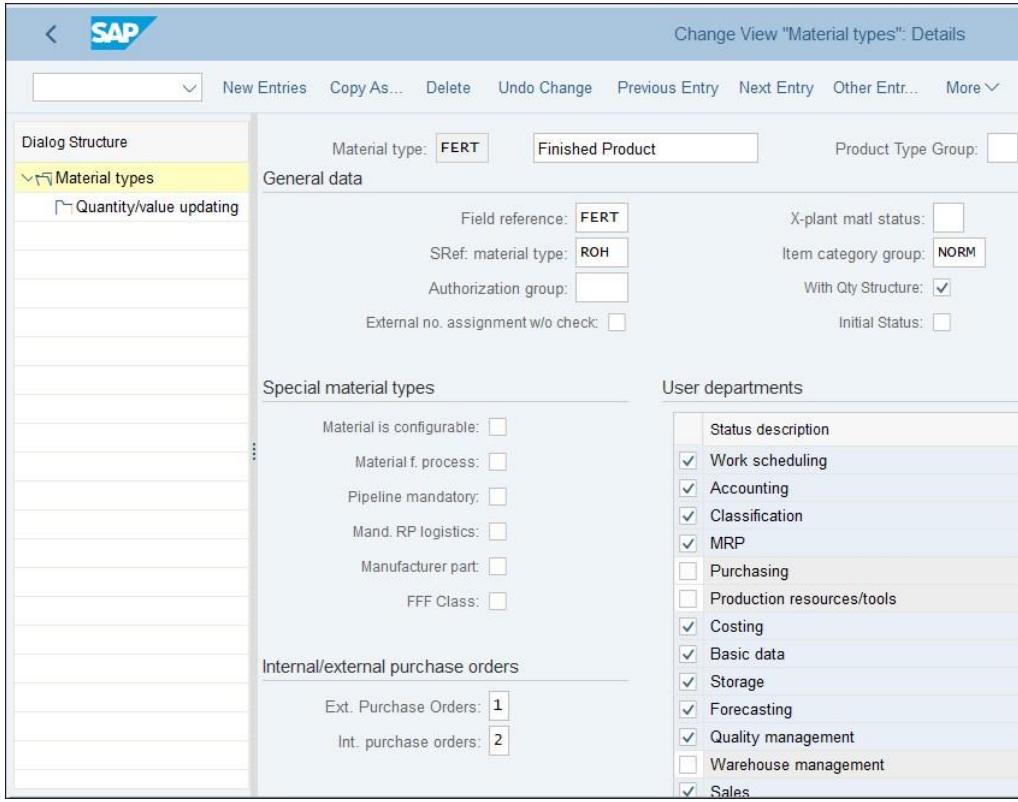


Figure 3.1 Material Types

3.2 Bill of Materials

Similar to the material master, a material's bill of materials (BOM) is used extensively in various areas of the supply chain, including planning, production, sales, 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 toolkit, and the owner's manual, among other things. These accessories are, in fact, components in a sales BOM.

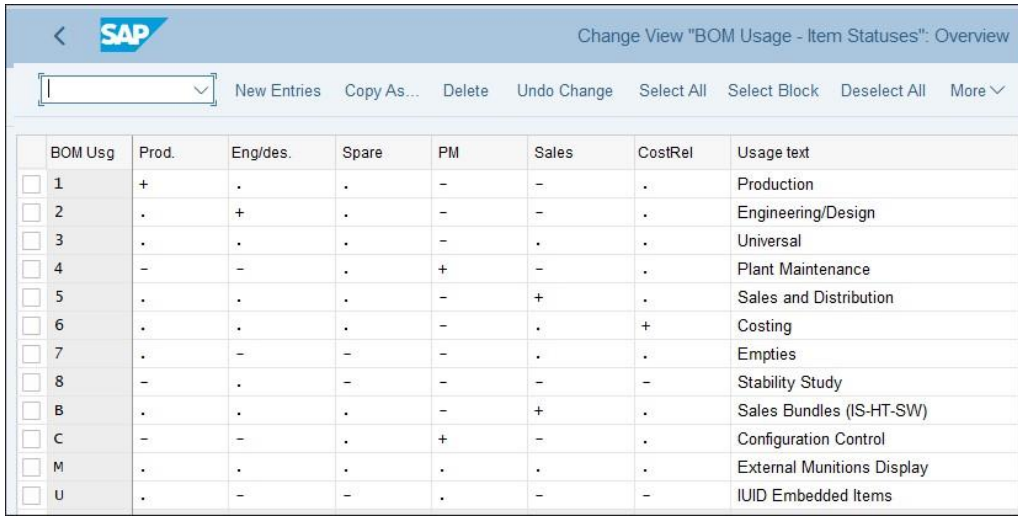
A material BOM is a central component in MRP. When the system runs the MRP on a material, it looks for its BOM to plan not just at the finished goods level but also at the components level and raw materials level. The material BOM is always a single level, and you can explode and display the cascade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

In the following sections, we'll cover the various business functions and controls available for BOM, including maintaining the various statuses of BOM as well as allowing or disallowing certain material type's usage in a BOM.

3.2.1 Define Bill of Material Usages

A BOM usage controls the activities and functions that the system can perform in business processes. You can also have a separate BOM usage for long-term planning (LTP) to simulate the materials and capacity requirements for a given business scenario. To create a new BOM usage, follow the configuration menu path, **SAP IMG 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).



BOM Usg	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	.	-	-	-	.	.	Empties
8	-	.	-	-	-	-	Stability Study
B	.	.	.	-	+	.	Sales Bundles (IS-HT-SW)
C	-	-	.	+	-	.	Configuration Control
M	.	.	.	.	.	.	External Munitions Display
U	.	-	-	.	-	-	IUID Embedded Items

Figure 3.2 BOM Usages

3.2.2 Allowed Material Types in the Bill of Materials 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. During the SAP project, if several company-specific material types are configured by the MM consultant, 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 menu path, **SAP IMG 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.

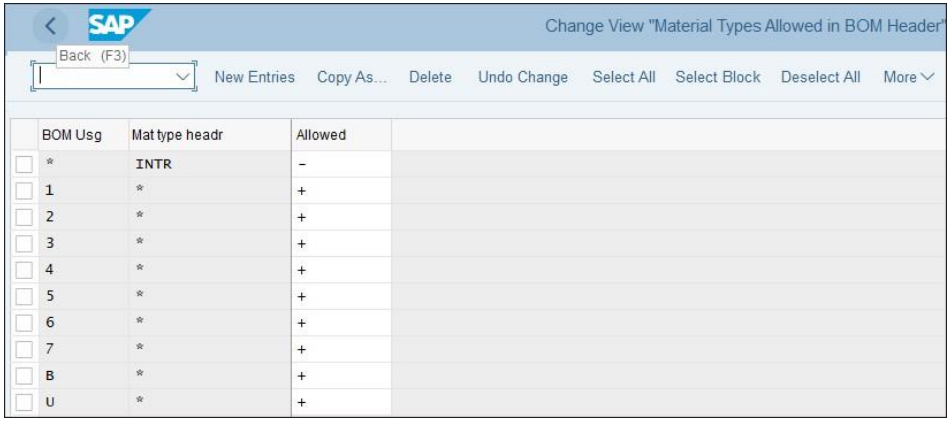


Figure 3.3 Allowed Material Types in the BOM Header

Note

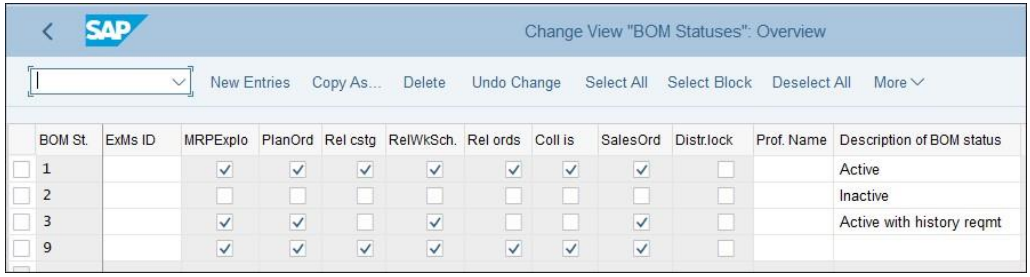
In addition to maintaining the control function of the material type at the BOM header level, you can also do the same for a material at the BOM item level. To do so, follow the configuration menu path, **SAP IMG Production Basic Data Bill of Material Item Data Define Material Types Allowed for BOM Items**,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

3.2.3 Bill of Material 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 of **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 menu path, **SAP IMG 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).



BOM St.	ExMs ID	MRPExplo	PlanOrd	Rel cstg	RelWkSch.	Rel ords	Coll is	SalesOrd	Distr.lock	Prof. Name	Description of BOM status
1		☑	☑	☑	☑	☑	☑	☑	☐		Active
2		☐	☐	☐	☐	☐	☐	☐	☐		Inactive
3		☑	☑	☐	☑	☐	☐	☑	☐		Active with history reqmt
9		☑	☑	☑	☑	☑	☑	☑	☐		

Figure 3.4 BOM Statuses

3.2.4 Bill of Material 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 make the desired changes, which adds a level of security.

To select the BOM usage and status combination for which you want to set the history requirements, follow the configuration menu path, **SAP IMG 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 Bill of Material

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 (IM).

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 sizes of the variables 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 IM parameter (**InvMg**) allows you to set that you can only use those materials whose quantities are managed in IM.

To maintain a new item category or make changes to the existing ones, follow the configuration menu path, **SAP IMG Production Basic Data Item Data Define Material Types Allowed for BOM Header**, or use Transaction OS24. Select or deselect the checkboxes to meet the business needs.

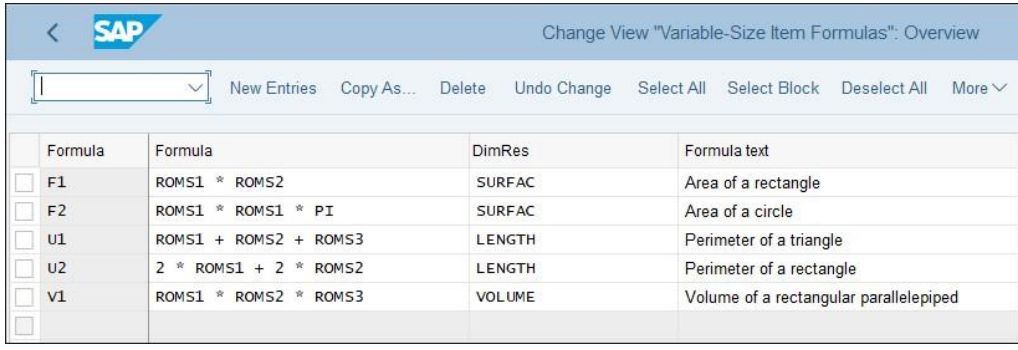
3.2.6 Variable Size Item Formulas

In the fabrication industry, components issued to produce an assembly are 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 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.

Note

Before you 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 system configuration menu path, **SAP IMG 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.



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 Bill of Material 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 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 menu path, **SAP IMG Production Basic Data Item Data Define Explosion Types**.

3.2.8 Bill of Material 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 menu path, **SAP IMG 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 persons and machines that adds value to the manufacturing process. During an SAP implementation project, the production team and the product costing team 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 machine capacities, whereas the product costing team ensures that the reporting for both activities and cost centers is available. For example, if the packaging process incurs significant costs that the product costing team needs to monitor, then it makes sense to create a packaging work center and assign a separate cost center and associated activities to it. If these costs don't require separate 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 mandatory or optional. We also discuss how you can use a standard value key (SVK) to define which activities are important for an operation 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 corresponding system 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 which master data applications and business processes of discrete manufacturing you can use the work center in. For example, work center category 0007 is available for rate routing in REM, and in this category, you'll find the available application option for REM. In the same way, work center category 0008 is available and used for process manufacturing, and, in this category, you'll find the master recipe application.

To create a work center category, follow the configuration menu path, **SAP IMG 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**.

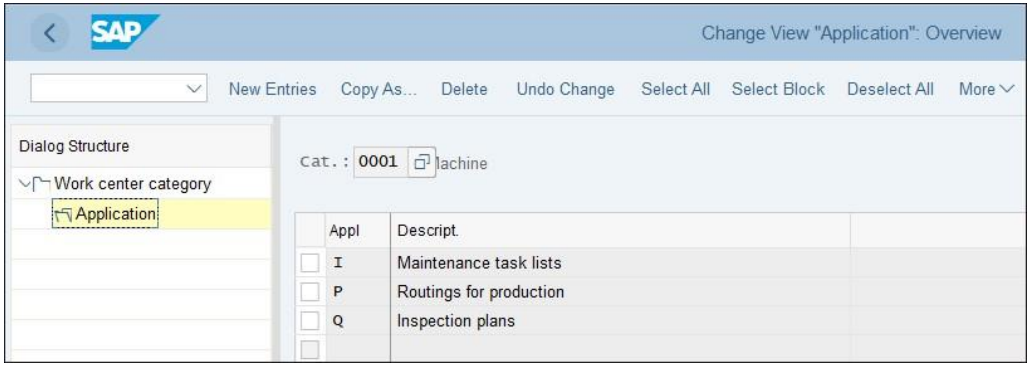


Figure 3.6 Application of Work Center Category

3.3.2 Field Selection in the Work Center

You can control the fields in the SAP 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. When a user enters information in one field, you can also control how the system prompts the user to perform any dependent function. This option works when one modifiable field relates to the influencing fields. For this 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 creates a work center with category 0001, selecting the **Backflush** field is also mandatory.

Note

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

To define field selection in a work center, follow the configuration menu path, **SAP IMG 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)

There's no entry in this field 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 marking a field entry as **Req.**, you can also select the **HiLi** checkbox to enable the user to quickly see the fields requiring entries.

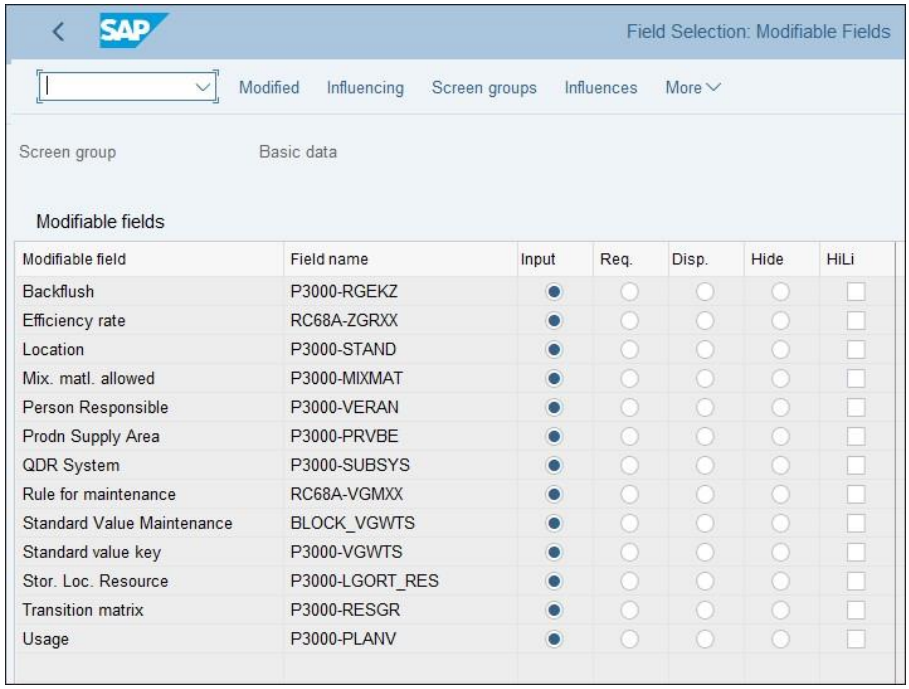


Figure 3.7 Modifiable Fields of the Basic Data Screen Group

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 "0007", and choose **Continue**. Select the **Req.** radio button

to ensure that whenever a user creates a work center of category 0007, selecting the **Backflush** indicator is mandatory.

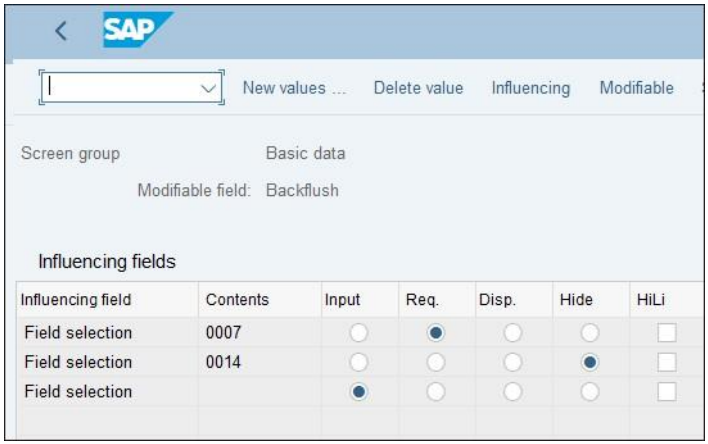


Figure 3.8 Modifiable Field with Influences

Repeat the same with the work center category **0014**, but this time, select the **Hide** radio button. The system won't show the **Backflush** field when the user proceeds to create a work center with work center category 0015.

3.3.3 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 menu path, **SAP IMG 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 menu path, **SAP IMG Production Basic Data Work Center Costing Work Center Formulas Define Formula for Work Centers**, or use Transaction OP54.

In Figure 3.9, notice the formulas for calculating the production processing duration.
The system calculates the capacity requirement as the following:

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

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

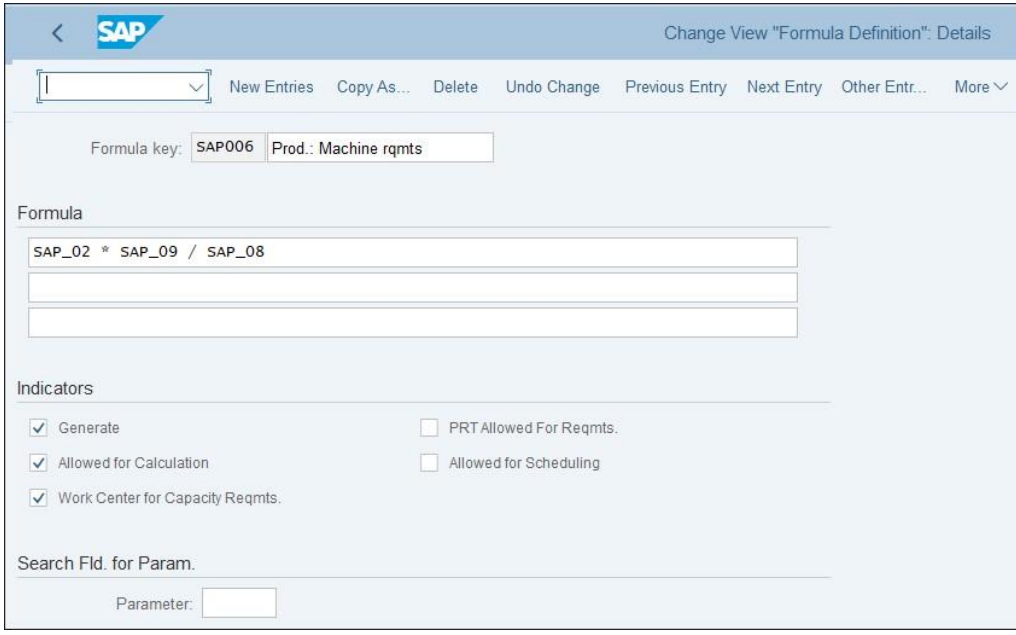


Figure 3.9 Formula Definition in the Work Center

Figure 3.10 shows the **Formula key** "ZPOWER" and the associated **Formula** that also uses the parameter "ZPOWER" in formula calculation. This **Formula Key** "ZPOWER" is then assigned to **Std val. key** (SVK) "ZTG2" as shown later in Figure 3.13.

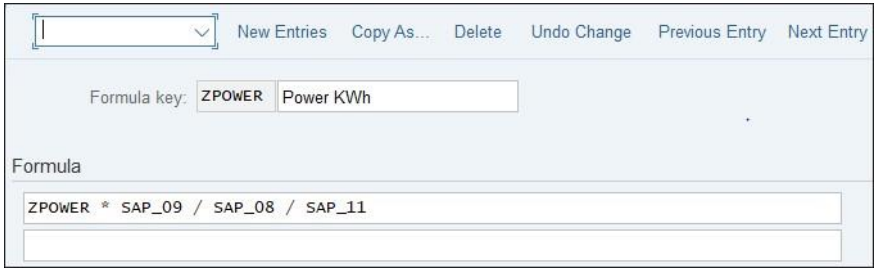


Figure 3.10 Self-Defined Parameter "ZPower" Used in a Formula Key

3.3.4 Standard Value Key

During the course of an SAP implementation project, one of the main areas where the production and the product costing teams collaborate is in defining the standard value key (SVK), which 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 following sequence of steps is used to define an 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.

Let's 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 a significantly high cost is associated with these values. For example, in the caustic soda industry, electricity consumption (power) is excessive and is closely monitored, so it's a critical cost component that the company wants to monitor and control. Similarly, in the steel rerolling industry, electricity and natural gas form significant costs of the finished product and therefore must be recorded and monitored. When determining the parameters to use and monitor for SVK, check and

confirm with the company to see if these parameters are quantifiable and measureable for recording in the SAP system.

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 this example, in the routing, 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 team and product costing team can monitor the variances between standard consumption and actual consumption.

You can assign up to six parameters to an 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 SVKs in scheduling and capacity calculations.

To define a parameter, use configuration menu path, **SAP IMG 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 3.11 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, you can give the dimension and the unit of measure in which you want to record the consumption value.

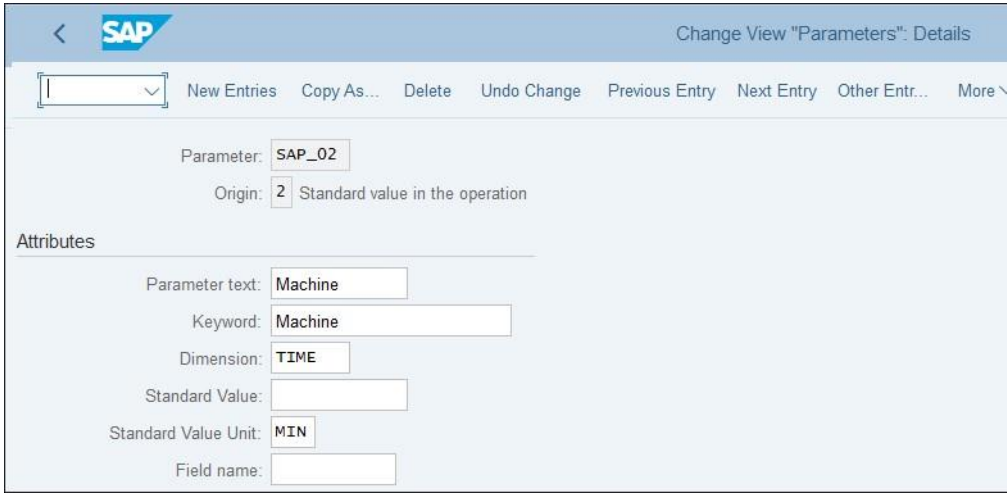


Figure 3.11 Machine Standard Parameter with Unit of Measure

Next, to create the SVK, follow the configuration menu path, **SAP IMG Production Basic Data Work Center General Data Standard Value Define Standard Value Key**, or use Transaction OP19 (or Transaction OPCM).

Figure 3.12 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 parameters 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.

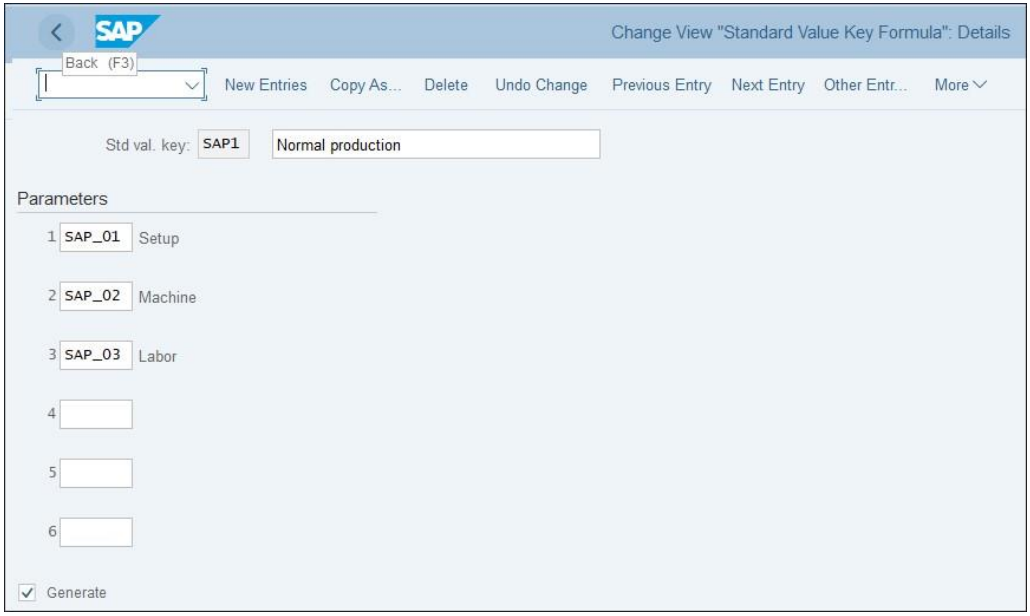


Figure 3.12 Standard Value Key Formula

Figure 3.13 shows an example of a self-defined **Std val. key** (SVK) "ZTG2" containing four parameters (labor hours, machine hours, factory overhead hours, and power) that a glass manufacturing company want to record, monitor, and make part of its product costing. You'll see in Chapter 6 that this SVK will be assigned to the ZFurnace work center that produces the molten glass before the actual and final shapes of glass-based products take place. Glass products can be anything from a car's windshield to wine glasses to glass doors

and windows. Refer toFigure 3.10 on how to first define a formula key “ZPOWER” that is then assigned to the SVK “ZTG2” in Figure 3.13.

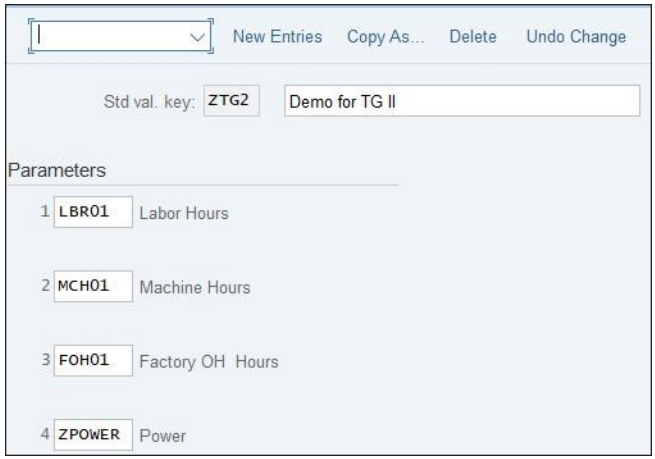


Figure 3.13 Self-Defined SVK Containing Self-Defined Parameters

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), such as queue time, wait time, and move time. If you don’t use the move time matrix, then you have to maintain this transition’s time information either in the work center or in the routing.

You assign the location group to the work center, and, in the move time matrix, you define the normal and minimum move times between locations. The system uses the working times that you maintain in the move time matrix for scheduling the move times. Basically, you’re performing two steps:

Maintain the location groups.

Maintain the matrix of move times from one location group to another.

To set up location groups, follow the configuration menu path, **SAP IMG Production Basic Data Work Center General Data Define Move Time Matrix**, or use Transaction OP30 (or Transaction OPJR).

Figure 3.14 shows the plant-specific location group. For this example, set **Plnt** (plant) as "1000", set **Loc. Group** (location group) as "0001", and choose the **Transport time matrix** folder.

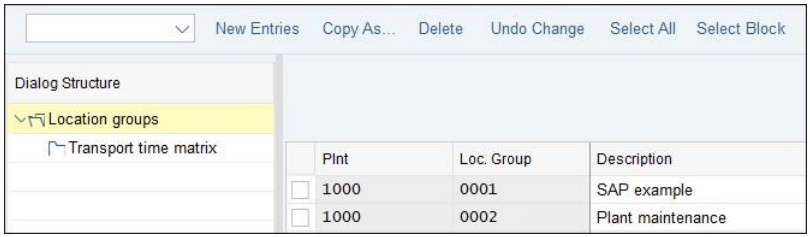


Figure 3.14 Location Groups/Transport Time Matrix

Note

Move time matrix and transport time matrix are synonymous.

In the screen that appears as shown in Figure 3.15, assign the standard and the minimum move times for the plant–location group combination. In the **Calendar** field, you can choose whether the move times defined are applicable every day of the week, according to the factory calendar, or according to the operating time and calendar given in the work center.

When the necessary configuration settings are in place, assign the location group in the **Scheduling** area of the work center.

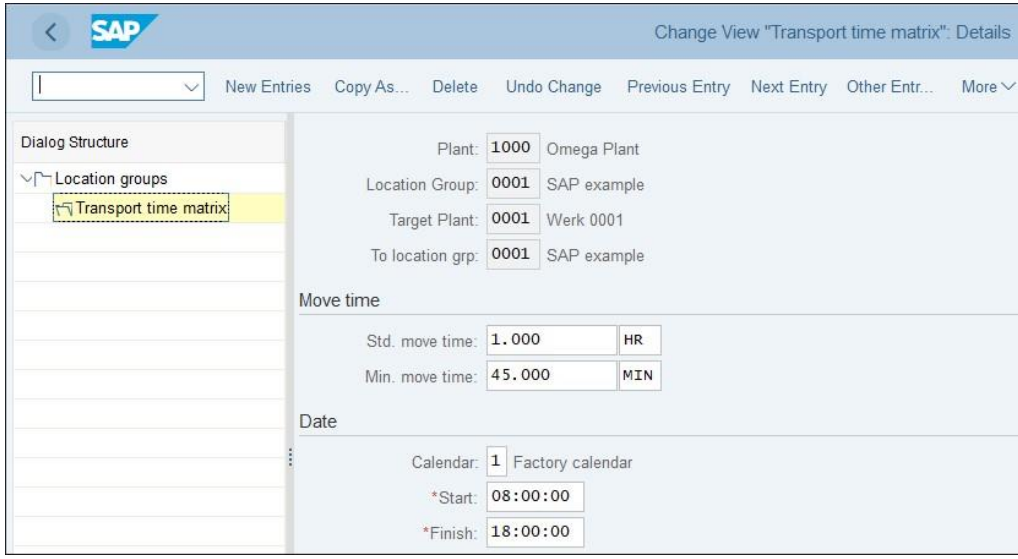


Figure 3.15 Transport Time Matrix

3.3.6 Control Key for Operations

A *control key* acts as a central function to control which actions a user or system can or can't perform on a specific work center. You have to select the relevant checkboxes and make the relevant settings in the control key. You then assign this control key in the **Default Values** area of the work center (or resource). When you assign the work center to the material's routing, the control key becomes an integral part of the operation and acts as a control function.

In a control key, you can define (among other things), whether some or all of the following functions are possible:

Scheduling

CRP

Inspection characteristics required for in-process (during production) inspection

Automatic goods receipt (GR)

Scheduling for external operations

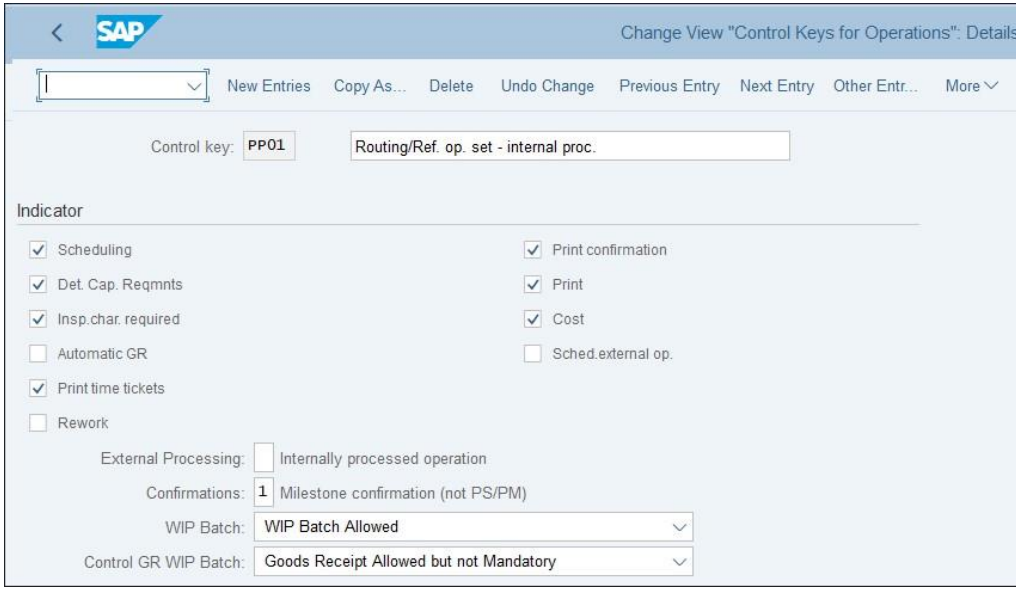


Figure 3.16 Control Key

You can also control the confirmation type required for a work center. You can control whether confirmation is required or optional for a given operation during the

order confirmation process. Further, you can also control whether an operation is a milestone confirmation. In a milestone confirmation, all of the preceding operations are automatically confirmed, as soon as you confirm the operation as having a milestone confirmation.

To create a new control key, follow configuration menu path, **SAP IMG Production Basic Data Work Center Routing Data Define Control Key**, or use Transaction OP00 (see Figure 3.16).

Note

In Chapter 6, we'll show how you can assign this control key in the **Default Values** area of the work center.

3.4 Routing

A *routing* is a set of operations that the material will undergo during the entire production process at relevant work centers. For example, a raw material is transformed into a finished product due to undergoing various operations (defined in the routing) performed at the relevant work centers.

Most of the important parameters for routing selection are made in the order typedependent parameters (Section 3.6), in which you incorporate controls such as routing selection as a mandatory or an optional requirement. The order type-dependent parameters also control whether routing selection is an automatic process or manual.

To set up the routing parameters, follow the configuration menu path, **SAP IMG Production Basic Data Routing Routing Selection Select Automatically**, or use Transaction OPEB. In Figure 3.17, the selection **ID** specifies the selection sequence according to which the system will select the planned type, usage, and status of the routing. The following list explains the first few columns:

ID

Combines all of the different priorities listed in the next column, **SP**.

SP

Lists the sequence in which the system will look for relevant routing during production order creation. In other words, it's the priority setting for routing selection.

Task List Type

Refers to the task list type that the system will consider, such as **N** for routing, **R** for rate routing, and **S** for reference operation set.

Plan Usage

Controls whether the routing is only used for production or is available for inspection plan usage too. The value **3** denotes that this routing will be available for all types of usages.

Description

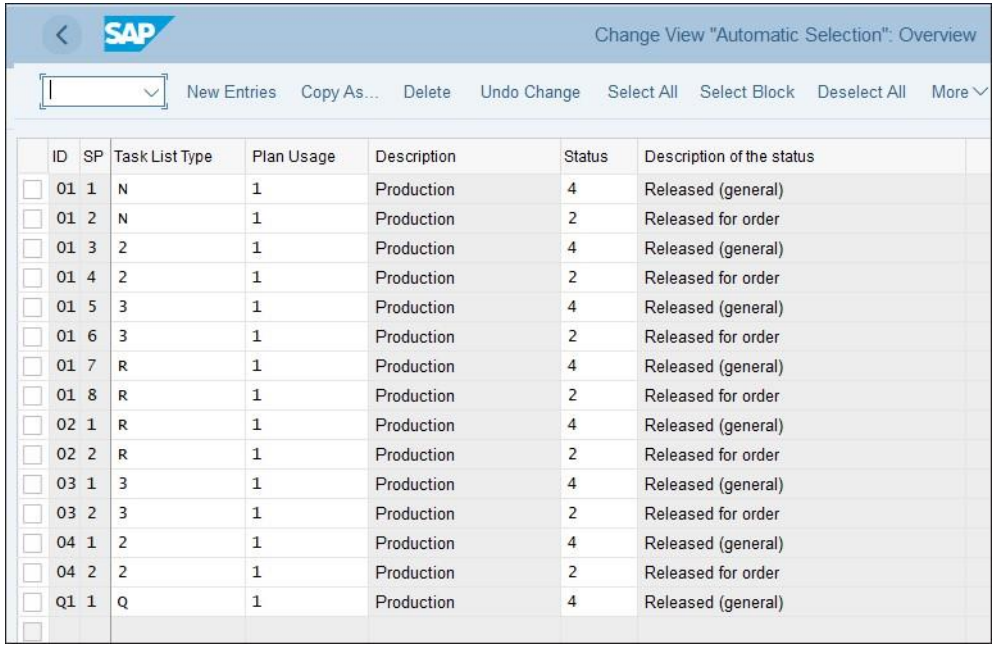
The description that appears after you select relevant usage from the **Plan Usage** field.

Status

Denotes the status that the system should look for in a routing or in a reference operation set and, if found, incorporate in the production order.

Description of the status

The description that appears after you select relevant usage from the **Description of the status** field.



ID	SP	Task List Type	Plan Usage	Description	Status	Description of the status
01	1	N	1	Production	4	Released (general)
01	2	N	1	Production	2	Released for order
01	3	2	1	Production	4	Released (general)
01	4	2	1	Production	2	Released for order
01	5	3	1	Production	4	Released (general)
01	6	3	1	Production	2	Released for order
01	7	R	1	Production	4	Released (general)
01	8	R	1	Production	2	Released for order
02	1	R	1	Production	4	Released (general)
02	2	R	1	Production	2	Released for order
03	1	3	1	Production	4	Released (general)
03	2	3	1	Production	2	Released for order
04	1	2	1	Production	4	Released (general)
04	2	2	1	Production	2	Released for order
Q1	1	Q	1	Production	4	Released (general)

Figure 3.17 Automatic Routing Selection

Note

You can use the selection IDs during scheduling of orders (planned orders or production orders). You can use Transactions OPU3, OPU4, or OPU5 to assign the relevant selection IDs to the order. See Section 3.6.1 to see how you can incorporate selection IDs into production orders (Transaction OPU3).

3.5 Production Order Configuration

During an SAP implementation, the PP consultant conducts workshops and finalizes several configuration objects, including order types and their number ranges. An *order type* is a unique identification and control function that enables the business process owner to quickly perform several functions, such as creating an order, automatically releasing an order, or scheduling an order.

The decision to create and make available different order types depends on how the company wants to see data, information, and depth of planning and controls required. For example, a company might want to sort all orders by separating all of the rework production orders from the normal production orders. This logical segregation of two different order types enables the planner to not only quickly segregate the available data in the system in the form of reports but also put in place the necessary system authorizations. Normally, companies also prefer to have production order types in direct relation to work centers. For example, in the cold-rolled steel sheets industry, if there are five different work centers, such as cold-roll sheets uncoiling, pickling, annealing, recoiling, and packing, then it makes sense to have five different production order types to enable every work center to have clear visibility of the activities and controls involved. Similarly, in the automotive assembly, the main work centers may be press shop, paint shop, and final assembly. In the textile industry, the work centers might be spinning, weaving, bleaching and dyeing, stitching, and finishing. In a pharmaceutical company, there may only be a need to create two order types—the first for bulk medicine such as pills, capsules, or tablets manufacturing, and the second for packing bulk medicines.

However, we suggest not overdoing it in this exercise because creating too many production order types can be confusing and also demands greater data entry and maintenance work. Instead, you can use operations and other work center criteria to meet your reporting needs. In the following sections, we'll show you how to create a new production order type in discrete manufacturing and assign it a new number range.

3.5.1 Maintain Order Types

An order type controls the following functions directly or through additional profiles:

Internal and external number assignment

Classification system

Commitments management

Status management for the different production statuses

Settlement

Scheduling

When defining an order type, the system automatically assigns the relevant order category. An order category distinguishes among various order types, not just in the production processes but also in plant maintenance (PM), quality management (QM), or controlling (CO) orders. Whenever you create a new order type for a particular application, the system automatically assigns the correct order category.

Figure 3.18 shows the list of order categories available in the SAP system when you hover over **Order category** and press (F4). A **PP Production Order** has **Order category 10**, whereas the **Order category** for a **Process Order** is **40**.

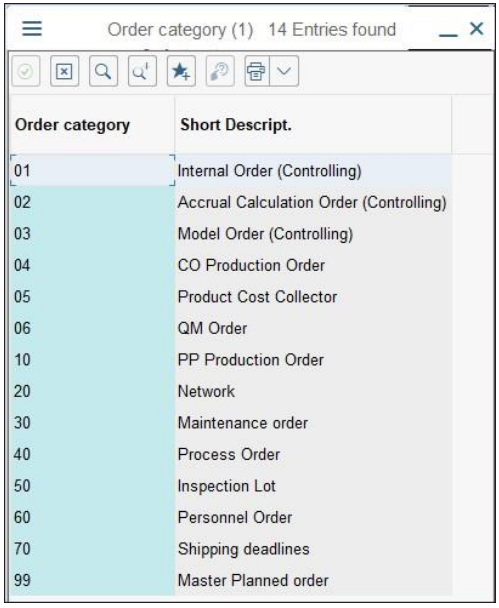


Figure 3.18 Order Categories

To create a new order type, follow the configuration menu path, **SAP IMG Production Shop Floor Control Master Data Order Define Order Types**, or use Transaction OPJH.

In Figure 3.19, notice that the system automatically assigns **Order category 10** to the production order. Create **Order Type** "PP10", and give a short description. For the **Settlement Profile**, you need to coordinate with the product costing team to assign the appropriate settlement profile to the production order.

[+]

Tips & Tricks

To save you the effort of defining all the parameters in any configuration object and also to lessen the chance of errors, we suggest that you copy it from one of the standard objects available and then make the desired changes to the newly created object. The copy function is available in all configuration objects. Look for the **Copy As** button as shown in the menu bar of Figure 3.19.

For this example, copy the standard and previously available production order **PP01** to create the new production order type **PP10**.

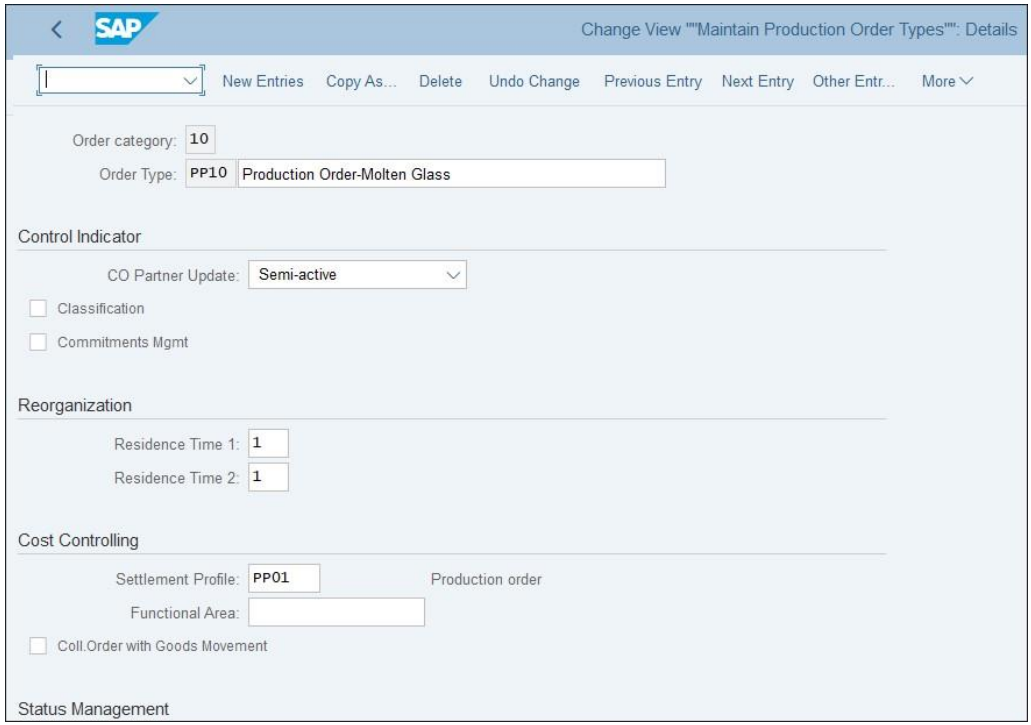


Figure 3.19 Maintain Production Order Types

Scroll down Figure 3.19 and click on the **Number Range General** button in Figure 3.20 to define the new number range to the newly created production order type **PP10**.

Figure 3.20 Number Range Creation

Note

You can also use Transaction CO82 to create a new number range group and define the interval for the production order. On this initial screen, click on **Change Groups**, and then perform all of the steps listed in Section 3.5.2.

3.5.2 Number Ranges

On the initial screen that appears, choose **GroupInsert.** In the screen that appears as shown in Figure 3.21, enter the new number range group. All production orders assigned to this number range group will use this number range. For this example, enter "Molten Glass" in **Group**, and define the new number range interval as "80000001" to "84999999". To facilitate your work, the system displays the existing number ranges available in the lower half of the screen. The newly defined number range can't overlap with the existing number ranges. Click on the **Insert** button, and the system enables you to define a new number range interval. In this example, the newly defined number range is assigned the tag **25** as shown on the left-hand side of Figure 3.21. You'll use this number range tag to assign it to the newly created production order type PP10.

Next, perform the following steps:

1. Select the **Molten Glass** checkbox, which represents the new number range group.
2. At the bottom of the same screen, look for **Not Assigned**, including the new created order type **PP10**. Click on order type **PP10**, and then click on **Select**.
3. Click on the **Element/Group** icon.

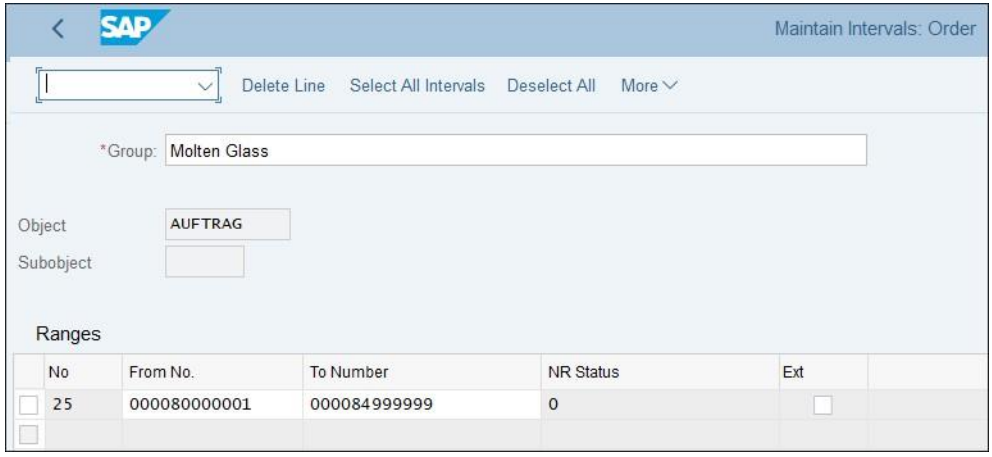


Figure 3.21 Insert Group Screen to Enter a New Number Range Interval

If you've successfully followed these steps in order, the final screen will look like Figure 3.22. Here the system assigns the newly created number range group **25** to the newly created order type **PP10**.

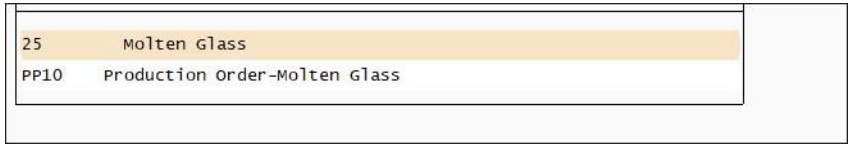


Figure 3.22 Number Range Group Assigned to Order Type PP10

In Chapter 6, you'll see that the production order for order type PP10 has the number range you've assigned here.

3.6 Order Type-Dependent Plant Parameters

After you've defined the new order type, the next step is to define order typedependent plant parameters. In this step, you make several settings to enable the system to control different functions during production order creation. You can, for example, control whether the system should automatically select the production version or provide the user with the option to select it manually in a popup that appears during production order creation. Similarly, you can assign a batch search strategy for batch-managed materials. You can also control which information the system should update to make it a part of the order

information system and logistics information system (LIS). Finally, you coordinate with the product costing team to enable them to make relevant settings from a cost center accounting (within SAP S/4HANA Finance) perspective.

To set up order type-dependent plant parameters, follow the configuration menu path, **SAP IMG Production Shop Floor Control Master Data Order Define Order Type-Dependent Plant Parameters**, or use Transaction OPL8. In Figure 3.23, notice the plant and order type combinations already available. For this example, select the **Plant 0001** and **Order Type PP01**, and choose the **Copy As** icon to copy all settings from order type PP01 to order type PP10. The system creates a new entry for plant 0001 and order type PP10.

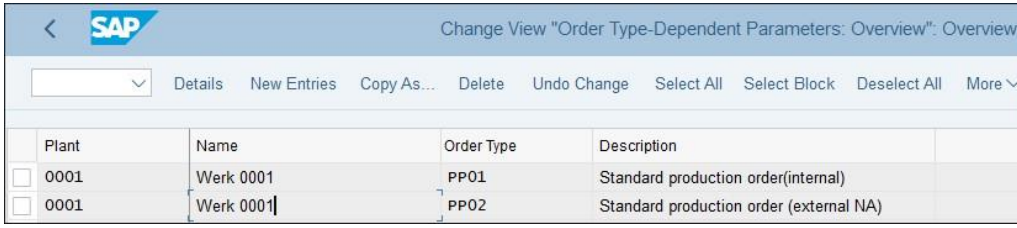


Figure 3.23 Available Order Type-Dependent Parameters

We'll now walk through the different tabs that are available for order type-dependent parameters.

3.6.1 Planning

In the **Planning** tab area shown in Figure 3.24, you can choose whether the system should bring up a popup window for you to manually select the **Production Version** or automatically assign the first available production version to the production order. In the**Routing** area, the **Selection ID** is the same as that covered in Section 3.4. You can choose from **Selection ID** for automatic or manual routing selection (or reference operation set) during production order creation, and you can also choose whether it's mandatory or optional for the system to have routing (or reference operation set) available during production order creation. You can also select the **Check Op. Details** checkbox to enable the system to check and automatically copy the work center details in the routing. You can even copy the routing header text into the production order.

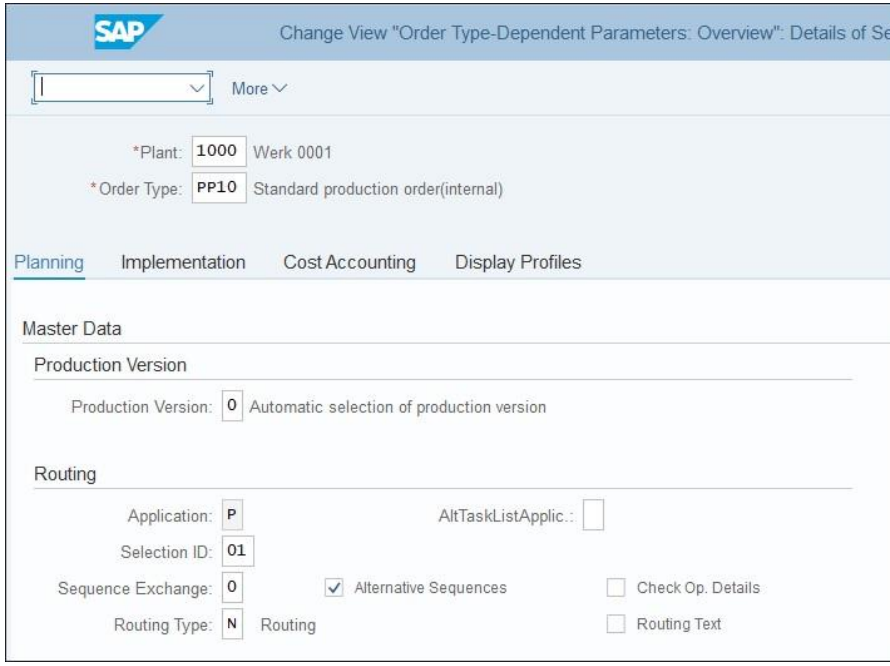


Figure 3.24 Planning Tab of Order Type-Dependent Plant Parameters

In the **Bill of Material** area, you can either choose to use the standard BOM application or enter a custom-defined BOM application, if you've previously created one.
Scroll down on the same screen to see the area shown in Figure 3.25.

In the **Batch Determination** area, you can enter the previously created batch-search strategy (primarily in the process industry but also in discrete manufacturing for batch-managed materials). You can coordinate with the MM team to define the batch search strategy and then assign it in the **Search Procedure** field. You can assign the **Substitute MRP Ctrller** or **Substitute Scheduler**, if the system is unable to find it in the material master or when you create a production order without reference to a material. You assign the MRP controller in the **MRP 1** view of the material master and the production scheduler (supervisor) in the **Work Scheduling** view of the material master.

When you create a production order, you can choose when the system should create reservations for in-house or stock-based materials and purchase requisitions for externally procured materials. Finally, on this screen, you can enter **Inspection Type** "03" to enable the

system to perform in-process (during production) inspection of the material. This is an integration point between PP and QM (see Figure 3.25).

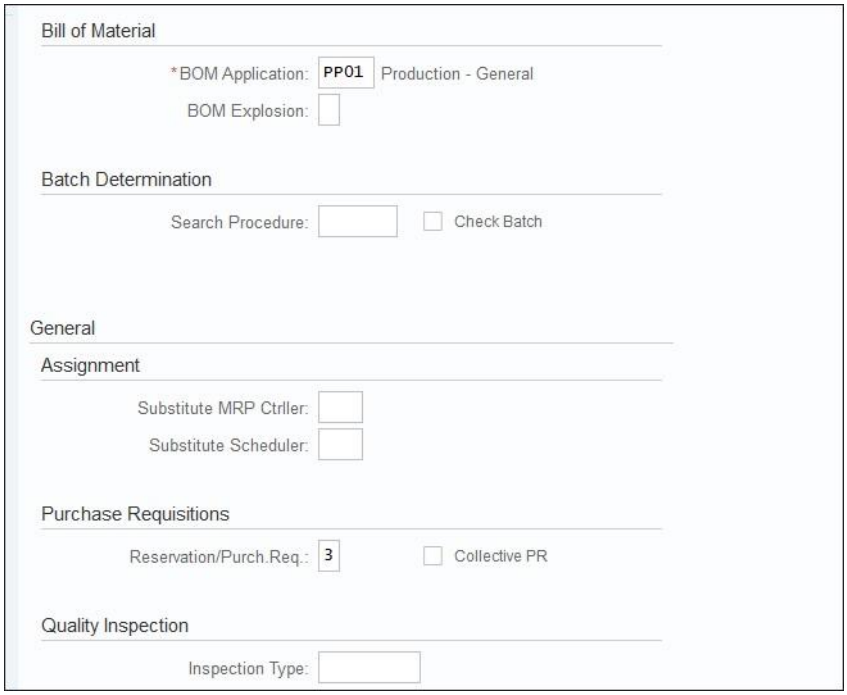


Figure 3.25 Planning Subarea of Order Type-Dependent Plant Parameters

Note

Chapter 9 covers batch management.

3.6.2 Implementation

In the **Implementation** tab (shown in Figure 3.26), make sure to select all of the relevant checkboxes, especially for the **Shop Floor Information System** and **Documentation of Goods Movement** areas.

Selecting these checkboxes will enable the system to automatically update the LIS, and you have the option to view documented goods movements (goods issue [GI] or goods receipt [GR]) for the production orders. The documented goods movements in the production order information system (Transaction COOIS) also show up in the complete GI/GR details.

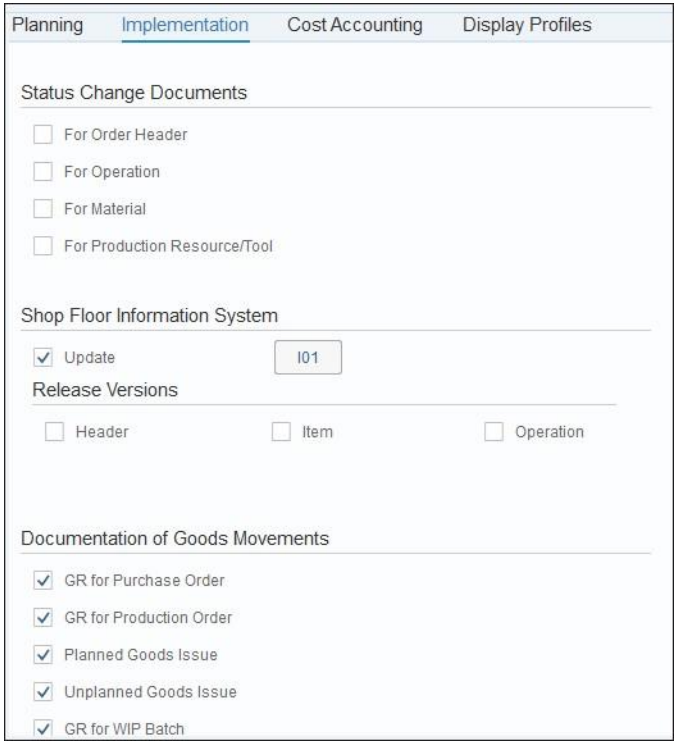


Figure 3.26 Implementation Tab of the Order Type-Dependent Plant Parameters

Scrolling down the screen, you can make specific settings for work in process (WIP) batches (see Figure 3.27), which we'll cover in detail in Chapter 9.

Figure 3.27 WIP Batch Settings

3.6.3 Cost Accounting

Figure 3.28 shows the **Cost Accounting** tab. We suggest that you coordinate with the CO resource (who handles cost object controlling) to ensure that the necessary configuration settings are in place.

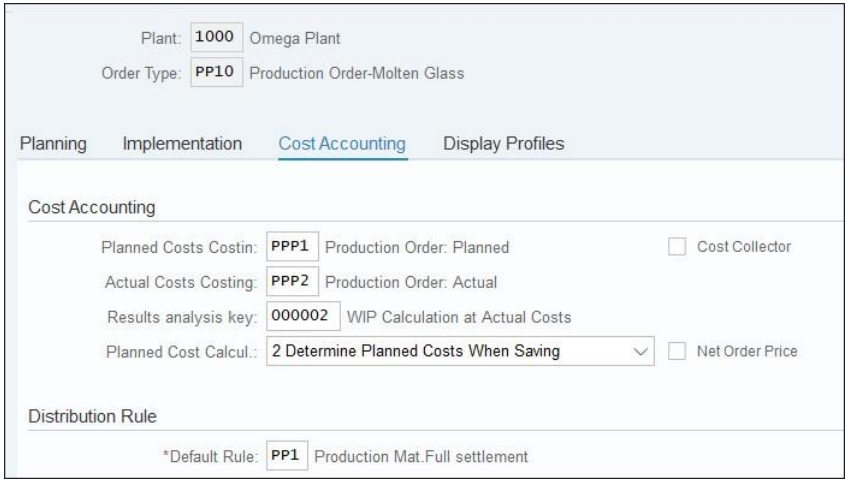


Figure 3.28 Cost Accounting Tab of the Order Type-Dependent Plant Parameters

3.7 Production Scheduling Profile

You use the production scheduling profile to define the tasks of the production order that the system automatically executes during creation or release of a production order. For example, the system can automatically release the production order as soon as you create it,

or the system can automatically send the shop floor papers for printing after you release an order. This saves you the time and effort to perform individual functions, when in fact you can combine a few of them. Further, you can assign a specific production order type that is used in make-to-stock (MTS) production, make-to-order (MTO) production, project planning, or production without material reference. You assign the production scheduling profile in the **Work Scheduling** view of the material master.

Additional control functions available in the production scheduling profile include the following:

Automatic actions on creating a production order

Automatic actions on releasing a production order

Material availability

Capacity availability

Automatic GR (along with the control key; Section 3.3.6)

Confirmation controls

Batch management settings

To create a new production scheduling profile, follow the configuration menu path, **SAP IMG Production Shop Floor Control Master Data Define Production Scheduling Profile**, or use Transaction OPKP. In the **Automatic Actions** area shown in Figure 3.29, you can control whether the system should automatically release a production order on its creation. This is applicable in those business scenarios when a formal or separate approval on the release of the production order isn't required; hence, immediate creation and its release serve the purpose. Similarly, on release of the production order, you can control whether the system is to automatically execute the printing function, schedule the order, or even create control instructions (see the information on process management in Chapter 4, Section 4.4, and on Execution Steps [XSteps] in Chapter 7, Section 7.7).

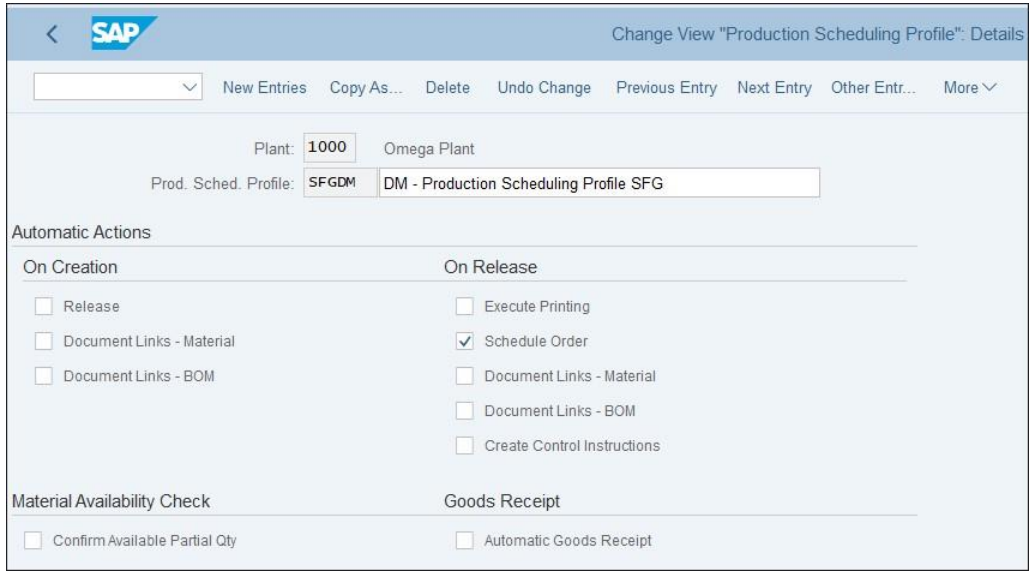


Figure 3.29 Production Scheduling Profile (Selection)

Note

Process integration is a relatively new offering for discrete manufacturing, including creation of control recipes. Refer to Chapter 4 and Chapter 7 for in-depth coverage of process management, as the underlying working and concepts are the same for discrete manufacturing.

For capacity planning, you can assign an overall profile, and then in the production order screen, you can navigate to the capacity planning screen, in which the system uses the profile you assign here. You can control whether the system should confirm the capacity availability as well as perform finite scheduling during production order creation.

Scroll down the screen to see the options shown in Figure 3.30. Here we recommend that you don't set the **Confirmation** area checkboxes. This ensures that the system automatically updates the production deficit or surplus (excess) in the production order as soon as you perform the necessary business processes, such as confirmation and GR. The only exception to selecting these checkboxes is when your production process is generally stable with few operational problems; then, a bit of a deficit or excess production doesn't make much difference to your reporting or monitoring needs.

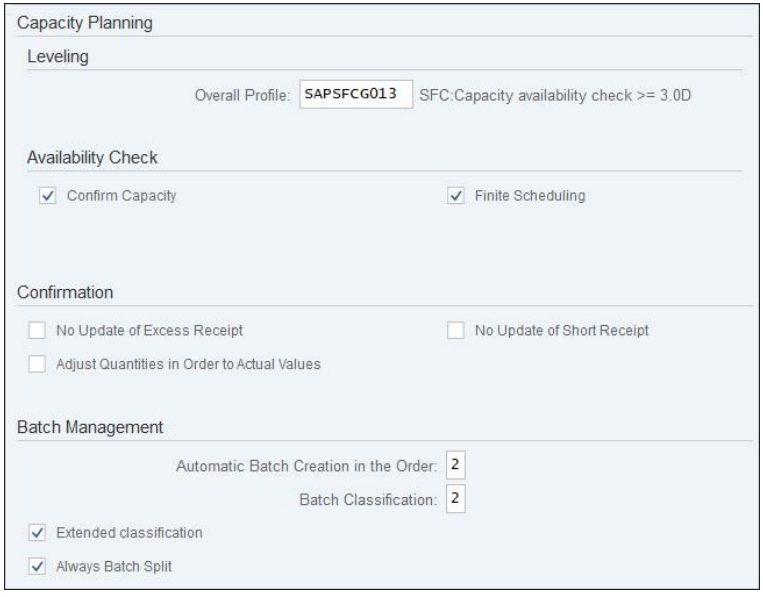


Figure 3.30 Production Scheduling Profile (Selection)

You can use the **Adjust Quantities in Order to Actual Values** parameter to adjust the operation durations and component requirements of subsequent operations on the basis of a scrap-adjusted quantity calculation. The system reschedules the relevant operations.

You can control how the system handles the batch-managed materials, and if it should automatically create the batch during production order creation, during its release, or not at all. If your company plans to integrate warehouse management (WM) or embedded Extended Warehouse Management (EWM) into the production process, then you can coordinate with the relevant WM/EWM resource to make the necessary settings on this screen (see Figure 3.31).

Figure 3.31 Order Types Assignment in the Production Scheduling Profile

3.8 Default Values for the Generation of Operations

During the production order creation, if the system is unable to find routing or a reference operation set, it no longer allows the user to create the production order. Further, if you create a production order without reference to a material, the system still needs a routing or reference operation set.

When you create a production order for a material, the system looks for its master data, such as a BOM and routing. Routing consists of operations involved in the production of a material. If you haven't maintained the master data yet, especially routing, then the system can refer to the default values to generate operations.

To manage these business scenarios, you can set default values for the generation of operations with a plant and order type combination. To do so, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Task List Selection Define Default Values**, or use Transaction OPJG.

For **Plant 1000** and **Order Type PP10**, we suggest that you make entries in all of the fields as shown in Figure 3.32.

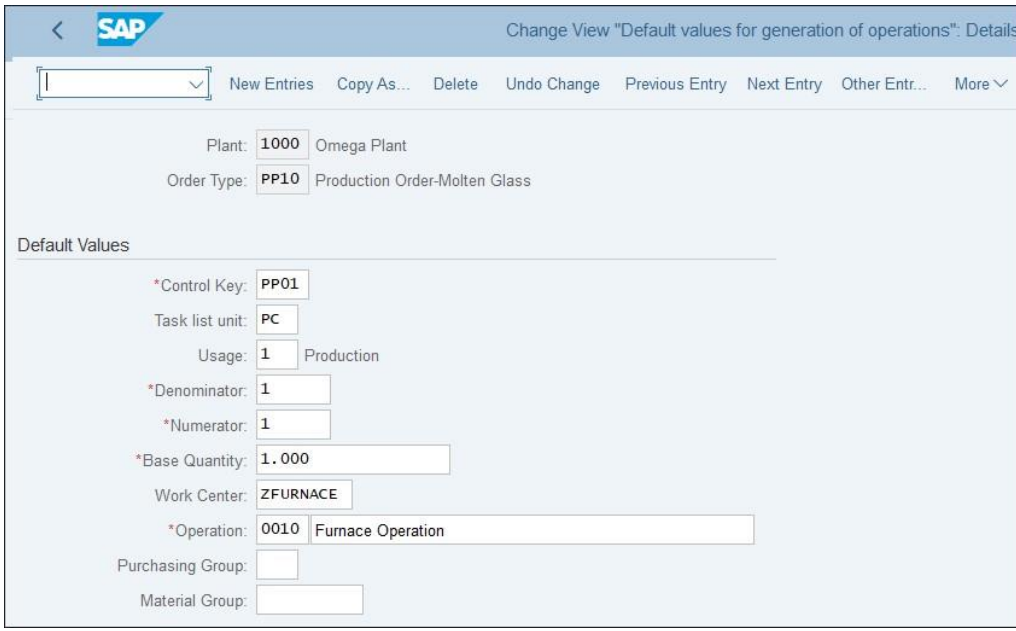


Figure 3.32 Default Values for Generation of Operations

3.9 Availability Check

An *availability check* enables the system to check and validate whether one or all of the required resources, whether it's material, capacity, or production resources/tools (PRT), are available in the production process. As a production planner and scheduler, you want to have a comprehensive overview of material and capacity availability or shortage to take necessary action, if required. In case of missing component availability, the system maintains an entry in the missing parts information system. Not only this, you can also control whether the system should allow creation or release of the

production order if it finds a shortage of material or capacity needed to produce the goods.

Several options are available for you to perform material or capacity availability checks. You can manually check these within the production order creation screen, or you can even use a separate transaction to perform the material availability check. Alternatively, you can make the settings in the availability check for the system to perform these functions automatically.

There are three different types of availability checks in the SAP system:

Material availability check

Checks the availability of the components for the production order either against actual stocks (and optionally receipts) or against the planning.

Capacity availability check

Checks whether sufficient free capacity is available for the order's operations.

PRT check

Checks whether the required PRT is free via a status in the master data.

Note

See Chapter 15 for more information on CRP.

The system makes availability checks during two levels:

Production order creation

Production order release

The following sequence of steps is involved in the availability checks:

1. Define the checking group.
2. Define the checking rule.
3. Define the scope of check.
4. Define the checking control.

We cover each of these steps in the following sections.

3.9.1 Define the Checking Group

To set the availability checking control, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Availability Check Define Checking Group**, or use Transaction OVZ2. In Figure 3.33, the availability (**Av**) **01** for **Daily requirements** has options to enter **TotalSales** and **TotalDlvReqs** on a daily, weekly, or monthly basis. If you select the **No check** checkbox, then the system switches off the available-topromise (ATP) check.

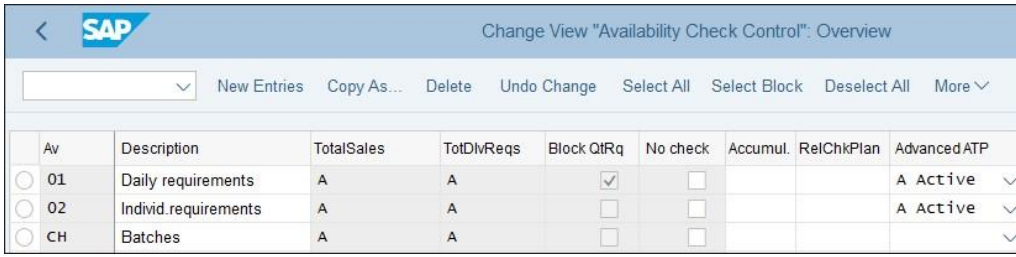


Figure 3.33 Availability Checking Control

3.9.2 Define the Checking Rule

You can define a checking rule to cater to various functional areas such as sales and distribution (SD), MRP, production order processing, or IM. This enables you to configure and integrate different checking rules for different applications to meet your business needs. To define the checking rule, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Availability Check Define Checking Rule**.

3.9.3 Define the Scope of Check

From the combination of the previously defined availability checking control as **01** (**Daily requirements**) and **Checking Rule** as **PP**, we proceed to define the scope of check. In a *scope of check*, you primarily define which inward and outward movements and stock types the system should consider during the availability check. For example, you can choose if the system should consider purchase orders whose GR on the delivery dates will ensure material availability. Similarly, you can set the relevant settings for the system to include (or exclude) firmed planned orders in its quantity and material availability calculation.

In the standard settings, the system only considers available unrestricted stock for the availability check; however, you may have business needs in which quality stock may also be considered as available stock during an availability check. For example, in ice cream manufacturing, the stock is kept in quality inspection even during transportation from one

plant to another, until it reaches its destination. If you want to include this quality stock in the material availability check, set the relevant indicator.

To define the scope of check, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Availability Check Define Scope of Check**, or use Transaction OPJJ.

In the screen shown in Figure 3.34, you can choose the stock types and inward/outward movements that best meet the business scenarios. Scroll down and notice that in the **Receipts in past** field (not shown), you can control whether the system should consider all of the past and future receipts or future receipts only.

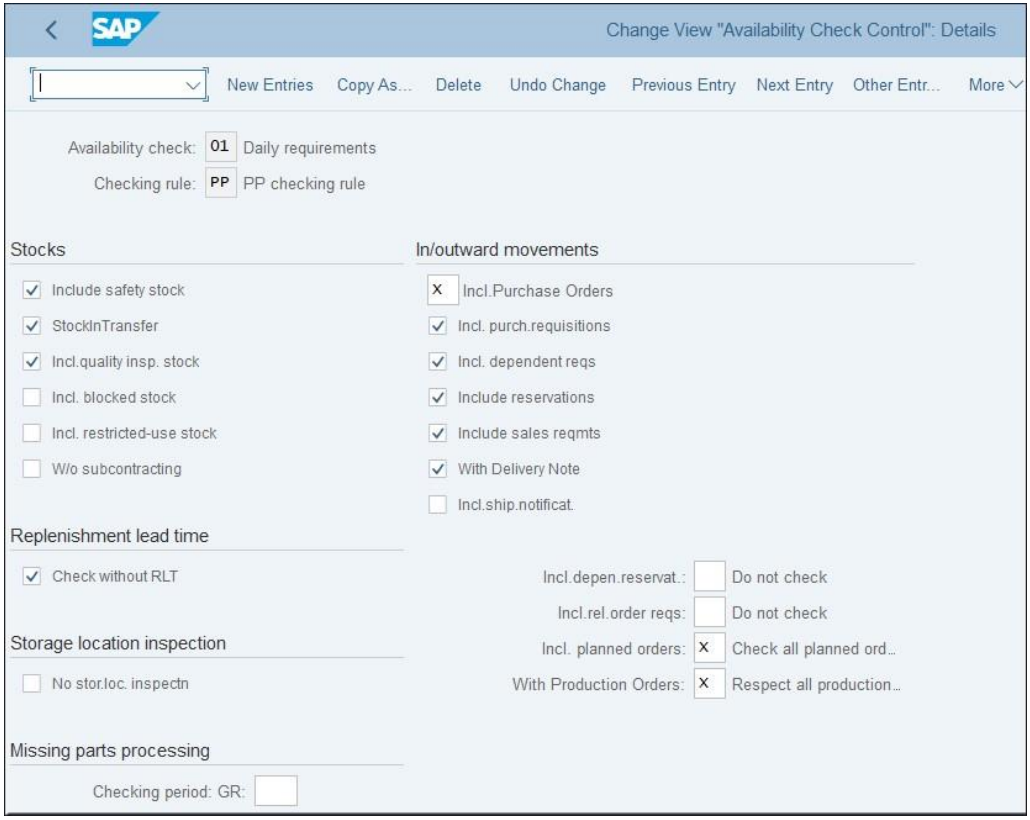


Figure 3.34 Scope of Check (Availability Checking Control)

You can now proceed to assign the checking group in the **MRP 3** view of the material masters for all the components in the **Availability check** field. For this example, use

availability checking group **01,** and assign it in the **MRP 3** view of the material masters for all the *components* used in producing the semi-finished product—molten glass.

3.9.4 Define the Checking Control

As mentioned previously, you can maintain comprehensive availability checks of material, PRT, and capacity during production order creation and release. Because creation and release of production orders are two important business functions, you can define the level of controls for each business function. For example, if you have a long lead time between production order creation and release, you can skip some of the availability checks, such as for capacity or PRT, until you release the order. Similarly, instead of a stringent control that the system doesn't allow the release of a production order until the material is available to produce it, you can select the option in which the user decides on releasing the production order, which meets business needs more closely so that at least partial production can commence.

To set up a checking control for production order creation and release, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Availability Check Define Checking Control**, or use Transaction OPJK. In the initial screen, you'll find several order type and plant combination entries. For this example, copy the standard settings of plant 0001 and order type PP01 and both business functions (**1**: creation, **2**: release) to the newly created order type PP10 and for plant 1000.

The screen shown in Figure 3.35 appears after you complete the copy function.

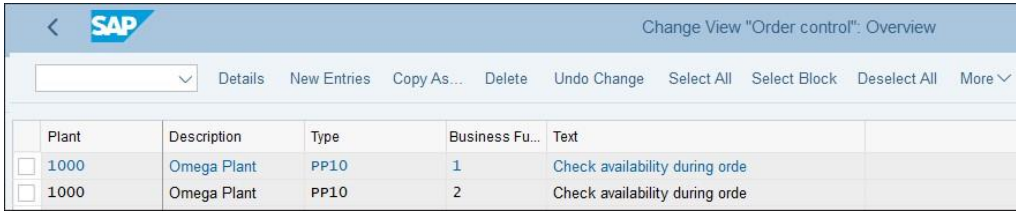


Figure 3.35 Checking Controls in the Creation and Release of a Production Order

Double-click on **Plant 1000**, **Type PP10**, and **Business Function 2** (release). In the screens shown in Figure 3.36 and Figure 3.37, notice that there are four distinct areas:

Materialavailability, **PRTavailability**, **Capacityavailability**,and **Batch assignment**. In the **Checking Rule** field, assign the rule **PP** that was discussed previously. For the **PRT availability**, select the **No check** checkbox, and the system won't check for PRT availability

during production order release. You can have different settings when you create a production order (**Business Function 1**).

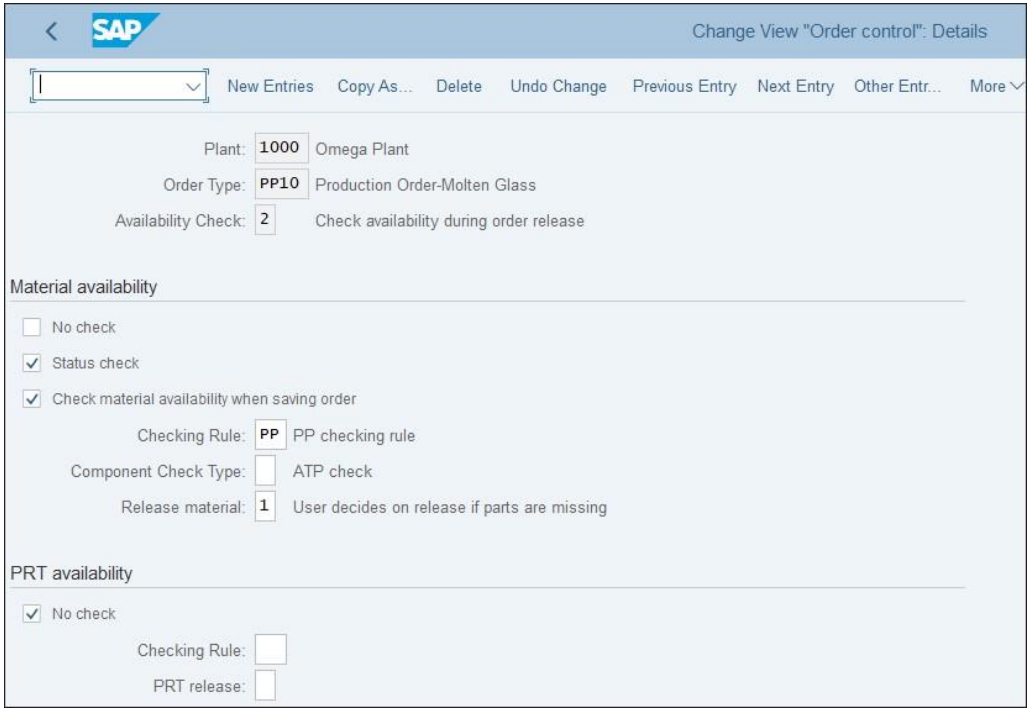


Figure 3.36 Availability Checks during Production Order Creation

For **Capacity availability** in Figure 3.37, assign an overall profile, and also select the option **1** for the **Release Order** field. This option enables you to decide on a runtime basis whether you can create a production order despite a capacity shortage. Finally, for the **Batch assignment**, the same logic of releasing (or not) a production order holds if there are missing batches assignment of components in a production order.

Save your settings, and repeat the same steps for **Business Function 1** (create production order).

Figure 3.37 Availability Check for Capacity

3.10 Scheduling

If you compare the planning of planned orders that are created during MRP, the system needs to incorporate dates of production for the individual operations in the production order. Apart from specific production times (setup and machine), you also need to add transition times, such as wait time, queue time, and move time, as well as safety times, such as opening period, float before production, or float after production.

Before we cover the scheduling in detail, it's important to note how the system takes the various dates into account during scheduling:

There are two scheduling types in SAP: basic dates scheduling and lead-time scheduling.

For planned orders, you can have only basic date scheduling (only basic dates). For production orders, you can have both (basic and production dates).

Whenever the system carries out lead-time scheduling, it automatically carries out basic date scheduling beforehand.

In finite scheduling and reduction of lead-time scheduling, the first step the system takes is to define the start and end dates of the production order without taking capacity constraints into account. The objective is to evaluate whether the dates are synchronized for timely and complete production. Primarily, there are two types of scheduling:

Backward scheduling

Determines the start date of the production order based on the latest finish date that you define in the production order.

Forward scheduling

Determines the end date of the production order based on the earliest start date that you define in the production order.

In finite scheduling, the system carries out individual planning (scheduling) for the production order and doesn't take interdependencies of various orders into account. If the system can't manage the production within the stipulated dates, then you can reduce the lead time with overlapping, splitting, or reducing the transition times. If you want the system to consider reduction during the planned orders creation stage (during an MRP run), then you can use Transaction OPU5 to configure it. Here are some of the steps you can take to reduce the lead time as well as optimize the production process:

If you've defined the float before production as three days, then you can reduce or eliminate this time to enable the system to bring back the production schedule to meet the target finish date. It also applies to the opening period and float after production. You can use Transaction OPU3 to achieve this.

Similarly, with splitting, you can divide a large production lot into several smaller lots, provided you have several individual capacities to manage it in parallel. With overlapping, the system passes the processed parts of the total lot directly on to the next machine.

You can reduce other times, such as queue time and wait time, where possible. You can add another workday or shift to the factory calendar to increase the number of available production hours.

In the following sections, we explain the different scheduling types available for production orders and how the system adjusts the scheduled dates if these aren't within the time frame of the basic dates. We also discuss how the scheduling margin key enables various buffers in production to account for any unforeseen or unexpected delays.

3.10.1 Scheduling Types for Production Orders

As previously covered, there are two primary types of scheduling: backward scheduling and forward scheduling. The other available options are backward or forward scheduling with time and current date. In **Current Date**, the system performs forward scheduling and uses the current date (today's date) as the start basic date in the planning.

With the scheduling type **Only Capacity Requirements**, the system calculates the capacity requirements only. The individual operations aren't scheduled, and the basic dates are copied as operation dates.

To set up the scheduling type, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Scheduling Specify Scheduling Type**, or use Transaction OPJN.

3.10.2 Scheduling Parameters for Production Orders

You assign the scheduling type in the scheduling parameters of the production order. You can make other settings in the scheduling parameters for the production order, and you can even control it up to the production scheduler level.

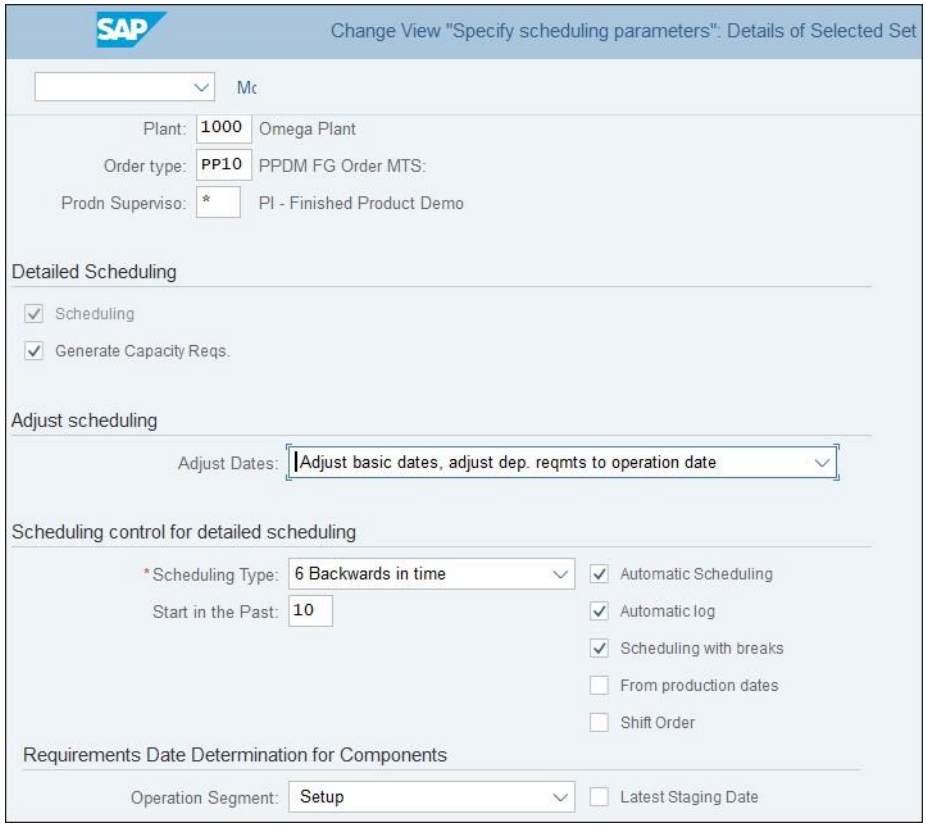


Figure 3.38 Scheduling Parameters for the Production Order

To set the scheduling parameters for the production order, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Scheduling Define Scheduling Parameters for Production Orders**, or use Transaction OPU3. The screens in Figure 3.38

and Figure 3.39 show **Plant 1000** and **Order type PP10** with no specific production scheduler. Select the **Generate Capacity Reqs.** checkbox to enable the system to generate capacity requirements during scheduling.

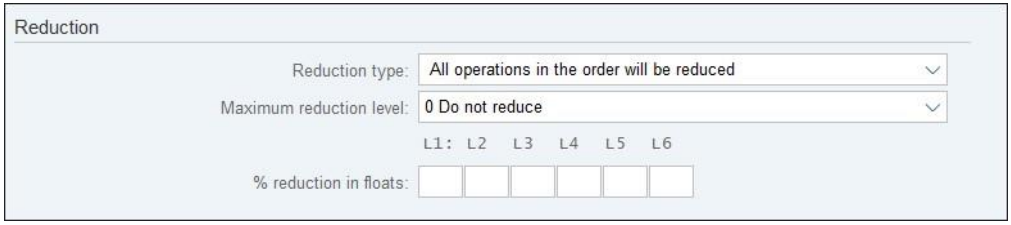


Figure 3.39 Scheduling Parameters for the Production Order (Cont.)

The **Adjust Dates** field describes whether the system determines the basic start and finish dates during scheduling. In backward scheduling, this applies to the basic start dates. Further, this only applies if lead-time scheduling creates production dates so that the time frame given by the basic dates isn't sufficient to include the production dates from lead-time scheduling anymore. In this case, one of the two basic dates is adjusted automatically.

The **Start in the Past** parameter specifies how many days in the past the basic start date may be before the scheduling type is overridden and the today scheduling (forward scheduling from today) is used. Here you first set the **Scheduling Type** that the system will consider in production order scheduling.

Tips & Tricks

The **Start in the Past** parameter is especially useful during an SAP implementation project when the user needs to enter the backlog entries from the cutover dates. For example, if the go-live date of an SAP system implementation project is July 8, 2019, and the user has to enter backlog from July 1, 2019, then an entry of "10" days in the **Start in the Past** field will facilitate that requirement.

3.10.3 Scheduling Margin Key

You assign the plant-specific scheduling margin key in the **MRP 1** view of the material master. Apart from the buffers at the operation level, two more buffers are available in the scheduling margin key to be used at the production order level:

Float before production

In forward scheduling, the system adds up the number of days to the basic start date of production. **Float after production**

In forward scheduling, the system adds up the additional days after production ends to calculate the basic end date.

These two buffers are available to account for any unforeseen delay in the production process, such as the late arrival of raw materials needed to produce the good or delayed end of previous production orders. In other words, it acts as a safety margin in planning. Similarly, the float after production is in place to account for any production or unforeseen machine breakdown delays that may affect the overall planning and scheduling. Further, these floats provide a certain degree of freedom from the capacity-planning step to move operations on resources and also consider dependencies of other operations of the order to maintain the sequence of the operations.

We suggest that you evaluate the actual production realities, including average or normal delays faced from the historical data, experience, and trends, and make the necessary settings in the configuration for scheduling the margin key. Later, when you have significant actual and real data built in the SAP system, you can use several statistics and other evaluation reports and information systems available in PP to revisit and update the data, which forms the basis for planning.

Finally, apart from floats before and after production, the scheduling margin key also contains the opening period and the release period. The *opening period* is a time interval at the beginning of the planned order and is used for the (collective) conversion of planned orders into production orders. The opening date is the beginning of the opening period and is prior to the basic start date of the planned order. The *release date* is the beginning of the release period and is prior to the start date of the production order. The released period may also be considered as the time it takes from creating a production order to its release, due to internal company processes and controls in place.

To set up the scheduling margin key, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Scheduling Define Scheduling Margin Key**.

For scheduling margin **Key 100** for **Plnt 1000**, the **Opening Period** is **10** days, the **Float After Production** is **1** day, the **Float Before Production** is **2** days, and the **Release Period** is **5** days (Figure 3.40).

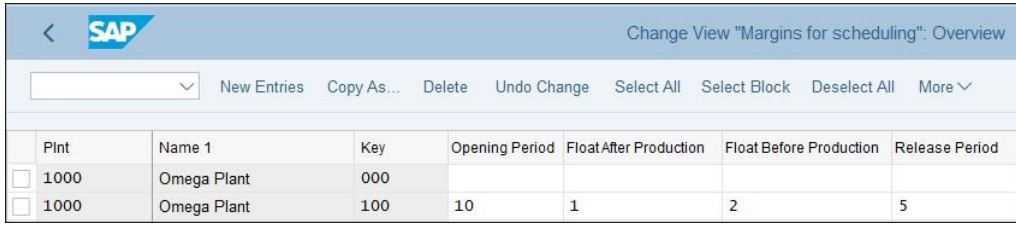


Figure 3.40 Scheduling the Margin Key

3.11 Reduction Strategy

It's only logical and practical to maintain buffers during the production processes to account for any unforeseen or other business contingencies. However, when needed, you can reduce or eliminate several of these buffers, especially when the system is unable to schedule a feasible and practical production plan.

To cancel the buffers, you can use a reduction strategy, which consists of reduction types and reduction levels. In a reduction type, you define whether the reduction is applicable to all operations of the production order or only to the critical part. In a reduction level, you define the levels, available up to six levels, to which you can reduce the floats. Depending on the reduction level that you select, you define the percentage reduction at each level. For this example, set the **Reduction level** to level **2**, and then define the percentage reduction in floats as 50% and 100%, respectively. Although you can set up different reduction levels, the system always tries to make it without reduction in the first place. If unable to do without reduction, and if the system is able to meet the scheduling needs during the first reduction in floats by 50%, no further reduction will take place; otherwise, it will move to the next reduction level.

Warning

We suggest that you avoid using all reduction levels for system performance reasons. The system first schedules the planned order with standard scheduling, but with each reduction level, the required system's resources to achieve the reduction increase greatly.

The reduction levels only reflect the reduction of the operations by shortening the queue, wait, and move times, as well as through splitting and overlapping.

If you haven't maintained the reduction strategy in the routing, then the system uses order type-dependent parameters at the plant level to perform reduction. A reduction strategy refers to the percentages by which the system reduces the interoperation times, such as transport time, and performs further reduction with overlapping and splitting.

To set the reduction strategies, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Define Reduction Strategies**, or use Transaction OPJS. In the screen shown in Figure 3.41, notice that there are three control elements—**Transport** (move time), **Overlap**, and **Split**—that you can use for reduction by the defined percentages given in the **Red. Queue** column. Be sure to select the relevant checkboxes for which you want to perform the reductions.

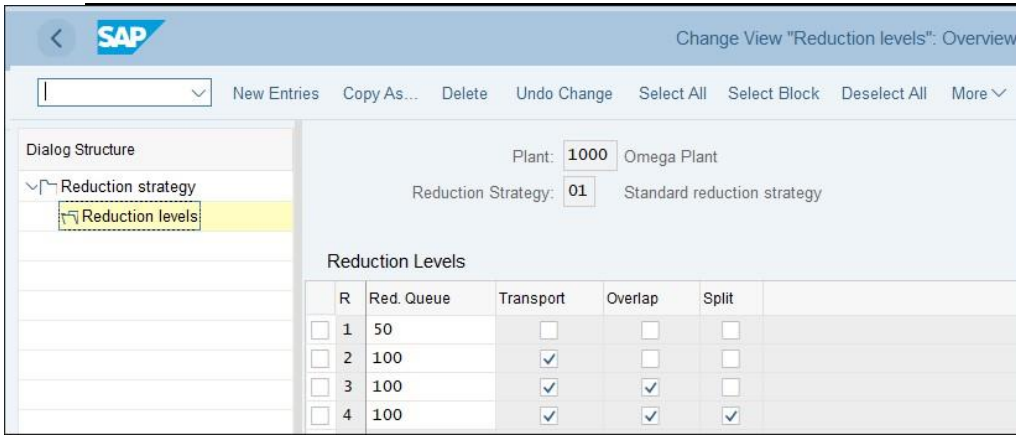


Figure 3.41 Reduction Levels

3.12 Confirmation

So far, all of the work that you've undertaken is merely at the various planning stages. From initial material forecast to running MRP to generation of planned orders, their conversions to production orders are all planning activities with no financial implications. For example, the production order creation signals to the production department to start production of the material. The production order quantity denotes the target or the planned quantity for production. The release of a production order enables the system to activate certain business functions such as printing shop floor papers, allowing issuance of components, or enabling confirmation of operations.

When the production department has actually produced some or all of the target/ planned quantity, it proceeds to confirm this produced quantity in the SAP system.

It's imperative that the user performs the confirmation as soon as the actual production data is available and ready for entry in the system. The data entry confirmation can also be an automatic process via bar code using a conveyor belt. Alternatively, the business normally agrees on the frequency with which it will perform confirmation, for example, once at the end of every 8-hour shift or once in 24 hours. The confirmation process also enables several other business processes, such as automatic GI (backflush), automatic GR, capacity reduction of the relevant work center, and updating costs.

In the following sections, we'll show you the various options and controls available for confirmation of an order.

3.12.1 Process Overview

When you perform confirmation against a production order, whether it's for an entire order or a milestone confirmation, the system makes actual data updates of the following objects:

Yield

Scrap

Rework

Depending on the settings that you've already made, when confirming an order, the system updates the following data in the production order:

Quantities (yield, scrap, rework), activities, dates, and order status

Backflush of the components

Automatic GR

Capacity reduction of the relevant work centers

Costs based on actual data entered during confirmation

Excess/shortage quantities for MRP-relevant materials

On the configuration side of confirmation, you can incorporate several checks and controls during the confirmation, including but not limited to the following:

Time when the system should backflush components

Check operations sequence

Check underdelivery and overdelivery quantity tolerances

Check if QM in-process results (during production) are entered for an operation

GR control for co-products

Actual cost of error handling during confirmation

Quantity (goods movements) of error handling during confirmation

Further, you can control the screen layout of confirmation to suit your business needs. You can even control the fields in which the data entry is required, optional, or hidden. See Section 3.12.3 to see how to manage this.

Let's move on to discuss the specifics of confirmation.

3.12.2 Parameters for Order Confirmation

To set up parameters for order confirmation, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Confirmation Define Confirmation Parameters**.

For **Plant 1000** and **Order Type PP10** (Figure 3.42), the **Process Control** field controls when the system should perform some or all of the following steps:

Goods movements, such as backflush

Automatic GR

Actual costs calculation

If you leave the **Process Control** field blank, then the system performs all activities online and immediately. Refer to Section 3.12.4 to see how you can control the settings as online, immediate, or in the background.

In the **Checks** area, you can control whether the system should ensure that the user adheres to the **Operation Sequence**, with varying degrees of controls from no check to warning to error. Similarly, if you've maintained the minimum and maximum tolerance limits in the **Underdelivery** and **Overdelivery** fields in the **Work Scheduling** view of the material master, the system copies this information during production order creation. When you perform confirmation of the order and enter the yield, the system checks to see if it's within the tolerance limits and acts according to the level of control set—no message, warning, or error. In case of an error message, the system won't allow you to proceed further or save the confirmation until you correct the error. The system considers the sum of yield and rework quantities for underdelivery/ overdelivery calculation.

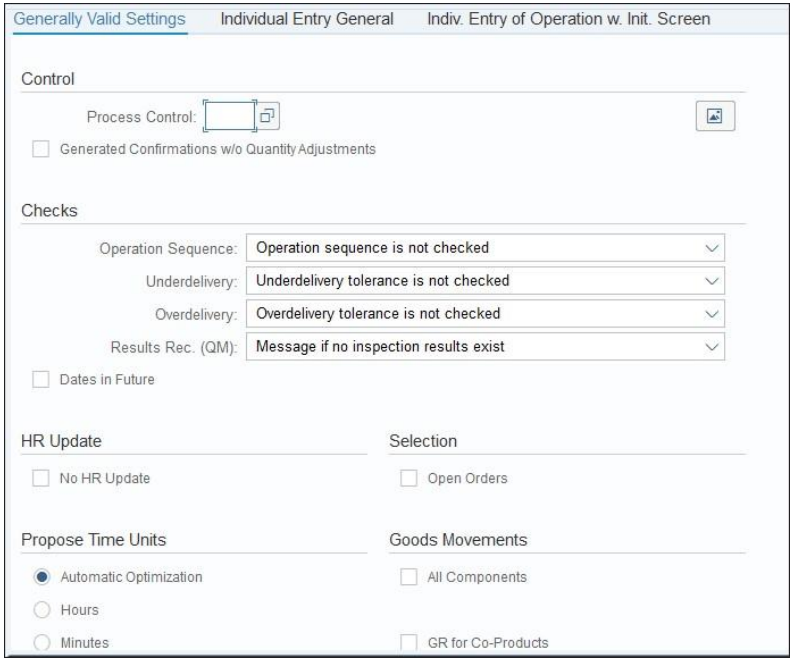


Figure 3.42 Generally Valid Settings Tab of Confirmation Parameters

Note

During the SAP implementation project, you discuss and agree with the client on the level of control required and then make the necessary settings. Generally, the control should neither be too loose nor too stringent to compromise the day-to-day working of business process owners. The level of control also depends on the stability of production processes and business maturity to reflect that optimum production should be within the defined tolerance limits. If there are large variations and deviations in yield, then a less stringent control will suffice.

Tips & Tricks

If you've set the underdelivery or overdelivery control as an error setting, the system won't allow you to exceed the defined tolerance limits. To attend to this, you can make changes in the **Goods Receipt** tab of the production order and perform the confirmation process again. This enables the user to deviate from one-time or limited deviation to the standard tolerance limits.

In the **Results Rec. (QM)** field and for in-process (during production) inspection, the system creates a quality inspection lot for one or more operations. This is an integration point between PP and QM processes. You can control whether the system should check to see if the inspection results of an operation for the inspection lot are already entered before it allows you to perform the confirmation of the next operation.

In the **Goods Movements** area of the screen, you can control whether the system should perform goods movement for all of the components by selecting the checkbox.

Click on the **Individual Entry General** tab, and the screen shown in Figure 3.43 appears. Here, you select the **Confirmation Type** that the system makes available during the confirmation process. It can be a **Partial confirmation**, **Final confirmation**, or an **Automatic final confirmation**.

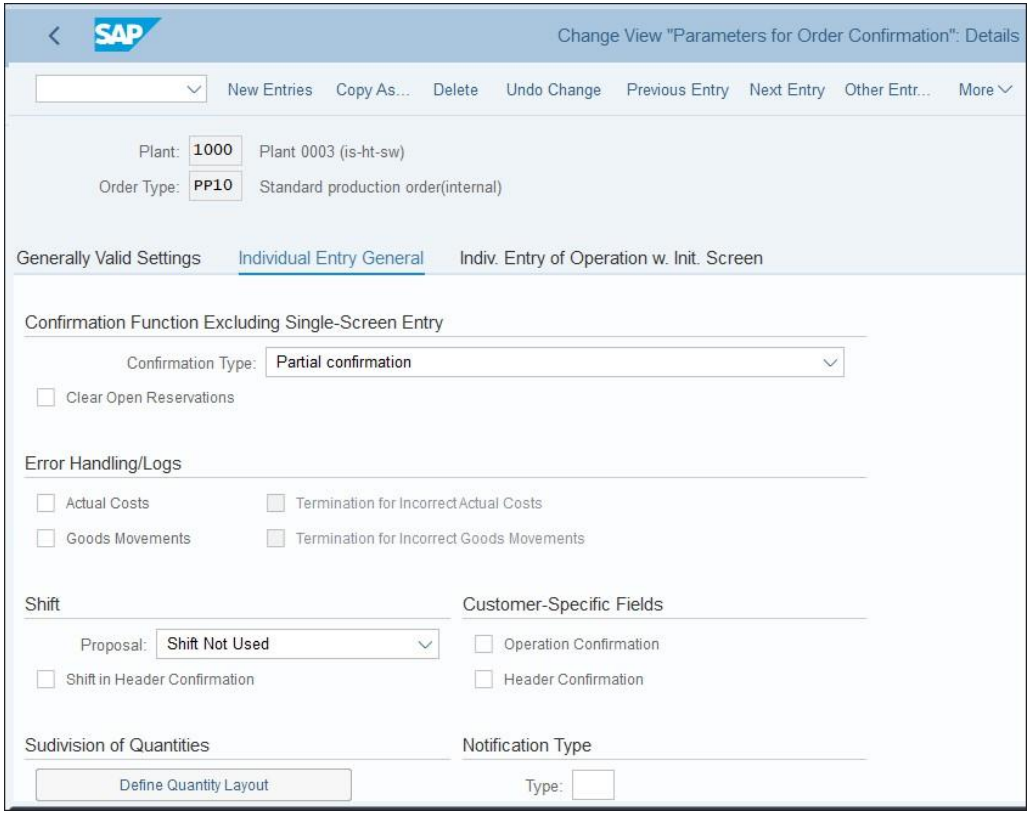


Figure 3.43 Individual Entry General Tab of Confirmation Parameters

The settings depend on how frequently the business performs the confirmation process. If there are large and frequent numbers of confirmations against a production order, then it makes sense to set **Partial confirmation** as the default. When you perform the final confirmation against the production order, you can manually set the **Confirmation Type** as **Final confirmation**. For **Automatic final confirmation**, the system checks whether the confirmed quantity is equal or less than the production order quantity. If it's less, then it automatically sets the status as **Partial confirmation**, whereas if the confirmation quantity is equal to or exceeds the production order quantity, then it automatically sets the status as **Final confirmation**.

For **Actual Costs** and **Goods Movements** in the **Error Handling/Logs** area, you can set whether the system should terminate the confirmation processing until you correct the error.

Click on the **Indiv. Entry of Operation w. Init. Screen** tab, and the screen shown in Figure 3.44 appears. The system offers you a large number of checkboxes to facilitate your data

entry work. For example, if you select the **Propose** checkbox in the **Quantities** area, the system proposes the quantity that you need to confirm for an operation or an order. You can also select the **Display** checkboxes to display any information for your reference purposes.

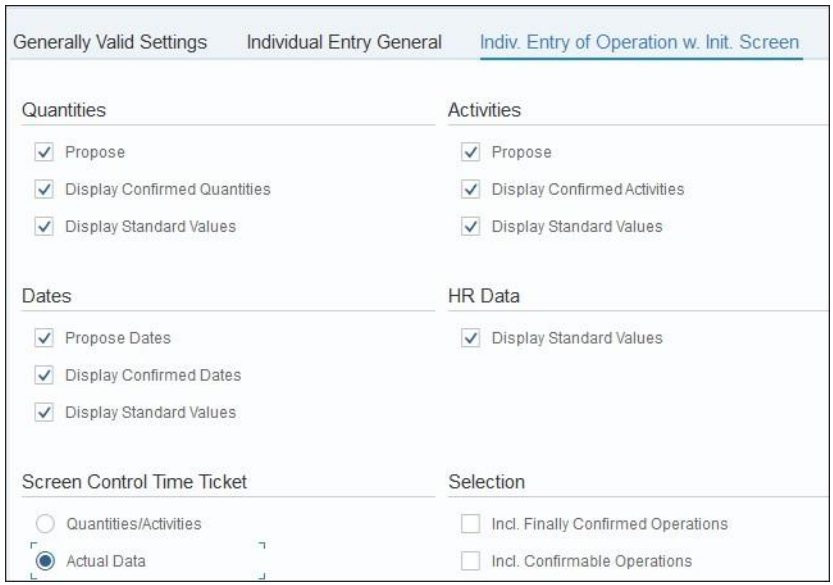


Figure 3.44 Indiv. Entry of Operation w. Init. Screen Tab Confirmation Parameters

We suggest that you select the**Actual Data** radio button in the **Screen Control Time Ticket** area, so that the system automatically proposes the data (quantity and activities) that you need to confirm. If you don't, then on the actual confirmation screen, you can manually click the **Actual Data** icon to bring the data that you need to confirm.

3.12.3 Single Entry Screen for Confirmation

You can control how the system displays the information on the confirmation screen (Transaction CO11N for discrete manufacturing or Transaction COR6N for process industries). In this step, you set up a profile and assign that profile to an individual user in the user parameter CORUPROF.

A profile for a single entry screen controls the user-defined layout for confirmation. In the layout, you can define the fields and the sequence in which they appear on the confirmation screen. For example, if you'd like the provision to enter long text in the confirmation screen to enable the process operator to write extensive shift details, you can select the relevant option. Similarly, you can control whether the system should list the activities to be confirmed as individual fields or in a tabular form.

To define a single entry screen for confirmation, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Confirmation Single Screen Entry Define Single Screen Entry**, or use Transaction OPK0. In Figure 3.45, you define the header area so that during the actual confirmation, the system brings up the relevant fields for you to enter the details. For example, you can choose whether the system should only allow you to enter the confirmation number at the header level or allow you to enter the production order number together with its operation.

Tips & Tricks

At any time, if you want to see how the chosen option will look on the confirmation screen, click on the **Display Detail Areas**, (the magnifying glass), and the system will show you a preview.

In Figure 3.45, once you click on the dropdowns from the **Area** you can select from the large number of options, such as quantities, activities, HR data, short and long text entry provision, dates, and even external IDs if you use a third party product to integrate the confirmation process with the production process. You can choose the sequence in which these details appear on the confirmation screen.

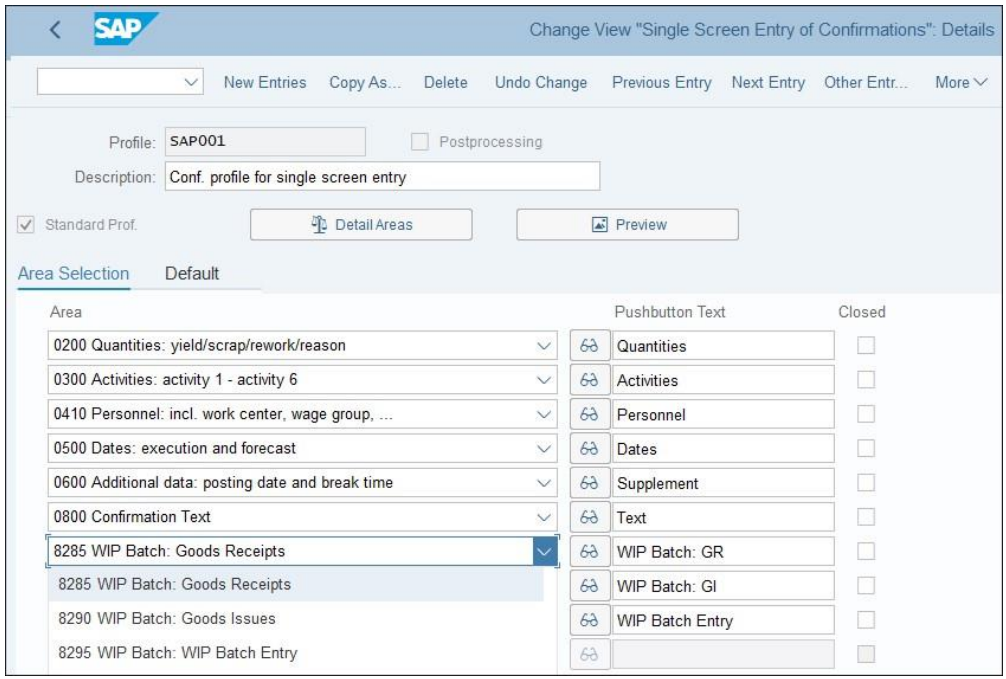


Figure 3.45 Single Entry Screen of Confirmation

In the **Pushbutton Text** fields, you can define the text of the pushbuttons to suit your business needs. The **Closed** checkbox enables you to have a minimized (closed) view of the information on the confirmation screen, which you can open when you're ready for data entry.

Tips & Tricks

To check that your settings are correct with no duplication or other layout error, you can use the **Detail Areas** button for a consistency check. Further, you can use the **Preview** button to simulate the confirmation screen.

Note

You have to activate enhancement CONFPP07 if you want more than one reason for variances. A practical workaround (without activating the enhancement) is that in the screen in Figure 3.45 and the **Detail Areas**, you can incorporate **Additional data: Reason** as many times as you want from the dropdown list.

3.12.4 Time of Confirmation

If you have a large number of confirmations that you need to perform on a daily basis, then it's practical to perform confirmations in the background, such as quantity update or backflush, when there is less of a workload on the system. However, if you want an immediate update of all quantity and activities data posted, you can set the necessary settings. These are the same settings used for the **Process Control** field at the beginning of Section 3.12.2. To set up time of confirmation, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Confirmation Single Screen Entry Define Time for Confirmation Processes**, or use Transaction OPKC. In Figure 3.46, you can choose when the system should update the following:

Auto GR (automatic GR)

Backflush

Actual Costs

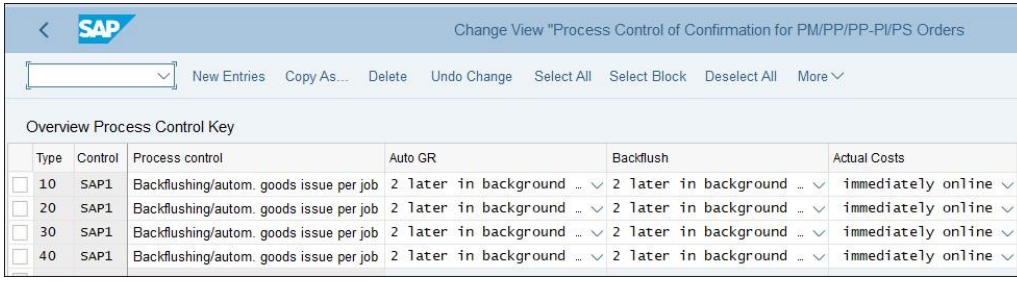


Figure 3.46 Process Control for Confirmation

The available update options are listed here:

Immediately online

Immediately in update program

Later in background job

We cover how you can set up background jobs in Section 3.16.

3.13 Reason for Variances

During confirmation against the production order, when you record the yield, scrap, and rework, you can assign a reason for variance between the planned and actual production. For example, assume that due to machine malfunction or defective components, your actual production was less than planned. You can assign the specific

reason for this deviation or variance. Similarly, when entering the scrap quantity, you can give the reason for variance. Later, when you execute the production order information system (Transaction COOIS), you can filter out the information based on the reason for variance. This helps you get a better understanding of the reasons behind the problems and helps you take corrective or preventive actions.

As a PP consultant during an SAP implementation project, you make a complete list of plant-related reasons for variances and configure them accordingly in the system. You can perform multiple partial confirmations and enter different reasons for variance for each deviation.

Note

If you have the business need to enter multiple reasons for variances, you can engage an ABAP resource and activate enhancement CONFPP07.

You can also assign a user status to a reason for variance to add further control in the confirmation.

Note

To set up a new status profile, use Transaction BS02.

To configure a new reason for the variance for a given plant, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Confirmation Define Reasons for Variances**, or use Transaction OPK5. Figure 3.47 lists the reason for variance for **Plant 1000**. If you select a specific reason for variance and click on the **User Status** folder, the system prompts you to enter the status profile and then the user status.

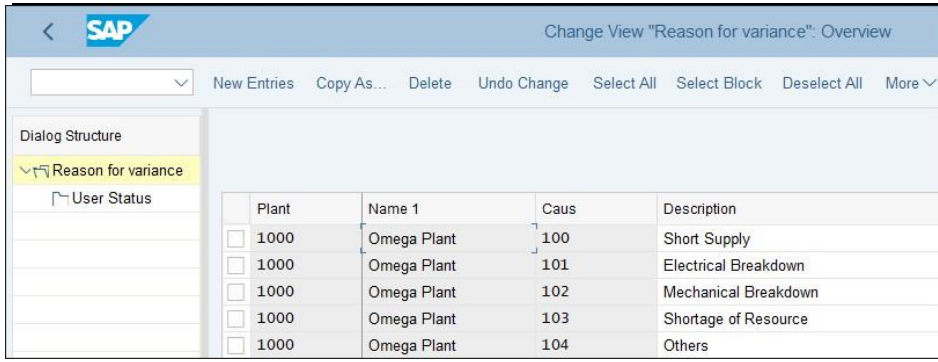


Figure 3.47 Reasons for Variance

3.14 Trigger Points

Trigger points are automatic functions that the system can perform when it's able to meet the user-defined condition. For example, when a user releases an operation, the system can automatically release all preceding operations via a trigger point. Minimal configuration steps are involved in trigger points: you define the trigger point usage and then define a group for the trigger points.

The **Trigger Point Usage** field provides a unique identification to list trigger points that will have common usage. This enables you to quickly select the relevant trigger point based on its usage. To define the (standard) trigger points usage, follow the menu path, **SAP IMG Production Shop Floor Control Master Data Trigger Point Define (Standard) Trigger Point Usage**. On the initial screen, enter an alphanumeric key, and give a short description of the trigger point usage.

You can group all of the trigger points together, which you can then assign to an operation. In doing so, you save the time and effort involved in individually creating and assigning trigger points.

To define a group for standard trigger points, follow the menu path, **SAP IMG Production Shop Floor Control Master Data Trigger Point Define Group for Standard Trigger Points**. On the initial screen, enter an alphanumeric key, and give a short description of the trigger points group.

3.15 Define Print Control

During the production process, you need to print several shop floor papers, for example, production order, pick list, or GI slip. The SAP system offers standard layouts for each shop

floor paper. During an SAP system project implementation, you also engage an ABAP resource to develop new scripts or modify the scripts of the shop floor papers to fulfill client's requirements. You discuss and evaluate with the client all of the shop floor papers needed as printouts. For example, you can eliminate the layout development of confirmation and its printout requirement if you have an SAP system terminal where you can make live data entries or use an upload program to automatically enter confirmation. Further, if you've installed Adobe Document Services, then it's also possible to have PDF printouts of the shop floor papers.

To make necessary settings to print shop floor papers, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Define Print Controls**, or

use Transaction OPK8. The resulting screen in Figure 3.48 lists the shop floor papers that you can individually work on and make the desired settings.

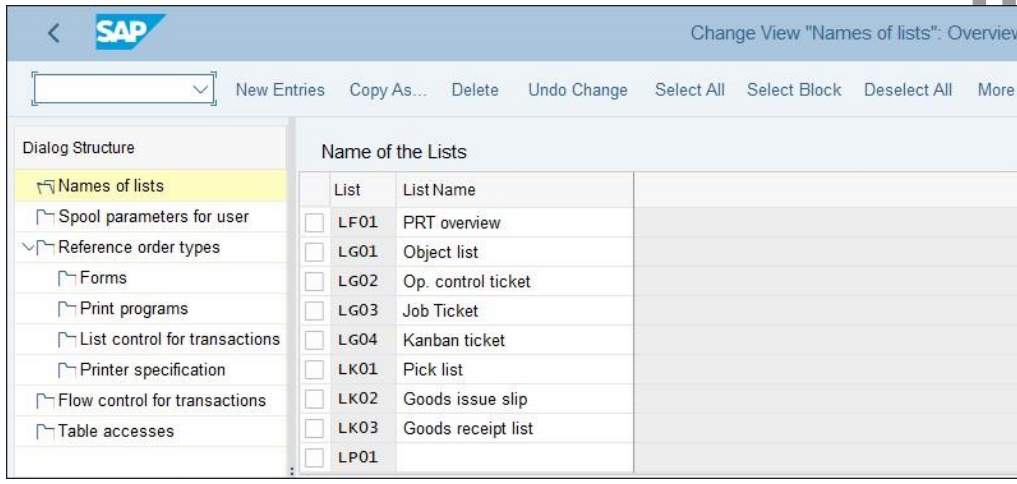


Figure 3.48 Printing Shop Floor Papers

Note

Chapter 6 shows how we used list **LG01** (**Object list**) shown on the right-hand side of Figure 3.48 to get printouts with the SAP system standard layout.

3.16 Background Jobs

To optimize your SAP system's resources, which will help to improve performance and minimize undue burdens, there are several processes you can set up as background jobs. A *background job* enables you to define the frequency with which the system automatically performs the desired function without manual intervention. For example, if you run MRP on a weekly basis and are generally satisfied with the results, you can set up a background job to automatically convert planned orders into production orders.

To set up a background job, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Schedule Background Jobs**, or use Transaction SM36.

We suggest that you use the **Job Wizard** icon because it provides a step-by-step approach of setting up a background job. Table 3.1 lists the program names of selected background jobs that you can set up, and the system asks for this information. Before setting up the background job, you should also set up the variant of the background job, so that the system processes only the relevant data.

Function	Program Name
Convert planned orders into production orders	PPBICO40
Print production orders	PPPRBTCH
Print shop floor papers	PPPRBSEL
Mass processing	COWORKDISPATCHNEW
Confirmation: Componentized processes (GR, GI, HR, actual)	CORUPROC
Confirmation: Fast entry records	CORUPROC1

Table 3.1 Background Jobs

Tips & Tricks

On the initial screen of Transaction SE38, you can enter the program name listed in Table 3.1 and choose **Execute**. The system takes you to the screen in which you can set screen parameters and save them by pressing (Ctrl)+(S) or by choosing **GotoVariantsSave as Variant**.

You can read additional documentation on the background program by clicking on the information icon, where available.

3.17 Summary

The logical and sequential configuration steps that we undertook in this chapter will enable you to perform the same set of steps and activities in configuration steps in process manufacturing. If you follow all of the steps covered in the chapter in a sequential and logical order, you'll be able to cover all of the major business processes and scenarios of production with production orders (shop floor control). See Chapter 6 to find more details that will align with your business processes.

The next chapter covers process manufacturing configuration.

Chapter 4

Process Manufacturing Configuration

Configuration basics in process manufacturing are generally the same as in discrete manufacturing. However, the process management functionality demands in-depth coverage because it's unique to process manufacturing only.

The configuration basics of process manufacturing are similar to those in discrete manufacturing. For example, the steps to define order types, assign number ranges, and define the screen layout for confirmation are the same in both production types. We recommend that you also read Chapter 3 and Chapter 6 for an in-depth understanding of the configuration settings and business processes, respectively.

The focus of this chapter is primarily on the configuration that is unique only to process manufacturing, for example, the master recipe profile that is only used in process manufacturing. At the same time, this chapter gives extensive coverage to the configuration area of process management.

We'll start by covering the standard settings and tools that you can use to optimize most of your configuration work related to process management. We then cover process messages and process message categories, followed by control recipes and process instruction sheets (PI sheets). Next, we'll discuss the process instructions, types, and categories, as well as how the system can facilitate several configuration steps using wizards. Using the scope of generation functionality, you can further reduce the data maintenance efforts involved in process management. We'll also cover background jobs for sending control recipes and how you can send process messages back to the SAP S/4HANA system as scheduled (background) jobs.

The concepts and the basics that you'll learn will enable you to implement a newer and more user-friendly functionality of process management known as Execution Steps (XSteps). You can also transition from process management to XSteps and still use all the configuration steps that you'll learn in this chapter.

We'll also show how the entire configuration undertaken so far facilitates the quick definition, simulation, and activation of process manufacturing cockpits. We present a simple example of how you can use a self-defined process instruction type and incorporate

its details in the PI sheet. When the system sends process messages back to its predefined destination, it also sends the details of the self-defined process instruction characteristic.

Note

Refer to Chapter 1 for features comparison among discrete manufacturing, process manufacturing, and repetitive manufacturing (REM), as well as how to decide which manufacturing type is most relevant for a given industry.

Let's get started.

4.1 Master Data in Process Industries

The master data in process manufacturing is similar to the master data of discrete manufacturing. For detailed configuration settings and business processes, refer to Chapter 3 and Chapter 6, respectively.

The following master data are specific to process industries and will be the main topics covered in this section:

Resource

Materials list (bill of materials [BOM])

Master recipe

Production version

The *resource* in process manufacturing is similar to the work center in discrete manufacturing. The creation of the *materials list* in process manufacturing is similar to the BOM in discrete manufacturing, so we won't cover these master data items here (see Chapter 3 and Chapter 6). For process industries, it's mandatory to have a master recipe and production version in the system. While the configuration of the master recipe has some uniqueness and is covered in this chapter, the creation of the production version is once again the same for discrete manufacturing and therefore isn't covered here.

4.1.1 Master Recipe Profile

Although most of the details in the master recipe profile are the same as in routing, the one exception is the option available for process management. Depending on the

master recipe profile that you use during the creation of the master recipe, the system offers the following options for process management:

Process Instructions XSTEPS

(Execution Steps)

XSTEPS OPTIONAL

If you choose **XSTEPS OPTIONAL** during the master recipe creation, the system provides you the option to either select **Process Instructions** or **XSTEPS**. You can't use both of them at the same time. In addition, if you previously used process instructions in the master recipe and now want to transition to XSteps, the system issues a warning message that you can't revert back to process instructions after you save the master recipe with XSteps activated.

To set up the master recipe profile, follow the menu path, **SAP IMG Production Planning for Process Industries Master Data Master Recipe Define Profile with Default Values**, or use Transaction OPN1. Choose **Profile/Recipe** on the initial screen, which takes you to the overview of the master recipe profile with three entries.

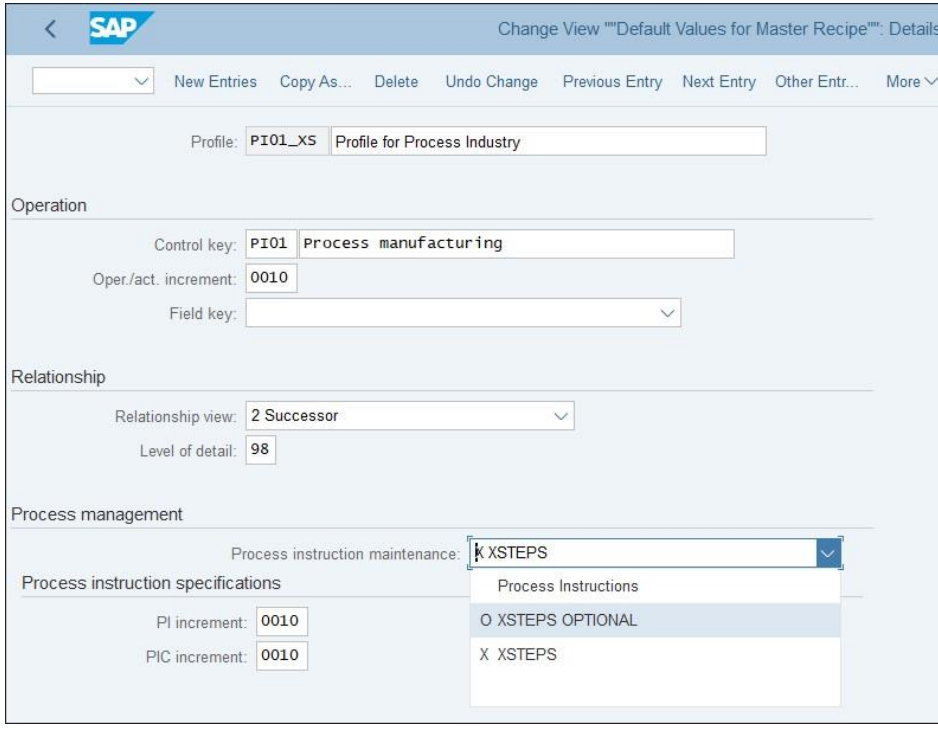


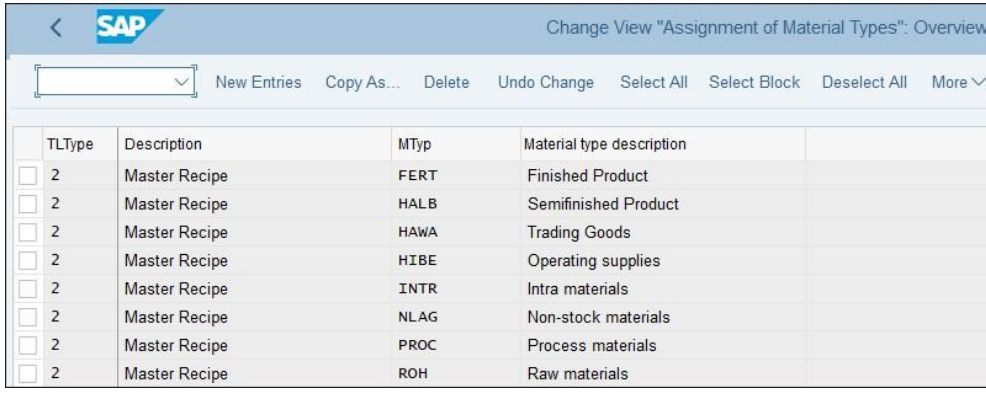
Figure 4.1 Detailed Screen for the Master Recipe Profile

Select **Profile PI01_XS**, and choose the **Details** icon, which leads to the screen shown in Figure 4.1. In this screen, you can update the fields, which then apply when you create the master recipe. Assigning a profile is a mandatory requirement when creating a master recipe. Notice the **Process instruction maintenance** dropdown in the **Process management** area and the available options, including **XSTEPS OPTIONAL**.

4.1.2 Task List Assignment to Material Types

Task list type 2 is used for a master recipe. When you create a process order, the system looks for the relevant master recipe and for task list type 2 to assign it to the process order. A task list consists of operations, phases, activities, control keys, and the relationship to the BOM. If your company has material types other than those available in a standard SAP system, then you need to maintain the task list relationship for each material type.

To define the task list assignment to the material type, follow the menu path, **SAP IMG Production Planning for Process Industries Master Data Master Recipe Assign Material Types**. In Figure 4.2, you can choose **New Entries** to define the task list type (**TLType**) as **2** and the company-specific material types used in process manufacturing.



TLType	Description	MTyp	Material type description
2	Master Recipe	FERT	Finished Product
2	Master Recipe	HALB	Semifinished Product
2	Master Recipe	HAWA	Trading Goods
2	Master Recipe	HIBE	Operating supplies
2	Master Recipe	INTR	Intra materials
2	Master Recipe	NLAG	Non-stock materials
2	Master Recipe	PROC	Process materials
2	Master Recipe	ROH	Raw materials

Figure 4.2 Task List Assignment with Material Type

4.1.3 Task List Status

The standard SAP system offers task list statuses to cater to various business scenarios. For example, when you're in the initial stages of defining the master recipe of a material, you can set the status to **1**, which is for **Creation**. The system won't make this

task list available for selection during process order creation or in production version creation. You can also have a task list that's specific for product cost controlling (COPC), and, in that case, it becomes available for costing purposes but not for production.

To define a task list status at the header level, follow the menu path, **SAP IMG Production Planning for Process Industries Master Data Master Recipe Data for the Recipe Header Define Recipe Status**, or use Transaction OP46.

Figure 4.3 shows that the task list **Status 4** enables you to perform all of the steps, such as using it in production (**RelInd**), using it for costing (**Cstng**), and performing consistency checks (**Cons.chk.**). You can perform a consistency check during master recipe creation to enable the system to point out any deviations or shortcomings in the master recipe that you can deal with before saving. You can even save a master recipe if the system issues warning or error messages that occur during consistency checks, and then you can correct them later.

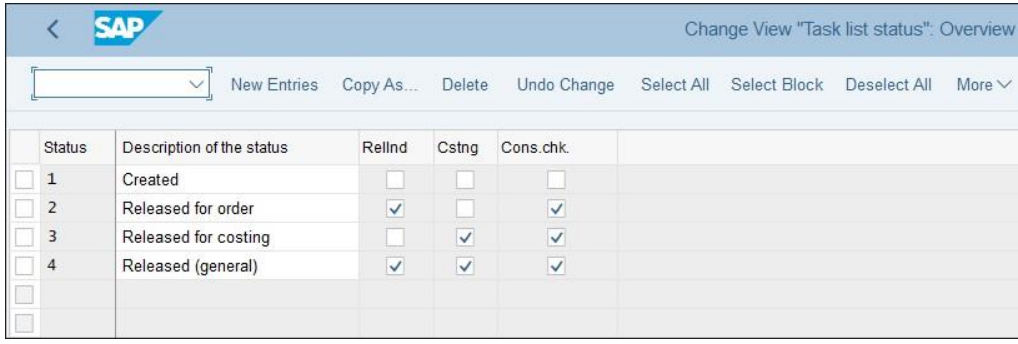


Figure 4.3 Task List Status

4.2 Order Type-Dependent Parameters

To have better control of your order types, you can create different order types within a plant. For example, you may have one order type for finished goods, another for semifinished goods, and a third one to capture rework details from normal production. Each order type can have a separate number range and its own order type settings. Further, you can control authorization to users based on the order type and plant combination. In order type-dependent parameters, you make settings that are applicable each time you create a process order for that specific order type and plant combination.

To set up order type-dependent parameters, follow the menu path, **SAP IMG Production Planning for Process Industries Process Order Master Data Order Define Order Type-Dependent Parameters**, or use Transaction COR4. In the initial screen, select **Plant 1000**

and **Order Type PI01** that leads to the **Master Data** tab. We'll discuss each of the tabs for configuring parameters in the following sections.

4.2.1 Master Data

Figure 4.4 shows the **Master Data** tab of order type-dependent parameters. Here you select **Automatic selection of production version** from the **Production Version** dropdown, and the system assigns the first available production version during planning and production execution steps. Alternatively, you can also use the **Manual selection of production version** option, and the system opens a popup during process order creation to enable you to select a production version manually.

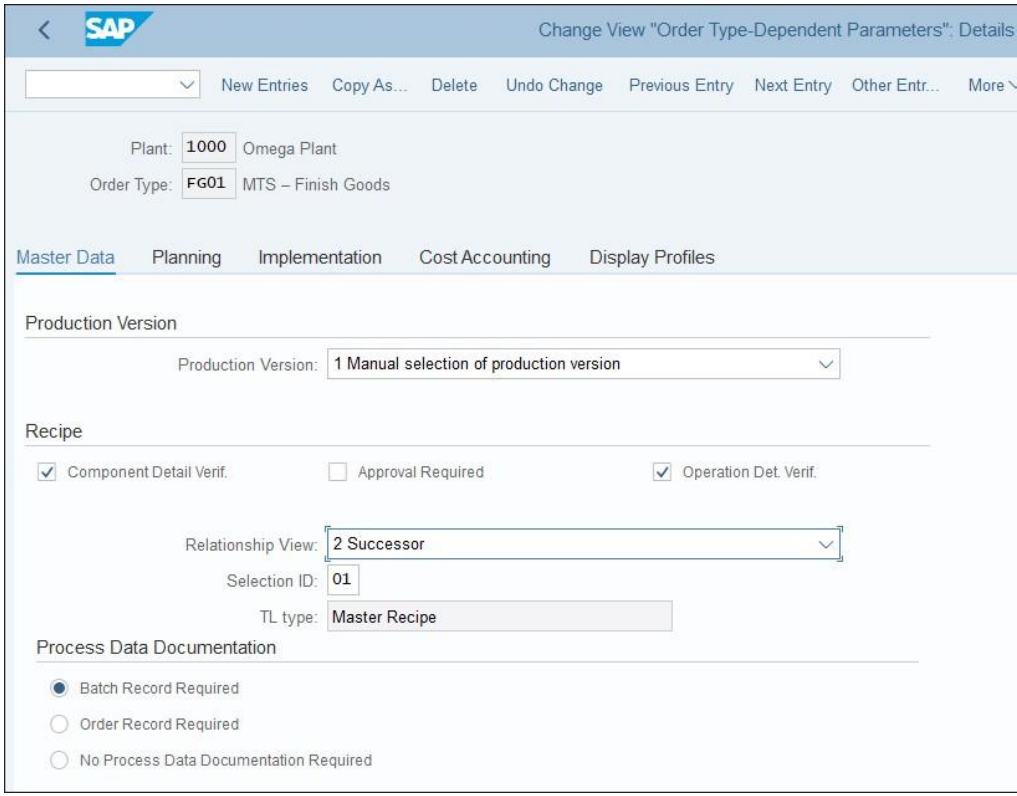


Figure 4.4 Order Type-Dependent Parameters: Master Data Tab

If you select the **Approval Required** checkbox, then the process order must first be approved before it can be released. When a user creates a process order, the system requires the order to be approved before allowing the user to release it. Similarly, if you set up the automatic process order release during creation (in the production scheduling profile), the system overrules the automatic release settings if you've set up the approval process (Section 4.3).

Note

To grant approval to a process order during its creation, follow the menu path, **Process OrderFunctionsApprovalIndividual Approval**.

4.2.2 Planning

In the **Planning** tab, you can select the **Scrap** checkbox if your business process has any such need (Figure 4.5). Normally in process industries, the scrap option or its recording finds less use.

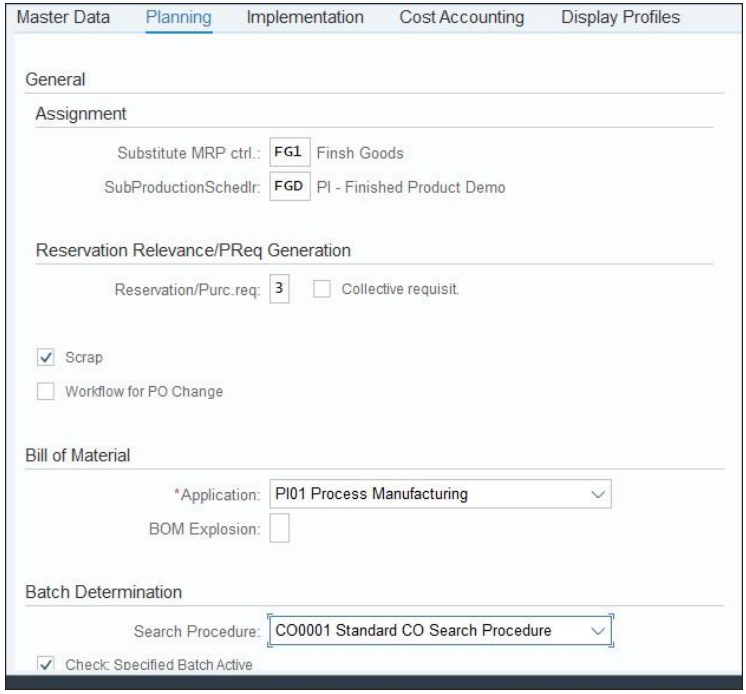


Figure 4.5 Planning Tab

For example, in the fertilizer industry, any visible or overflow material (spilled-over material) is automatically sent back in the production process chain, so there is no scrap recording during production. However, in the steel rerolling industry, it's common to have production scrap, so the **Scrap** option needs to be activated in such business scenarios. You can also assign the relevant inspection type for in-process inspection in the **Planning** tab, as well as make settings for batch determination.

Chapter 9 covers batch management.

4.2.3 Implementation

In the **Implementation** tab, make sure to select all the relevant checkboxes, especially for the **Shop Floor Information System** and **Documentation of Goods Movement** areas (Figure 4.6). If you don't select the checkboxes, the system won't update the logistics information system (LIS), nor will you have the provision to see the documented goods movements (goods issue [GI] or goods receipt [GR]) for the process orders. The documented goods movements in the process order information system (Transaction COOISPI) also won't show any details.

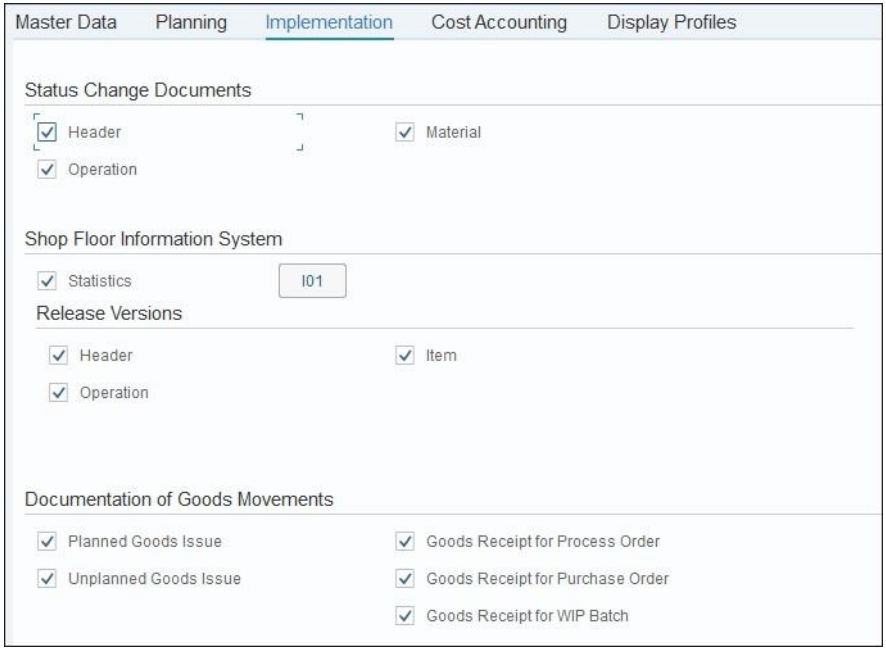


Figure 4.6 Implementation Tab

4.2.4 Cost Accounting

In the **Cost Accounting** tab, we suggest that you coordinate with a controlling resource (responsible for cost object controlling) to ensure that the necessary configuration settings are in place.

4.3 Production Scheduling Profile

The production scheduling profile in process manufacturing is similar to the one in discrete manufacturing. However, in process manufacturing, it provides the option to automatically generate the control recipe when you release a process order. A control recipe enables the process operator to record important plant parameters. We cover the details concerning control recipes in Section 4.4.1.

To set up the production scheduling profile, follow the menu path, **SAP IMG Production Planning for Process IndustriesProcess OrderMaster DataDefine Production Scheduling Profile**, or use Transaction CORY (see Figure 4.7).

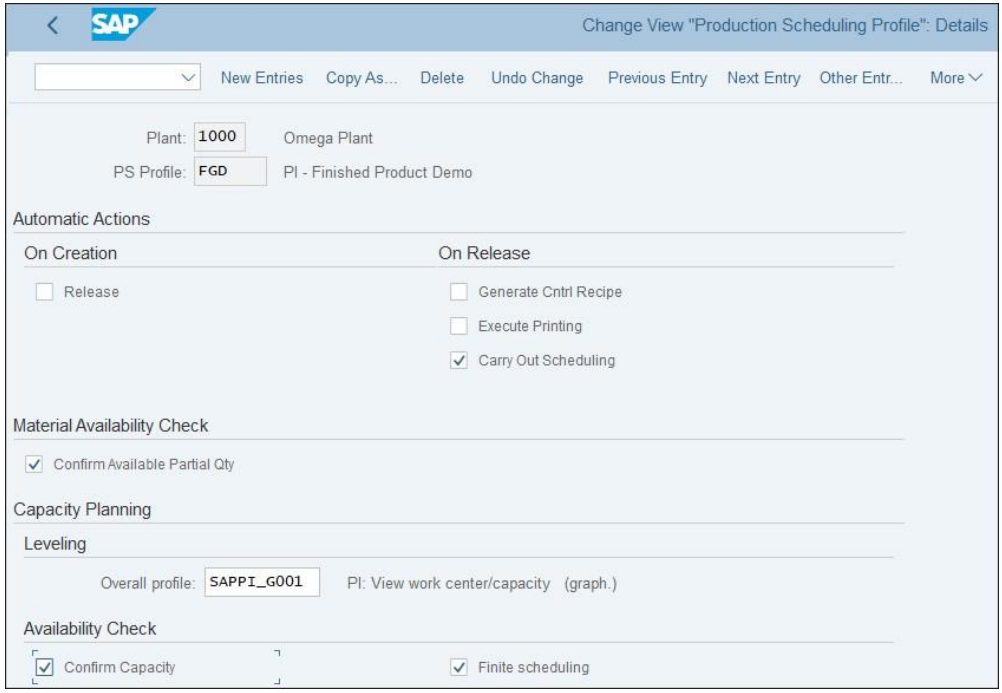


Figure 4.7 Production Scheduling Profile

On the initial screen, select **Plant 1000** and **PS Profile** (production scheduling profile) **FGD**. In this example, we haven't selected the **Generate Cntrl Recipe** checkbox in the **On Release** area (within the **Automatic Actions** area). In Chapter 7, we'll show you how to manually generate a control recipe when you release the process order.

Using Transaction MM02 to change the material master, you can assign the production scheduling profile in the **Work scheduling** tab (see Figure 4.8). Whenever you create a process order of this material and plant combination, the system automatically triggers the settings you made in the production scheduling profile.

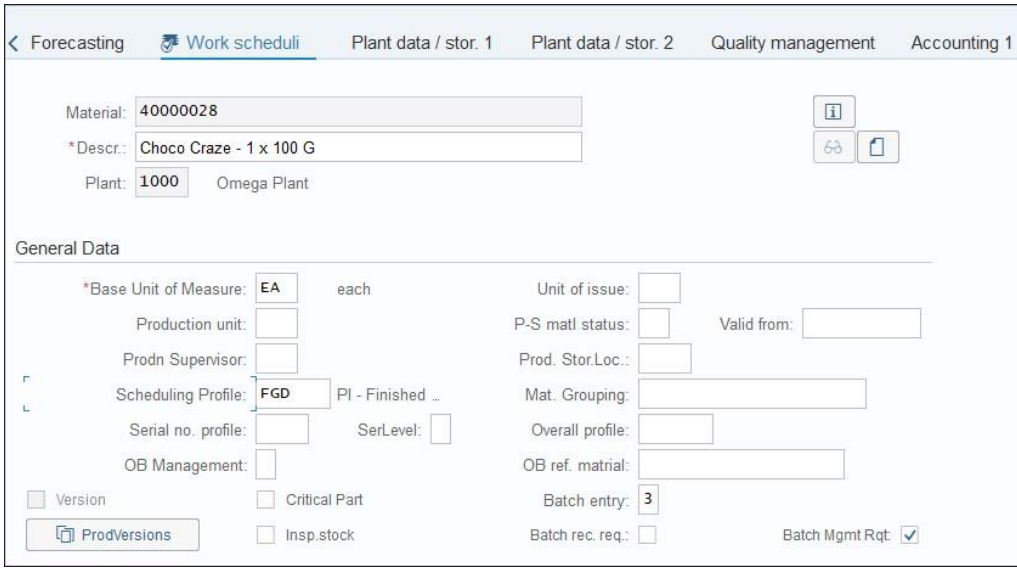


Figure 4.8 The Production Scheduling Profile in the Material Master

4.4 Process Management

Process management falls within the purview of production planning for process industries (PP-PI), which covers all the important elements involved in recording the process parameters' information or performing specific functions. Creating a process order forms the basis for the generation of the control recipe (see Figure 4.9). The control recipe is sent to the process control in the form of a process instruction sheet (PI sheet). The process operator not only follows the instructions given in the PI sheet but also fills in the PI sheet with relevant plant parameters and other important data and returns it as a process message back to either the SAP system or to an external system.

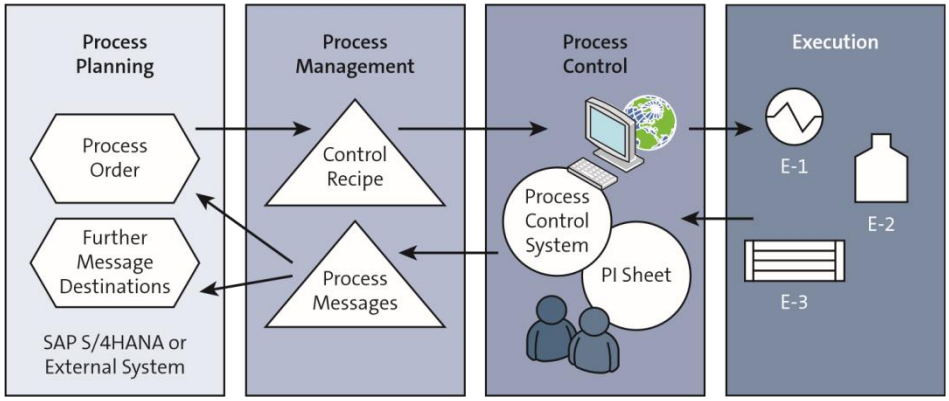


Figure 4.9 Process Management Overview

Although this section applies more to the business process side of process management, it's important to have a basic understanding of the concepts and terminologies used throughout the remaining chapter before moving on to some standard settings and tools

4.4.1 Key Terminology

The important terms used in process management are as follows:

Control recipe destination

The *control recipe destination* specifies the technical address to which a control recipe is transferred. An operation in a master recipe can have several phases, and each phase can have a different control recipe destination. In the process order, you can create one control recipe for each control recipe destination. Therefore, if there are three different phases, it's possible to have three different control recipe destinations (e.g., mixing, blending, and liquid ammonia sections). Typically, at the process order release, the system creates control recipes for each control recipe destination in the process order. All phases of a process order with the same control recipe destination are combined into the same control recipe. A control recipe destination defines whether the process instruction of a phase is transferred to an external system (process control system [PCS]) or is converted to a PI sheet for a line operator. It also specifies which system or line operator executes the process instructions of a phase.

Process instruction characteristic

A released characteristic within a characteristic group is available for use in the process instruction. Process instruction characteristics are allocated to process instructions either directly in the master recipe or by process instruction category. Process instruction,

together with the corresponding characteristic value, determines the information transferred or requested, that is, the status of the control recipe. It also determines how the requested data is processed (e.g., the message category to be used to report the data).

Process instruction category

The process instruction category specifies the type of process instruction (i.e., process parameter or process data request). It also specifies the characteristics of this process instruction, that is, information to be sent via this instruction.

Process message characteristic

A released characteristic within the characteristic group is available for use in process messages. Process message characteristics are allocated to process message categories. Process message characteristics, together with the corresponding characteristic values, determine the content of the process message. The process message can be sent to an external system, SAP Office mail recipients, or custom-defined ABAP tables. **Process message category**

The process message category specifies the characteristics to be allocated to a process message, that is, the information to be sent. It also specifies the message destinations for the process message. Every process message sent via process management must be assigned to a process message category.

PI sheet

A PI sheet is used as an input and output form for plant parameters and is customizable according to individual production processes. This customized PI sheet is part of either configuration activity or master data management. Due to its intuitive features, a PI sheet can be used for many functions, such as calling up a transaction while remaining in a PI sheet, displaying documents, recording shift highlights, posting GI/GR, undertaking confirmation of a phase, calculating results, and jumping to record results for quality inspections.

To create a custom process message or a custom process instruction, you can leverage your knowledge and experience in creating characteristics in the classification system. The only difference between classification and process message/instruction creation is that the former doesn't offer the option to incorporate details specific to

process management. In our example in the following section, we'll show how you can use process instruction to fetch a field, **Process Order Start Date**, from the process order automatically and integrate it in the PI sheet.

Now let's discuss the important one-time settings that you need to make in your SAP system to activate process management. This entails sequence steps, in which you can copy the standard settings delivered by the SAP system to your specific plants.

4.4.2 Standard Settings and Tools

The system offers a large number of standard process messages, process message categories, process instructions, and process instruction categories. These are all available in the SAP system's plant 0001. You can copy all of these standard settings from plant 0001, except process instruction categories, which you need to copy manually. An easier way to do this is to copy the SAP system reference plant 0001 to your desired plants.

You need to perform a few important steps in the right sequence to ensure that minimal work and effort are involved in integrating process management in your business processes. Use menu path, **SAP IMG Production Planning for Process Industries Process Management Standard Settings**, as shown in Figure 4.10.

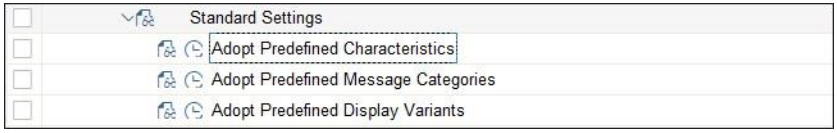


Figure 4.10 Standard Settings in Process Management

Next, follow these steps:

1. Use Transaction O23C to transport predefined characteristics from the SAP systemreference client, which is 0001, to your SAP system client. The **Copy Object Lists** screen appears when you successfully perform the first step.
2. Access Transaction O22C to transport preconfigured process message categoriesfrom the SAP system reference plant 0001 to your plants. The screen shown in Figure 4.11 appears after you enter the target plant.
3. In this example, enter the target plant as "1000". Use the **Copy** icon to copy it to the target plant. The system issues a warning message: **The SAP standard settings are copied to your target plant. Objects with identical names are overwritten.**
4. When you see the **Do you want to copy?** message, click **Yes**.
5. Access Transaction CO60_VM to transport the PI sheet's display variants from theSAP reference plant to your login client. Make sure to select all available display variants, and choose **Save** before you exit the screen.

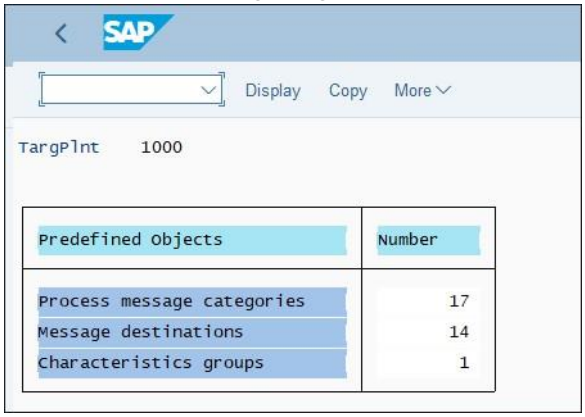


Figure 4.11 Predefined Objects of Process Messages

The SAP system also offers standard characteristics groups in process management, both for process instructions and for process messages. The system groups the process instruction characteristics in group PPPI_01, whereas it groups the process message characteristics in group PPPI_02. When you create a self-defined process instruction or process message characteristic, ensure that you assign it to the relevant characteristics group to enable it to work correctly.

Tips & Tricks

To ensure that you can see the characteristics groups (PPPI_01 or PPPI_02) in the dropdown, click on **Customize Local Layout** (or press (Alt)+(F12)) on the main screen, select **OptionsInteraction DesignVisualization and Interaction**, and then choose **Show Keys within the Dropdown Lists**.

When you implement process management, you need to ensure that you release the process instruction and process message groups to the requisite plants. To release process messages group, use menu path, **SAP IMG Production Planning for Process Industries Process Management Process Messages Define Characteristics Groups for Process Messages Release for Process Messages**, or use Transaction O08C.

To release a process instructions group, use menu path, **SAP IMG Production Planning for Process Industries Process Management Process Instructions Define Characteristics Groups for Process Instructions Release for Process Instructions**, or use Transaction O09C.

If the process messages or process instructions groups aren't defined, available, or released for your desired plant, you can copy them with reference to another plant, where these are available and released.

To copy all settings from reference plant 0001 to your desired plant, use menu path, **SAP IMG Production Planning for Process Industries Process Management Tools Copy Settings between Plants**, or use Transaction O20C. In the ensuing screen, enter the reference plant, which is "0001", and the target plant to which you want to copy the standard system's settings ("1000" in this example).

Tips & Tricks

If you're using a new SAP client for the first time (e.g., production system [PRD]), then there's a possibility that the process management won't work. If that happens, just run Transaction O23C and then Transaction O22C once (and in the same order), and this should solve the problem.

Alternatively, you can also make it a part of your SAP go-live checklist to ensure that you run these two transactions in the PRD system before starting any PP-related data entry in the system.

4.5 Process Messages

Process messages enable the process operator to send the requested data back to the SAP system, which then performs the necessary functions. For example, you want the process operator to inform you (through process messages) about the consumption (GI) of all of the materials used in the production process (against a process order). The process operator fills in the PI sheet, which contains the provision to record actual material consumption details, and marks the status of the PI sheet as **Complete**. The process operator then sends the process message containing the consumption details to the process message destination in the SAP system, after which the system will perform the actual GI posting against the process order in the system.

The system offers a large number of standard process messages and process message categories, but you can still define your own process messages to attend to specific business needs. For example, you might want specific information that the system should send back to the SAP system based on the process operator's input in the PI sheet.

In the following sections, we'll go through the details of how to create or define and set up a process message. Your first step is to create a process message characteristic.

4.5.1 Create a Process Message Characteristic

Your first step is to use menu path, **SAP IMG Production Planning for Process Industries Process Management Process Messages Define Characteristics for Process Messages Create Characteristics for Process Messages**, or you can use Transaction O25C.

For this example, create process message characteristic **ZPI_Creation_Date**, and define the characteristics group (**Chars Group** field) as **Process Message Characteristic** in the **Basic Data** tab. Define the **Data Type** as **Date**. In Chapter 7, we'll show how you can use this self-defined process message to send details back to the SAP system.

4.5.2 Process Message Destination

To create a new process message destination, use the menu path, **Production Planning for Process IndustriesProcess ManagementProcess MessagesProcess Messages DestinationsDefine and Set up Process Messages Destinations**, or use Transaction **O03C.**

For this example, create a new process message **Destination PP10** for**Plant 1000**, and then choose **Target fields/Message destinations** on the left-hand side of the screen. The **Change View** screen shown in Figure 4.12 appears. Here the system allows you to enter the process message characteristic, "ZPI_CREATION_DATE1", which you created in the previous step.

You can set your self-defined process message destination so that the system is able to send the process messages to the defined destination. When the system receives information from process messages, it processes them in the SAP system using function modules. For external systems, the process messages with information are sent back to the SAP system using remote function call (RFC) connections. You can select the **Individual** checkbox (not shown) if you want the system to process each process message individually. This option is generally used in complex process messages involving function module destinations.

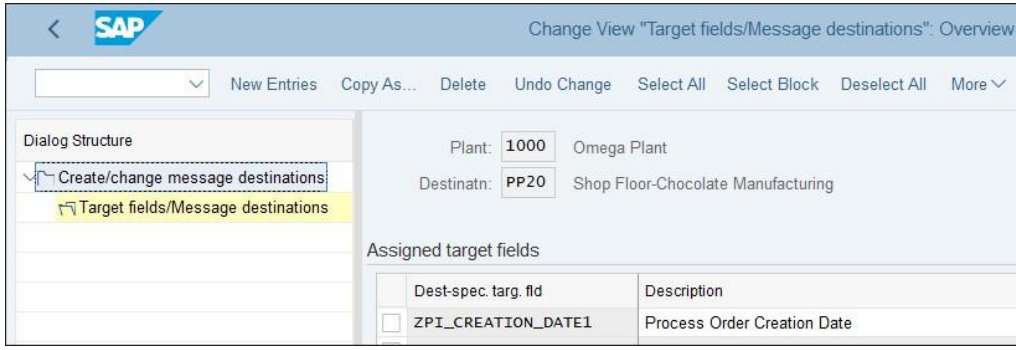


Figure 4.12 Target Field in the Process Message Destination

Note

We suggest that you engage a Basis (SAP NetWeaver) resource to manage the configuration of RFC destinations.

4.5.3 Process Message Categories

In process management, the system first sends the control recipe to the control recipe destination as a manual or automatic (background) job. The plant operator receives the control recipe in the form of a PI sheet and fills in the requisite data. When the data entry is complete, the process operator sets the status of the PI sheet as **Complete**. This enables the system to communicate the data back into the SAP system in the form of *process messages*. The process messages are the instructions to proceed with performing the necessary functions, such as data entry or data updates.

The system embeds the process message category within the process instruction category. For example, the system embeds the process message category PI_PROD within the process instruction category APROD_1. The process instruction category APROD_1 enables you to record the production and also perform GR against the process order through the process message category PI_PROD. When you create a process order, generate a control recipe, send it to the control recipe destination, maintain the PI sheet, and set the status to **Complete**, the system processes the process messages by sending the completed data such as quantity produced or GI to the SAP system, which then process the data using function modules or Business Application Programming Interfaces (BAPIs).

There are several process message categories that cater to different business scenarios, such as the material consumption message, message on control recipe status, confirmation of a phase, or even new batch creation (provided that batch management is already active for the material).

Figure 4.13 shows the list of selected and standard process message categories available in the SAP system. The system automatically assigns the relevant process message category in the process instruction category in the standard offering. For self-defined process message and process instruction categories, you need to ensure that you incorporate the relevant process message category within the process instruction category.

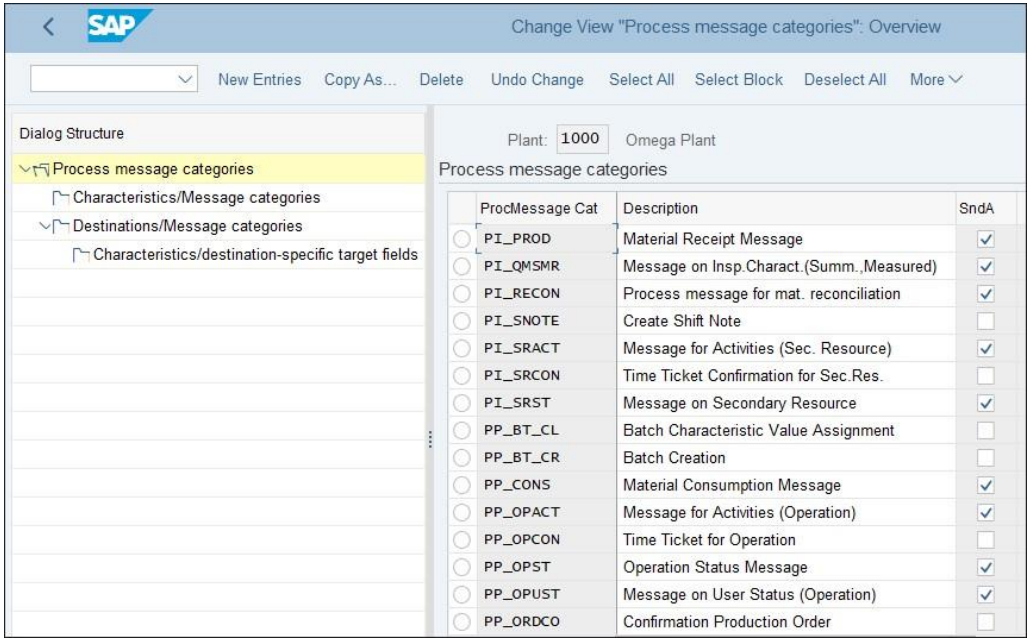


Figure 4.13 Overview of Process Message Categories

The screen shown in Figure 4.14 appears when you select process message category **PI_CONS** and double-click on **Destinations/Message categories**. On the right-hand side of the figure, the system assigns the destination (**Dest**) **PP04** to which it will send the process messages. You can further map source and target characteristics that you want to send to specific destinations.

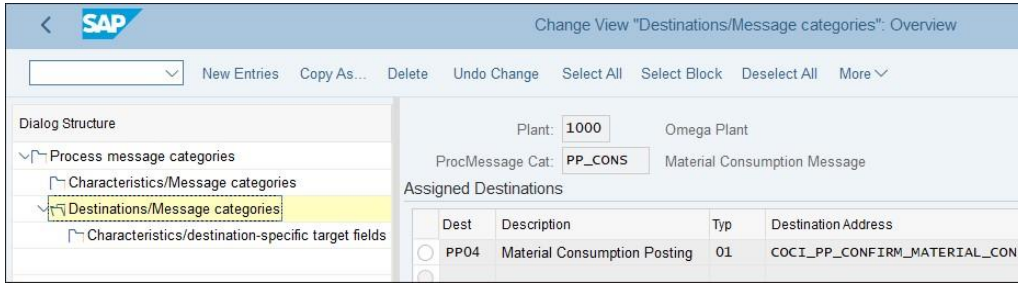


Figure 4.14 Process Message Categories

To view the list of standard process message destinations available in the SAP system, place the cursor on the **Dest** field and press (F4).

The screen shown in Figure 4.15 appears when you select **PP_CONS** in the **ProcMessage Cat** field and select **PP04 Material Consumption Posting** in the **Destination** field.

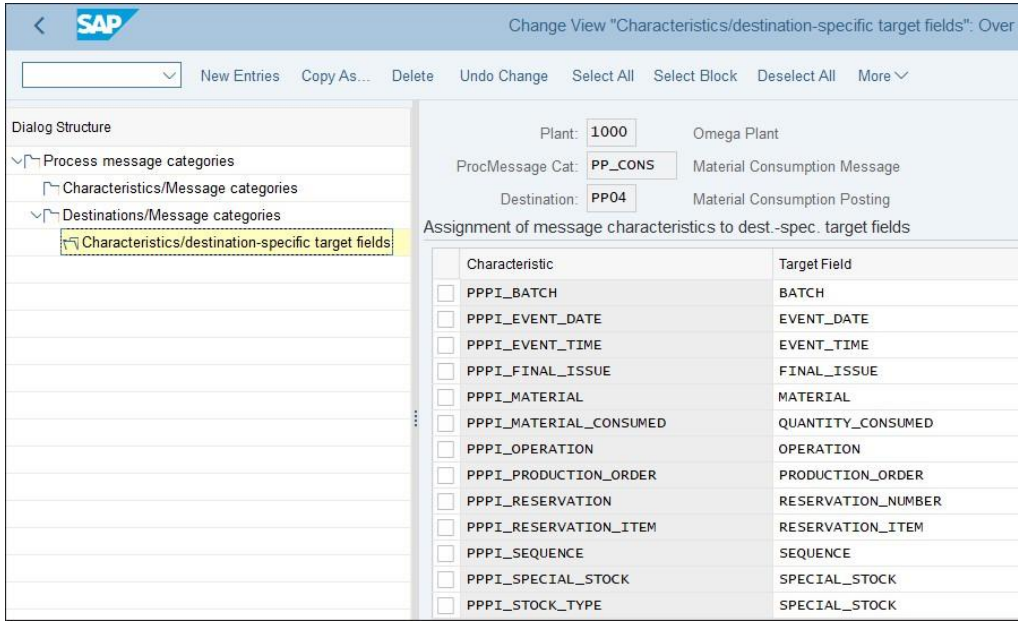


Figure 4.15 Process Message Category PP_CONS and Destination PP04

On the right-hand side of the screen, the system maps each process instruction characteristic (source characteristic) with the process message characteristics (target characteristic/field). The **Characteristic** column lists all of the process instruction characteristics, whereas the

Target Field column enables you to map each process instruction characteristic with its respective process message characteristic.

Now let's walk through the entire set of activities involved in process messages with an example. The example in Figure 4.16 defines the process message category **PP20**.

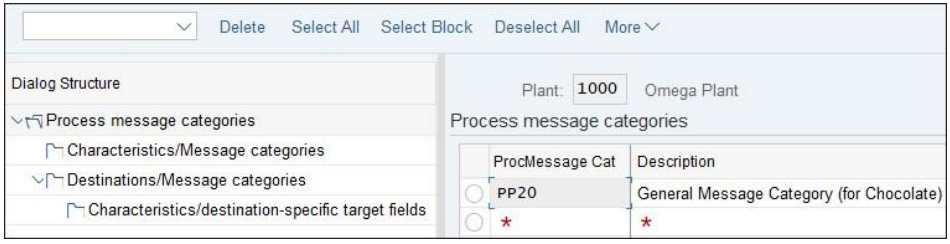


Figure 4.16 Process Message Category PP20 for Plant 1000

Follow these steps:

1. Select **PP20**, and click on **Characteristics/Message categories** to open the screen shown in Figure 4.17. Now you see the **PP20** in the **ProcMessage Cat** field and **1000** in the **Plant** field.

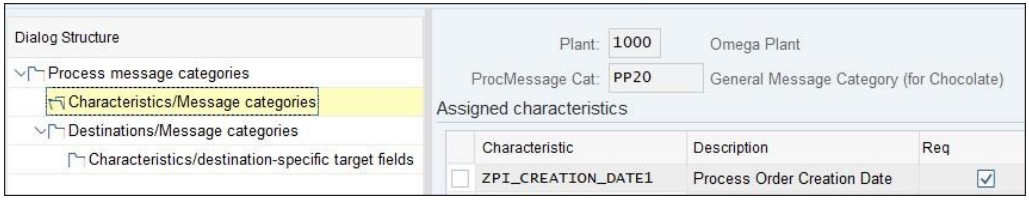


Figure 4.17 Process Instructions Characteristic in the Process Message Category

2. Choose **Characteristics/Message categories** on the left-hand side of the screen, and then on the right-hand side, enter the process instruction **Characteristic** "ZPI_ CREATION_DATE1".
3. Select the **Req** checkbox to denote that it's required (mandatory) to enter details in this field.
4. Double-click on **Destinations/Message categories** on the left-hand side, and the screen shown in Figure 4.18 appears. Incorporate the process message **Destination PP20** (**Shop Floor-Chocolate Manufacturing**), and also assign the destination type (**Typ**), which in this example is **01** or **COCM_PROCESS_RECORD**.

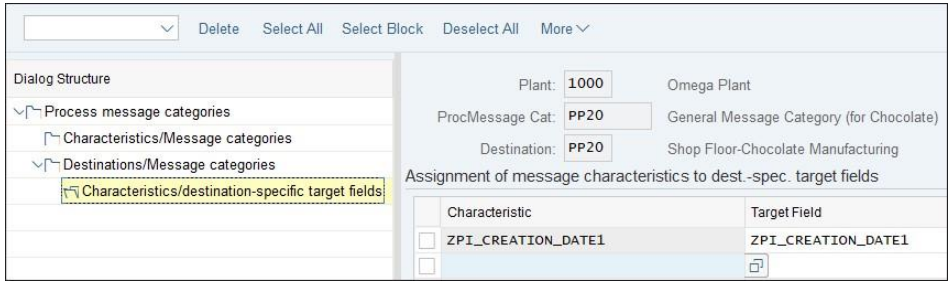


Figure 4.18 Process Message Destination in the Process Message Category

5. Select the **Process Message Destination PP20**, and choose **Characteristics/destinationspecific target fields** on the left-hand side. On the right-hand side of this screen, perform one-to-one mapping of the process instruction characteristic with the process message characteristic at the process message **Destination PP20**. For this example, map process instruction characteristic **ZPI_CREATION_DATE1** with the process message characteristic **ZPI_CREATION_DATE1**.

4.6 Process Instruction Category

A *process instruction category* consists of different process instruction types. In the master recipe, you have to assign the process instruction category, which then automatically incorporates the different process instruction types assigned to the process instruction category.

In the following section, we deliberately took a longer route to explain the various process instruction types to cover the concepts and the fundamentals involved in each type. Toward the end of this section, we also show you how to use the wizard to create any of the seven different process instruction categories for various business scenarios.

4.6.1 Process Instruction Types

When you define the process instruction category, you have to assign a process instruction type to enable the system to process the data accordingly. Eight different process instruction types are available:

Process parameters

Process data requests

Process message subscriptions

Calculations

Inspection results requests

Dynamic function calls

Sequence definitions

Universal

Table 4.1 summarizes the different process instruction types, which are also explained in detail later. Universal isn't included because it applies to all types.

We discuss each of these in the following sections.

Process Instruction Type	Process Instruction Type Description	Usage in PI Sheets (Types 1 and 4)	Usage in External PCS (Types 2 and 3)	Sending Process Parameter Details	Process Message Requests to Process Message Destinations
1	Process parameters	✓	✓	✓	
2	Process data requests	✓	✓		✓
3	Process message subscriptions		✓		✓
4	Process data calculation formulas	✓			✓
5	Inspection results requests	✓			✓
6	Dynamic function calls	✓			✓
7	Sequence definitions	✓		✓	✓

Table 4.1 Process Instruction Categories

Process Instruction Type 1: Process Parameters

Process instruction type 1 is the simplest of all because it only requires the user to enter parameter values. In the PI sheet, you'll see a label for process parameter, into which you enter the parameter value. Figure 4.19 shows the screen for the process instruction category **AMAT_1** for process instruction type **1**. If you use this process instruction type in the process order (or in the master recipe), the system automatically fills in most of the details, such as material number, short text, issuance quantity for the operation, and phase. In column **A** (for automatic), the system automatically fills in all of the requisite fields.

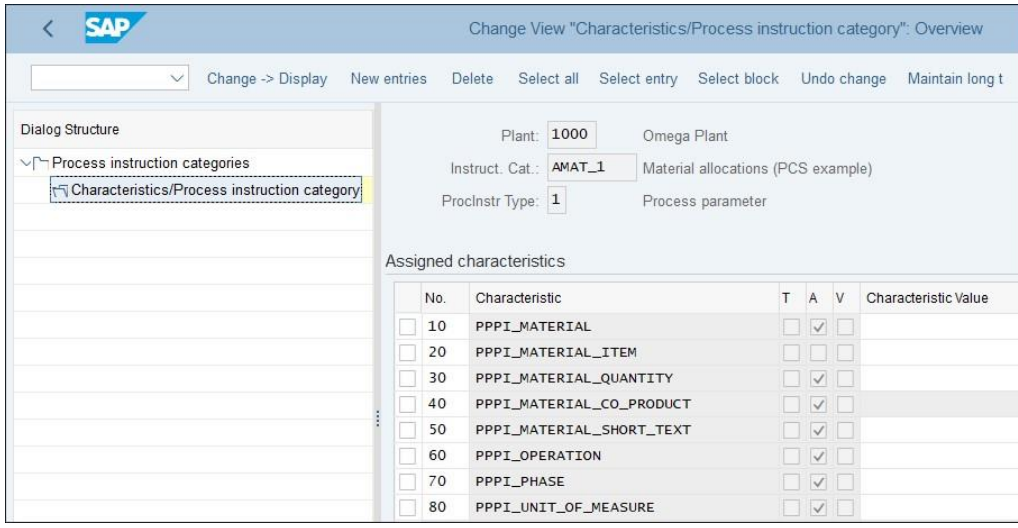


Figure 4.19 Process Instruction Type 1: Material Assignment

Process Instruction Type 2: Process Data Requests

Process instruction type 2 requires the user on the shop floor to enter the required data and send it back to the SAP system through process messages, so that the system is able to perform the necessary data entry or updates. Either the system requires the user to enter the process parameter value manually, or the system can fill in the value automatically, depending on how you've set up the process instruction characteristics. We'll cover both examples of process parameter value entry (manual input as well as automatic).

Figure 4.20 shows the screen for the process instruction category **AQMSMR_1** and process instruction type **2**. It contains the process message category **PI_QMSMR** to enable the system to send back the parameter values that the shop floor operator has entered.

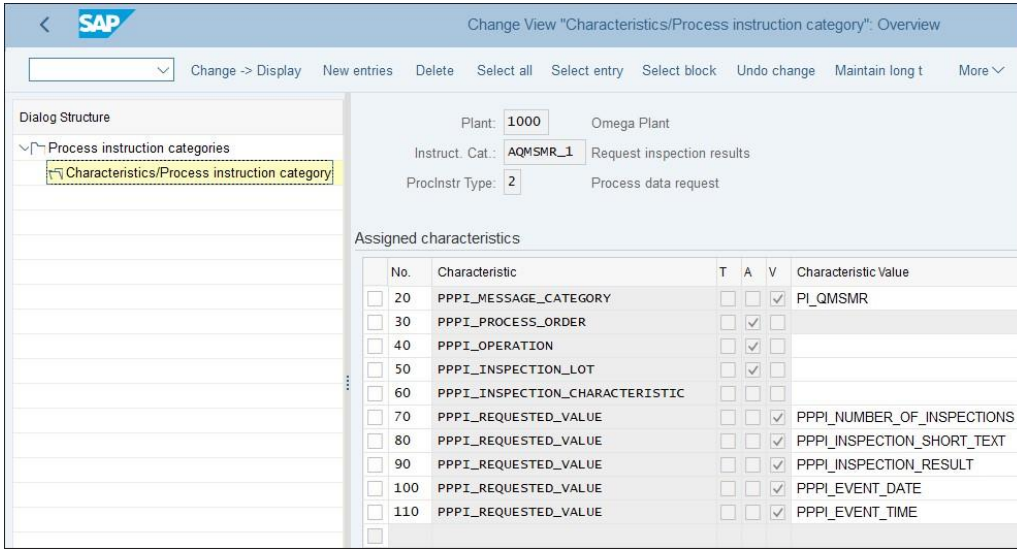


Figure 4.20 Overview of the Control Instruction Category for AQMSMR_1

This example is for quality inspection results for in-process (during production) inspection. The system automatically fills in the **Characteristic Value**, such as operation number and inspection lot number, but you have to maintain the characteristic value for the characteristic **PPPI_INSPECTION_CHARACTERISTIC**. This value is basically the master inspection characteristic (in quality management [QM]), against which you're requesting the process operator to enter the values. The process operator also enters values (**PPPI_Requested_Value**) in the PI sheet. During process messages sending, the system sends the entered information back to the SAP system for further processing.

Another example for process instruction type 2 is the process instruction category **AREAD1**. It contains the process message category **READ** to enable the system to send back the parameter values that the shop floor operator has entered. In the PI sheet, when the process operator enters the parameter value for the characteristic value **PPPI_Material_Quantity**, the system sends this value during the process messages sending. The system automatically fills in the characteristic values for the **PPPI_ Event_Date** and **PPPI_Event_Time**, with the date and time the user enters the requested process parameter values.

Later, we'll also show how the system automatically fills in the characteristic value for a self-defined process instruction characteristic.

Process Instruction Type 3: Process Message Subscriptions

Figure 4.21 shows the screen for the process instruction category **APROD_1** and process instruction type **3**.

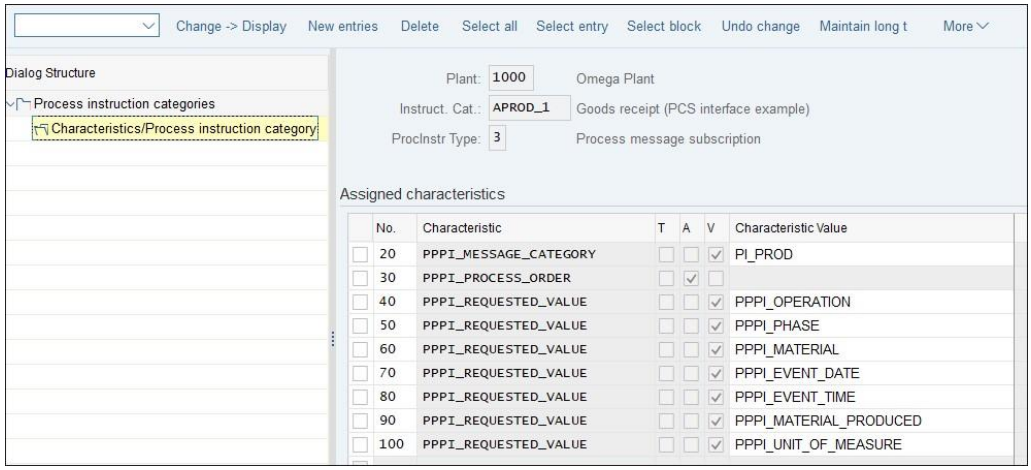


Figure 4.21 Process Instruction Type 3: Process Message Subscription

It contains the process message category **PI_PROD** to enable the system to send back the parameter values that the shop floor operator has entered. In this specific example, the process operator sends the quantity produced against the process order for which the operator wants to record GR against the process order. The process operator records the goods produced information in the PI sheet and sets the status of the PI sheet as **Complete**. Upon processing the process message, that is, sending it back to the SAP system, the system updates the goods produced information in the process order and also creates the material and accounting documents.

Process Instruction Type 4: Calculations

In this process instruction type, the system can perform calculations in the PI sheet based on the calculation formula that you've defined. The system uses the process message category to send back the calculated value to the predefined destination.

The standard process message category is NREAD.

Table 4.2 provides the details of some of the important process instruction characteristics that you can use for calculation. You may also refer to Figure 4.22.

Characteristic	Characteristic Value	Details

PPPI_INPUT_ REQUEST	KS PRODUCTION	You can define any characteristic value, and the system displays it accordingly in the PI sheet.
PPPI_VARIABLE	B	This is the variable that you can define for the calculated value.
PPPI_EVENT	PARAMETER_ CHANGED	If you use this characteristic and its value, the system automatically does the calculation. If not, you have to manually choose the **Calculator** icon to trigger calculation.
PPPI_ CALCULATED_ VALUE	NH3_02	This characteristic value was already created using Transaction CT04 and is assigned here. It governs and controls several parameters, such as whether the field input is mandatory, whether a negative data entry is possible, or whether you can select a value from the dropdown option in the PI sheet.
PPPI_ CALCULATION_ FORMULA	A*20	This is the calculation formula. The variable A needs to be previously defined in the PI sheet. You can use up to eight lines of characteristic to define a long or complex formula.
PPPI_UNIT_ OF_MEASURE	KG	This is the unit of measure of the calculated value.

Table 4.2 Process Instruction Characteristics for Calculation

In the screen shown in Figure 4.22, you can give a field description to the **Characteristic PPPI_INPUT_REQUEST**, and the system will display it in the PI sheet. Further, you can define the formula that the system will use in the calculation in the value field for **Characteristic PPPI_CALCULATION_FORMULA**. If the formula is too long to fit on one line, you can enter the formula in up to eight characteristics. All you have to do is add a new line, enter the characteristic "PPPI_CALCULATION_FORMULA", and continue entering formula details in the value field until the formula is complete.

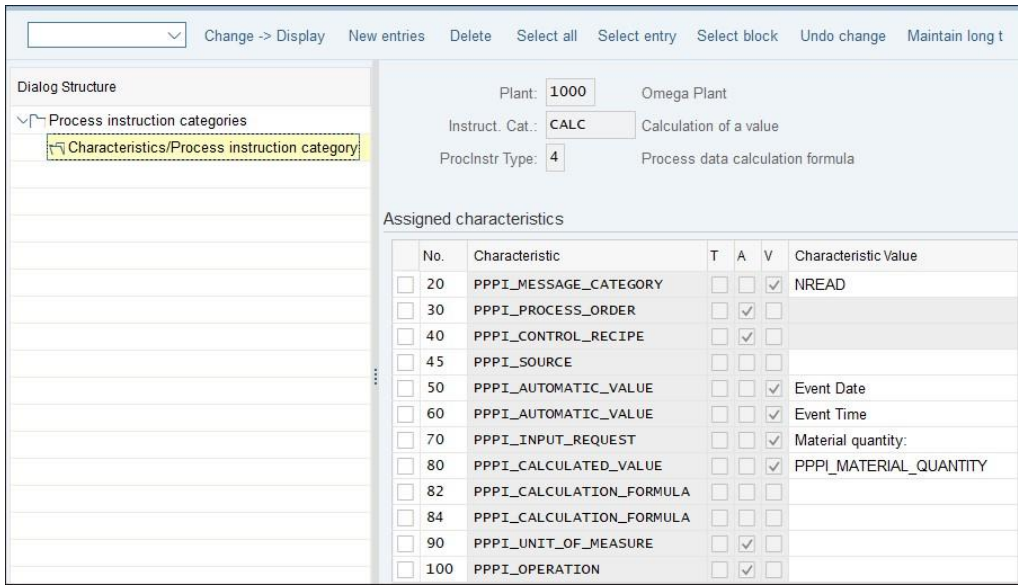


Figure 4.22 Process Instruction Type 4: Calculation

Process Instruction Type 5: Inspection Results Requests

In this process instruction type, you can navigate to the screen or transaction within the PI sheet, in which you can record inspection results of an operation or a phase. In other words, it provides the option to record the quality results. The standard process instruction category available for operations is QMJUM; for phase, it's QMJUM_PH. Depending on the process instruction category that you select, you can then define the operation (see Table 4.3) or the phase (see Table 4.4).

Characteristic	Characteristic Value	Details
PPPI_OPERATION	–	The operation for which you want to record quality inspection results

Table 4.3 Process Instruction Type 5 for Operation

Characteristic	Characteristic Value	Details
PPPI_PHASE	–	The phase for which you want to record quality inspection results

Table 4.4 Process Instruction Type 5 for Phase

Process Instruction Type 6: Dynamic Function Calls

Process instruction type 6 uses the dynamic function call, wherein you can call any SAP system transaction in the PI sheet to facilitate your business process. For example, before you initiate the process of GI against a process order within the PI sheet, you want to quickly check the stock overview of the materials. Similarly, while remaining in the PI sheet, you also want to perform the phase confirmation of the process order. In the first example, you can call Transaction MMBE for a stock overview. In the second example, you can call or navigate to the phase confirmation Transaction COR6N.

Table 4.5 provides an overview of each process instruction characteristic and its function.

Characteristic	Characteristic Value	Details
PPPI_FUNCTION_ NAME	COPF_CALL_TRANSACTION	The system uses this function module to call up a transaction.
PPPI_BUTTON_TEXT	Display Process Order	The system displays the text **Display Process Order** (or any other text) on the pushbutton in the PI sheet.
PPPI_FUNCTION_ DURING_DISPLAY	Allowed	This control function determines whether the system should show or forbid display of the desired information.
PPPI_EXPORT_ PARAMETER	NEW_SESSION	–
PPPI_INSTRUCTION	–	–
PPPI_EXPORT_ PARAMETER	TCODE	–
PPPI_TRANSACTION_ CODE	COR3	This is the transaction code that we want to display in the process order.

Table 4.5 Process Instruction of Type 6

In Figure 4.23, the process instruction category **C_DURAT** enables you to calculate the duration.

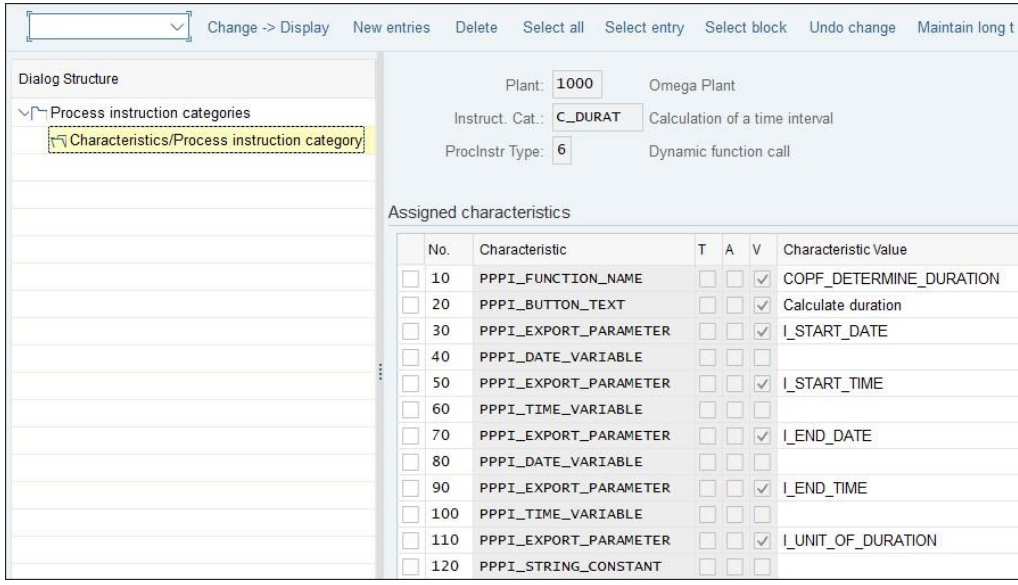


Figure 4.23 Process Instruction Type 6: Calculation of Duration

For each export parameter (**PPPI_EXPORT_PARAMETER**), such as **I_START_DATE** or **I_START_TIME**, you can enter the values in **PPPI_STRING_VARIABLE**, and the system automatically calculates the duration. You may use this duration for calculating machine hours or production duration. The system uses function module COPF_DETERMINE_DURATION.

Process Instruction Type 7: Sequence Definitions

When you incorporate process instruction type 7 in the process instruction of a master recipe, the system prompts you to enter the phases' relationships with each other. This enables the system to provide the business process owner with the necessary control so that unless a predecessor phase is complete, the successor phase can't start, or its data entry in the PI sheet can't be made. When you send the process message of a predecessor phase, only then will the system enable you to enter the details of operation of the next (successor) phase. In this process instruction type, you assign the following process instruction character, along with its value (see Figure 4.24).

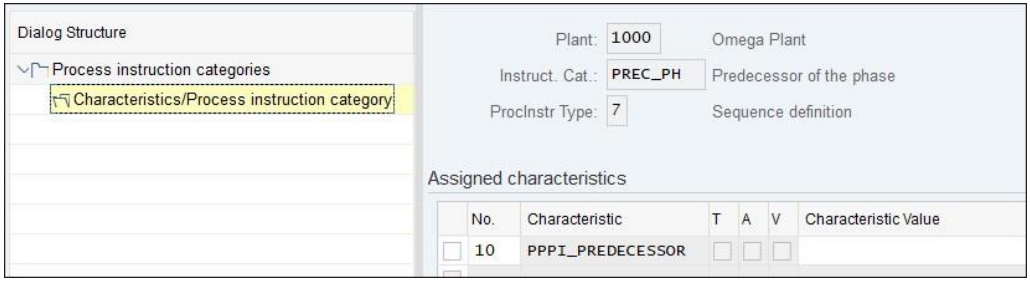


Figure 4.24 Process Instruction Type 7: Sequence Definition

Process Instruction Type 0: Universal

Now that you know how each process instruction type differs, you can use process instruction type 0 to attend to specific business processes that the standard process instruction types don't cover. In addition, if you plan to implement the process manufacturing cockpit, you need to define all of your process instruction categories of type 0 to enable the system to use it. See Section 4.9 on configuring the process manufacturing cockpit in the SAP system.

4.6.2 Using a Wizard or Process Instruction Assistant

With the exception of process instruction type 0, you can use a wizard to help you define the category of each process instruction type. For example, if you want to create a new process instruction type 4 (calculation) for a new process instruction category, you can use the **PI assistant** button to open this step-by-step instruction tool, which eliminates the need to know the complexities involved, such as characteristics PPPI_INPUT_VALUE.

Table 4.6 is the list of standard process instruction categories available in the SAP system to enable business users to perform routine process management functions.

PI Category	PI Category Description	PI Category Type
AACT_1	**Activity for phase (PCS example)**	1
ACONS_1	**Matl Consumption (PCS Interface Example)**	3
ACRST_I	**Change ctrl recipe status (PCS example)**	3
AMAT_1	**Material allocations (PCS example)**	1

Table 4.6 Available Process Instruction Categories

PI Category	PI Category Description	PI Category Type
AOPST_I	**Change operation status (PCS example)**	3
AORD_1	**Order data (PCS example)**	1
APHACT_1	**Confirmation of activity (PCS example)**	3
APHAR_1	**Parameter for phase (PCS example)**	1
APHASE_1	**Phases (PCS example)**	1
APHSQ_1	**Predecessor/successor of a phase**	1
APHST_1	**Change phase status, minimum scope (PCS)**	3
APHST_2	**Change phase status incl. resource (PCS)**	3
APHST_I	**Change phase status, all charact. (PCS)**	3
APROD_1	**Goods receipt (PCS interface example)**	3
AQMSMR_1	**Request inspection results**	2
AREAD1	**Request a measured value**	2
AREAD2	**Request two measured values**	2
ASRACT_1	**Confirm. of activity for sec.res. (PCS)**	3
ASRST_I	**Status of secondary resource (PCS)**	3
BATCH_CL	**Value assignment to batch characteristic**	2
BATCH_CR	**Batch creation**	2

Table 4.6 Available Process Instruction Categories (Cont.)

CALC	**Calculation of a value**	4
CONF_PH	**Confirmation - create for phase**	6
CONS_1	**Material consumption, minimum scope**	2
CONS_2	**Material consumption, batch in message**	2
CONS_3	**Mat.consumption, storage locat. in mess.**	2
CONS_4	**Mat. consumption, reservation in message**	2
CONS_5	**Mat.consumpt., final issue ind. in mess.**	2

PI Category	PI Category Description	PI Category Type
CONS_BDR	**Mat.consumption, batch determinat., split**	2
CONS_BDS	**Mat. consumption, batch determination**	2
CONS_C	**Mat. consumption, target/actual value**	2
CONS_I	**Material consumption, all message char.**	2
CRST_I	**Change control recipe status**	2
C_DURAT	**Calculation of a time interval**	6
C_END_T	**Calculation of an end date**	6
C_STRT_T	**Calculation of a start date**	6
DOC_SHOW	**Display a document**	6
DOC_SHW2	**Show document via URL**	0

Table 4.6 Available Process Instruction Categories (Cont.)

INSTR	**Control instruction with note**	1
MAT_CALC	**Call material quantity calculation**	6
MFLOW_BW	**Material flow, backward flushing**	2
MFLOW_FW	**Material flow, forward flushing**	2
MI_HUCMP	**Identification**	6
MI_HUCNS	**Separate GI posting for HU**	6
MI_HUSQU	**Sequence check for HUs**	6
MI_HUSTC	**Check completeness of picking**	6
MI_HUSTG	**Picking for HUs**	6
MI_MATBA	**Mat.ident. on material/batch level**	6
PHST_1	**Change phase status, minimum scope**	2
PHST_I	**Change phase status, all charact.**	2
PH_ACT	**Activity confirmation for phase**	2
PH_CON	**Time ticket confirmation for phase**	2
PMC_LAY1	**Ex.: Layout definition with 2 frames**	0
PMC_LAY2	**Ex.: Layout definition with 3 frames**	0
PMC_LAY3	**Ex.: Layout definition with default style**	0

Table 4.6 Available Process Instruction Categories (Cont.)

PMC_LAY4	**Ex.: definition of a header area**	0
PMC_LAY5	**Ex.: layout definition w/ simple style**	0
PM_MDOC	**Message for meas. point, plant maint.**	2
PREC_PH	**Predecessor of the phase**	7
PROD_1	**Goods receipt, minimum scope**	2
PROD_2	**Goods receipt, batch in message**	2
PROD_3	**Goods receipt, storage location in mess.**	2
PROD_4	**Goods receipt, order item in message**	2
PROD_5	**Goods receipt, final deliv. ind. in mess**	2
PROD_I	**Goods receipt, all message characterist.**	2
QMJMP	**Jump to QM results recording for operatn**	5
QMJMP_NS	**Jump to QM for new sample drawing**	6
QMJMP_PH	**Jump to QM results recording for phase**	5
QMJMP_SD	**Jump to sample-drawing processing**	6
QMRES	**Record a value relevant to QM**	2
QMRES_PH	**Record inspection result for phase**	2
READ1	**Request a measured value**	2
READ2	**Request two measured values**	2
READ2_S	**Tabular request with signature**	2

Table 4.6 Available Process Instruction Categories (Cont.)

READR	**Data request with display of oth. values**	2
RECON	**Material Reconciliation**	6

Table 4.6 Available Process Instruction Categories (Cont.)

PI Category	PI Category Description	PI Category Type
SIGN	**Request a signature**	2
SR_ACT	**Activity confirmat. for sec.resource**	2
SR_CON	**Time ticket confirmation for sec.res.**	2
SR_END	**End of secondary resource**	2
SR_START	**Start of secondary resource**	2
TA_CALL	**Call any transaction**	6
TMS_CNS1	**Matl Consumption: Batch Mgmt Reqmt/Phase**	2
TMS_CNS2	**Matl Cons.: No Batch Mgmt Reqmt/Phase**	2
TMS_CNS3	**Matl Cons.: Batch Mgmt Reqmt/Operation**	2
TMS_CNS4	**Matl Cons.:No Batch Mgmt Reqmt/Operation**	2
TMS_PP	**Represents RMS Process Parameter**	2
TMS_PPT	**Represents RMS Process Parameter (Text)**	2
TMS_PROD	**Goods Receipt, Minimum Scope**	2
TMS_PR_F	**Label Printing: Finished Product**	6
TMS_PR_I	**Label Printing: Stream**	6

Table 4.6 Available Process Instruction Categories (Cont.)

4.6.3 Creating a Self-Defined Process Instruction Category

Now that we've covered the basics of the process instruction category, let's create a self-defined process instruction category of type 0 as an example. In Chapter 7, we'll show how to use this self-defined process instruction category PP20.

To create a new process instruction category, use menu path, **SAP IMG Production Planning for Process Industries Process Management Process Instructions Define Process Instruction Categories (General)**, or use Transaction O12C.

On the initial screen that appears, enter "1000" in the **Plant** field, and choose the **Continue** icon to open the screen shown in Figure 4.25.

The screen that appears shows the list of available process instruction categories for **Plant 1000**. Notice the **ProcInstr.type** field and if you place the cursor on this field and press (F4), the system shows a dropdown list of process instruction types. These are the same process instructions that we covered in Section 4.6.1. Choose **New Entries**, and you'll see the screen as shown in Figure 4.25.

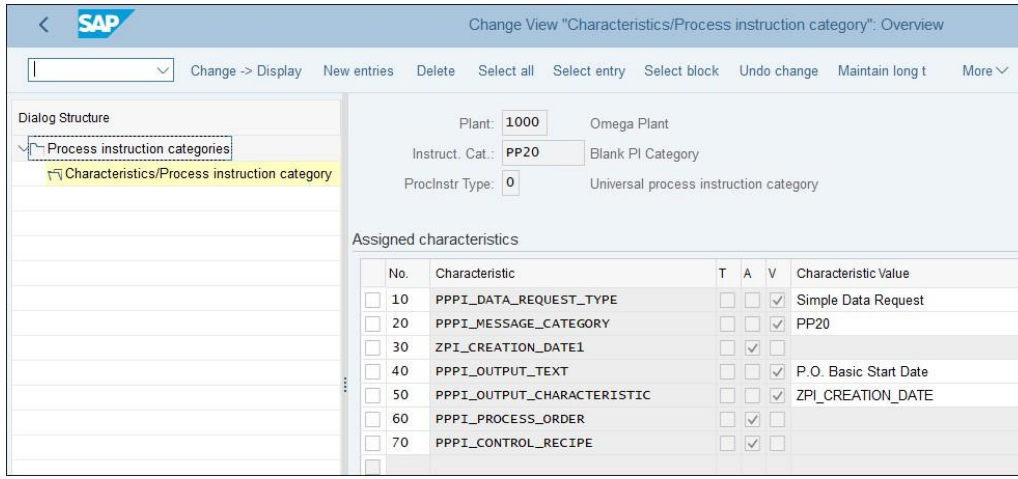


Figure 4.25 Overview Screen of Process Instruction Category PP20

In the initial screen that appears, define the process instruction category **PP20** of type **0** (universal) and give a short **Description**. Next, select the **Process instruction category**, and double-click on the**Characteristics/Process instruction category** field on the left-hand side of the screen to enter specific process instruction characteristics. For this example, enter the characteristics as shown in Table 4.7.

Characteristic	Characteristic Value
PPPI_DATA_REQUEST_TYPE	Simple Data Request
PPPI_MESSAGE_CATEGORY	PP20

ZPI_CREATION_DATE1	
PPPI_OUTPUT_TEXT	**P.O. Basic Start Date**
PPPI_OUTPUT_CHARACTERISTIC	**ZPI_CREATION_DATE**
PPPI_PROCESS_ORDER	
PPPI_CONTROL_RECIPE	

Table 4.7 Process Instruction Characteristics in Self-Defined

Process Instruction Category PP10

Table 4.7 consolidates the configuration that you've made so far. It incorporates the process message category PP20 as well as the self-defined process instruction characteristic ZPI_CREATION_DATE. See Section 4.6.4 to create a self-defined process instruction characteristic. Also note that the system automatically fills in the characteristic values that are blank in the preceding table.

4.6.4 Creating a Self-Defined Process Instruction Characteristic

Although the SAP system offers a large number of standard process instruction (and process message) characteristics, unique business processes or business needs often require custom-defined or self-defined characteristics.

Example

The process operator wants to refer to specific information for a process order or its operations in the PI sheet. You notice that this isn't available in the standard offering. Similarly, there are some standard fields for which you want the process operator to send back the requisite information through process messages. The option to selfdefine the process instruction characteristic offers the flexibility that you can choose a large number of fields in the production process and use them to bring together different information in the PI sheet.

For our example, create a simple self-defined process instruction characteristic that automatically fetches the process order start date when the user creates the process order.

You can use this characteristic to display this information (process order end date) in the PI sheet. Although this example uses automatic value assignment—that is, the system automatically fills in the date field—you can also use it to request that the process operator send the requisite information in the form of a process message. You also use process instruction characteristics to define the RFC destination to which you want to send process instructions to an external control system.

To create a new process instruction characteristic, follow the menu path, **SAP IMG Production Planning for Process Industries Process Management Process Instructions Define Characteristics for Process Instructions Create Characteristics for Process Instructions**, or use Transaction O25C.

Figure 4.26 displays the initial screen to create the process instruction characteristic. Notice the similarities that you find in creating a standard characteristic (Transaction CT04) when compared with creating a process instruction characteristic.

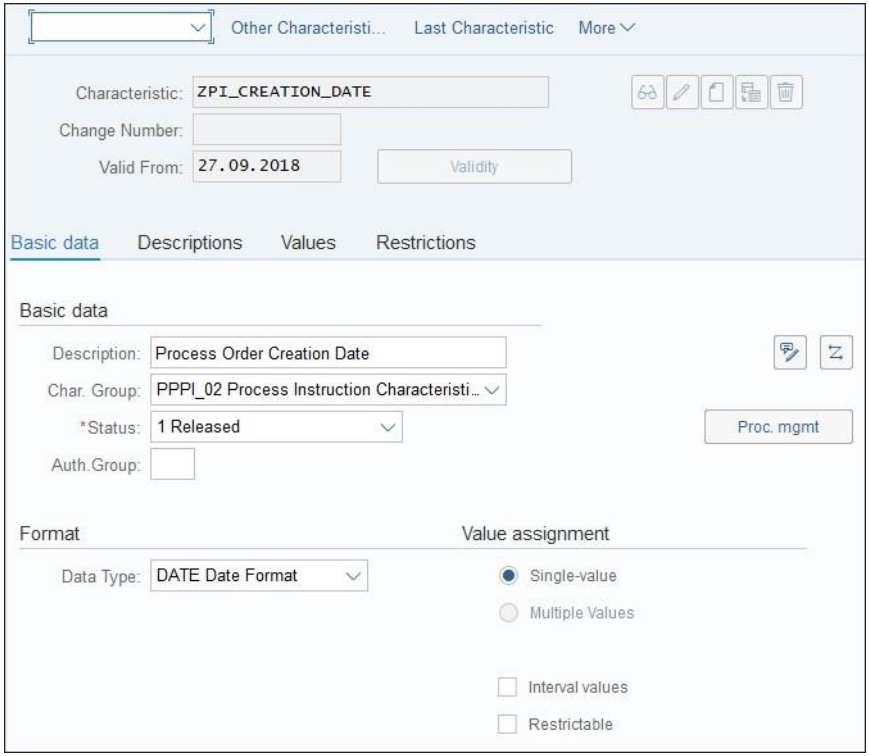


Figure 4.26 Initial Screen to Create a Process Instruction

For this example, create **ZPI_CREATION_DATE,** and click on the **Basic data** tab. In this tab, it's important to ensure that the **Char.** (characteristics) **Group** is defined as a process instruction characteristic (**PPPI_02**). This is the same characteristic group that we covered in Section 4.4.2.

Define the **Data Type** as **DATE Date Format**, and click on the **Proc. mgmt** icon. The system displays a popup that allows you to incorporate additional process instructions and process messages details. If you place the cursor on the **Table** field and press (F4) or click on the dropdown option, the dialog box shown in Figure 4.27 appears. This screen provides you the option to select any of the five tables available: **Process order (header)**, **Operation**, **Phase**, **Resource**, and **Material (header)**. Depending on the table that you select, the system displays the fields associated with it.

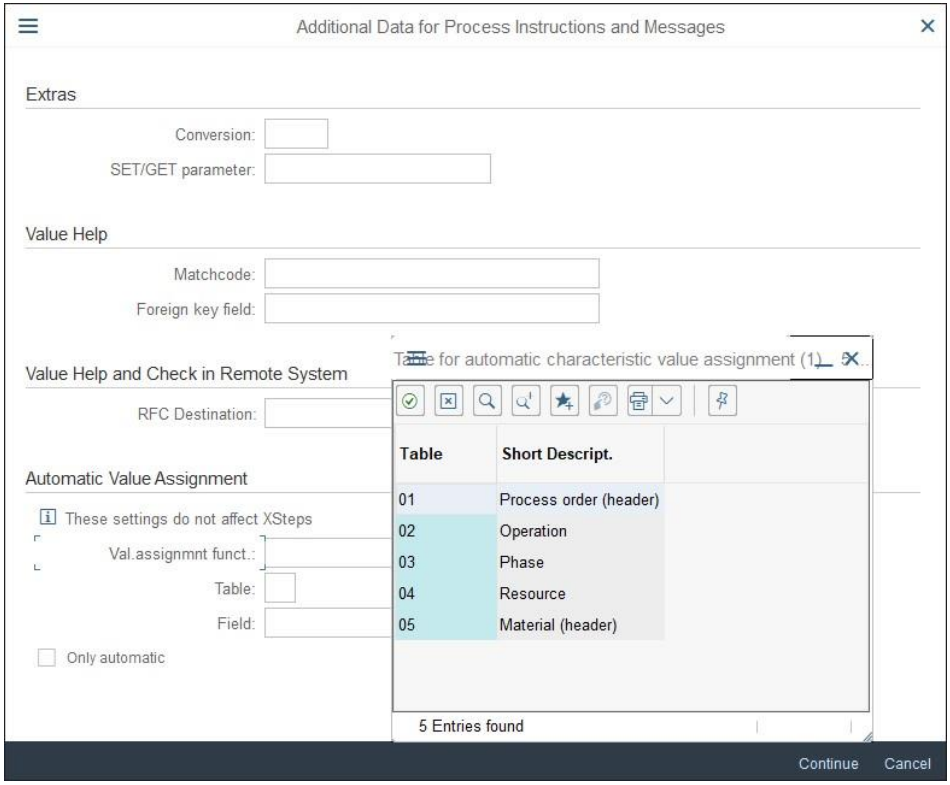


Figure 4.27 Automatic Value Assignment for Process Order Tables

For this example, select **01 Process order (header)**, and the system brings you back to the previous screen. This time, place the cursor in the **Field** field, and again press (F4) to see a

limited selection of fields that are available in the process order table. Select the **Field GSTRP**, which is the technical name of the process order start date (see Figure 4.28).

Figure 4.28 Automatic Value Assignment of the Basic Finish Date in the Process Order

Apart from entering the **Table** and the **Field**, select the **Only automatic** checkbox to enable the system to automatically fill in the requisite information in the process instruction characteristic and save it. When the user creates the process order, and the system assigns start and finish basic dates of the process order, the system fetches the basic start date of the process order and makes it an integral part of the PI sheet.

Tips & Tricks

If your business process involves the creation of a simple process instruction characteristic, then you can use Transaction CT04 (which doesn't have a process management option) to create characteristics and ensure selection of the correct characteristic group.

4.7 Control Recipe/Process Instruction Sheets

There are four types of control recipe destinations. Two of these are used when you want to transfer information within the SAP system. The other two facilitate the transfer of information with external systems. The system creates a control recipe when you release a process order. This creation of the control recipe can be automatic (controlled in order type-dependent parameters, Section 4.2), or you can generate it manually. Creating the control recipe and then sending the PI sheet to its destination enables the process operator to begin recording important plant parameters.

Table 4.8 provides the necessary details on the different types of control recipes.

Control Recipe Destination Type	Destination Location	Output Type
1	SAP system	ABAP list-based PI sheet
2	External control system	External control system
3	External control system	External system
4	SAP system	Browser-based PI sheet

Table 4.8 Control Recipe Destination Types

If the control recipe destination is of either type 1 or 4, then the system sends the recipes to different destinations within the SAP system. The system creates a control recipe, either user-driven (manually) or automatically, and consolidates the process instructions for a given order and destination in the form of the PI sheet. The PI sheet contains user-defined details, for example, process notes, process steps, input fields, calculations, options to sign the phases of the PI sheet, details to enter GI (consumption), and navigation to the confirmation screen or to record in-process quality results. When the process operator sets the status of the PI sheet to **Complete**, the system sends the data back to the SAP system in the form of process messages. The system then uploads the information from the process messages into the SAP system tables using function modules and BAPIs. If the control recipe destination is of either type 2 or 3, then the system consolidates the process instructions in the control recipe of the process order and sends them to external PCSs.

An internal SAP system destination can be any logical or virtual destination where the process operator receives the PI sheet and fills in the data. For example, internal destinations can be mixing unit, packing unit, blending, ammonia section, urea section, or quality section. For external destinations, that is, external PCSs, these are the RFC destinations of the external system.

You can also integrate a digital signature using an SAP system login and password. The following options are available for use with digital signatures:

Activating or deactivating the PI sheet

Locking or unlocking PI sheet

Changing the status of the PI sheet to **Complete**

Entering each parameter value in the PI sheet

Digital signature options are also available in case a parameter value deviates from predefined limits, as well as for completion of each phase in the PI sheet. If you want to automatically generate process instructions to minimize maintaining them in the master recipe, you can do so when creating the control recipe destination. See Section 4.7.2 for information on the scope of generation. In the following sections, we'll explain how to set up a control recipe destination, as well as make the necessary settings for the scope of generation for process instructions.

4.7.1 Create a Control Recipe Destination

To create a new control recipe destination, follow the menu path, **SAP IMG Production Planning for Process Industries Process Management Control Recipe/PI Sheets Control Recipe Destinations Define and Set Up Control Recipe Destinations**, or use Transaction O25C.

In the screen shown in Figure 4.29, create a new control recipe destination **PP** of **Type 4** (browser-based PI sheet). Give a short description as well as the **Destination address**

as **PRODUCTION FLOOR-CHOC. MANUF.** Select the **SortMat** checkbox to enable the system to display materials in the same order they appear in the master recipe or in the process order. If you place the cursor on the **Type** field and press (F4) or use the dropdown option, you'll see the four different types of control recipe destinations available to choose from (this is the same as in Table 4.8).

Figure 4.29 Control Recipe Destination: Overview

Figure 4.30 shows the details screen to create the control recipe destination. The options to incorporate digital signatures in some or all of the processes are shown.

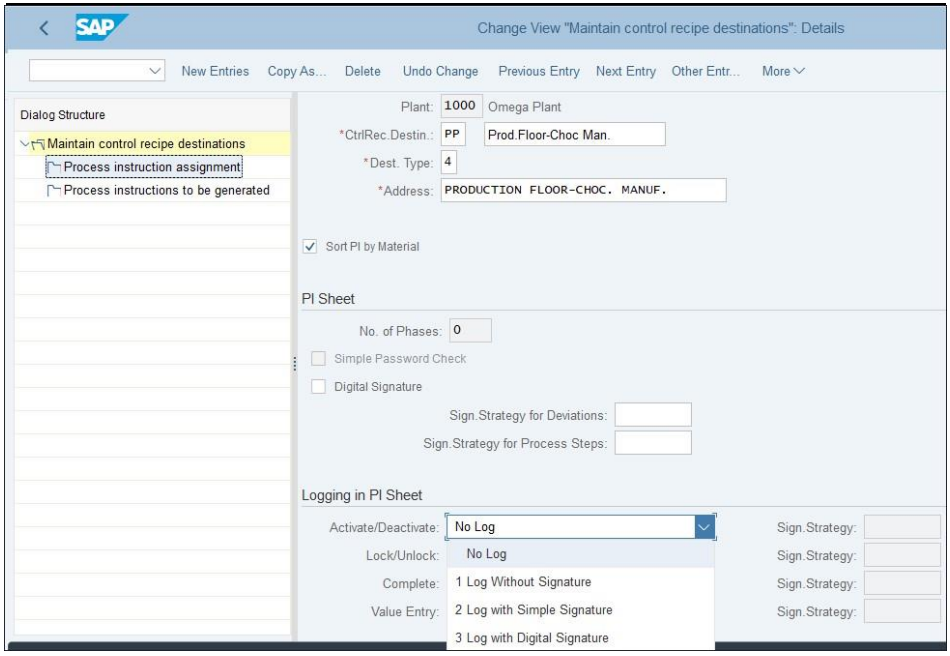


Figure 4.30 Maintaining Control Recipe Destination Detail Screen

4.7.2 Scope of Generation

In some situations, the process operator enters the same data. You can automate the entry of this data so that it's the same every time with the use of scope of generation.
This is helpful in the following situations:

To confirm the quantity produced or activities consumed at the end of each phase To enter shift details at the end of every phase or operation

To ensure that each master recipe created for a specific destination should have standard instructions and notes, which then become visible in the PI sheet

Figure 4.31 shows the **New Entries: Overview of Added Entries** screen that appears during the creation of control recipe destination **10** for **Plant 1000** and when you choose **Process instructions to be generated** on the left-hand side of the figure.

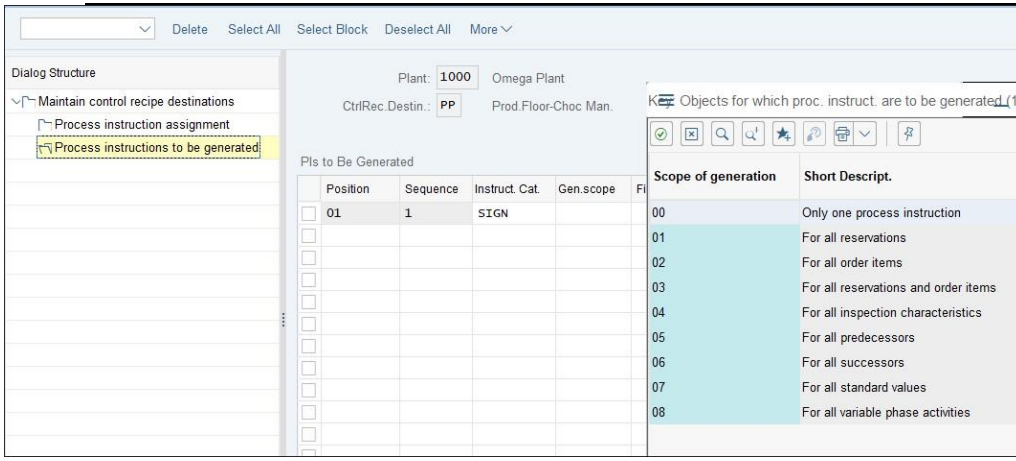


Figure 4.31 Process Instructions to Be Generated during Control Recipe Creation

Place the cursor on the **Position** field and press (F4), and the dialog box appears. Here you see the position in the control recipe where you want to place the process instruction category. It can be at the start or end of a control recipe, an operation, or a phase.

When you select the position, the next step is to assign a process instruction category, place the cursor on the **Gen.scope** field, and press (F4). This opens the screen shown in Figure 4.31, where you see the scope of generation to enable the system to generate process instructions based on the given details. For example, you can select the **01** option for the GI process instruction category. When the system creates a

process order and incorporates the materials list based on the BOM, it also simultaneously creates a reservation with item numbers. If you want to record consumption (GI) against the process order using the PI sheet, you can select the relevant process instruction category (**CH_CONS** or **CH_CONS2**) and define the scope of generation as **01** (**For all reservations**).

For this example, assign the instruction category **SIGN** that the system will generate once and at the end of the PI sheet (refer to Figure 4.31).

Tips & Tricks

When you create the process instruction category **SIGN**, make sure that you assign a characteristic value (e.g., **PI Completion Signoff**) to the process instruction characteristic **PPPI_INPUT_VALUE**.

4.8 Background Jobs

Background jobs help to automate processes that otherwise require manual intervention. For example, when you create a process order and generate its control recipe, you have to manually send it to the control recipe destination. You can configure the system to automatically send the control recipe as soon as the system generates it or even periodically. Similarly, sending back process messages to the SAP system can be a manual effort that you can manage as a background (automatic) job.

Apart from sending control recipe and process messages, you can also delete them periodically to save the system's precious resources. For example, you may not process messages older than six months and can delete them.

In this example, we show how to set up a background job for sending a control recipe, and the same steps apply in sending process messages and deleting process messages as background jobs. You need to know the program that is responsible for the background job.

4.8.1 Background Job for Sending Control Recipes

To set up the background job for sending a control recipe as soon as the system creates it, follow the menu path, **SAP IMG Production Planning for Process Industries Process Management Control Recipe/PI Sheet Define Background Job for Sending**, or use Transaction SM36. Figure 4.32 shows the initial **Define Background Job** screen to define the background job. Enter "ZPP_PI_SEND" in the **Job Name** field, and press (Enter).

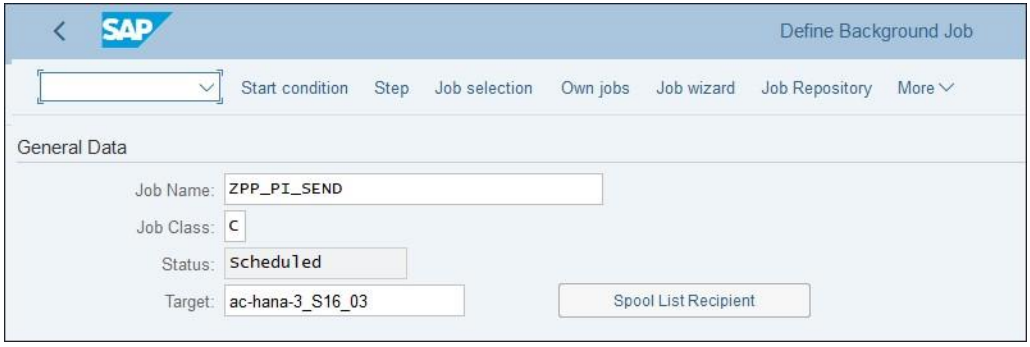


Figure 4.32 Initial Screen for Defining a Background Job to Send a Control Recipe

On the next screen, enter “SAP_NEW_CONTROL_RECIPES” in the **Event** field, which causes the system to send the control recipe as soon as the system creates it. If you then click on the **Start condition** button, you can define the schedule for sending control recipes to various destinations. You can also assign the program name **RCOCB006** to set up the background job.

Tips & Tricks

You can use the **Job wizard** button to enable the system to guide you in a step-bystep process of setting up a background job, not just for sending a control recipe to a destination but for any background jobs. It’s important to know the program name for which you want to define the background job.

4.8.2 Background Job for Sending Process Messages

In Transaction SM36, you use program RCOCB004 to send newly created process messages as a background job. The system also processes the process messages that have statuses of **To Be Submitted** and **To Be Submitted with Warning**. This program is for sending process messages within the plant. If you want to send process messages across different plants, then use program RCOCB002. The corresponding event is SAP_NEW_PROCESS_MESSAGES.

Tips & Tricks

Whenever you define a background job using Transaction SM36, you also have to assign a variant to it. You can use Transaction SE38 to create a new variant for any background job (and its associated program). On the initial screen, enter the program name, click on the **Variants** radio button, and then click the **Change** button. On the next screen, give the variant that you want to create a name for, and click on **Create**.

4.8.3 Background Job for Deleting Process Messages

The background program enables you to delete process messages as a background job. You can use Transaction SM36 to set up the background job.

4.9 Process Manufacturing Cockpit

The process manufacturing cockpits find diverse application in areas where the activities performed, actions taken, or results recorded aren't referencing any specific process order. In the cockpit, you can make use of function calls, for example, to call up a transaction or to display a document. You can also create a cockpit if you have a predefined set of activities that you perform on a specific resource or work center. The cockpit also facilitates input or output data entry as well as calculations. The system creates a PI sheet with reference to a process order, and the system reflects any changes or updates made to it. In a cockpit, you don't have to give reference to a process order. Here are some examples in which you can create process manufacturing cockpits to meet your business needs:

- You need to record values of five specific process parameters of the plant and report these back to the main control room. The reporting for the parameters doesn't reference a specific process order but is used to ensure that there is regular recording and consistent transmission of this information.
- The production process generates an ancillary product (a by-product of low value), but you don't want to record it with reference to any specific process order, nor do you want to book the cost of the by-product generation to a process order. Further, you want to record its quantity after every three days along with other details, such as date of recording, person who recorded this information, and signature.
- Your company has installed a new production line for which it wants to ensure that the latest technical drawings and manuals are available for process operators to refer to. These drawings are for each work center or work station. In the process manufacturing cockpit, the process operator only has to click on the relevant drawing's icon, and all details become visible.

You can create process manufacturing cockpits for as many applications or activities as needed. Because the cockpit makes use of a process instruction category, you can also incorporate a process message category into it. When you've made entries in the cockpit, the system generates process messages that you can send to the predefined destinations.

To define a process manufacturing cockpit, follow the menu path, **SAP IMG Production Planning for Process Industries Process Management Define Process Manufacturing Cockpits** (see Figure 4.33).

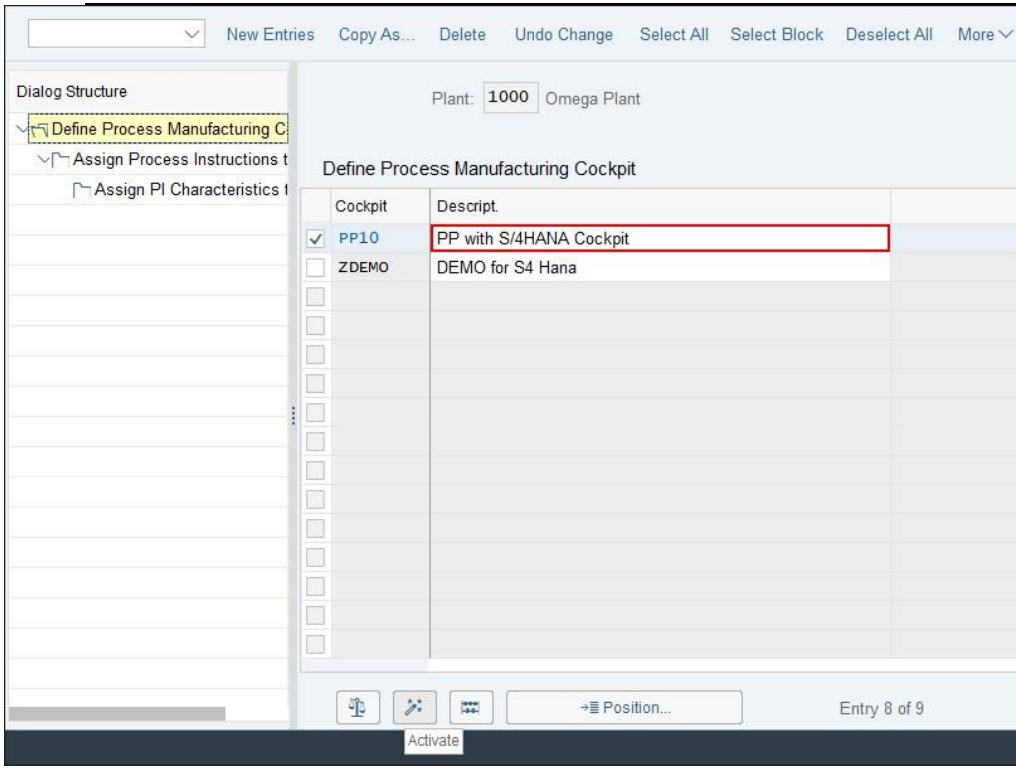


Figure 4.33 Initial Screen for a Process Manufacturing Cockpit

Here you define **Cockpit PP10** for **Plant 1000**. Notice that you can check the newly created cockpit for correctness by choosing the **Check** icon, and you can also simulate it by choosing the **Simulate** icon located at the bottom of the screen. Finally, you have to ensure that you activate a process manufacturing cockpit before it becomes available or before changes made to the cockpit become effective. To activate the cockpit, choose the **Activate** icon.

For this example, select **Cockpit PP10**, and double-click on **Assign Process Instructions to Cockpits**. This takes you to the screen shown in Figure 4.34, where you enter four different process instruction categories. The system only allows process instruction categories of type 0 (universal). The **Line no.** column defines the sequence in which the process instruction categories will appear in the process manufacturing cockpit. You can create a new process instruction category with reference to the existing ones and assign it as type 0.

The **Ref** (reference) checkbox ensures that the system automatically reflects any changes made in the specific process instruction category.

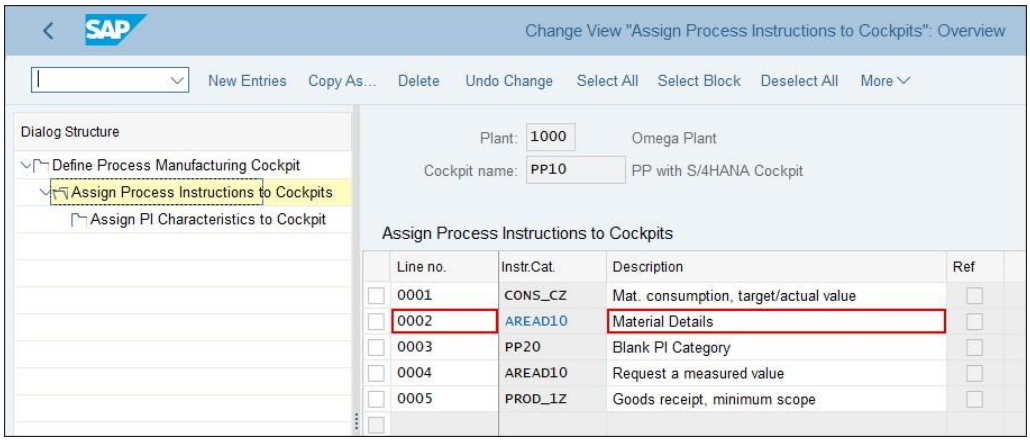


Figure 4.34 Assigning Process Instruction Categories to Cockpits

Tips & Tricks

A quick and easy way to use the desired process instruction category in the process manufacturing cockpit is to copy the original process instruction category as a reference and define it as type 0 (universal) during the copy function. In this example, the process instruction category **PROD_1** is used as a reference to create a new process instruction category **PROD_1Z**, which is defined as type 0 (universal).

In Chapter 7, we'll show you the outcome and the output of the process manufacturing cockpit, PP10, which you created in this chapter.

4.10 Summary

Most of the configuration settings that are applicable in discrete manufacturing also apply to process manufacturing. However, the process management area in PP for process industries requires detailed coverage. The concepts and fundamentals covered in the chapter equally apply if you plan to implement XSteps in discrete manufacturing or use process manufacturing cockpits.

The next chapter covers the configuration basics of the last main manufacturing type we'll discuss in this book: repetitive manufacturing.

Chapter 5

Repetitive Manufacturing Configuration

Configuration steps in repetitive manufacturing include creating a repetitive manufacturing profile, setting scheduling parameters for a run schedule quantity (planned orders), and selecting backflush settings for use online or in the background.

The configuration steps in repetitive manufacturing (REM) are relatively straightforward, without many complexities when compared to discrete manufacturing or process manufacturing types. In fact, the very purpose of REM is to enable lean manufacturing in actual business scenarios with correspondingly fewer entries in the SAP S/4HANA system. REM may not be able to manage complex manufacturing processes, but it can be used to bring about significant process optimization with a decreased data entry workload and improved system performance.

This chapter begins by explaining how to set up the REM profile using the REM assistant. The assistant guides the user with a step-by-step approach to ensure that the correct settings are made during the REM profile creation stage. The assistant also provides the detailed function of each configuration step and gives recommendations where necessary. You can even choose the desired production method, such as make-to-stock (MTS) or make-to-order (MTO). We deliberately took the long route to REM profile creation by using the assistant because we wanted to focus on explaining every available option in detail and with business examples.

At the end of REM profile creation by using the assistant, we explain the "normal" or the prevalent method of creating an REM profile with a single screen (and multiple tabs). Here, we also explain the options that aren't available in the REM profile assistant. If you're configuring an REM profile for the first time, we suggest that you use the REM profile assistant. If you're already familiar with the REM profile and the functionalities it offers, then you can directly proceed to using the single-screen REM profile creation option.

We cover scheduling REM planned orders and running schedule quantity and then proceed to discuss the layout and display settings available on various screens in REM processing. You'll get to see the effects of the REM configuration in Chapter 8, in which we cover the production planning for REM in detail. Finally, we also cover the settings available to optimize day-to-day business transactions, such as backflushing.

Note

Refer to Chapter 1 for features comparison among discrete manufacturing, process manufacturing, and REM, as well as how to decide which manufacturing type is most relevant for a given industry.

Let's get started.

5.1 Repetitive Manufacturing Profile

The REM profile enables you to control several important functions that form the basis of regular or periodic data recording in the system. This includes the options to post activities online or at a later date, automatic goods movements of all or some of the materials, and stock and/or automatic batch determination, among others. To create an REM profile using the REM profile assistant, follow the SAP configuration menu path, **SAP IMG Logistics Production Repetitive Manufacturing Control Create Repetitive Manufacturing Profile Using Assistant**, or use Transaction OSPT.

In the following sections, we'll explain the steps involved in setting up an REM profile.

5.1.1 Repetitive Manufacturing Production Type

While creating an REM profile, you can decide whether you want to use the profile for the

MTO or MTS production method.

Note

Chapter 11 covers MTO and MTS production methods.

Depending on the option you select, the system correspondingly displays the relevant screens and options to choose from. If you choose MTO production, you create a profile suited to REM that references the sales order. If you choose MTS production, you create a profile suited to REM that doesn't reference the sales order.

You can also use an REM profile template to copy previously created and available REM profiles to create a new REM profile. This step copies all the settings of the REM template profile into the new REM profile, and you can then make the desired changes where needed.

Tips & Tricks

Choose the **Meaning** icon available on each screen of the REM profile creation to get information on the underlying concept of that functionality or area.

Choose the **Recommendation** icon available in each screen of the REM profile creation to see system advice on recommended settings.

For this example, we'll create an REM profile for an MTS production method. Figure 5.1 shows the initial screen to create an REM profile using the assistant. For this example, select the **Make-to-stock - REM** radio button, and then choose **Next**.

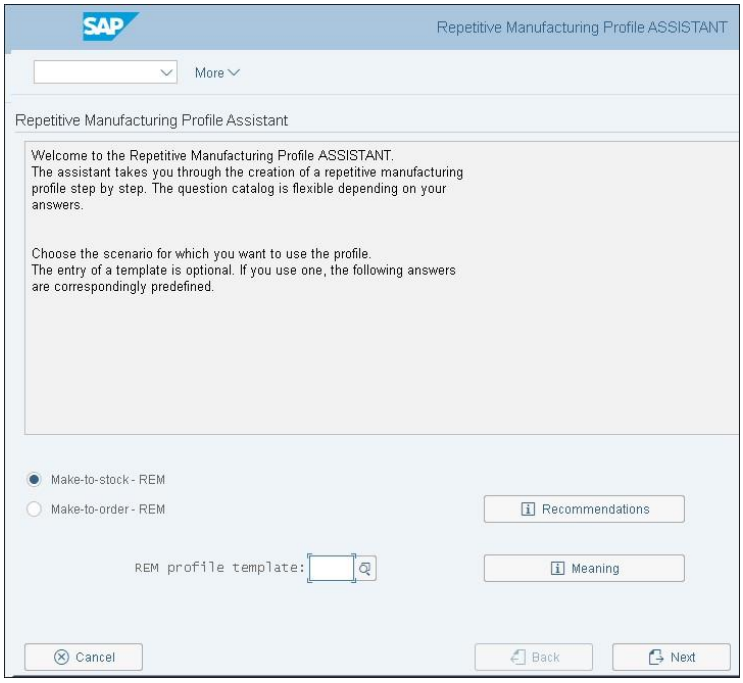


Figure 5.1 Initial Screen of the Repetitive Manufacturing Profile Assistant

5.1.2 Reporting Points

A *reporting point* (RP) enables the system to record consumption or other details, such as identifying the work in process (WIP) and better stock visibility in inventory management (IM), which are specific to actual information in time and equally helpful in reporting. As shown in Figure 5.2, you can select whether you want the system to include no RPs or make the RP mandatory or optional. The RP serves the same purpose as a milestone does in routing for discrete manufacturing. If you select the **Mandatory reporting points** option, then you have to define an RP at the time of assembly or component backflush.

Figure 5.2 Reporting Points

You can use RPs in one of the following situations:

If you use *mandatory* RPs, then you must backflush at every RP. It makes sense to backflush at RPs if the goods issue (GI) is to be posted as close as possible to the actual issuance of the materials or if WIP is to be calculated.

If you use *optional* RPs, you can carry out the normal final backflush, and then use RP backflush only in certain situations. At optional RPs, you can use the standard goods receipt (GR) posting procedures in REM for backflushing and then only backflush at RPs for special purposes, for example, when backflushing scrap or when calculating WIP. The optional RP makes sense when you usually don't have a need for an RP at all, but due to technical issues in the production line, you want to evaluate extra material issuance or extra scrap generation.

For this example, choose **Mandatory reporting points**, and then choose **Next**.

5.1.3 Automatic Goods Movements

The automatic goods movement option applies to RP backflush only. Without RPs, you can only post the GR on final confirmation. In Figure 5.3, you can choose whether you want the system to perform automatic GR at the time of assembly backflush. When you record assembly backflush and confirm the yield, the system automatically performs the GR at the last RP.

Figure 5.3 Automatic GR

When using optional RPs, you choose the setting in automatic GR because you usually backflush the components along with the GR posting.

When using mandatory RPs, you can only backflush at RPs. The normal GR posting isn't available here. Therefore, for mandatory RPs, the recommendation is to define the last workplace on your production line as an RP with the automatic GR setting. If you set the automatic GR option, you have to post activities and GIs manually for operations that lie after the last RP. This is normally an exception to the preceding rule/recommendation.

For this example, choose **Automatic GR**, and then choose **Next**.

Note

While configuring the REM profile using the assistant, your system displays either the screen shown in the preceding figure or the screen shown in the following figure. This is dependent on the option you've previously selected while creating a REM profile.

5.1.4 Reporting Points Confirmation and Kanban

Depending on your system release, you can select whether you want to use RPs with or without Kanban, as shown in Figure 5.4. RP Kanban enables you to monitor the production process at the intermediate level by using Kanban for processing products in individual operations. The RPs record the confirmation that an operation has completed. For this example, choose **RP Confirmation w/o Kanban**, and then choose **Next**.

Figure 5.4 RP Confirmation for Kanban

5.1.5 Activities Posting

In the next screen, you can choose whether or not you want the system to also post the activities to a product cost collector at the time of assembly backflush by choosing the **Post activities** or **No activity posting** radio button. Activities may be machine hours, labor hours, or processing time, and they are defined in rate routing. If you follow the lean manufacturing approach, in which even the data entry effort is minimal, activities posting

involves additional use of the system's resources, such as material calculation and price updates. Activities posting should only be considered if it's significant when compared with cost. We suggest that you engage a product cost controlling (CO-PC) resource to help with the decision-making process on activities posting.

If you instruct the system to post production activities, it calculates these activities either on the basis of details from the standard cost estimate or from preliminary costing in the cost collector for material. Additionally, the system posts the activities during the confirmation process. For this example, choose **Post activities**, and then choose **Next**.

5.1.6 Separated Backflush

You can choose whether you want the system to perform separated backflushes or not by selecting the **Separated backflush** or **No separated backflush** radio button. This option is primarily used to improve a system's performance, especially if it gets slow due to a large number of confirmations. With separated backflush, you can uncouple certain aspects of backflushing during the confirmation process by scheduling them as separate background jobs offline.

You use the separated backflush in the following cases, for example:

To improve system performance

If you're dealing with large bills of materials (BOMs)

For sales orders with many schedule lines for small quantities

For this example, choose **Separated backflush**, and then choose **Next**.

If you choose **No separated backflush**, then Figure 5.5 will appear wherein you can choose whether you want the system to simultaneously post GR and GI in the same transaction of assembly confirmation. In REM, the final confirmation also encompasses GR. You can choose whether you also want to post GI during the confirmation process. If you choose the **Post GR only** option, you can post the GIs for the components collectively, for example, using the GI transaction in REM.

For this example, choose **Post GR and GI** in the assembly confirmation.

Figure 5.5 Automatic GR and GI

5.1.7 Process Control

In Figure 5.6, you can choose when GI and calculation of costs are performed and whether GI and calculation of costs are aggregated during confirmation. While you have the option to let the system perform several steps/functions together, you can use the **Process control** option to customize the process according to your business needs. You can click on the **Customizing** button on this screen to make the necessary changes. However, we cover the customization of process controls later in Section 5.5.

Figure 5.6 Process Control in Backflushing

It's important to note that you'll only get this option if you chose **Separated backflush** in the previous step. In that case, you have to define the process control for this separated backflush, and there are four options available to maintain.

For this example, enter the **Process control** "SAP1", and choose **Next**.

5.1.8 Firming Planned Orders

It makes sense to firm the planned orders when you create them in the REM planning table because a firmed planned order won't change during the material requirements planning (MRP) run. You also have the options to not firm the planned order at the time of its creation and to firm planned orders in the planning time fence only.

For this example, choose **Firm planned orders in plng time fence**, and then choose **Next** (Figure 5.7).

Figure 5.7 Firming Planned Orders in REM

5.1.9 Automatic Stock Determination

You can choose to take advantage of the system performing the automatic stock determination at the time of component or assembly backflush by selecting the **Use stock determination** radio button. The prerequisite is that you've already set up the automatic stock determination procedure in the system. Stock determination enables the system to suggest available stock for consumption based on the defined criteria.

For this example, choose **Do not use stock determination**, and then choose **Next**.

5.1.10 Batch Determination Procedure

Similar to the previous automatic stock determination procedure, you can also choose whether or not the system should perform the batch determination procedure in REM by selecting **Separate batch search procedure** or **No separate batch search proc**. The material, in this case, must be batch-managed to use this functionality. Batch determination enables the system to suggest available batches for consumption based on the defined criteria. For this example, choose **No separate batch search proc.**, and then choose **Next**.

Note

Batch determination is covered in Chapter 9.

5.1.11 Reduction in Planned Order Quantities

In the screen shown in Figure 5.8, you can choose whether you want the system to reduce the production quantities in the planned order or in the run schedule quantity (RSQ) when you perform assembly confirmation of a material. You can also choose whether you want the system to reduce the planned order quantity only if it pertains to a specific production version. As each production version reflects a production line, this option enables you to reduce planned order quantities as soon as the goods on the production line (in direct relation to the production version) are produced.

For this example, choose **All**, which causes the system to reduce planned order quantities in all cases. Choose **Next**.

Figure 5.8 Reduction in Planned Order Quantities

5.1.12 Reduction Period

In the screen shown in Figure 5.9, you can choose the period in days during which the system should reduce the planned order quantities. The system considers the reduction period from today and expands to consider the defined dates in the future. For example, if you're consistently faced with overproduction and want to avoid additional production for the defined days in the future, then you can enter the reduction period here. In addition, note that the system reduces the planned order quantities dates of the past in any case and accords them higher priority than the current date or future dates.

For this example, enter "3" in the **Reduction period** field, and then choose **Next**.

Figure 5.9 Reduction Period for Planned Orders

5.1.13 Create New Planned Orders on Goods Receipts Reversals

In the screen shown in Figure 5.10, you can choose whether the system should automatically create planned orders for reversed quantities. If you choose not to, then the system automatically creates planned orders during the MRP run if necessary. For this example, choose **No planned order creation**, and then choose **Next**.

Figure 5.10 Planned Order Creation on GR Reversals

5.1.14 Online Error Correction

You can choose how the system processes errors encountered during transaction postings, such as a failed component backflush due to a mismatch in IM. Other types of errors may include an insufficient quantity of a component's stock in a component backflush, a missing storage location for GI or GR, and so on. If you opt for **No online correction** or **Optional online correction**, you can use a separate transaction to attend errors separately, provided that reprocessing records are created (see the next step). You can also choose **Online correction mandatory**. For this example, choose **Optional online correction**, and then choose **Next**.

5.1.15 Reprocessing Errors Log Maintenance

During automatic goods movement processing, such as backflushing, sometimes the processing isn't successful due to insufficient stock, an incorrect storage location, or missing or nonupdated rates for activity types. All such unsuccessful records end up in errors log maintenance for reprocessing and to note that they haven't been resolved yet.

In the screen shown in Figure 5.11, you can choose how the system should manage all reprocessing records of all items that caused the errors. The available options are that the

system won't maintain any reprocessing record, the system will maintain collective reprocessing records, or the system will maintain individual and collective reprocessing records of errors. For this example, choose **Indiv.and cumul. reprocessing records**, and then choose **Next**.

Figure 5.11 Reprocessing Incorrect Records

5.1.16 Movement Types for Stock Postings

On the next screen (Figure 5.12), the system provides standard movement types that the system uses to perform various IM transactions. For example, for GI against an REM planned order, the movement type is **261**, and its reversal is reflected in movement type **262**.

Figure 5.12 Movement Types for MTS Production

If you have any customized movement type to record an inventory transaction, you can enter it on this screen. The prerequisite for using a customized movement type is that you've maintained it in the system previously and then assign it on this screen. Choose **Next**.

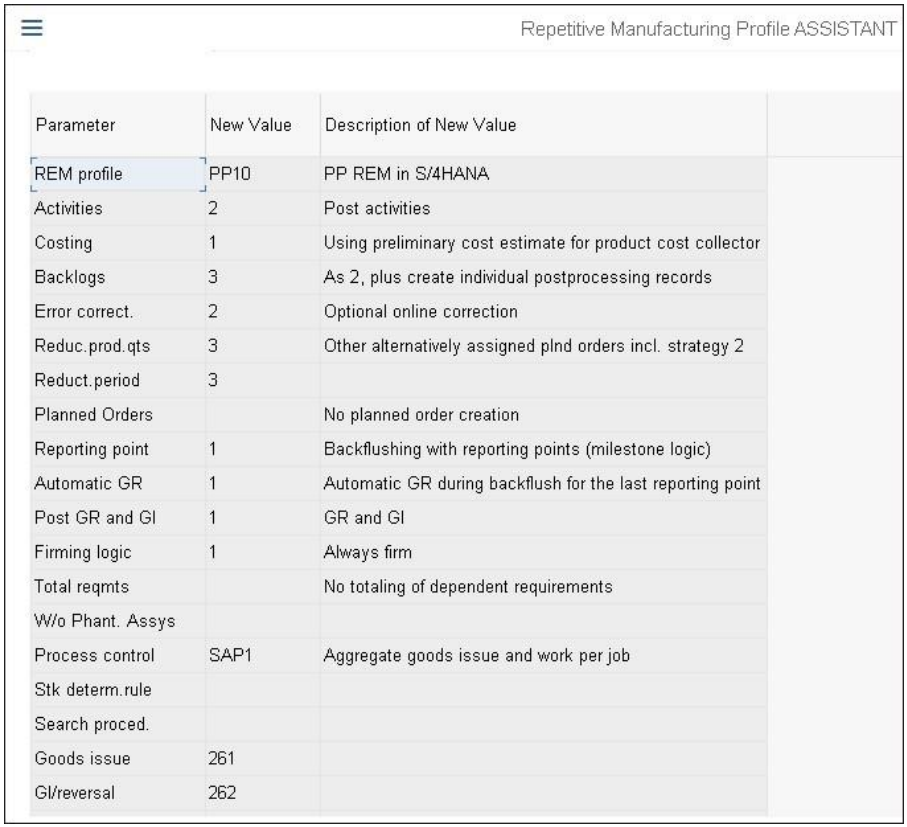
5.1.17 Naming the Repetitive Manufacturing Profile

You'll now see the last screen of the REM profile creation process using the assistant. In this screen, enter the **REM profile** "PP10", and give it a short description. You can go back and make changes to any of the settings you've made so far.

5.1.18 Summary of Repetitive Manufacturing Profile Settings

Figure 5.13 shows the overview/summary screen of the REM profile PP10. Choose **Continue**, and then save. Scroll down to review the remaining options that you configured for the REM profile in the previous screens.

After you've created the REM profile, you can't use the same transaction to make changes to it because it's only for the creation of the REM profile. At the same time, when you become familiar with the REM profile, you can proceed to directly create it without using the REM profile assistant. This saves time and effort because all of the selection options are available on one screen and in different tabs.



Parameter	New Value	Description of New Value
REM profile	PP10	PP REM in S/4HANA
Activities	2	Post activities
Costing	1	Using preliminary cost estimate for product cost collector
Backlogs	3	As 2, plus create individual postprocessing records
Error correct.	2	Optional online correction
Reduc.prod.qts	3	Other alternatively assigned plnd orders incl. strategy 2
Reduct.period	3	
Planned Orders		No planned order creation
Reporting point	1	Backflushing with reporting points (milestone logic)
Automatic GR	1	Automatic GR during backflush for the last reporting point
Post GR and GI	1	GR and GI
Firming logic	1	Always firm
Total reqmts		No totaling of dependent requirements
W/o Phant. Assys		
Process control	SAP1	Aggregate goods issue and work per job
Stk determ.rule		
Search proced.		
Goods issue	261	
GI/reversal	262	

Figure 5.13 Overview of the REM Profile after All Settings Are Made

To make changes or to update any field in the already-created REM profile, follow the SAP configuration (Transaction SPRO) menu path, **ProductionRepetitive ManufacturingControlDefine Repetitive Manufacturing Profiles**, or use Transaction OSP2. Here, you can make changes to **REM Profile PP10**. For this example, scroll down and choose **Backflush using standard cost estimate for material** (not shown), and then save the REM profile (see Figure 5.14).

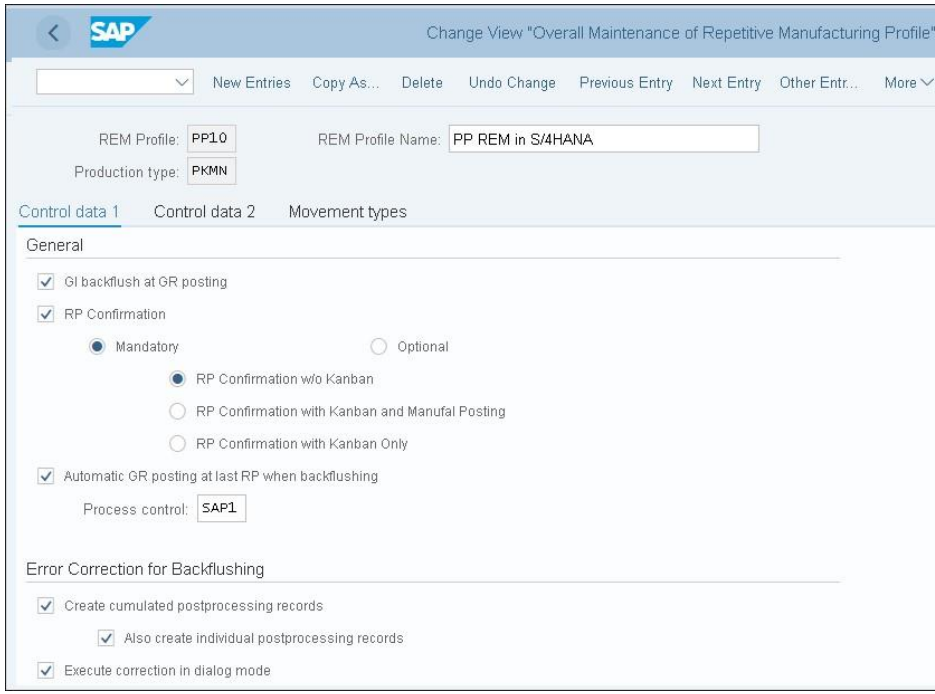


Figure 5.14 Overall Maintenance of the REM Profile

5.2 Scheduling Planned Orders

The next basic configuration topic we'll discuss is scheduling planned orders. As in the discrete manufacturing or process manufacturing types, you can take advantage of the available scheduling options. You can set scheduling parameters for planned orders in REM by following the configuration menu path, **SAP IMG Production Repetitive Manufacturing Planning Define Scheduling Parameters for Planned Orders**. The initial screen appears for maintaining the scheduling parameters for a planned order. Because the order type for the REM planned order is "PE", enter **Plant** "1000" and **Order Type** "PE", and double-click the **Plant** field (**1000**). It's important to note here that the **Order Type** "**PE**" is identical to the RSQ.

After this selection, choose the **Detail** icon. This takes you to the detailed screen to set scheduling parameters for the REM planned order of **Order Type PE** and **Plant 1000** (see Figure 5.15).

Because REM uses rate-based scheduling, select both the **Scheduling** and **Generate Capacity Reqs.** checkboxes. At the same time, if your organization decides to use detailed scheduling for all non-REM applications, you can select the relevant scheduling and capacity requirements checkboxes to meet the business need.

You can also select the **Scheduling Type**, which, for this example, is **Forwards**. You can also choose from **Backward Scheduling** and **Current Date** as scheduling types. Refer to Chapter 3 in which we cover scheduling in detail. Although the details covered in Chapter 3 are applicable to scheduling production orders, the same equally applies to planned orders.

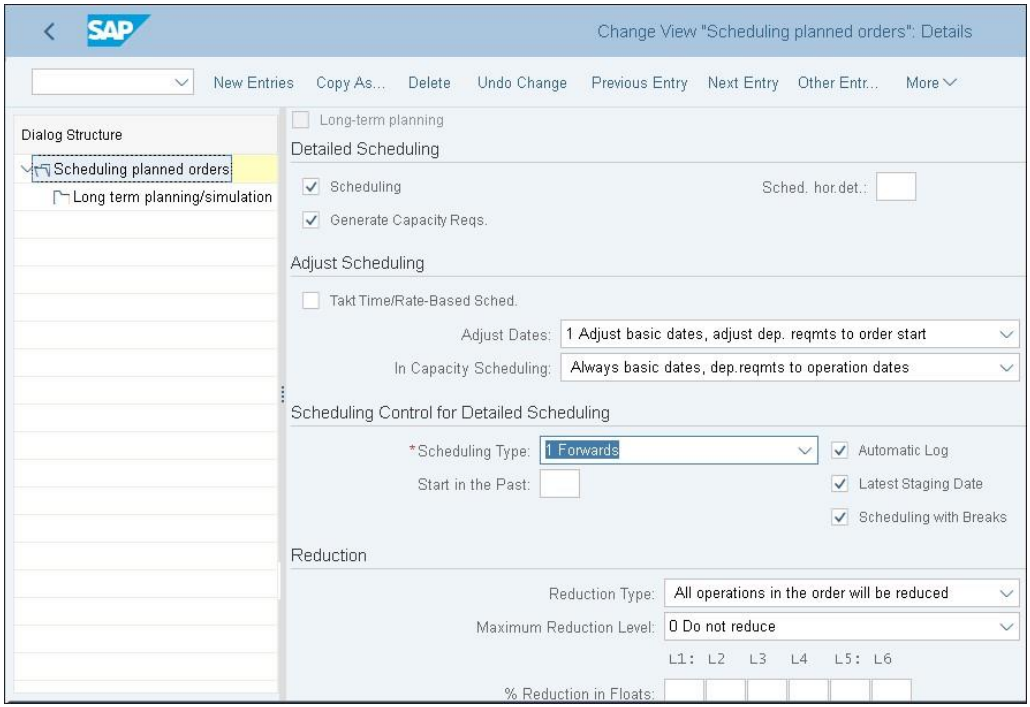


Figure 5.15 Detailed Screen of Scheduling Parameters for Planned Orders

5.3 Display

You have a few different options to control how different settings will appear in your system. The following sections cover two display options.

5.3.1 Entry Parameters for a Planning Table

You can choose how the display entry parameters of the REM planning table should look or how to present the requisite information. The settings you make in this section will eventually be available on the initial parameters selection screen of the REM planning table (Transaction MF50). To maintain or change the entry parameters of the planning table, follow configuration menu path **SAP IMG Production Repetitive Manufacturing Planning Table Maintain Entry Parameters** (see Figure 5.16).

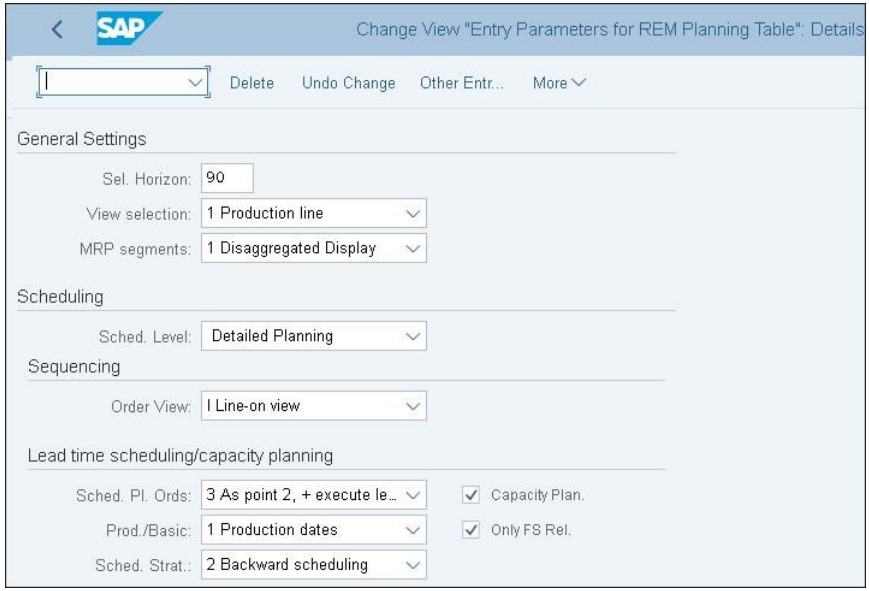


Figure 5.16 Entry Parameters of the REM Planning Table

You'll be able to see the impact of the preceding configuration on the parameters selection screen of the planning table (Transaction MF50), which we cover in Chapter 8.

5.3.2 Maintain Rows Selection

You can control the display of information within the planning table, including receipts, requirements, and stock situations. To configure rows selection in the planning table, follow the configuration menu path, **SAP IMG Production Repetitive Manufacturing Planning Table Maintain Rows Selection**. For this example, select all the checkboxes (see Figure 5.17); however, you should select only the checkboxes

relevant to your business needs to keep things lean when dealing with your company's unique situation.

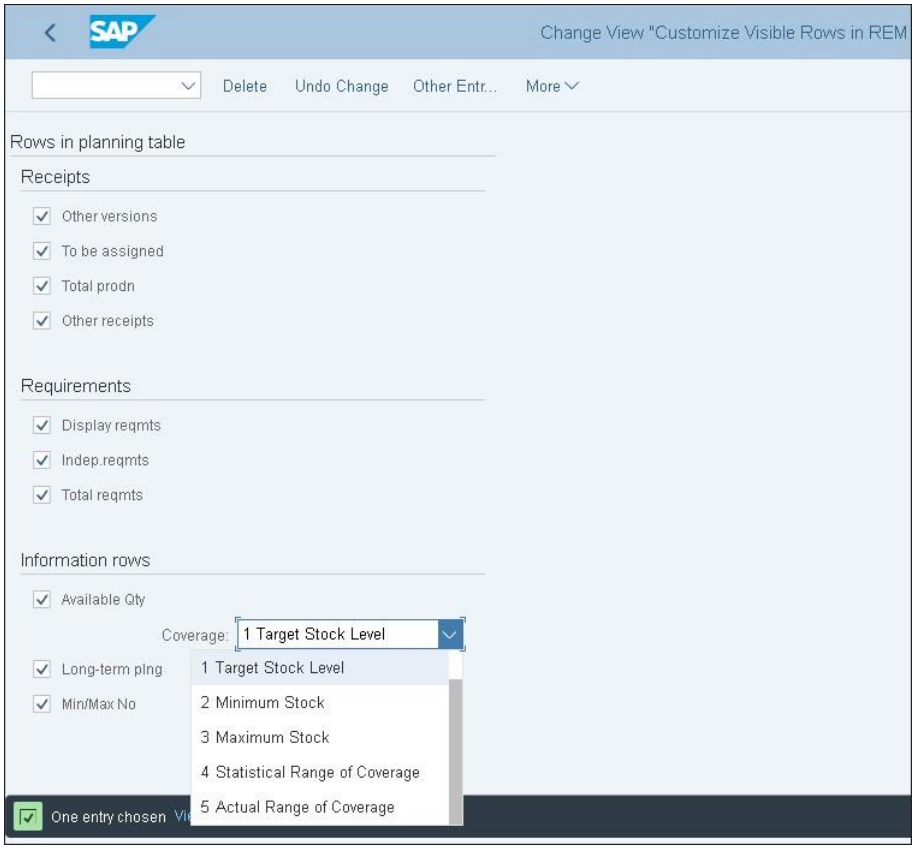


Figure 5.17 Visible Rows in the REM Planning Table

5.4 Material Staging

A *pull list* is basically a movement of stock (stock transfer) from storage location to storage location that uses inventory movement type 311. It's also known as *material staging*. You can also assign previously configured stock determination and batch search procedures on this screen. For the necessary settings, follow the configuration menu path, **SAP IMG Production Repetitive Manufacturing Material Staging Define Control Data for Pull List** (see Figure 5.18).

Figure 5.18 Pull List Control

5.5 Global Settings for Confirmation and the Logistics Information System

Some settings are maintained at the global level. This includes the period the system is to take into account when automatically updating statistics (logistics information system [LIS]) of the planning figures. It also includes the option allowing you to require the system to display the planned order number of the RSQ number during backflushing.

To configure the necessary settings, follow the configuration menu path, **SAP IMG Production Repetitive Manufacturing Backflushing Maintain Global Settings for Confirmation and LIS**. In the **Start: current date+** and **Finish: current date+** fields (see Figure 5.19), you can choose to start from the current date (the earliest) and give any number of future dates.

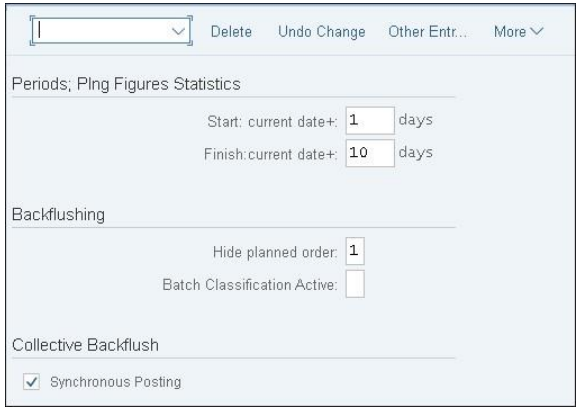


Figure 5.19 Field Selection Table in REM

5.6 Operational Methods Sheet

When you maintain the process control for confirmation, you can control when the system should update the transactions, such as backflush or activities costs calculation. The system can update the information immediately and online by using an update program or later in a background program. It's therefore important to ensure that you select the process control when you're creating the REM profile.

In Figure 5.20, if you place the curser in the **Backflush** field and press (F4), the dropdown on the right side of the screen appears. From the dropdown, you can choose one of the three backflushing options available. To set the relevant parameters, use configuration menu path, **SAP IMG Production Repetitive Manufacturing Backflushing Separate Backflushing Processes Define Confirmation Processes**.

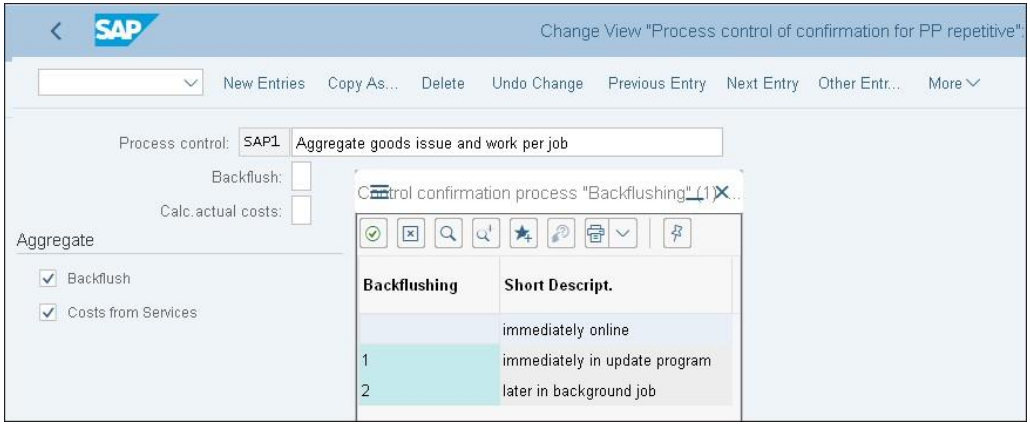


Figure 5.20 Process Control Confirmation Parameters

5.6 Operational Methods Sheet

The operational methods sheet (OMS) supports business tasks in the entire REM cycle. An OMS shows the production details that a plant operator needs to produce the goods. You can make several layout and configuration settings to customize the display layout of an OMS. For example, you can specifically select the desired fields from the work center, operation, component, production resources/tools (PRT) or Document Management System (DMS) that you want to appear in the OMS. You can separately customize the header and table (item) details.

To create an OMS, follow the configuration menu path, **SAP IMG Production Basic Data Line Design Operational Method Sheet**, or use Transaction OLDPS. In the **Table Assignments** area shown in Figure 5.21, you can select **COMPONEN**, **MATERIAL**,

OPERATIO, or **PRT**, for example, from the **Table ID** column. Next, you can use the**Assign fields** folder available on the left-hand side of the screen to choose the fieldthat you want to display in the OMS.

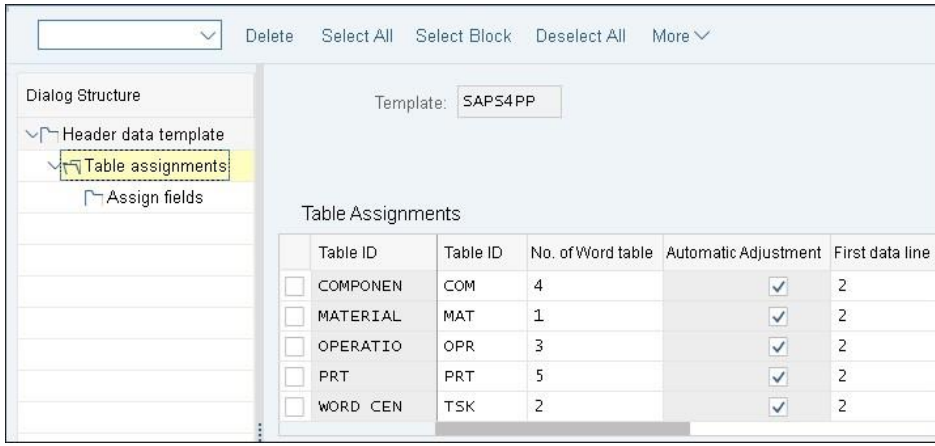


Figure 5.21 Operational Methods Sheet

In Chapter 8, we'll show how the settings you made here enable you to display (and print) the OMS in REM. You have to ensure that integration with Microsoft Word is in place as well. The prerequisite is to have at least Word for Windows 95 installed with macros enabled. The template file is placed within the SAP system, which the system refers to while creating the OMS.

5.7 Summary

The REM profile is the main configuration activity, and it controls the various functions that you can perform in REM. You assign the configured REM profile in the material master. You can configure the scheduling parameters of RSQs as well as alter the display layout of the planning table. You can control when the system performs automated functions, such as backflush, either online or in the background.

In the next chapter, we'll cover the business processes associated with discrete manufacturing in the SAP S/4HANA system. The chapter will build upon the configuration concepts and understanding you developed in Chapter 3.

PART III

Production Planning Workflows

Chapter 6

Production Planning for Discrete Manufacturing

This chapter covers the important business processes and functions that are used in discrete manufacturing. You'll find the vital and logical links to understand how the configurations you made in Chapter 3 match with your business processes when dealing with products or materials that are subject to high changeability.

Discrete manufacturing, which is also interchangeably referred to as shop floor control (SFC) in the SAP system, is characterized by frequent change in products on the production lines. The demand for the product is generally irregular, and often the entire production process is complex, including the routing (the sequence of work steps). The assemblies are often placed in interim storage, and the components are staged with reference to production order.

Discrete manufacturing finds extensive implementations in the high-tech, steel sheets recoiling, pumps, textile, steel rerolling, and automobile industries. Production planning (PP) for discrete manufacturing helps with production order creation, material/capacity availability checks, variance calculation, and much more. It also helps manage and smooth out some of the related business processes that are involved with this type of manufacturing, including scheduling, costing, and goods issue/goods receipt (GI/GR). To help manage the business processes seamlessly, PP for discrete manufacturing works with most other functionalities in SAP S/4HANA.

Note

The master data and processes in discrete manufacturing and process manufacturing have significant similarities. You can find the specific details of process manufacturing in Chapter 4, but this chapter covers the general master data and process specifics in detail.

This chapter begins with an overview of discrete manufacturing and explains how it fits in the planning and production perspectives. Important discrete manufacturing master data is covered next, with extensive focus on creating material, bill of materials (BOM), work center, routing, and finally the production version. The concepts and the fundamentals that we cover in this chapter equally apply to process manufacturing and repetitive manufacturing (REM). After covering the master data creation, the same master data is used to cover end-to-end business processes of discrete manufacturing—from production order creation to completion and settlement.

Finally, some additional functions available in discrete manufacturing are also covered to optimize the business processes. Let's get started with an overview of discrete manufacturing.

6.1 Process Overview

Figure 6.1 provides an understanding of the end-to-end process flow in discrete manufacturing. The process begins when requirements from manually created planned orders, material requirements planning (MRP), or sales and distribution (SD) flow in, and for which the production process must initiate. To initiate the production process, you need a production order 1. The system schedules the order 2, as well as checks for material and production resources/tools (PRT) requirements and their availability 3, to see if it's able to produce the required quantities or not. It also checks for capacity 4 needed to produce the material. If the system is unable to find the requisite capacity, it reflects an overload.

The next step is to release the production order 5 to enable the system to perform additional functions. You can't perform several functions until you release the order, including printing shop floor papers 6. The production execution step is the actual and physical production of material, and the first step toward production is material withdrawal from the warehouse 7.

The plant operator then enters the operation or order confirmation to record the actual processing of material or production, including scrap produced or rework required 8. The production department delivers the produced material to the warehouse, which performs the GR against the production order 9. The last two steps reflect SAP S/4HANA Finance's controlling (CO) functionality's integration with PP, in which order settlement j takes place, and the production order k is closed.

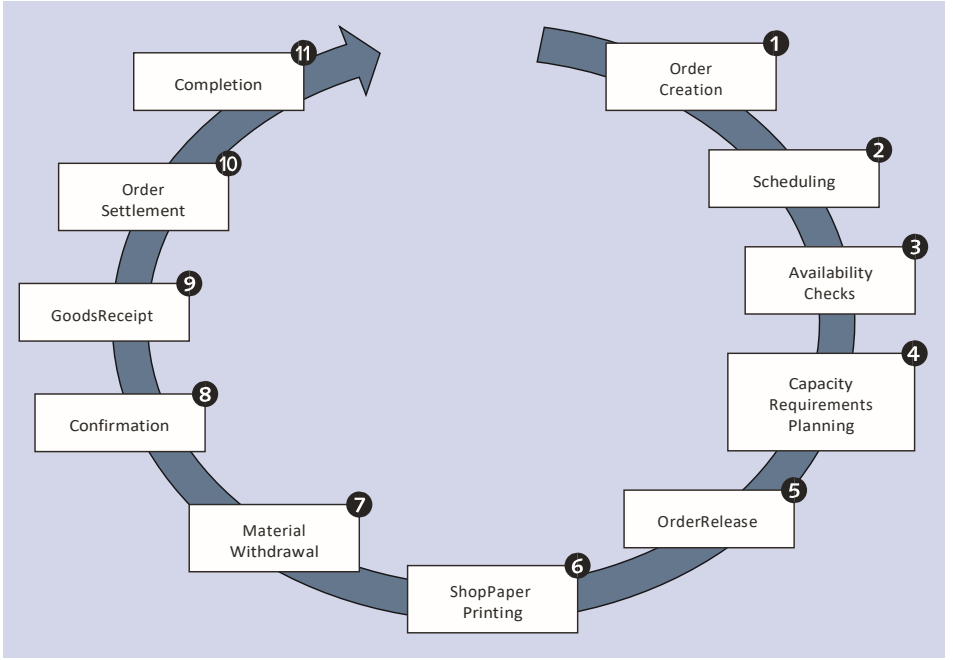


Figure 6.1 Process Flow in Discrete Manufacturing

6.2 Master Data

Before running processes and transactions in the SAP system, it's imperative to set up complete and comprehensive master data. In discrete manufacturing (and in other manufacturing types), if you set up master data in the right sequence, then it's much easier to connect with other types of master data because the predecessor-successor relationship is already taken care of.

The following steps outline the procedure that need to be followed to set up master data correctly, which is discussed in more detail in the following sections:

1. Create the *material master* of the product (a finished good or an assembly) that need to be produced. You can also create the material master for the raw material that will eventually become part of the production process.
2. Create the *BOM* of the product that you want to produce and assign components, together with the quantities needed to produce the product. If applicable, you can also define a

scrap percentage at the operation or component levels. You can also maintain details of co-products or by-products in the BOM.

3. Create the *work center.*
4. Create *routing* for the material, in which you assign the previously created work center.
5. Create the *production version* for the material, and assign the material's BOM and routing.

Due to the highly diverse nature of the material master creation process, we cover it briefly in this chapter, while offering much greater coverage of the PP-specific master data (specifically the BOM, work center, routing, and production version).

Note

Refer to Chapter 3 for a more in-depth understanding of the configuration specifics for discrete manufacturing.

6.2.1 Material Master

A material master is whatever the company wants to maintain as an inventory item. Examples are far ranging and include the following: a finished product that the company first produces in-house and then sells, a raw material it procures and consumes in the production process, consumables (e.g., greases, lubricants, or gloves), trading goods that it buys and then sells, or spare parts for maintenance on machines.

Creating and maintaining information on a material master is the collective and combined responsibility of a company's various departments and divisions. A material master is a central element; therefore, everyone contributes their share of maintaining different information. In the SAP system, maintaining logically structured information absolutely helps the relevant department efficiently perform day-to-day business functions.

Example

A company produces a finished good (a product). For this product, the company needs to maintain information for producing the product, selling it, maintaining planning and design data, quality control and life span, costing, and more.

More than likely, one person or department won't know all of the information related to many business functions. For example, the sales personnel may not know the quality tests a product goes through. Similarly, the production department won't necessarily care about the selling price of the product because they are just concerned or focused on producing it. However, the salesperson needs instant access to selling price and the applicable taxes or discount on creation of a sales order. Similarly, the production supervisor wants better control on underdelivery and overdelivery tolerances allowed for a material, whereas the warehouse in-charge needs instant information on storing the product.

To add greater visibility to the entire material master creation process, the SAP system provides *views*, in which the relevant departments of the company (depending on which SAP functionality they're working with) can fill in their share of information. The **Basic Data** view contains basic information that is applicable to the entire material master, such as base unit of measure, gross and net weights, volume, product hierarchy, and design/drawing information. We cover the details of these views later in this section.

When you create a material master, you also have to define the *material type*, that is, whether it's a raw material, a semifinished product, a trading good, a spare part, or a consumable item. The material type controls the views that it makes available for the user to maintain information for later use. The views contain either organizationindependent or organization-dependent details. The organization-independent information is, for example, the material description or its weight and volume. The organization-dependent information, that is, information specific to a plant or storage location, may be the planning or the forecasting data that is unique to a plant only. For a different plant (organization-dependent), the planning or forecasting data may be different.

Table 6.1 provides an overview of plant-independent and plant-dependent views of the material master. The appearance of a checkmark in a column denotes the data that you need to maintain for a given function.

Material View	Organization-Independent	Plant	Storage Location	Storage Number	Sales and Distribution
Basic Data 1 and **2**	✓				

Classification	✓				
Sales: Sales Org.	✓				✓

Table 6.1 Material Master Views

Material View	Organization-Independent	Plant	Storage Location	Storage Number	Sales and Distribution
Sales: General/Plant	✓	✓			
Foreign Trade/Export Data		✓			✓
Sales Text		✓			✓
Purchasing		✓			
Foreign Trade/Import Data		✓			
Purchase Order Text	✓				
MRP 1–4		✓			
Advanced Planning		✓			
Forecast		✓	✓		
Work Scheduling		✓			
Plant Data/Storage 1 and **2**	✓	✓	✓		
Warehouse Management 1 and **2**		✓		✓	
Quality Management		✓			
Accounting 1 and **2**		✓			
Costing 1 and **2**		✓			

Table 6.1 Material Master Views (Cont.)

Following is a broad explanation of the data in some of the views of the material master:

Basic Data

These views consist of information such as base unit of measure, which is the smallest unit of measure in which you maintain the product's inventory. It consists of gross weight, net weight, volume, product hierarchy, size/dimension, and design/drawing details by enabling you to use the Document Management System (DMS).

Classification

This view enables you to classify specific materials with identical or similar characteristics into groups and to categorize those groups based on specific characteristics. Due to its diverse and practical nature of application, it's available in several areas of the SAP system. You can classify materials, as well as customers and equipment. Further, when there isn't any other option to do so, you can use classification to maintain material-specific information.

Sales

These views contain details such as delivering plant, selling unit of measure, taxes, conditions (e.g., gross price and taxes), sales order text, transportation group, loading group, and item category. You have to maintain these views for materials that you want to sell.

Purchasing

This view contains the purchase unit of measure, purchase group, material group that groups together materials with similar attributes, purchasing value key that incorporates underdelivery and overdelivery tolerances, GR processing time, and batch management. For externally procured material, you have to maintain this view.

MRP

These views enable you to define how to procure a material and how to plan and control this material within the production process. The definition of the procurement type specifies whether a company procures the material externally or produces it in-house, or if both scenarios are possible. It enables you to specify whether the material follows reorder point planning or is demand driven. Using a strategy group, you can also control whether material is make-to-stock (MTS), make-to-order (MTO), or assemble-to-order (ATO) production. Material planning for a procured or produced material requires that you maintain some or all of the MRP views.

Note

Chapter 12 and Chapter 13 cover MRP.

Advanced Planning

Production planning and detailed scheduling (PP-DS) with SAP S/4HANA introduces the advanced capacity planning and heuristics for materials planning that were previously available in SAP Advanced Planning and Optimization (SAP APO). PP-DS transactions are executed directly in SAP S/4HANA, thereby eliminating the need for separate

installation to run PP-DS transactions. The material master and the work center creation are also synchronous, which means that a material or a work center that has just been created can be immediately available for planning in PP-DS. **Forecast**

This view enables you to define the forecasting parameters and models, such as constant, seasonal, moving average, or trend. If you already know the forecasting data properties, then you should make a selection from one of the available forecasting models. If you're unsure of which model to select, the system provides you the option for automatic model selection. You can also define the number of historical and forecast periods based on which the system runs forecasting.

Note

Chapter 10, Section 10.4, covers forecasting.

Work Scheduling

This view contains details for underdelivery and overdelivery tolerances for inhouse production, the production scheduler, the production scheduling profile that controls several business functions, the production unit of measure, and the production time in days. For material produced in-house, you have to maintain this view. It's possible to have a different unit of measure, which, in this case, is the production unit of measure that may be different from the base unit of measure. **Plant Data**

This view contains information such as storage bin, temperature conditions, and shelf-life data for batch-managed materials, including maximum storage period, minimum remaining shelf life, and total shelf life.

Quality Management

This view provides the option to select different inspection types that a material may go through, for example, finished goods inspection, raw material inspection, and in-process (during production) inspection. The quality management (QM) procurement key denotes whether raw material must be quality-managed and the relevant certificate type.

Accounting

These views contain the price control indicator, that is, whether the material will be valued at a standard price or moving average price, and the valuation class.

Costing

These views contain details such as overhead group, origin group, and variance key.

Note

The creation of material types and also the material master is largely driven by materials management (MM) processes, with other functional areas supporting and facilitating it.

Now let's create a new material, in which you can maintain some of the important views. To create a new material master, follow the menu path, **Logistics Production Material Master Create (General) Immediately**, or use Transaction MM01 (see Figure 6.2). On the initial screen that appears, select the **Industry sector** as **M Mechanical Engineering** and the **Material Type** as **FERT Finished product** from the dropdown (not shown).

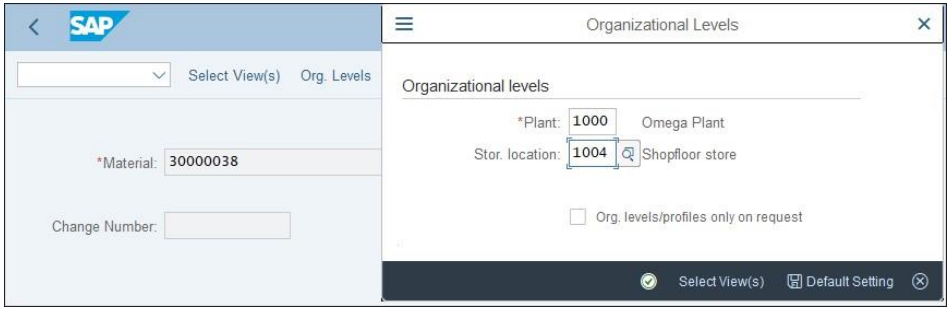


Figure 6.2 Initial Screen for Material Master Creation

Next, click on the **Select View(s)** in Figure 6.2, and the screen shown in Figure 6.3 appears, showing the list of views that were briefly covered earlier. You don't have to select and maintain all the views, only those that you'll eventually use in your business processes. For example, if you don't intend to include a material in planning, then you don't have to maintain **MRP** views of the material.

Select the **Basic Data** views, and the screen shown in Figure 6.4 appears, showing the **Basic data 1** tab of the material master. Here, the system automatically assigns it an internal material number, **30000038**. In this view, you can maintain information such as **Base Unit of Measure**, **Gross Weight,** and **Net Weight**. The right-hand side of the screen shows the various views that you can maintain for this material.

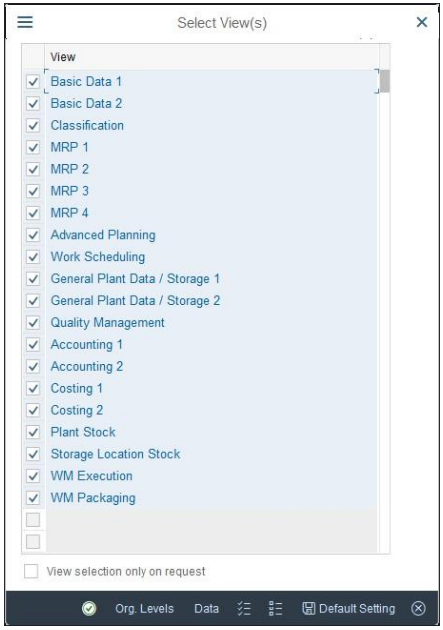


Figure 6.3 Selecting the Views Option in Material Master Creation

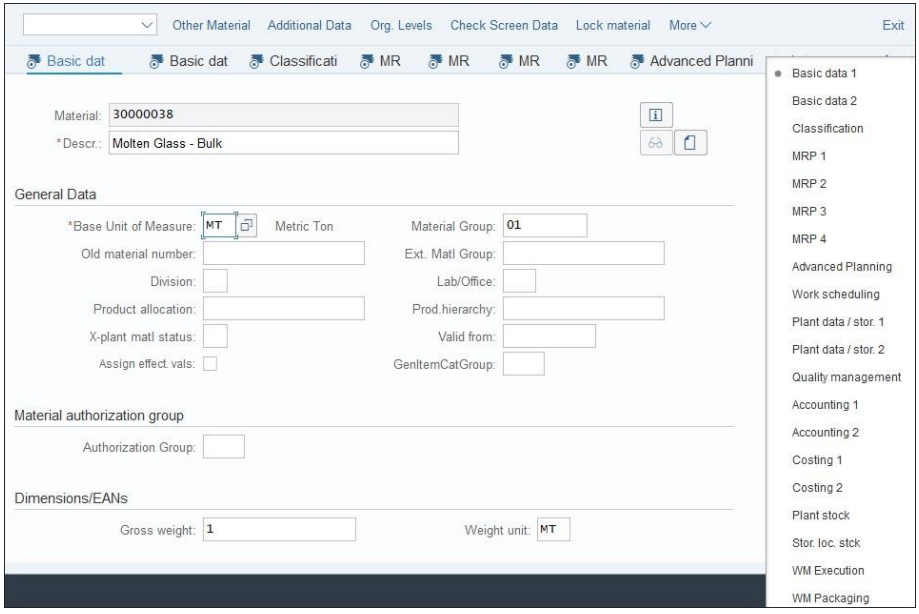


Figure 6.4 Basic Data View of the Material Master

6.2.2 Bill of Materials

A material's BOM consists of components grouped together with the relevant quantities that are needed to produce the material in the production process. For example, if vanilla ice cream is the main product, then its BOM will consist of all the ingredients (components) needed to produce it. Similarly, to produce an automobile, you need an engine, a chassis, a body, and a large number of other components.

To create the BOM of a material, follow the menu path, **Logistics Production Master Data Bills of Material Bill of Material Material BOM Create**, or use Transaction CS01. On the initial screen, enter **Material** "30000038" and **Plant** "1000", as shown in Figure 6.5. This is the material number for which you want to create the BOM. In the **BOM Usage** field, enter "1" to specify the purpose of creating and using a BOM. **BOM Usage 1** denotes that it's for production purposes and will be available when you create a production order for this material. Other BOM usages are in **SD BOM**, **PM BOM**, and **Costing BOM**.

Enter the **Valid From** field as "01.01.2018" to denote the date from which the BOM becomes available in the production process. In this example, the BOM validity starts from January 01, 2018 (01.01.2018), when a user creates a production order. The BOM won't be available when the user creates a production order in the month of December 2017, for example. If no date is given, the system automatically assigns the BOM's creation date as the **Valid From** date. The purpose of the BOM validity is to ensure that if the company has a new BOM starting at a later date, then the validity of the new BOM can be set accordingly, which then becomes available during the production process.

In the **Alternative BOM** field, you can specify up to 99 different alternative BOMs for a material. This means that the same material can be produced in up to 99 different ways by having an alternative BOM option available. For example, when one component of a material's BOM is unavailable in stock, you can select another alternative BOM to continue with the production process. When you first create a material's BOM, the system automatically assigns the alternative BOM as 1. When you create a new BOM for the same material, the system issues a warning message and internally assigns the next alternative BOM number to it.

Click on the **Header** to open the **Create Material BOM: Header Overview** screen. The base quantity of a material denotes the quantity based on which you define the material's BOM components. The system then automatically divides the component's quantity with the base quantity during production order creation. This is especially useful when component quantities are very small and defined, for example, in milligrams for vanilla flavor.

For this example, assign a base quantity of "1 MT" in the BOM header as shown in Figure 6.5. Hence, the components and their quantities that you define in the BOM denote the requirements to produce 1 MT of material 30000038.

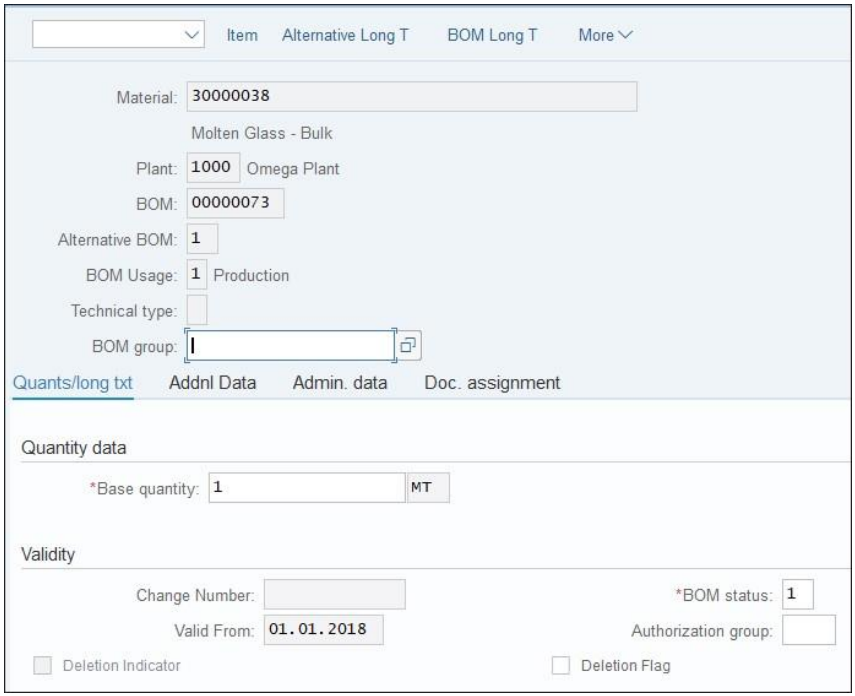
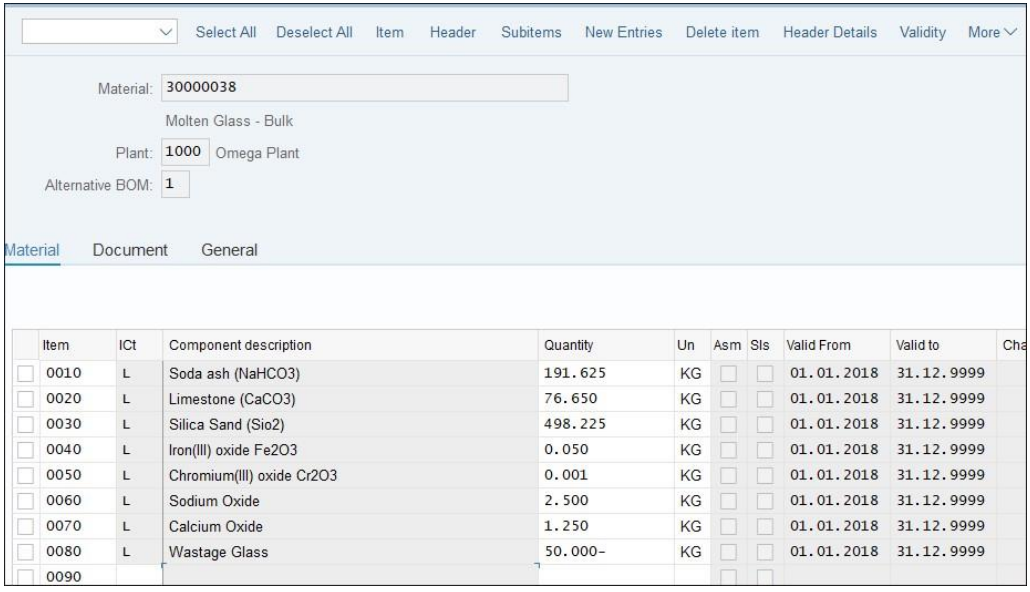


Figure 6.5 BOM Header

The **BOM status** field controls whether the BOM is active and is available for usage. The value **1** denotes that it's active. If you want to deactivate a BOM, you can change the status of the BOM to **Inactive** at any time.

Click on the **Item** button to go to the screen shown in Figure 6.6, which shows the item overview of the BOM.

Enter material numbers for the individual components, together with the quantity for each. The system will divide the component's quantity with the base quantity (if any) during the production order creation to calculate the quantity of the component needed to produce the main material, which in this case is 30000038.



Item	ICt	Component description	Quantity	Un	Asm	Sls	Valid From	Valid to	Cha
0010	L	Soda ash (NaHCO3)	191.625	KG			01.01.2018	31.12.9999	
0020	L	Limestone (CaCO3)	76.650	KG			01.01.2018	31.12.9999	
0030	L	Silica Sand (Sio2)	498.225	KG			01.01.2018	31.12.9999	
0040	L	Iron(III) oxide Fe2O3	0.050	KG			01.01.2018	31.12.9999	
0050	L	Chromium(III) oxide Cr2O3	0.001	KG			01.01.2018	31.12.9999	
0060	L	Sodium Oxide	2.500	KG			01.01.2018	31.12.9999	
0070	L	Calcium Oxide	1.250	KG			01.01.2018	31.12.9999	
0080	L	Wastage Glass	50.000-	KG			01.01.2018	31.12.9999	
0090									

Figure 6.6 BOM Item Overview

Select the line item **0010**, and click on **Item**, which opens the screen shown in Figure 6.7. Some of the important fields in this screen are listed here:

Fixed Quantity

This checkbox denotes that regardless of production order quantity, the component quantity remains fixed. For example, to produce a main material in 50 kg, the component quantity required is 50 kg. To produce 35 kg of the main material, the system calculates the component quantity of 35 kg, as defined in the material's BOM. However, if you select the **Fixed Quantity** indicator together with the component **Quantity** of, say 35 kg, the system calculates the component quantity required as 35 kg even if the main material's production quantity is 50 kg.

Operation scrap in %

Operation scrap defined in percentage increases the issuance quantity of a component to account for scrap during the production process. For example, if operation scrap is defined as 5%, and the component quantity is defined as 100 kg, the system automatically calculates the required component quantity as 105 kg to account for the operation (during production) scrap. It's mandatory to select the **Net ID** (not shown) when defining operation scrap.

Component Scrap(%)

Component scrap is defined as percentage increases of the issuance quantity of a component to account for scrap during the production process. For example, if component scrap is defined as 10%, and the component **Quantity** is defined as 100 kg, the system automatically calculates the required component quantity as 110 kg to account for the operation scrap.

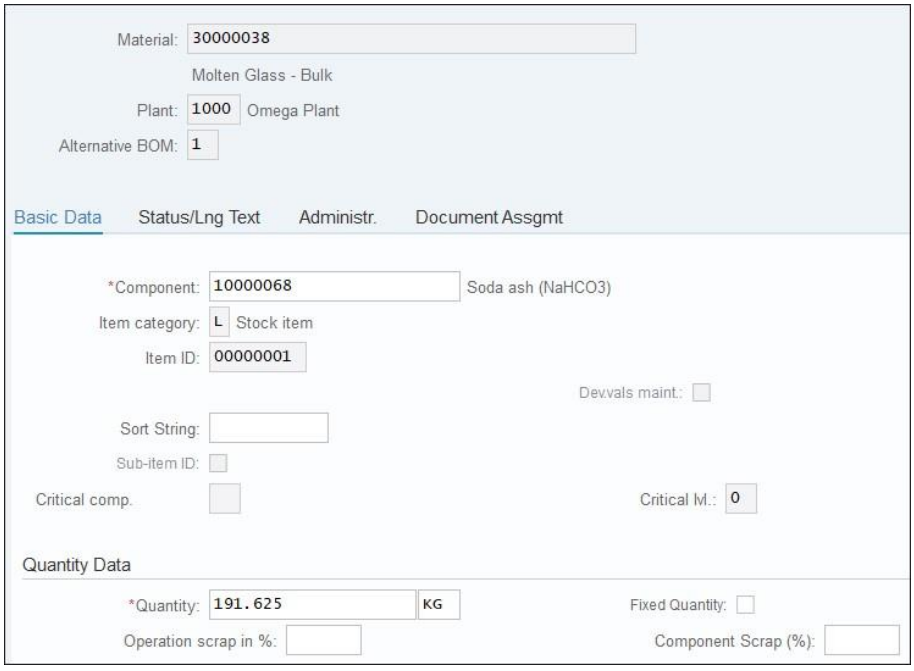


Figure 6.7 Detailed View of the BOM Item

If both scrap types that are selected are defined (operation scrap as well as component scrap), the system considers both scrap types during the component quantity calculation. During the MRP run, the system takes all of these scrap definitions into account to suggest planning proposals.

Scroll down the screen (see Figure 6.8). If the normal production of a product also generates a co-product, then you can select the **Co-product** checkbox.

If you have business scenarios in which the production process entails that the main material can also be one of its BOM components, then this is only possible if you select the **Recurs.** (recursive) **allowed** checkbox.

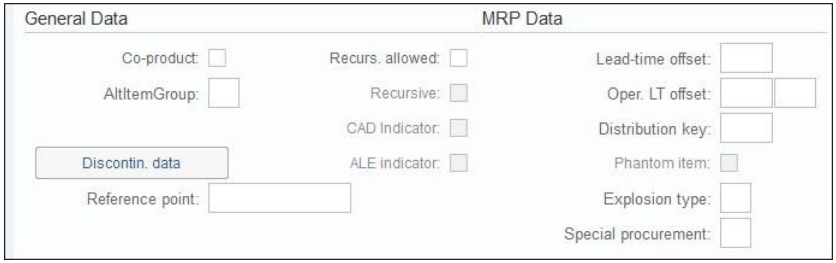


Figure 6.8 Additional Details in the BOM Item

In the **MRP Data** area of the screen, the **Lead-time offset** field helps with planning a component's availability. For example, to produce material as soon as the first shift starts in the morning, you approach your warehouse to issue the requisite components one day earlier. To handle this scenario, you enter "–1" so that the component's required availability date is one day earlier than the planned start date of the production. You denote the negative number of the workday to reflect that you need components earlier than the start date of production, and you use a positive number of days to show that you don't need the components for the defined number of days after the start of production. The system ignores this option if you work with leadtime scheduling (and not just basic date scheduling). To enable this behavior for leadtime scheduling, you need to assign the components to the corresponding operations in the routing. Note that such a positive or negative lead time is always independent from lot size.

The **Special procurement** field enables you to define a component-specific special procurement-like phantom assembly or procurement from another plant. Maintaining a special procurement type at the component level has higher precedence than at the material level. During an MRP run, the system explodes the material BOM and evaluates parameters maintained at the component level for planning purposes before it looks for the information at the material level.

Click on the **Status/Lng Text** tab in Figure 6.7 to see the fields in Figure 6.9.

Enter the **Prod. stor. location**. During the backflush process in SFC, the system looks for information in this field because it acts as an issue storage location. If the customer or vendor supplies the material instead of the company using its own material in production, then you can select the relevant option from the **Mat. Provision Ind.** dropdown field. Finally, you can also control whether the component is considered during product cost calculation or the system excludes it by selecting the relevant option in the **CostingRelevncy** field.

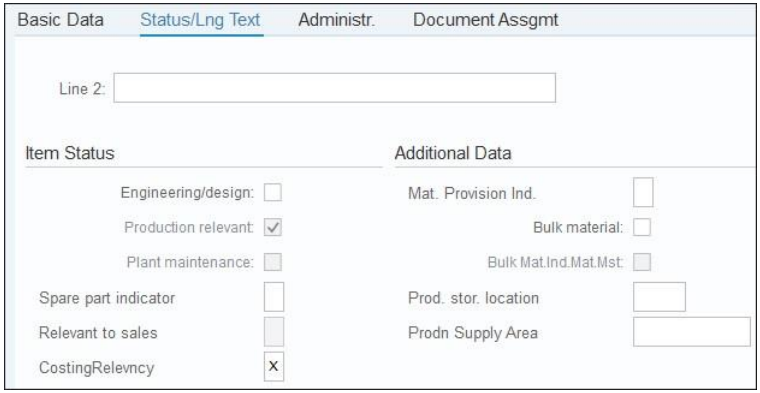


Figure 6.9 Status/Lng Text Tab of BOM Item Details

Tips & Tricks

You can make mass changes to the BOMs to attend to any new business requirements. For example, you might want to replace an old and obsolete component number in all of the materials' BOMs in which it's currently in use, or you might want to change the component's quantity in all of the materials' BOMs in which it's in use. You can use Transaction CS20 to make mass changes to the BOM. On the upper half of the screen, define the selection criteria, and then in the lower half of the screen, define the changes you want to make. While making the desired changes, be sure to select from one of the several radio buttons available.

6.2.3 Work Center

A work center can be a production facility, a processing unit, a machine or group of machines, or even a laborer or group of laborers directly involved in the production process. You can also group together machines and laborers in a single work center. To create a work center, follow the menu path, **LogisticsProductionMaster DataWork CentersWork CenterCreate**, or use Transaction CR01.

Note

For process industries, you create a resource and follow the menu path, **LogisticsProduction – ProcessMaster DataResourcesResourceResourceCreate**, or use Transaction CRC1.

On the initial screen, enter **Plant** "1000", for which you want to create a new work center. It's mandatory to assign a plant while creating a work center. Enter the **Work Center** as "ZFURNACE". It's an alphanumeric identification to denote a work center. Enter "0001" in the **Work Center Category** field; this is a control function used to ensure that only the relevant screens are eventually available during work center creation. Work center category 0001 denotes a machine, whereas 0007 denotes a production line.

Other important functions on the screen are **Copy from Plant** and **Copy from Work Center.** You can select the checkboxes of the reference work center views that you want to copy to the new work center. These functions help in reducing data entry efforts during the new work center creation by automatically making available all of the necessary information from the reference work center to the new work center, which you can change as needed.

In the following sections, we'll cover the various tabs available in a work center and the data you need to maintain, as well as this data's impact on business processes.

Basic Data

Click on the **Basic Data** tab of the work center, and enter a short description of the work center. In the **Usage** field, enter "009" (see Figure 6.10). A *usage* is a control function that controls whether this work center eventually becomes available for various other tasks, such as during the creation of routing or in the production version. **Usage 009** denotes that you can use this work center in all task list types.

The two important fields on this screen are the following:

Shift Note Type

A *shift note* is an option to record the important shift-related details of a work center. These can be general details of the shift as well as any specific problem encountered at this specific work center during the production process.

Shift Report Type

A *shift report* compiles and consolidates all of the information from a single shift note or multiple shift notes and is available either in Adobe Acrobat (PDF) or other formats, as well as on the layout defined for a company. The user can also digitally sign a shift report before a printout is possible and send a shift report by email.

Recall from Chapter 3 that we discussed the configuration of the **Standard value key** field in which we entered "ZTG2" that consisted of four activities to note and record during the production process when the work center "ZFURNACE" was used. These four activities are labor hours, machine hours, factory overhead, and power. A standard value key (SVK) denotes activities performed on the work center as well as the option to record them or otherwise. Some of the activities are production time, setup time, processing time, or labor time. When you enter "SAP1", the system automatically brings up three activities (**Setup**, **Machine**, and **Labor**) for which you'll record the actual details in the confirmation process (see Figure 6.11).

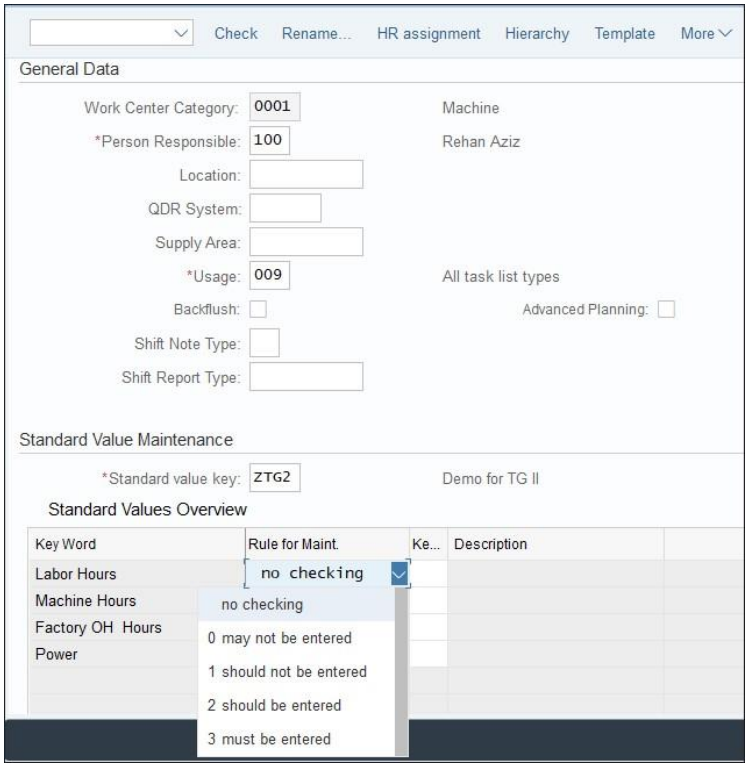


Figure 6.10 Basic Data View of the Work Center

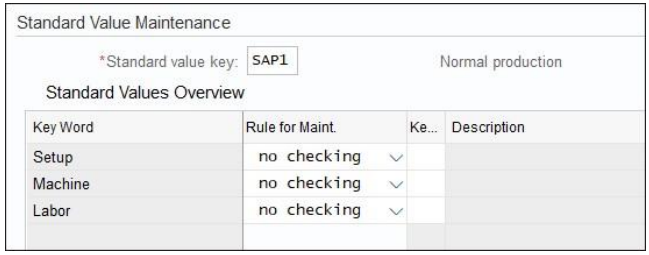


Figure 6.11 Standard Value Key "SAP1"

Enter "Machine" under **Key Word**, and select **3 must be entered** under **Rule for Maint**. If you mark this activity as **must be entered**, then during the creation of a routing, you're required to enter the actual duration of the activity; otherwise, the system won't allow you to save the routing. Other maintenance options are **may not be entered**, **should not be entered**, and **should be entered**, which offers various degrees of control from an information message to a warning message, if the requisite information (duration in this case) isn't recorded during confirmation.

In addition, you can select the **Backflush** checkbox on this screen, so that the system automatically issues components at the work center (in this example, ZFURNACE) during the confirmation process.

Note

In Chapter 3, we made the field settings that require the selection of the **Backflush** field.

Default Values

Click on the **Default Values** tab to see the options shown in Figure 6.12.

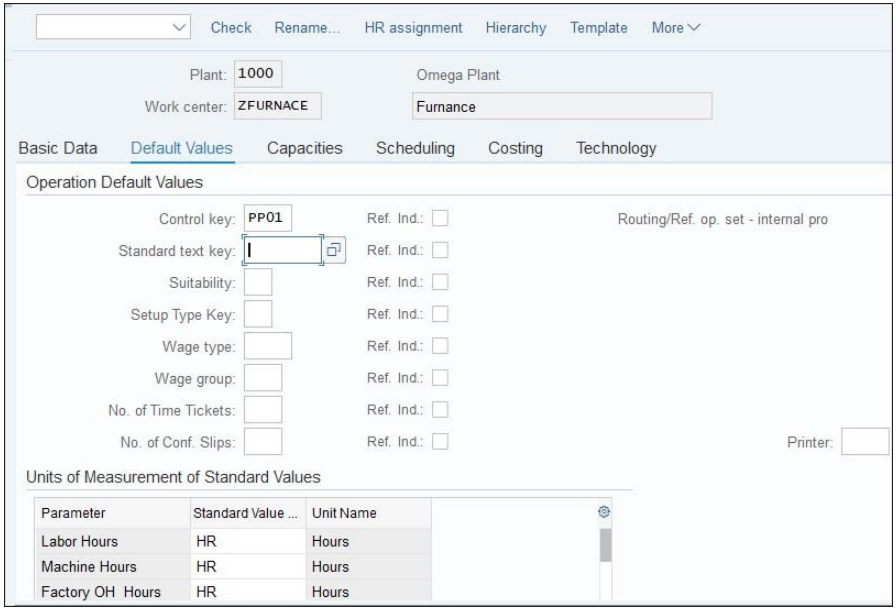


Figure 6.12 Default Values View of the Work Center

Assign the **Control key** "PP01" to the work center. A *control key* is a control function that determines whether you can perform an activity or a task associated with the work center or not. A control key controls several functions, such as scheduling, cost, automatic GR, print confirmation, and print**.** If any of the checkboxes of the control key aren't selected, then you can't perform that step or function on this work center (ZFURNACE). For example, if the **Scheduling** checkbox isn't selected in the control key, then the system won't perform scheduling on this work center.

Note

Chapter 3, Section 3.3.6, covers how to configure a control key.

Capacities

Click on the **Capacities** tab to see the options shown in Figure 6.13. Enter the **Setup Formula** "SAP005", which denotes the setup formula that the system will use during capacity calculation. For the **Processing Formula**, enter "SAP006", and for the **Teardown Formula,** enter "SAP007". These formula entries are for **Capacity category 001**, which is for **Machine**.

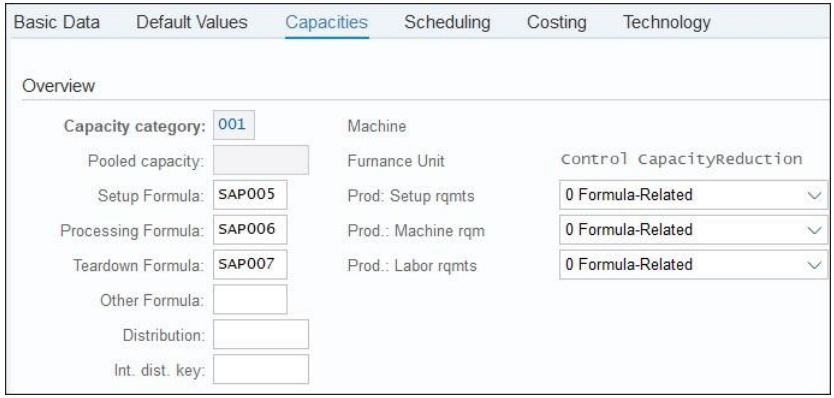


Figure 6.13 Capacities View of the Work Center

Note

See Chapter 15 for details about capacity requirements planning (CRP).

Click on the **Capacity header** in the toolbar at the bottom of the **Capacities** tab to open the **Change Work Center Capacity: Header** screen for work center ZFURNACE (Figure 6.14).

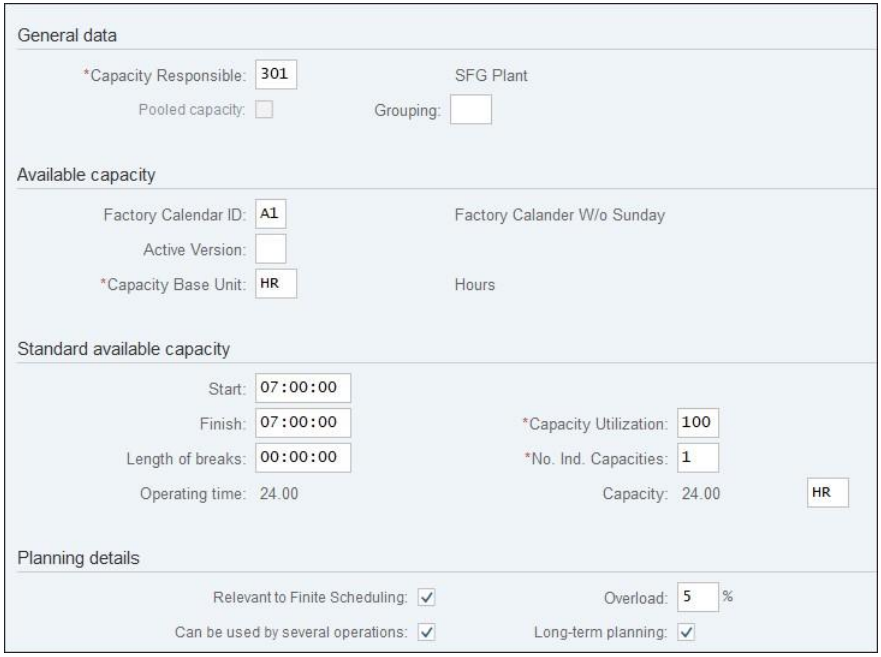


Figure 6.14 Capacity Header

The capacity header contains comprehensive capacity details, such as start and end time of shift, breaks, overload percentage allowed for capacity, shifts and intervals, and factory calendar.

Note

Refer to Chapter 2 for information about setting up the factory calendar and capacity planner group.

For this example, maintain the following in each field:

Short Text for Capacity (not shown): "Furnace Unit"

This short text describes the capacity category, for example, a specific production line or machine.

Capacity planner grp (not shown): "001"

It's important to assign a capacity planner group to a work center, so that during evaluation of capacities, the capacity planner group can be one of the evaluation criteria.

The capacity planner group shouldn't be the name of the person but instead the name of the area or domain of responsibilities.

Grouping: "51"

If apart from your normal shift timings during the entire calendar year (factory calendar), you have any specific slow or busy seasons in which you either increase or decrease the number of shifts or intervals, then you can logically group them using the grouping function. For example, in several countries, Fridays have longer breaks, whereas in other countries, Saturday is a half-working day. You can attend such business scenarios using grouping, which doesn't fall under normal start, finish, and break timings.

Factory Calendar ID: "A1"

This is the same factory calendar that you configured in Chapter 2; now assign it to the work center.

Capacity Base Unit: "HR" (for hours)

This is the unit of measure (in hours) in which the system displays the capacity of a work center.

Start: "07:00:00"

This is the start time of a shift of a work center.

Finish: "07:00:00"

This is the end time of a shift of a work center.

Length of breaks: "00:00:00"

This is the total length of break during the start and end of shifts. Break timing deducts the availability time of the capacity of a production line. For example, if a machine runs 12 hours a day, with 2 hours of daily breaks, then the available capacity of the production line is 10 hours.

Capacity utilization: "100" (percent)

This is the actual capacity utilization factor. This factor has to be as realistic and as close to actual capacity of a production line as possible to enable the system to calculate the available capacity of the production line. You can use it to model for statistically unforeseen downtimes. When your SAP system has built up a significant amount of data, you can use one of many available statistics reports on capacities to update the information in this field. For example, you've maintained a value of

100% in this field, but the statistics reports reveal that capacity is never utilized by more than 90%. In this case, you can update the information to 90% here so that the system ensures realistic and practical capacity planning, and you have greater confidence in the system-generated results. (Refer to Chapter 18 on reporting.)

No. Ind. Capacities: "1"

This is the number of individual capacities associated with a production line. For example, four individual ice cream mixers are created as one production line. Thus, the individual capacities are 4 in number and directly multiply with the timings of the capacity of the production line. For example, if the available capacity of a production line is 10 hours in a day, and there are 4 individual capacities, then the total available capacity of the production line is 40 hours. If you're going to use splitting in routing and also define the number of splits, then it's important to also define the number of capacities because the system checks for this information during scheduling. **Relevant to Finite Scheduling**

This checkbox causes the work center to consider capacity overload during capacity evaluation.

Overload: "5%"

A capacity overload in percentage directly increases the capacity availability of the production line by the defined percentage. If, for example, the total capacity of a production line is 40 hours with 10% overload, then the available capacity is 44 hours. A 10% overload of 40 hours is 4 hours, and it adds up to 40 hours to show the total available capacity at 44 hours.

Long-term planning (checkbox)

This checkbox enables the system to consider the production line availability during long-term planning (LTP). LTP typically is a simulative planning of material and production lines over a longer period.

Note

See Chapter 14 for detailed information on LTP.

Click on the **Intervals** button, and then in the screen shown in Figure 6.15, you can assign specific intervals or shifts that are applicable for the defined duration. For this example, define that from **01.11.2018** until **20.11.2018**, there will be a shift **Sequence** consisting of a **7**-day cycle in which there will be **3** shifts.

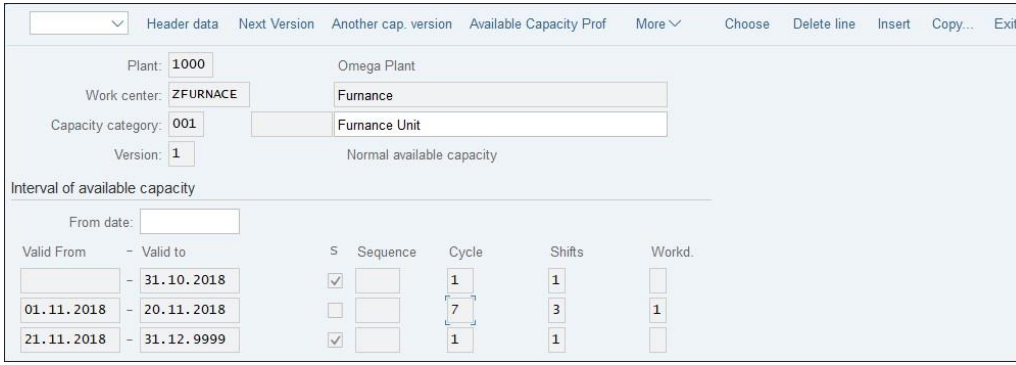


Figure 6.15 Interval in Capacity Header

Scheduling

Click on the **Back** icon, and then click on the **Scheduling** tab to see the options shown in Figure 6.16. Enter the standard formulas available for discrete manufacturing, as covered in detail in Chapter 3.

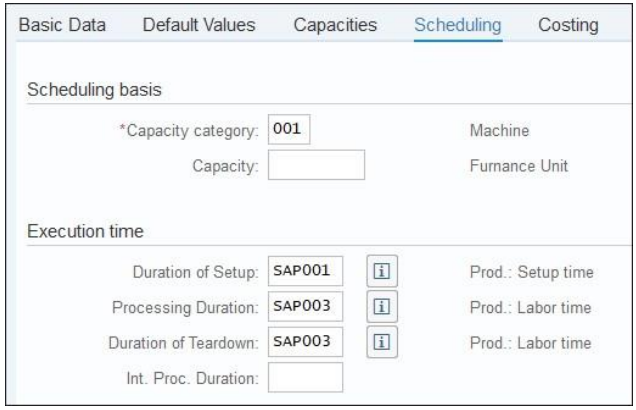


Figure 6.16 Scheduling View of the Work Center

Costing

Click on the **Costing** tab to see the options shown in Figure 6.17. Because PP comprehensively integrates with product cost controlling's cost object controlling (part of SAP S/4HANA Finance), each work center needs to have a cost center. You can assign one cost center to multiple work centers, but you can't have multiple cost centers assigned to a work center.

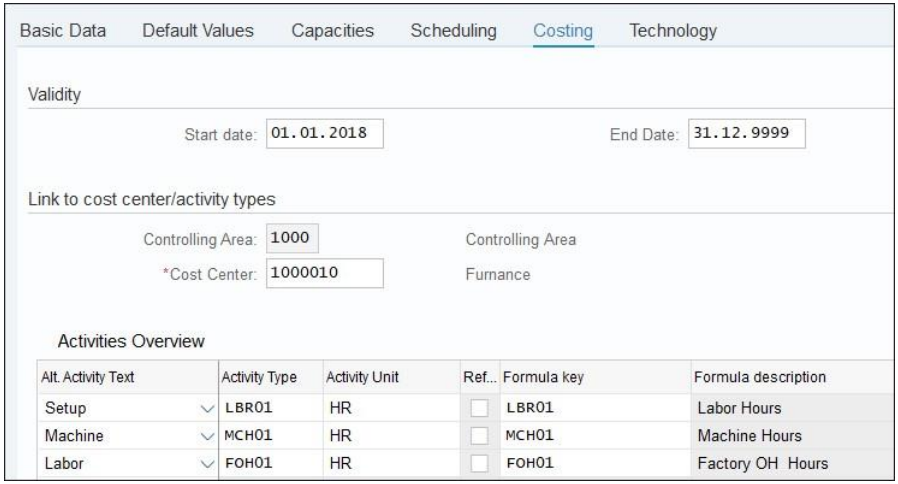


Figure 6.17 Costing View of the Work Center

Note

You need to coordinate with the CO person to ensure that each cost center and associated activity type for the given controlling area has price planning.

In the same step, you also have to ensure that activity types and cost centers are already in place so that you can assign them in the work center.

Enter the following details:

Start Date: "01.01.2018"

This is the start date of the availability of the cost center for the work center.

End Date: "31.12.9999"

This is the end date of the availability of the cost center for the production line.

Cost Center: "1000010"

Every work center requires direct assignment of a cost center so that when you perform work using the work center, the system is able to accumulate all of the costs on the designated cost center.

Activity Type (Alt: Activity Text Setup): "LBR01"

Activity type denotes the predefined rate with which the system calculates the cost incurred to perform machine setup.

Formula (Alt: Activity Text Setup): "LBR01"

A formula denotes the parameters that the system considers to calculate the cost incurred to perform machine setup.

Repeat the same process of entering activity types and formulas for the other remaining two activities, **Machine** and **Labor**, and then save the work center.

6.2.4 Routing

The routing of a material can contain a series of operations. The operation details are defined for each operation based on the production quantity, production time, and associated unit of measure. You assign work centers to the routing, which should also contain an SVK, in which the standard values for setup time, production time, and teardown time are defined. The routing is the sequence of logical production processes through which a product will, for example, transform from raw material into a finished product.

To create the routing of a material, follow the menu path, **LogisticsProductionMaster DataRoutingsRoutingsStandard RoutingsCreate**, or use Transaction CA01.

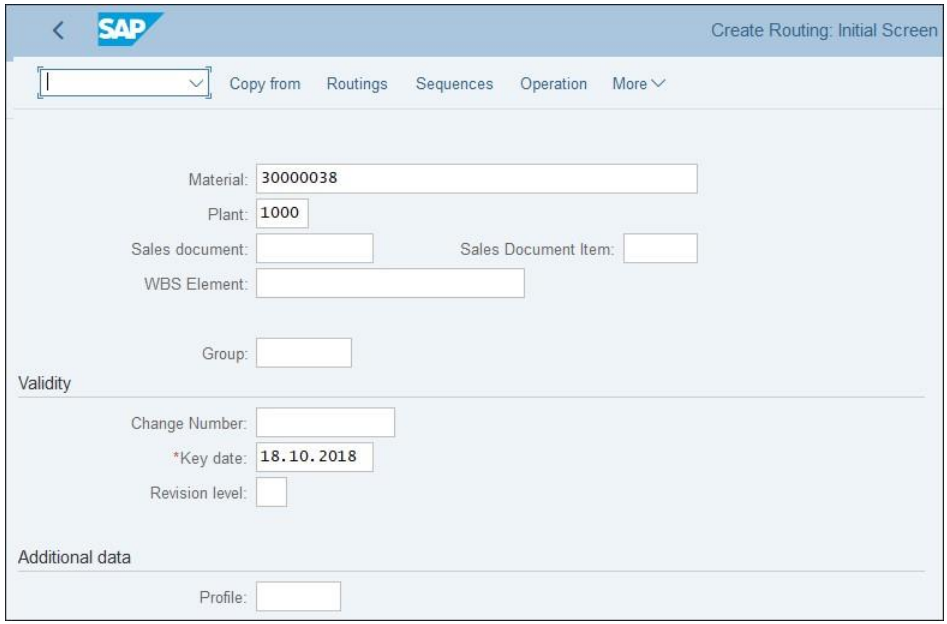


Figure 6.18 Initial Screen for Routing

Figure 6.18 shows the initial screen to create routing. Enter the **Material** as "30000038" and **Plant** as "1000". In the **Key date** field, enter "18.10.2018" to denote the date when the routing becomes available in the production process. Because the routing validity starts on October 18, 2018 (18.10.2018), when you create a production order, for example, for the month of August 2018, this routing won't be available.

If no date is given during routing creation, then the system automatically assigns the routing's creation date as the valid from date.

In the following sections, we'll cover the various elements and options available in routing.

Header Details

Click on **Routings**. In the header details of the routing shown in Figure 6.19, enter the following:

Usage: "1" (which denotes Production)

This makes the routing available during subsequent production activities, in which the system uses routing during creation of the production order.

Status: "4" (which denotes Released)

This makes the routing available during subsequent production activities, in which the system uses routing during creation of the production order. If the status of the routing is set to **Being Created** (**Status 1**), it won't be available when you create a production order for the material.

Planning work center: "ZFURNACE"

This is the work center that you previously created and is now used in the planning and production of the material.

Note

Normally, you should have several work centers created before creating a routing. The **Planning work center** field should either be left open/blank or made to include the "bottleneck" work center that you want to evaluate during the planning process.

The **From Lot Size** field denotes that the smallest quantity of the production order must be at least 1 PC for the system to consider using this routing. The **To lot size** field denotes the maximum quantity of the production/order.

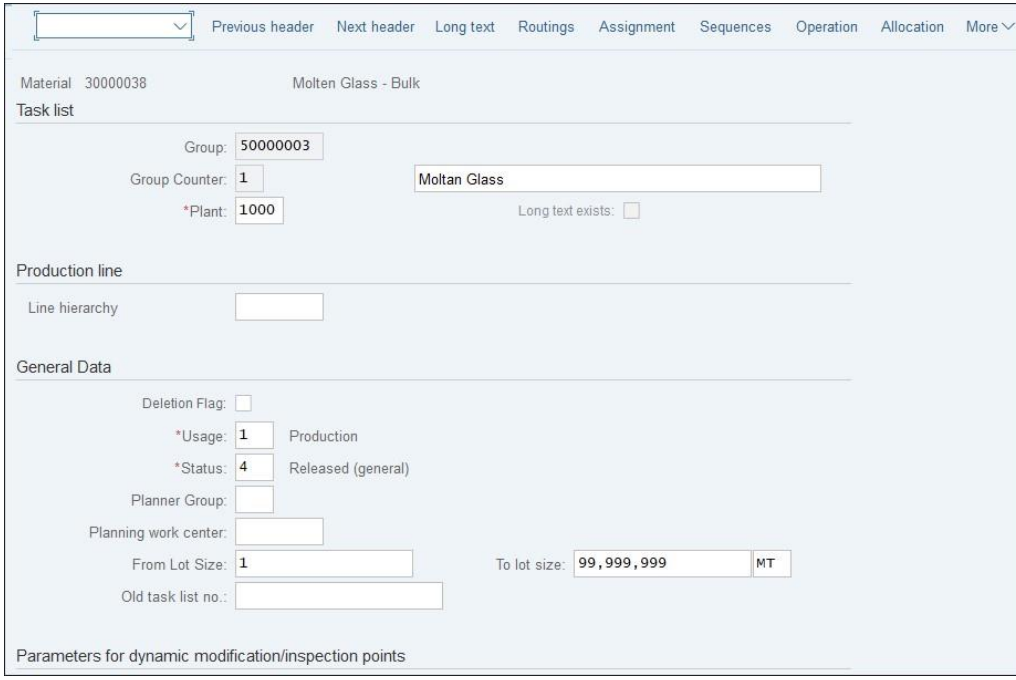


Figure 6.19 Header Details in Routing

The **Parameters for dynamic modification/inspection points** area of the screen is the integration point between PP and QM in SAP. The parameters you enter here determine whether the system carries out an inspection for the inspection type, for the individual inspection lot, or for the master inspection characteristics.

Note

Because QM also integrates with discrete manufacturing, you need to engage a QM resource for this activity.

Click on the **Operation** button, which takes you to the screen shown in Figure 6.20 where you enter the **Work center** as "ZFURNACE". This denotes assigning a previously created work center to an operation, which is used in the production of material and for which you're creating the routing. An operation defines, for example, a singlelevel detail of a production step. Select the first line item, **Operation 0010**, and double-click on the **Operation 0010**, which takes you to Figure 6.21.

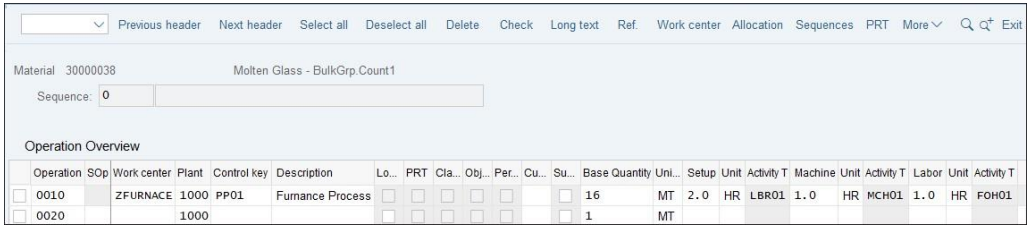


Figure 6.20 Operations Overview of Routing

Operations

Figure 6.21 shows the operations detailed view in which you can enter the following:

Setup: "2.0 HR"

You define the time it takes to set up the machine for this task. Any deviation in setup time, either positive or negative, has direct impact on the costs of goods manufactured (COGM).

Act. Type: "LBR01"

An *activity type* is a result of the direct integration of PP with the product cost controlling functionality (CO-PC). In fact, PP completely integrates with CO-PC. An activity type contains the financial rate (value-based) to perform an activity during production. So, five hours of production time has an associated cost of producing the material. Any deviation in production time, either positive or negative, has a direct implication on the COGM.

Machine: "1.0 HR"

You've defined in the work center that recording duration information in routing is a mandatory field (in the rule for maintenance when you selected the **must be entered** option), so you have to define the time it will take in this work center's operation of the manufacturing process.

Labor: "1.0 HR"

You define the time it takes to dismantle or tear down the setup of the machine or the production line. Any deviation in teardown time, either positive or negative, has a direct implication on the COGM.

Enter the **Act. Type** for each of the three activities:**Setup**, **Machine**, and **Labor**. These durations are for the **Base Quantity** of **16 MT** of material (**30000038**) produced.

Notice that the system automatically incorporates the **Control key** that you defined in the work center, **ZFURNACE**, in the previous step.

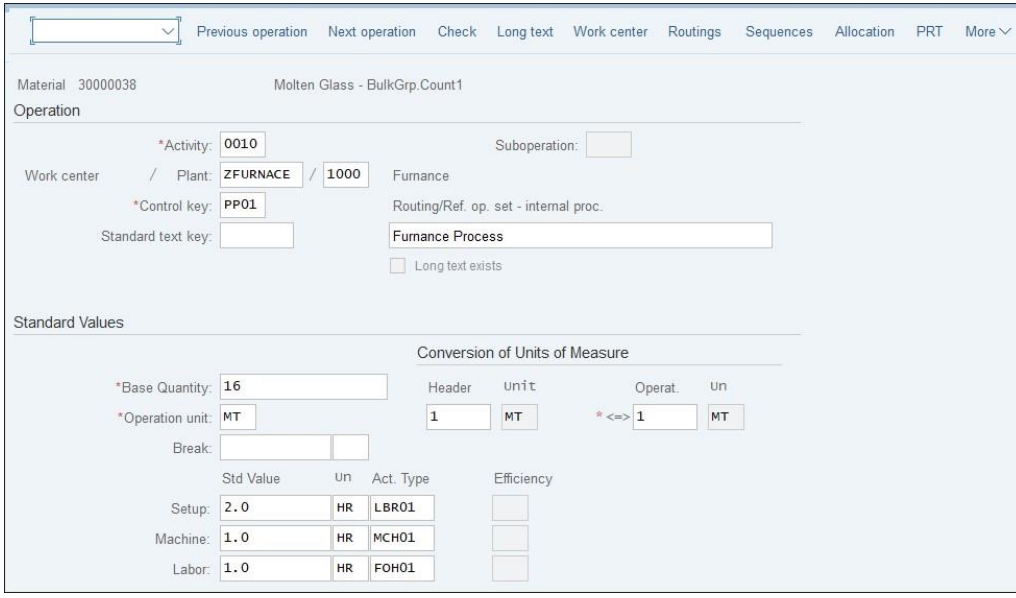


Figure 6.21 Operation Details in Routing

Scroll down to see the screen area shown in Figure 6.22. Here you can assign the reduction strategy that you configured for plant 1000 in Chapter 3. Further, selecting the **Teardown/Wait Parallel** (simulation) checkbox enables you to have the simulated details during scheduling. You can define the normal and minimum interoperation time. The interoperation times consist of wait time, queue time, and move (transport) time. During reduction, that is, during scheduling conflict in basic dates, the system switches to minimum interoperation times, as well as further reduction based on the reduction strategy and reduction levels defined.

Scroll down the same screen to see the screen areas shown in Figure 6.23. With **Splitting**, you can divide a large production lot into several smaller lots provided you have several individual capacities to manage it. The system checks the number of splits with individual capacities that you had defined in the work center.

With **Overlapping**, the system passes the processed parts of the total lot directly on to the next machine. You can choose to define the minimum overlap time as well as the minimum send-ahead quantity to the next operation.

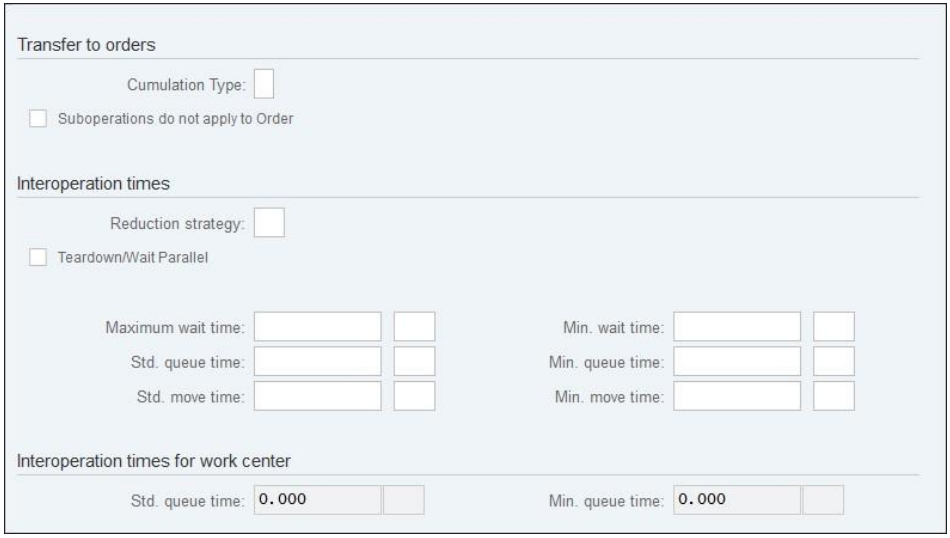


Figure 6.22 Operation Details in Routing: Interoperation Times

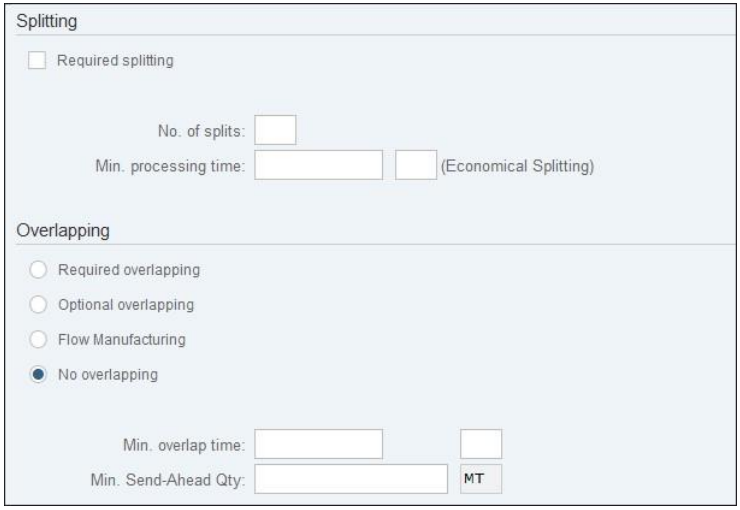


Figure 6.23 Item Details in Routing: Splitting and Overlapping

The information in the **General data** tab (see Figure 6.24) relates to the percentage scrap (planned) for the operation and integrating with your HR system. You can also integrate, for example, the person doing the confirmation on the shop floor to your HR system.

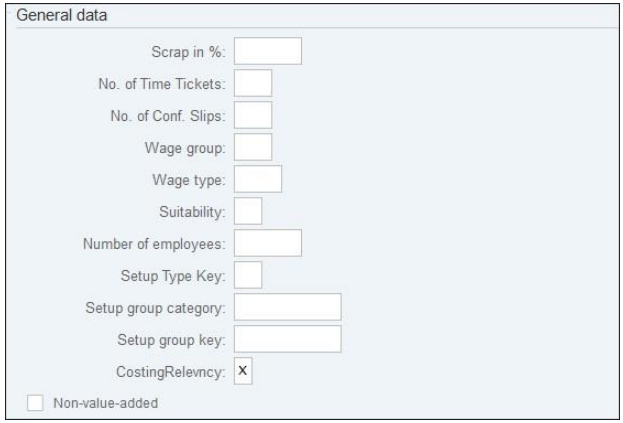


Figure 6.24 Item Details in Routing: General Data

Scroll down further on the same screen to see the screen area shown in Figure 6.25. Here, the **Subcontracting** checkbox reflects the details that you can enter in case the material processing involves subcontracting. A subcontracting process entails that you'll engage services of a vendor to perform some of the steps in the production process, for which you either don't have the in-house expertise or find it cost-effective to outsource it.

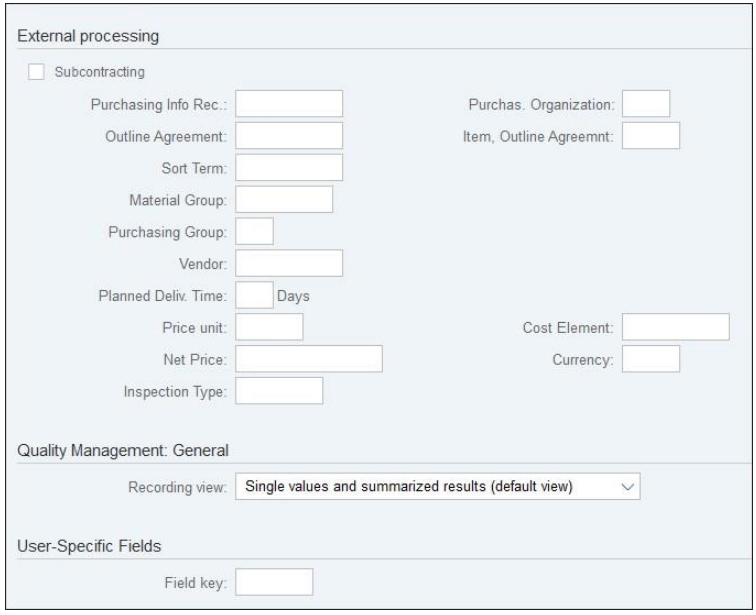
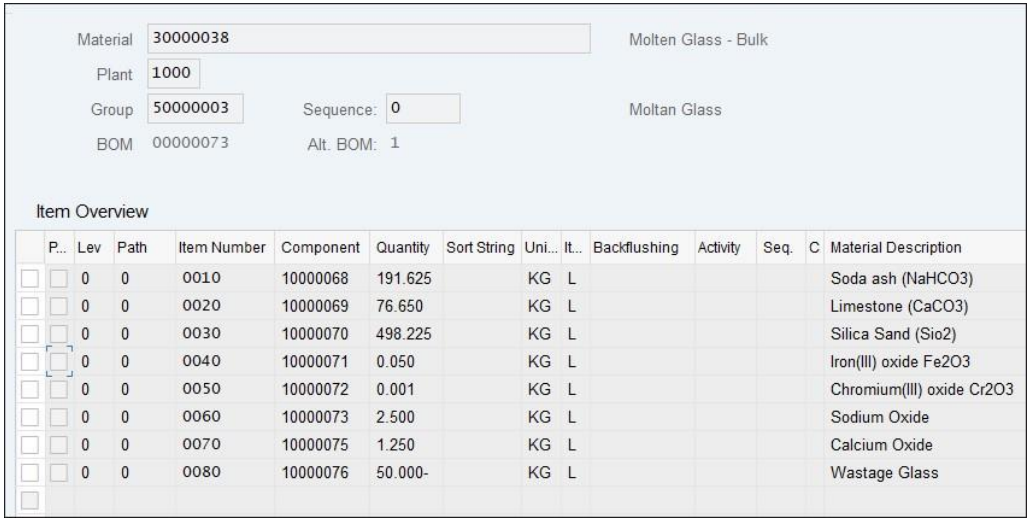


Figure 6.25 Item Details in Routing: Subcontracting

You select the **Subcontracting** checkbox and enter the procurement details in the remaining fields. When the system creates a production order for the material, it also creates a purchase requisition for the subcontracting operations.

Components Assignment

Next, press (F6), or follow the menu path, **GotoOperations Overview**, and the system brings you back to the **Operations Overview** screen. In this screen, click on the **Components Allocation** to open the screen shown in Figure 6.26. Here you find the component allocation in routing. These components are directly taken from a material's BOM, which you've already created in the previous step. If you don't assign a specific component to the specific operation, the system assigns all components to the first operation of the routing during lead-time scheduling. This means that all components must be available at the first operation, so that during backflush, the system is able to consume all components in the first operation during its confirmation.



Material 30000038 Molten Glass - Bulk
Plant 1000
Group 50000003 Sequence: 0 Moltan Glass
BOM 00000073 Alt. BOM: 1

Item Overview

P...	Lev	Path	Item Number	Component	Quantity	Sort String	Uni...	It...	Backflushing	Activity	Seq.	C	Material Description
	0	0	0010	10000068	191.625		KG	L					Soda ash (NaHCO3)
	0	0	0020	10000069	76.650		KG	L					Limestone (CaCO3)
	0	0	0030	10000070	498.225		KG	L					Silica Sand (Sio2)
	0	0	0040	10000071	0.050		KG	L					Iron(III) oxide Fe2O3
	0	0	0050	10000072	0.001		KG	L					Chromium(III) oxide Cr2O3
	0	0	0060	10000073	2.500		KG	L					Sodium Oxide
	0	0	0070	10000075	1.250		KG	L					Calcium Oxide
	0	0	0080	10000076	50.000-		KG	L					Wastage Glass

Figure 6.26 Material Component Overview

If your business process entails that a few components are used or needed in the later stages of the production process, then you can select them and use the **Reassign** button to assign specific components to the operation. For this example, assign the **Component 10000068** to **Oper./Act. 0020**. This means that while the system will consume other components on the first operation's (0010) confirmation using the backflush functionality, it will consume component 10000068 when the user confirms operation 0020. To ensure that the system

uses the backflush functionality, check the **Backflushing** checkbox. Notice the component **10000076** with a negative quantity of **50.000 KG** that denotes it being a by-product being produced in the production process. So, while all components in a material BOM are consumed during the production process, the co-product or by-product are generated or produced instead in addition to the production of the main material (in this example, it's **Material 30000038 Molten Glass - Bulk**).

Material Assignment

Go back to the routing header screen, click on the **MatlAssignment**, and the popup shown in Figure 6.27 appears. **Material 30000038** in **Plnt 1000** is assigned an internal group as 50000003 with the group counter (**GrC**) as **1**. Later, we'll use this group (50000003) and the group counter (**1**) in creating the next PP master data, which is the production version. It's important to add that every combination of a group, and the group counter reflects a certain planned working process.

Figure 6.27 Material Assignment

You can assign several materials, together with their respective plants, to this routing group. All such materials belonging to this routing group will have the same group but will have ascending group counter numbers.

Tips & Tricks

If you have several materials undergoing the same production process, you no longer need to create separate routings for each. Just create one routing, and assign relevant materials (with plants) to it. This saves time and effort in creating an important master data (routing) and also eliminates or reduces redundant data entry efforts.

Sequences

Whenever we refer to routing, we imply that it will be a sequence of operations in a logical order. For example, when we define operations 10, 20, and 30 for a routing, we concur that operation 10 will be the first step of the production process, then operation 20, and finally operation 30. It also means that we confirm the operations in the same sequence. However, you can also maintain parallel and alternate sequences in routing. *Parallel sequences* enable you to split up the production process if you can carry out specific production steps of an order simultaneously. The *alternative sequences* represent an alternative in being able to produce a product in the production process in different ways.

You can call the sequence overview by clicking the **Sequences** icon in the initial routing screen. The sequence overview displays all parallel and alternative sequences contained in the routing:

The system numbers the sequences and also contains a sequence category. The standard sequence contains sequence category 0.

The parallel sequences contain sequence category 1.

The alternative sequences contain sequence category 2.

When you first create a routing and define an operation, the system contains a standard sequence. When you click on the **New entries** button, a popup appears in which you can select either **Alternative sequence** or **Parallel sequence**. For this example, choose **Parallel sequence** (see Figure 6.28), and the system navigates to the screen shown in Figure 6.29.

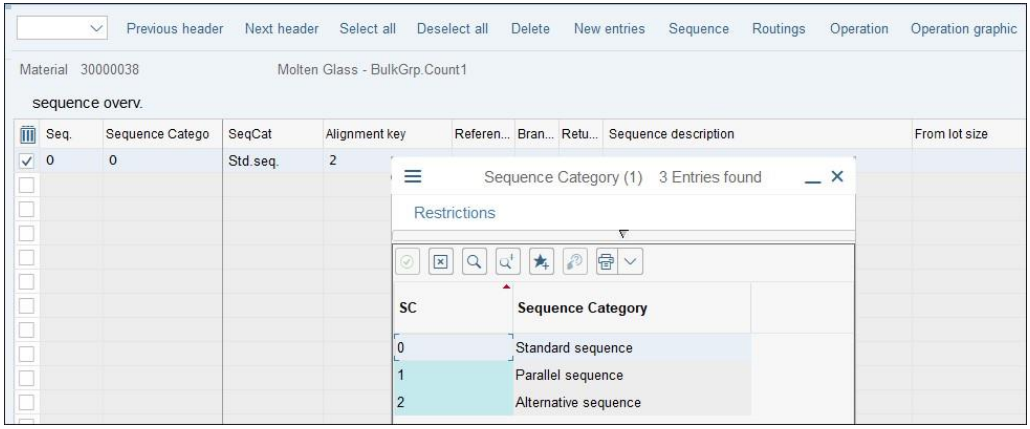


Figure 6.28 Choosing a Sequence Category

In Figure 6.29, **Sequence 1** refers to the first sequence with reference to the original operation's sequence, which is **0**. The **Branch operation** field stipulates that operation when the system should proceed with the parallel sequence. The **Return operation** field denotes the operation number that the system must return to or branch back to after the parallel operation. It's mandatory to define the return operation.

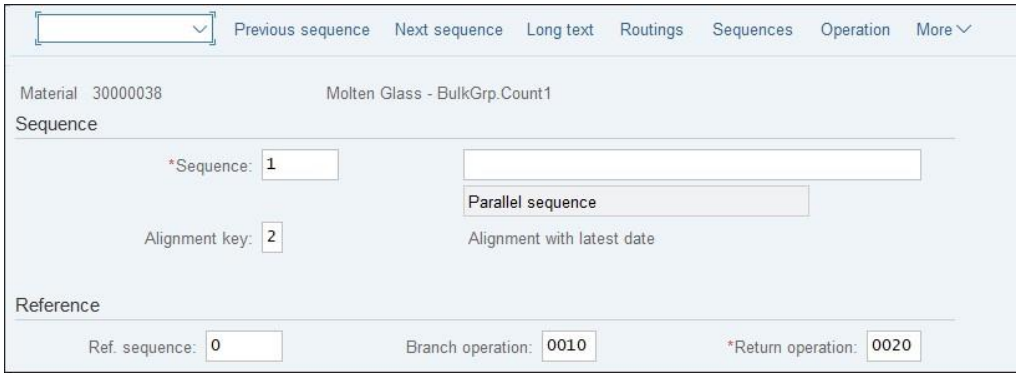


Figure 6.29 Sequence Details

Here is a sequence overview for **Material 30000038**. It stipulates that the system will branch off to a parallel sequence on operation **0010** and will return to a standard sequence in operation **0020**.

For **Alternative sequence**, you can define the minimum and maximum lot sizes that are applicable for the alternative sequence.

Production Resources and Tools

Production resources/tools (PRTs) are movable operating resources that you can assign to internal and external operations in the routing. Examples of PRTs include tools, materials, documents or drawings, and test equipment. PRTs play an important role in facilitating the production process. For example, to move heavy metal containers from one production line to the next, you need a pair of large metal hooks, which is a PRT.

You can assign a PRT to an operation of a routing by clicking on the **PRT** icon. In Figure 6.30, assign a **Material** PRT "40000130", and assign a **Quantity** of "1.000". You can use this screen to create more PRTs, such as documents and equipment, by using the corresponding **Document** and **Equipment** buttons.

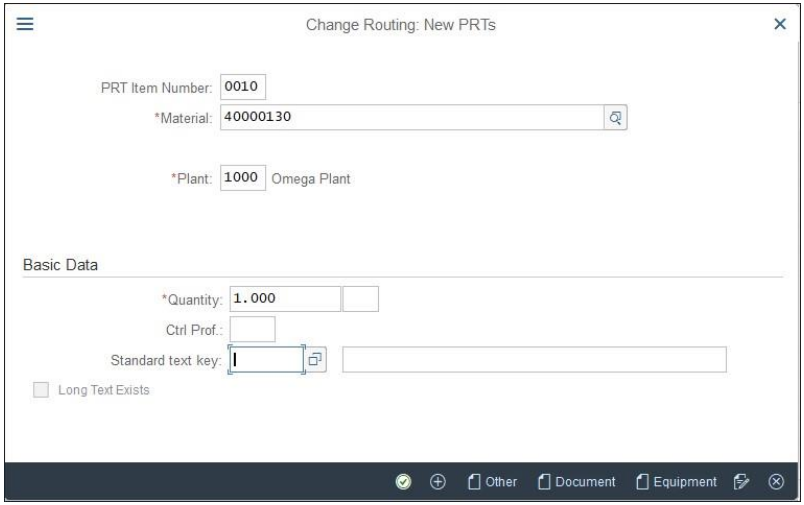


Figure 6.30 PRT Assignment

Delete Task List

One of the advantages of PP master data is the fact that you can delete the master data from the system and avoid having to archive it. You delete master data, for example, when you wrongly create a work center or an incorrect routing. You can delete any PP master data that isn't in use.

To delete routing or, in fact, any task lists (e.g., rate routing, master recipe, or inspection plan), use Transaction CA98. On the initial screen, enter the selection parameters, and choose the relevant deletion options.

Engineering Workbench

You can use the Engineering Workbench to create or make changes to PP master data, such as BOMs or routing. The Engineering Workbench is an interactive and intuitive tool to enable you to make collective changes to, for example, BOM headers of several materials at once.

You use Transaction CEWB to access the Engineering Workbench, and then on the initial popup, select the work area that you want to work on. The work area can be the BOM header, BOM item, routing header, or routing item. On the parameters selections screen, enter the parameters, and then choose **Load BOMs and Task Lists.** In the ensuing worklist, you can make the desired changes to PP master data or create a new worklist.

6.2.5 Production Version

Production versions denote different ways by which a company produces a material. This includes, for example, a material having one routing but multiple BOMs. Hence, for each BOM and the same routing, the system needs a separate production version to denote uniqueness of the different ways to produce the same material. The requirement to create a separate production version also applies when there is one BOM for a material but multiple routings. In process manufacturing and in REM, it's mandatory to create and make available a production version. Creating a production version isn't a mandatory requirement in discrete manufacturing, however. The salient features of the production version include the following:

Production versions can also be quantity range-specific, thus acting as a control function. For example, you can create one production version that has a quantity limitation of 1 to 1,000 PC and another production version for quantities greater than 1,000 PC.

Production versions can also be validity period-specific, thus acting as a control function. For example, you can have a production version that is valid from April 01, 2019, until March 31, 2019. From April 01, 2019, onward, you may have a new production version. When the system has to assign a production version to the production order, it searches for specific validity dates. When the system finds the relevant production version, it automatically assigns it.

If the system is able to find multiple production versions fulfilling the search and application criteria, it assigns the first available production version to the production order.

To facilitate production version creation in SAP S/4HANA, a new report called CS_ BOM_PRODVER_MIGRATION is available. To execute the report/worklist, use Transaction SE38, enter "CS_BOM_PRODVER_MIGRATION" on the screen that appears, and click **Execute** or press (F8). On the screen that appears, you can choose to enter materials and the associated plants or simply entering a plant will bring up all the materials whose BOMs exist and quality for production version creation. To simulate production versions creation, choose the **Run in Simulation Mode** radio button, and click **Execute**. To create production versions in actual mode, choose the **Run in Actual Mode** radio button.

You can choose to approve individual, selective, or all production versions creation and finally click on **Approve**. A message appears to confirm creation of the production version.

To create a new production version, follow the SAP menu path, **LogisticsProductionMaster DataProduction Versions**, or use Transaction C223.

In Figure 6.31, and in the **Selection Conditions** area, enter the **Plant** as "1000", enter the **Material** as "30000038", and then press (Enter). If the system is unable to find any

production version of the material, then the lower half of the screen is blank. If it does, then the system displays the relevant production versions.

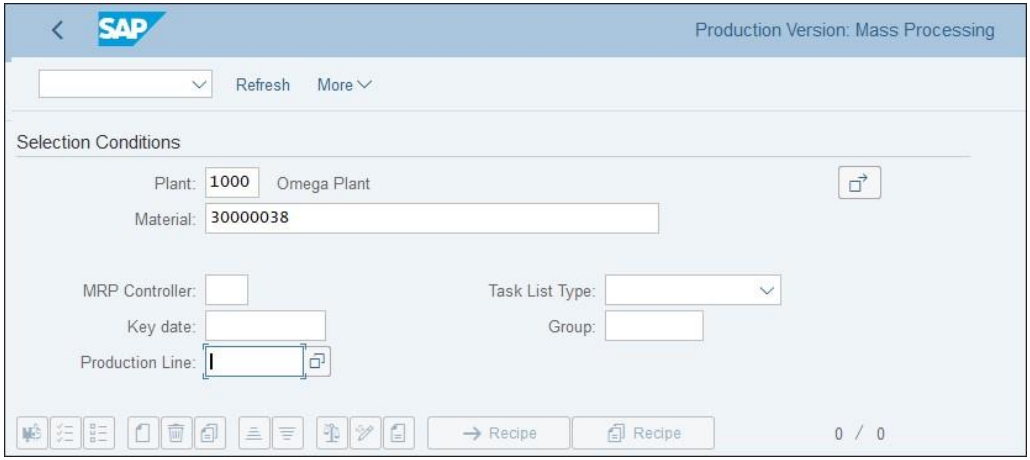


Figure 6.31 Production Version Initial Screen

From the menu bar available at the center of the production version creation screen, you have just about all of the options normally needed while creating production version master data. This includes copying, deleting, copying from a template, and so on. Choose the **Create Production Version** to open the screen shown in Figure 6.32. Enter the basic details such as **Plant** "1000", **Production Version** "0001", a **Production Version Text**, **Valid from** "01.01.2018", and **Valid to** "31.12.9999".

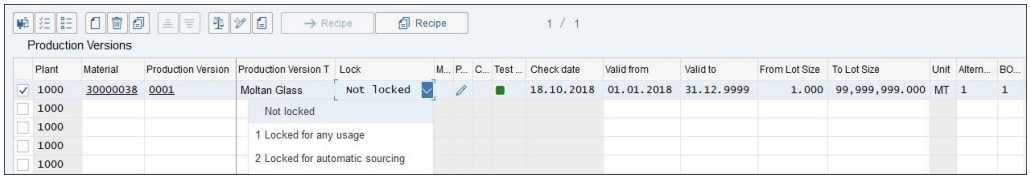


Figure 6.32 Overview Screen of the Production Version

Select the first line item, and double-click on it, or click on the **Detail** icon, which brings up the screen shown in Figure 6.33.

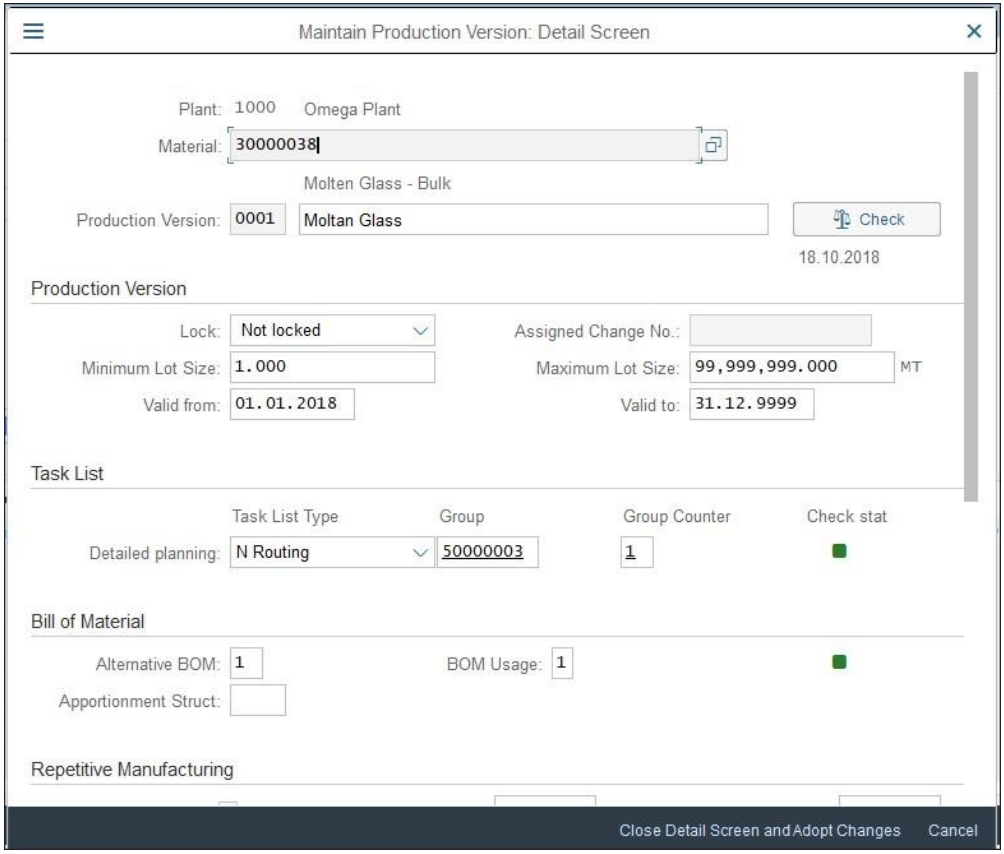


Figure 6.33 Detailed Screen of the Production Version Enter the details as noted in Table 6.2.

Field	Value	Additional Details/Remarks
Material	30000038	–
Production Version	0001	–
Valid from	01.01.2018	This field is the start of the validity date of the production version.
Valid to	31.12.9999	This field is the end of the validity date of the production version.

Table 6.2 Parameters Entry in the Production Version

Field	Value	Additional Details/Remarks
Detailed planning	Routing (N)	Task list type **N** denotes that it's a routing. Each task list type represents a different function. Type list type **R** represents a rate routing, whereas task list type **Q** represents a quality inspection task list. Enter the routing that you created in the previous step. For this example, enter routing **Group** "50000003" and a **Group Counter** of "1".
Alternative BOM	1	This is the BOM that you created in the previous step.
BOM Usage	1	This field is the BOM usage, where **1** refers to the usage production.

Table 6.2 Parameters Entry in the Production Version (Cont.)

The **Lock** field provides you with the flexibility to lock or unlock the production version anytime to allow or restrict accesses to the production version during production order creation. A locked production version won't be available for selection during production order creation.

Finally, click on the **Check** button located on the top right hand side of the screen to evaluate whether the details incorporated in the production version, such as BOM and routing, are correct and valid. It's important to add here that you can also include data in the production version that doesn't make sense, such as selecting an incorrect work center as a production line.

The system confirms that it's able to find a relevant task list (routing) as well as the BOM, which meets the other criteria of the production version. This includes having validity dates of the routing and BOM, which falls within the validity specified in the production version as well as the lot sizes mentioned in the production version (see Figure 6.34). Click on the **Cancel** icon.

The green traffic light against the task list as well as the BOM denotes that the consistency check was successful, and this production version will be available to users during production order creation. If a warning or error is observed during consistency check, the system denotes it with a yellow or a red sign, respectively. In the production version, it's possible to check if previously created and nonchecked production versions are still valid or not.

Click on the **Close detailed screen and adopt changes**, and save the production version.

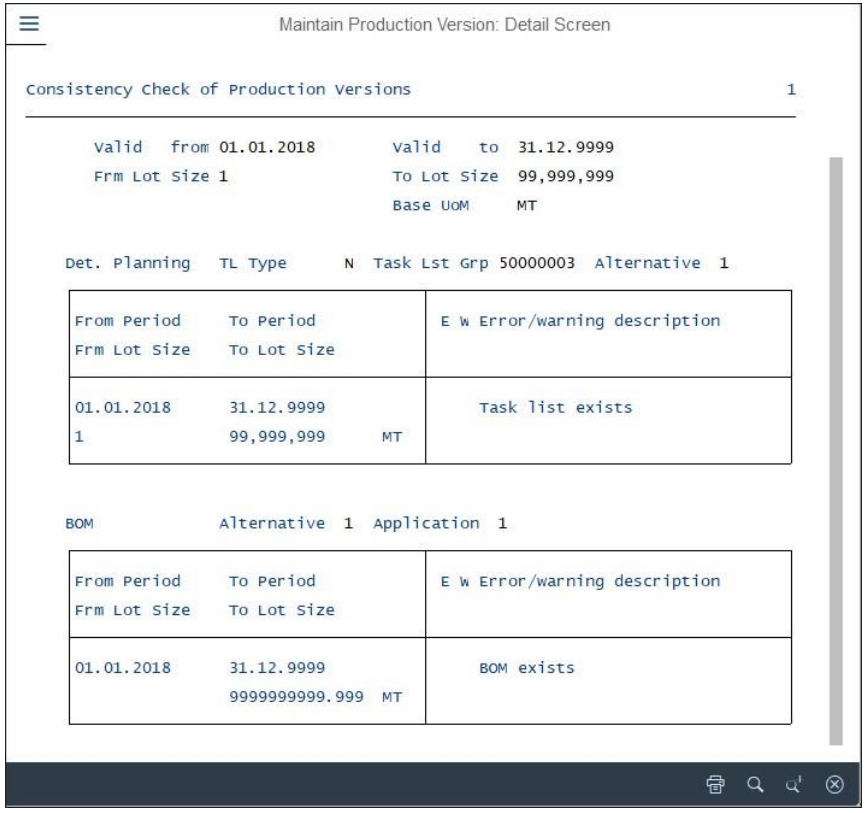


Figure 6.34 Results of a Production Version Consistency Check

6.3 Production Order Management

The *production order* is the formal element that informs the production department on how to proceed with producing a product. It contains details on production quantities, the components required to produce the material, the operations (consisting of work centers) that are involved in production, and the scheduling details of production, among many other details. Due to the highly integrated nature of production with CO-PC, all planned costs are in place when you first create the production order.

The master data of a material that we covered in the previous sections forms the core and the central information for the production order. In other words, when you create a production order for a material, the system looks for its BOM, routing, and

production version (if applicable). The system copies all of the information from the master data, so that minimal efforts are involved in production order creation. Regardless of whether you create the production order by converting planned orders from MRP or manually, the system fetches the master data in the production order. You can individually or collectively convert planned orders of MRP into production orders. You can also create the production order without reference to any planned order.

The production order is also the central component used to record and update all of the activities or functions that the users perform. For example, you can manually or automatically enable the system to check and perform the following functions or activities in the production order (depending on the configuration settings): checking material or capacity availability, generating the control instruction, calculating planned costs, and more.

Later, when you perform functions with reference to the production order, such as GI, confirmation, or yield/scrap updates, the system keeps updating the information.

The production order consists of the following elements, which we'll discuss in the following sections: **Header data**

Contains organizational information such as the order number and costs, quantities, and dates for the order as a whole.

Operations data

Contains detailed operations dates, default values, and the confirmed quantities and dates. **Components data**

Contains detailed information about components, such as the requirements quantity and reservation number.

Reread master data

Enables rereading the master data to ensure the production order has the most upto-date information. **Statuses**

Controls and displays various system or user-defined statuses of a production order. **Trigger points**

Contains detailed information about trigger points, that is, one action or a status triggers another action.

To create a production order, follow the menu path, **LogisticsProductionShop Floor ControlOrderCreateWith Material**, or use Transaction CO01.

On the initial production order screen, enter **Material** "30000038", production **Plant** "1000", and order **Type** "PP10", as configured in Chapter 3. Choose **Continue**.

6.3.1 Header Data

Figure 6.35 shows the header data screen of the production order. It consists of information that is applicable to the entire order, such as production order number, the material number, the plant, and the order type. The **General** tab includes the planned production quantity, the scrap quantity, the scheduling details, and the reduction details. If you've converted a planned order into a production order, the system automatically copies the details from the planned order, such as quantity, scrap percentage (and its equivalent quantity), BOM, routing (if available), scheduling, and capacity details. The left-hand side of the screen shows the dropdown consisting of more options related to production order management.

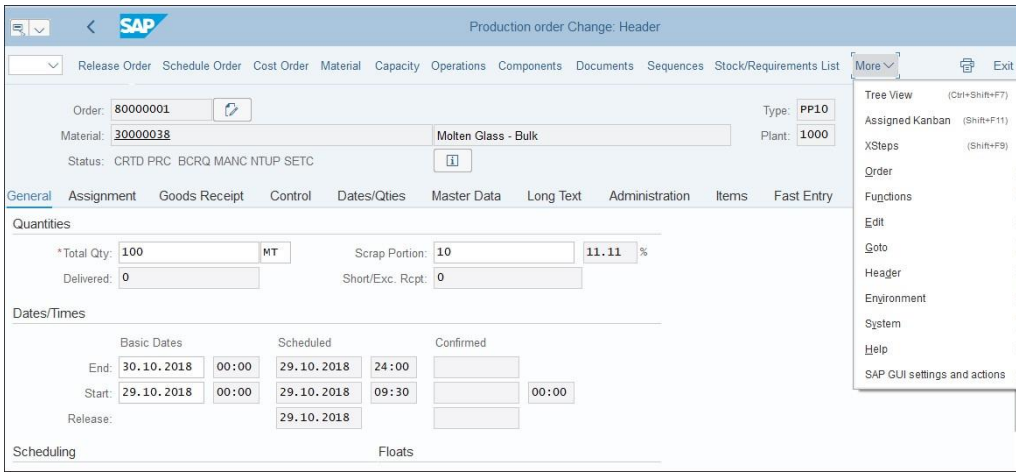


Figure 6.35 Production Order Header

When you perform subsequent business functions, such as confirmation, the system automatically updates the relevant fields, at both the production order level and the operation level.

You'll notice a large number of system statuses, which the system keeps on updating as you continue to perform business functions. These business functions can include activities such as releasing or printing the production order, providing confirmation, and closing or locking the production order.

Further, if you've set up **User Status** at the production order level, then it also becomes visible just below the **System Status** in the production order header.

The following briefly covers some of the information available in various tabs of the production order header: **Assignment**

This view contains the responsible MRP controller, the production scheduler, the sales order number and its item number (for MTO production), the work breakdown structure (WBS) element (for engineer-to-order [ETO]).

Goods Receipt

This view contains control parameters for goods movements, deviation tolerances, GR processing time, and production location.

Control

This view contains the parameters for the calculation, the production scheduling profile, and the control parameters for scheduling: creating capacity requirements, scheduling allowing for breaks, and automatic rescheduling in the event of scheduling-relevant changes.

Dates/Qties

This view contains the overview of planned and actual times and quantities.

For this example, in the **Total Qty** field in Figure 6.35, enter "100", and the system automatically calculates the **Scrap Portion** field, if you've maintained it in the **Assembly scrap** field of the **MRP 1** view of the material master. Because we configured the system to perform backward scheduling, it asks for the end basic date. Enter "30.10.2018", and the system automatically calculates the **Start Basic Date**. Notice that it takes the floats into account, as **Sched. Margin Key 001** (not shown) is in place and enables the system to calculate schedule dates. It also performs reduction up to level 2.

Let's now evaluate the information maintained in the operations view of a production order. Click on the **Operations Overview** icon.

6.3.2 Operations Overview

The **Operation Overview** screen details the sequence with which a product will undergo a production process. It uses information from the routing and the operations that are scheduled for the order. The system denotes each operation with an operation number, together with the associated work center and the control key that you defined in the work center. The control key determines the functions that the user can perform for an operation, such as printing and whether confirmation is required or not allowed. It also controls scheduling and CRP. Other details that are available in this screen are trigger points, the PRTs, and an assignment flag for material components.

Figure 6.36 shows the **Operation Overview** screen of a production order. Double-click on **0010** in the **Op.** column, and the system navigates to the operation detail screen.

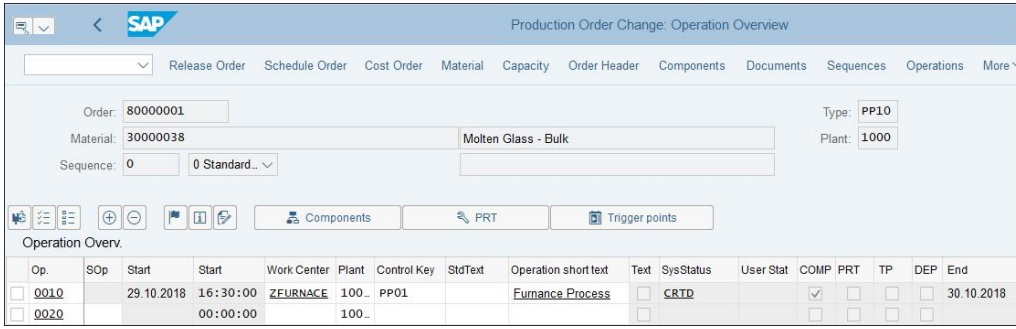


Figure 6.36 Operation Overview in the Production Order

The detail operation screen shown in Figure 6.37 has several tabs, of which some of the important ones are described here:

General

This view contains general information on the operation, such as the percentage scrap, number of shop floor papers to print, and setup type key. It also contains the cost calculation relevance indicator, which specifies whether the operation is included in the cost calculation.

Default Values

This view contains the default and standard values copied from the routing and directly relates to the operation quantity, that is, the planned values for performing the operation and the corresponding units of measure.

Ext. Processing

This view contains information on externally processed operations such as subcontracting, which involves operations processed at the supplier's end. The material–supplier relationship known as the purchasing info record is entered in this view. The system checks to see if the control key for the operations allows external processing or not. If it doesn't, then you can't enter the external processing details here.

Transition Times

This view contains scheduling data that affects the operation segments outside the execution time. This data includes the reduction strategy and level and the pertinent transition times: wait time, queue time, and move time. The system checks to see if the control key for the operations allows scheduling or not.

Splitting

In this view, you can maintain splitting data that controls whether, how, and when an operation may or must be split during the scheduling. The system checks to see if the control key for the operations allows scheduling or not.

Overlap

In this tab, you can maintain data on operations that the system can consider in overlapping during production order scheduling. The system verifies if overlapping is required, and, if so, the minimum overlap time and the minimum sendahead quantity. The system checks to see if the control key for the operations allows scheduling or not.

Dates/Times

This view contains the results of the infinite scheduling for the operation. The scheduling determines dates for the operation segments, such as setup time, processing time, teardown time, and wait time. For each of these operation segments, the system determines the duration and the earliest and/or latest start date with time. In determining the earliest dates and times, the system makes an assumption that the operation will use minimal queue and wait times. In determining the latest dates and times, the system uses normal queue and wait times in scheduling. The system checks to see if the control key for the operations allows scheduling or not. **Qties/Activities**

In this view, the system displays the confirmed quantities and activities for the operation.

Dates Confirmed

This view contains the actual processing dates for the operation.

Capacity Requirement Assignment

In this view, you can split the total requirement of the operation into subrequirements.

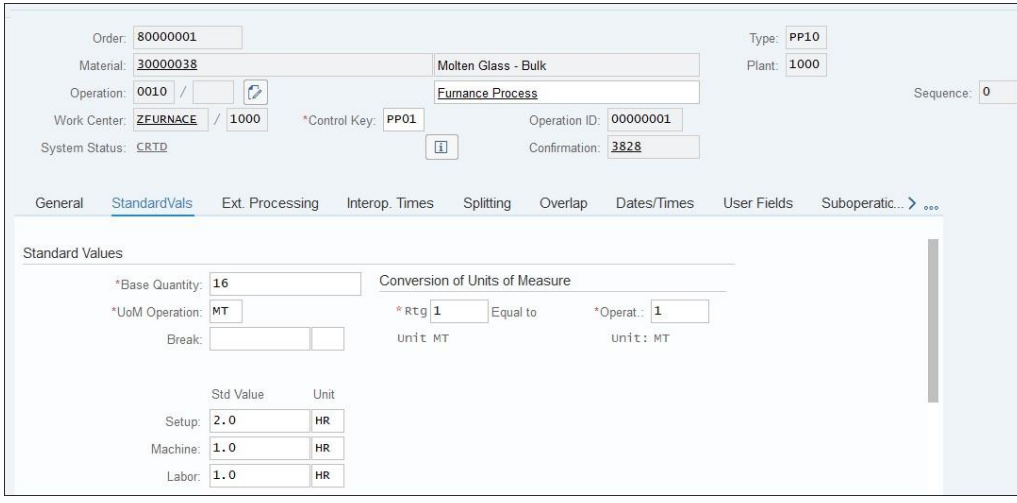


Figure 6.37 Detailed View of an Operation

6.3.3 Standard Trigger Points

As an SAP system consultant or a business process owner, you're always looking for ways to optimize existing business processes and functions, especially when the processes have matured, and you can transition from manual intervention to automation.

You'll use a *trigger point* to enable the system to perform predefined functions when an event occurs in a production order. Trigger points automatically trigger functions, for example, releasing all subsequent operations, when you release the first operation. You can assign trigger points in the routing or to individual production orders.

You can perform the following functions with trigger points:

Release of directly following operations

An event occurrence triggers the automatic release of the subsequent operations. **Release up to release point**

An event occurrence triggers the release of all subsequent operations up to and including the next operation, which is given the **Release Stop** indicator.

Release of previous operations

An event occurrence triggers the release of all previous operations.

Create order with template

An event occurrence (e.g., material is faulty) means that the system creates a new production order to post-process the material. The system creates an order using standard routing without reference to a material.

Include standard routing

An event can incorporate a standard routing in an existing production order. In this case, you have to specify the operations between which the system inserts standard routing.

Trigger workflow

An event occurrence, such as material unavailability, triggers a workflow task, such as sending an email.

You can create standard trigger points, which then serve as a template that you can use to create new trigger points. You can also group together different trigger points into a trigger point group. This group then copies all of the trigger points when you assign it to the routing or the production order.

Note

We cover creating trigger point groups in Chapter 3, Section 3.14.

You first have to create a trigger point and then assign it to an operation in the routing (or production order). Give a short text to the trigger point, and then assign this trigger point to the **TrigPointUsage** "FERT" and **TriggerPtGroup** "FERT".

Next, select the **TrigPointFuncts** checkbox in the **Usage** area, and then select one of the trigger point functions, such as **Release succeeding operations**, when the **Syst.Sts** (system status) is **CRTD** (created). Click on the **Parameters** icon, and the **Parameters for Function**popup appears. Here you specify an event so that when the system status of the operation of an order is **CRTD** (created), this triggers an automatic release of succeeding operations. The **Status change** field enables you to define if a particular event sets or resets the status.

Depending on which trigger point function you chose to implement, the system then brings up the corresponding parameter's entry options. For example, if you select the **Create order with reference** function, the system asks you to enter the status (e.g., **Partially Confirmed** or **Scheduled**), which it will check to activate the trigger function.

It then asks you to define parameters, such as routing group number, group counter, and production order type.

6.3.4 Components Overview

At any time in the production order creation screen, you can navigate to **Components Overview**. The system reads the BOM data to bring up the components that will be used in the production process. You can assign each component of the BOM to an operation in the production order. If you don't do this, the system automatically assigns all components to the first operation. You can also change this assignment by using the **Reassign** option. For nonstock components, the system creates a purchase requisition when the production order is created and saved. This is an integration point between PP and MM. During the entire procurement process, the system maintains the link with the production order.

Figure 6.38 shows the components overview screen of the production order. The details covered here are the same as previously covered in the BOM master data creation.

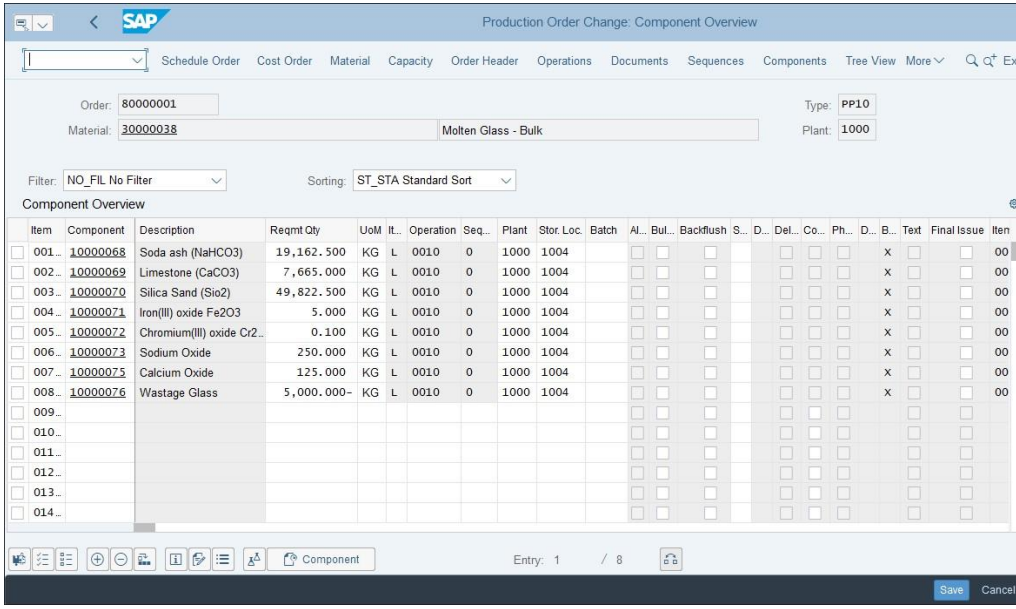


Figure 6.38 Components Overview

Figure 6.39 is the detailed view of the first component, **10000068**, of the material BOM.

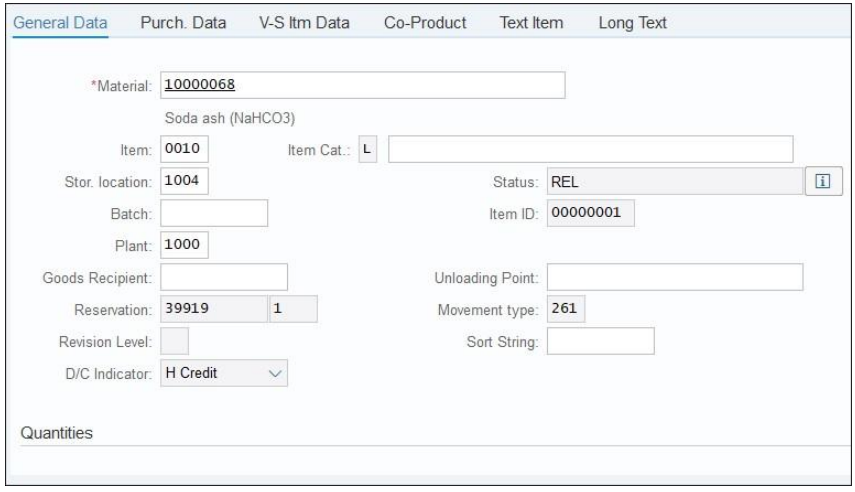


Figure 6.39 Detailed View of a Component in a Production Order

6.3.5 Reread Master Data

When you create a production order, the system reads the relevant PP master data and makes it an integral part of the production order. In the SAP system, you first create the master data and then use this master data in day-to-day business transactions, such as production order creation. The system doesn't automatically read any changes you make to the master data later on. For example, you've already created a production order of a material that reads the PP master data, including its BOM. Now, if you make changes in a material's BOM, the system doesn't automatically reflect these changes in the newly created production order. If you have a business need to reread the master data, you can do this by choosing **More Functions Read PP Master Data** in the production order screen**.** If you've made any interactive or manual changes in the production order, reading PP master data again will overwrite all changes made.

Further, there is a limit on when you can read the PP master data again. For example, if you've already confirmed or performed a GR against a production order, then it's no longer possible to read the PP master data again.

6.3.6 Statuses

Whenever the business process owner performs any function, such as creating a production order, performing scheduling, checking capacity requirements or material availability, or generating a control instruction, the system keeps updating the status. These updates in status can be at the header level or operations level of the production order. Similarly, when you perform partial or complete confirmation, perform goods movement, or receive goods, the system correspondingly updates the status after every activity. In addition to system status, there is also user status. The system status works according to preconfigured rules and logic, whereas you're free to define your own rules in the user status.

When you run the production order information system (Transaction COOIS), you can choose status or user status as one of the selection parameters. For example, you list all of the production orders that have partial confirmation status (**PCNF**).

Figure 6.40 appears when you click on the **Status** in the production order header.

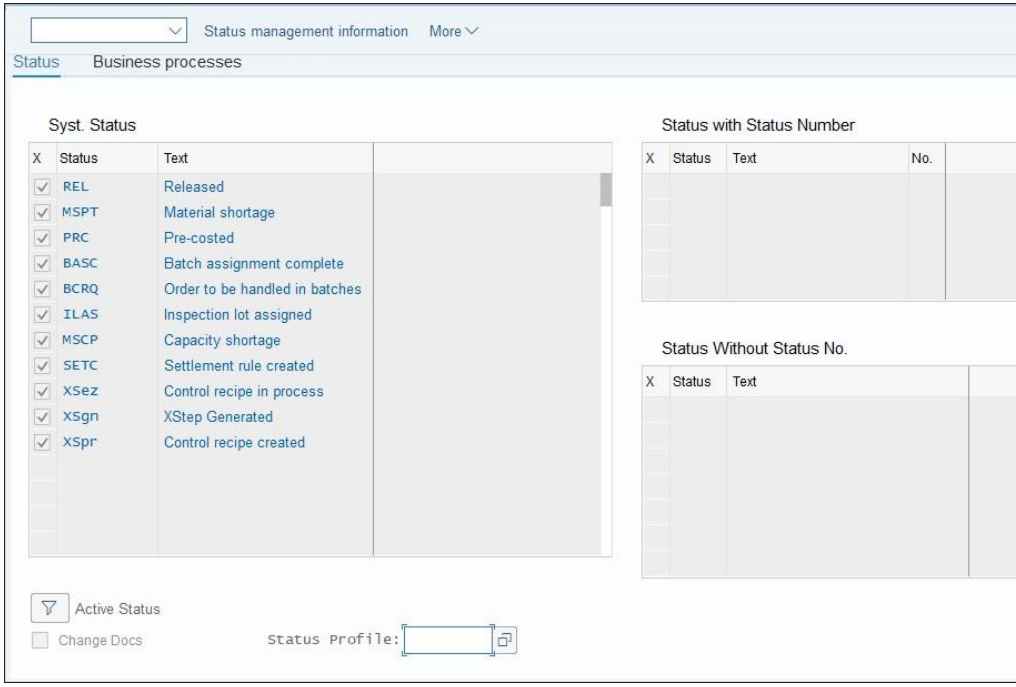


Figure 6.40 Status View of the Production Order

6.3.7 Scheduling

Building on the information covered in the work center discussion (Section 6.2.3) and in the routing discussion (Section 6.2.4), this section provides more in-depth information on the factors that the system considers when scheduling production orders. For example, the system takes the following into account from the work center: factory calendar, shift timings, maximum capacity utilization (in percentage), overload percentage, and number of individual capacities. From the routing, it considers information such as setup, processing, transition times, splitting, and overlapping.

When the system performs scheduling for the production order, it takes the following factors into consideration (we'll discuss these in more detail in the following sections):

Dates in the production order

Finite scheduling

Transition times

Splitting

Overlapping

Float before production and safety time

Reduction

In the production order, when you enter the basic dates, the system performs comprehensive scheduling and also takes the dates and times into account. The dates may be the opening period and float before production (defined in **Scheduling Margin Key**), and the times may be transition times, such as wait, move, or queue times.

Dates of the Production Order

Depending on how you've configured the scheduling type for the production order, the system takes the basic dates into account. Refer to the production order creation screen shown previously (Figure 6.36), in which you define the backward scheduling type, the system prompts you to enter the end date (**Basic**) (e.g., "29.10.2018"). The system calculates the scheduled end date as 30.10.2018 at 24:00. The system arrives at this schedule based on the following factors (and in the same sequence by performing forward scheduling):

Float before production

Operations times

Safety time (float after production)

GR processing time

In MRP, if you use backward scheduling, the system starts with the planned availability date. Therefore, the first object that the system considers is the GR processing time to get the basic order finish date. Then, based on the in-house production time, the system calculates the basic order start date. Afterwards, starting from the basic order finish date, the float after production is considered to get the production finish date. From there (due to backwards scheduling), the operations are considered for calculating the production start date. Finally, the float before production is applied, and, if necessary and allowed by Customizing Transaction OPU5, the initial basic start data is adjusted. The durations of the operations are made up of waiting, setup, edit, teardown, and transport. In the production order, the system displays the operation dates and timings on the **Dates/Times** tab. Figure 6.41 shows the operation details screen of **Operation 0010**. Starting from the queue time, it takes the setup, processing, teardown, wait, and finally move times into account for the operation.

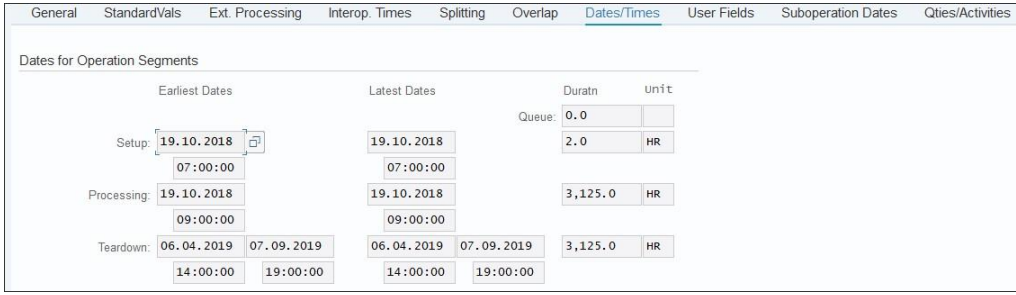


Figure 6.41 Dates and Times Details in the Operation View

Finite Scheduling

The objective of finite scheduling is an organization type in capacity planning that takes account of current capacity loads. *Finite scheduling* calculates the start and finish dates for operations in an order. In infinite scheduling, the capacity requirement isn't given due consideration. It also doesn't take into account the interdependencies of production orders.

The system uses backward and forward scheduling. In backward scheduling, the system determines the start date of the production order based on the latest finish date. In forward scheduling, the system determines the finish date of the production order based on the earliest start date. It's equally important to ensure that apart from scheduling, the material availability is another very important factor that you need to take into account. If it isn't possible to manage production within the given dates, then you can minimize the lead time by overlapping, splitting, and reducing the transition times, float before production, and safety time. During finite scheduling (capacity planning), you can also use the float times as degrees of freedom to move operations there to get a feasible plan for your resource-critical operations; that is, the production dates can be variable within the limits of the basic order dates.

Splitting

You can use *splitting* to split an operation into several suboperations that you can process in parallel with each other. This reduces the overall lead time of the operation. A prerequisite for splitting is that the work center capacity must contain multiple individual capacities; otherwise, parallel processing isn't possible. The system looks for this split information in the capacity header of the work center.

Figure 6.42 shows the **Splitting** tab in the operations view. The system only performs the splitting during scheduling if it finds the **Required splitting** indicator checked; otherwise, it considers splitting during reduction. If you don't specify the number of splits and the

minimum processing time, the system distributes the processing time equally among the number of available capacities.

The **Maximum Number of Splits** field specifies the maximum number of splits that may take place for the operation. For an economical and practical perspective, a **Minimum Processing Time** must also be set.

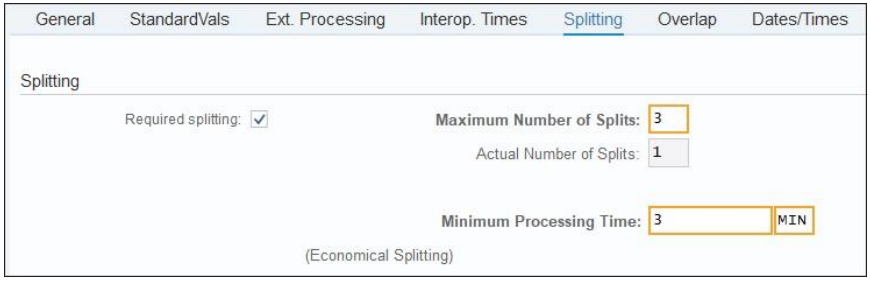


Figure 6.42 Splitting in the Operation View of the Production Order

Overlapping

Maintain the **Overlapping** parameters, the **Minimum Send-Ahead Qty,** and the **Minimum Overlap Time** in the operation data of the routing. These parameters relate to the overlapping with the follow-up operation.

During scheduling, if the minimum overlapping time isn't reached, no overlapping takes place. This is the case, for example, when the remaining processing time after the processing of the minimum send-ahead quantity is too small. The minimum overlapping relates to the processing time. Transition times, such as wait time or move time, don't contribute to the minimum overlapping time.

Depending on the settings made in the routing or production order for overlapping, when the system schedules the order, it performs overlapping during reduction (**Optional overlapping**), always (**Required overlapping**), or never (**No overlapping**).

Figure 6.43 shows the **Overlap** tab in the production order.

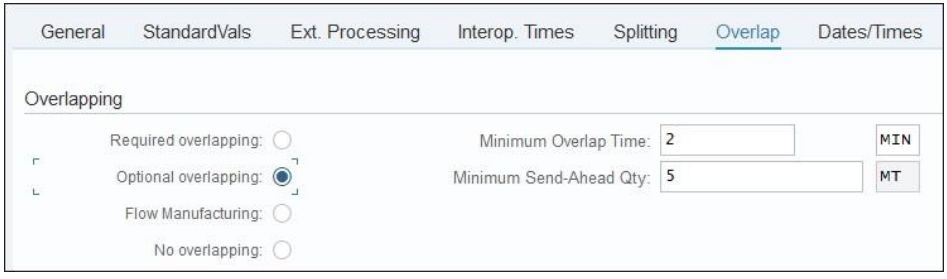


Figure 6.43 Overlapping in the Operation View of the Production Order

Float before Production

In Chapter 3, Section 3.10.3, we covered the scheduling margin key, which provides additional buffers to the production process from unforeseen delays. Refer to Figure 6.35 again and notice the **Floats** area on the lower-right side of the screen. The float with **Sched. Margin Key** stipulates float before production, float after production, and release time.

Reduction

While the buffers help in maintaining overall stability for the production process, you can reduce or eliminate them when needed. For example, if the system is unable to schedule production within the defined basic dates, it implements reduction up to the levels that you defined in Customizing. If you refer to Figure 6.35, notice that the system performs **Reduction level 2** on the lower-left side. This is the maximum level that we allowed for reduction in Chapter 3. The system first tries to resolve the scheduling issue without reduction, then with reduction level 1, and only if necessary finally with reduction level 2. Before making reduction, the system considers whether the production dates (after scheduling) are within the basic dates, and, if so, it makes no reduction. If not, the system continues the reduction process until it either meets the basic production dates or reaches the last reduction level, whichever comes first.

For example, you've configured the system to reduce up to two levels; however, if the system is able to meet the basic production date after first-level reduction, it secures the production dates. In this case, it doesn't proceed to the next reduction level. For such cases, there is also the chance to finally let the system adjust the basic dates to the new lead-time scheduling situation in Customizing Transactions OPU5/OPU3 (this is recommended). Otherwise, there might be production dates outside the basic dates, and the corresponding exception message occurs.

6.3.8 Availability Checks

Depending on how you've configured *availability checks*, you can either perform this step automatically during production order creation or its release, or interactively (manually) within the production order creation screen. Further, you can perform the material availability check for an individual production order or for a large number of production orders collectively.

Three different types of availability checks are available for a production order:

Material availability check

Checks the availability of the components for the production order, either against actual stocks (and optionally receipts) or against the planning.

Capacity availability check

Checks whether sufficient free capacity is available for the order's operations.

PRT check

Through a status in the master data, checks whether the required PRT is free.

For automatic availability checks, you can make the relevant configuration settings to enable the system to check for one or all of the availability checks during an order creation or order release (refer to Chapter 3, Section 3.9, for these). For example, if there is a significant lead time between order creation and its release, you can choose not to perform a capacity check on order creation but instead during order release.

You can also set how the system should proceed if it finds missing capacity, missing PRTs, or a material shortage (due to missing parts) during the availability check. The following options are available for material, capacity, and PRT checks during order creation or release:

Disallow order creation or release when there is a shortage.

Allow order creation or release when there is a shortage.

Allow the user to decide (interactive) to allow creation or release of an order when there is a shortage.

Material Availability Check

Despite all of the planning, checks, and balances in place, and even keeping the minimum stock levels, it's imperative for a production planner to consistently check material availability to ensure there is no disruption in the entire production process. The immediate and visible purpose of the material availability check is to ensure that the requisite components are available for the production order. If not, the system creates an entry in the missing parts list, which the production and the procurement planners can work on together to procure the components. So for inhouse produced parts, the production planner can coordinate internally to ensure the requisite component's availability. For externally procured material, the procurement planner can take advantage of the missing parts list to coordinate and attend to procurement priorities.

With every availability check that you perform, the system correspondingly updates its status. In the material availability check, for example, the system assigns a status **NMVP**, if it makes no material availability check. A production order whose component requirements

are checked and confirmed attain the status **MABS** (material confirmed). If the system can't confirm the availability of one or several components, the order receives the status **FMAT** (missing material), and the system creates a missing parts list. In the production order, click on the **Component availability** button. If all components are available, then the system issues an information message to confirm material availability; otherwise, the popup shown in Figure 6.44 appears. Click on the **Missing Parts Overvi** (overview) button.

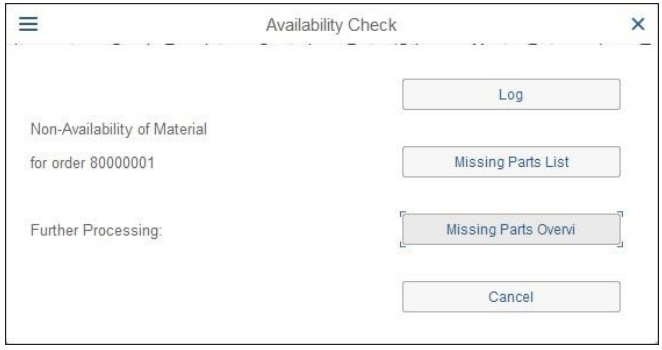


Figure 6.44 Material Availability Check

Figure 6.45 shows the missing parts overview, missing parts list, and other detailed information on the production order, such as the requirements quantity and the component's availability situation.

No. of Components Checked: 7
Missing Parts: 6
Overall commitment date could not be determined

Material	Plant	Storage location	Requirement quantity	Requirements date	Conf./Allocated qty	Committed date	Material description	Indicator missing p..	F
10000068	1000	1004	9,581,250.000	19.10.2018	95,017.750		Soda ash (NaHCO3)	X	
10000069		1004	3,832,500.000	19.10.2018	68,007.100		Limestone (CaCO3)	X	
10000070		1004	24,911,250.000	19.10.2018	0.000		Silica Sand (Sio2)	X	
10000071		1004	2,500.000	19.10.2018	989.950		Iron(III) oxide Fe2O3	X	
10000073		1004	125,000.000	19.10.2018	972.500		Sodium Oxide	X	
10000075		1004	62,500.000	19.10.2018	986.250		Calcium Oxide	X	

Figure 6.45 List of Missing Components

While this example shows how you can interactively check for material availability within the production order change screen (Transaction CO02), the system also offers a choice called the *missing parts information system*. You should first perform a mass availability check on production orders, and then if this activity finds missing parts, you can use the missing parts information system to further work on producing or procuring the components.

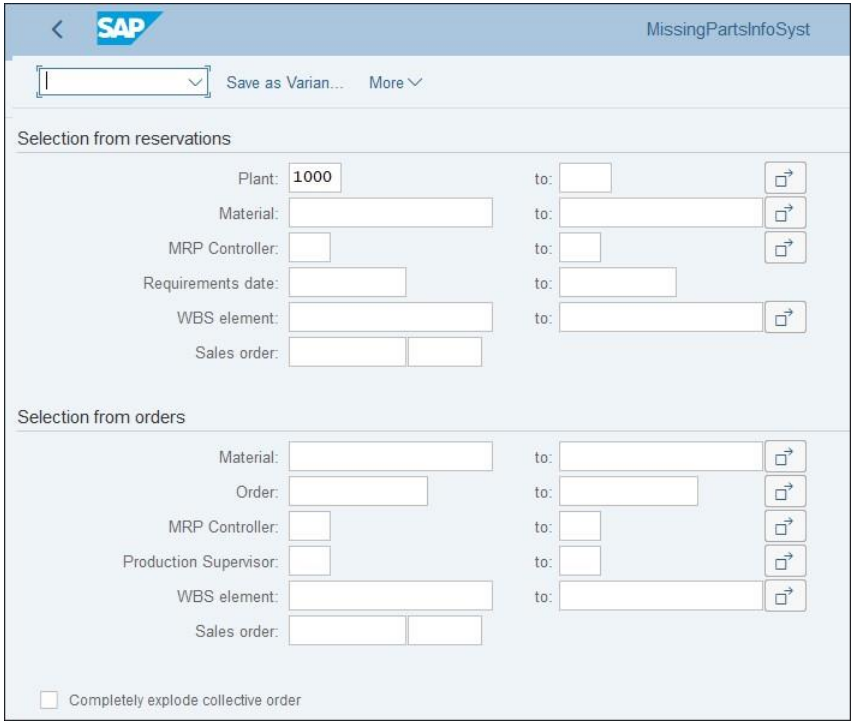
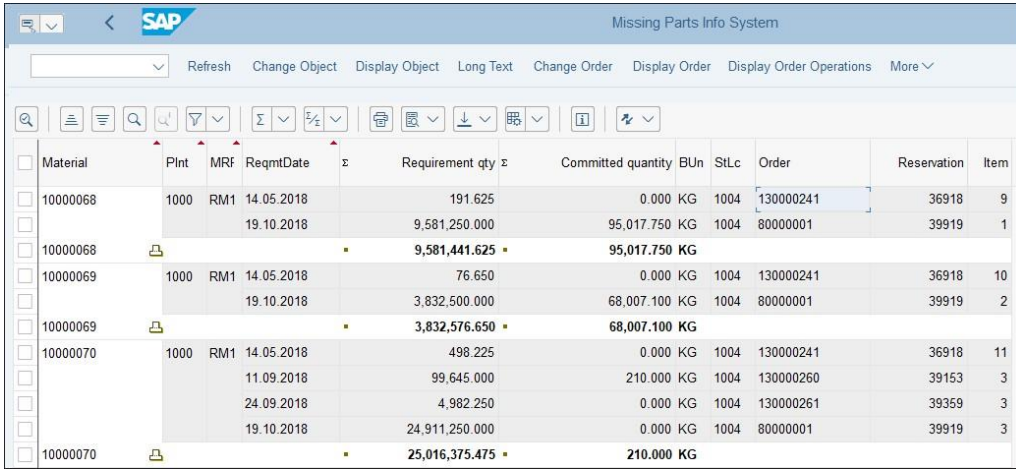


Figure 6.46 Initial Screen of the Missing Parts Information System

To access the missing parts information system, follow the menu path, **LogisticsProductionShop Floor ControlInformation SystemMissing Parts Info System**, or use Transaction CO24. Figure 6.46 shows the initial screen in which you assign the **Plant** as "1000". In the **Selection from orders** area, enter the **Material** as "30000038", for which you want the system to check for missing components.

Press (F8) or choose **Execute**, and the screen shown in Figure 6.47 appears, listing the missing components against the production **Order 80000001**.



Material	Plnt	MRP	ReqmtDate	Requirement qty	Committed quantity	BUn	StLc	Order	Reservation	Item
10000068	1000	RM1	14.05.2018	191.625	0.000	KG	1004	130000241	36918	9
			19.10.2018	9,581,250.000	95,017.750	KG	1004	80000001	39919	1
10000068				**9,581,441.625**	**95,017.750**	**KG**				
10000069	1000	RM1	14.05.2018	76.650	0.000	KG	1004	130000241	36918	10
			19.10.2018	3,832,500.000	68,007.100	KG	1004	80000001	39919	2
10000069				**3,832,576.650**	**68,007.100**	**KG**				
10000070	1000	RM1	14.05.2018	498.225	0.000	KG	1004	130000241	36918	11
			11.09.2018	99,645.000	210.000	KG	1004	130000260	39153	3
			24.09.2018	4,982.250	0.000	KG	1004	130000261	39359	3
			19.10.2018	24,911,250.000	0.000	KG	1004	80000001	39919	3
10000070				**25,016,375.475**	**210.000**	**KG**				

Figure 6.47 Missing Components in the Missing Parts Info System Screen

Tips & Tricks

If you run the missing parts information system for the first time in a newly created SAP system client, the system may produce an error stating that you need to run a specific program first. Use Transaction SE38 and program PPCOXPR1, and choose **Execute** (or press (F8)). You need to perform this activity only once for a given SAP system client.

To collectively check material availability for several production orders, follow the menu path, **LogisticsProductionShop Floor ControlControlCollective Availability Check**, or use Transaction COMAC. On the initial screen, define the selection parameters for which you want to perform the availability check, and then choose **Execute**. In the ensuing screen, select all of the production orders and press (F8) (or choose **Execute**) to perform the collective availability check. The system creates a log that you can check to see the results of the collective availability check.

Capacity Availability Check

Similar to the material availability check, you can also enable the system to perform a capacity availability check automatically during the production order creation or release. For this example, when you create a production order, the system automatically checks the capacity and informs you of the shortage. You can choose **Detailed Info** to gain a comprehensive overview of the capacity shortage, or you can choose **Finite Scheduling** and

then choose **Confirm All** in the next popup. This enables the system to perform finite scheduling and propose the next available date when available capacity can ensure production.

Further, when you're in the production order creation or change screen, you can choose the **Capacity Availability Check** (see Figure 6.48). You'll see a screen offering the option to release a production order despite capacity shortage or cancel an order release. (This is the same setting that you configured in Chapter 3.)

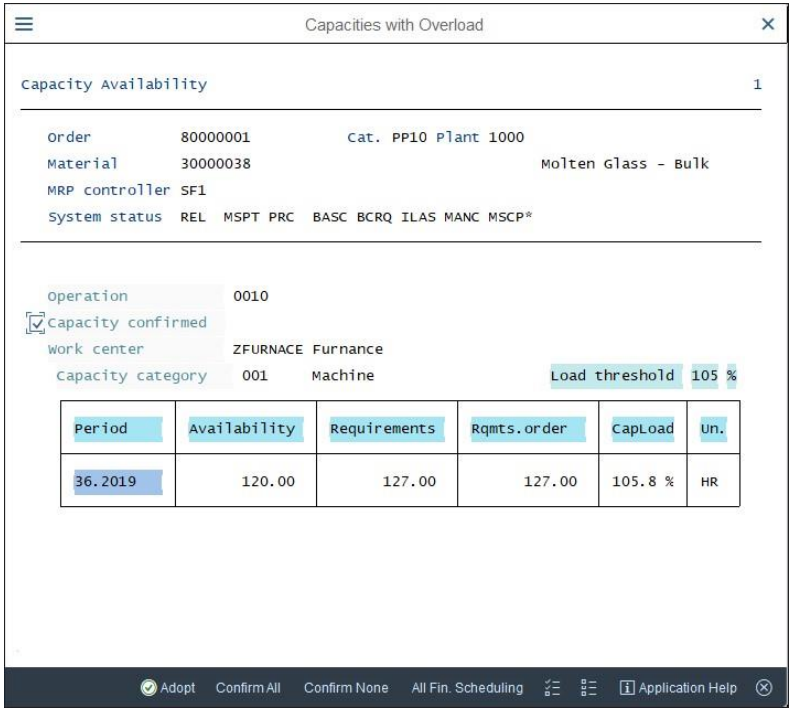


Figure 6.48 Capacity Availability Check

You use the following menu path within the production order: **More Goto Capacity Planning Table** (see Figure 6.49).

Note

Chapter 15 describes CRP in detail.

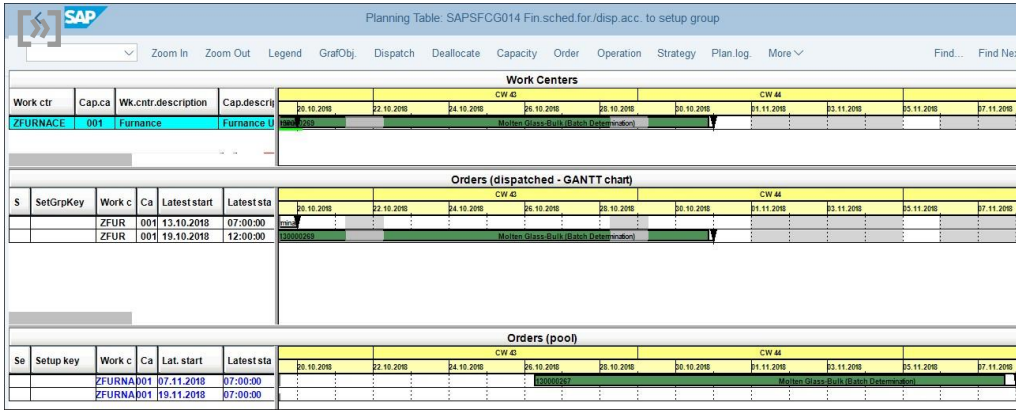


Figure 6.49 Capacity Requirements Planning Table

6.4 Release Production Order

When you create a production order, the system ensures that it contains the complete information you need to proceed with actual production. However, you can't initiate the actual production until you release the production order. Only a released production order enables you to do the following:

Print shop floor papers.

Withdraw materials from the warehouse.

Confirm the operations for the order.

Record GR for the order.

As with other business functions in the production execution, there are several options you can use to efficiently manage the release of individual or multiple production orders:

Automatic release on creation of production order

Individual release

Collective release

We'll discuss these options in the following sections.

6.4.1 Automatic Release

You can automatically release a production order as soon as you create it by making the relevant settings in the production scheduling profile and assigning it to the material master. The automatic production order release option is more applicable in those business scenarios when there is a short lead time between order creation and release or in scenarios when the business and production processes are mature enough to use this option. While using this option enables you to eliminate a step of creating and then releasing an order and thus optimizes the business process, it also offers a loose control, wherein there is no intermediate check to see if the scheduling permits production, for example. Chapter 3, Section 3.7, provides details on how you can achieve automatic order release on its creation.

6.4.2 Individual Release

When you create a production order, the system assigns it a **CRTD** status, which denotes that it's in the creation stage. You can release it by clicking on **Release**. On its release, the system updates the status of the order from **CRTD** to **REL**. While this option will release the entire production order and thus release all of its operations, you can also control the release of an individual operation within the production order. For example, if there is a long production or lead time for operations, then you can maintain greater control with a release at the operation's level. To do so, choose **OperationRelease** in the operation overview screen of the production order.

Figure 6.50 is the popup to let the user decide if the production order can still be released despite material, capacity, or PRT shortage.

Figure 6.50 User Decides to Release a Production Order or Not

To avoid having to release individual operations, you can also use **Trigger Point**, which we've already covered in this chapter.

6.4.3 Collective Release

To release several production orders simultaneously, you can use the collective release option. To do so, follow the menu path, **LogisticsProductionShop Floor ControlControlCollective Release**, or use Transaction CO05N.

Figure 6.51 shows the parameters selection screen in which you can define the parameters, such as material number, plant, order type, MRP controller, or production supervisor, to enable the system to bring up relevant orders for release.

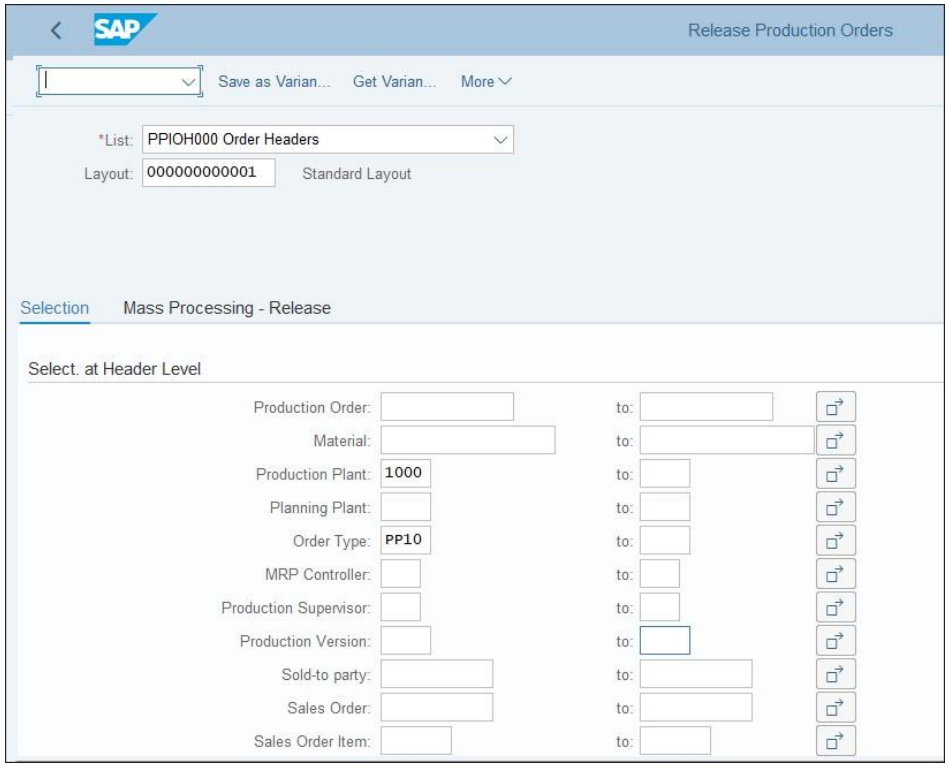


Figure 6.51 Mass Release of Production Orders

For this example, define **Material** as "30000038" and production **Plant** as "1000", and choose **Execute** or press (F8). Figure 6.52 appears consisting of a production order that has the **CRTD** (created) status. Select the order, and then select the **Execute** option from the **Mass processing** icon dropdown.

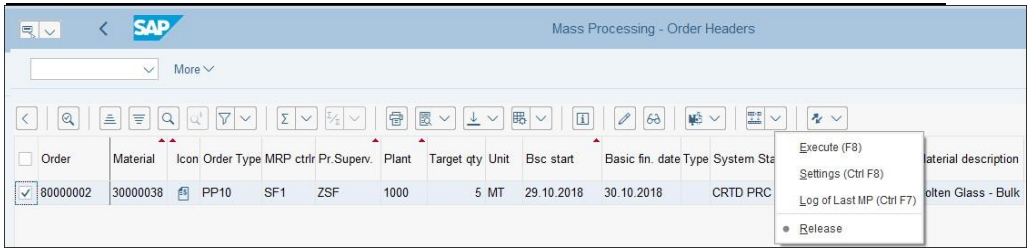


Figure 6.52 Mass Processing of Production Orders: Detailed Screen

The mass processing log appears showing that the collective release of production orders was successful (Figure 6.53). During the production order's release, the system also carried out the material availability check, and on finding no missing part (material shortage), successfully executed the release function.

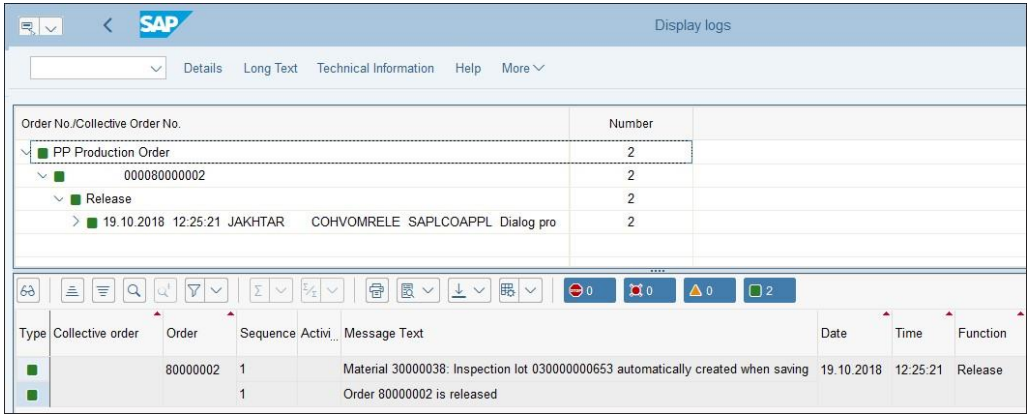


Figure 6.53 Log of Mass Processing Activity (Production Orders Release)

6.5 Printing

Upon the creation, release, and saving of a production order, the next logical step is to print shop floor papers, including the production order. The need to print shop floor papers is more prevalent where the production personnel don't have access to the SAP system to check the details online and hence need printouts. The shop floor papers consist of several objects that you can print, including production orders, GI slips, confirmation slips, document lists, pick lists, time tickets, Kanban tickets, and PRT overviews. Depending on the company's business needs, you can print some or all of them and hand them over to concerned production personnel for their information. If required, shop floor papers can be saved as PDFs using the Adobe Document Server.

The layout, printer settings, and other configuration settings were covered in Chapter 3. For this example, use the standard form (layout) for production orders that the SAP system provides for various shop floor papers.

It's also important to note that you can only print a production order (or other shop floor papers), after you release it. You can use the manual option to print the shop floor papers or control the printing from the production schedule profile, in which you can select the checkbox that causes the system to automatically perform the printing function on release. You can individually print the shop floor papers of a production order by using the change production order transaction (Transaction CO02) and selecting **More Order Settings List Control**.

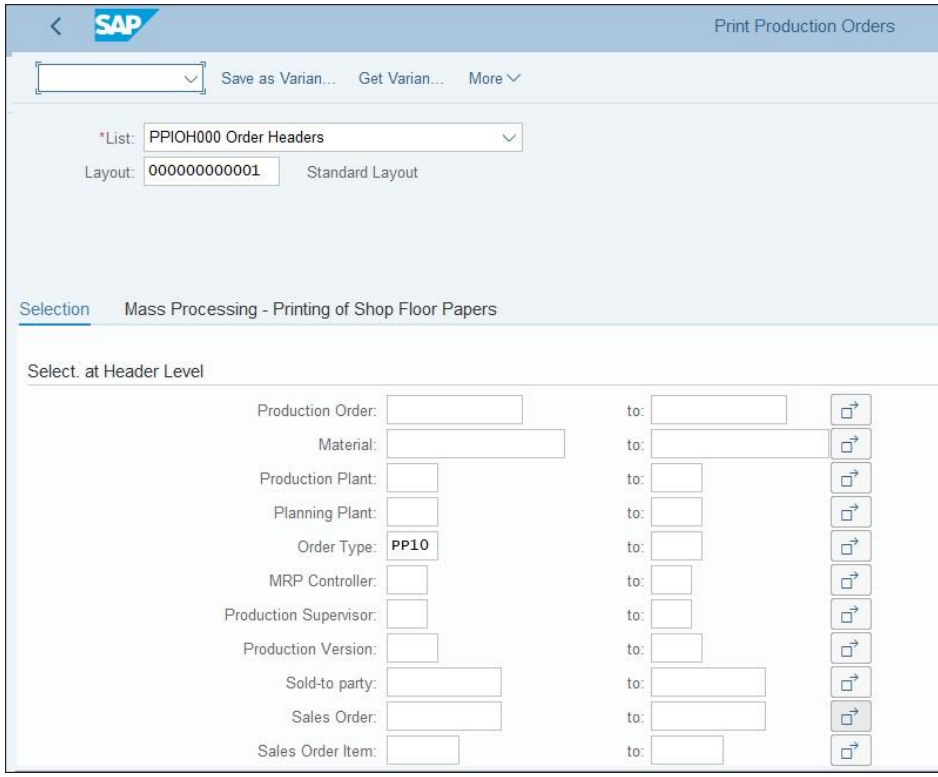


Figure 6.54 Initial Screen to Print Shop Floor Papers

To print shop floor papers, follow the menu path, **LogisticsProductionShop Floor ControlControlPrint**, or use Transaction CO04N. On the resulting screen shown in Figure 6.54, enter these parameters: **Production Plant** "1000", **Order Type** "PP10", and **Production**

Order "80000002". In the tab **Mass Processing – Printing of Shop Floor Papers**, choose the checkbox **Display applicat. toolbar** and click **Execute**. When using Transaction CO04, maintain these same parameters and choose the **Original printout** radio button.

Note

You can only print an original shop floor paper once. For any subsequent print requirement of the same shop floor paper, select **Reprint**.

Choose **Execute** or press (F8), and Figure 6.55 appears showing the **Object list** (production order) print preview. It contains just about all of the information you need on a production order, such as order start and end dates, the operations involved in production, and the components required at each operation.

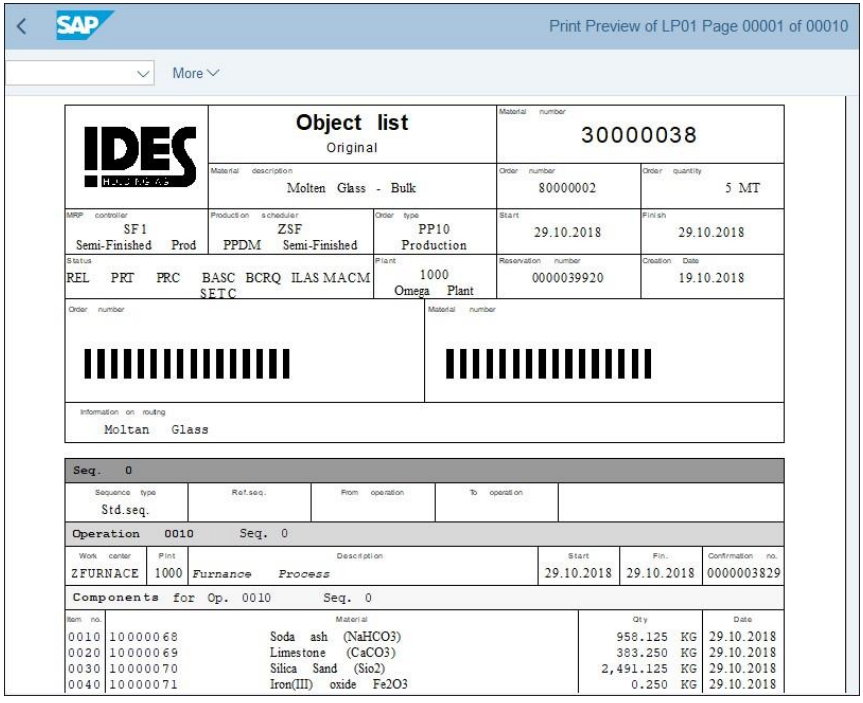


Figure 6.55 Print Preview of Object List (Production Order)

If you define more generic selection criteria on the initial parameters selection screen (refer to Figure 6.54), such as material number or plant only, then Figure 6.56 appears consisting of a large number of production orders that you can print selectively.

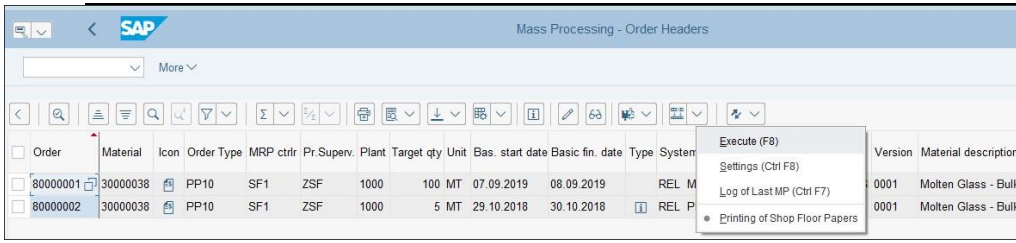


Figure 6.56 Item Overview of Shop Floor Papers for Printing

6.6 Material Withdrawal

After the system creates a production order (even before the production order is released), it automatically creates a material reservation. You'll pull from this reserve in the next actual production process. The next business function is to withdraw material from the warehouse. During the SAP system implementation, the production team and the product costing team decide which components will form BOMs and which will be charged off to the production cost center. For example, low-value items, such as greases, scrubbers, cleaning solutions, and lubricants, are used in the production process but aren't the components used in manufacturing a product. Similarly, bulk material isn't part of the BOM. There are three ways in which you can perform material withdrawal against the production order, which we'll discuss in detail in the following sections:

GI against production order

Picking list

Backflush

On GI posting, the system enables several activities in the background:

Reduces the stock quantity of the material by the withdrawn quantity at both the plant level and storage location level

Updates the consumption statistics, as these consumption figures eventually facilitate forecasting

Reduces the reservation with the quantity withdrawn

Debits the production order with the actual costs

Creates a material document showing the GI and an accounting document, consisting of all postings in SAP S/4HANA Finance (material stock and consumption accounts)

6.6.1 Goods Issuance against the Production Order

The system uses movement type 261 for GI against the production order. This means that you can withdraw the material directly from the warehouse against the production order or first transfer it from your main warehouse to the virtual production floor storage location and then post GI as you consume it. If you use the second option, you must first create a transfer posting (movement type 311) to transfer material from the main storage location to your shop floor storage location. There is an issuing and a receiving storage location for this type of transfer posting. At the shop floor storage location, you can issue the material as and when consumed, and the system reflects the material stock at the shop floor storage location also. This business scenario is more applicable when you can issue smaller quantities of materials that are used frequently.

To perform GI against the production order, follow the SAP menu path, **LogisticsMaterials ManagementInventory ManagementGoods MovementGoods Movement**, or use Transaction MIGO. Figure 6.57 shows the initial screen in which you select **Goods Issue** from the first dropdown list and then select **Order** from the next dropdown list. Next, enter the production order number as "80000001". It's also important to note that the system should use movement type 261, which we discussed earlier. This is shown on the far-right side of the screen in the **GI for order** field.

When you press (Enter), the system brings up the list of components directly from the production order (see Figure 6.57). This screen shows the same components that the system reads from the production order's components overview screen and suggests for GI. You can make changes to the quantities, if desired, and also enter the storage location (**SLoc**), from where you want to issue the components. Finally, select the **OK** checkbox for each component that you want to issue. Save your entries, and the system creates a material document number (and a corresponding accounting document).

Figure 6.58 is the display production order screen (Transaction CO03) in which you navigate to the **Components details** screen. It shows **Reservation 39919** and item **1** for the production order, along with the **Requirement Qty** and the **Withdrawal Qty** (after the GI step).

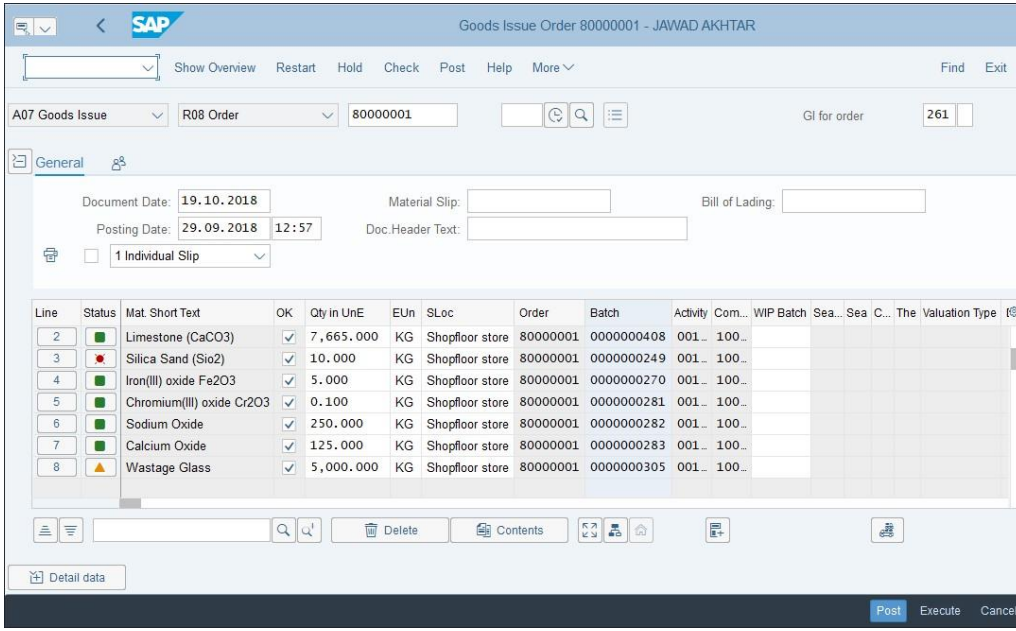


Figure 6.57 GI against the Production Order

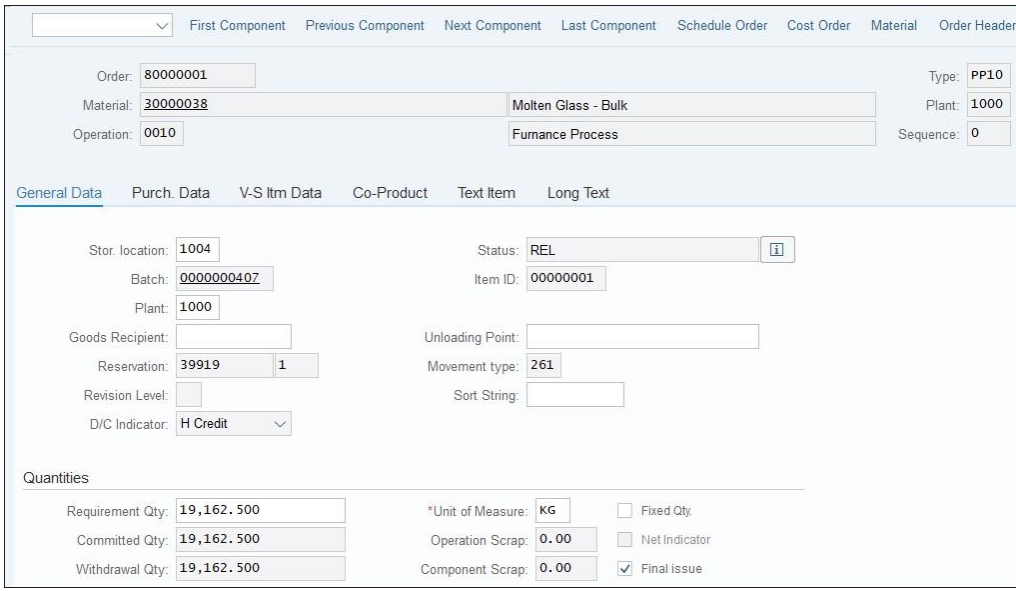


Figure 6.58 Material Withdrawal in the Component View of the Production Order

6.6.2 Picking List

Picking is another process of performing the same function of material withdrawal from the warehouse. A *picking list* is an intuitive and interactive option you can use to issue materials against production orders. To issue components by using a picking list, follow the menu path, **LogisticsProductionShop Floor ControlGoods MovementsMaterial StagingPick**, or use Transaction CO27.

Figure 6.59 shows the initial screen that offers you a large number of options to enter parameters, based on which the ensuing picking list will appear. For this example, define these parameters: **Material** "30000038", **Plant** "1000", **Work center**"ZFURNACE", and **Plant** (for work center) as "1000".

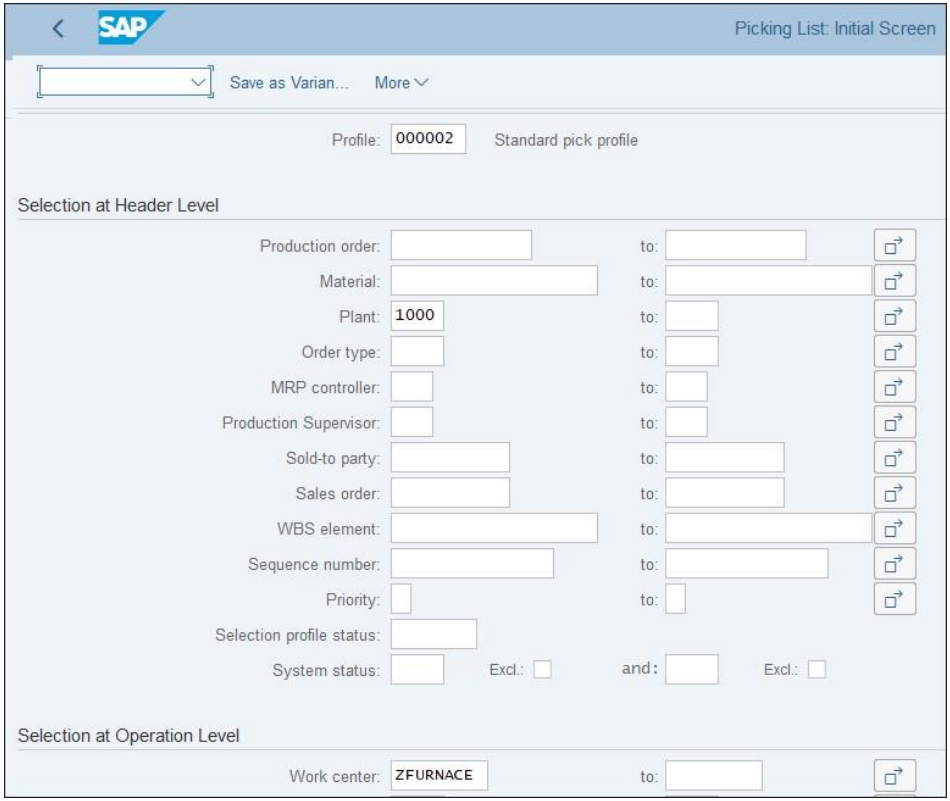
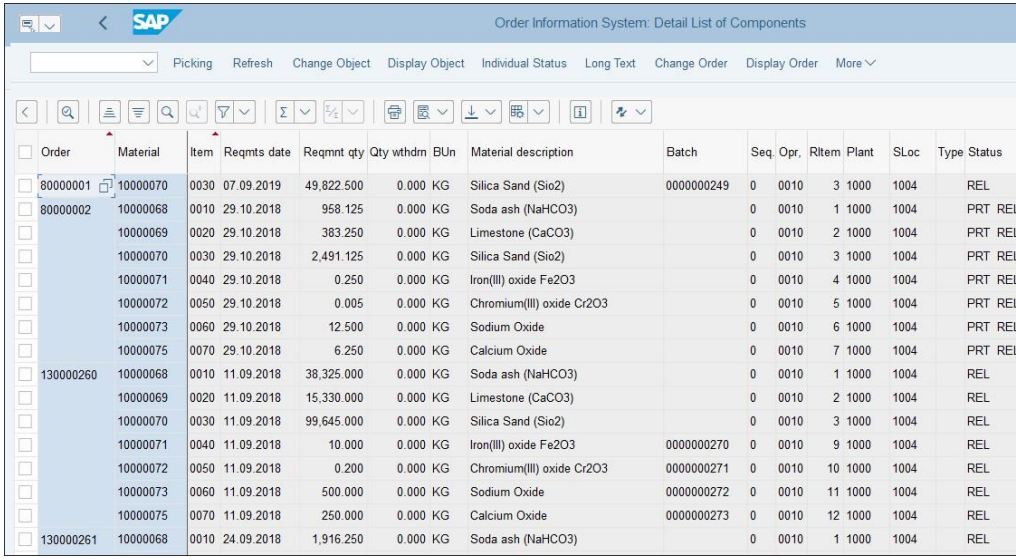


Figure 6.59 Initial Screen of Picking List

Choose **Execute** or press (F8) to open the screen shown in Figure 6.60. This screen consists of several production orders against which you can initiate the picking process. Select the

first four components that pertain to the **Order 80000002** by setting the checkboxes (the first column on the left hand side of the screen) against each component, and click on the **Picking** button in the toolbar.



Order	Material	Item	Reqmts date	Reqmnt qty	Qty wthdrn	BUn	Material description	Batch	Seq.	Opr.	RItem	Plant	SLoc	Type	Status
80000001	10000070	0030	07.09.2019	49,822.500	0.000	KG	Silica Sand (Sio2)	0000000249	0	0010	3	1000	1004		REL
80000002	10000068	0010	29.10.2018	958.125	0.000	KG	Soda ash (NaHCO3)		0	0010	1	1000	1004		PRT REL
	10000069	0020	29.10.2018	383.250	0.000	KG	Limestone (CaCO3)		0	0010	2	1000	1004		PRT REL
	10000070	0030	29.10.2018	2,491.125	0.000	KG	Silica Sand (Sio2)		0	0010	3	1000	1004		PRT REL
	10000071	0040	29.10.2018	0.250	0.000	KG	Iron(III) oxide Fe2O3		0	0010	4	1000	1004		PRT REL
	10000072	0050	29.10.2018	0.005	0.000	KG	Chromium(III) oxide Cr2O3		0	0010	5	1000	1004		PRT REL
	10000073	0060	29.10.2018	12.500	0.000	KG	Sodium Oxide		0	0010	6	1000	1004		PRT REL
	10000075	0070	29.10.2018	6.250	0.000	KG	Calcium Oxide		0	0010	7	1000	1004		PRT REL
130000260	10000068	0010	11.09.2018	38,325.000	0.000	KG	Soda ash (NaHCO3)		0	0010	1	1000	1004		REL
	10000069	0020	11.09.2018	15,330.000	0.000	KG	Limestone (CaCO3)		0	0010	2	1000	1004		REL
	10000070	0030	11.09.2018	99,645.000	0.000	KG	Silica Sand (Sio2)		0	0010	3	1000	1004		REL
	10000071	0040	11.09.2018	10.000	0.000	KG	Iron(III) oxide Fe2O3	0000000270	0	0010	9	1000	1004		REL
	10000072	0050	11.09.2018	0.200	0.000	KG	Chromium(III) oxide Cr2O3	0000000271	0	0010	10	1000	1004		REL
	10000073	0060	11.09.2018	500.000	0.000	KG	Sodium Oxide	0000000272	0	0010	11	1000	1004		REL
	10000075	0070	11.09.2018	250.000	0.000	KG	Calcium Oxide	0000000273	0	0010	12	1000	1004		REL
130000261	10000068	0010	24.09.2018	1,916.250	0.000	KG	Soda ash (NaHCO3)		0	0010	1	1000	1004		REL

Figure 6.60 Goods Movements Overview in the Picking List

You can make any last-minute changes to the issuance quantities. If you have missing issuance storage locations, then you can enter them on this screen. Notice that the **Movement Type** is **261** (not shown), which is for GI against the order. In this step, the system also performs the stock determination to ensure that the components required for issuance are available in stock. If you've configured any specific stock determination rule and assigned it in the **Stock Determ. Group** field in the **Plant Data/Storage 2** tab of the material master, then the system accordingly suggests the components during the picking function.

Choose **Save**, and the system performs the GI in the background. If you then choose **Refresh**, the issued components—for which no further issuance is possible—won't be available in the picking list.

6.6.3 Backflush

In the backflush process, the system simultaneously posts the GI when you confirm the operation to which you assigned the components. In this way, the system optimizes the

confirmation process by performing a two-in-one function. For production orders, there are three ways in which you can activate the backflush functionality in the production process:

In the material master

In the work center

In the material component assignment

We'll discuss these in further detail in the following sections.

Activate Backflushing in the Material Master

Figure 6.61 shows the **MRP 2** view of the material master (component) with the **Backflush** field. If you place the cursor on the field and press (F4), the system brings up the two available options shown on the right-hand side of the screen. The first option is that the system always backflushes (**1**) this component during the confirmation process. The second option is that it will look for the work center to see if the backflush checkbox (**2**) is selected to enable it to execute the backflush function.

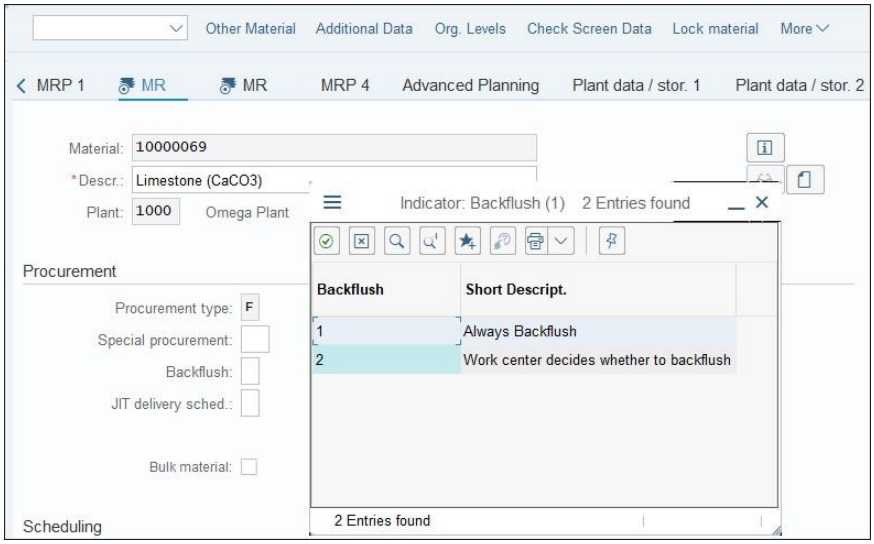


Figure 6.61 Backflush Options in the Material Master

Activate Backflushing in the Work Center

Figure 6.62 shows the **Basic Data** tab of **Work center ZFURNACE** for **Plant 1000** (Transaction CR02), in which you can select the **Backflush** checkbox.

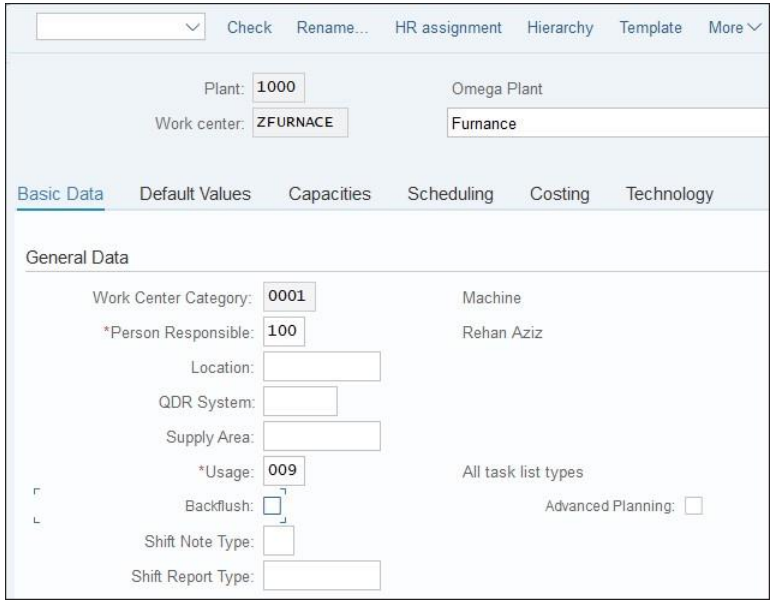


Figure 6.62 Backflush Option in the Work Center

Activate Backflushing in the Material Component Assignment

Figure 6.63 shows the **Production Order Change: Component Overview** screen of routing (Transaction CA02), in which **Component 10000069** includes the **Backflush** option.

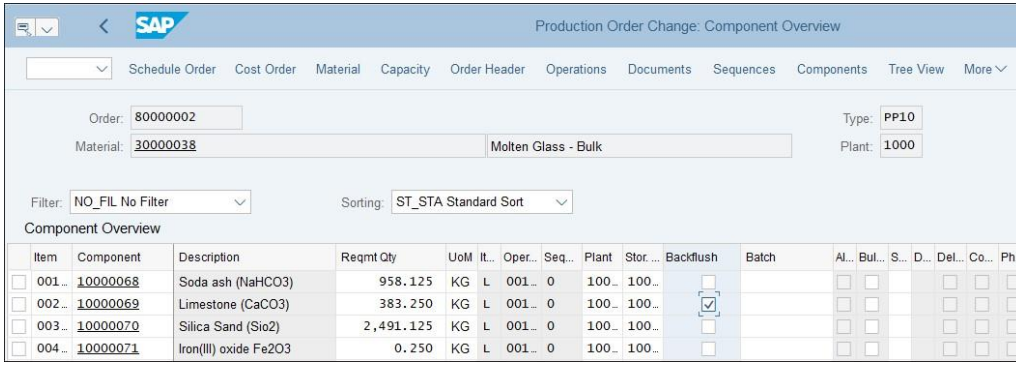


Figure 6.63 Backflush Option in Routing

Tips & Tricks

If you haven't maintained the **Backflush** indicator in any of the master data (material master, BOM, or routing), you can still select the **Backflush** checkbox in the **Production Order Change: Component Overview** screen of the production order. However, this is applicable to the specific production order only and will in no way update the master data.

With the three backflush options just discussed, it's important to understand the sequence in which the system makes the decision of whether to backflush. Figure 6.64 shows the backflush decision-making process.

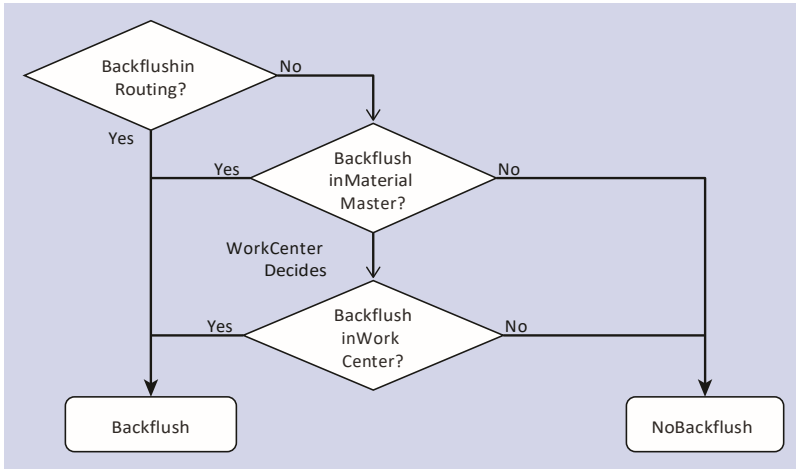


Figure 6.64 Decision-Making Process for Backflushing

6.7 Confirmation

To bring comprehensive visibility to the entire production process, the confirmation process provides the production scheduler and the MRP controller with important information: the quantities produced and confirmed for each operation or order. The types of confirmation that you can perform are listed here:

Quantities/subsets

Activities (setup time, processing time, etc.)

Dates (start and end dates for setup, processing, etc.)

Personnel data (personnel number, number of employees)

Work centers used

As previously mentioned, a confirmation process automatically triggers some or all of the following business functions, depending on how you've configured the system or set up the master data:

Updates the actual costs

Reduces the capacities of the work centers involved

Performs GI for backflush components

Performs GR for the automatic GR material

The system calculates the remaining order quantity from the four quantity fields in the production order based on the following formula:

Remaining quantity = Total quantity – scrap – delivered + expected yield variation (due to underdelivery/overdelivery)

The available options in confirmation are listed here:

Time events

If you want the confirmations to be based on specific points in time, you can have *time events* confirmed. For example, you can specify the date and time the process starts and the date and time the process ends. The system automatically calculates the processing time based on this data.

Milestones

If you've defined an operation as a *milestone*, the confirmation of the milestone operation includes all previous operations. For example, during in-process (during production) quality inspection, you can only confirm scrap quantity after you perform the quality inspection at an operation.

Progress confirmations

Like the milestone confirmation, the *progress confirmation* of an operation automatically includes all previous operations. However, in contrast to the milestone confirmation, you don't have to specifically mark an operation as a progress confirmation. A special characteristic of the progress confirmation is that each confirmation always considers the entire quantity that has been produced until the confirmation is triggered. A progress

confirmation is useful if several partial confirmations are required and if it's easier to determine the total quantity rather than only the newly added quantity.

You can also confirm an entire production order. However, you won't be able to confirm the details of the actual activities in this case. The system uses standard activities details given in the production order.

Next, let's discuss the various options available to perform confirmation for a production order.

6.7.1 Confirmation at the Operations Level

You can opt to confirm an operation either with a time ticket or a time event. For a confirmation with a time ticket, the system confirms the quantities, activities, dates, and personnel data of an operation. The activities that you can confirm depend on the SVK, whereas the quantities that you can confirm are yield, scrap, and rework. For dates, you can specify the start and end of the execution, including time and calendar date.

To bring greater visibility to the production process, you can periodically confirm the produced quantity at a work center. The frequencies with which you confirm an operation or an order depend entirely on business needs. For example, in 24 hours, you can confirm the quantities produced at the end of an 8-hour shift. This means you have to perform two partial confirmations and one final confirmation. When you perform the final confirmation, the system no longer expects any further confirmation against the operation or the order. The partial confirmation option is especially useful and practical for operations with long lead times. When you partially confirm an operation, the system assigns the production order a status of **PCNF**, whereas for final confirmation, it assigns the status as **CONF**.

To proceed with confirmation of a time ticket, follow the menu path, **LogisticsProductionShop Floor ControlConfirmationEnterFor OperationTime Ticket**, or use Transaction CO11N.

Figure 6.65 shows the initial screen to confirm the time ticket. Enter the **Order** number as "80000001", enter **Operation** as "0010", and press (Enter). The system automatically brings up the data that you can confirm. In this screen, you enter the actual quantities, activities, and duration details to enable the system to perform automatic functions as discussed earlier (e.g., updating costs, releasing capacities, etc.).

Tips & Tricks

If the system doesn't automatically bring up the data that you want to confirm, click on the **Actual Data** button.

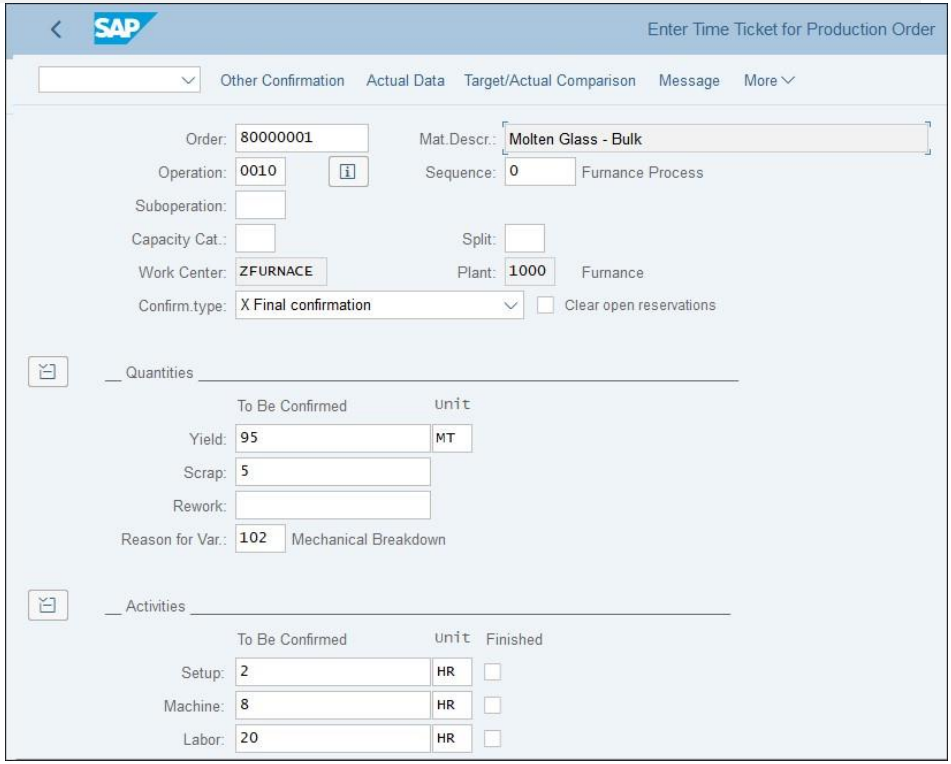


Figure 6.65 Operation Confirmation of the Production Order

Notice the **Confirm.type** field, which, in this case, has the value of **Final confirmation**. In partial confirmation, you can select the relevant option from the dropdown list. In the **Automatic Final Confirmation** option, the system checks whether the confirmed quantity is equal to, higher than, or less than the production order quantity. If it's less, then it automatically sets the status as **Partial confirmation**, whereas if the confirmation quantity is equal to or exceeds the production order quantity, then it automatically sets the status as **Final confirmation**.

Further down this screen, you can also assign a **Reason for Var.** (variance) in case there is a deviation between planned and actual production quantities.

Tips & Tricks

You can add multiple reasons for variances by using enhancement CONFPP07.

Figure 6.66 shows the lower half of the time ticket for the production order. Here, the **Posting date** is a mandatory field, and, by default, it uses the date of confirmation as the posting date. Other details, such as **Personnel No.** (not shown), are integration points between PP and your HR system.

You can also enter a long text to provide greater details regarding any problem encountered in the production process or any other findings worth recording during the production process.

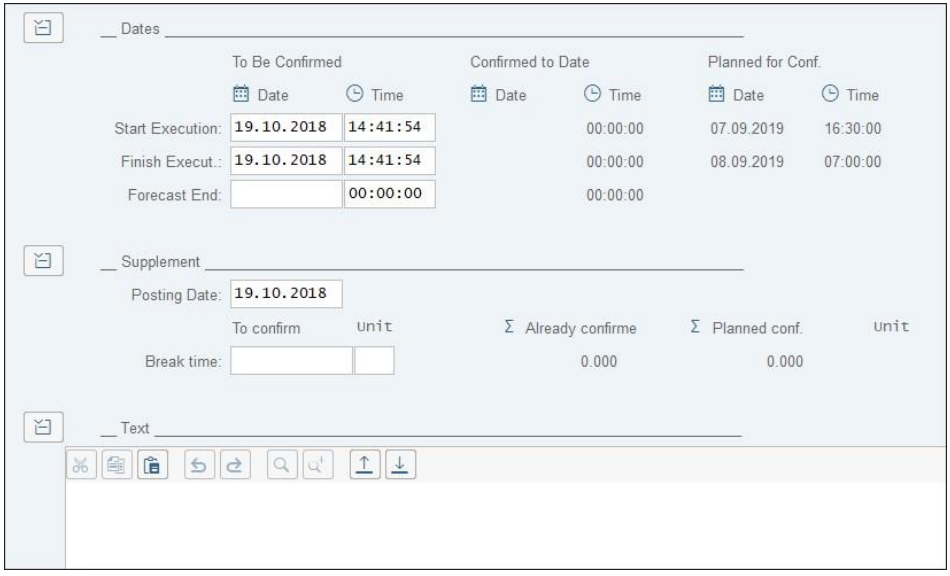


Figure 6.66 Additional Input Options in Operation Confirmation

Click on **More Goods Movements**, and the system navigates to the screen shown in Figure 6.67. This screen shows the components that the system will backflush when you save the confirmation. Notice that only three components are available for backflush on this screen.

Save the confirmation, and you'll see a message indicating the successful save of the confirmation (time ticket) and also that the system was able to successfully perform goods

movement (which in this case is components backflush) for the three components. (In Section 6.9.1, we cover what to do if the goods movement fails.)

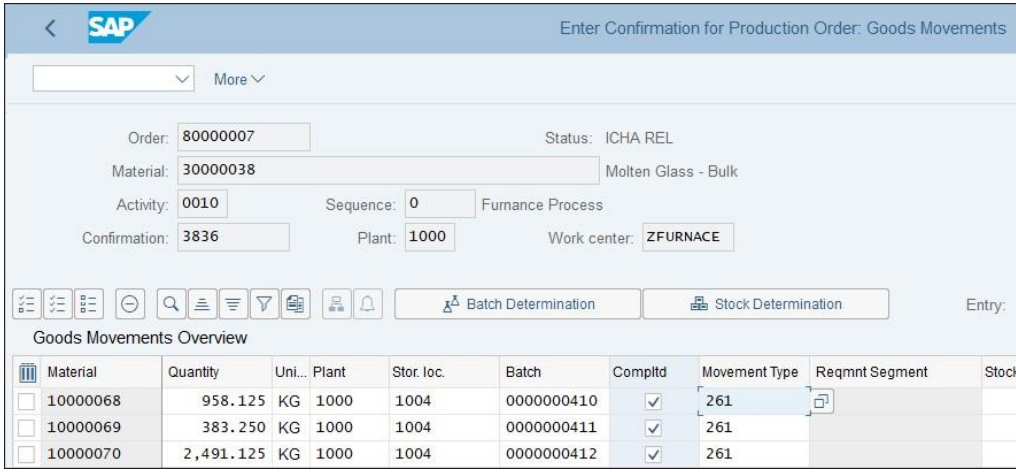


Figure 6.67 Goods Movements (Backflush) in Confirmation

6.7.2 Progress Confirmation

Each progress confirmation specifies the total quantity. For example, you create a production order of 50 PC of a material. The production process is distributed across two days. On the first day, 30 PC are produced, while the remaining 20 PC are produced on the second day. If you use the regular confirmation, the system confirms 30 PC in a partial confirmation on the first day and includes the remaining 20 PC in the final confirmation on the second day. For progress confirmation, the system confirms 30 PC on the first day and 50 PC on the second day.

You can enter progress confirmations using Transaction CO1F.

6.7.3 Confirmation for Order

You can also enter a confirmation for the entire order. In this case, the system confirms the operations based on the confirmed quantity. To proceed with the confirmation of an order, follow the menu path, **LogisticsProductionShop Floor ControlConfirmationEnterFor Order**, or use Transaction CO15.

Figure 6.68 displays just about all of the options available for confirmation, with the exception that you can't enter details of the actual activities consumed. When you confirm

the quantity (**Yield Quantity**), the system uses standard activities details. Notice that the option to backflush components, using the **Goods Movements** button, is also available in this screen.

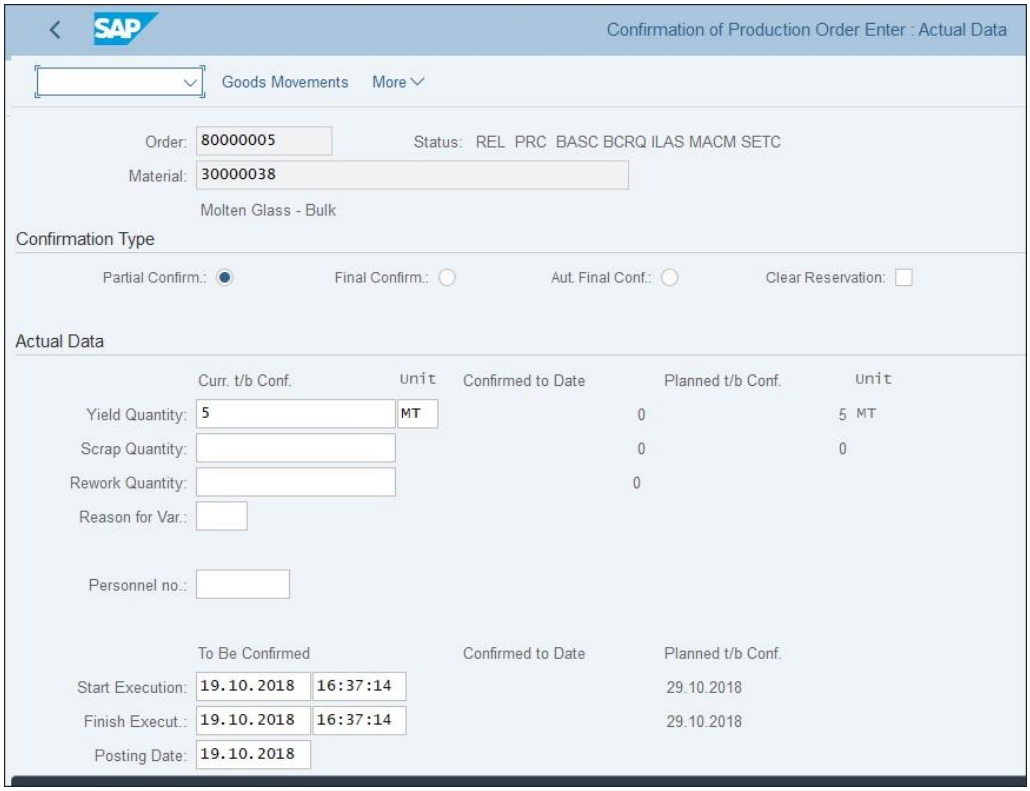


Figure 6.68 Production Order Confirmation

6.7.4 Confirmation Cancellation

If you've entered incorrect confirmation details, such as quantity or activities, you can cancel the confirmation using Transaction CO13. On the initial screen, enter the order number together with the operation number. On the next screen, choose **Save** to save the confirmation cancellation. There's no provision to make changes to a confirmation. You'll have to first cancel the confirmation and then do the confirmation again.

6.7.5 Display Confirmation

You can display the entered confirmation using Transaction CO14.

6.8 Goods Receipt

As soon as the last step or the operation in the production process is complete, you'll place the produced material in stock for future sales or for consumption in the next assembly. This step increases the physical inventory of the material. When you put the material in stock, you can post it in one of the following stock types:

Unrestricted (freely usable) stock

Quality inspection stock

Blocked stock

If you use QM with PP in the production process, then the stock will go into quality inspection. The QM user performs the results recording and usage decision and also performs the stock posting of quality stock into unrestricted (or blocked) stock.

When you post GR against the production order, the system carries out many activities in the background:

The system increases the relevant stock type and also updates the information in the **Delivered Quantity** field of the production order. If you post the material to consumption, then the system updates consumption statistics, which facilitates the forecasting process.

The system credits the production order, and the stock value increases.

If you post material to consumption, the system debits the recipient. The system updates the General Ledger (G/L) accounts in SAP S/4HANA Finance, such as the material stock account and the factory activity account.

The system creates a material document showing the GR as well as an accounting document, consisting of all postings in SAP S/4HANA Finance.

You can use either a manual or automatic process to perform the GR, which we'll discuss in the following sections.

6.8.1 Goods Receipt: Manual Process

To perform GR against the production order, follow the menu path, **LogisticsMaterials ManagementInventory ManagementGoods MovementGoods Movement**, or use

Transaction MIGO. Figure 6.69 shows the initial screen in which you first select the **Goods Receipt** dropdown option, and then from the next dropdown, select **Order**.
Enter the production order number as “80000001”.

It's important to note that the system uses movement type **101**, as shown on the farright side of the screen in the **GR goods receipt** field. When you press (Enter), the system brings up the details of the material for which you can perform GR against the production order (see Figure 6.69).

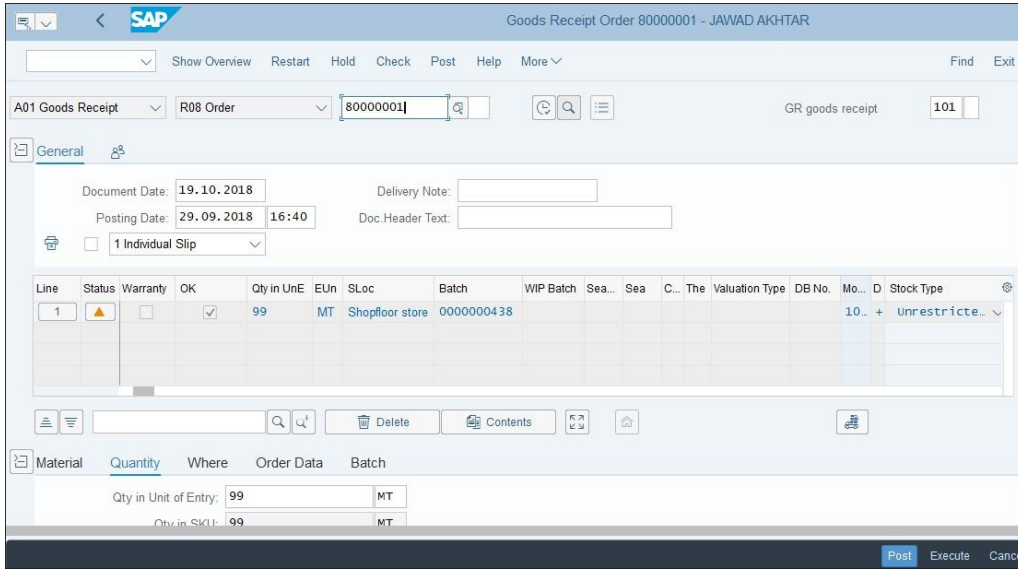


Figure 6.69 GR of the Production Order

You can make changes to the quantity to reflect the actual GR quantity and enter the storage location (**SLoc**) of the receiving storage location. Finally, select the **OK** checkbox. Save your entries, and the system creates a material document number (and a corresponding accounting document).

Note

You can perform the GR of a co-product in the same way.

For this example, we performed the GR of 99 MT of the **Material 30000038** against the production order.

If you go back to the display production order screen (Transaction CO03), the system updates the **Delivered** field to reflect the GR against the production order (see Figure 6.70).

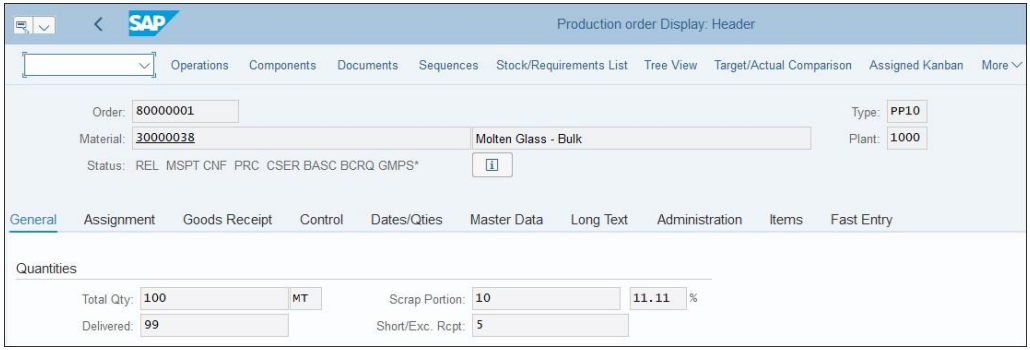


Figure 6.70 Shortage/Excess Production Updates in the Production Order

The system updates two fields, that is, **Delivered** and **Short/Exc. Rcpt**. A negative quantity in the latter field reflects a shortage in production and its eventual GR.

Depending on how you've set up the confirmation parameters of the production order, the system either issues a warning or an error message if it finds confirmation that the GR quantity deviates from the predefined tolerance limits. You can maintain the upper and lower tolerance limits in the **Work Scheduling** view of the material master. If you don't maintain any tolerance limits, then the system infers this to be 0% tolerance and doesn't allow you any underdelivery or overdelivery.

6.8.2 Goods Receipt: Automatic Process

To optimize the business process and eliminate manual data entry efforts, you can also perform automatic GR against the production order when you confirm the last operation. To activate automatic GR, you need to make settings at two different configuration objects: control key and production scheduling profile.

In each of these configuration objects, you have to select the **Automatic Goods Receipt** checkbox. You then assign the control key in the **Default Values** tab of the work center and assign the **Production scheduling profile** in the **Work Scheduling** view of the material master.

Note

We cover the automatic GR settings in Chapter 3.

6.9 Postprocessing

When you opt for automated business functions, such as backflush or automatic GR, sometimes the system faces errors in posting these automated transactions. For example, during a scheduled backflush, if the system is unable to find the quantity to be backflushed in stock or if the storage location (to backflush from) is missing, it leads to errors in goods movements.

As a business process owner, you need to make sure that you frequently check the log for errors in goods movements and attend to the issues in a timely fashion.

In the following sections, we'll cover how to resolve errors due to goods movement and errors in cost calculations.

6.9.1 Reprocessing Goods Movements

To correct or reprocess the errors in goods movements, follow the menu path, **LogisticsProductionShop Floor ControlConfirmationReprocessingGoods Movement**, or use Transaction COGI.

On the initial parameters selection screen, you can enter several relevant parameters so that the system only brings up the relevant records for you to process. For this example, enter **Plant** "1000" and **Material** "30000038", and choose **Execute**.

The screen in Figure 6.71 consists of a list of three records that need to be reprocessed. You can select a record and click on **Display errors** to know the nature of the error, as shown in Figure 6.72.

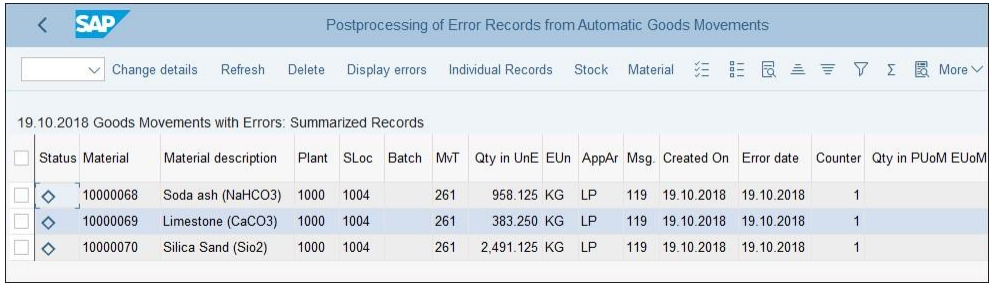


Figure 6.71 Postprocessing Records of Automatic Goods Movements

Figure 6.72 shows that the system found missing batch information, which leads the system to terminate automatic goods movement processing. Select all three records, and click on the **Change details** button.

Figure 6.72 Error Details in Automatic Goods Movements

In Figure 6.73, enter the **Batch** for each of the three records, and then click on the **Back** icon.

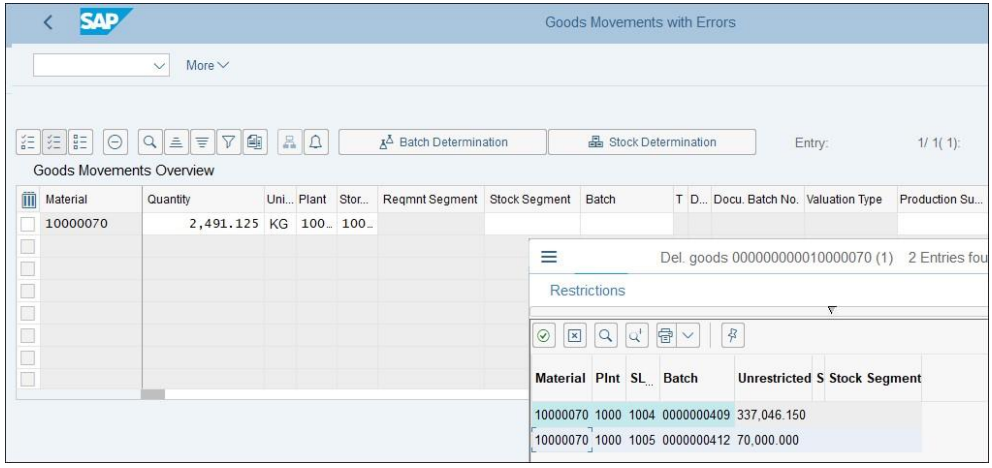


Figure 6.73 Goods Movements with Errors

The screen in Figure 6.74 shows the successful reprocessing status of all four records with a green traffic light. Save the records, and the system reprocesses them and posts the GI.

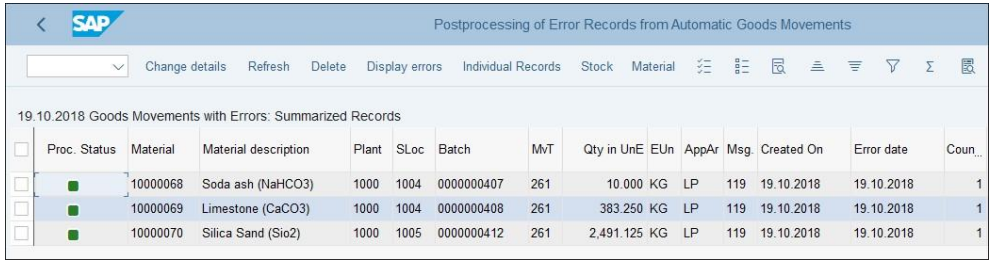


Figure 6.74 Log on Automatic Goods Movements before Posting

6.9.2 Cost Calculation

Similar to automatic goods movement errors, the cost calculation errors arise during the confirmation process when the system updates the costs based on entered data, such as activities. Depending on how you've configured the system, errors occurring during the confirmation process and cost calculation can appear as warnings or errors. For warnings, the system allows you to save the confirmation so that you can process the actual costs later on. For errors during costs calculation in confirmation, the system doesn't allow you to save the confirmation.

To reprocess the actual costs of the production order, follow the menu path, **LogisticsProductionShop Floor ControlConfirmationReprocessingActual Costs**, or use Transaction COFC. Figure 6.75 shows the postprocessing error log that you need to engage and coordinate with the CO-PC resource to manage.

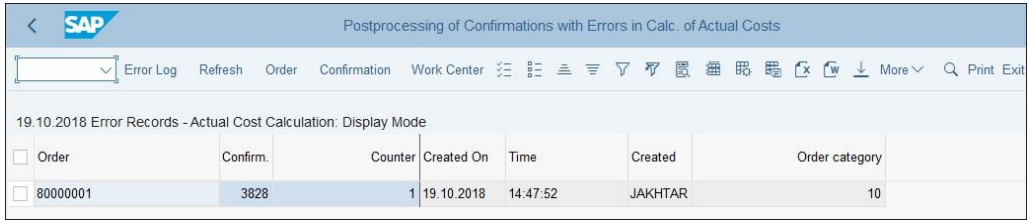


Figure 6.75 Postprocessing Confirmations with Errors in Cost Calculations

6.10 Settlement and Completion

When you create a production order, the system calculates the planned cost of the order. Thereafter, every business function that you perform will directly reflect as costs, which continue to accrue. This occurs, for example, when you withdraw components against a production order, when you confirm an operation's activities, or when any external processing (subcontracting) is involved in the production process. The system debits all of these actual costs and only credits it when you perform GR against the production order. The basis of crediting an order is either on the standard price or on the moving average price that you've maintained in the **Accounting 1** view of the material master. The standard price control may not reflect the actual costs of production and so must be passed on to settle the production order.

The CO-PC team normally proceeds with the settlement process after all production steps are ensured and the order has the status of **Delivery completed**. With the right settings in

place, the system assigns a settlement rule to the production order as soon as you create the order. A settlement rule defines the recipient to which the system will settle the order and distributes the percentages of costs to various settlement receivers. Some of the settlement receivers can be a material, a cost center, a project, or a sales order. Normally, the CO-PC team assigns the settlement receiver of the production order to the material account. So, the settlement receiver is the material, and the settlement share is 100%. You can display the settlement rule of a production order by choosing **More HeaderSettlement Rule**.

When you perform GR against the production order, the system credits the production order and debits the material stock account. If the price control in the material master is standard price, then the system valuates the material at the standard price. Because the actual production costs often vary, the system posts the difference to the price difference account during the settlement process.

For the moving average price control in the material master, the system automatically valuates the material at the moving average that it determines. For the moving average calculation, it takes the total value of the material stock account and divides it by the total quantity of material available in all of the storage locations.

You can evaluate the *overheads* separately that must be part of CO-PC. Overheads can be management or employee salaries, administration, and even utilities, such as electricity.

You can also evaluate the *variances* separately between planned and actual costs that occur due to the actual components and activities consumed that are different (either more or less) from the plan according to the BOM and routing.

Similarly, as soon as the GI for the production order takes place, the system reflects this as *work in process (WIP)*, and it remains so until the GR is posted and the stocks are updated. You can individually or collectively view the WIP details of production orders.

The completion of an order is logically divided into two distinct areas to distinguish logistical and accounting-based completion. When you technically complete the order and assign it the status **TECO**, the system updates the MRP-relevant details and deletes all reservations of components and capacity requirements. You can technically complete an order any time by choosing **More FunctionsRestrict ProcessingComplete Technically** in the order screen. You'll then no longer be able to make changes in the production order. Further, with a technically completed order, you can no longer post costs to the order or perform any further confirmation.

While in the production order screen, you can set the completion status by choosing **More FunctionsRestrict ProcessingClose**. The system denotes the completion by the status **CLSD**.

You can also carry out both the completion and the technical completion in mass processing steps. We explain the mass processing function in Section 6.11.4.

6.11 Additional Functions and Information Systems

In this section, we cover several of the functions you can use to optimize your business processes. We suggest that you check out the features and functionalities available in each area of working, such as master data, transactional data, or reports. You can do so by navigating the menu path and checking out the available options in relevant folders (e.g., routing or work center).

6.11.1 From Planned Order: Individual Conversion

Although this entire chapter is primarily focused on covering the master data and the transactional data in the production processes, you can also effectively use the planning data, which the system generates when you run MRP. The output of MRP is the generation of planned orders, which you convert into production orders for in-house production and purchase requisitions for external procurement. For in-house produced materials, it's important that the system is able to find the PP master data, such as BOM, routing, and production version.

There are two options for you to convert planned orders into production orders: interactive conversion in Transaction MD04 or individual conversion using Transaction CO40. With production order creation, all of the remaining functions are the same as covered in this chapter, such as its release, cost calculation, control instruction generation, and scheduling.

Note

See Chapter 12 and Chapter 13 on MRP.

6.11.2 From Planned Orders: Collective Conversion

You can convert several planned orders into production orders collectively using Transaction CO41. On the initial screen, enter the selection parameters that the system will consider in bringing up the relevant planned orders. You also assign an **Order Type** on the

initial screen, so that the collective conversion of planned orders to production orders is all of the same order type.

Note

You can use report PPBICO40 for the automatic conversion of planned orders into production orders in a batch job.

6.11.3 Production Order Creation without a Material

You can create a production order without reference to a material; for example, you may want to create a capacity placeholder for postprocessing or for maintenance works without using the maintenance orders. You can also use this option to record extra production costs incurred during rework and can give reference to the main (parent) production order for settlement.

You use Transaction CO07 to create production orders without a material. On the initial screen, you need to enter the short text and assign a routing. If no routing is available, the system generates the operation from the default value that you defined in Customizing.

6.11.4 Mass Processing

To process large volume of transactions data or to simply optimize routine business processes, you can use the mass processing functionality for the following functions:

Performing confirmation

Creating capacity requirements

Picking

Costing

Checking material availability

Generating control instructions

Printing shop floor papers

For this example, you can perform the confirmation function using mass processing by following the SAP menu path, **LogisticsProductionShop Floor ControlControlMass Reprocessing**, or by using Transaction COHV.

Figure 6.76 shows the initial parameters entry screen, in which the system offers a large number of parameters to select from. Enter **Production Plant** "1000", enter **Order Type** "PP10", and choose the **Mass Processing** tab.

In the next screen, select **Confirmation** from the **Function** dropdown, and choose **Execute** (see Figure 6.77).

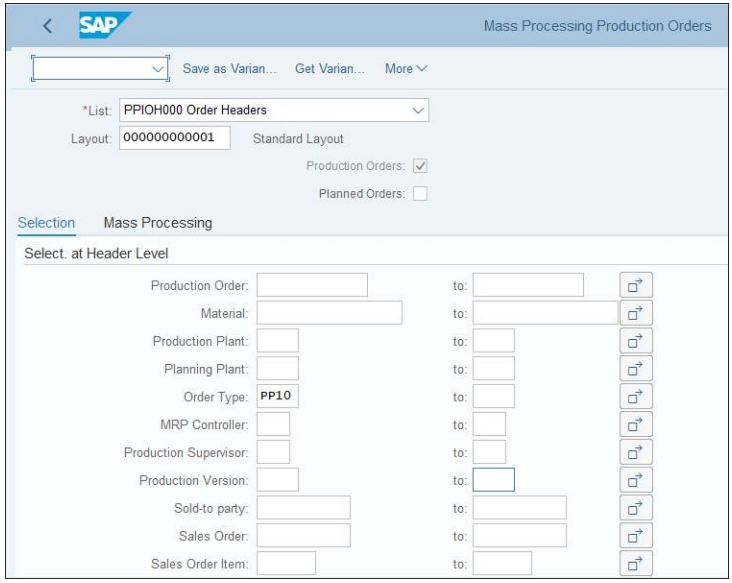


Figure 6.76 Initial Screen of the Mass Processing Functions

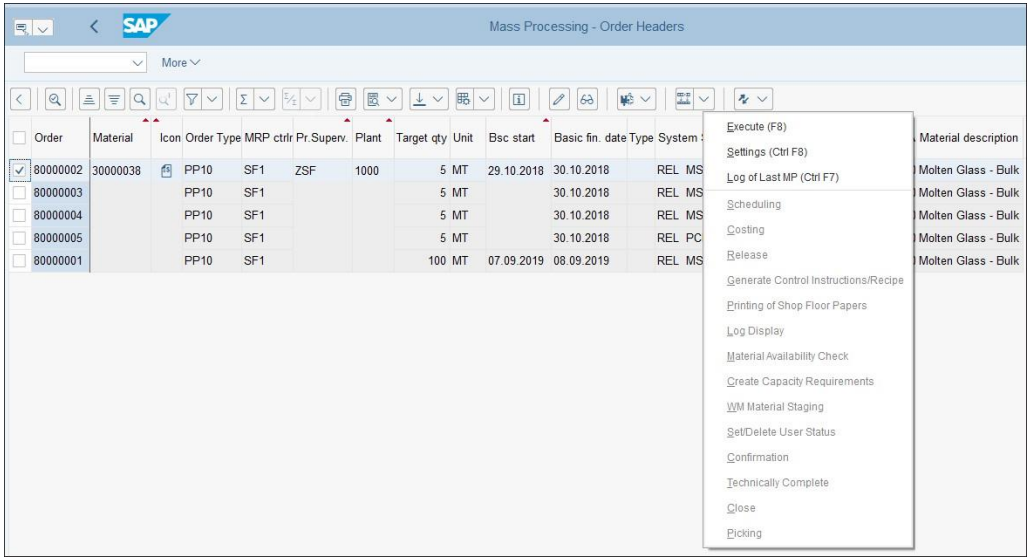


Figure 6.77 Confirmation through the Mass Processing Function

The system opens the worklist, where you select the **Production Order 80000002** and choose **Execute**. The system then displays the log of mass processing in Figure 6.78.

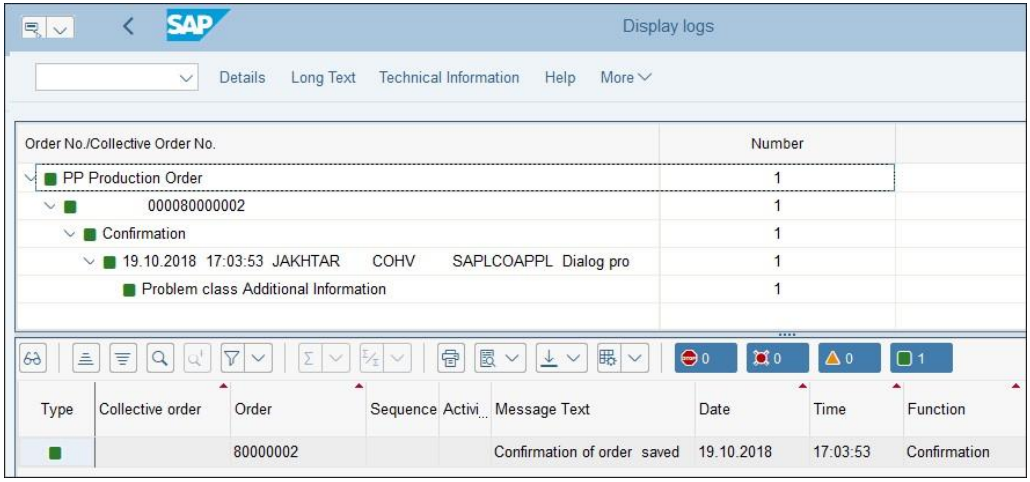


Figure 6.78 Log of Mass Processing

6.11.5 Information Systems

Due to the highly integrated nature of the SAP system, any activity or business function that you perform with reference to the production order automatically updates the relevant information.

Figure 6.79 shows the screen that appears after you choose **More Production Order Documented Goods Movements** within the production order display option (Transaction CO03), in which all of the GIs and receipts performed in MM are automatically updated.

Figure 6.80 shows the itemized costs of the production order, providing a detailed costs breakdown. It also keeps on updating the planned costs with actual costs to provide a quick evaluation. This is an integration point between PP and the CO-PC team.

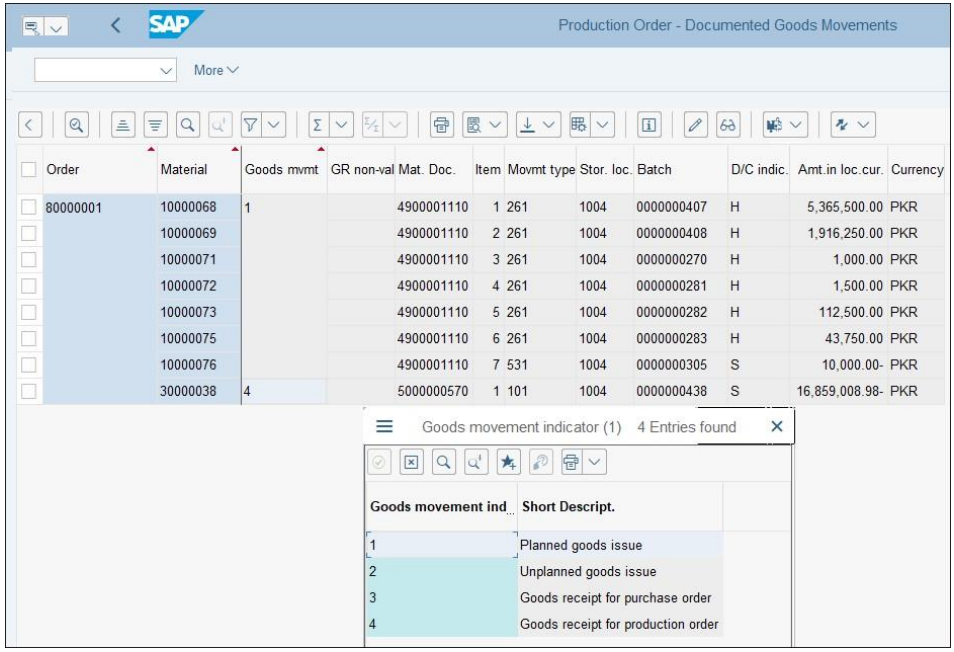
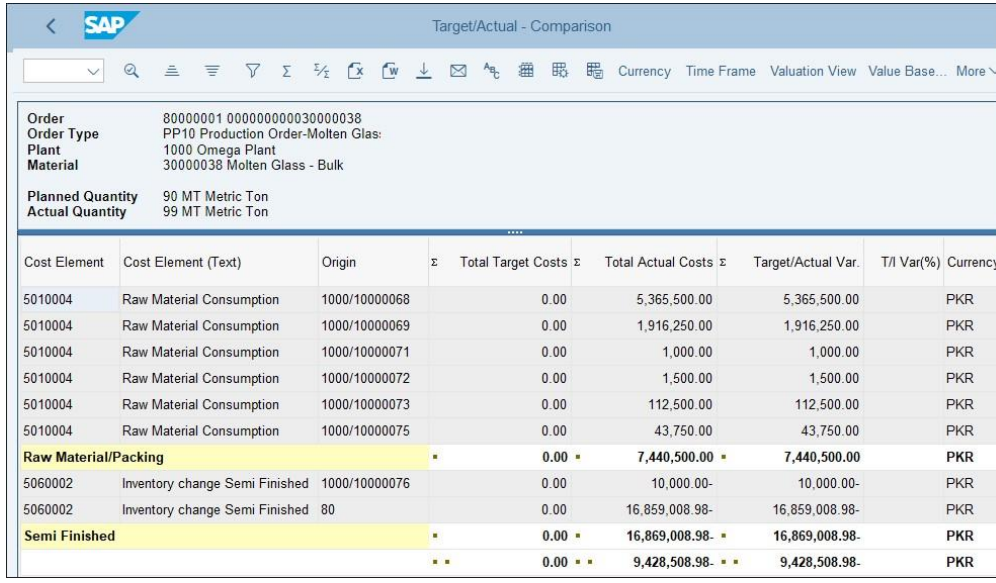


Figure 6.79 Documented Goods Movement in the Production Order



Cost Element	Cost Element (Text)	Origin	Total Target Costs	Total Actual Costs	Target/Actual Var.	T/I Var(%)	Currency
5010004	Raw Material Consumption	1000/10000068	0.00	5,365,500.00	5,365,500.00		PKR
5010004	Raw Material Consumption	1000/10000069	0.00	1,916,250.00	1,916,250.00		PKR
5010004	Raw Material Consumption	1000/10000071	0.00	1,000.00	1,000.00		PKR
5010004	Raw Material Consumption	1000/10000072	0.00	1,500.00	1,500.00		PKR
5010004	Raw Material Consumption	1000/10000073	0.00	112,500.00	112,500.00		PKR
5010004	Raw Material Consumption	1000/10000075	0.00	43,750.00	43,750.00		PKR
Raw Material/Packing			**0.00**	**7,440,500.00**	**7,440,500.00**		**PKR**
5060002	Inventory change Semi Finished	1000/10000076	0.00	10,000.00-	10,000.00-		PKR
5060002	Inventory change Semi Finished	80	0.00	16,859,008.98-	16,859,008.98-		PKR
Semi Finished			**0.00**	**16,869,008.98-**	**16,869,008.98-**		**PKR**
			0.00	**9,428,508.98-**	**9,428,508.98-**		**PKR**

Figure 6.80 Item Cost Overview of the Production Order

6.12 Summary

The production process in discrete manufacturing entails the creation of important master data followed by production execution that itself consists of order creation, GI, confirmation, and GR. Handling scrap, co-products, by-products, completion, and settlement processes occurs in both manufacturing types (discrete and process). You can print shop floor papers, such as object lists. You can also use a large number of tools and functionalities to optimize your business processes, such as backflush, automatic GR, mass processing, and postprocessing. You can also implement WIP batches to have better control over the entire production process.

The next chapter discusses the business processes in production planning for process industries (PP-PI).

Chapter 7

Production Planning for Process Manufacturing

Building on the important configuration of process manufacturing that you undertook in Chapter 4, this chapter covers the important business processes and functions, as well as 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.

Production planning for process industries (PP-PI) is characterized by product complexity. For many industries, it's necessary to integrate batch management and quality management (QM) with 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 semisolid form, or where the processed material can't 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 endto-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 configurations made in Chapter 4.

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

Because PP-PI processes, such as goods issue (GI), confirmation, and goods receipt (GR) are all similar as in discrete manufacturing, we suggest that you visit the relevant sections of those chapters (Chapter 3 and Chapter 6).

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

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 the master recipe of the material, the system calculates the components' quantities. If not, it reads off the information from the material's bill of materials (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 sheet (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 release the process order manually. 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.

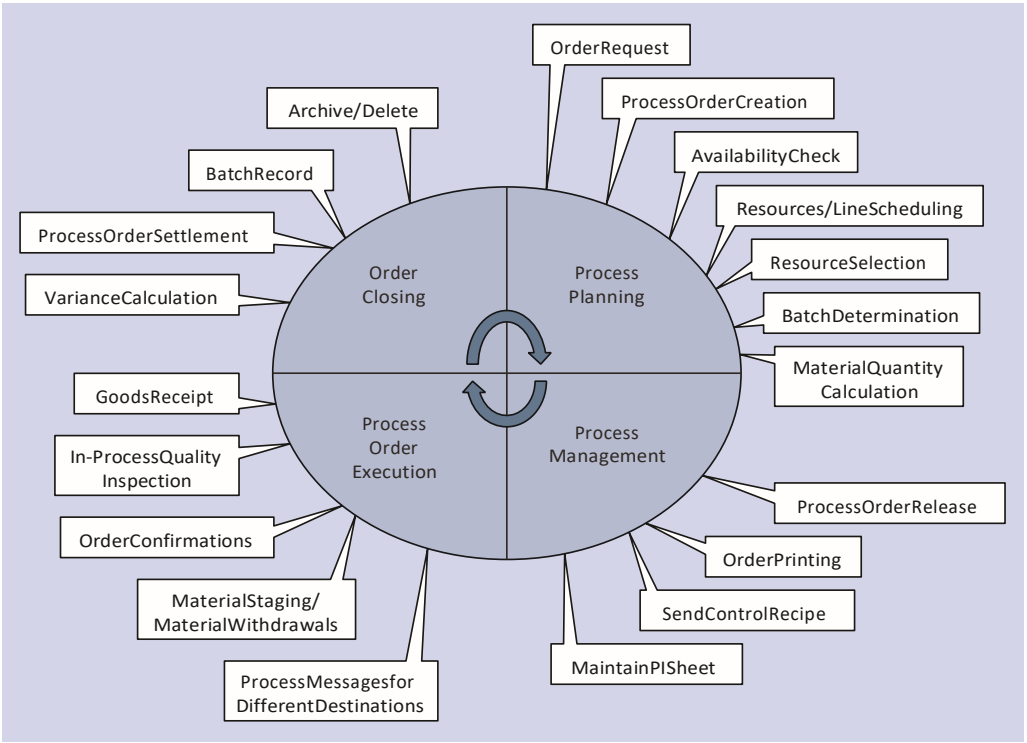


Figure 7.1 Production Planning and Execution in Process Industries

The materials management (MM) functionality plays an important role when you want to issue raw materials and components against a process order. QM processes, if integrated with production planning (PP), enable 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 MM to ensure GR against the process order. You can now send the process messages back to the SAP 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. PP completely integrates with cost object controlling in the SAP 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 GR.

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 (REM). If you set up master data in the right sequence, it's much easier and logical to interconnect the master data because you've already taken care of the predecessorsuccessor relationship.

The master data creation for process manufacturing begins with the material master of the product (a finished good or an assembly). You create the 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 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 the master data is in place, your controlling (CO) team can create a product cost estimate of the material and release it.

Note

You need to maintain a close coordination and liaison with the CO team to ensure that when working in PP, 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 for you. 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

Production version

Master recipe

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

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 a commercial basis. You can also relate a material to being either consumed or produced. A few examples of material are raw material, packing material, consumables, semifinished goods, and finished goods. The material isn't just restricted to production-based processes but all those for which the company wants to maintain inventory (stock items). Therefore, you may also have materials that are used in plant maintenance (PM) processes, or you can even have nonvaluated materials.

For PP-PI, there is an extensive use of *batch management*. 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 nonreproducible unit with unique specifications. The key properties of a batch are homogeneity and nonreproducibility.

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. Complete batch traceability, batch determination, and batch derivation functionalities are available. You can use the batch information cockpit (Transaction BMBC) for complete top-down or bottom-up evaluation of material batches.

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 can't 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

Chapter 9 covers batch management.

7.2.2 Bill of Materials

The 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 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, you 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, you use Transaction CRC1.

The system offers and makes available standard configuration for PP-PI, which you can use if your business processes aren't 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 SF01 (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, you should 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, Section 6.2.5, for a detailed understanding of the business process of a production version and how to create one in the SAP system. It's mandatory to create a production version for process manufacturing (and in REM), 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. Use Transaction C223 to achieve this objective instead.

7.2.5 Master Recipe Creation

Before you create the master recipe, you can create a production version and include BOM details only (without 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 the 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 the 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 the 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, **LogisticsProduction – ProcessMaster DataMaster RecipesRecipe and Material ListCreate**, or use Transaction C201. On the initial screen of the master recipe, enter the **Material**, **Plant**, and **Profile** (see Figure 7.2), and the header screen appears. Recall from Chapter 4 that the master recipe's profile is a control function to allow or disallow certain functions, such as XSteps being optional or mandatory. The **Key date** controls when the master recipe will be available for production process. You can either enter the key date manually, or, if you don't make any entry, the system uses the date of master recipe creation as the key date.

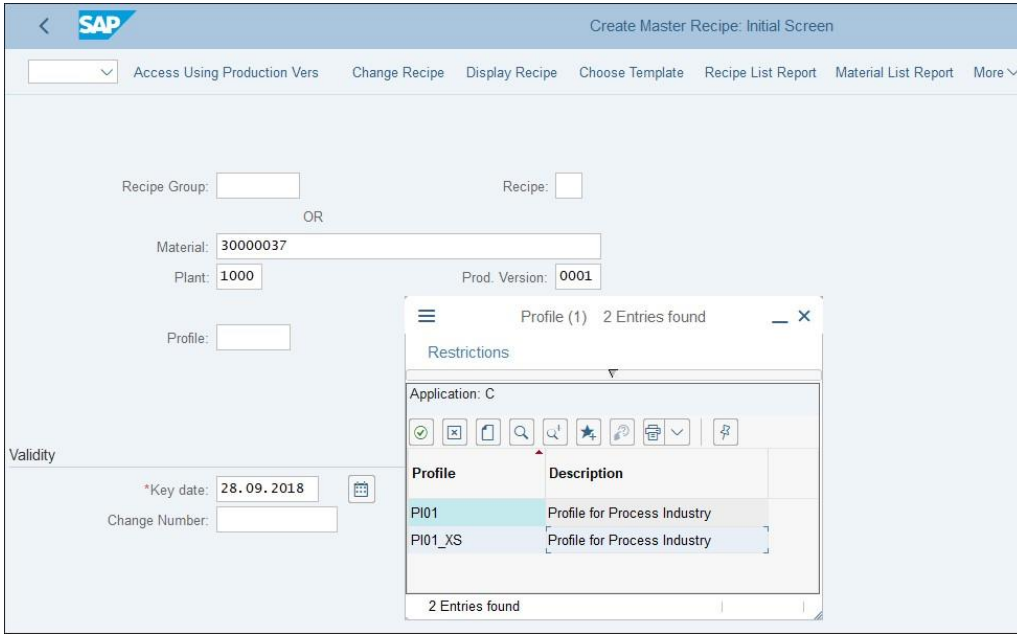


Figure 7.2 Initial Screen of Master Recipe Creation

We'll discuss the different elements of this screen in the following sections.

Recipe Header

Figure 7.3 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.

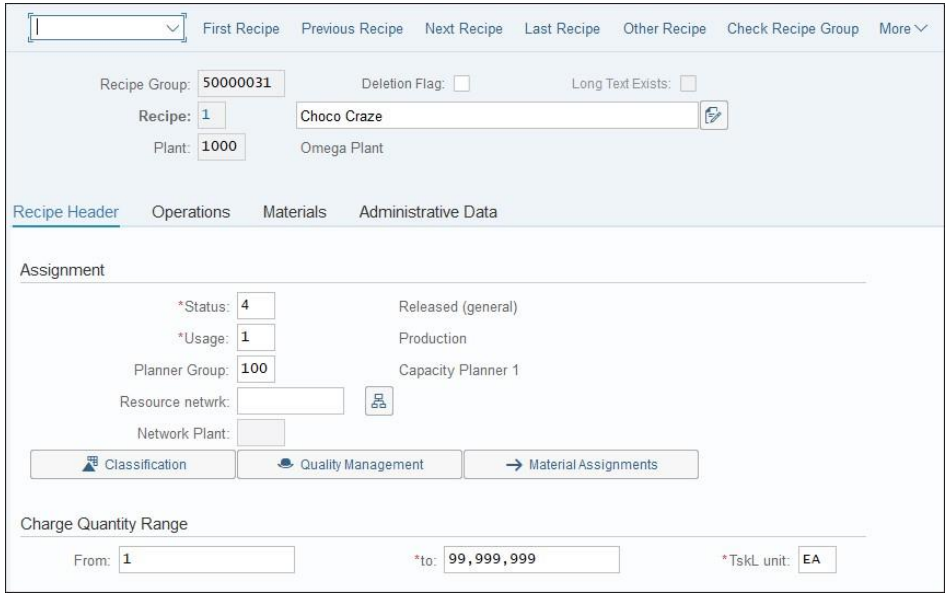


Figure 7.3 Header Details of the Master Recipe

As an example, when the master recipe unit of measure is pieces (PC), and the operation unit of measure is kilograms (kg), then for every 7 kg of the operation, there are 4 PC of the master recipe with a quotient of 4/7. The charge quantity is 4 PC, and the operation quantity is 7 kg. 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 the system includes 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 aren't 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 trigger the material quantity calculation manually 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 7.4 by choosing **GotoMaterial Quantity**

Calculation or by clicking on **Material Quantity Calc.** (calculation) in the **Materials** tab of master recipe.

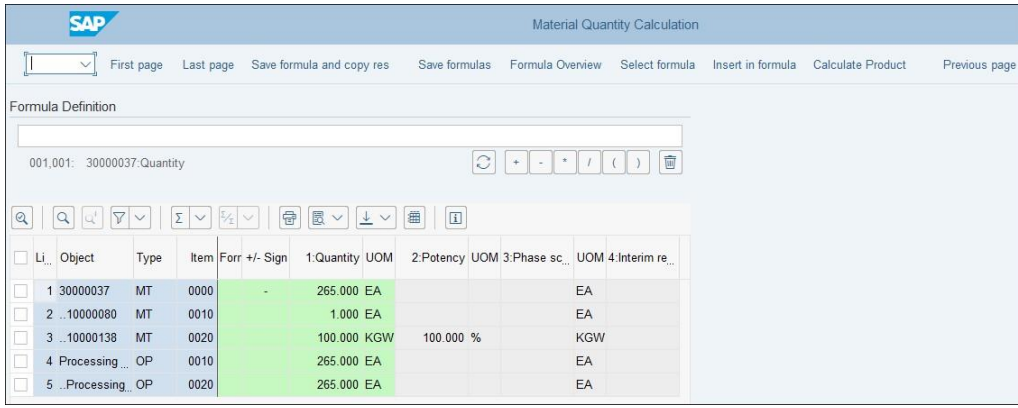


Figure 7.4 Material Quantity Calculation in the Master Recipe

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

1. On the screen shown in Figure 7.4, 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 wantto include in the formula or place the cursor on the variable, and click on the **Insert in formula** button from 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.

Operations and Phases

Master recipes use a *phase*, which works 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 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, finishstart, finish-finish, or start-start. The phases can work either 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 **GotoRelationships.**

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, **GotoProcess ManagementProcess Instructions**.

Figure 7.5 shows the **Operations** tab of the master recipe, in which the **Operation** is **0010**. Enter the **Resource** "ZSFG" at the operation level, and the system automatically copies it in all of the phase below it. The phase is **0020** and is denoted by the **Phase Indicator** checkbox. When you define an operation as a phase, you also have to define the **Sup. Operation**, which, for this example, is **0010** (the operation).

The control recipe **Destination** is **PP**. This is the same control recipe destination that you configured in Chapter 4.

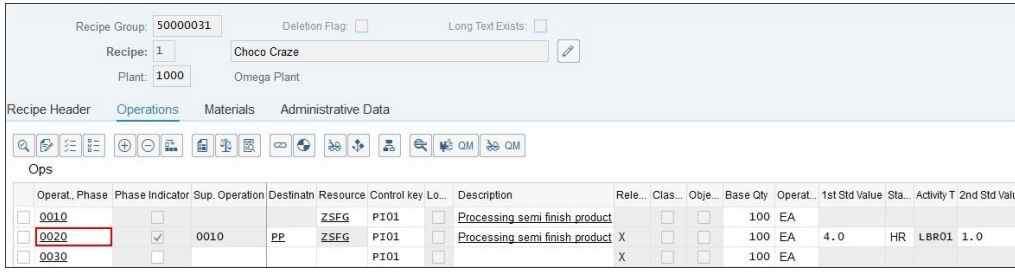


Figure 7.5 Operations Overview in the Master Recipe

Notice that the system automatically copies the **Control key**, **PI01**, from the **Resource ZSFG**. Select the phase **0020,** and double-click the line item **0020** (the operation), and the system takes you to the screen shown in Figure 7.6.

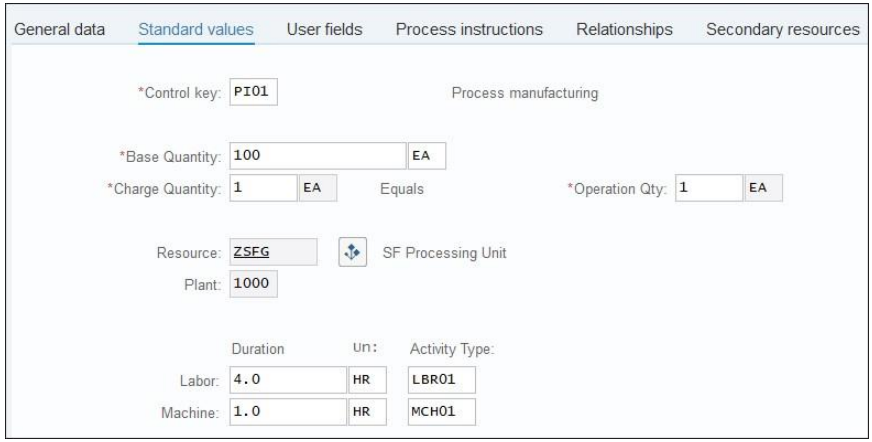


Figure 7.6 Standard Values in the Master Recipe

This shows the **Standard values** tab of the master recipe in which you can enter the duration of the activities, such as **Labor, Machine**, or **Setup** (not shown) hours required to produce the material at each operation. From here, you can click on the **Process instructions** tab to configure the process instructions that are an integral part of process management. We'll visit this screen a bit later in the upcoming section.

Because characteristics have such an important role to play in process management, we'll cover the topic first in the next section.

7.3 Characteristics

A characteristic describes an object and can have one value or a range of values that are valid. In this section, we'll begin by covering the steps required to create a characteristic and the available options. We'll also cover the associated configuration settings that can help users effectively create characteristics and put relevant controls in place.

Use Transaction CT04 to create the characteristic via the menu path, **SAP Menu Cross-Application Components Classification System Master Data Characteristics**.

In Figure 7.7, information related to the characteristics is defined such as description, data type, number of characteristics, decimal places (if any), and unit of measure. Table 7.1 describes some of the important fields that you'll see in various tabs of Figure 7.7.

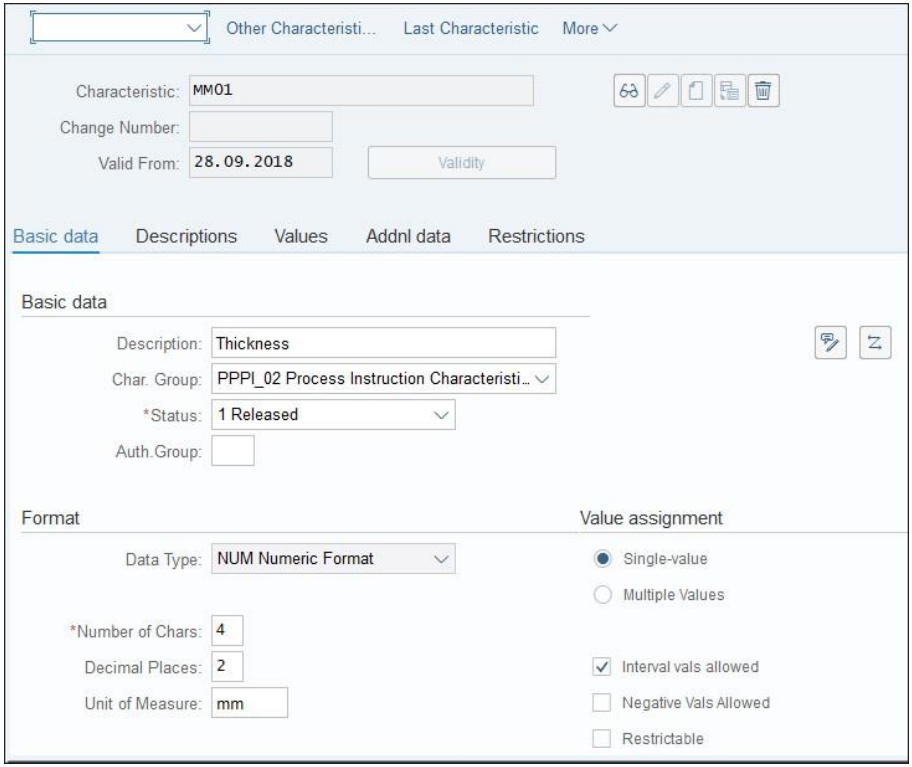


Figure 7.7 Basic Data Screen for Transaction CT04

Field Name	Field Description and Value
Description	Description of the characteristic; for example, thickness.
Char. Group	Groups together similar characteristics in one group.
Status	Status of the characteristics, for example, **Released**, to indicate it's ready for use.
Data Type	Indicates the type of data this characteristic has; for example, date, time format, or numeric format.
Number of Chars	Indicates the number of characters a value of this characteristic can contain.
Decimal Places	Indicates the number of decimal places if the format is numeric.
Unit of Measure	Unit of measure of the characteristic (quantitative/numeric), if any.
Single-value/Multiple Values (radio buttons)	Option in case a single value or multiple values are allowed for a characteristic. An example of multiple values usage is when you can select a surface finish as coarse, pitted, and uneven. For multiple values, the system offers a checkbox for each value to select from the dropdown list.
Negative Vals Allowed (checkbox)	Option if negative values are allowed. You can't enter a negative value for a characteristic if you don't select the checkbox.
Entry Required (checkbox)	Option if the user must enter a value for this characteristic. If it's not selected, then entering a value is optional.

Table 7.1 Details of Individual Fields of a Characteristic

You'll then switch over to the **Values** tab (see Figure 7.8) and maintain values of this characteristic. For example, a characteristic provides an option to record the pump value, which can then be searched in the material master along with any other characteristic. Select

the **Additional Values** checkbox to ensure that values other than the prefixed 10, 20, or 30 are also allowed for entry as an input value.

Click on the **Addnl data** tab to see the options. You can enter the relevant DMS documents number, document type, document part, and document version, if any. Following are the details of the various checkboxes and their functions:

Not ready for input

You can't enter a value in this characteristic. In other words, a preassigned default or calculated value automatically fills the characteristic field, and the user has no option to make an entry.

No Display

The system won't display a characteristic.

Display Allowed Values

If several values are already available from the **Values** tab of the characteristic, the system displays those values to facilitate the user during data entry.

Unformatted Entry

If this checkbox is selected, the system makes the provision to set the characteristic's field length to a maximum of 30 so the user can make multiple entries, separated by colons. If not selected, then the system displays the exact length of the characteristic for data entry.

Proposed Template

If selected, the system proposes or displays the template to facilitate the user during data entry. Click back to the **Basic data** tab to view the template details.

Finally, on the **Restrictions** tab, you can restrict the use of a characteristic to specific class types; otherwise, it will be available for use in all class types. For example, entering class type "001" will restrict this characteristic to the material class type only.

Save the characteristic by choosing **Save** or pressing (Ctrl)+(S).

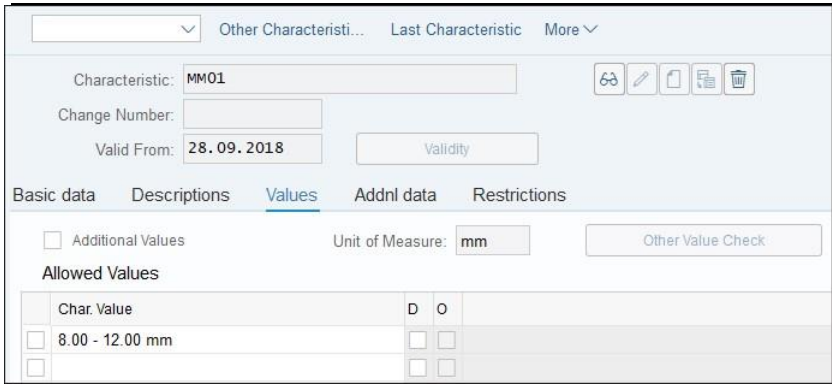


Figure 7.8 Allowed Values for a Characteristic

Note

If you create a characteristic with a date format and eventually use the same in any class, the system will *not* provide the standard option of bringing up a calendar from which to choose a date. The user has to enter the date manually. If you want to have the calendar option in the dropdown of the date characteristic, you need to engage the assistance of an ABAP consultant.

Tips & Tricks

The standard system offers the provision to use a separate batch input program to upload large numbers of characteristics.

SAP includes a number of templates that can be used for the entry of information into the characteristic values. If a new template is required for a specific characteristic value, this can be configured.

Many characters are configured for use in the templates. These can be found using the configuration navigation path, **SAP IMG Cross-Application Components Classification System Characteristics Define Template Characters**.

Figure 7.9 shows the characters that are defined for use in the templates. The **Usage**field determines how the character is used via the following options:

1: Numeric character that is valid for numeric and character formats.

2: Alphanumeric character that is valid for character formats.

3: Character that is valid for the character format.

4: Preliminary sign that is valid for the character format.

5: Separator that is valid for the character format.

By accessing the transaction using the configuration navigation path, **SAP IMG Cross-Application Components Classification System Characteristics Define Templates**, you can configure new characteristic value templates or modify existing templates. Figure 7.10 shows the templates that have been configured for use with characteristics.

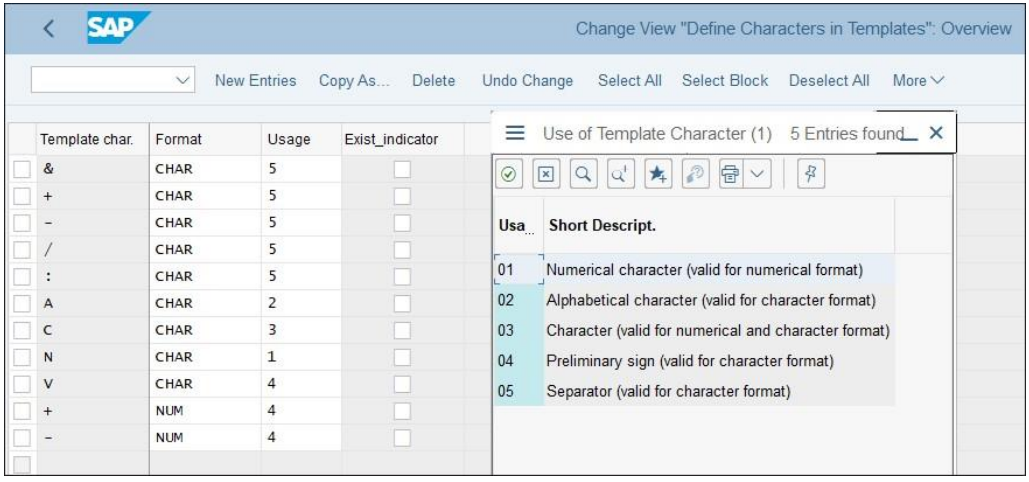
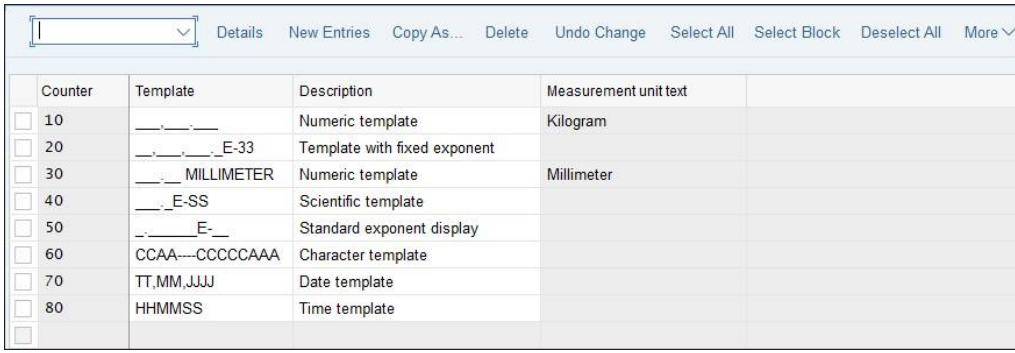


Figure 7.9 Configuration to Define Characters for Characteristic Templates



Counter	Template	Description	Measurement unit text
10	___.___.___	Numeric template	Kilogram
20	__.___.___._E-33	Template with fixed exponent	
30	___.__ MILLIMETER	Numeric template	Millimeter
40	___._E-SS	Scientific template	
50	_._____E-__	Standard exponent display	
60	CCAA----CCCCCAAA	Character template	
70	TT,MM,JJJJ	Date template	
80	HHMMSS	Time template	

Figure 7.10 Configuration That Allows the Creation and Modification of New Characteristic Value Templates

7.4 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 7.6.

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, a functionality is needed in the SAP system that can 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 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 functional areas such as MM, QM, and DMS. It offers functionality such as GIs and GRs, 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.

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

In the following sections, we'll cover some of the elements of process management and how you can intuitively create a PI sheet.

7.4.1 Elements in Process Management

Figure 7.11 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.

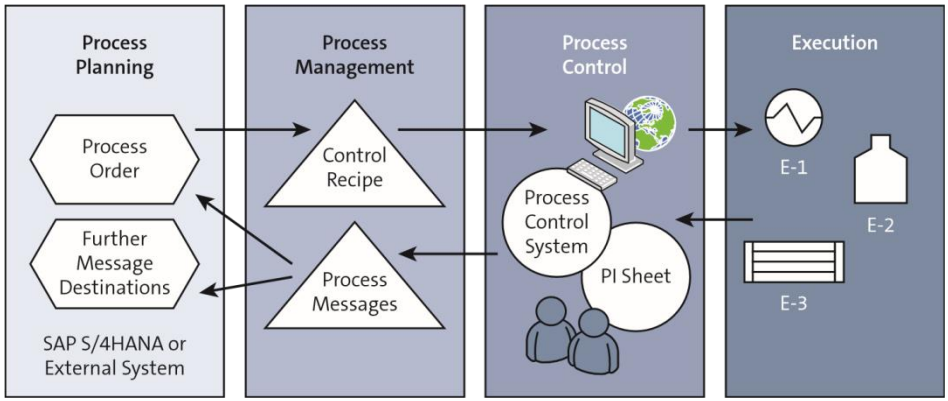


Figure 7.11 Overview of Process Management

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 to the SAP system or to an external system.

7.4.2 Integrating Process Management

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

Note

The OPC is a standard that uses component object model/distributed component object model (COM/DCOM) technology to define interfaces independent of the manufacturer for use in an industry. The SAP 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.

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

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.

7.4.3 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 phases of that operation. Within each phase, 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 7.12, there are two process instruction categories, **AREAD1** and **PP20**. **AREAD1** relates to the request to the shop floor to get the measured value of the process parameter. The second process instruction category, **PP20**, is the same one that you configured in Chapter 4. The **Control Recipe Destination PP** (**Prod.Floor-Choc Man.**) is also the same one that you configured in Chapter 4.

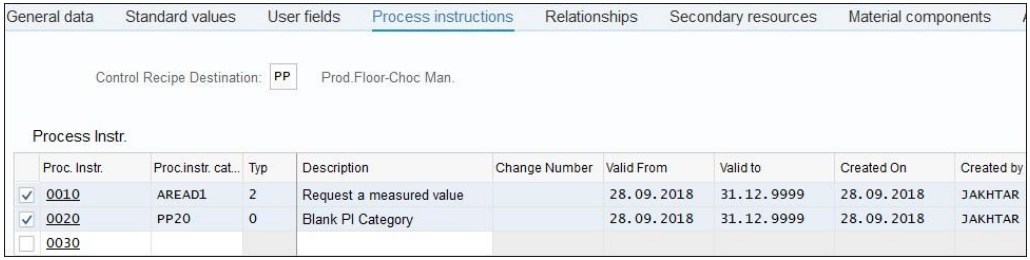


Figure 7.12 Process Instructions for Control Recipe Destination PP

Note

Implement SAP Note 2508866 in SAP S/4HANA if you face an error during selection of process instruction categories via (F4) help.

Double-click on the **Proc. Instr.** (process instruction) **0010** (with **Proc.instr. category AREAD1**) to go to the screen shown in Figure 7.13.

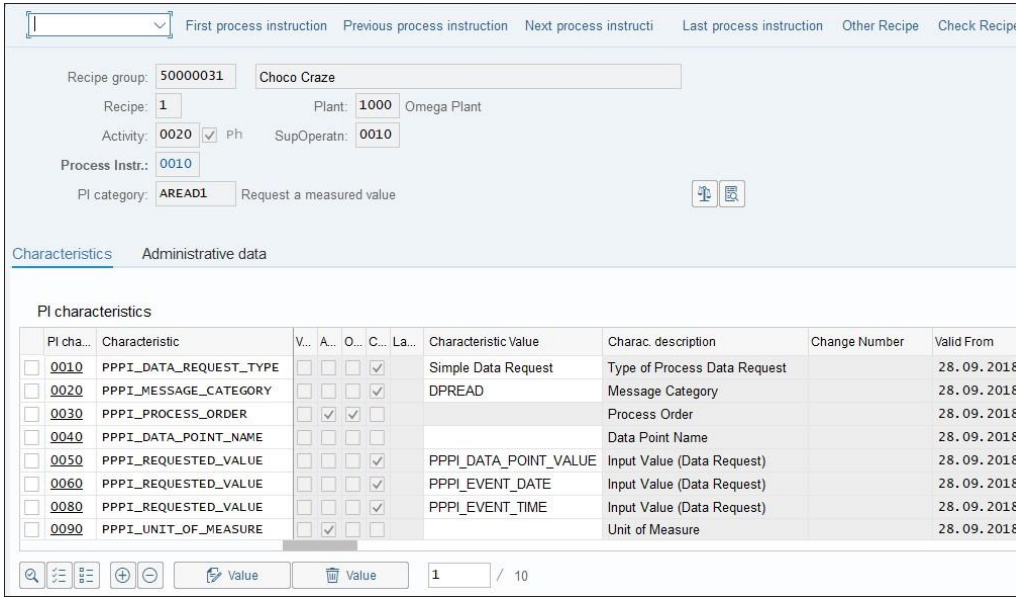


Figure 7.13 Process Instruction Characteristics for PI Category AREAD1

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 located at the center-right of Figure 7.13 to check the consistency of the sequence of process instruction characteristics and the value of each characteristic defined. Then click the **Simulate Process Instruction Sheet** icon to show the simulated version of what the field and other information will eventually look like in a PI sheet.

Figure 7.14 contains the **Message Category PP** that you configured in Chapter 4. It also contains the process instruction **Output Characteristic ZPI_CREATION_DATE1** that you created earlier in Chapter 4. In the PI sheet, this field should show the **Process Order. Start**

Date of the process order. The output characteristic also has the same value (**ZPI_CREATION_DATE1**) assigned.

Figure 7.14 Self-Defined Process Instruction Category

7.4.4 Process Instruction Sheet

Figure 7.15 and Figure 7.16 show a general example of different sections of a PI sheet displaying input fields, calculations, tables, values to choose from a dropdown, and operator's notes as some of the options available.

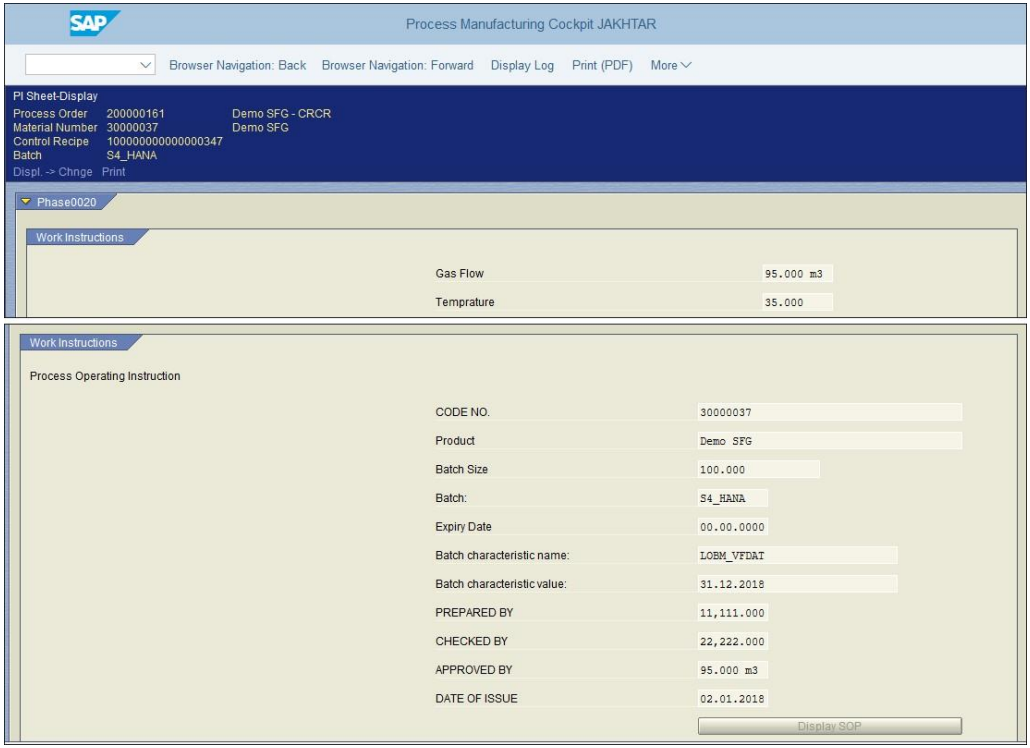
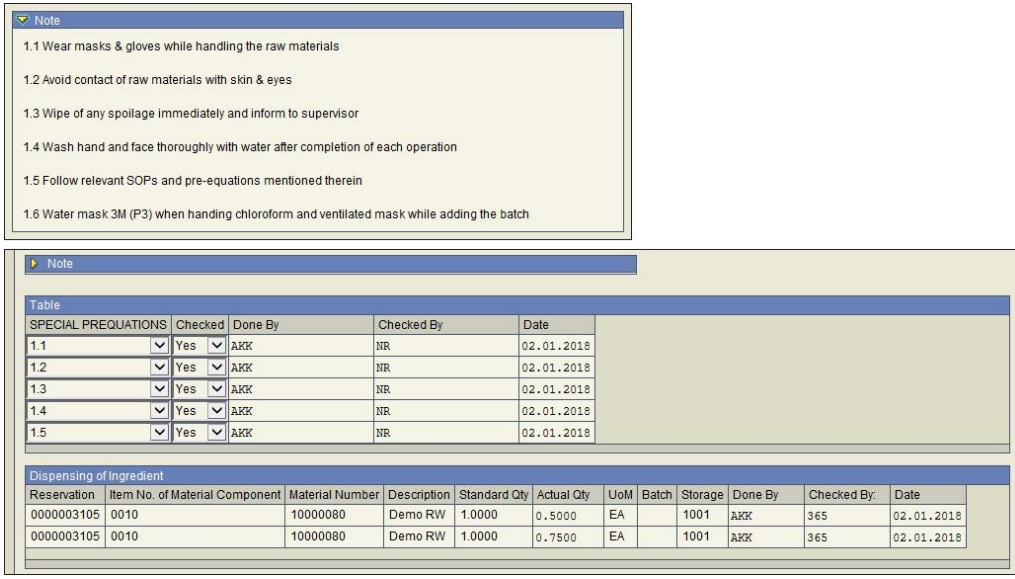


Figure 7.15 A Section of a Sample PI Sheet



Note

1.1 Wear masks & gloves while handling the raw materials

1.2 Avoid contact of raw materials with skin & eyes

1.3 Wipe of any spoilage immediately and inform to supervisor

1.4 Wash hand and face thoroughly with water after completion of each operation

1.5 Follow relevant SOPs and pre-equations mentioned therein

1.6 Water mask 3M (P3) when handing chloroform and ventilated mask while adding the batch

Note

Table

SPECIAL PREQUATIONS	Checked	Done By	Checked By	Date
1.1	Yes	AKK	NR	02.01.2018
1.2	Yes	AKK	NR	02.01.2018
1.3	Yes	AKK	NR	02.01.2018
1.4	Yes	AKK	NR	02.01.2018
1.5	Yes	AKK	NR	02.01.2018

Dispensing of Ingredient

Reservation	Item No. of Material Component	Material Number	Description	Standard Qty	Actual Qty	UoM	Batch	Storage	Done By	Checked By:	Date
0000003105	0010	10000080	Demo RW	1.0000	0.5000	EA		1001	AKK	365	02.01.2018
0000003105	0010	10000080	Demo RW	1.0000	0.7500	EA		1001	AKK	365	02.01.2018

Figure 7.16 A Section of a Sample PI Sheet (Cont.)

The following sections 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 7.2 contains the PP-PI characteristics needed for input field functionality in the PI sheet, as shown in Figure 7.17.

Characteristic	Characteristic Value	Description
PPPI_INPUT_ REQUEST	**Thickness**	This is the standard **PP-PI** characteristic whenever it's required that a field has an input value. The field value corresponding to this characteristic given as **Thickness** will be the display name of the field in the PI sheet.

Table 7.2 PP-PI Characteristics and Their Values for Input Fields as Defined in Process Management

Characteristic	Characteristic Value	Description

PPPI_VARIABLE	**A**	Each field can be tagged as a variable whose value can subsequently be used in calculations, if needed. For this example, give the variable tag as "A" as defined in the characteristic value.
PPPI_REQUESTED_ VALUE	**MM01**	This **PP-PI** characteristic is the output value of a field. However, what governs the format and other details actually comes from characteristic value **MM01**. Recall that we just covered creating characteristic "MM01" in Section 7.3.

Table 7.2 PP-PI Characteristics and Their Values for Input Fields as Defined in Process Management (Cont.)

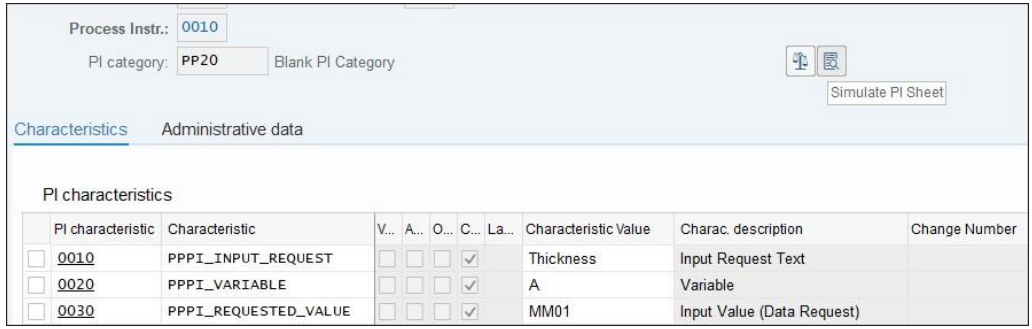


Figure 7.17 Process Instructions Characteristics for an Input Value

Figure 7.18 shows the simulation of the **Thickness** field and how it will look in the PI sheet. Hence, the PP-PI 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 "A", and the output format of the numeric value will be governed by characteristic **MM01**. For example, characteristic **MM01** stipulates having a field length of four (4) characters with two decimal places and no negative values. In such a case, values such as 5.35 or 5.88 are acceptable, but –5.28 isn't acceptable in the PI sheet. The decimal is also counted as a character.

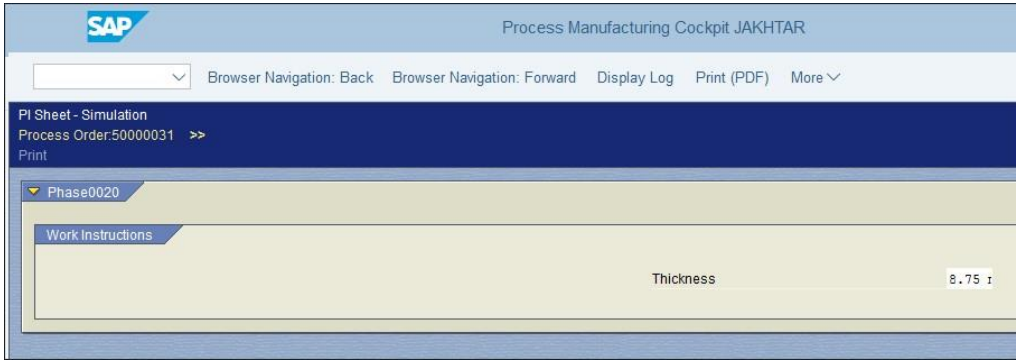


Figure 7.18 Input Value in the PI Sheet

Tips & Tricks

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

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 7.3 contains the PP-PI 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). In addition, while using variables in a calculation formula, they must previously be defined in the same PI sheet.

Characteristic	Characteristic Value
PPPI_INPUT_REQUEST	**Revised Thickness**
PPPI_VARIABLE	**B**
PPPI_CALCULATED_VALUE	**MM01**

Table 7.3 PP-PI Characteristics and Their Values for Calculation Fields as Defined in Process Management

Characteristic	Characteristic Value
PPPI_CALCULATION_FORMULA	A * 1.05
PPPI_EVENT	PARAMETER_CHANGED

Table 7.3 PP-PI Characteristics and Their Values for Calculation Fields as Defined in Process Management (Cont.)

The simulated version of the calculated field will appear as shown in Figure 7.19. The system automatically calculates the **Revised Thickness** field by using the formula that you defined in the master recipe for this field. Notice a small calculator icon right next to the **Revised Thickness** field to denote that it's a calculated field. This field is also noneditable. If you make changes to the parameter value **Thickness**, the system automatically updates the calculated values.

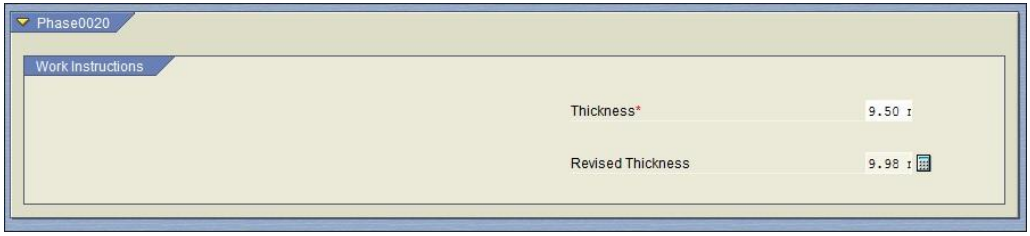


Figure 7.19 Calculation Field in a PI Sheet

Input Group and Dropdown Selection

Table 7.4 contains the PP-PI characteristics needed for the input group 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	MM02

Table 7.4 PP-PI Characteristics and Their Values for Input Groups as Defined in Process Management

Characteristic	Characteristic Value
PPPI_UNIT_OF_MEASURE	kg

Table 7.4 PP-PI Characteristics and Their Values for Input Groups as Defined in Process Management (Cont.)

They will result in a display as shown in Figure 7.20.

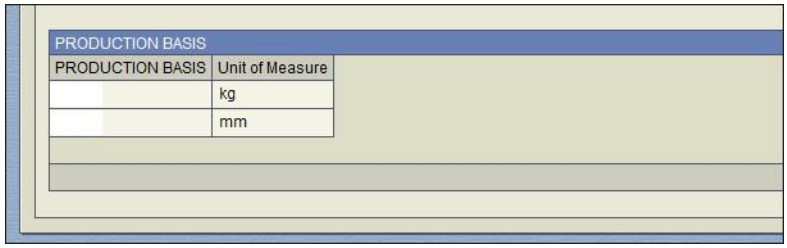


Figure 7.20 PP-PI Characteristics for the Input Group Field Functionality in a PI Sheet

Call Function

As explained in Table 7.5, you can use the PI sheet to call up a transaction while remaining within the PI sheet's 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 note that 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	

Table 7.5 PP-PI Characteristics and Their Values for Call Functions as

Defined in Process Management

Characteristic	Characteristic Value
PPPI_EXPORT_PARAMETER	TCODE
PPPI_TRANSACTION_CODE	COR3

Table 7.5 PP-PI Characteristics and Their Values for Call Functions as Defined in Process Management (Cont.)

The simulated version of the characteristics is shown in Figure 7.21. When the **DISPLAY PROCESS ORDER** button shown here is clicked, it brings up Transaction COR3 (Display Process Order).

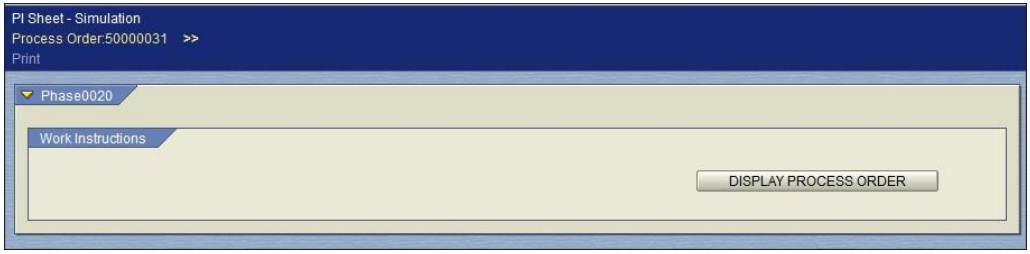


Figure 7.21 Call Function in the PI Sheet

Table Entry

Often there is a business need to enter multiple values in a tabular form for a single value or multiple values of parameters. Table 7.6 lists all the PP-PI 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 this example).

Characteristic	Characteristic Value
PPPI_DATA_REQUEST_TYPE	Repeated Data Request
PPPI_MINIMUM_TABLE_SIZE	4
PPPI_MAXIMUM_TABLE_SIZE	6
PPPI_INPUT_REQUEST	Shift-wise Flow Reading

PPPI_VARIABLE	**ABC**

Table 7.6 PP-PI Characteristics for Activating the Format with Multiple Values

Characteristic	Characteristic Value
PPPI_REQUESTED_VALUE	**MM03**

Table 7.6 PP-PI Characteristics for Activating the Format with Multiple Values (Cont.)

Figure 7.22 illustrates the simulated version table entry format and shows the option to enter six values. The option to maintain decimal places for each value is controlled via characteristic **MM03**.

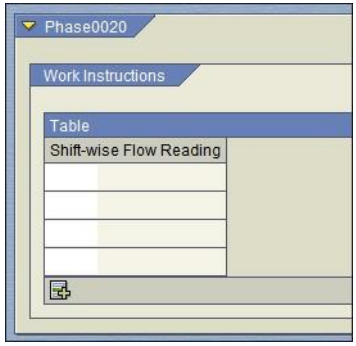


Figure 7.22 Table in a PI Sheet

Long Text Input

Generally, at the end of every shift, the company requires the process operator to prepare shift highlights and/or other important details. To do this, you can use the long text functionality in the PI sheet. Table 7.7 lists the PP-PI characteristics needed for the long text functionality in a PI sheet.

Characteristic	Characteristic Value
PPPI_INPUT_REQUEST	**Shift Highlights**
PPPI_REQUESTED_VALUE	**PPPI_MESSAGE_TEXT**

Table 7.7 Required PP-PI Fields for Activating the Text Box in a PI Sheet

Figure 7.23 shows the text box that becomes available in the PI sheet, in which the process operator has entered shift details.

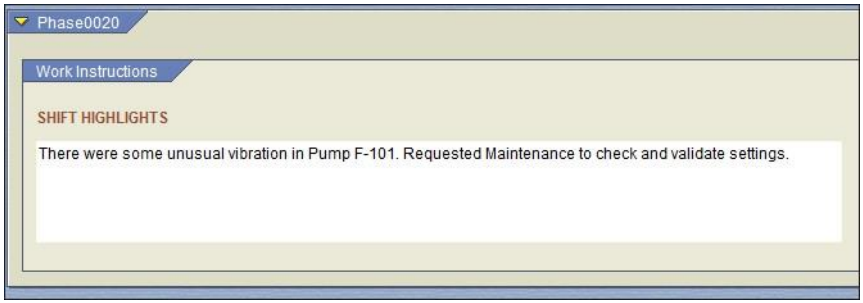


Figure 7.23 Shift Details (Notes) in the PI Sheet

Instructions and Notes

Generally, businesses want to make sure that the line operator has easy and instant accessibility to various instructions and other notes during the course of the shift.
The functionality of instructions and notes is useful in such scenarios.

Table 7.8 provides a list of the PP-PI characteristics needed to maintain instructions and notes in a PI sheet. To enter the desired text that you want to display on the PI sheet, select the characteristic **PPPI_INSTRUCTION** (or **PPPI_NOTE**), and click on the **Value** icon at the bottom of the screen. You can enter the text that you want to see being displayed in the PI sheet, as well as use some of the formatting options, such as bold, italic, large fonts, or text alignment center/right.

Characteristic	Characteristic Value
PPPI_INSTRUCTION	–
PPPI_NOTE	–

Table 7.8 PP-PI Fields for Activating the Instructions and Notes in a PI Sheet

Document Management System in the Process Instruction Sheet

Sometimes the line operator is required to refer to a specific user manual or machine instruction manuals to perform a task or to rectify a production problem during operation. For this purpose, process management completely integrates with the DMS in SAP, which is a central repository used to store important documents and other references for use.

Table 7.9 contains the PP-PI characteristics that you need to maintain to activate DMS in a PI sheet.

Characteristic	Characteristic Value
PPPI_FUNCTION_NAME	COPF_DOCUMENT_SHOW_DIRECT
PPPI_BUTTON_TEXT	Instruction Manual – Complete
PPPI_FUNCTION_DURING_DISPLAY	Allowed
PPPI_EXPORT_PARAMETER	DOCUMENT_TYPE
PPPI_STRING_CONSTANT	Z01
PPPI_EXPORT_PARAMETER	DOCUMENT
PPPI_STRING_CONSTANT	10000000332
PPPI_EXPORT_PARAMETER	DOCUMENT_PART
PPPI_STRING_CONSTANT	000
PPPI_EXPORT_PARAMETER	DOCUMENT_VERSION
PPPI_STRING_CONSTANT	00

Table 7.9 PP-PI Characteristics for Activating the DMS

Digital Signature on Completion of the Process Instruction Sheet

Digital signature in the SAP system is the process of authenticating information and requires the user to enter his name along with a password before the system can accept an entry or perform a function. For example, when a function is executed, the user is required to digitally sign the PI sheet in the popup box that appears.

7.5 Process Order Execution

When compared with production order execution in discrete manufacturing, process order execution has differences as well as similarities:

You can use batch allocation, either automatically or manually, within the process order.

The system automatically executes the formulas of the material quantity calculation that is defined in the master recipe using the batch allocations.

When you release the process order, the system can create the control recipe automatically, or you can click on the relevant icon within the process order creation screen to do it manually.

You can also create a test control recipe in a process order to check or validate settings.

The system creates a control recipe for each control recipe destination of the process order. If there are three control recipe destinations in the process order, then the system creates three control recipes for the process order.

Integration points, such as in-process inspection, finished goods inspection, capacity requirements planning (CRP), material requirements planning (MRP), sales and operations planning (S&OP), and long-term planning (LTP), also remains the same.

Figure 7.24 illustrates the important elements in a process order.

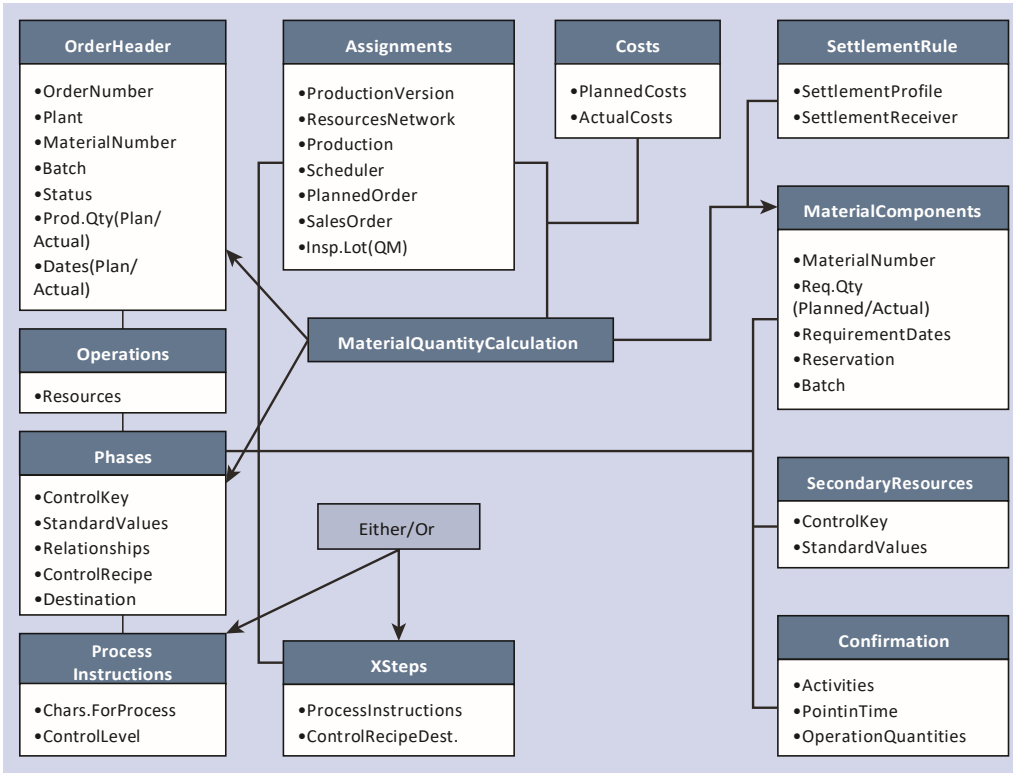


Figure 7.24 Elements of a Process Order

7.6 Process Management in Action

The main steps involved in process management are listed here with numbers corresponding to each step, as shown in Figure 7.25:

1. The first step is the process order creation. The process order reads the material master data, including the master recipe and materials list (BOM). It also takes the material quantity calculation into account. The master recipe contains all the information related to process management and is used for the generation of a control recipe.
2. When you release the process order and generate the control recipe, the system creates a PI sheet.
3. The next step is to send the generated control recipe to the predefined destination in the master recipe (in this example, it's **PP – Production Floor Choc. Manu.**).
4. The PI sheet is now available at the destination, and you maintain the PI sheet.
5. You update the status of the PI sheet as **Complete**. Once completed, no further changes to the PI sheet are possible.
6. The last step is to send the process messages to their required locations so that the system can perform the necessary predefined actions.

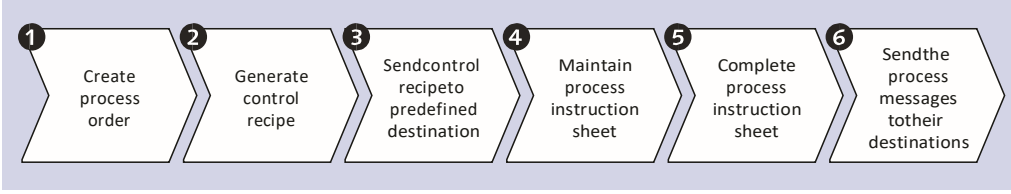


Figure 7.25 The Main Steps in Process Management

You'll learn how to accomplish each of these steps in the following sections.

7.6.1 Creating and Releasing a Process Order

To create a process order, follow the menu path, **LogisticsProduction – ProcessProcess OrderProcess OrderCreateCreate with Material**, or use Transaction COR1. Enter **Material** number "30000037", **Plant** "1000", and order **Type** "SF01", and then press (Enter). Figure 7.26 shows the detailed **Change Process Order Header – General Data** screen. On this screen, enter the production quantity in the **Total Qty** field as well as the order finish date in the **End** field. Notice that the **Start** date of the process order is **01.10.2018**. In the PI sheet, the system should automatically be able to fetch this date in the **Process Order start date** field. Release the process order by clicking on **Release** (not shown).

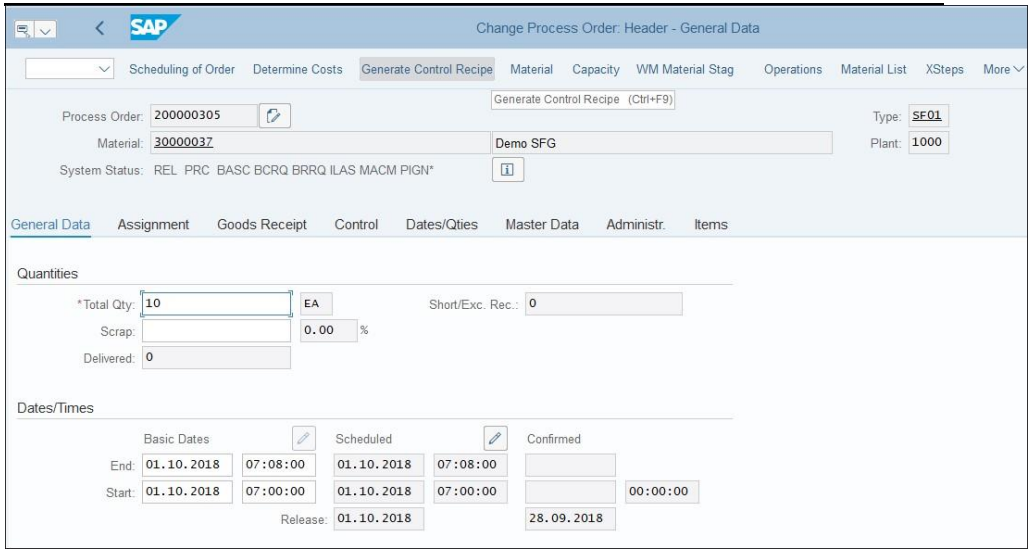


Figure 7.26 Header Screen for Process Order Creation

7.6.2 Generating a Control Recipe

After you release the process order, choose the **Generate Control Recipe** button at the top of the **Change Process Order: Order Operation** screen (refer to Figure 7.26) to generate a control recipe. An information message appears at the bottom of the screen to inform you that the system created a control recipe (see Figure 7.27) and also generated a log. The system has now created a PI sheet. With the control recipe being generated, save the process order by choosing **Save** in the process order screen. The system generates a process order number, which, in this example, is **200000305**.

Tips & Tricks

You can automate the control recipe creation on process order release by making the relevant settings in the production scheduling profile (refer to Chapter 4) and then assigning this production scheduling profile in the **Work Scheduling** view of the material master.

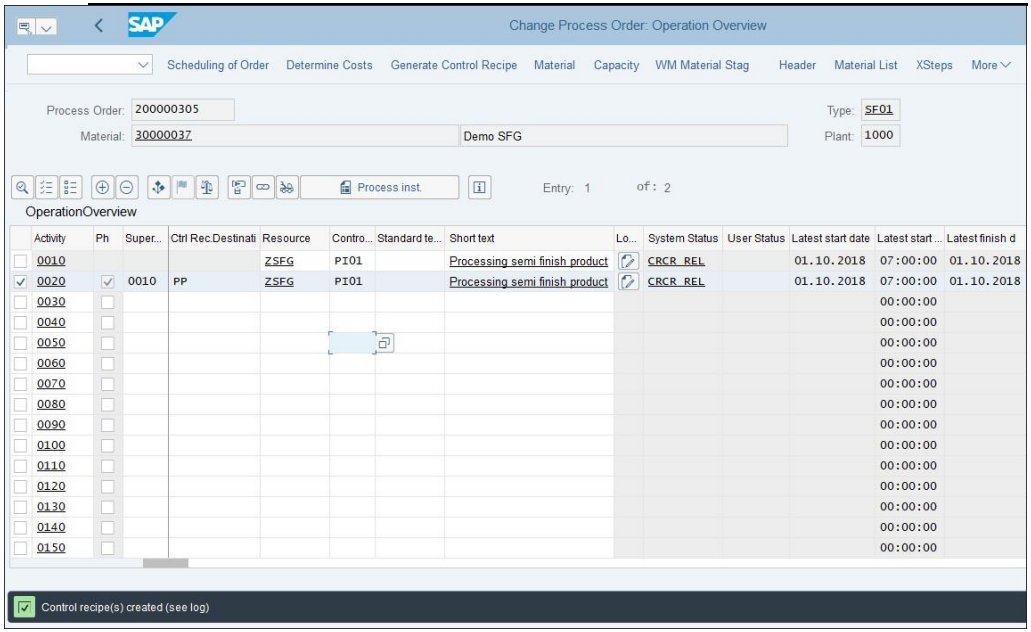


Figure 7.27 Control Recipes Created

Generating a control recipe creates a PI sheet. You've maintained the necessary checks and balances, such as defining tolerance limits to parameters values, requiring sign-off at the end of each operation or phase, or integrating digital signatures in process management. If you realize that you've sent incorrect information in the PI sheet, you can create a new PI sheet (by generating a new control recipe) to attend to this. This situation arises after you've already performed all the necessary steps in process management.

To generate a new PI sheet, follow these steps:

1. Use Transaction CO67, and in the **Worklist for PI Sheets** screen containing the PI sheet with the **Complete** status, select the PI sheet, and then choose **PI SheetDelete**.

   The system issues a message stating that the selected entry (PI sheet) was deleted.

2. Use Transaction CO57 to create a process message manually. In this option,enter the **Plant**, and use **Process Message Category PI_CRST**. Enter the process order number of the deleted control recipe, enter the number of the deleted control recipe (from the previous step), and set the **Control Recipe Status** as **00007** (**Discarded**).

3. Save the process message, and the system states that a new process message hasbeen created, including the process message number.

4. Use Transaction CO54XT, and on the initial parameters selection screen, enter theprocess order number and the process message category as "PI_CRST". Press (F8), or click on the **Message List** icon.
5. Select the process message number created in the previous step, and click on the**Send** icon to send the process message. The system issues an information message to inform that the process message has been processed.
6. Use Transaction CO53XT, and on the initial screen, enter the **Plant**, the process order number, and the destination address (in this example, it's "Production Floor"). Press (F8), or click the **Display** icon.
7. In the **Control Recipe Monitor** screen, select the relevant control recipe number, and click on the **Delete** icon. The system issues an information message that the control recipe has been deleted and, at the same time, assigns the status of the control recipe as **Discarded**.
8. Use Transaction COR2 for the change in process order, and click on the **Generate Control Recipe** icon to create a new PI sheet for the same process order.

7.6.3 Downloading and Sending a Control Recipe

You can manually send a control recipe to a destination in a nonautomated environment (as a background job). To do so, follow the menu path, **LogisticsProduction – ProcessProcess ManagementControl RecipeControl Recipe Monitor**, or use Transaction CO53XT. Figure 7.28 shows the initial screen with selection parameters for the control recipe. For this example, use the same **Manufacturing Order** number **200000305**, and assign the **Destination Address** as **Production Floor-Choc. Manuf.** (PP), which you configured in Chapter 4. Click on the **Created, Sent** button to view the generated control recipe.

In the screen shown in Figure 7.29, select the line item, and click the **Send** button to send the control recipe to destination PP. The status will be updated from **Created** to **Sent**.

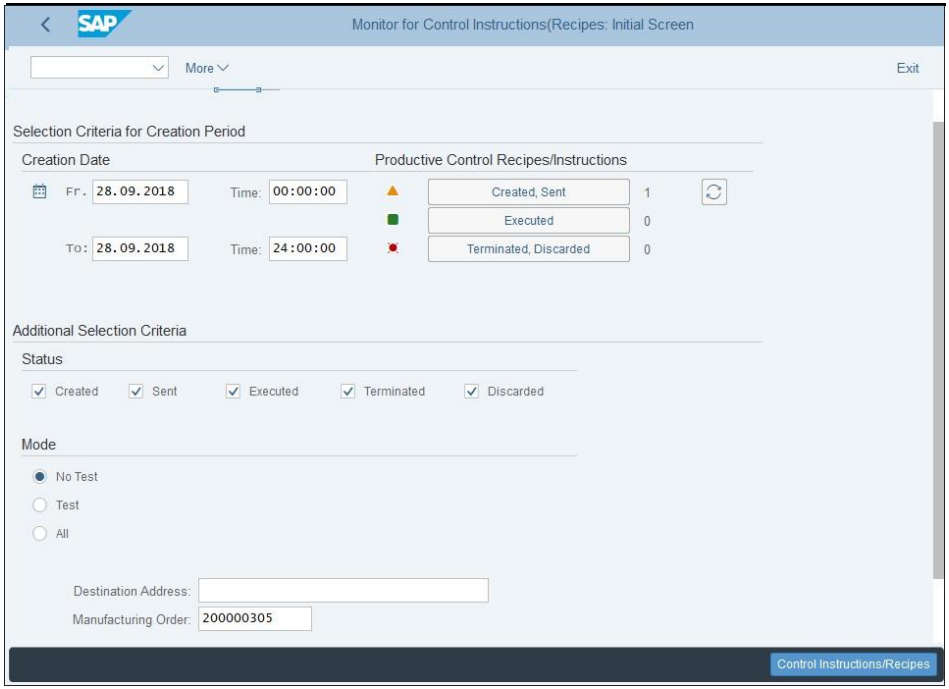


Figure 7.28 Initial Screen of the Control Recipe Monitor

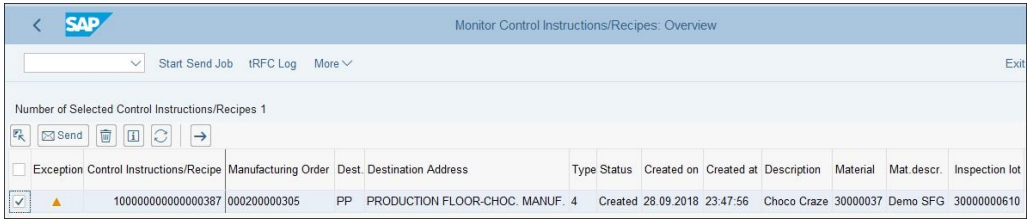


Figure 7.29 Control Recipe Monitor

The control recipe has the following statuses as detailed in Table 7.10.

Control Recipe Status	Control Recipe Description	Details
CRCR	Created	This status appears in the process order when the system generates a control recipe.

Table 7.10 Control Recipe Statuses

Control Recipe Status	Control Recipe Description	Details

CRFI	Processed/finished	This status appears on completion of all details in the PI sheet and setting the status of the PI sheet to **Complete**.
CRAB	Discarded	The system assigns this status to the control recipe when you discard the PI sheet before the start of the execution.

Table 7.10 Control Recipe Statuses (Cont.)

When you set the PI sheet to **Completion** status, the system automatically sends the process message category PI_CRST to the SAP system. This process message category has the process message characteristic PPPI_CONTROL_RECIPE_STATUS for which the system automatically sets the value to **Processed**. In the process order, the system sets the status of the control recipe to **CRFI**. This is one of the statuses that you'll find in Table 7.10. In the **Control Recipe Monitor** screen, you can have comprehensive information on the discarded, terminated, or sent control recipes.

When the system downloads the control recipe destination types 1 or 4, it's then known as a PI sheet. When the system downloads control recipes of destination types 2 or 3, it reaches an external system or external PCS.

Note

You can schedule a background job for downloading and sending control recipes with program RCOCB006 (batch job name: SAP_NEW_CONTROL_RECIPE).

Refer to the detailed settings of the background job covered in Chapter 4, Section 4.8.

7.6.4 Maintaining Process Instruction Sheets

To maintain the PI sheet, follow menu path, **LogisticsProduction – ProcessProcess ManagementProcess Instruction SheetWorklist – Maintain**, or use Transaction CO55. You can click **All Selections** so that the system can offer you more selection options on the initial screen that aren't visible when you first execute Transaction CO55. For example, apart from new and in-process PI sheets, you can also select PI sheets that you discarded and terminated (see Figure 7.30). You can also use this transaction to display completed PI sheets by selecting the relevant checkbox.

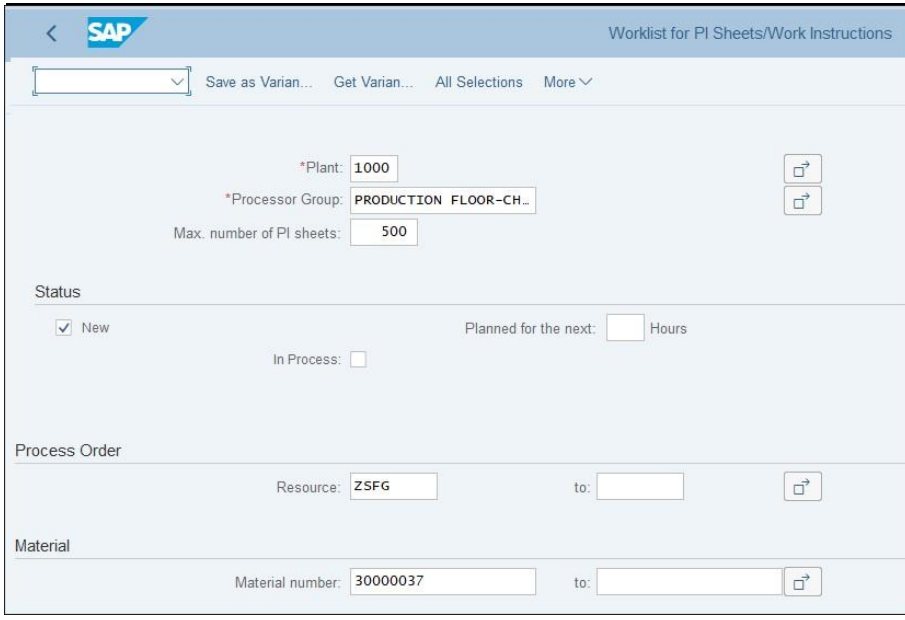


Figure 7.30 Initial Screen for PI Sheets

Enter **Plant** "1000" and **Processor Group** (which is the description of the control recipe destination) as "PRODUCTION FLOOR-CHOC. MANUF.", and then choose **Execute** or press (F8). The corresponding PI sheet's worklist is now available for maintenance (see Figure 7.31).

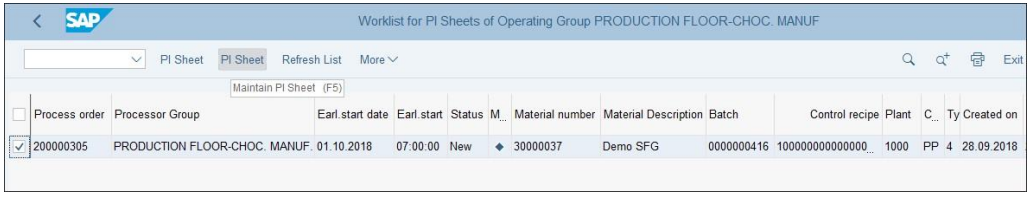


Figure 7.31 Worklist of PI Sheets for Operating Group Production Floor

This is the process instruction worklist, which meets the selection criteria. For this example, there is only one PI sheet in the worklist. Select the relevant PI sheet, and click **Maintain PI Sheet** (see Figure 7.31) to start data input (data maintenance).

Figure 7.32 shows the PI sheet with all of the input fields available for maintenance.

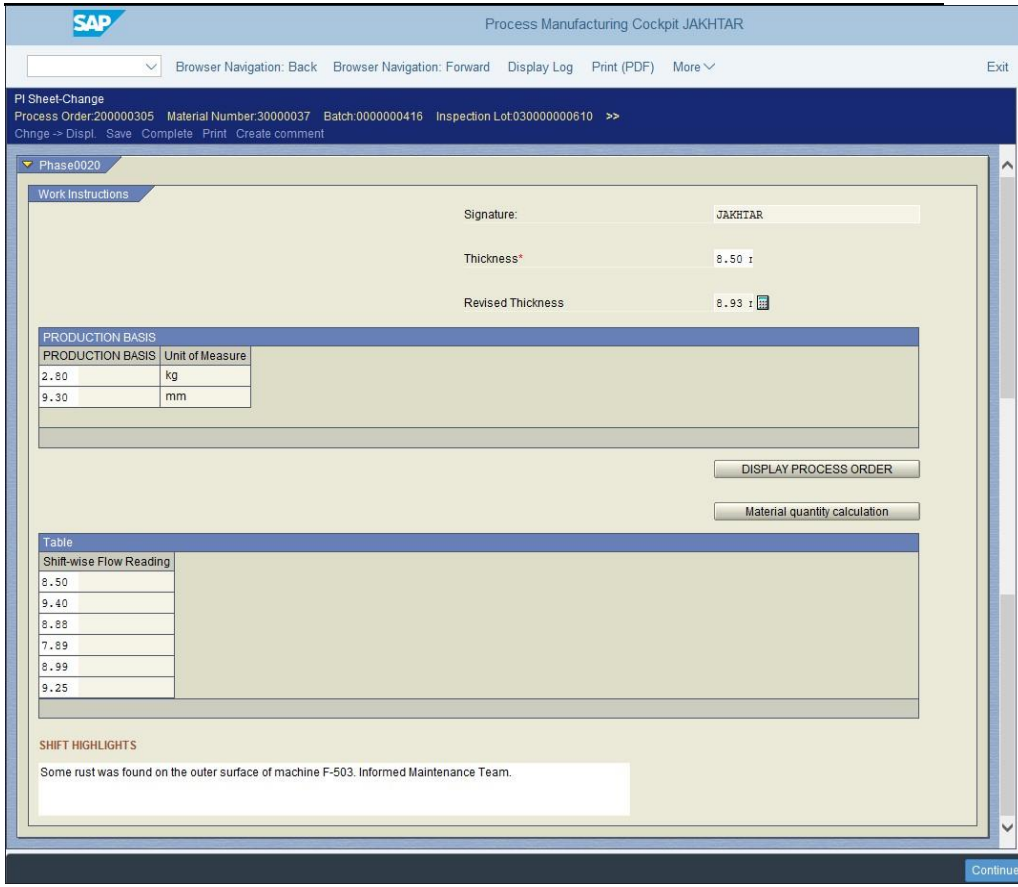


Figure 7.32 Maintaining the PI Sheet

The PI sheet may contain several fields and other important functions already filled in, such as default views or calculation fields.

Enter the value for the **Thickness** parameter**.** A red asterisk next to the parameter denotes that it's a mandatory field you need to maintain.

Tips & Tricks

You can control whether an entry in the field is optional or mandatory by selecting the relevant checkbox in the characteristic (Transaction CT04).

The **SHIFT HIGHLIGHTS** text box enables you to enter detailed text. You can also make entries in the two tables of the PI sheet.

7.6.5 Completing Process Instruction Sheets

When you've made all entries in the PI sheet, you can either save it or mark the status as **Complete** by using the light-blue colored buttons at the top of the PI sheet (refer to Figure 7.32). You can use the **Save** function as many times as needed to save partial and incomplete information in the PI sheet. You use the **Complete** function when all details in the PI sheet have been incorporated. Note that after using the **Complete** function, it's no longer possible to make changes to the PI sheet.

Note

If you've made the relevant settings in the configuration (Chapter 4) of the control recipe destination, then the system shows a popup message to digitally sign the PI sheet on completion.

7.6.6 Sending Process Messages

The PI sheet automatically creates a process message with all the information that the system needs to send to specific destinations. This information may be a GI against a process order, a GR against a process order, or a confirmation of a process order. Sending the process message executes the function module with the gathered information.

Process messages in a productive system are typically sent via a background job of program RCOCB002 (cross-plant) or program RCOCB004 (plant-specific).

Warning

Be sure to monitor process messages because sometimes a process message sending fails if, for example, data is missing from the PI sheet. You can monitor and delete process messages with Transaction CO54XT and manually create them with Transaction CO57.

You can also create, test, check, and monitor process messages, although the system doesn't process these process test messages at the destination as it does for normal process

messages. You create test process messages to check whether the system is able to transfer all the relevant information from various systems and destinations.

To send a process message, follow the menu path, **LogisticsProduction –ProcessProcess ManagementMessageMessage Monitor**, or use Transaction CO54XT. Enter the **Plant** and the **Creation Date** range for the process message (see Figure 7.33), and then click the **To Be Sent** button to send the messages.

In the process messages worklist shown in Figure 7.34, there are two process messages categories, **Sign** and **PI_CRST** (not shown), that the system needs to send. Notice that the sender of these process messages is **PRODUCTION FLOOR-Choc. Manuf.** (configured in Chapter 4). Select the first process message, **SIGN**, and click on the **Change** (the pen icon).

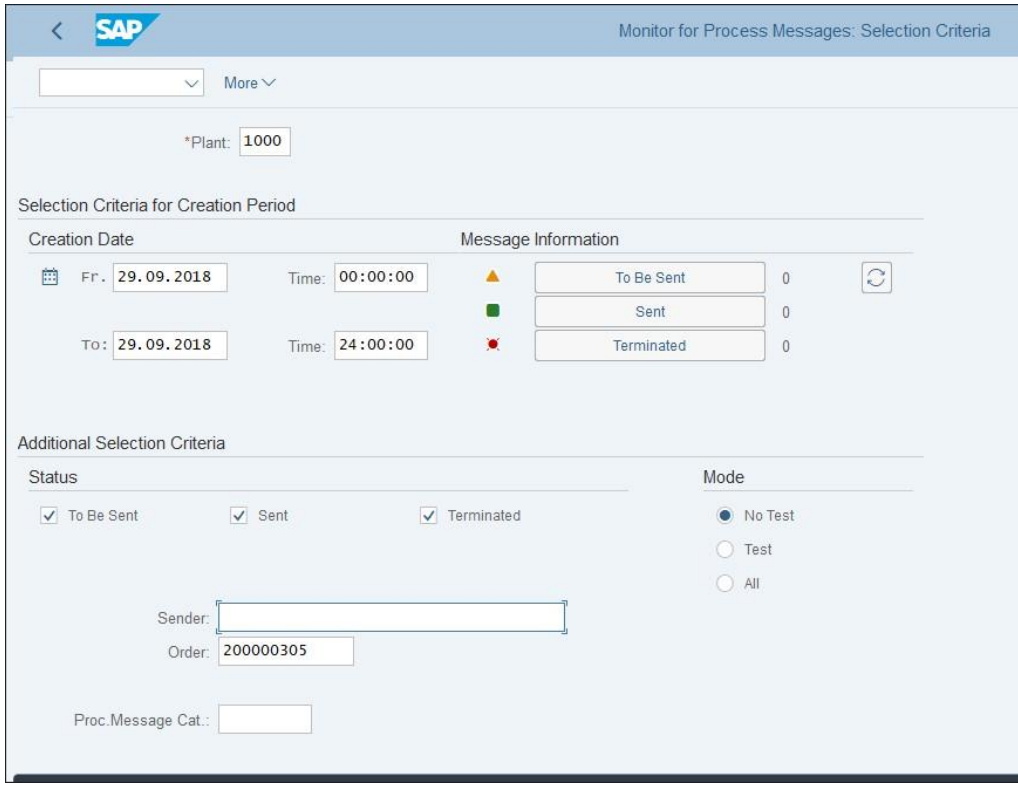


Figure 7.33 Process Messages Monitor

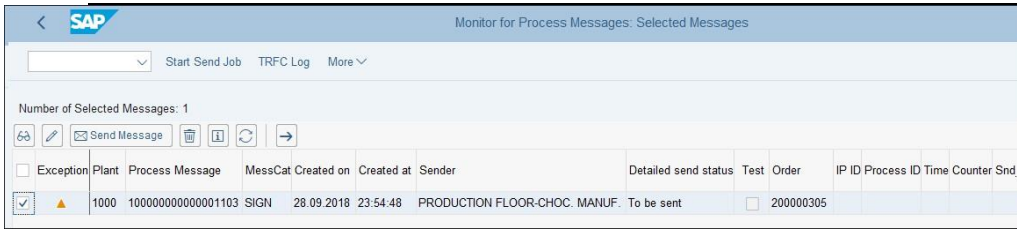


Figure 7.34 Process Messages from the Production Floor Sender

In Figure 7.35, the system automatically incorporates the **Char. Value**, which is the date **20.10.2018** for the **Characteristic ZPI_CREATION_DATE1**.

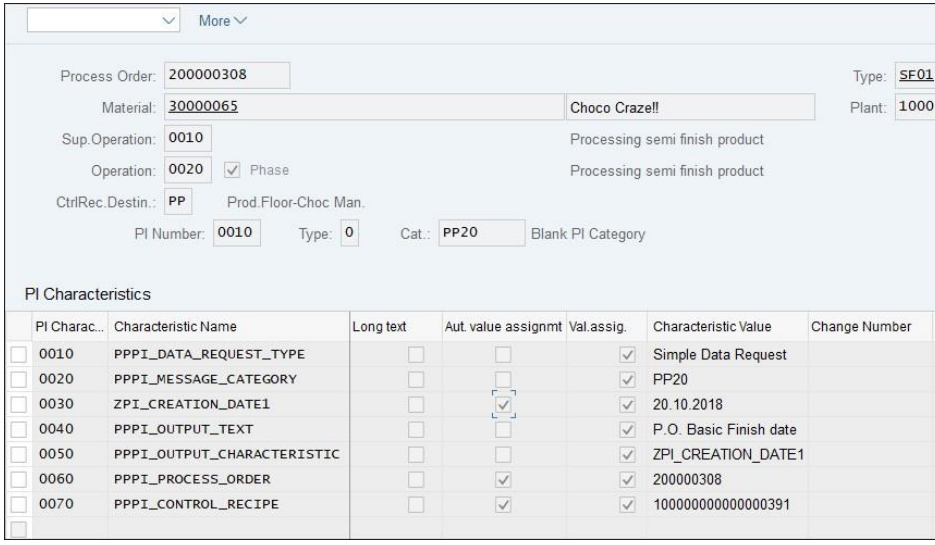


Figure 7.35 Process Message with Message Category PP

Some of the other salient features of process messages are described in the following list:

For process message categories that have errors or are terminated during processing, you can resubmit them for processing using the **Process Messages Monitor** screen.

You can create process messages manually using Transaction CO57. Then these manually created process messages are visible in the **Process Messages Monitor** screen where you can process them further.

The system uses Business Application Programming Interfaces (BAPIs) or function modules to update the process messages. The system processes the received process messages using these function modules.

The system uses a remote function call (RFC) connection to communicate with an external PCS using process messages. You need to define the RFC destination for every external system; you can engage an SAP NetWeaver (Basis) consultant for this task. The system uses alerts of critical situations or milestones in the production run. The alerts can be from either the external control system or internal shop floor operator.

You can use a special destination type in the process message, **SAP Office User**, to inform specific SAP system users about the status of process messages (and also control recipes).

7.7 Execution Steps

Execution Steps (XSteps) are extensively used not only in PP-PI but also in discrete manufacturing. In fact, all of the concepts, fundamentals, features, and functionalities covered in Chapter 4 and in this chapter apply if you need to integrate XSteps with discrete manufacturing. In the following sections, we'll discuss where you can find a repository of standard XSteps that you can use as a reference to create your own XSteps and how to set up a specific function or parameter in the PI sheet. We then address the transition that you can make from process management to XSteps. The remaining sections then focus on how you can leverage the configuration you made in Chapter 4 and the process management concepts you developed earlier in this chapter for XSteps.

7.7.1 Repository for Standard XSteps

The standard XSteps repository is an invaluable resource to gain a better understanding of how to use XSteps. It contains detailed and step-by-step instructions on how you can effectively use all the features and functionalities of XSteps.

To access the repository of standard XSteps, follow the menu path, **Logistics – Production – ProcessMaster DataStandard XStep Repository**, or use Transaction CMXSV. For this example, enter **Plant** "1000", and choose **Execute**. The screen shown in Figure 7.36 appears, containing comprehensive details on XSteps.

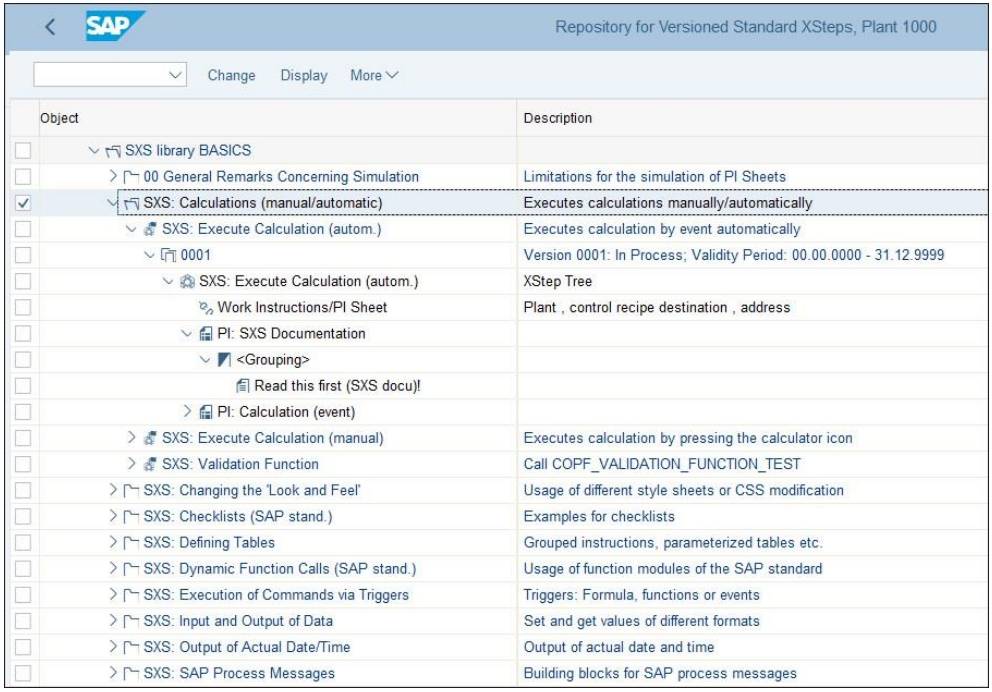


Figure 7.36 XSteps Repository

SAP provides a standard XSteps library that can be downloaded from the SAP Store (*https://store.sap.com*) in an XML format and imported into the SAP system. The XSteps provided in this library can be used as a starting point or even as a model for the creation of your own XSteps. They are included on the SCN SAP Core Manufacturing Sample Application and Best Practices, which is provided by SAP and can be downloaded for free from the SAP Store. Download a file called *Basic_Standard_XStep_ Templates.zip*. This file contains detailed technical documentation about the implementation of XSteps and a folder called *XML_files_V_1_0* (the name may change if a new version is delivered) that contains XML files with the standard XSteps.

After downloading and extracting the content of the file, you're ready to import the library into the system.

7.7.2 Importing the Standard XSteps Library

To import the XML file containing the standard XSteps library, use Transaction CMXSV. After you execute Transaction CMXSV, define the plant by populating the **Plant** field in the

initial screen that the system displays. Click the **Execute** icon or press the (F8) key to access the XSteps repository.

With the repository open, right-click the **Standard XSteps** folder and then choose **Create Folder** to create a new folder to store the standard XSteps.

The newly created folder appears in the next screen with the description **<Folder>**. After you double-click this folder, you can change the description in the popup screen that appears. The next step is to import the downloaded XML file containing the standard XSteps library to the newly created folder. To complete this step, right-click the folder you just created, and select the **Import Standard XStep** option.

In the popup screen that appears, select the file named **SXS Library BASICS V1_0.XML** under the previously mentioned folder, **XML_files_V_1_0**, and then click the **Open** button.

7.7.3 Switching from Process Instructions to Execution Steps

Whenever you transition from process instructions to XSteps in the master recipe, the system issues the warning message that all previously created process instructions become invalid when you save the changes made in the master recipe. Additionally, the profile in the master recipe (see Chapter 4, Section 4.1.1) should allow for the creation of XSteps. You'll see a warning message that appears when you first click on the **XSteps** icon (in the master recipe). Click **Yes** to proceed further (see Figure 7.37).

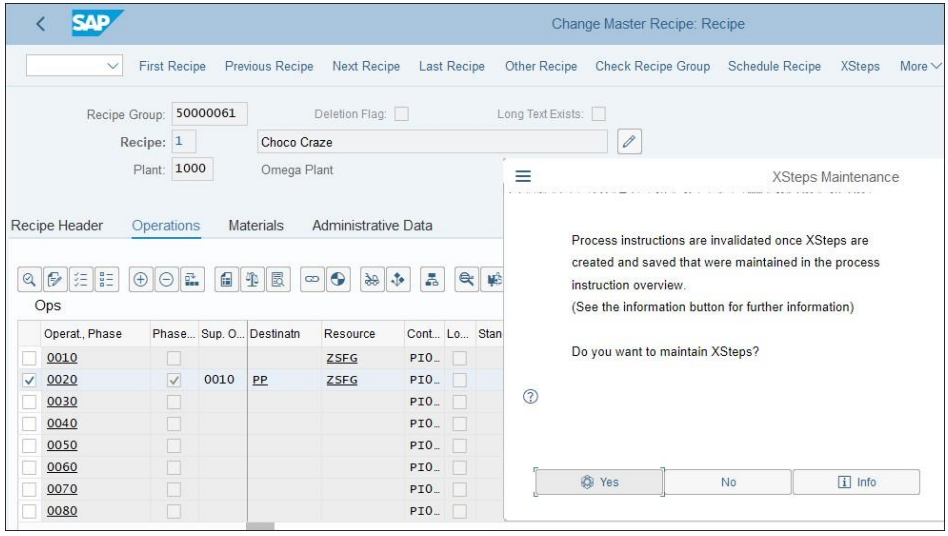


Figure 7.37 Switching from Process Instructions to XSteps

7.7.4 General Information

On the XSteps creation screen in the master recipe, click on the **XStep Tree**, and the system creates an **XSteps** icon on the left-hand side of the screen. Select the **XStep Tree** icon again, right-click, and select **Properties** from the dropdown.

Tips & Tricks

You can also select the relevant field in XSteps, such as process instruction or calculation, and press (Enter), and the system will bring up the **Properties** option, wherein you can make the desired changes.

In the **Node Attributes** screen that appears as shown in Figure 7.38, enter a short **Description**, which then becomes visible throughout the XSteps tree. Click on the **Parameters** tab to bring up the next screen, which is described in the next section.

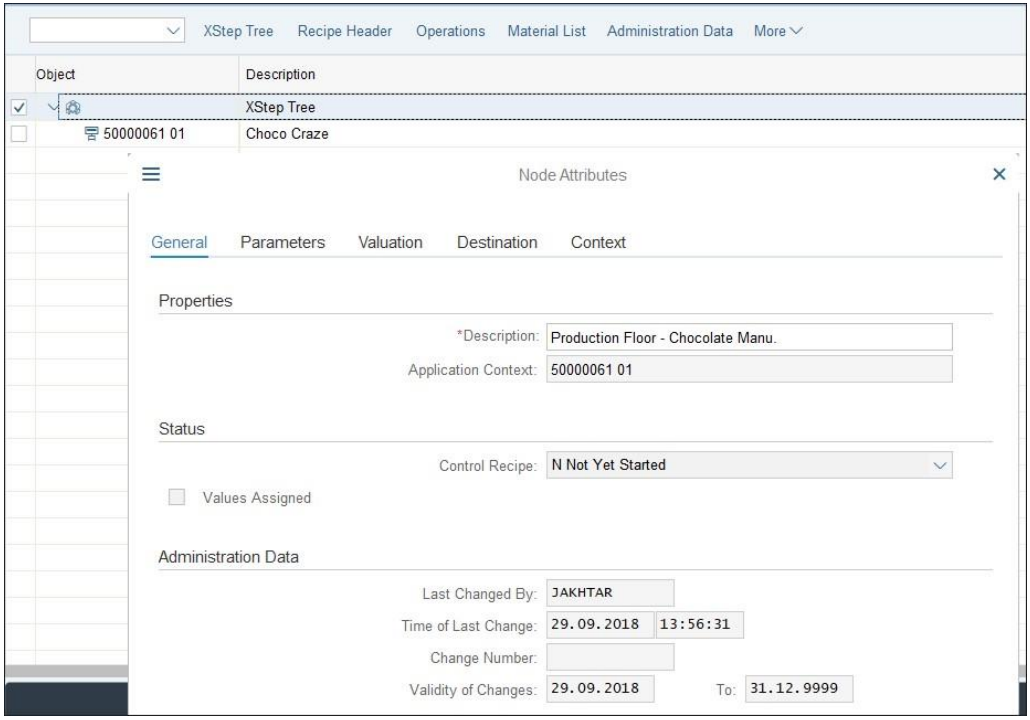


Figure 7.38 Node Attributes in XSteps

7.7.5 Parameters

Figure 7.39 shows the screen in which you define all the parameters you'll use in the XSteps for data entry or calculation. Unless you define parameters on this screen, you won't be able to select them when you want to; for example, you won't be able to create an input value in the process instructions. If you only have a numeric value, which you won't subsequently use in calculation, then you don't need to define the parameter.

For this example, define two parameters, **T01** and **T02**, and give a short **Description** for each. It's important to enter the **Characteristic** ("PPPI_PARAMETER_VALUE", in this example). You can also enter the characteristics that you had previously created using Transaction CT04 (in the classification system). However, in this case, use characteristic value "PPPI_PARAMETER_VALUE" delivered by the SAP system. If you need to enter parameter values in a table, then you can select the **Tabular** checkbox.

Figure 7.39 Parameters in XSteps

7.7.6 Valuation

In the same screen, click on the **Valuation**tab to open the screen shown in Figure 7.40, which provides the option for how you want the system to valuate the parameters. You can even define a fixed value in the **Value** field, if a value remains constant. Additionally, if the value refers to another parameter or value, you can refer to the relevant parameter.

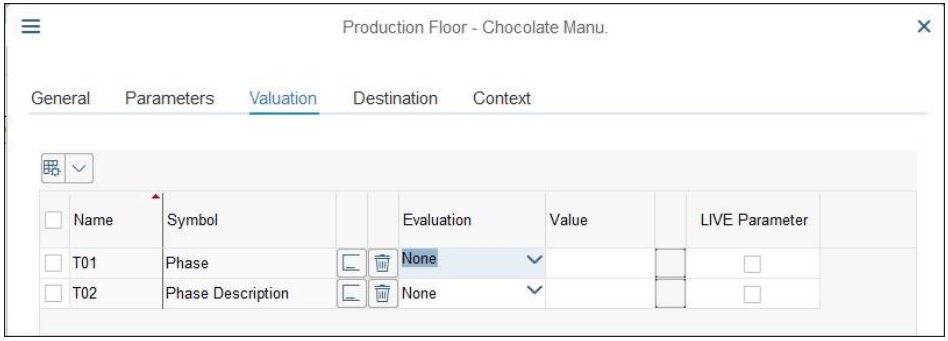


Figure 7.40 Valuation in XSteps

7.7.7 Control Recipe Destination

Click on the **Destination** tab, and the screen shown in Figure 7.41 appears, in which you assign the control recipe destination defined in Chapter 4. For this example, double-click the control recipe destination **Prod. Floor-Choc Man.** (PP), which was defined in Chapter 4 and is now assigned here.

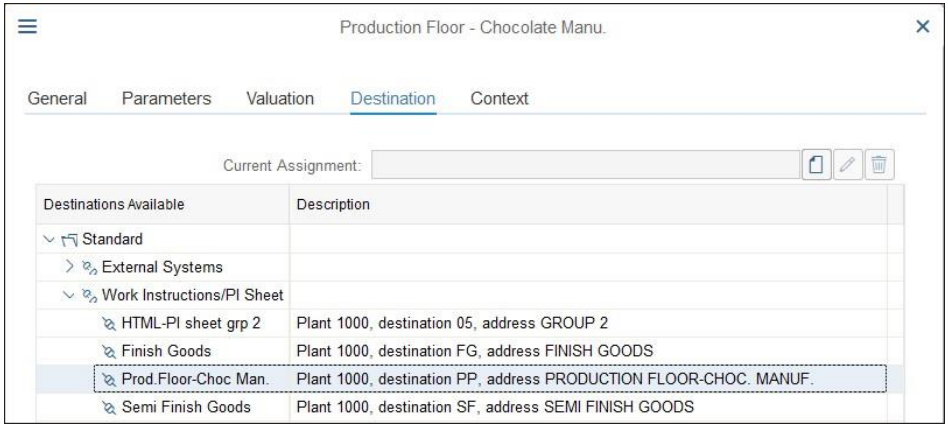


Figure 7.41 Destination in XSteps

Click on the **Close** icon (not shown) in Figure 7.41.

After you've successfully entered the details in the previous four figures, the screen appears as shown in Figure 7.42, and you can perform the next step: the creation of process instructions in the XSteps tree. To do so, place the cursor on the **Production Floor - Choc. Manuf.** field (in the XSteps tree), and right-click to bring up the options.

From the available options, choose **Create Process Instruction**.

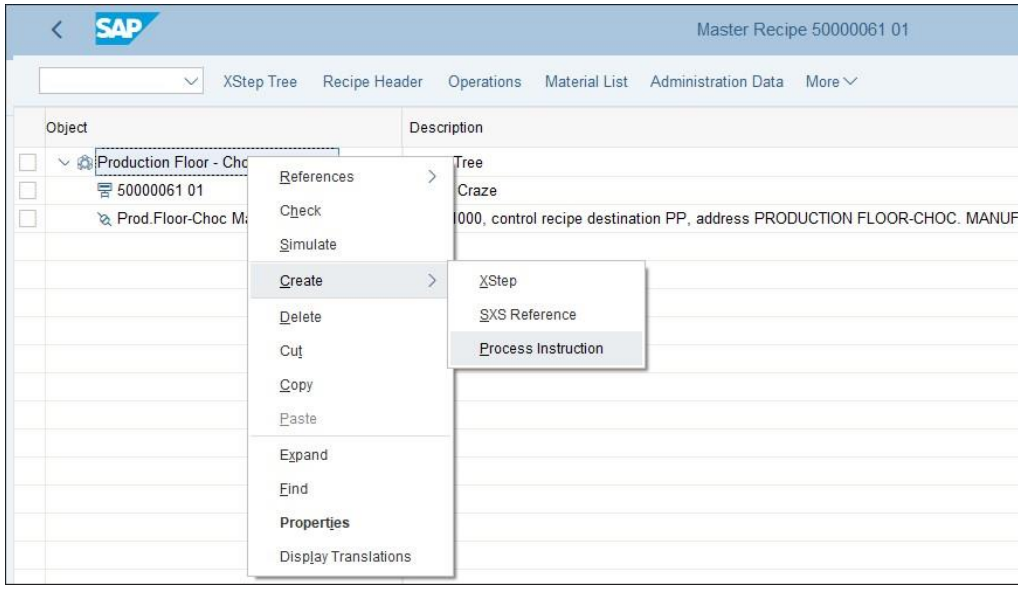


Figure 7.42 Process Instruction Creation in XSteps

7.7.8 Process Instructions

You'll now be able to create a new process instruction by right-clicking on **New Process Instruction**, choosing **CreateControl Data**, and then choosing your option. You can now freely define the input parameters, output parameters, and function modules, or you can manage control data, such as calculations, process messages, commands, or function calls.

Figure 7.43 appears when you select the process instruction and bring up the properties (by either pressing (Enter) or right-clicking to select the **Properties**option). For this example, enter the **Description** to identify the process instruction.

Note

Now that you know how to access the **Properties** option of any element in XSteps, we'll only cover the details of the element, such as input value, output value, or calculation, without repeatedly referring to the **Properties** option.

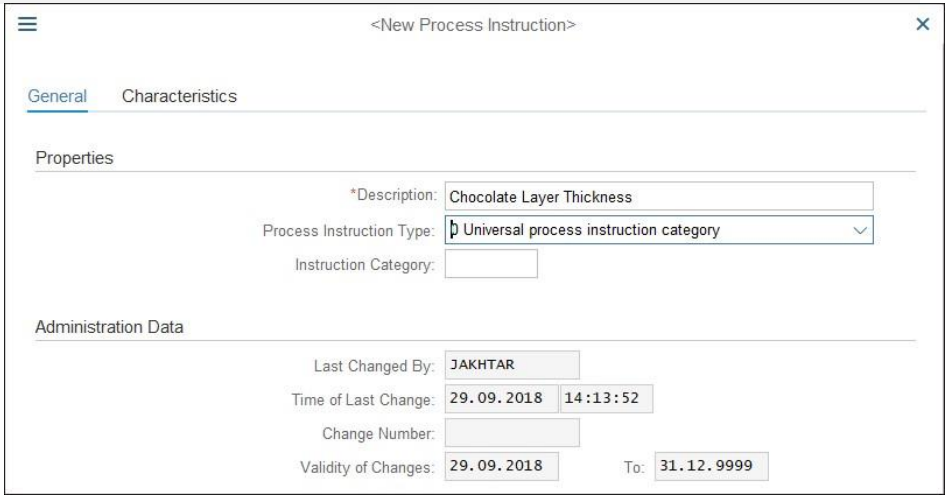


Figure 7.43 General Tab in Calculations

The following sections cover some XSteps features that we've previously touched upon to help you understand the similarities between process management and XSteps. We also show additional features in XSteps.

Parameter Values in XSteps

Figure 7.44 appears when you create the first parameter value by choosing **CreateEntryParameter Value**. Enter the short **Description**, "CLT_Original", and from the **Parameters** area, select **T01 Choc. Layer (Original)** from the **Name** dropdown list. Notice that this is one of the same parameters that you defined when you first created the XSteps tree. The remaining three tabs provide in-depth options on how you want to validate the values entered for a parameter. You can choose to always accept a value, accept it with a digital signature, or never accept an out-of-range value. You can even create your own text that the system will display in case of a failed check.

Repeat the same process to create the second parameter value, with a **Description** of "CLT_Smooth", and select the parameter's name from the **Name** dropdown list.

Tips & Tricks

You can also choose **CreateEntryNumeric Value** to achieve the same results as just described, but you need to select the **Parameters** option from the dropdown list in the **Default Value** tab.

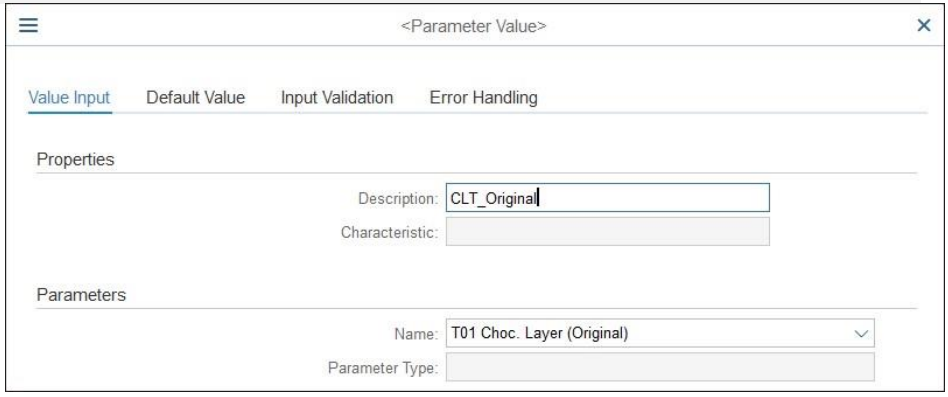


Figure 7.44 Characteristic Details and Validation in XSteps

Calculation in Execution Steps

Now that you've created two parameter values in the XSteps tree, you can use them in calculations. You can perform any kind of calculation, as long as the parameters are already defined in the XSteps tree. For this example, use the simple calculation of subtracting the value of one parameter from the other to display the result as a calculated field.

To perform calculation, choose **CreateControl DataCalculation**. Figure 7.45 appears in which you enter a short **Description**: "Difference". In the lower half of the screen, enter "T02 - T01" in the **Calculation Formulas** box.

An important aspect to note is the **Event** field, in which you enter "PARAMETER_CHANGED". An event is a control function that triggers the necessary action when the user or the system fulfills a certain and predefined event. For this example, stipulate that whenever there is a change (an event) in the **Difference** field, the system should automatically calculate and update the value in the field. If you don't define an event, you'll then manually have to click on the **Calculator** icon to update the calculation in the **Difference** field, based on any changes made to the parameter values.

Other examples of events include the system unlocking the table fields when the user maintains the PI sheet, locking the tables when all entries in the table are made, or activating or deactivating the PI sheet.

Tips & Tricks

To view all the available options in events, place the cursor on the **Event** field, and press (F4), or click on the dropdown option.

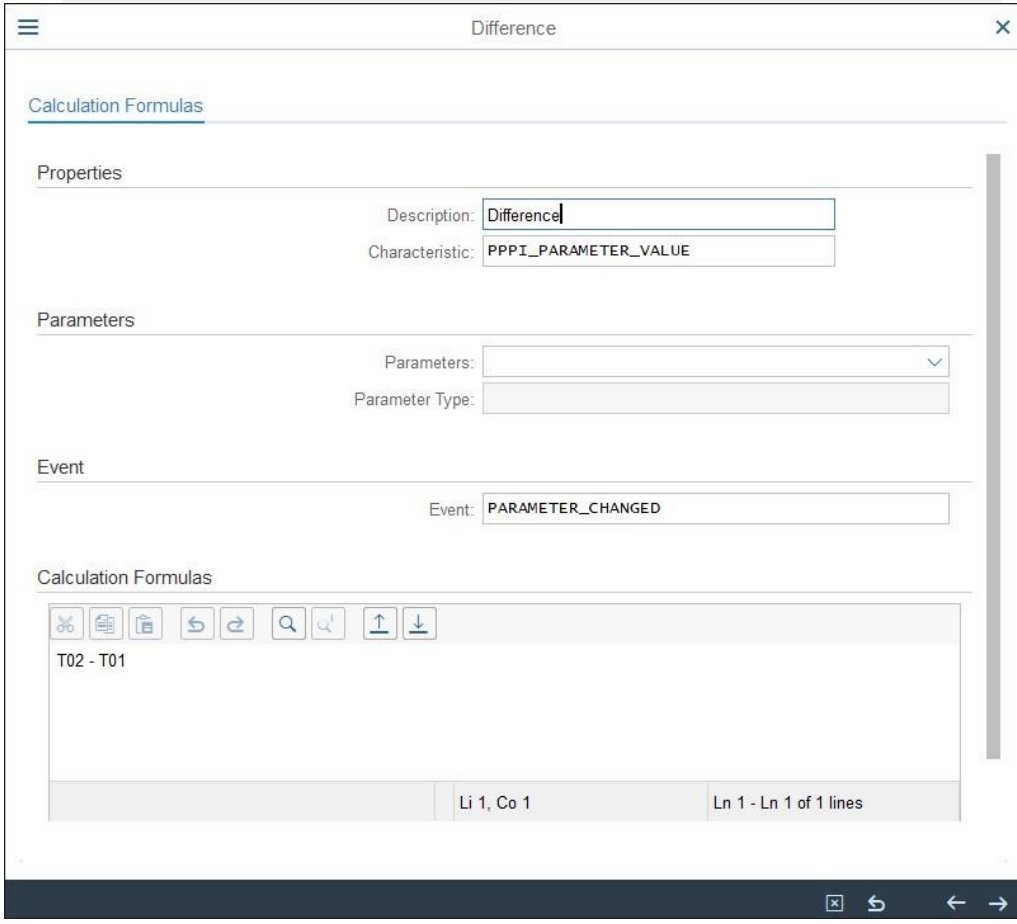


Figure 7.45 Calculation Formula in XSteps

To simulate the fields, you can place the cursor on either the XSteps tree or on the process instruction and then either press (F8) or right-click and choose **Simulate**.

Figure 7.46 shows how the screen looks when you've entered not only the two parameters but also the calculation. Notice that the calculated field **Difference** has a small **Calculator** icon next to the field to denote that this is a calculated value.

Figure 7.47 shows the data entered in both fields and the calculated results in the **Difference** field.

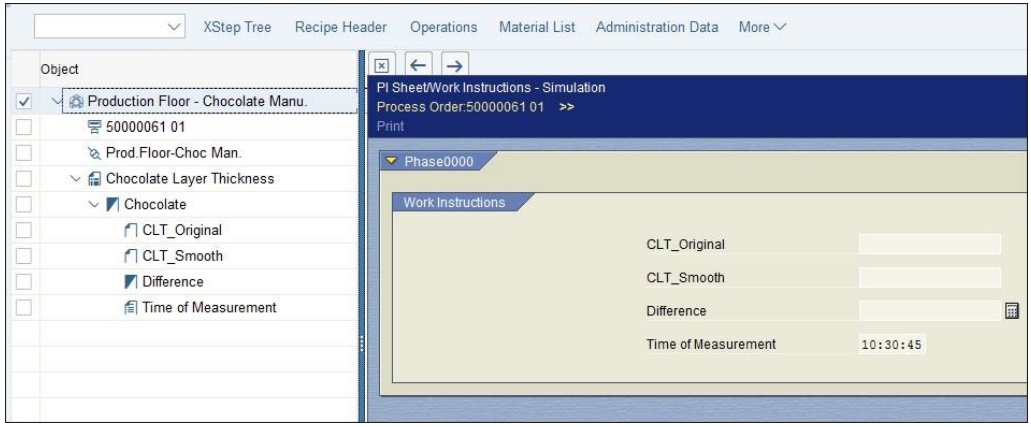


Figure 7.46 Simulation of a Calculation Formula in XSteps

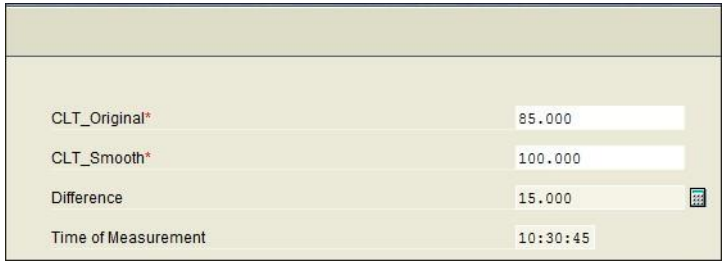


Figure 7.47 Calculated Field in XSteps

Many input, output, and control options are available in the XSteps tree, so we briefly discuss the most relevant ones in the following sections.

Note

We encourage you to explore the large number of options available in XSteps, including the option to incorporate website addresses and images/figures (e.g., hazard or gloves signs), the option to enter long text or a short note, and so on. You can immediately simulate the results to see if your settings are correct. If they aren't correct, the system provides you the guidance to correct them or points out the shortcoming or deviation.

Output Characteristics and Values in Execution Steps

If there is a fixed value that you want to display in the XSteps or subsequently in the PI sheet, you can use the **Output Characteristic** option. Enter the **Description** "Value Output (Fixed)" and use **Characteristic PPPI_Parameter_Value** with a fixed value of **40**. On the left-hand side of the same figure, you can again use the **Output Characteristic** option, but this time, select the **Characteristic** as **Note,** and in the **Long Text**, enter the text shown. This is a fixed text that will display when you process the PI sheet. Figure 7.48 shows the dropdown option to choose a parameter value. These individual values were maintained in the characteristic (Transaction CT04) and now are available to choose from.

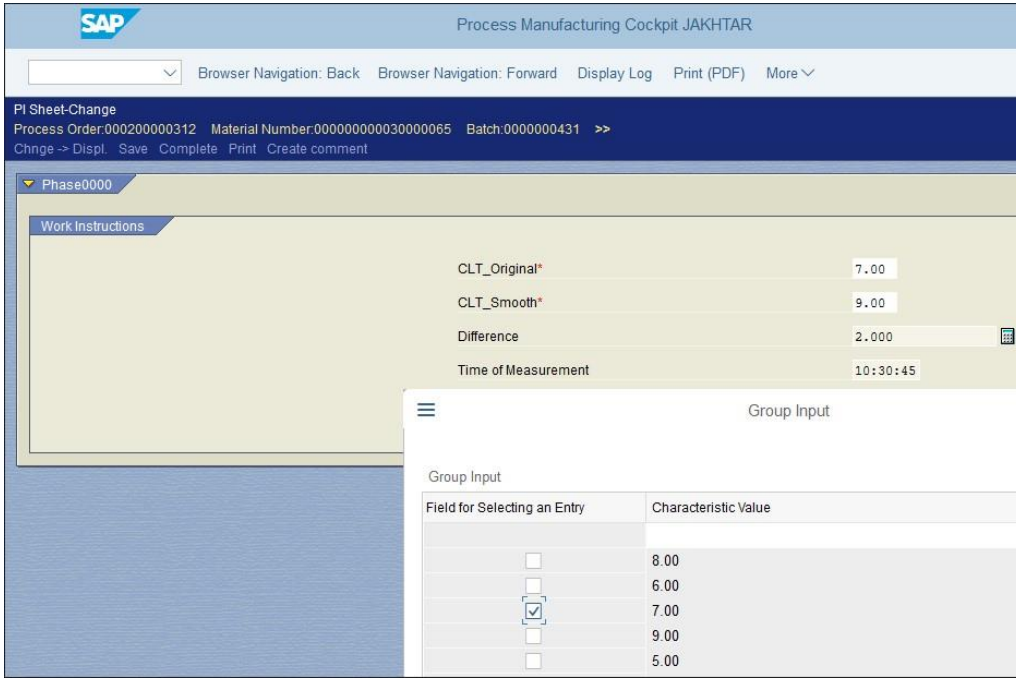


Figure 7.48 Simulation of Output Characteristic in XSteps

Control Instruction

You can change the description of how each control instruction in the PI sheet appears. This option helps in combining the relevant process instructions in one visual tab, so that it's easier for the line operator to either enter the details of the process parameters or simply use the available functions. To ensure that the system displays control instructions as a tab, first enter the desired description of the control instruction, and then select the **Control Instruction** characteristic from the dropdown menu.

Tables in Execution Steps

To generate a table in the PI sheet using XSteps, you need to first create a process instruction and then choose **CreateControl DataTable**. Figure 7.49 provides the option to enter the minimum and maximum number of lines (rows) that must appear in the table. When you've created the table, you can create the input value of the parameters by choosing **CreateEntryNumeric Value (or Parameter Value)**.

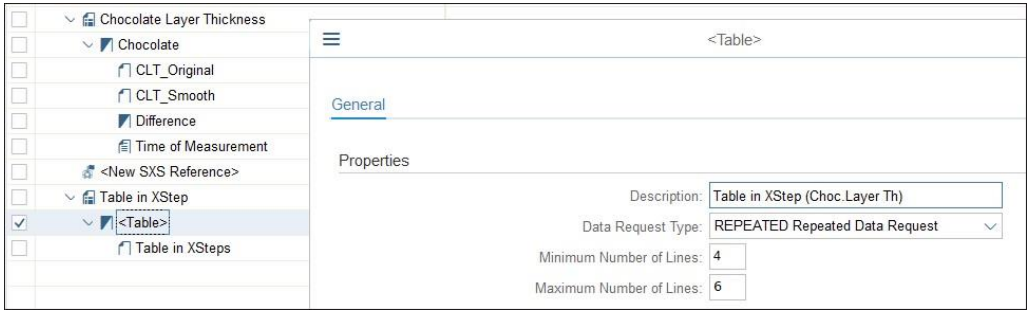


Figure 7.49 Tables in XSteps

Figure 7.501 shows the simulated version of table entry and the same in the actual PI sheet 2.

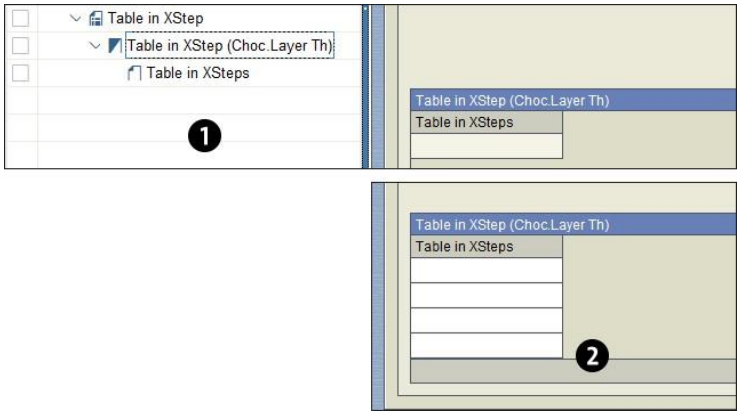


Figure 7.50 Simulation of Table Entry

Scope of Generation in Execution Steps

Whenever you create an XStep, the system provides the option to define the scope of generation, just as it does for process instructions. You can define the scope of generation for materials, resources/work centers, documents, or orders. The generation options in XSteps are far greater when compared to process instructions. Figure 7.51 lists the available options for scope of generation.

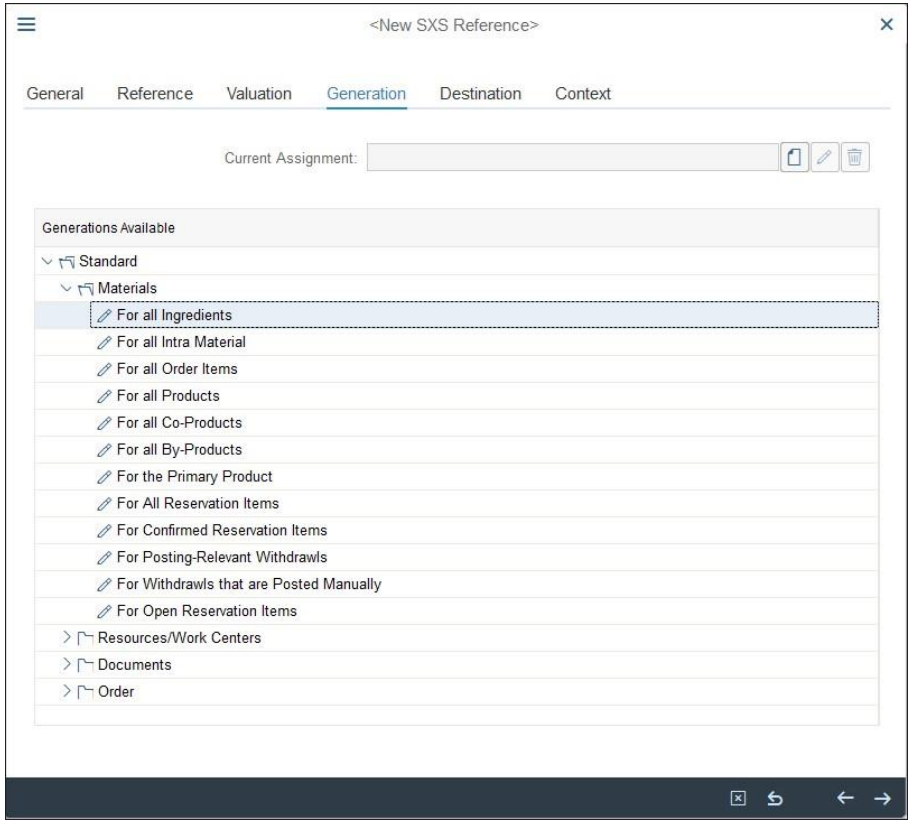


Figure 7.51 Scope of Generation in XSteps

Signature in Execution Steps

At the process instruction level in XSteps, you can incorporate a signature at various steps of data entry (or other input) to validate the information entered. You can even enter details of a digital signature, if you've already configured it in the system and when you choose it via **Create Control Data Signature**.

Process Messages in Execution Steps

At the same level where you can enter a signature in the process instruction, you can also choose to select the associated process message. To do so, choose **CreateControl DataProcess Message**. We use the same process message example here that we created in Chapter 4. Enter the **Process Message Category** "PP20", and the relevant message characteristic automatically appears.

Execution Steps Overview

You can place the cursor on any level and press (F8) to simulate the PI sheet, and it will appear on the right-hand side of the figure.

[+]

Tips & Tricks

You can drag and drop any element in the XSteps to your desired location. For example, if you want **Table Entries** to appear earlier in the XSteps tree, simply select it and drag it to your desired new location.

7.8 Process Messages Evaluation

The system offers process messages evaluation as a report that you can use to access information on process messages. The process messages evaluation integrates with Microsoft Excel and offers you the option to save the evaluated information either as a pivot table or simply as an Excel worksheet.

You can use all the standard or self-defined process message characteristics in evaluation. You can self-define the layout for evaluation, that is, regarding how the system should display the information during evaluation. You need to create an evaluation version before you can use it to evaluate process messages.

For process messages evaluation, use the menu path, **LogisticsProduction – ProcessProcess ManagementEvaluationProcess Messages**, or use Transaction CO52.

On the initial screen, first enter the **Plant** as "1000" and the **Evaluation version** as "PP", and then choose the **Create** icon. You need to create an evaluation version first before you can use it in process messages evaluation. You can also create a new evaluation version with reference to an existing version. To create an evaluation version, simply enter the **Plant**, and

click on the **SAP XXL** icon. The system takes you to the screen shown in Figure 7.52, wherein you can select the relevant checkboxes and save.

The system asks you to enter the **Evaluation version** and its **Description**.

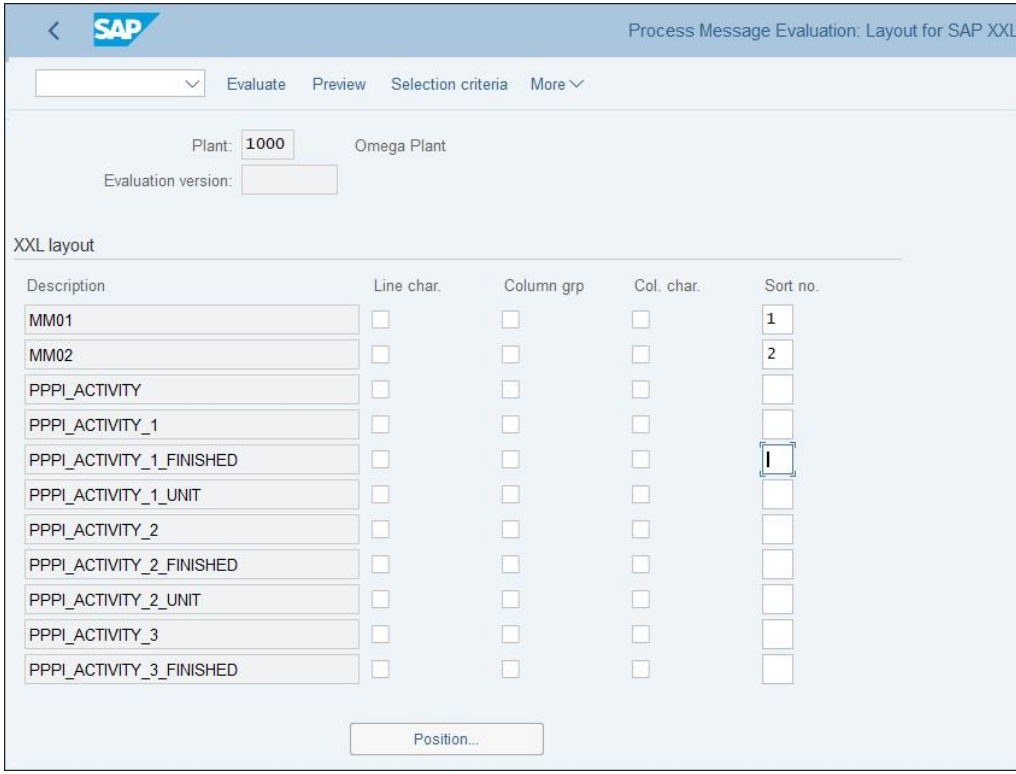


Figure 7.52 Selection Screen of Process Messages Evaluation

For this example screen in Figure 7.52, use the previously created **Evaluation version PP**, and select the checkboxes in the line (**Line char.**) and column characteristics (**Col. char.**) columns for the characteristics (process messages) that you want to evaluate. For the **Line char.** option, select the requisite checkboxes so that the data appear in horizontal lines (in rows). For the **Col. char.** option, select the requisite checkboxes so that the data appear in columns. For this example, the control recipe status appears in a column, whereas the control recipe destination appears in a row.

If you select the **Evaluate** option, the system downloads the information either in the Excel spreadsheet or in pivot table format. Alternatively, you can also use the **Preview** option. The first column and the related rows will show the control message ID. In the second column, the first row pertains to the control recipe status, whereas the second row reflects the control recipe number.

7.9 Process Manufacturing Cockpit

Building on the configuration made in Chapter 4 for the process manufacturing cockpit, PP10, we now show how it appears when you want to use it for data entry and reporting purposes. To access the process manufacturing cockpit, use the menu path, **LogisticsProduction – ProcessProcess ManagementManufacturing CockpitStart**, or use Transaction COPOC.

On the initial screen, enter the **Plant** as "1000" and the cockpit **Name** as "PP10". Choose **Execute**.

Figure 7.53 shows the manufacturing cockpit PP10, in which you enter the required details. All details are optional, except for the **Material quantity consumed** field because it's a mandatory field denoted by the red asterisk. When you exit the process manufacturing cockpit, the process messages automatically become available in the message monitor (Transaction CO54XT). From there, you can send them to the predefined destinations.

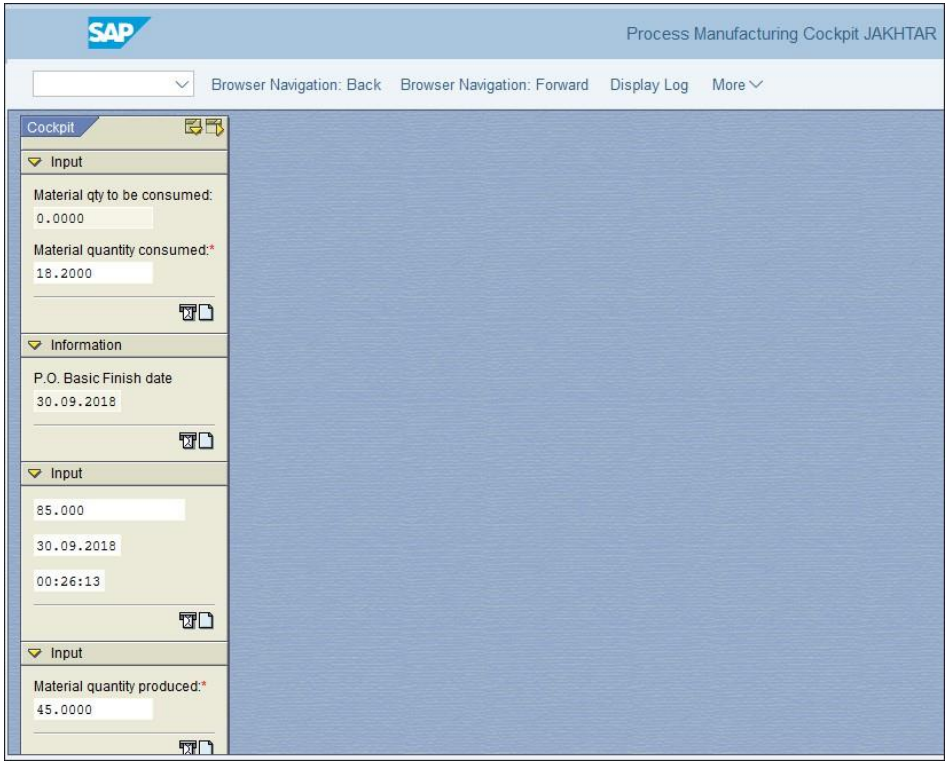


Figure 7.53 Process Manufacturing Cockpit: PP10

7.10 Summary

Generally, the production processes in process industries are no different from that of discrete manufacturing, except that it offers options to record greater details of the processes. However, it offers functionalities such as process management, which is unique to PP-PI only. With the introduction of XSteps, the process management functionality not only becomes easier to implement in PP-PI but also finds its usage in the discrete manufacturing industries.

The next chapter covers production planning in repetitive manufacturing.

Chapter 8

Production Planning for Repetitive Manufacturing

This chapter covers the important business processes and functions in repetitive manufacturing, along with the vital and logical links of configuration required.

Repetitive manufacturing (REM) is mainly used for production scenarios with high repetition rates, high product stability, and low product complexity. REM is characterized by quantity-based and period-based production (uninterrupted production over a longer period of time). The REM type is often mixed up with takt-based flow manufacturing, which is usually used whenever the production process is based on a takt time (e.g., in the automobile industry). Both production types (REM and taktbased flow manufacturing) have different business backgrounds and properties, and they use different SAP technology, different master data, and even different planning tools.

Note

Refer to Chapter 1 for comparisons of discrete manufacturing, process manufacturing, and REM, as well as how to decide which manufacturing type is most relevant for a given industry.

In this chapter, we explain what REM is and how it fits into the planning and production perspectives. We walk you through the REM process flow and provide a comprehensive, step-by-step understanding of each process involved. We describe the important REM master data and walk through how to run the end-to-end material requirements planning (MRP) process to show how you can use planning to optimize your production and procurement processes. We also discuss performing the material availability check for missing components.

Then, we cover actual and daily business processes: planning tables and material staging, based on the current material situation; the creation of a production list; REM confirmation at the assembly, components, and activity levels; and capacity requirements planning (CRP). Next, the chapter moves toward handling scraps at various levels, cancellations, and reversals. A short discussion on cost object controlling is next, followed by discussing Heijunka and its role in REM. Finally, the chapter concludes with a few important evaluation reports available in REM.

We've linked this chapter's discussion to the configuration you made in Chapter 5 as often as possible. If deemed necessary, the pointers to necessary configurations are given in this chapter.

8.1 Overview

Companies that work with high-volume and mass-produced materials (e.g., pens, pencils, or batteries) find that REM best reflects their production processes, rather than discrete manufacturing or process manufacturing. If the actual business process is quite simple and straightforward, consider implementing the lean REM production type as long as it's able to fulfill the business needs from a functional perspective.

The SAP S/4HANA system supports and offers make-to-order (MTO) REM, which enables you to handle configurable materials. REM supports handling unit management, in which goods and packaging are mapped as a logistic unit. Serial number assignment for unique identification is also possible in REM. Make-to-stock (MTS) REM is equally possible.

In the following sections, we'll cover how REM plays a central role in production planning and production execution, as well as discuss the REM process flow.

8.1.1 Roles of Repetitive Manufacturing in Planning and Production

Figure 8.1 provides an overview of the role of REM in the planning and production areas of the SAP system. The planning process starts with requirements coming from sales and distribution (SD) or from the material forecast and then becomes a part of demand management. The system runs the MRP based on the figures given in the demand program, and the outcome of the MRP run (planning run) is the creation of procurement proposals. These procurement proposals can be planned orders (order

proposals), purchase requisitions for external procurement, or delivery schedules for scheduling agreements with vendors. In REM, you can't convert the planned orders because these are sufficient to trigger the production process. In fact, the REM planned orders obtain the new order type of the *run schedule quantity (RSQ)* when the system assigns a production version to them.

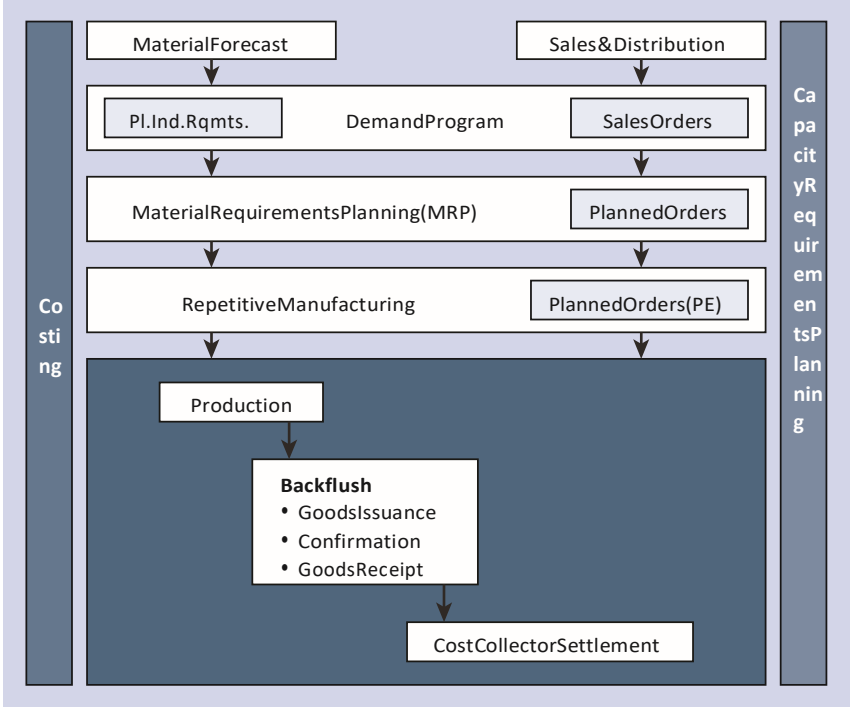


Figure 8.1 REM in Production Planning

After actual production execution, you record the relevant information in the system, such as components consumptions, activities consumptions, and production yield. Because REM is a period-based manufacturing type, you finally proceed to the settlement process, in which variances and overheads are also settled during the cost collector settlement.

8.1.2 Repetitive Manufacturing Process Flow

Figure 8.2 illustrates the end-to-end process flow in REM.

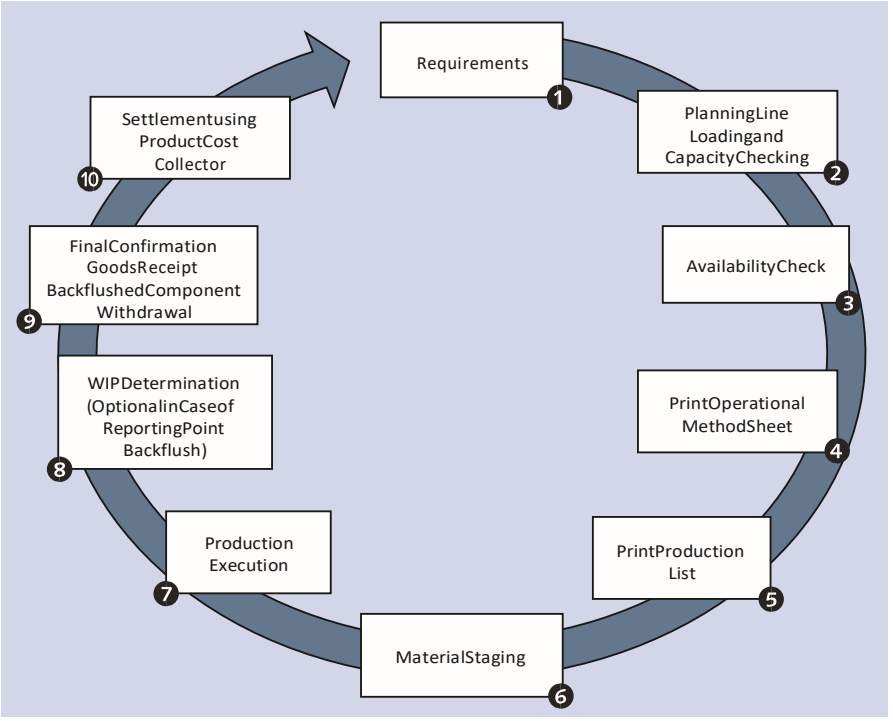


Figure 8.2 Process Flow in REM

The process flow sequence is described in the following list:

1 The process begins when requirements from MRP (through planned independent requirements [PIRs]) or SD flow in for which the production must initiate.

The system covers the infinite requirements with planned orders during the MRP run.

2 The system performs the line loading and checks the capacity requirements to see if it's able to produce the required quantities. If not, it's overloaded.

3 The system checks for the availability of the components needed to produce the material.

4 You can print the operational methods sheet (OMS) that contains detailed instructions for producing the material.

5 You can also print the production list, which contains quantities to produce and important dates. You can print a production list specific to a material or to a production line. Following the lean manufacturing principle, these are the only two shop floor papers.

6 You need to stage the material by undertaking a transfer posting from the main store to the production floor from where you issue the components to the production lines.

7 The production execution step is the actual and physical production of the material.

8 If your business process entails working and reporting with reporting point (RP) backflush (milestone confirmation), then you can calculate the work in process (WIP).

9 You record the production yield, record issuance, consumption of components, and postproduction activities. You can also record excess component consumption, excess activities such as machine hours or labor hours consumed (as compared to standard durations), and scrap. You can also record any deviation in consumption. j The last step reflects controlling (CO)'s integration with production planning (PP), in which you perform settlement using the product cost collector (PCC).

Note

You can also integrate quality management (QM) processes into the REM production process to ensure that all product produced in-house will go through the quality checks before being dispatched to customers.

8.2 Master Data

Before running processes and jobs in the SAP system, it's imperative that you set up complete and comprehensive master data. REM has its own unique master data that often overlaps with other production types, such as discrete manufacturing or process manufacturing. If master data is set up in the right sequence, it's much easier and logical to interconnect because you've already taken care of the predecessorsuccessor relationship.

Table 8.1 provides an overview of the master data that you need in REM. It begins with the material master of the product (a finished good or an assembly) in which you specifically mark the REM type in the **MRP 4** view of the material master by selecting the relevant checkbox, and also assign the REM profile, which you previously configured (in Chapter 5). You also assign the selection method (entry **2**) for the production version in the material master.

Material	Production Version

Activating **REM** indicator Assigning REM profile	Activating **REM** indicator Rate-based planning Bill of material (BOM) assignment Production line Receipt storage location
Bill of materials (BOM)	**Cost object controlling**
Material BOM	PCC or even product cost estimate
Work center (production line)	**Rate routing**
Production line as work center	Assign work center (production line)—usually one operation Production rate (quantity per time)

Table 8.1 Master Data of REM

You create the BOM of the product that you want to produce and assign components together with the quantities needed to produce that product. If needed, you can also define the scrap percentage at the operation or component level.

You then create the work center or production line and create rate routing for the material, in which you also assign the previously created work center.

Finally, you create the production version for the material and assign the material's BOM and rate routing. You also select the **REM** checkbox to denote that the material produced will follow the REM process.

When all of the logistics master data is in place, your CO team can create PCCs of the material. This can be specific to the production version or can be independent of the production version.

Note

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

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

One possible approach to having several cost centers within one production line is accomplished by incorporating additional cost-relevant operations (in the rate routing) and still keeping the principle of just one work center for production (and PP).

We'll now discuss how to set up each of the REM-specific master data areas.

8.2.1 Material Master

The first step in creating REM-specific master data begins with creating the necessary settings in the material master of the product (an assembly or a finished good). To change the material master, follow the menu path, **LogisticsMaterials ManagementMaterial MasterMaterialChangeImmediately**, or use Transaction MM02. On the resulting screen, enter **Material** number "30000061", and press (Enter) to bring up the organizational level where you enter **Plant** "1000" and **Stor. loc.** "1004". Choose **Continue** to bring up **Select Views**, in which you select **MRP 4** and press (Enter) again.

Figure 8.3 shows the screen where you can maintain the details related to REM production processes in the **MRP 4** view of the material master.

Next, select the **Repet. Manufacturing** checkbox, which denotes that the material will undergo the REM production process. Select **PP10** in the **REM profile** field.

Note

This is the same REM profile that you configured in Chapter 5.

An REM profile is a four-digit code that determines the following:

The movement type that the system uses to post goods receipts (GRs) and goods issues (GIs)

How the system reduces planned order and RSQs in the confirmation process How the system makes the correction in the assembly's components (according to BOM), which enables you to define whether GI posting isn't possible in the system due to forgotten GR postings or whether the system should process the same later on in a separate backflush processing transaction

How the system deals with production activities during confirmation, such as setup or machine hours

Save the settings in the material master.

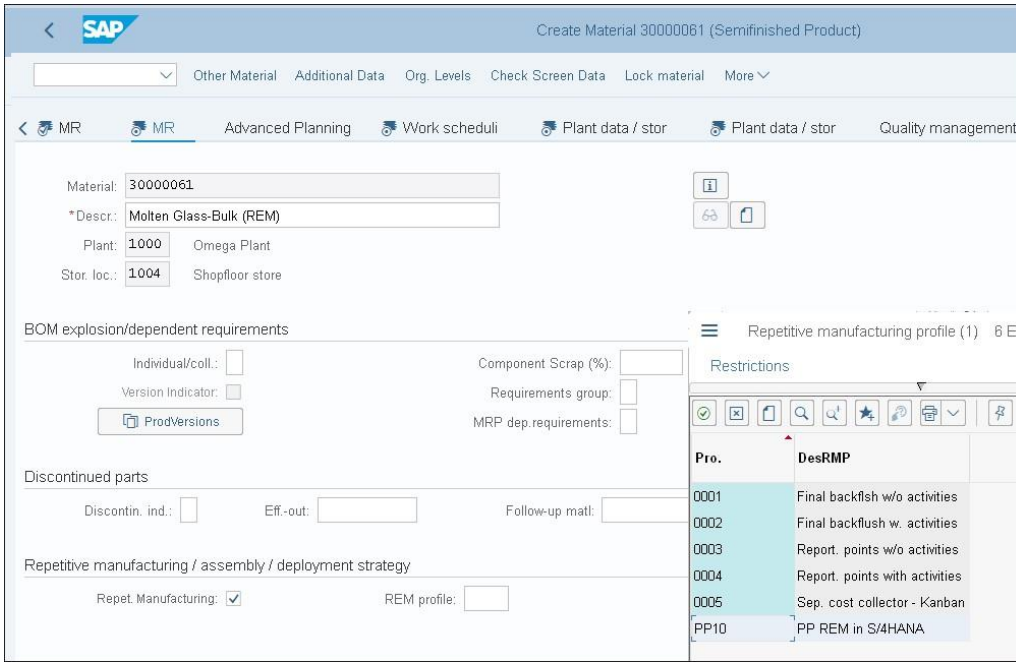


Figure 8.3 REM Indicator in the MRP 4 View of the Material Master

8.2.2 Bill of Materials

The process used to create a material BOM for REM is no different from the process in discrete manufacturing. Refer to Chapter 6, Section 6.2.2, in which we covered the details of material BOM creation.

8.2.3 Work Center (Production Line)

The alternative term for a work center is *production line* in the SAP system. *Work center* is specific to discrete manufacturing, whereas *production line* is specific to REM. Production lines are usually created as simple work centers in the system (and because the SAP system refers to these as work centers, we'll do the same here). In the work center, you define the availability of the production line. In REM, following the lean manufacturing principle, all work stations in the production line aren't modeled as individual work centers. Rather, the entire production line (with all of its work centers) is modeled as one work center. The production line created as the work center is entered in the **Production line** field in the production version. This same work center is specified in the single operation of the rate routing. Production lines that need to include or model more than one work center can be represented in a line hierarchy.

To create a work center (production line), follow the menu path, **LogisticsProductionMaster DataWork CentersWork CenterCreate**, or use Transaction CR01. On the initial screen to create the work center, enter **Plant** "1000", for which you want to create a production line. It's mandatory to assign a plant while creating a production line.

Enter "FURNACE" as the **Work center**. It's an alphanumeric identification to denote a production line. A production line can be a production facility, a processing unit, a machine or group of machines, or a laborer or group of laborers directly involved in the production process.

For this example, set the **Work Center Category** field as "0007". This control function ensures that only the relevant screens are eventually available during production line creation. A work center category 0007 denotes a production line.

Other important functions in this screen are **Copy from Plant** and **Copy from Ref. work center**. These functions help reduce the data entry efforts during the new production line creation by automatically making available all of the necessary information from the reference production line to the new production line, which you can change as needed.

In the following sections, we'll cover the five tabs of a work center and the information that needs to be maintained.

Basic Data

Figure 8.4 shows the **Basic Data** tab of a production line. Here, enter a short description of the production line in the text box at the top-right of this screen. In the **Usage** field, enter "009". A *usage* is a control function that controls whether this production line eventually becomes available for various other tasks, such as during the creation of rate routing or the

production version. A usage of 009 denotes that this production line can subsequently be used in all task list types.

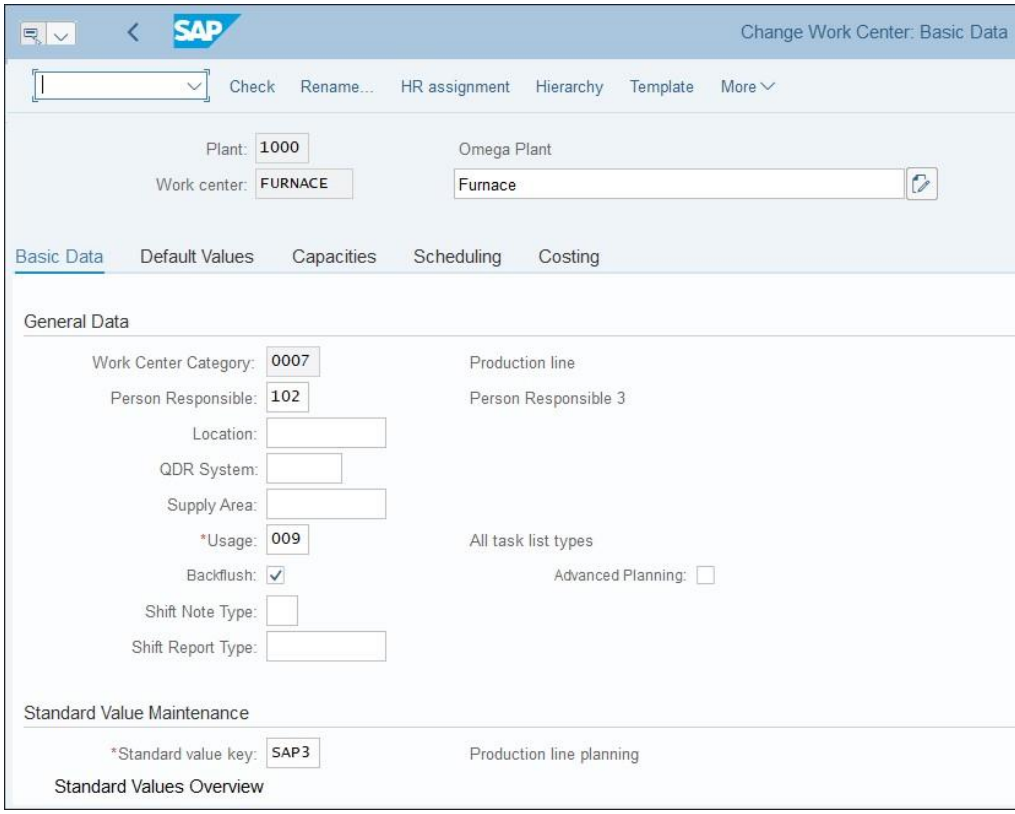


Figure 8.4 Work Center: Basic Data

The two important fields on this screen are described here:

Shift Note Type

A shift note is an option to record important shift-related details of a production line. These can be general details of the shift as well as any specific problem encountered at this specific production line during the production process.

Shift Report Type

A shift report compiles and consolidates all of the information from a single shift note or multiple shift notes. These are available as PDFs and other formats, as well as on the layout defined for a company. The user can also digitally sign a shift report before a printout is possible and send a shift report by email.

In the **Standard value key** field, enter "SAP3". A standard value key (SVK) denotes activities performed on a specific production line as well as the option to record them or otherwise. Some of the activities include production time, setup time, processing time, and labor time. For REM, the SAP system already provides the SVK SAP3, which you can use.

You must enter the production time as a rule for maintenance. If the **Production time** (not shown) is assigned as **must be entered** from the dropdown list, you're required to enter the actual duration of the activity during the confirmation of the REM planned order. Otherwise, the system won't allow you to save the confirmation. Other maintenance options are **may not be entered**, **may be entered**, or **should be entered**, offering various degrees of control from an information message to a warning message, if the requisite information (duration, in this case) isn't recorded during confirmation.

Default Values Tab

Click on the **Default Values** tab to see the screen shown in Figure 8.5, where you assign the **Control keyPP01** to the work center. A *control key* is a control function that manages whether you can perform an activity or a task associated with the work center. Place the cursor on the **Control key** field, and press (F4).

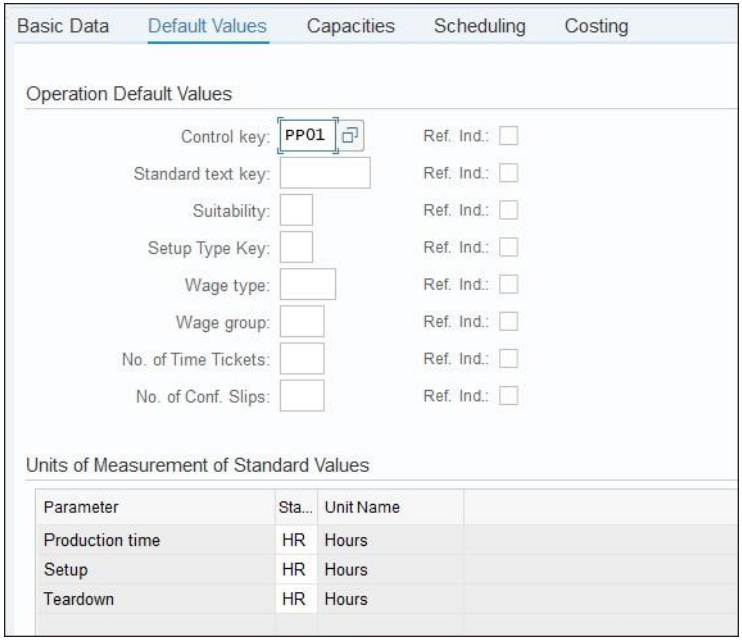


Figure 8.5 Work Center: Default Values

While placing the cursor on **Control key PP01**, if you choose the **Detailed information** button, the system shows the details in the lower half of the same screen. Notice that in REM, only the following checkboxes are included: **Scheduling**, **Det. Cap. Reqmnts.**, **Cost**, **Insp.char. required**, and **Confirmations**. All other checkboxes don't work for REM. If the checkbox isn't selected, then you can't perform that step or function on this work center (FURNACE). For example, if the **Scheduling** checkbox isn't selected in the control key, then the system won't perform scheduling on this work center.

In addition, notice that for the **Confirmations** field, you have to select option **1** (milestone confirmation) if you want to use RP backflush during confirmation.

Note

You can set up the control key by using Transaction OPJ8.

If you place the cursor on the **Confirmations** field and press (F4), a screen will appear that provides several confirmations options.

Capacities Tab

Click on the **Capacities** tab in the work center (production line) creation screen to see the options screen shown in Figure 8.6. In the **Capacities** tab, enter the **Setup Formula** "SAPR01", which denotes the setup formula that the system will use during capacity calculation. For **Processing Formula**, enter the formula "SAPR02". This is for **Capacity category 001** for **Machine** (shown at the top of the screen).

Note

See Chapter 15 for information on capacity requirements planning (CRP).

Click on the **Capacity header** button at the bottom of the **Capacities** tab. This brings up the header screen of capacity for work center FURNACE as shown in Figure 8.7. The capacity header contains comprehensive details for the capacity: start and end time of the shift, length of breaks, overload percentage allowed for capacity, shifts and intervals, and factory calendar.

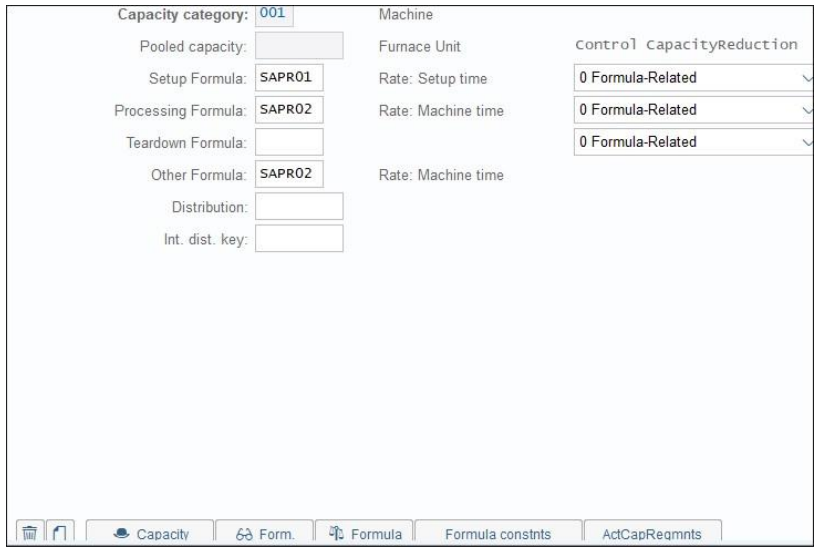


Figure 8.6 Work Center: Capacities

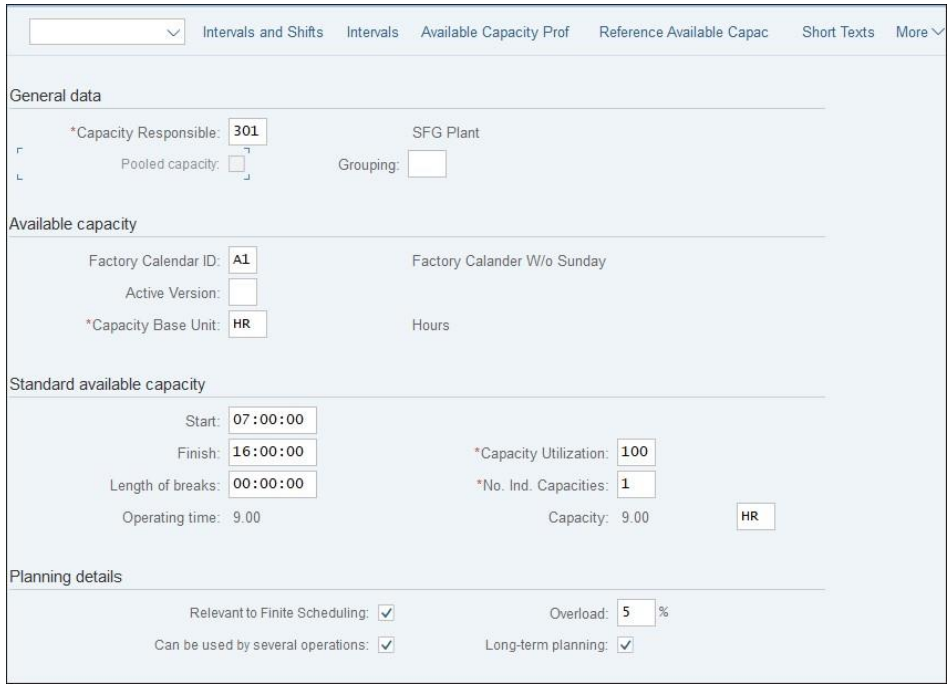


Figure 8.7 Work Center: Capacity Header

Note

Refer to Chapter 2 for information on how to set up the factory calendar and capacity planner group.

For this example, enter the following in each field (or select the relevant checkbox):

Capacity Categoryshorttext(not shown):"FURNACE(Machine Capacity)" This short text describes the capacity category, for example, the specific production line or machine.

Capacity Responsible:"301"

It's important to assign a capacity planner group to a production line, so that during evaluation of capacities, the capacity planner group can be one of the evaluation criteria. The capacity planner group shouldn't be the name of the person but instead the area or domain of responsibilities.

Capacity Base Unit:"HR"(for hours)

This is the unit of measure (in hours) in which the system displays the capacity of a production line.

Start:"07:00:00"

This is the start time of a production line.

Finish:"16:00:00"

This is the end time of a production line.

Length of breaks:"00:00:00"

This is the total lengths of breaks during the start and end of shifts. Break timing deducts the availability time of the capacity of a production line. For example, if a machine runs 12 hours a day, with 2 hours of daily breaks, then the available capacity of the production line is 10 hours. Note that this fact is considered in lead-time scheduling of orders.

Capacity Utilization:"100"(percent)

This is the actual capacity utilization factor. This factor has to be as realistic and as close to actual capacity of a production line as possible to enable the system to calculate the available capacity of the production line. The capacity utilization is reduced accordingly if the production line can't be used for a certain percentage of time, for example, due to machine failure.

No. Ind. Capacities:"1"

This is the number of individual capacities associated with a production line. For example, four individual ice cream mixers are created as one production line. Thus, the individual capacities are 4 in number and directly multiply with the timings of the capacity of the production line. For example, if the available capacity of a production line is 10 hours in a day, and there are 4 individual capacities, then the total available capacity of the production line is 40 hours.

Relevant to Finite Scheduling

This checkbox requires the system to consider capacity overload during capacity evaluation. **Overload %**

A capacity overload in percentage directly increases the capacity availability of the production line by the defined percentage. If, for example, the total capacity of a production line is 40 hours with 10% overload, then the available capacity is 44 hours. A 10% overload of 40 hours is 4 hours, and it adds up to 40 hours to show the total available capacity at 44 hours. Because we aren't considering any overload, you don't need to maintain any information here.

Long-term planning

This checkbox enables the system to consider the production line availability during long-term planning (LTP). LTP refers to a simulative planning of material and production lines over a longer period.

Note

See Chapter 14 for more information about LTP.

Scheduling

Click on the **Back** icon, and then click on the **Scheduling** tab (see Figure 8.8). Enter the standard formulas available for REM (these are covered in detail in Chapter 6).

Note

See Chapter 15 to learn more about CRP.

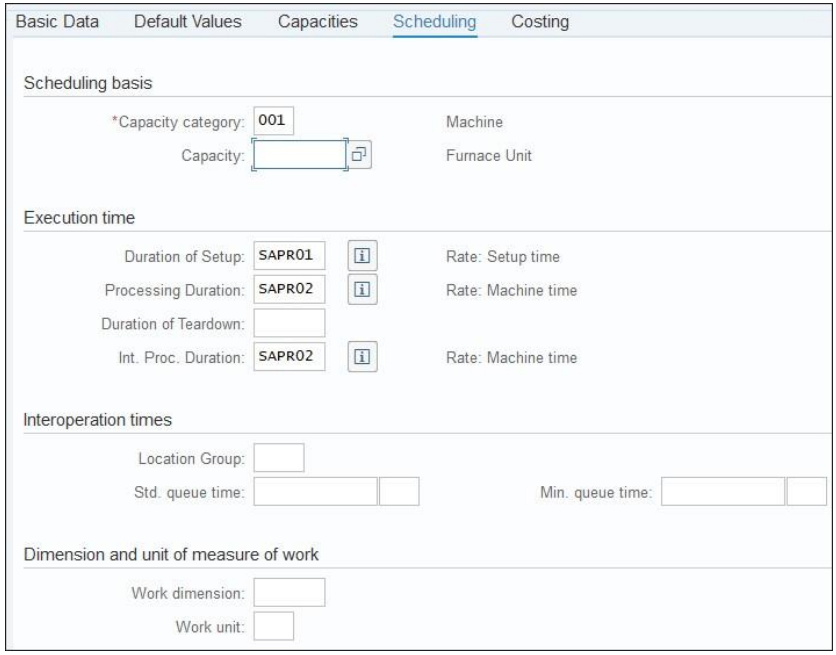


Figure 8.8 Work Center: Scheduling

Costing

Because PP comprehensively integrates with the cost object controlling functionality in product cost controlling (CO-PC), each work center needs to have a cost center. You can assign multiple cost centers or just one cost center to multiple work centers in the **Costing** tab, but you can't have multiple cost centers assigned to a single work center.

Note

You need to coordinate with the CO person to ensure that each cost center and associated activity type for the given controlling area has price planning.

In the same step, you have to ensure that activity types and cost centers are also in place, so that you can assign them in the work center.

In the screen shown in Figure 8.9, enter the following details:

Start date

This is the start date of the availability of the cost center for the production line.

End Date

This is the end date of the availability of the cost center for the production line.

Cost Center

Every production line requires the direct assignment of a cost center, so that when you perform work using a production line, the system is able to accumulate all of the costs on the designated cost center.

Activity Type(productiontime)

Activity type denotes the predefined rate with which the system calculates the work performed by a production line.

Formula key(productiontime)

A formula denotes the parameters that the system considers while calculating the cost incurred in performing work at a production line.

Save the work center.

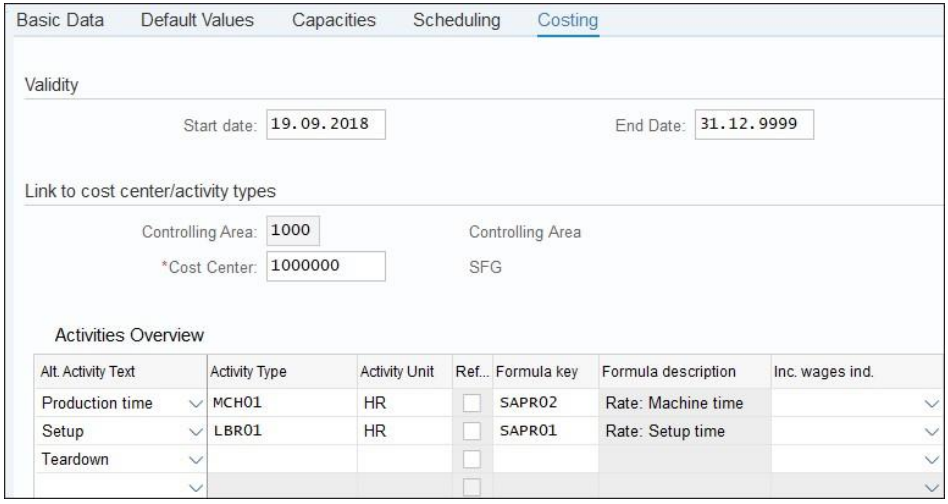


Figure 8.9 Work Center: Costing

8.2.4 Routing

Rate routings are designed for the maintenance of production rate-based task lists and are used in REM, among other business scenarios. In a standard rate routing, the base quantity (e.g., pieces) generally remains constant, and the time-related data, such as the processing time, is maintained using standard values. Rate routing works exactly the opposite. The production quantities are maintained on the basis of individual items, and the reference time

is constant. Thus, a rate routing describes the quantity of an item that must be produced within a given period of time.

A rate routing can contain a series of operations. The production rate is defined for each operation based on the production quantity, production time, and associated unit of measure. The production rate is determined as the quotient of the production quantity and production time. This enables you to determine the production quantity in terms of tons per shift, for example. Usually, only one operation is production relevant, and the others may be controlling or print relevant. Using line hierarchies, you can always have several production-relevant operations to support capacity leveling on different work centers along the production line.

All other aspects of the functionality and maintenance of standard routings and rate routings are identical. You assign work centers to the rate routing, which should also contain the SVK in which the standard values for production time, setup time, and teardown time are predefined.

Reference routings are used as a reference or template in routings. A reference rate routing contains a sequence of operations. As with rate routing, the production rate for an operation is defined on the basis of the production quantity and reference time. The functionality and maintenance of reference routings are similar to those of reference operation sets.

To create a rate routing, follow the menu path, **LogisticsProductionMaster DataLine DesignRate RoutingCreate**, or use Transaction CA21. On the initial screen to create rate routing, enter the **Material** "30000061" and **Plant** "1000". In the **Key date** field, enter "26/09/2018", and denote the date when the rate routing becomes available in the production process. Because the rate routing validity starts from September 26, 2018, when you create a REM planned order for the month of July 2018, for example, this rate routing won't be available.

If no date is given during rate routing creation, then the system automatically assigns the rate routing's creation date as the valid from date.

In the following sections, we'll cover the various elements of rate routing.

Header Details

Click on the **Header** icon. In the header details of the rate routing, enter the following:

Usage:"1"(for production)

This makes the rate routing available during subsequent production activities, in which the system will use rate routing during the creation of the REM planned order.

Status:"4"(released)

This makes the rate routing available during subsequent production activities, in which the system will use rate routing during the creation of the REM planned order. If the status of the rate routing is set to **Being Created** (**Status 1**), it won't be available when you create the REM planned order for the material.

Planning Work Center:"FURNACE"

This is the production line you previously created, which is now used in the planning and production of the material.

From Lot Size:"1"PC

This denotes that the smallest quantity of the REM planned order must be at least 1 PC for the system to consider using this rate routing. In other words, this rate routing is applicable when you create the REM planned order of a quantity greater than or equal to 1 PC.

To:"100,000"PC

This denotes that the maximum quantity of the REM planned order must be at most 100,000 PC for the system to consider using this rate routing. In other words, this rate routing is applicable when you create a REM planned order of quantity greater than or equal to 1 PC but less than or equal to 100,000 PC.

Note

Because QM also integrates with REM, you can engage the QM resource for this activity.

Click on the **Operations** button. The resulting screen is shown in Figure 8.10, in which **FURNACE** is the work center. This denotes assigning a previously created work center (production line) to an operation, which is used in the production of material and for which you're creating the rate routing. An operation defines a single level of detail for a production step.

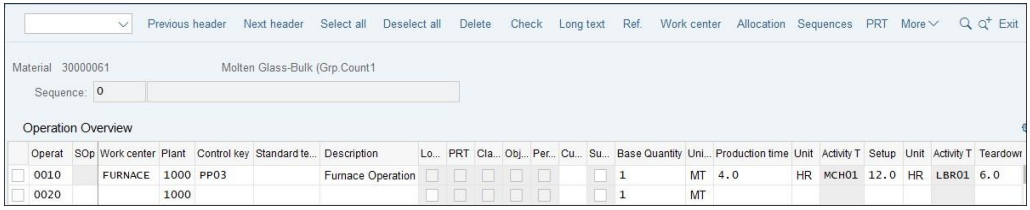


Figure 8.10 Routing: Operation Overview

Operations

Select and double-click on the first line item, **Operat 0010**, which takes you to the screen shown in Figure 8.11.

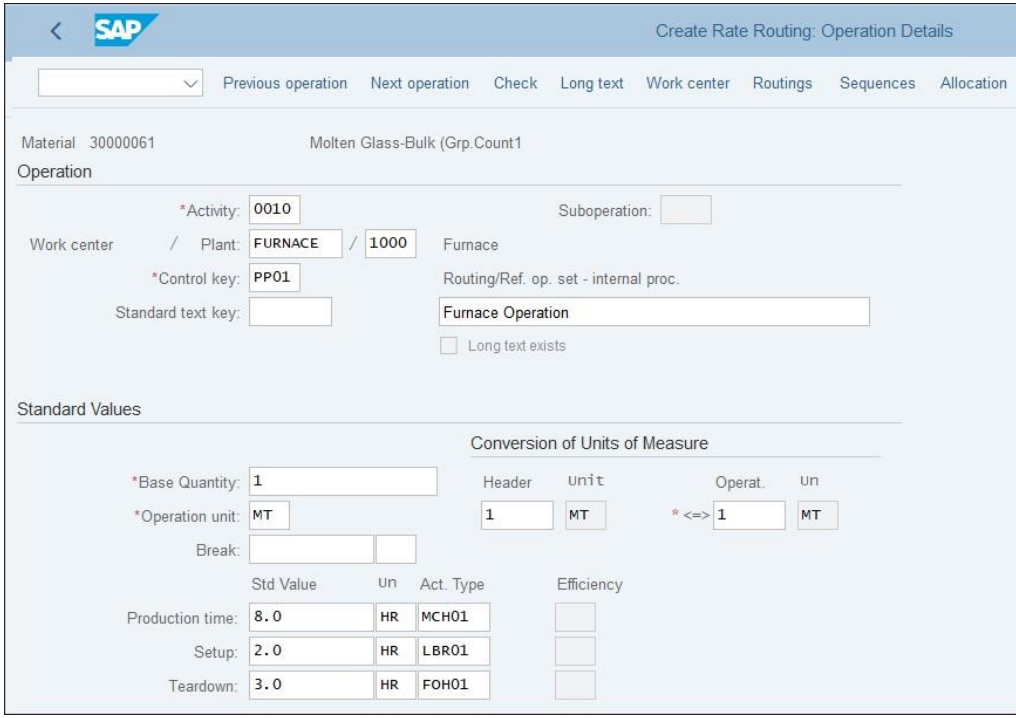


Figure 8.11 Routing: Operation Details

Here you see the operation's detailed view in which you can enter the following:

Production time:"8.0 HR"(hour)

You defined in the production line that recording duration information in rate routing is a mandatory field (by using the maintenance control**must be entered**); hence, you have to define the time it will take in the production line step of the manufacturing process.

Act. Type:"MCH01"

An activity type is a result of direct integration of PP with CO-PC. In fact, PP completely integrates with CO-PC. An activity type contains the financial rate (valuebased) to perform an activity during production. So, 5 hours of production time has an associated cost of producing the material. Any deviation in production time, either positive or negative, has a direct implication on the cost of goods manufactured (COGM).

Setup:"2.0 HR"

You define the time it takes to set up the machine or the production line for this task. Any deviation in setup time, either positive or negative, has a direct implication on COGM. (You must enter **Act. Type** "LBR01" here.)

Teardown:"3.0 HR"

You define the time it takes to dismantle or tear down the setup of the machine or the production line. Any deviation in teardown time, either positive or negative, has a direct implication on COGM. (You must enter **Act. Type** "FOH01" here.)

Components Allocation

Next, press (F6) or choose **GotoOperations Overview**, and the system brings you back to the **Operations Overview** screen. In this screen, click on the **Components Allocation** icon.

Figure 8.12 shows the component allocation in rate routing. These components are directly taken from a material's BOM, which you've already created in the previous step. If you don't assign a specific component to the specific operation, the system assigns all components to the first operation of the rate routing. This means that all components must be available at the first operation, so that during backflush, the system is able to consume all components in the first operation.

Figure 8.12 Material Component Overview in Routing

If your business process entails that a few components are used or needed in the later stages of the production process, then you can select them and use the **Reassign** button shown in the menu bar of Figure 8.12 to assign specific components to the operation.

Because there is only one operation in REM, the preceding scenario of material assignment is broadly more applicable in discrete manufacturing than in REM.

Material Assignment

Going back to the rate routing header screen, click on the **Assignment** button to see the screen shown in Figure 8.13. Here, **Material 30000061** in **Plnt 1000** is assigned an internal **Group** as **50000009** (not shown) with the group counter (**GrC**) as **1**. Later, you'll use this group (**50000009**) in creating the next part of the REM master data, the production version.

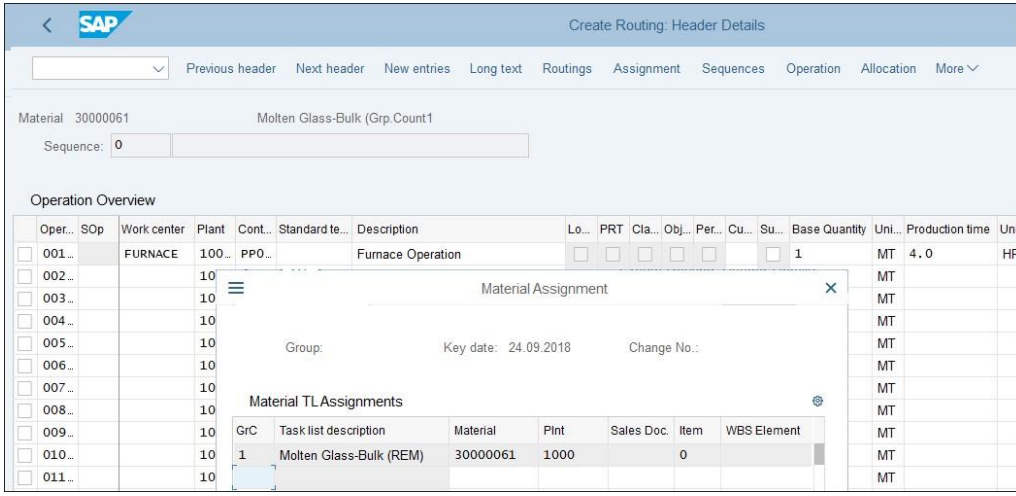


Figure 8.13 Material Assignment to Routing

You can assign several materials, together with their respective plants, to this rate routing group (**50000009**). All such materials belonging to this rate routing group will have the same group but with an ascending group counter number.

In other words, if you have several materials undergoing the same production process, you no longer need to create separate routings for each. Just create one rate routing, and assign relevant materials (with plants) to it. This saves time and effort in creating an important part of the master data (rate routing) and also eliminates or reduces redundant data entry efforts.

Save the rate routing.

8.2.5 Production Version

Production versions denote different ways by which a company produces a material, for example, a material with one rate routing but multiple BOMs. Therefore, for each BOM and the same rate routing, the system needs a separate production version to denote uniqueness during the REM planned order creation. The requirement to create a separate production version also applies when there is one BOM for a material but multiple routings. In the REM process, it's mandatory to create a production version and make it available.

The production version can also be specific to the quantity range, thus acting as a control function. For example, you can create one production version that has a quantity limitation of 1 to 1,000 PC and another production version for a quantity greater than 1,000 PC.

The production version can also be specific to the validity period, thus acting as a control function. For example, you can have a production version that is valid from April 1, 2015, to March 31, 2018. From April 1, 2018, onward, you may have a new production version. When the system has to assign the production version to the REM planned order, it searches for specific validity dates and automatically assigns the relevant production version when it's found.

If the system is able to find multiple production versions fulfilling the search and application criteria, it assigns the first available production version to the REM planned order. The first available production version refers to the list that you can call from the material master (in the **MRP 4** or **Work Scheduling** views). To create a new production version, follow the SAP menu path, **SAP Menu LogisticsProductionMaster DataProduction Versions**, or use Transaction C223.

On the **Selection Conditions** area of the screen shown in Figure 8.14, enter **Plant** "1000" and **Material** "30000061", and then press (Enter). If the system is unable to find a production version of the material, then the lower half of the screen appears blank. If the system is successful, then it displays the relevant production versions.

A menu bar is available at the bottom of the production version creation screen. You have just about all of the options normally needed while creating production version master data, including copying, deleting, copying from a template, and so on.

Click on the **Create Production Version** icon, and an almost empty screen appears in which you maintain details, as shown in Figure 8.15.

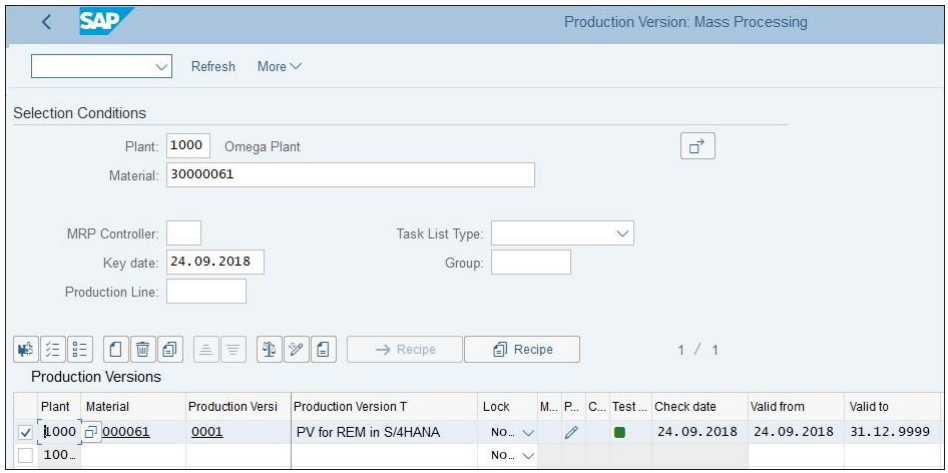


Figure 8.14 Production Version: Initial Screen

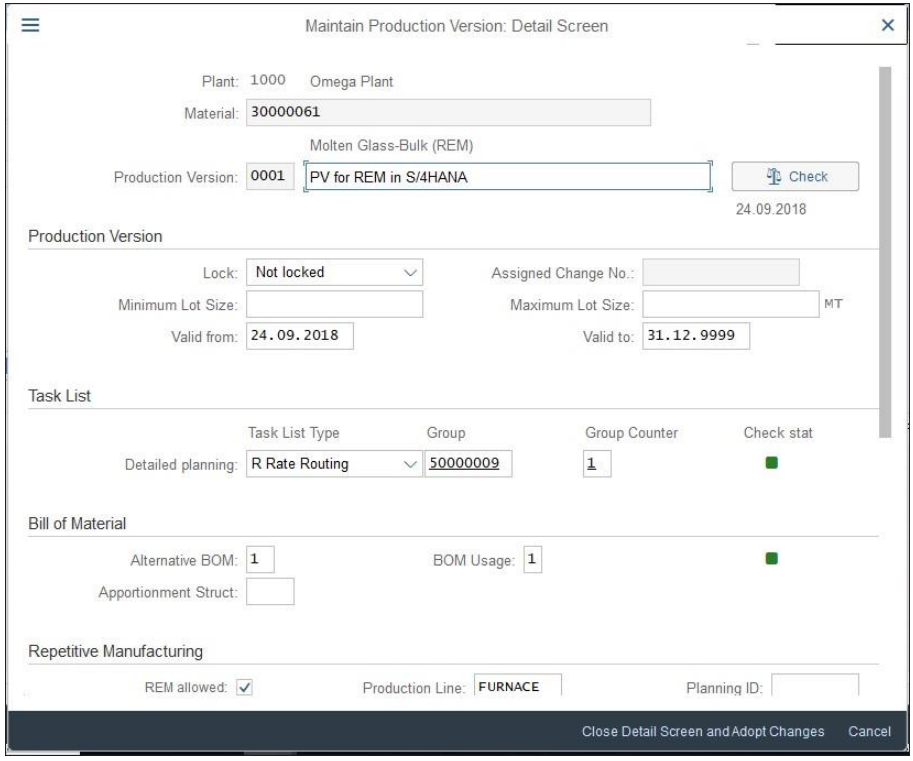


Figure 8.15 Production Version of Material 30000061

Enter the details as noted in Table 8.2.

Field	Value	Additional Details/Remarks
Material	**30000061**	–
Production Version	**0001**	–
Minimum Lot Size	**1.000**	This field sets the minimum REM planned order quantity for which the system offers this production version for selection. Leaving this field blank entails that there is no minimum quantity limit.
Maximum Lot Size	**9,999,999.000**	This field sets the maximum planned order quantity for which the production version is applicable.
Valid from	**24.09.2018**	This field denotes that when you create the REM planned order starting on or after 24/09/2018, the system offers this production version for selection. If the start date of the REM planned order is before 24/09/2018, the system won't make this production version available for selection. If you leave this field blank, the system automatically incorporates the current date as the validity start date of the production version.
Valid to	**31.12.9999**	This field sets the end validity date of the production version.
Detailed planning	**R Rate Routing**	Task list type **R** denotes that it's a rate routing. Each task list type represents a different function; for example, task list type **Q** represents quality inspection. For this example, enter rate routing **Group** "50000009" and **Group Counter** "1".
Alternative BOM	**1**	This is the BOM that you created in the previous step.
BOM Usage	**1**	In this field, **1** refers to the usage production.

REM allowed	Select checkbox	This checkbox selection is mandatory to denote that the production version is applicable and becomes available during the REM process.

Table 8.2 Parameters Entry in the Production Version

Field	Value	Additional Details/Remarks
Production line	**FURNACE**	Because REM is generally a simpler production process, only one production line (work center) is involved.
Receiv. location (not shown)	**1004**	Entering a value makes it a default setting, and the system automatically proposes it during GR or confirmation of the REM planned order.

Table 8.2 Parameters Entry in the Production Version(Cont.)

The **Lock** field in the **Production Version** area of the screen provides you with the flexibility to lock or unlock the production version anytime to allow or restrict accesses to the production version during the REM planned order creation. A locked production version won't be available for selection during the REM planned order creation.

Finally, click on the **Check** button (consistency check) to evaluate if the details incorporated in the production version are correct and valid.

The system confirms that it's able to find a relevant task list (rate routing) as well as the BOM, which meets the other criteria of the production version. This includes having validity dates for rate routing and the BOM, which falls within the validity specified in the production version as well as the lot sizes mentioned in the production version. Click on the **Cancel** icon.

The green traffic light against the task list as well as the BOM indicates that the consistency check was successful, and this production version will be available to the user during REM planned order creation. If a warning or error is observed during the consistency check, the system indicates that with a yellow or a red traffic light, respectively.

Note

The consistency check isn't a prerequisite to using a correct production version. But if you use this option, it will give you the needed confidence that you'll eventually have a valid production version to work with.

Click on **Close detailed screen and adopt changes**, and save the production version.

8.3 Material Requirements Planning in REM

We'll provide extensive coverage of MRP in Chapter 12 and Chapter 13. In this section, however, we show how you can use MRP for preplanning of REM-based manufacturing types. The preplanning process entails that you've already planned to produce predetermined quantities of a product and use MRP for comprehensive planning, including the components (BOM) of the product. It's important to note that there are no REM-specific details of MRP; REM uses standard MRP. For example, preplanning isn't a prerequisite for REM. You can also use REM based on sales orders only (MTO). For this example, we use strategy 40 (MTS production method), which is a typical case in REM. You can use any planning strategy in conjunction with REM (MTO and MTS).
We'll focus on a typical real-world example in the glass manufacturing industry.

For normal and standard planning, the planning process starts with either a sales order forming the basis of planning or quantities calculated from forecasting. Any or all of these quantities are forwarded to demand management, which ends up forming the PIRs. The MRP considers PIRs and generates procurement proposals, including planned orders. You evaluate the planning results and convert them into procurement elements for external procurement; you don't need to convert them any further or for REM types. The steps are as follows:

1. **Maintain planned independent requirements**

   Use Transaction MD61 to enter the PIRs into the screen shown in Figure 8.16. Enter the **Material** "30000061", **Plant** "1000", and **Version** "00", and then define the planning horizon from "01/09/2018" to "25/10/2019". Press (Enter). Next, enter planning quantities as maintained in Figure 8.16, and save the PIR. The next step is to run the MRP.

Figure 8.16 Planned Independent Requirements

2. **Run material requirements planning**

In this step, you run MRP Live by using Transaction MD01N. Figure 8.17 shows the initial screen to run MRP. Set the parameters as shown, and click **Execute** (not shown) to begin the process of running MRP. As soon as the system completes the planning process (MRP run), it displays the planning results.

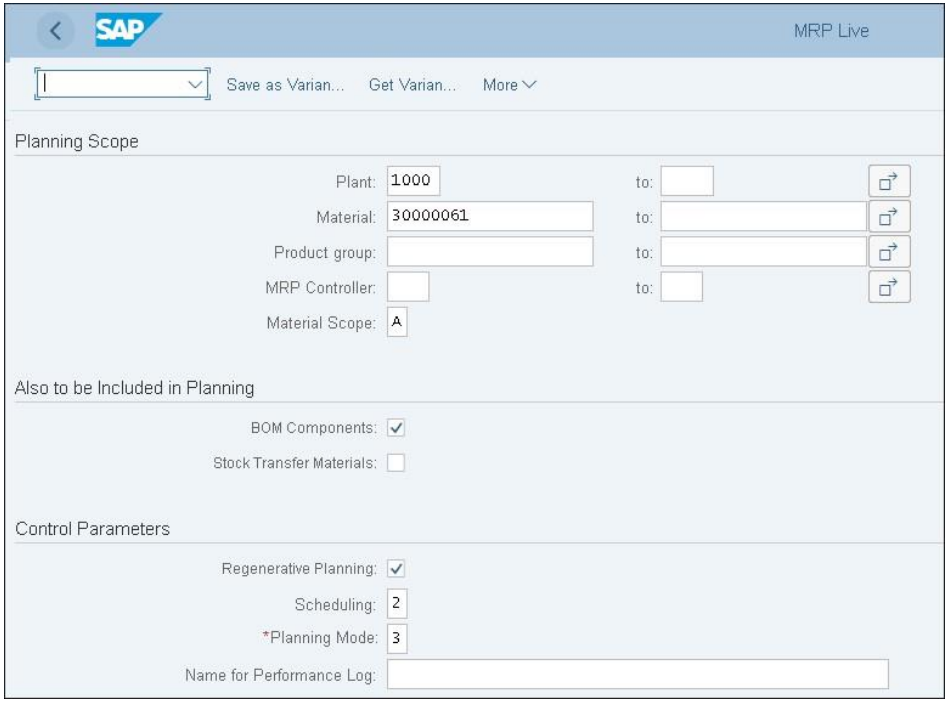
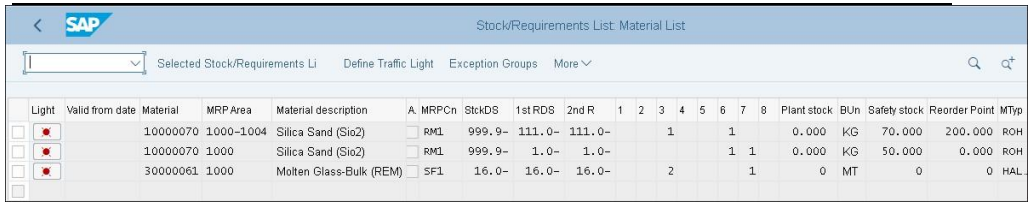


Figure 8.17 Initial Screen of MRP Live

3. **Display planning results**

Figure 8.18 shows the planning results for both material 30000061 and its associated components. The next step is to evaluate the planning results of material 30000061 by either double-clicking directly on the material or first saving the planning results and then using Transaction MD04 for material and plant combination to see the stock/requirements list. For this example, use the first option by directly double-clicking on the planning results of material 30000061 (the last material in the list).



Light	Valid from date	Material	MRP Area	Material description	A.	MRPCn	StckDS	1st RDS	2nd R	1	2	3	4	5	6	7	8	Plant stock	BUn	Safety stock	Reorder Point	MTyp
		10000070	1000-1004	Silica Sand (Sio2)		RM1	999.9-	111.0-	111.0-			1			1			0.000	KG	70.000	200.000	ROH
		10000070	1000	Silica Sand (Sio2)		RM1	999.9-	1.0-	1.0-						1	1		0.000	KG	50.000	0.000	ROH
		30000061	1000	Molten Glass-Bulk (REM)		SF1	16.0-	16.0-	16.0-			2				1		0	MT	0	0	HAL

Figure 8.18 Planning Results of the MRP Run

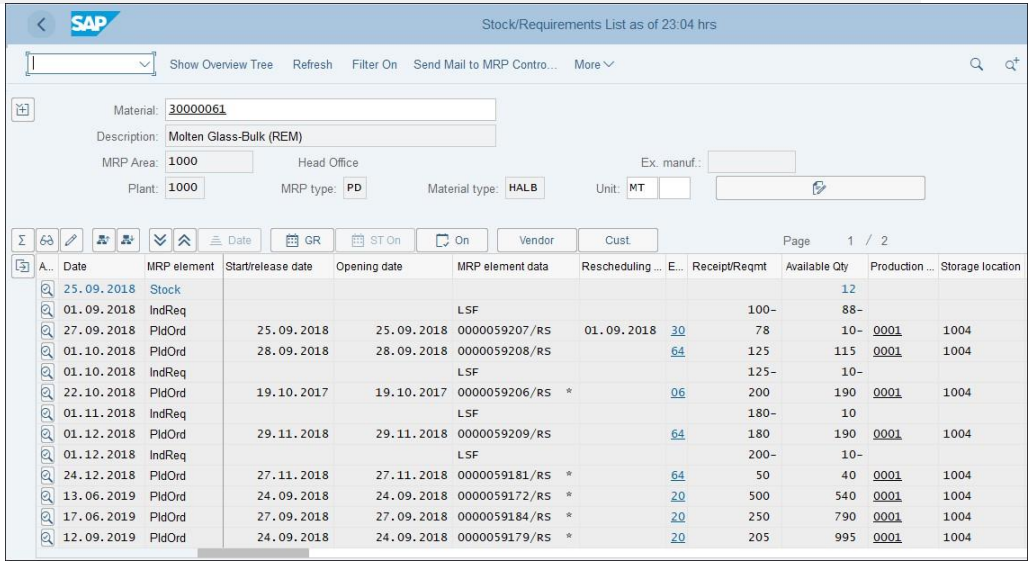
4. **Evaluate planning results (material level)**

   Double-click **Material 30000061** to open the screen shown in Figure 8.19. Here you see the planning results for material 30000061, which contains an available stock of 12 MT. Next, the system takes the existing and firmed RSQ (REM planned order) of 100 MT into account and arrives at a cumulative quantity of 88 as the available quantity.

Additionally, the system creates multiple planned orders to cater to the PIR.

Note

In principle, you should only make manual changes to the REM planned orders in Transaction MD04.



A..	Date	MRP element	Start/release date	Opening date	MRP element data		Rescheduling ...	E...	Receipt/Reqmt	Available Qty	Production ...	Storage location
	25.09.2018	Stock								12		
	01.09.2018	IndReq			LSF				100-	88-		
	27.09.2018	PldOrd	25.09.2018	25.09.2018	0000059207/RS		01.09.2018	30	78	10-	0001	1004
	01.10.2018	PldOrd	28.09.2018	28.09.2018	0000059208/RS			64	125	115	0001	1004
	01.10.2018	IndReq			LSF				125-	10-		
	22.10.2018	PldOrd	19.10.2017	19.10.2017	0000059206/RS	*		06	200	190	0001	1004
	01.11.2018	IndReq			LSF				180-	10		
	01.12.2018	PldOrd	29.11.2018	29.11.2018	0000059209/RS			64	180	190	0001	1004
	01.12.2018	IndReq			LSF				200-	10-		
	24.12.2018	PldOrd	27.11.2018	27.11.2018	0000059181/RS	*		64	50	40	0001	1004
	13.06.2019	PldOrd	24.09.2018	24.09.2018	0000059172/RS	*		20	500	540	0001	1004
	17.06.2019	PldOrd	27.09.2018	27.09.2018	0000059184/RS	*		20	250	790	0001	1004
	12.09.2019	PldOrd	24.09.2018	24.09.2018	0000059179/RS	*		20	205	995	0001	1004

Figure 8.19 Planning Results of Material 30000061

Save the MRP results (if you've used the simulation mode), and all of these planning details will become available in the REM planning table.

8.4 Planning Table

The planning table in REM is highly interactive and enables the planner to perform many functions and activities with all details automatically updated. For example, if you create a new planned order in the planning table, the system automatically updates the capacity requirements in the upper half of the planning table screen. The planning table also provides comprehensive visibility on material and capacity availabilities. In fact, important planning in REM, such as line loading planning, is generally undertaken in the planning table.

In the following sections, we'll discuss the planning table parameters and how to create orders.

8.4.1 Parameters Selection

To access the planning table in REM, follow the menu path, **LogisticsProductionRepetitive ManufacturingPlanningPlanning TableChange Mode**, or use Transaction MF50. Figure 8.20 shows the initial screen for the selection criteria, which allows you to enter important selection parameters. Based on the input parameters you define in the parameters selection screen, the ensuing planning table then displays the relevant information.

In REM, the system refers to the main information with reference to the production version of the material; therefore, you have the option to enter data specific to the production version on the selection screen. Some of the other selection options are **Production line**, **Material**, **Product group**, **MRP controller**, and so on.

For this example, enter **Plant** "1000" (entering either the **MRP area** or **Plant** on the parameter selection of the planning table is mandatory). Select the **Production line** radio button, and enter the work center or the production line "FURNACE", for which the system brings up the relevant data and other information in the planning table. Let's review the four tabs and the options available in the REM planning table.

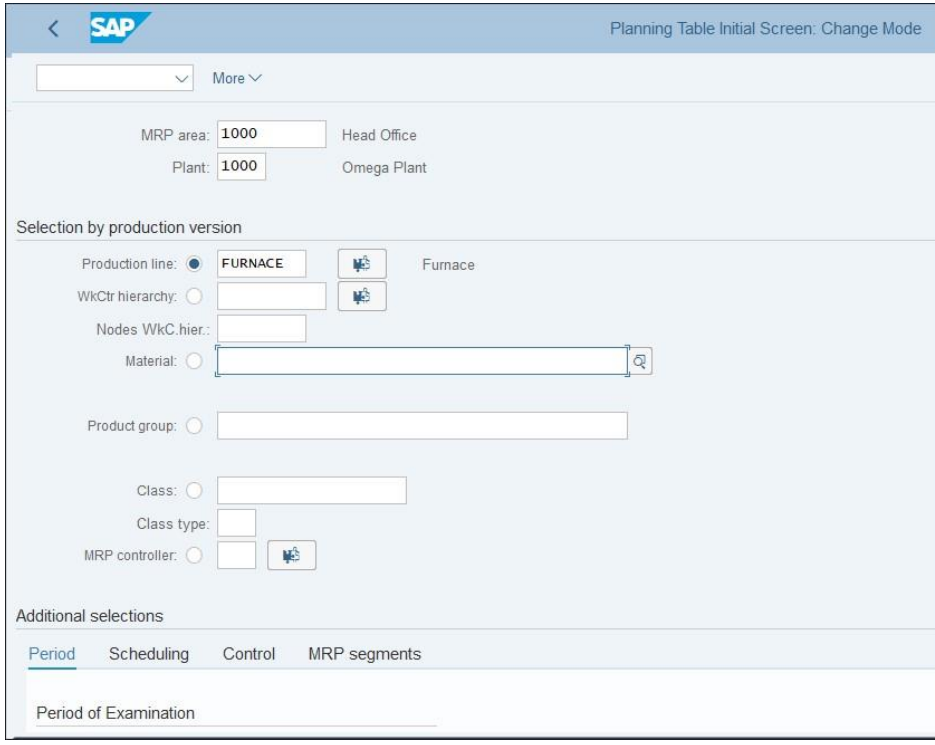


Figure 8.20 Initial Screen of the Planning Table

In Figure 8.211 and for **Start**, enter "24.09.2018", and for **End**, enter "23.03.2019". The system restricts the display of information in the planning table based on these start and finish dates. Additionally, the system won't show planning information in the planning horizon that lies outside the planning horizon. Assign the **Period** field by **W (Week)**, and the system shows planning details in a monthly basket. You can also choose to display planning information in the planning table, either in days or weeks.

Click on the **Scheduling** tab 2. The scheduling options available in this screen enable you to select options to make them available in the planning table. You can choose whether you want the system to perform rate-based planning and select whether it should consider basic dates or production dates during planning. You can also enable the system to perform capacity planning by selecting the relevant checkbox.

Note

We suggest that you make the same selection for the planning table as you did when you maintained the rate routing in the production version. Except, in this case, the capacity requirements can be evaluated properly during planning. We also suggest that you check on the configuration in Transaction OPU5 to see if the relevant settings are in place. We cover the settings for Transaction OPU5 in Chapter 3.

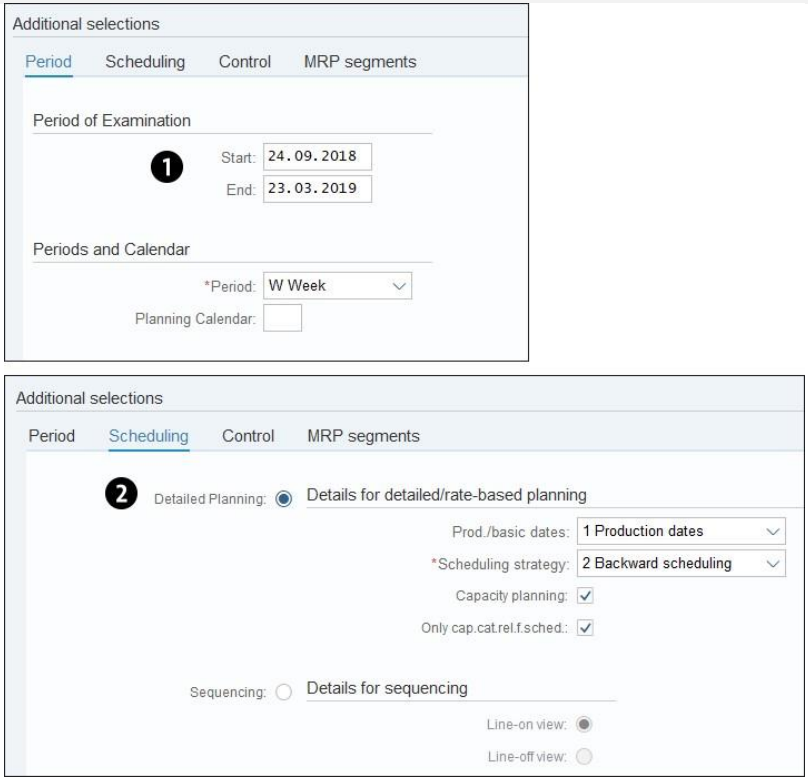


Figure 8.21 Period of Examination and Scheduling in the REM Table

Click on the **Control** tab in Figure 8.223 in which you can choose whether you want the system to show the **Material overview**, **line overview**, or both. You can also limit your information display in the planning table further if you select the **Sel. production only**

checkbox and then choose from the **Selection rule** dropdown option. In the selection rule, you can choose to display only receipts, requirements and stocks, or PIRs.

Click on the **MRP segments** tab 4 next, and you can choose to display various MRP elements, such as direct production and even sales document number for MTO production, by selecting the relevant checkboxes.

All of the parameter selection options are the same that you configured in Chapter 5, Section 5.3. However, you have the flexibility to change parameters, as we've done with **Scheduling strategy** in the **Scheduling** tab of the **Planning Table Initial Screen: Change Mode**. In our configuration for the scheduling strategy, we defined the scheduling strategy as **Backward Scheduling**, whereas in the **Scheduling** tab, we changed this to **Forward Scheduling**.

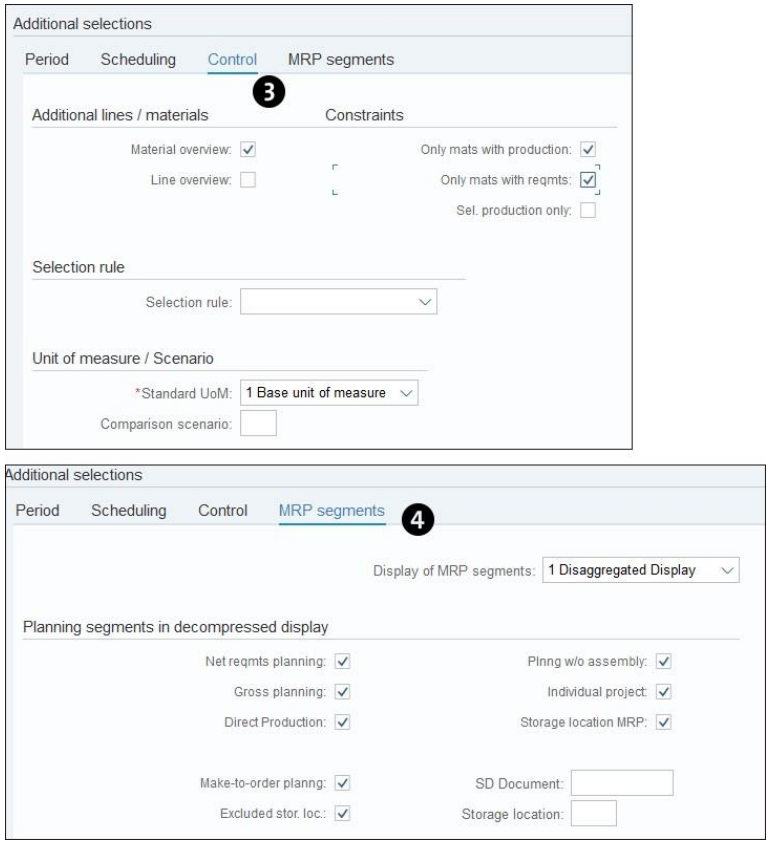


Figure 8.22 Control and MRP Segments in the REM Table

Click on the **Execute** button located (not shown) on the bottom right-hand corner of the **Planning Table: Initial Screen** shown earlier in Figure 8.20, and the screen shown in Figure 8.23 appears. The upper half of the screen displays the complete capacity data, including the required and available capacities of the production line, **FURNACE**, which you've maintained in the production version before.

Figure 8.23 Planning Table

The lower half of the screen displays material-specific information. In the **Preplanning** field, the system displays the same PIRs that you created in an earlier section (refer to Section 8.3).

The planning table also displays the settings you made in Chapter 5, Section 5.3, including

the display of available quantity, total production, total requirements, and the coverage as target stock.

Tips & Tricks

If you're unable to see editable fields such as **FURNACE** or **Not Assigned**, as shown in the planning table in Figure 8.23, double-click on the **Not Assigned** field under **Material Data**, and these fields will appear.

8.4.2 Creating a Repetitive Manufacturing Planned Order

As a planner, you often have to make changes to the existing planning elements, such as planned orders, or create new planned orders to account for production constraints or other practical realities, such as an unplanned plant or machine shutdown. Because the REM planning table is interactive, you can perform all the important planning functions and much more within the REM planning table. On exiting the REM planning table, you have to save your planning to enable the system to update the information accordingly.

For this example, create a new planned order by placing the cursor in the **FURNACE** field and entering a quantity of "350" for any week (column **W 42(15.10)**). Then double-click the field in which you entered the quantity 350 to open the screen shown in Figure 8.24.

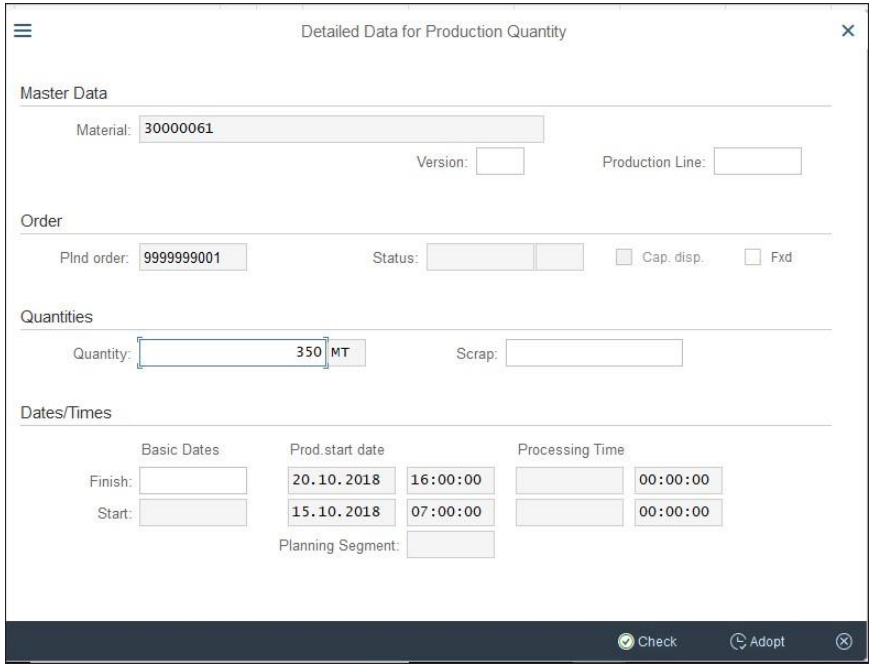


Figure 8.24 Planned Order Creation in the Planning Table

Here, the system has given a temporary planned order number (**Plnd order: 9999999003**) and enables you to make changes to the production version, production line, or production start or finish dates. You can also choose the **Fxd** checkbox, which will ensure that no changes are made to the planned order during the MRP run.

Click on the **Adopt** button, and the details are copied to the planning table.

You can double-click the **Quantity** field, and this time the system assigns a permanent planned order number to which you can make a large number of requisite changes, if desired. To make changes to the planned order, click on the **Change** icon (not shown), and Figure 8.25 appears. This screen shows that the REM planned order is referred to as **Run schedule quantity**, which is due to the fact that you created the new quantity directly on the production line. You can change the **Order Quantity** and add the **Scrap Quantity** to account for any production losses (see Figure 8.26). The system automatically copies all other details, such as storage location data and the production version number from the REM master data. Scroll down and the system also automatically selects the **Repetitive mfg** checkbox from **Version 0001** (not shown).

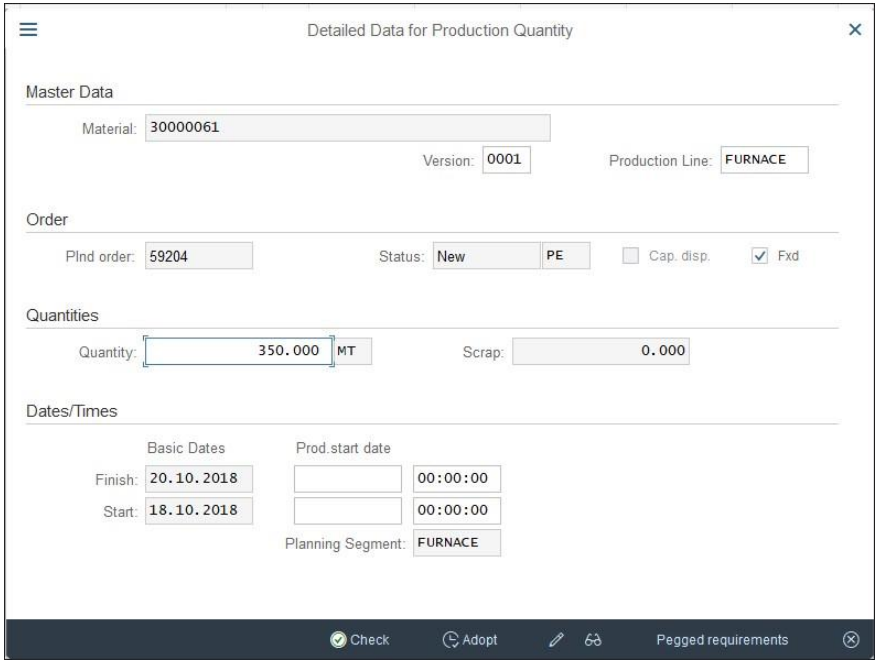


Figure 8.25 Header Screen of the Planned Order (Run Schedule Quantity)

The **Planned Order** checkbox in the **Firming** area (see Figure 8.26) indicates that during the MRP run, the system won't make automatic changes to this REM planned order. The system automatically firms all manually created REM planned orders, according to the setting you made in the REM profile in Chapter 5.

Click on **Schedule Planned Order** at the top of the screen, and the system shows the **Detailed scheduling** tab. When you've performed detailed scheduling for the material, you can choose **GotoCapacity Leveling** in the planned order, and the screen in Figure 8.27 appears showing the capacity requirement.

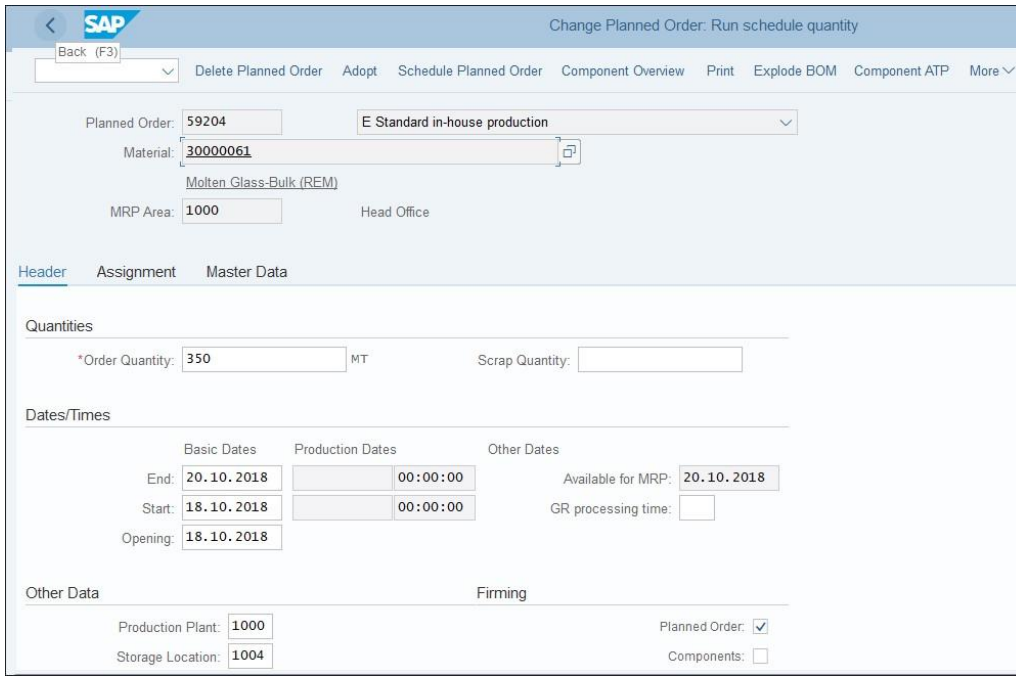


Figure 8.26 Scheduling a Planned Order

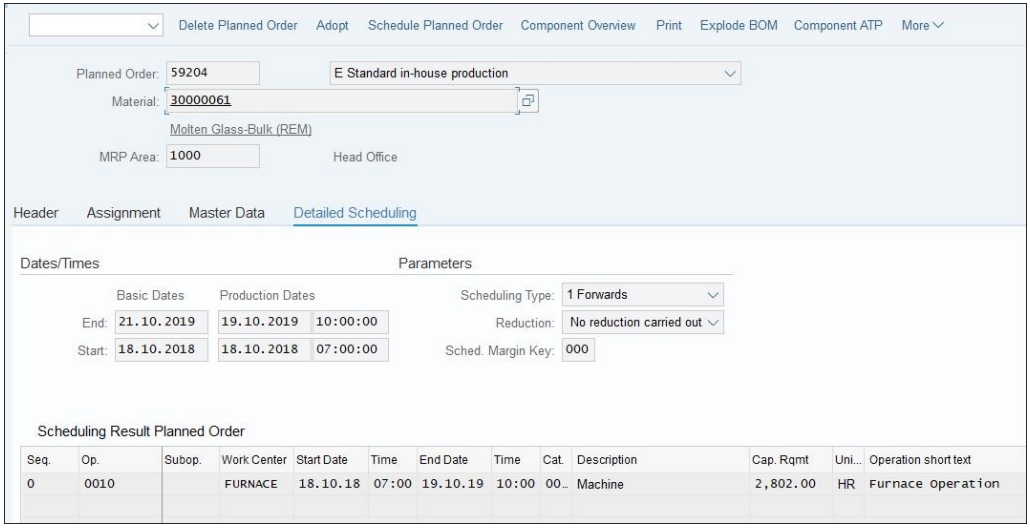


Figure 8.27 Capacity Planning

Clicking on **Component ATP** (available to promise) in Figure 8.27 will bring up the **Availability Check** screen shown in Figure 8.28 wherein out of the three components checked, the system found one component missing—**10000070**.

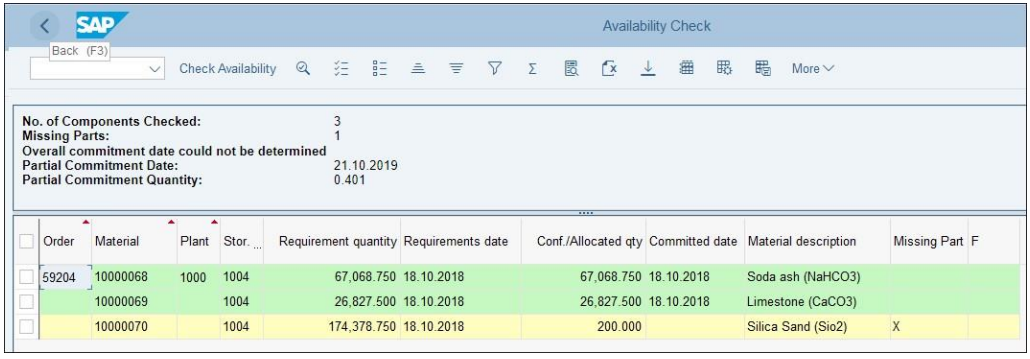


Figure 8.28 Components Availability

Tips & Tricks

Because you're in the **Change Planned Order** screen, you can perform a large number of activities and functions, for example, components availability check, capacity check, or reexploding the BOM for the material.

As an MRP planner, you can decide whether you want to use Transaction MD04 or Transaction MF50 for daily work. In Transaction MF50, you can work on a period basis, whereas in Transaction MD04, all work is order based.

8.4.3 Capacity Planning

If you go back to the REM planning table, you can set up graphics for capacity planning by clicking on the **Graphical Planning Table** icon. Within the REM planning table shown in Figure 8.29, you can evaluate the capacity situation (located in the upper half of the screen). Generally, at this stage, the capacity situation at the work center is agreed upon and already known, except in cases of urgent or immediate business need, such as sequence planning (within shifts or in days). The capacity planning function in the REM planning table is similar to the graphical planning table used in discrete manufacturing. It's therefore an exception rather than the norm to plan capacity in the planning table. Planned order **59206** located in the lower-half of the screen (in light blue shade) can be selected and dispatched to the production line, so it will appear in the upper-half of the screen (**Dispatched Production**).

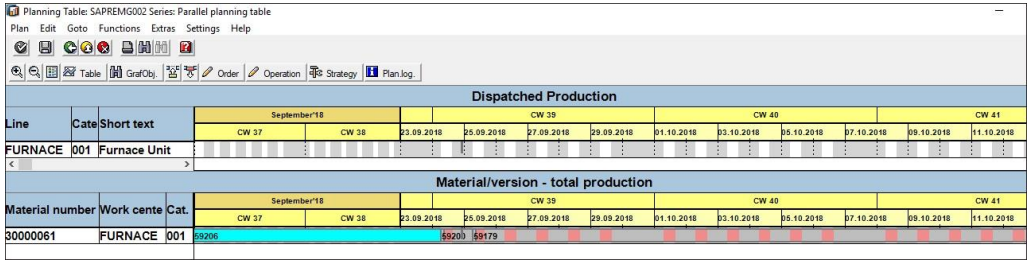


Figure 8.29 Capacity Planning

You can perform all of the CRP and capacity leveling functions in the REM planning table. Some of these functions include the following:

Rescheduling

Dispatching

Performing deallocation

Making changes to the REM planned order

Making changes to the rate routing operations

Note

See Chapter 15 for more about CRP.

8.4.4 Changes and Evaluations

You can make any changes or evaluations in the planning table, and the system updates all information on a real-time basis. Some of these functions are listed in Table 8.3.

Function	Function Detail
Create new planned order	Place the cursor on the **Not Assigned** field in the planning table, and click on this icon to create a new planned order.
Expand periods	Switch from the months planning periods to weeks.

Table 8.3 Selected Functions in the REM Planning Table

Function	Function Detail
Collapse periods	Switch from the days planning periods to weeks. The shift is the smallest period, whereas the month is the largest period.
Select material	Display more planning materials associated with the production line.
Select (production) line	Display production lines from the rate routing.
Hide material	Hide the already-displayed materials.
Hide (production) line	Hide the already-displayed production lines.
Graphical planning table	Display a graphical version of capacity planning.

Table 8.3 Selected Functions in the REM Planning Table (Cont.)

8.4.5 Range of Coverage

If you've already undertaken the necessary configuration for the range of coverage profile in the **MRP 2** view of the material master, then the option to evaluate the coverage becomes available in the planning table. You first have to activate it from the **View** menu. The range of coverage profile contains the parameters for calculating the dynamic safety stock. This is a statistical calculation on the basis of average daily requirements. The range of coverage profile includes, for example, maximum stock level, minimum stock level, target stock, statistical, and actual range of coverage.

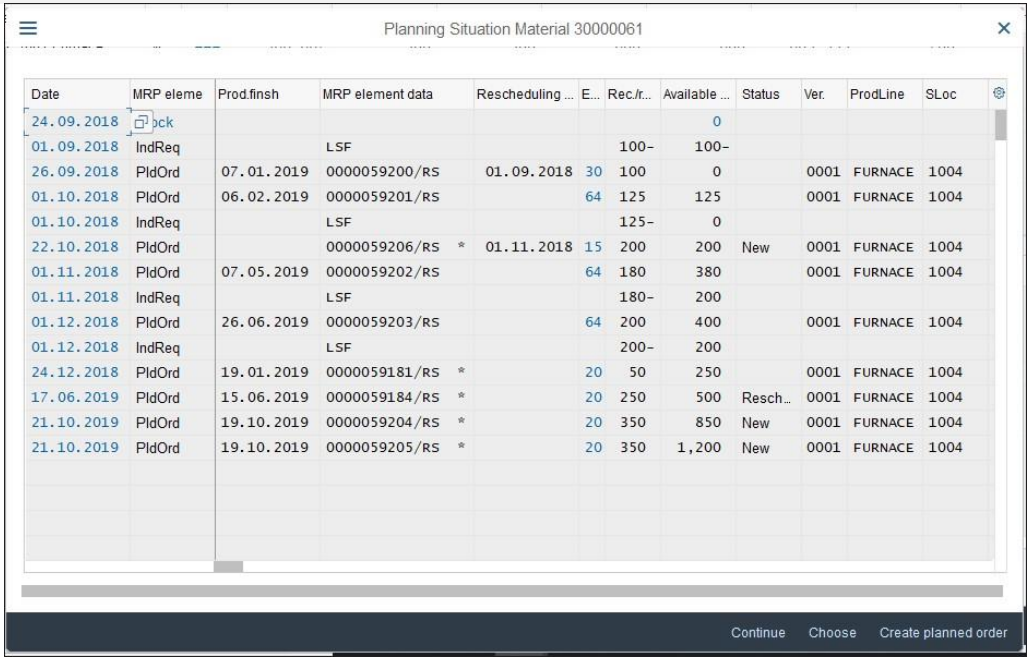
Because we've configured the **Target Stock** display in the **Coverage** field (refer to Chapter 5, Section 5.3.2, showing the **Coverage** field and the **Target Stock Level** value), the system displays the **Target Stock** as a default setting in the REM planning table. You can change this display (**Target Stock**) in the REM planning table by choosing **ViewRange of Coverage Profile** (see Figure 8.30). You can select the maximum or minimum stock level displays in the planning table.

Material Data	Un	Due	W 39 (24.09)	W 40 (01.10)	W 41 (08.10)	W 42 (15.10)	W 43 (22.10)	W 44 (29.10)	W 45 (05.11)	W 46 (12.11)	W 47 (19.11)	W 48 (26.11)
30000061 Molten Glass-Bul...	•••											
Available Quantity	MT	-88	-10	-10	-10	-10	190	10	10	10	10	-10
Preplanning	MT	100		125				180				200
Σ Total Requirements	MT	100		125				180				200
Actual Range of Cov.	•••						34.1	25.1	22.1	16.1	10.1	
0001 FURNACE	MT						200					
Not Assigned	MT											
Σ Total Production	MT						200					

Figure 8.30 Actual Range of Coverage in the REM Planning Table

Note

We encourage you to explore the features and functionalities in the planning table for REM. For example, clicking on the **Situation** icon in the REM planning table will bring up Figure 8.31.



Date	MRP eleme	Prod.finsh	MRP element data		Rescheduling ...	E...	Rec./r...	Available ...	Status	Ver.	ProdLine	SLoc
24.09.2018	ock							0				
01.09.2018	IndReq		LSF				100-	100-				
26.09.2018	PldOrd	07.01.2019	0000059200/RS		01.09.2018	30	100	0		0001	FURNACE	1004
01.10.2018	PldOrd	06.02.2019	0000059201/RS			64	125	125		0001	FURNACE	1004
01.10.2018	IndReq		LSF				125-	0				
22.10.2018	PldOrd		0000059206/RS	*	01.11.2018	15	200	200	New	0001	FURNACE	1004
01.11.2018	PldOrd	07.05.2019	0000059202/RS			64	180	380		0001	FURNACE	1004
01.11.2018	IndReq		LSF				180-	200				
01.12.2018	PldOrd	26.06.2019	0000059203/RS			64	200	400		0001	FURNACE	1004
01.12.2018	IndReq		LSF				200-	200				
24.12.2018	PldOrd	19.01.2019	0000059181/RS	*		20	50	250		0001	FURNACE	1004
17.06.2019	PldOrd	15.06.2019	0000059184/RS	*		20	250	500	Resch...	0001	FURNACE	1004
21.10.2019	PldOrd	19.10.2019	0000059204/RS	*		20	350	850	New	0001	FURNACE	1004
21.10.2019	PldOrd	19.10.2019	0000059205/RS	*		20	350	1,200	New	0001	FURNACE	1004

Figure 8.31 Planning Situation

8.5 Material Staging

Material staging refers to the step in which the components from the replenishment storage location are transferred to the issuing storage location. These components are consumed during the actual production process. This step involves the stock transfer transaction with standard movement type 311, and it transfers stock from the replenishment storage location to the issuing storage location. The system issues or backflushes the components of the material from an issuing storage location.

Tips & Tricks

The alternative term used in material staging is *pull list*. A pull list provides details on which material's components are faced with shortages. At the same time, it also triggers stock transfers. You can also use storage location MRP or Kanban as the pull list.

You can view the current or existing material situation of the planned orders before proceeding to stage the materials. Evaluating the current material situation gives you a better idea, as well as helps in deciding which components you should stage first. Material staging in REM is typically carried out with reference to a certain time horizon or a certain time interval, for example, a shift or until the end of the week. Except for MTO, you don't stage material with reference to any specific planned order. Similarly, the GR of the material produced is period based, with or without reference to planned orders.

In the following sections, we'll explain how to view the current situation, trigger replenishment, evaluate the material documents that the system created for material staging, and perform collective availability checks.

8.5.1 Current Situation

To view the current situation in the pull list, follow the menu path, **LogisticsProductionRepetitive ManufacturingMaterial StagingPull List – Current Situation**, or use Transaction MF63.

In the initial parameters selection screen, you can choose from a large number of selection options and also define the end date for requirements in the **Selection Horizon for Rqmts** field**.** This is the date until which the system will consider requirements of materials. There are also selection options if your company uses the Kanban production process or has integrated with either warehouse management (WM) in SAP S/4HANA or embedded Extended Warehouse Management (EWM) in SAP S/4HANA.

For this example, define the **Plant** as "1000" (this is a mandatory entry requirement), and set the **Selection Horizon for Rqmts** as "25/08/2018"—the end date until which the system will consider all materials requirements. If the materials requirements lie outside the horizon, they won't show up in the current list of material staging.

Further limit your selection to **Production Line** (work center) "FURNACE", and choose **Execute** or press (F8). This brings up the screen shown in Figure 8.32. The system

shows the current stock and requirements situation of the planned orders in detail. It also shows the available stock, as well as the shortage quantities for the period under evaluation. The system shows the shortage quantity of each individual material.

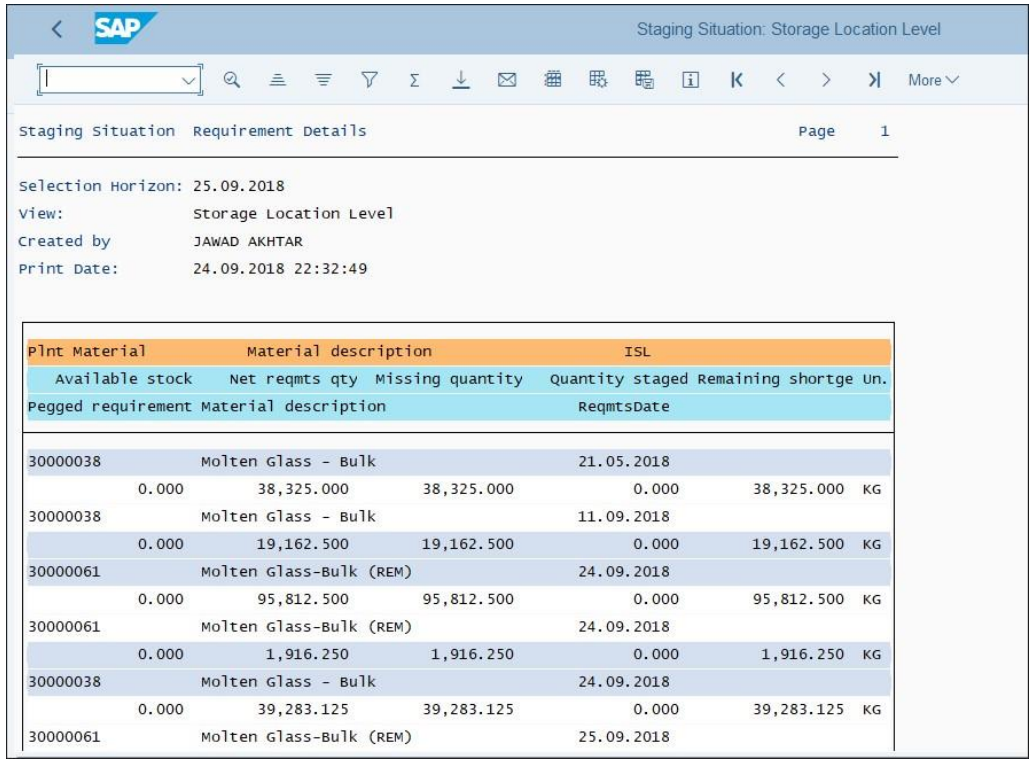


Figure 8.32 Staging Situation: Storage Location Level

8.5.2 Trigger Replenishment

To trigger replenishment from one storage location (replenishment storage location) to another (issuing storage location within a plant), follow the menu path, **LogisticsProductionRepetitive ManufacturingMaterial StagingPull List – Trigger Replenishment**, or use Transaction MF60.

You can enter the initial parameters in the selection screen, which takes you to the screen shown in Figure 8.33. Note that the subsequent screen appearance will greatly depend on the parameters that you defined on the initial parameters selection screen.

In the upper half of Figure 8.33, the system shows a summarized view of three materials (10000068, 10000069, and 10000070); the system needs varied quantities against various planned orders. This is the same quantity shortage you've seen previously in Section 8.5.1.

You can click on the **Replenishment Proposals** button in Figure 8.33, and the details in the lower half of the screen appear, including details of various requirements for the three materials.

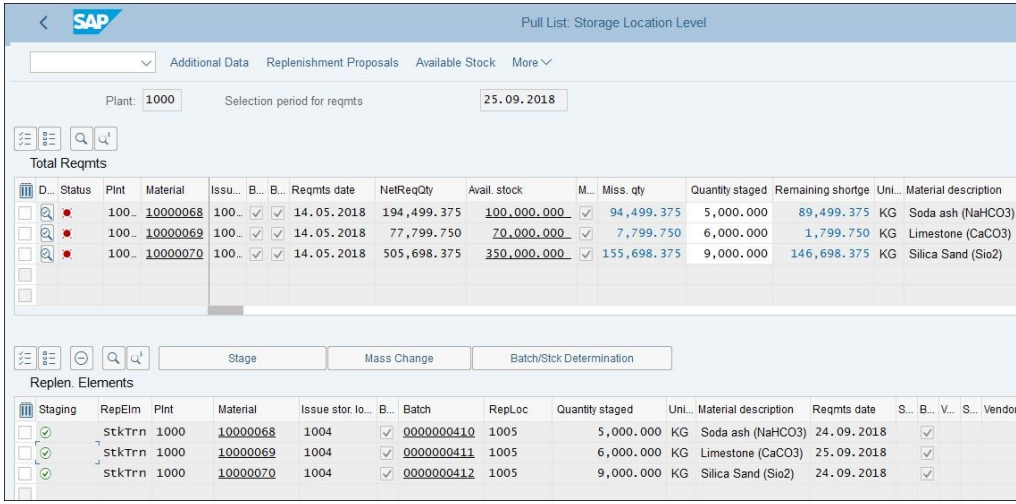


Figure 8.33 Pull List at the Storage Location Level

Click on the **Additional Data** button to see the detailed information on the requirements for each of the materials. For the first material, enter the **Quantity staged** as "5000", and in the lower half of the same screen, enter the **RepLoc** (replenishment storage location) as "1005" (not shown).

The system is able to detect the replenishment storage location automatically if you've activated it in the global settings of the transaction. Select the line item, and click on the **Stage** button.

If the staging is successful, the system displays the relevant message on the left-hand side of the screen (see the **Staging** column and the green checkmark) and also turns the status traffic light green. Because this is a transfer posting between two storage locations, the system creates a material document. A material document records the details of inventory movements. You can use Transaction MIGO to view the material document created after material staging.

8.5.3 Collective Availability Check

As a production planner, it's important that you frequently and consistently monitor the availability of the components that are needed to produce the material. While you can

always perform an availability check of an individual planned order in REM, it's more efficient if you perform a collective availability check on several materials simultaneously to gain a better understanding of the material availability situation and then plan or take action accordingly.

In the collective availability check option, you can use a large number of selection parameters to choose the information that the system should display.

To perform a collective availability check, use menu path, **ProductionRepetitive ManufacturingPlanningCollective Availability Check**, or use Transaction MDVP. On the initial screen, enter the desired parameters, and choose **Execute** or press (F8). If the system finds a materials shortage, it identifies the shortage with a red traffic light. You can then click on the **Missing Parts** icon for an in-depth analysis and evaluation because it contains details of the requirements versus available quantities as well as the dates when the required and shortage material should be in store to timely initiate the production process. The availability check function in SAP checks the availability but isn't able to trigger replenishment.

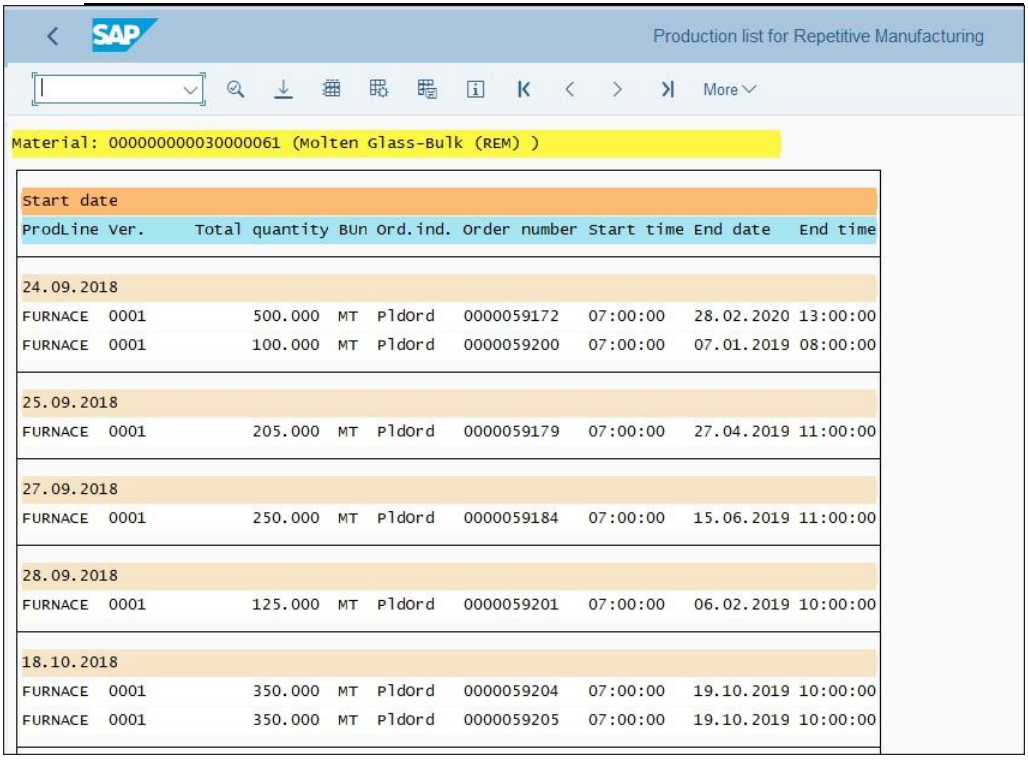
8.6 Production List

A *production list* is a list of REM planned orders that you can print for your information and record. You can create and print the production list for a specific production line or work center hierarchy. This is helpful for production supervisors and line operators (shop floor), who don't have access to the SAP system, for their information as well as for necessary planning and action, where needed. On the selection screen, you can even choose how the ensuing production list should appear as an output.

To create a production list, follow the menu path, **LogisticsProductionRepetitive ManufacturingPlanningProduction List**, or use Transaction MF51.

In the initial selection parameters screen, you can choose to print the production list based on the defined period, and you can choose if you want the system to consider only firmed planned orders, scheduled planned orders, or dispatched planned orders.

For this example, define the period of examination as **01/01/2018** to **25/09/2020**, and enter the **Production line** as "FURNACE". Choose **Execute** or press (F8) to open the screen shown in Figure 8.34. This screen shows the production list of REM planned orders. In the period under evaluation, there are a few REM planned orders in the production list. These are RSQs, which means that you can proceed with production because they are already assigned to the production line **FURNACE**.



Start date									
ProdLine	Ver.	Total quantity	BUn	Ord.ind.	Order number	Start time	End date	End time	
24.09.2018									
FURNACE	0001	500.000	MT	PldOrd	0000059172	07:00:00	28.02.2020	13:00:00	
FURNACE	0001	100.000	MT	PldOrd	0000059200	07:00:00	07.01.2019	08:00:00	
25.09.2018									
FURNACE	0001	205.000	MT	PldOrd	0000059179	07:00:00	27.04.2019	11:00:00	
27.09.2018									
FURNACE	0001	250.000	MT	PldOrd	0000059184	07:00:00	15.06.2019	11:00:00	
28.09.2018									
FURNACE	0001	125.000	MT	PldOrd	0000059201	07:00:00	06.02.2019	10:00:00	
18.10.2018									
FURNACE	0001	350.000	MT	PldOrd	0000059204	07:00:00	19.10.2019	10:00:00	
FURNACE	0001	350.000	MT	PldOrd	0000059205	07:00:00	19.10.2019	10:00:00	

Figure 8.34 Production List

Operational Methods Sheet

The operational methods sheet (OMS) is primarily used for production personnel to have a clear understanding and step-by-step directions involved in producing a material. You can configure the layout and the information that you want to see on the OMS. It integrates with Microsoft Word, and you can make any last-minute changes and print it. Further, there is an option to print the sheet at the header level or at the operation level.

To print an OMS, follow the menu path, **LogisticsProductionMaster DataLine DesignRate RoutingPrint Operational Method Sheets**, or use Transaction LDE1. On the initial parameters selection screen, enter **Material** “30000061” and **Plant**

"1000". It's also important to select a template for either the cover sheet or individual operation, or both. For this example, select the template for the individual operation, and choose **Execute** or press (F8). Word opens, and when the system asks you to choose to enable or disable the macros, choose **Enable**.

8.7 Confirmation

Assume that your company manufactures products on a long production line with a long lead time. With long lead times, the GIs for the components may be posted much later in the system than when they are actually physically withdrawn. All components used along the production line are usually backflushed during final confirmation. However, the GIs for the first components at work centers are posted on time and not by backflushing with final confirmation at the end of the production line.

An REM confirmation indicates that you've performed actual production and are now entering the details of the goods produced in the system. It's important to note that during the assembly backflush, the system automatically posts the component consumptions (GI).

Depending on how you've set up the REM profile and assigned it to the material, the system accordingly performs the necessary functions. In this case, it makes sense to use RP confirmation to post the withdrawal of components (and production activities) at an earlier stage after operations are already completed.

In the following sections, we cover how you can perform confirmation for REM assembly, REM components, and REM activities. We'll give you an overview of when and how backflushing should be used in REM situations, as well as the different types of backflushing that are available in REM.

8.7.1 Overview

When you post the GR for the finished parts during confirmation, a number of different actions are performed by default (these are controlled to a large extent using the REM profile):

Posting GI for the components used by using the backflush option

Reducing RSQs/planned orders and the associated capacity requirements on the production lines

Posting production costs incurred (material costs, production activities, overhead costs) to a PCC

Creating a data entry document (material and/or financial document)

Updating statistics in the logistics information system (LIS)

Other optional actions (see the **Details** icon in the confirmation transaction) include the following: Taking account of the setup costs for material quantities that are independent of their lot sizes

Posting component/assembly scrap

Performing collective entry for different materials in a line

Archiving confirmation documents

Performing GI confirmation only or activity confirmation only (more/less activity)

Using RP confirmations

Decoupling confirmation processes

Performing aggregation

Using postprocessing and reversal options

In addition, production based on sales orders enables confirmation with reference to sales orders.

Note

We configured the REM profile PP10 in Chapter 5, Section 5.1; please revisit that chapter to view which settings were made.

Although the system-recorded components' consumptions are based on a BOM calculation, you have the option to make changes to consumption quantities during the REM assembly backflush. Separately, you also use this component's backflush option to record excess component consumption, either against a specific REM planned order or for general consumption during the production process.

The confirmation can be any of the following types:

Assembly confirmation

The production of goods is complete, and you want to record the yield of the produced material. At the same time, you're also recording the consumption of the components against the produced goods based on the standard BOM. The user can also record the assembly scrap on the same screen with a different posting.

Component confirmation

You can record the *extra consumption* of the components against the produced goods based on the standard BOM. You can also record the component scrap on the same screen. Further, you can also issue components if backflush isn't applicable (this scenario isn't used often).

Activity confirmation:

You can record *excess consumption* of the activities, such as machine hours, labor hours, or setup hours, against the produced goods based on the rate routing. You can also record the activity scrap on the same screen.

As with assembly backflush, several options are available on the component backflush screen:

Record corresponding information during REM confirmation and backflush. This flexibility is available because the REM production type caters to all MTS or MTO productions.

Record components' scrap, either with reference to the assembly material or as standalone. The movement type for scrap is 551.

Reverse the material document for an already-posted consumption or scrap.

Perform a reversal function, without reference to any material document.

8.7.2 Assembly Confirmation

To access the REM confirmation for an assembly backflush, follow the menu path, **LogisticsProductionRepetitive ManufacturingData EntryRepetitive Manufacturing Confirmation**, or use Transaction MFBF. In the initial screen of REM confirmation, select the **Assembly backflush** radio button (see Figure 8.35). You use the screen to confirm the production yield as well as record components' consumption and activities (if configured in the REM profile).

You can also record assembly scrap by clicking on the **Scrap** button. We cover how to record assembly scrap later in this chapter in Section 8.8.3.

If you click on the **Details** button, the system brings up the REM profile (in this example, PP10), in which you can still change the following options:

Post activity backflush

Stock posting to unrestricted, quality, or blocked stock

Backflushing options, for example, from online to background

Post ordering costs

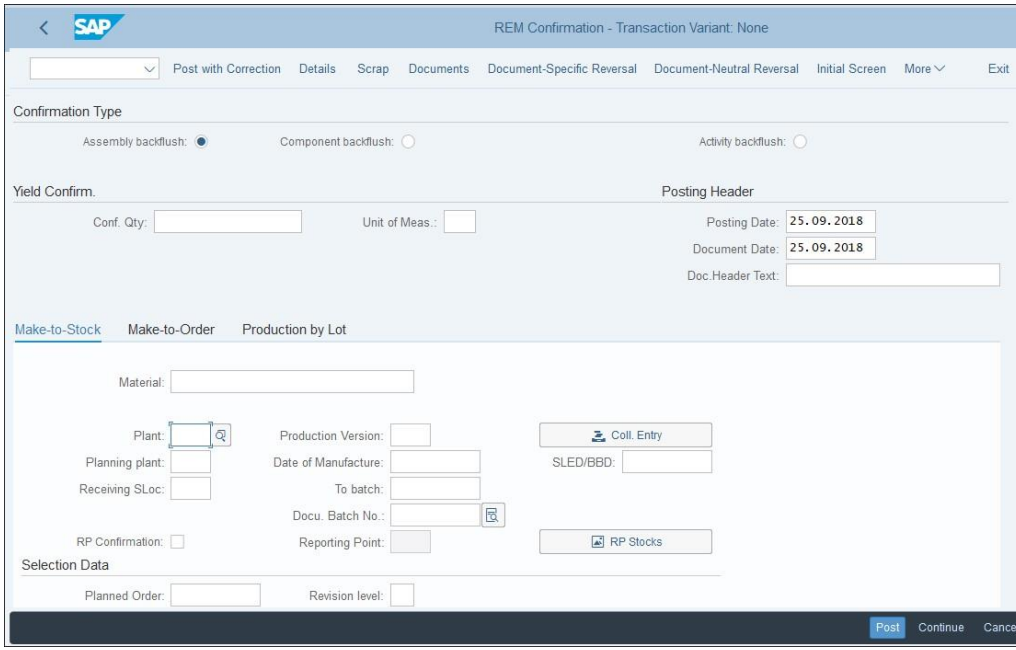


Figure 8.35 Assembly Backflush in REM Confirmation

You can assign the posting date as the document date on which you want to post the REM assembly backflush. Further, you can also use this screen for document-specific or document-neutral reversals of the entered values. We cover document-specific reversal in Section 8.8.

It's also important to note that you have the flexibility to record the yield of the assembly without reference to the REM planned order because then the system is able to account for period-based confirmation. However, doing so won't reduce the quantity specific to the planned order for the MTS scenario (if such settings are made in the REM profile). For MTO, the system reduces the planned order quantity.

The three tabs **Make-to-Stock**, **Make-to-Order**, and **Production by Lot** cater to various production scenarios.

8.7.3 Component Confirmation

As soon as you select the **Component backflush** radio button shown previously in Figure 8.35, the system offers the following two options: **No BOM explosion (Manual Component Entry)**

In this option, you have to enter the assembly in the **Material** field so that the system is able to find the link with the PCC. If you then select **No BOM explosion**, the **Process component list** is empty. **Propose Components acc.to BOM**

This option enables you to enter a quantity of the assembly material, and the system explodes the assembly BOM and proposes the component quantities for backflush or excess consumption. While selecting this option, you need to provide the reference quantity of the assembly material.

You can also select if you want excess component consumption for a specific RP or after the last RP by selecting the relevant radio button. This radio button only appears if you enter a valid RP.

8.7.4 Activities Confirmation

When you select the **Activity backflush** radio button in the REM confirmation screen (Transaction MFBF) shown earlier in Figure 8.35, the system displays the following two options:

No planned activities from rate routing

In this option, you have to enter the material number together with the activity types as well as the corresponding duration of each activity. The system doesn't make any suggestions.

Fetch planned activities from rate routing

With this option, when you enter the quantity of the assembly material, the system refers to the rate routing of the assembly material and proposes the details. When selecting this option, you need to give the reference quantity of the assembly material.

8.7.5 Actual Assembly Confirmation

In the screen shown in Figure 8.36, you now perform the actual assembly backflush posting for **Material 30000061**, **Plant 1000**, and **Production Version 0001**. The yield confirmation for the material in this REM assembly backflush is **10 MT**.

Because the configured and assigned REM profile PP10 stipulates that there should be mandatory RP backflushing, select the **RP Confirmation** checkbox, and also assign **Reporting Point 0010**.

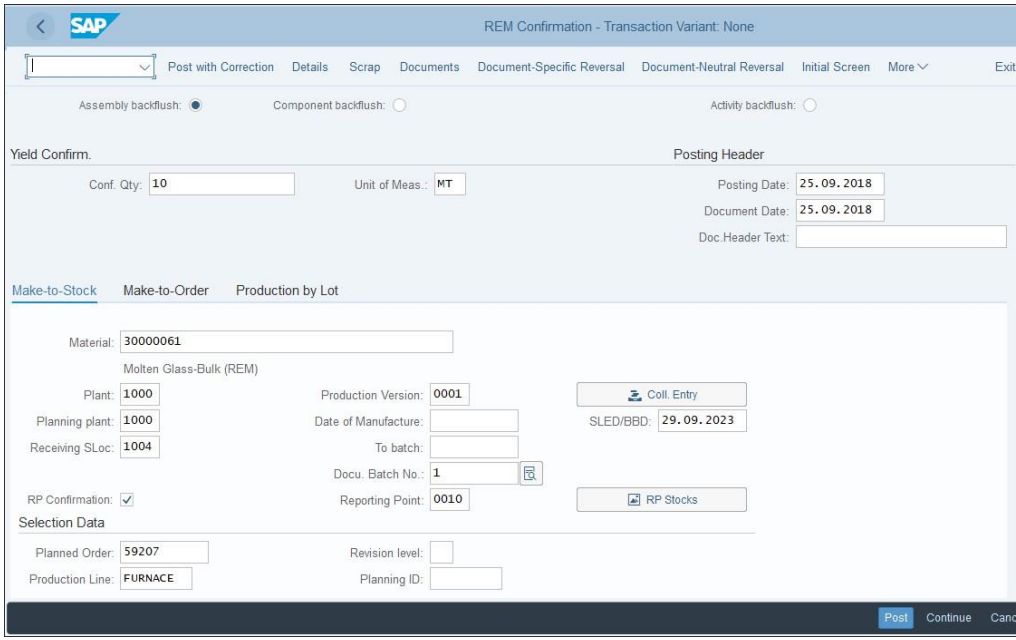


Figure 8.36 Assembly Backflush against the Planned Order

RP backflush in REM occurs when the system is able to automatically backflush several operations in the processing sequence. Using the RP backflush procedure, you can backflush components synchronized with actual consumption as much as possible. From the controlling perspective, RP backflush displays WIP for assemblies that haven't completely been backflushed. The REM profile controls whether you can use the RP backflush for a material; further, you use the control key to determine whether an operation is an RP operation (milestone). If so, then all previous operations that haven't been confirmed yet or all previous operations that aren't mandatory RPs are automatically backflushed together. If several operations are marked as RPs, the system should backflush components according to the processing sequence of the RP operations.

Save your entries at this stage, and the system performs the following three functions:

Performs GR (yield confirmation) of 10 PC for material 30000061

Performs backflush (GI) of components according to the BOM of 30000061

Records and updates activities according to the rate routing of material 30000061

Click on the **Post with Correction** button in the menu bar to open the screen in Figure 8.37, which shows that the system is performing two functions simultaneously. First, it's confirming the yield of **5 MT** for the assembly **Material 30000061**; then, in the second step, it's recording the consumption of all the components that are used in the production of the assembly. Notice the **Movement Type 261**, which indicates consumption or GI as shown in Figure 8.38.

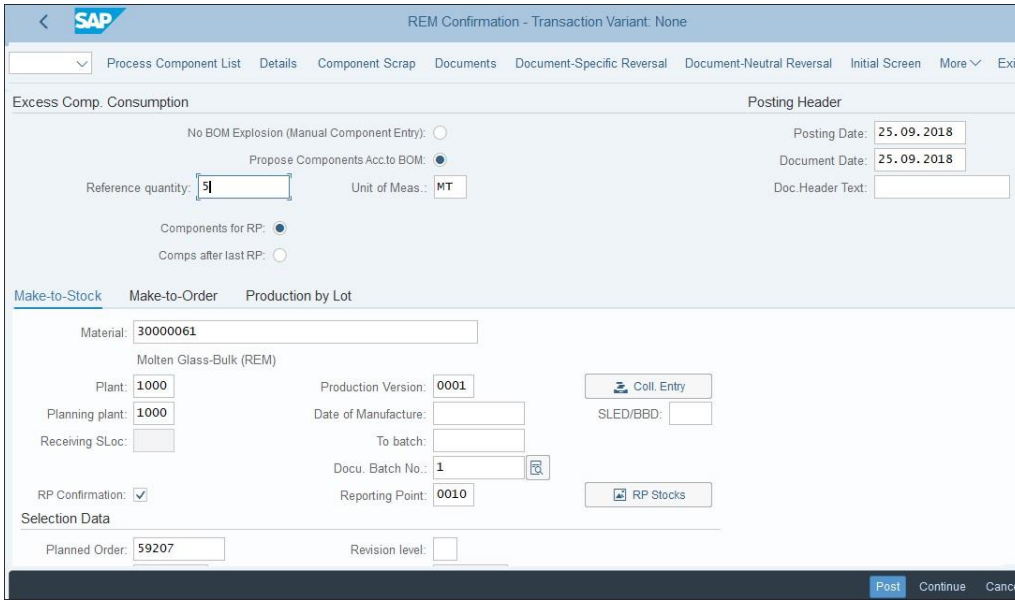


Figure 8.37 Components Overview of Assembly Backflush

You can change the quantity of any component, if needed, and add or delete components, as necessary. For example, to overwrite (change) the quantity of component 10000069, you need to overwrite the quantity given in the **Quantity** column (see Figure 8.38).

Similarly, to delete a component from this figure, you need to first select the component, and then click on the **Delete** icon. In the ensuing screen of **Processing Activities**

(see Figure 8.39), you can make changes to the activities such as machine hours or labor hours. It takes the standard duration details from the rate routing of material 30000061. You can make changes to the durations to reflect actual durations (whether on the higher or lower side), and the system correspondingly and automatically updates the cost details when you save the confirmation.

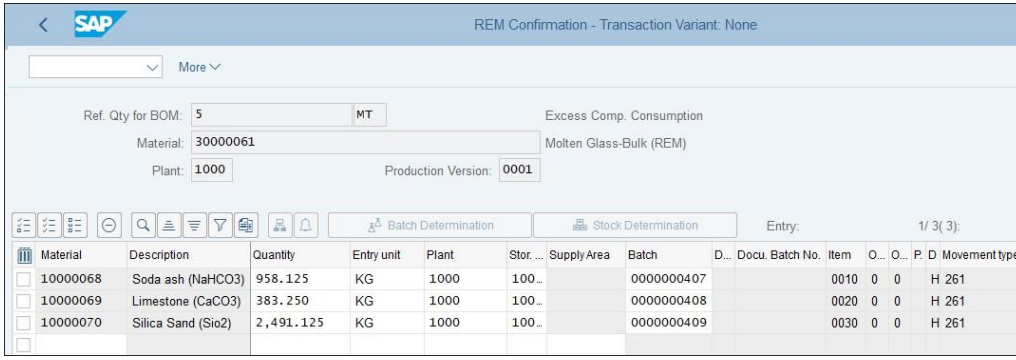


Figure 8.38 Posting Excess Comsumption

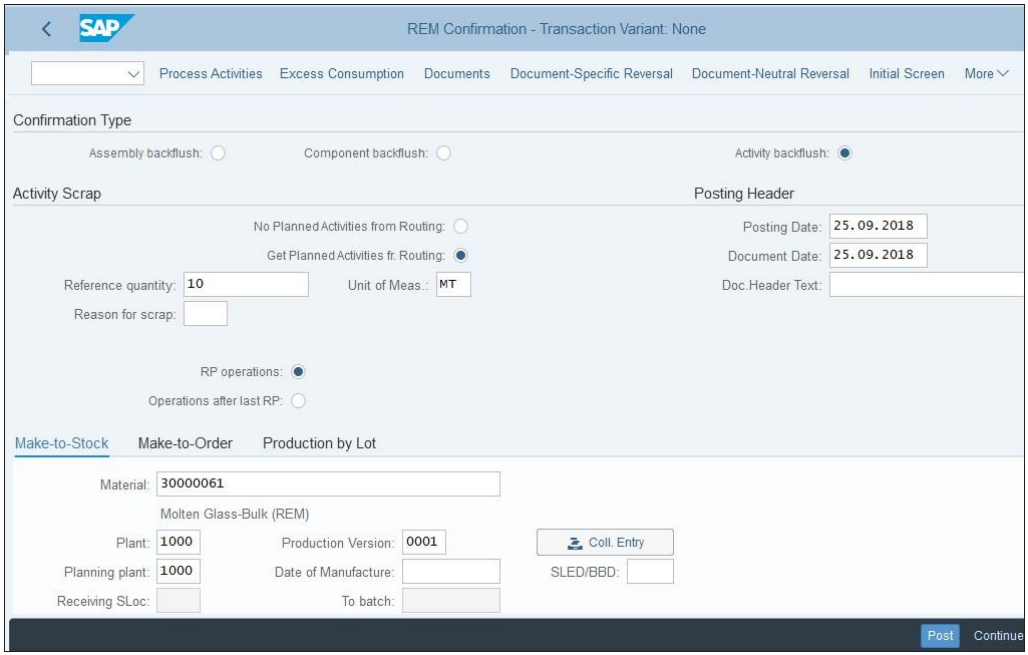


Figure 8.39 Processing Activities

In the **Reason** field, you can also define the reason for the excess consumption of activities. This is also known as reasons for variance. When you run the standard SAP system reports, you can give reasons for variance as one of the selection criteria to generate a report, which eventually helps in analysis and evaluation. Examples of reasons for variance can be machine malfunctions, electrical faults, labor shortages, emergency shutdowns, and so on.

Note

Reasons for variances in confirmation are plant-specific, and you can define them using configuration Transaction OPK5.

Tips & Tricks

When defining reasons for variance, you should take your past experience into account on the major or possible reasons that resulted in delayed production, excess consumption, and so on. You should also consider which reasons are important for your analysis and reporting purposes and thus should be available as a selection option when running standard or custom-developed reports.

When you save the REM assembly backflush, the system issues the following message at the bottom of the screen confirming the goods movements (GI and GR) and activities posting: **GR and GI with document XXX and activities posted**. This means that the system successfully posted GR (production yield), GI (components consumption), and recording of the actual production activities durations. It's important to add that the business process depends on whether the planned activities, per the rate routing, have been adjusted manually during the confirmation according to the real production efforts or not.

8.7.6 Separated Backflush

If you have a large number of backflush processes to manage—that is, a high volume of data entry for GI as well activity postings—you can use the separated backflush functionality. In separated backflush, you can let the system post GI and activities during the slower time of the day (or even schedule it at night). You can control whether you want separate backflush in the REM profile creation (configuration).

To perform separate backflush, follow the SAP menu path, **LogisticsProductionRepetitive ManufacturingData EntrySeparated Backflush**, or use Transaction MF70.

Enter the appropriate parameters on the initial screen, and select the appropriate checkboxes, such as **Post Goods Issue** and/or **Post Production Activities**.

8.7.7 Postprocessing of Components

If you've defined that you don't want the system to perform online error correction during REM confirmation, then you can correct these errors later. The nature of the error can be that there were insufficient component quantities for backflush (GI) during confirmation, for instance, due to incorrect or delayed postings in materials management (MM). Alternatively, there can be errors when the system is unable to find the storage location to backflush (GI) components from.

It's important to ensure that you do attend to these errors later because these continue to accumulate in the incorrect goods movement log. To postprocess components (or other errors), follow the SAP menu path, **LogisticsProductionRepetitive ManufacturingData EntryPostprocessPostprocessing Individual Components**, or use Transaction COGI.

Note

To use Transaction COGI, you also need to ensure that you've selected the **Also create individual postprocessing records** option in the REM profile.

Enter the appropriate parameters on the initial screen, and choose **Execute** or press (F8). The ensuing screen lists all the confirmations in which the system found errors and wasn't able to process them successfully. You can even display the details of the errors to help you understand why they occurred, for example, a missing storage location.

Note

The standard tool for REM postprocessing is Transaction MF47.

8.7.8 Collective Confirmation

The SAP system provides an option to collectively enter a large volume of data that you don't need to enter and post individually. However, this option is limited to

recording assembly backflush and assembly scrap. As already covered, with assembly backflush, the system records production yield and consumes components according to the BOM. For assembly scrap, it consumes additional components of the assembly with reference to the assembly's BOM.

To use the collective confirmation functionality, follow the menu path, **LogisticsProductionRepetitive ManufacturingData EntryCollective Entry**, or use Transaction MF42N (see Figure 8.40).

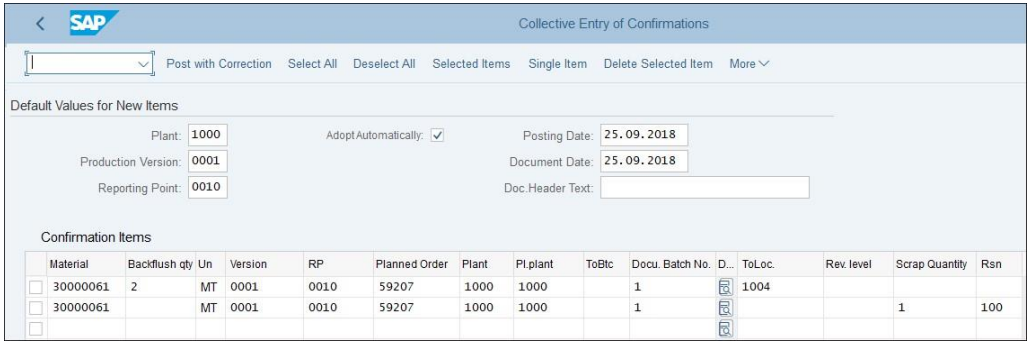


Figure 8.40 Collective Confirmations

For this example, enter the details shown, including assembly **Material** "30000061", **Backflush qty** of "2" **PC**. In the second line, enter the **Material** "30000061" and the **Scrap** quantity of "1" **PC**. The system creates two material documents, the first for the assembly backflush and the second one for assembly scrap (excess components consumption, without any yield).

8.8 Reversals and Scrap

In a normal business scenario, the process operator occasionally faces a situation in which there was a data entry error or the confirmation details posted in the system differ from the actual production figures. In such cases, reversal becomes inevitable. In REM, you can perform document-specific reversal or document-neutral reversal. You can perform the reversal while remaining in the REM confirmation screen (Transaction MFBF) and selecting the **Doc-Specific Cancellation** icon. When you do this, the system takes you to Transaction MF41. Alternatively, you can also use a separate transaction code (Transaction MF41) to reverse a specific document (we use this option in this example).

In the following sections, we'll discuss how you can perform reversal to the documents already posted in the system, such as during RP backflush. As already stated, there are two types of document reversals. In *document-specific reversal*, you can select the specific document that you want to reverse. On the other hand, in *document-neutral reversal*, you can correct the total confirmed quantity, for example, for a day. In this case, you just have to reverse the difference between the previously posted quantity with the correct quantity, which reduces the overall posting efforts. Later in this section, we also cover how you can manage REM actual scrap for component, assembly, and activity.

8.8.1 Document-Specific Reversal

To proceed with a document-specific reversal of confirmation, follow the menu path, **LogisticsProductionRepetitive ManufacturingData EntryReverse**, or use Transaction MF41. In the initial screen for parameters selection (see Figure 8.41), you can give as much detail as possible or available to enable the system to bring up only the relevant documents for reversal.

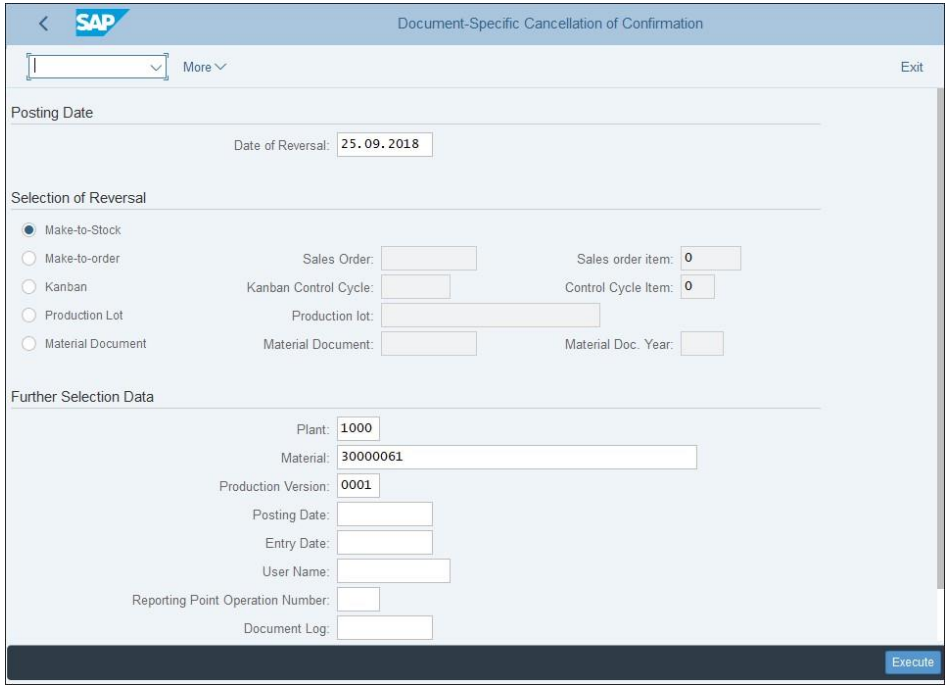


Figure 8.41 Document-Specific Cancellation of Confirmation

For this example, define the posting date or **Date of Reversal** as "25.09.2018", which means the system will post the reversal on that posting date.

To limit the selection further, enter **Plant** "1000", **Material** "30000061", and **Production Version** "0001". Choose **Execute** or press (F8) to open the screen in Figure 8.42, which shows a selective list of material documents and the corresponding RP documents. Place the cursor on the first material document, which is **4900001105**, and click on the **Reverse** button. Upon a successful reversal (of both material documents and activity posting), a message appears at the bottom of the screen: **Material movement with document and posting reversed**.

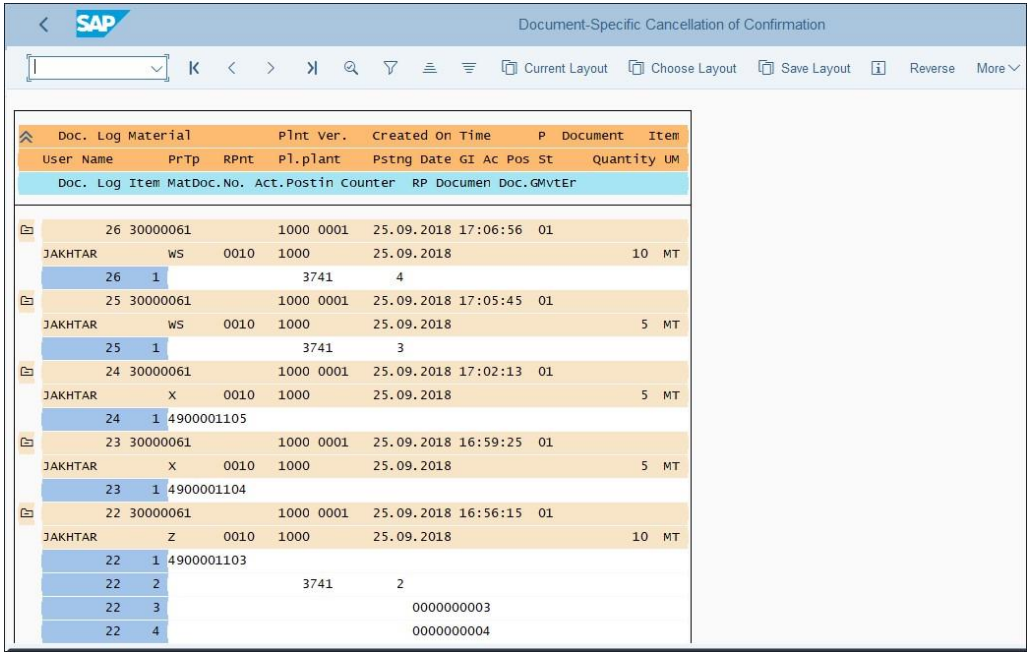
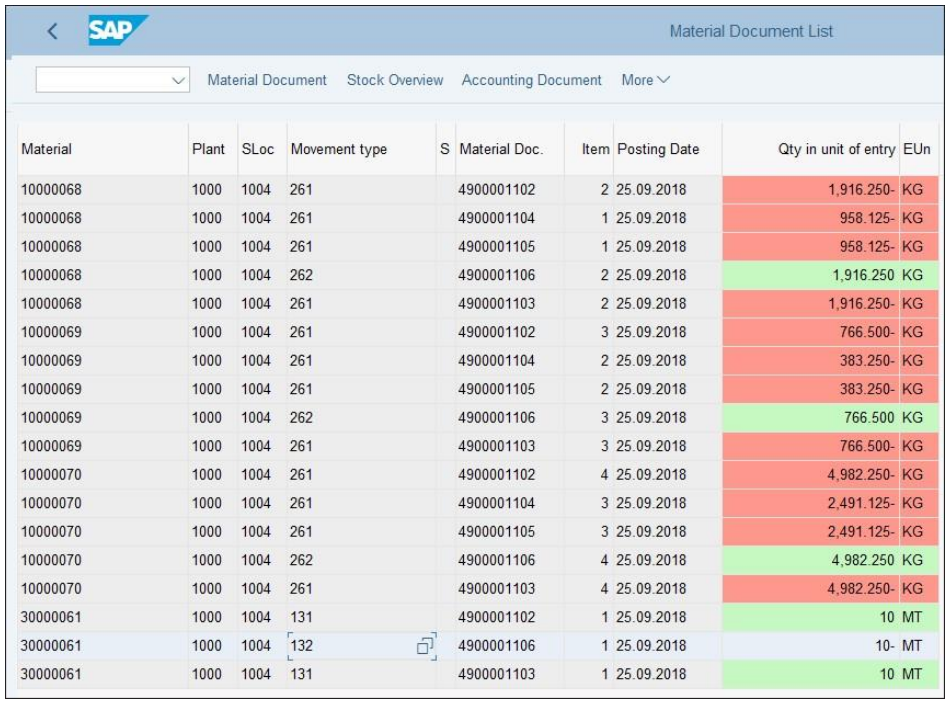


Figure 8.42 Detailed Screen for Document-Specific Reversal

On reversal, the system reverses the production yield confirmation with movement type 132, whereas the component consumption is reversed with movement type 262. The document number of the reversal document posted is 4900001106. These are the standard reversal movement types for REM. The material document reversal and the associated reversal movement types also validate the settings you made in Chapter 5, Section 5.1.16.

Figure 8.43 shows the **Material Document List**, accessed using Transaction MB51. It contains the reversal details, including **Movement type 132** and **262** for assembly and components reversals.



Material	Plant	SLoc	Movement type	S	Material Doc.	Item	Posting Date	Qty in unit of entry	EUn
10000068	1000	1004	261		4900001102	2	25.09.2018	1,916.250-	KG
10000068	1000	1004	261		4900001104	1	25.09.2018	958.125-	KG
10000068	1000	1004	261		4900001105	1	25.09.2018	958.125-	KG
10000068	1000	1004	262		4900001106	2	25.09.2018	1,916.250	KG
10000068	1000	1004	261		4900001103	2	25.09.2018	1,916.250-	KG
10000069	1000	1004	261		4900001102	3	25.09.2018	766.500-	KG
10000069	1000	1004	261		4900001104	2	25.09.2018	383.250-	KG
10000069	1000	1004	261		4900001105	2	25.09.2018	383.250-	KG
10000069	1000	1004	262		4900001106	3	25.09.2018	766.500	KG
10000069	1000	1004	261		4900001103	3	25.09.2018	766.500-	KG
10000070	1000	1004	261		4900001102	4	25.09.2018	4,982.250-	KG
10000070	1000	1004	261		4900001104	3	25.09.2018	2,491.125-	KG
10000070	1000	1004	261		4900001105	3	25.09.2018	2,491.125-	KG
10000070	1000	1004	262		4900001106	4	25.09.2018	4,982.250	KG
10000070	1000	1004	261		4900001103	4	25.09.2018	4,982.250-	KG
30000061	1000	1004	131		4900001102	1	25.09.2018	10	MT
30000061	1000	1004	132		4900001106	1	25.09.2018	10-	MT
30000061	1000	1004	131		4900001103	1	25.09.2018	10	MT

Figure 8.43 Material Document with Reversal Movement Types

8.8.2 Document-Neutral Reversal

To proceed with the document-neutral reversal of confirmed quantities, use Transaction MFBF (the REM backflush screen). Enter the **Plant** and **Material**, click on the **Document-Neutral Reversal** button in the toolbar, and enter the quantity that you want to reverse. Finally, click on the **Post** icon to post the reversal in the system (refer to Figure 8.37).

8.8.3 Repetitive Manufacturing Actual Assembly Scrap

At any time during the REM confirmation screen for assembly, component, or activity backflush (Transaction MFBF), you can switch the screen layout to record scrap of any of these three backflush types. To do so, click on the **Scrap** icon available in the REM

confirmation screen. For this example, show the assembly backflush for the material by using the reference quantity.

The system consumes the components per the BOM of the material (assembly) along with activities. It uses movement type 261 to consume the components without recording any assembly yield.

After you click on the **Scrap** icon, select the **Backflush RP (reporting point) scrap** radio button, and enter the reference scrap quantity of "3", and the screen shown in Figure 8.44 appears. As usual, you also give reference to **Material 30000061** and **Plant 1000**.

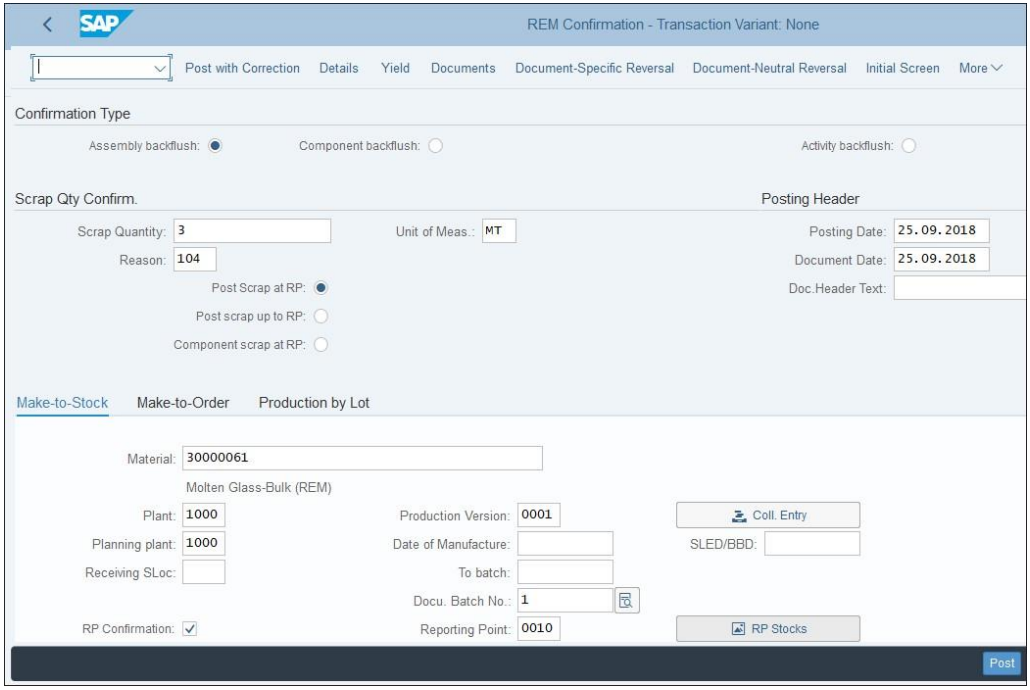


Figure 8.44 Scrap Posting for Assembly

8.8.4 Repetitive Manufacturing Actual Component Scrap

If you need to post scrap with reference to component scrap, select the appropriate radio button, and then the system will post the GI to scrapping while booking the cost of scrapped components to the PCC. The movement type for GI against scrapping is 551.

If you choose to do actual components reversal with reference to the material (assembly), then you have to also give the reference quantity, which the system uses to calculate the

components reversal. You can post the component scrap by clicking on the **Save** icon, or you can use the **Post with Correction** button in the toolbar to make any individual changes and then save those changes.

8.8.5 Repetitive Manufacturing Actual Activity Scrap

You can also record activity scrap with or without reference to a planned order but with reference to material by selecting the appropriate radio button. The system brings up the option to record activity scrap (reversal of record activities) with or without reference to a material's rate routing. If you choose to post the activity scrap with reference to the material, then you also have to give the reference quantity, which the system uses to calculate the activity reversal. You can post the activity scrap by clicking on the **Save** icon, or you can use the **Post with Correction** icon to make any individual changes and then save those changes.

8.8.6 Reset Reporting Point Confirmation

You can also reset the specific quantity posted against RP confirmation. This is necessitated when you want to cancel a milestone due to incorrect entry and must also reset the stock posted up to that RP confirmation.

To reset the RP confirmation, follow the menu path, **LogisticsProductionRepetitive ManufacturingData EntryReset RP Confirmation**, or use Transaction MF4R. On the initial screen, the system provides you the option to enter a document and the posting dates and make further selections, which are specific to the material or production line. You can also click on the**RP overview** icon to display RP information. When you've made the desired parameters selection, click on the **Save** icon (on the initial screen), and the system resets the RP confirmation.

8.9 Costing Activities (Cost Object Controlling)

Before recording the actual yield confirmation, components backflush, or activities recording, all of which have financial implications, you need to coordinate with the

cost object controlling person to ensure that the necessary and preliminary work on the costing side is taken care of. Some of these activities include the following:

Creating a PCC

Creating a material cost estimate

Releasing the material cost estimate

Performing settlement

During confirmation in REM, the material costs for the components and the production activities (except if a material cost estimate with price update has been carried out in advance) are automatically posted to the PCC during backflushing. The option to post activities is enabled in the REM profile before you can actually post activities. The PCC is debited with the material costs, production activities, and overhead. A PCC such as an order (a cost controlling object) may have an infinite validity. In the REM profile, you can define whether the actual data entry of the activities is to be made with reference to the standard material cost estimate or according to preliminary costing for the PCC. While creating a PCC, you can decide whether there should be several production version-specific cost collectors or one production version-independent cost collector.

During confirmation, the PCC is credited with the valuation price (materials controlled with standard price) or with the moving average price of the assembly (materials controlled with the moving average price).

Overheads aren't determined with reference to an operation, that is, not for each goods movement or activity confirmation. Rather, they are determined periodically during period-end closing in CO using an overhead structure and are posted to the PCC.

Components different from the planned components may be used in production, or the overhead cost rates may change. This results in variances in the PCC, and a settlement must be carried out. The aim of the settlement is to credit the PCC in full. During settlement, the costs not yet credited to the PCC are transferred. For a material that is valuated using the standard price, the variant costs are posted to the price difference account.

Settlement in REM is always based on the period and on the costs in the PCC (productrelated cost object controlling).

8.10 Heijunka

REM is also often used in production planning in the Japanese automobile industry and is known as *heijunka*. Heijunka is used effectively for production smoothing, and it also uses sales and operations planning (S&OP), demand management, MRP), CRP, and sequencing.

Heijunka allows for even distribution according to the Every Part Every Interval (EPEI) principle. EPEI suggests that you have every part on the schedule, every period; that is, a small amount of each part is produced every shift, every day, every week, or every month, depending on how the scheduling periods are defined. Heijunka then distributes orders evenly over a specific period and sequences them according to the principle of equal distribution. In Japanese, heijunka means "leveling." Leveling can be done by volume or by product. If, for example, a family of products that uses the same production process has demand that varies between 500 and 800 units, then it might seem a good idea to produce the exact amount that was ordered by the customer. Distributing the demand in equal, average quantities over a certain period of time provides a much more reliable supply to fulfill fluctuating order quantities.

Many value streams produce a mix of products, and, therefore, decisions have to be made in terms of product combinations and sequences. The economic order quantities play an important role and are driven by changeover times and the inventory required. Implementing heijunka resulted in a different situation whereby it reduced the time and cost of changeovers so that smaller and smaller batches aren't prohibitive, and lost production time and quality costs aren't significant. The demand for products could be leveled for upstream processes, reducing lead times and total inventories along the entire value stream.

As mentioned earlier, in an REM environment, the option of using heijunka is already available. There is an option in takt-based scheduling to plan according to the heijunka principle of equal distribution. Heijunka—the scheduling of rates according to equal distribution—is such a mixed model scheduling method. In fact, you'd look at the demand of the total week and then distribute the rates according to EPEI.

First, we must split the demand into lot sizes that allow equal distribution. The MRP run does that automatically by taking the total weekly demand and splitting it into individual planned orders according to the lot sizing procedure maintained in the **MRP 1** view of the material master (lot sizing is covered in detail in Chapter 12). To show how this looks in the SAP system, create a model mix using Transaction LDD1

(to create) or Transaction LDD2 (to maintain). A prerequisite for line balancing is the existence of a line hierarchy with a maximum rate. Line hierarchies are created using Transaction LDB1 and represent the assembly line with all its work centers.

Note that the line hierarchy doesn't represent the flow of the product but rather the hierarchy of the work centers the product flows through (or doesn't flow through). The line hierarchy can consist of line segments and feeder work centers assigned to a level-by-level hierarchical structure. The line hierarchy can have a scheduling segment (usually the bottleneck work center) that is then used in the production version of the materials being assembled on the line. In the production version, you also assign the routing that is used to assemble the product and consists of a sequence of operations that follows the assembly line.

8.11 Reporting

We'll be covering standard reporting extensively in Chapter 18, including several reports available specifically for REM. In the following sections, we briefly cover two of them:

Document log information RPs

statistics

8.11.1 Document Log Information

The SAP system maintains a comprehensive log of each and every material document posted or canceled, which is known as the *document principle*. As a planner, it's often important to have access to the material document information for evaluation purposes, as well as for identifying individual documents against which incorrect or incomplete entries were made and must now be reversed or canceled.

To access the document log information in REM, follow the menu path, **Logistics ProductionRepetitive ManufacturingEvaluationsDisplay Data Entry Documents**, or use Transaction MF12. On the initial parameters selection screen, enter the parameters, such as **Plant**, **Material**, **Production Version**, or **Posting Date**, and choose **Execute** or press (F8). Not only does the system bring up relevant documents for display, it also provides you with the option to reverse any document, if needed. We've already covered document-specific reversal in Section 8.8.1 (see Figure 8.45).

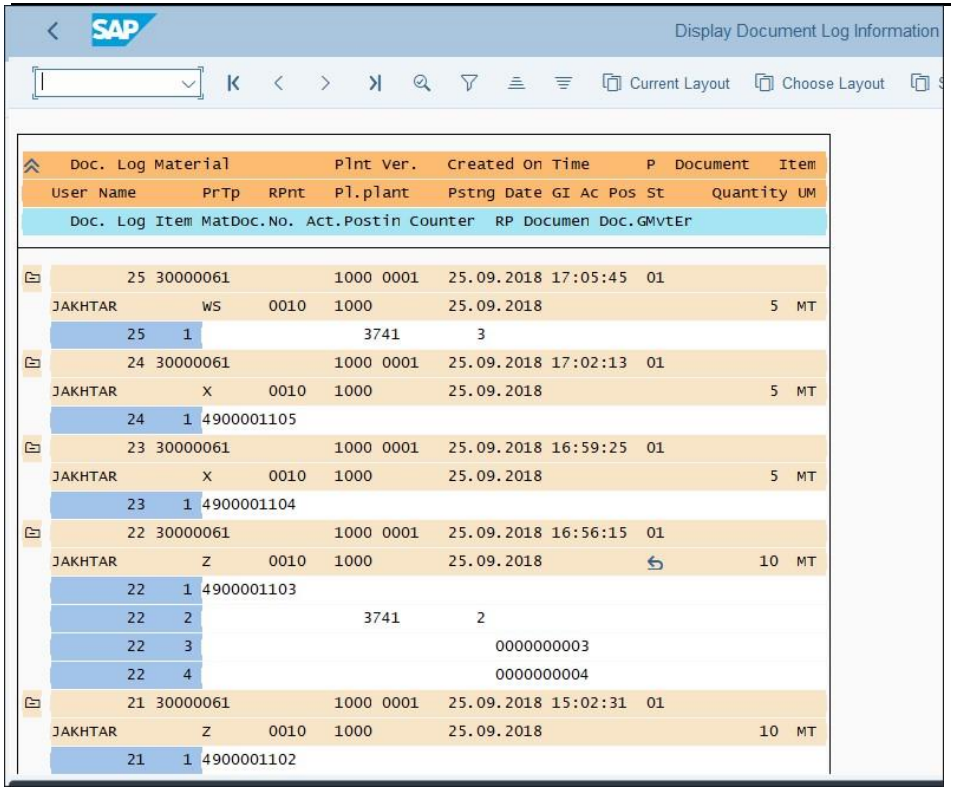


Figure 8.45 Document Log Information

8.11.2 Reporting Point Statistics

RP statistics is one of the several statistics reports available to facilitate evaluation. To access RP statistics, follow the menu path, **LogisticsProductionRepetitive ManufacturingEvaluationsLIS StatisticsReporting Point Statistics**, or use Transaction MCRM. On the initial parameters selection screen, enter the relevant parameters, such as **Material**, **Plant**, **Production Version**, or **RP**. You can also provide a period of evaluation so that the system only brings up relevant information. Choose **Execute** or press (F8) to open the screen shown in Figure 8.46.

In this statistics report, you can get details on the confirmed quantity at each RP, as well as the confirmed scrap recorded. You can also switch to different views and details, for example, date-wise evaluation, RP-wise evaluation, production version-wise evaluation, or production line-wise evaluation, by clicking on the **Switch drilldown** button

and then selecting the desired radio button. You can also use these RP evaluations as valuable reporting tools to evaluate the WIP.

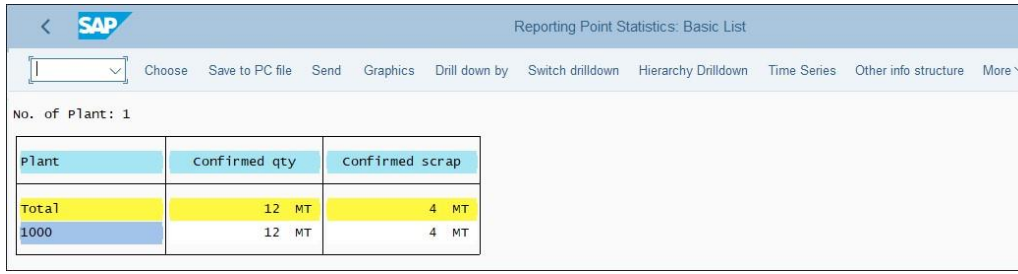


Figure 8.46 REM Reporting: RP Statistics

8.12 Summary

For material produced in bulk quantity and with relatively fewer production steps and complexity when compared with production types such as discrete manufacturing or process manufacturing, you can implement the REM production type. You can plan line loading, material staging, backflush assembly, components, and activities as frequently as deemed necessary and practically from the business perspective. All costs associated with REM production of a material continue to accumulate in the PCC, and you can periodically settle it. Due to the highly integrated nature of PP with CO-PC, you maintain extensive coordination to ensure that the inventory, financial, and business results are in line with the company's business processes.

The next chapter discusses batch management and why it's important in processing manufacturing.

PART IV

Production Planning Tools

Chapter 9

Batch Management

Batch management is an important part of a company's ability to procure, produce, store, and sell material. The batch defines a quantity of material by characteristics unique to that batch. Those characteristics determine how the material in that batch is used, sold, or moved.

Certain material can be defined in SAP as being batch managed. A batch is a quantity of material that represents a homogeneous unit with unique specifications. The batch of material may refer to a quantity of chemical that is produced in one process or a quantity of bottles of water that were filled on a certain filling line from a specific tank. There are many ways in which a batch can be defined. In SAP, the batch is used to identify units of material as they move through the system. The batch can have specific characteristics that enable it to be identified and used within the production planning (PP) functionality. This chapter describes the processes in creating and changing a batch and the process of batch determination. The first section gives an overview of the batch and how it's used in industry.

We'll start out this chapter by covering the configurations settings you need to ensure are in place to start using the batch management functionality in your SAP system. After configuration, we cover the requisite master data followed by the business processes associated with batch management, such as manually creating a batch master as well as how the system automatically creates the batch master during various business transactions. We'll then discuss the specialized but important batch management topics, such as automatic batch determination, batch derivation, and shelf-life expiration of batches. The chapter will conclude with some important batch management reports including the Batch Information Cockpit (BIC).

9.1 Batch Management Overview

The definition of a batch differs among companies, industries, and countries. For example, in the pharmaceutical industry, strict guidelines and regulations determine

what a batch is. These regulations on batches and batch control include the ANSI/ ISA-88 standard and the Food and Drug Administration (FDA) 21 CFR Part 11 specifications in the United States.

Although there is no one exact definition of a batch, the following definition from ExxonMobil Aviation may help:

> *A batch is the specific quantity of a material produced in a single manufacturing process, i.e., under the same conditions, thus featuring identical properties. Each batch of material is given a batch number. Each batch of a material is tested with regard to relevant characteristics to ensure it meets the values or within the range for those characteristics.*

A second definition of a batch is from the Marathon Oil Company, which significantly differs from other definitions:

> *A batch is a shipment of a single product that is handled through the pipeline without mixing with preceding or following shipments.*

This third definition of a batch is from the Hawaiian Coffee Association:

> *A batch refers to a quantity of coffee coming to the roaster. Quantities of the same coffee arriving at different times would be viewed as separate batches. Changes from batch to batch—even of the same variety of bean—must be detected by the roaster if he is to produce coffees that are consistently the same.*

Whatever the definition, the fact is that the batch has to be identified by a batch record. This can be as simple as identifying bags of coffee beans as they arrive at the plant or as complex as identifying a batch by numerous qualifying characteristics to ensure quality and safety.

A batch of material can either be purchased from a vendor or produced internally. The need to manage materials by batch has been discussed; however, in SAP, the material must be identified as batch-relevant.

The identification of a batch record is especially important for the pharmaceutical industry due to the regulations set down by the FDA in the United States and other regulatory bodies across the world, such as the Drugs Controller General of India (DCGI), Bundesgesundheitsamt (BGA) in Germany, Health Canada, and the Medicines and Healthcare Products Regulatory Agency (MHRA) in the United Kingdom.

These regulatory bodies are primarily interested in public safety. The regulations, such as FDA 21 CFR Part 11 in the United States, are aimed at improving the efficiency of quality control and the quality assurance process. Each batch produced has to be quality tested, with the results stored electronically against the batch number.

The most critical use of the batch number in the pharmaceutical industry is for product recall. The batch number also can be used as the tracking device for companies in case of subsequent errors or contamination. Manufacturers publish product recalls every day, but for the pharmaceutical industry, product recalls can save lives.

A pharmaceutical company can voluntarily recall a product. If the company finds that a result from a test on a batch was incorrect, putting the batch out of tolerance, then the product made from that batch could be hazardous.

The errors could go all the way back to the vendor, if any of the material was purchased. If a vendor informs the company that a batch of purchased material was out of tolerance, then this batch must be traced through the production process to find all finished goods batches that may contain the faulty batch.

In the United States, the FDA has the power to request that a company initiate a recall when it believes that a drug violates the Food, Drug and Cosmetic Act (FDCA). A recall will be requested when the FDA concludes the following:

A drug that has been distributed presents a risk of illness or injury or gross consumer deception.

The manufacturer or distributor hasn't recalled the drug.

FDA action is necessary to protect the public health.

In a recall, the manufacturer informs the retailer, wholesaler, or even the consumer concerning how to identify the batch number on the product and which batch numbers are a part of the recall.

Let's begin with the configuration basics of batch management.

9.2 Batch Level and Batch Status Management

In the following sections, we'll follow the step-by-step approach in covering the configuration steps required to set up batch management in the SAP system.

9.2.1 Define the Batch Level

The batch level can be defined at different levels, but by default it's defined at the plant level. At the beginning of an SAP implementation project, it's a materials management (MM) consultant helps the company decide the batch level at which it requires for batch monitoring and reporting.

Use the following guidelines to determine that batch numbers are unique at the following three levels:

Plant and material combination level

In this level, the plant and material combination have unique batch numbers. Different material in the same plant can be assigned the same batch number, and the same material in different plants can also be assigned the same batch number. In this given context, the material is transferable from one plant to another, and although the batch number is the same, the specification of the destination batch will remain unchanged.

Material number level

As the batch numbers are created at the material level, the same batch numbers can be used for other material as well. After you set the batch level as the material in the system, a material can have the same batch number even though the materials are in different plants with the same specifications. The same batch number can be reassigned for other materials with a different specification.

Client level

The batch level is set at the client level, which is the highest level. The same batch number can't be used for different material or different plants. The batch number assigned is rather unique and can be assigned only once; thus, every material will always have a new or different batch number.

The system's default setting is the plant level. As mentioned earlier, this can be customized to the batch level you need. However, you need to keep in mind that while switching to a higher level is always possible, lowering your level is only possible from the client level to the material level. This is because the batch data is organized so that it has to be converted whenever it's switched to another batch level.

To define the batch level, follow these steps:

1. Go to **SAP IMG Logistics – General Batch Management Specify Batch Level and Activate Status Management**. Choose the Batch level we just discussed (client, plant, or material level), and then save.
2. Choose **Batch status management** to activate batch management status in the client, select the **Active** checkbox, and then save.
3. Choose **Plants with batch status management**, set the **Batch status management** checkbox in the resulting list for those plants where batch status management has to be active. Select the checkboxes and save.

4. Choose the **Initial status of a new batch**, specify which initial new batches are to be assigned for each *material type,* and check the **Initial Status** box for each material type that will be batch-managed.

9.2.2 Batch Number Assignment

In this step, you define the batch number range and assignments. To do so, follow the menu path, **SAP IMG Logistics – General Batch Management Batch Number Assignment Activate Internal Batch Number Assignment**.

In the resulting screen, select the **Active** radio button to activate the internal batch number assignment. You can also define whether internal batch number assignment is allowed for GRs that have an account assignment via **SAP IMG Logistics – General Batch Management Batch Number Assignment Internal Batch Number Assignment for Assigned Goods Receipt**.

In the next step, define the number ranges for internal batch number assignment by following the menu path, **SAP IMG Logistics – General Batch Management Batch Number Assignment Maintain Internal Batch Number Assignment Range**.

In the standard SAP system, you can set the number range object BATCH_CLT, and the number range 01 from 0000000001 to 9999999999 has been defined.

Similar to the internal batch number assignment, you can assign a number range for external number assignment. Follow the menu path, **SAP IMG Logistics – General Batch Management Batch Number Assignment Maintain Number Range for External Batch Number Assignment**.

You can maintain the external number range by clicking on the **Number Ranges** button and then the **Change Intervals** button. Here, you can use the already-defined number range or create a new number range by clicking on the **Inset Interval** button.
Enter the number (**No.**), **From number**, and **To number**, and then click **Save**.

Note

SAP enhancement SAPLNOIZ can be used for internal batch number assignment. This enhancement comprises two function module exits to define number ranges or templates for batch numbers:

EXI_SAPLVO1Z_001

This exit is used to replace the number range object and/or interval proposed with your own number range object by the system and/or interval. It's also used

to stop the system from assigning an internal number based on the material or plant. This exit can be used to stop the dialog box from appearing.

EXIT_SAPLVO1Z_002

This exit helps assign your own number or even change the number assigned by the system.

9.2.3 Creation of New Batches in the Production Process

In this step, you can configure how the system creates new batches for process/ production orders. To define the new batch creation for process/production orders, follow the menu path, **SAP IMG Logistics – General Batch Management Creation of New Batches Define Batch Creation for Production Order/Process Order**, or use Transaction CORW.

You can make specific settings in batch management for the existing production control profiles. Choose the production control profile for which you want to make settings, and select the required option (see Figure 9.1) for automatic batch creation:

Automatic batch creation at order creation

Automatic batch creation at order release

No automatic batch creation in production/production order

Then select the batch classification option in the **Batch Classification** field. In addition, select the **Extended Classification** checkbox so that more batch-specific functionalities are available.

The production scheduling profile (**PS Profile**), which in this example is **SFGDM** is then assigned in the **Work Scheduling** view of a material master.

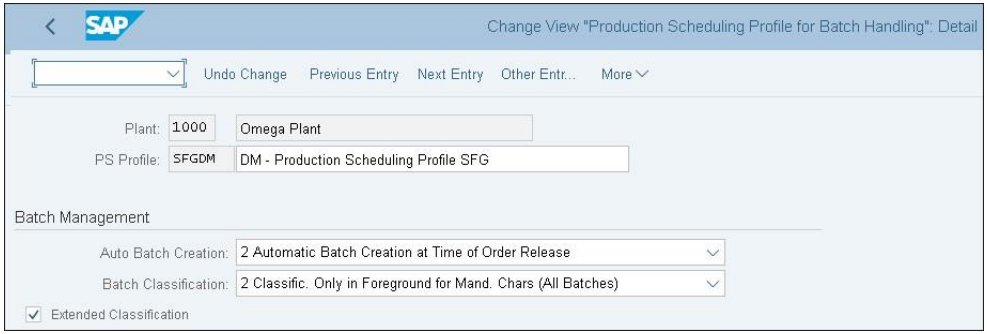


Figure 9.1 Batch Management in the Production Process

9.2.4 Batch Creation for Goods Movement

You can also define the new batch creation settings for movement types. Follow the menu path, **SAP IMG Logistics – General Batch Management Creation of New Batches Define Batch Creation for Goods Movements**.

For instance, when batch numbers aren't determined by the system automatically, you may want to assign a batch number for goods receipt (GR) on a production or a process order (movement type 101) manually. To achieve this, choose the **Automatic/ manual without check** option for movement 101, as shown in Figure 9.2.

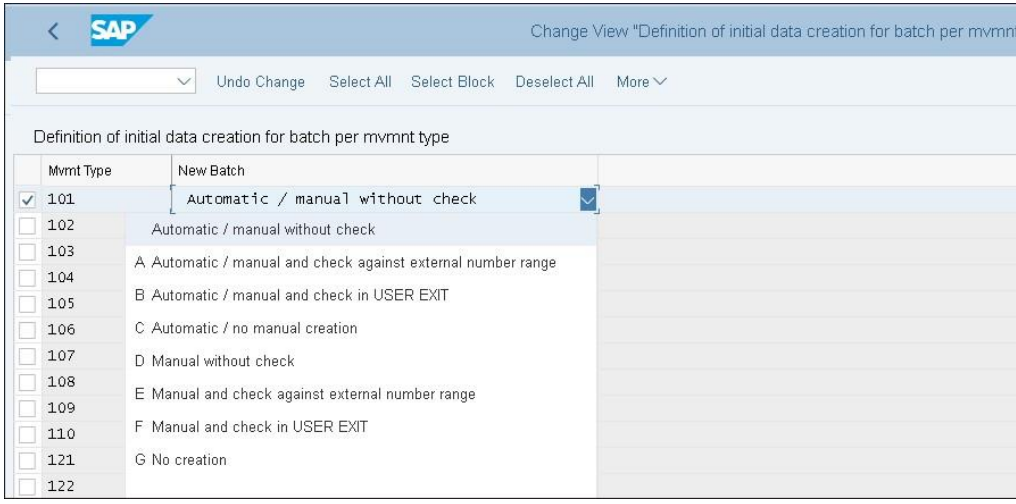


Figure 9.2 Batch Management with Movement Type

For each material type, you can also define whether a new batch can be created via the batch master creation transaction (Transaction MSC1N). To do so, follow the menu path, **SAP IMG Logistics – General Batch Management Creation of New Batches Define Initial Creation of Data for Batch Master Transactions**. If you want to assign the batch numbers only automatically by the system and don't want to opt for assigning manually, especially for the finished products, then choose option **Automatic/no manual creation** for material type FERT.

This brings an end to the basic configuration settings you need for batch management. In the next section, we discuss how to set up master data in batch management.

9.3 Master Data in Batch Management

A first step when working with batch management is to identify the material that needs to be batch managed and then update the material master record by setting the batch management requirement. Let's go over the different master data management processes and steps specific to batch management in the following sections.

9.3.1 Activate Batch Management in the Material Master

In the SAP system, batch master records always depend on material master records. Therefore, your first step is to define batch management requirements in the material master. Go to Transaction MM01 (Create Material Master), enter all of the required details, and select the **Batch Mgmt Rqt** (batch management requirement) checkbox to denote that the material has to be handled in batches (see Figure 9.3). The following views of the

material master contain the checkbox for batch management:

Sales and Distribution

General plant data

Purchasing

Work scheduling

All views are the same, and any change/updating that is done in one view appears in all views.

Tips

The indicator for the material can be changed from batch managed to nonbatch managed only if there has been no stock for the current period and the previous period. This is to allow for transactions posting of batch-managed materials in any previous period.

In the SAP system, batches are posted *for* a material, so the batch master records are always dependent on material master records. If there is a mismatch of subjected material and batch requirement, all stocks need to be posted out from the previous fiscal year, the previous period, and the current period. To do this, reset the **Batch Mgmt Rqt** checkbox and repost the stock in batches into the system.

Similarly, you can cancel the batch requirement for any material you don’t want to be batch managed. If you have to reorganize the batch master records, you must

reset the **Batch Mgmt Rqt** checkbox to empty, post the required batch requirement, and then post the stock back into the SAP system using Transaction MIGO.

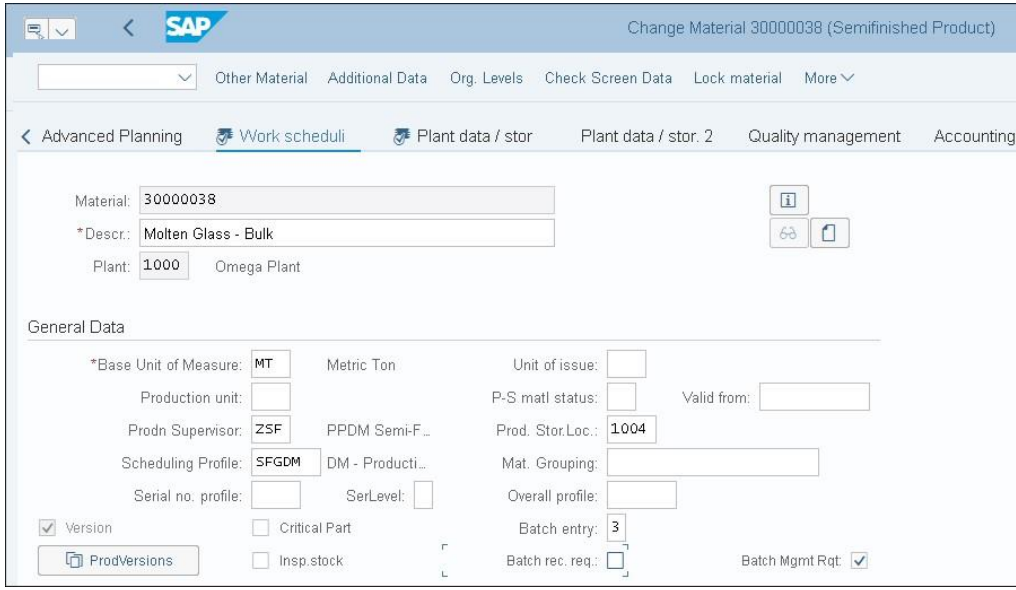


Figure 9.3 Activation of Batch Management in the Material Master

9.3.2 Batch Classification

To differentiate batches of material depending on their individual properties, you can use characteristics to define the properties. For example, the paint industry uses color, coverage, and viscosity as characteristics to classify different batches. The coldroll coil (CRC) industry uses finish, thickness, and quality to classify different batches.

These characteristics are created in the SAP system and assigned to the materials. The same classification concept as in materials classification is applied in defining batch classification.

A company that deals with various types of paints wants to capture the characteristics of paint: coverage, color, and viscosity. A class has to be created with the characteristics for coverage, color, and viscosity wavelength. This class has to be assigned to a material. Every time a new batch is created for the material, the characteristic values need to be entered. Let's briefly define characteristics and their assignment to a class specific to batch management.

Define Characteristics

First, create the various characteristics for your materials such as thickness, viscosity, density, and so on. We've discussed the characteristics and classes in detail in Chapter 7, so we won't go into the same detail here.

To create characteristics, follow the menu path, **SAP Menu Cross-Application Components Classification System Master Data Characteristics**, or use Transaction CT04.

In the resulting screen, enter the **Characteristic** name, and click **Create**. Enter a **Description** as shown in Figure 9.4. In the **Status** field, you have the **In Preparation**, **Locked**, and **Released** options. A **Released** status means that the characteristic can be used; a status of **In Preparation** or **Locked** means that it can't be used.

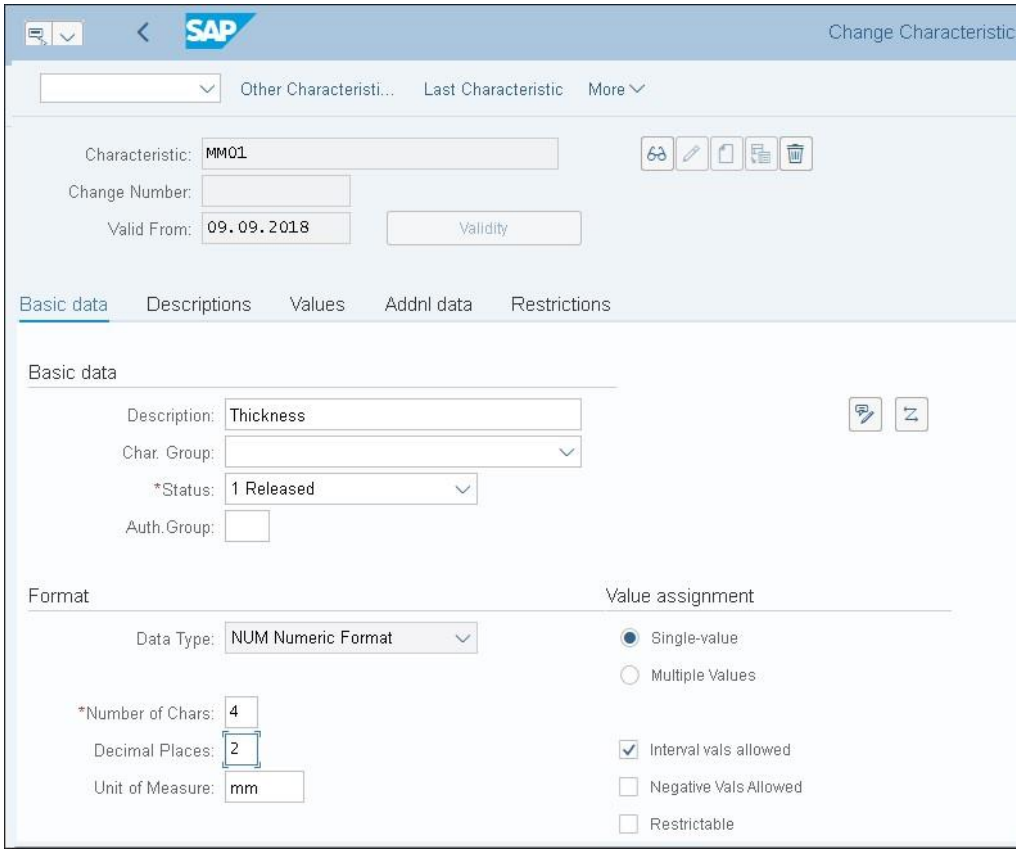


Figure 9.4 Characteristic

In the **Value assignment** area, select either **Single-value** or **Multiple Values**. The **Singlevalue** radio button specifies that only one value can be assigned to this characteristic; the **Multiple Values** radio button is used when more than one value is possible.

Select the **Values** tab, and enter the possible values for this characteristic, as shown in Figure 9.5. The **Additional Values** checkbox allows you to enter characteristic values that aren't defined. After you've defined the values, you can save the characteristic. In this example, we've taken the characteristic **Thickness**, and the value of thickness can be within the range of 8.00 to 12.00 mm.

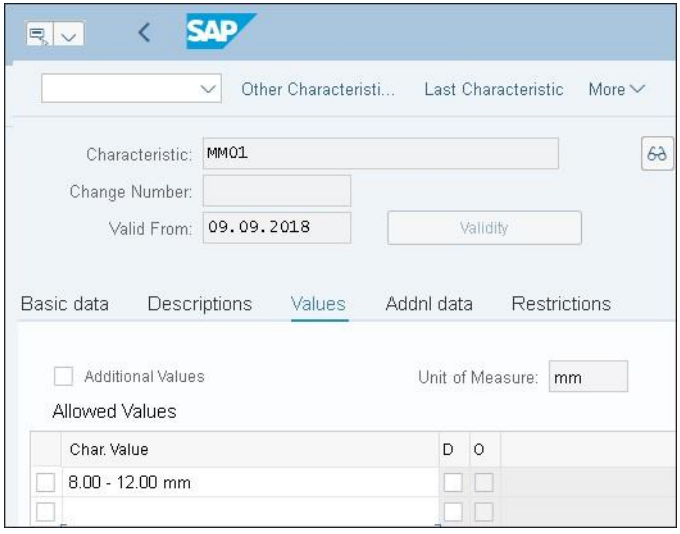


Figure 9.5 Characteristic Values

Now that you've created a characteristic, you need to assign the characteristics to the class, which is explained in the following section.

Define Class and Assign Characteristics

A class represents a group of characteristics. Classes are defined based on the material classification, such as a garment, oil and grease, or metals. To define a class, follow the menu path, **SAP Menu Cross-Application Components Classification System Master Data Classes**, or use Transaction CL02. Enter the **Class type** as "023" (**Batch Class**), and fill in the appropriate **Class** name, which in this example is "ZTGDEMOPP". Then click **New**. Enter a description, and set the **Status** as **Released**. Enter the validity dates.

On the **Char.** tab, assign the characteristics to the class, as shown in Figure 9.6. In this case, we've assigned three characteristics: **ZCLS (Product Class)**, **ZPD** (**Date of Manufacture**), and **MM01** (**Thickness**).

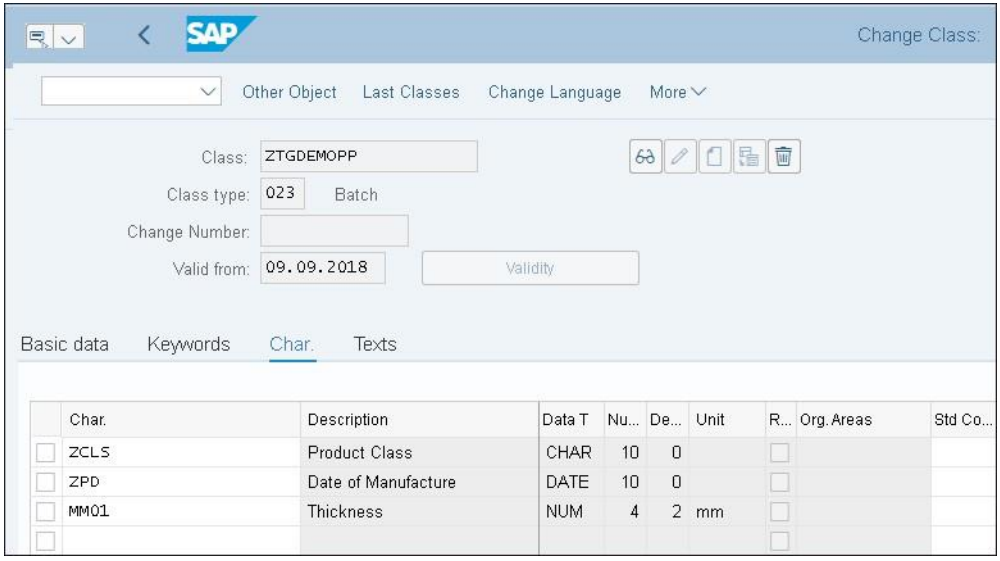


Figure 9.6 Asisgnment of Characteristics to a Class

9.3.3 Assigning Classification in the Material Master

After you've defined the class, you need to assign it to the material master via Transaction MM01. Choose the **Classification** view for **Material** "30000038", and enter **Class Type** "023" to assign the previously created class **ZTGDEMOPP**. Doing so will automatically bring up all three characteristics assigned to the class, as shown in Figure 9.7. Here, you can maintain specific characteristic values pertaining to this material. Because this is a master data step, note that characteristics values assigned are for the material master only and *not* for batches of a material.

With requisite master data created for batch management, the next section discusses the business processes associated with batch management.

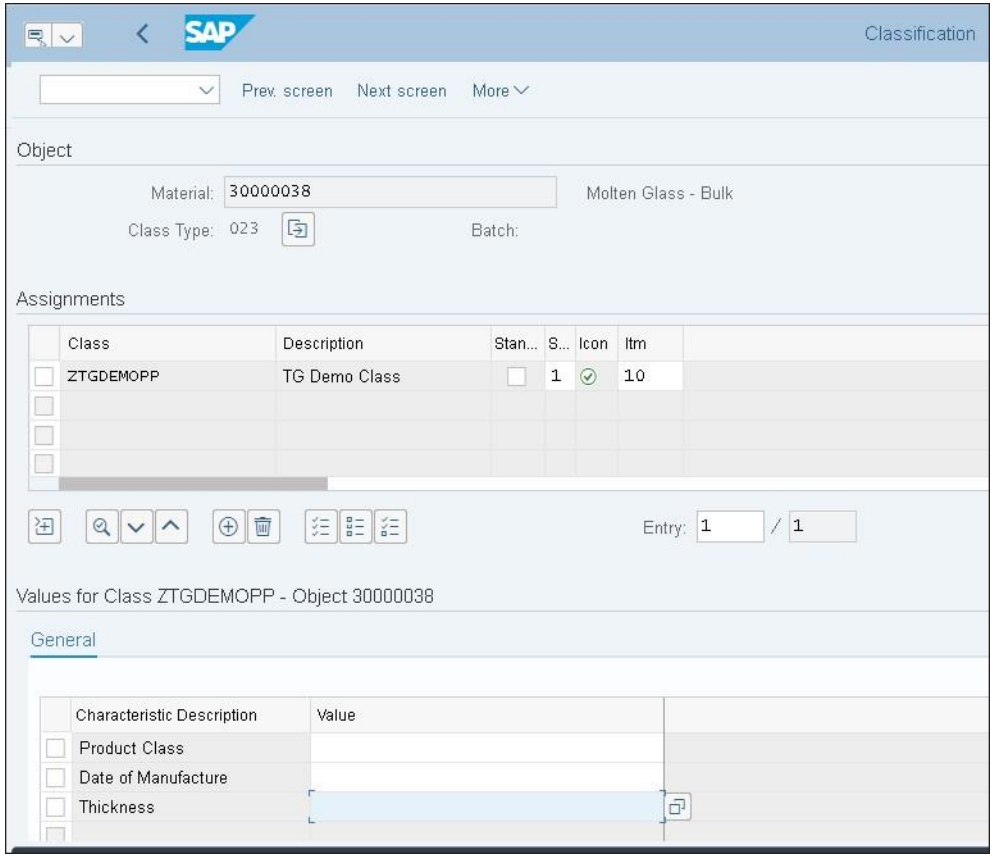


Figure 9.7 The Classification View of a Material Master

9.4 Business Processes of Batch Management

In the following sections, we'll cover the business processes of batch management in the SAP system. Some of these business processes include manually or automatically creating a batch, changing or deleting a batch, using the classification function in a batch, and attaching documents to a batch.

9.4.1 Create a Batch Master Manually

A batch master record for a material can be created manually or automatically in the background by the system when you receive goods for the first time. A manually created

batch of a material can then be assigned during stock posting, such as during GR of a material from the procurement or production processes.

To create batch master records manually, follow the menu path, **SAP Menu Logistics Central Functions Batch Management Batch Create**, or use Transaction MSC1N (see Figure 9.8).

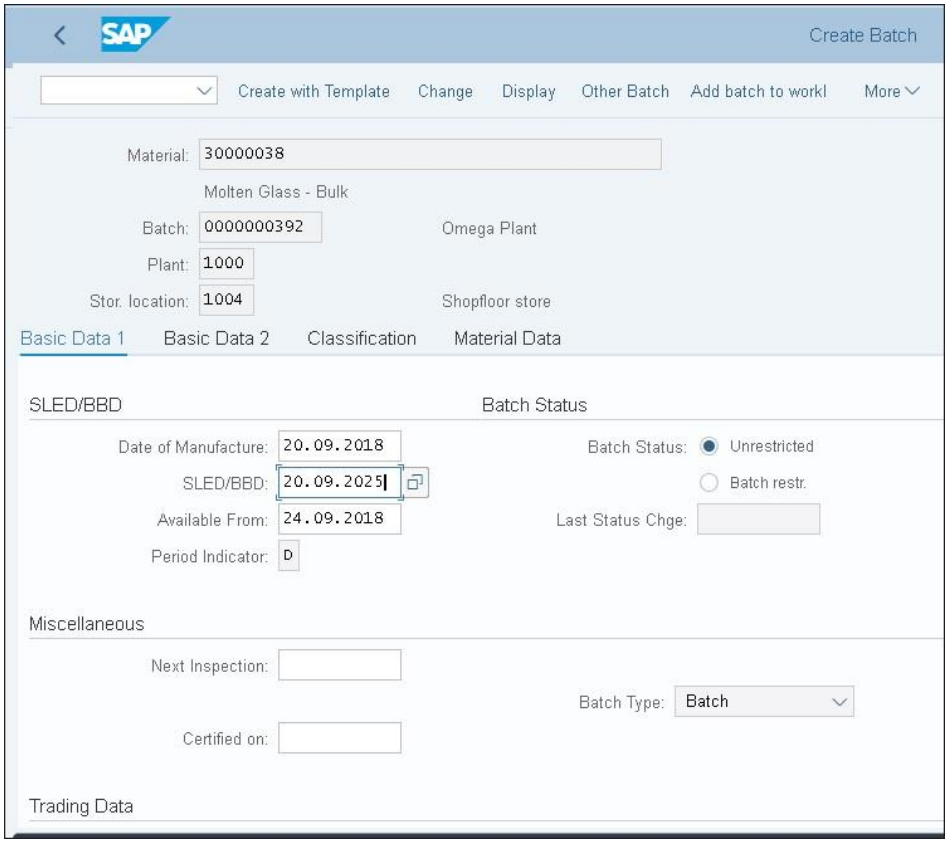


Figure 9.8 Manually Creating a Batch of a Material

Enter a material, plant, and storage location for which you want to create a batch master record. If you've defined the internal number range, the system will create the batch number automatically after you press (Enter). The data in a material master applies in general for all the batches assigned to this master record. By contrast, a batch master record contains data that uniquely identifies the corresponding batch and characterizes the unit as one that can't be reproduced.

Various types of information are stored in the batch master record. Some can be updated manually, and some can be updated automatically. We'll discuss some of the relevant information in different tabs in the following sections.

Basic Data 1

Important fields and checkboxes in the **Basic Data 1** tab from Figure 9.8 are as follows:

Date of Manufacture

The date when the batch was produced can be entered into this field. In some industries, this field is also used as the date the material was tested or retested. If a material is found to be still in tolerance after the shelf-life date has expired, the material can be retested, and the date of the retest is entered into this field, in addition to a new **Shelf Life Exp. Date**. Check with your clients to determine whether they need to use this field.

SLED/BBD

The **SLED/BBD** (shelf life expiration date) field is the date on which the shelf life of this batch will expire. The shelf life of a product can vary between plants. This date can be used in the sales process, as customers may have set a requirement on the acceptable number of days of shelf life remaining. Some companies use this field to indicate the date on which a batch needs to be retested. If the company has implemented the quality management (QM) functionality, then the system uses this field to see if the material's batch expiration is about to be reached so that the system can create a quality inspection lot for retesting the material.

Available From

This field indicates when the batch will be available. For example, if a material needs to remain in the quality inspection process for a certain number of days after testing, then the quality department can enter a date to inform other departments of when the batch is expected to be available.

Batch Status

These radio buttons allow the batch to be classified as having restricted or unrestricted use. If the **Unrestricted** option is set, then the batch has no restriction placed on its use. If the **Batch restr** option is set, the batch is treated like blocked stock in planning but can be selected by batch determination if the search includes restricted-use batches.

The **Batch Status** can be set to restricted from unrestricted by changing the checkbox in the batch record. A material document will be posted that shows the movement of stock between the two statuses.

Next Inspection

This date field allows the quality department to enter the date of the next quality inspection of the batch, if applicable to this material. This field is helpful when a company must retest a material's batch after every predefined period. This material retesting process is known as recurring inspection.

Vendor Batch

If the material is purchased, then the batch number assigned by the vendor can be added to the batch record. It's important to any product recall procedure that the vendor batch number is noted. The **Vendor Batch** field (not shown) allows a 15-character string to be entered.

Basic Data 2

In this tab, you can maintain the **Texts** and **Freely definable date** fields. There are six date fields. This is optional and only necessary if you want to use these dates somewhere in the process. The other fields on the screen are six date fields: **Date 1**, **Date 2**, and so on. These fields don't have any standard functionality. The six **Date** fields can be used for whatever purpose is defined by the client. For example, these fields could contain the dates on which the material was inspected by the quality department.

Classification

In this tab, you can use the class that was assigned to a material during material master classification. You can enter the characteristics values here by clicking on the**New** button. After you click the **New** button, you can enter the values of all the characteristics listed based on the material class, as shown in Figure 9.9.

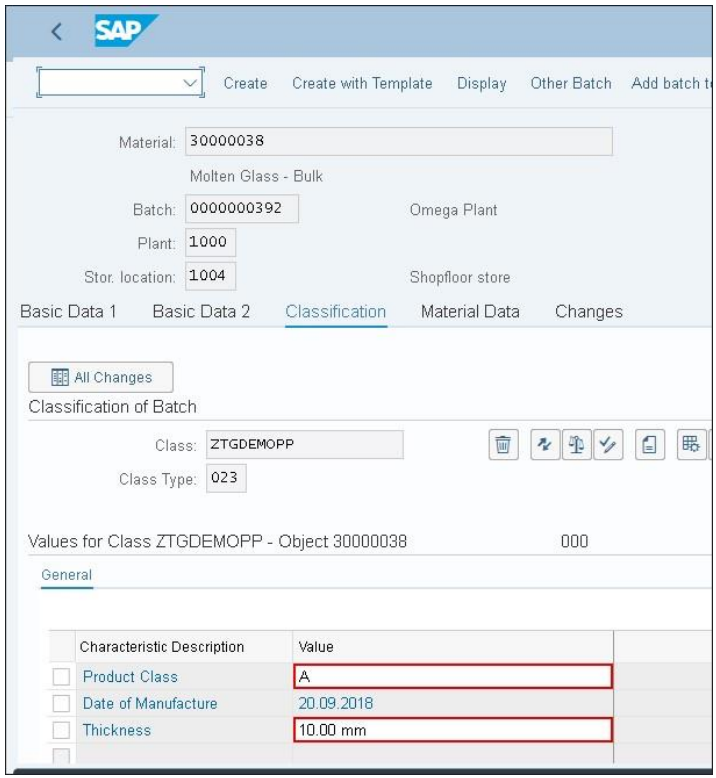


Figure 9.9 Classification Tab of a Batch Master

Material Data

In this tab, you can use the information from the material master record. Clicking the **All changes** icon (shown in Figure 9.11) will display the change history of the batch. This tab won't appear when you're creating a batch for the first time, but you can see it when you change or display a transaction.

Configuration Tip

If you also want to link documents to a batch, then a configuration step must be completed. Follow the menu path, **SAP IMG Logistics – General Batch Management Batch Master Activate Document Management for Batches**, or use Transaction ODOC.

The configuration in Transaction ODOC is simply switching on the field to allow document management for batches. The options are **Active** and **Inactive**.

9.4.2 Changing a Batch

After the batch has been created, there may be an occasion where the batch record needs to be amended, either to modify a characteristic or to add a new linked document. To change a batch record, follow the menu path, **SAP Menu Logistics Materials Management Material Master Batch Change**, or use Transaction MSC2N.

The user can make changes to the batch record, but these changes are recorded and are available to review. The **Change Batch** screen has an extra tab in the change mode. This tab accesses a screen to view all changes made to the batch record. The **Changes** screen (refer to Figure 9.8) shows the changes made to the batch record. The information recorded includes the user who created and changed the record, as well as the fields that have been changed, including their values. This information is important to some companies because a strict audit record is needed to show compliance with federal or local regulations. In the pharmaceutical industry, companies manufacturing items that are to be consumed are under strict regulations from the FDA. Companies should at all times ensure that their record keeping is compliant with FDA regulations.

9.4.3 Deleting a Batch

There is no transaction used solely for deleting a batch, but you can delete a batch through Transaction MSC2N.

Figure 9.8, shown earlier, provides the initial screen of the change batch transaction, which has a **Batch Deletion Flag** checkbox that can be set if the batch is to be deleted. However, setting the deletion flag doesn't immediately delete the batch. The checkbox allows the batch to be processed by an archiving program that will determine whether the batch can be deleted. If the batch can't be deleted, the deletion flag will remain until either the archiving program determines that the batch can be deleted or until the deletion flag is removed.

9.4.4 Automatic Creation of a Batch in Goods Movement

You can define the automatic creation of batch numbers in the SAP system, whether for movement type or production and production orders. For instance, you can customize the system to automatically create unique batch numbers whenever goods are delivered against a production order. This means that every time goods with movement type 101 are received, the unique batch number for the material received is created by the system automatically.

Here we present an example of how the system automatically creates a batch master on GR with reference to a production order (movement type 101).

To receive goods with reference to a production order and via movement type 101, go to Transaction MIGO (see Figure 9.10). Enter the production order number "130000261" after selecting **Goods Receipt** followed by selecting **Order** from the two dropdowns located on the top-left side of the screen. In the item details, you come across one more tab: **Batch**. Notice that the system has automatically and already created a batch 393.

Click the **Classification** button in the **Batch** tab in Figure 9.10 to enter the values of the characteristics, as shown in Figure 9.11.

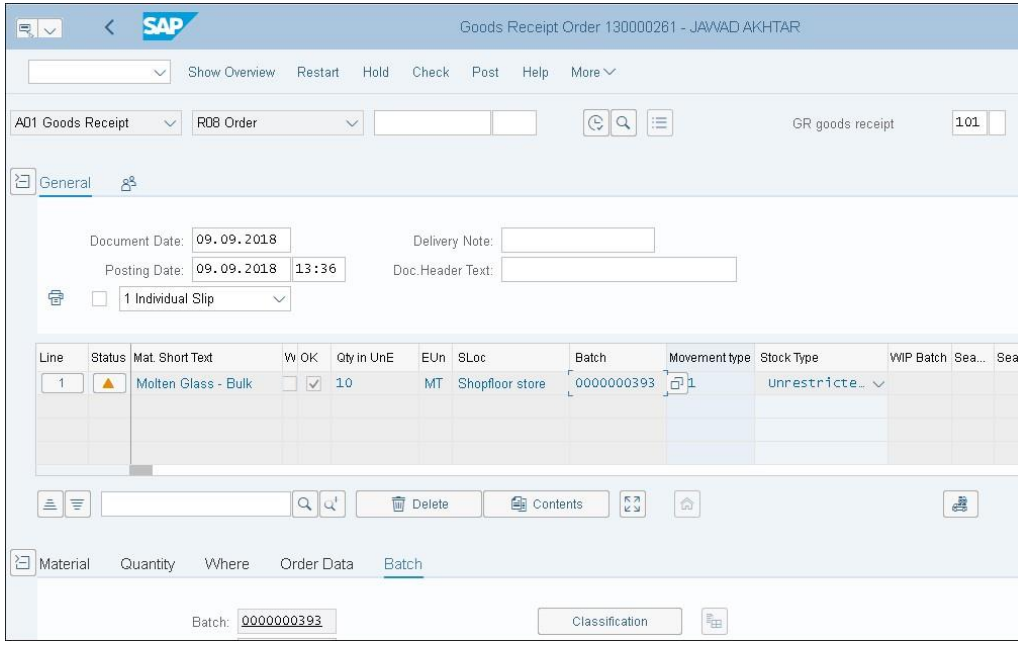


Figure 9.10 GR of a Batch-Managed Material

In Figure 9.11, you can maintain characteristics values such as that of **Product Class** and for **Thickness**.

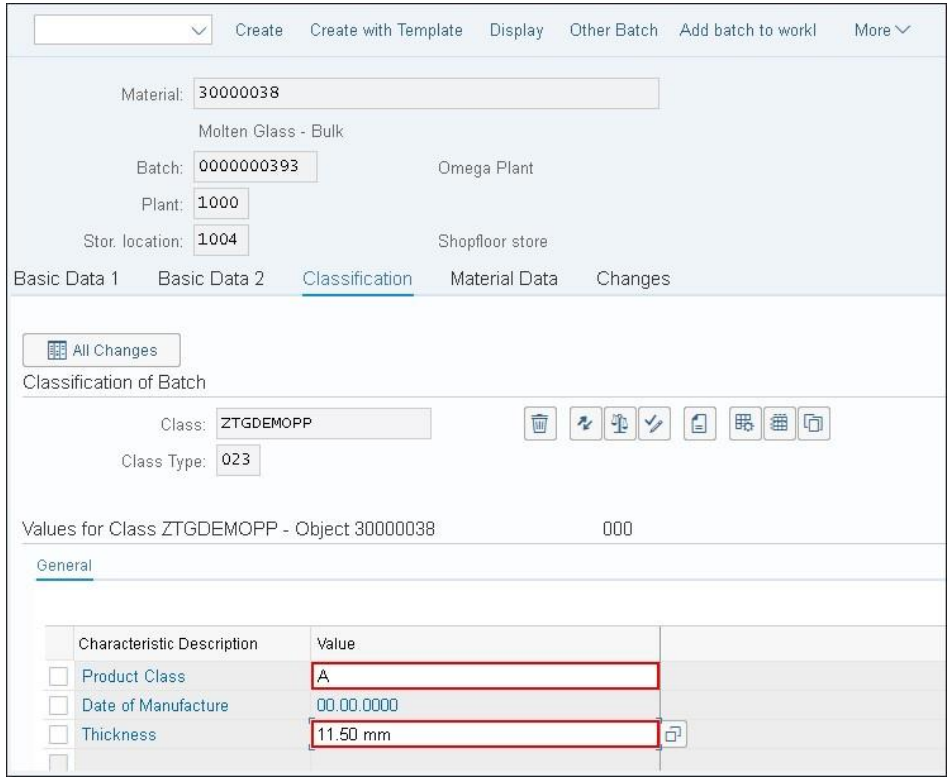


Figure 9.11 Classification View of a Batch during GR

9.4.5 Stock Overview

In the stock overview report, you can view how the stock is kept under different batches. Go to Transaction MMBE, enter the plant code and material number, and execute the report. You can see the stock overview with respective batch numbers, such as batch number 393 that we just received in the previous step. Figure 9.12 shows batch 393 of material 30000038 with quantity 10.0 MT.

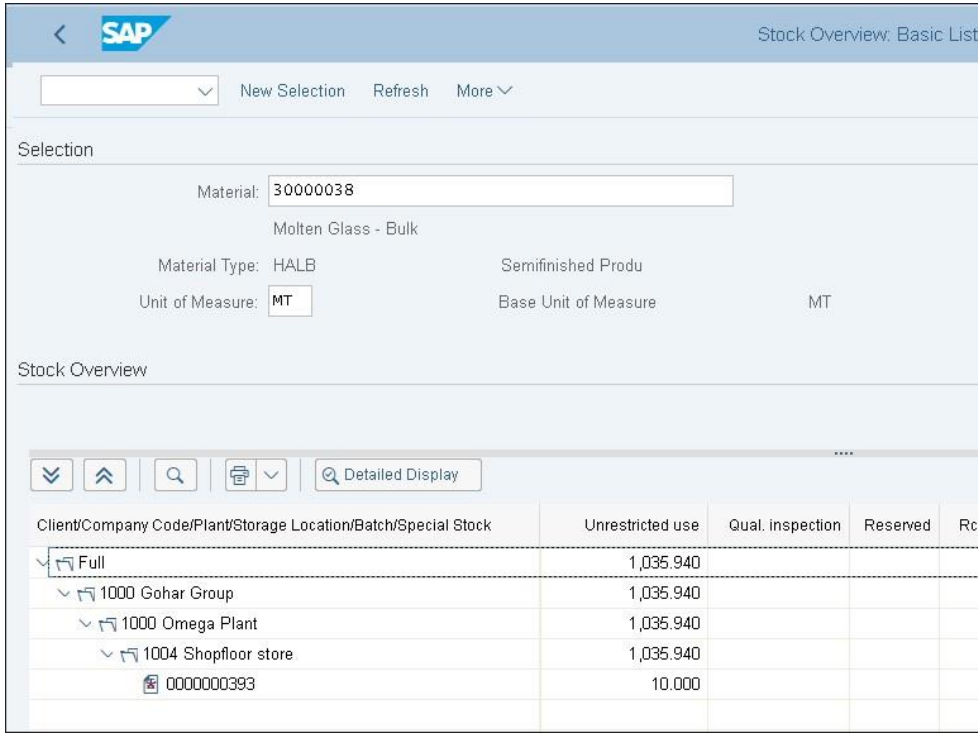


Figure 9.12 Stock Overview

After you issue the material, and if there are multiple batches of the same material in stock, the system automatically lets you choose the batch number from the material to be issued. If you want to assign a batch number based on some strategy, the batch determination strategy should be configured. We cover the entire batch determination topic in the next section of this chapter.

You can use batch usage transactions to track the batches and for analysis. Transaction MB56 will give you the details of a batch where-used list. SAP also provides the Batch Information Cockpit (BIC), which is a central tool for tracking batches, as discussed in Section 9.9.

9.5 Batch Determination

The batch determination process isn't unique to PP. The process is important in sales and distribution (SD), materials management (MM), and warehouse management (WM) as well. Batch determination uses strategy types, search strategies, and search procedures for a batch to be identified in the relevant area.

In a real-world scenario, you'll receive one material in a number of batches, and this will be kept in storage location stock or in warehouse storage bins. When you want to issue the material to production, you need to have a strategy to choose different batches. Defining the strategy in the system where the system determines and offers up the right batch to pick is the process of batch determination. Batch determination uses the condition technique. Strategy records of the respective application, such as PP, MM, SD, or WM, determine batch determination. Different strategy records in the system have to be created for different purposes, such as goods issue (GI) to production, GI to customer, GI to cost center, and so on. Batch determination can be used in production, production order, goods movement, sales order/delivery, cost center, and transfer order functions.

Customizations for each application, such as production, inventory, sales, and stock transfers, are stored in search procedures, which run the batch determination. After the batch determination procedure is set up, the system automatically accesses the corresponding entry of the application, which further refers to the relevant entries in Customizing.

Figure 9.13 shows how the system searches the batch number using the batch determination procedure. In any transaction, the system will first determine the application area—PP (production planning) and production planning for process industries (PP-PI), MM, WM, or SD—and then determine the search procedures, which are assigned based on different combinations (Figure 9.13, 1, 2). In the case of PP or PPPI, the system will determine the order type and plant from the transaction and then find a search procedure (3, 4). For MM, the system will find a search procedure based on movement type. And, in case of SD, the search procedure will be based on sales organization, distribution channel, division, and sales document type.

The search procedure helps the system determine the search type 5. The search type helps to identify the condition types and condition tables 6. The system will find the appropriate batch number based on the access sequence system.

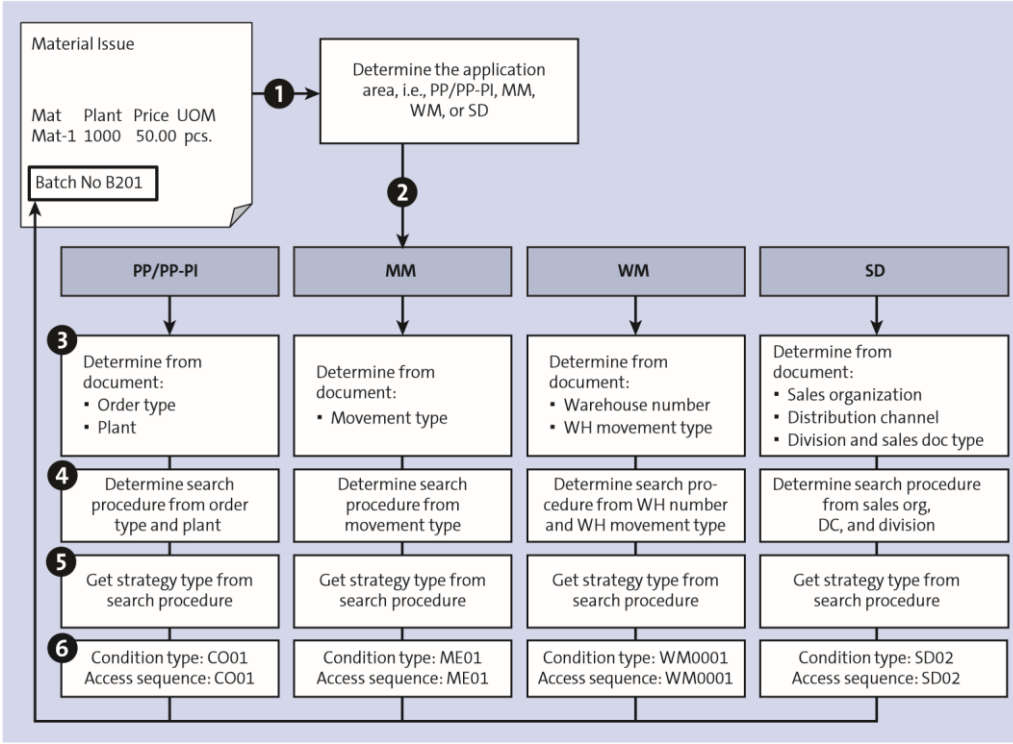


Figure 9.13 Batch Determination Flow in Logistics and Supply Chain

In the following section, we start out with the necessary configuration steps required to set up automatic batch determination in the production process of PP for discrete manufacturing (production order). However, you can also use the same logic and process steps we cover here to set up automatic batch determination in other applications, such as PP-PI (process manufacturing), MM, SD, and WM. These configuration steps are then followed by covering the necessary master data required for batch determination. Finally, we'll also show how the configuration and the master data setup eventually are reflected in the batch determination business process.

Next, let's perform the following configuration steps in their logical and sequential order.

9.5.1 Define Condition Tables

The batch determination condition table includes a number of fields for selection and to record and assign values to those fields.

There are five options for condition table creation, depending on which business process you want to use batch determination for:

Production order (Transaction OPLB)

Process order (Transaction OPLB)

Inventory management (IM) (Transaction OMA1)

SD (Transaction V/C7)

WM (Transaction OMK4)

To define the condition table of a production order, follow the menu path, **SAP IMG Logistic – General Batch Management Batch Determination and Check Condition tables Define Production Order Condition Tables**, or use Transaction OPLB.

You'll find options to define condition tables for each application area, that is, production order, process order, IM, SD, and WM separately.

In Figure 9.14, and for our example, we created a new **Table 550** by copying from the standard condition table 030. Copying a table allows us to use the batch determination procedure specific to the **Order Type/Plant/Component** combination.

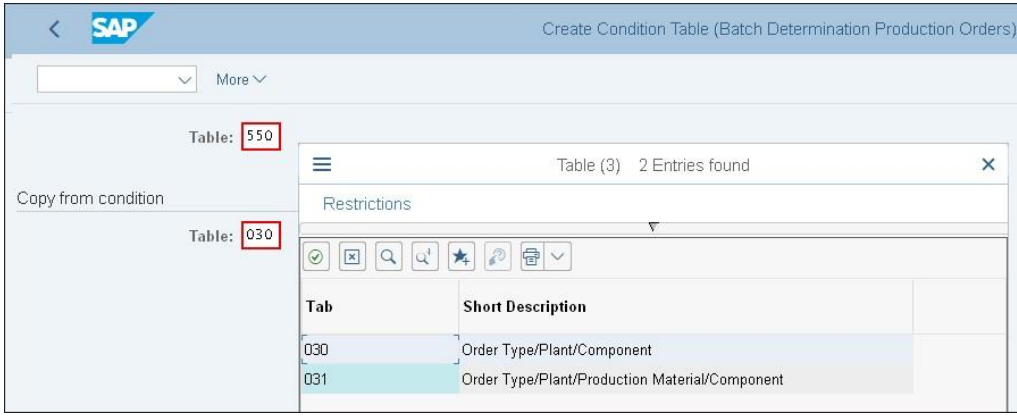


Figure 9.14 Condition Table in Batch Determination

Tips & Tricks

It's always a good idea to copy any new configuration object from an existing one and then make the desired changes to the newly configured object. Doing so not only saves time and effort but also reduces the chances of missing important configuration settings that will then be unable to give the desired results in transactions processing.

Figure 9.15 shows the newly created condition table 550 in which the three selected fields are **Order type**, **Plant**, and **Material** (which is basically the component), as shown on the left-hand side of the figure. You can choose additional fields from the catalog on the right-hand side of the same figure so they too are available for selection during the batch determination procedure. For example, if you place the cursor on the **Valuation Type** from the field catalog and click the **Select field** button, then during the batch determination, the system will only suggest batches of materials available with specific valuation types.

Figure 9.15 Creating a New Condition Table

Click the **Generate** button, and the system will create the condition table as shown in Figure 9.16.

Figure 9.16 shows the log generated on the successful creation of the new condition table 550.

Figure 9.16 Log after Condition Table Creation

9.5.2 Define the Access Sequence

For each batch strategy type, there is a batch determination access sequence. This allows the batch strategy type to access the condition tables in the correct sequence. To define an access sequence for PP, follow the menu path, **SAP IMG Logistics – General Batch Management Batch Determination and Batch Check Access Sequences Define Production Order Access Sequences**.

Figure 9.17 shows the access sequence for a production order. Select the access sequence, and click the **Edit** button. You can define the sequence of tables you want the system to follow. For example, in Figure 9.17, the system will first search the **Order Type/Plant/Material** combination, then the **Order Type/Plant/Component** combination, and so on.

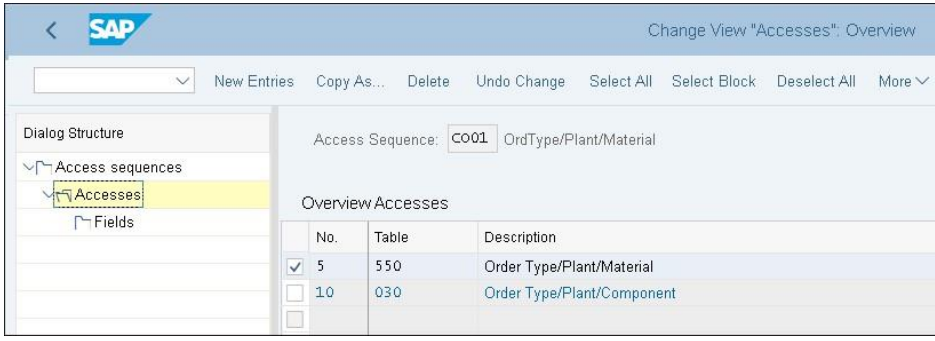


Figure 9.17 Access Sequence in Batch Determination

In the standard system for production orders, access sequences CO01 and CO02 are defined, just as in the standard SAP system for IM, access sequences ME01 and ME02 are defined. And, in the standard system for SD, access sequences SD01, SD02, and SD03 are defined.

It's recommended to make a copy of the standard access sequences available and then make changes in the condition table sequences to meet your unique requirements.

Here, we select the standard access sequence **CO01** and make a copy of it by choosing **Copy As**. In the screen that appears, we define the new access sequence as "ZPPO" while confirming to copy all dependent entries from access sequence CO01 to ZPPO.

In the screen that appears, the newly created access sequence **ZPPO** is assigned to the previously created condition **Table 550** (see Figure 9.18). The access sequence ZPPO has three fields that the system will consider during batch determination: **Order Type**, **Plant**, and **Material**.

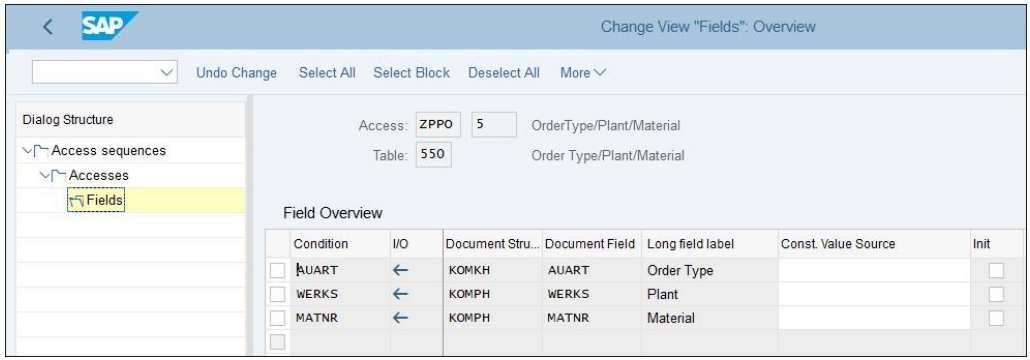


Figure 9.18 Newly Created Access Sequence ZPPO

9.5.3 Define Strategy Types

The batch strategy type is the specification that tells the system what type of criteria to use during the batch determination process. A batch strategy can be defined in the five areas already mentioned. Define the strategy types for each application area by following the menu path, **SAP IMG Logistics – General Batch Management Batch Determination and Batch Check Strategy Types Define Production Order Strategy Types**. Click the **New** button, or copy the standard strategy type provided by SAP. It's recommended to copy the standard strategy type, then make the required changes, and save the new strategy type. In our example, we created a new strategy "CO03" and also assigned the previously configured access sequence "ZPPO", as shown in Figure 9.19.

In Figure 9.19, we also assigned **Class Type 023** (**Batch**) and the previously created associated **Class ZTGDEMOPP**. This is the same class we created in the previous section for

the batch determination processes, and we are now assigning it in the newly created strategy type “CO03”.

In the **Selection** area, there is an option to define the values of certain characteristics within a **Class**. The values can be maintained by clicking on the **Maint.** button. Additionally, you’ll need the following information:

Selection type

This field allows the user to determine how the batches are selected at the commencement of the batch selection. If the **Selection type** field is left blank, then the system will display the batches that meet the selection criteria.

Sort sequence

This field allows the user to choose a sort that will define how the batches are sorted if they are selected. **Sort sequence** can be maintained on this screen if desired. Later in this section, we’ll also cover how to create a sort sequence and assign it to a condition record.

Batch split

This area contains the **No. of splits** field that defines the number of batch splits that are allowed during the batch determination.

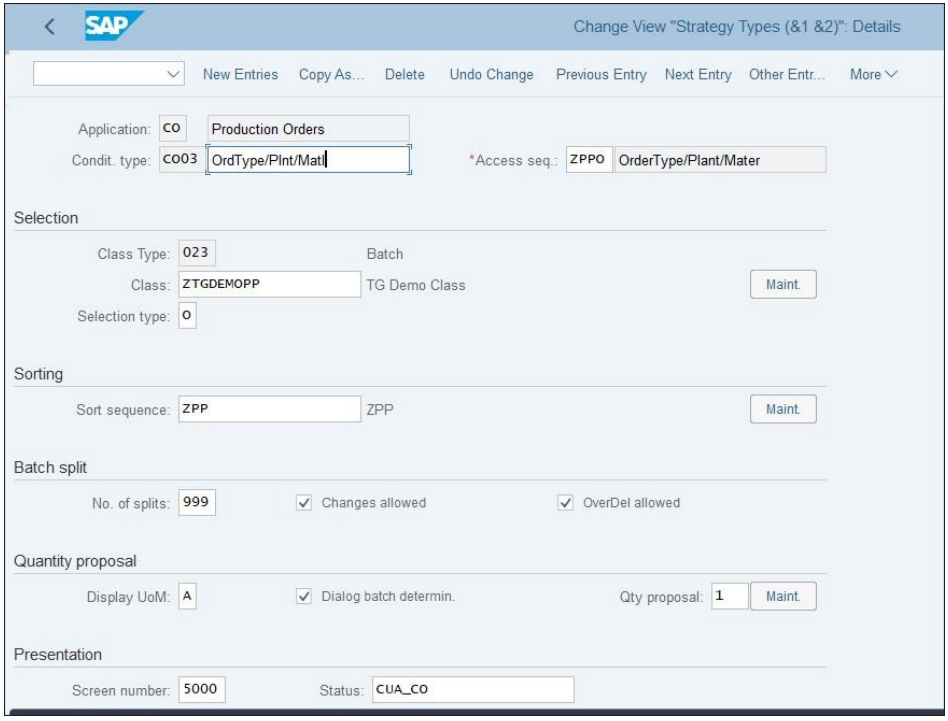


Figure 9.19 Strategy Type

9.5.4 Batch Search Procedure Definition

In this IMG activity, you define search procedures for batch determination in a production order. Follow the menu path, **SAP IMG Logistics – General Batch Management Batch Determination and Batch Check Batch Search Procedure Definition Define Production Order Search Procedure**, or use Transaction OPLG (see Figure 9.20).

Click the **New** button to define the search procedure, or define it by copying the SAPprovided search procedure. As always, it's recommended to copy the standard procedure (so that you don't miss any required settings), make the required changes, and save the entries.

In Figure 9.20, we created a new batch search **Procedure ZC0001** by copying the standard procedure CO0001. Next, select the newly created batch search procedure ZC0001, and click the **Control** folder located on the left-hand side of the screen.

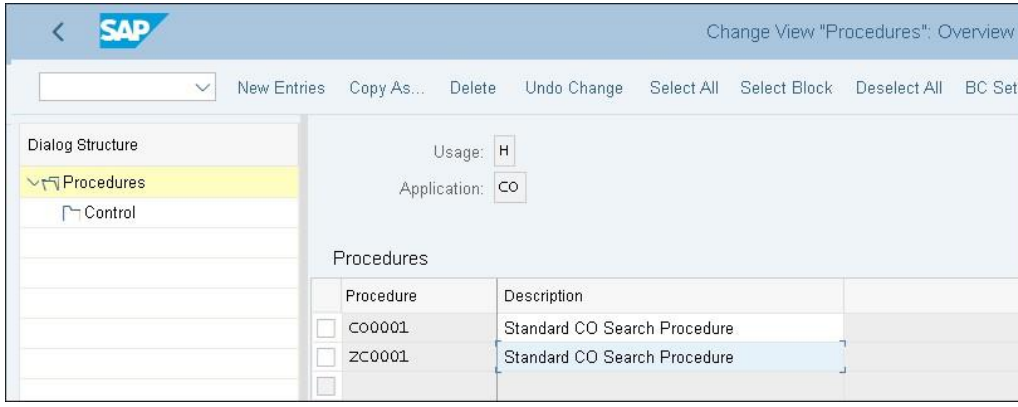


Figure 9.20 Defining the Batch Search Procedure

The previously created condition type (**CTyp**) **CO03** is now assigned to the newly created batch search procedure ZC0001, as shown in Figure 9.21.

Figure 9.21 Assigning the Condition Type to the Batch Search Procedure

9.5.5 Batch Search Procedure Allocation and Check Activation

In this step, you need to assign the batch search procedure to specific movement types as shown in Figure 9.22. So for a particular movement type, such as 261 (GI against a production order), this search strategy will help to search the relevant batches during the batch determination process.

Follow the menu path, **SAP IMG Logistics – General Batch Management Batch Determination and Batch Check Batch Search Procedure Allocation and Check Activation Allocate IM Search Procedure/Activate Check**, or use Transaction OMCG.

In Figure 9.22, we assigned the previously configured batch search procedure **Z00001** to movement type **261**. Be sure to select the **Check Batch** checkbox for the relevant movement type so that the system will trigger automatic batch determination while issuing out material against the production order and against movement type 261.

Figure 9.22 Assigning the Batch Search Procedure to Movement Type 261

9.5.6 Batch Search Procedure for Production Orders

In this final configuration step, the previously configured batch search procedure ZC0001 is assigned to the plant–order type combination. Follow the menu path, **SAP IMG Logistics – General Batch Management Batch Determination and Batch Check Batch Search Procedure Allocation and Check Activation Assign Search Procedures to Production and**

Activate CheckAssign Search Procedure to Production Order and Activate Check, or use Transaction OPL8.

Figure 9.23 shows that **Plant** "1000" and **Order Type** "ZPP3" are assigned the batch **Search Procedure** "ZC0001". The **Check Batch** checkbox is also selected so that the system uses this assigned batch search procedure during production order creation.

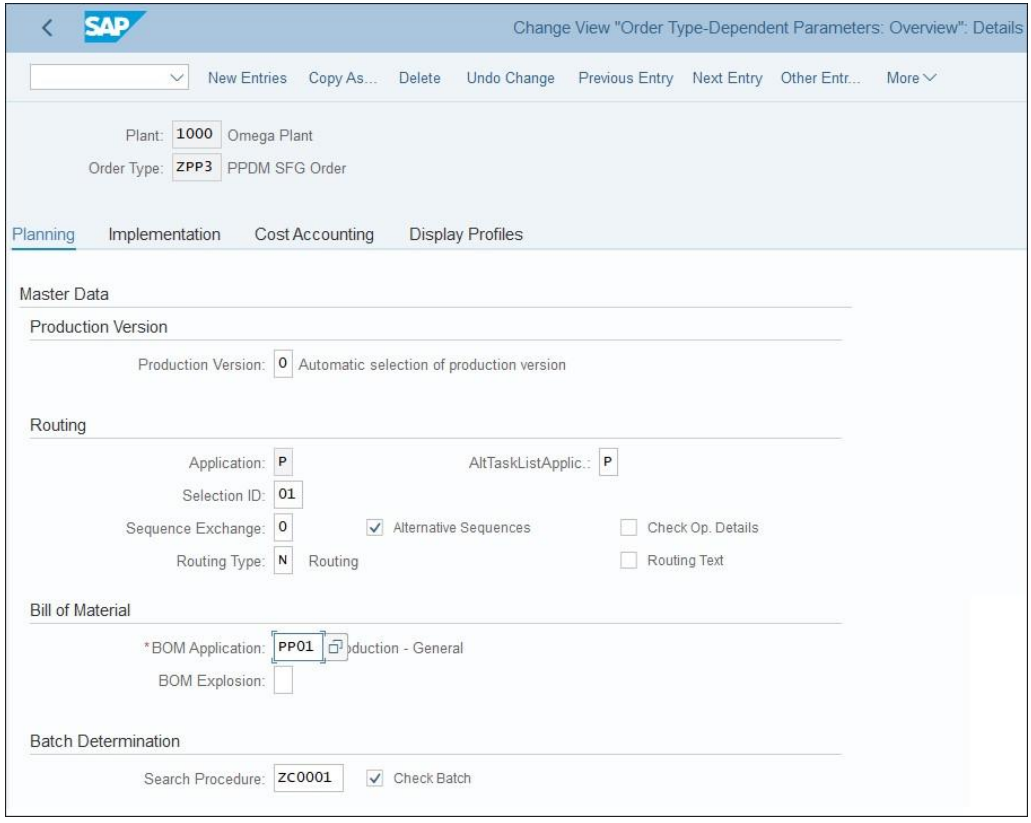


Figure 9.23 Assigning the Batch Search Procedure to the Plant-Order Type Combination

With these steps performed, the necessary configuration required for batch determination is complete. The next two are the required master data management steps required to set up automatic batch determination.

9.5.7 Creating Sort Rules

A sort sequence enables the system to choose batches that meet the user-defined sort criteria of characteristics. For example, batches of a material *expiring first* are prime candidates to be sorted in ascending order so they can be consumed at the earliest possible date. This sort strategy is known as first expiration first out (FEFO). Other sort strategies can be first in first out (FIFO) and last in first out (LIFO). Any other type of sort sequence is also possible, which we'll soon show with an example.

Access Figure 9.24 by following the menu path, **Logistics Central Functions Batch Management Batch Determination Selection and Sort Sort Rule Create** or by using Transaction CU70.

Create a new **Sort sequence** "ZPP", assign the previously created **Characteristic MM01**, and select the **Ascending** checkbox. Doing so will lead to the system suggesting batches of material with values in ascending order during the batch determination process. For example, there are four batches of a material with a thicknesses (characteristic, MM01) as 0.6 mm, 0.5 mm, 0.9 mm, and 0.35 mm. The system will first suggest batches of material with a thickness of 0.35 mm followed by batches with a thickness of 0.5 mm, and so on, to adhere to the ascending order of thickness during the batch determination procedure.

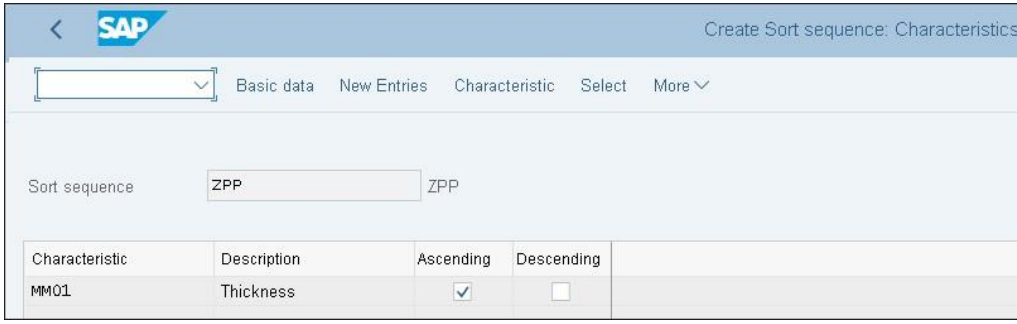


Figure 9.24 Creating the Sort Sequence in Batch Determination

9.5.8 Maintaining Condition Records

As a last step to automatic batch determination, you need to maintain condition records. These condition records are then picked by the system. To maintain a condition record, follow the menu path, **SAP Menu Logistics Central Functions Batch Management Batch Determination Batch Search Strategy For Production Order Create**, or use Transaction COB1.

Select the strategy that you've defined in the earlier configuration steps (in this case, **CO03**), and select the **Order Type** (**ZPP3**) and the **Plant** (**1000**) combination. Enter the **Material**

"30000063", as shown in Figure 9.25. Select the first line item, and then choose the **Sort** button to open the screen shown in Figure 9.26.

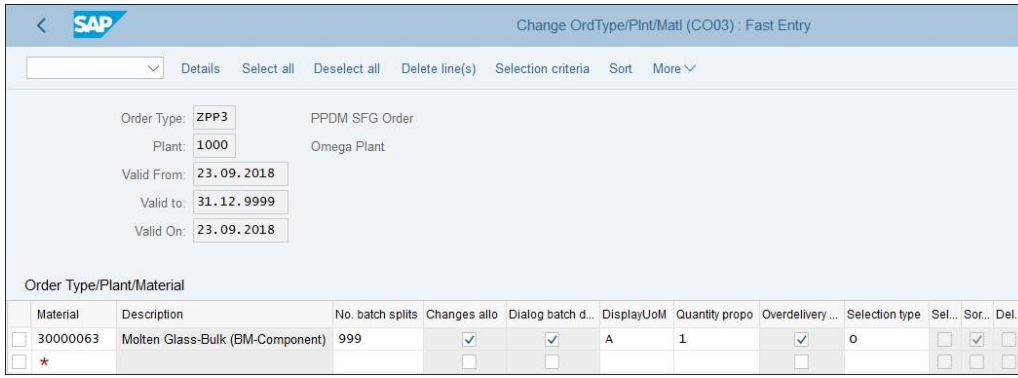


Figure 9.25 Batch Search Strategy

Figure 9.26 shows the complete details of the condition record. We've assigned the previously created **Sort rule** "ZPP" and marked **Characteristic MM01** (**Thickness**) in ascending order (**ASC** checkbox) .

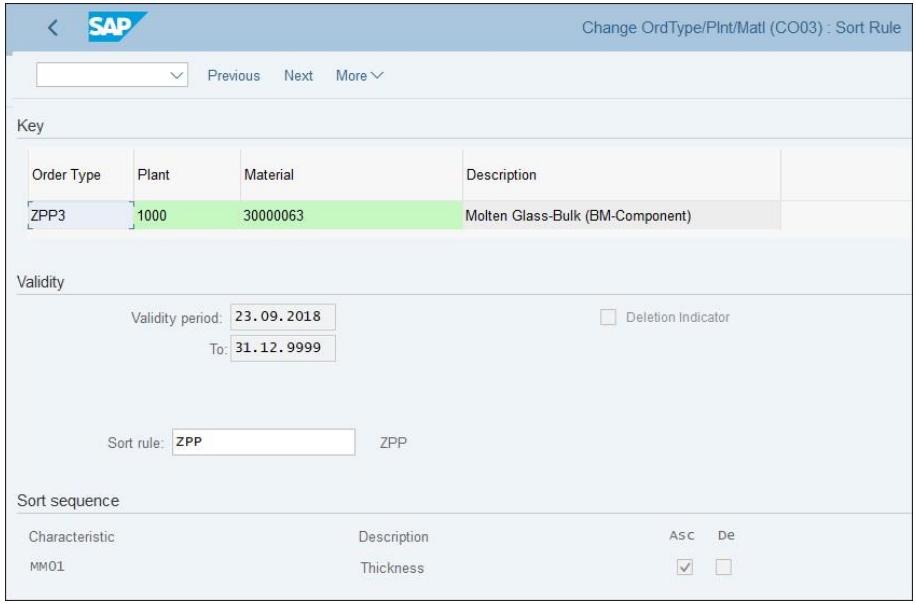


Figure 9.26 Assigning Sort Sequence in the Batch Search Strategy

The configuration and master data setup required for the batch determination procedure is complete. Let's now run the business process that entails creating a production order of

order type ZPP3 for plant 1000 for a finished good in which the component is material 30000063 undergoing the batch determination process.

Tips & Tricks

Before running the business process to test batch determination of a component, it's a good idea to use this checklist:

1. Make sure the component is managed in batches (i.e., the **Batch Management** checkbox is selected in the component's material master).
2. Ensure the component is part of the material's bill of materials (BOM) for whichthe production order is created.
3. Ensure that, along with sufficient stock of the component's batches, there are alsomultiple batches with different characteristic's values (in our example, thickness) so that you can test the completeness and correctness of the batch determination process.
4. Reconfirm your entry in the **Batch entry** field in the **Work scheduling** view of the component's material master. For example, you can choose whether you want to automatically or manually trigger batch determination upon release of a production order.

9.5.9 Stock and Batch Determination

If you have materials that you manage in batches, then you can make the relevant settings to enable the system to automatically consider stock or batch determination (or both) for a given order type. To do so, follow the configuration menu path, **SAP IMG Production Shop Floor Control Operations Stock and Batch Determination of Goods Movement**, or use Transaction OPJ2.

In the screen shown in Figure 9.27, you can set the Plant and order type (**Ty.**) combination and select the no stock determination (**No SD**) and batch determination (**BD**) checkboxes.

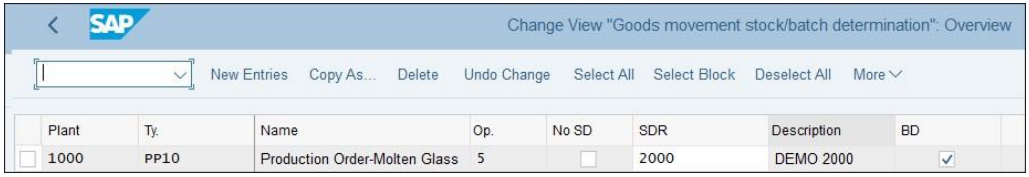


Figure 9.27 Stock and Batch Determination

Note

We suggest that you engage a MM resource to help with stock and batch determinations.

9.5.10 Business Process

Use Transaction CO01 to create a production order of order type ZPP3 for plant 1000. Enter the header material "30000062", and maintain other basic production order details, such as order quantity and dates. Navigate to the **Component Overview** shown in Figure 9.28. As you can see, component **30000063** needs a total of **100 MT** to produce the main material **30000062**. Select component **30000063**, and click the **Batch determ.** (batch determination) icon at the bottom of the screen. The system not only determines the relevant batches that meet the sort sequence of characteristic "Thickness" but also splits the total required quantity of 100 MT into multiple batches.

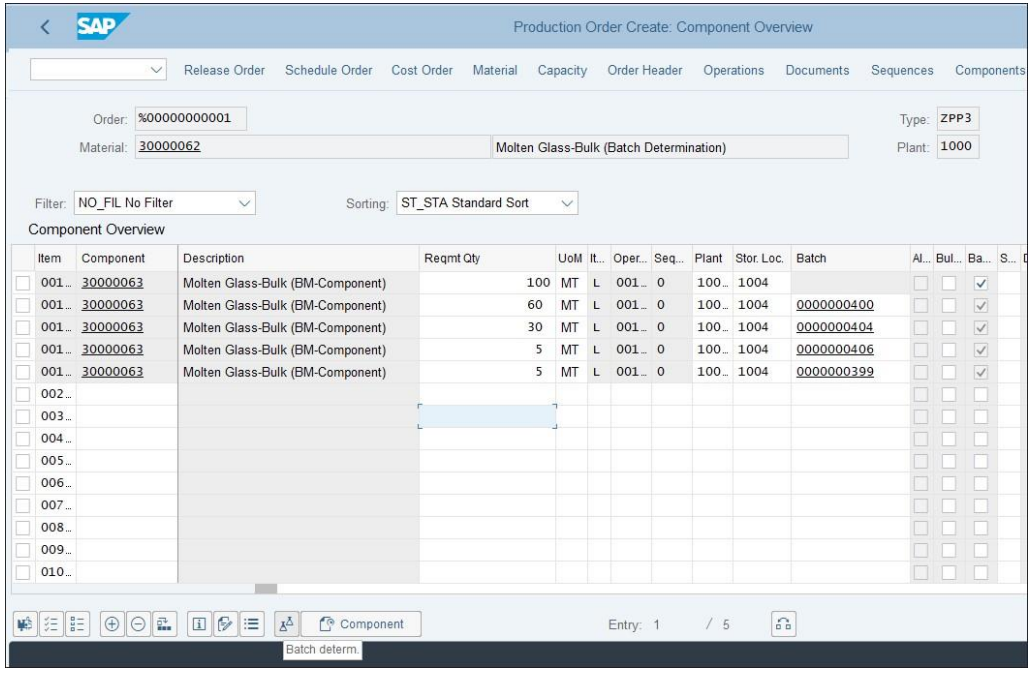


Figure 9.28 Batch Determination

Here you can see that the system has automatically determined and then assigned four batches of material 30000063: 400, 404, 406, and 399. Let's evaluate this in more detail: The system first evaluates the sort criteria "Thickness" to see which batch has the lowest thickness value and assign that batch's quantity to the production order. However, if the assigned batch's quantity isn't sufficient to cater to the complete requirement (in this case, 100 MT), the system proceeds to the next batch with the next higher thickness value and assigns the batch's quantity to the production order. The system continues doing so until multiple batches in the total required quantity are assigned to the production order.

Let's now also quickly check whether the configured batch determination for the production order is correctly configured.

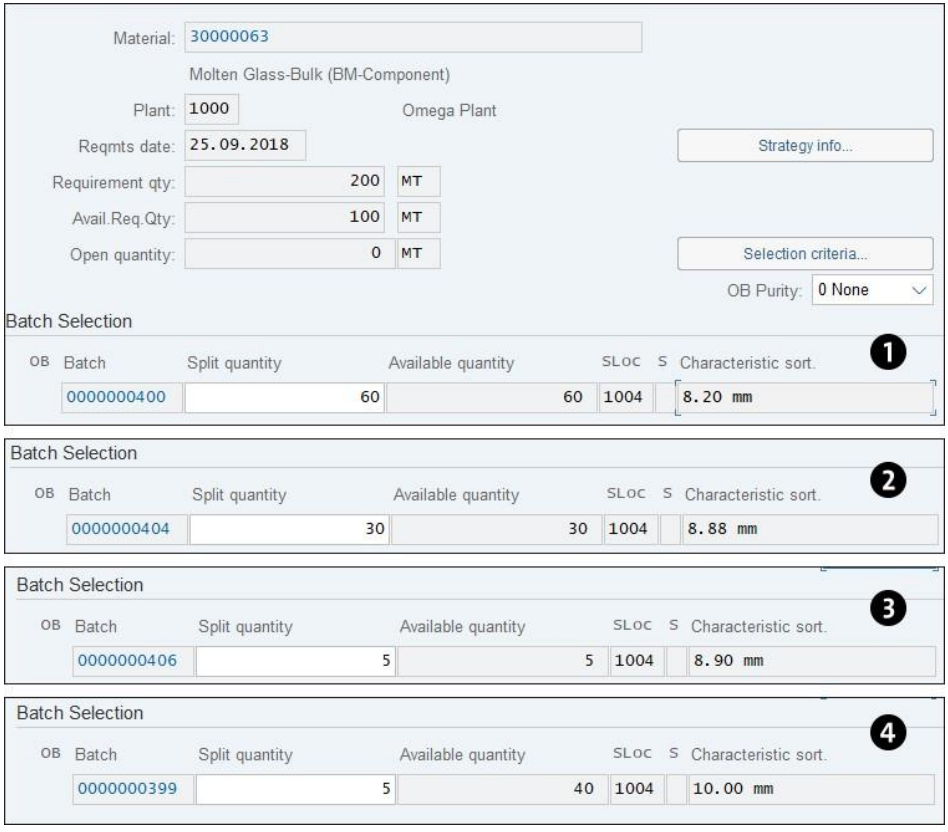


Figure 9.29 Batch Determination according to Sort Sequence

Figure 9.291 shows that batch 400 has the lowest characteristic (thickness) value of 8.20 mm but is only available in a quantity of 60 MT, which was assigned to the production order. Next, the system found that batch 404 had the next higher thickness value of 8.88 mm 2 in a quantity of 30 MT. This batch too was assigned to the production order while the system continued searching for more batches to meet a total required quantity of 100 MT. Next, it found that batch 406 with thickness value 8.90 mm 3 had a quantity of only 5 MT, which was therefore assigned to the production order. Finally, out of the available quantity of 40 MT for the fourth batch (399) with the highest thickness value of 10.00 mm, the system only needed 5 MT to meet a total requirement of 100 MT 4 and, therefore, accordingly assigned the same to the production order. These settings validate the ascending sort sequence of the thickness characteristic that we set up for batch determination.

9.6 Recurring Inspection and Expiration Dates

The ability to inspect batch-managed goods—whether they are procured raw materials or produced semifinished or finished goods—before their expiry dates ensures sufficient time and flexibility for companies to respond to any unforeseen situations.

Recurring inspection (also called repeat inspection) at regular intervals allows business users to take advantage of standard functionality to automatically create inspection lots when the expiry dates of batch-managed goods approach. The details related to the shelf life of materials are managed in individual batches. The batches nearing expiration can go through quality control checks of results recording and usage decisions to decide whether they can still be used. This functionality offers time and cost savings by enabling the business to act proactively and, thus, optimizes the entire logistics and supply chain operations of the company.

A significant challenge for any organization is to keep track of batch-managed materials with shelf-life expiration dates. This is especially the case in process-based industries for slow-moving materials or materials with a short shelf life. Tracking this information allows an organization to ensure that those materials are consumed first in the case of raw materials and sold first in the case of finished goods. This minimizes the material and financial costs associated with the need to destroy and scrap the goods or materials.

At the time of producing goods, the system is able to calculate and suggest a bestbefore date (BBD). Similarly, on procurement of goods, the system is able to calculate and suggest a shelf-life expiration date (SLED). Therefore, it makes sense to ensure that recurring inspection takes place *before* the goods are about to expire.

Note

Although this example shows the integration between PP and QM in the SAP system, you can still use several batch-specific functions even if QM isn't yet implemented in your company.

We recommend that you engage a QM consultant to ensure an end-to-end integration among PP, MM, and QM functionalities for the batch-managed business processes covered in this section.

This section outlines the important master data you need to successfully set up recurring inspection. We'll show how to manually create an inspection lot that triggers the recurring inspection program and also touch on an automatic trigger option. For the QM part of the master data setup, we recommend that you engage a QM consultant to cover the following QM-specific master data setup.

9.6.1 Quality Management Master Data Checklist

For recurring inspection to work correctly, you need to set up the following QM master data:

Activation of recurring **Inspection Type 09** in the material master

Inspection plan Usage **9** (**Material Check**)

Status set to **4** (**Released**)

Activation of Recurring Inspection Type in the Material Master

Although the material may have been created previously, you still need to activate its QM view. If the QM view is already activated, you need to activate the new inspection type for recurring inspection at the organizational level (plant). To activate the recurring inspection type, follow the menu path, **Logistics Materials Management Material Master Material Create (General) Immediately**, or use Transaction MM01.

Enter Material "10000265", and choose the **Select view(s)** button. Select the **Quality Management** view, and then choose **Organizational Levels**. Enter Plant "1000", and choose **Continue**. This leads to the **Quality Management** view of the material master Here,

maintain an **Inspection interval** of **10** days to denote that material inspection is due after every 10 days. In the case of recurring inspection, the system refers to the information maintained in this field to calculate the next inspection date. Choose **Insp. Setup**, and in the ensuing popup, maintain the **Inspection Type 09** for recurring inspection. Make sure to select the **Active** checkbox to activate this inspection type.

Back to the **Quality management** view, this time, choose the **Plant data/Stor. 1** view, and the screen shown in Figure 9.30 appears.

Figure 9.30 shows the **Shelf life data** area in which we maintain the shelf life data, including the minimum, maximum, and total shelf life of a material. While calculating or updating the SLED, the system looks for the date of manufacturing against the production/production order or date of GR against the purchase order and adds up the period, such as days or weeks from the **Total shelf life**, to come up with the SLED/ BBD. In this example, the system adds 20 days from the **Total shelf life** field to the date of manufacture to suggest a SLED/BBD. For SLED/BBD calculation, the system considers calendar days.

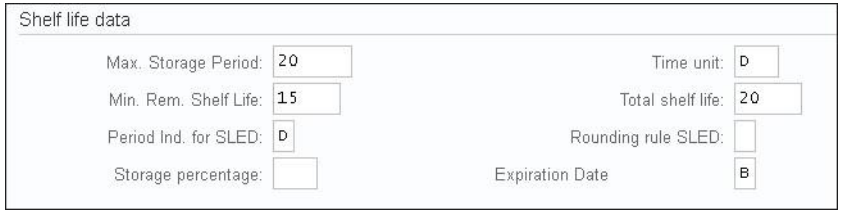


Figure 9.30 Shelf Life Data in Plant/Stor. 1 View of the Material Maser

[+]

Tips & Tricks

The maximum storage period of a material should have the longest duration in terms of period. The total shelf life of a material must be greater than its minimum remaining shelf life. Further, it makes sense for an inspection interval (see Figure 9.31) to be less than the total shelf life.

Figure 9.31 Inspection Interval in the QM View of the Material Master

Batch Master

Let's look at some of the details about the material's batch, which is about to expire. When materials are batch managed, it's always the batch—not the individual material—that expires. To change the batch, follow the menu path, **Logistics Materials Management Material Master Batch Change**, or use Transaction MSC2N. Enter **Material** "10000265", **Plant** "1000", the storage location (**Stor. location**) where the batch is stored as "1001", and the material **Batch** number as **0000000029**. Press (Enter) so that Figure 9.32 appears.

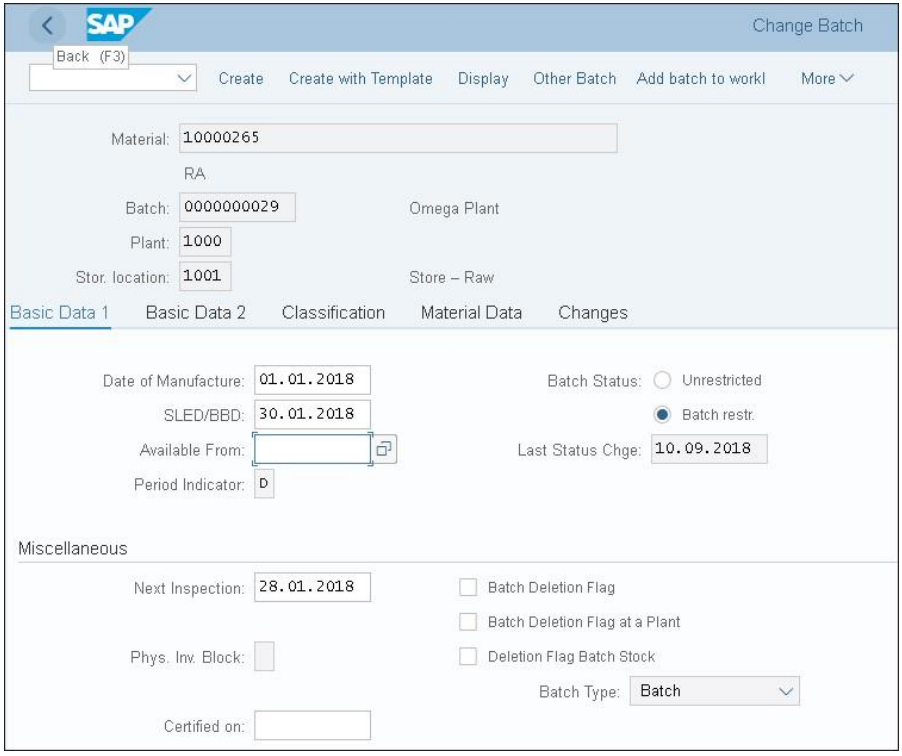


Figure 9.32 Shelf Life Expiration Date and the Next Inspection Date

The **Next Inspection** field is of paramount importance for recurring inspection. Together with the inspection interval that we previously covered (in the QM view of the material master), the system calculates the next inspection date whenever a business user records the usage decision of an inspection. Here the next inspection date is January 28, 2018 (**28.01.2018**), and inspection should occur after every 15 days. On executing the recurring inspection program, which we'll cover next, the system adds another 15 days to this date (28.01.2018) to arrive at 12.02.2018. In reality, the system comes up with a date that is one

day earlier than the date maintained in the **Next Inspection**field. This is to ensure that the quality inspector is able to inspect the material, record its results, and decide on its usage (the usage decision) at least a day before the product is set to expire.

The **Date of Manufacture** field in this case is **01.01.2018** (January 1, 2018). For in-house production of finished or semifinished goods, this is the date when the user records GR against a process or production order. If this batch contains material (e.g., raw material) received against a procurement process, then at the time of recording its GR, the system prompts the warehouse person to enter the date of manufacturing mentioned with the accompanying vendor's quality certificate or supporting documents, such as a packing list. On executing the recurring inspection program, the system looks for the data maintained on shelf-life expiration to come up with a new SLED/BBD.

Note

If there is any unique business need, the SAP system also provides user exit QEVA0003 to define a different logic for calculating a next inspection date for a recurring inspection. You need to engage an ABAP resource for this activity.

9.6.2 Business Processes

To set the initial parameters for recurring inspection, follow the menu path, **Logistics Quality Management Quality Inspection Worklist Inspection Lot Creation Deadline Monitoring Trigger Manually**, or use Transaction QA07. In Figure 9.33, enter **Material** "10000265", **Plant** "1000", and **Batch** as "29". You can define other parameters as needed.

In this example, we define the **Initial run in days** as "5" and that the material should transfer to quality inspection stock at the time of inspection lot creation (**To insp.stock at insp. date** checkbox) by the recurring inspection program. Therefore, all materials whose inspection dates fall in the next five days (from today's date or the date on which you run the transaction) are considered during the deadline monitoring program run. After such materials are identified, the system not only creates inspection lots for them but also moves the stock from unrestricted stock to quality inspection through the transfer posting process. Refer to Table 9.1 for information about the various fields and functions, which you can also eventually map with your company's business processes.

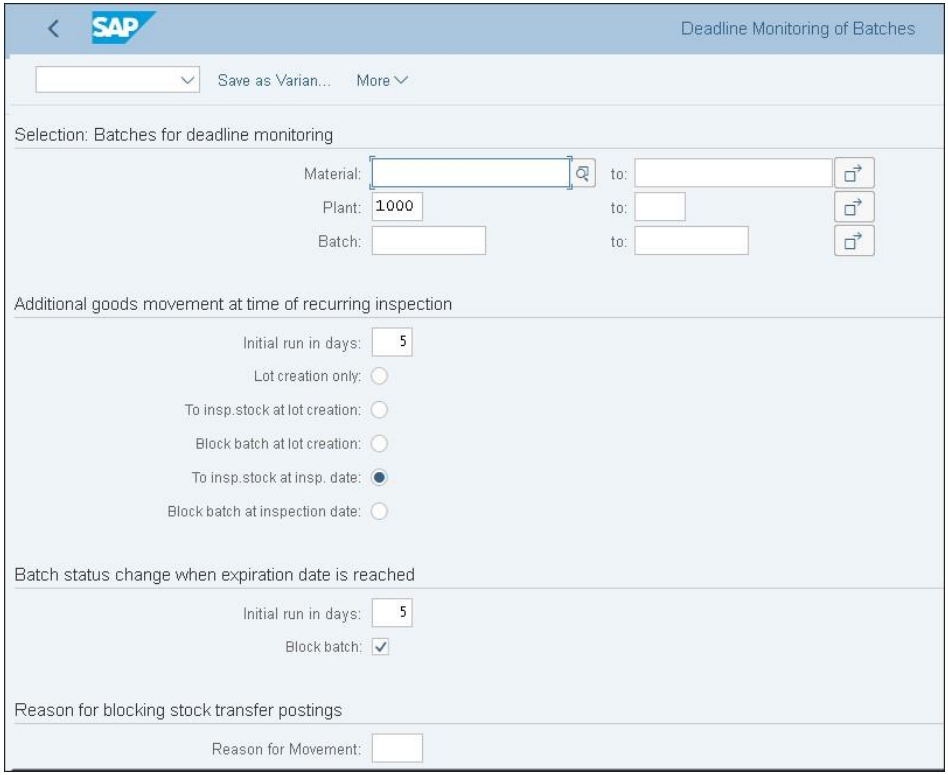


Figure 9.33 Deadline Monitoring (Recurring Inspection)

Field	Function/Description
Initial run in days	The number of days ahead in the next inspection date for the system to consider for recurring inspection purposes. If you've maintained five days, and if today is December 15, 2018, then the system looks for all the material batches whose next inspection date is on or before December 20, 2018.
Lot creation only	The system only creates an inspection lot, but the batch is still in unrestricted use stock.

Table 9.1 Details of Fields and Functions in a Recurring Inspection Manual Run

Field	Function/Description

To insp. stock at lot creation	The system creates an inspection lot and transfers the batch to quality inspection stock. The status of the batch changes to **Restricted**.
Block batch at lot creation	An inspection lot is created, and the batch is blocked for any usage until the usage decision is made.
To insp. stock at insp. date	The system transfers the batch to inspection stock on the date when the user needs to perform quality inspection.
Block batch at inspection date	The system transfers the batch to blocked stock on the date the user needs to perform inspection.

Table 9.1 Details of Fields and Functions in a Recurring Inspection Manual Run (Cont.)

Choose **Execute** to see the detailed log in Figure 9.34. The system informs that the batch's expiration date is reached and the material's batch is assigned a **Restricted** status.

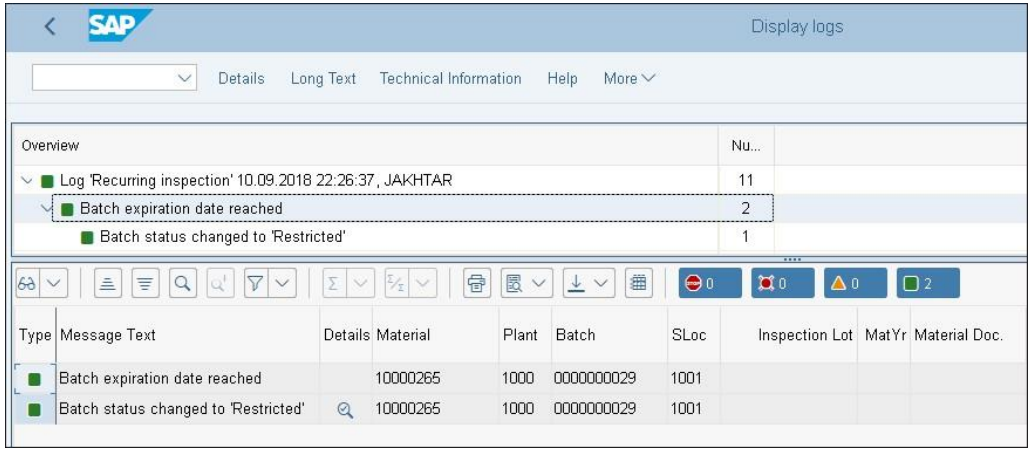


Figure 9.34 The Log Display of Deadline Monitoring

Tips & Tricks

To bring about organizational efficiency and optimization, you can automate and schedule the recurring inspection process via scheduling jobs at regular intervals using Transaction QA06. First, you need to define a variant. The next step is to maintain the frequency with which the system runs the scheduled program for recurring inspections. It's best to schedule these programs during slow working hours (i.e., weekends or nights) to conserve the system's resources.

You can use Transaction MB5L, which is the shelf life list, to gain comprehensive visibility of materials whose shelf lives have ended or are about to end (see Figure 9.35).

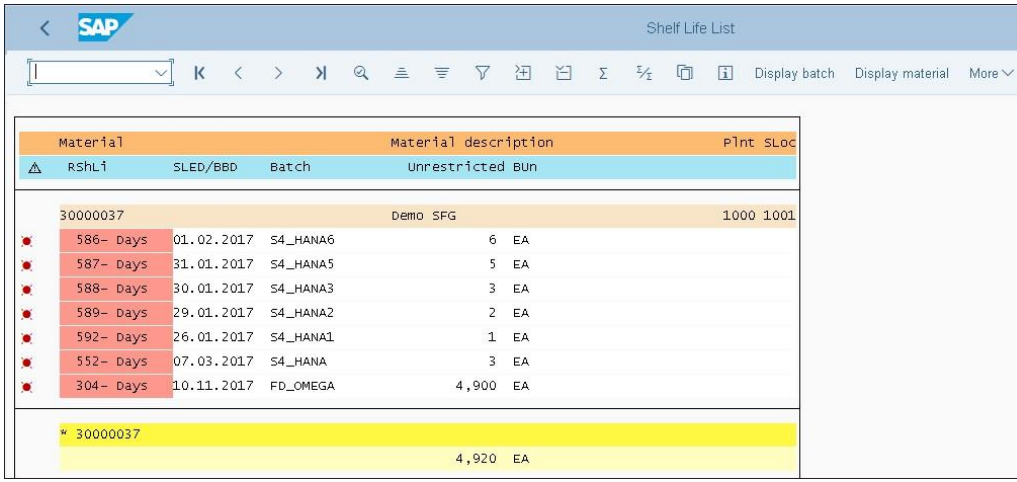


Figure 9.35 Shelf Life Expiry List

9.7 Batch Derivation

With batch derivation, you can efficiently and automatically transfer a batch's characteristics values from the sender material's batches to the receiver material's batches, thereby saving you time, data entry effort, and cost. Batch derivation enables you to maintain one-to-one, one-to-many, and many-to-one relationships between the sender's and the receiver's materials to bring in complete visibility of information and data.

Whenever a batch-managed material is processed in the production process, its characteristics change, and the batch-managed material attains different physical and chemical attributes. These changed attributes are maintained as characteristics values of the batch-managed materials. With batch derivation, you can control how

the system manages the characteristics values flowing from a sender material to a receiver material.

In this section, we'll cover the basic configuration settings you need to activate batch derivation. Next, we'll move on to the master data you need to set up, including settings in the material master, classification, and batch derivation–specific settings. Finally, we'll cover the end-to-end business process in which we show how the settings made for master data are reflected in the batch derivation process. For this example, the sender material is 30000038 (Molten-Glass Bulk, a semifinished material consumed during the production process to produce finished good, 40000022), whereas the receiver material is 40000022 (Troy, a finished good).

Let's start with the configuration basics of batch derivation.

9.7.1 Configuration Basics

Activate batch derivation in the configuration settings by following the menu path, **SAP IMG Logistics – General Batch Management Derivation of Batch Data Activate Batch Derivation** or by using Transaction DVSP. In the screen that appears, select the **Derivation Active** radio button, and save your settings.

In the following sections, we'll cover the end-to-end business process of first setting up batch derivation master data, which entails setting up details of sender and receiver materials of a batch's data. We'll then use an example to show how the sender material's batch data automatically flows into a receiving material's batch data through the batch derivation process.

9.7.2 Classification in Material Master

In the material master of the sender material and receiver material, you need to maintain the classification view, wherein you can incorporate class type 023, which is specific to batch-managed materials. To maintain the classification view or make changes to the already-maintained classification view in the material master, follow the menu path, **Logistics Materials Management Material Master Change Immediately**, or use Transaction MM02 (Figure 9.36).

Figure 9.36 incorporates class 023_MM of **Class Type 023** (**Batch**) and has three characteristics whose descriptions are given as **Product Class**, **Date of Manufacture**, and **Thickness**, respectively. On this screen, you only need to assign an already-created class,

which in this example is 023_MM. After you assign an already-created class, the system automatically assigns the characteristics associated with the class. You don't have to assign any specific value to the characteristics (in the **Value** column) because you do this during the transactional data entry.

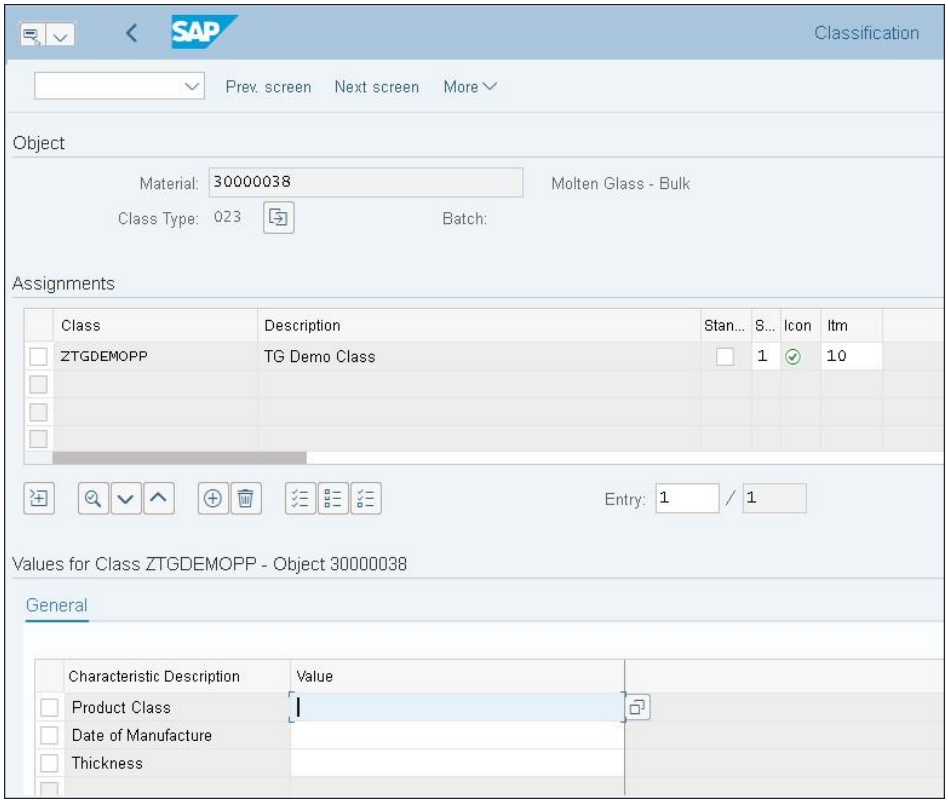


Figure 9.36 Classification View in the Material Master

Note

The classification settings that you make for the sender material also apply to the receiver material, especially the common characteristics whose values you want the system to transfer during batch derivation. Although the preceding example shows classification details of sender material 30000038, we've made similar classification settings for receiver material 40000022. Refer to Chapter 7 on classification.

In the following sections, we'll cover the steps involved in setting up batch derivation, including maintaining details of sender and receiver materials' batch details and how a sender material's batch data flows into a receiver material's batch.

Classification: Class with Characteristics

It's important to understand how class and characteristics are linked together. To view the structure of class 023_MM and the characteristics associated with it, follow the menu path, **Cross-Application Components Classification Master Data Classes**, or use Transaction CL02. In the initial screen, enter **Class** "023_MM" and **Class type** "023" (**Batch**), and then click **Change**.

Figure 9.37 consists of three characteristics—ZCLS, ZPD, and MM01—whose only descriptions appeared or were visible in Figure 9.36. We refer to several instances when the system interchangeably displays the characteristics or their descriptions. The data type of the first characteristic, ZCLS, is **CHAR** and consists of 10 characters; the data type of ZPD is **DATE**, and the data type of MM01 is **NUM** with up to 4 characters. MM01 has a unit of measure **mm** (millimeter) and with two decimal places.

For this example of batch derivation, we'll only use the characteristics **ZCLS** (**Product Class**) and **MM01** (**Thickness**).

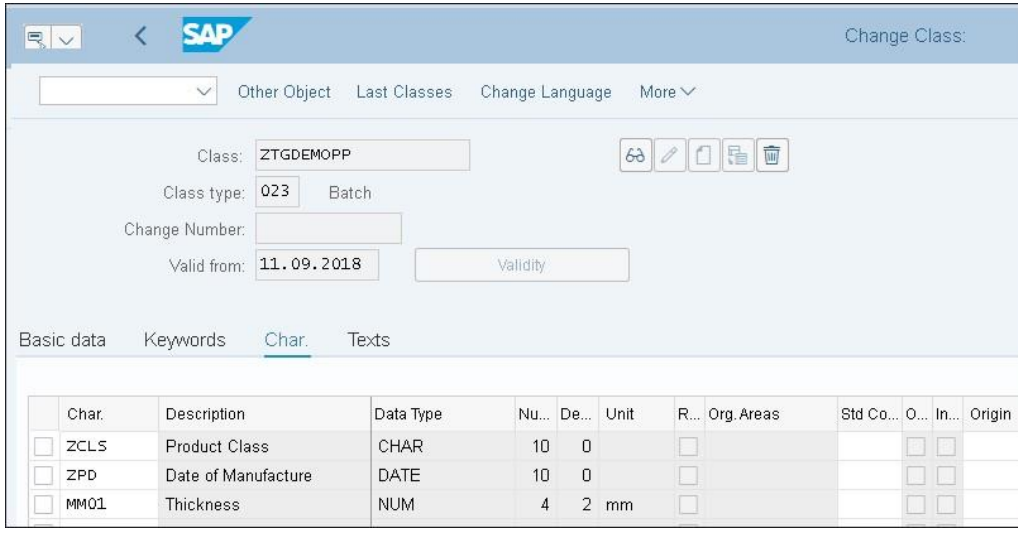


Figure 9.37 Characteristics Assignment in Class

Batch Derivation: Sender Material

For batch derivation settings for the sender material, including the characteristics, follow the menu path, **SAP Menu Logistics Central Functions Batch Management Batch Derivation Sender Condition Records Create**, or use Transaction DVS1. On the initial screen in which the standard **Strategy Type** option is available, the available key combinations offer the options to choose only the **Sender Material Number** radio button or **Receiver Material + Sending Material** radio button. This key combination enables you to maintain not just the sender material's information but also the receiver's material. Place your cursor on the **Strategy Type** field and press (F4) to see the dropdown and to select condition type **BDS1**. After you select **BDS1** and press (Enter), the system opens a popup screen to provide radio buttons to enable you to select a combination of both receiving and sending material information on the same screen, and only sender material number information. For this example, we select the first radio button (**Receiving Material + Sending Material**) and choose **Continue**.

In Figure 9.38, enter "40000022" in the **Receiver Material** field and validity dates in the **Valid From** and **Valid to** fields. If you don't enter the validity dates, the system automatically selects the date of creation of the condition record until **December 31, 9999**. If you want to use a different validity than what the system proposes, use the **Validity** (not shown).

Enter sender material "30000038" in the lower half of the screen. In this section of the screen, you can enter multiple sender materials for one receiver material. Select the **Sender Material 30000038**, and then click **Choose**.

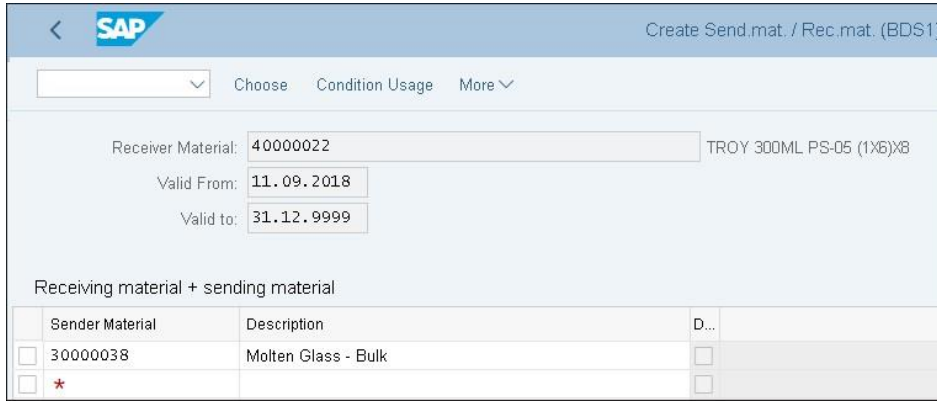


Figure 9.38 Defining the Sender-Receiver Relationship

Figure 9.39 consists of details about both **Sender Material 30000038** and **Receiver Material 40000022**. Enter the characteristics "ZCLS" and "MM01" in the lower half of the screen, which tells the system to send the characteristic values of these two characteristics from material 30000038 (the sender material) to material 40000022 (the receiver material). These are the same characteristics that you previously maintained in the **Classification** view of material masters 40000022 and 30000038 (refer to Figure 9.36).

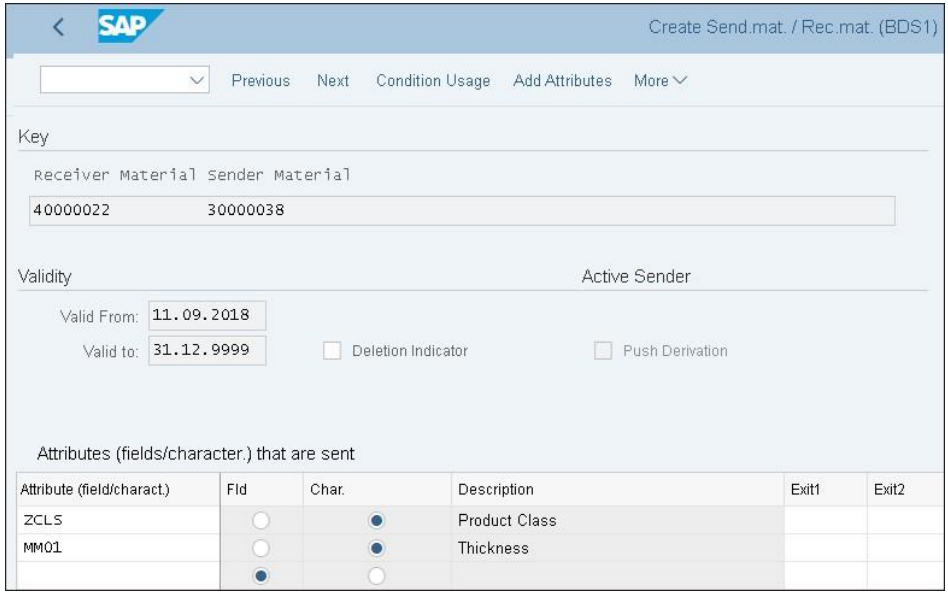


Figure 9.39 Attributes of the Sender Material

The next step is to define the event or instance when the system performs batch derivation for the receiver material. The option of automatic batch derivation is possible at the time a production or production order is released, GR of a production or production order, GR of a purchase order, usage decision from quality inspection process, or transfer posting between two batches of different materials with common characteristics. It's also possible to perform manual batch derivation, if there is any such business need. Choose **Condition Usage** or press (F7).

Select **Event 200** (see Figure 9.40) by clicking it once until it highlights to enable the system to perform batch derivation on the release of a production or a production order. Choose **Continue**, and save your settings.

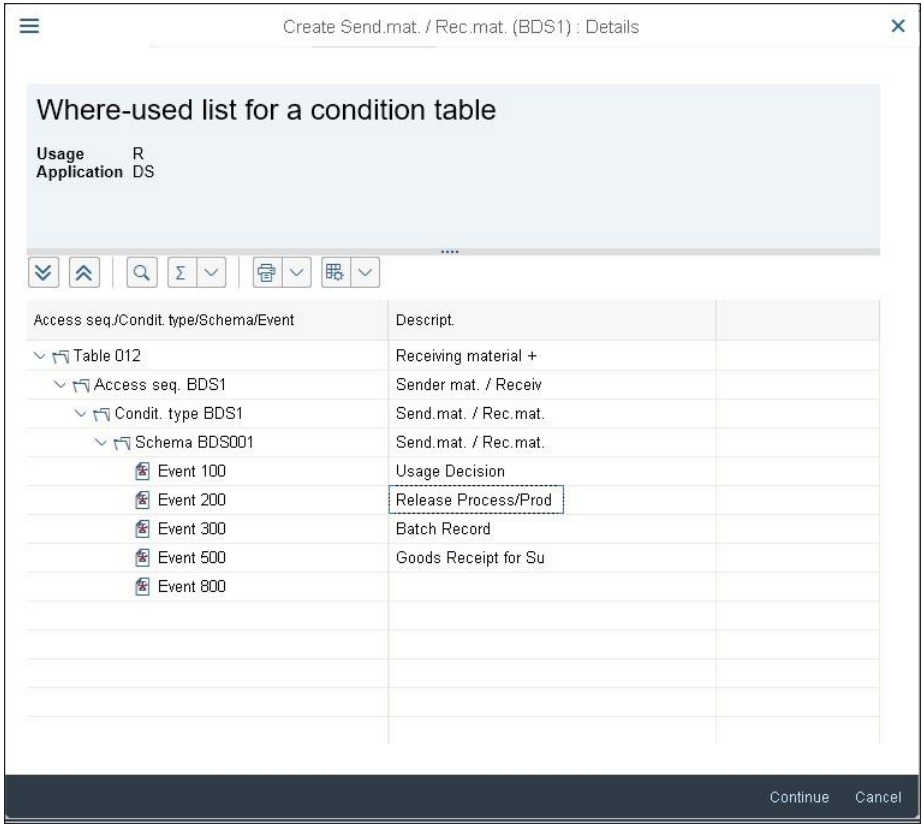


Figure 9.40 Choosing Event for Batch Derivation

So far, we've covered batch derivation for the sender material while also associating it with the receiver material. However, the setting for the receiver material is significantly more detailed than the setting for the sender material, especially regarding how the system responds if batch derivation can't be performed on the receiver material or one of the characteristic values derived from batch derivation is missing.

Batch Derivation: Receiver Material

For batch derivation settings for receiver material, including the characteristics, follow the menu path, **SAP Menu Logistics Central Functions Batch Management Batch Derivation Recipient Condition Records Create**, or use Transaction DVR1. On the initial screen, the **Strategy type** option is available for the receiver material key combination. This key

combination enables you to enter not just the receiver material's information but also that of the receiving material type. After you place your cursor on the **Strategy type** field and press (F4), the system brings up the **Condition typesBDR1** and **BDR2** to select. Select **Condition type BDR1**, press (Enter), and in the popup that appears, choose the **Material Number** radio button.

Enter **Receiver Material** "40000022". If you don't enter the validity dates, the system automatically selects the date of creation of the condition record until December 31, 9999 (infinity). Next, choose **Receiver material – 40000022**, and then choose **Details** so that Figure 9.41 appears. Here, enter the same two characteristics or attributes "ZCLS" and "MM01" of the class 023_MM. Next, select both of these characteristics, and choose the **Rules** button located at the bottom of the screen.

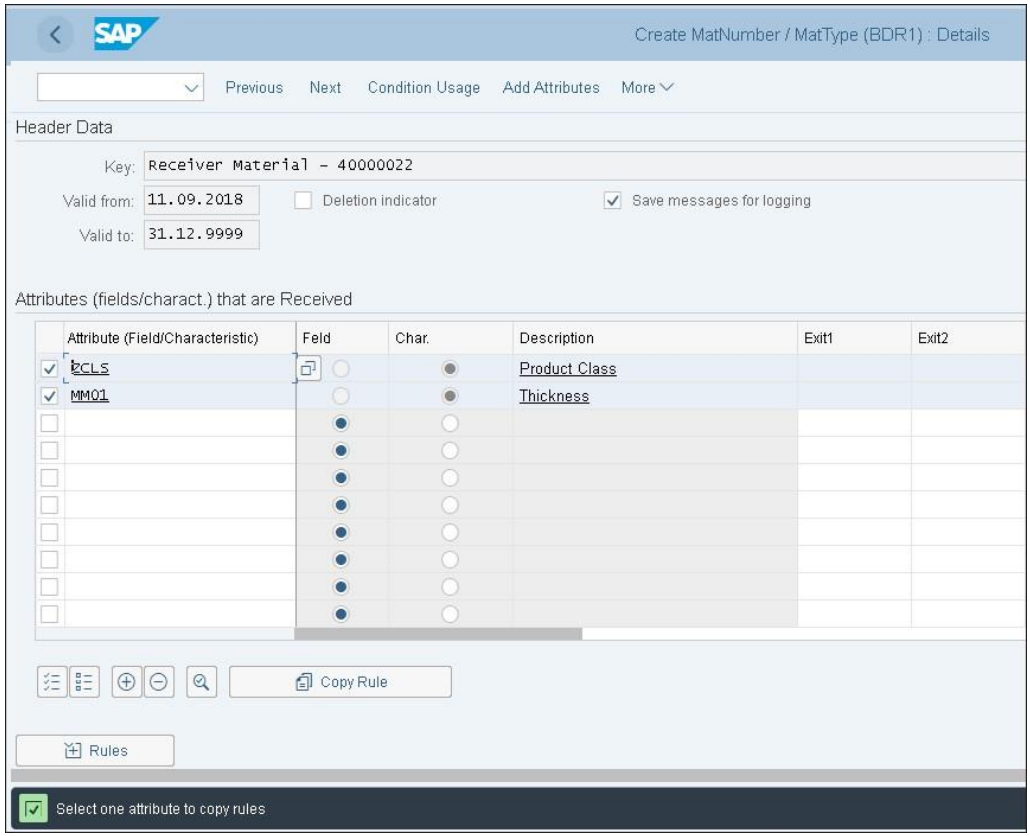


Figure 9.41 Attributes for Characteristics of the Receiver Material

In Figure 9.42, you can define the rules for every individual characteristic that the system needs to follow if it can't perform batch derivation. In this example, we set the rules for the first characteristic **ZCLS**, in which we set the control level to warning in case the system finds the sender field empty. An empty sender field means that there is no characteristic value in the sender material's classification, so nothing transfers to the receiver material during batch derivation. You can also turn these warning messages into error messages if you want to ensure that the user handles batch derivation–related issues as soon as an error message appears. The second control setting for the same characteristic ZCLS stipulates how the system reacts if it's able to previously find an already-entered value in the characteristic. If the system will overwrite this characteristic, you can indicate whether the system will do so with a warning message or bring up an error message that doesn't allow overwriting.

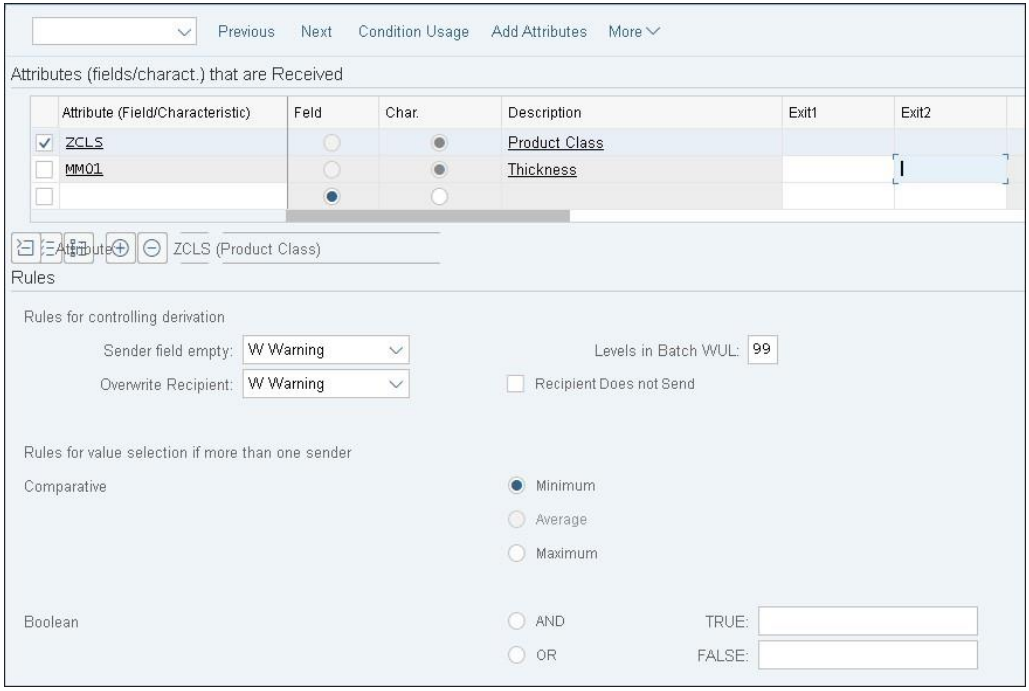


Figure 9.42 Rules for Characteristics of the Receiver Material

Repeat the same rules setting for the second characteristic, MM01.

9.7.3 Business Processes

The business process of batch derivation begins with creating a production order for the receiver material 40000022 (the finished good) in which the system automatically assigns the sender material 30000038 (Molten Glass-Bulk) as one of its components.

To create a production order, use Transaction CO01. Enter the receiver **Material** "40000022", the **Plant** "1000", and the **Order type** "ZPP1", and then press (Enter). Maintain the order header details, such as the production order quantity and dates, and then navigate to the **Component Overview** shown in Figure 9.43. In the **Component Overview** of the production order for the receiver **Material 40000022**, in which the system assigns a specific **Batch** number **276** of the sender material or **Component 30000038**. Double-click **Batch 276** so that Figure 9.44 appears.

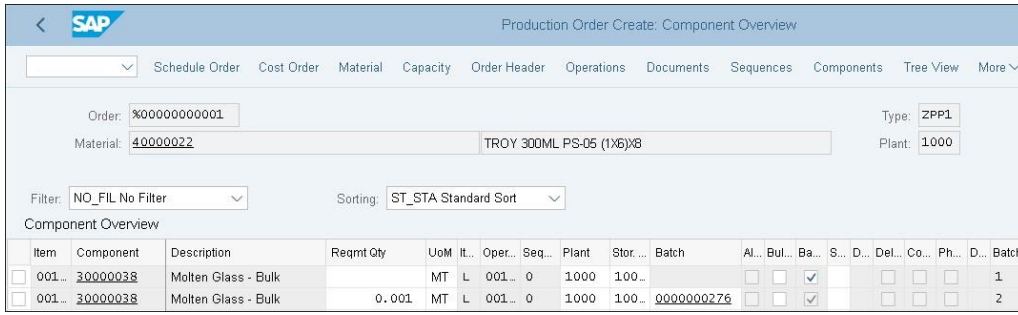


Figure 9.43 Production Order Creation

Figure 9.44 shows the already-maintained characteristics values of **Batch 276** of **Material 30000038**, in which the characteristic **Product Class** is a assigned a value of "A" whereas characteristic **Thickness** has a value of "11.75 mm".

Figure 9.45 shows the production order header screen and the **Goods Receipt** tab. To test whether batch derivation is correctly set up, first manually create the GR batch of the receiving material (40000022), which, in this example, is **Batch 395**. To manually create the batch, simply click the **Create Batch** icon next to the **Execute Batch Derivation** icon. Don't forget to release the production order at this time because we made the settings to trigger the batch derivation functionality only for a released production order (refer to Figure 9.40).

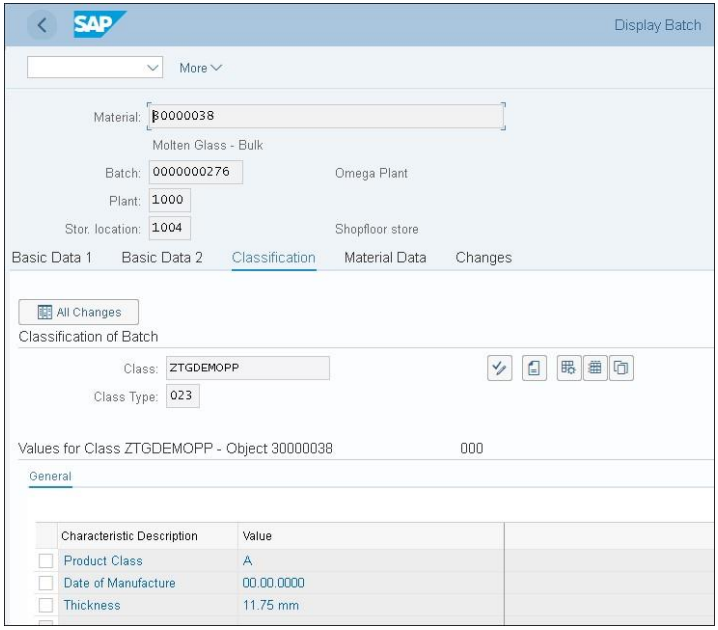


Figure 9.44 Characteristics Values of Sender Material's Batch 276

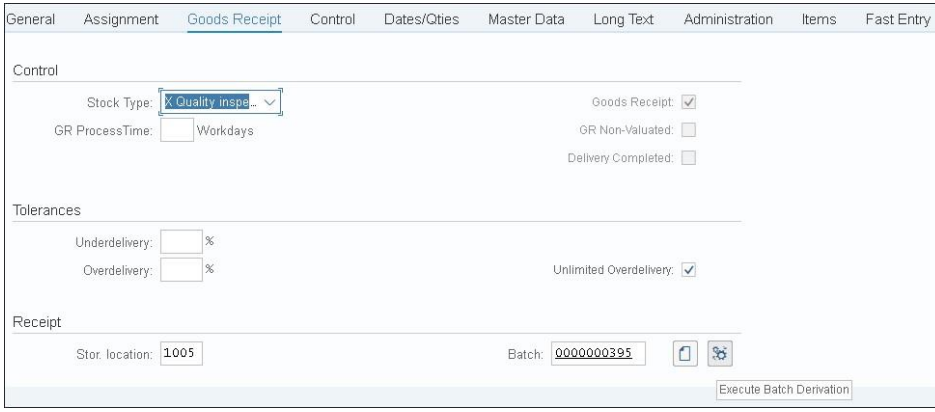


Figure 9.45 Receiver Material's Batch 395 Created on Production Order Release

Click the **Execute Batch Derivation** icon so that Figure 9.46 appears.

Figure 9.46 shows that the system has successfully performed batch derivation on receiver **Material 40000022** and its associated **Batch 395**. Click the **Details** button so that Figure 9.47 appears.

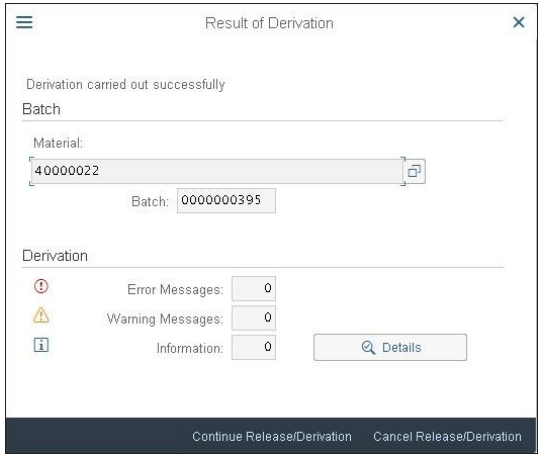


Figure 9.46 Results of Batch Derivation

Figure 9.47 shows the automatic batch-derived characteristics values of the two characteristics that are the same as shown previously in Figure 9.44.

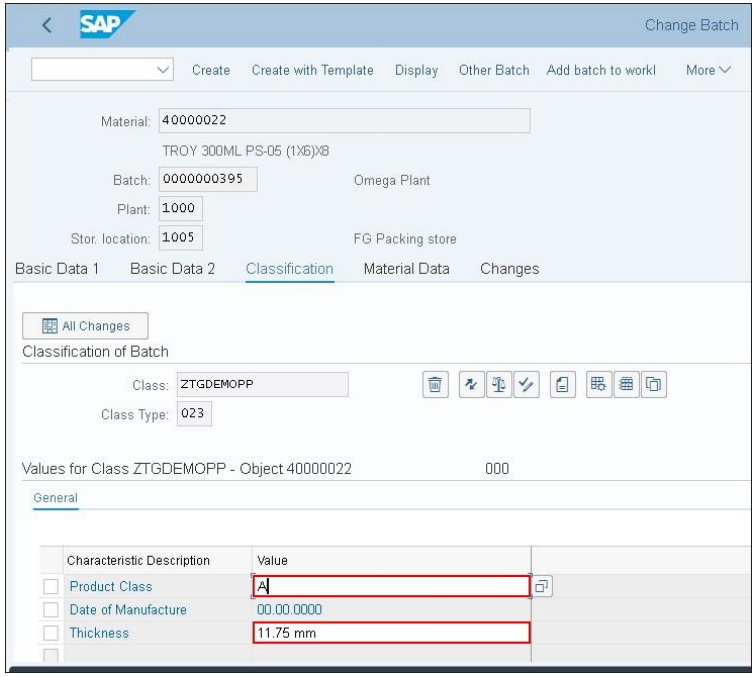


Figure 9.47 Batch Derivation-Based Characteritics Values of Receiving Material's Batch 395

9.7.4 Reporting

Transaction DVMO (Batch Derivation Monitoring Report) shows the status of batch derivations of different materials. The status with different traffic lights (red, yellow, and green) denotes the current batch derivation status of various batches of sender and receiver materials.

While Figure 9.48 shows the batch derivation details of our just-concluded example, Figure 9.49 shows a range of materials that has either successfully or unsuccessfully gone through the batch derivation process.

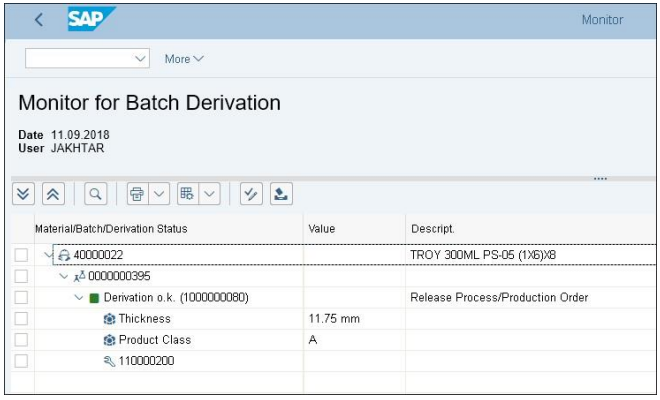


Figure 9.48 Batch Derivation Monitor

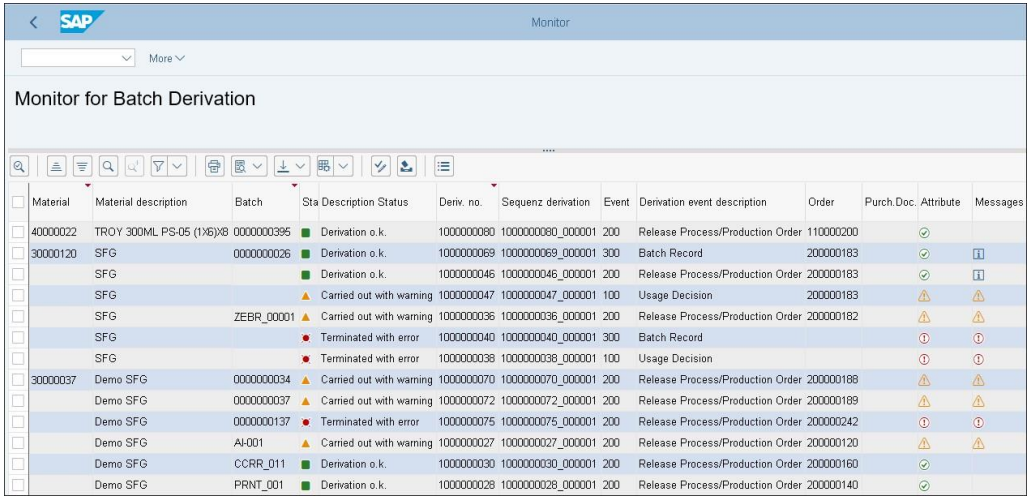


Figure 9.49 Batch Derivation Monitor Cockpit

9.8 Batch Traceability of Work in Process Batches

Batch traceability is a key functionality used not only in the chemical and food industries but also in almost all industries, including in discrete manufacturing. SAP delivers the batch where-used list (Transaction MB56) in the SAP system. This where-used list enables business users to trace the batch from the finished product to the raw material (top down) or from the raw material to the finished product (bottom up). The work in process (WIP) batch is used to keep the batch traceability on a production order when several batches of raw material are consumed and several batches of a finished product are generated.

Transaction MB56 works well in most cases. However, there is a limitation on a production order with N:N batches. In a standard production order, there is no link between the raw material batch consumed and the finished product's batch received in the warehouse; therefore, the batch where-used list determines all the batches of raw material for each batch of the finished product.

Consider, for example, that a problem was detected in one of the raw material batches after production. In this case, it isn't possible to identify exactly which batch of finished product was produced with this problematic batch of raw material. In previous releases, the only solution for this scenario was to create separate production orders for each raw material batch, but that required more data entry, inefficient business processes, and a significant amount of manual work.

In this example, we focus on the WIP batch functionality that is available in the system for production and production orders in SAP S/4HANA. More specifically, we explain how to enhance the batch where-used list to show a link between each raw material batch consumed and the respective finished product batch produced on a production order. Our example involves a simple production order with two operations and a few components.

In the following sections, we start out with the necessary configuration that you'll need to set up WIP batches, followed by the required master data setup. Next, we transition to the business processes involved in WIP batches, and finally conclude by using the BIC reporting tool to trace WIP batches.

9.8.1 Configuration Settings

Following are the configuration steps that you'll need to perform before creating the confirmation profile.

Activating Work in Process Batch Business Functions

Two business functions are related to the WIP batch functionality that you'll need to activate using Transaction SFW5: LOG_PP_WIP_BATCH and LOG_PP_WIP_BATCH_02. For the basic use of the WIP batch and for the scenario covered here, it's necessary to only activate the first business function. However, you should activate the second business function as well because it brings additional functionalities for the WIP batch, such as inventory valuation, use with documentary batches, and use on an order split.

To activate the business function using the Switch Framework (Transaction SFW5), select the business function, and choose the **Activate Changes** button.

[!]

Warning

You can't deactivate these business functions after they are activated.

Activate Work in Process Batch

After the business function activation, it's also necessary to activate the WIP batch functionality in configuration. To complete this step, use Transaction OMCWB, choose the **Active** radio button, and then save.

[!]

Warning

Once activated, this configuration setting also can't be reversed, In other words, when you allow the use of the WIP batch functionality in your SAP system, it isn't possible to get back to the original state in which WIP batches can't be used.

Activating the Original Batch

You must also activate **Original Batch Reference Material**. To complete this step, execute Transaction OMT0. In the initial screen that appears (see Figure 9.50), select the **Original Batch Reference Material** checkbox and save. Doing so enables the system to use this functionality in master data.

Figure 9.50 Activating Original Batch Reference Material

Confirmation

Now that you've already activated the WIP batch and original batch management functionalities, you need to create a new confirmation profile. Because the WIP batch information must be posted during the production order confirmation, your confirmation profile will include the WIP batch-specific subscreens.

For necessary configuration settings for the confirmation profile, use Transaction OPK0, and choose the standard confirmation profile **SAP001**. In the next screen (see Figure 9.51), in the **Area Selection** tab, you need to add areas **8285 WIP Batch: Goods Receipts, 8290 WIP Batch: Goods Issues**, and **8295 WIP Batch: WIP Batch Entry** to the standard **Profile SAP001**.

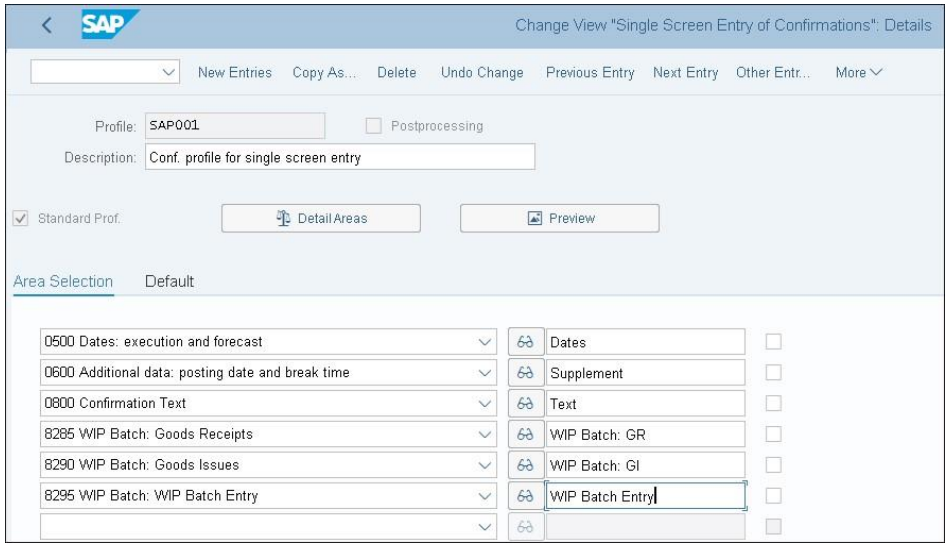


Figure 9.51 Confirmation Profile

9.8.2 Master Data Setup

Let's now delve into the requisite master data that you need to set up for WIP batches.

Confirmation Profile in the User Profile

To set the confirmation profile created in the previous step to default while posting a confirmation using Transaction CO11N, you need to choose the **Standard Prof.** (standard profile) checkbox on the initial screen of Transaction OPK0. However, because WIP batch is a very specific functionality that may not be used in all scenarios, here's an alternative. For each business user who posts a confirmation using WIP batch, you can add this confirmation profile to the user parameters. User parameters are used to store user-specific settings. To add a new user parameter, use Transaction SU3, add the **Set/Get Parameter ID** as "CORUPROF", and enter the previously created confirmation profile ("sap001") as the **Parameter value** (see Figure 9.52). You can either do this step yourself or request your SAP NetWeaver team member for help.

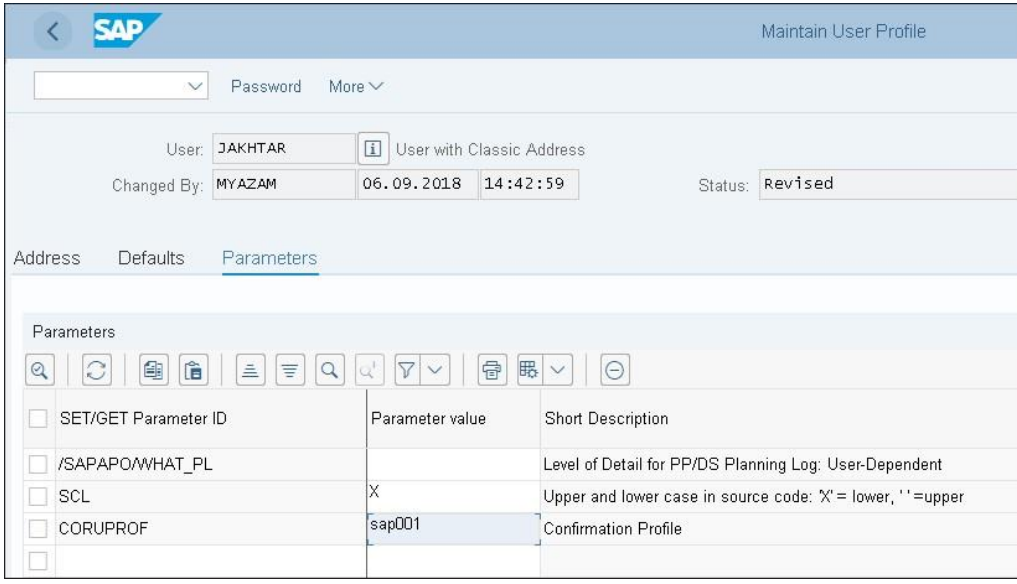


Figure 9.52 Confirmation Profile in the User Profile

Original Batch in the Material Master

As previously explained, activating the **Original Batch Reference Material** checkbox in configuration activates the **OB Management** (original batch management) field in the

material master's **Work scheduli** tab (see Figure 9.53). The value of the **OB Management** field must be set to **1** (**Allowed**) for the finished product, but it isn't necessary to set any value for the raw material. You'll also note that the **Batch Management** checkbox (not shown) has been selected.

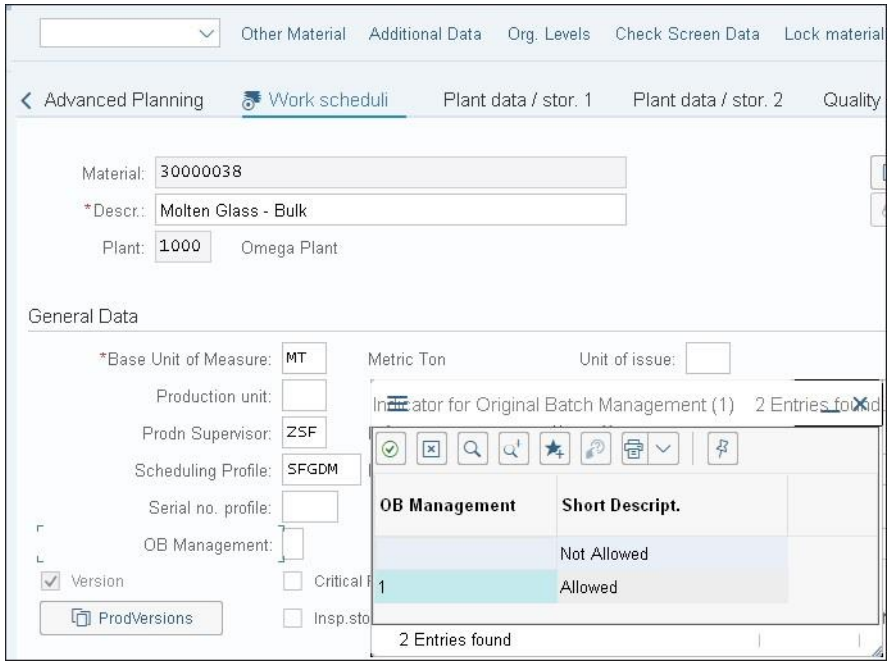


Figure 9.53 Allowing Original Batch Management in the Material Master Let's

now move to the business processes of WIP batches.

9.8.3 Business Processes

The business processes in WIP batches entail creating a production order, which is followed by confirmation in which you create the WIP batches. The system automatically posts the GI and GR.

Production Order

Consider the example shown in Figure 9.54 of a regular production order that appears after you execute Transaction CO02. This screen shows two operations in the **Operation Overv.** (operation overview) section and multiple components in the **Objects** section.

To post the confirmation using WIP batches, you need to create a link between the raw material and the finished product. It isn't necessary to make any change in the production order header or components. You can go directly to the order confirmation.

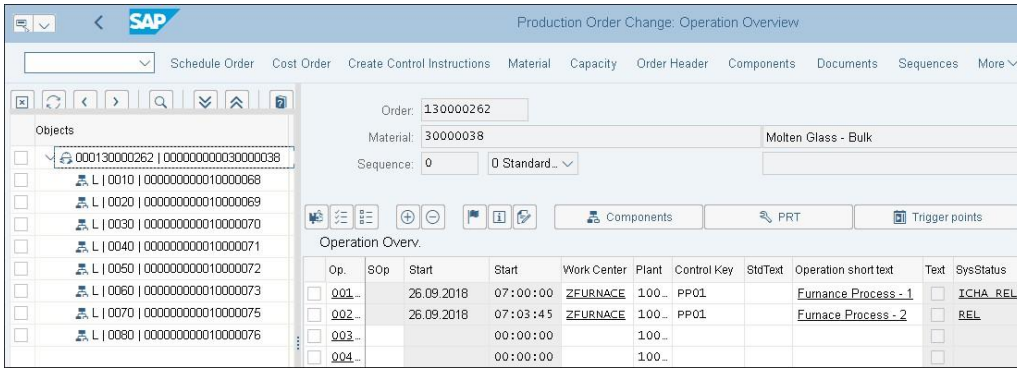


Figure 9.54 Production Order with Components and Operations

Confirmation and Goods Issuance

When posting a confirmation using the WIP batch confirmation profile, you'll notice some of the following details:

The button to display the **Goods movements** overview isn't displayed.

The GR goods movement is always proposed, even if automatic GR isn't set for the production order.

The GIs goods movements are always proposed, even if the **Backflush** checkbox isn't set for the components.

All the goods movements are proposed without quantity.

Access the figure shown in Figure 9.55 using Transaction CO11N, and enter the production **Order** "130000262" and its first **Operation**, which, in this example, is "0010".
Scroll down the screen to evaluate the information provided here.

The same three areas—**WIP Batch: GR**, **WIP Batch: GI**, and **WIP Batch Entry**—that were set in the confirmation profile are displayed here. In the **WIP Batch: GI** area, the system proposes several components, of which we choose the raw **Material 10000071** and its associated batch 280 for consumption (using **Mvmt Type 261**). Select this line item, and then choose the **Create WIP Batch** button.

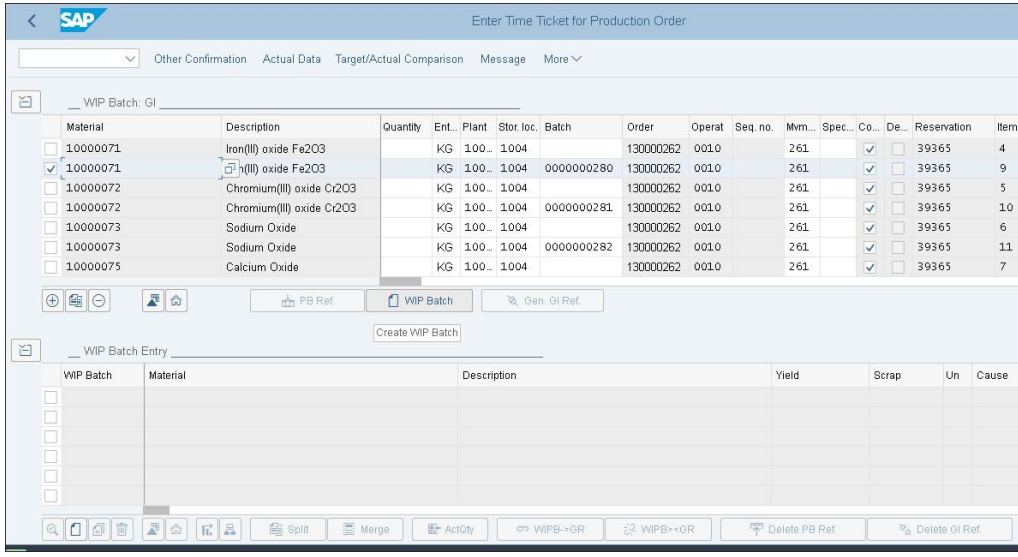


Figure 9.55 Confirmation with WIP Batches

In the popup screen that appears (see Figure 9.56), enter the name of your WIP batch in the **WIP Batch** field (e.g., "WIP_B_001"). With this process, you're creating a link between the raw material batch consumed and the WIP batch. Click **Continue**.

Figure 9.56 WIP Batch

As you can see in Figure 9.57, the system prompts you to maintain characteristic values of this **WIP Batch** "WIP_B_001".

In Figure 9.58, you can maintain the standard confirmation details, such as the yield, scrap, rework, and associated activities (e.g., machine or labor hours).

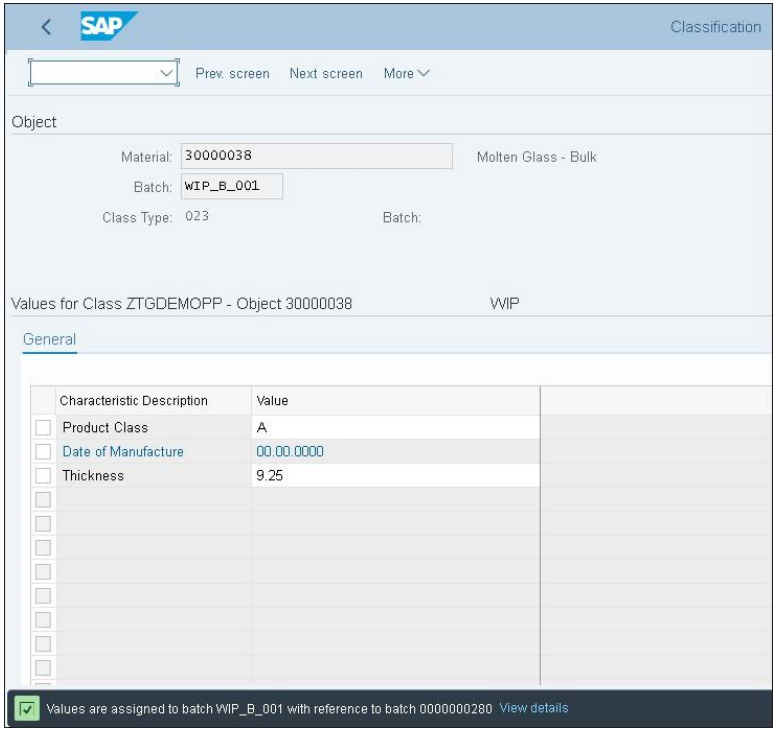


Figure 9.57 Maintaining Characteristics Values of a WIP Batch

Figure 9.58 Yield Entry for the WIP Batch

Work in Process Batch Goods Receipt

As explained previously in this section, the GR movement is proposed by default in the **WIP Batch: GR** section; however, it's proposed without quantity, so you need to input the quantity. After that, you must select the GR item and the respective **WIP Batch**, as shown in

Figure 9.59. In Figure 9.59, first select the **WIP Batch WIP_B_001** followed by clicking the **WIPB->GR** button. This will bring up the screen shown in Figure 9.60.

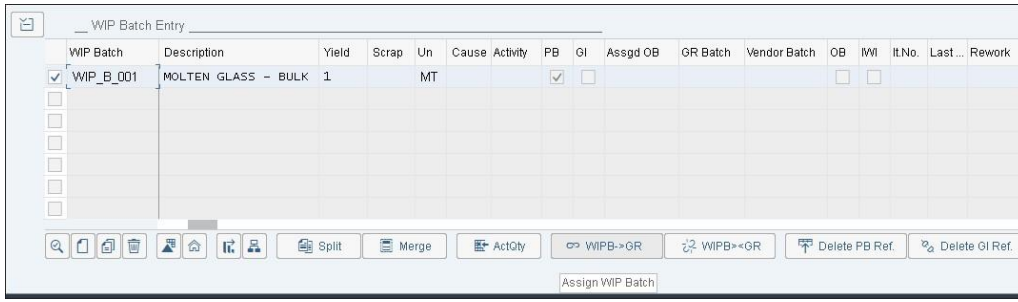


Figure 9.59 Assigning a WIP Batch to a Finished Good Batch

In Figure 9.60, notice that the system has created the **GR Batch** number **396** for finished good **Material 30000038** in the **WIP Batch: GR** section. This confirmation can now be saved, and because the WIP batch was already linked to the raw material, you now have a link between the raw material and the finished product material.

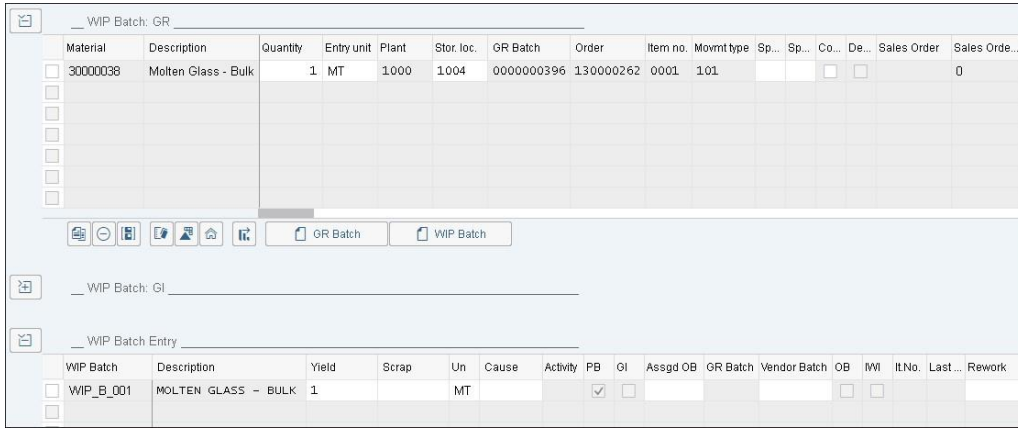


Figure 9.60 WIP Batch GR

The following summarizes how the system links up a raw material's batch to a WIP batch and then to a finished good's batch for the production order 130000262:

Raw Material 10000071 (batch number 280): WIP Batch (WIP_B_001): Finished Good 30000038 (batch number 396).

You'll see the same link-up when we cover reporting in Section 9.8.4.

When posting GR of a finished goods batch, the screens in Figure 9.61 and Figure 9.62 appear so that you can maintain the relevant information in the mandatory fields. In Figure 9.61, maintain the expiry date of **Batch 396** of **Material 30000038**; in Figure 9.62, maintain the characteristics values of the two characteristics.

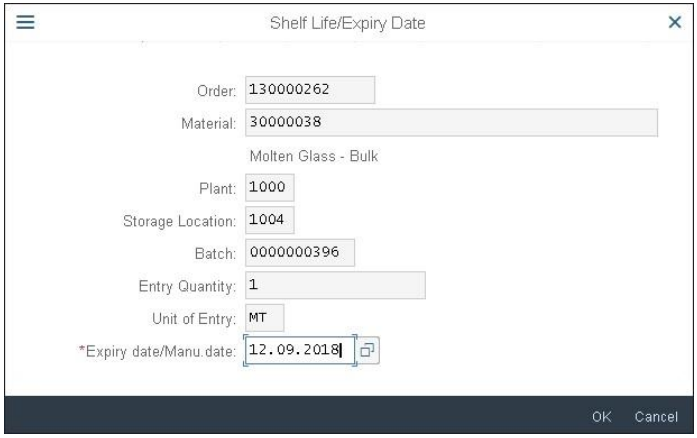


Figure 9.61 Maintaining the Expiry Date of a Finished Good

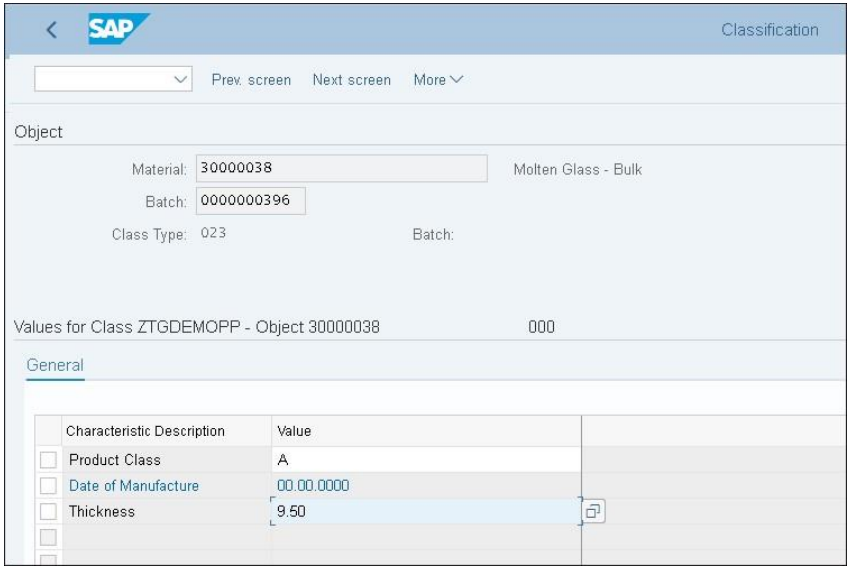


Figure 9.62 Maintaining Characteristics Values of Finished Goods

Note

Now that you have a basic understanding of WIP batches and how they work, we suggest you explore several additional features and functionalities available to handle all business processes.

For example, in the earlier Figure 9.59, we showed how to link up **WIPB->GR** (linking WIP batch with GR), but what if you mistakenly created a wrong link? To undo or delink this linkage, you can use the **WIPB><GR** icon to correct the error.

9.8.4 Work in Process Batches Reporting

Access the **Batch Information Cockpit** screen (see Figure 9.63) using Transaction BMBC to see the report on WIP batches. Enter the **Material** "30000038", its associated **Batch** "396", and the **Plant** "1000", and then click **Execute Selection** (top left in the menu bar).

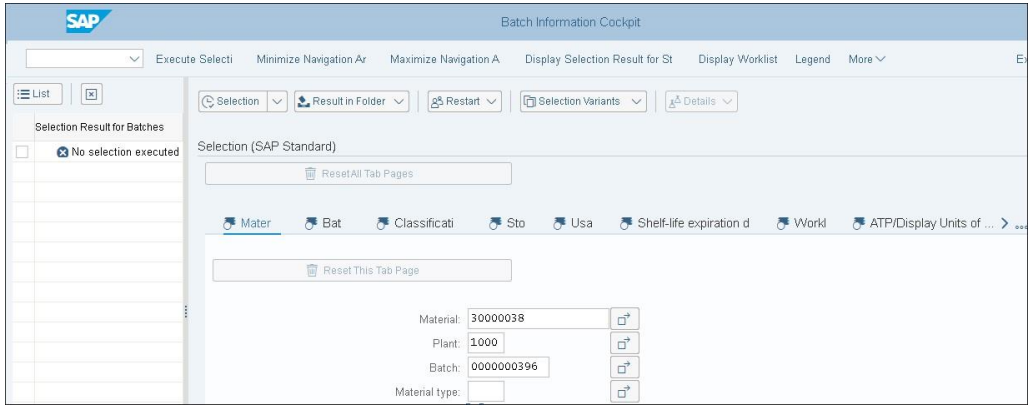


Figure 9.63 Batch Information Cockpit

Figure 9.64 brings up **Batch** (**396**) for **Material 30000038** that meets the selection criteria. Click this batch **396** on the left-hand side of the screen, and then select **Usage** from the **Details** dropdown icon.

For batch **396** for the finished good **30000038**, Figure 9.65 shows the **Top-Down Analysis** of the production order **130000262**, the raw material **10000071**, and its associated batch **280**. However, these screen details still don't show the associated WIP batch that created during confirmation. To view the details of the WIP batch, click production order **100000262**, and then choose **WIP Batch**.

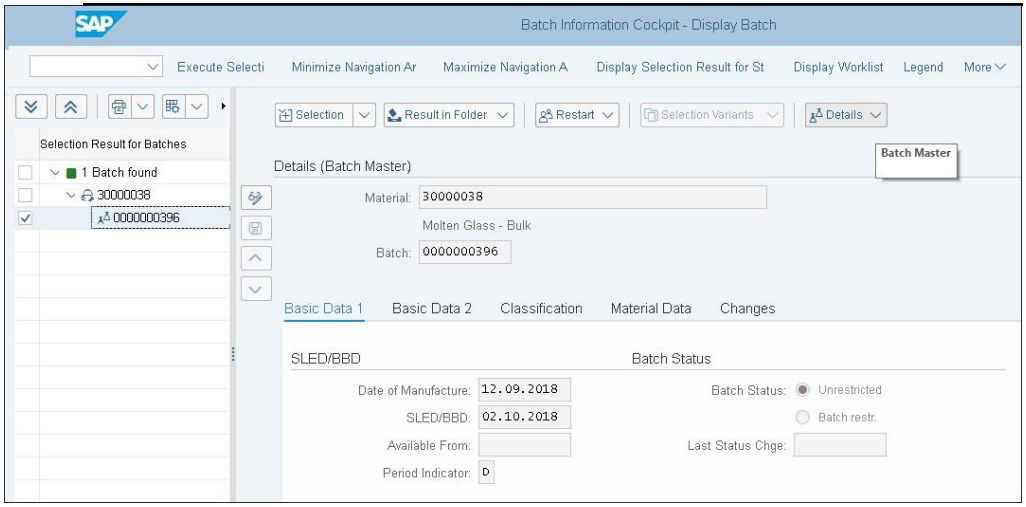


Figure 9.64 Batch Usage

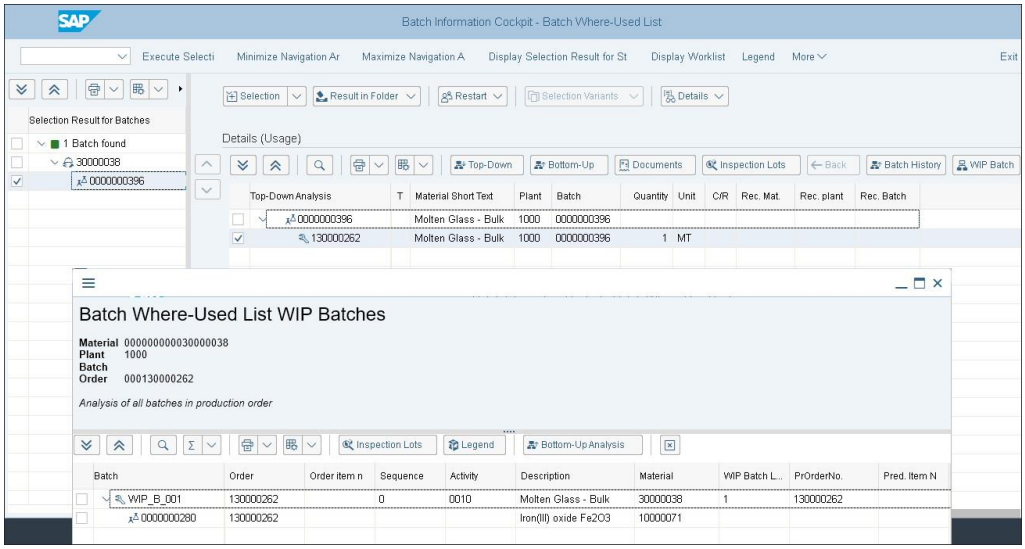


Figure 9.65 Top-Down Analysis

The lower half of the screen of Figure 9.65 shows the same WIP batch's linkage that we previously covered:

Raw Material 10000071 (batch number 280): WIP Batch (WIP_B_001): Finished Good 30000038 (batch number 396).

Note

Refer to SAP Note 1473025, which answers frequently asked questions about WIP batches. Further, note the following:

Transaction BMOBPRO is a report that shows original batches in production.

Transaction BMOBPUR is a report that traces original batches in procurement.

The next section looks at the BIC and how it can be used to analyze and monitor batches.

9.9 Batch Information Cockpit

In process industries, such as food and pharmaceutical, traceability of the ingredients or components within a production or procurement process is of paramount importance. Batch traceability across the entire logistics and supply chain processes is also a legal requirement in many industries and Good Manufacturing Practice (GMP) to maintain in case there is a batch recall. Companies often develop complex custom reports to view and analyze the batch traceability when BIC can serve the same purpose. With BIC, you can do the following:

Perform top-down and bottom-up traceability analysis. With top-down, a finished good traces all the raw, packaging, and semifinished materials that were used in making the finished product's batch. With bottom-up, it's possible to gain the traceability of the ingredients or raw materials and trace all the finished goods that were made using these ingredients or raw materials' batches.

Access the batch master to display and change information related to the batch directly from the BIC while performing the traceability analysis of a batch.

Display the stock information of the batch.

Display the stock position of a material and its associated batches.

To access BIC, follow the menu path, **Logistics Central Functions Batch Management Batch Information Cockpit**, or use Transaction BMBC**.** Figure 9.66 shows the initial screen to set parameters that the system then considers to bring up relevant batches of materials. Notice the various tabs available on the right-hand side, which you can use to enter specific information. The left-hand side of the screen provides a search functionality.

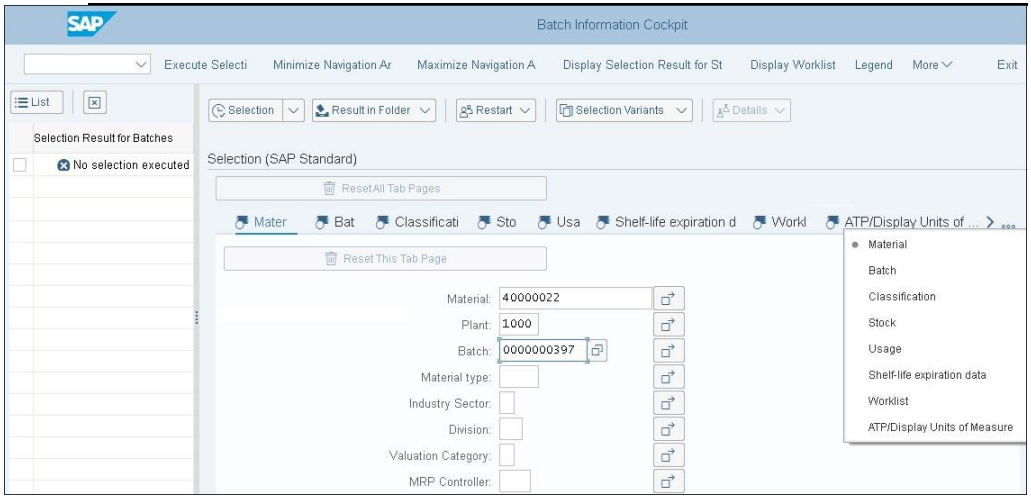


Figure 9.66 Batch Information Cockpit

For this example, enter Material "40000022", Plant "1000", and Batch "397". Choose **Selection**, and then choose**Execute**. This brings up Figure 9.67. The left-hand side shows that the system is able to find the relevant material-plant-batch combination.
The right-hand side appears when you select **Usage** from the **Details** dropdown.

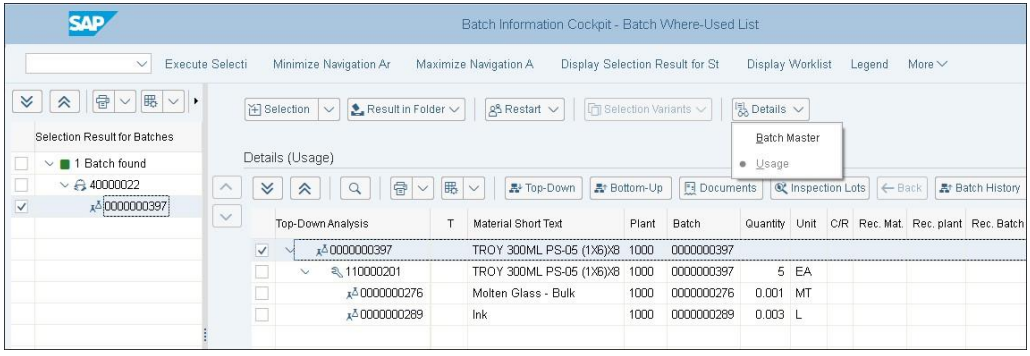


Figure 9.67 Batch Where-Used List

Figure 9.67 shows the top-down analysis for the batch 397 of material 40000022 in plant 1000. It shows that this batch was produced from production order **110000201**, which, in turn, consumed **Batch 276** of material 30000038 (**Molten Glass-Bulk**) and batch **289** of the raw material **Ink**. The raw materials procured externally from suppliers will show up the material document numbers in the same top-down analysis.

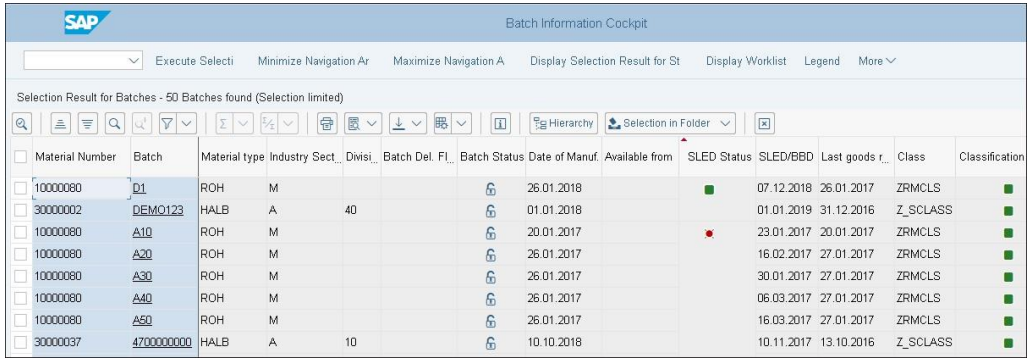
9.10 Electronic Batch Record

Note

We suggest that you explore several features and functionalities of BIC that you can use to take advantage of a large amount of available information.

For example, in Figure 9.67 and in the **Usage** tab, you can choose whether the system should bring up a top-down list or bottom-up list. Similarly, you can gain comprehensive visibility of all batches that have expired or whose expiration date is approaching.

In Figure 9.68, BIC has been run, and several batches have been selected. The materials are shown, and the matches can be displayed by highlighting the material. The information regarding the batch is then displayed in a main screen. The tabs represent the number of different screens with information on this batch.



Material Number	Batch	Material type	Industry Sect.	Divisi.	Batch Del. Fl.	Batch Status	Date of Manuf.	Available from	SLED Status	SLED/BBD	Last goods r.	Class	Classification
10000080	D1	ROH	M				26.01.2018			07.12.2018	26.01.2017	ZRMCLS	
30000002	DEMO123	HALB	A	40			01.01.2018			01.01.2019	31.12.2016	Z_SCLASS	
10000080	A10	ROH	M				20.01.2017			23.01.2017	20.01.2017	ZRMCLS	
10000080	A20	ROH	M				26.01.2017			16.02.2017	27.01.2017	ZRMCLS	
10000080	A30	ROH	M				26.01.2017			30.01.2017	27.01.2017	ZRMCLS	
10000080	A40	ROH	M				26.01.2017			06.03.2017	27.01.2017	ZRMCLS	
10000080	A50	ROH	M				26.01.2017			16.03.2017	27.01.2017	ZRMCLS	
30000037	4700000000	HALB	A	10			10.10.2018			10.11.2017	13.10.2016	Z_SCLASS	

Figure 9.68 Central Area of the Batch Information Cockpit

9.10 Electronic Batch Record

In highly regulated industries such as pharmaceutical, there's often a legal requirement to maintain a complete trail and record of all the batches used in the entire logistics and supply chain of manufacturing a product. Often, it's not just the batches received from the procurement process or batches consumed in the production process that are important for record keeping but also maintaining a complete record of various quality inspections that took place in the manufacturing process. Electronic batch record (EBR) or batch record, for short, captures these inspection details too.

Access the screen shown in Figure 9.69 by following menu path, **Logistics Central Functions Batch Management Tools Batch Record** or using Transaction COEBR.

On the left-hand side, you can see a complete trail of material **30000120** and its associated **Batch 26**. As you drill down the same node, you'll see the process orders, the two types of quality inspections (**04**—for finished goods inspection, **03**—for inprocess inspection) as well as the **Material List** (BOM) used in the production process.

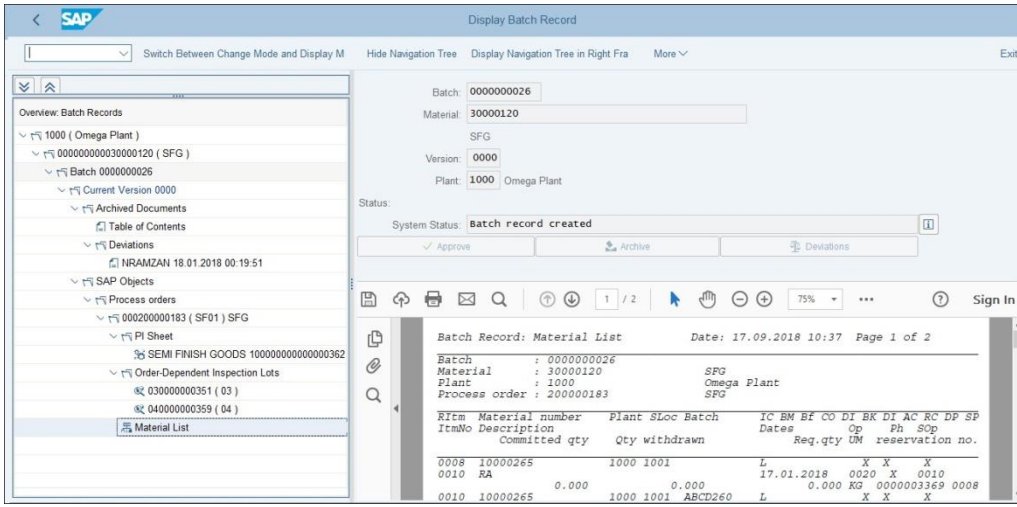


Figure 9.69 Electronic Batch Record

On the upper-right side of the same screen, you can only **Approve** an EBR for archiving if the statuses of various elements (e.g., process or production order, inspection lots, etc.) are set as required for electronic archiving. Here, the system also guides you on all the perquisites of EBR. After **Approval**, an EBR can be archived by clicking on the **Archive** button.

The lower-right side shows comprehensive details of EBR in a PDF format.

Note

We recommend engaging a SAP NetWeaver consultant to ensure that the necessary authorization required for archiving electronic batches are granted. The SAP NetWeaver consultant will also set up a document repository required to store the EBRs being archived.

In some industries, such as consumer products or automotive suppliers, there are legal requirements to store where-used data of materials used for production and delivered to customers. Enabling recall actions becomes a mandatory and critical

issue for these industries. Data can be recorded by managing all relevant materials in batches, but this method has a negative impact on data volume. When turning on batch management, entering a batch number becomes obligatory for all goods movements. Then all inventory postings must be executed on the batch level, and labor costs for IM will increase.

With the documentary batch record, it's important to ensure that a partial stock of a material is traceable without having to maintain a batch's data. This reduces the effort and complexities involved in maintaining batch data. The documentary batch record finds greater use in automotive and consumer goods industries but is unsuitable for use in dangerous goods.

Documentary batch processing can be achieved in the following ways:

Documentary batches can be entered during goods movements.

In a production order, entering documentary batches is only possible at backflush. In WM, entering documentary batches must be enabled during transport order confirmation.

This section has described the transactions that you'll use to create, change, and delete a batch record.

9.11 Summary

Batch management is important to a large number of process-based industries. It has developed from just an identification of a group of items to a process that allows companies to perform product recalls, select and sell by batch characteristics, and identify expiring stock. As the drive for a competitive advantage continues, companies will further investigate how batch information can lower production time and hasten material to the customer.

Chapter 10 discusses sales and operations planning (S&OP).

Chapter 10

Sales and Operations Planning

Sales and operations planning strives to maintain a balance between 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 sales and operations planning to come up with a feasible production plan or use flexible planning if you have complex and diverse planning needs.

Sales and operations planning (S&OP) 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 S&OP. S&OP is mainly about sales-driven forecasting and consolidating forecasts and uses only neutral key figures (numbers) for that. In contrast to this, production planning (PP, including material requirements planning [MRP] and capacity requirements planning [CRP]) is all about production and takes into account requirements instead of key figures. Still, MRP in SAP S/4HANA doesn't consider capacities, but CRP does. For a value-based plan, you need to transfer the sales or production figures to profitability analysis (CO-PA).

The biggest incentive for implementing S&OP 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 demand management in the form of planned independent requirements (PIRs). Forecasting plays a major role in helping the planner arrive at a plausible operations plan.

Note

Long-term planning (LTP) is also available in SAP as a planning and simulation tool. LTP offers several planning options, including simulating the components' requirements quantities, inventory controlling activities, and capacity requirements. LTP has

its limitations, however. For example, LTP can't take into account a product's demand fluctuation or the effect of changes in one key figure, such as sales quantity or production quantity, whereas both are possible in flexible planning. Refer to Chapter 14 for more information on LTP.

In this chapter, we'll start with an overview of what S&OP 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. We also cover a lesser-known and used application of flexible planning known as standard analysis reporting. The standard analysis in flexible planning uses all the concepts and fundamentals that you'll learn in this chapter. Let's get started with an overview.

10.1 Standard Sales and Operations Planning

The following sections begin with an overview of S&OP and the similarities and differences between standard S&OP and flexible planning. It then moves to cover forecasting, and concludes with coverage of standard analysis in flexible panning.

10.1.1 Overview

In standard S&OP, 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, restricted to individual materials or a group of materials, then standard S&OP can fulfill your business needs.

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 about 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 (e.g., 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 in the decision-making process.

This is where S&OP 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 demand management where they appear as planned PIRs with an "active" version. When the system runs the MRP, it considers the active PIRs to arrive at procurement proposals (in-house production and external procurement).

In the planning process, a planning table is needed in the SAP 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 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 S&OP), take special events (e.g., trade shows or the Olympics) into account for increases in sales or take natural calamities (e.g., 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 (PRTs).

When deciding which S&OP options (standard S&OP 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 S&OP 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 S&OP, 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 configuration, many presettings, and definitions.

SAP offers several standard analyses reports in all logistics areas, 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, such as six months.

For example, standard analyses bring forth information such as the purchase and invoiced values (key figures) of all the materials (characteristics) during the past six months (period). The standard analyses reports that SAP offers for each logistics functional area have 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 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 functionality, but concepts and details covered in this chapter are equally applicable to other functionalities such as QM, plant maintenance (PM), materials management (MM), and sales and distribution (SD).

Note

See Chapter 19 in which we cover reporting, including standard analyses in PP.

This example of flexible planning from both perspectives (flexible planning and standard analysis in flexible planning) in this chapter remains primarily focused on SD and its integral correlation with PP processes.

Note

Regardless of whether you implement standard S&OP or flexible planning, we encourage you to read the entire chapter because 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 S&OP for a material or material group. We've 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 S&OP but not in flexible planning, although the option is available in both planning types.

Figure 10.1 shows that S&OP 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.

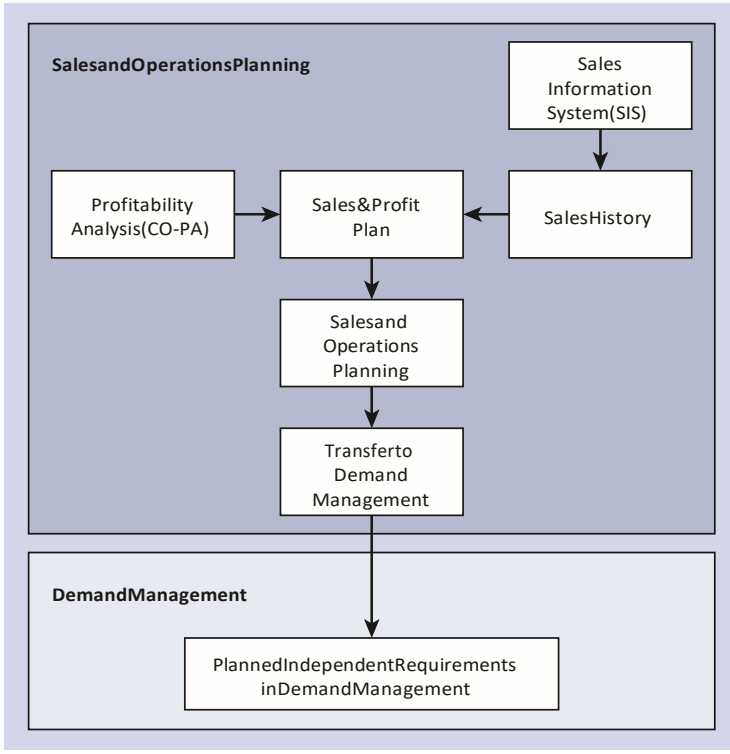


Figure 10.1 Process Overview of Sales and Operations Planning

Profitability analysis (CO-PA)

Information from CO-PA 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 10.4.

The figures from S&OP are eventually transferred to demand management in the form of PIRs, which form the basis of MRP.

We list the objects used in S&OP (standard S&OP and flexible planning) and provide their logical relationship in Figure 10.2. The objects in S&OP form an integral part in the planning process, so it's important to have a comprehensive understanding of them.

Information structure(info structure)

This is the data structure that stores the important planning parameters. The planning data is stored in key figures for the CVCs. As previously explained, characteristics can be selection criteria 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 S&OP, 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 10.2 to see how each of the objects is linked in S&OP.

Figure 10.3 provides a graphical comparison between the planning methods available for standard S&OP and flexible planning.

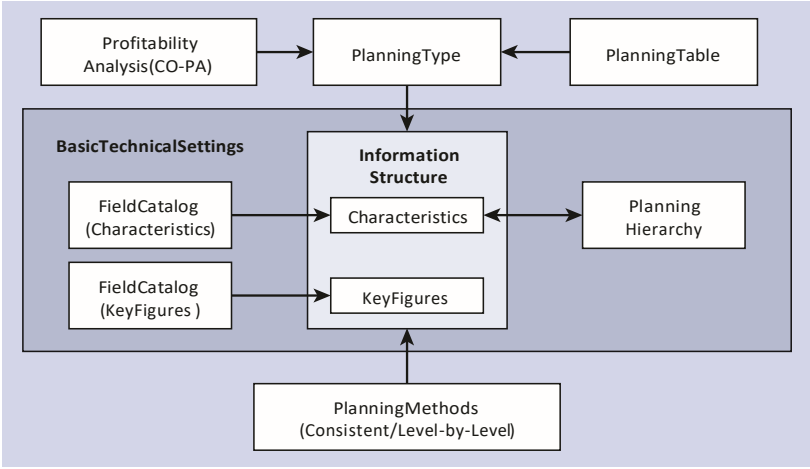


Figure 10.2 S&OP Objects

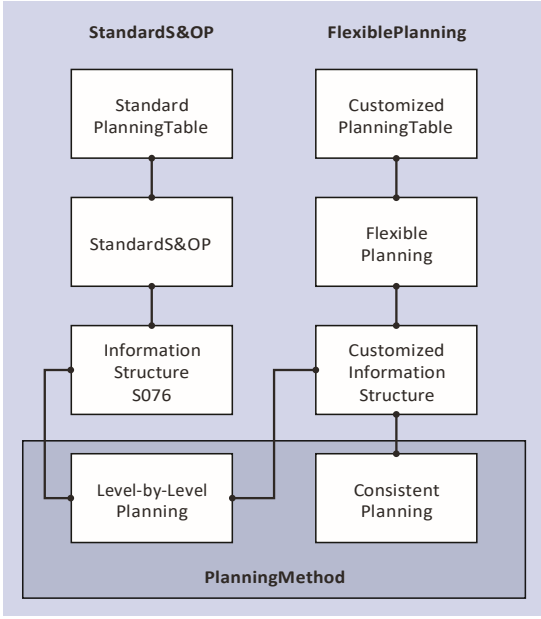


Figure 10.3 Standard S&OP, Flexible Planning, Level-by-Level Planning, and Consistent Planning

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

10.1.2 Information Structures

You can create and change the info structures with the configuration menu path, **SAP IMG Logistics General Logistics Information System (LIS) Logistics Data Warehouse Data Basis Information Structures Maintain Custom Information Structures**. You can also use Transaction MC21 to create info structures and Transaction MC22 to change them.

Figure 10.4 shows **Info Struct. S076**, which is used in standard S&OP.

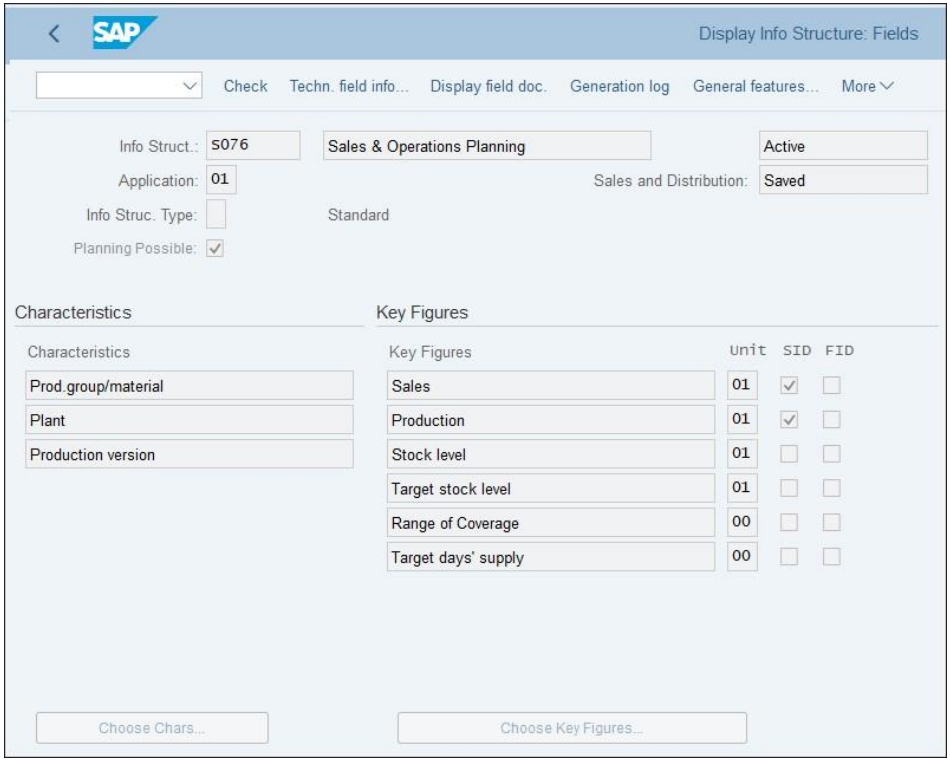


Figure 10.4 Standard SAP Info Structure S076

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.

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

To view or set parameters for info structures and key figures, follow the configuration menu path, **SAP IMG Logistics Production Sales & Operations Planning (S&OP) Master Data Set Parameters for Info Structures and Key Figures**, or use Transaction MC7F.

In Figure 10.5, double-click on the info structure (**Table**) **S076,** or select the same and choose the **Details**, which takes you to the **Change View** "**Info structure planning**

parameters": Details screen. This area stipulates that the planning method used in standard S&OP is level-by-level planning (denoted by **I** in the **Planning method** field).

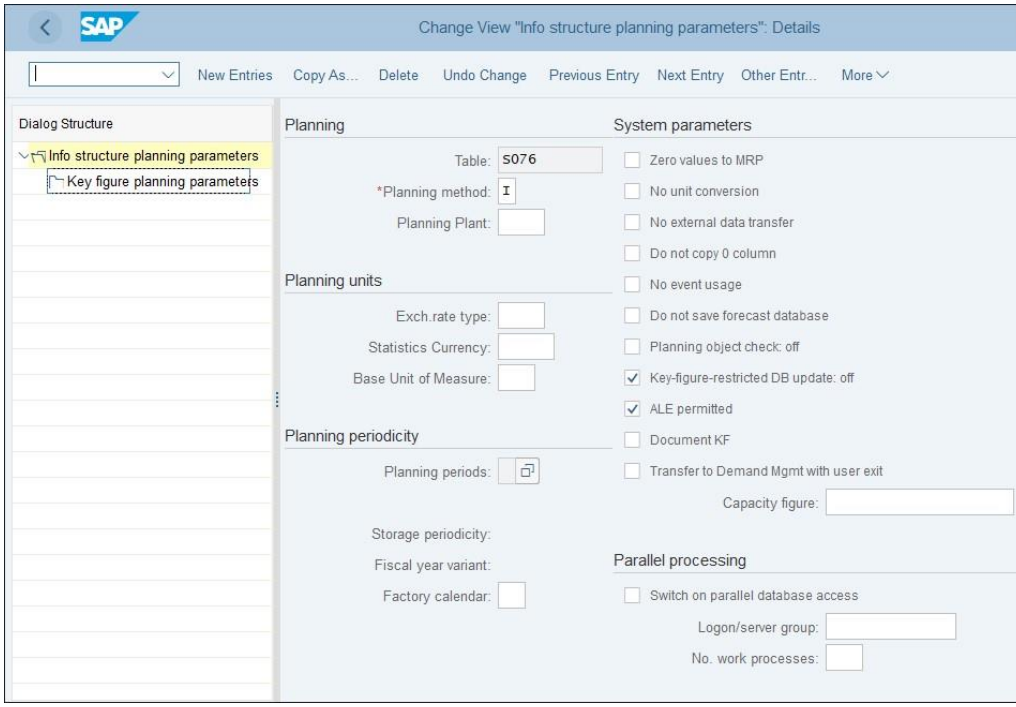


Figure 10.5 Planning Parameters of the Info Structure

Choose the **Key figure planning parameters** folder on the left-hand side of the screen, which takes you to the screen shown in Figure 10.6. The lower half lists the key figures available for standard info structure S076. Double-click on the **ABSAT** field, and a popup appears (see Figure 10.7). 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.

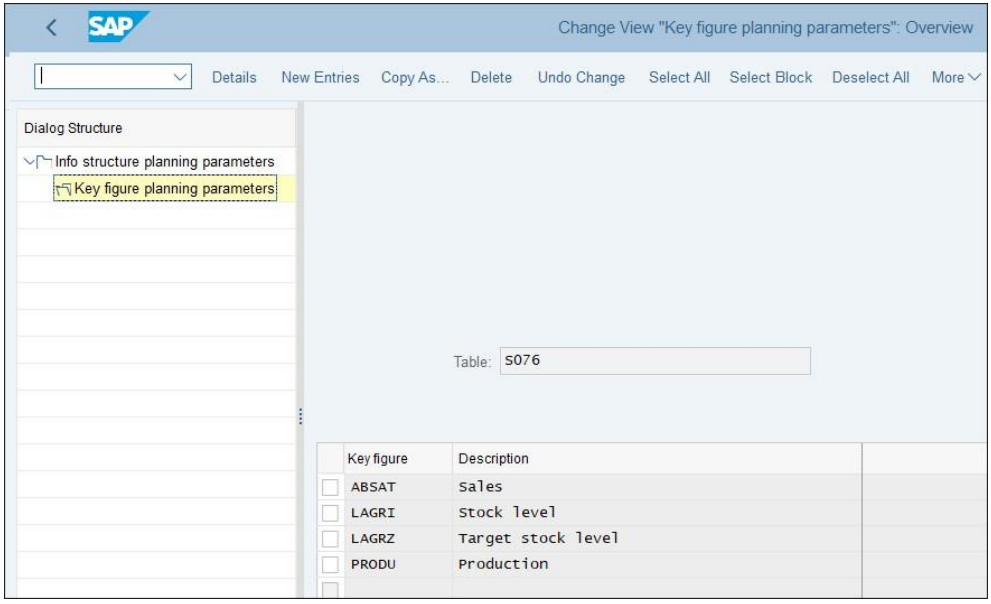


Figure 10.6 Key Figures Planning Paremeters

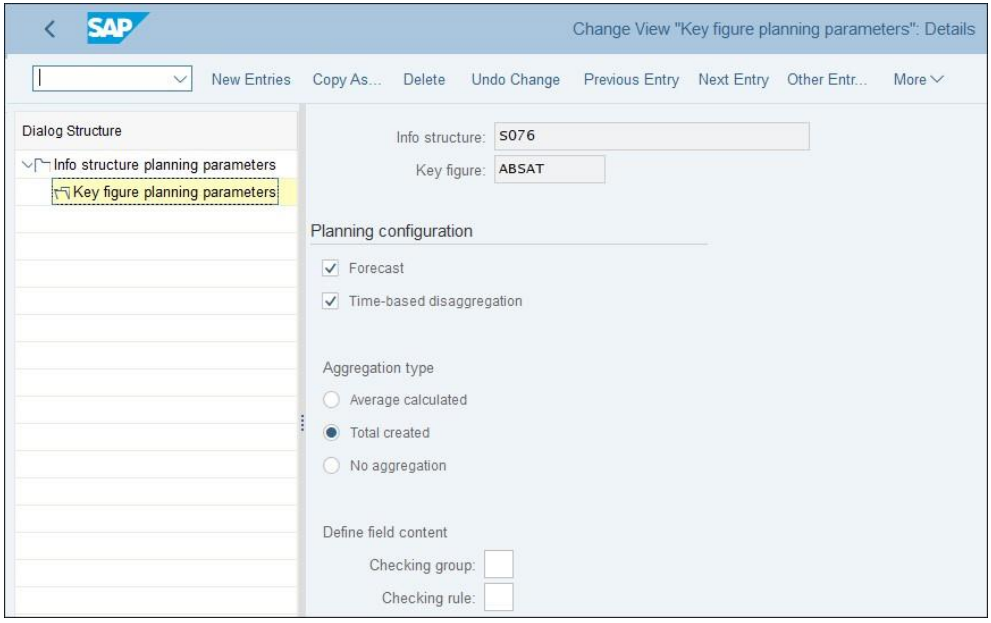


Figure 10.7 Details of a Key Figure ABSAT

10.1.3 Planning Methods

In the beginning of this chapter, we mentioned that with standard S&OP, the configuration and other settings are predefined, with limited options to customize parameters to meet your business requirements. For example, in standard S&OP, 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 (i.e., 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 10.1 provides a comparison of planning methods available in standard S&OP and in flexible planning.

Standard S&OP	Flexible Planning
Preset configuration	Individual configuration based on business processes
Planning based on product groups/ proportional factors	Planning based on planning hierarchies
Standard planning table for key figures entry	Customized planning tables
Level-by-level planning	Consistent planning or level-by-level planning

Table 10.1 Features of Standard S&OP and Flexible Planning

With standard S&OP, you can only plan using level-by-level planning (see Table 10.2), 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. Because it doesn't automatically aggregate or disaggregate planning data, you have to manually perform these functions.

Table 10.2 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 update and account 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 10.2 Features of Consistent Planning and Level-by-Level Planning

10.1.4 Planning Types in Standard Sales and Operations Planning

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 data 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). The data is stored in the info structure, so the different planning types depend on each other because 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 S&OP has been configured with three planning types, which are used automatically in standard S&OP 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 sections, we'll go through the steps you need to follow to create a product group that you can use in standard S&OP. We also show how you can transfer the planning results of a product group to demand management as PIRs.

Create a Product Group

Figure 10.8 shows that in this example, we're using info structure S076 in standard S&OP to create a product group called Troy_SOP for plant 1000. This product group has two materials, 40000022 and 40000023, 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.

For this example, to create the product group in the system, follow the SAP menu path, **LogisticsProductionSOPProduct GroupCreate**, or use Transaction MC84. For the **Product group Troy_SOP** and **Plant 1000**, enter the materials, "40000022" and "40000023" and their proportional factors of "60" and "40" (percentages).

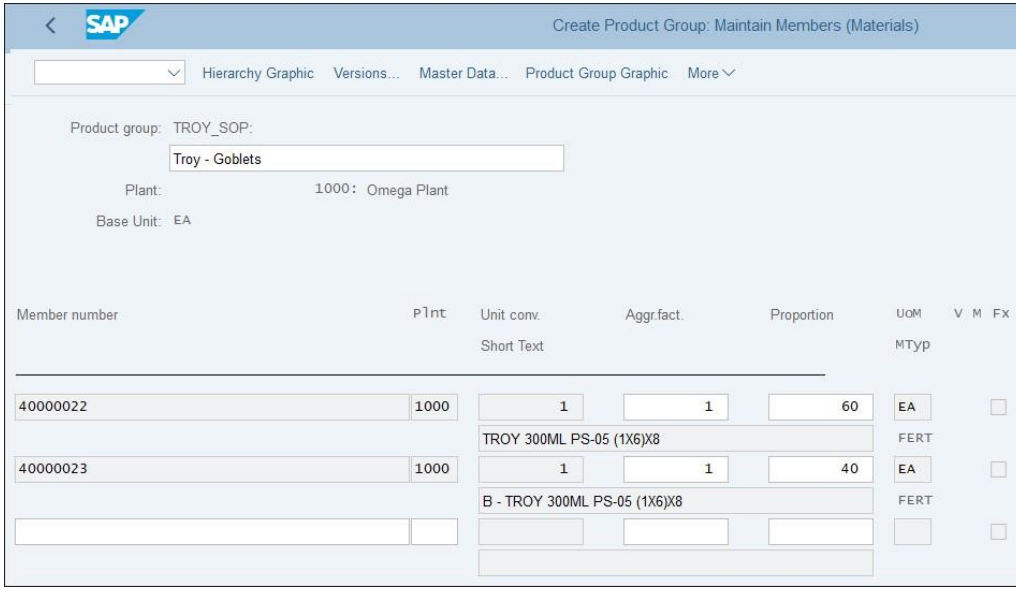


Figure 10.8 Creating Product Group Troy_SOP

Choose the **Product Group Graphic** button to view the product group graphically (see Figure 10.9).

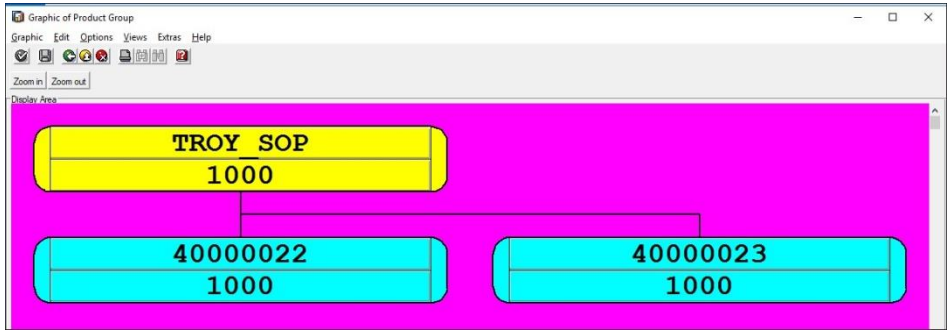


Figure 10.9 Graphical View of the Product Group

In addition to the interactive entry, you can also calculate proportional factors on the basis of historical data via the menu path, **MoreEditCalculate 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 **MoreEditDistribute Proportional Factors**. Save the product group.

Create a Plan for the Product Group

To plan the product group in standard S&OP, use the menu path, **LogisticsProductionSOPPlanningFor Product GroupCreate**, or use Transaction MC81.

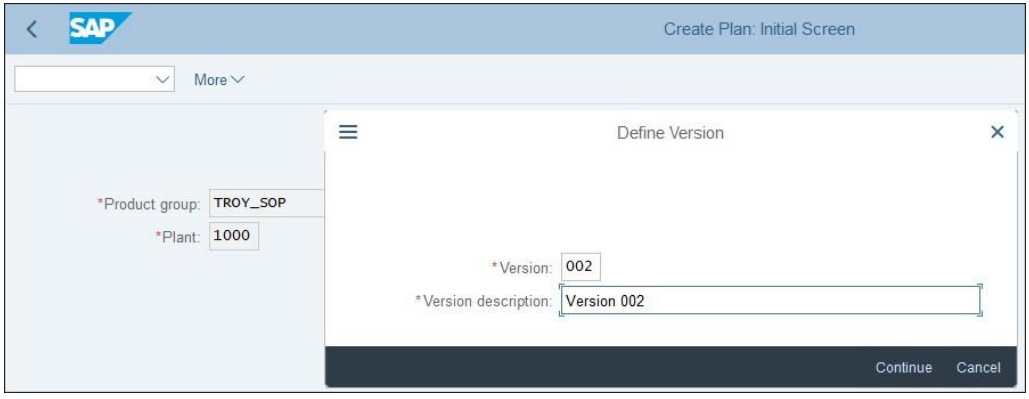


Figure 10.10 Planning in Standard S&OP

Figure 10.10 shows the initial screen of the rough-cut plan for the product. Enter the **Product group** "Troy_SOP" and **Plant** "1000", and then press (Enter) to go to the **Define**

Version dialog box. In this screen, enter the planning **Version** "002" and the **Version description** as "Troy_SOP_PG", and again press (Enter) to go to the **Create Rough-Cut Plan** screen.

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 this example, by entering sales data for the next six months. In Figure 10.11, click the **More** dropdown menu to see 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 proportional from production or from sales

To use any of these options, the system must have significant historical data to help in effective and reliable planning.

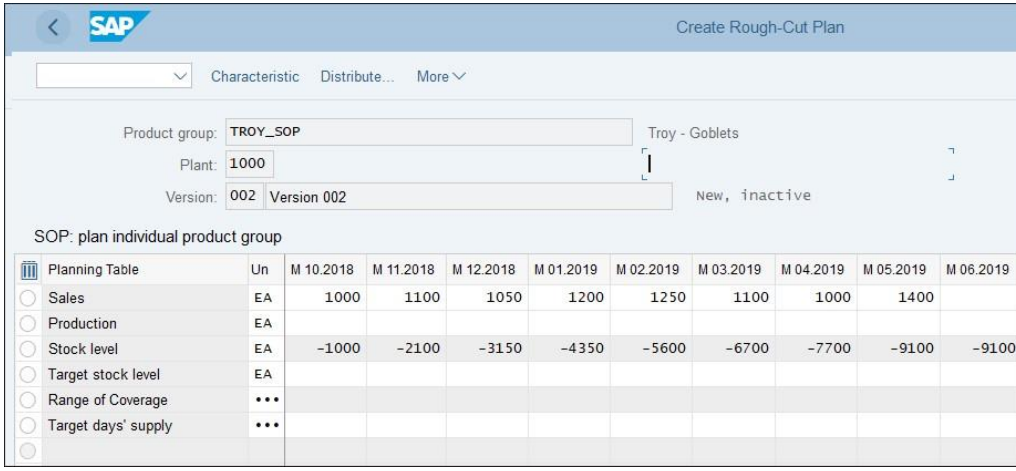


Figure 10.11 Sales Plan in Standard S&OP

Options to Create a Production Plan Automatically

While remaining in the planning table (Transaction MC81), Figure 10.12 shows how you can create a production plan with the following options by clicking on **More** from the top menu bar:

Synchronous to sales

Sales figures are used as operations plans.

Target stock level

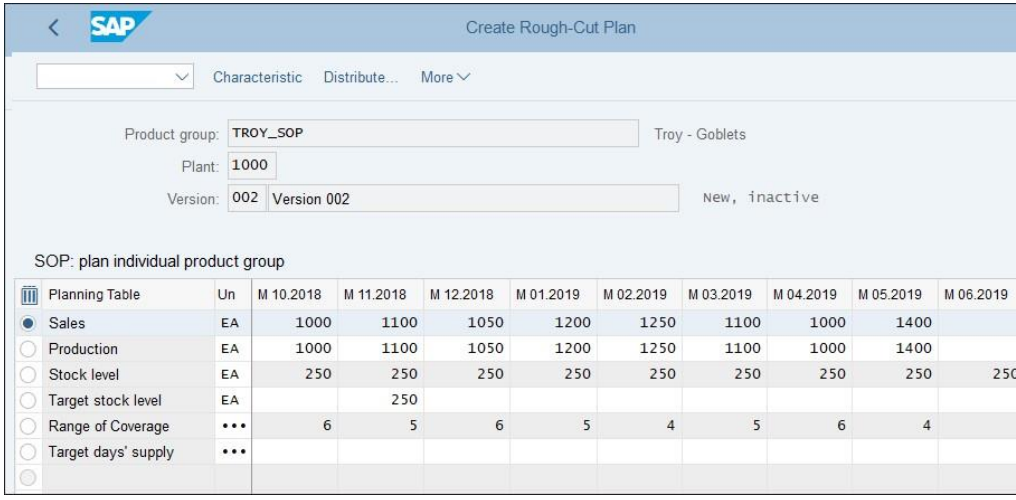
The operations plan is configured in such a way that the target stock level is reached in each period.

Target days'supply

The operations plan is configured in such a way that the target stock level is reached in each period. **Stock level = zero**

The operations plan is configured in such a way that the entire stock level is consumed.

Depending on your business requirement, you can choose if you want the production plan to be equal to the target stock level or if you eventually want the target stock to be zero at the end of the period. In this example, we want to create the production plan synchronous to the sales plan. This production plan has also taken the target stock levels into account at the end of each period.



Planning Table	Un	M 10.2018	M 11.2018	M 12.2018	M 01.2019	M 02.2019	M 03.2019	M 04.2019	M 05.2019	M 06.2019
Sales	EA	1000	1100	1050	1200	1250	1100	1000	1400	
Production	EA	1000	1100	1050	1200	1250	1100	1000	1400	
Stock level	EA	250	250	250	250	250	250	250	250	250
Target stock level	EA		250							
Range of Coverage	•••	6	5	6	5	4	5	6	4	
Target days' supply	•••									

Figure 10.12 Options to Create a Production Plan in Standard S&OP

It's important to note that these production figures have no direct implications on the production or procurement. The purpose of entering or incorporating these numbers (key figures, e.g., sales or production) is to come to a common understanding, where relevant stakeholders, be it sales or production, can transfer the *finalized* key figures to demand management in the form of PIRs. For example, several planning versions are created in the system from which input and feedback from sales and production are taken. The sales or the production figures are revised either in the same planning version or by creating a new

version. The finalized version eventually transfers to demand management and reflects as PIRs with the **Active** checkbox selected.

The next step is to transfer the production plan to demand management, where the requirements of individual members (materials) of the product group are reflected as PIRs. When the transfer of the product group quantities to demand management takes place, the system disaggregates at the material level according to the proportional factor defined previously. In this example, we've given a proportional factor of 60% and 40% for the two materials. In the next section, we show how the system disaggregates (divides up) the total planning quantities of the product group in a 60 to 40 ratio.

Transfer to Demand Management

You can directly transfer the planning figures from the planning table to demand management by selecting the relevant key figures (e.g., production) and using the menu path, **More Extras Transfer to Demand Management**. Alternatively, you can also use the menu path, **Logistics Production SOP Planning For Product Group Transfer PG to Demand Management**, or you can use Transaction MC75.

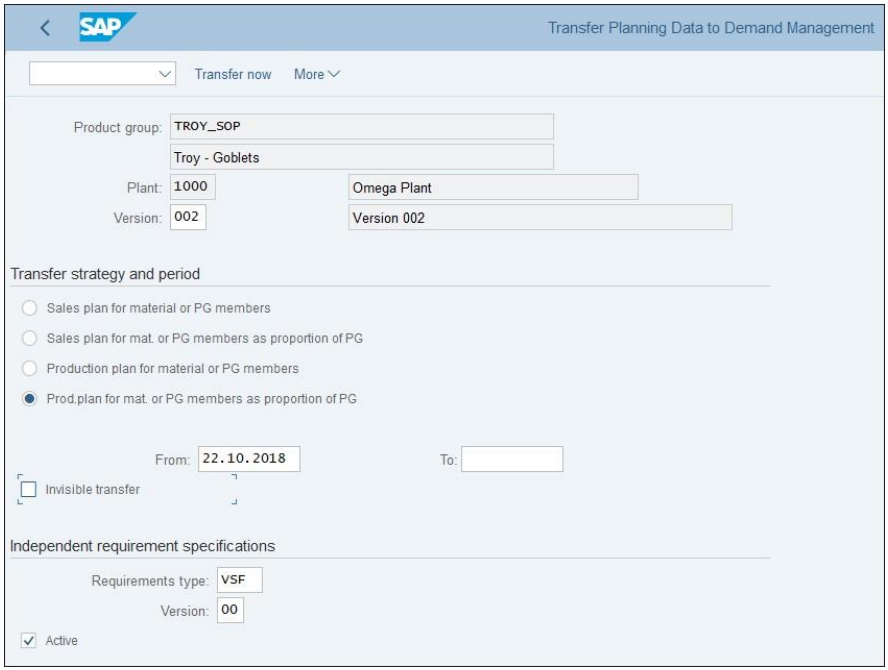


Figure 10.13 Transfer Product Group to Demand Management

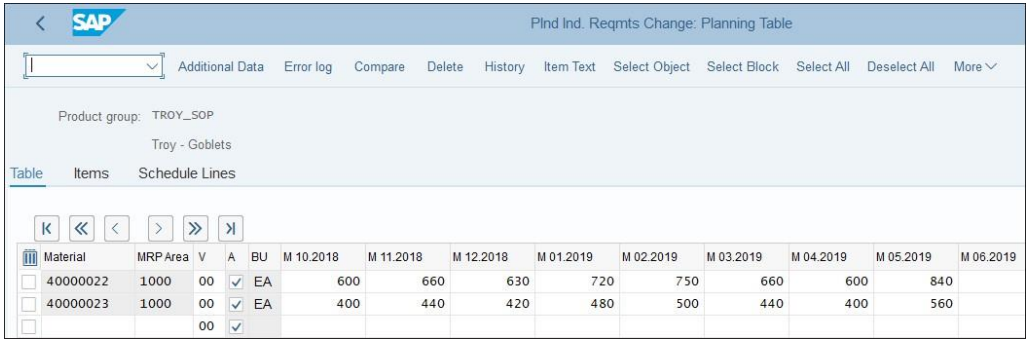
Figure 10.13 shows the initial screen in which you assign the **Version** "002" of the product group and plant for transfer to demand management. The **Prod.plan for mat. or PG members as proportion of PG** radio button enables you to transfer the production plan to demand management.

You can also specify the requirement type and the version of PIR within which the system transfers the values. In this example, assign **Requirements type** as "VSF" and **Version** as "00", and choose **Transfer now**. A message log appears after the transfer is made.

Planned Independent Requirements in Demand Management

To check and confirm whether production figures of the product group were successfully transferred in demand management as PIRs, follow the SAP menu path, **LogisticsProductionDemand ManagementPlanned Independent RequirementsDisplay**, or use Transaction MD63.

On the initial screen, you enter the selection parameters such as **Product group** "PUMP_SOP", **Plant** "1000", **Requirements type** "VSF", and **Selected version** "00", which were all previously defined in Figure 10.13. Press (Enter), and Figure 10.14 shows how the product group breaks down into individual members (materials) with the transferred quantity divided in a ratio of 60% to 40%.



Material	MRP Area	V	A	BU	M 10.2018	M 11.2018	M 12.2018	M 01.2019	M 02.2019	M 03.2019	M 04.2019	M 05.2019	M 06.2019
40000022	1000	00	✓	EA	600	660	630	720	750	660	600	840	
40000023	1000	00	✓	EA	400	440	420	480	500	440	400	560	
		00	✓										

Figure 10.14 PIRs in Demand Management

10.1.5 Distribute Key Figures

During the course of planning the key figures, often the planner needs to make mass changes to several key figures at once. This can be tedious if done one by one or manually. You can use **Distribute** to make mass changes to a key figure in the same row or column. The following are some of the changes that you can make: Perform mathematical

calculations, such as addition, subtraction, multiplication, and so on, on all values (or a selection) of a key figure.

Increase or decrease all the values (or a selection) of a key figure by a defined percentage.

Distribute a value across the time series and replace the old values.

In Figure 10.15, the option to distribute key figures is available from the menu bar by clicking **Distribute** in the planning table. In the **Distribution Functions** dialog box that appears, you can enter a number in the **Val. Field** followed by selecting the right operand (**OP**). The list of available operands appears (shown on the right-hand side of Figure 10.15).

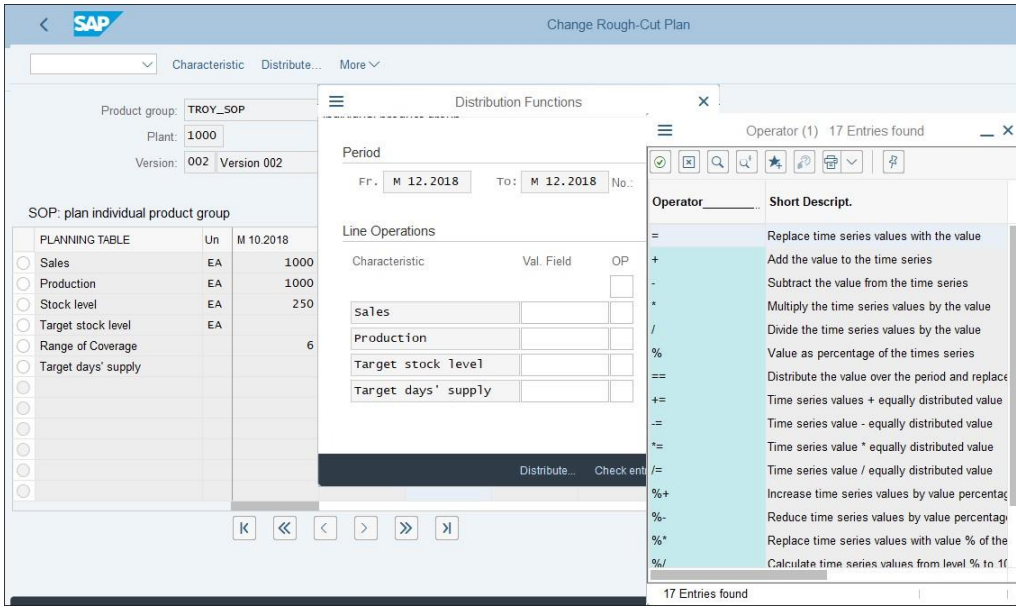


Figure 10.15 Distribution Functionality to Key Figures in S&OP

Figure 10.16 shows the graphical representation of the key figures, including sales, production, or stock level, to enable the materials planner the necessarily visibility of inward and outward movements of materials.

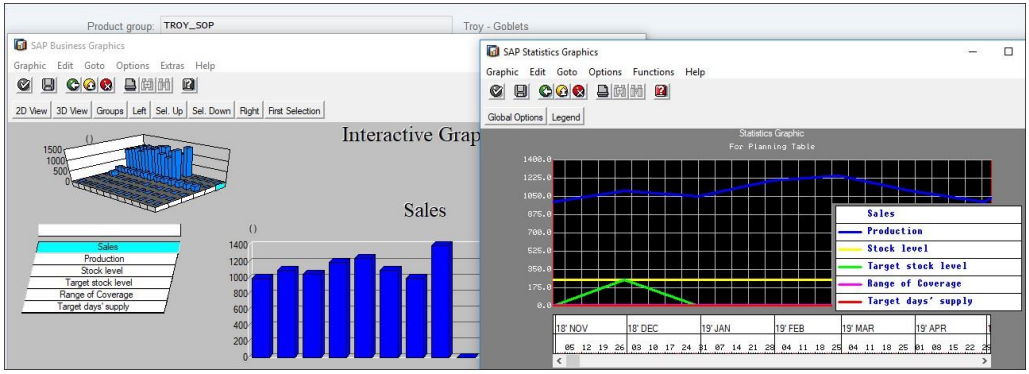


Figure 10.16 Graphical Represenation of Key Figures in S&OP

The following sections cover aggregation and disaggregation as well as tools and features available not only in standard S&OP but also in flexible planning.

Aggregation and Disaggregation

During the course of planning, available tools such as aggregation and disaggregation of key figures help the planner to plan at one organizational (characteristics) level and transfer the values (key figures) to other characteristics levels, based on the defined proportions. Automatic aggregation and disaggregation is a tool available for the planner to help prepare a reliable and realistic sales (or production) plan. For example, the planner wants to consolidate (aggregate) the production quantities (key figures) at a plant level (characteristic). In this scenario, the aggregation tool is helpful to quickly consolidate the desired information. Another example of aggregation occurs when the sales organization is at the highest level, then the distribution channel, then the division, then the material level, and finally the plant level.

Automatic aggregation and disaggregation are consistently available between all planning levels in consistent planning, whereas in level-by-level planning, you need to manually trigger them. Because standard S&OP doesn't offer consistent planning, only level-by-level planning is possible.

The system enables you to drill down data from higher levels to lower levels (disaggregation) or progressively sum up the data from the lower levels to the higher levels (aggregation of sum or average). The ultimate objective of planning, either in standard S&OP or in flexible planning, is to obtain a plan at the lowest level of the characteristic combinations (e.g., at the product group or material levels) and forward the plan to PP.

The planning hierarchy consists of CVCs and their disaggregation percentages. For example, if you have a CVC of sales organization, distribution channel, division, material, plant, statistics currency, and document currency, then you can view the historical sales data or a forecast plan for given key figures of the characteristics. The system disaggregates if the data is viewed from the lower levels of the hierarchy, and it aggregates the same if the data is viewed from the higher levels using the same set of disaggregation proportions.

Automatic Calculation of Proportional Factors

When you've maintained the planning hierarchy, you can run Transaction MC9B (Using Planning Hierarchy) for consistent planning to allow the system to calculate the proportional factors based on the disaggregation proportions. These proportional factors become the base in consistent planning for the aggregation and disaggregation.

Time-Based Disaggregation

When rough-cut S&OP transfers the data in demand management, the system requires a *time-based disaggregation*. In S&OP, the planning is carried out in periods of weeks or months, whereas the PIR needs a current date for its planning activities. If the business process is simple, then the requirement of the period is scheduled for the first working day of the period without any further configuration. However, if you need an in-depth and complex distribution of quantities, then you need to define distribution strategies and period splits. The distribution strategy is assigned to the period split for weekly and monthly distribution. The period split, in turn, is assigned to the plant and the planning group.

Planning Hierarchy in Standard Sales and Operations Planning

The planning hierarchy in standard S&OP defines the proportion of one material with respect to others. For example, a material with a 40% proportional factor enables the system to divide all planning figures of this material to 40% of the total planning figures. You can create planning hierarchy master data in standard S&OP by maintaining product groups. You can also generate the master data automatically using Transaction MC8P for info structure S076. Alternatively, you can also run program RMCPSOPP (using Transaction SE38) to generate the master data for info structure S076. When you're in the product group as in standard S&OP or planning hierarchy in flexible planning, you have to define proportional factors. The system then uses these defined proportional factors either in level-by-level planning or in consistent planning.

Table 10.3 provides an overview of the usage of proportional factors in consistent planning and level-by-level planning.

Planning Mode	Calculation Method	Usage of Proportional Factors	Number of Levels
Level-by-level planning	–	Direct	Single
Consistent planning	Calculation based on the planning hierarchy	Multiplication of proportional factors of multiple levels	Multiple
Consistent planning	Calculation based on actual data	–	Multiple

Table 10.3 Usage of Proportional Factors in Disaggregation

To aggregate or disaggregate planning figures in standard S&OP, follow the menu path, **LogisticsProductionSOPDisaggregationBreak Down PG Plan**, or use Transaction MC76. Having selected the product group, plant, and the version, you'll be redirected to a screen in which you can make changes to the proportional factor of each member of the product group and also select the relevant checkboxes to run the standard macros when the planning table screen for standard S&OP appears.

10.1.6 Working with Macros

Macros enable you to automate the linking of key figures in the planning table by using calculation rules. In standard S&OP, the system provides macros for the calculation of the projected stock level and for the creation of an operations plan on the basis of the sales plan. You also can use macros in aggregation and disaggregation during level-by-level planning. You can't define your own macros in standard S&OP.

In the planning table, first select the **Sales** line item, and then choose **More Macro**, which brings up the list of standard macros available to select from. For this example, choose **Aggregation: Sales**, which aggregates the individual sales figures for material 40000023. The individual sales figures of the second material (40000022) aren't shown.

Note

Self-defined macros in flexible planning are covered in greater detail in Section 10.2.6.

10.2 Flexible Planning

It's amply evident that standard S&OP offers limited options in terms of solutions to diverse and complex business scenarios and processes. If your company intends to carry out very lean and production-focused forecasting of sales figures, then you should check whether standard S&OP is able to fulfill your needs.

For more complex planning scenarios, flexible planning can help. In flexible planning, you can plan and process planning data from any organizational unit, whether it's a sales organization, a distribution channel, or a production plant. Flexible planning begins with designing an info structure. An info structure defines a structure with organizational units and business planning values, for example, forecast values in different periods, their relationships, and different views of planning values from different organizational units' perspectives, whether it's sales, production, or procurement. Gaining an in-depth understanding of how to define an info structure to fulfill business planning requirements is very important for successful implementation of flexible planning.

You can also use info structures for product allocation. For example, in the automobile industry, it's common to assign sales quotas to different regions and to automotive dealers to ensure that a company's automobile is in every region it serves. In an info structure for production allocation, you maintain dealer-wise sales quota. During sales order creation for a specific dealer, the system then checks the information maintained in the info structure for product allocation to see if the dealer is still eligible to place orders. Similar to standard S&OP where everything is preconfigured, in flexible planning, a table is designed using the basic steps of configuring a selfdefined info structure, setting the parameters for the info structure and key figures, and configuring the planning type.

In this section, we not only show you how to successfully set up flexible planning but also specifically cover the update fields (key figures) involved in flexible planning. These update fields enable a planner to better use the flexible planning functionality when features such as macros, aggregation or disaggregation, events, and rough-cut planning aren't involved. The update fields apply to standard analysis in flexible planning.

S&OP offers the creation of a planning hierarchy and maintenance of disaggregation percentages for the CVCs in a hierarchy. As mentioned previously, a planning hierarchy is available in flexible planning only.

The section also covers self-defined macros, aggregation/disaggregation, events, and rough-cut planning profiles because all of these features hold significant value to the planner.

10.2.1 Creating a Self-Defined Info Structure

Because we've already covered the salient features of the info structure for flexible planning in Section 10.1.2, we'll now create the self-defined info structure in flexible planning.

You can create and change these structures using the configuration menu path, **SAP IMG General LogisticsLISLogistics Data WarehouseData BasisInformation StructuresMaintain Custom Information Structures**. You can also use Transaction MC21 to create info structures and Transaction MC22 to change them.

Figure 10.17 shows the initial screen to create an info structure. For this example, define the **Info Structure** as "S655", and enter the description as "SOP: Info_Structure_ Troy". It's important to select the application because the resulting catalog (consisting of characteristics and key figures) will then appear accordingly. For this example, set the **Application** as "01" for SD. It's also important to choose **Planning Possible** to enable the user to perform planning functions in flexible planning.

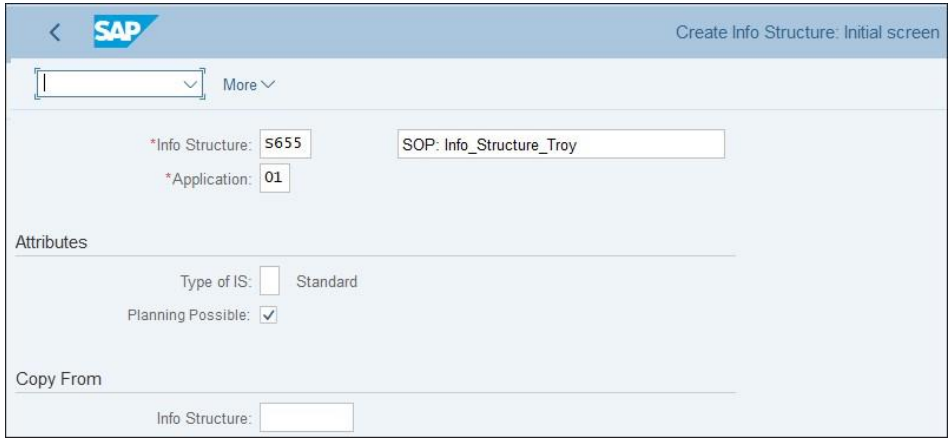


Figure 10.17 Self-Defined Info Structure Creation in Flexible Planning

Press (Enter) to open the screen shown in Figure 10.18. Click on the **Choose Chars** button, which brings up the option to select characteristics from the catalogs. For this example, select the following characteristics from three catalogs:

SD: Sales Organization (order)

- **Sales Organization**

- **Distribution Channel**
- **Division**

SD: Article (order)

- **Material**
- **Plant**

SD: Units (delivery)

- **Document Currency**
- **Statistics currency**

If the selection is made in the correct order, the resulting screen will look like the **Characteristics** as shown on the left-hand side of Figure 10.18.

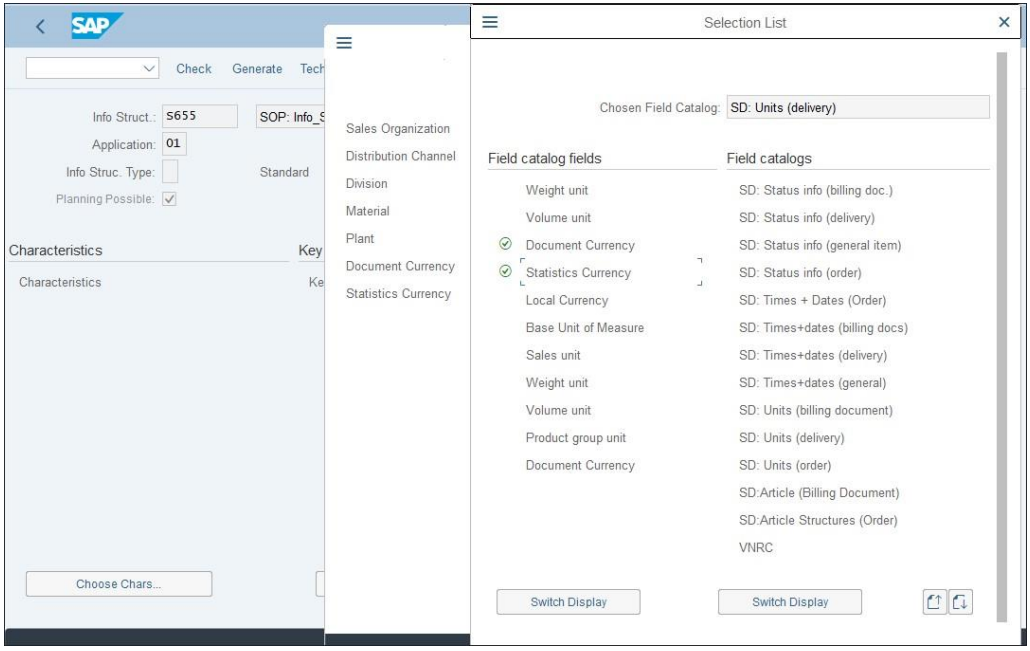


Figure 10.18 Characteristics and Key Figures in Flexible Planning

Next, to select the key figures, click on **Choose Key Figures,** and select the key figures from the following catalog. For this example, select the following key figures from two different catalogs:

Key Figures: SOP

- **Sales**

- **Production**
- **Stock level**
- **Target stock level** – **Available capacity**

SD: Values, prices (order)

- **Net price**
- **Net value**

All the key figures you select in Figure 10.18 get copied to a temporary area, and you confirm your selection by choosing **Copy + Close**. If the selection is made in the correct order, the resulting screen will look like the **Key Figures** area (Figure 10.19).

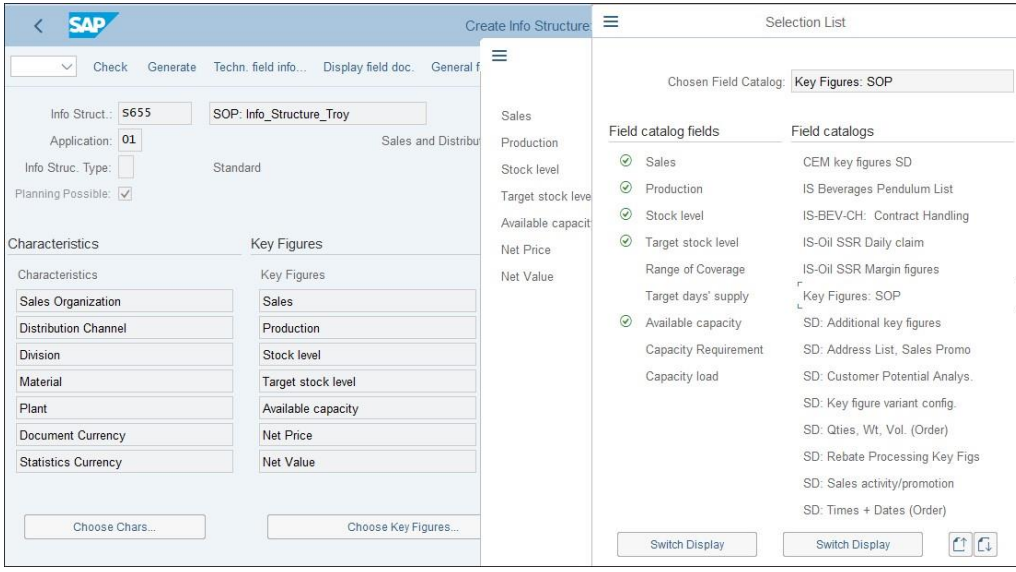


Figure 10.19 Characteristics and Key Figures in Flexible S&OP

Click on the **Generate** button to open the **Log** screen shown in Figure 10.20. Here you see that the creation of info structure S655, in the form of an SAP table, was successful.

If there are any errors, a warning or error message will appear, thus enabling you to address the problem to avoid issues during the planning activity phase.

The next step in the info structure for flexible planning is to define the *planning method*. The SAP system offers two types of planning methods as we've already discussed:

Consistent planning

Level-by-level planning

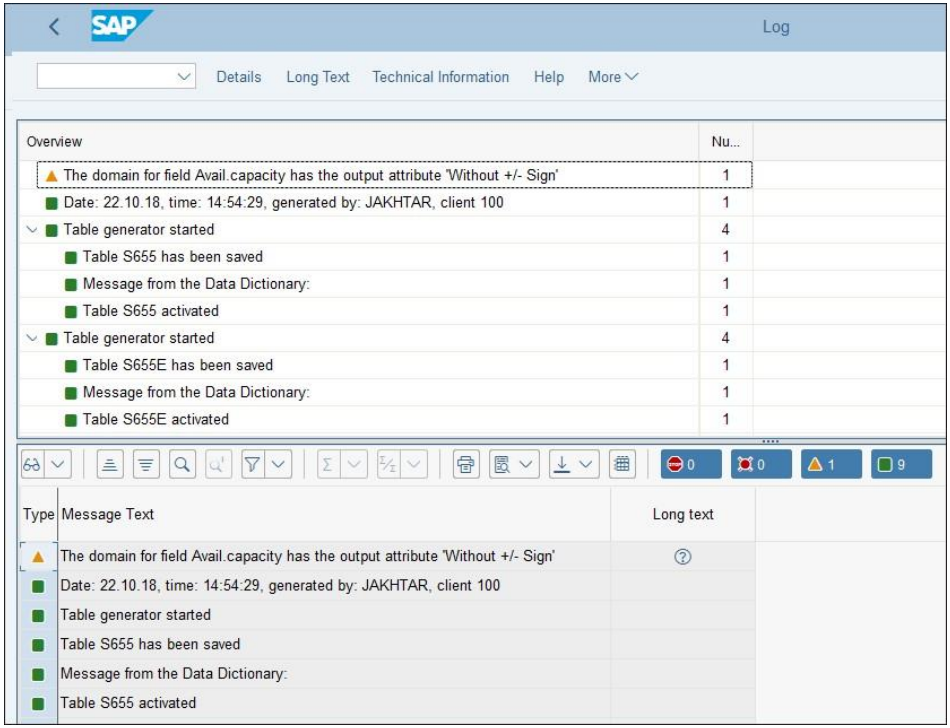


Figure 10.20 Info Structure in Flexible S&OP

The planning method determines the method of disaggregation of data and the storage of data at various levels of planning. Refer to Section 10.1.5 for details.

To set up a planning method for the self-defined info structure, follow the configuration menu path, **SAP IMG ProductionSales & Operations Planning (SOP)Master DataSet Parameters for Info Structures and Key Figures**, or use Transaction MC7F. In the overview screen of the various info structures available, double-click on the info structure (**Table**) **S655**. The screen shown in Figure 10.21 appears where you assign the **Planning method** as "K" (for consistent planning) and the **Planning Plant** as "1000" so that the system automatically uses this plant during transfer of key figures to demand management.

Two other important fields are **Statistics Currency** and **Base Unit of Measure**. For this example, assign "PKR" and "EA", respectively, to these two fields. The **Statistics Currency** field enables the system to use it as a base currency, whereas the **Base Unit of Measure** is the smallest unit of measure in which the inventory figures are shown. If a material has a different base unit of measure than what is being used in planning, then the conversion factor must be defined.

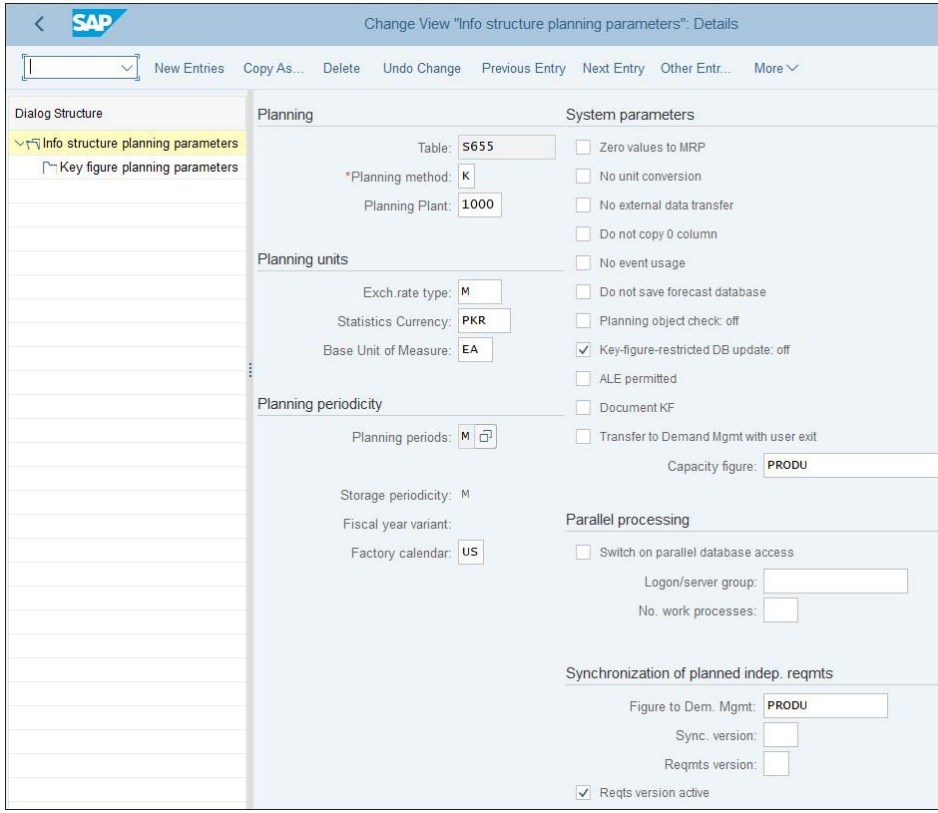


Figure 10.21 Planning Parameters in the Info Structure

By using the **Capacity figure** field value "PRODU", you can work with production line values from the planning table while carrying out rough-cut capacity planning. Similarly, by using the **Figure to Dem. Mgmt** value "PRODU", you ensure that the system uses the production line values while transferring the planned values to demand management.

Finally, assign "US" in the **Factory calendar** field, which will enable the system to refer to the working days and holidays during rough-cut capacity planning.

Note

You can perform rough-cut capacity planning in a planning table to see if the planned forecast values are within the constraints, for example, available capacity at a critical work center. If they aren't, you can adjust the planned forecast values until the capacity load value is shown within permissible limits. For rough-cut capacity planning, you use the production quantity from the planning table. The system selects the production quantities of different periods from the PP line in the planning table to calculate the capacity requirement and display the capacity load as a percentage value.

The screen shown in Figure 10.22 appears when you choose the **Key figure planning parameters** folder in Figure 10.21.

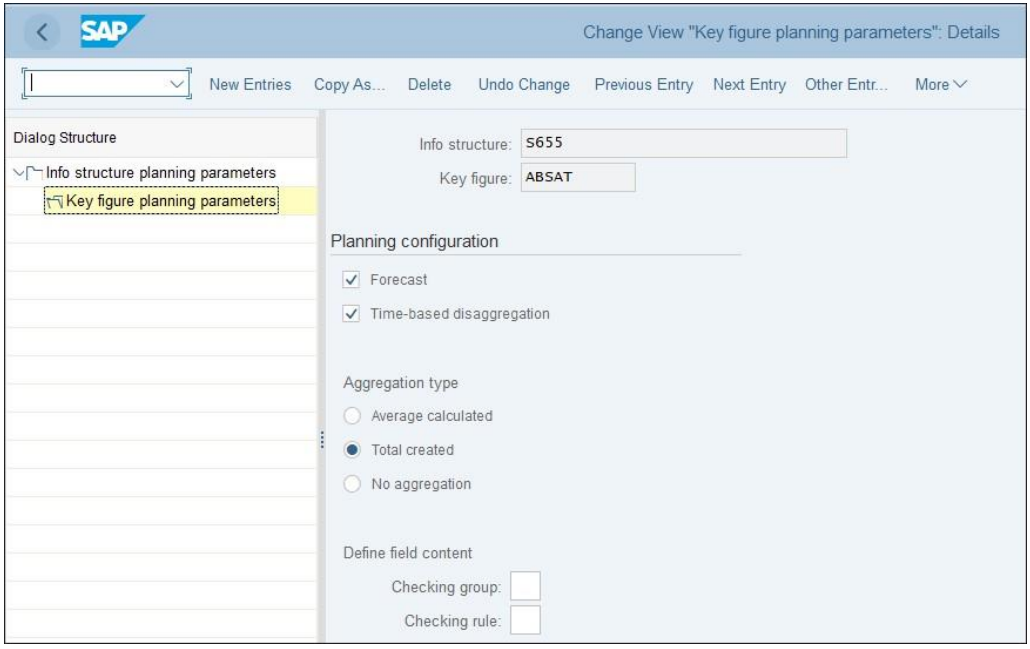


Figure 10.22 Key Figures in the Info Structure

The lower half of Figure 10.22 lists all the key figures you selected during the info structure creation. Double-click **ABSAT**, and in the screen that appears, choose between two options:

Forecast

Choose this checkbox to allow forecasting. If **Forecast** isn't selected for the key figures, then forecasting isn't possible for the key figure in the planning table.

Time-based disaggregation

This determines the type of aggregation with three possible options: average value of the total key figures value of a lower level is aggregated to the higher level, the total of key

figure values of the lower level is aggregated to the higher level, or no aggregation is to be carried out at all from the lower level to the higher level. It's always recommended to use the total aggregation method.

10.2.2 Planning Hierarchy

In standard S&OP, only level-by-level planning is possible. Although the characteristics of the info structure already fine-tune the planning levels, you must still assign characteristic values to them to carry out planning at those levels. For this example, the custom info structure S655 contains the characteristics sales organization, distribution channel, division, material, plant, document currency, and statistics currency.

A planning hierarchy also enables the planner to define the proportional factor of each of the characteristics and in the same sequence of the characteristics in which they are supposed to be planned. You create a planning hierarchy for the following two important reasons:

To let the SAP system knows how the characteristics values are involved in S&OP. To let the SAP system knows the percentage proportional weight of each of the characteristics values in the organizational hierarchy. This is known as the *disaggregation* percentage, which is used by the system to disaggregate or aggregate the data across various levels during planning and consolidation. We've already covered aggregation and disaggregation in Section 10.1.5.

In level-by-level planning, the disaggregation percentage is used directly for disaggregation/aggregation purposes. In consistent planning, the disaggregation percentages are used to calculate the proportional factors used in aggregation and disaggregation.

You need to fulfill the following prerequisites before you can successfully create a planning hierarchy:

Create an info structure with an active status.

Configure the planning parameters for an info structure.

Create the update rules and activate these rules (if applicable).

You can only create one planning hierarchy for a given info structure. In addition, note that you can only use one info structure in consistent planning, whereas in level-by-level planning, you can use one or multiple info structures.

To maintain the planning hierarchy for the self-defined info structure S655, use SAP menu path, **LogisticsLogistics ControllingFlexible PlanningPlanning HierarchyCreate**, or use Transaction MC61.

Enter the **Info structure** "S655" as shown in Figure 10.23. In the ensuing **Characteristics** popup, enter all the details. Note that if you don't enter the details after a specific level, the system triggers the planning hierarchy to maintain the proportional factor. For example, if you don't enter any details for **Division**, then the next three characteristics, **Material**, **Plant**, and **Document Currency**, will enable you to reflect the planning hierarchy in which you can, for example, enter multiple material numbers with a proportional factor for each.

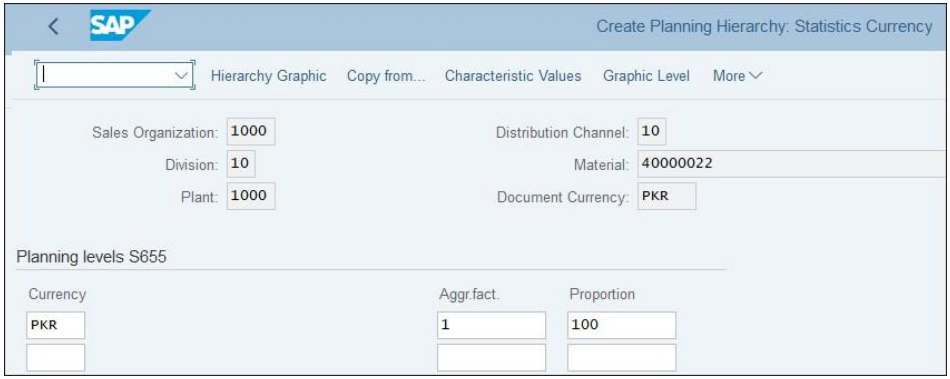


Figure 10.23 Creation of Planning Hierarchy

In the **Create Planning Hierarchy: Statistics currency** screen, maintain the statistics **Currency** as "PKR" with a **Proportion** of "100".

You can navigate from the higher level to the next level by selecting the characteristics values and choosing the **Next Level** icon or by just double-clicking on a characteristic value. You can also check the graphical representation by clicking the **Hierarchy Graphic** button in the **Maintain Planning Hierarchy** screen or directly with Transaction MC67.

Tips & Tricks

You can also have the system automatically create the planning hierarchy along with the disaggregation percentages based on the historical data available in the info structure and its version by using Transaction MC9A (Generate Master Data). You can simulate the creation of a planning hierarchy as well.

10.2.3 Planning Type

With the planning hierarchy already in place, the next step is to maintain the planning type, which then becomes an underlying template or layout in the planning table.

As mentioned previously, in maintaining a planning type for flexible planning, you can define your own macros, assign events, allocate rough-cut capacity planning, and deploy planning versions. The planning type then becomes a format, layout, or template of the planning table, containing key figures and arranged in the desired way. A planning type is similar to a Microsoft Excel program, where you can, for example, include the headings on the left-hand side of the worksheet and the data for the headings on the right-hand side of the sheet.

You can also create multiple planning types for a given info structure. Each planning type arranges the key figures of the info structure as desired on a planning table that has its own macros to convert or translate the available data of an info structure. Having multiple planning types enables the planner to plan the same data arranged in different templates and from different perspectives to arrive at a feasible operations plan. Alternatively, if you're going to use only one planning type, you can save the data under different planning versions and then finalize on one final planning version, activate it, and transfer the finalized planning data to demand management.

Note

In flexible planning, it's only possible to transfer the finalized planning to demand management if you have the plant characteristic and the material characteristic included in the different characteristics defined in the planning hierarchy.

You create the planning types with reference to an info structure (in this example, it's S655). The name of the planning table must start with a Z or Y only. The name of the planning type can be up to 11 characters.

To create a planning type, use SAP menu path, **LogisticsLogistics ControllingFlexible PlanningToolsPlanning Type/MacroCreate**, or use Transaction MC8A. In the **Planning Type: Create** screen shown in Figure 10.24, enter the **Planning type** "Z655", select the **Line layout** and **Macros** checkboxes**,** and press (Enter).

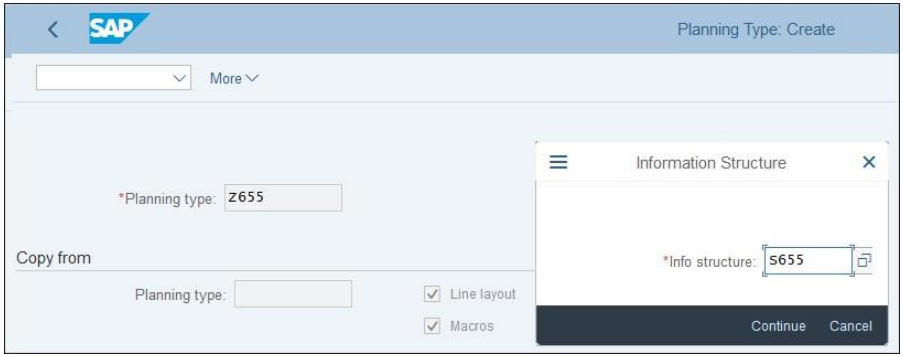


Figure 10.24 Planning Type

When the popup appears, enter the **Info structure** "S655", and press (Enter) again to open the **Define Planning Type** dialog box (see Figure 10.25).

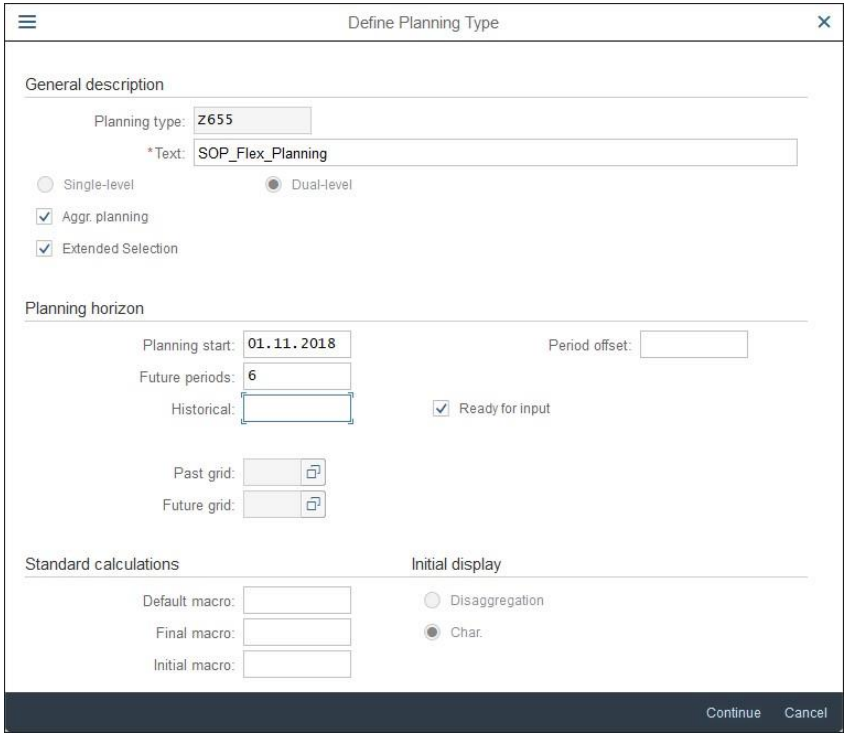


Figure 10.25 Creation of Planning Type

Define the planning horizon by entering the **Planning start** date, the **Future periods** involved in forecasting, and the **Historical** data that needs to be pulled in from the info structure.

The planning start date is the date or the period from which you want to begin planning. This is the start of the future periods; that is, if you've opted for six future periods starting from 01.11.2018 (November 01, 2018), and the period is set as monthly periods in the configuration for info structure, the planning table would show six monthly columns starting from 11.2018 to 04.2019.

Similarly if the historical data is set for six months, for example, the system only pulls in the historical data for the past six months. This historical data will be used to forecast for the future periods. Press (Enter) or choose **Continue** to open the screen shown in Figure 10.26.

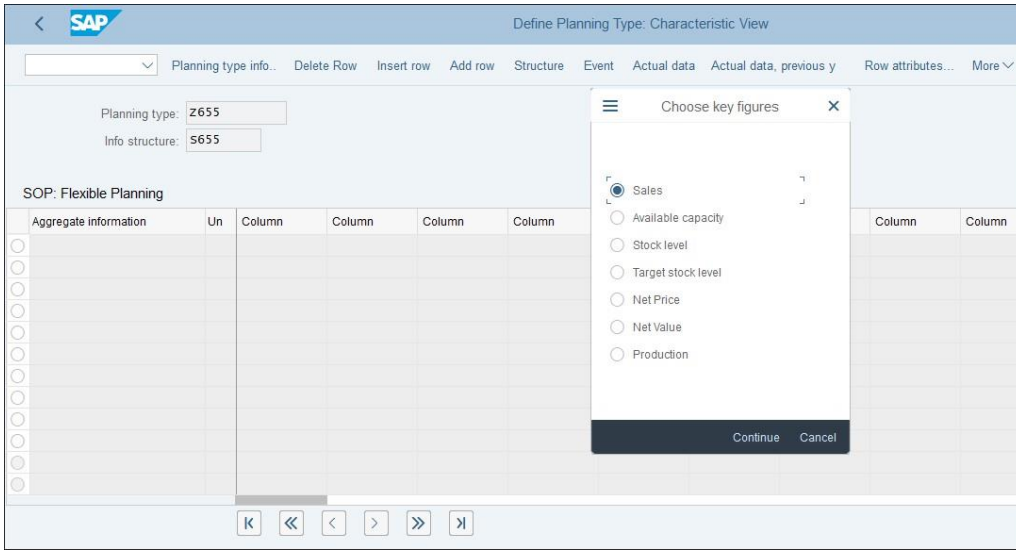


Figure 10.26 Structure Assignment in Planning Type

You can add or remove key figures to the planning type by clicking the **Structure** button to add the key figures, clicking the **Add row** button to insert a blank row, and clicking the **Actual data** button to add a row that will bring in the actual data in the planning table belonging to version 000 (which contains the actual data) of the info structure. To have the actual data brought in for a key figure, you should first keep your cursor on the key figure for which you want to have the actual data brought in, and then choose the **Actual data** button. For example, if you keep your cursor on the **Sales** key figure and then choose **Actual data**, the system adds a row called **Actual Sales** below the **Sales** key figure.

The actual data row is a noneditable row, although you can use it in formulas (macros) to arrive at the data of other rows. You can use the actual data row to compare the actual data to the planned data.

Tips & Tricks

You also can bring in external data for a key figure using the user exit EXIT_SAPMMCP6_001. To create a row for the external data, you keep your cursor on a key figure, and then go to **MoreEditUser Exit Data**.

Figure 10.27 shows how the planning type will look after you've successfully incorporated all of the needed key figures in the planning table and in the desired sequence. You'll need to repeatedly click **Structure**1 to bring each key figure 2 into the planning table in the desired order or sequence 3. When you're finished, save the planning type.

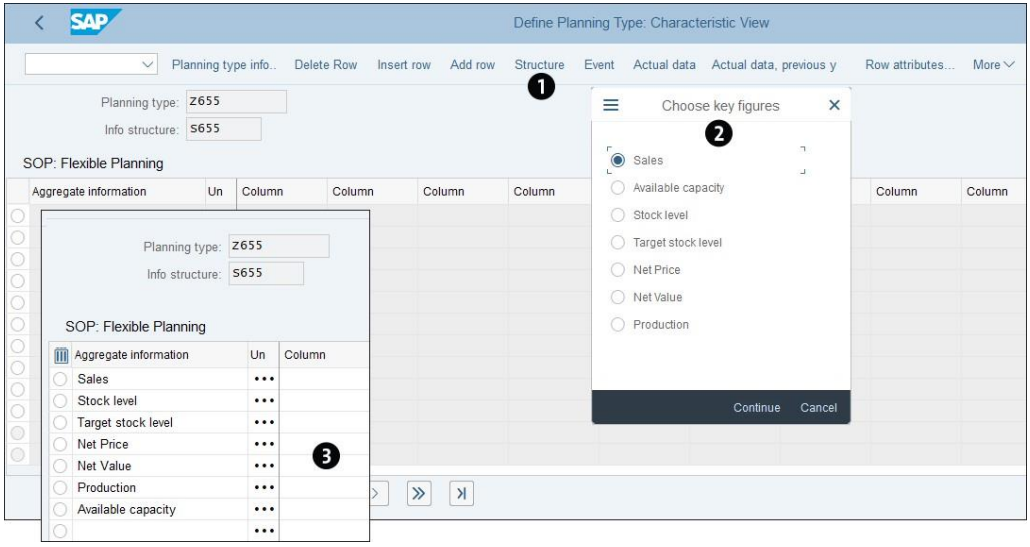


Figure 10.27 Planning Table in Flexible Planning

10.2.4 Working with Self-Defined Macros in Flexible Planning

You can create self-defined macros in the planning type by using the menu options **More MacroCreate.** Follow these steps:

1. In the **Define Macro** window, enter the **Macro** name and the **Description** of the macro, and then press (Enter).
2. Select the **Display** and **Calc. selected area** checkboxes in Figure 10.28.

3. Place the cursor on the **Operand** field in Figure 10.28, and either use drilldown or press (F4) to select a key figure in the ensuing window. For this example, select the key figure **Sales**, and choose **Continue**.
4. Use the drilldown for the **Op** field, and in Figure 10.29, you can see that all of the normal operands, such as addition, multiplication, and so on, are available to choose from to perform mathematical calculations.
5. Enter the value "0.90" as the second **Operand,** and you'll see **Production** key figure in the **Result** field in Figure 10.28.

   In other words, whenever you manually enter values or make available the data in the key figure **Sales** of the planning table and execute the **Adj_Prod** macro, the key figure **Sales** will be multiplied by 0.9, and the results will be shown in the **Production** key figure.
6. Save the macro**.**

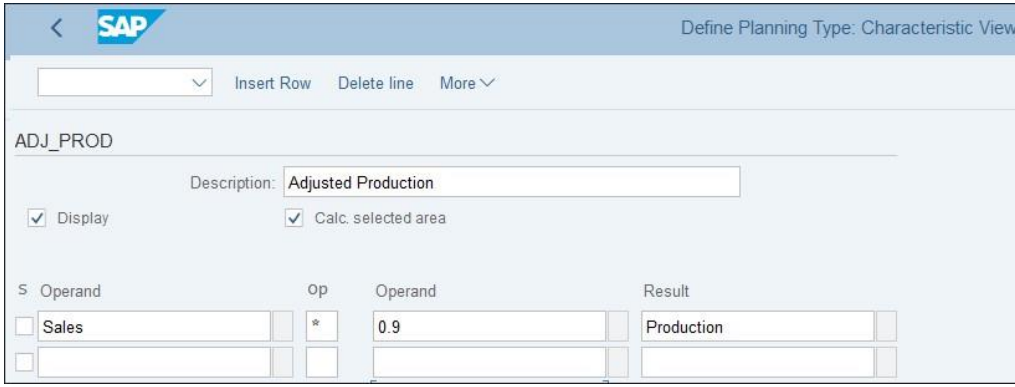


Figure 10.28 Self-Defined Macro

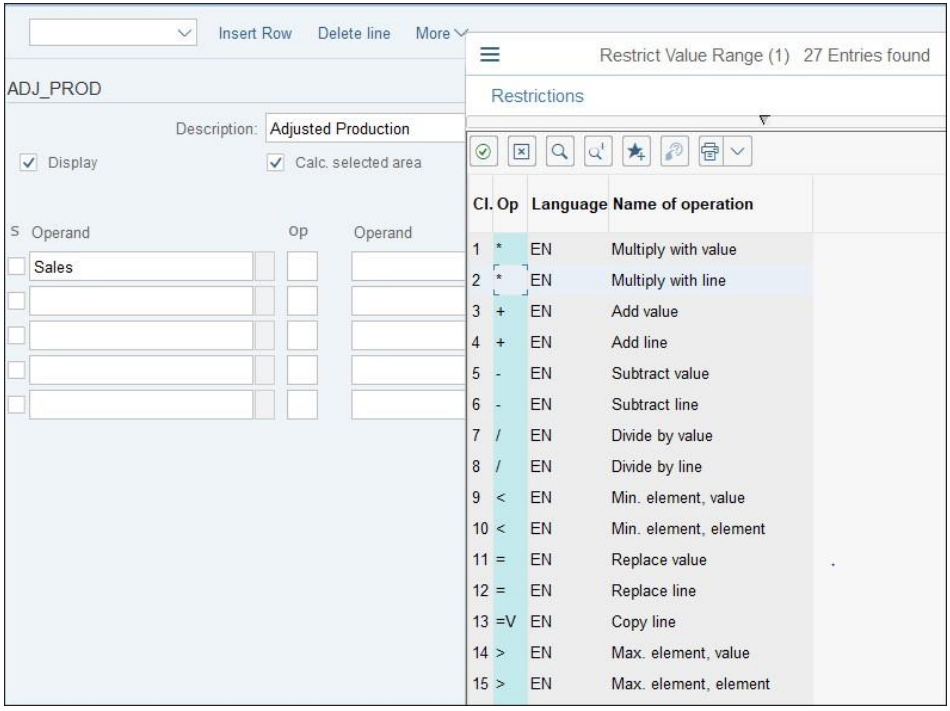


Figure 10.29 Available Operands

For this example, define a second macro, **TOTAL**, which multiplies the key figure **Sales** with **Net Price** to result in a **Net Value** key figure, as shown in Figure 10.30.

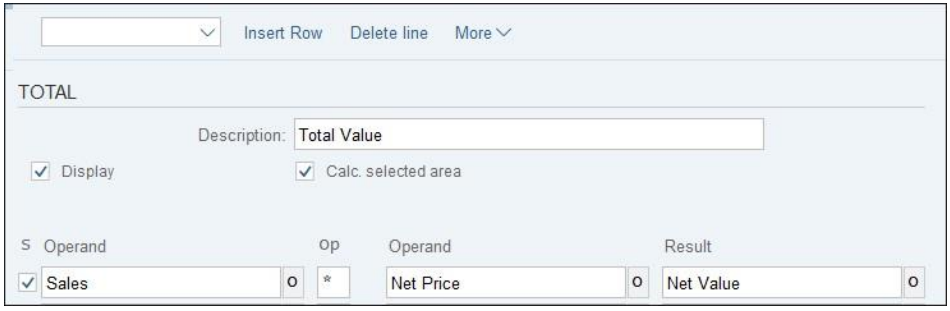


Figure 10.30 Second Self-Defined Macro

After you manually enter the **Sales** quantity in Figure 10.31, you can simulate the selfdefined macros by choosing **More MacroExecute**, which brings up the option to select

a macro to execute. Execute both macros one by one, and examine the results (see Figure 10.32) to see if they conform to the formulas defined in the macros.

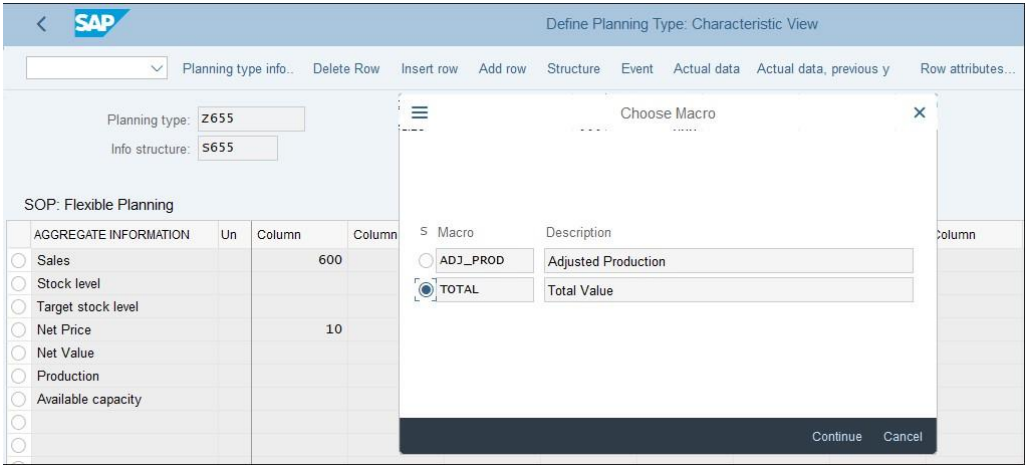


Figure 10.31 Executing Macros

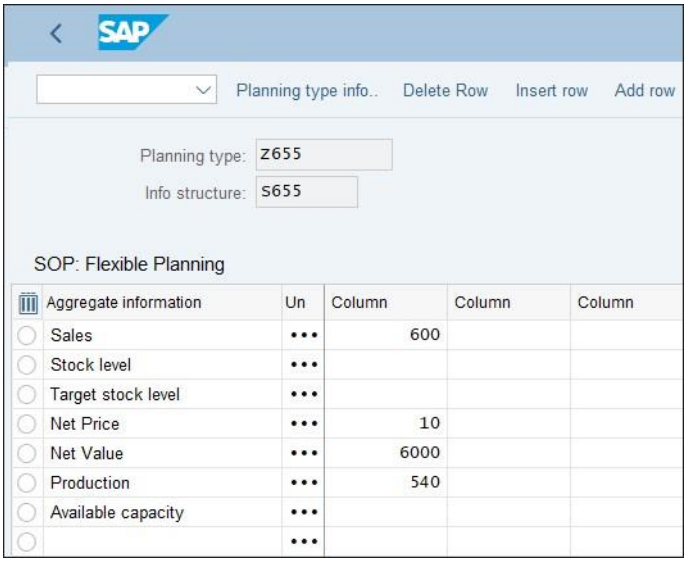


Figure 10.32 Testing Self-Defined Macros

Tips & Tricks

You can even record the macros by choosing **More Macro Record**.

If needed, you can delete the obsolete or incorrectly created macros or edit them from the same menu path within the planning type.

10.2.5 Row Attributes in a Planning Type

For any of the key figures, you can double-click on the key figure or select it and choose the **Row Attribute** icon to set the properties or the attributes of the key figure, as shown in Figure 10.33. You can mark the key field as a **Planning line** (input required), an **Output line** (display only), a **Text line** (information-only key figure), or an **Auxiliary line**, which can be used as a variable in macros. You can also determine the aggregation type of the key figure. In Figure 10.33, we changed the standard description of key figure **Production** to **Adjusted Production**.

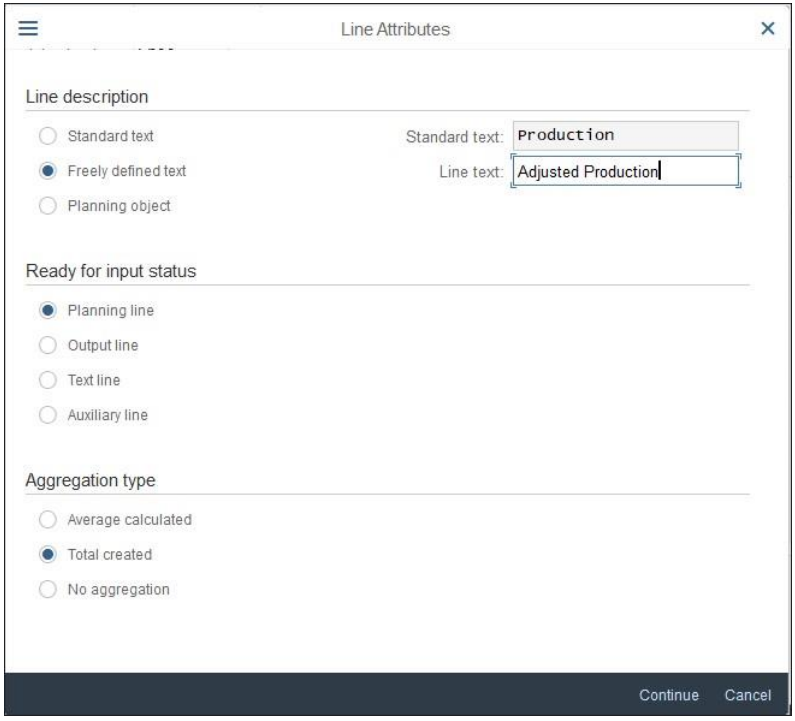


Figure 10.33 Line Attributes in Planning Type

10.2.6 Planning in the Planning Table

Apart from entering the sales, calculating the production quantities, or running macros, you can also perform the following functions (all covered in this chapter, with the exception of

transfer to CO-PA): Forecasting historical data in the planning table (see the "Execute Forecast" section, next, as well as Section 10.4)

Transfer to demand management (Section 10.1.4)

Capacity planning (rough-cut planning) (Section 10.5)

Events (Section 10.6)

Transfer to CO-PA

To create a new plan in flexible planning for the self-defined info structure, use the menu path, **LogisticsLogistics ControllingFlexible PlanningPlanningCreate**, or use Transaction MC93. Follow these steps:

1. Enter the planning type as "S655" for this example. You can also use, for example,"Z655" for the planning type to clearly indicate a link with info structure Z655.
2. Enter the characteristics combinations for which you want to create the planningtable.
3. Enter the **Version** number, "001", of the info structure data that is to be used in the planning table. The planning version 001 is an inactive version.
4. Press (Enter) to open the planning table. When the planning table screen opens, you can enter the data from the info structure for the key figures.

Instead of manually entering the **Sales** key figure, you can use the sales information system, which is also separately covered in Section 10.1.

In the following sections, we'll cover how to execute a forecast, check and validate the self-defined macros, and transfer the results of forecast to demand management.

Execute Forecast

Select the **Sales** key figure row, and proceed with executing the forecast from the menu in the planning table by choosing **More EditForecast**.

In Figure 10.341, you can manually enter the **Period intervals**, with both **Forecast** as well as **Historical data**. For this example, use historical data from the past six months to execute the forecast for the next six months. Alternatively, you can also give the same details by choosing **No. of periods** and assigning **No. of forecast periods** and **No. of historical values.**

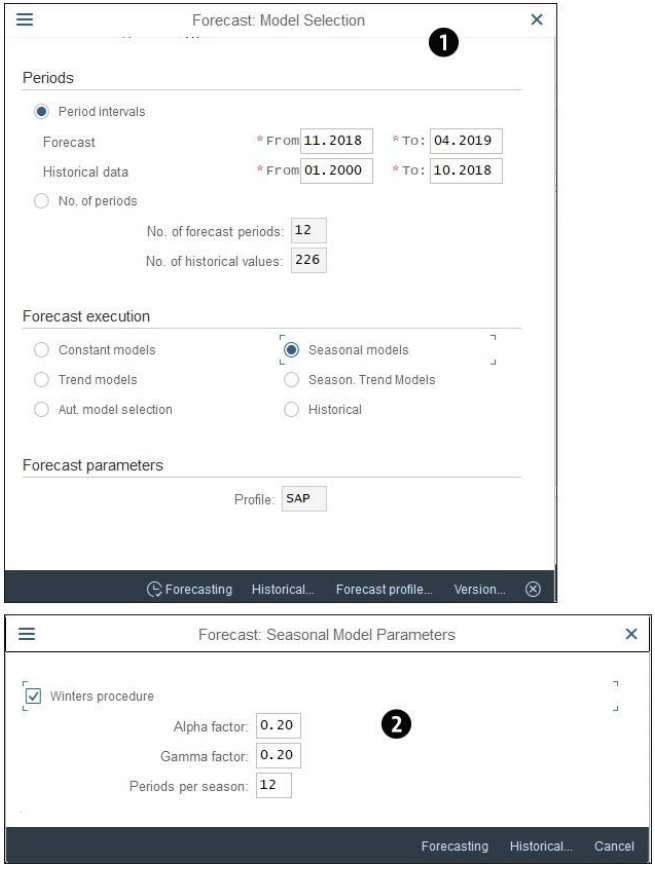


Figure 10.34 Executing a Forecast in Flexible Planning

Next, in the**Forecast execution** area, select the forecast model, which for this example is **Seasonal models**. You can change or update the historical values by choosing the **Historical** button. You also can manually enter or correct the historical values, as we've done in this example. When you choose the **Forecasting** button, depending on the forecast model selected, you need to enter further details, such as **Alpha factor** and **Gamma factor**2.

Tips & Tricks

To save yourself from entering all of the preceding details, you can use the **Forecast profile** button shown in Figure 10.34 2. We cover creating forecast profiles in Section 10.4.3.

You can execute the forecast by clicking on the **Forecasting** button 2. This takes you to the **Forecast: Results** screen that shows the forecast values for the next six months (see Figure 10.35). Choose **Continue**, and all of the forecast figures are automatically copied to the **Sales** key figure of the planning table.

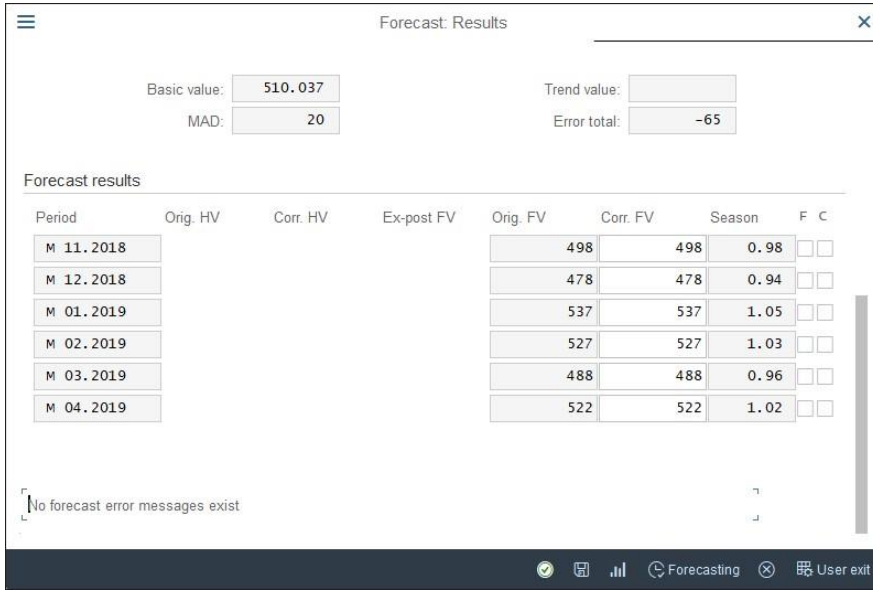


Figure 10.35 Results of the Forecast

The result is a graphical comparison between the historical and forecast figures for the period under consideration, that is, six months of historical figures and six months of forecast figures.

Note

Because we've separately covered forecasting in sufficient detail in this chapter, we've intentionally limited the discussion here to only the basic steps involved in forecasting in the planning table.

Validate Self-Defined Macros

After the **Sales** figures are in place from the forecasting activity, and you've manually entered the **Net Price**, you execute both the macros (see Figure 10.36), and the system automatically fills in the **Net Value** and **Adjusted Production** key figures (Figure 10.37).

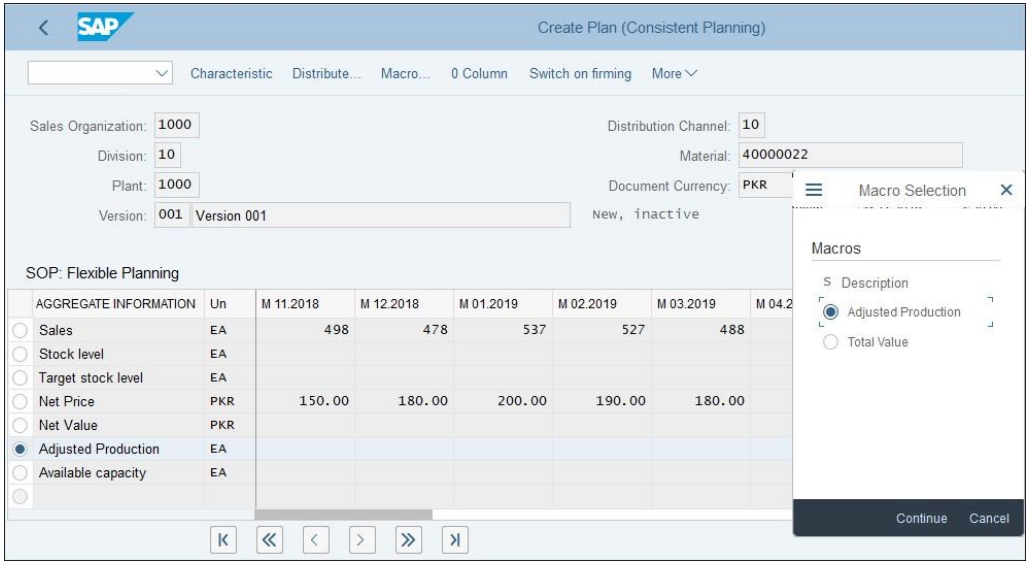


Figure 10.36 Executing Macros

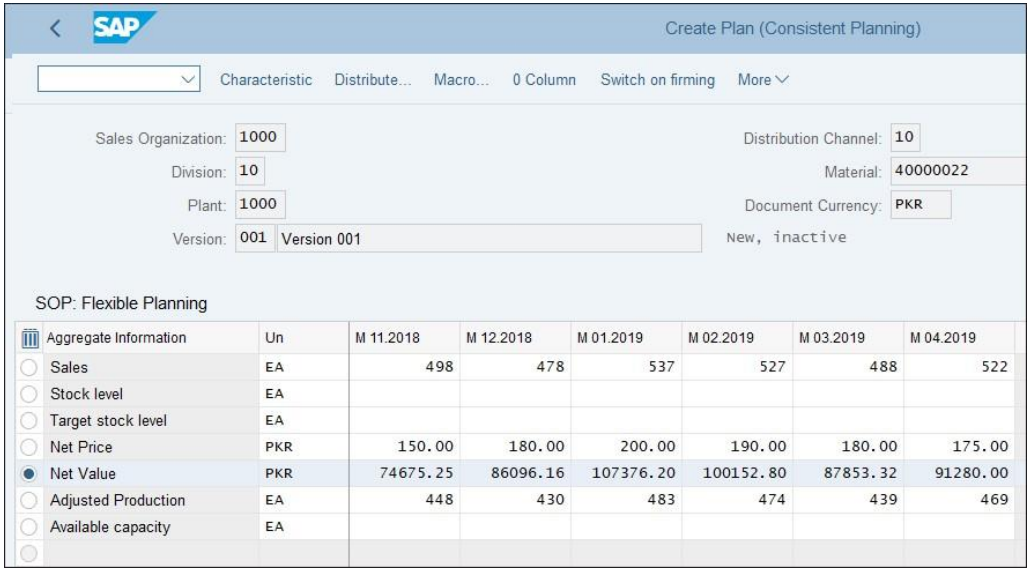


Figure 10.37 Planning Figures after Executing Forecast and Running Macros

With the **Adjusted Production** figures also now in place within the planning table, you transfer the same to demand management, in which the system will reflect the quantities of the production key figures as PIRs.

Transfer Key Figures to Demand Management

While remaining within the planning table, select the **Production** row, and choose **More ExtrasTransfertoDemandManagement** (see Figure 10.38).

Alternatively, you can use the menu path, **LogisticsLogistics ControllingFlexible PlanningEnvironmentTransfer Material to Demand Management**, or use Transaction MC90.

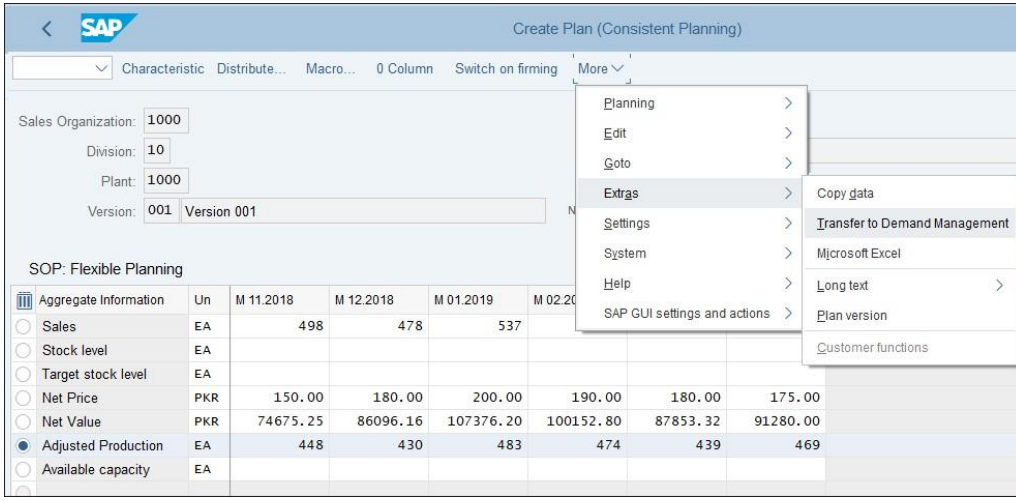


Figure 10.38 Transferring Planning Data to Demand Management

The screen shown in Figure 10.39 appears, in which you assign the **Version** "001" of **Info structure** "S655" for transfer to demand management. The **Key figure** for this example is **PRODU** (production), and the transfer horizon begins from **22.10.2018** (October 22, 2018).

Further, you can also specify the requirement type and the version of PIR within which the system transfers the values. For this example, assign **Requirement type** "VSF" and **Version** "00", and then choose the **Transfer now** button from the menu bar.

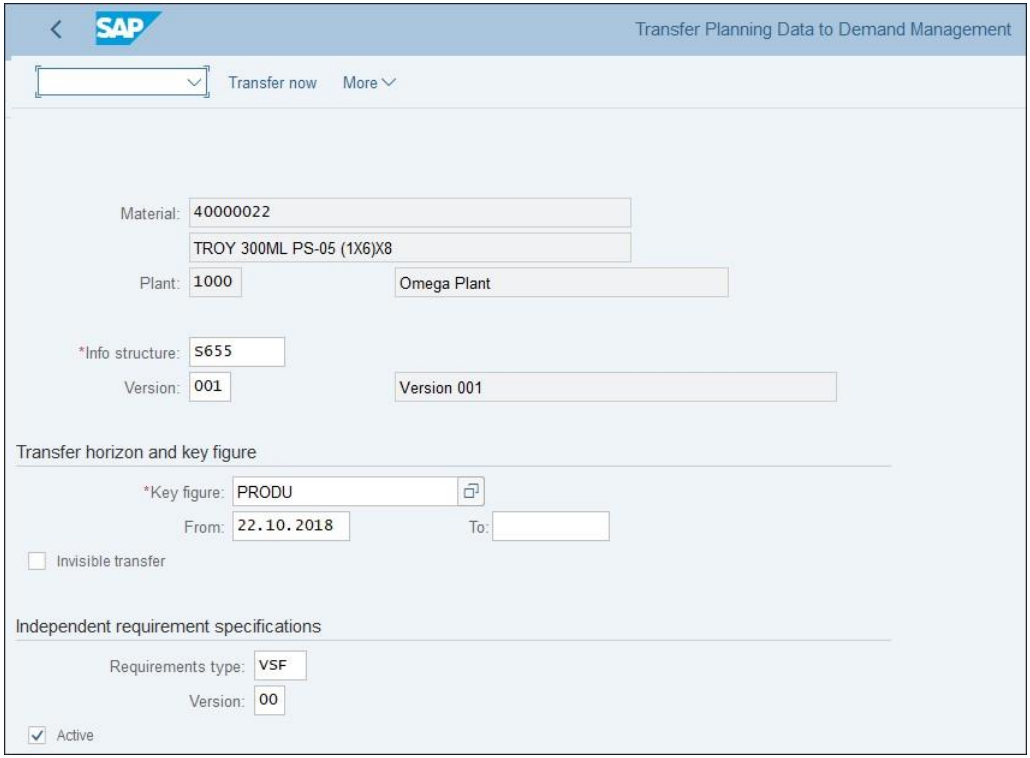


Figure 10.39 Transfer of Planning Data to Demand Management

A message log appears after the transfer of key figures to demand management.

Transfer Results Validation in Demand Management

To check and confirm whether production figures were successfully transferred to demand management as PIRs, follow the SAP menu path, **LogisticsProductionDemand ManagementPlanned Independent RequirementsDisplay**, or use Transaction MD63.

On the initial screen that appears, you need to enter the selection parameters, such as **Material** "40000022", **Plant** "1000", **Requirements type** "VSF", and **Version** "00", which were all previously defined in Figure 10.39. Press (Enter), and in the screen shown in Figure 10.40, notice that the transferred quantities are complete and correct.

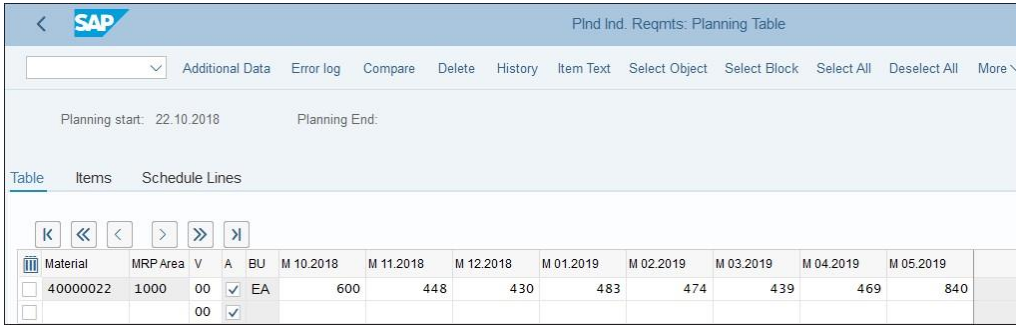


Figure 10.40 Validation of Transferred Planning Data as PIRs

This brings an end to the standard steps involved in flexible planning, but there are a few salient features of the planning table, especially those related to planning hierarchy, that we need to discuss next.

10.2.7 Additional Features of Planning Tables

Following are some additional features related to planning tables:

Checking header information

To check the header information, which shows the planning hierarchy levels, choose **More SettingsChoose Header Info** in the planning table.

Firming/unfirming key figure data

During consistent planning and to ensure that aggregation and disaggregation won't change the key figures data, you can firm or unfirm the key figure data. Choose **More SettingsFirmingSwitch On.** You also need to follow the following sequence in the firming process:

- Activate fixing.
- Change the value.
- Deactivate fixing.

You can deactivate fixing by choosing **More SettingsFirmingUnfirm Period**.

Determining decimal places and rounding

You can determine the number of decimal places and also allow rounding of key figures by pressing (F8) or choosing **More SettingsPlaces after Decimal Point**. **Copying key figure data from another info structure**

You can copy data for a key figure from another info structure by choosing **More**

ExtrasCopy Data. The copy of key figure data takes place from the source info structure for a given period to the target info structure.

Showing row totals

You can show the row totals by choosing **More SettingsShow Row Totals**.

Transferring all planning table data

You can transfer the entire data of the planning table to Excel by choosing **More ExtraMicrosoft Excel**.

Moving up or down the planning hierarchy

You can use the following options to move up or down the planning hierarchy within the planning table:

- **Member**
- **Owner**
- **Next member**
- **Previous member**
- **All members**

10.3 Version Management

In the info structure, the planning data is retained in versions. This enables the planner to carry out simulations. You can assign any number to a version, and these remain inactive with the exception of two specific versions having defined meanings and functions: version 000 always contains actual data, and version A01 is the active version.

Every version that is created and for which data is stored in the planning table, all of the values for each of the key figures, and characteristics combinations entered either manually or evaluated by macros, events, or forecasts are directly updated in the info structure against the respective version number.

You can copy one version's data to another version as well as delete the obsolete or unwanted versions, as you'll see in the following sections.

10.3.1 Copy a Version

Depending on whether you're using standard S&OP or flexible planning, you can use the following menu paths or transactions to copy one version to another:

Standard S&OP

Choose **LogisticsProductionSOPPlanningVersion ManagementCopy**, or use Transaction MC78. **Flexible planning**

Choose **LogisticsLogistics ControllingFlexible PlanningPlanningVersion ManagementCopy**, or use Transaction MC8V.

To copy the PIR details of the source version to the target version of an info structure, enter the **Source version** (in this example, it's version "001") to the **Target version** (in this example, it's "A00"), and choose **Copy** at the top of the screen (see Figure 10.41). You can also give the date range (**Period**) that you want to use to copy the PIR details of the source version to the target version.

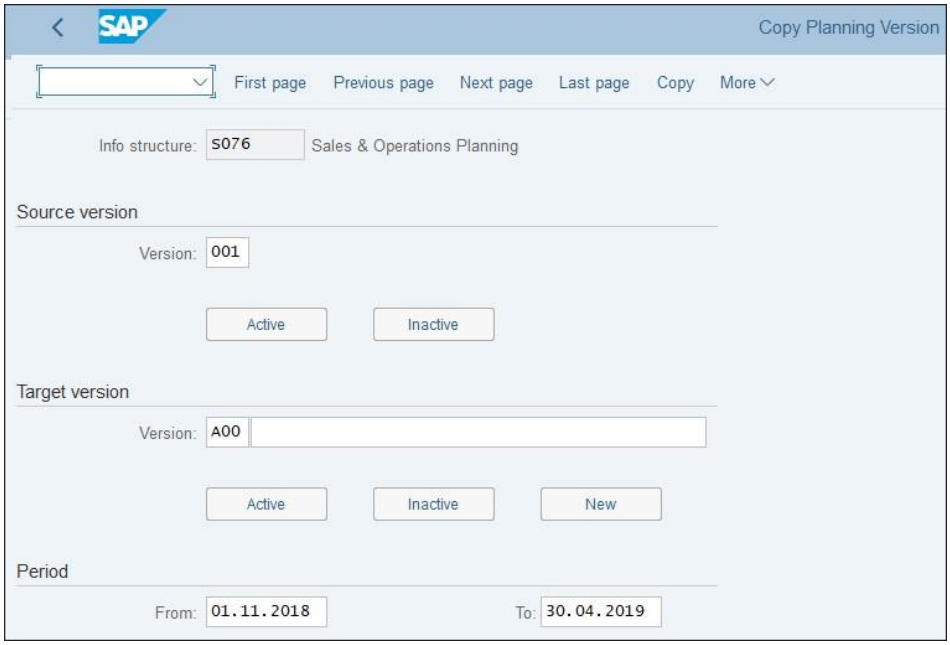


Figure 10.41 Copy a Planning Version

10.3.2 Delete a Version

Depending on whether you're using standard S&OP or flexible planning, you can use the following menu path, or transactions to delete planning versions:

Standard S&OP

Choose **Standard SOP: LogisticsProductionSOPPlanningVersion ManagementDelete**, or use Transaction MC78.

Flexible planning

Choose **LogisticsLogistics ControllingFlexible PlanningPlanningVersion ManagementDelete**, or use Transaction MC8W.

To delete one or several versions of an info structure, select the relevant checkboxes next to the version numbers, and choose **Delete** at the top of the screen.

10.3.3 Scheduling a Copy Version or Scheduling a Delete Version

You can schedule a background job to delete or copy a planning version or to activate an existing planning version by using Transaction MC8K.

To schedule a copy from one target version of one info structure to another info structure, use Transaction MC8Q.

10.4 Forecasting

A *forecast* is the prediction of future requirements and is based on the past consumption trend in a given period of time. These consumptions can be, for example, material withdrawal against the production order, process order, or even cost center. Whenever you create a new material in the system, the system automatically incorporates the **Consumption** tab in the **Additional Data** area of the material master. The consumption for finished goods can be against the sales order. Hence, forecasting offers enormous benefits to plan any material type, whether it's a raw material, a consumable, a packing material, a semifinished good, or even a finished good, based on historical consumption figures. While each withdrawal or consumption updates the information in the system, you can also manually enter the past consumption figures of a material to help drive and facilitate the forecasting.

A detailed analysis of the consumption figures provides a pattern or other valuable information on the consumption pattern, that is, a constant consumption, a moving average, or a seasonal trend model. Therefore, the system offers several standard forecasting models to choose from. If you're not sure which forecast model to select, then the system allows the planner to select **Automatic Model Selection** to facilitate forecasting. However, using this option has its disadvantages.

Warning

SAP doesn't recommend using **Automatic Model Selection** for forecasting because it eventually ends up incorporating one of the several forecast models (e.g., constant, moving average, or seasonal) available in the material master. The SAP-recommended forecasting model may not be in line with your business scenario.

Tips & Tricks

When using the forecasting tool, take a couple of materials as test cases and run the entire forecasting cycle. This forecasting cycle includes maintaining historical values, selecting the right forecasting model, and maintaining additional forecasting parameters. Finally, execute the forecast and see if the forecast results closely match with what you expect the system to do. If it doesn't, you need to consider evaluating other available forecasting models or refining the forecasting parameters. After you've gained the necessary experience with a limited number of materials, you can replicate the same steps for other similar materials. Be sure to periodically review and update the forecasting parameters to ensure reliable material planning results.

This section covers the forecasting options available in S&OP (which are standard and flexible planning) as well as the options available in the material master in case you want to run forecasting on a consumable material or a packing material, which isn't part of S&OP. We'll begin with covering the fields and options available in the forecasting view of the material master (e.g., forecast models, and configuring and using the forecast profile). Finally, we'll cover the weighting group and splitting indicator that can be used in forecasting.

10.4.1 Forecasting View in the Material Master

You can enter the forecast parameters in the forecasting view of the material master with Transaction MM02. Figure 10.42 shows the **Forecasti** view of **Material 40000022** for **Plant 1000**. Details of all the important fields on the screen are given in the subsequent sections of this chapter.

When you run the forecast for a material–plant combination (Transaction MP30) or for the entire plant (Transaction MP38), the system uses information from the material master and offers no option to make changes in the forecast parameters.

Note

You can navigate to the **Forecast** menu in SAP system via the menu path, **LogisticsProductionProduction PlanningMaterials Forecast**.

You can also execute forecasting in the following:

S&OP for materials or for product groups

Flexible planning

When executing a forecast in either of these areas, the system provides you with the option to select the forecast profile as well as make changes to the default data defined in the forecast profile. You can also carry out forecasting for consumptionbased materials, as essentially the concepts and the fundamentals remain the same.

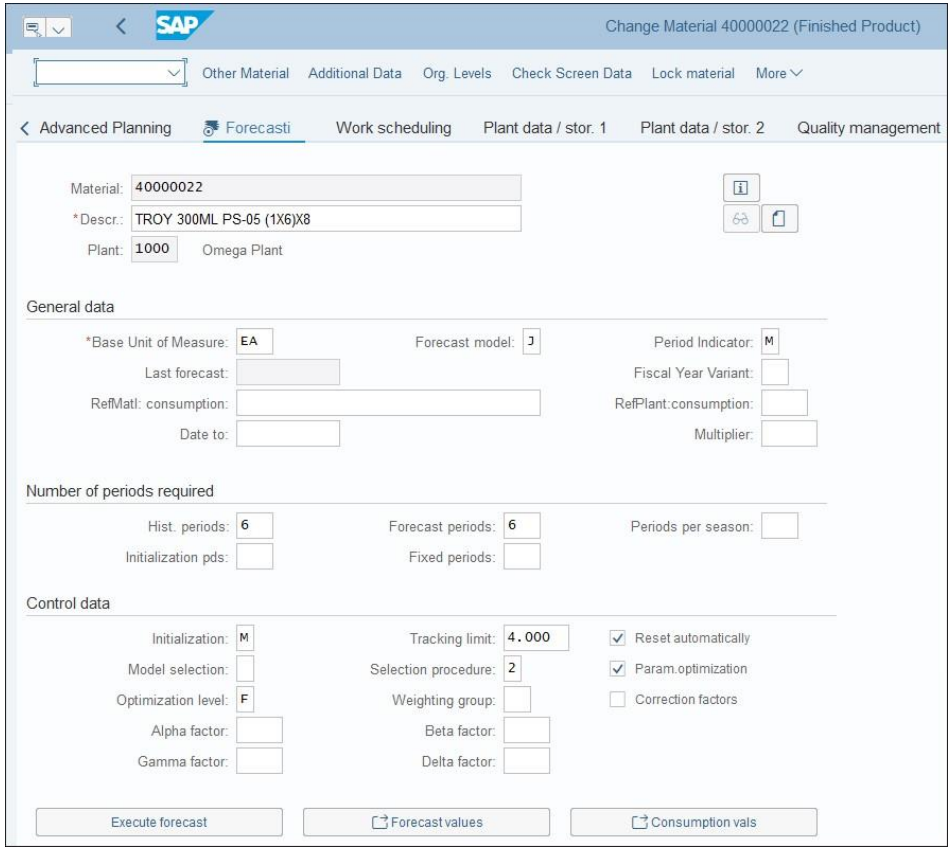


Figure 10.42 Forecasting View in the Material Master

Table 10.4 covers the fields shown in Figure 10.42.

Field	Description
Forecast model	Indicates your chosen forecast model. For example, a forecast model **N** (no forecast/external model) enables the SAP system to create forecasts from external sources, such as an Excel file or even a legacy system (Section 10.4.2 where we cover this topic in detail).
Period indicator	The periods in which the consumption values and the forecast values are managed.
Fiscal year variant	The fiscal year in which the consumption values and the forecast values are managed.
RefMatl: consumption	The consumption data a material that the system uses to forecast values of a new material. If two or more materials have a similar consumption history, then one material can form a reference material for other, and yet a multiplier can still apply to individual material to account for any increase or decrease in consumption values and forecast values (see the definition of **Multiplier** below).
Date to	Date up to which the system uses the consumption values of the reference material to calculate new material forecast values.
RefPlant: consumption	The plant of the reference material.
Multiplier	The multiplication factor that the system uses for the reference material's historical values to calculate new material forecast values.
Hist. periods	Indicates the number of historical values the system uses for a material forecast.
Forecast periods	Indicates the number of period splits for which the forecast values should be created.
Periods per season	Indicates the number of periods that belong to a season. Use the option only if the forecast model is a seasonal forecast model.

Initialization pds.	Number of periods used for initialization. Initializing is resetting the system's settings, which can be automatically or manually enabled. Initialization takes place when the material is forecast for the first time or when there is structural changes to a material's time series, such as a change in a material's forecast model, a change in historical values, or a change in forecast values.

Table 10.4 Parameter Details of the Forecasting Screen in the Material Master

Field	Description
Fixed periods	Number of periods the system won't recalculate the forecast values in the next forecast. This option is helpful to avoid fluctuation in a forecast's calculation or because the production can no longer react to changed planning figures within the planning horizon.
Model selection	Specifies if the system should check for the values for trend *or* seasonal fluctuation or for a trend *and* seasonal fluctuation. Set this indication if the system should help in automatic forecast model selection.
Optimization level	Specifies the increment by which the system optimizes (rough, middle, finer) the forecast parameters.
Alpha factor	Specifies the smoothing factor for updating the basic values. If left blank, the default value is **0.2**.
Gamma factor	Specifies the smoothing factor for updating the seasonal index. If left blank, the default value is **0.3**.
Tracking limit	Specifies the amount (or number of times) by which the forecast values may be deviated from the actual values. Every time a forecast runs, the system compares the tracking limit with the tracking signal. The tracking signal, which calculates internally, is the quotient and the mean average deviation (MAD). The system uses the tracking signal to control the accuracy of the forecasts. If the tracking signal is greater than the tracking limit, the system issues exception message and ask you to (re)check the selected forecast model.

Selection procedure	Defines the procedure by which the system selects the optimum forecast model. By standard, there are two methods that the system uses: **1**: Uses a significant test to determine whether a trend or a seasonal pattern is present and then select the forecast model based on the basis of results. **2**: Uses more precise and granular calculation than procedure **1** but consumes more system resources. This procedure carries out the forecast using all models, optimizes the parameters, and then selects the model with the smallest MAD.
Weighting group	Indicates how many historical values are used to calculate the forecast and what weighting is given to each of the historical values.

Table 10.4 Parameter Details of the Forecasting Screen in the Material Master (Cont.)

Field	Description
Beta factor	Specifies the smoothing factor for the trend value. If left blank, then a default value of **0.1** is used.
Delta factor	Specifies the smoothing factor for the MAD. If left blank, then the default value is **0.3**.

Reset automatically	If selected, the system automatically resets the forecast model if the tracking limit is exceeded. Additionally, the system selects a new model during the next forecast run.
Param.Optimization	If selected, the system optimizes the smoothing factors needed by the given forecast model. When this indicator is set, parameter optimization is carried out both for the first and for subsequent forecasts. The system calculates a number of different parameter combinations and selects the one that produces the lowest MAD.
Correction factors	If selected, the system calculates the forecast values by taking into account the correction factors as defined in Customizing.

Table 10.4 Parameter Details of the Forecasting Screen in the Material Master (Cont.)

Tips & Tricks

When SAP S/4HANA is implemented for the first time, there aren't any historical consumption values available in the system that can form the basis of forecasting. In such scenarios, it's possible to manually enter the unplanned or the total consumption quantities of a material. In case of maintaining consumption values of a large number of materials, then creating an upload program is a more practical approach. To manually enter the total consumption values in the material master (Transaction MM02), navigate to the **Additional Data** button followed by choosing the **Consumption** tab. You'll also need to define the plant for which the consumption values are maintained and for which forecasting is being executed.

10.4.2 Forecast Models

Forecast modeling has been devised to aid in forecasting particular events. The forecast model is designed around factors that the client believes are important in influencing the future use of a material. The client also uses past consumption of a material to determine its future use. Both of these methods should produce a reliable forecast. A number of forecast models are available within SAP S/4HANA, as follows: **Constant model**

The constant model assumes that the use of material is constant. This isn't to say that the use of material is the same each month, but that the variation in material usage fluctuates little, and a constant mean value is calculated. This forecast model applies to electricity consumption in an office, for example. Although summer months raise electricity consumption due to increased air conditioning use, the consumption doesn't vary a great deal from the mean value over a longer period of time, such as a year.

Trend model

The trend model is used when there is an identifiable increase or decrease of material over a period of time. The trend may include areas of movement away from the trend, but the overall movement follows the trend. For example, a downward trend over time may represent the use of printer cartridges for top-selling printers that become obsolete over a short period of time, perhaps only 12 to 18 months. As the purchase and use of the printer decreases, the cartridges used in that printer will slow also.

Seasonal model

The seasonal model affects many businesses due to the weather, holidays, or vacations. The seasonal model is defined as a pattern that repeats for each period. For example, the annual seasonal pattern has a cycle that is 12 periods long, if the periods are months. A seasonal model may be applicable to a company that makes patio furniture, which experiences a greater demand in the months of May through September, and this pattern is repeated each year.

Seasonal trend model

The seasonal trend model is similar to the seasonal model, except that instead of the same pattern occurring each period, the pattern is moving further away from the mean value, either positive or negative. For example, California sparkling wine manufacturers can see a positive seasonal trend. They have a seasonal pattern in demand for their products, and for them, the seasonal pattern has a positive trend, as sales have continued to rise. A negative seasonal trend can be shown in beer manufacturers who have a seasonal market, but the overall trend continues to be negative as sales slow each year.

Tips & Tricks

If your clients haven't developed forecast models in the past or don't know which forecast model fits best, they may want to allow the SAP system to analyze the historical data and determine an appropriate forecast model to use. The forecast model

J (automatic model selection) is available in SAP S/4HANA. After the model has been selected, the client can use this as a starting point and make modifications in the future. However, it's equally important to revisit the system-proposed and selected forecast model to ensure it closely matches the consumption trend.

10.4.3 Forecast Profile

A forecast profile consists of the user-defined values (parameters), which then become available during the execution of forecasting. You can, however, still make changes to these values (parameters) in the forecast profile before executing the forecast. To create a forecast profile, use configuration menu path, **SAP IMG ProductionSales & Operations Planning (SOP)FunctionsForecastingMaintain Forecasting Profiles**, or use Transaction MC96.

Figure 10.43 and Figure 10.44 show a standard available forecast profile "SAP" that can be copied to create a new profile and make desired changes.

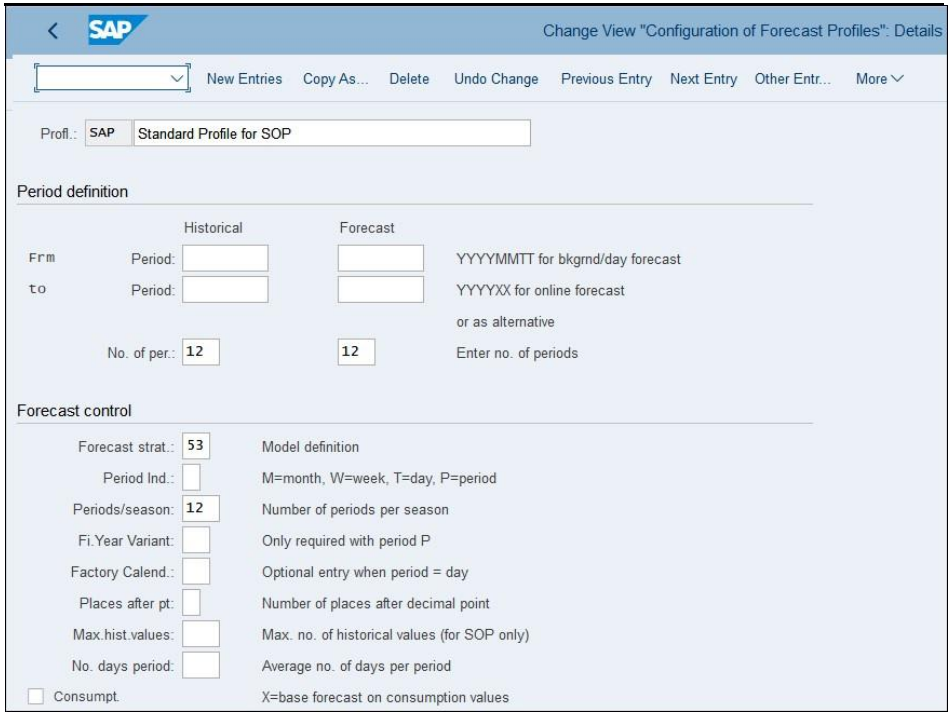


Figure 10.43 Forecast Profile

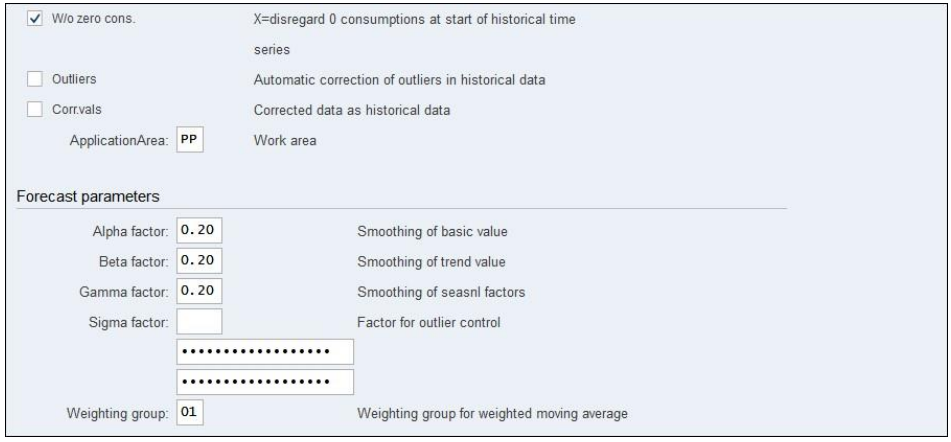


Figure 10.44 More Options in a Forecast Profile

The details of the important fields in the forecast profile are given in the following list.

Frm Period/to Period

The period or intervals for the historical data and for forecast data, which you'll use during forecasting. **Period Ind.**

The period or interval of the required future periods for which the forecasting will trigger. **Forecast strat.**

The forecasting strategies/models that the system will use to carry out the forecast. Forecasting strategies are covered in Section 10.4.4. **Factory Calend.**

The factory calendars specify the holidays or the fiscal year variant. For this example, assign factory calendar "US".

Periods/season

The number of periods in a season if there is a seasonal trend.

Max.hist.values

Maximum number of historical periods; for example, enter "12" and the system will consider the past 12 months' historical values to suggest forecast values.

Consumpt.

This checkbox is used to base the forecast of historical consumption as in standard S&OP's level-by-level planning forecast based on the material consumption history.

Forecast parameters

Corrects historical values for the following (see Figure 10.44):

- **Alpha factor**: Used to smooth the basic value.
- **Beta factor**: Used to smooth the trend value.
- **Gamma factor**: Used to smooth the seasonal index.
- **Sigma factor**: Used to correct the historical figures that lie outside the predefined upper and lower tolerances. The lower the sigma factor, the greater is the control on forecast figures. SAP recommends using a value between 0.6 and 2.0.

10.4.4 Forecast Strategy

Table 10.5 lists the relationship of various forecast models and the corresponding forecast strategies. For each forecast strategy (or model) selection, you have to give details of the parameters, such as **Alpha factor**, **Beta factor**, or **Gamma factor**, which is highlighted in the Additional Information column of the table. For example, if the demand of a product is generally constant throughout the year, then you can select the constant model. Similarly, if you want to maintain an average quantity of material in the warehouse, then you can use the moving average model. In moving average, it adds up the total quantity of the material from historical figures and then divides this total quantity with the period under consideration to

arrive at an average number. So, you need to evaluate your consumption figures for a given historical period to which the forecasting model fits best to meet your business requirement.

Time Series Development	Forecast Model	Forecast Strategy	Additional Information
Constant progression	Constant model	10	The end results are constant figures.
Constant progression	Constant model with firstorder exponential smoothing	11	Maintain an alpha factor to smooth the basic values.
Constant progression	Constant model with automatic alpha smoothing factor adoption	12	First-order exponential smoothing is used.
Constant progression	Moving average model	13	It averages out the values based on the number of historical values.

Table 10.5 Forecast Models and Forecast Strategies

Time Series Development	Forecast Model	Forecast Strategy	Additional Information
Constant progression	Weighted moving average model	14	Maintain a weighting group.
Trend-like pattern	Linear regression	20	It evaluates the trend in values to come up with plausible trend values.
Trend-like pattern	First-order exponential smoothing	21	Maintain alpha and beta factors to smooth out the basic and trend values.
Trend-like pattern	Trend model of second-order exponential smoothing	22	Maintain alpha and beta factors to smooth out the basic and trend values.
Trend-like pattern	Automatic alpha smoothing factor adoption	23	Maintain second-order exponential smoothing with or without model parameter optimization.

Season-like pattern	Seasonal model (winters procedure)	31	Maintain alpha factors, gamma factors, and periods per season for basic and seasonal smoothing.
Season-like pattern	Seasonal model of first-order exponential smoothing	40	Maintain alpha, beta, and gamma factors and periods per season.
Automatic model selection		50	The system takes its own calculation and factors into account and determines/ suggests the appropriate model.
Automatic model selection		52	This is more time- and resource-consuming, but it provides more reflective results.
Historical data way		60	The system will use the past or historical values as is, without automatically making any corrections or adjustments.

Table 10.5 Forecast Models and Forecast Strategies (Cont.)

Figure 10.45 shows the dropdown list of some of the forecast strategies available for you to choose from and assign the same in the forecast profile.

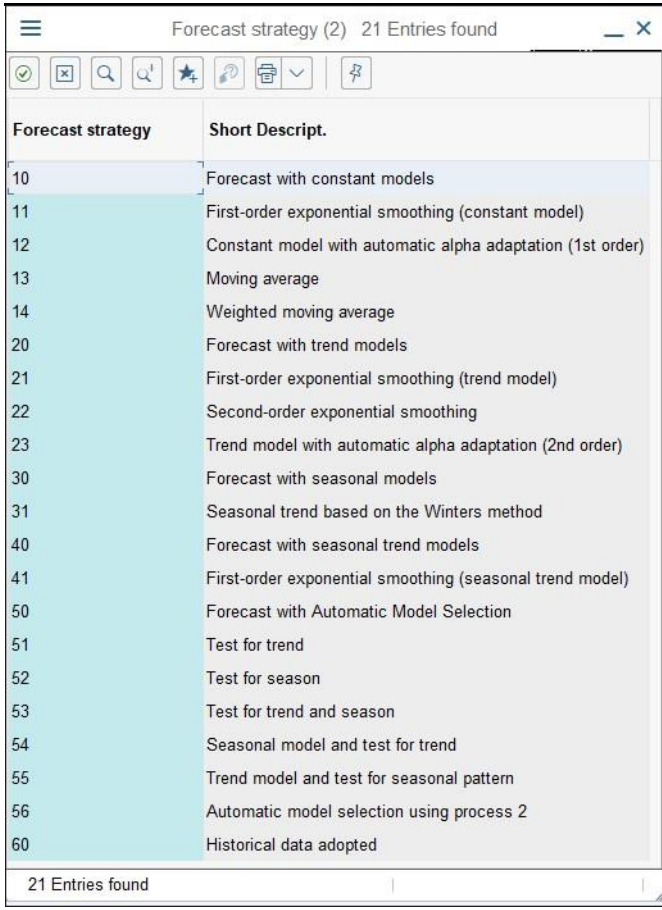


Figure 10.45 Forecast Strategy

10.4.5 Using the Forecast Profile

When you choose the **Forecast profile** (refer to Figure 10.342) while executing the forecast, the **Forecast: Forecast Profile** popup appears in which you can select the relevant forecast profile. The system considers all of the forecast parameters during forecasting. If you still want to make any last-minute changes to the values defined in the forecast profile, then choose the **Change** option in which you can make the desired changes and execute the forecast. To configure a new forecast profile, use Transaction MP80.

We've already covered how to execute a forecast in Section 10.2.6. So, here's the summary on some of the more important topics of forecasting.

On forecast execution, the system calculates the **MAD** (mean average deviation), the **Trend Value**, and the **Error Total** of the forecast values. The **MAD** option helps the planner identify

the degree of variability and a subsequent decision on buffering strategies to avoid stock-outs. For example, an **Error Total** of 44 is divided by the **MAD** value of 13 (44 ÷ 13 = 3.385) and is compared with the **Tracking Limit** set at 4.000 (in the material master) to decide if the forecast model is still applicable or warrants selecting a new or a different forecast model. An error total is the sum of all errors in the past consumption series (refer to Figure 10.35).

Tips & Tricks

When executing a forecast, be sure to check out the forecast error messages by double-clicking on them and attending to them as appropriate.

The graphical version of the forecast figures show the following:

In yellow, the details of the historical corrected consumption values

In blue, the details of the historical originating consumption values, if any

In red, the originating forecasting values

In green, the corrected forecasting values, if any

Tips & Tricks

The forecast model is another important parameter as it tells the system what to look for: a trend pattern, constant consumption from period to period, or seasonality. You can also choose to let the system perform a number of tests so that it can automatically identify the pattern and set it after the executing a forecast run.

Here are three different ways to perform forecasting on individual materials or a group of materials:

At a single material and plant level, use Transaction MP30.

At the total materials and plant level, use Transaction MP38.

At a single material and plant level, use Transaction MM02.

Tips & Tricks

To view or print the consumption values and the forecast values of individual materials or all materials in a plant, here are the transaction codes:

Individual material: Transaction MP32

Total forecast: Transaction MPDR

10.4.6 Weighting Group

The weighting group defines how many of the consumption values the system takes into account during the forecast run and what weightage should be given to each value. More often, the recent consumption values get higher weightage than the ones in the past.

The weighting group works only for the weighted moving average forecast model or forecast model W. You can set the **Delta Factor** to smooth out the forecast values using this forecast model. To set up the weighting group, follow the menu path **SAP IMG Materials Management Forecast Weighting Groups for Weighted Moving Average**.

10.4.7 Splitting Indicator

In forecast-based planning, you have to execute material forecasts first, and based on the results of the forecast, the system calculates and plans future consumption quantities. You can select the forecasting periods to be in days, weeks, months, or for the entire year. The system can consider safety stock in the net requirement calculations. The system takes receipts into account to ensure the demand from the forecast is met. If the demand isn't met, then the system creates procurement proposals.

You can specify the number of historical periods that the system uses in forecasting and also the future forecast horizon (periods) for each material. After the planning run, the system makes material available in the beginning of the period. You have the option to further divide or split these material requirements into finer detail by using the **Splitting Indicator** in the **MRP 3** view of the material master.

The period pattern for the forecast (day, week, month, or posting period) and the number of prediction periods can be defined separately for each material. However, the period pattern of the forecast may not be detailed enough for MRP because it may not provide the required granularity. For this reason, you can use the **Splitting Indicator** to

define for each material how the forecast requirement values may further be distributed to a more detailed period pattern for MRP purposes.

You can maintain the **Splitting Indicator** in configuration by following the menu path, **SAP IMG Materials Management Forecast Define Splitting of Forecast Requirements for MRP**. The **Splitting Indicator** contains the number of periods to be considered as well as the number of days and/or weeks for which the splitting is to be carried out.

Following are the three possible forecast requirements:

No. of days

How many periods are to be calculated to the day in MRP. **No.**

of weeks

How many periods are to be calculated to the week in MRP.

No. of periods

For how many periods—in addition to the periods to be split—is the system to carry out the net requirements calculation in the planning run.

10.5 Rough-Cut Planning Profile

For you to carry out capacity analysis in standard S&OP or in flexible planning, you need master data for the capacity requirements for production of a base quantity of the material or product group. This master data is known as a *task list*, and it can be a routing, rate routing, master recipe, or rough-cut planning profile. Normally, a rough-cut planning profile is created for the material–plant combination because it provides a rough estimation of the capacity requirements.

Warning

An important point to consider is that not every info structure created or used in S&OP has plant as a characteristic. This makes the capacity planning very difficult. It's for this reason that a planning plant should be entered in the **Set parameters for info structure and key figures** configuration screen (Transaction MC7F). Additionally, without reference to the plant and material, transfer of key figures to PIRs isn't possible.

Because the capacity evaluation is performed at the plant level, it's advisable to include it in the info structure and percentage splits given to them for disaggregation and aggregation purposes.

Also in the **Set parameters for info structure and key figure** screen (Transaction MC7F), you should enter a key figure in the **Capacity figure** field, whose planned figures in the planning table will be considered in capacity planning. For this example, we used the PRODU value in the capacity figure (refer to Figure 10.21).

Based on the details given in the rough-cut planning profile, the resource leveling calculates the resource load for the operations plan and thus enables you to quickly estimate feasibility in terms of capacity.

Next, we'll cover the rough-cut planning profile and how the system reflects pegged requirements.

10.5.1 Create a Profile

To create a rough-cut planning profile, use SAP menu path, **LogisticsLogistics ControllingFlexible PlanningToolsRough Cut Planning ProfileCreate**, or use Transaction MC35.

On the initial screen of a rough-cut planning profile, enter info structure "S655", and click **Execute**, which opens the popup shown on the right-hand side of Figure 10.46. Enter all of the characteristics details, and press (Enter). The **General Data** screen shown in Figure 10.47 appears.

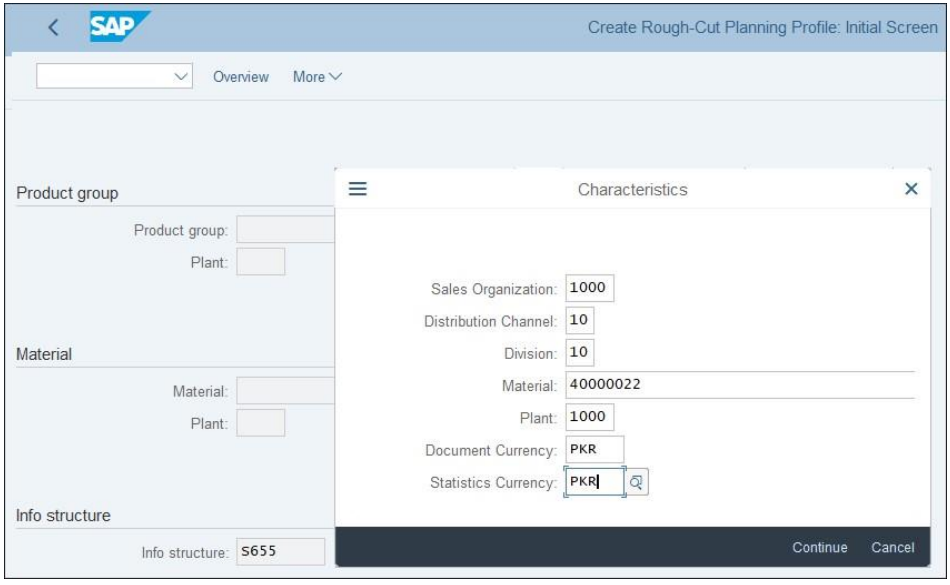


Figure 10.46 Initial Screen for Characteristics Assignment

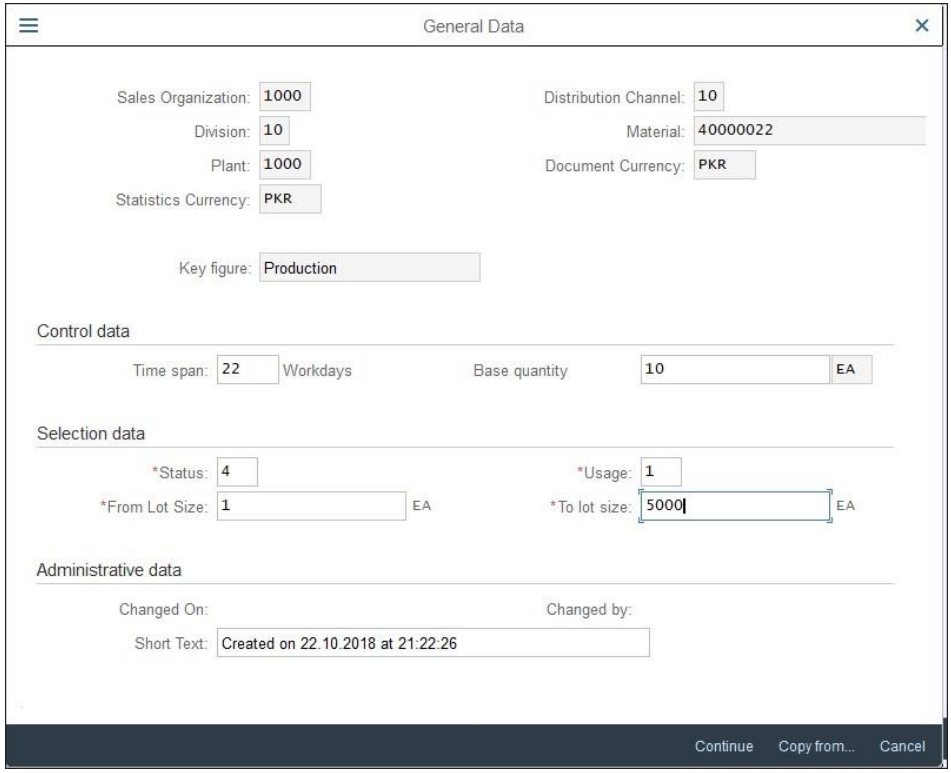


Figure 10.47 General Data in a Rough-Cut Planning Profile

On this screen, enter "22" in the **Time span** field, and enter "10" **EA** in the **Base quantity** field. Set the **Status** to "4" (for **Released**), set the **Usage** to "1" (for production), and press (Enter).

Tips & Tricks

You can change the parameters in the **General Data** screen when needed. For example, you can change the number of working days to account for any national or unannounced holiday in a month.

In the screen that appears as shown in Figure 10.48, double-click the first line of the **RESOURCE TABLE** column. In the **Resource Type** dialog box, choose **Work Center**. As a

result, the system displays the **Resource** popup in which you can enter the **Work center** as "ZMOLDING", **Plant** as "1000", and **Unit** as "EA".

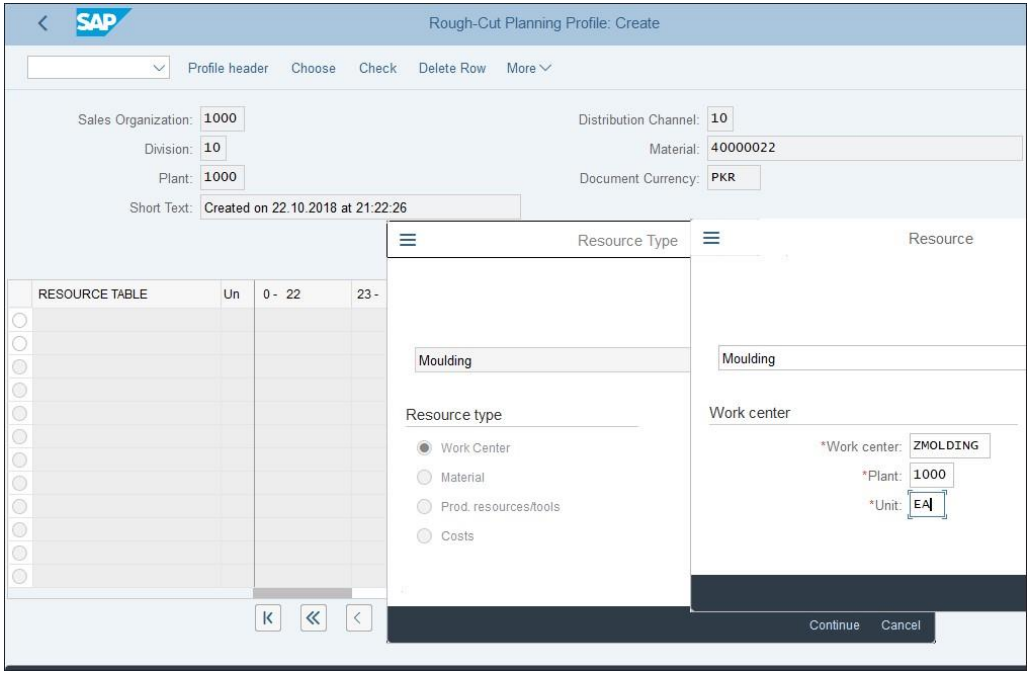


Figure 10.48 Creation of a Rough-Cut Planning Profile

Note

Although work center is used as a resource in this example, you can also use other resources such as PRT or materials.

The planning table allows you to display the available capacity and the capacity requirement via menu path, **More ViewsCapacity situationRough-cut planningShow** (see Figure 10.49).

The **Planning Table** area shows that based on the monthly production figures, the system shows the capacity requirements against the available capacity at the work center.

The capacity utilization is immediately calculated when the plan changes, which facilitates the interactive adjustment of the operations plan to the capacities. However, the resource-leveling process doesn't provide any standard function for adapting the production plan to the available capacity.

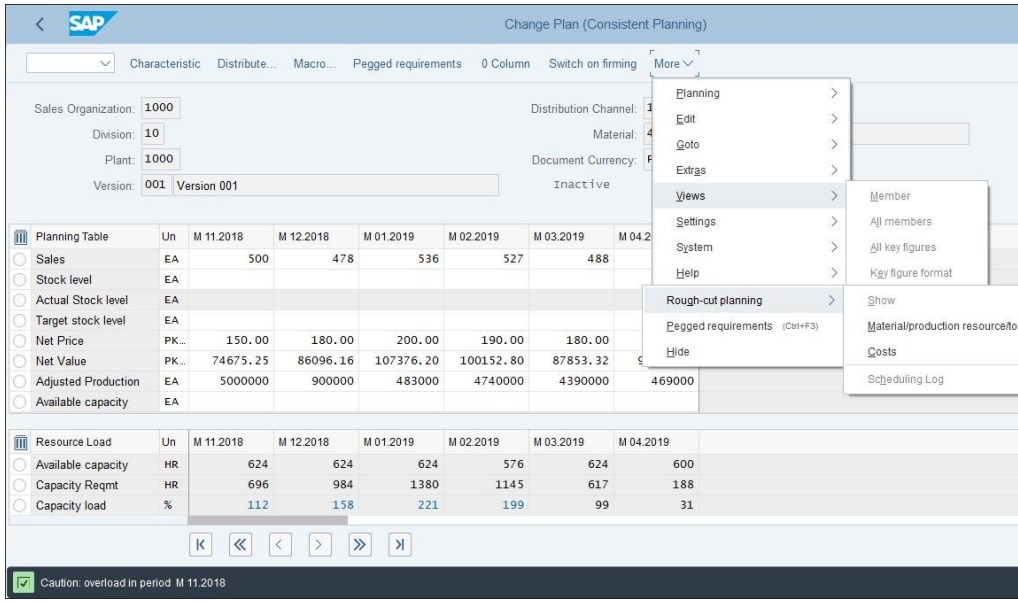


Figure 10.49 Rough-Cut Planning View in Planning

If a capacity is overloaded, a corresponding message is displayed in the footer. For this example, this is the case for November 2018. There's also a capacity overload during the next three months as shown with blue font in the monthly columns for the **Capacity load** row.

10.5.2 Pegged Requirements

Within the planning table, pegged requirements offer a quick way to gain a better understanding of a workload on a resource, whether it's a work center, a material, or a PRT,

to evaluate pegging. The term "pegged" is synonymous with "association" or "attachment," which means one planning element is attached to another. To view the pegged requirements within the planning table, choose **More ViewsPegged Requirements** to open the **Source of requirements** screen (see Figure 10.50). You can also double-click any field in the three capacity rows in Figure 10.49 so that Figure 10.50 appears.

Figure 10.50 Pegged Requirements

10.6 Events

Major events, national holidays, games, planned promotions, and festivals can affect sales quantities (by increasing or decreasing), so understanding events in advance will help your planning efforts. You can increase or decrease your sales quantities using a functionality called *events*.

The events functionality is applied to the sales key figures in all possible cases or to any other key figures that give you the sales quantities or sales values. The system provides the option to assign events across all the characteristics levels or for a specific characteristics level for which the event should be applied.

For example, let's say initially you used the forecasting tool and seasonal model to come up

with the planned sales figures. Later, your company decides to participate in an important and relevant trade show that should have a positive impact on your company's sales. To attend to this anticipated surge in product sales (or demand), you can incorporate this event (the trade show) into your planned sales figures to enable the system to account for the increase. The events are assigned to the planning types and thus come into play in the planning table.

Note

Creating an event isn't a mandatory activity in the planning process, so you can opt out of the event option in the planning situation, if needed.

The SAP system provides two ways of modeling an event: *cumulative modeling* and *percentage modeling*. For cumulative events, the sales quantity affected by the event

is maintained as a difference quantity in absolute figures. The overall sales quantity is represented as the total of normal sales and includes the event. For percentage events, the sales quantity affected by the event refers to the quantity planned in the **Sales** key figure.

In the following sections, we'll show you how to create events and assign them to planning. We'll also show how an event's assignment impacts materials planning.

10.6.1 Create Events

You can create events using the menu path, **LogisticsLogistics ControllingFlexible PlanningToolsEventsCreate**, or by using Transaction MC64.

The initial screen to create an event is shown in Figure 10.51. For this example, enter the **Event Number** as "S655: SOP EVENT", and then press (Enter). In the **General Information** popup, select the **Proportional** radio button, and press (Enter) again.

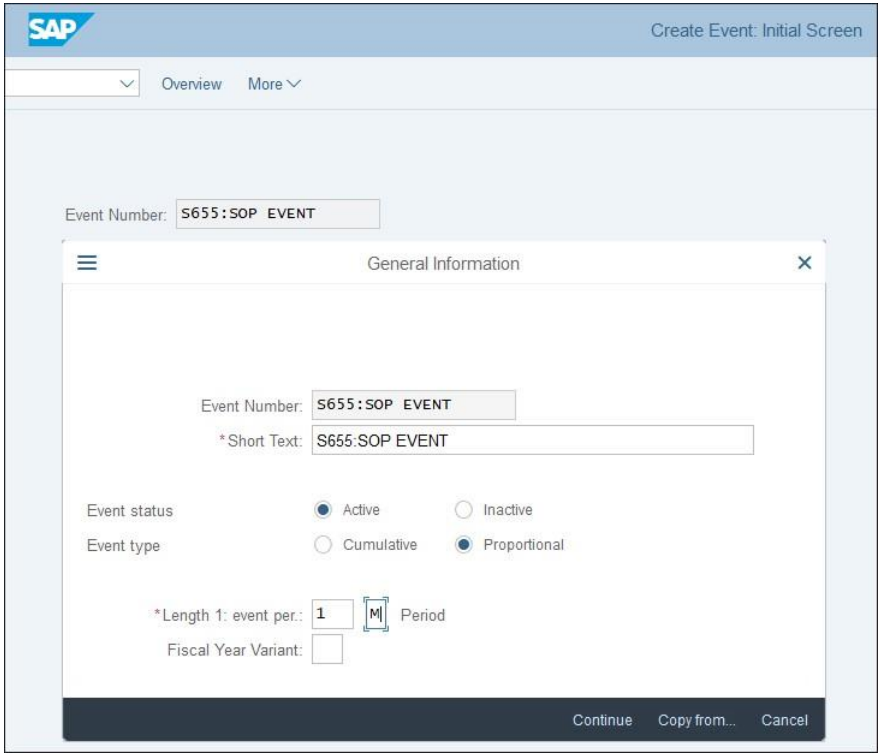


Figure 10.51 Creation of an Event

In the **Proportional Event** screen shown in Figure 10.52, enter the monthly **Change** in percentage, and then choose **Assignment**, which opens the **Info Structure** popup. In this popup, assign the **Info structure** as "S655".

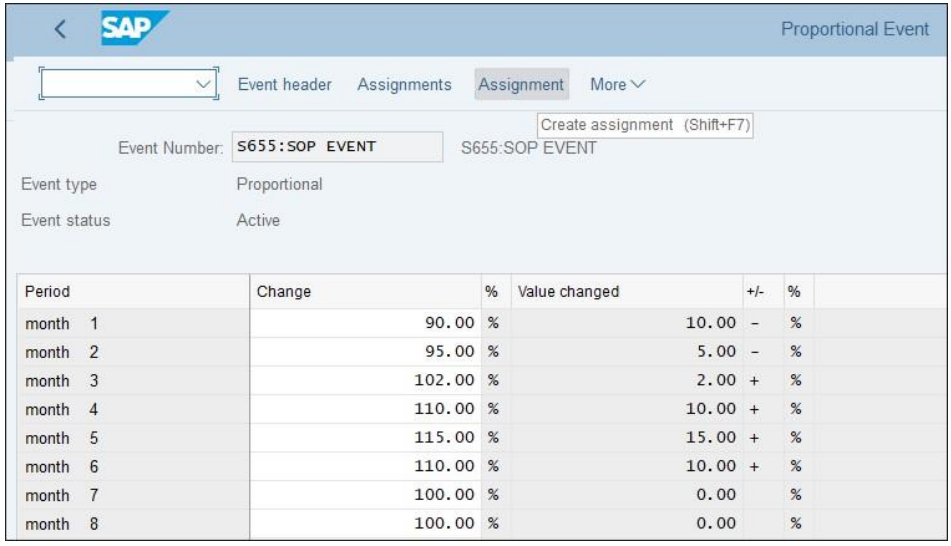


Figure 10.52 Assigning an Event to an Info Structure

Now that you've created the event, you move straight into assigning that event.

10.6.2 Assignment of Events

The screen shown in Figure 10.531 appears after you've finished creating the event in the previous section. In this screen, the characteristics of the info structure automatically appear and are filled in, such as **Sales Organization** and **Division**, along with other information shown.

For this example, select the **Sales** key figure radio button, and then select the **001** radio button 2 for the inactive version. Finally, the system proposes the current data for the event, which you can change. You also need to choose the **Status** checkbox to indicate that the event status is active.

Finally, choose **Assignments**, which takes you to a screen that provides the list of event assignments, which you can change or even delete (see Figure 10.54).

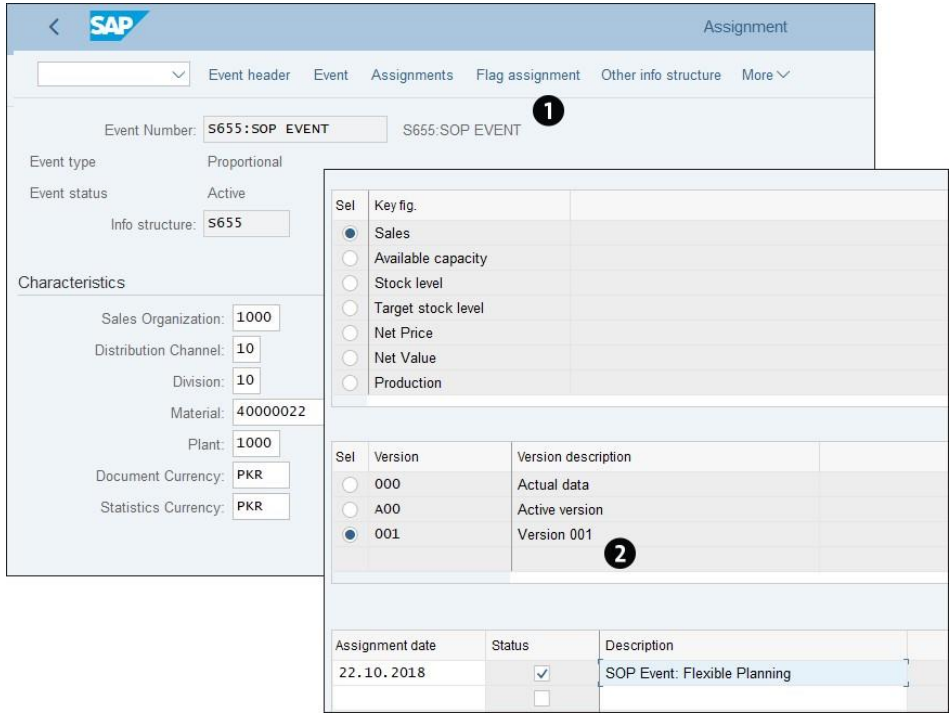


Figure 10.53 Assignment of the Event

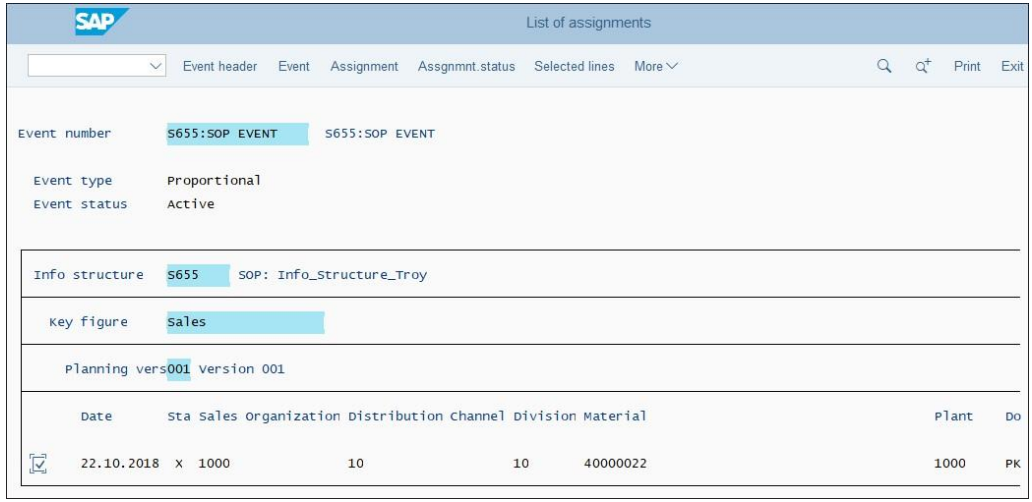


Figure 10.54 List of Event Assignments

10.6.3 Events in Planning

With all the necessary settings and assignments made for the event, you can now test the same to see whether the planning results are reflective of the event in the planning type.

The planning type table is a frame designed to enable the planner to plan the planning figures. Therefore, it makes sense to link the events in the planning type itself, so that when the planning type is used to plan in a planning table (using the key figures), the events come into play automatically.

Figure 10.55 shows the change screen of the planning type (Transaction MC8B) for the same **Planning type Z655** and **Info structure S655**.

For this example, select the **Sales** radio button and click on the **Event** button from the menu bar so that the key figure **Stock level** appears for selection. Save the planning type.

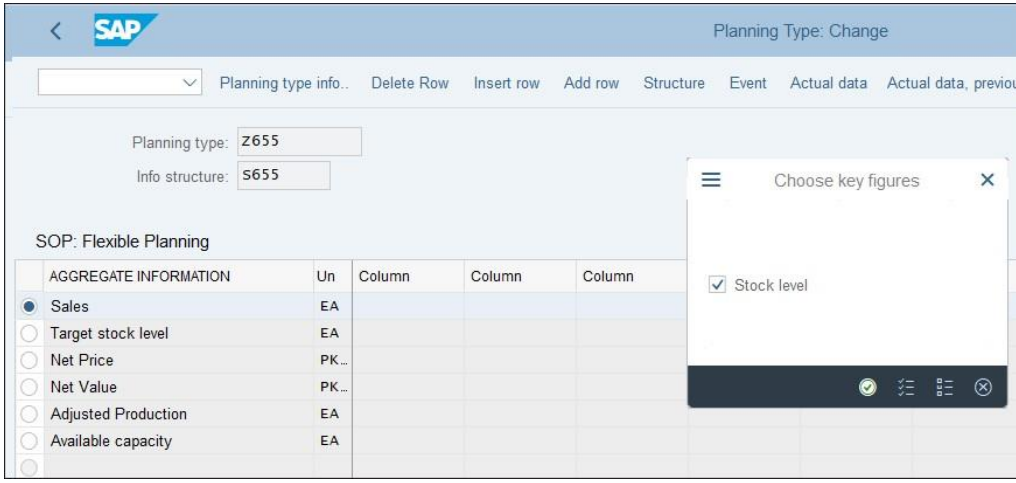


Figure 10.55 Events in the Planning Type

The next step is to change the existing plan (or create a new plan) for the same planning type Z655 and info structure S655 and see how the entered stock figures reflect the impact of an event (Figure 10.56).

In this step, you need to use a key figure from the existing set of key figures to represent "events" in the planning type. Normally, such a figure is an unused or unwanted key figure from the list. If you already know that you're going to use events in planning, we suggest having one or two unwanted key figures that aren't related to any planning activities to be exclusively used for purposes such as an event. If you've already used all of the key figures

in the planning type, you may need to delete the key figure (Transaction MC8B) that you're going to use for adding the event, so that when you click on the **Event** icon, the key figure will be shown as available for addition.

In the planning type, keep your cursor on a key figure (location where you want the event-related key figures to appear—preferably below the **Actual Sales** or **Sales Quantities**), and then choose **Event**. This action shows you a list of unused key figures, from which you can choose one and press (Enter), so that the system draws in four other new event-related key figures in its place. In short, the system requires a key figure that can be overwritten with the four new key figures required for planning events.

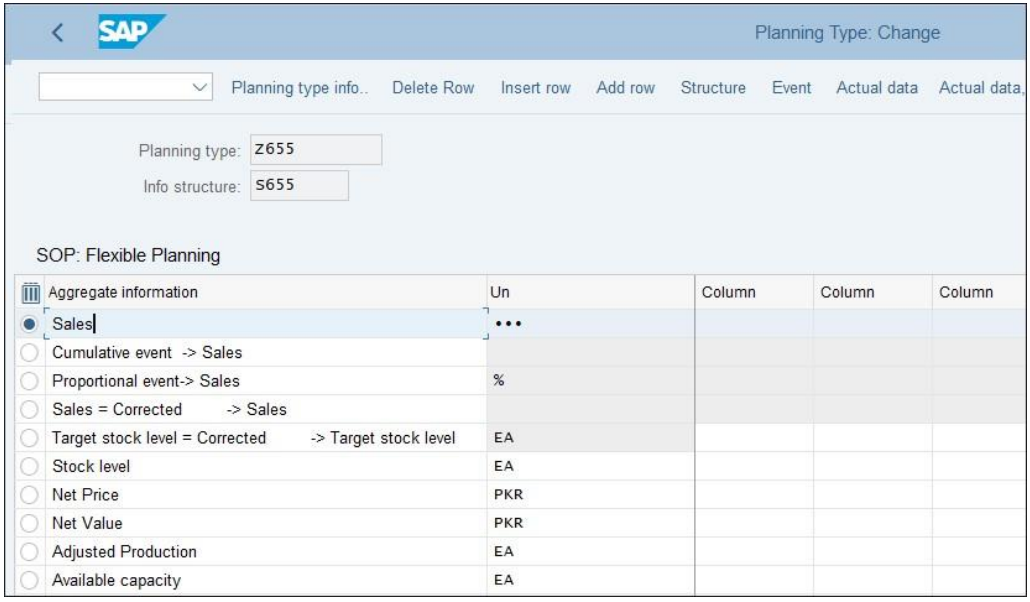
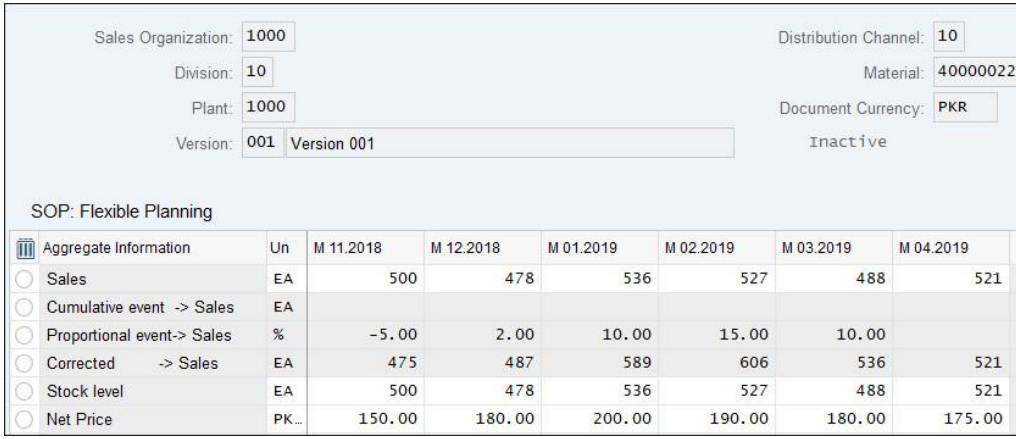


Figure 10.56 Event Working in Flexible Planning

Figure 10.57 shows the change mode screen (Transaction MC94) in which you can manually enter quantities in each month for the **Sales** field. Notice that the **Proportional event -> Sales** field reflects the details of the event (Event Number: S655:SOP Event) (not shown).



Sales Organization: 1000 Distribution Channel: 10
Division: 10 Material: 40000022
Plant: 1000 Document Currency: PKR
Version: 001 Version 001 Inactive

SOP: Flexible Planning

Aggregate Information	Un	M 11.2018	M 12.2018	M 01.2019	M 02.2019	M 03.2019	M 04.2019
Sales	EA	500	478	536	527	488	521
Cumulative event -> Sales	EA						
Proportional event-> Sales	%	-5.00	2.00	10.00	15.00	10.00	
Corrected -> Sales	EA	475	487	589	606	536	521
Stock level	EA	500	478	536	527	488	521
Net Price	PK...	150.00	180.00	200.00	190.00	180.00	175.00

Figure 10.57 Event in Flexible Planning

Note

It's very important to note that the impact of an event won't be visible in the planning table unless you make changes to quantities in the **Sales** field and save the planning table. Then, the next time you enter the planning table, you should be able to see the planning table values populated in the event-based key figures, which for this example is the **Corrected -> Sales** field that takes the percentage change (proportional) from the row **Proportional Event -> Sales**.

10.7 Mass Processing in Sales and Operations Planning

As a planner attending to a large and diverse range of materials and products, it becomes imperative to maintain several of them during the planning phase. In many planning steps, it's crucial that the planner performs the requisite functions online and interactively; however, planners can automate a few planning steps in the mass processing functionality of S&OP. Some of the mass processing steps that you can perform are listed here:

Forecasting

Determining the opening stock level

Running a macro

Transferring planning data to demand management

Copying key figure information from one info structure to another

Transferring S&OP key figure data to CO-PA

Because these steps eventually become routine work for a planner, it certainly makes sense to use the mass processing function.

In mass processing, you must define activities that describe the individual steps that are involved and carried out, as well as their assignment to mass processing jobs. Before you create a mass processing job in S&OP, you need to create a planning activity.

10.7.1 Planning Activity

A *planning activity* defines the function that you'll execute through a given mass processing batch job. The planning activity consists of function profiles, which define the functions in detail. You need to create each of the function profiles separately before the creation of the planning activity in SAP.

To create a planning activity, use the configuration menu path, **SAP IMG ProductionSales & Operations Planning (SOP)FunctionsMass ProcessingDefine Activities**, or use Transaction MC8T**.**

Enter the name of the planning activity in the **Key f.plng.activity** field (for this example, "SOP"), the **Planning type** ("Z655"), the planning activity type, and the corresponding activity profile, which require execution through this planning activity. For a given function that requires mass processing execution, you need to choose the relevant activity type. After you select the relevant **Activity**, the corresponding activity profiles, such as **Macro**, **Transfer profile**, or **Copy profile**, also become available for you to select from.

10.7.2 Setting Up a Mass Processing Job

To set up the mass processing job, you need to perform the following steps in the given sequence:

1. Assign a name to the mass processing job.
2. Assign the info structure and version.
3. Assign the planning type.
4. Assign a name to the variant.
5. Select the selection screens.

6. Define the characteristic values, activity, and aggregation level.
7. Save the variant.

To create the mass processing job, follow the SAP menu path, **LogisticsLogistics ControllingFlexible PlanningPlanningMass ProcessingCreate**, or use Transaction MC8D. (You can use Transaction MC8E to change it and Transaction MC8F to delete it.) The following steps are involved:

1. Create a planning job. For this example, enter the **Job number** as "SOP_SAP" and a short description of the **Job name** as "SOP_SAP_Flex_Plan".
2. Choose **Execute**, and maintain the **Info structure** "S655" and **Version** "001", on which to apply the mass processing job.
3. Choose **Execute**, and maintain the **Plng.type** "Z655", which is the specific planning type within the info structure on which the system will perform the mass processing function.
4. Select a planning type, and then maintain the **Variant Name** for the selection screen details.
5. Enter the variant name in the **Create variant** field, which in this example is "SOP_ Flex_Plan", and choose **Create** to create the variant and enter the selection screen details.
6. Select the **Created** checkbox, and choose **Continue** to proceed with maintaining the selection screen details.

After you're finished creating the planning job, perform the following functions:

1. Select the characteristics levels on which the system will run the mass processingjob, the **Aggregation Level** and the **Planning activity**. You configured the planning activity in Section 10.7.1. The planning activity consists of functions that the system performs through mass processing. It contains the profiles for the respective functions that are configured.
2. Click on the **Attributes** button to go to the **Variant Attributes** popup.
3. You can select whether you want to run the mass processing in the backgroundonly by selecting the relevant checkbox. Save the variant attributes.

10.7.3 Scheduling the Mass Processing Job

You can schedule the mass processing job using Transaction MC8G. You need to specify the variant name and use the standard batch scheduling function.

You can also monitor the mass processing jobs using Transaction SM37. You can use Transaction MC8I to obtain an overview of a specific job. To delete the mass processing job, you can use Transaction MC8F.

10.8 Standard Analysis in Flexible Planning

Now that you've learned all options and features available in flexible planning, we'll cover a lesser-known functionality of standard analysis in flexible planning. In Chapter 19, we'll show how you can take advantage of the large number of standard analysis reports available using predefined and preconfigured info structures in all the logistics areas of the SAP system. However, this section covers a user-defined info structure (not a predefined info structure) that you can still use in standard analysis. Userdefined standard analysis helps when you want to evaluate all the desired key figures in one report (analysis report) by using one info structure. This eliminates the need to refer to two or more predefined info structures to obtain the desired information.

The following summarizes the steps involved in creating a standard analysis in flexible planning:

1. Maintain a self-defined info structure (Transaction MC21).
2. Set parameters for the info structure and key figures (Transaction MC7F).
3. Create update rules for the info structure (Transaction MC24). Maintain an updaterule for each key figure, and then click on **Activate updating**. You may use the **Check** icon to simulate update rules. Finally, click on the **Generate** icon to generate the update rules for the info structure.

In flexible planning, you update the rules for key figures within the info structure so that when you run the standard analysis report, the system brings up the relevant information.

The step to define the update rule is ensured right after creating and activating the info structure. Using Transaction MC24, you can create the update rules for the characteristics and key figures of the info structure.

Update rules enable the system to do the following:

Know which characteristics and key figures the system must update when the user performs the business transactions.

Know the SAP tables from where the system needs to fetch the data for given key figures and characteristics. It also includes the information for the dates, which the system should use for records, or data that are populated in the structures.

The *update group* is equally important because it defines the business areas and the tables that you'll use for updating the info structure. You can maintain multiple update rules for a given key figure by copying an existing rule.

The SAP system offers functional areas such as MM, SD, PP, QM, project systems (PS), and PM, among others.

[!]

Warning

You should only include the key figures for which you're updating the info structure from SAP system tables of the application area to ensure that the system isn't overburdened.

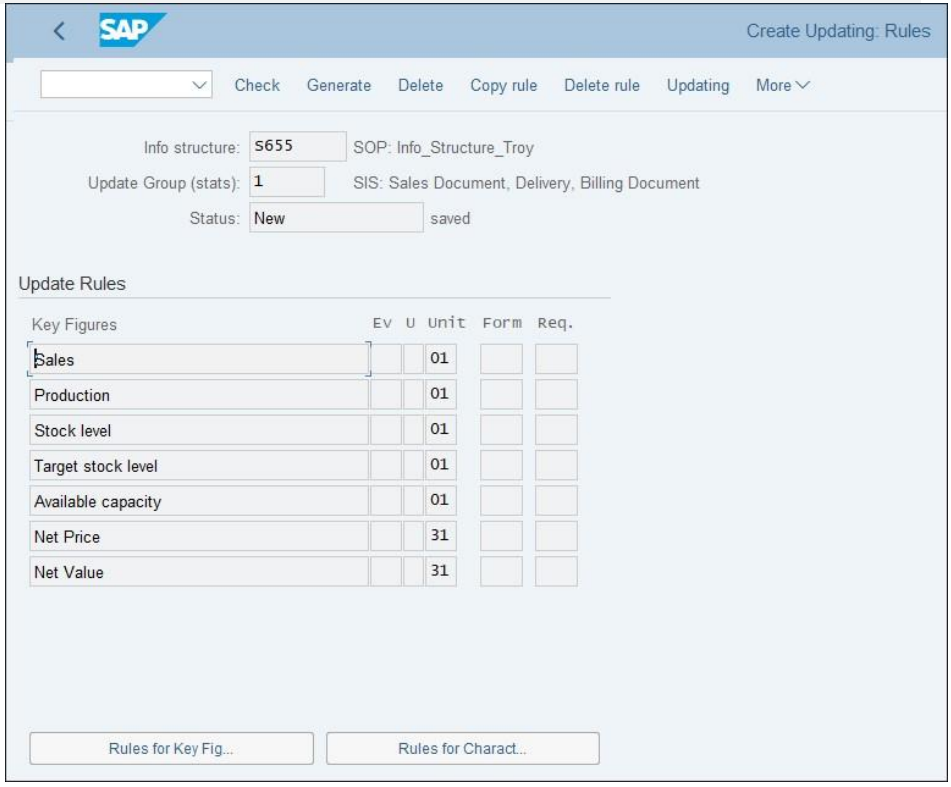


Figure 10.58 Updating the Self-Defined Info Structure

Note

To update groups in configuration, follow menu path, **SAP IMG Logistics Information System (LIS)Logistics Data WarehouseUpdatingUpdating DefinitionSpecific Definition Using Update RulesMaintain Update Rules** (see Figure 10.58).

Before the activation is done, you should also check the consistency of the set update rules by choosing the **Generate** button to check for any errors or warning messages and eliminate them. An info structure with errors won't be generated, and no data will be populated in the info structure.

After attending to the update rules, you need to configure the parameters to update data in the info structure. The period split must match with the period for planning, that is, **Set planning parameters for the info structure** (Section 10.2.2).

1. Perform the business transactions, such as creation of sales order or productionorder.
2. You can create the necessary transaction data in the SAP system to test the updateof the info structure in the SAP tables. For example, create a sales order with order quantity and order value (if these two key figures are used in the self-defined info structure), and see if the data is automatically updated in the info structure (table) by using Transactions SE16N or SE11 and giving the details of the self-defined info structure.
3. Run standard analysis for the self-defined info structure (Transaction MC9C). Onthe initial screen, enter the self-defined info structure, and enter **Version** "000" (actual data). Press (Enter), and on the next screen, your defined characteristics will be available to choose from.

Tips & Tricks

You can check the update log by using Transaction MC30. Enter the user ID, and choose **Execute**. Keep the cursor on the info structure number, and choose the **Details** button to check the data updated in detail. Choose the **Analysis** button to check the programs used in updating the info structure.

Note

All of the master data and transactions for flexible planning are listed in one place, under the following SAP menu: **LogisticsLogistics ControllingFlexible Planning**.

10.9 Summary

S&OP offers significant optimization to the business processes by helping the planner use standard S&OP or flexible planning. For standard S&OP, the product group is used to define the percentage or the proportional factor of each material within the group or hierarchy, whereas in flexible planning, the planning hierarchies are used.

You can make extensive use of standard or self-defined macros and also create large numbers of planning versions. The final operations plan gets transferred to demand management as PIRs. The forecasting tool is also available in standard S&OP and in flexible planning to facilitate proposing realistic planning figures. Events help you take any specific spike or dip in planning figures into account. The rough-cut planning profile provides better visibility on capacities and materials commitments. You can perform a large amount of routine planning work by using the mass processing functionality. You can also use flexible planning to perform standard analyses for the self-defined info structure.

The next chapter covers demand management.

Chapter 11

Demand Management

It's important to establish a balance between anticipating the demand for the products and ensuring that the right production, procurement, and distribution processes are in place to fulfill them for eventual consumption. It's also all about taking advantage of several available planning tools to come up with realistic planning figures in demand management.

Demand planners in companies are always striving to maintain a balance between the anticipated demands of a product from customers and ensuring its timely availability. Demand management today is much more than using the forecasting tool to predict what to produce and when. In fact, it has evolved into taking a much closer and critical look at each step of the entire sales, production, procurement, and distribution element for ensuring an optimal balance. This balance is necessary so that the optimum inventory of raw material is maintained in the company's warehouses, and the machines' capacities aren't booked on those products that won't sell well or suddenly have several unexpected and unanticipated customer-specific orders, resulting in undue long lead time and delayed deliveries.

The overall goal of production planning (PP) in general and demand management in particular is to better serve customers by reducing the following:

Replenishment lead times

Storage costs

To achieve these goals, one of the effective materials planning approaches is to group materials according to their individual demand patterns. Depending on the business and reporting needs, as few groups as possible for better transparency on the shop floor and as many as necessary for flexibility should be created. To make this materials grouping logical and easier to understand, we've structured similar strategy groups in such a way that you'll find all make-to-stock (MTS) or make-to-order (MTO) groupings in relevant sections of this chapter.

We begin this chapter by discussing important elements of demand that will form the foundation of PP in SAP S/4HANA. Next, we'll cover various planning strategies— from MTS to MTO to assemble-to-order (ATO)—so you can make informed decisions on which strategy to use either for an individual material or for a group of materials. Although standard strategies available in the SAP system are sufficient for most business needs, we'll also cover how to create a customized requirement class for a strategy to meet any specific or unique business needs. Finally and after all these demand management concepts and foundations are in place, we'll show some examples of demand management working in the SAP S/4HANA system.

Let's begin with discussing the core elements of demand management that you'll be using throughout this chapter and then in the rest of book.

11.1 Elements of Demand Management

The main elements based on which demand management works can be broadly categorized into the following four areas:

Consumption modes and logic

Determining the requirement type

Availability check

Total replenishment lead time (TRLT)

11.1.1 Consumption Modes and Logic

A consumption mode determines whether consumption of planned production quantities is to be carried out as backward or forward consumption, or whether both consumption types are allowed. In backward consumption, the system looks for the planned independent requirement (PIR) quantity that exists directly before the sales order. In forward consumption, the system looks for the PIR quantity that exists directly after the sales order. You also need to maintain the consumption period in the **MRP 3** view of the material master or in the configuration for demand management. The consumption period (forward or backward) is specified in workdays and is valid from the current date. Sales orders, material reservations, and dependent requirements then consume the PIR quantities that lie within the consumption period and after (for forward consumption) or before (for backward consumption) the requirements date.

In the consumption process, the system compares PIR quantities and dates of materials with actual customer requirements or demand, such as sales orders. The consumption process is defined for every planning strategy by combining a requirements type from demand management and a requirements type from sales order management. This step means that the requirements type entered when maintaining PIRs is compared to the customer requirements type specified in configuration.

The following prerequisites must be met for consumption mode: You must maintain the **Consumption mode** in the material master record (**MRP 3** view, as shown in Figure 11.1). The **Consumption mode** field offers the following four options (available as dropdown options when you place the cursor on the field and press (F4)):

1–Backward consumption only

2–Backward/forward consumption

3–Forward consumption only

4–Forward/backward consumption

The customer requirement consumes the PIR quantity that either directly precedes or follows it. If the PIR quantity directly preceding the customer requirements doesn't cover the customer's requirement, then the system looks for the next closest PIRs in the future or past. During this process, the system refers to the consumption periods maintained in the material master or in configuration for demand management. The consumption periods determine the intervals (for backward or forward consumption) within which customer requirements consume PIRs. Customer requirements that lie outside the consumption period aren't consumed. If no consumption periods have been maintained, you can only consume requirements that are planned on the same day. The allocation of customer requirements to PIRs is carried out dynamically. This step means that if sales orders or planning are rescheduled, the allocation is deleted and redefined.

[+]

Tips & Tricks

Although this isn't always applicable, we suggest that the number of days that you enter for each period must realistically account for consumption to avoid overproduction to meet the customers' requirements. On the other hand, overproduction is sometimes encouraged to ensure maximum use of resources. The consumption intervals rather relate to the time granularity of PIRs.

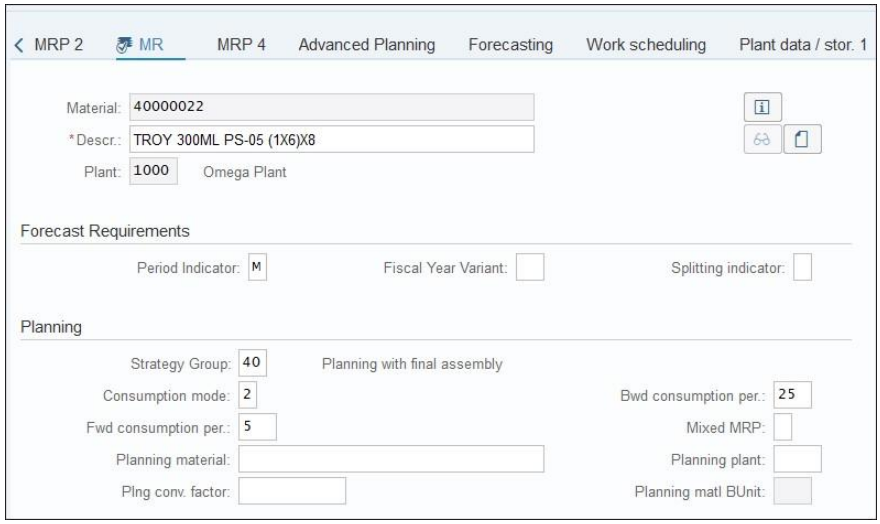


Figure 11.1 Consumption Mode in the MRP 3 View of the Material Master

11.1.2 Determining the Requirements Type

A requirements type contains the control parameters to plan and consume PIRs and customer requirements. Different requirements types or combinations of requirements types from PIRs and customer requirements are defined for each planning strategy (see Figure 11.2).

Note

You don't have to define any new strategies because SAP's standard delivery provides all strategies to meet most business needs. There may only be a few cases that require defining customized planning strategies and is covered in Section 11.7.

If you want the system to automatically determine the requirements type when creating the PIRs, enter strategy groups for the corresponding materials in the material master record. If the strategy group allows a number of planning strategies, the system proposes the requirements type from the main strategy.

If you refer to Figure 11.1, you'll notice that **Strategy Group 40** is assigned to the material. Figure 11.2 shows that for **Strategy 40**, the associated **Reqmts type for indep.reqmts** is

"VSF" (**Planning with final assembly**). The associated **Reqmt type of customer reqmt** is "KSV" (**Sales order with consumption**).

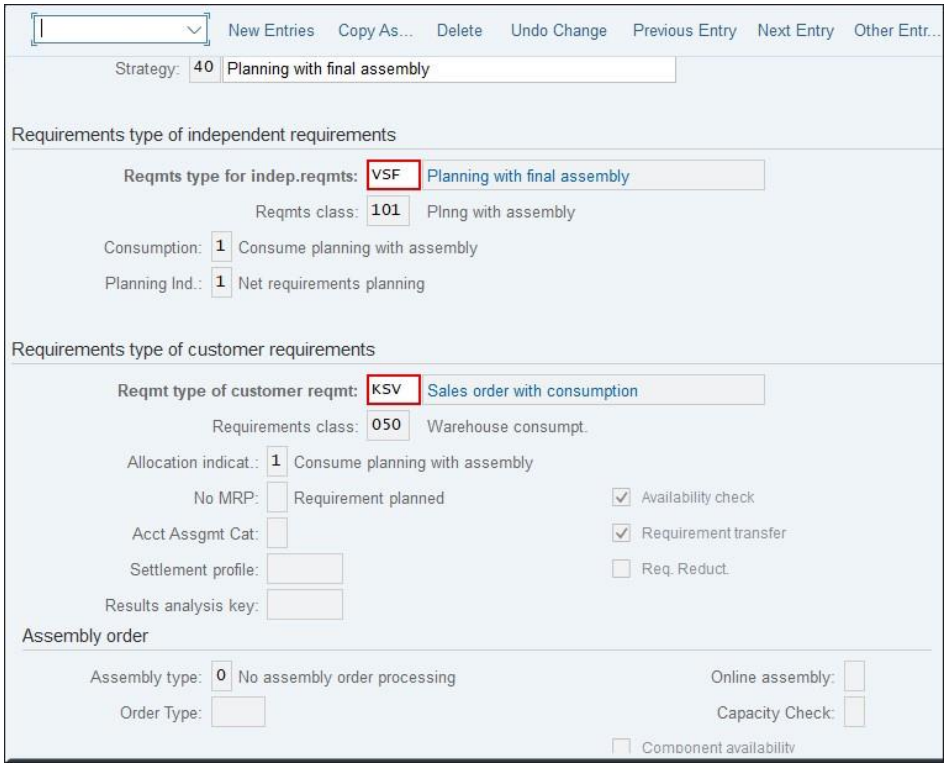


Figure 11.2 Configuration Settings of Strategy 40

The planning strategies represent the business procedures to plan and produce a material. In the system, the planning strategies are recorded in configuration by a combination of requirements types from demand management and sales order management (refer to Figure 11.2). This combination determines either the consumption of PIRs by customer requirements or how the availability check is to be carried out.

By assigning a planning strategy to a particular material, the system determines the correct requirements type (and all the control parameters of the requirements class) when creating PIRs or sales orders. The following assignments have to exist to assign the requirements classes to PIRs and sales orders:

Planning strategy to a strategy group (from demand management) so that a material can be planned with various planning strategies

One main strategy and up to six alternative strategies

Strategy group to the material (in the material master record) so that the system can automatically determine the correct requirements type

Planning strategy to the material requirements planning (MRP) group (assigned in the configuration for demand management) in which the MRP group is assigned to the material in the material master record

You can see how various elements of requirement classes and planning strategy link up with each other in Figure 11.3. In Section 11.7, we'll cover the step-by-step approach to configuring the elements shown in Figure 11.3.

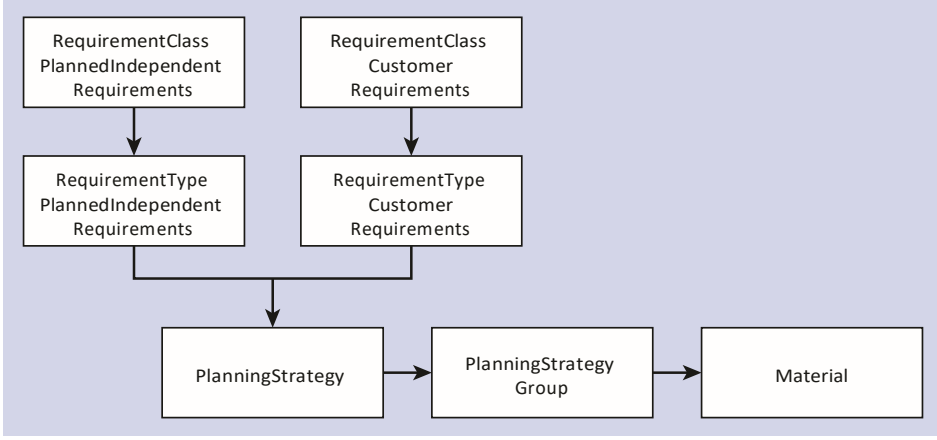


Figure 11.3 Relationships among Requirements Type, Requirements Class, and Planning Strategy

Table 11.1 shows how requirements types for independent requirements link up with requirement types for customer requirements. You may also quickly refer to Figure 11.2 and the associated strategy 40 and notice that the same details of strategy 40 are covered in Table 11.1.

Strategy	Requirements Type for Independent Requirements	Requirements Type for Customer Requirements

10	LSF	MTS production	KSL	Sale from stock without independent requirement reduction
11	BSF	Gross PIRs	KSL	Sale from stock without independent requirement reduction

Table 11.1 Planning Strategy Assignments

Strategy	Requirements Type for Independent Requirements		Requirements Type for Customer Requirements	
20			KE	Individual sales order without consumption
25			KEK	MTO with configurable material
26			KEL	MTO for material variants
30	LSF	MTS production	KL	Sales order manufactured by lot size
40	VSF	Planning with final assembly	KSV	Sales order with consumption
50	VSE	Planning without final assembly	KEV	MTO with consumption
52	VSE	Planning without final assembly	KSVS	Sales order with consumption
54	VSE	Planning without final assembly	KEKT	MTO with consumption
55	VSE	Planning without final assembly	KELV	MTS with consumption without final assembly
56	VSE	Planning without final assembly	KEKS	MTO with consumption of characteristics planning

59	VSEB	Planning; phantom assemblies		
60	VSEV	Planning the planning material	KEVV	Individual customer with planning material consumption
63	VSEV	Planning the planning material	KSVV	MTS with consumption of planning material
65	VSEV	Planning the planning material	ELVV	MTO variant with planning material
70	VSFB	Planning for assemblies		

Table 11.1 Planning Strategy Assignments (Cont.)

Strategy	Requirements Type for Independent Requirements		Requirements Type for Customer Requirements	
81			KMSE	Assembly planned order
82			KMFA	Assembly with production order
89	VSE	Planning for assemblies	KMSE	Assembly planned order

Table 11.1 Planning Strategy Assignments (Cont.)

11.1.3 Availability Check and Total Replenishment Lead Time

A crucial element of an effective production planning is the way a material's availability is checked in the sales order and how the demand is transferred from the delivery proposal to the production schedule. To set up this process, you have to maintain an availability check and a total replenishment lead time (TRLT) (or not) on the **MRP 3** view of the material master that also has the strategy group and the consumption rules as well. The availability check with its associated rule and scope of check will drive what happens when a sales order is entered using Transaction VA01. On sales order creation, an availability check is

triggered, and if the customer's requested delivery date can't be met, a view with a delivery proposal pops up. The delivery proposal attempts to address the following three questions:

Is a one-time delivery in full on the customer-requested delivery date possible?

When is the complete delivery of all requested items possible?

When can partial deliveries be made?

The availability check in a sales order shows two dates separated by a forward slash (/). The first date indicates the ship date, and the second is the material availability date that is relevant for MRP and will show in Transaction MD04 if some other conditions are met and the dates and quantities are fixed. Depending on what proposal is selected and agreed with the customer, the checkbox next to the delivery proposal can be selected to confirm the dates. Those dates will then be relevant for production and materials planning, and everything in planning works toward meeting these dates. How these dates were determined depends on the scope of the check.

A combination of **Availability check** (from the **MRP 3** view of the material master) and the **Checking rule** (according to the option chosen to carry out the availability check)

determine the delivery date to the customer. You can define the objects, parameters, and elements that the system considers (or doesn't consider) in the procedure to check for availability.

One of the most relevant settings in the scope of check is the decision regarding whether you check with or without TRLT. The TRLT is a measure primarily used in MTO because it's the time it takes to replenish the product in question if there is nothing readily available in stock. If the system checks *with* TRLT (the field scope of check is unchecked), the availability check only looks out to the end of the lead time. If it doesn't find enough quantity to fulfill the demand in that period, it confirms *any* quantity just after the TRLT. Subsequently, the next MRP run will generate an additional order proposal to fulfill the demand.

In the following sections, we'll begin by discussing various planning strategies for MTS, followed by MTO. We'll also cover strategies relevant to ATO, planning components, and, finally, planning strategies relevant to variant configuration.

11.2 Strategies for Make-to-Stock Production

The planning strategies explained in this section are designed for planning procurement (production or purchasing) of components by planning the final products. Choose a MTS strategy if the following is true:

The materials aren't segregated; that is, they aren't assigned to specific sales orders. Costs need to be tracked at the material level and not at the sales order level. If the stock is produced independently of sales orders, always use MTS production because it's then possible to immediately provide goods to the customers from that stock. You may even want to produce goods without having sales orders, if you expect that there might be customer demand in future. This means that MTS strategies can support a close customer-supplier relationship because the objective is to quickly provide your customers with goods from your stock. Returns that have passed quality inspection and other unexpected goods receipts (GRs) can be used for other sales orders.

Avoid maintaining unreasonably high stock levels by doing the following: Create a production plan in advance (in demand management) to plan your stock. If you use this option, you may also want to decide whether sales orders exceeding your production plan are to affect the actual production or not.

Receive sales orders as early as possible (e.g., using scheduling agreements).

MTS strategies generally consist of up to five stages. Table 11.2 illustrates which stages are involved in which strategies, where 1 denotes allocations and 2 denotes reduction of PIRs.

	Planning Strategies					
Stages in order	40	30	10	11	52	63
Demand management (creation of PIRs)	Yes	No	Yes	Yes	Yes	Yes
Procurement before sales	Yes	No	Yes	Yes 2	Yes	Yes
Sales order	Yes 1	Yes	Yes	Yes	Yes 1	Yes 1
Procurement after sales	No	Yes	No	No	Yes	Yes
Goods issue (GI) for delivery and reduction of PIRs	Yes	Yes	Yes	Yes 2	Yes	Yes

Table 11.2 Five Stages of MTS Strategies

Let's now discuss the MTS planning strategies in detail.

11.2.1 Strategy 40: Planning with Final Assembly

This strategy is probably the most widely used MTS strategy. If you can forecast production quantities for the final product, it makes sense to use this planning strategy. PIRs are consumed by incoming sales orders so that the master plan is always adjusted to suit the current requirements situation. Therefore, the important feature of this planning strategy is that you can react quickly to a customer's requirements. The smoothing of the master plan is less important here. Moreover, strategy 40 has the following qualities:

PIRs are entered at the finished product level and trigger the procurement and production of the necessary assemblies and components before receipt of the sales orders.

It's possible to use information from the sales forecast, from the sales information system, or other planning tools to plan production quantities.

As soon as the sales order is received, it consumes the PIRs. This step means that you can compare the PIRs situation with the actual customer requirements situation.

An accurate availability check is performed according to available-to-promise (ATP) logic during sales order processing.

The system checks whether sufficient PIRs have been planned to cover the sales order.

Requirements from the sales orders are passed onto production and can lead to changes being made to procurement if the requirements from the sales orders exceed the PIR quantities.

If there is insufficient coverage of components—that is, the sales order quantities exceed the PIR quantities—the sales orders can't be confirmed. The system therefore automatically adjusts the master plan.

PIR quantities that are left unconsumed increase the warehouse stock of the finished product. However, the system doesn't create additional production orders if sufficient stock exists.

When using this strategy, maintain the following master data for the finished product in the material master:

Strategy group "40" in the **MRP 3** view

Consumption parameters (**Consumption mode**, **Bwd consumption**, **Fwd consumption**) to allow consumption of independent requirements

Default values taken from the MRP group if no consumption parameters are maintained in the material master

Item category group (e.g., "NORM") in the **Sales: Sales Org. Data 1** view

Note

Unlike other planning strategies, planning strategy **Planning with Final Assembly (40)** doesn't require the material master MRP availability check to contain a specific value. This field doesn't impact the strategy 40 planning process. You can also use the sales and distribution (SD) checking rule with (or without) replenishment lead times and can be seen in the sales order under **Edit Item availability Goto Scope of check**.

The MTS strategy 40 starts with the entry of the forecast 1 in Figure 11.4. This can be done manually via Transaction MD61, through upload from a spreadsheet, or via transfer out of

sales and operations planning (S&OP) in the SAP system by use of info structures, product groups, or a flexible planning hierarchy. You can also employ the long-term planning (LTP) (see Chapter 14) component in the system to simulate various versions and set the **Active** checkbox for a specific version into demand management, which is basically the PIR. The MRP run then generates supply proposals 2 that can be sequenced, leveled, and scheduled within available capacity 3, and then collectively checked for missing parts.

The resulting production schedule will fill up the inventory before the sales orders drop in. Any customer request for product can now be directly fulfilled from freely available, neutral inventory 4, and, as the orders come in, they find the remaining quantities of the forecast (looking backwards, forwards, or both according to the rules set in **MRP 3**) and consume it with the respective quantities of the orders 5. This allows for comparing and monitoring of forecasted quantities with the actual order quantities.

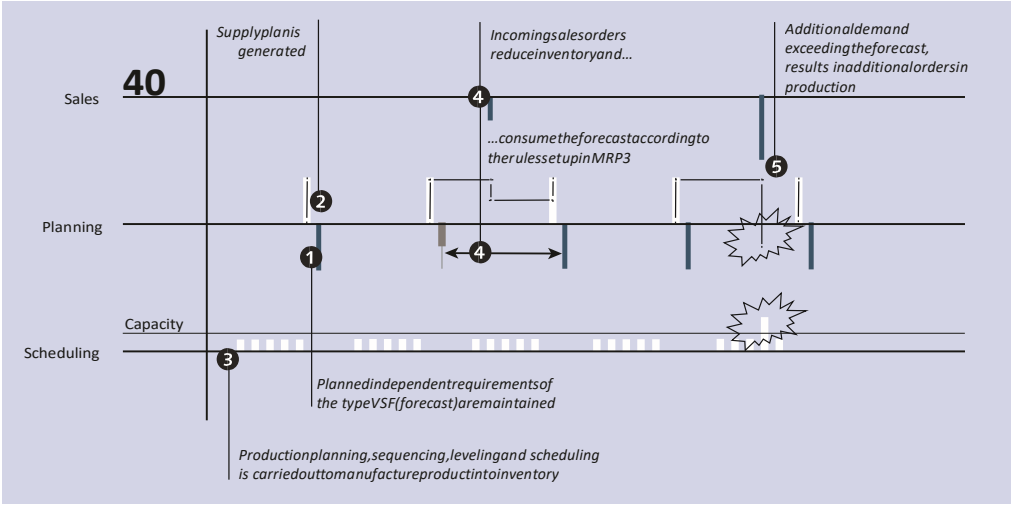


Figure11.4 Strategy40:MTS

11.2.2 Strategy 30: Production by Lot Size

In strategy 30, procurement is based only on sales orders, and no planning for the finished product is involved. Depending on the dates, several sales orders can be grouped together for production in one single lot. Moreover, strategy 30 has the following qualities:

It's not possible to use information from other SAP planning tools, such as forecasting, sales information systems, or S&OP (except when combined with schedule line agreements).

An accurate availability check is performed according to ATP logic during sales order processing.

Lot size optimization and rounding mechanisms are possible. Depending on the dates, several sales orders can be grouped and collectively produced in a single lot. The lot size in this procedure can depend on various aspects of production, such as pallet size or production optimization.

Leftover stock from previous procurements can be used. Using leftover stock for other sales orders is particularly useful for companies that mainly produce goods for major customers but also want the option to sell smaller requirements from stock.

PIRs aren't consumed by sales and stock orders. However, the delivery "consumes" the schedule lines or sales order items because it updates goods as delivered. If an issue is made for a particular sales order, the system reduces the sales order quantity.

Stock orders are reduced when the goods are sold from stock.

Note

You need to maintain the ATP indicator (**Availability check** field in the material master) so that you can check with replenishment lead times. In the standard system, checking rule **01** or **A** checks with replenishment lead times are available.

To define how the availability of components in production orders is checked follow the configuration menu path, **SAP IMG Sales and Distribution Basic Functions Availability Check and Transfer of Requirements Availability Check Availability Check with ATP Logic or Against Planning Carry Out Control for Availability Check**.

The checking rule in the sales order is always **A** in MTS strategies. In the standard system, checking group **01** is set up so that daily requirements are passed on to production. This means that there is only one line visible in the stock/requirements list that contains the cumulated quantity for one day, rather than the individual sales orders. Hence, the sales order number doesn't display on the **Order** line in the stock requirements list.

As shown in Figure 11.5, nothing happens unless a sales order is entered 1, and the availability check determines a feasible delivery date for confirmation. The MRP run will then create an order proposal with a larger lot size (rounding or minimum) 2, and the lot size is produced into inventory. The sales order will then take the requested quantity from

inventory 3, and the rest remains in inventory for future orders to consume 4 until the inventory runs out. As soon as a new sales order demands more product than what remains in inventory, the cycle will repeat itself.

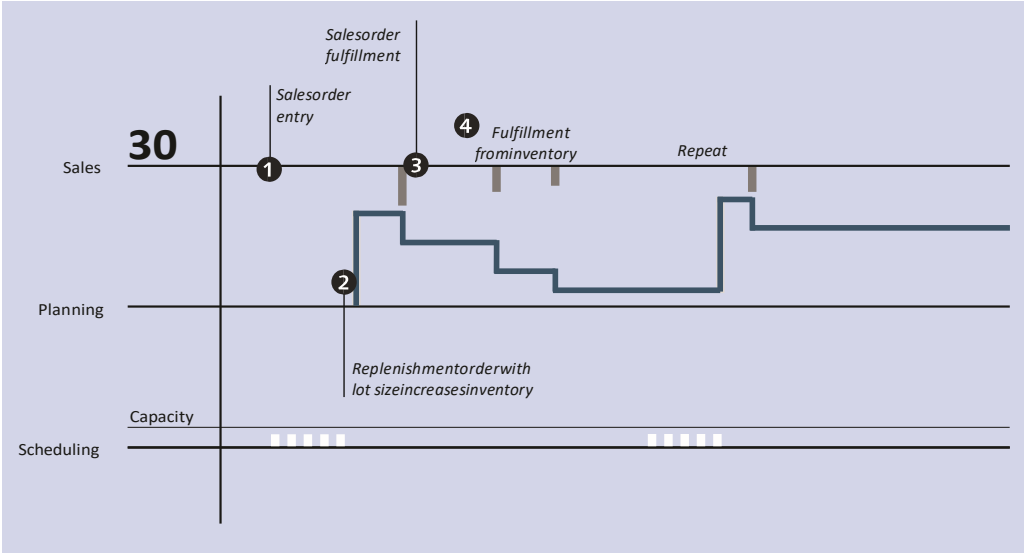


Figure11.5 Strategy30

Tips and Tricks

While using this strategy type, there's no need for a PIR. However, we suggest not removing the PIR from the configuration settings because it may be used if necessary.

The following master data prerequisites need to be maintained for the finished product:

Maintain **Strategy group** "30" in the **MRP 3** view of the material master.

Use the **Availability check** field (in the **MRP** view and the **Sales: General/Plant** view) so that you perform an availability check with replenishment lead times ("01" in the standard system).

Set the item category group (e.g., "NORM") in the **Sales: Sales Org. 2** view of the material master.

Because procurement is based only on sales orders, no planning for the finished product is involved here, which means knowing the sales order situation in advance. Therefore, with regard to the production time and replenishment lead times of the components, this strategy is sometimes combined with scheduling agreements.

You can also procure the necessary components with the following:

- Individual planning of the components, for example, using strategy 70 (Section 11.5.1)
- Consumption-based components
- Kanban components

Note

For setting up Kanban in the SAP system, refer to the E-Bite titled *Configuring Kanban in SAP ERP MM and PP* (SAP PRESS, 2015), which is available at *www.sap-press.com/4013*.

11.2.3 Strategy 10: Net Requirements Planning

Strategy 10 is particularly useful in mass production environments. It's often combined with repetitive manufacturing (REM). Choose this strategy if you want production to be determined by a production plan (demand management), and if you don't want sales orders to directly influence production. One of the most important features of this planning strategy is that it enables you to smooth the demand program.

This planning strategy is used in the customer packaged goods industry because it's possible to plan the demand for ice cream, for example, while a single order should not affect production. This strategy is also used for products with seasonal demand where production needs to be smoothed. Moreover, strategy 10 has the following qualities:

Procurement is only determined by PIRs, which leads to smoothing of production that is unaffected by irregular sales orders.

An accurate availability check is performed using ATP logic during sales order processing. Sales orders can be displayed for information purposes only. They don't affect production quantities. Goods are sold from stock.

The PIRs are reduced at GI for the delivery. You can compare the PIRs situation with the actual customer requirements.

PIRs left unreduced increase the warehouse stock of the finished product and cause procurement to be decreased or, due to netting, to not take place at all in the next period.

If you want the system to reduce future PIRs when it makes withdrawals for unplanned sales orders, maintain the appropriate consumption period.

Tips & Tricks

You need to work with an availability check that checks without TRLT (e.g., "02" in the standard system). For this strategy, it usually makes sense to create a new checking rule that combines **Check without TRLT** with the passing on of daily requirements.

First the forecast is generated as shown in Figure 11.61. This can happen through manual input into Transaction MD61, an upload from an Excel or Access datasheet, or using SAP's forecasting component in the logistics information system (LIS) with a subsequent transfer of demand. After the forecast has been generated, it becomes relevant to MRP. The MRP run will generate order proposals to meet the forecast at the respective periods 2. The order proposals are now turned into supply elements, and inventory is built up accordingly. Incoming sales orders have absolutely no impact on that supply (or production) program and are fulfilled from available inventory 3. This is where strategy 10 differs from other MTS strategies: it protects the production schedule and allows for the smooth flow of the replenishment process. To make sure the process works in its entirety, you'll have to ensure that the sales availability checking rule doesn't use the TRLT. After a GI is posted (to a sales order or not), the PIR is reduced (unallocated) 4.

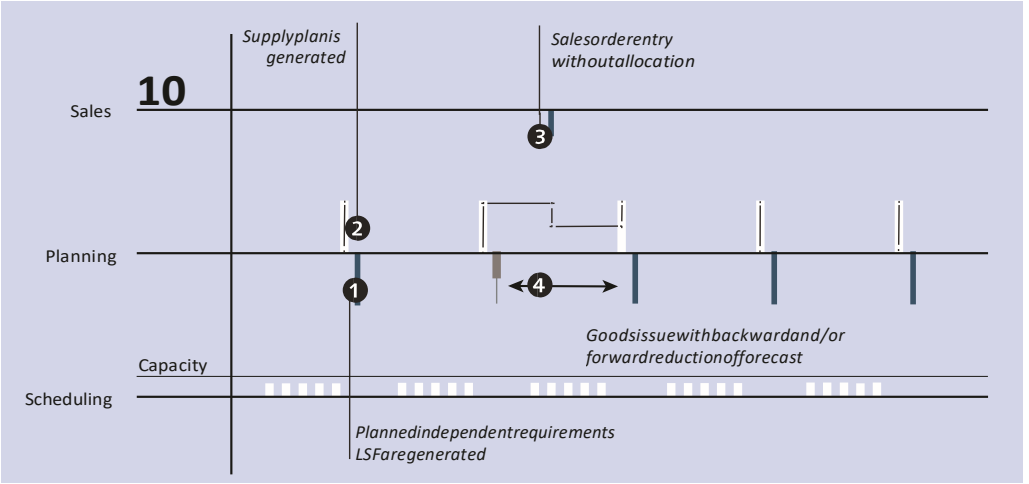


Figure11.6 Strategy10

While using this strategy type, maintain the following master data prerequisites for the finished product:

Strategy group "10" in the **MRP 3** view

Item category group (e.g., "NORM") on the **Sales: Sales Org. 2** view

Availability check field in configuration so that you perform an availability check without replenishment lead times (in the standard system, enter "02")

11.2.4 Strategy 11: Gross Requirements Planning

The MTS strategy *gross requirements planning* is particularly useful in mass production environments and is often combined with REM. This strategy is particularly useful if you need to produce, regardless of whether you have stock. This strategy is often found useful for steel, fertilizer, or cement manufacturing because they can't shut down production. A blast furnace or a cement factory must continue to produce, even if this means producing stock. For example, if your planned demand is 100 pieces, and you have 50 pieces in inventory, the MRP run will generate an order proposal for 100 pieces, ignoring the 50 that are already available.

This planning strategy is to some extent similar to net requirements planning (10). However, the following differences exist:

There is no netting of stock with demand; only the planned quantities are produced. Production is only determined by PIRs, which leads to production smoothing. PIRs are reduced during GR for an order (planned order in REM, production order, process order, or purchase order).

Gross requirements planning (11) also has the following features in common with net requirements planning (10):

Production quantities can be planned relatively effectively by means of PIRs. You can use information from the sales information system, flexible planning, or other planning tools to plan production quantities. Therefore, production and procurement of the required components are triggered before the sales order stage.

Individual sales orders, which can be somewhat irregular, don't affect production. An accurate availability check is performed according to ATP logic during sales order processing.

Using lot size or rounding keys, you can perform a *lot size optimization* during planning so that you always plan convenient lot sizes in demand management or during the MRP run (lot sizes are covered in Chapter 12, Section 12.5).

Note

You need to work with an availability check that functions without checking the replenishment lead time. These details are covered in production by lot size (30) and net requirements planning (10).

When using this strategy type, maintain the following master data for the finished product:

Maintain **Strategy group** "11" in the **MRP 3** view.

Set the **Mixed MRP** indicator to "2" in the **MRP 3** view.

Set the item category group (e.g., "NORM") on the **Sales: Sales Org. 2** view.

Maintain the **Availability check** field so that you perform an availability check without the replenishment lead time (checking group "02" in the standard system).

11.2.5 Strategy 52: Planning with Final Assembly and without MTO

This strategy, along with planning with a planning material and without MTO (63), discussed in the next section, allows you to procure components based on PIRs. Production of the finished product, however, is based on actual sales orders, similar to MTO strategies. This planning strategy ensures that you can react quickly to customer requirements, even if the finished product has a long overall lead time. You can avoid the main value-added process until you have a customer. This strategy is very similar to strategy 50, which uses MTO production.

Production quantities can be planned relatively effectively with PIRs for the finished product. It's possible to use information from the sales forecast, the sales information system, or other planning tools to plan production quantities. Only the procurement of the component is triggered before the sales order stage. Final assembly takes place after a sales order has been entered.

Strategy 52 is very similar to MTO strategy 50, except that the actual sales orders aren't segregated in individual segments in Transaction MD04 (Stock/Requirements List) but rather are listed in the **Net Requirements** section. Moreover, strategy 52 has the following qualities:

The PIRs are consumed during the sales order stage. Therefore, you can compare the PIRs situation with the actual customer requirements.

An availability check is performed on the basis of the PIRs.

Demand from sales orders is passed on to production and triggers production after the sales order stage, even if insufficient components are planned. The sales orders, however, can't be confirmed if there is insufficient coverage of components. PIR quantities for the finished products that are left unconsumed increase the warehouse stock and cause procurement to decrease or not take place at all in the next period. This procedure is known as *netting*.

From a costing perspective, this is a MTS strategy, in contrast to strategy 50, which is MTO. This means that stock of the finished material isn't linked to each customer order. As such, this strategy doesn't take stock that exceeds the PIRs (due to customer returns, over production, etc.) into account, when creating a sales order.

Stock for finished goods should be handled through an exception process.

Maintain the following master data for the finished product:

Set **Strategy group** "52" in the **MRP 3** view.

Lot size key "EX" must be set in the **MRP 1** view because lot size optimization would be incompatible with the allocation logic, which could result in over-planning and incorrect results in the ATP check.

Ensure that no rounding profile or rounding values are taken into account.

Maintain consumption parameters (**Consumption mode**, **Bwd consumption**, **Fwd consumption**) so that the independent requirements can be found.

Set the item category group (e.g., "NORM") on the **Sales: Sales Organization 2** view.

Note

In this strategy, there is only an availability check against PIRs. A material is considered available if a PIR can be consumed. Therefore, unplanned stock (returns or unplanned production quantities, e.g., over-deliveries) isn't taken into account. The **Availability Check** indicator (**MRP** and **Sales: General/Plant Data** screens) isn't relevant in this case because an availability check according to ATP logic doesn't take place.

Tips & Tricks

A bill of materials (BOM) is required for the finished product, and there are no major implications for the BOM components. However, for the components, it's important to set the following:

MRP type to **P*** (or **M***) on the **MRP 1** view to plan the components in MRP

Individual/coll. indicator to "2" in the **MRP 4** view as a starting point for your master data setup (see Figure 11.7)

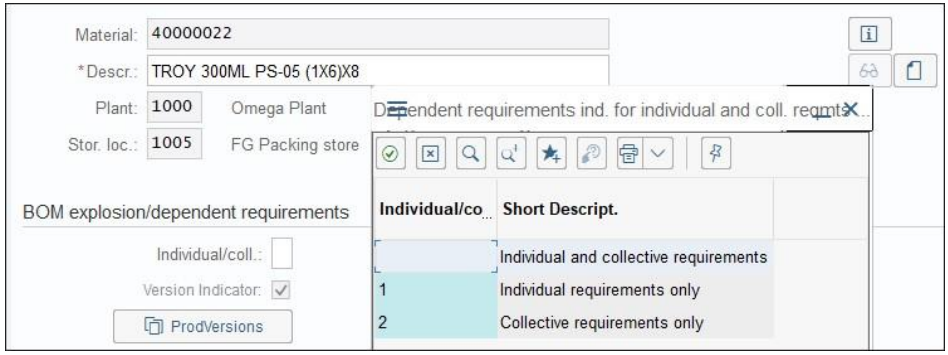


Figure 11.7 Individual or Collective Options in the MRP 4 View

11.2.6 Strategy 63: Planning with a Planning Material and without MTO

This strategy enables planning of different sizes or packages for one product. For instance, you may want to sell a product in packages, such as the following:

Containing 1 liter, 2 liters, and 1 gallon

Labeled in English, German, and Hindi

All variants are set up as different material numbers. In addition, a planning material that consists of only nonvariant components, which means excluding the packaging materials that form the variants is usually set up. All variants are linked to the planning material with the correct conversion factors. The packaging materials (boxes or cartons for the different sizes or different labels) can be planned based on consumption because they aren't too expensive. Moreover, strategy 63 has the following qualities:

The planning material could be sold in the same way as any *variant* product. However, it's generally used as an "artificial" material that only contains the nonvariant parts. The BOMs of the variant products contain additional components that diversify the product. These variant components can't be planned exactly using this strategy.

Handles the variant components in the following way:

– The variant components are consumption-based.

- The variant components are planned independently using a planning strategy for components.
- An over-planning or an under-planning of the variant components is accepted.
- If your products have a high level of variance, you may want to use characteristics planning to automate the planning of components.
- This strategy can also be used as a cross-plant version of strategy 52.
- Procures nonvariable components based on the PIRs of a planning material.
- Production of the finished product, however, is based on actual sales orders. This procedure guarantees that you can quickly react to customer requirements, even if the finished product has a long overall lead time, and avoid the main value-added process until you have a customer.
- Have the same basic features as planning without final assembly and without MTO (52). In addition, more than one material can consume the PIRs of one planning material.
- Lends itself to the planning of variants of one product. (The term variant, here, indicates similar products, not variant configuration.) For example, imagine similar parts sharing a BOM group (which isn't necessary in this strategy) so that you can easily exchange a component in all similar BOMs. You usually have up to several dozen variants, whereas variance would be much higher in variant configuration.

Tips & Tricks

This strategy is often used to manage a simple but effective method of capacity planning. The PIRs for the planning material represent a given capacity situation. All variant materials require a similar capacity, and there is an allocation of given capacity with requested capacity at the order entry stage. Using the total requirements list, you can easily check the capacity situation.

In the following sections, we'll discuss planning strategies associated with MTO production.

11.3 Strategies for Make-to-Order Production

The planning strategies covered in this section are designed to produce a material for an individual sales order. That is, production of finished products only begins on receiving a sales order. Therefore, MTO strategies always support a close customersupplier relationship because sales orders are closely linked to production. MTO can also be used in production using variant configuration and ATO environments. The usage in these areas is due to the close link between the sales order and production that exists in a MTO environment and is required in ATO and variant configuration.

Choose a MTO strategy, if both of the following are true:

The materials are segregated and uniquely assigned to specific sales orders.

Costs need to be tracked at the sales order level and not at the material level.

Note

For the sake of clarifying the master data settings, MTO strategies should always be combined with lot-size key EX (lot-for-lot), and rounding values should not be used. Even if you would maintain other lot-size keys or rounding values, these values don't take effect in MTO strategies.

Several options exist that enable procurement of components for specific sales order items. It's also possible, however, to use a different planning strategy to procure components without having a sales order yet. Using one of these planning strategies allows you to keep your replenishment lead time low via the following:

Plan on the basis of the finished product, such as planning without final assembly (50) or planning with a planning material (60).

Plan at the component level (Section 11.5).

Use consumption-based or Kanban-controlled components.

Know that customer stock can exist on any BOM level.

Note the close link of sales orders to stock results in the customer section of the stock/requirements list.

In the basic MTO strategy, make-to-order production (20), no specific product structures are required. Therefore, it doesn't matter if the material has a BOM or not. The material can be produced in-house or procured externally. No planning is involved in this strategy.

Planning without final assembly (50) and planning with a planning material (60) do require a specific product structure (i.e., a BOM, which means the BOM header material is always produced in-house). These planning strategies assume that you want to plan the procurement (production or purchasing) of your components by planning the finished products. This strategy means you need a fairly stable demand for your finished products. If, however, you can plan more easily at the component level than at the finished product level, Section 11.5.

Let's cover each of the MTO strategies in more detail.

11.3.1 Strategy 20: Make-to-Order Production

As the name suggests, in MTO production, a product is produced specifically for an individual sales order. This planning strategy is used when planning of the (parent) product is neither required nor possible. Demand management isn't involved in this process, nor is there an allocation mechanism. Orders are taken as they come. This strategy represents a production procedure where, in theory, each product is only produced once, although over time the same or similar production processes are repeated. Each product is specifically produced for an individual customer; therefore, the finished product is rarely placed in stock. Out of the three buffers—inventory, capacity, and time—only the latter two are available to the MTO process.

While considering this strategy, the following requirements have to be met for the components:

Procure all necessary components within the TRLT.

Plan at the component level, if required.

Use consumption-based components or Kanban-based components.

Alternatively, receive the sales orders at a very early stage to account for the replenishment lead time of the components.

Moreover, with strategy 20, note the following:

The sales order quantities are planned for production using the sales order number. The quantities produced for the individual sales orders can't be changed. Each quantity is maintained specifically for the individual sales order. A separate segment is created in the MRP list (Transaction MD04) for MTO production. Starting from the sales order, you can apply this type of planning to as many levels of the BOM as needed.

Assemblies and components are also produced or procured specifically for the pegged order, and stock is also managed separately for this sales order.

The production and procurement costs are maintained for each sales order in either a settlement order or in a project at the sales order item level. A detailed analysis of the planned and actual costs is ensured.

A special aspect to consider is the indicator "E" entry in the **Acct Assgt Cat.** field in the **Requirements type of customer requests**, which drives the posting of any value add during the replenishment process to the customer-specific account throughout all levels of the BOMs. Everything isn't only MTO but also accounted for to the sales order.

You can also use this production technique to create ATOs. The assembly order triggers the creation of either a production order or a planned order and provides you with a precise delivery schedule. The delivery schedule is based on availability and the production requirements of the relevant assemblies and components (Section 11.4).

In Figure 11.8, a sales order is entered first 1. If the customer requests the delivery within the TRLT, the availability check in the sales order allows confirmation only for the first date after the lead time counting from today 2. That date, after being fixed in the delivery proposal of the sale order, then drives the MRP availability date, and the MRP run can generate the replenishment or order proposal 3. Only then, the production scheduler can find time on the schedule to fit production in 4.

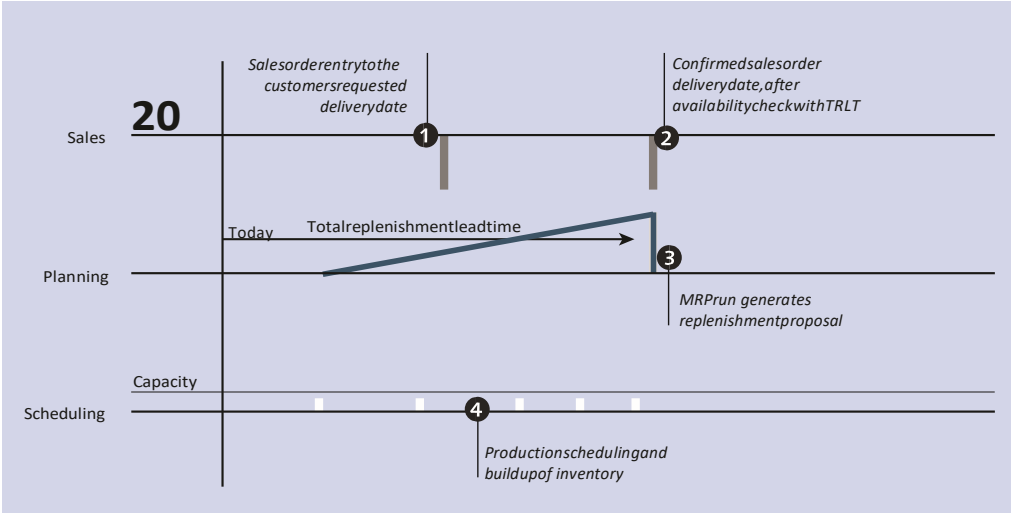


Figure11.8 Strategy20

While using strategy 20, maintain the following master data settings for the finished product:

Strategy group "20" in the **MRP 3** view

Item category group (e.g., "NORM") in the **Sales: Sales Org. 2** view

11.3.2 Strategy 60: Planning with a Planning Material

This planning strategy is particularly useful for planning BOMs that contain variable and nonvariable parts. The important feature of this strategy is the flexibility to procure nonvariable components based on planning in demand management. Production of the finished product is based on actual sales orders. This procedure ensures that a materials planner is able to quickly react to customer requirements even if the finished product has a long overall lead time. The main value-added process can begin upon having a sales order from a customer.

This strategy lends itself to planning the variants of one product. The term "variant" is used here to indicate similar products. It's not used in the sense of variant configuration. You need to imagine similar parts sharing a BOM group so that you can easily exchange a component in all similar BOMs, for example. You usually have several dozen variants, whereas variance would be much higher in variant configuration.

This strategy can be used for planning different sizes or packages for one product.

This strategy has the same basic features as strategy 50. In addition, many materials can consume the PIRs of one planning material. For more information on the differences between these strategies, Section 11.3.3.

In strategy 60, the nonvariable parts are planned using the BOM of a *planning material*. In this instance, the planning material is used purely for planning purposes. It's not actually produced itself but rather used to pass on the dependent requirements of the nonvariable parts from the finished product. The variant parts can be planned using the strategy planning at assembly level (70) as discussed in Section 11.5.1. The advantage of planning with a planning material is that you can plan all the nonvariable parts included in several finished products together.

These variant components can't be planned exactly using this strategy. Instead you need to ensure the following are true regarding the variant components:

Consumption-based

Independently planned using a planning strategy for components

Alternatively, you can accept an over-planning or under-planning of the variant components.

While using strategy 60, the following prerequisites need to be met:

You need to create a separate material master record for the planning material and enter the planning material in the material master record (on the **MRP** screens) of all finished products that are to be planned using this planning strategy. There are no major implications for the BOM components. However, you need to enter "P*" or "M*" for **MRP type** (on the **MRP view**) to plan the component in MRP.

Consider setting the **Individual/coll.** indicator (on the **MRP 4** view) to **2** for a MTS procurement of components in a MTO environment.

11.3.3 Strategy 50: Planning Without Final Assembly

It makes sense to use this planning strategy when the main value-added process is final assembly. This strategy and planning with a planning material (60) are probably the most widely used strategies in a MTO environment. Like all MTO strategies, use strategy 50 if production is unique for every customer, where it's impossible or difficult to change the stock for different sales orders.

This strategy is preferred for MTO processes because the lead time to the customer is shortened due to only the top level of the BOM structure being procured to order instead of

the entire BOM. An inventory/order interface is introduced just below the level of the finished product. The intermediates are procured into stock so that they are available after the sales order comes in, and the only time it takes to finish is the time for final assembly. This is achieved by way of statistical (planned) orders of the order type VP. Moreover, strategy 50 has the following qualities:

Production quantities can be planned effectively. You can use information from the sales information system, S&OP, or other planning tools to plan production quantities.

Procurement of the components is organized by means of PIRs entered at the finished product level. The system creates special planned orders at the finished product level for these PIRs. These orders are only relevant for production after a sales order for the finished product exists.

PIRs that are scheduled using this particular strategy are listed in a separate segment in the MRP list. The planned orders are created with the order type VP and are unconvertible. The sales orders for this strategy are entered as individual customer requirements and maintained in a separate segment in the planning run.

The assemblies are, however, produced or procured before the sales order is entered. Production is carried out up to one level before the finished product level, and the assemblies and components required for producing the finished product are placed in stock to await the incoming sales order.

Final assembly is triggered after a sales order has been entered.

An availability check is performed on the basis of PIRs. Therefore, unplanned stock (e.g., returns) isn't considered for sales.

The incoming sales order consumes the PIRs, and this in turn reduces the unconvertible planned order quantity.

The system creates a new convertible planned order for the sales order quantity. If the unconvertible planned order quantity isn't exhausted by the sales order quantity, it remains in the system. If the sales order quantity exceeds the PIR quantity, the unconvertible planned order quantity is increased.

The PIR quantities that remain unconsumed increase the warehouse stock of the components and cause procurement to decrease or not take place at all in the next period (as mentioned previously, this is called netting).

In this strategy, there is only an availability check against PIRs. A material is considered available if a PIR can be consumed. Therefore, unplanned stock (returns or unplanned production quantities, e.g., over-deliveries) isn't taken into account. The **Availability**

check indicator (**MRP** and **Sales: General/Plant Data** screens) isn't relevant in this case because an availability check according to ATP logic doesn't take place.

The following prerequisites need to be in place when using strategy 50:

Maintain **Strategy group** "50" in the **MRP 3** view of the finished product.

Maintain consumption parameters (**Consumption mode**, **Bwd consumption**, **Fwd consumption**) so that the independent requirements can be found. If no independent requirements can be found, default values are taken from the MRP group.

Maintain item category group (e.g., "NORM") on the **Sales: Sales Org. 2** view. A BOM is required for the finished product. There are no major implications for the BOM components. However, you need to maintain the following settings for the BOM components:

- Set the **MRP type** to "P*" (or "M*") to plan the components in MRP (or use consumption-based components).
- Set the **Individual/coll.** indicator to "2" for a MTS procurement of components in a MTO environment.

While strategies 50 and 60 are very similar to strategies 52 and 63, differences do exist, as listed in Table 11.3.

Strategy	50, 60	52, 63
Costing, settlement, work-inprocess (WIP), and so on	MTO	MTS
Finished product stock (and component stock (if required)	Segregated per sales order item	Not segregated
Lot-size indicator and rounding values	Lot-size indicator and rounding values being ignored	User ensures that the appropriate values are set

Table 11.3 Differences between Strategies 50/60 and 52/63

The next section covers planning strategies for ATO or assembly orders.

11.4 Strategies for Assemble-to-Order

Strategies for ATO provide the functionality required to carry out an availability check at the component level when the sales order (or customer quotation or inquiry) is created, with the following results:

The committed order quantity of the sales order is based on the component with the smallest available quantity.

The confirmed delivery date of the sales order is based on the availability date of the component that is latest on the available time axis.

Changes to quantities or dates in the sales order affect production and procurement. Changes to dates or quantities in production and procurement change the confirmation date and the committed quantity in the sales order.

When a sales order is created with the planning strategy *assembly processing*, the system automatically creates a procurement element—the assembly order. You can choose among the following procurement elements for the assembly order:

Planned order

Production order

Process order

Network (project)

Scheduling is carried out for the assembly order. When creating the sales order, capacity planning is also possible. Furthermore, the BOM is usually exploded for the assembly order to determine the corresponding components. The availability check is carried out automatically for the components. The check can be carried out either according to ATP logic or against PIRs (at the assembly level). This check determines the committed quantity for the desired delivery date. If no quantity can be committed for the desired delivery date, the system calculates and displays the missing parts. If necessary, it also determines a partial quantity and a total confirmation date (if ATP logic is used for checking).

If a material is configured in the sales order, the results of the configuration are copied to the assembly order, and the system checks the availability of the components selected on the basis of the configuration. Any changes to the date or the quantity in the sales order are immediately passed on to the assembly order.

When you work with planned orders, the changes made to sales orders affect planned orders at all times. The following is valid for the production order:

Changes made to the sales order are only valid for the production order until it's released.

Changes to the assembly order automatically adjust the committed quantities and dates in the sales order. You can also set the system so that any changes made to the assembly order don't affect the sales order.

Additionally, the following procedures (assembly types) are supported:

A 1:1 procedure, that is, exactly one procurement element for each sales order item (static procedure)

A loose link between sales order items and procurement elements in which you can split quantities and dates in the sales orders and production (dynamic procedure)

Let's now discuss the associated planning strategies of ATO.

11.4.1 Strategy 81: Assembly Processing with Planned Orders

Assembly processing with planned orders (81) is particularly useful if production control is managed using the following:

Production orders

However, you don't want to create the production order along with the sales order. You can use the planned order for adjusting planning and then convert it into a production order at a later date.

REM

The planned order is then the run schedule quantity, which you can plan using the planning and control tools provided by REM. With this procedure, the GR for the material can be posted with reference to the sales order number. Thus, the costs can also be directly assigned to the sales order, even in REM.

Strategy group 81, assembly processing with planned orders, is predefined for planned orders. In this strategy, the dynamic procedure (i.e., the loose link between the planned order and sales order) is preset as the assembly type. Strategy group 81 refers to both the following requirements type and requirements class in the standard system:

Requirements type KMSE

Requirements class 200

Use assembly processing with REM if several of the following situations are applicable:

Production of the finished product is carried out in clear and simple steps.

The assembly is produced in a constant flow over the production lines.

Simple routings are used, or assembly can be carried out without routings.

The components can be staged anonymously at the production lines. The components are procured, for example, with Kanban, using consumptionbased planning, or with the planning strategy subassembly planning.

The effort required for production control and backflushing needs to be reduced. The production process is kept as simple as possible. There are only a limited number of production levels involved in producing the product. The number of components is relatively low, however, and it's fully possible to produce a large number of finished products due to configuration options.

The components required for final assembly are selected through the configuration in the sales order and are staged at the production line anonymously. The finished product is assembled without a routing, and the operations are similar. The planning table in REM provides the planner with an overview of the production rates. At this point, the planner can also check capacities for the production lines and distribute the ordered quantities to the production lines with available capacity.

When production is complete, the GR for the finished product is posted with reference to the sales order number (a special function exists in REM for this step). After the GR

posts, the goods are withdrawn for the specific sales order, and the assembly order is deleted.

For these scenarios, you can also work without using the planning functions of REM. In this case, capacity planning isn't carried out from the planning table in REM, but instead using the capacity leveling functions in capacity planning (see Chapter 15 on capacity requirements planning). However, you can still use the backflushing functions in REM.

Whether or not you use the planning table for REM depends on the following: You want to use the planning table in REM to assign the production quantities to production lines or to carry out capacity planning, for example. If you want to use the planning table, you must maintain the following data in the material master record:

- Allow REM for the material. To do so, you must enter a REM profile. Various control parameters are contained in this profile, for example, for the movement types in backflushing and for posting costs (see Chapter 5 and Chapter 9).
- Use a profile for which a cost collector has to be created manually, as a cost collector isn't required for MTO production.
- The REM profile also determines whether the costs are posted with or without activities (machine costs, labor costs, etc.) when backflushing. If you decide to post with activities, they are automatically posted with the final backflush.
- Create a production version containing the data relevant for production (alternative BOM, group, group counter, production line, etc.). If you work without routings, you must enter at least the BOM and the production line in the production version.

If you don't want to use the planning table to plan the run schedule quantities, and, instead, for example, you want to use the following:

- The current stock/requirements list from MRP to gain an overview of the run schedule quantities
- The capacity leveling functions from the stock/requirements list or from capacity planning to adjust the master plan

If you choose not to work with the planning table, you must include the appropriate settings in the material master record.

You must enter a REM profile. Various control parameters are contained in this profile (e.g., for the movement types in backflushing and for posting costs). As already mentioned previously, we recommend using a profile for which a cost collector has to be created manually, as a cost collector isn't required for MTO production. The REM profile also determines whether the costs are posted with or without activities (machine

costs, labor costs, etc.) during backflush. If you decide to post with activities, they are automatically posted with the final backflush. Note that the special GR posting with reference to the sales order is available whether you work with or without the planning table.

11.4.2 Strategy 82: Assembly Processing with Production Orders

Assembly processing with production orders is particularly useful, when one or more of the following is true: **Status management functionality is required.**

Status management, for example, can be used to do the following:

- Document the current processing status of an object.
- Allow or forbid certain business transactions.
- Group or select objects by status (e.g., all orders with the status **Released**, or all components with the status **Missing Part**).
- Trigger rework functions automatically (using trigger points).

You want to carry out business functions at the operation level, such as the following:

- Releasing operations – Printing shop papers
- Entering completion confirmations **You need to keep track of costs during the production process.**

Every confirmation or goods movement carried out for the production order causes an update of the actual order costs.

You want to use the collective order functionality.

A collective order is a structure that links production orders over several manufacturing levels. It offers the following advantages:

- Any changes to dates or quantities have an immediate effect on any dependent orders within the collective order.
- No goods movements are required for subassemblies.
- You can carry out an availability check across all production levels.
- Each production order is automatically settled to the superior production order. The top production order is then automatically settled to the sales order.

Collective orders are especially suited to the following types of production:

- Continuous flow production

– Production using parallel production lines

– MTO production **You want to use the rework functionality.**

You can use the rework functionality to compensate for malfunctions or errors that occur during the production process. With *unplanned* malfunctions/errors, you can do the following:

– Insert rework operations.

– Insert reference operation sets.

– Create rework orders.

With *planned* malfunctions/errors, you can control rework by using trigger points. **You want to produce co-products.**

Only if you set up assembly processing with production orders can you use coproducts.

The following options are available when creating a sales order:

Create a production order directly, and immediately use all the production order functionalities (e.g., the status maintenance).

Create a planned order first, which is converted into a production order at a later date.

In this case, you can also implement planning decisions (e.g., external procurement or in-house production) later on in the assembly process. Note that in assembly processing, you can only convert planned orders into production orders if you use a strategy group or requirements class with a *dynamic* assembly type.

All configuration settings required for assembly processing with production orders, such as strategy group, requirements class, and order type, are already predefined by SAP in the standard system.

Strategy group 82, assembly processing with production orders, is predefined for production orders. In this strategy, the static procedure (i.e., the 1:1 link between the production order and sales order) is preset as the assembly type.

Strategy group 82 refers to both the following requirements type and requirements class in the standard system.

Requirements type KMFA

Requirements class 201

Order type PP04, production order with assembly processing, is predefined in requirements class 201. Note that if, for some reason, you want to use an order type different from the one predefined by SAP, you must ensure that the following scheduling parameters are set for that order type:

Enter **Backward Scheduling**.

Select **Adjust Basic Dates**.

If you use all the standard system settings, you don't need to make any additional settings in configuration.

11.5 Strategies for Planning Components

The purpose of planning at the component level is to procure components to stock (without sales orders) and quickly react to customer demand. The planning strategies explained in this section are designed to plan the procurement (production or purchasing) of components by planning the components. These strategies are particularly useful if one or more of the following is true:

A variety of finished products exist, possibly with an irregular demand pattern where planning isn't possible.

The finished products are consumption-based.

The planning of components also lends itself to separate organizational departments. Component planning in one department isn't influenced by the planning of the finished product in another department.

Choose the relevant strategy (either 70 or 59) for planning components if the following hold true:

The components aren't segregated; that is, they aren't uniquely linked at specific orders.

Costs must be tracked at the component (material) level and not at the order level.

Strategies for planning components can be used for both MTS and MTO scenarios. To use a strategy for a MTS planning of components in a MTO environment, set the **Individual/coll.** indicator (on the **MRP 4** view) to "2" as a starting point for your master data setup.

The planning of components has the following in common with MTS strategies: You can automate the planning stage by using information from the forecast and pass on the results from these applications directly to demand management.

MTS costing applies.

Smoothing of production against customer requirements may be an important aspect.

Strategies for planning components are usually combined with a lot-size key different from EX or with rounding values.

In planning at assembly level (70), no specific product structure of the component is required. In other words, it doesn't matter whether the component has a BOM. The material can be produced in-house or procured externally (e.g., raw materials). Planning at the phantom assembly level (59) requires a special product structure.

11.5.1 Strategy 70: Planning at Assembly Level

If a more reliable forecast can be produced for certain assemblies than for the multitude of product variants, this planning strategy is particularly useful for manufacturers of products with variants.

This strategy is very similar to planning with final assembly (40) covered earlier. The difference being, however, that PIRs are allocated to consumption of production orders (or schedule lines in REM) and not to consumption of sales orders. The material to be planned is a component in a larger structure, often referred to as an *assembly* or *subassembly*.

Take the following factors into consideration when using strategy 70:

Stock for the assembly usually exists.

PIRs are entered at the assembly level.

Procurement (planned by means of the PIRs) is therefore triggered before the production order stage (or schedule line in REM).

The planned orders for the assembly/components are convertible.

You can smooth procurement according to order demand.

An accurate availability check is performed according to ATP logic during order processing.

Requirements from production orders (or planned orders) are passed on to production and can lead to changes being made to procurement after the sales order stage if the order quantities exceed the PIR quantities. However, order quantities can't be confirmed if there is insufficient coverage of components. Therefore, the system automatically adjusts the master plan.

The PIRs are consumed during the production stage. Therefore, the PIR situation can be compared with the actual order requirements.

The unconsumed PIR quantities increase the warehouse stock of the component and cause procurement to decrease or not take place at all in the next period (i.e., netting).

Here are the master data of the assembly perquisites for using strategy 70:

Maintain strategy group "70" on the **MRP 3** view.

On the **MRP** view, enter "1" for assembly planning (the **Mixed MRP** indicator).

Set consumption parameters (**Consumption mode**, **Bwd consumption**, **Fwd consumption**, on the **MRP** view) to allow for consumption of PIRs.

If you use this strategy in a MTS environment, you also need to enter "2" for the **Individual/coll.** indicator.

11.5.2 Strategy 59: Planning at Phantom Assembly Level

This strategy can be used for a set of components that meet all of the following criteria:

Components are always assembled together in various finished products.

Components are planned together.

Components don't make up an assembly (they constitute a *phantom* assembly).

Moreover, take the following factors into consideration when using strategy 59 (this strategy is similar to planning at assembly level [70]):

Component requirements can be planned relatively effectively. Procurement, planned by means of PIRs, is triggered before the production order stage.

You can smooth procurement based on order demand.

An accurate availability check is performed according to ATP logic during production order processing. An availability check at the component level is possible in the production order.

If the order quantities exceed the PIR quantities, requirements from production orders (or schedule lines) are passed on to production and can lead to changes being made to procurement after the sales order stage.

The PIRs are consumed during the production stage. You can compare the PIR situation with the actual order requirements.

Due to its phantom nature, in contrast to strategy 70, stock doesn't exist for the assembly in strategy 59.

The following master data prerequisites for the phantom assembly need to be ensured while using strategy 59:

Maintain strategy group "59" on the **MRP 3** view.

For assembly planning and the **Mixed MRP** indicator, enter "1".

Maintain consumption parameters (**Consumption mode**, **Bwd consumption**, **Fwd consumption**, on the **MRP** view) to allow for consumption of PIRs.

Maintain "50" in the **Special procurement** field on the **MRP** view (phantom assembly).

Enter "2" for the **Individual/coll.** indicator in the **MRP 4** view.

To maintain the master data of the components in the phantom assembly, enter "1" in the **Backflush** field ("2" may also be possible) on the **MRP** view. Backflushing is essential because the components are planned with only one PIR and not with individual PIRs. Subsequently, the strategy can only work correctly if all reservations are simultaneously reduced. This procedure is only possible when the GI for the components is posted at a later stage, as in backflushing.

In addition, all components of the phantom structure have to be linked to the same operation. BOMs must be maintained for the finished products and for the phantom assembly.

11.6 Production with Variant Configuration

This section explains the issues involved in the planning of configurable materials. It's important to note that this section isn't about variant configuration as such. We understand that you're already familiar with variant configuration. All planning strategies are MTO.

The variance or variety of products is the key driver to choosing the right planning strategies. Planning with only a few variants differs fundamentally from planning thousands or millions of variants. Some examples for configurable products are bicycles, computers, or cars. This series of products shows an increasing variance:

A bicycle might have only a few characteristics, for example, color and frame type. A computer might have more characteristics, for example, hard-disk, casing, CPU, country, or color.

A car might have hundreds of characteristics, each with a number of characteristics values.

The number of characteristics and characteristic values leads to different approaches on the way these materials could be planned. To make this point clear, consider the number of possible variants:

A bicycle might have 7 colors and 2 frame types, which result in $7 \times 2 = 14$ variants. A computer might have 2 hard-disk types, 3 casing types, 2 CPU types, 2 country versions, and 3 possible colors, resulting in $2 \times 3 \times 2 \times 2 \times 3 = 72$ variants.

A car with some dozens variants can easily have a million or more variants.

After further examination, you could reduce the variants for planning purposes: The colors of the bicycle are typically cheap and based on planned consumption, so it may be more practical to plan only the two variants of the frame type. A similar reduction could be applied to the computer as well. For example, you could use consumption-based procurement for cheap components. Then you would plan only the expensive components (e.g., you might want to plan only CPU types and casing types, resulting in six variants).

Similar planning approaches can be used for more complex products, such as cars or elevators.

If you let the customers configure the product fully, then in that case you could plan the components directly (e.g., using strategy planning at assembly level [70]). This approach would result in one set of PIRs for all components (which aren't procured as consumption-based or Kanban-controlled). The generation of these PIRs could be performed manually, from a technical point of view. Yet to simplify this process, you might want to plan the characteristics directly and have the system generate the PIRs of the components.

A totally different approach, even for complex products such as cars, would be to define a set of variants (formerly called *stockable types*) that are produced as MTS. The advantage

of this approach is that your customers can be served immediately from stock. The downside is that your customers can't fully configure the product; they need to willingly buy from stock.

This section describes potential ways to cope with products that have a practical limited number of possible permutations of characteristics and characteristic values (*low variance*). Essentially, it describes the use of variants to sell configurable materials. Variants can be used to facilitate work with configurable materials. Variants of a configurable material are, for example, defined to prefabricate frequently required configurations and place them in stock (for that reason, variants were formerly called stockable types). For some configurable materials, it may be difficult to determine the possible variants. To use strategies for variants effectively, you must have an estimate of future consumption for each variant. If the configuration isn't changed during the sales order stage, then production can occur at the production before the sales order stage.

Variants can be planned on the finished product level using any MTO strategy, such as planning without final assembly (50) or planning with a planning material (60). These strategies were already covered previously in this chapter. The planning of variants with MTO strategies combines the advantages of MTO production (i.e., very short delivery time or cost tracking on the sales order level) with the advantages of variant configuration (i.e., one BOM and one routing for a whole product family).

Table 11.4 illustrates which stages are involved in which strategies.

Strategy/Stage	55	26	65
Similar MTO Strategy	50	20	60
1. Demand management	Yes	No	Yes
2. Procurement before sales	Yes	No	Yes
3. Sales order	Yes	Yes	Yes
4. Procurement after sales	Yes	Yes	Yes
5. GI for delivery and reduction of PIR	Yes	Yes	Yes

Table 11.4 Production with Variant Configuration

The strategy MTO for material variants (26) is similar to the strategy MTO production (20). The difference is that MTO for material variants (26) lets you change the configuration of the variant. See Table 11.5 for differences and commonalties between strategies 25 and 26.

Strategy/Stage	25	26
Configuration (of a variant)	Must	Can
Material used in sales order	Configurable material	Variant
Default configuration (frequently used configurations can be stored)	*One* configuration defaulted per configurable material using the defaults in characteristics	Several configurations can be stored (i.e., one c onfiguration can be stored per variant)
Entry in SD order	Configurable material	Variant

Table 11.5 Difference between Strategies 25 and 26

As already discussed in the beginning of this chapter, the SAP standard planning strategies are generally sufficient to cater to most business processes and scenarios; however, there are always exceptions and therefore a need to create a custom requirement class and associated planning strategy. This is covered in the next section.

11.7 Create a Custom Requirement Class

You can create your own planning strategies, for example, for assembly processing because there's a need to change one of the following:

Create assembly orders with your own order types.

Use specific methods of availability check for the components (e.g., to display a missing parts list).

Use specific methods for capacity check.

In fact, the planning strategies delivered in the standard system for assembly processing provide examples on how you could proceed. Planning strategies 81, 82, and

86 are similar to the planning strategy MTO production (20) in terms of production planning. That is, no real production planning is involved; the order is merely created without the leveraging procurement started by PIRs.

However, you could also set up planning strategies for assembly processing that would work similar to planning without final assembly (50) or planning with a planning material (60). That is, you could set up planning strategies where you would create PIRs first to procure the components and then assemble the finished product by using assembly processing.

[!]

Warning

SAP recommends the following when maintaining requirements classes:

Never change existing requirements classes.

If necessary, try to choose an existing requirements class with the desired properties. First, check to see if your requirements specification can be covered with existing strategies/requirements classes.

If there is no requirements class with the desired properties, copy an existing one and change the copy.

In this case, create a new requirements type and strategy as well. Don't change existing strategies and requirements types.

To construct your own planning strategy for assembly processing requires the following steps (for each step, use a number range starting with "Z" or "9") (see Figure 11.9):

1. Copy the relevant requirements classes into your custom requirements class.
2. Create a requirements type, and include your newly created requirements class.
3. Create a planning strategy, and include your newly created requirements type.
4. Create a strategy group, and include the newly created planning strategy.
5. Assign the strategy group to the *MRP group*.
6. Assign the MRP group to the **MRP Group** field in the **MRP 1** view of the material master via Transaction MM01 or Transaction MM02. Because assigning an alreadyconfigured object into master data, such as a material master, is a frontend activity; therefore, this step isn't covered in detail.

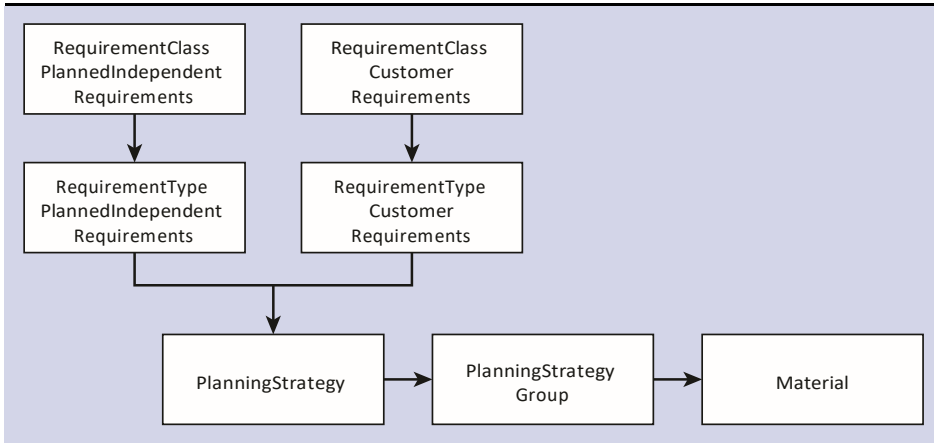


Figure 11.9 Relationships among Requirements Type, Requirements Class, and Planning Strategy

The following sections describe each of these steps in detail.

11.7.1 Copy Standard Requirements Class

In this configuration step, go to menu path, **SAP IMG Sales and Distribution Basic Functions Availability Check and Transfer of Requirements Transfer of RequirementsDefine Requirements Classes**, and follow these instructions:

1. Select an existing requirements class line (e.g., **ReqC 201**), and click **Copy as**. Each requirement class contains a number of control functions.

[+]

Tips and Tricks

When choosing requirements class lines, select the requirements class:

200, 201, or 040 to get a planning strategy similar to MTO production (20)

045 to get a planning strategy similar to planning without final assembly (50)

060 to get a planning strategy similar to planning with a planning material (60)

200 to get a planning strategy similar to assembly processing with characteristics planning (89)

2. Change the **Reqmts class** key, and add a short text (to change the key, use a number range starting with "Z" or "9").

3. Under **Assembly**, enter your **Assembly type** (e.g. "2").
4. Enter your **Order type** (e.g., "PP04"). Change this field for production and process orders; leave it blank for planned orders.
5. Select **Avail. Components** if desired.
6. Enter your **Dialog Assembly** (e.g., "3"). This entry determines the reaction on the ATP check.
7. Enter **Capacity Check**if desired. Save your entries.

11.7.2 Create a Requirements Type and Add the Requirements Class

In this configuration step, go to menu path, **SAP IMG Production Master Planning Demand Management Planned Independent Requirements Requirements Types/ Requirements Classes**, and follow these instructions:

1. Select the line **Define requirements types and allocate requirements class**.
2. Select an existing requirements type line (in this example, **RqTy KMFA**), and make a copy of it.
3. Change the **RqTy key**. Use a number range starting with "Z" or "9" (e.g., change "KMFA" to "ZMFA").
4. Enter short text for **Requirements type**.
5. Under **ReqCl**, enter the new requirements class created in the previous section. This step links the requirements type to the requirements class. Save your entries.

11.7.3 Create a Planning Strategy

In the configuration step, go to menu path, **SAP IMG Production Master Planning Demand Management Planned Independent Requirements Planning Strategy**, and follow these steps:

1. Select the line **Define strategy**.
2. Select an existing line (e.g., **Strategy 82**), and create a copy by clicking **Copy as**.

3. Change the **Strategy** key (use a number range starting with "Z" or "9", and add a short text).

4. Link this strategy to the newly created requirements types from the previous step. Save your entries.

Tips and Tricks

To link newly created requirements types, you can do one of the following:

- Leave the **Reqmt type for Indep reqmts** section blank. In **Reqmt type of customer reqmt**, enter the copy of the requirements type that links to requirements class 200, 201, or 040 to get a planning strategy similar to MTO production (20).
- In the **Reqmts type for indep. Reqmts** section, enter requirements type "VSE" (which links to requirements class 103). In the **Reqmt type of customer reqmt** section, enter the copy of the requirements type that links to requirements class 045 to get a planning strategy similar to planning without final assembly (50).
- In the **Reqmts type for indep. Reqmts** section, enter requirements type "VSEV" (which links to requirements class 104). For the **Reqmt type of customer reqmt** section, enter the copy of the requirements type that links to requirements class 060 to get a planning strategy similar to planning without planning material (60).
- In the **Reqmts type for indep. Reqmts** section, enter requirements type "VSE" (which links to requirements class 103). For **Reqmt type of customer reqmt**, enter a copy of the requirements type that links to requirements class 200 to get a planning strategy similar to assembly processing with characteristics planning (89).

11.7.4 Create a Strategy Group and Include the Newly Created Planning Strategy

In the configuration step, go to menu path, **SAP IMG Production Master Planning Demand Management Planning Strategy**, and follow these steps:

1. Select the line **Define strategy group**.
2. Select an existing line (e.g., **Strtgy grp 82**).
3. Make a copy, and change the **Strategy group** key (use a number range starting with "Z" or "9").
4. Maintain a short text in **Description**, and enter the new planning strategy in **Main plg. Straty** to link to the newly created planning strategy. Save your settings.

11.7.5 Assign Strategy Group to a Material Requirements Planning Group

To assign the strategy group to a MRP group, follow the configuration menu path, **SAP IMG Production Production Planning Demand Management Planned Independent Requirement Planning Strategy Assign MRP Group to Strategy Group** (see Figure 11.10).

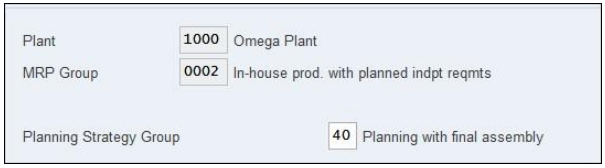


Figure 11.10 Assignment of a Strategy Group to an MRP Group and Plant

You can now use the planning strategy in your material masters. In the following sections, we'll cover how to create various requirements, such as PIRs and customer independent requirements, and we'll discuss these evaluations.

11.8 Business Processes in Demand Management

In the following sections, we'll show how to either manually maintain PIRs or copy the planning figures from one of the several planning tools available, such as forecasting or LTP. Customer independent requirements are covered next followed by evaluating all requirements. Finally, we'll show how to reorganize or delete PIRs that are either too old or no longer needed for planning purposes.

11.8.1 Planned Independent Requirements

PIRs are the direct outcome of S&OP and form an integral part of demand management. During the MRP run, the system refers to PIRs with an active version to come up with procurement proposals.

Note

Refer to Chapter 10 for information about S&OP and how the data and information flows into demand management.

You can also create the PIR independently. In fact, demand management offers a far greater number of options to create PIRs than S&OP does**.** To create PIRs, follow the menu path, **LogisticsProductionProduction PlanningDemand ManagementPlanned Independent RequirementsCreate**, or use Transaction MD61.

Figure 11.11 shows the initial view to create PIRs. For this example, enter **Material** "40000022" and **Plant** "1000", and also assign the **Version** as "00" (**REQUIREMENTS PLAN**).

Define the planning period in months, so that the system brings up the relevant field for data input. Notice that you can also enter default user parameters by choosing the **User Parameters** button and then entering the relevant details. These parameters then form the default settings for PIRs. However, if you preset a requirements type, this overrules the strategy settings and is therefore not recommended.

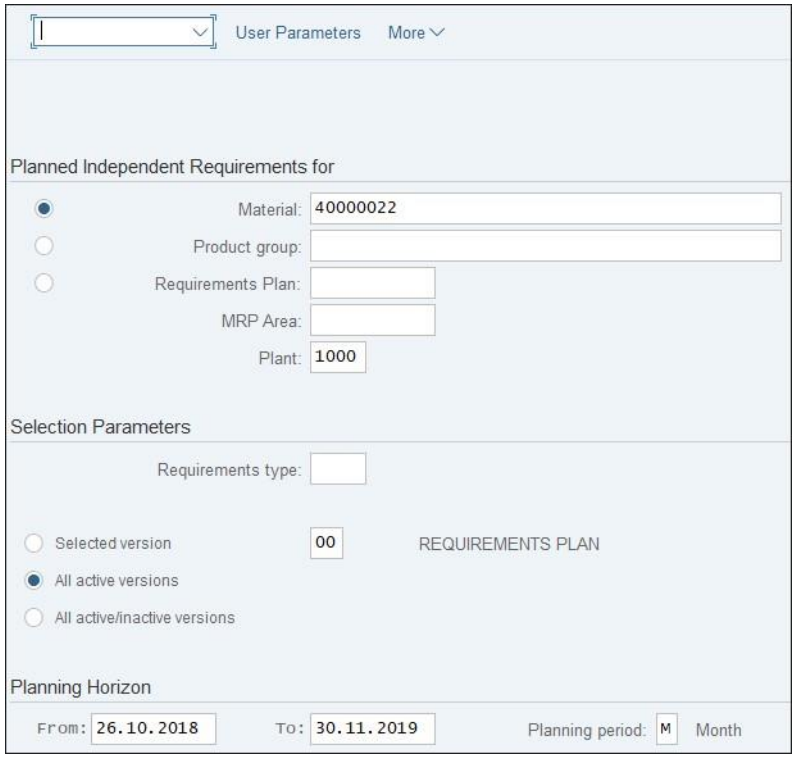


Figure 11.11 Initial Screen of Planned Independent Requirements

Press (Enter), and the PIR view appears in which you manually enter monthly production figures for **Version 00** (Figure 11.12). Notice the checkbox for column **A**, which indicates that the PIR for material 40000022, plant 1000, and version GP is active. An *active* version indicates that the system will consider it during the operational planning run (MRP). This

compares with LTP MRP in which the system can also consider an inactive version to come up with procurement and production proposals (simulated).

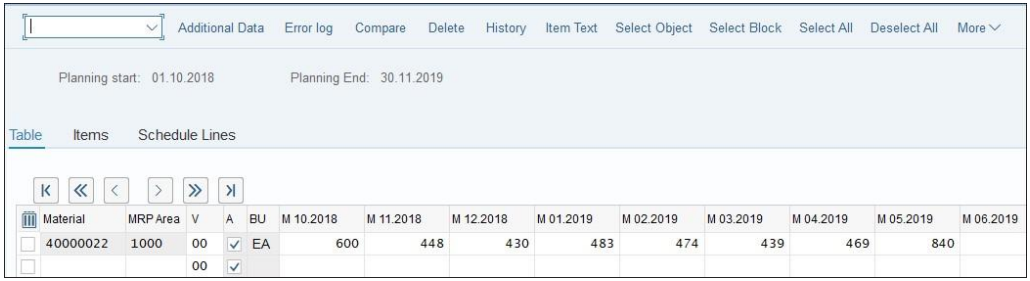


Figure 11.12 PIRs

Figure 11.13 shows the **Items** tab of the PIR for **Material 40000022**, wherein the system assigns the requirement types of PIRs based on the strategy type defined in the material master.

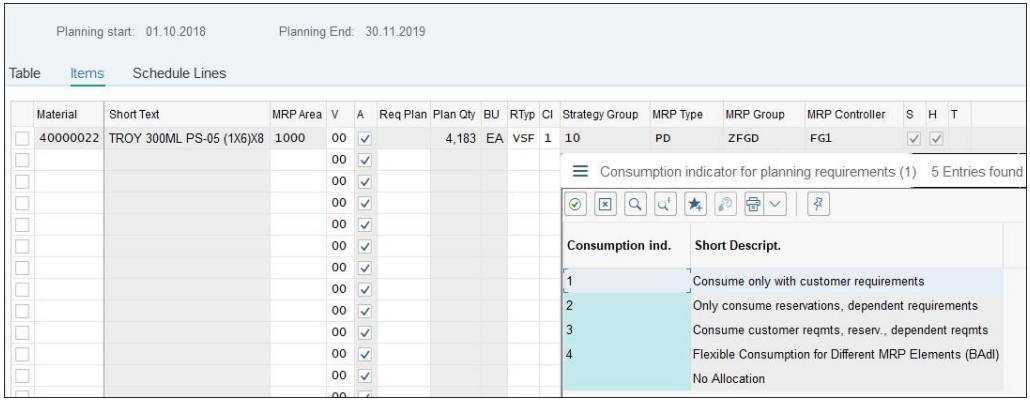


Figure 11.13 Consumption Type in PIRs

For this example, the system assigns requirement type **VSF**, which is for planning strategy **40**. Pressing (F4) while keeping your cursor in the **CI** (consumption indicator) field reveals that **Consumption 1** to **Consume only with customer requirements** applies.

Figure 11.14 shows the detailed **Schedule Lines** view of the PIRs. Because you chose the planning period to be in months on the initial PIRs view, the same can be changed, if needed. The system also shows the planning (financial) values of the quantities. However, there are other options available to change the time granularity to daily or weekly.

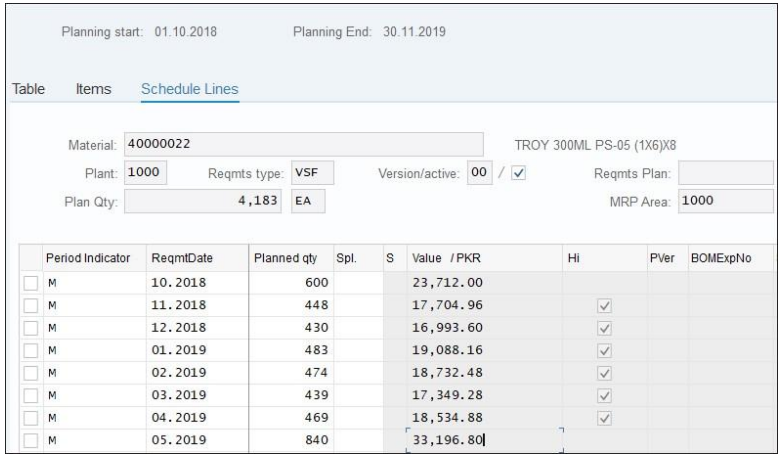


Figure 11.14 Schedule Lines in PIRs with Financial Values

Note

The system enables you to leverage the objects and layouts for display in the PIRs. We encourage you to explore these options.

While you manually entered the production quantities in the view shown earlier in Figure 11.12, you also have the option to automatically copy PIRs from several other planning tools. This is shown in Figure 11.15, where you can copy the results from the forecast of the material (the forecast on the material must already be executed and results saved), from a sales plan, or from a production plan. You can even copy results from simulative planning (LTP).

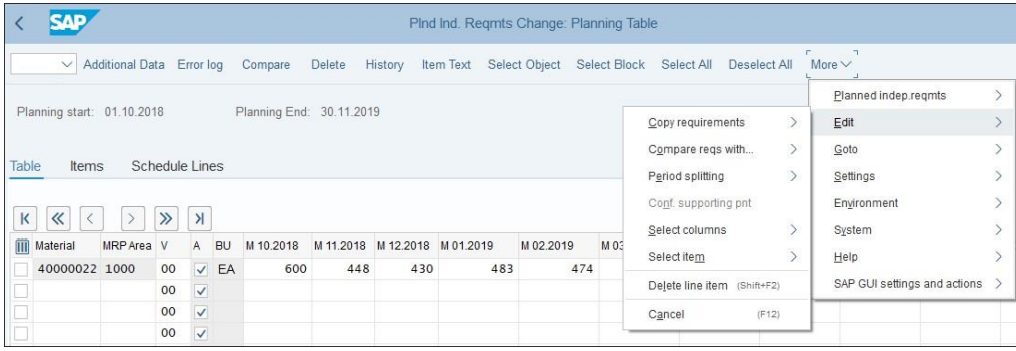


Figure 11.15 Options Available to Create PIRs

Note

LTP is covered in Chapter 14.

Another highly intuitive feature of PIR creation is that you can also compare the PIR quantities with consumption, with the forecasting results, and with the sales or production plans. To do this, choose **MoreEditCompare reqs with**.

When you enter the quantities in the PIR or transfer them for S&OP, you have to assign a version number, which denotes different demand plans. There may be several inactive versions and even some simulation versions available in the system. The inactive or simulation versions are used in a simulation tool, such as LTP, whereas an active version becomes part of operative planning (MRP). The recommendation for the SAP system is to have version 00 as the one and only active version, whereas all other versions must remain either inactive or used in simulations (LTP).

While the standard version numbers available are generally sufficient for the business processes of the company, you can also create new version numbers if needed, or you can amend the existing ones to make them more reflective of the business needs. To create a new version, use configuration menu path, **SAP IMGProduction PlanningDemand ManagementPlanned Independent RequirementsDefine Version Numbers** (see Figure 11.16), or use Transaction OMP2.

Language	Version	Version text
EN	00	REQUIREMENTS PLAN
EN	01	Requirements plan 1
EN	02	Simulation 2
EN	03	Simulation 3
EN	04	VERSION 04
EN	05	VERSION 05
EN	AA	QUOTA FRM SALES PLAN
EN	AB	SALES PLAN
EN	AG	QUOTA FRM PROD. PLAN
EN	GP	PRODUCTION PLAN
EN	IS	MAT.FROM INFO STRUC.

Figure 11.16 Versions for PIRs

11.8.2 Customer Independent Requirements

When the user enters the sales order in the system, the system immediately adjusts it with the PIR as consumption. While sales orders and associated activities, such as outbound delivery and post GI, form the basis of consumption and PIR adjustments, it's also possible to independently create customer independent requirements in demand management without reference to a sales order.

To create customer independent requirements, follow the menu path, **Logistics ProductionProduction PlanningDemand ManagementCustomer RequirementsCreate**, or use Transaction MD81. Figure 11.17 shows the initial view to create the independent requirement. When you drill down the **Requirements type** field (by pressing (F4) while keeping the cursor on the field), a large number of standard requirement types specific to the customer will be available to choose from. If you've assigned a strategy group in the **MRP 3** view of the material master, the system automatically assigns a requirement class to the customer independent requirements.

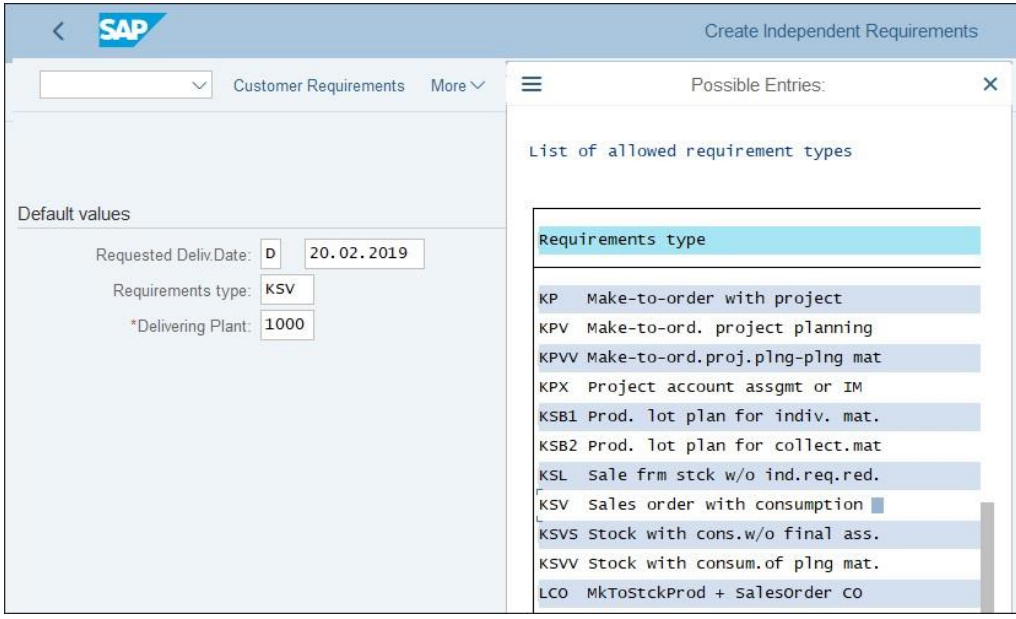


Figure 11.17 Creation of Independent Requirements

Note

While the system automatically fills in the **Requirements type** field whenever you've assigned a strategy group to the material master, you can overwrite it if you have alternative strategies defined in the strategy group.

Press (Enter), and the view shown in Figure 11.18 appears where you can enter **Material** number "40000022" and an **Order Quantity** of "250" "EA" for **Plnt** "1000". Save the customer independent requirements, and the system generates an internal number for the customer requirement, which, for this example, is 50000001.

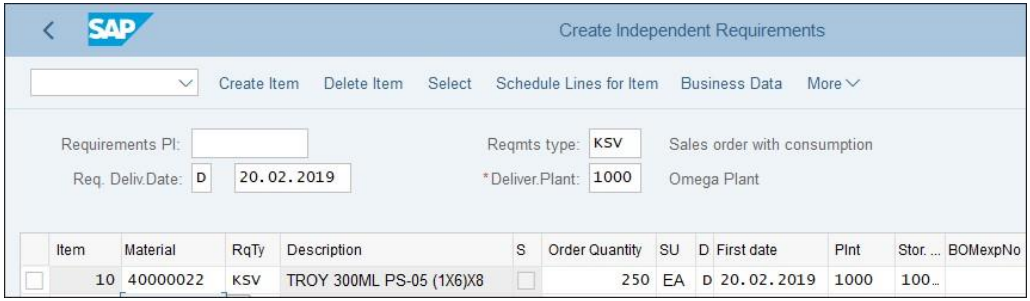


Figure 11.18 Independent Requirements with Requirement Type KSV

Next, you'll run the MRP to see how the system accounts for the customer requirements in the planning run.

11.8.3 Planning for Independent Requirements

Run the MRP on material 40000022 and plant 1000 using Transaction MD01N. The next step is to evaluate the stock/requirements list for independent requirements.

11.8.4 Stock/Requirements List for Independent Requirements

To evaluate the stock/requirements list, including independent requirements after the MRP run, use the menu path, **LogisticsProductionProduction PlanningDemand ManagementEnvironmentStock/Requirements List**, or use Transaction MD04. As shown in Figure 11.19, the customer requirement is shown as **CusReq** in the **MRP elemnt** column.

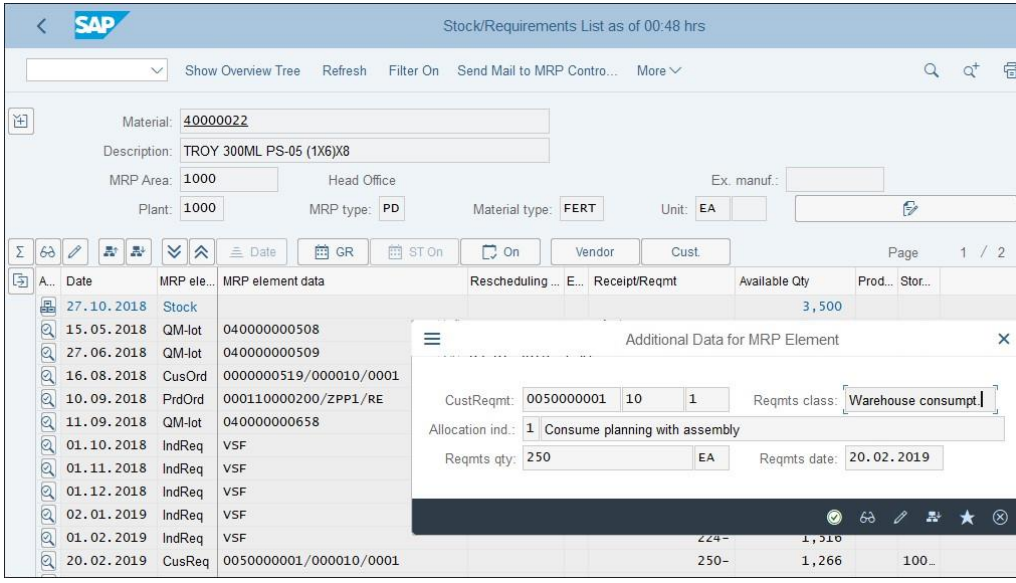


Figure 11.19 Results of MRP with Customer Requirements

11.8.5 Total Independent Requirements: Evaluation

At any given time, you can evaluate the total PIRs of a material and its consumption. The system displays the **Planned Qty.** as available in the system, whereas the **Total assignment** column shows the consumption figures. Use the menu path, **LogisticsProductionProduction PlanningDemand ManagementEvaluationsDisplay Total Reqmts**, or use Transaction MD73. Here you see the initial view (see Figure 11.20), wherein you enter the **Material** "40000022", enter the **Plant** "1000", and select the **Output List 1** option from the dropdown list.

Press (Enter), and the **Display Ind Requirements with Assigned Cust. Requirements** view shown in Figure 11.21 appears. Here you see the monthly planned quantity you previously entered in Figure 11.12 in the upper half of the view, and you see the customer requirement of **250 PC** in the lower half.

When you have only the dynamic consumption, then this is shown in the **Total Assgmnt** column. If the entire process is finished—that is, the sales order is delivered— the system shows the quantity in the **Withdrawal qty** column.

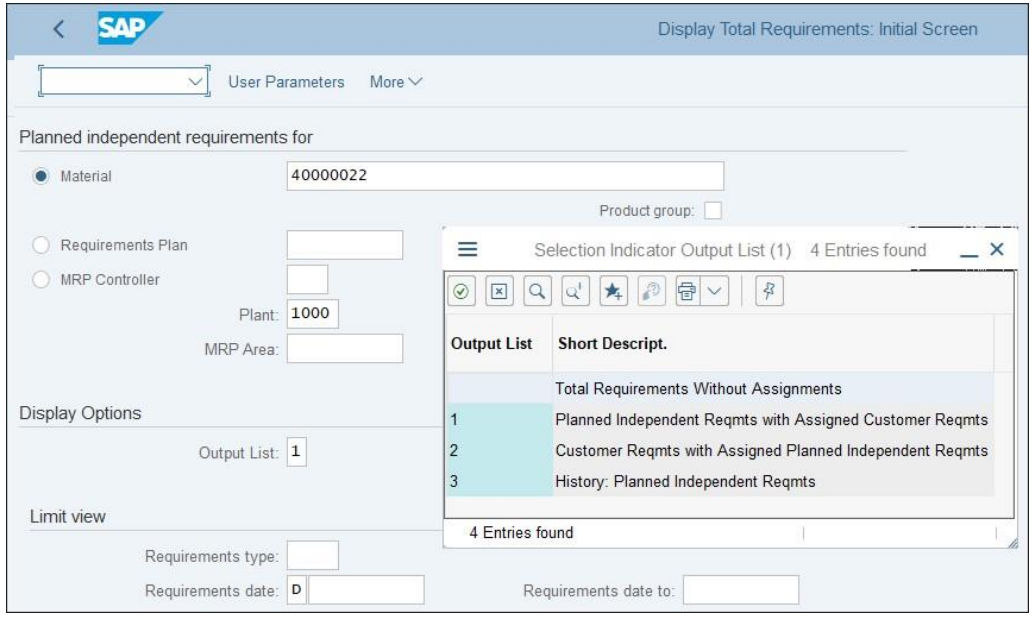


Figure 11.20 Initial Screen for Total Requirements of Material 40000022

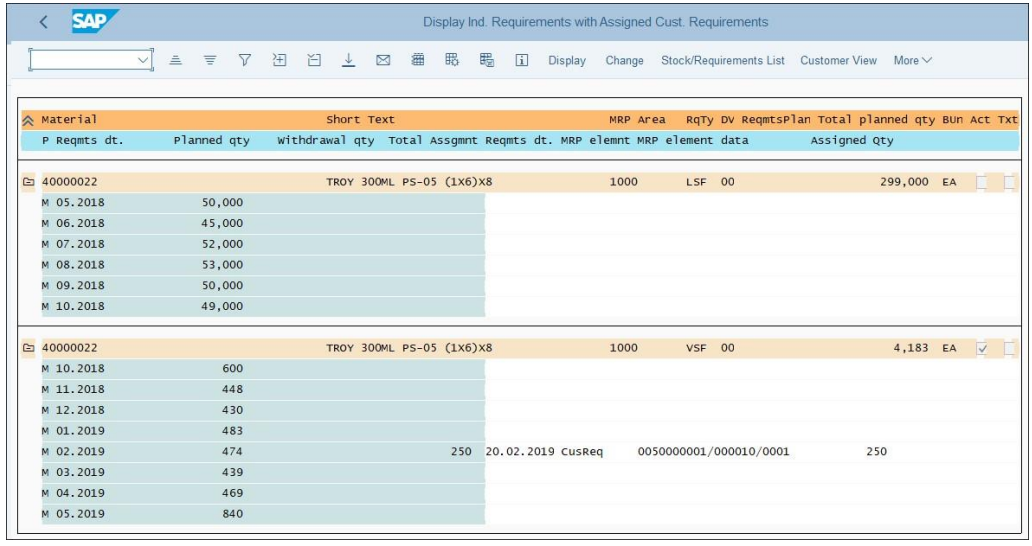


Figure 11.21 Total PIR and Requirements for Material 40000022

11.8.6 Total Independent Requirements: Reorganization

Although the PIRs are automatically reduced, you must regularly and periodically evaluate the PIRs in the system to see if the same needs to be eliminated (or adjusted). This helps ensure that old and nonrelevant planning data no longer becomes part of the planning process during the MRP run.

To evaluate the PIR, use the menu path, **LogisticsProductionProduction PlanningDemand ManagementEnvironmentIndependent Requirements: ReorganizationAdjust Requirements**, or use Transaction MD74. In the initial view, you can give the initial parameters, so that when the system is executed, it only brings up the relevant results for consideration and action. Notice that you also have the flexibility to evaluate the results of the organization in the **Test Mode (No Database Changes)** (see Figure 11.22). This helps in evaluating the results in simulative mode before actual reorganization.

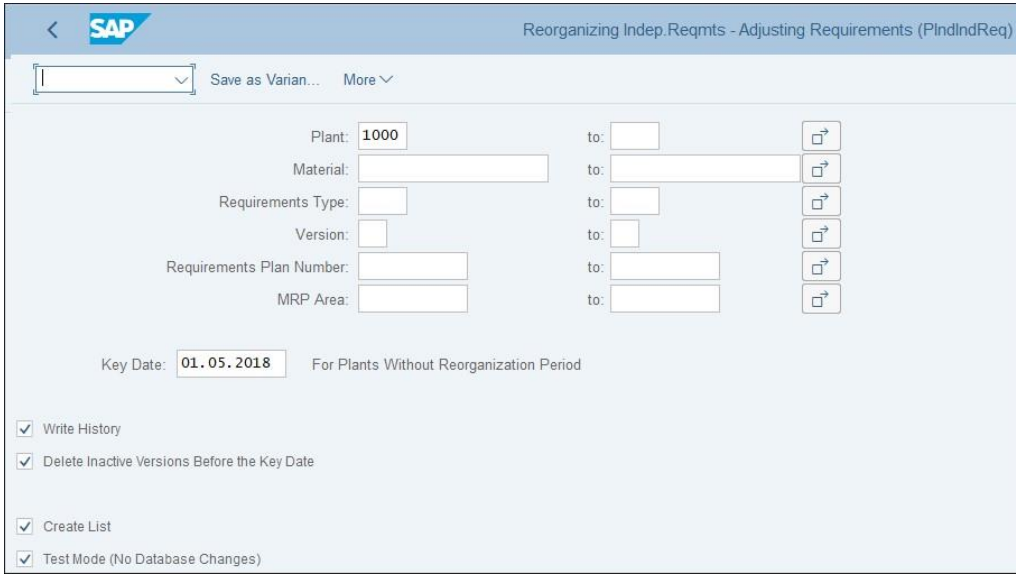


Figure 11.22 Initial Screen for Reorganizing PIRs

The **Key date** field refers to the date *until* which the system should bring up the PIR data for reorganization. For this example, it's **01.05.2018** (May 01, 2018), and the system should consider all of the PIRs *until* the month of May in 2018. It's important to highlight that such PIR reorganization is ensured for past/old PIRs only, which the company no longer wants to plan for or account for in demand management.

Tips & Tricks

You can define the plant-level PIR reorganization using Transaction OMP8, where you can define the number of days. The system subtracts these days from today's date to come up with the reorganization date. The system reorganizes all PIR data older than the reorganization date.

After you enter the initial parameters, press (F8) or choose **Execute** to open the view shown in Figure 11.23. This view brings up the data for the four months, until May 2018, to which the system was able to find PIRs for the material 40000022 and plant 1000 containing quantities as well as other materials and their associated quantities.

After evaluation, you can organize (delete).

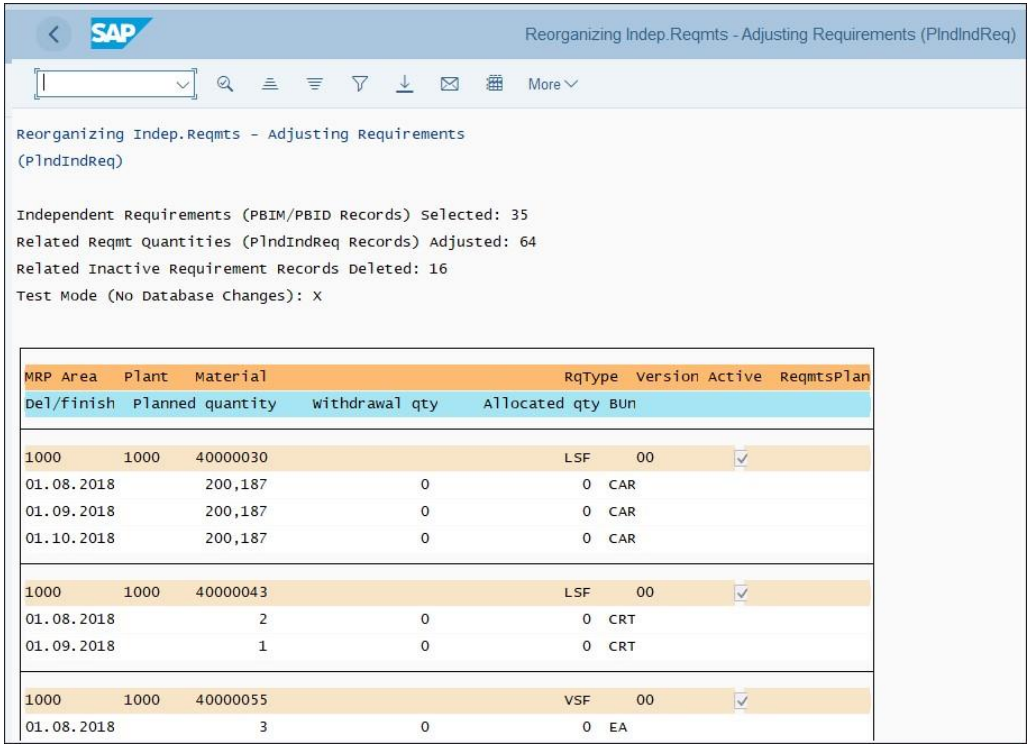


Figure 11.23 Simulative Results of PIR Organization

11.8.7 Planned Independent Requirements: Reduction

PIRs are reduced during the GI. Unlike consumption, the PIRs are actually reduced and not just consumed. During MTS production using strategy 10, the oldest PIR is reduced first.

However, the reduction can also affect PIRs in the future if relevant strategies are used with consumption such as reduction in consumption strategies 40, 50, 60, and so on.

Here, reduction simply takes place according to the current consumption situation when posting the GI. For this strategy to work, you need to set the configuration data accordingly. The configuration is performed using Transaction OMJJ. For nonconsumption strategy 10, you have this setting in the requirements class. This transaction is in the domain of materials management (MM), wherein you make relevant settings per movement type. For nonconsumption strategy 10, these settings are available in the requirements class.

After executing Transaction OMJJ, you can provide the movement type; for example, "601" (GI against delivery). In the **Updating Control** area shown in Figure 11.24, you can select the **Ind. rqmts reduction** checkbox to enable the system to reduce the PIRs at the time of GI (e.g., movement type 601) against a sales order.

During assembly planning, the PIR is reduced when goods are withdrawn for the production order.

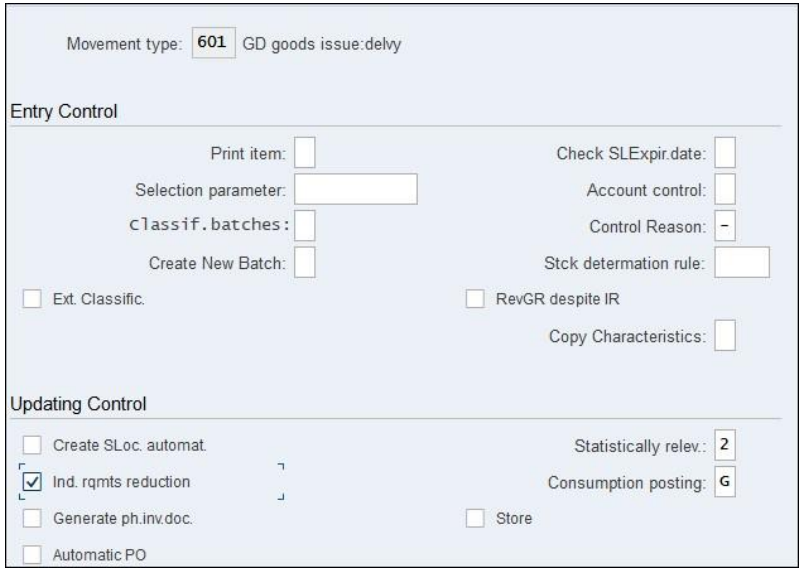


Figure 11.24 Configuration Settings of PIR Reduction

Table 11.6 provides an overview of common (selected) planning strategy types to which the system reduces the PIRs, based on specific transactions such as GI against a sales order or production order.

Planning Strategy	Planning Strategy Description	PIRs Reduction
10	MTS production	GI (sales order, MTS)
20	MTO production	GI sales order
30	Production by lot size	GI (sales order, MTS)
40	Planning with final assembly	GI sales order
50	Planning without final assembly (MTO)	GI sales order
52	Planning without final assembly (MTS)	GI production order
60	Planning with planning material (MTO)	GI sales order
63	Planning with planning material (MTS)	GI production order
70	Subassembly planning	GI production order
82	Assembly planning with production order	GI sales order

Table 11.6 Relationship of Selected Strategy Types and PIR Reduction

11.9 Summary

Demand management acts as a central point to account for both the planning for production processes and the consumption to sales processes. With the right strategy type used for each material based on its production process, demand management can optimize the business processes by not only helping the user enter realistic planning quantities such as PIRs but also by showing how these relate to the automatic and dynamic adjustment of PIRs on receipt of sales orders and their further processing, including GI. The flexibility to assign different planning and consumption strategies broadly mitigates the insecurities and other risks involved. At the same time, the system keeps a realistic check on the quantities entered in PIRs compared to the actual demand situation by making appropriate adjustments.

The next chapter covers the foundations of material requirements planning (MRP).

Chapter 12

Foundations of Material Requirements Planning

Material requirements planning is an integral part of production planning and materials management. In this chapter, you'll build the foundations required to use this tool to optimize your logistics and supply chain planning processes.

Material requirements planning (MRP) is a highly versatile and intuitive planning tool that generates procurement proposals to fulfill in-house production and external procurement demands to help the production and procurement planners optimize their business processes. Furthermore, it generates these procurement proposals for all levels of production-based materials and also takes lead times, scrap quantities, external procurements, special procurements, planning cycles, planning calendars, and lot sizes into account. MRP isn't limited to quantities calculations—it includes scrap and stock considerations, and also provides in-depth scheduling solutions and capacity requirements.

To use the results of MRP effectively, you need to provide complete, correct, and comprehensive master data as often as possible. To facilitate this initiative, the system also offers several helpful tools: planned delivery time calculation, for external procurement; statistical analyses, for in-house production times or external procurement times; forecasting tools; calculation of safety stock; and reorder point planning. With the passage of time and with more experience and reliable data, you can continue to update the planning data (the MRP data in four different MRP views of a material) and continue the refining and optimization process.

This chapter begins with a process overview of MRP, including the important role of MRP in all of supply chain planning. It covers both types of MRP—that is, MRP for deterministic replenishment procedures and stochastic replenishment procedures— and their variants.

We'll also cover important influencing factors involved in ensuring calculation of reliable planning results, such as MRP types, lot sizes, scrap, and safety stocks. We'll also discuss scheduling, procurement proposals as well as rounding the lot sizes. Wherever applicable, we also cover the necessary configuration to get MRP up and running in your system.

Note

Although this chapter primarily helps to build your foundations, concepts, and understanding of MRP, see Chapter 14 on long-term planning (LTP) to see how to put MRP to actual use via a real-life example from the molten glass industry. Chapter 13 covers running MRP Live and its associated topics.

12.1 Process Overview

During an SAP system implementation project, or even later on when you want to start taking advantage of planning tools such as MRP, be sure to follow a step-by-step approach in identifying materials that you want to plan with MRP. You can plan just about any kind of material with MRP. Broadly, you should consider the following factors and take the following steps:

1. To begin, prepare a comprehensive list of all materials (e.g., in a Microsoft Excelfile). This Excel file may be a template that your SAP system's consultant will make available for you. Materials can be finished goods, components, assemblies, raw materials, packing materials, consumables, or maintenance spares. You can also plan materials with special procurement types, such as subcontracting materials, phantom assemblies, pipeline materials, procurement from another plant, production in another plant, stock transport orders (interplant transfer), and so on.
2. Segregate the materials that you want to plan from those that aren't worth thetime, effort, or cost involved in planning, and then eliminate them from the Excel file.
3. For materials that you want to plan, segregate them further by classifying them asA, B, or C types (as you'll see later in Figure 12.3). Type A materials are high values and generally cover finished goods, semifinished/assemblies, raw materials, packaging materials, and so on. Type B and C are medium- to low-value materials, such as consumables, routine maintenance spares, and so on.

Using deterministic replenishment procedures for all A-type materials, individually evaluate each and every important factor involved in MRP to see how these fit in the planning and give you the desired results. For example, ask yourself questions such as the following:

What should the safety stock of this material be?

How many days of planning window do I need so that the system doesn't make any automatic changes to my production (or procurement) plan?

When there is a requirement for a material, how much should I plan (exact quantity, minimum quantity, maximum quantity, etc.)?

How should the incoming sales orders consume my planning figures?

Is this material make-to-stock (MTS) or make-to-order (MTO)?

Do I need to produce this material for a specific project?

Is this assembly produced in-house or at another plant of the company? How much scrap (percentage) does the production of a material generate for a product or subassembly, so I can incorporate that in planning? Should I also first forecast material requirements by using a forecasting tool and adjust forecast values before proceeding with material planning?

You need to be asking these (and many more) questions for each material and correspondingly entering or updating the information in the Excel file.

For raw materials or packaging materials, and because these are externally procured, you need to know answers to questions such as the following:

What is the planned delivery time of this material?

What is the goods receipt (GR) processing time?

How much underdelivery and overdelivery of a material is allowed?

Is there a scheduling agreement or a contract (quantity or value) with a vendor for a material? Is there a quota arrangement in place, in case of multiple vendors for the same material?

We suggest that you involve your procurement personnel (materials management [MM]) to help you answer these (and many more) questions because they have firsthand knowledge and experience regarding the procurement.

For B- and C-type materials, consider using consumption-based planning or stochastic replenishment procedures. For consumption-based planning, you can choose whether you want to use reorder-based planning that can manually or automatically suggest the reorder point of each material based on historical consumption. For manual reorder point planning, you have to enter the reorder point quantity, which may be based on your past experience or

from consumption figures available in another planning program (not the SAP system). Further, you can also take advantage of the forecasting tool to help you plan your future consumption. Forecasting also uses historical consumption data available in the system.

Because planning is a continuously evolving and ongoing process, you can continue to fine-tune the planning parameters of materials to help the system come up with planning results that you can use in your production and procurement processes almost immediately (and without need of significant adjustments). For example, when you first entered the planned delivery time of a material, it was five days, but as the system built up a significant database of this information (planned delivery time) in the past year, the average delivery time turned out to be seven days. You can update this information in the **MRP** view of the material master so that future planning results of MRP are more reflective of this reality. The system also makes available a tool (Transaction WPDTC) to provide you with a comparison between the information that you've entered in the material master and the actual planned delivery time that the system recorded for each delivery. Several such analysis reports and tools are available in the SAP system.

Whether it's MRP or consumption-based planning—that is, deterministic or stochastic replenishment procedures, respectively—you'll define a large number of factors in the four different **MRP** views of the material master to influence the planning results of MRP. In fact, the system refers to this detailed information in the **MRP** views to come up with procurement proposals. Some of these factors may be how the system performs the net requirements calculations, what percentage of safety stock to consider in planning, the lot-sizing procedures to use, if forecasting is a necessary prerequisite to planning, and how to manage special procurement types. In the following sections, we cover the important factors and parameters that you need to set up to achieve the desired planning results from MRP and that you can subsequently use in your production and procurement activities.

Figure 12.1 provides an overview of the role of MRP in the planning and production areas of the SAP system.

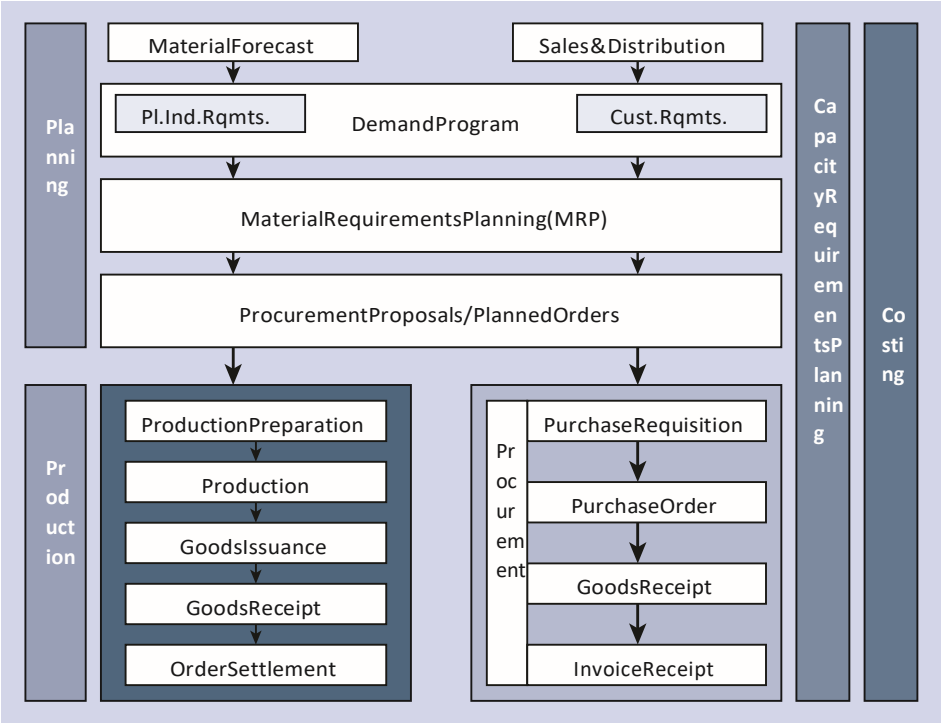


Figure 12.1 MRP in Planning

The planning process starts with requirements coming from sales and distribution (SD) or from a material forecast and becomes a part of demand management. The system also takes customer requirements and planned independent requirements (PIRs) into account. The PIR with an active version consists of quantities of the material on which you want to run MRP. The system runs MRP based on the details given in the demand program, and the outcome of the MRP run is the creation of procurement proposals. These procurement proposals can be planned orders (order proposals), purchase requisitions for external procurement, or delivery schedules for scheduling agreements with vendors. The procurement proposals distinctively divide up into two separate yet interlinked areas: procurement for externally procured materials and production for in-house produced materials.

Figure 12.2 shows how you can categorize materials for planning purposes into two major subareas: deterministic and stochastic replenishment procedures.

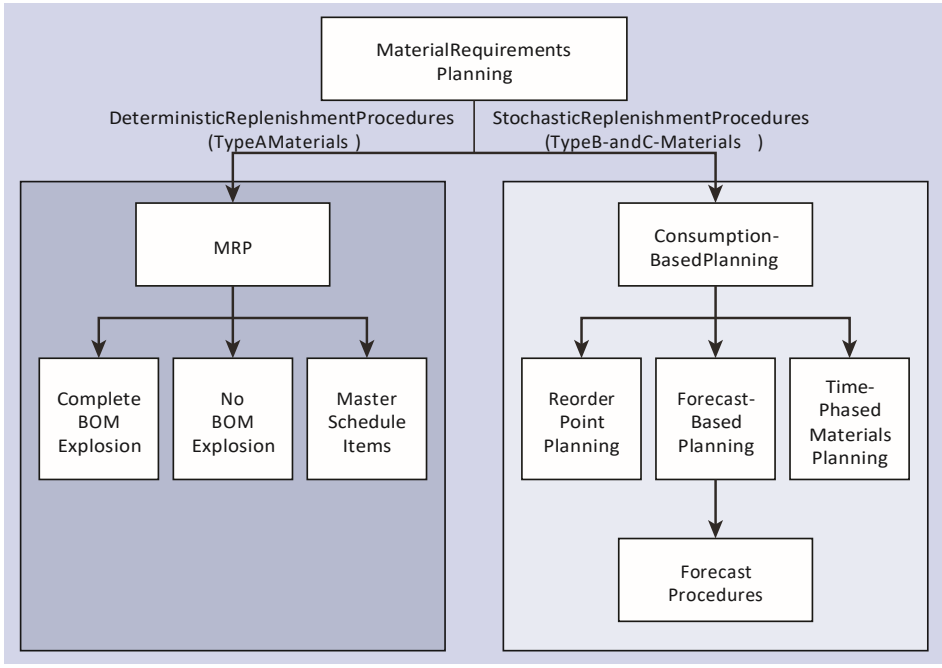


Figure 12.2 MRP and Consumption-Based Planning

Tips & Tricks

Transactions MC40 and MC41 are quite helpful in letting a material planner segregate materials into A-, B-, or C-types based on their usage or consumption values (past) or even requirement values (future). For example, you can use ABC analysis to classify those customers that generate 75% of sales volume as A customers, the next 15% as B customers, and the rest as C customers. Similarly, you can classify your materials by aggregating their consumption values (or sales volume) of materials until they reach 80% (or whatever boundaries you define) of your total value and then by designating all these materials as A items.

These ABC analyses can then be incorporated into the **ABC indicator** field in the **MRP1** view of the material master. Note the A, B, or C indicators that can be made part of their respective material masters in Figure 12.3 1, 2, and 3.

Figure 12.3 1 is the parameters selection screen available for Transaction MC40 or MC41, whereas 2 shows the ABC analysis based on requirements values (Transaction MC41). Finally, 3 is an ABC analysis based on consumption values (Transaction MC40)

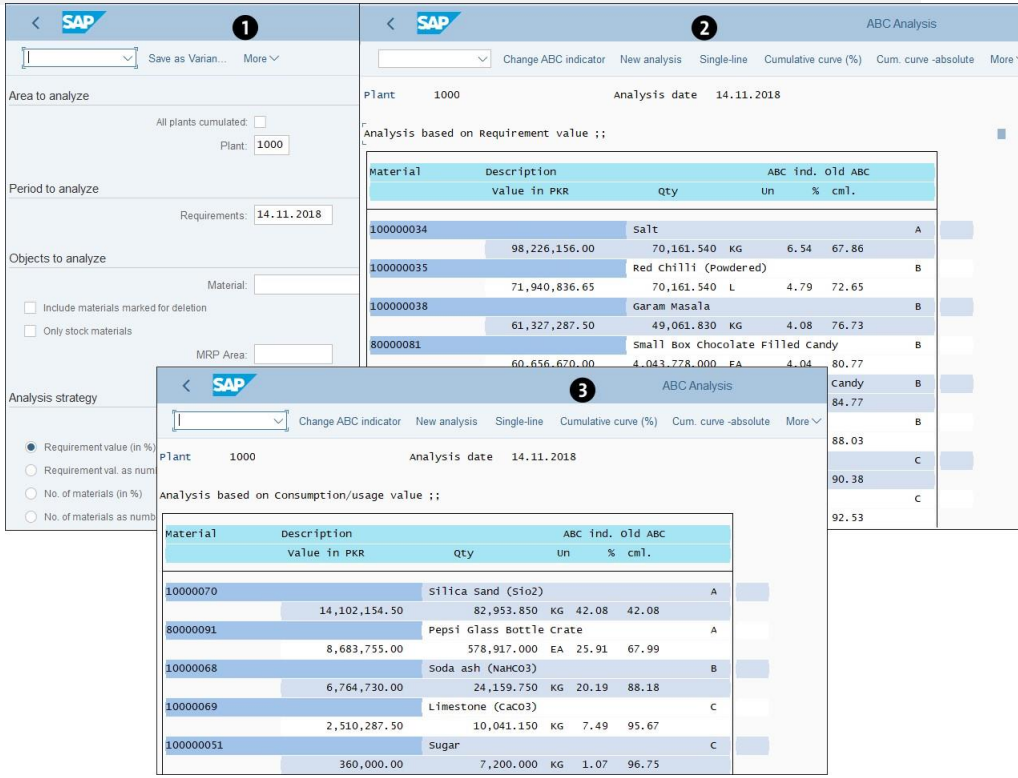


Figure 12.3 ABC Analysis Using Transactions MC40 and MC41

Let's now discuss both types of materials replenishment procedures—deterministic and stochastic (or consumption-based)—in greater detail, along with an overview of the MRP types associated with them.

Deterministic replenishment procedures and MRP types (type A materials)

Deterministic planning is to plan for the future; that is, the MRP run will create order proposals in a quantity and for a time period exactly as required without taking any elements of probability or randomness into account.

For example, a material that is planned using MRP type PD will always create the exact quantity proposal to meet the material demand and at a time it's needed. This MRP type usage is most prevalent due to its easy setup because it doesn't involve any automation. To add some quantity buffer to this planning type to ensure enough stock is still available during the replenishment lead time as well as to prevent stock-out, a safety stock is maintained. But because every individual material's planning demands equally considering various other factors individually, such as whether the material's demand is high or low and whether the lead time to replenish is long or short, this MRP type isn't effective when used across a large number and diverse types of materials.

MRP type PD is planning deterministically (SAP calls that MRP). PD simply looks at demand in the future and covers it with a procurement proposal that has a delivery date just before the demand occurs. Other deterministic MRP types are P1, P2, P3, P4, and D1. They require a planning time fence to be set, and they help you by keeping planned orders that are generated by the MRP run out of that period of time. These MRP types can also protect a short-term production program and are fixed automatically when they fall within the frozen zone. MRP type M0 is used to plan your important finished (or unfinished) products separately from the rest. It has its own master production scheduling (MPS) planning run and is meant to cut down on processing time before the plan is released to the bill of materials (BOM) structure. As in the P series, the M1, M2, M3, and M4 types allow for the protection of a planning time fence and automatic fixing of procurement proposals. MRP type D1 (demand-driven replenishment [DDR]) works the same as MRP type M1 with the difference that stock are replenished to the maximum level.

Consumption-based replenishment procedures and MRP types (type B and type C materials)

These procedures are also called stochastic or having some degree of randomness and an element of probability. The future planning of their demand and correspondingly their supply availability of these materials is based on past consumption patterns. Hence, there is a probability and randomness to this process that can be buffered with safety stocks, capacity, or time.

In stochastic planning procedures, the system tries to cover future requirements by making stock levels available that fulfill these future requirements with the least amount of inventory investment. That is why consumption-based, or stochastic, replenishment policies underlie an estimating process. Here, the safety stock settings for these procedures play an equally important role. Because future stockholdings are predicted to the best of the procedure's capabilities and because there is some level of randomness and variability in demand, a buffer in the form of safety stock in most cases is indispensable to avoid stock-outs.

The need for a buffer level depends on the length of the replenishment lead time, the variability of that lead time, the variability in demand, and a desired, stipulated

service level that communicates the planner's percentage of acceptable stock-outs to the system. Using these parameters, the system—or for manual procedures, the planner—can calculate a safety buffer that should deliver the expected results in terms of availability and stockholding. The first groupings of consumption-based replenishment procedures are the reorder point types. Reorder level planning is a consumption-based method because it requires inventory to be available at all times and doesn't wait until there is demand before replenishment is triggered. The next grouping is forecast-based planning procedures, such as MRP type VV. Finally, the third grouping is time-phased planning procedures, such as MRP types R1 and R2.

Let's now discuss the deterministic replenishment procedures and its associated MRP types available in the SAP system in the following section. The next section will then cover stochastic replenishment procedures and their associated MRP types.

12.2 Deterministic Replenishment Procedures

When you decide to plan a material using MRP, one of the first parameters that you define in the material master is the MRP type. An MRP type is a control function used to control several subsequent steps. For example, if you define the MRP type as "ND" for no planning, the system won't plan the material at all. If you use MRP types that starts with P* (e.g., PD, P1, P2, etc.), you can control how the system takes the net requirements calculations into account and how it firms the procurement proposals for MRP during the MRP runs. The net requirements calculation takes the plant stock and all receipts into account and then subtracts the requirement quantities. If the net requirements calculation comes up with a shortage or deficit quantities, the system creates procurement proposals during the MRP run.

In the net requirements calculation, the system determines the available stock based on the following formula:

Plant stock – Safety stock + Open order quantity (purchase orders, production orders, fixed procurement proposals) – Requirement quantity (PIRs, customer requirements, material reservations, forecast requirements for unplanned additional requirements) = Available stock

If it evaluates that there is no shortage, then the system doesn't create procurement proposals.

Note

We'll cover only the standard materials replenishment procedures and their associated MRP types to develop the necessary foundations and understanding required to use them first before opting for customization.

12.2.1 MRP Type PD

MRP type PD is planning deterministically (SAP calls that MRP). In its initial configuration, the PD may also include a forecast on unplanned consumption (see the **Forecast ind.** and **Cons. Ind. Forecast** fields). When you enter a forecast model in the **Forecasting** screen, the PD will forecast unplanned consumption (you can see the unplanned consumption in the consumption history) and display additional requirements (**Unpld. Cons.**) in the stock requirements list (Transaction MD04).

PD simply looks at demand in the future and covers it with a procurement proposal that has a delivery date just before the demand occurs, as shown in Figure 12.4.

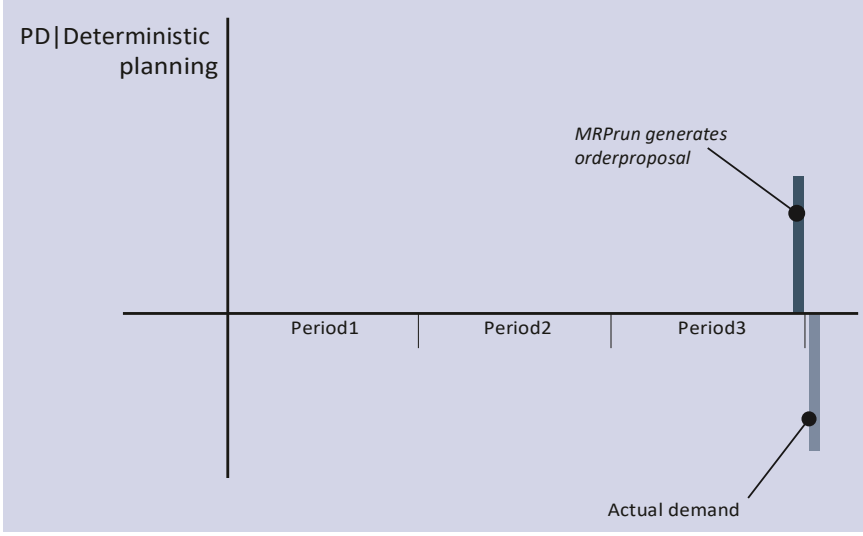


Figure12.4 MRPType:PD

Because PD is deterministic, it waits for demand to arrange supply. If there is demand, and the MRP run gets executed, a supply proposal is generated to cover that demand. This MRP type is well suited for expensive purchased parts and therefore costly to store, its consumption is highly variable and unpredictable, and the lead time to procure is short.

This type of planning is carried out for the quantities planned in PIRs or quantities planned in incoming sales orders (MTO or MTS), dependent requirements, and stock transfer requirements—that is, any requirement that is MRP-relevant. In this type of net requirements calculation and its planning, the following apply:

The system doesn't consider nor ask for any forecast information or historical consumption values. Material planning is ensured only on the basis of absolute requirements or demands in hand.

The system determines the available stock in the planning run, which is required to meet the demands, with the following logic:

Plant stock + Scheduled receipts from production and purchase – All of the demands (e.g., from sales orders, material reservations, and PIRs)

If the available stock is unable to fulfill the demand, then depending on the settings of the planning run, it creates planned orders for in-house production as well as purchase requisitions, delivery schedules/scheduling lines, or purchase requisitions for external procurement.

As already mentioned earlier that other deterministic MRP types are P1, P2, P3, and P4 and require a planning time fence to be set, and they help you by keeping planned orders that are generated by the MRP run out of that period of time. The difference between these four MRP types lies in the firming or not firming of the procurement proposals and what requirements in which period are considered.

Similarly, the MRP type M0 is used to plan important finished (or unfinished) products separately from the rest. As in the P series, the M1, M2, M3, and M4 types allow for the protection of a planning time fence and automatic fixing of procurement proposals.

Let's consider an example of firming type P1 to explain how firming works. In firming type P1, the system automatically firms the existing procurement proposals as long as these are within the defined planning time fence. Additionally, it creates new order proposals when it evaluates that there is going to be a shortage of material within the planning time fence. However, the system pushes the new procurement proposals outside the planning time fence to ensure that the production plan isn't disturbed. When the newly created procurement proposals begin to fall within the planning time fence, the system automatically firms them and makes them a part of the production plan.

To ensure greater stability to the production and procurement plans, you can take advantage of firming logic and the planning time fence. The *firming logic* defines how the system should handle the existing or new procurement proposals by automatically firming the planned orders, allowing an option for manual firming, or allowing neither of those. The

planning time fence allows for the definition of a range within which MRP doesn't create, change, move, or delete any procurement proposals. This can be a great reliability factor for the production department if a planning time fence such as the following is used: for the next five days starting from today, the production plan shall not be changed, not even if there are new sales orders.

You can maintain the planning time fence in the **MRP 1** view of the material master or in Customizing. The planning time fence is the number of workdays (and not calendar days) within which you can protect your master plan. The system firms the procurement proposals to protect them from any changes. However, as an MRP planner, you still have the flexibility to make any last-minute manual changes, if needed. Firming of the procurement proposals (planned orders, purchase requisitions, delivery schedules) falling within the planning time fence prevents the proposals from being adapted in the next planning run. In other words, in the planning time fence, the system doesn't create or delete any procurement proposals nor does it change the existing proposals.

The system calculates the planning time fence from the current date and adds up the number of working days incorporated as the planning time fence in the material master (**MRP 1** view). You can also define the planning time fence in the configuration settings of **MRP Group** because it's easier for you to just assign this MRP group to the material master. When the system moves forward in the time scale, it's logical that any procurement proposal, which was previously outside this planning time fence, will start to move within the planning time fence one by one. When they move in to this time fence, they are automatically firmed for protection from changes. That means the horizon keeps rolling with time.

There two firming options for procurement proposals are automatic firming and manual firming.

There are 10 MRP types with firming available in the system (M0, M1, M2, M3, M4, P1, P2, P3, P4, and D1), and these differ with regard to the automatic firming of elements within the planning time fence and also with regard to the creation of new elements.

It's important to note that firming type M0 behaves just like MRP type PD; that is, the planning time fence is inactive for this MPS time.

Note

The firming type M refers to MPS, whereas firming type P refers to MRP.

Table 12.1 shows the similarities of firming types for both MRP (firming type P) and MPS (firming type M).

Firming Types	0	1	2	3	4
MRP Types	**PD M0**	**P1 M1 D1**	**P2 M2**	**P3 M3**	**P4 M4**
Firming methods of existing procurement proposals (within the planning time fence)					
No firming of procurement proposals within the planning time fence.	✓				
Automatic firming of procurement proposals within the planning time fence.		✓	✓		
Manual firming of procurement proposals within the planning time fence (no automatic firming of procurement proposals).				✓	
Firming methods of new order proposals (within the planning time fence)					
Automatic creation of new procurement proposals to cover the shortages within the planning time fence. However, the system pushes the dates of these new procurement proposals outside the planning time fence.		✓		✓	
No new procurement proposals created to cover the material shortages within the planning time fence.			✓		✓

Table 12.1 Firming Types in Planning

You can also set how the system should account for roll-forward. A roll-forward defines the number of workdays starting from today (both forward and backward) in which the system can proceed to delete the firmed planned orders if you didn't convert them to either production orders or purchase requisitions. For example, you want to delete all of the firmed planned orders older than five days during the next MRP run. To do this, you select the MRP type with firming (e.g., **P1**) and select the **Delete firm planned orders** option from the **Roll forward** field. Next, you define "–5" in the **Roll forward** field in MRP group

parameters for the specific plant (Transaction OPPR). The negative value (number of days from today) is for deletion of the past and firmed planned order, and a positive value is to manage deletion of the firmed planned orders in the future. In the same MRP group settings (Transaction OPPR), you can also assign the number of workdays (from today) that you want the system to firm the planned orders for the relevant firming type.

Figure 12.5 shows the **MRP 1** view of the material master and shows various **MRP Types** in the dropdown menu as well as the **Planning time fence** field.

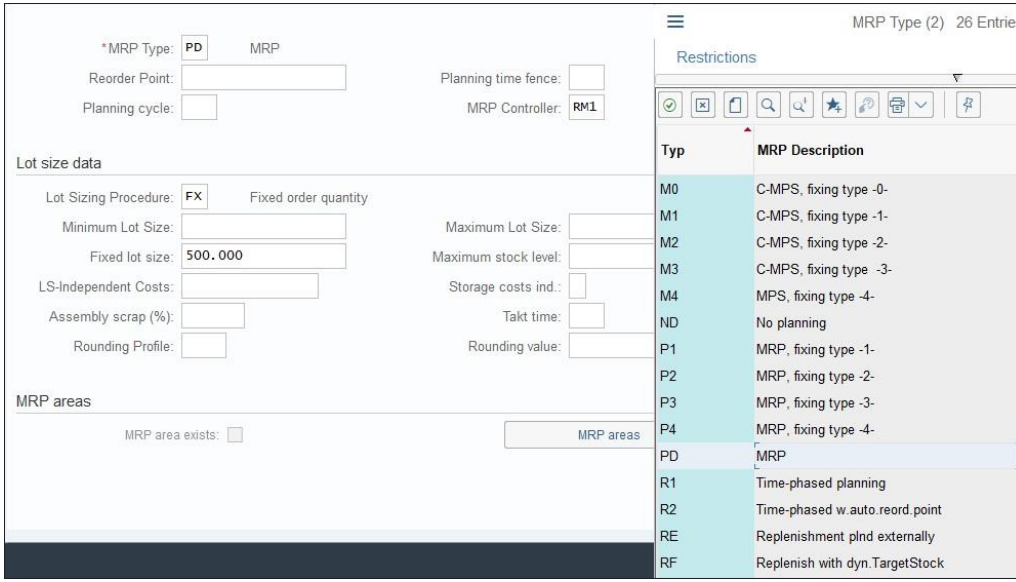


Figure 12.5 Planning Time Fence

12.2.2 MRP Type VB

VB is the simplest and most manual of the reorder point MRP types. When using MRP type VB, you'll have to calculate and set the reorder point manually and maintain it in the **Reorder Point** field in the material master. The reorder point may be based on historical consumption values or even best guess. Although not required, it's recommended to maintain safety stock when using this MRP type.

Further, it's suggested to look at the past consumption of the material in question and derive an estimated, future daily consumption quantity from that amount. You can then multiply this quantity with the number of working days (those days where your company consumes

the material) within the total replenishment lead time (TRLT). That lead time should be maintained in the **MRP 2** screen of the material master record (**Planned Delivery Time** + **GR Proc.Time** + **Purchasing Time** fields). The product of future daily consumption with the lead time gives you an inventory point that, if reached, you'll have to reorder so that you don't run out before the next receipt comes in. Depending on the variability in the estimated consumption or lead time, it may be necessary to raise the reorder point by a safety stock when that shifts below (see Figure 12.6).

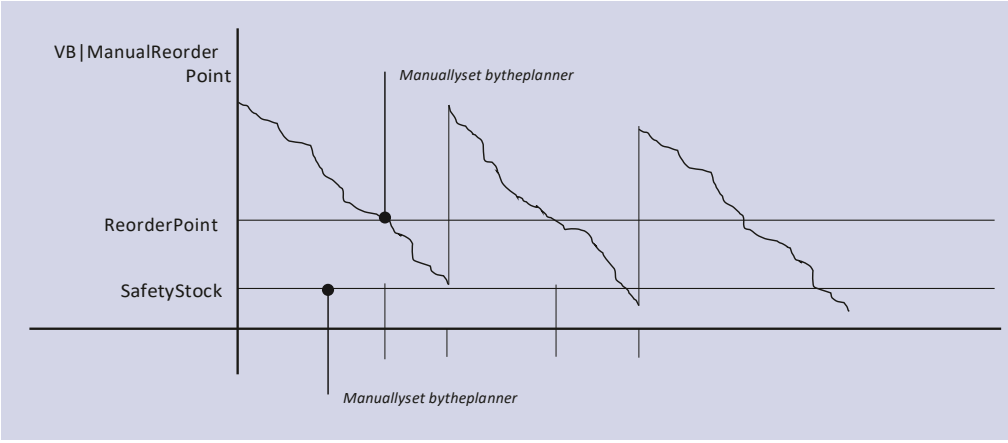


Figure 12.6 Reorder Point Planning

Tips & Tricks

There are many ways to calculate and guess future daily consumption. Transaction MC.9 for example, gives that history. However, when looking at the table with key figures and characteristics, you can only see monthly totals, and even though you might want to divide the monthly total by the number of working days in that month, you can't ensure that there was somewhat consistent consumption day by day. But if you display the consumption graphic in the logistics information system (LIS), you can apply a number of helpful tools to get all the information you need. This way, you can see if there's consistency in the consumption over time and figure out how much inventory you need to get you through the lead time without any stockouts. Then add a safety stock and maintain it in the material master's **MRP 2** view. Subsequently, you maintain **MRP Type VB** and fill in the **Reorder point** in the **MRP 1**

view of the material master. The reorder point quantity is your estimated consumption within the TRLT plus the safety stock quantity.

We mentioned that while you don't have to maintain a safety stock at all in **MRP 2**, it's recommended to have that kind of information readily available (see Figure 12.7). The system creates an exception message 96 (see Chapter 13, Section 13.2.3, on exception messages) every time the stock falls into that range, it's an indication over time whether the reorder point is too low or there's an opportunity to lower it (and with it the average stockholding of this material). The more often exception message 96 appears, the more likely the reorder point is too low. But if exception message 96 appears only rarely, it's time to look into lowering that reorder point.

We'll show an example of reorder point planning in Chapter 13, Section 13.4.

Material	Description	ABC ind.	Old ABC
	Value in PKR	Qty Un	% cml.
40000081	Choco Craze!!		A
	61,600,000.00	77,000.000 EA	52.01 52.01
40000082	Pepsi 250ML 24P		A
	15,400,000.00	77,000.000 CRT	13.00 65.01
30000043	Pepsi Final Syrup		B
	9,699,690.00	464,100.000 L	8.19 73.20
30000044	Simple Syrup		B
	9,598,632.00	314,400.000 L	8.10 81.31
100000051	Sugar		B
	9,360,000.00	187,200.000 KG	7.90 89.21
70000032	Pepsi Empty Bottle 250ML		C
	7,354,200.00	1,838,550.000 EA	6.21 95.42
100000048	Pepsi Concentrate		C
	4,800,000.00	96.000 DR	4.05 99.47

Figure 12.7 MRP Type: VB

You can control the MRP procedure (see Figure 12.8) that the system uses in the MRP type. Place the cursor on the **MRP procedure** field, and click on the dropdown option or press (F4). Figure 12.8 shows the configuration screen of manual reorder point planning (**MRP Type VB**). Notice that you can take advantage of the system's functionality of automatically calculating safety stock as well as reorder points. For configuration of the MRP type, Section 12.4.

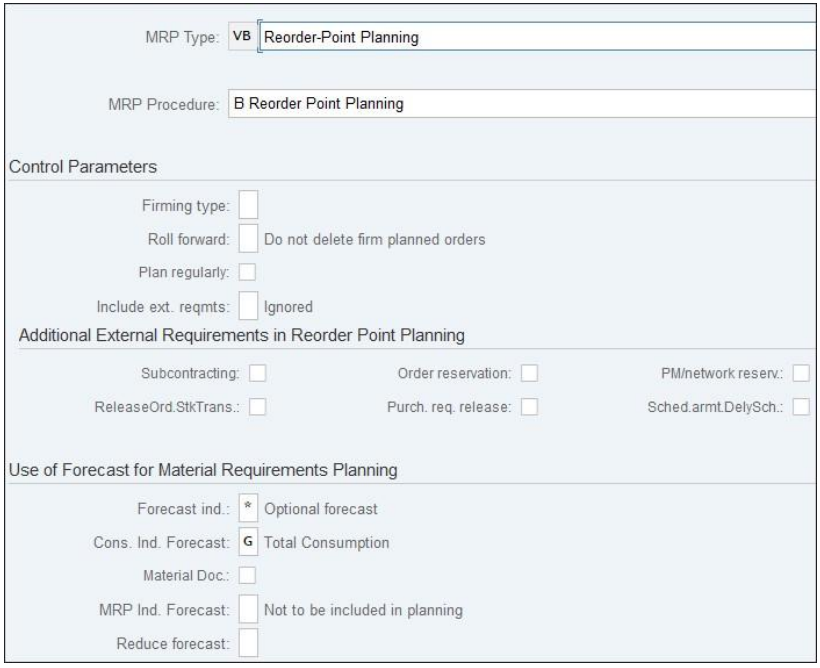


Figure 12.8 Reorder Point Planning

Tip & Tricks

Use the fixed lot-sizing procedure for reorder point based planning so that the system procures the fixed lot size, instead of only creating a proposal for the deficit quantity.

12.2.3 MRP Type VM

To achieve more automation and greater accuracy in the reorder point procedure, MRP type VM can be used. MRP type VM eliminates guesswork and lets the system do the figuring. But the system can only figure and calculate reliable and authentic values if the underlying

basic data and specifically the historic consumption are accurate. This procedure requires timely and accurate GR/GI postings because it's using that data to figure mean absolute deviation (MAD) and therefore consistency in consumption, lead time deviation, and various settings (e.g., planned delivery time and service level) to come up with a reorder point. If any of this information isn't maintained correctly, VM will produce reorder points that either cause stock-outs or drive the inventory to potentially very high levels. In any case, VM uses the material master's **Forecasting** screen to automatically calculate the reorder point and a safety stock quantity via the following procedure:

1. On the **Forecasting** screen, use its settings and historical consumption to calculate a past MAD. The system does so by comparing an ex-post forecast to the actual past consumption.
2. Use the service level being maintained in the **MRP 2** view of the material master and a standard formula to calculate a safety stock quantity.
3. Calculate the future anticipated daily consumption by running a forecast in thematerial master record.
4. Multiply the working days in the TRLT with the future anticipated daily consumption. This is the basic value that you'll see in the forecasting results.
5. Add the safety stock quantity to the basic value. This is the calculated reorder point.
6. During this procedure, the **Forecasting** screen is used for simulation purposes only. The forecasted quantities won't become MRP-relevant. The forecast is simply used to perform an ex-post forecast that allows for the determination of MAD, which is then used to determine the degree of variability for the calculation of reorder point and safety stock (see Figure 12.9).

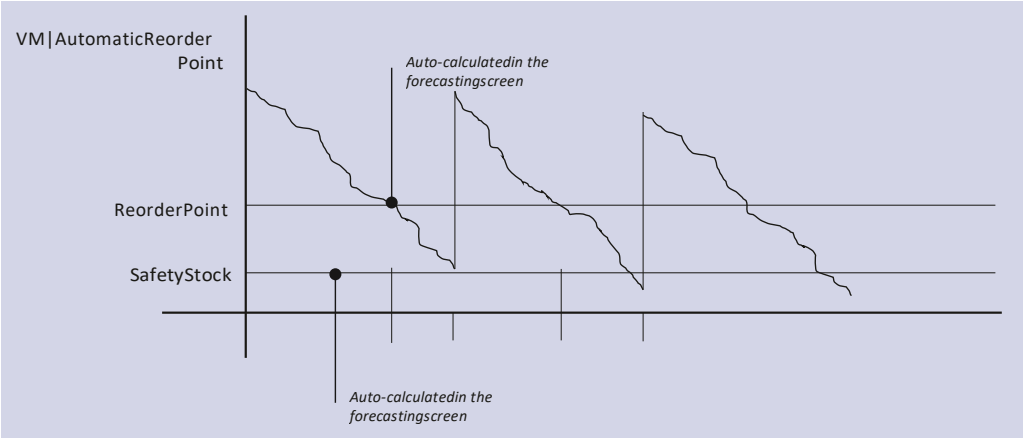


Figure 12.9 MRP Type: VM

When deciding to use this planning procedure, take the following factors into consideration:

The higher the degree of variation (MAD), the higher the safety stock requirement and the higher the reorder point will be.

The longer the replenishment lead time, the higher the reorder point needs to be to get through the replenishment lead time.

The longer the replenishment lead time, the greater the chance of an unforeseen consumption. This is increasing variability and with it safety stock requirements and the reorder point.

The higher the service level percent maintained in **MRP 2**, the higher the safety stock requirement and with it the reorder point.

The higher the daily consumption, the higher the reorder point. At the same time, the forecast is obligatory and uses total consumption.

Figure 12.10 shows the automatic reorder point calculation, safety stock calculation, and other calculations.

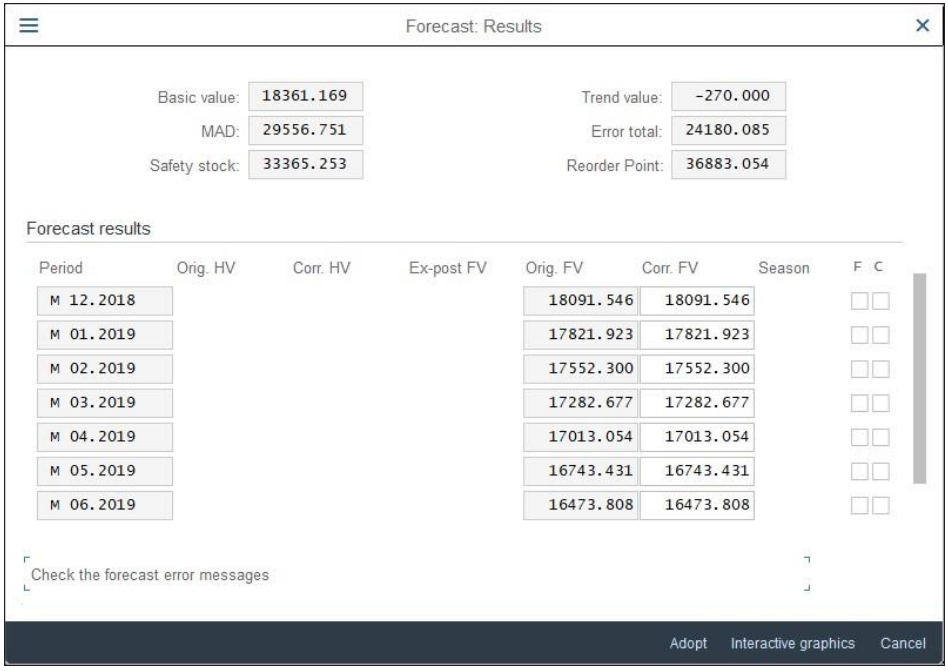


Figure 12.10 Safety Stock and Reorder Point Calculation Using MRP Type VM

12.2.4 MRP Type V1

MRP type V1 acts exactly like VB, except that it takes external requirements into consideration. The safety stock and reorder point have to be set and calculated manually for this procedure. You can choose and configure what those external requirements are, such as order reservations, released stock transport orders, and released purchase requisitions. If there is a sales order reservation within the replenishment lead time (include **Ext. reqmts** "2"), then the order is triggered early because the amount of demand from the reservation is taken into account for the determination of when the reorder point is broken.

While using this MRP type, it's helpful to use a lot-size procedure that adds those external requirements within the lead time to the ordering quantity. Because these demands are already known, it makes sense to add them to the order size, so that at the time of receipt, the consumption can be replenished in full. Therefore, the V1 type offers an advantage over both the VB and the VM types in that it's not purely driven by the past but a little more proactive and includes future requirements in the planning process.

12.2.5 MRP Type V2

MRP type V2 provides the *most* sophisticated and advanced reorder point procedure so far. Not only does it include external requirements, but it also calculates safety stock and reorder point automatically using the **Forecasting** screen in the material master record. As a word of caution, beware of too much automation too soon, unless you fully understand this material planning procedure.

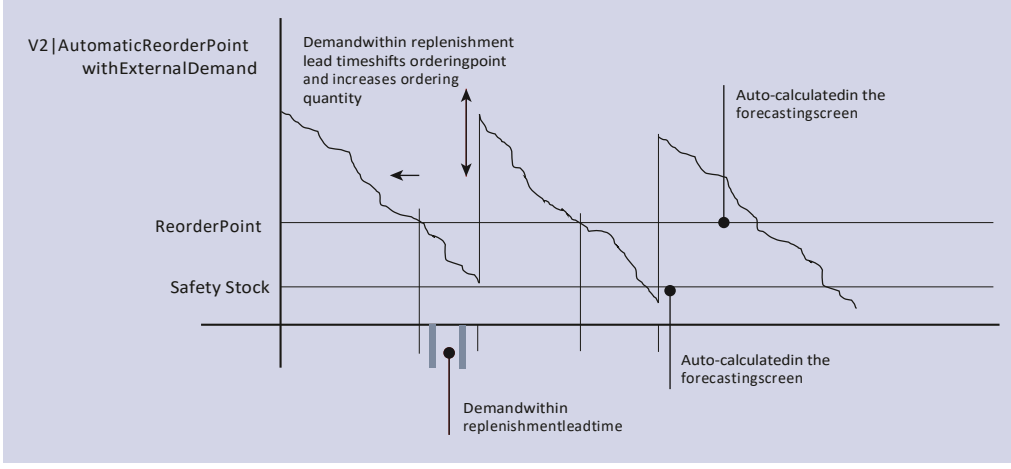


Figure 12.11 MRP Type: V2

MRP type V2 automatically calculates a reorder point based on length of lead time, variability in the consumption, and the service level you set. So the V2 type combines the automatic calculation of the planning parameters with the consideration of external demand. This procedure is based on a simple reorder point methodology that is sophisticated enough to automate the planning process and optimize the inventory holdings (see Figure 12.11).

12.2.6 MRP Type D1

In DDR, the planning run creates a new supply element, such as a purchase requisition, a planned order, or a stock transfer requisition, when the net flow position of a material falls below the reorder point maintained in the material master. The aim of the planning run is to create supply elements to fulfill demand by using a better quality of demand signal. This means that it's possible to create supply elements that meet real customer demand more accurately. This, in turn, achieves improved service levels on the one hand while lowering inventory levels and bound capital on the other.

As this MRP type uses firming type 1 (same as MRP type M1), the procurement proposals within the planning time fence are firmed automatically as soon as their date is at least one day before the end date of the planning time fence. The date of new procurement proposals created in the planning time fence is moved to the end date of the planning time fence. As a result, these new procurement proposals aren't firmed.

The equation for generating supply elements is the net flow equation:

On-hand stock + Open supply – Open past (including today's) demand – Qualified spike demand

In this equation, the quantity of stock on hand is added to the quantity of open supply. Then the total quantity of open demand (including today's demands) plus the qualified spike demand is subtracted. This results in the net flow position. If the day's net flow position is below the reorder point, a supply element is created for the amount that will bring the stock level back up to the maximum stock quantity.

Note

See Chapter 13, Section 13.7, where DDR is covered in detail.

12.3 Stochastic Replenishment Procedures

Some of the stochastic replenishment or consumption-based MRP procedures require that you execute and save the forecast before the system carries out MRP. In such cases, the

Forecasting indicator in the relevant MRP type is marked as mandatory/obligatory, rather than optional. When you execute the forecast on a material, the system looks for the forecasting parameters that you've maintained in the forecasting view of the material master, such as forecasting model and historical or forecast (future) periods. Further, depending on the model that you've selected, it also considers smoothing factors, such as alpha, beta, gamma, or delta. In forecasting, the system considers the planned and unplanned consumption quantities of the material for the periods under evaluation and comes up with forecast (future) figures. When the forecast results are saved, the MRP for forecast-based consumption planning uses these forecast figures to create procurement proposals after the MRP run.

The following stochastic replenishment procedures require executing a forecast as a prerequisite to an MRP run:

Forecast-based planning

Time-phased materials planning

In the following sections, we cover forecast-based and time-phased materials planning.

12.3.1 MRP Type VV

The system updates the consumption data in the material master as total consumption (planned consumption and unplanned consumption) or unplanned consumption. To view the consumption details of the material, go to the **Basic Data** view of a material master (Transaction MM02), and click on the **Additional Data** icon. Of the several tabs, the last tab holds consumption quantities. Per the MRP reservations, the system updates the consumption data of the planned consumption. If consumption isn't planned per MRP reservations, or if the material issuance quantity is greater than the reservation quantities, then the system updates the unplanned consumption.

In MRP type configuration, you can choose the type of historical consumption of a material for planning whether the system uses total consumption or unplanned consumption. You can also choose the reduction method for forecast requirements. The default system setting is reduction by consumption.

As we've already covered forecasting in detail in Chapter 10, we'll only briefly cover details relevant to forecast-based consumption planning. The consumption forecast for components is based on material withdrawals. You can maintain the forecast parameters in the **Forecasting** view of the material master, as shown in Figure 12.12.

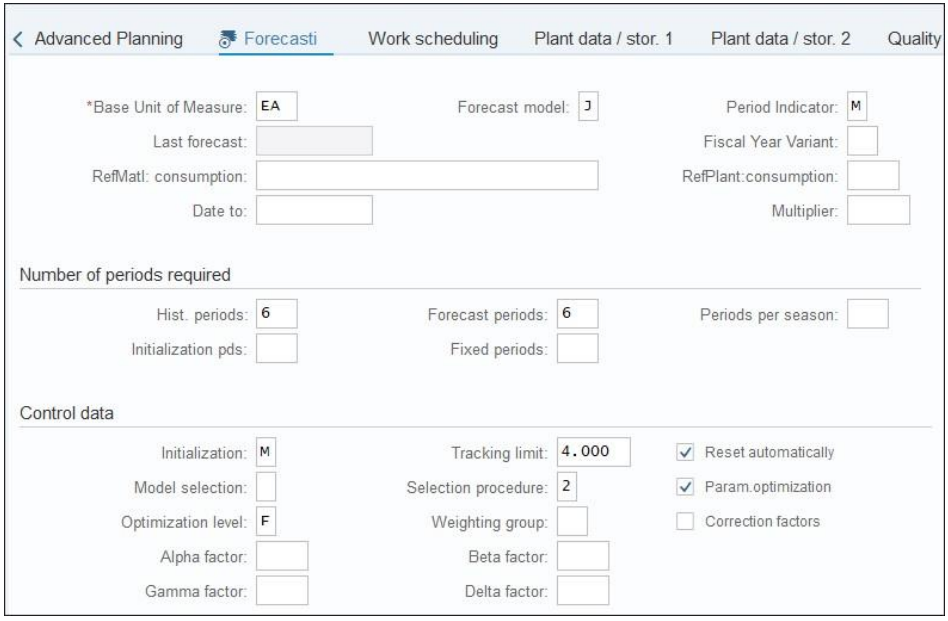


Figure 12.12 Forecasting View of the Material Master

The parameters include the granularity of the forecast, that is, whether it's carried out on the basis of monthly, weekly, or daily values. The granularity can be defined using the **Period Indicator**. Other entries specify the number of historical periods based on which the forecast is carried out, as well as the number of forecast periods. You can either specify the forecast model directly or have it determined automatically. Some of the possible forecast models include the following:

Constant model (**D**)

Trend model (**T**)

Seasonal model (**S**)

Seasonal trend model (**X**)

Moving average (**G**)

The **Execute forecast** button (not shown) located further down in Figure 12.12 enables you to carry out a forecast in the material master, while the other two buttons allow you to edit the historical values and the forecast values.

You can run an individual forecast for a material or as an overall forecast for several materials. For an individual material forecast, use Transaction MP30. After executing the forecast, you can change the forecast results and also correct forecast values interactively. You can change the forecast using Transaction MP31 and display the forecast using Transaction MP32.

For the overall forecast, use Transaction MP38 to restrict the planning scope by plants, materials, and **ABC** indicators. The **ABC** indicator can be maintained in the **MRP 1** view of the material master.

In MRP type VV, the forecast is carried out at an individual material level. In fact, each material can have its own forecasting screen activated in the material master. MRP type VV can also be used for finished goods. There are many situations that call for setting up a finished product to VV. MRP type VV is a consumption-based replenishment strategy in that it maintains inventory in anticipation of actual demand. The inventory is replenished to a forecast, which is based on the material's own consumption history, hence the name material forecast. This is a good strategy when demand is predictable, but the lead time to replenish is long. But by putting "artificial" demand out there by using the forecasting functionality, MRP can generate all supply elements far ahead of time. All that is required is to convert the requisition into an order at the date that the system suggest you do so (see Figure 12.13).

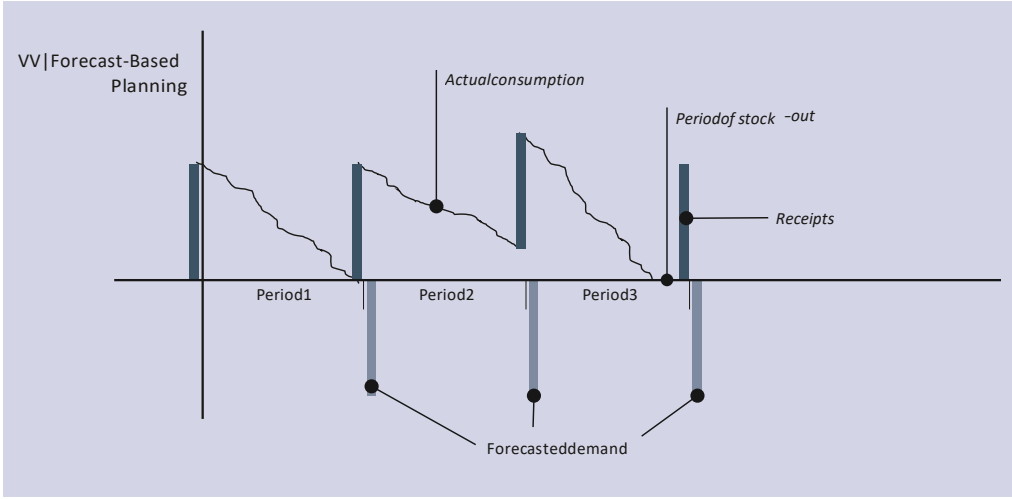


Figure 12.13 MRP Type: VV

[!]

Warning

VV doesn't take demand spikes into consideration. Any changes in demand will flow into the consumption pattern and eventually be picked up by the forecast module. The system might increase or decrease the forecast or state that the current underlying model isn't applicable anymore. So, like all the other strategies, use MRP type VV if and when it meets the business need.

For MRP type VV to function, maintain all the parameters in the **Forecasting** screen of the SAP system. Identify the periodicity by which to run the forecast to create demand with the **Period Indicator** in the **Forecasting** view of the material master. This setting will eventually determine with what frequency the forecast is run automatically for the material in question. The options are listed here:

Daily (D)

Results in daily demand records for every working day visible in Transaction MD04 and relevant to the MRP run. Be aware, however, that a daily forecast will also result in daily replenishment and may be an unnecessary consumption of system's resources. **Weekly (W)**

The most often used periodicity allows for relatively low average inventory holding because doing so brings in less inventory than in a monthly periodicity. It's also flexible and quick to detect spikes and periods of low consumption.

Monthly (M)

Used for less important or less expensive items because doing so brings in large quantities with few orders. **Posting period (P)**

Freely definable according to a period to set up in financial accounting (FI). After the **Period Indicator** is set, you can decide how many periods from the past you want to include in the forecast calculation. It's also possible to set aside a number of periods for an ex-post forecast, and you can identify the number of periods for which the forecast run generates demand.

You can maintain the **Splitting indicator** in configuration menu path, **SAP IMG Production Requirements Planning Forecast Define splitting of Forecast Requirements for MRP**. The **Splitting indicator** contains the number of periods to be considered as well as the number of days and/or weeks for which the splitting is to be carried out (see Figure 12.14).

Plnt	Name 1	SI	Per. Ind.	Period Ind. Descr.	No.Day	No. Wk	Per
1710	Plant 1 US	A	M	Monthly	1	2	4
1710	Plant 1 US	A	W	Weekly	4		16

Figure 12.14 Distributing the Forecast Values to Different Periods

In the **MRP 3** view of the material master, you can assign the **Splitting indicator** in the relevant field (Figure 12.15).

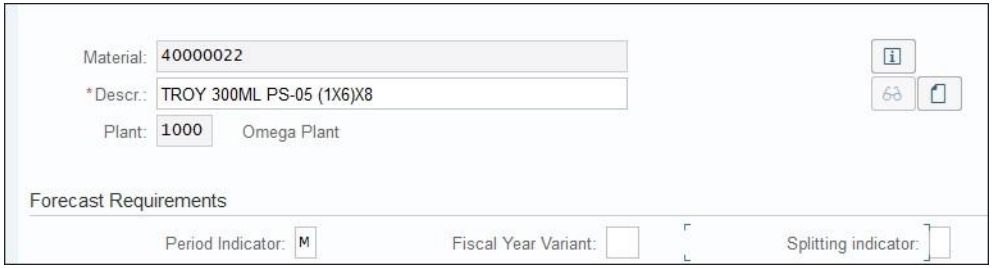


Figure 12.15 Splitting Indicator in the Material Master (MRP 3 View)

12.3.2 MRP Types R1 and R2

Materials that are replenished using a time-phased planning method are scheduled so that the MRP run considers them for planning only at specific dates in the week. This is determined by the planning cycle in which the MRP run is only triggered on specific days of a week. Time-phased planning can be carried out with consumptionbased—stochastic—procedures or with deterministic ones. MRP type R1 simply plans for an MRP run on the days scheduled by the planning cycle, which might lead to stock-outs when large consumption happens on a day not included in the planning cycle. This is where MRP type R2 is the better choice because it calculates a reorder point automatically and triggers the planning run whenever the reorder point is broken.

For example, if a vendor always delivers a material on a certain day of the week due to its own internal route and delivery planning, then it makes sense to carry out your

company's planning run that follows the same cycle and is displaced by the delivery time. Similarly, if the company procures or produces certain material during specific times of the year only, then time-phased planning is used. For example, chocolate manufacturers in a few hot and humid climatic countries cease production during the summer months. In such cases, all production and procurement planning are confined to the defined planning cycle only.

To plan a material based on time phases, you must use Transaction MM02 to enter the **MRP Type** for time-phased planning and the **Planning cycle** in the material master (see Figure

12.16). A forecast is also used in this planning concept, and the general procedure is very similar to forecast-based planning with the difference that the procurement intervals are predefined.

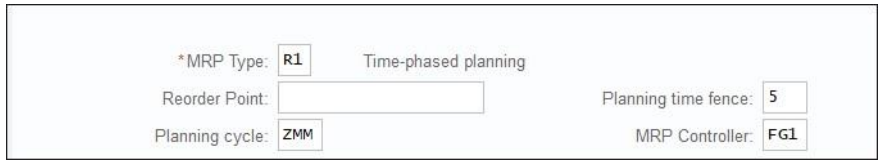


Figure 12.16 Time-Phased Materials Planning

The configuration basics of setting up a planning cycle are the same as setting up a planning calendar, which is described in Chapter 13, Section 13.3.

12.4 Configuring Material Requirements Planning Types

You can configure the MRP type by following the menu path, **SAP IMGProductionMaterial Requirements PlanningMaster DataCheck MRP Types**. Here you see the detailed view of **MRP Type PD** (see Figure 12.17). Almost all options available on this screen, such as firming type, forecast indicator, and consumption indicator, were previously discussed.

You can control the MRP procedure that the system uses in the MRP type. Place the cursor on the **MRP Procedure** field, and click on the dropdown option or press (F4).
Figure 12.18 shows the resulting available list of MRP procedures.

Figure 12.17 Configuration (Transaction SPRO) of MRP Type PD

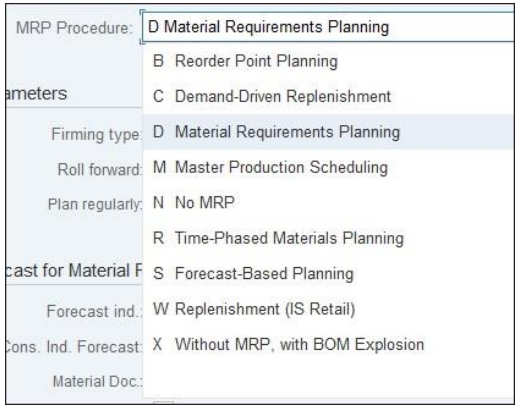


Figure 12.18 MRP Procedures

Note

MRP procedure **X Without MRP, with BOM Explosion** is used in the production planning and detailed scheduling (PP-DS) area of SAP S/4HANA. The use of this MRP procedure and its associated MRP type X0 (see Table 12.2) is covered in Chapter 16, which discusses PP-DS.

Table 12.2 is a side-by-side comparison of the available MRP types in a standard (blank) SAP client and SAP Best Practices client. For the sake of providing as much coverage of different MRP types as possible, we chose to cover the standard client in this chapter.

SAP S/4HANA 1809 – Blank Client		SAP S/4HANA 1809 – Best Practices	
D1	Demand-Driven Replenishment, fixing type -1-	D1	Demand-Driven Replenishment, firming type -1-
M0	MPS, fixing type -0-	M0	MPS, FCST Consumption, No Firming
M1	MPS, fixing type -1-	M1	MPS, FCST Consumption, Auto Firming, New Ords after PTF
M2	MPS, fixing type -2-	M2	MPS, FCST Consumption, Auto Firming, No New Ords in PTF
M3	MPS, fixing type -3-	M3	MPS, FCST Consumption, Manual Firming, New Ords after PTF
M4	MPS, fixing type -4-	M4	MPS, FCST Consumption, Manual Firming, No New Ords in PTF
ND	No planning	ND	No planning
P1	MRP, fixing type -1-	P1	Forecast Consumption, Auto Firming, New Ords after PTF
P2	MRP, fixing type -2-	P2	Forecast Consumption, Auto Firming, No New Ords in PTF
P3	MRP, fixing type -3-	P3	Forecast Consumption, Manual Firming, New Ords after PTF

P4	MRP, fixing type -4-	P4	Forecast Consumption, Manual Firming, No New Ords in PTF

Table 12.2 Available MRP Types

SAP S/4HANA 1809 – Blank Client		SAP S/4HANA 1809 – Best Practices	
PD	MRP	PD	Forecast Consumption, No Planning Time Fence
R1	Time-phased planning	VB	Reorder-Point Planning
R2	Time-phased w.auto.reord.point		
RE	Replenishment plnd externally		
RF	Replenish with dyn.TargetStock		
RP	Replenishment		
V1	Manual reord.point w. ext.reqs		
V2	Autom. reord.point w. ext.reqs		
VB	Manual reorder point planning		
VI	Vendor Managed Inventory		
VM	Automatic reorder point plng		
VS	Seasonal MRP		
VV	Forecast-based planning		
X0	W/O MRP, with BOM Explosion		

Table 12.2 Available MRP Types (Cont.)

12.5 Lot Sizing Procedures

After performing a net requirements calculation, when the system determines a material shortage, it looks to information maintained in the **Lot-Sizing Procedure** field in the **MRP 1**

view of the material master. The lot sizing specifies the quantity that the system should propose when it comes across a quantity shortage of a material. For the system to create the correct lot size as a procurement proposal, it also looks for other information, such as safety stock, maximum or minimum lot size, static or dynamic safety stock, scrap percentage, and rounding value.

It's very important to determine lot sizes to ensure optimum inventories and good service levels. Suppliers occasionally demand minimum order quantities, which end up as excess inventory levels, especially for slow-moving items. It's possible to maintain

inventory controls or gates that are then easier to manage. Between procurement or purchasing and materials planning there is a gate, which means that materials planning should generate the most economical lot size, generate an order proposal with that optimal lot size, and initiate the purchasing process.

The advantage of having these kinds of gates is that you can build a basis for negotiations with the suppliers. For example, if the materials planner applies the conditions in the **Minimum Lot Size** field in the material master, then the MRP run will always generate order proposals using the minimum quantity. Lot-size procedures in the SAP system help the planner find the most optimal quantities to order. An MRP run not only automatically generates the order proposal but also suggests the perfect lot size to bring in, so that availability is assured without holding too much inventory. There are several lot-size procedures already preconfigured and available in the standard SAP system.

The lot sizing procedure is assigned in the **MRP 1** view of the material master (Transaction MM02). For this example in Figure 12.19, assign **Lot Sizing Procedure** as "EX" (**Lot-for-lot order quantity**).

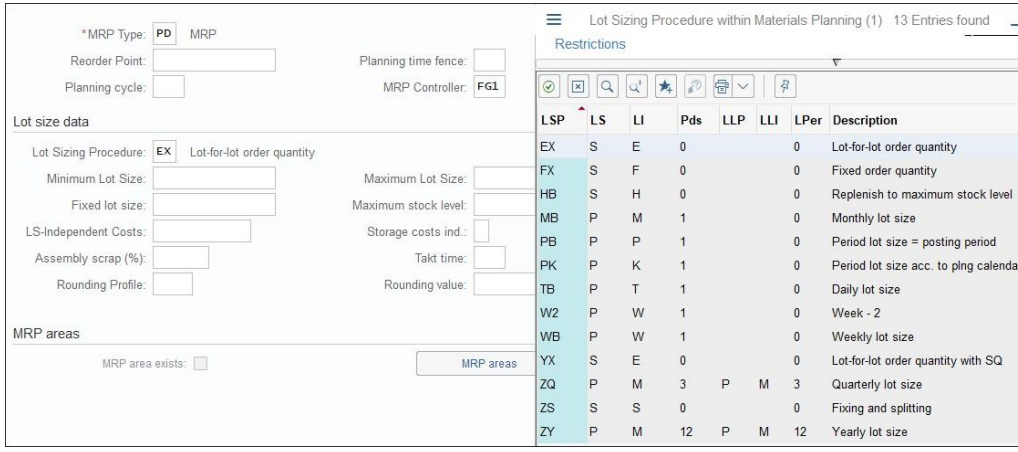


Figure 12.19 Lot Sizing Procedure in the Material Master

There are three different lot-sizing procedures in the SAP system:

Static lot-sizing procedures

Periodic lot-sizing procedures

Optimum lot-sizing procedures

We'll discuss these procedures in the following sections, before moving on to configuring lot sizes.

12.5.1 Static Lot-Sizing Procedures

The static lot-sizing procedures can further be categorized as exact lot sizing, fixed lot sizing, fixed lot sizing with splitting, and replenish to maximum stock level, as described in the following subsections.

Lot Size: EX (Exact Lot Sizing)

The system creates planned orders or procurement proposals to cover the exact shortage requirement only. For example, if a net requirement quantity of a material is 110 units, the system creates the procurement proposal for 110 units only (see Figure 12.20).

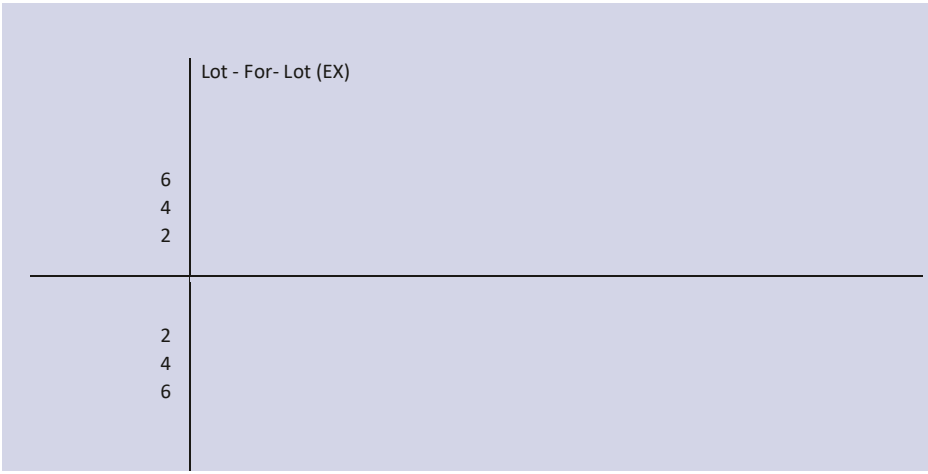


Figure 12.20 Lot Size: EX

Lot Size: FX (Fixed Lot Sizing)

The system proposes the total requirement in multiples of fixed lots. For example, if the lot size is fixed as 60 units, and the shortage quantity is 240, then the system creates 4 planned orders to cover the shortages.

Lot Size: FS (Fixed Lot Sizing with Splitting)

The system proposes the total requirement in multiples of fixed lots with overlap. This lot sizing is generally preferred if you can't procure a large quantity at once and hence must split the quantity with an overlap. With this lot-sizing procedure, you have to assign a fixed

lot quantity together with a rounding value. The rounding value must be a multiple of the fixed lot quantity. For example, if the lot size is fixed as 100 units, and the rounding value is 20 units, then the system creates five planned orders to cover the shortages (see Figure 12.21).

It's also possible to shift the orders by a certain *takt* time, which means a control parameter for scheduling based on takts (i.e., physical areas of a production line). This procedure avoids the simultaneous scheduling of numerous orders and thus ensures that the actually required lead time is observed. If you use splitting in combination with a fixed lot size, the rounding value must be a multiple integer of the fixed lot size. The takt time indicates the offset between order dates in terms of workdays. The different orders overlap in time and are shifted against each other by the takt time.

For example, assign **Lot Sizing Procedure** as "FS" (**Fixed lot with splitting**) and give a **Fixed lot size** of "100". Next, set the **Rounding value** as "25" (it should be a multiple of the fixed lot quantity). Further, maintain a **Takt time** of "3" days (workdays). When the system runs the MRP, assuming there is no existing stock of the material in the plant, it will create four planned orders of 25 each for the total quantity of 100 and will also delay the start date of each planned order by three workdays (takt time).

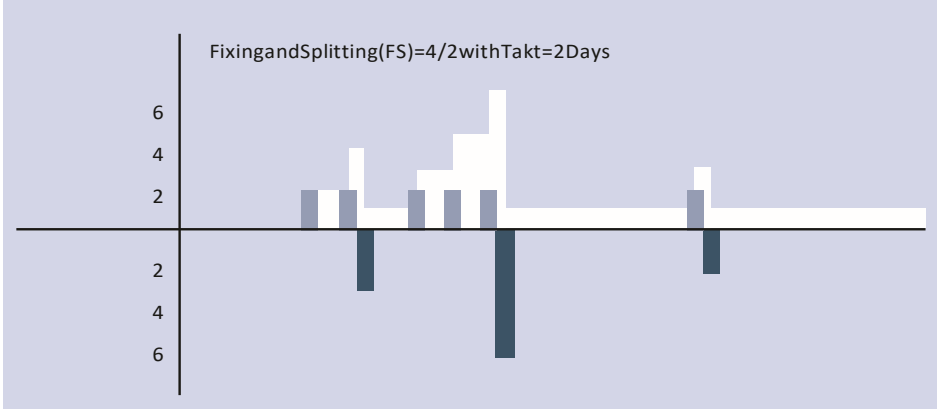


Figure 12.21 Lot Size: FS

Lot Size: HB (Replenish to Maximum Stock Level)

The system creates planned orders to fill it to the maximum stock level. You have to define the maximum stock level in the relevant field of the **MRP 1** view of the material master. For example, if the maximum stock level is 300 units, and the demand quantity is 50 units, the

system creates a planned order of 350. It first ensures that the 300 units of stock fill up, and then the demand quantity is added to it.

When the reorder point is broken, the MRP run figures the difference between the current sock level and the maximum stock level desired and creates a replenishment quantity correspondingly.

When using this lot-sizing procedure, some consumption occurs during the replenishment lead time, and when the replenishment quantity is received, the stock level might be considerably lower than at the time the replenishment quantity was calculated. One way to address this issue is the inclusion of demand within the replenishment lead time by making relevant configuring settings in a lot sizing procedure as covered in Section 12.5.4.

12.5.2 Periodic Lot-Sizing Procedures

The periodic lot-sizing procedures can be further categorized into daily lot sizing, weekly lot sizing, monthly lot sizing, or lot sizing of any other periodicity. For example, if the lot-sizing procedure is daily, then the system considers demand with all the receipts for that day and creates a daily shortage proposal in case a shortage exists. If it's a weekly lot size, then the system combines all the requirements for a week and comes up with one procurement proposal.

In other words, several demands can be covered with a single supply element. These procedures all collect demand in a specified period and create exactly one supply element to cover the total demand quantities in that period. However, it's important to mention that the longer the period, the more inventories need to be maintained. This is because the MRP run generates an order proposal that brings in the entire quantity needed in that period to the date of the first demand. For example, if you're using a three-month period, and you have a demand of one piece on the first date of the first month, the order proposal would bring in the entire quantity needed for three months' worth of demand on the first day. In that case, you would have lots of inventory carrying cost to deal with if the item in question is of high value. Periodic lot-size procedures are effective when used with cheap items with low inventory-carrying costs.

Tips & Tricks

You can use Transaction OMI4 to set the availability date as either the start or the end of the period (Section 12.5.4).

12.5.3 Optimum Lot-Sizing Procedures

In the optimum lot-sizing procedure, the production or purchase of materials entails fixed lot size costs, such as setup costs for machines or PO costs and variable costs, which are referred to as capital tie-up due to stockholding. To minimize the variable costs, you need to ensure that you procure quantities as small as possible. To minimize the fixed costs, you should procure quantities as large as possible. Optimum lotsizing procedures consider variable and fixed costs and determine optimal lot sizes according to different procedures based on these costs.

Example

Phosphoric acid is the main component used in the production of specialized fertilizer, Di-Ammonium Phosphate (DAP). The company wants to replenish to maximum stock of phosphoric acid at the time of placing new orders. However, there are supplier requirements regarding minimum and maximum order limits for shipment. To cater to this business need, you create a new MRP lot size (which may also be a copy of MRP lot size HB: replenish to maximum stock level) and also select the **Check Min. (minimum) lot size** and**Check Max (maximum) lot size** checkboxes. You assign this self-defined MRP lot size to the **MRP 1** view of the material master. The system now prompts you to enter the minimum and maximum lot sizes of the material. Not only will the system now make sure to replenish the material to the maximum stock level, but it will also take the minimum and maximum lot sizes into account while creating procurement proposals.

To illustrate this example further, the storage tank capacity of phosphoric acid is 40,000 MT, the minimum lot size is 20,000 MT, and the maximum is 25,000 MT. Currently, the stock in the storage tank has dropped to 10,000 MT. The system creates one planned order for 25,000 MT, which ensures that this is the maximum lot size it can go up to and still remain within the maximum storage tank capacity of 40,000 MT. If you hadn't defined the minimum or maximum lot sizes, the system would have created a planned order of 30,000 MT to replenish the existing stock of 10,000 MT to the maximum of 40,000 MT.

Optimum lot-size procedures strive to strike a balance between ordering cost and stockholding cost. They are therefore optimizing the total cost of inventory. For example, let's look at the lot-size procedure EX, which brings in—in its simplest version—exactly as much as you need at exactly the time when you need it. In other words, there's no need to carry inventory forward to meet any other demand, but whatever comes in consumed immediately. However, there's certainly an ordering cost that needs to be paid every time there is a demand. So if you have five demands in one month, you'll end up paying for five orders. This is different with a monthly lot-size procedure where you have only one order per month. But if you take the same situation with five demands, the order will bring in the total quantity to meet all demands throughout the months to the first demand, and you'll have to carry forward the stock that isn't consumed by the first demand. On the other hand, you have the cost of only one order.

When you use an optimum lot-size procedure instead, the system (the MRP run) will figure out automatically—for any given demand situation—what the optimum order quantity and order frequency is to arrive at the minimum between ordering cost and stockholding cost. It does so by using various formulas, such as the least unit cost formula, the Groff formula, or the part period balancing formula. They all aim to strike the optimum balance between ordering and stockholding costs.

To determine the variable costs, you need to use the storage costs percentage specified in storage costs indicator (**Storage costs ind.**). You enter the storage costs indicator along with the ordering costs in the **MRP 1** view of the material master. The system calculates the variable costs according to the following formula:

Variable costs = Requirement × Price × Storage costs [%] × Storage duration ÷ 365

In the **MRP 1** view of the material master, you can enter the **Storage costs ind**. as well as **Ordering costs**.

12.5.4 Configuring Lot Size

Table 12.3 is a summary of a selection of standard MRP lot sizes with lot-sizing procedures. When you select a certain lot size, some of them require additional information and must be maintained in the material master, as noted in the final column.

MRP Lot Size	Lot-Sizing Procedure	Lot Size Indicator	Fields
EX: Exact lot size calculation	Static lot size	E: Exact lot size	

FK: Fixed lot size for customer MTO production	Static lot size	F: Fixed lot size	

Table 12.3 Selection of MRP Lot Sizes and Lot-Sizing Procedures

MRP Lot Size	Lot-Sizing Procedure	Lot Size Indicator	Fields
FS: Fixed/splitting	Static lot size	S: Fixed with splitting	**Fixed lot size**, **Rounding value**, **Takt time**
FX: Fixed order quantity	Static lot size	F: Fixed lot size	**Fixed lot size**
HB: Replenish to maximum stock level	Static lot size	H: Replenishment to maximum stock level	**Maximum stock level**
MB: Monthly lot size	Lot size according to flexible period length	M: Monthly lot size	
PK: Lot size according to flexible period length and planning calendar	Lot size according to flexible period	K: Period based on planning calendar	
TB: Daily lot size	Lot size according to flexible period length	T: Daily lot size	
WB: Weekly lot size	Lot size according to flexible period length	W: Weekly lot size	
WI: Least unit cost procedure	Optimization lot size	W: Least unit cost procedure	**Ordering costs**, **Storage costs ind.**
DY: Dynamic lot size creation	Optimization lot size	D: Dynamic planning	**Ordering costs**, **Storage costs ind.**
GR: Groff lot-sizing procedure	Optimization lot size	G: Procedure according to Groff	**Ordering costs**, **Storage costs ind.**

SP: Part-period balancing	Optimization lot size	S: Part-period balancing	**Ordering costs**, **Storage costs ind**.

Table 12.3 Selection of MRP Lot Sizes and Lot-Sizing Procedures (Cont.)

Although standard lot sizes available in the SAP system are generally sufficient to fulfill most business needs, you can configure the MRP lot size to attend to any specific business process.

To configure the MRP lot size, use menu path, **SAP IMGLogisticsProduction**

Material Requirements PlanningPlanningLot-Size CalculationCheck Lot-Sizing Procedures, or use Transaction OMI4. Figure 12.22 displays MRP **Lot Sizing Proc. EX** for an exact lot size calculation.

You can also set different or applicable lot-sizing parameters for short-term and longterm horizons. Procurement/production always takes place with the lot size of the short-term horizon. The long-term horizon enables the forecast function (mostly aggregated, e.g., via monthly periodic lot size). This is often useful in reducing the number of requirement coverage elements, especially if fixed lot sizes are used that are smaller than the average requirement quantity. Typically, a period-based lot size is used for the long-term horizon.

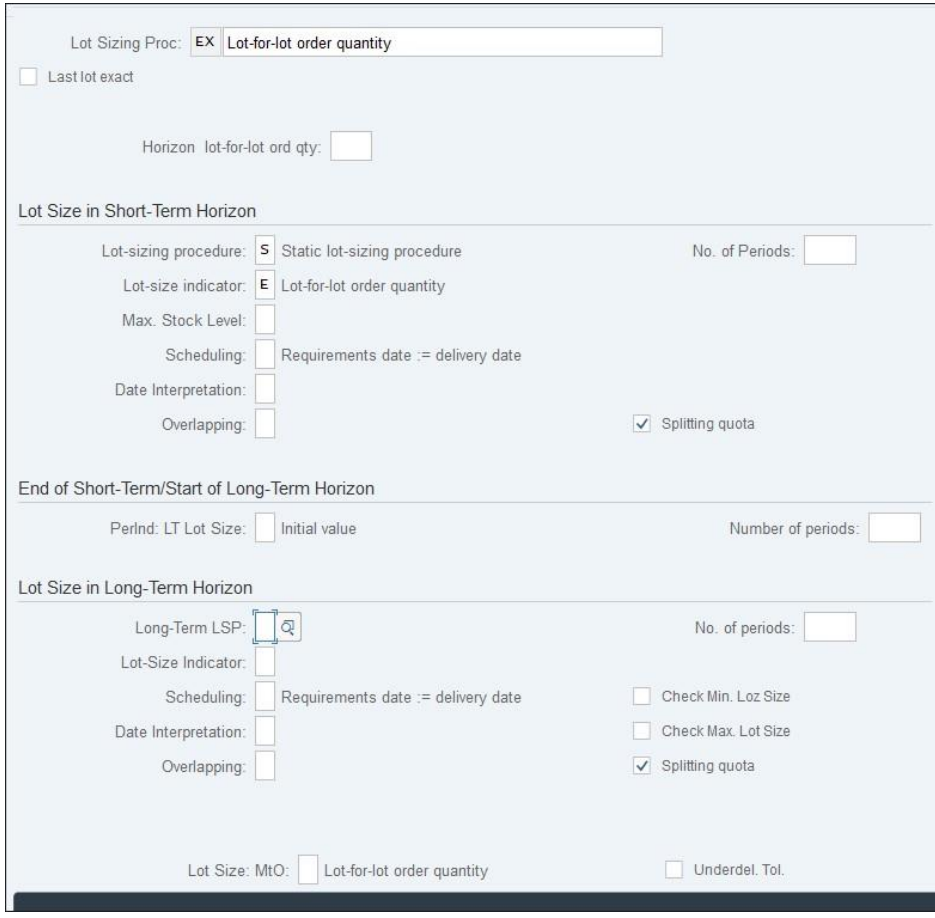


Figure 12.22 Lot Size Configuration

Tips & Tricks

If fixed lot sizes are used for financial or practical reasons, and without any technical need, you can avoid surplus procurements by setting the **Last lot exact** checkbox in the configuration of the MRP lot size. This is particularly applicable for higher value goods.

12.6 Rounding

In some cases, it's useful to round the quantities of the procurement proposals. In the simplest business scenario, you can use a rounding value. In this case, the order quantity of the requirement coverage element always represents a multiple of the rounding value. In more complex scenarios where the rounding value depends on the requirement quantity, you can use a rounding profile. The rounding profile enables you, for example, to model different pack sizes.

The system offers static and dynamic rounding profiles. The *static* rounding profiles round up the value after a threshold value has been reached. If the rounding value exceeds the threshold, the system continuously rounds the value until it reaches the next threshold. You can create rounding profiles by using Transaction OWD1.

Example

If the rounding value is 30 units, the procurement quantity is 75 units, and the minimum lot size is 15 units, then the system always rounds up the planned order to a multiple of 30 units, specifying the rounding to a quantity of 30 units. In this example, the system rounds off the procurement quantity of 75 units to 90. You can use the **Rounding value** option in the **MRP 1** view of the material master in almost all lotsizing procedures.

The static rounding value method may not fulfill all business scenarios in which a given rounding value is used and the procurement proposals are rounding to that value. There may also be business processes in which the rounding value may change based on the size of the procurement proposal. In such instances, you can use a static rounding profile. For example, you can configure the system to have a rounded value of 10 units if the procurement

quantity is at least 1 unit. For the procurement quantity of 31 units or more, the system should round this off to 50 units.

Using Transaction OWD1, this example in Figure 12.231 shows that a **Rounding Profile PP01** has been created for **Plant 1000**. Click on the **Static** button, and the next screen 2 pops up. Enter the threshold values and the rounding values. Click on the **Simulation** button to bring up the **Simulation Selection** dialog box 3. Enter the **Quantity simulation** of "1" unit and **to qty** of "150", and choose **Continue**. The system then displays the simulation results 4.

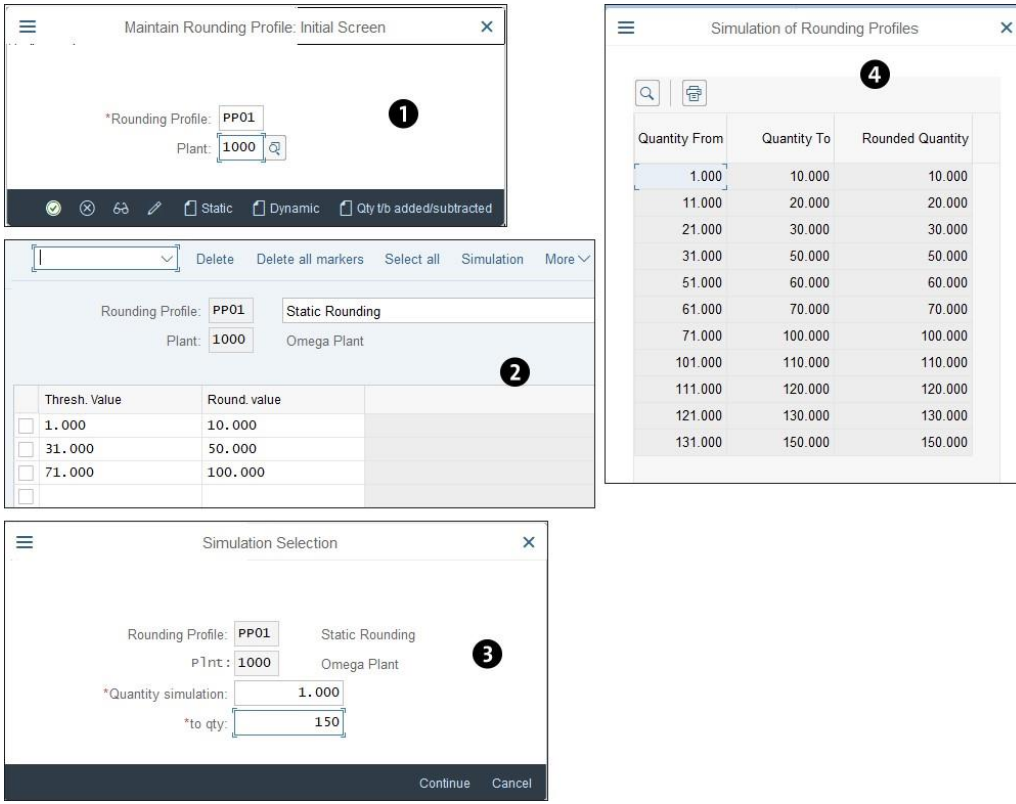


Figure 12.23 Rounding Profile (Static)

If you want to specify how the system acts when it reaches a certain threshold value by either adding up or reducing the quantity to the defined percentage, go back to Figure 12.231. This time, click on the **Qty t/b added/subtracted** button, and the screen shown in Figure 12.24 appears. You can define the threshold values and then enter the percentage that the system should add or subtract to the procurement quantity. So, if the procurement quantity is less than or equal to 100 PC, the system

will add up to 10% to it. When the procurement quantity is greater than 100 but less than or equal to 200, it will reduce the quantity by 15%.

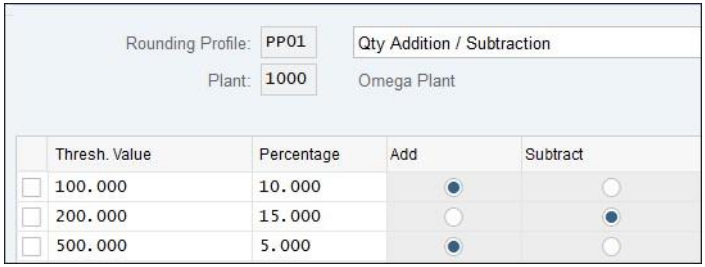


Figure 12.24 Quantity Addition/Subtraction Profiles

In a dynamic rounding profile, you need to define the rounding off method as well as the rounding rule. The rounding off method may be a multiple of order unit or sales order. You can also use an available customer exit to define any unique rounding method. For a rounding rule, you can either round up or down the threshold value by the defined percentage.

12.7 Scrap

Companies are often faced with problems relating to materials they can't use, known as scrap, whether from defective finished goods produced, excess consumption of raw material due to wastage in the production process, or operational inefficiencies. The SAP system offers several options to maintain scrap or waste details at every level—the assembly or the component (raw material) level—so that production and procurement planning are closely synchronized with actual and practical situations.

Based on historical data or practical experience, you can maintain assembly and component scrap as master data, which subsequently facilitates production and procurement processes. Scrap is treated differently in the SAP system. Scrap in real life can be available or even sold but isn't treated as inventory in the SAP system.

The two types of scrap described here are as follows:

Assembly scrap

This is completely unusable finished or semifinished product for which the raw material was issued in accordance with a BOM. Assembly scrap is different from co-products or by-products, which are inventory managed in the SAP system.

Component scrap

This allows the system to increase the issuance quantity of the component against a production order by the defined percentage to account for scrap or wastage during production.

Successfully assigning assembly and component scrap in master data enables an SAP system to consider scrap not only during production planning—either by increasing production quantity to account for assembly scrap or increasing the issuance quantity to account for component scrap—but also during procurement planning. During the MRP run, the system takes the scrap percentage into account and reflects it in the planning proposals generated.

To enter the details of assembly or component scrap in the MRP view of the material master, follow the menu path**, LogisticsMaterials ManagementMaterial MasterMaterialChangeImmediately**, or use Transaction MM02.

In the following sections, we'll provide additional details on the different types of scrap and also explain how to maintain details of their different uses.

12.7.1 Assembly Scrap

You can enter assembly scrap in the **MRP 1** view of the material master. Here, enter the assembly scrap in the form of a percentage in the **Assembly scrap (%)** field. If this material is then used as an assembly, the system considers it during scrap calculation by correspondingly increasing the production order quantity. For example, say you've defined an assembly scrap of 10% for the material. When you create a production order, say of quantity 100 PC, the system automatically increases the production order quantity to 110 PC to account for 10% scrap. At the same time, it also issues an information message. Because the production order quantity increased to 110 PC, the system accordingly increases the components' quantities also, as it reads this information from the material's BOM (and multiplies the production order quantity, which, in this case, is now 110 PC with the components' quantities).

12.7.2 Component Scrap

You can enter component scrap in the **MRP 4** view of the material master in the form of a percentage. If this material is then used as a component in the BOM, the system considers it during scrap calculation. For example, entering 10% scrap for 100 kg of

component material increases the component issuance quantity in the production order to 110 kg (see Figure 12.25).

Figure 12.25 Component Scrap

12.7.3 Operations and Component Scraps in Bill of Materials

In Transaction CS02, to change a BOM for a material, click on the **Item overview** column. In the screen that appears (see Figure 12.26), you can enter operation scrap as well as component scrap in percentages. When you enter operation scrap in a percentage, you also select the **Net ID** checkbox.

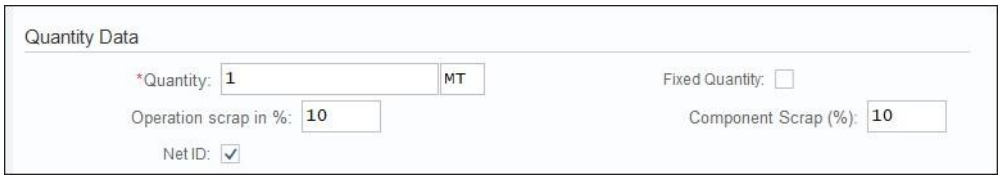


Figure 12.26 Operation and Component Scrap in the BOM

If you enter both operation scrap and component scrap in the BOM, the system takes *both* of them into account. For example, for the component quantity of 1.00 kg, the system calculates the final component issuance quantity as 1.21 kg, after first taking operation scrap and then component scrap into account. That is, it used the calculations 1.00 kg × 1.10 = 1.10 kg and then again 1.10 kg × 1.10 = 1.21 kg.

Tips & Tricks

Maintaining a component scrap percentage in a material master (Figure 12.25) will enable the system to consider the *same* scrap percentage whenever and wherever this component is used in any material's BOM. However, if there's a business scenario to maintain different scrap percentages of the component used in different products, then it makes sense to maintain the component scrap details in each material's BOM (Figure 12.26).

For example, raw tomatoes are used as a component in producing different products. If the *same* quantity of raw tomatoes are wasted (as scrap) in producing different products, then maintain this scrap percentage in the material master for raw tomatoes. However, if raw tomatoes wastage percentages are *different* for different products, such as tomato ketchup, tomato paste, tomato puree, and tomato soup, then maintain these individual wastage (scrap) percentages in each of the four tomato-based products so that the SAP system correctly calculates the raw tomatoes quantities required to procure and/or produce each of the four products and their associated wastages.

12.7.4 Scrap in Routing

You use Transaction CA02 to change a routing for a material. In the **Item overview** column, go to the **General data** area (see Figure 12.27). You can enter operation scrap as a percentage. When you create a production order, the system increases the component issuance quantity by the defined percentage to account for operation scrap in the routing.

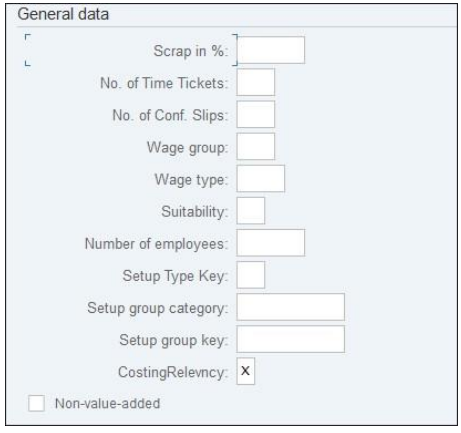


Figure 12.27 Scrap in Routing

12.8 Safety Stock

Safety stocks are quantity or time buffers to account for variability in supply and demand. The system offers two types of safety stock: static (i.e., absolute) safety stock and dynamic safety stock (i.e., safety days' supply).

In the following sections, we'll cover how the safety stock availability can be used in net requirements calculation and also the selection method that the system uses for receipts.

12.8.1 Static Safety Stock

The static or absolute safety stock enables the system to subtract it from material availability calculations (net requirements calculation). The safety stock must always be available to cover for unforeseen material shortages or unexpected high demand (see Figure 12.28).

The static safety stock certainly has its uses, especially when your objective is to guarantee 100% availability on a cheap part; however, for most situations, the system will drive up dead stock because the variability in demand may lead to a constant availability of stock that may never really be used.

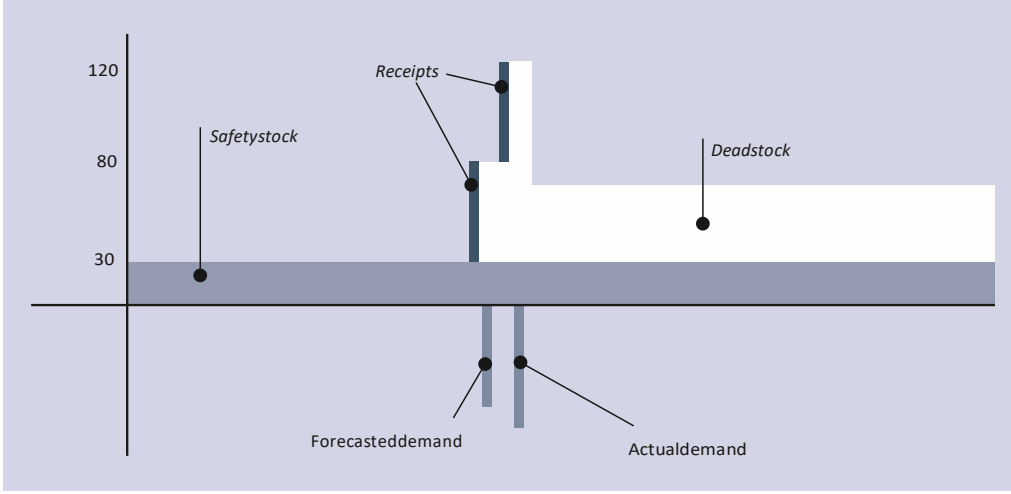


Figure 12.28 Static Safety Stock

The simplest buffering strategy of all is the use of a static safety stock that can be maintained manually in the **Safety stock** field (see Figure 12.29). Maintain a safety stock quantity, and the MRP run will ignore that quantity for planning purposes and set it aside for bad times. In fact, the **Stock/Requirements List** in Transaction MD04 subtracts that safety stock in the first line and then works without it for everything it does and looks at.

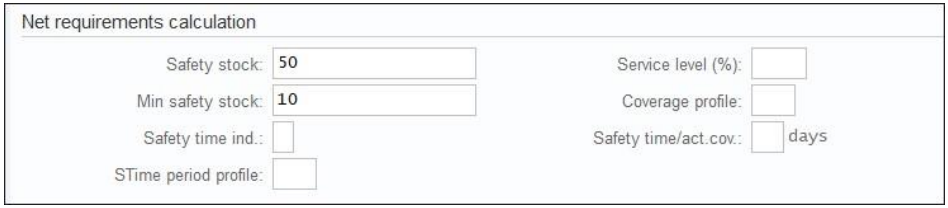


Figure 12.29 Safety Stock and Safety Days' Supply

Figure 12.30 (Transaction MD04) shows that the safety stock quantity is immediately subtracted from free available stock and simply ignored for all future planning.

Figure 12.30 Not Considering Safety Stock as an Available Quantity

12.8.2 Safety Stock Availability

To avoid the unnecessary creation of planned orders for a smaller quantity, which can otherwise be covered by the safety stock, you can define the percentage (share) of safety stock that the system can use in such business scenarios. For example, during the MRP run, the system assesses a shortage of 2 PC of a material. You have, however, maintained a safety stock of 40 PC for this material, which the system doesn't consider in the MRP run. If you define that a 10% safety stock can be used to account for smaller shortages, which for this example means that 4 PC come from safety stock, then the system can cater to this small requirement or shortage of 2 PC from the 4 PC available from safety stock and no longer creates a procurement proposal.

To define the safety stock parameters, use configuration menu path, **SAP IMG LogisticsProductionMaterial Requirements PlanningPlanningMRP CalculationStocksDefine Safety Stock Availability**. For this example, the system can consider 10% of the safety stock for **Plnt 1000** and **MRP Group 0001** for net requirements calculation (see Figure 12.31). You eventually assign the MRP group in the **MRP 1** view of the material master.

Figure 12.31 Share of Safety Stock

12.8.3 Dynamic Safety Stock with Range of Coverage Profile

A dynamic safety stock in the SAP system can be employed by use of the **Range of Coverage** profile. With the receipts-forecasted demand safety stock profile, you can set a target dynamic safety stock, a minimum level, and a maximum level. If effectively implemented, then the MRP run will always try to keep the target dynamic safety stock available for planning. But other than with the static safety stock, no additional quantities are brought in unless the safety stock falls below the minimum. Therefore, if you set the minimum low in planning, all safety stock is used as a buffer. Additionally, if the actual demand turns out to be less than what was planned, the maximum level in the coverage profile keeps the stock from blowing up in case of under-consumption of the planned demand.

In case of a fixed lot size or a minimum order quantity, the target coverage may be exceeded. But the coverage profile also has a maximum coverage due to a fixed lot size or a rounding value.

In a coverage profile, the levels (minimum, target, and maximum) aren't set in quantities but are managed in days of coverage. That fact provides the dynamic part of the safety stock because the objective is to hold three days of future demand in safety to buffer demand and supply variability. That means, if the demand goes up, there's more safety stock, and if the demand goes down, it'll be less.

To set up the range of coverage profile, follow the configuration menu path, **SAP IMG Production Material Requirements Planning Planning MRP Calculation Define Range of Coverage Profile (Dynamic Safety Stock)**, or use Transaction OMIA (see Figure 12.32).

The **Determine range of coverage** area is used to calculate the future daily demand. This is done by collecting demand over a horizon (you have to set the horizon here in the first section), and then the total is divided by the number of days within that horizon (working days or calendar days must be identified in this section) to arrive at a future average daily

demand. This future average daily demand is then multiplied with the levels you set in the **Determine average requirements** area. Therefore, when calculated, you end up with a quantity for minimum target and maximum target. For example, if the levels are Min. = 1, Tgt = 5, and Max. = 20, and the future average daily demand was 10 pieces for the next three months, then the levels will be 10 pieces minimum, 50 pieces target dynamic safety stock, and a maximum desired stock level of 200 pieces.

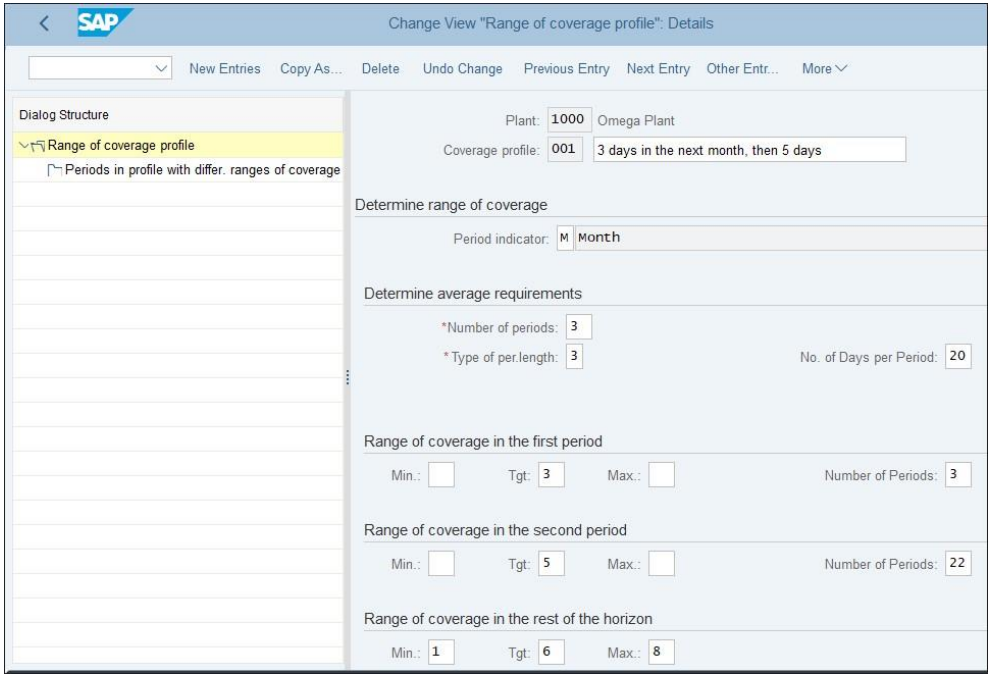


Figure 12.32 Range of Coverage Profile

It's important to note that those numbers are only valid for the period where the future average daily demand is 10 pieces. If that changes, the levels change also.

Figure 12.32 shows **Coverage profile** "001" for **Plant** "1000".

The dynamic safety stock is calculated by the formula:

Dynamic safety stock = Average daily requirement × Range of coverage

In this equation, the average daily requirement is calculated by the formula:

Requirements in the specified periods ÷ Number of days in the total period length

For the calculation of the average daily requirements, the following parameters must be maintained: **Period indicator**

This indicator determines the calendar period for which average daily requirements needs to be carried out. The following values can be maintained: weeks (**W**), months (**M**), and periods according to the planning calendar (**K**). For this example, maintain "M" for a monthly coverage of safety stock.

Type of per.length

This indicator is used to determine the length of the individual periods in detail. The following values can be maintained: workdays, calendar days, standard days. If standard days is selected as a period length, the number of days determined per period must be maintained in the field.

Number of periods

The number of periods are defined that are used to calculate the average daily requirements.

Range of coverage profile in the first period

The **Number of Periods** is "3" months. The **No. of Days per Period** is "20" days.

Range of coverage in the second period

The target safety stock (**Tgt**) is to cover "5" days.

Range of coverage in the rest of the horizon

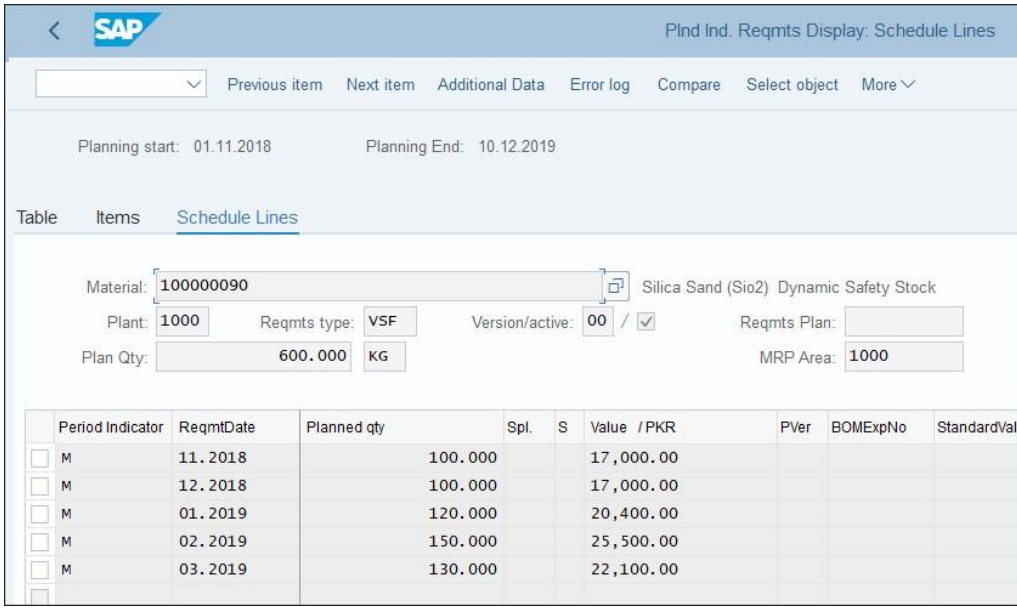
A minimum stock of "1" day, target stock of "6" months, and a maximum of "8" days of target safety stock are planned.

Figure 12.33 is the **MRP 2** view of material master wherein you assign the previously configured **Coverage profile** "001" for plant "1000".

Figure 12.33 Assigning the Coverage Profile in the Material Master

With these configuration and master data settings in place, let's now show the dynamic safety stock calculation with an example.

Figure 12.34 is the monthly requirement (PIRs – Transaction MD61) shown in the **Planned qty** column for the next five months for **Material 100000090** and **Plant 1000**.



Period Indicator	ReqmtDate	Planned qty	Spl.	S	Value / PKR	PVer	BOMExpNo	StandardVal.
M	11.2018	100.000			17,000.00			
M	12.2018	100.000			17,000.00			
M	01.2019	120.000			20,400.00			
M	02.2019	150.000			25,500.00			
M	03.2019	130.000			22,100.00			

Figure 12.34 Independent Requirements

After running MRP Live (Transaction MD01N), go to **Stock/requirement list** (Transaction MD04), as shown in Figure 12.36.

Let's evaluate the planning results in detail. Because it's already November, the system calculates safety stock requirements for the *next* month (December) by considering average daily requirement for the next three months (December, January, and February). Here the system considers three months because in the coverage profile, the period maintained was "3" (three months):

((100 + 120 + 150 kg) PIRs) ÷ (3 (Period) × 20 (Standard days of each period)) = 370 ÷ 60 = 6.16 kg of Daily average requirement

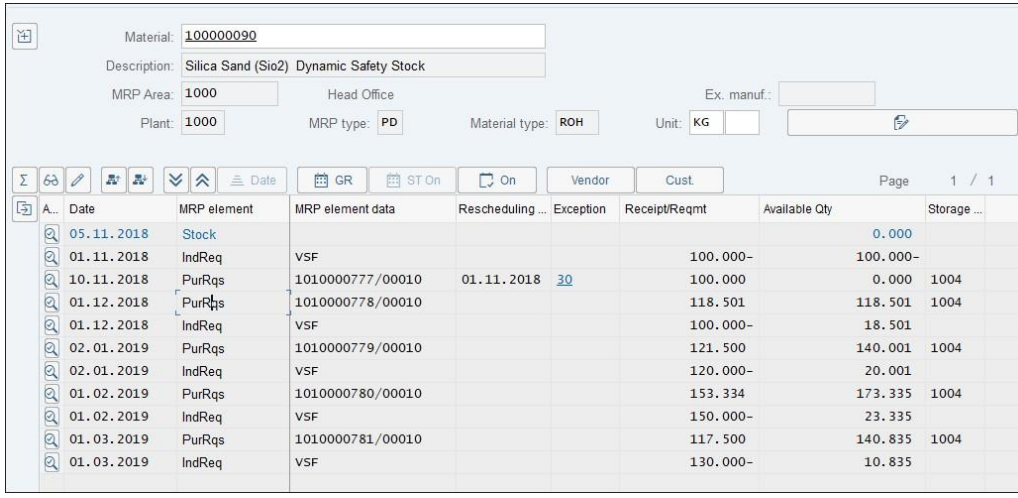
Note

All requirements and calculations are in kilograms (kg) and all calculations are rounded off to two decimal places.

Because the target days of first period in coverage profile is maintained as "3" days of daily average requirement (6.16 kg), therefore to cover this requirement of three days of safety stock (dynamically calculated) is calculated as:

6.16 (Average daily requirement) × 3 (Three days of target safety stock) = 18.51 kg of safety stock (Period 1)

Figure 12.35 shows that in December, 2018, the system created a purchase requisition **1010000778** for quantity **118.51 KG** (100 kg was the original requirement while 18.51 kg was to account for three days of safety stock).



A...	Date	MRP element	MRP element data	Rescheduling ...	Exception	Receipt/Reqmt	Available Qty	Storage ...
	05.11.2018	Stock					0.000	
	01.11.2018	IndReq	VSF			100.000-	100.000-	
	10.11.2018	PurRqs	1010000777/00010	01.11.2018	30	100.000	0.000	1004
	01.12.2018	PurRqs	1010000778/00010			118.501	118.501	1004
	01.12.2018	IndReq	VSF			100.000-	18.501	
	02.01.2019	PurRqs	1010000779/00010			121.500	140.001	1004
	02.01.2019	IndReq	VSF			120.000-	20.001	
	01.02.2019	PurRqs	1010000780/00010			153.334	173.335	1004
	01.02.2019	IndReq	VSF			150.000-	23.335	
	01.03.2019	PurRqs	1010000781/00010			117.500	140.835	1004
	01.03.2019	IndReq	VSF			130.000-	10.835	

Figure 12.35 Procurement Proposals Created after the MRP Run

Let's now also see how the system calculates safety stock for the next month (January, 2019). For the *next* month's (January) safety stock requirement's calculation, the system considers requirements for the next three months (January, February, and March):

(120 + 150 + 130 – PIRs) ÷ (3 (Period) × 20 (Standard days of each period)) = 6.66 Requirement per day

The target days of the first period in the coverage profile is maintained as "3" days; therefore, to cover this requirement of three days of safety stock (dynamically calculated) is calculated as 6.66 × 3 = 20.00 of safety stock. This quantity can be seen in the **Available**

Qty column. The requisition **1010000779** is created for quantity 121.50 kg against the requirement of 120 kg because the system takes into account the availability of safety stock of 18.5 kg from the previous month (December) to calculate the net requirement quantity (20 kg of safety stock required for January versus 18.5 available from December, and hence the net quantity needed for January is 1.5 kg (20.0 – 18.5)). Therefore, the purchase requisition quantity is for 121.50 kg against the PIR of 120 kg.

Figure 12.36 is the summarized view in which the **Targ.** (target) **Stock** column validates the safety stock calculations shown earlier.

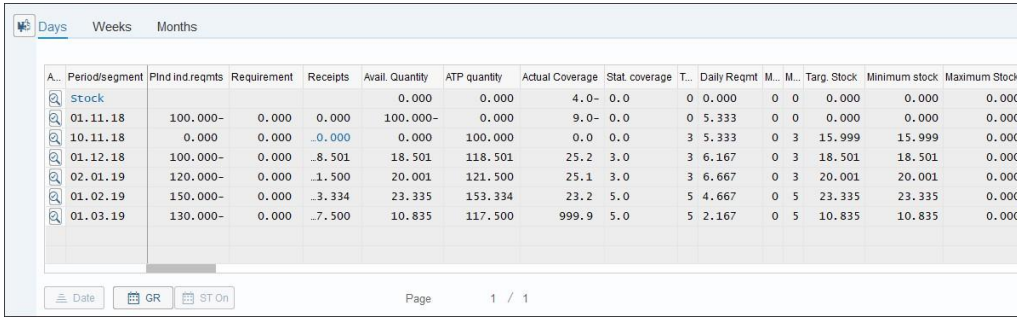


Figure 12.36 Actual Coverage and Days' Supply

12.8.4 Safety Stock and Safety Time

For days' supply/safety time, the system plans the GR in advance by the period specified as safety time. Thus, planned days' supply of the stock, in fact, corresponds to the number of days specified as safety time. The system shifts back the date of the receipts by the number of working days and also takes the factory calendar into account.

In the **MRP 2** view of the material master, you'll also find the **Safety Time/act.cov.** field. The system uses the number of days you fill in this field to simulate the requirements to an earlier date, displaced exactly by those number of days. By using this field, you pull your requirements in so that the MRP run creates the receipts for replenishment order proposals to an earlier date. Therefore, safety time is a time buffer and doesn't increase any quantities. Because the actual requirement doesn't change, the only difference is that the receipt comes in earlier and provides an additional coverage for the time it was pulled forward.

The fact that the safety time brings the receipts in earlier as actually needed serves the purpose that when there's a supply delay. It therefore provides a time float and thus works alongside the safety stock, which acts as a quantity float.

You make the relevant entries in the **MRP 2** view of the material master. The system refers to the planning of a safety days' supply as safety time. To consider the safety time, you need to set the **Safety time ind.** to "1" (for independent requirements) or "2" (for all requirements), and then also give the **Safety time/act.cov.** in days. Further, you can define deviations from the constant safety time using a safety time period profile (**STime period profile** field).

12.9 Scheduling

For the system to automatically schedule procurement proposals during the MRP run, it's important to maintain the requisite information in the MRP views of the material master. In the following sections, we'll discuss the options to maintain lead time details for in-house and external procurement that then enable the system to ensure effective planning and scheduling of both in-house and externally procured materials.

12.9.1 Scheduling In-House Production

You can schedule the in-house production in the planning run, and the system creates planned orders in two different ways:

Basic date determination

The system schedules the dates based on the production time defined in the material master.

Lead time scheduling

The system schedules the dates (and time) based on the information in the routing (or master recipe). Besides a more detailed scheduling result, the MRP run can also generate capacity requirements for the planned orders, and perform capacity planning, sequencing, leveling, and scheduling with planned orders.

In an MRP run, you can select the option for the system to schedule based on basic date determination or lead time scheduling.

12.9.2 Basic Date Determination

Basic date determination is a type of scheduling that determines the basic dates within which production is to take place. For this reason, the in-house production time defined by the basic dates should be bigger than or equal to the in-house production time defined by the

routing explosion. In an MRP run, the system first calculates the basic order dates from the data in the material master. Then, in detailed planning, it uses the data in the routing. In the context of basic date scheduling, no operation dates are defined, and no capacity requirements are generated. The determination of the in-house production time can be carried out as quantity dependent or quantity independent. In both cases, the system refers to the entries in the material master and also takes the factory calendar into account.

Tips & Tricks

You can use Transactions CA96 and CA97 to update the **In-house production** parameter in terms of **days** in the **MRP 2** view of the material master (see Figure 12.37). At the same time, Transaction CA97 helps you update the **Assembly Scrap** field in the material master, which is taken from the total operation scrap in the routing of material.

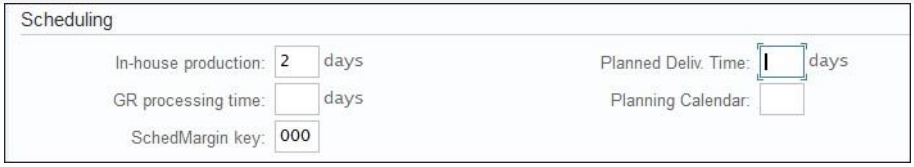


Figure 12.37 In-House Production Time and Scheduling Margin Key

Note

The scheduling margin key (SMK) is the float consisting of the number of days it takes to release a production order and the number of days before and after production when the material finally becomes available. SMKs are buffer times for scheduling.

The next two sections cover in-house production times that are either dependent or independent of quantity produced.

Quantity-Independent In-House Production Time

In this case, the in-house production time doesn't depend on the order quantity; that is, small quantities require the same amount of time as large quantities. This assumption is valid for planning if the order quantity is limited by the lot-sizing procedure, if experience

has shown that order quantities usually don't differ very much, or if the daily granularity can cover the fluctuations of the order quantity.

Quantity-Dependent In-House Production Time

If you can no longer ignore the influence of the order quantity of the in-house production time, you can also calculate the in-house production time as quantity-dependent. For this purpose, you need to carry out a detailed evaluation of the in-house production times and maintain the **Setup time**, **Interoperation**, and **Processing time** fields as well as the **Base quantity** in the **Work Scheduling** view of the material master (see Figure 12.38). The interoperation time represents a summary of move times, wait times, and safety times. Only the processing time is quantity-dependent because it depends on the base quantity. The setup and interoperation times are quantity-independent and are added to the processing time.

The following formula describes the quantity-dependent in-house production time:

In-house production time = Setup + (Order quantity ÷ Base quantity) × Processing time + Interoperation time

You can maintain parameters either for the quantity-independent or quantitydependent in-house production time (see Figure 12.38).

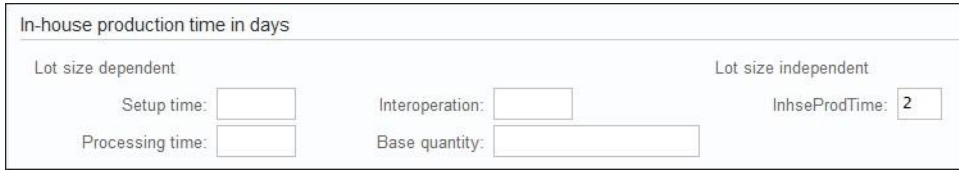


Figure 12.38 In-House Production Time in Days

12.9.3 Planned Order Dates

In backward scheduling, you can derive the dates for the planned order from the requirement date. To do this, you must deduct the various periods, including opening period, in-house production time, and GR processing time, from the requirement date.

In forward scheduling, the system shifts the order start date to the current date, and the opening period is omitted. Forward scheduling occurs in the MRP run only if the requirement date is too close to the current date.

Figure 12.39 shows the **Dates** area for the planned order for the material, in which it takes the various dates into account to arrive at the start and finish dates of the order. Because this

is backward scheduling, enter the **End** (order finish) date as "04.02.2019". The system uses SMK 001 to come up with the basic date calculations. All dates are in workdays (Monday through Friday) per the factory calendar.

Figure 12.39 Basic Dates Determination in a Planned Order

While remaining in the **Change Planned Order** screen, you can also perform scheduling by clicking on the relevant icon. In scheduling, the system accurately calculates the time it takes to perform each activity at every operation of the work center.

12.9.4 Scheduling External Procurement

When planned orders for externally procured materials or purchase requisitions are created, the system refers to the **Planned Deliv. Time** information in the material master to calculate how long (on average) it will take for the supplier to deliver the requisite material (see Figure 12.40).

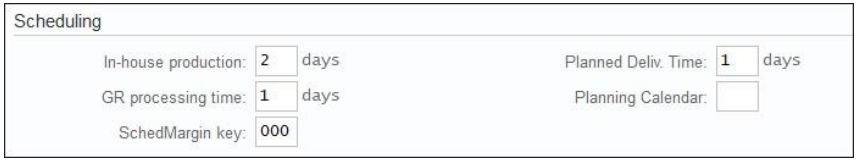


Figure 12.40 Scheduling for Planned Delivery Time

The planned delivery time refers to workdays that appear in the factory calendar, provided you haven't specified a planning calendar. As an alternative to determining the planned delivery time from the material master, you can determine the planned delivery time from the purchasing info record. If you want to do this, this scheduling type must be allowed in the plant parameters. Moreover, the source list for the material must contain a relevant entry.

Tips & Tricks

You can use Transaction WPDTC to calculate and compare the planned delivery time of a material (or group of materials) in the material master, purchasing info record, and vendor.

The scheduling process for external procurement is carried out similarly to that of inhouse production except that it uses four periods (for backward scheduling):

Opening period

Purchasing department processing time

Planned delivery time

GR processing time

These periods are deducted from the requirement date. The purchasing department processing time is maintained in the **Plant parameters** area (see Figure 12.41). These options are described in Section 12.11.3.

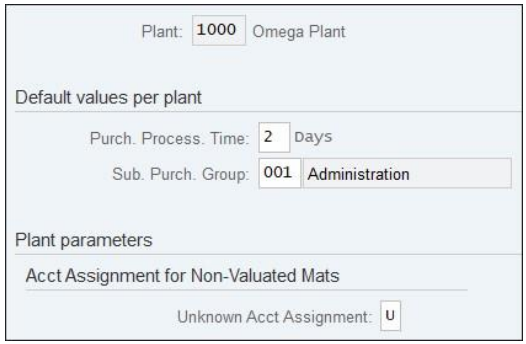


Figure 12.41 Purchase Processing Time in Configuration

12.9.5 Forward and Backward Scheduling

You can make a distinction between the scheduling types regarding whether you want to use backward scheduling or forward scheduling, and you can also choose whether production takes place in-house or externally.

Similarly, the following interdependencies also exist for different MRP procedures:

Materials planned in forecast-based planning

MRP

For the two MRP procedures, the start dates are known, and the planning should ensure that materials are available on these dates. The determination of basic dates for in-house production and of the release date for purchasing therefore occurs as *backward scheduling* in these MRP procedures. Only if the basic date determined during scheduling is in the past does the system automatically switch to *forward scheduling* from today's date (when the MRP run took place).

In reorder point planning, the dates are defined by means of forward scheduling. After the reorder point is fallen short of during the MRP run, you need to initiate the procurement activities. The availability date of the materials is determined based on the date of the material shortage.

For external procurement, the order finish date corresponds to the delivery date, while the order start date corresponds to the release date. Here, the processing time in purchasing, the GR processing time in terms of workdays, and the planned delivery time of the material in terms of calendar days are all taken into account. For external procurement, the system creates either a planned order or a purchase requisition. Purchase requisitions for external procurement plan the external procurement quantity. After the system completes the planning, you can convert the planned order into a purchase requisition, and then the purchase requisition gets converted into a PO. In the initial screen of the planning run, you can use the **Creation** indicator for purchase requisitions to define whether the system should directly create purchase requisitions or whether it should first create planned orders.

If a delivery plan exists for a material, and the source list contains an MRP-relevant entry, you can directly generate delivery schedules in MRP. This applies if you have a scheduling agreement of materials with the vendor. You can do this by specifying the **Creation** indicator for delivery schedules in the initial screen of the planning run.

12.10 Procurement Proposals

When you run MRP in the system, the system looks for procurement type information to decide if the ensuing procurement proposals entail in-house production, external procurement, or both. The **Procurement type** in the **MRP 2** view of the material master defines which of the alternatives applies to the material in the plant (see Figure 12.42). If both in-house production and external procurement are allowed, MRP assumes in-house production by default. For example, the raw material is generally not sold or produced in-house, so it makes sense to maintain the procurement

type as external. Similarly, the finished product isn't procured but instead is produced in-house, so it makes sense to assign it an in-house procurement type. Finally, the semifinished good may be produced in-house as well as procured externally, so you may assign it the procurement type as both.

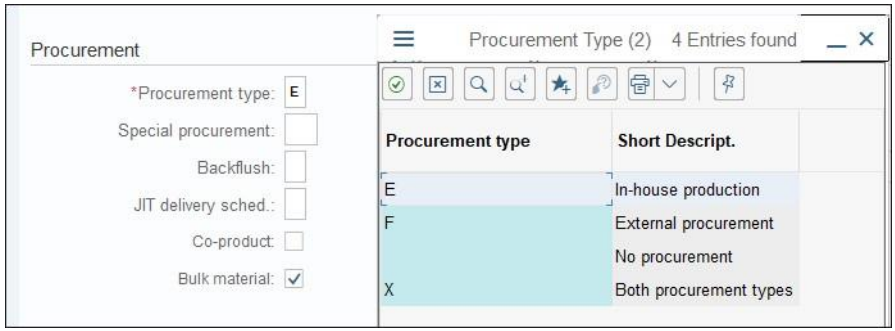


Figure 12.42 Procurement Type in the Material Master

In the MRP run, the system creates planned orders. These planned orders are converted into a production order (or process order) for in-house production. For external procurement, the planned order can be converted into a purchase requisition, which in turn is converted into a PO or PO item.

In the following sections, we'll discuss how to interactively create planned orders from a stock/requirements list. We'll also show you how to independently create a planned order for a material and the planned order profile it uses. Finally, you'll see how to check for component availability, including available-to-promise (ATP) logic.

12.10.1 Planned Orders

Planned orders contain an order quantity, a start date, and a finish date. The start and finish dates are the result of the scheduling process and are based on the factory calendar. The availability date can occur after the finish date if a GR processing time has been maintained.

In addition, the planned order contains the dependent requirements from the BOM explosion as well as organizational data.

There are a couple of ways in which you can manually create planned orders:

While remaining in the stock/requirements list (Transaction MD04)

By using Transaction MD11, which is the planned order creation transaction

For this example, we show you how to create a planned order in the stock/ requirements list. Later, we'll also show how to manually create a planned order using Transaction MD11.

Planned Order Creation with Interactive Planning

You can carry out interactive planning by specifically creating planned orders using Transaction MD11 or by using interactive MRP for material and plant via Transaction MD43. In the latter case, the system displays the current requirement and stock situation. The **Planning** button enables you to trigger automatic MRP (see Figure 12.43). The system displays the planning result, which is still only a simulation at this point.

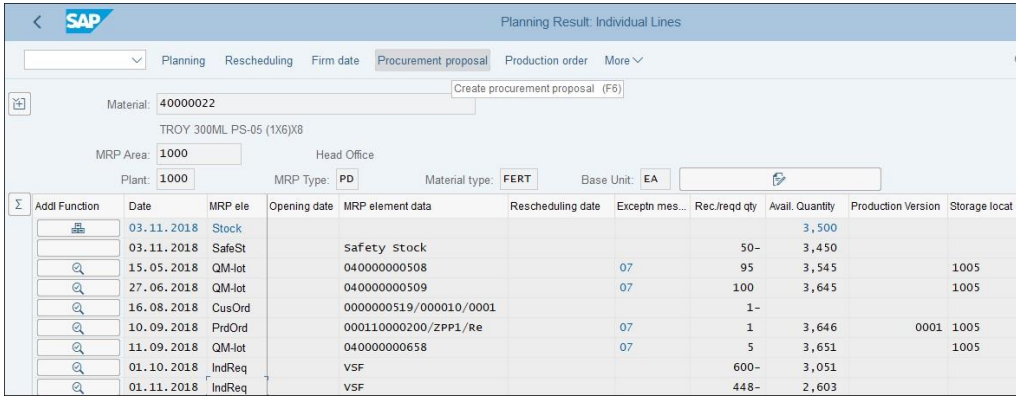


Figure 12.43 Planning Results

The system doesn't create the planned order until you save the planning results. Moreover, Transaction MD43 also enables you to create and reschedule specific procurement proposals manually, when you click on the **Procurement proposal**, **Production order**, or **Rescheduling** buttons.

Figure 12.43 shows the planning results of the **Material 40000022** and **Plant 1000**. While remaining in interactive planning, choose **Create procurement proposal** (see Figure 12.43). In the **Select Procurement Proposal** popup (see Figure 12.44), select the procurement proposal, which for this example, is a planned order with the profile **LA**. Click **Continue** or press (Enter) to open the **Planned order** creation popup (see Figure 12.45). Enter the details, such as order quantity, start date, and so on, and choose **Continue**. The system incorporates a new planned order for the material (see Figure 12.46). For this example, it creates the planned order number **59842**.

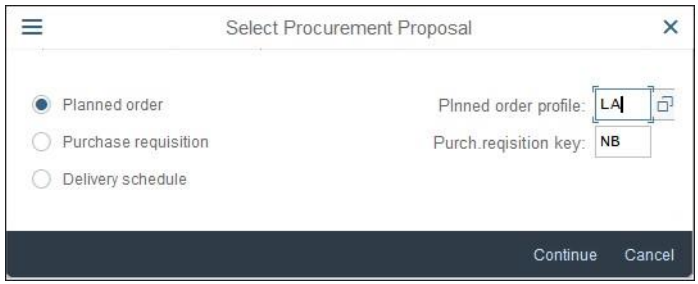


Figure 12.44 Interactively Creating a Planned Order

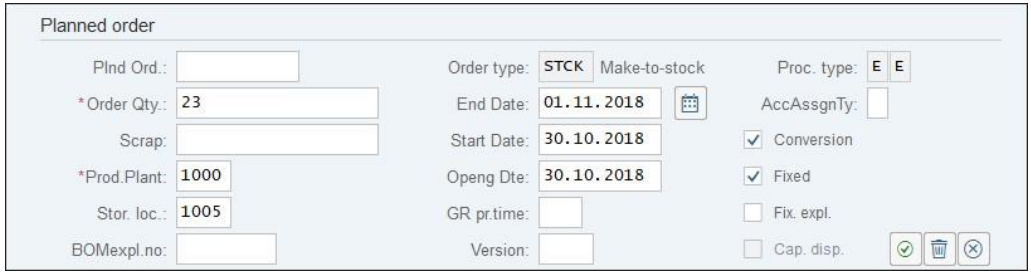
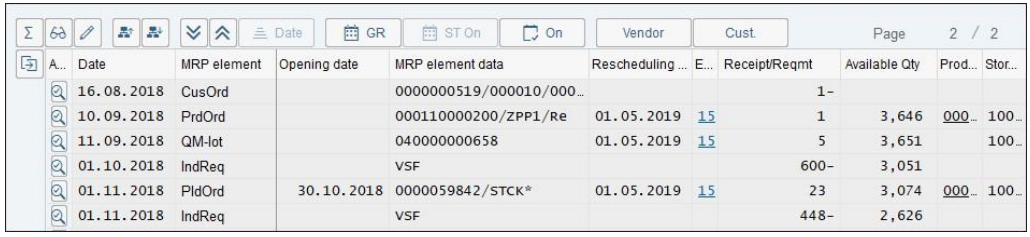


Figure 12.45 Planned Order: Detailed Screen



A...	Date	MRP element	Opening date	MRP element data	Rescheduling ...	E...	Receipt/Reqmt	Available Qty	Prod...	Stor...
	16.08.2018	CusOrd		0000000519/000010/000...			1-			
	10.09.2018	PrdOrd		000110000200/ZPP1/Re	01.05.2019	15	1	3,646	000...	100...
	11.09.2018	QM-lot		040000000658	01.05.2019	15	5	3,651		100...
	01.10.2018	IndReq		VSF			600-	3,051		
	01.11.2018	PldOrd	30.10.2018	0000059842/STCK*	01.05.2019	15	23	3,074	000...	100...
	01.11.2018	IndReq		VSF			448-	2,626		

Figure 12.46 Planned Order 59842 in the Stock/Requirements List

Manual Creation of Planned Order

You can use Transaction MD11 to manually create a planned order. On the initial screen that appears, enter the **Plnned order profile** "LA", which supports MTS production. Press (Enter), and provide the material number, the plant, the order quantity, and the basic dates, as shown in Figure 12.47. A manually created planned order is always firmed, and the system denotes it with an asterisk "*" in the stock/requirements list (Transaction MD04). The **Conversion indicator** ensures that the planned order can eventually be converted either into a production order (or a process order) for in-house production or into a purchase requisition for external procurement.

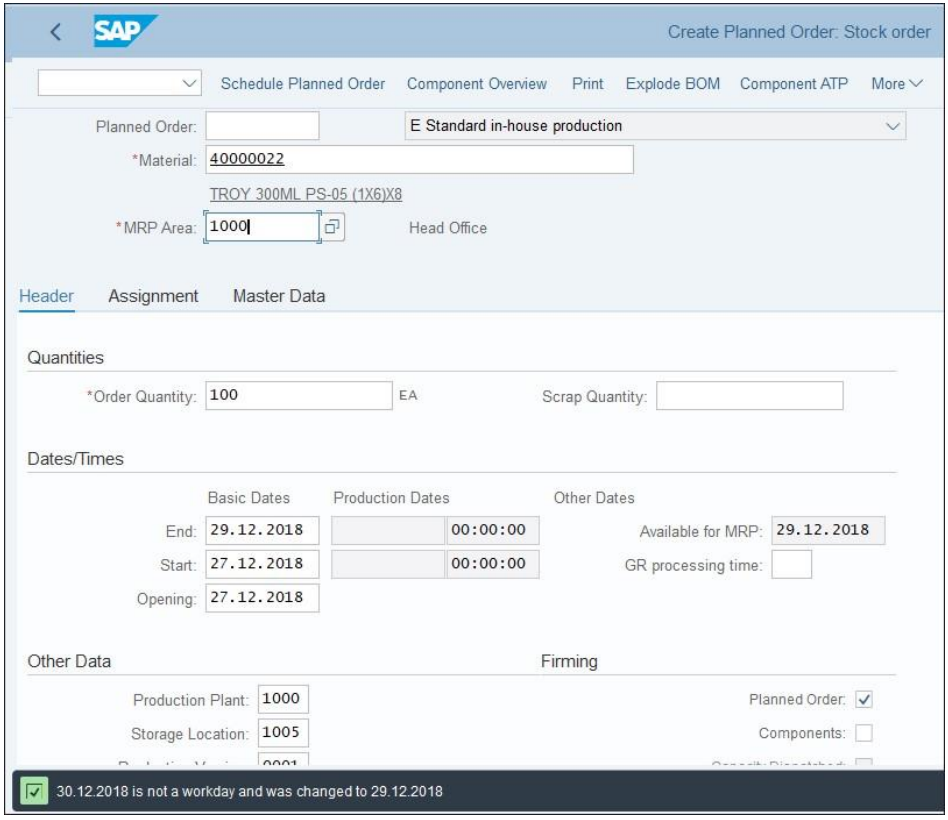
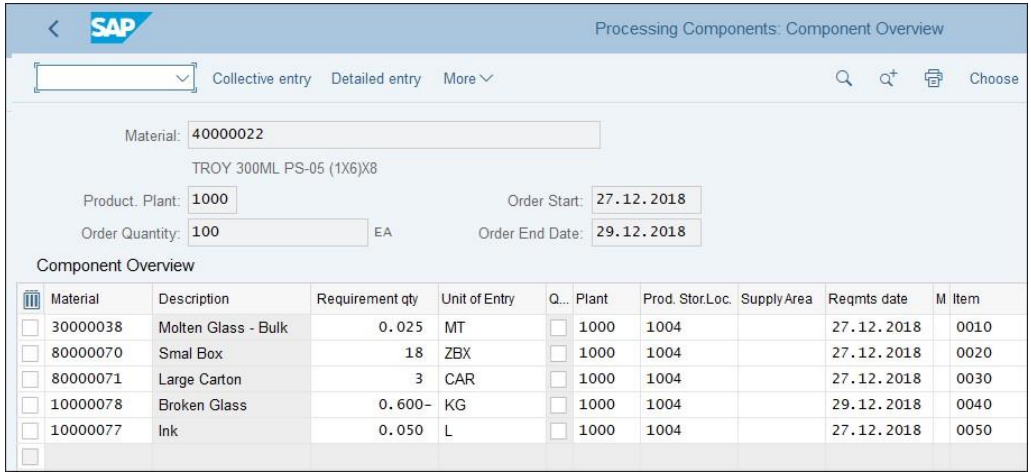


Figure 12.47 Planned Order Creation

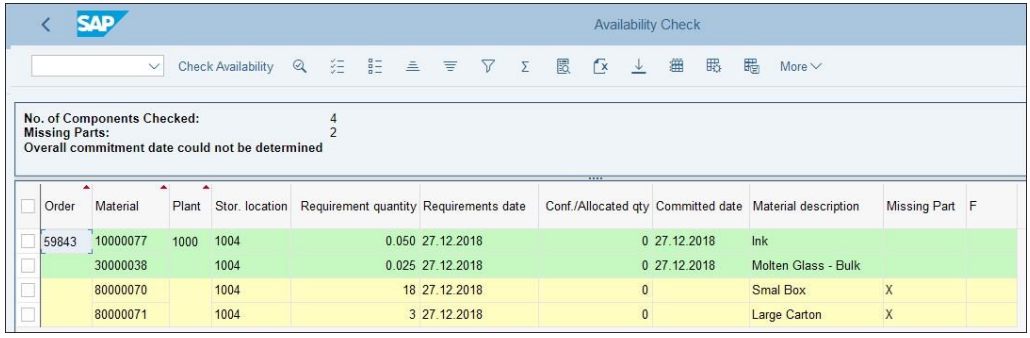
Next we perform two functions: check the availability of the material's components to ensure smooth production and check the components ATP. Figure 12.48 shows the BOM (component) details of **Material 40000022**. You can make any desired changes, if needed.



Material	Description	Requirement qty	Unit of Entry	Q...	Plant	Prod. Stor.Loc.	Supply Area	Reqmts date	M	Item
30000038	Molten Glass - Bulk	0.025	MT		1000	1004		27.12.2018		0010
80000070	Smal Box	18	ZBX		1000	1004		27.12.2018		0020
80000071	Large Carton	3	CAR		1000	1004		27.12.2018		0030
10000078	Broken Glass	0.600-	KG		1000	1004		29.12.2018		0040
10000077	Ink	0.050	L		1000	1004		27.12.2018		0050

Figure 12.48 Components Availability in a Planned Order

Increase the planned order quantity of **Material 40000022** to "1000" units (or any large quantity), and then choose **Comp. ATP** (see Figure 12.47) to open the **Availability Check** screen (see Figure 12.49) Notice that the available component quantities are shown with green lines, while the system reflects the shortages with yellow lines.



Order	Material	Plant	Stor. location	Requirement quantity	Requirements date	Conf./Allocated qty	Committed date	Material description	Missing Part	F
59843	10000077	1000	1004	0.050	27.12.2018	0	27.12.2018	Ink		
	30000038		1004	0.025	27.12.2018	0	27.12.2018	Molten Glass - Bulk		
	80000070		1004	18	27.12.2018	0		Smal Box	X	
	80000071		1004	3	27.12.2018	0		Large Carton	X	

Figure 12.49 Components Availability and ATP Check

When you choose the **Back** icon, it leads to the planned order header screen. The system is only able to commit a material's quantity of the planned order quantity of 1,000 because it uses **ATP check**. **ATP check** enables the system to advise the quantity that it can commit or promise based on the current available stock and other reservations/issuances.

12.10.2 Planned Order Profile

You've already seen during the planned order creation that you have to enter a planned order profile. You can define the order profile in configuration by following the path, **SAP IMGProductionMaterial Requirements PlanningProcurement ProposalsPlanned OrdersDefine Order Profile**. The order profile is used for both planned orders (**Object type 1**) and purchase requisitions (**Object type 2**), and it contains information on the permitted procurement types and special procurement types.

Other available object types include the following:

Reservation

Production order

Simulation order

To create a new planned order profile, choose **New Entries**. Enter a name for the planned order profile, and select the object type. Finally, in the detailed screen, enter the procurement type or even special procurement control parameters.

12.10.3 Purchase Requisitions

You can also directly create a purchase requisition with Transaction ME51N and change it with Transaction ME52N. To create a PO with reference to a purchase requisition, you use Transaction ME21N, and then use Transaction ME22N to change it.
This is in the domain of MM and isn't covered further in this book.

12.11 Configuration Settings for Material Requirements Planning

In the following sections, we'll show you the configuration settings that you need to make to ensure that MRP runs at the plant level:

MRP activation

Scope of planning configuration

Plant parameters configuration

MRP group configuration

12.11.1 Material Requirements Planning Activation

This configuration step allows you to choose the plant for which you want to activate MRP. To do so, follow the configuration menu path**, SAP IMGLogisticsProductionMRPPlanning File EntryActivate MRP and Set Up Planning File**, or use Transaction OMDU.

12.11.2 Scope of Planning Configuration

When you run plant-level MRP with Transaction MD01, the scope of MRP generally refers to a specific plant. You can also refer to several plants if you define a corresponding planning scope. You can define the planning scope using the following configuration menu path, **SAP IMGProductionMaterial Requirements PlanningPlanningDefine Scope of Planning for Total Planning**.

12.11.3 Plant Parameters Configuration

You can configure MRP up to the following three levels:

Plant parameters

MRP groups

Material master (MRP views)

Material master settings have higher priority than MRP group parameters, which in turn have higher priority than plant parameters. No setting can be found on all three levels, but they can be on up to two of them. Therefore, plant parameters are usually used to set defaults, which can be overruled if necessary.

The plant parameters of MRP contain a view of numerous configuration settings that are relevant to MRP. The plant parameters screen shows whether certain configuration settings have been maintained or whether they are still in their initial status. Using this screen enables you to navigate directly to the relevant configuration area.

In the plant parameter configuration step, following are some of the configurations:

Reference Plant

Number ranges

Direct Procurement

Available Stock

Rescheduling

External Procurement

Conversion of planned orders

Dependent Requirements availability

Floats (Schedule Margin Keys)

BOM Explosion

BOM/Routing Selection

To configure plant parameters, follow the configuration menu path, **SAP IMGLogisticsProductionMaterial Requirements PlanningPlant Parameters**, or use Transaction OPPQ. Click on the **Maintain** button. A popup appears in which you enter the **Plant** as "1000", and then click on the **Maintain** icon. You'll then see a detailed screen where you can maintain the individual plant parameters.

12.11.4 Material Requirements Planning Group Configuration

You can group materials using MRP groups and then assign the MRP group in the **MRP 1** view of the material master. Each of the MRP groups can have its own set of MRP parameters. When you work with an MRP group, you have the following options, which are specific to a material or group of materials:

Strategy group

Settlement type and horizon

Rescheduling horizon and planning horizon

Production storage location selection

Conversion order types of planned orders

Planning horizon

Planning time fence and roll-forward periods

BOM and task list selection IDs

Direct procurement parameters

Planned order scheduling parameters

- Start number of days allowed in the past

Availability checking groups

Period split for distributing the independent requirement

Maximum MRP intervals

Availability of safety stock for MRP

BOM explosion

Direct procurement of nonstock items

Creation indicators for purchase requisitions

Scheduling of external procurement according to the information record

Checking rule for dependent demand

To configure MRP groups, follow the configuration menu path, **SAP IMGLogisticsProductionMaterial Requirements PlanningMRP GroupsCarry out Overall Maintenance of MRP Groups**, or use Transaction OPPR.

On the initial screen, enter the **Plant** as "1710", and click on the **Maintain** button. In the popup that appears, enter the **MRP Group** "0010", and click on the **Maintain** button. Figure 12.50 and Figure 12.51 show part of the **MRP Group** detailed screen for maintaining individual parameters of the MRP group.

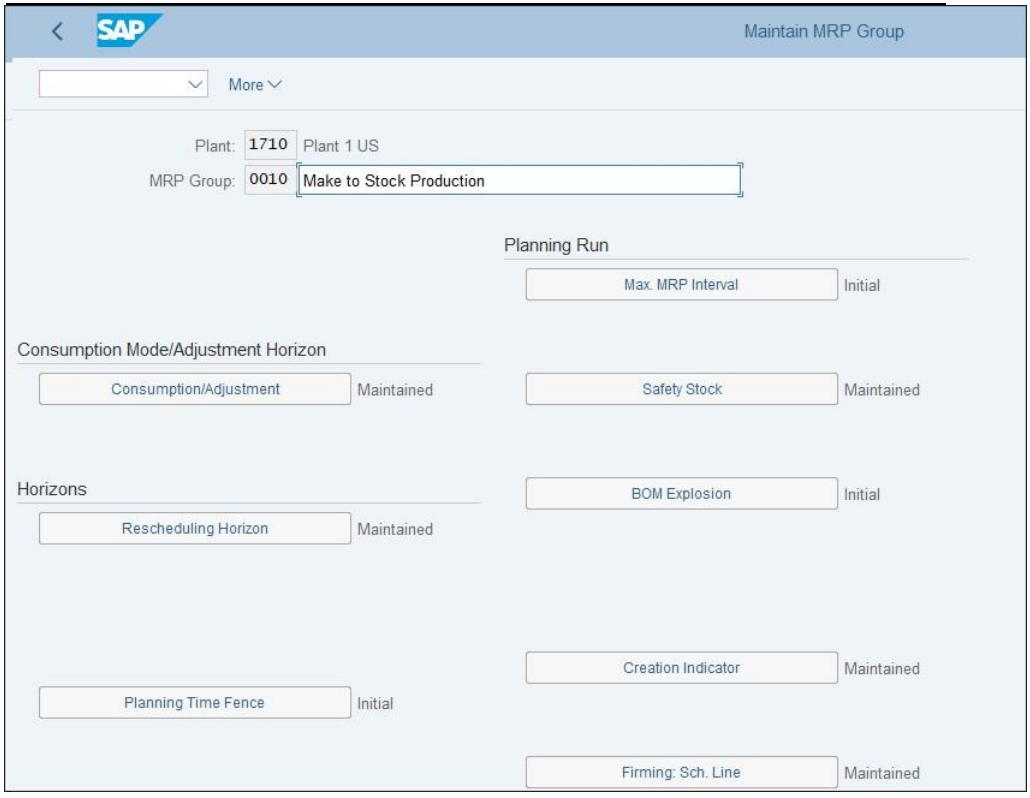


Figure 12.50 Maintain MRP Group: Partial Screen 1

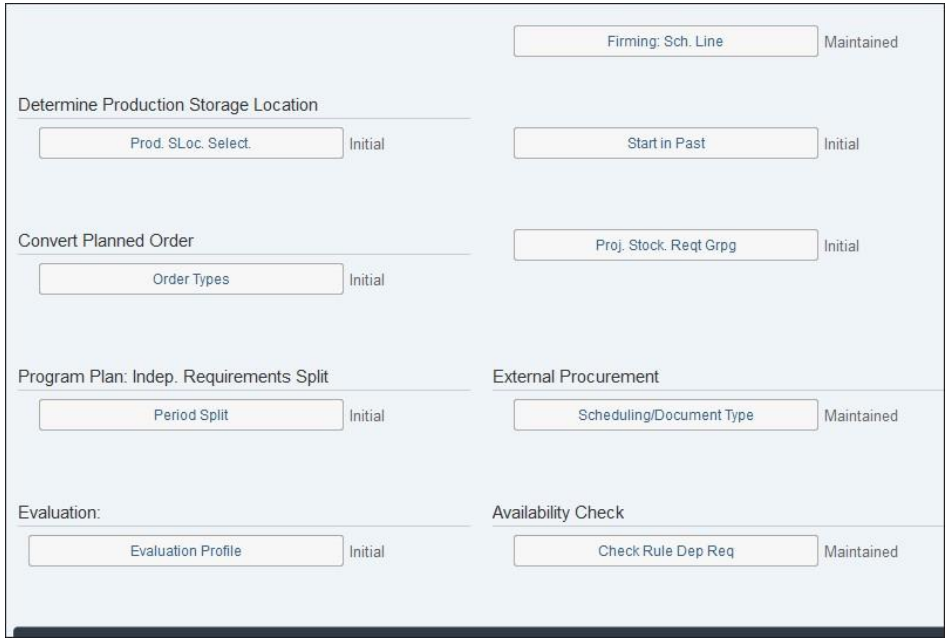


Figure 12.51 Maintain MRP Group: Partial Screen 2

When you've configured the MRP group, save the group, and assign it in the **MRP 1** view of the material master (see Figure 12.52).

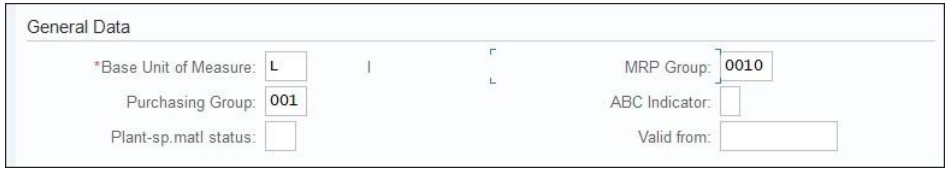


Figure 12.52 MRP Group in the Material Master

Note

While this example covers the maintenance of an MRP group, you can also create a new MRP group, delete an existing MRP group, or copy an MRP group from an existing one. You can also assign the MRP group to a material type by following the configuration menu path, **SAP IMGLogisticsProductionMaterial Requirements PlanningMRP GroupsDefine MRP Group for Each Material Type**.

12.12 Summary

You can take enormous advantage of the MRP functionality in the SAP system to help improve and optimize the business processes. You can plan all types of materials, including high-, medium-, and low-value materials. The various lot-sizing procedures and safety stocks ensure that there's neither an overstock nor a stock-out situation. The planning calendar helps you plan materials that are specific to particular calendars only. Further, you can give individual attention to a material if it has any specific or unique business need.

The next chapter covers running MRP in the SAP system as well as discusses demanddriven replenishment (DDR) in SAP S/4HANA.

Chapter 13

Running Material Requirements Planning

The material requirements planning foundations built in the previous chapter can now be put to use by running MRP Live and evaluating the planning results. Demand-driven replenishment is also now embedded in SAP S/4HANA.

During the course of an SAP S/4HANA implementation project, a question is often raised regarding which of the many planning tools available in SAP to use to make planning and operations more efficient. While there's no "right answer" that fits all situations, it's best to strive to use as many of the tools as possible to get a greater return on investment from the SAP S/4HANA system. The follow-on question regards how often these planning tools should be used. Again, an effort needs to be made to maintain a balance between using and not using a tool.

For example, it doesn't make sense to run material requirements planning (MRP) very frequently as doing so disturbs the procurement and production schedules. But not running MRP as often as required is also to be discouraged because, without running MRP, the system won't be able to calculate the net requirement situation of each material, and thus the company risks stock-outs or even overstocked situations. A logical approach to using these planning tools can be to consider long-, medium-, and short-term planning horizons and then leverage these tools.

For example, based on historical consumptions of materials, forecasting can be used for a longer-term planning horizon. Then, long-term planning (LTP) can be used to simulate the forecast figures to see if the company has the resources to produce or store the materials. When LTP results are found satisfactory, these can be used for rough-cut planning or even sales and operations planning (S&OP) for an eventual transfer to demand management, which may only be used for the medium-range planning horizon. Finally, MRP and then capacity requirements planning (CRP) can be used as short-term planning tools to ensure smoother operations management.

There's no constraint or limitation on using any planning tool at any time, so these can be used as standalone tools or together in a logical and structured manner.

MRP consists of the following steps as shown in Figure 13.1:

1 Check the planning file to avoid planning materials that aren't needed.

2 Determine the material shortage quantity (or surplus quantity) by carrying out a net requirements calculation.

3 Calculate the procurement quantity to include lot sizes for planned orders or purchase requisitions.

4 Schedule basic dates or lead time (for in-house production only).

5 Select the source of supply by determining the procurement proposal.

6 Determine the requirement of subordinate parts on the basis of the bill of materials (BOM) explosion by carrying out a dependent requirements determination.

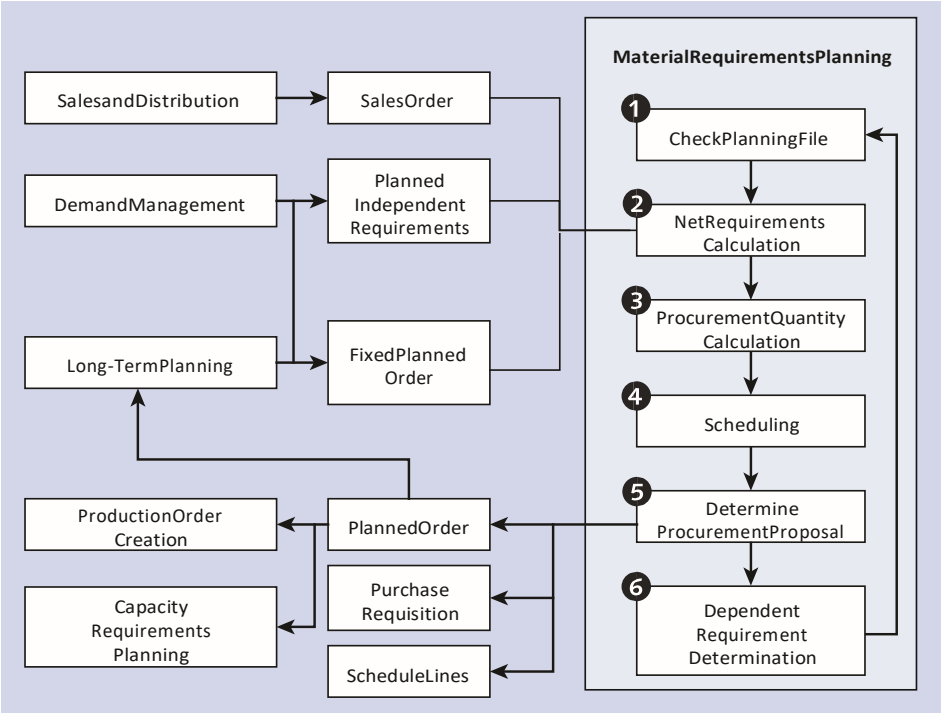


Figure 13.1 Process Steps in MRP

Now that we've covered the basics of MRP, we need to bring together all the concepts and understanding developed previously from Chapter 10, Chapter 11, and Chapter 12

and put them to actual and practical use in this chapter by showing how to run MRP Live followed by evaluating the planning results. Next, we cover how to configure and use a planning calendar. This is then followed by covering configuration and business processes of using the MRP planning areas. We'll also briefly discuss classic MRP as well as different types of planning runs. Finally, the chapter concludes with a detailed discussion of demand-driven replenishment (DDR) in SAP S/4HANA.

Let's begin with MRP Live.

13.1 MRP Live

MRP Live is the new version of MRP, developed to achieve maximum performance when using an SAP HANA database. In MRP Live, the entire MRP logic is carried out directly on SAP HANA, including database selection. This means that all the MRP steps, from net requirements calculation to the creation of the replenishment proposal, are carried out on SAP HANA.

Let's first understand how MRP Live differs from the classic MRP transactions, including the main functionalities, restrictions, and transactions available for MRP Live, when compared with the classic MRP.

New Transaction MD01N was created specifically to run MRP Live. In classic MRP, there were different transactions available to execute a total MRP run (Transaction MD01); a single-item, multilevel MRP (Transaction MD02); and a single-item, singlelevel MRP (Transaction MD03). Transaction MD01N replaces all of those classic MRP transactions, as it provides more flexible selection criteria with more fields and options for selection, as shown in Figure 13.2.

However, it's not possible to replace multilevel, make-to-order (MTO) planning (Transaction MD50) and the individual project planning (Transaction MD51) with MRP Live. For such business scenarios, the classic MRP transactions should be used, or the header material should be planned within MRP Live, with the **BOM Components** checkbox selected so that all the components are also checked.

Transaction MD01N was also designed considering the simplification concept. Therefore, when compared with the classic MRP transactions, some changes are as follows: The creation indicator for purchase requisitions and schedule lines does not exist in Transaction MD01N. This means that MRP Live directly creates purchase requisitions for materials procured externally or creates a schedule list.

The creation indicator for MRP lists is also not available in MRP Live for performance reasons. This means that MRP lists aren't created by MRP Live. If it's necessary for you to create MRP lists, the material should be planned with the classic MRP transactions (e.g., Transaction MD01). Otherwise, you can use the stock/ requirements list (Transaction MD04) to analyze the MRP results.

The scope of planning is no longer necessary because you can now select one or more plants in Transaction MD01N. MRP Live can also automatically determine the sequence of plants for planning, so the scope of planning becomes obsolete with MRP Live.

Processing key NETPL (Net Change in the Planning Horizon) isn't available in Transaction MD01N. This processing key was created to restrict the MRP run on the planning horizon for a faster MRP run. Because the MRP performance is much better with MRP Live, this processing key and the planning horizon concept are obsolete.

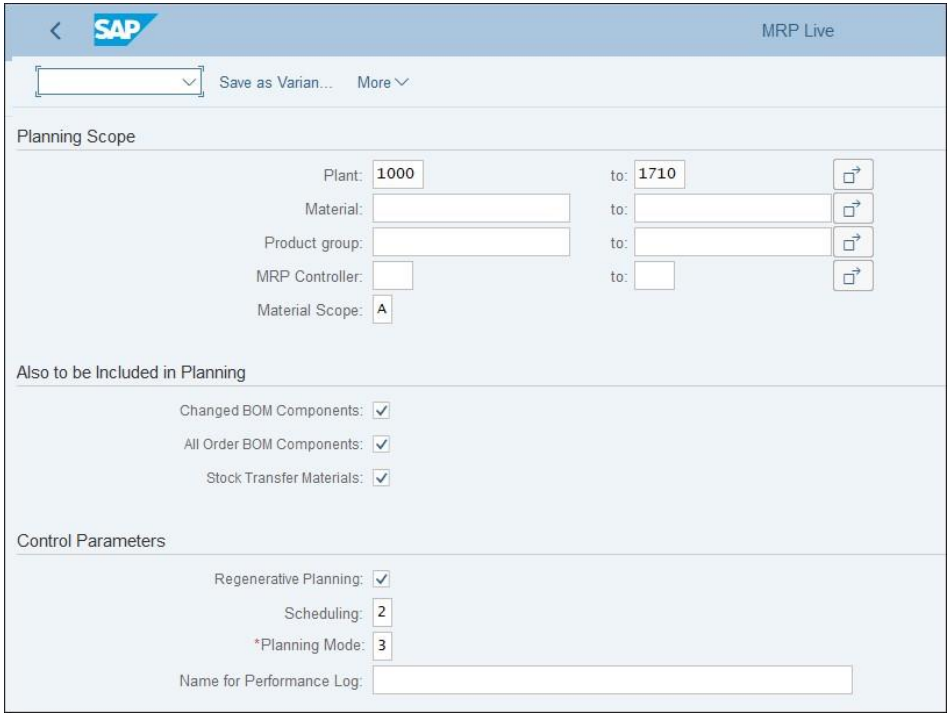


Figure 13.2 MRP Live

The flag to determine if parallel processing should be used isn't available in MRP Live; parallel processing is automatically triggered by the system. In addition, you no longer need to define the destinations for parallel processing in Transaction OMIQ because they will be determined automatically based on the server group. The user exit key and user exit

parameter fields aren't available. In the classic MRP transactions, user exits SAPLM61C_001 and EXIT_SAPMM61X_ 001 allowed the user to select which materials would be planned by MRP, and the most common use was to plan all the materials of a specific MRP controller. In Transaction MD01N, the MRP controller is already available as a selection criterion. If a different selection criterion is necessary, it's possible to use the product group or the multiple material selection as a selection criteria.

Besides changes related to the transaction design, there are some changes to the MRP process that must be considered:

Total requirements aren't supported on MRP Live.

Just like the classic MRP transactions, total dependent and sales requirements aren't supported on MRP Live.

Subcontracting on MRP Live is only supported with MRP areas.

In classic MRP transactions, a separated planning segment is created for each vendor on a subcontracting scenario. In MRP Live, however, this functionality is no longer available. This means that the subcontracting scenario must be mapped with MRP areas. Therefore, you need to create an MRP area for each vendor in Customizing and assign this MRP area to the materials that will use the subcontracting scenario. See Section 13.4 for more on MRP planning areas.

Replenishment proposals aren't reusable.

In classic MRP transactions, unfirmed planned orders and purchase requisitions weren't necessarily changed during the MRP run in the case of a quantity or date change. Now, in MRP Live, if the date or quantity of a replenishment proposal must be changed by MRP, the replenishment proposal is deleted and a new one is created. Basically, this means that the number of existing planned orders and purchase requisitions may be changed more frequently in MRP Live than in the classic MRP.

Note

As MRP Live is a new materials planning tool, some very specific settings aren't yet implemented; a complete overview of those restrictions can be found in SAP Note 1914010.

Under very specific scenarios, the number of replenishment proposals generated by MRP Live can differ from the number of replenishment proposals generated by classic MRP. This happens, for example, when using a reorder point MRP type with external requirements (e.g., MRP type V1) or a safety stock. This happens because, in classic MRP, the safety stock (or reorder point) quantity is added to the replenishment proposal created to cover the first requirement. In MRP Live, on the other hand, a separate replenishment proposal is created to cover the safety stock. Even though there may be more replenishment proposals in MRP Live, the total quantity of the replenishment proposals generated should be the same as the total quantity in classic MRP.
You'll see this with an example in Section 13.4.

To access MRP Live, follow the menu path, **SAP Menu Production MRP Planning MRP Live**, or use Transaction MD01N (see Figure 13.2).

As you can see, far more materials planning options are available in MRP Live, such as selecting a specific group of materials and saving them as a variant. Planning via **Product group** and **MRP Controller**, and even choosing **Material scope** to decide whether MRP Live is to run on master production scheduling (MPS) materials only, MRP materials only, or both. **BOM Components** can also be planned. Enter the parameters shown in Figure 13.2, and click **Execute**.

Whenever MRP Live finds a material planning setting that is still not supported, it automatically switches to the classic MRP logic to plan without further problems. However, this isn't the best approach to achieve optimal performance with MRP Live. You can identify for which materials a restriction was found and a classic MRP was executed by analyzing the MRP Live results in Transaction MD01N. On the MRP Live results screen, the system displays how many materials were planned directly in SAP HANA and how many were planned using the classic MRP logic. By clicking the **Materials with messages** button on the results screen (see Figure 13.3), you can see exactly which materials could not be planned with MRP Live and which restriction caused them to be planned using the classic MRP logic.

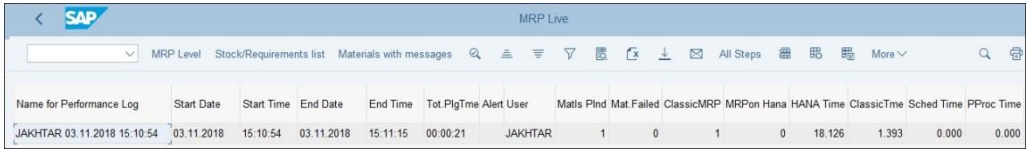
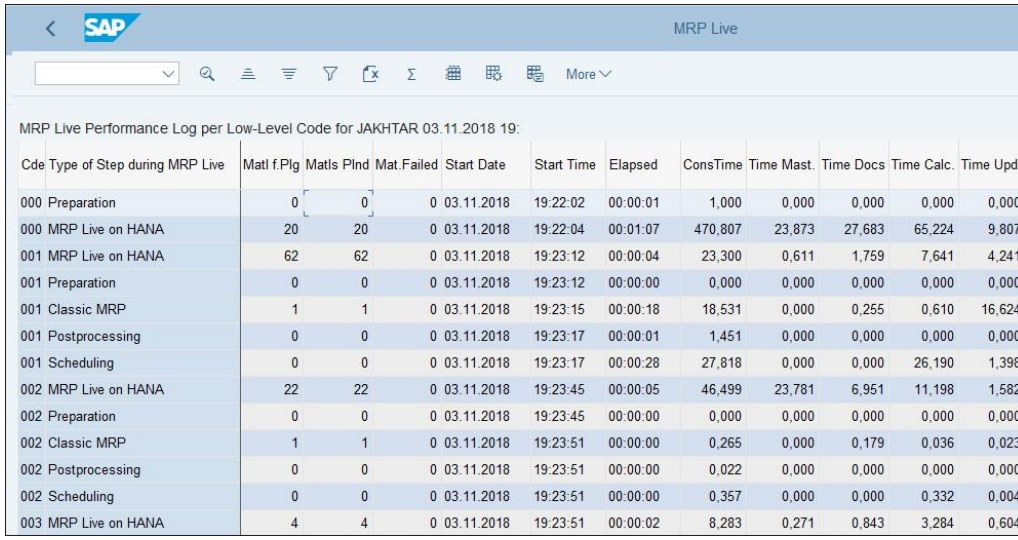


Figure 13.3 Planning Results from MRP Live

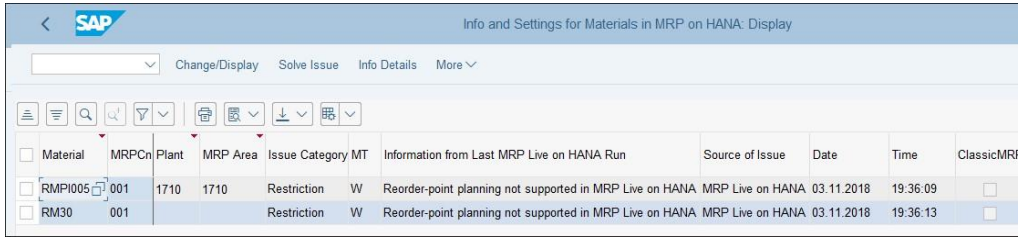
Figure 13.4 shows that 20 materials were planned at the finished goods level (see first column, **Cde 000**) via MRP Live, while 62 materials were planned at the code level **001**. One material was planned using classic MRP; the details are shown in Figure 13.5.



Cde	Type of Step during MRP Live	Matl f.Plg	Matls Plnd	Mat.Failed	Start Date	Start Time	Elapsed	ConsTime	Time Mast.	Time Docs	Time Calc.	Time Upd.
000	Preparation	0	0	0	03.11.2018	19:22:02	00:00:01	1,000	0,000	0,000	0,000	0,000
000	MRP Live on HANA	20	20	0	03.11.2018	19:22:04	00:01:07	470,807	23,873	27,683	65,224	9,807
001	MRP Live on HANA	62	62	0	03.11.2018	19:23:12	00:00:04	23,300	0,611	1,759	7,641	4,241
001	Preparation	0	0	0	03.11.2018	19:23:12	00:00:00	0,000	0,000	0,000	0,000	0,000
001	Classic MRP	1	1	0	03.11.2018	19:23:15	00:00:18	18,531	0,000	0,255	0,610	16,624
001	Postprocessing	0	0	0	03.11.2018	19:23:17	00:00:01	1,451	0,000	0,000	0,000	0,000
001	Scheduling	0	0	0	03.11.2018	19:23:17	00:00:28	27,818	0,000	0,000	26,190	1,398
002	MRP Live on HANA	22	22	0	03.11.2018	19:23:45	00:00:05	46,499	23,781	6,951	11,198	1,582
002	Preparation	0	0	0	03.11.2018	19:23:45	00:00:00	0,000	0,000	0,000	0,000	0,000
002	Classic MRP	1	1	0	03.11.2018	19:23:51	00:00:00	0,265	0,000	0,179	0,036	0,023
002	Postprocessing	0	0	0	03.11.2018	19:23:51	00:00:00	0,022	0,000	0,000	0,000	0,000
002	Scheduling	0	0	0	03.11.2018	19:23:51	00:00:00	0,357	0,000	0,000	0,332	0,004
003	MRP Live on HANA	4	4	0	03.11.2018	19:23:51	00:00:02	8,283	0,271	0,843	3,284	0,604

Figure 13.4 Materials Planned via MRP Live and Classic MRP

Figure 13.5 shows the materials with messages after the MRP Live execution. Clicking on the **Solve Issue** button will redirect you to the master data where this restriction is found (generally the material master), so that you can change your settings and avoid this restriction to ensure that the material is planned with MRP Live.



Material	MRPCn	Plant	MRP Area	Issue Category	MT	Information from Last MRP Live on HANA Run	Source of Issue	Date	Time	ClassicMRP
RMPI005	001	1710	1710	Restriction	W	Reorder-point planning not supported in MRP Live on HANA	MRP Live on HANA	03.11.2018	19:36:09	
RM30	001			Restriction	W	Reorder-point planning not supported in MRP Live on HANA	MRP Live on HANA	03.11.2018	19:36:13	

Figure 13.5 Materials with Message from MRP Live

After you've run the MRP, the materials planner spends more time in the stock/requirements list evaluating the supply-demand situation of material and taking actions where required.

13.2 Stock/Requirements List

We now briefly explain a few of the available analysis and evaluation functions of the stock/requirements list after an MRP Live run. The stock/requirements list is not only a materials evaluation tool but also an intuitive dashboard that a materials planner can use to create, change, or delete planning elements.

From accessing the planning, production, sales, or procurement details of either an individual material or collectively of several materials, the stock/requirements list details the parameters, such as MRP type, lot size, or the replenishment lead time (RLT), used in material planning. The logical and structured grouping of exception messages enables a materials planner to immediately see which materials need urgent actions, such as expediting procurement or production to meet customer orders or even canceling or delaying procurement or production orders that are no longer needed as early as originally planned. Evaluation tools, such as stock overview or day's supply, provide planners with complete visibility of demand and supply situations of materials.

Stock Overview

There is another important report—the stock overview report—that isn't discussed in this section. The stock overview report provides the current stock situation of the material and is quite helpful for material planners. You can use Transaction MMBE to access the stock overview report. In the initial parameter screen, enter the **Material** number, together with the **Plant**, and select other parameters, such as **Storage location** or **Special Stock Indicator**. With the stock overview report, you can only view the stock details of one material at a time. Choose **Execute** or press (F8).

If you want to view the warehouse stock of a large number of materials all at the same time, you can use Transaction MB52.

13.2.1 Overview

Figure 13.6 shows the **Stock/Requirements List: Initial Screen** (Transaction MD04).

The stock/requirements list describes all MRP-relevant elements for a material within a plant. These include the stock, customer requirements and planned independent requirements (PIRs), dependent demands, planned orders, and production orders. In addition, it shows parameters that are relevant to MRP, such as the safety

stock or the planning time fence. For all elements, details can be displayed and changed, if this is permitted. Usually, the system displays the availability date of a goods receipt (GR). But you can also display the GR date instead, for example, to plan actions in case of delays. We'll also discuss the following options available in stock/ requirements list along with several other options:

Display of exception messages

Jump into the detail view

Jump into the order report

Display GR date or availability date

Show the replenishment lead time (RLT)

Change the MRP elements

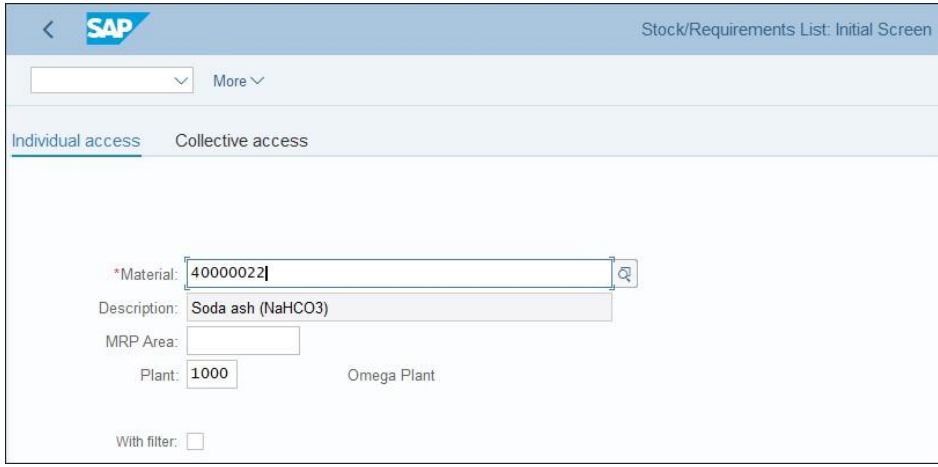


Figure 13.6 Initial Screen of Stock/Requirements List: Individual Access

Figure 13.7 shows some of the features and options available in the stock/requirements list.

Figure 13.8 shows that when you're already on the stock/requirements list, you can click on the **Expand Header Details** icon on the top-left of the screen to find all the parameters used by the system in planning the material. In other words, you no longer have to separately view the MRP parameters in the material master but can do so while remaining in the stock/requirements list.

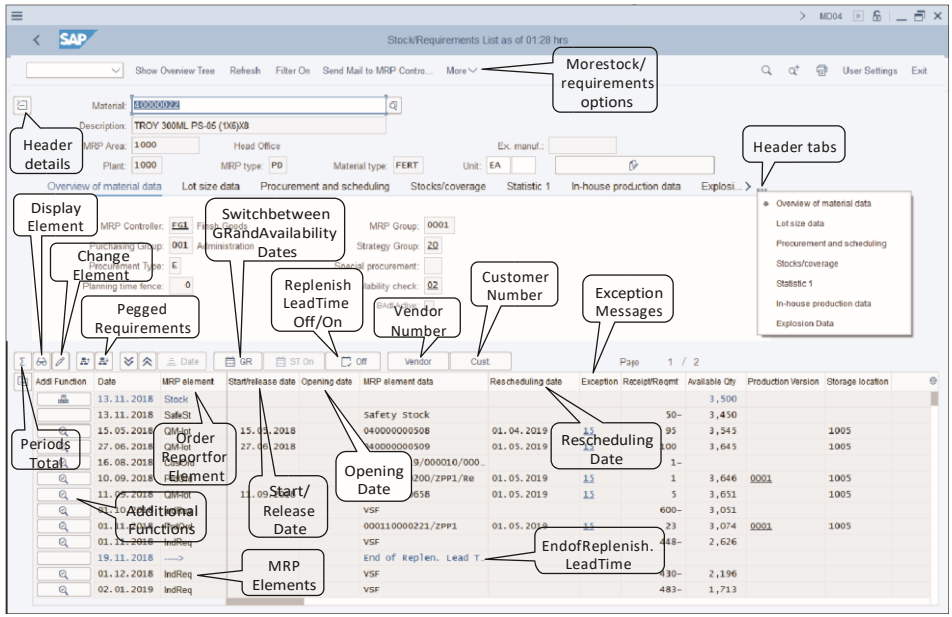


Figure 13.7 Features and Options in Stock/Requirements List

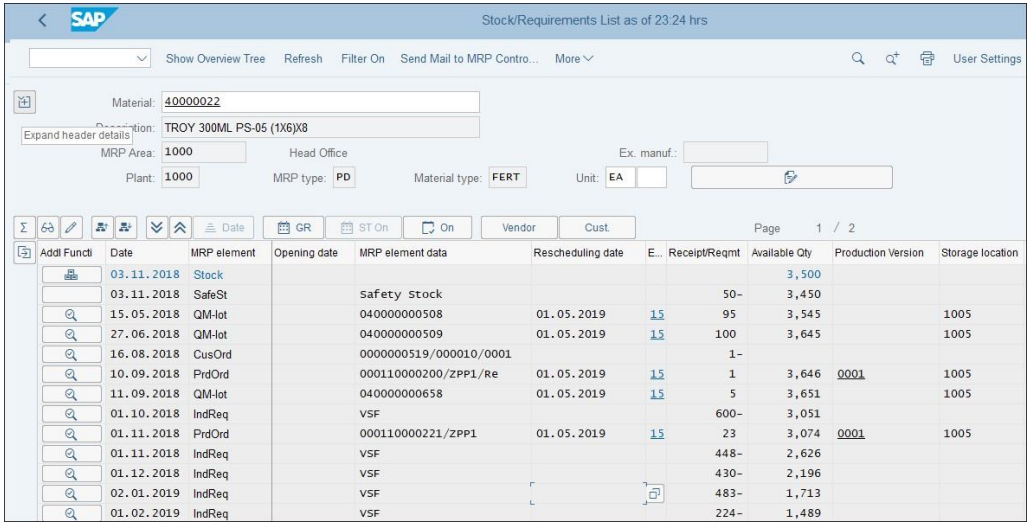


Figure 13.8 Stock/Requirements List

Let's evaluate some more details shown in Figure 13.8. On **03.11.2018** (November 03, 2018), the opening **Stock** of material **40000022** in the **Available Qty** column is **3,500**.

There's a safety stock requirement (**SafeSt**) for material **40000022** for a quantity of **50**, which the system immediately deducts from the available stock of **3,500** and shows the **Available Qty** column as **3,450**.

To interactively convert a planned order into a production order, click on the **Element details** icon (the magnifying glass) next to **MRP element 59842** (not shown) in Figure 13.8, and the popup shown in Figure 13.9 will appear.

Figure 13.9 offers more details about the system-generated (automatic) planned order **59842** for quantity **23**. MRP controller can both display this planned order and make any manual changes if needed. Further, it's also possible to convert this planned order into a production order. To do so, click on **-> Prod.Ord.** and the screen shown in Figure 13.10 appears.

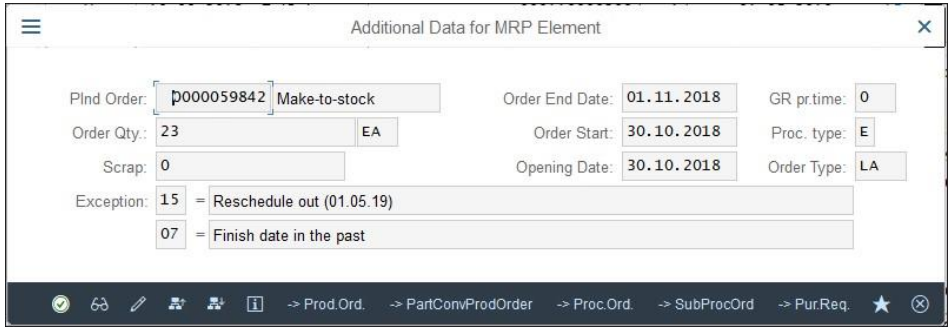


Figure 13.9 Converting a Planned Order into a Purchase Order (PO)

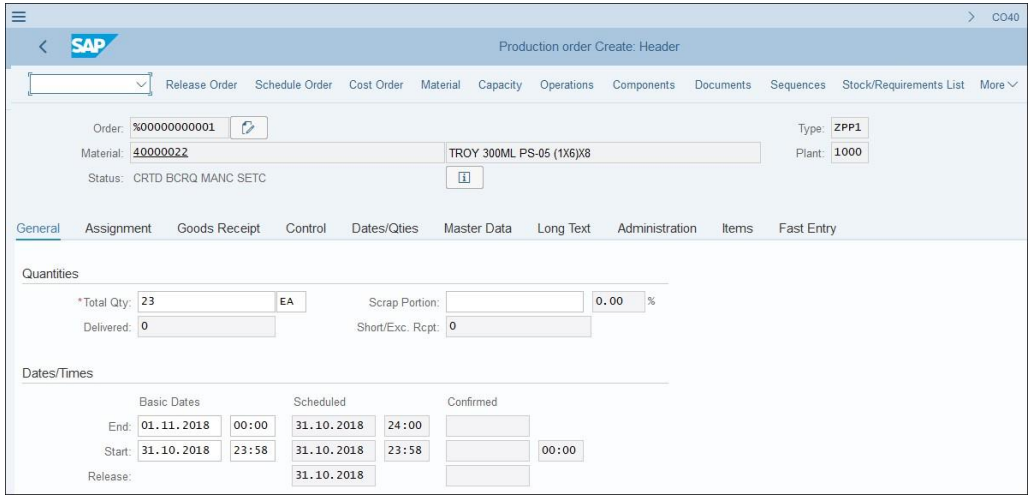
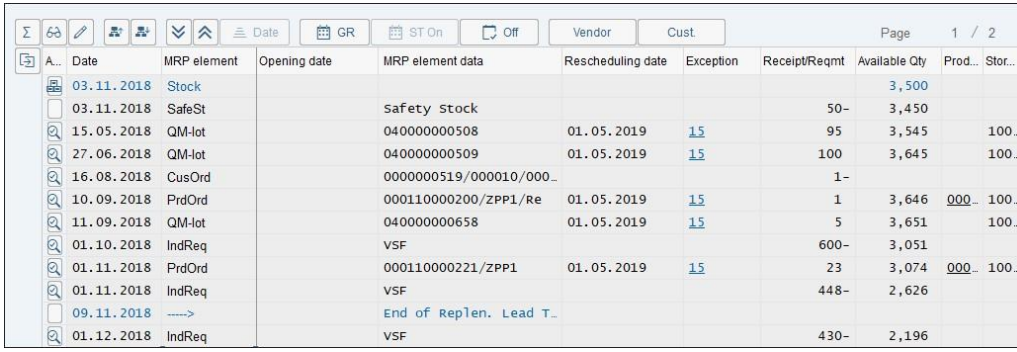


Figure 13.10 Production Order Created from a Planned Order Conversion

In Figure 13.10, which is a production order, if you click on the **Assignment** tab, you'll notice the automatically assigned planned order number **59842** in the lower half of the screen (not shown). Save the production order, and the system will create a production order number, which in this example is **110000221**.

Figure 13.11 is the stock/requirements list (Transaction MD04) after conversion of the planned order **59842** into a production order. Production order **110000221** is displayed for a quantity of **23**.



A...	Date	MRP element	Opening date	MRP element data	Rescheduling date	Exception	Receipt/Reqmt	Available Qty	Prod...	Stor...
	03.11.2018	Stock						3,500		
	03.11.2018	SafeSt		Safety Stock			50-	3,450		
	15.05.2018	QM-lot		040000000508	01.05.2019	15	95	3,545		100...
	27.06.2018	QM-lot		040000000509	01.05.2019	15	100	3,645		100...
	16.08.2018	CusOrd		0000000519/000010/000...			1-			
	10.09.2018	PrdOrd		000110000200/ZPP1/Re	01.05.2019	15	1	3,646	000...	100...
	11.09.2018	QM-lot		040000000658	01.05.2019	15	5	3,651		100...
	01.10.2018	IndReq		VSF			600-	3,051		
	01.11.2018	PrdOrd		000110000221/ZPP1	01.05.2019	15	23	3,074	000...	100...
	01.11.2018	IndReq		VSF			448-	2,626		
	09.11.2018	----->		End of Replen. Lead T...						
	01.12.2018	IndReq		VSF			430-	2,196		

Figure 13.11 Converted Production Order in the Stock/Requirements List

Refer to the initial screen of Transaction MD04 as shown in Figure 13.6, but this time click **Collective access**, and enter any of the several selection parameters, such as **MRP controller RM1**. Doing so will bring up a list of materials which the MRP controller RM1 is responsible for planning. You can also use Transaction MD07 for collective access of stock/requirements list.

13.2.2 Traffic Lights for Days' Supply and Receipt Days' Supply

The red, yellow, and green traffic lights in both Transaction MD06 and Transaction MD07 in Figure 13.12 give a quick indication in the list view of potential overstocking or understocking:

A red light will appear if a demand in the past is still unfulfilled. How far in the past this demand element lies is specified by the negative days of supply shown in a column in the list display.

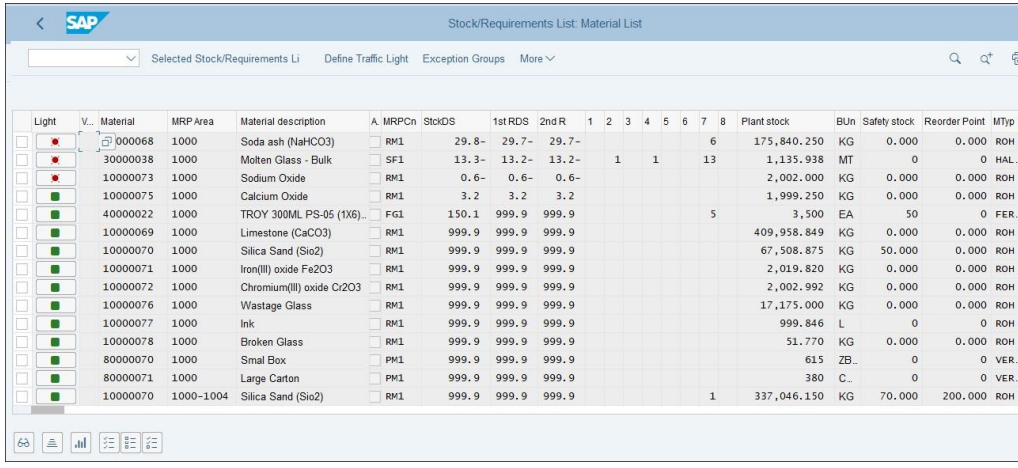
A green light doesn't mean everything is in order. It can also mean that there is more stock than needed to fulfill requirements in the future. Green lights, therefore, can alert you if there is too much inventory held.

Yellow lights are assigned to materials where demand and supply is in perfect balance.

SAP allows changes to the traffic light settings to tell the system when a material's planning should be alerted with a red or green light and what range is acceptable to have an item with a balanced demand and supply.

You can develop a traffic light system that can provide relevant and useful information. For example, consider setting up the list so that traffic lights are sorted from most urgent materials handling down to long-term opportunities. One such scenario can be setting the monitor so that materials with stock days of supply below safety levels (and not only after they are overdue) have a red light. Anything that has receipts coming in to cover demand within an acceptable time frame gets a yellow light, and anything that has too many receipts coming too early—and therefore needs to be expedited out—gets a green light.

You can also use the traffic lights for exception messages, so that the exception groups considered more important are sorted above the ones that aren't so urgent combined with the ranges of coverage.



Light	V..	Material	MRP Area	Material description	A.	MRPCn	StckDS	1st RDS	2nd R	1	2	3	4	5	6	7	8	Plant stock	BUn	Safety stock	Reorder Point	MTyp
		000068	1000	Soda ash (NaHCO3)		RM1	29.8-	29.7-	29.7-							6		175,840.250	KG	0.000	0.000	ROH
		30000038	1000	Molten Glass - Bulk		SF1	13.3-	13.2-	13.2-		1		1			13		1,135.938	MT	0	0	HAL..
		10000073	1000	Sodium Oxide		RM1	0.6-	0.6-	0.6-									2,002.000	KG	0.000	0.000	ROH
		10000075	1000	Calcium Oxide		RM1	3.2	3.2	3.2									1,999.250	KG	0.000	0.000	ROH
		40000022	1000	TROY 300ML PS-05 (1X6)..		FG1	150.1	999.9	999.9							5		3,500	EA	50	0	FER..
		10000069	1000	Limestone (CaCO3)		RM1	999.9	999.9	999.9									409,958.849	KG	0.000	0.000	ROH
		10000070	1000	Silica Sand (Sio2)		RM1	999.9	999.9	999.9									67,508.875	KG	50.000	0.000	ROH
		10000071	1000	Iron(III) oxide Fe2O3		RM1	999.9	999.9	999.9									2,019.820	KG	0.000	0.000	ROH
		10000072	1000	Chromium(III) oxide Cr2O3		RM1	999.9	999.9	999.9									2,002.992	KG	0.000	0.000	ROH
		10000076	1000	Wastage Glass		RM1	999.9	999.9	999.9									17,175.000	KG	0.000	0.000	ROH
		10000077	1000	Ink		RM1	999.9	999.9	999.9									999.846	L	0	0	ROH
		10000078	1000	Broken Glass		RM1	999.9	999.9	999.9									51.770	KG	0.000	0.000	ROH
		80000070	1000	Smal Box		PM1	999.9	999.9	999.9									615	ZB..	0	0	VER..
		80000071	1000	Large Carton		PM1	999.9	999.9	999.9									380	C..	0	0	VER..
		10000070	1000-1004	Silica Sand (Sio2)		RM1	999.9	999.9	999.9							1		337,046.150	KG	70.000	200.000	ROH

Figure 13.12 Stock/Requirements List: Collective Access

In the stock/requirement list or in the MRP list, the system calculates the number of days on the time axis for which the existing stock of material can fulfill the requirements.

Receipt days' supply indicates how long the current stock and the expected receipts can cover the requirements. The system offers two different types of receipt days' supply:

Receipt days' supply 1

Receipt days' supply 2

You can select the receipt elements for both types of receipt days' supplies by following the configuration menu path, **SAP IMG Production Material Requirements Planning Evaluation Define Receipt Elements for Receipt Days' Supply**. In the configuration, you can select which procurement elements the system should consider or exclude in its calculation for days' supply.

For example, you can define two receipt days' supplies. This enables you to instruct the system to take the less binding receipt elements into account for the first receipt days' supply, and to take only the binding receipt elements, such as production orders and shipping notifications, into account for the second days' supply. The **Safety stock** field controls whether the days' stock supply considers safety stock while calculating the number of days until the warehouse stock falls below the safety stock. If you enter indicator "1", the system uses the number of days until the stock falls below 0.

13.2.3 Exception Messages

The system generates exception messages in MRP when it encounters alerts during the planning run. The system displays exception messages for each relevant procurement element in the stock/requirements list (refer to the **Exception** column in Figure 13.11). You can also view the exception elements by choosing **More Edit Find in the List**.

The main elements of exception messages are priority, assignment to group, suppress message, create MRP list, and text of exception message. Exception messages are displayed primarily in four transactions:

Transaction MD04 to display the dynamically created stock requirements situations for an individual material. Transaction MD05 to display the MRP list, a snapshot from the time when the MRP run last planned the material.

Transaction MD06 to display a collective list of materials with their respective MRP lists.

Transaction MD07 to display a collective list of materials with their respective stock/requirements situations.

Tips & Tricks

You can change the text of exception messages to denote the importance of an exception. For example, you can change text to "Warning: stock fallen below safety stock level" to help you quickly segregate exception messages with a warning from exception messages with information. To make limited changes to the existing exception message, follow the configuration menu path, **SAP IMG Production Material Requirements Planning Evaluation Exception Messages Define and Group Exception Messages**.

Let's now briefly discussion the eight different exception messages groups:

Group 1 Exceptions

An MRP run generates exception messages in group 1 when the date that was determined using the opening period is in the past. For example, the start date of a planned order might be November 15th. That is the date when the planned order must be converted to a process order so that the goods are produced on time to fulfill a demand. From this date, the system then subtracts the working days, for example, 4 days, from the opening period (it's the number of days maintained for the opening period in the scheduling margin key) and arrives at the opening date of the planned order, which, in this example, will be November 11th. If the planned order isn't converted to production order after November 11th, the system will display a message in this group. In other words, it's an extra time buffer to alert the planner to convert an order proposal into a fixed supply element.

Group 2 Exceptions

This group contains exception messages that inform about missing the release date to convert a purchase requisition or planned order into a PO or production order, respectively. You can see the release date in Transaction MD04. There are actually two hidden columns—one for the opening date and the other one for the release date. If you can't see the **Start/release date** and **Opening Date** columns in Transaction MD04, be sure to make them visible (refer to Figure 13.7). Move the cursor so that you can see two lines, and then drag the columns open. These columns provide valuable information about opening and conversion dates of your order proposals.

The release date was calculated by subtracting the lead time from the requirements date (backward scheduling); therefore, it represents the latest date an order proposal has to start (fixed, converted, a PO sent out to supplier, a production order send to the shop floor) so that the material can be received at the required date. If this date is missed, on-time material availability might not happen, thereby causing service levels to degrade.

As in group 1, an exception informs the user of a new order proposal, 03, and an exception informs the user of an existing order proposal. This time, however, it's the start (or release) date that is relevant. To address why the **03 New, and start date in the past** message is issued, evaluate possible lead time errors in the master data, or look at the availability checking rule, which might have allowed a requirement to drop in within the RLT. It's also possible to maintain Customizing settings so the system switches onto forward scheduling from today's date onward, in case the start date falls into the past. The **06 Start date in the past** message informs the user of an existing order proposal that has missed its conversion date. To address these errors, get all these elements up to date and release them on time with the correct lead time, which will determine the correct start/release date. If there's a need to reschedule an order proposal instead of being releasing it, then check the basic data setup to see if it's faulty and doesn't generate the correct dates automatically. When exception **63 Production start before order start** appears, it's due to incorrect configuration settings. The system has suggested a production start that lies before the order start in lead time scheduling. This message can be fixed by selecting the option to adjust the basic dates in the scheduling parameters for the order proposals (Transaction OPU5).

Group 3 Exceptions

Group 3 messages reflect a more serious problem as it not only informs about missing the start/release date of the order, but the finish date has passed as well. With the **04 New, and finish date in the past** message, the MRP run keeps on trying to adjust the proposals to match supply with demand. Dates are adjusted with new order proposals creation, which creates a bullwhip effect in the planning process. The exception monitoring needs to be prioritized to ensure finish dates in the past don't happen at all or occur at an absolute minimum.

The **07 Finish date in the past** message is very critical because it alerts the user of an impending outage, unless there's enough safety stock to get through the demand that's waiting for that order to be received. Message 07 can come from a purchase requisition, a planned order, a PO, or a production/process order. In all cases, an immediate action is warranted. Under no circumstances should there be orders in the system where the finish date has passed. It actually means that the finish date (or the GR date in the case of a PO) lies in the past.

Also part of group 3 for late finishing is exception message **64 Production finish after order finish**, which informs the user of an inconsistency in scheduling. The production finish, which was calculated using the routing's lead time, lies after the basic date (calculated from

the material master's lead time). Again, this is because the basic dates aren't adjusted—a setting in Customizing Transaction OPU5.

Group 4 Exceptions

Exceptions from group 4 are general messages and are for information only to address master data or Customizing inconsistencies. These exceptions can only be in Transaction MD06 (Collective MRP Lists) and not in Transaction MD07 (Collective Stock/Requirements Situation) because the system can't tell when the last planning run was, as the dynamically created stock/requirements situation (in Transaction MD07) has no time stamp and therefore doesn't know the new from the old.

Following are some of the exception messages in group 4:

01 Newly created order proposal

An order proposal was newly created in the last planning run. This message is generated if there is new demand in the system or when MRP runs use planning mode 3(delete planning dates).

42 Order proposal has been changed

The order proposal was changed in the planning run, either because of a change in demand situation or because of changes made in the master data settings after the last planning run.

44 Order proposal re-exploded

The order proposal's BOM was reexploded in the planning run, and new dependent requirements were created.

46 Order proposal has been manually changed

The order proposal was manually changed in the single-item planning run.

Group 5 Exceptions

Group 5 exception messages result from errors in the BOM explosion during the MRP run. Message **50 No BOM exists** means there is most likely no BOM for the material, or, in sales order processing, a sales order BOM could be missing. If the MRP run generates a planned order to cover demand, but it can't find a BOM suitable for the order, message **52 No BOM selected** appears. It could be that there are BOMs assigned to the material, however, the selection criteria can't assign the appropriate one to the planned order.

If exception message **53 No BOM explosion due to missing config.** appears, it's due to missing configuration and customization because the line items in the BOM didn't receive dependent requirements.

Message 54 No valid run schedule is an exception when using repetitive manufacturing. A run schedule is like a planned order, and the correct quantities couldn't be determined by the MRP run.

Group 6 Exceptions

Group 6 exceptions result from an availability check that evaluates stock shortages or excess stock. All messages in this group are related to quantities and stock levels. For example, message **25 Excess stock** points to the planned available stock's coverage to be greater than the maximum stock coverage specified in the range of coverage profile. Because the range of coverage profile is used to keep a check on minimum, target, or maximum stock levels, the MRP run checks to see inventory below the defined levels. However, if there is a rounding value, fixed lot size, or minimum order quantity maintained in the policy, this maximum will be exceeded.

For customer individual stock segments to manage individual customer stock, exception **26 Shortage in individual segment** will alert the user to higher stock levels than planned for in a range of coverage profile. When using a planning time fence with fixing types (P2 or P4 in deterministic planning), message **56 No requirements coverage** can alert the user of a shortage within the planning time fence.

Message **57 Disc. matl (discontinued material)** describes a situation wherein a material is partly replaced by a follow-up or replacement material used in the discontinuation process. As you can replace a part with a follow-up material in the discontinuation process, you might want to receive an alert if the discontinued part was only partially replaced by the substitute material. Another exception in discontinuation is message **58 Uncovered reqmt after effective-out date**, which is generated if a requirement exists after the effective-out date for a part that is to be discontinued and therefore can't be covered by planned stock. And if there is a receipt—maybe from a previously generated PO—that brings in stock after the effective-out date of a discontinued part, you'll receive exception **59 Receipt after effective-out date**. These are very helpful alerts to manage discontinuation of parts without interruptions, stock-outs, or leftover, unconsumed stock.

When using quota arrangements, you'll source parts or materials from various vendors with an equal or unequal distribution of required quantities, called a quota. For example, you could order a quantity of 100 pieces for the same part from three different vendors with quotas of 40%, 35%, and 25% of the required total quantity. Should the MRP run, for

whatever reason, exceed the maximum release quantity of the quote, then the exception **70 Max. release qty – quota exceeded** appears.

An exception message that you probably see often is **96 Stock fallen below safety stock level**, which informs the user that the static safety stock set in the MRP 2 screen of the material master record is low. If you never receive this message, then your inventory level is probably too high, and all the safety stock turns into unused dead stock. So it's a good thing to receive the occasional message 96 because it means that you're making good use of your buffer without binding too much cash in inventory holdings. In addition, when a material has exception message 96, its traffic light turns to red, and its **Days of Supply** turn to –999.9, which means that you can see all materials whose safety stocks are breached on top of your list in Transaction MD07. This might help in managing priorities and effectively addressing exception messages.

Group 7 Exceptions

Four exception messages are contained in this group. One is for nonfixed order proposals (30), and the other three are for fixed replenishment elements, such as POs and production orders. The latter three require manual rescheduling of the orders because they are fixed, and the MRP run doesn't change them anymore. The system does suggest the date to reschedule to. The four messages are explained in more detail here:

10 Bring process forward

When a demand date or quantity has changed, and a certain quantity of goods is needed at an earlier time, instead of creating another order proposal, the MRP run suggests bringing the already-ordered quantities in to an earlier delivery date so they can be used to fulfill the changed demand. The rescheduling has to happen manually, and the process is often called expediting because the planner will need to reach out to supplier to see if expediting the delivery to an earlier date, faster than the originally agreed lead time, is possible.

15 Postpone process

This message informs the user that the opposite has to happen: the ordered quantities aren't needed as early as was originally agreed to. It would be better if the supplier could deliver later because the demand has moved out to a later date. Not expediting out as suggested by message 15 will lead to too much inventory too early.

20 Cancel process

This message occurs when a demand is reduced or disappears altogether. This message only appears on fixed supply elements such as a PO or a production/process order. At an

earlier time, there must have been a demand causing the creation of an order proposal that must have been converted to a fixed supply order. Subsequently, the demand disappeared or was reduced, but because the supply was fixed, the MRP run can't delete the order.

30 plan process according to schedule

The MRP run isn't able to fulfill the demand because, according to master data or routing settings, the lead time is too long to bring the materials in on time.

Group 8 Exceptions

As with group 4, messages out of group 8 can't be seen in Transaction MD07 but only in Transaction MD06. If the planning run was terminated for a material, users see message **98 Abnormal end of requirements planning**. The reasons for this message to appear may be due to defective master data that prevents planning or even a prerequisite not being met, such as mandatory forecasting on the material wasn't performed prior to the MRP run.

When dealing with exception messages, following are some of the ways to prioritize handling them:

1. Group 8 is the most important of all the groups, so look at the abnormal ends firstwhere the planning run aborts. Address these materials first.
2. Next, look at group 5. These concern structural problems, and the planning runcan't even come up with a date or quantity because the demand doesn't get exploded down to the lower level.
3. Then check out group 3. Not only did a date to firm a receipt get missed, it's alreadytoo late when the receipt was supposed to come in to fulfill a demand.
4. After that, attend to the group 2 problems wherein the date was missed when aproposal needed to be firmed, so that you can receive the quantity after the regular lead time. If a date is missed, rescheduling and manual expediting is the only option.
5. Group 1 exceptions are only relevant while using the opening horizon to have anadditional check where external procurement is triggered first by a planned order and then by a purchase requisition.
6. Therefore, group 7 messages ought to be tackled next. These require expeditingand may take much more time to get through, but at least you can create a list at this point. The list can be worked off later in the day (call vendors, check with purchasing, look at the warehouse for inventories, etc.).

7. Next deal with group 6. Inventory excess or shortages usually require a change instrategy. Again, make a list and see how to reduce these exceptions over time, applying a different MRP type, changing the lot-size procedure, looking at safety stock levels, and a lot more.
8. Finally, you have to look at the general messages in group 4 to check and see whythere is a new proposal or why they have changed. These messages are information only and don't necessarily require action.

13.2.4 Order Report

Figure 13.13 shows the order report of each element of the stock/requirements list. In this example, it shows that production order **110000200** has component **40000022**, which doesn't provide the requirement coverage and is denoted by the red traffic light. The green traffic light further down the report represents a satisfactory stock situation, whereas the red one represents a signal for the planner to take action.

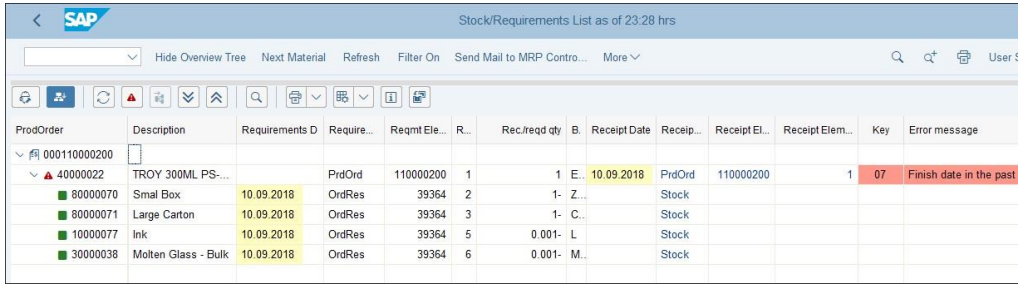


Figure 13.13 Order Report

13.2.5 Material Requirements Planning Elements

Because the system denotes each planning element separately, you can use the dropdown or filter function so that the system only displays the desired information (see Figure 13.14).

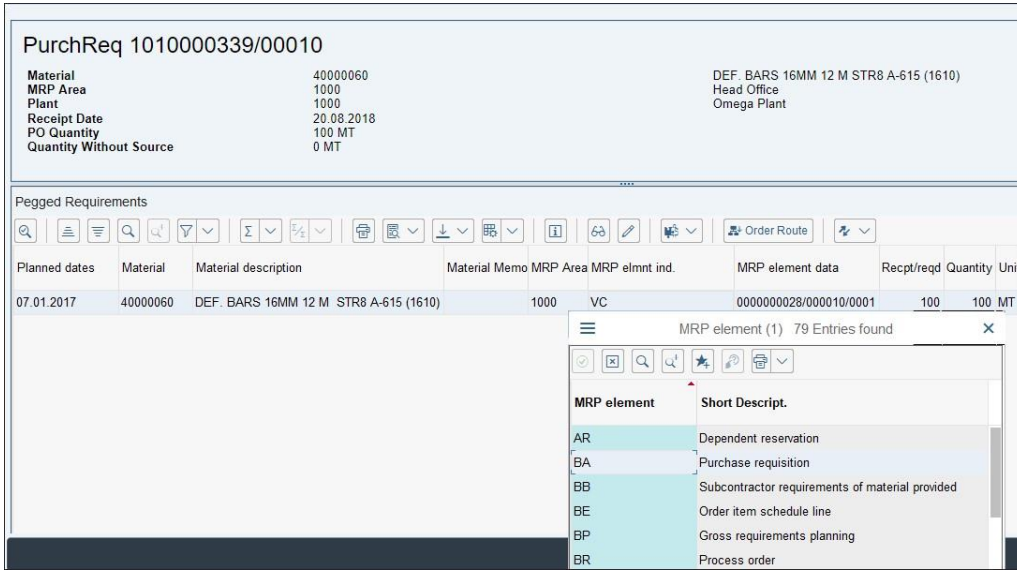


Figure 13.14 MRP Elements in Procurement without Requirements

13.2.6 Header Details of Stock/Requirements List

Referring back to Figure 13.8, you can click on the **Header details** icon to find all the parameters used by the system in planning the material. In other words, you no longer have to separately view the MRP parameters in the material master but can do so while remaining in the stock/requirements list. Further, you can also evaluate the end of RLT, which is shown in the lower half of Figure 13.15.

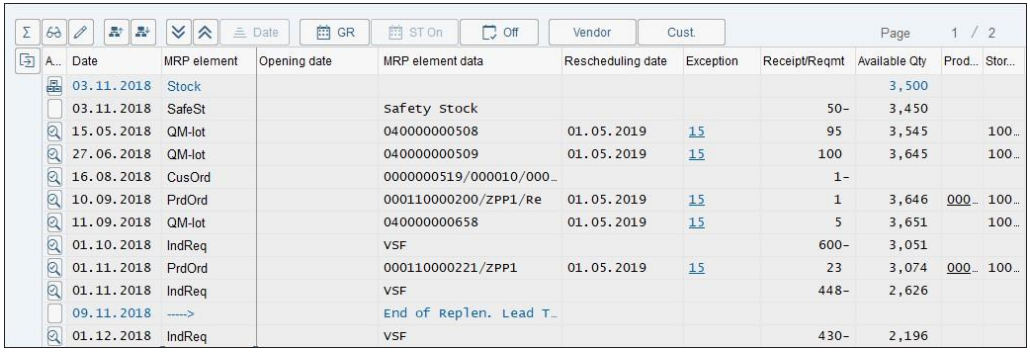


Figure 13.15 Replenishment Lead Time

13.2.7 Interactive Conversion of Procurement Elements

When you click on the **Additional Data for MRP Element** icon (the magnifying glass icon on the left-hand side of the stock/requirement list) of any procurement element (e.g.,, a planned order), a popup appears wherein you can perform the interactive conversion of a planned order either into a purchase requisition for external procurement or a production/process order for in-house production.

13.2.8 Summation View

Figure 13.16 shows that you can toggle between the summation and detailed view of all planning elements (receipts, issuances/requirements, etc.). This icon is located on the left-hand side of Figure 13.16 (next to **Days**).

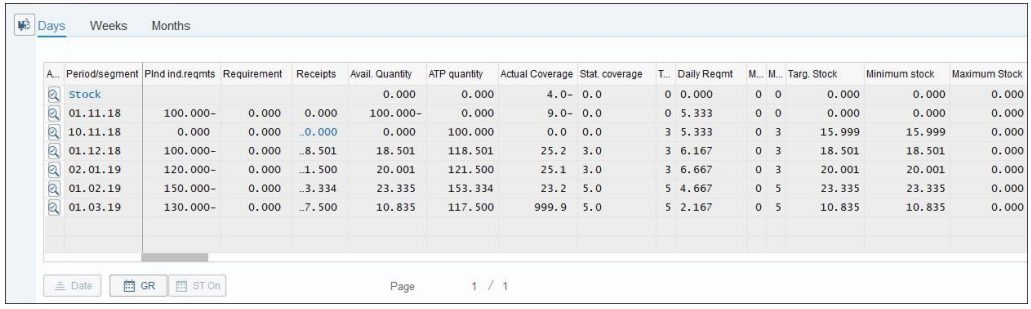


Figure 13.16 Summation View of the Stock Requirement List

13.2.9 Stock Statistics

Figure 13.17 appears when you choose **MoreGotoStock Statistics** in the stock/ requirements list. The stock statistics provide comprehensive details of the stock situation of the material.

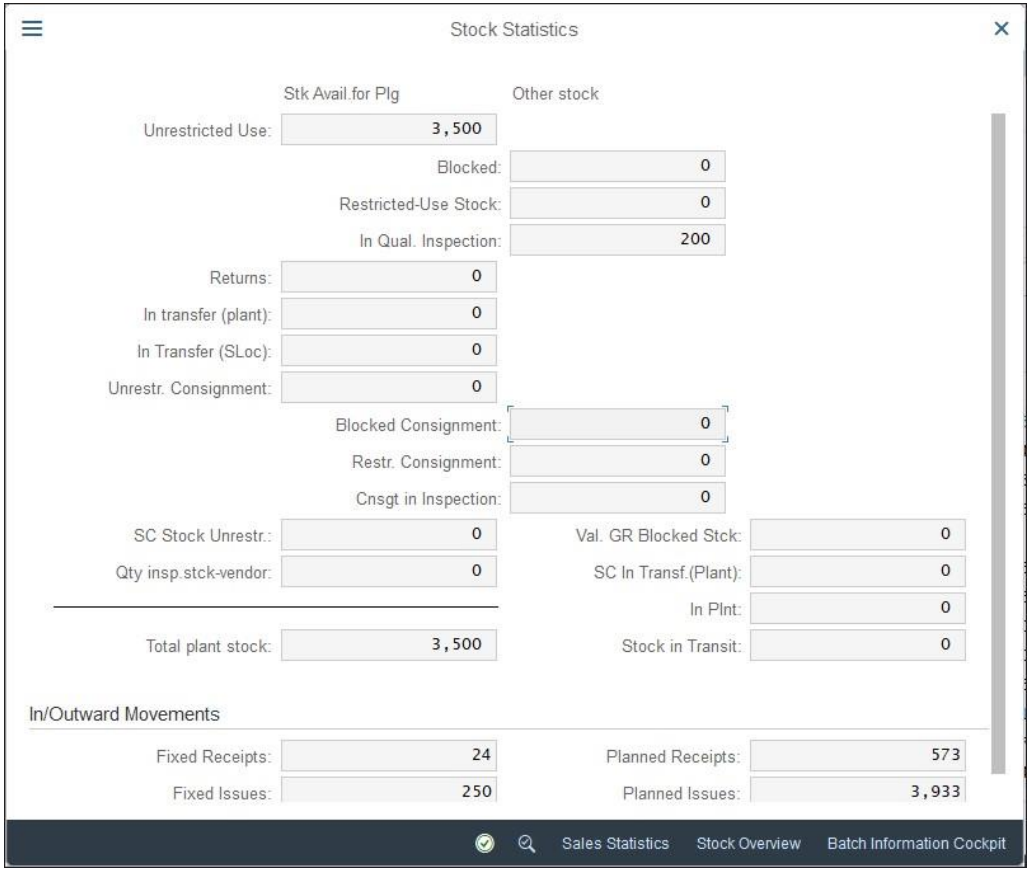


Figure 13.17 Stock Statistics

13.2.10 User Settings

You can save individual display settings in the stock/requirements list to suit your preferences or business needs. Refer back to Figure 13.8 and you'll see the **Settings** icon available on the top-right hand side of the screen.

Note

We encourage you to explore the several other features and functionalities of stock/requirements list by clicking on different icons and choosing from the menu options.

13.3 Planning Calendar

There are several instances in which either the company receives goods on specific days of the week or the vendor supplies goods only during specific days of the week. In other words, the planning of material differs from the factory calendar of the company. For example, several agricultural products used in the production process of edible products are produced only during specific periods of the year. The company must procure them and also store them to ensure they are available for consumption during the production process. For example, red chilies, an agricultural product, is only produced from January to April. The company uses the planning calendar to ensure the system creates procurement proposals of this raw material (red chilies) within the four-month time period.

It's also possible to specify a planning date in the planning run. This option is useful because it enables you to bring the planning run forward to an earlier date. If the planning run is set for Monday, for example, you can perform this planning run on Friday.

You can assign the planning calendar in the **MRP 2** view of the material master (Transaction MM02). Figure 13.18 shows the **Planning cycle** field, in which you enter the planning calendar.

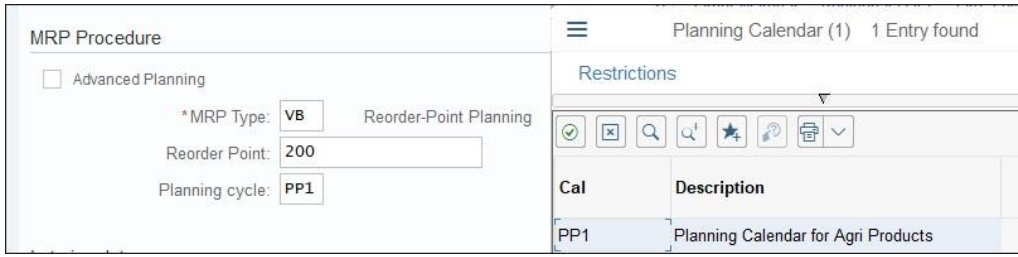


Figure 13.18 Planning Calendar in the Material Master

To create a new planning calendar, follow the configuration menu path, **SAP IMGProductionMaterial Requirements PlanningMaster DataMaintain Planning Calendar**, or use Transaction MD25.

In Figure 13.191, after you define the **Planning calendar** as "PP1" for **Plant** "1710", select the **Following working day** radio button if the period start date isn't a working day.

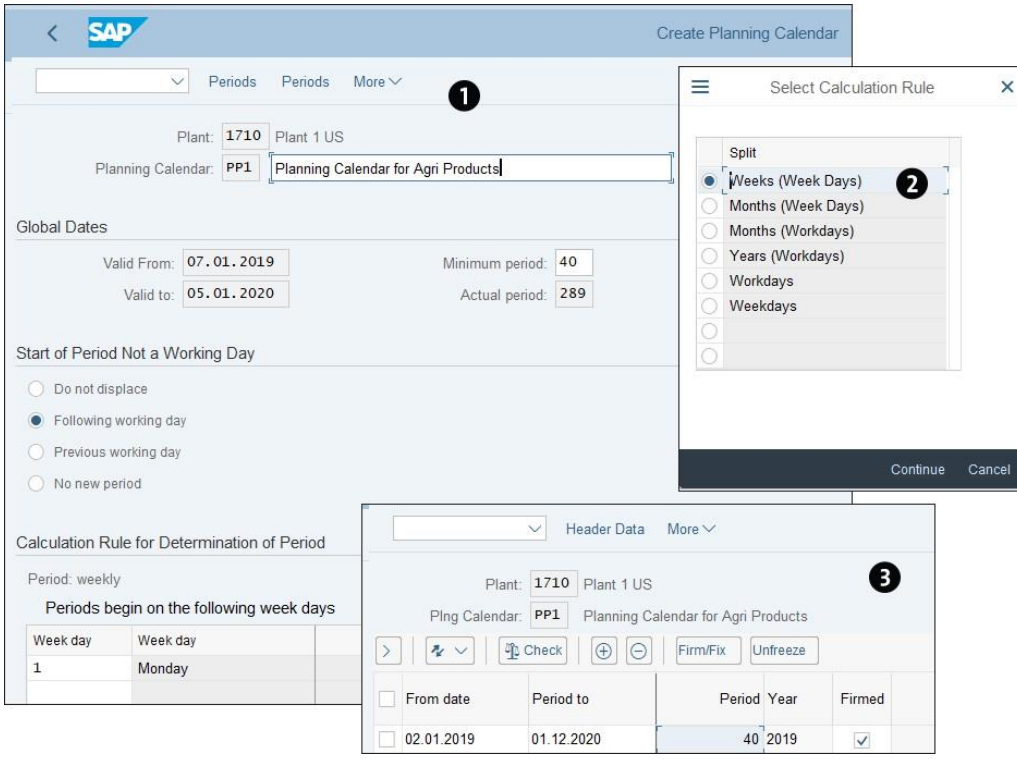
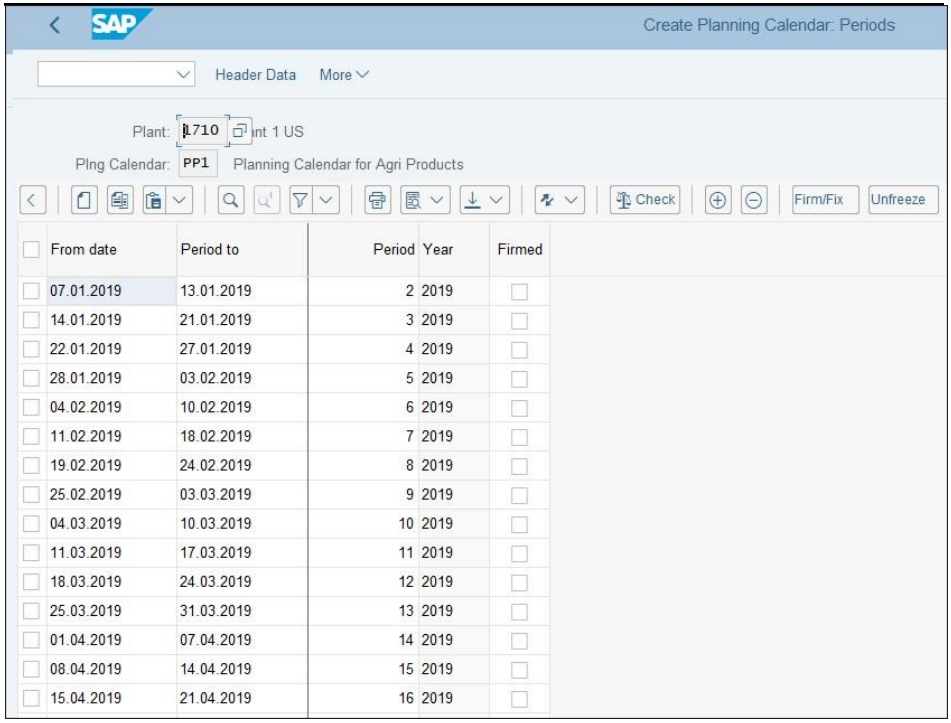


Figure 13.19 Setting Up a Planning Calendar

You can also define the minimum number of periods that the system must generate in the planning calendar. When you press (Enter), a popup appears 2, in which you can select weekdays, workweek, workdays, work months, and so on. Click on the **Periods** button, and the **New Dates** popup appears 3, in which you enter the start and end date of the planning calendar. Choose **Continue**.

In Figure 13.20, notice that all period (planning) starts from Monday, and this is the same as defined in the lower half of the first screen shown in Figure 13.191.



From date	Period to	Period	Year	Firmed
07.01.2019	13.01.2019	2	2019	
14.01.2019	21.01.2019	3	2019	
22.01.2019	27.01.2019	4	2019	
28.01.2019	03.02.2019	5	2019	
04.02.2019	10.02.2019	6	2019	
11.02.2019	18.02.2019	7	2019	
19.02.2019	24.02.2019	8	2019	
25.02.2019	03.03.2019	9	2019	
04.03.2019	10.03.2019	10	2019	
11.03.2019	17.03.2019	11	2019	
18.03.2019	24.03.2019	12	2019	
25.03.2019	31.03.2019	13	2019	
01.04.2019	07.04.2019	14	2019	
08.04.2019	14.04.2019	15	2019	
15.04.2019	21.04.2019	16	2019	

Figure 13.20 Planning Calendar

13.4 Planning Areas

Apart from running MRP at a single plant level, at a material level, or at a product group level, you can activate MRP areas if you want to run MRP on the following:

Single storage location or a group of storage locations

Subcontractor

The advantage of setting up MRP areas is that you can plan material at the storage location level, which allows you to plan material differently from the MRP planning of the material at the plant level. For example, if you have a consumable material that is stored at several storage locations in a plant, then you can set the MRP type of this material as “ND” (no planning) at the plant level. However, for two specific storage locations with high consumption of this consumable material, you can set the MRP type as “VB” (reorder point planning) to ensure that the system helps in replenishment of this material as soon as it drops below the reorder point level in those two storage locations. MRP areas make this materials planning possible.

In this section, we show the configuration of MRP areas; activating the MRP areas in the material master, including defining important planning parameters; running the MRP for MRP areas; and finally evaluating the planning run's results.

Warning

After you activate MRP areas in the SAP system, you can't deactivate them. Therefore, you need to extensively deliberate the use of MRP areas before proceeding to implement them.

13.4.1 Configuration

These two main configuration steps involved in setting up MRP areas are setting the **MRP area active** checkbox and defining the MRP areas, as described here for a storage location:

1. To activate MRP areas, use SAP configuration menu path, **SAP IMG Production Material Requirements Planning Master Data MRP Areas Activate MRP for MRP Areas**. Here, select the **MRP area active** checkbox and save.
2. To define MRP areas, use SAP configuration menu path, **SAP IMG Production Material Requirements Planning Master Data MRP Areas Define MRP Areas**.
3. Choose **New Entries**, set **MRP Area** as "1000–1004", and provide a description.
4. For **MRP area type**, select **02** from the dropdown menu, which is for storage location MRP. Assign the **Plant** as "1000", and press (Enter).
5. On the left-hand side of the screen, double-click on **Assign storage locations**, which leads to the screen shown in Figure 13.21.

Note

MRP area type 02 is the standard case to define additional MRP areas on the storage location level. MRP area type 01 is for the plant MRP areas and is created automatically by converting the planning file for MRP areas. MRP area type 03 is for subcontracting, in which you maintain your company's stock at vendors' premises and ensure materials planning.

6. Assign the **Recg. stor. loc.** (receiving storage location) as "1004" for **Plant** "1000", and save the entry.

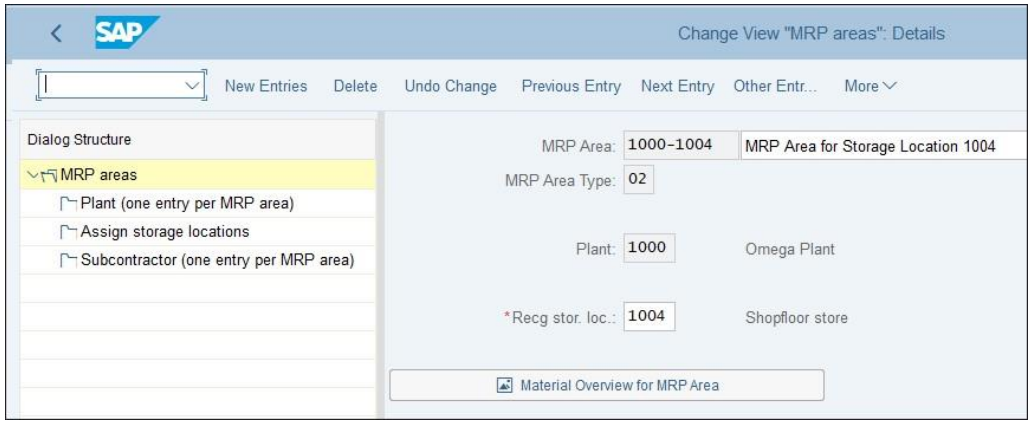


Figure 13.21 Configuration Settings for MRP Areas for a Storage Location

For this example, we used a single storage location for the plant, but you can also group several storage locations under one MRP area. This storage location (or locations) will be planned separately and independently from planning at the plant level. Additionally, you can define subcontracting MRP areas within a plant to enable you to plan material availability at the subcontractor (vendor) level.

13.4.2 Set Up in the Material Master

With the necessary configuration settings for MRP areas in place, you can activate the storage location MRP for the material 10000090 for plant 1000 and for storage location 1004.

Using Transaction MM02 for the change in the material master and entering **Material** "10000090" for **Plant** "1000" and for **Stor. Loc.** "**1004**", select the **MRP 1** view. In Figure 13.22, click on the **MRP areas** button so that the **Change MRP Area** screen in Figure 13.23 appears. Select the configured **MRP Area 1000–1004**.

Figure 13.22 MRP Areas in the Material Master

Assign the MRP type as VB for manual reorder point planning at the MRP area level, and set **Reorder Point** as "200.00". Assign other parameters such as **MRP Controller** "RM1" and **Fixed Lot Size** of "100.00", as shown in Figure 13.23. Click on the **MRP 2** tab.

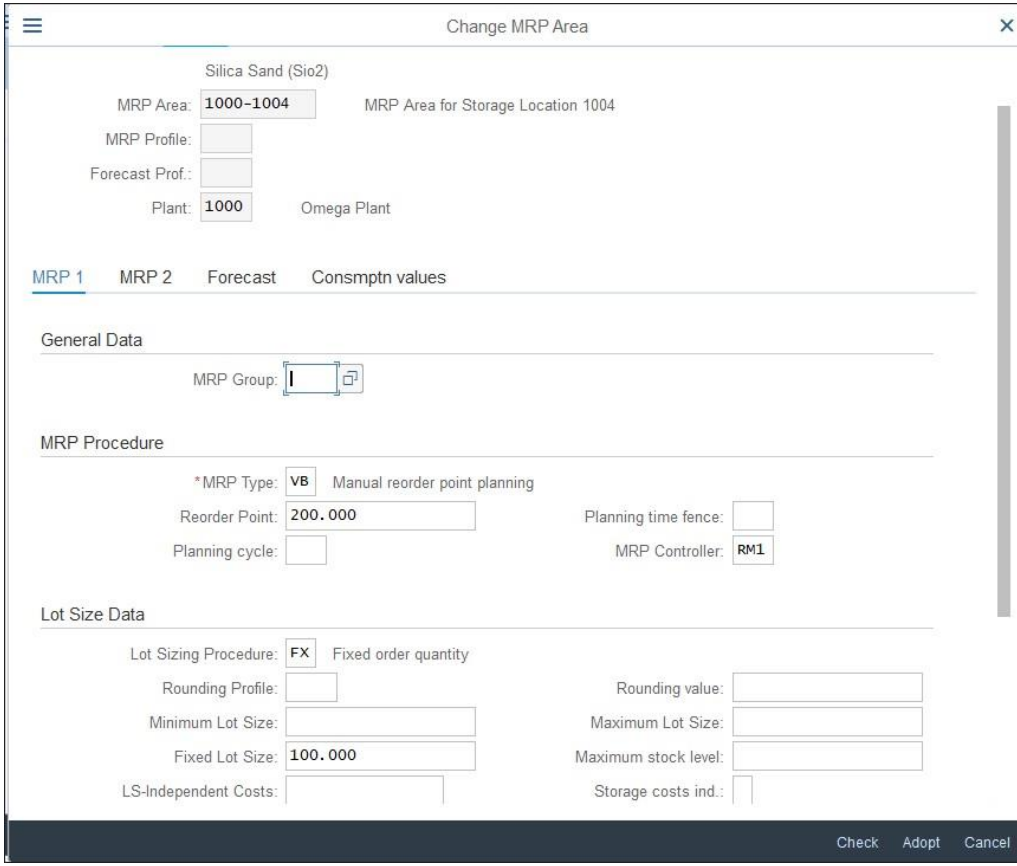


Figure 13.23 MRP Area Settings for the Storage Location in the Material Master

In the **MRP 2** tab, more planning options are available at the material level, such as defining a **Safety stock** of "70.000" at the MRP areas level (Figure 13.24). Enter a **Planned Deliv. Time** of "5" days, and click on the **Forecast** tab.

The **Forecast** tab page enables you to enter forecast parameters and also interactively execute a forecast of the material. Finally, click on the **Consmptn values** tab. You can enter the planned and unplanned consumption values. Click on the **Adopt** icon in MRP areas, and save the material master settings.

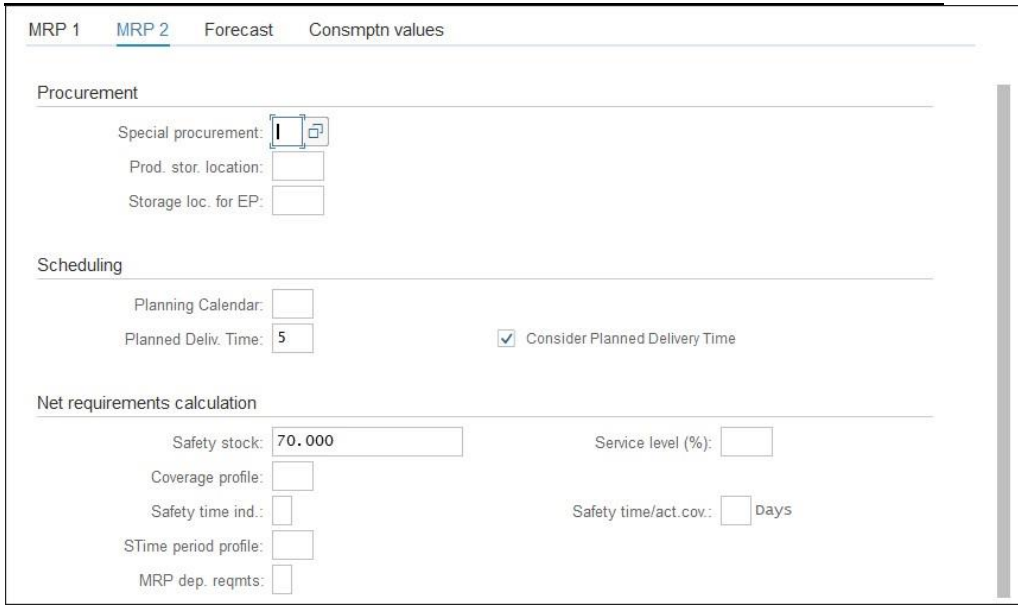


Figure 13.24 MRP 2 Tab of MRP Area 1000–1004

13.4.3 Running Material Requirements P at the Planning Area Level

To run the MRP for MRP areas interactively, use Transaction MD01N (MRP Live), and enter the parameters, such as **Material** "10000090". On executing the MRP Live transaction, the screen shown in Figure 13.25 appears. Notice that **Material 10000070** belongs to the **MRP Area 1000–1004**. Click on the **Selected Stock/Requirements Li** button to go to the screen shown Figure 13.26, discussed in the next section.

Figure 13.25 Planning Results from MRP Live Using the MRP Area

13.4.4 Planning Results

Figure 13.26 shows the planning results of **Material 10000090** in **MRP Area 1000–1004.** Because there was no opening **Stock**, and the stock has fallen below the safety stock in the warehouse (storage location of the MRP areas), the system creates new purchase

requisitions 1010000789 and 1010000790 with a fixed quantity of 100 each (this is because we defined a fixed lot size in Figure 13.23). Notice **Exception 96** to denote that **stock fallen below safety stock level** (message details in the lower half of the screen).

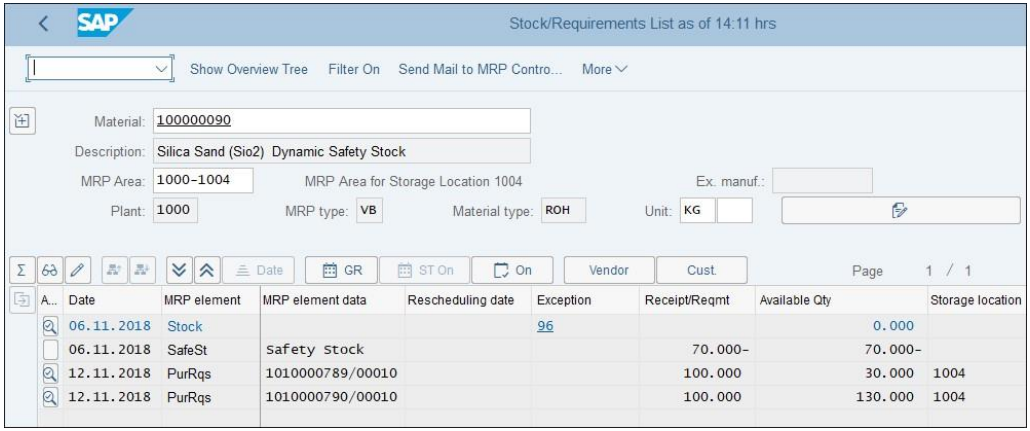


Figure 13.26 Planning Results of Material 10000070 for MRP Area 1000–1004

13.5 Classic Material Requirements Planning

Now that we've already covered MRP Live and associated business processes, let's also briefly cover the basics of classic MRP and some of the important functionality it offers. Access Figure 13.27 using Transaction MD02 to run MRP of a single material at an **MRP Area** level "1000–1004".

Following are some of the important selection parameters of MRP:

Processing key

The processing key enables the system to decide the type of planning run it needs to carry out for the material. The options for the planning run are **NETCH**, **NETPL**, and **NEUPL**.

Purchase requisition key

If external procurement is implied, the system considers this setting during the planning run. If necessary settings are in place, then the system can directly create purchase requisitions for all externally procured materials. Alternatively, the system can create planned orders that you can convert into purchase requisitions.

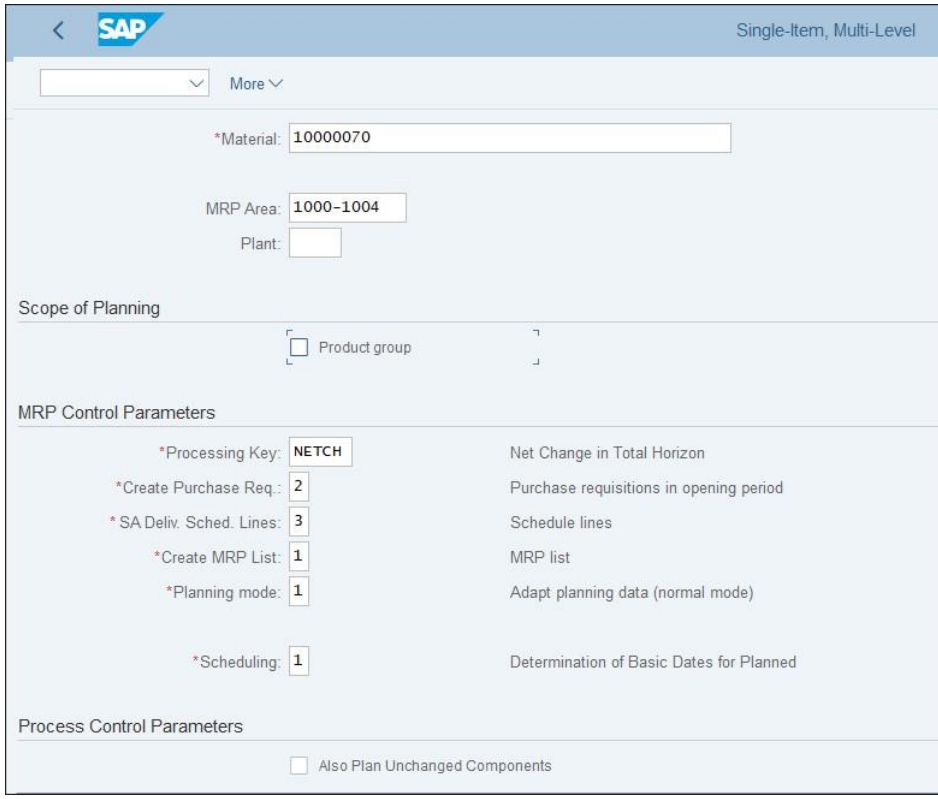


Figure 13.27 Single-Item, Multi-Level MRP (Initial Screen)

Delivery schedules

If you've maintained a source list for the material and have incorporated scheduling agreements with vendors in the source list, the system can create schedule lines.

Creation of MRP list

The system includes the results of the planning run in the MRP list after the planning run. An MRP list is a static or frozen list of stock/requirements situations with the date and time immediately after the planning run. This indicator controls how the system should create the MRP list. The available options are for the system to create an MRP list for all planned orders, create an MRP list for planned orders with exceptions, or don't create any MRP list at all. Exceptions are alerts in the system that the planner needs to keep an eye on.

Planning mode

During the planning run, the system plans various procurement elements, such as the unfirmed planned orders, purchase requisitions, and scheduling agreements, once again in the next planning run. You can control how the system should proceed with the planning data that are already there (from the latest planning run or due to interactive activities of the MRP planner). Three options are available:

– **Adopt Planning data**
  If there is any change in requirement quantities, dates, or lot-sizing procedures for the unfirmed planned orders (or other procurement elements), the system reexplodes the BOM for the new quantities in the MRP run.

– **Re-explode BOM and routing**
  The system reexplodes the BOM and routing if there is a change in the BOM master data, routing, production versions, or BOM explosion numbers. This helps to ensure that the system reexplodes the BOM for the existing unfirmed planned orders. The procurement proposals created in the previous planning aren't deleted but are adjusted to take the changes into account.

– **Delete and Recreate Planning data**
  The system deletes the existing procurement proposals (i.e., the entire planning data of the previous planning run), unless they are firmed and reexplodes the BOM and routing, thereby creating altogether new procurement proposals.

Scheduling types

For in-house produced materials, the system offers two types of scheduling options:

– Basic date scheduling

– Lead time scheduling

After you enter the parameters on the initial screen of Transaction MD02, and press (Enter) twice (first to confirm the MRP parameters causing the entered parameters to turn red and then to execute the MRP), the system takes you to the planning result screen of a large number of materials. In this result, not only the finished or semifinished goods (10000070) are planned but also all the components of the BOM. You can view the planning results of a material by double-clicking it.

13.6 Types of Planning Runs

Depending on your business process, you can use one of the several types of planning runs available in the SAP system. A planning run denotes the level and mode at

which you want to run MRP. For example, you may want to run MRP on an individual plant or group of plants, individual material or group of materials (product group), in online mode, or in background mode.

Some of the planning runs include the following:

Total planning online

Total planning background

Single-item planning, sales order

Single-item planning, project

We discuss each of the planning runs in the following sections.

13.6.1 Total Planning Online

In this type of planning run, the system carries out a multilevel planning run, that is, for all the materials in a plant, for all the materials in multiple plants, or for MRP, as defined through **Scope of Planning**, which is available in the selection screen. Total planning online is carried out using Transaction MD01.

If your business process requires you to consider and use other parameters in the MRP run, you can either define or use a user exit. For example, if you want to carry out the MRP run for a set of MRP controllers only or for a specific procurement type (E: Inhouse managed, F: Externally procured, X: Both), then you use a user exit. The user exit enhancement is M61X00001, and you need to engage an ABAP consultant for this.

13.6.2 Total Planning Background

With the total planning background method, you can carry out the planning in the background, as opposed to the foreground or online. Using Transaction MDBT, you can create a variant of the Transaction MD01N screen and schedule it in the background on a periodic basis. The program name for Transaction MDBT is RMMRP000. Use Transaction SE38, give the program name, and define the variant to execute the MRP in the background.

13.6.3 Single-Item Planning, Sales Order

For MTO production, you can use single-item planning for a sales order. You need to give the sales order number together with the line item of the sales order and use Transaction MD50 to execute the planning. The system not only creates a procurement element or receipt

with the sales order reference for the finished good but also plans all the components defined in the BOM of the finished good.

13.6.4 Single-Item Planning, Project

You can also execute separate planning for engineer-to-order (ETO) materials. If the material—finished good or a spare part of a raw material—is assigned to a work breakdown structure (WBS) element, then you can use Transaction MD51 to execute planning.

Note

Materials planning is a very complex topic and requires a much deeper understanding of how to formulate materials planning rules and policies in a company that can then be mapped in the SAP system. Here, we highly recommend *Materials Planning with SAP* (*www.sap-press.com/3745*, SAP PRESS, 2015) as it does a complete justice to this topic.

13.7 Demand-Driven Replenishment

Demand-driven replenishment (DDR) in SAP S/4HANA is based on the demanddriven material requirements planning (DDMRP) methodology from the Demand Driven Institute (*www.demanddriveninstitute.com*).

In the following sections, we'll explain the importance of ensuring smoother materials and relevant information flows. Next, we'll discuss how decoupling at important points in the logistics and supply chain provide the necessary buffers to dampen demand and supply variabilities. We'll also discuss the key terms used in DDMRP followed by first briefly discussing the five components of DDMRP and then how they map with the DDR in SAP S/4HANA.

13.7.1 Why Use Demand-Driven Replenishment?

First, let's look at why distortions to material and relevant information occur, as illustrated Figure 13.28.

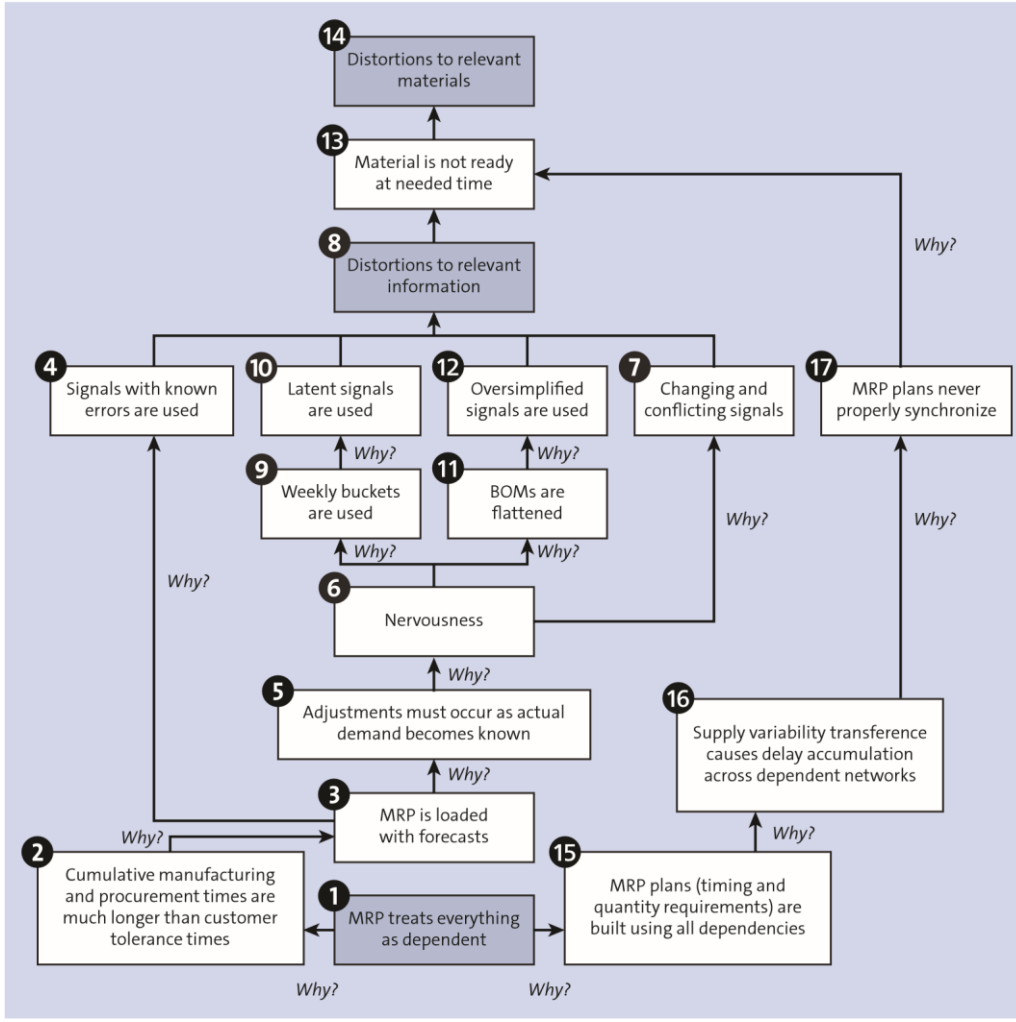


Figure 13.28 Distortion to Material and Information Flows (©Demand Driven Institute, Used with Permission)

Starting at the bottom of Figure 13.28, materials planners use MRP 1 to calculate future demand for the products to ensure timely production and procurement. However, due to the inherent logic of MRP, it treats everything as dependent and acts as one big calculator to suggest production and procurement quantities of materials on specific dates. In today's complex and globalized supply chain, the time it takes to procure and produce a product is much longer than it has ever been. At the same time, customers today have far more

choices, thereby leading to shrinking customer tolerance time for a company to deliver or ensure availability of a product 2.

To better predict customers' demand to feed into the MRP program, companies use the forecasting tool 3. Unfortunately, using even the best forecasting model or program always has a degree of error. The longer the forecast horizon is, such as yearly, quarterly, or even monthly, the greater is the degree of error 4. The more detailed level at which the forecasting is done, such as at individual product or SKU level, the more amplified is the forecasting error leading to distortion of relevant information 8.

Refer again to the bottom of Figure 13.28. While the MRP uses forecast to predict demand 3, when the actual customers' demand is known, adjustment between forecasted demand versus actual demand must happen 5, leading to nervousness 6 in the entire logistics and supply chain. These conflicting and often-changing demand signals 7 lead to distortion of relevant information 8. This distorted or unreliable information used for materials planning is one of the two major reasons for the bullwhip effect. The bullwhip effect is the amplification of supply variability as the result of demand variability that has cascading and negative ripple effects on the supply chain.

The second effect of nervousness 6 is that companies often use the materials planning, such as production or procurement planning in time horizons of one-week or even two-week buckets 9, to bring some sanity to production or procurement plans and to prevent frequent changes to these plans. In doing so, planners use latent signals j that again result in distortion to relevant information 8.

The third factor that adds nervousness to the supply chain is when materials planners attempt to flatten BOMs k to reduce materials quantities or scheduling variabilities. In doing so, materials planners end up using oversimplified signals l for procurement or production planning, further adding to the distortion of relevant information 8. When distorted information 8 is used, it's no surprise that the products or materials required aren't ready or available when needed m, eventually culminating in the distortion of relevant materials n. When relevant materials are distorted, companies either end up with products that don't sell (overstock scenario) or with no products to deliver on time to meet demand (out-of-stock scenario); both scenarios lead to missed business opportunities and lost customers.

Let's now go back again to the bottom of Figure 13.28 to understand how the MRP program that treats all materials as dependent 1 leads to the same distortions to relevant materials created by nervousness in the supply chain previously. The MRP program performs a level-by-level explosion of BOMs of finished goods to calculate quantities of semifinished,

packing, and raw materials (just like a big calculator) required at specific times; the resultant MRP plans of quantities and schedules are based on all these dependencies o.

Because the MRP program is designed to ensure quantities of all materials in a BOM eventually net to zero after taking any safety stock into account, any change in plans, variability, or disruption on the supply side has multiplying effects on all dependent requirements, leading to delays accumulation p. The delays accumulate, but the gains don't; thus material planners have MRP-generated production and procurement plans that are never properly synchronized q between demand and supply. The end results are the same as before: companies end up with overstock of slowmoving products or products that don't sell, while stock-outs occur for high-demand products.

The solution to the distortion of relevant information and the quagmire of material flows lies in decoupling the logistics and supply chain to reduce the bullwhip effect. Decoupling entails disconnecting the ever-present and constantly increasing variability between demand and supply by placing buffers at strategic points, known as *decoupling points*. Materials planners then regularly monitor the buffers in the material value chain—from procurement to production to distribution—to ensure timely action and interventions where necessary. There are three types of buffers:

Stock buffer

The stock situation at each buffer is closely monitored to ensure there's no shortage of the required materials.

Time buffer

This buffer manages demand and supply variability that may impact production or procurement scheduling.

Capacity buffer

This buffer at production lines or work centers provides the cushions required for smoother flow to materials produced in-house.

Figure 13.29 represents the supply chain. Starting from the left, a buffer is placed at the decoupling point 1, which is between the component manufacturing and subassembly steps. Notice the reduction in variability wave 2 to dampen the bullwhip effect and the associated lead time reduction 3.

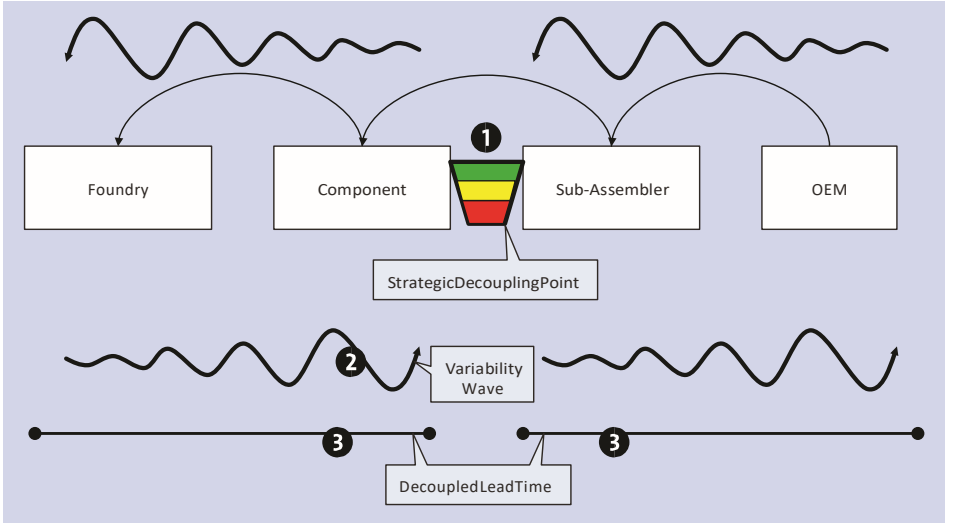


Figure 13.29 Decoupling Point (©Demand Driven Institute, Used with Permission)

Three areas in the logistics and supply chain where you can implement and benefit from DDR are as follows: **Purchasing**

Purchased parts often experience supply variability.

Operations

Production operations that produce several common parts or work centers with bottleneck capacities are the prime candidates for DDR. For finished goods sold by a company directly to its customers, implementing DDR can mitigate the risks of demand variability due to customers' changing requirements of a company's products. **Distribution**

Finished goods or even services' spare parts are distributed to different distribution centers and experience significant demand variability.

13.7.2 Key Terms

Before we dive into the five components of DDMRP, consider the following list of some important DDR terms and their meanings. These terms are either defined in supply chain associations, such as APICS, or by the Demand Driven Institute:

Item type

Categorizes various material types, such as procured (P), intermediate (I) or semifinished (SF), manufactured (M), and distributed (D).

Average daily usage (ADU)

The average consumption of a material in a given time period.

Minimum order quantity (MOQ)

The minimum procurement quantity imposed by the supplier, or the minimum production quantity or economic order quantity of a material.

Imposed or desired order cycle (DOC)

The frequency of procuring a material either imposed from the supplier side or a company's own ordering cycle. **Decoupled lead time (DLT)**

The longest but reduced unprotected or unbuffered lead time in the BOM to procure or produce a material. **Lead time factor (LT factor)**

Denotes a factor in the lead time to procure or produce a material in the *range* of 0.0–1.0. Longer lead times will have smaller LT factors and vice versa. Materials planners mutually agree to define the lead time categories (long, medium, and short) and then assign an LT factor to each lead time category. Here's an example:

- Long lead time: LT factor = 0.20
- Medium lead time: LT factor = 0.50
- Short lead time: LT factor = 0.85

Variability factor (VF)

Denotes the demand or supply variability of materials in the range of 0.0–1.0. Higher variability in demand or supply will have higher VF and vice versa. Materials planners mutually agree to define the VF categories (stable, intermittent, and unstable/unpredictable demand/supply) and then assign VF to each category. Here's an example:

- Erratic supply/demand (high variability): VF = 0.85
- Semistable supply/demand (significantly high variability): VF = 0.70
- Mostly stable supply/demand (medium variability): VF = 0.40
- Stable supply/demand (low variability): VF = 0.25

Buffer profile

A logical grouping of materials sharing similar characteristics, such as materials being procured, manufactured, or distributed across warehouses. The buffer profile also mentions the LT factor and VF of each material. A buffer profile consists of an item part, lead time category (and LT factor), and variability category (and VF). For example, a buffer profile M, M (0.4), L (0.33) means the following:

- Part is **M**anufactured (M)

- Has **M**edium lead time (M) with a lead time factor (0.4)
- Has **L**ow (L) demand/supply variability with a VF (0.33)

13.7.3 Demand-Driven Material Requirements Planning Components

In this section, we'll discuss the five components of DDMRP (see Figure 13.30) and show how to effectively *position* buffers at strategic inventory locations, *protect* the flow of materials and relevant information by evaluating buffer profiles, and then dynamically adjust these buffers. Finally, an efficient *pull* system is put in place to reduce variabilities between demand and supply through demand-driven planning. This is followed by execution while ensuring the changing supply and demand dynamics adapt to the logistics and supply chain. We'll also show how these five components map to DDR applications.

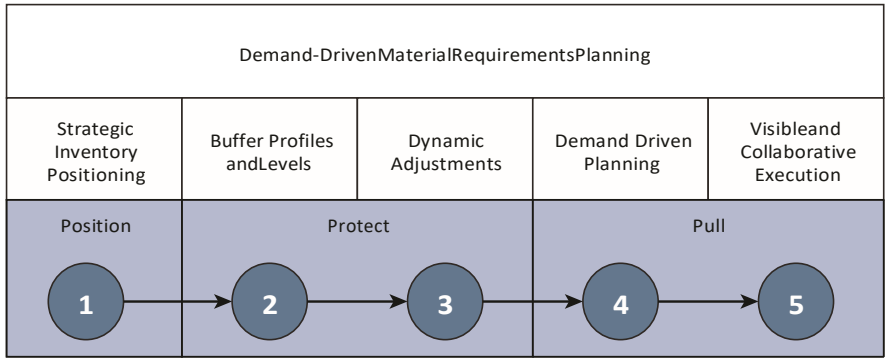


Figure 13.30 Five Components of DDMRP (©Demand Driven Institute, Used with Permission)

Strategic Inventory Positioning

In this component (refer to Figure 13.30), a materials planner decides how much stock to hold (the buffers) at specific decoupling points. Materials that share similar characteristics and attributes (e.g., raw or packing materials with long lead times, finished goods with high demand variability, or several intermediate products sharing a common machine or a bottlenecked work center) are grouped together and assigned relevant buffer profiles, and then buffer levels are maintained.

Let's take a look at the three buffer zones (red, yellow, and green) and how to calculate them (see Figure 13.31).

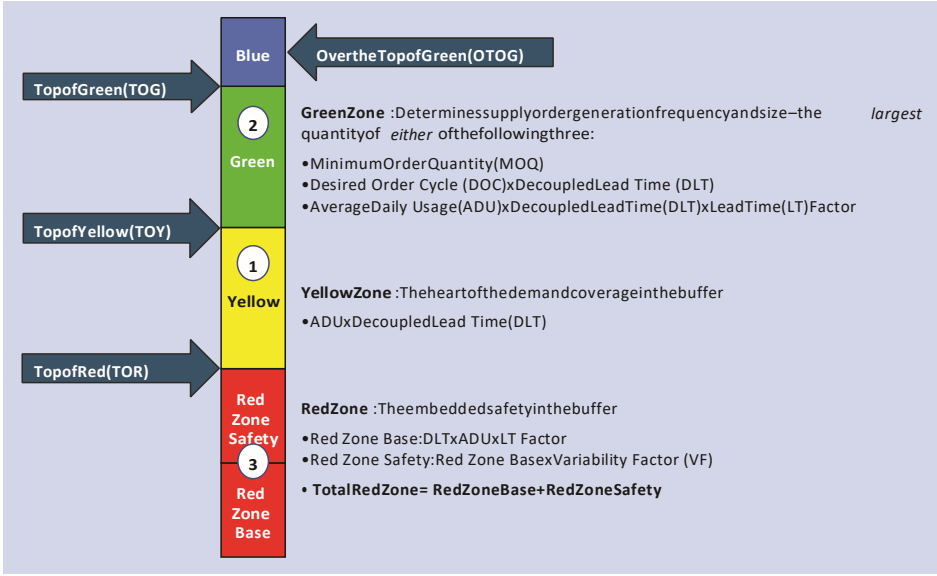


Figure 13.31 Buffer Zones Calculations (©Demand Driven Institute, Used with Permission)

To get a better sense of buffer positions, consider the following four abbreviations and their meanings: **Top of red (TOR)**

The highest point of the red zone. When the stock, schedule, or capacity breaches the red zone, it signals an urgent action or immediate attention.

Top of yellow (TOY)

The highest point of the yellow zone. Breaching TOY means a warning of a buffer situation. TOY = Red Zone + Yellow Zone.

Top of green (TOG)

The highest point of the green zone that reflects a comfortable buffer position until it crosses into the TOY zone. TOG = Red + Yellow + Green.

Over the top of green (OTOG)

A situation in which the on-hand or available stock is over the top of the defined green zone (TOG) and signals an excess inventory position.

Figure 13.32 shows an example of calculating the buffer zones. Start out with calculating the yellow zone, followed by the green zone, and finally the red zone. Data required to calculate all three zones are also shown in Figure 13.32. Meanwhile, you can calculate the following:

TOR: 90

TOY: Red + Yellow = 90 + 150 = 240

TOG: Red + Yellow + Green = 90 + 150 + 90 = 330

Part Buffer Calculation – An Example			
Average Daily Usage (ADU)	15	**Green Zone**	**90** (the largest of three calculated values)
Buffer Profile (**M**anufactured, **M**edium Lead Time, **L**ow Variability)	M, M (0.4), L (0.33)		LT Factor: **60** (DLT (10)x ADU (15) x Lead Time Factor (0.4))
MOQ (Minimum Order Quantity)	50		Minimum Order Quantity: **50**
Imposed or Desired Order Cycle (DOC)	6 days		Order Cycle: **90** (6(DOC) x 15(ADU))
Decoupled Lead Time (DLT)	10 days	**Yellow Zone**	**150** (10(DLT) x 15(ADU))
Lead Time Factor (M) = 0.4 Variability Factor (L) = 0.33		**Red Zone**	**120** (Red Base (**60**) + Red Safety (**30**))
			Red Base: **90** (DLT (10)x ADU (15) x Lead Time Factor (0.4))
			Red Safety: **30** (Red Base (90) x Variability Factor (0.33))

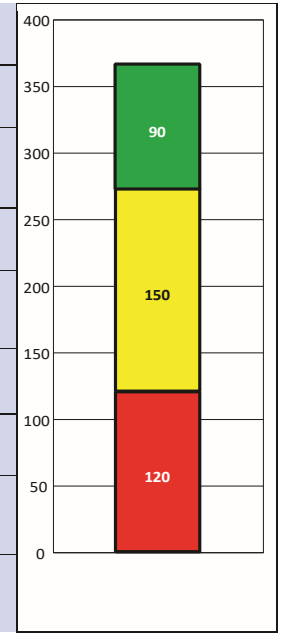


Figure 13.32 Buffers Calculation: An Example (©Demand Driven Institute, Used with Permission)

Buffer Profiles and Levels

A buffer profile consist of a combination of settings, such as if the material is procured or produced, if it has high or medium variability factor or if the lead time is long or short. A buffer profile also consists of specific numeric values assigned to materials with high lead times or low variability factors. The buffer level evaluates the average daily usage of a material to decide the buffer levels that need to be maintained for a material.

Dynamic Adjustments

In this component (refer to Figure 13.30), a materials planner oversees dynamic adjustments to buffers to account for product seasonality, stage of a product maturity such as a soon-to-be-discontinued product or a new product introduction, and capacity adjustments, and then prebuilds the requirements in anticipation of future demand or slowdown. Buffers, such as stock buffers, also adjust dynamically to account for supply variability, a procurement or production schedule mismatch, or a machine reaching an overload capacity situation. As

already covered, the stock, schedule, and capacity buffers adjust dynamically to ensure elimination of distortions to relevant information and materials flows.

Demand-Driven Planning

In this component (refer to Figure 13.30), a materials planner uses the visual planning tools to create replenishment orders where necessary. Replenishment orders are created based on the *net flow equation*:

Net flow equation: On-hand + On-order – Qualified sales order (or demand)

In this equation, *on-hand* is the available stock in the warehouse, *on-order* refers to the quantities of materials ordered and awaiting receipt, and *qualified sales order (or demand)* refers to the sales orders due today, past due, and qualified future spikes. The qualified future spike considers the quantity threshold within a defined time horizon on a *daily* time bucket to decide if the spike qualifies to be included in the calculation for net flow equation. For example, a qualified future spike is included in the net flow equation calculation when the demand quantity of material is 50 units or more (the quantity threshold) on a single day (daily time bucket) and within the time horizon of one week.

Visible and Collaborative Execution

In this component (refer to Figure 13.30), materials planners take action to convert suggested replenishment orders into procurement orders, production orders, or stock transport orders. Further, materials planners use material lead times or scheduling synchronization alerts to attend quickly to any material or scheduling disruptions that threaten to destabilize the supply chain. DDR is a priority-based pull system that alerts planners visually whenever a situation warrants action or attention.

Mapping Demand-Driven Replenishment Components

Table 13.1 and the previously shown Figure 13.30 show the DDMRP components mapping with the available SAP Fiori DDR apps in SAP S/HANA, respectively.

DDMRP Component	DDMRP Component Description	DDR App	Functionality of DDR App
1	Strategic Inventory Positioning	Schedule Product Classification (DD)	Performs classification (ABC, EFG, PQR).

		Mass Maintenance of Products (DD)	Based on classification, the MRP type D1 (new MRP type available for DDR) is set manually. Classification can be changed manually as well.
		Schedule Lead Time Calculation of Products (DD)	Performs calculation of decoupled lead times using MRP type D1 and classification according to EFG.
2	Buffer Profiles and Levels	Schedule Buffer Proposal Calculation	Calculates buffers based on decoupled lead times using MRP type D1.
		Manage Buffer Levels	Enables users to adjust calculated values of buffers.
		Buffer Positioning	Provides planner with detailed visuals of a product structure to help with informed decisionmaking on effective buffer positioning.
3	Dynamic Adjustments	Schedule Buffer Proposal Calculation	Calculates buffers based on decoupled lead times using MRP type D1.
		Manage Buffer Levels	Enables users to adjust calculated values of buffers.

Table 13.1 DDMRP Components Mapping with DDR Apps in SAP S/4HANA

DDMRP Component	DDMRP Component Description	DDR App	Functionality of DDR App

4	Demand-Driven Planning	MRP Run	Creates receipt elements.
		Replenishment Planning	Supports planners during MRP postprocessing with planning status display.
5	Visible and Collaborative Execution	Replenishment Execution	Displays on-hand buffer status.
		Planner Overview	A dashboard that enables planner to quickly take actions on materials needing immediate attention.

Table 13.1 DDMRP Components Mapping with DDR Apps in SAP S/4HANA (Cont.)

In the following sections, we'll put into practice the DDMRP concepts and theoretical understanding gained so far by mapping them in SAP S/4HANA in a step-by-step manner.

13.7.4 Material Master

Figure 13.33 shows the material master 11 in plant 1710 wherein the **MRP type** field is assigned "D1". We'll use this material-plant combination throughout the DDR example. Meanwhile, for the sake of this example, maintain the numeric values for different fields in the material master as noted in Table 13.2, which also includes the purpose they serve.

Field in Material Master	Field Value in Material Master	Purpose in DDR
Maximum Stock Level	"1,000"	TOG
Reorder Point	"200"	TOY
Safety Stock	"50"	TOR – Red Base
Minimum Safety Stock	"0" (no value)	TOR – Red Safety

Table 13.2 Material Master Fields Maintenance for Buffers in DDR

Tips & Tricks

As this is just an example, simply maintain any reasonable values in all fields. The DDR process will automatically calculate and update these fields based on actual material usage or consumption data, which we'll show in the subsequent sections.

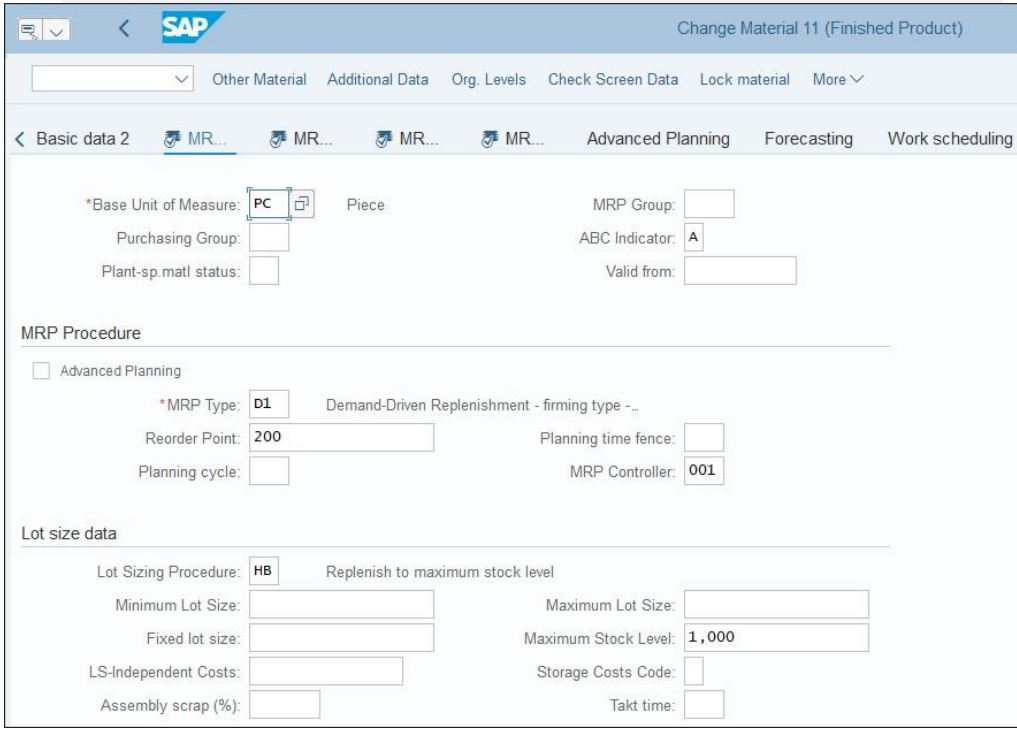


Figure 13.33 MRP Type D1 in Material Master

Figure 13.34 is the **Demand-Driven Replenishment** tab available in the **Stock/Requirements List** (Transaction MD04) in which the **Net flow position** is shown along with other details. Notice that despite maintaining various stock levels, such as safety stock or reorder point as discussed in Table 13.2, their values aren't shown. The data in these fields will be updated when we cover the entire DDR process.

And for this example only, you trigger the ADU (average daily use) of material by performing some goods issue (GI) and GR transactions beforehand in the system in different dates. For example, receive this material in a storage location against initial stock posting (Transaction MIGO, movement type 561) on different dates in the past. Similarly, issue out (consume) this material against a cost center (Transaction MIGO, movement type

201) on different dates in the past so that the system is able to automatically determine the ADU. In addition, manually create a few material reservations for this material in future dates (Transaction MB21, movement type 201). This step will enable the system to calculate the ADU for future consumption.

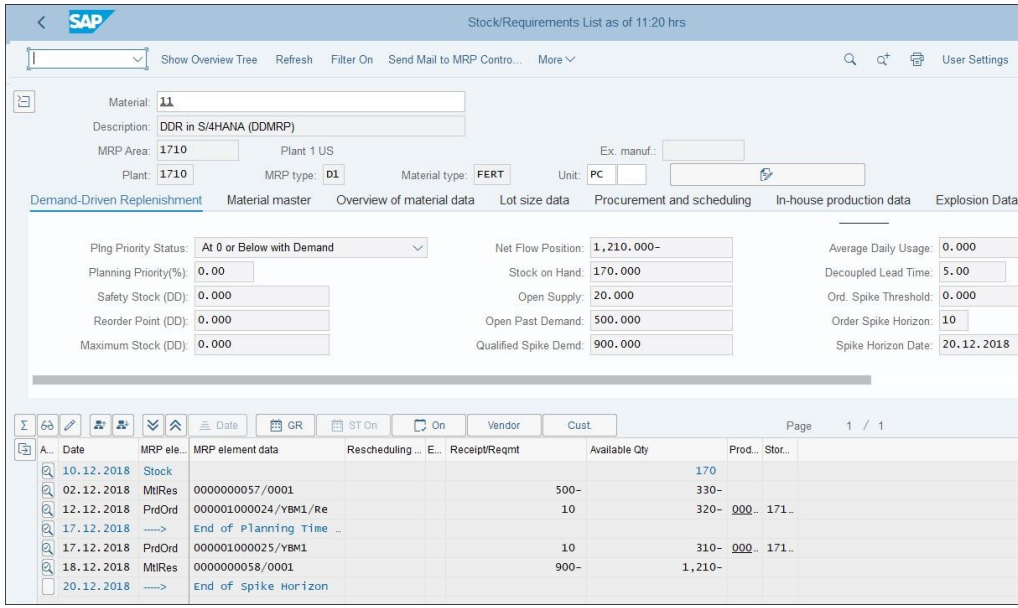


Figure 13.34 Stock/Requirements List for DDR Material Let's

now begin the DDR process in SAP S/4HANA.

13.7.5 Schedule Classification of Products

Classification is a central step in determining the decoupling points in a multilevel BOM structure as part of the DDR approach. The planning objects' material/plant or material/plant/MRP areas are valuated according to their essential characteristics and assigned to classes on this basis. This classification helps to identify the appropriate settings for each planning object, which should be selected based on these characteristics.

In the context of DDR, these settings are defined in a certain way. The results of classification lead to the assignment of buffer profiles in a subsequent step: stock positioning.

As a result, classification is a central building block in the planning process of the DDR approach in SAP.

The SAP Fiori app Schedule Product Classification (DD) is available. After opening the app, an overview screen appears that displays the job runs of the past. Choose the **New**1 button in Figure 13.35 to display an overview on which you can make the settings for the classification, while the popups 2 and 3 provide scheduling options.
Scroll down to see the screen shown in Figure 13.36.

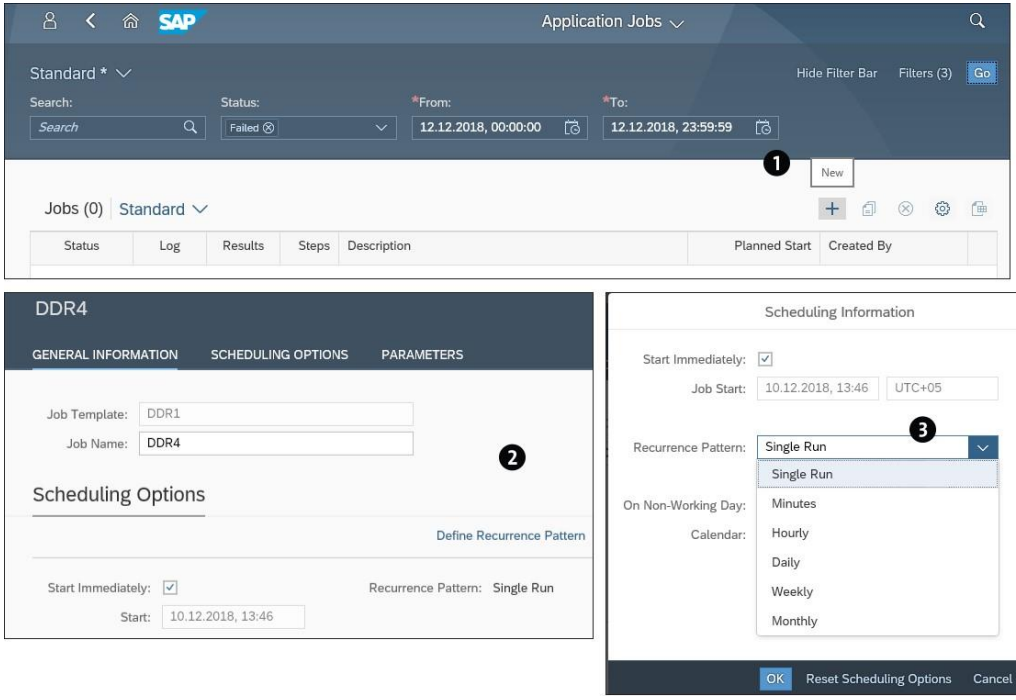


Figure 13.35 Schedule Classification of Products: Scheduling Options

Beneath the general settings, such as the selection of the objects to be classified and job start times, Figure 13.36 shows the settings for three different classification procedures:

ABC analysis

XYZ analysis

PQR analysis

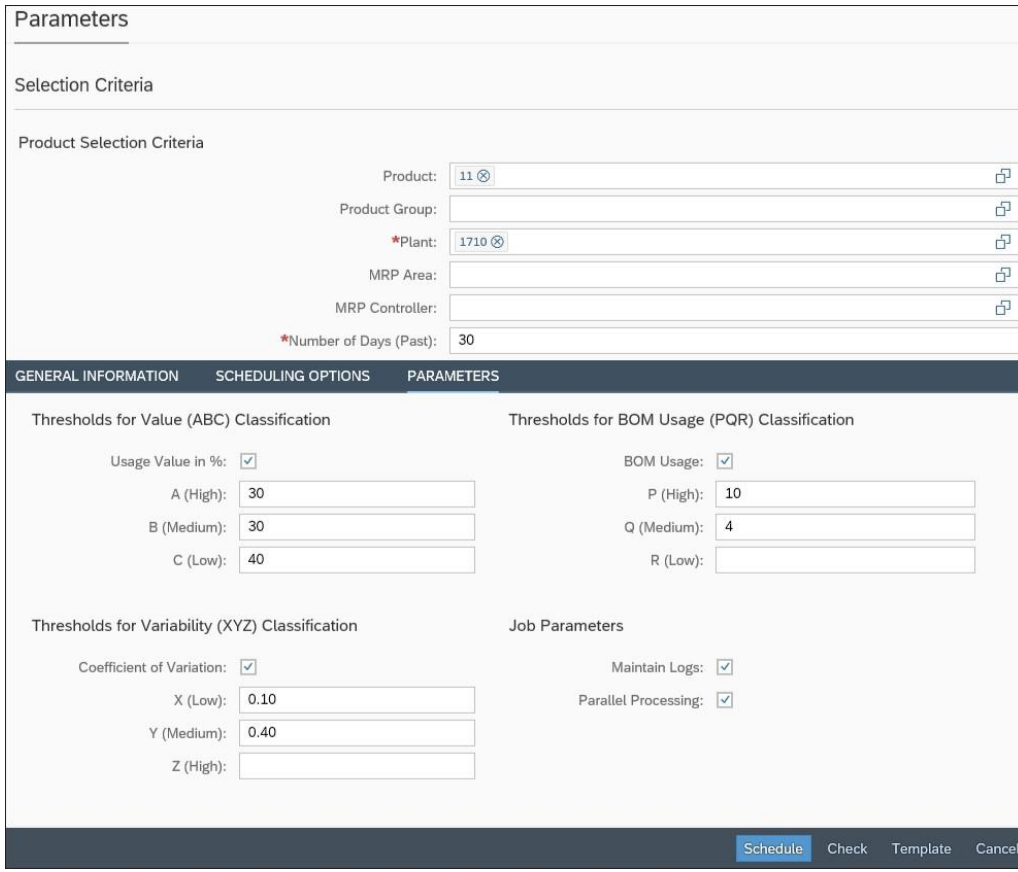


Figure 13.36 Schedule Product Classification (DD) App: Parameters Selection

The ABC classification evaluates the relative importance of a material/plant or material/plant/MRP area combination in relation to the other planning objects analyzed on the basis of historical consumption. The objects are divided into three groups:

A materials

Relative to all objects analyzed in a run, these have had the highest consumption value in the past. **B materials**

These materials have a lower proportion of total consumption compared to A materials. **C materials**

These materials have the lowest proportion.

The SAP Fiori app Schedule Product Classification (DD) analyzes material movements to determine *past consumption* in the specified period, but it's not possible to influence the selection of material documents.

You can only influence the threshold values that are used to delimit the previously mentioned classes. They can be maintained as percentage values in the app by scrolling further down in Figure 13.36. For classification, the consumption value is determined on the basis of the material documents. The materials involved in the classification run are then sorted in descending order according to their consumption value. An "A" is assigned to a planning object until the threshold value of, for example, 70%, is reached cumulatively across all materials of the class. The subsequent materials are then assigned a B classification until the following, for example, 20% of the consumption value is reached; the remaining materials are classified as C materials. The Schedule Product Classification (DD) app can perform this analysis at the level of material/plant combinations as well as at the level of material/plant MRP area; other levels aren't possible.

ABC analysis is therefore a way of dividing the planning objects into classes according to their value-based significance. This analysis method is now being combined with two other methods that bring in further important aspects for the identification of key characteristics, thus facilitating the goal of being able to assign optimal settings to a planning object, for example, with regard to buffer configuration. One of the two additional classification methods provided by the Schedule Product Classification (DD) app is the XYZ analysis. This analysis method is used to assess the predictability of future demand on the basis of past consumption. Analogous to the ABC analysis, there are three classes: **X materials**

These materials have the most constant consumption, so it's assumed that future consumption can be predicted with high accuracy, and therefore buffers for the coverage of uncertainties can be reduced.

Y materials

The materials in this class have greater variations in consumption than X materials.

Z materials

These materials show the greatest variations in consumption, so it's assumed that predictability accuracy is low.

The criterion for assessing predictability is a statistical fluctuation factor called the *coefficient of variation*, which determines, squares, and sums up the deviation of each individual observed historical values from the mean value. This sum is then divided by the number of observed values and normalized to the mean value to obtain a relative fluctuation measure.

Similar to ABC analysis, the Schedule Product Classification (DD) app enables the maintenance of threshold limits for the XYZ analysis. Unlike ABC analysis, however, these are absolute values, not percentage values.

The last possible classification methodology within the framework of the Schedule Product Classification (DD) app is the PQR analysis, which you can use to analyze the planning objects to determine how many BOMs they are used in. The reason for this type of analysis is to find out whether there is a single use or multiple use and thus how many recipients are relevant for the object.

The three classification methods mentioned can be used to classify material/plant combinations or material/plant/MRP area combinations according to the following essential characteristics:

How important they are in relative terms in the material spectrum

How predictable the future demand is

How many objects are used

These three characteristics are then used to determine the central settings of the DDR process, mainly to define how these objects are controlled and whether inventory needs to be maintained. Therefore, the results of the classification will play an important role in the next step: stock positioning.

Note

In the SAP S/4HANA-based DDR, there is another possibility to classify objects: EFG classification. This is based on the RLT. However, before you can decide how to classify an object on the basis of the RLT, you need to calculate the decoupled RLT that doesn't exist at this early stage. Therefore, this type of classification can only be executed with a different app in a later process step, which we'll also discuss.

A summary of the results of the classification run can be viewed in the application log of the Schedule Product Classification (DD) app. You can access this log directly in the initial screen of the app or by clicking the **Back** button in the job settings overview.

From the overview, you can branch to two more detailed views:

Job Log

Shows messages that have been identified by the system during runtime. In this context, it's also possible to filter by message types.

Job Details

Provides settings selected for the job, such as threshold values or selections.

The results of the classification are often used together with other information to make the previously mentioned decisions, which will play a role at a later stage. If, in addition to the mathematically deductible criteria of the classifications, additional criteria that can't be mathematically derived are used to make appropriate decisions, this is referred to as grouping. For example, it can make sense to treat a simple standard part different from a more complex electronic part with a similar consumption behavior, that is, with comparable classification results. When classes and groups are combined, the term *clusters* is often used.

With the Schedule Product Classification (DD) app, groupings can't be used directly; they are only included in a next step. For this purpose, DDR offers another SAP Fiori app called Mass Maintenance of Products (DD), as shown in Figure 13.37.

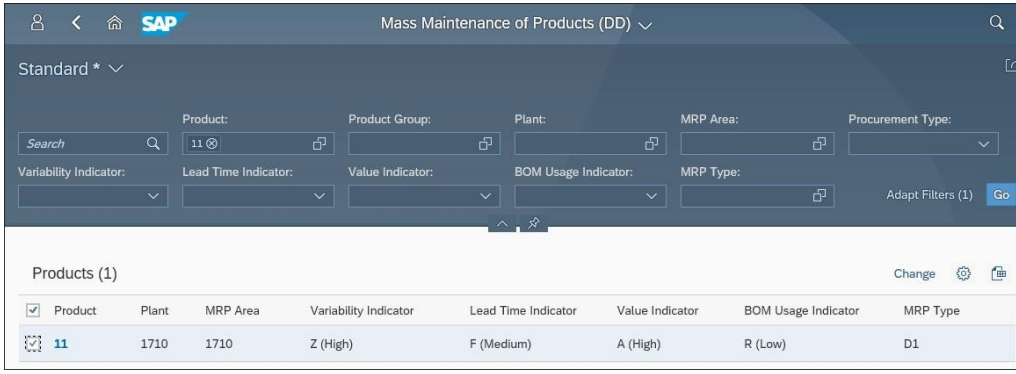


Figure 13.37 Mass Maintenance of Products (DD) App

Objects can also be selected here, and central information (e.g., classification results) can be adjusted (see Figure 13.38). The Mass Maintenance of Products (DD) app can also be used to derive stock positioning from the classification results.

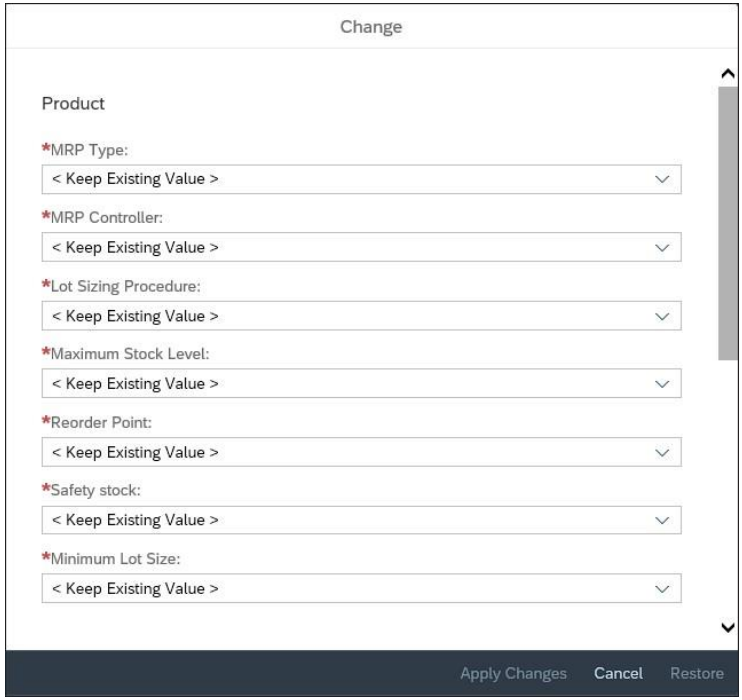


Figure 13.38 Mass Maintenance of Parameters

The product classification is very important because it's based on this classification that the system determines the variability factor and the lead time factor. These values are used later in the buffer proposal calculation.

SAP delivers a standard buffer profile with standard values for the variability and lead time factors. The standard values are defined for those factors. There is no configuration transaction or menu path to maintain the buffer profile values. However, those values can be accessed and changed by accessing view cluster PPH_DD_PROFILE_ ASG_VC after executing Transaction SM34 (see Figure 13.39)

Considering the material 11 previously classified with **Variability indicator Z – High** and **Lead Time Indicator M – Medium** (refer to Figure 13.37), the corresponding **Variability Factor** is 0.80, and the corresponding **Lead Time Factor** is 0.30, as shown in Figure 13.391. These factors directly affect the buffer calculation, so the higher the factor, the higher the buffer calculated. Figure 13.392 offers an option to make plant-specific settings, such as the spike horizon or the threshold factor, specific to a plant only. Let's review the four fields in some greater detail:

Spike Horizon Constant

A constant, usually measured in days, which helps calculate the **Order Spike Horizon** when summed with the product of the **Spike Horizon DLT Multiplier** and the **Decoupled Lead Time**. The associated formula is as follows:

Order spike horizon = (Spike horizon DLT multiplier × Decoupled lead time) + Spike horizon constant

Spike Horizon DLT Multiplier

A multiplicative factor that when multiplied with the **Decoupled Lead Time** and summed with a **Spike Horizon Constant** helps calculate the order spike horizon, which helps identify order spikes. The associated formula is as follows:

Order spike horizon = (Spike Horizon DLT Multiplier × Decoupled Lead Time) + Spike Horizon Constant **Spike Threshold**

A selected quantity that in combination with the **Order Spike Horizon** qualifies an order spike.

On-Hand Alert Threshold

A selected quantity that qualifies an on-hand alert spike.

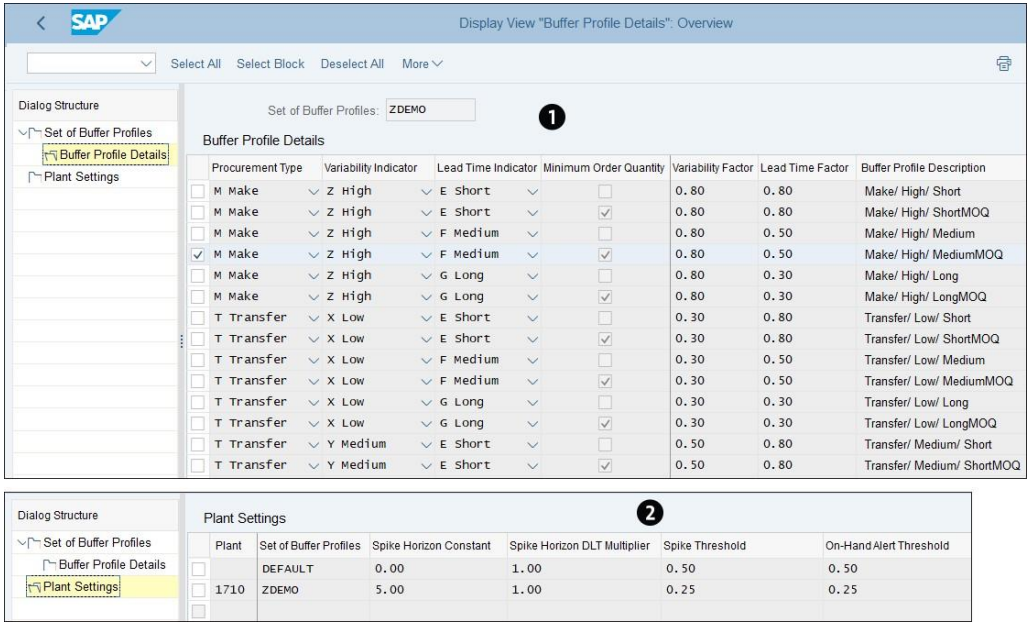


Figure 13.39 Buffer Profile Details

13.7.6 Lead Time Determination

After explaining the possibilities of decoupling information based on the inventory positioning in the previous section, the next step of the DDR procedure is lead time determination. This step can only be carried out after the decoupling point information has been stored because the calculation of the decoupled lead times required for the subsequent buffer calculation is based on these decoupling points.

The SAP Fiori app Schedule Lead Time Classification of Products (DD) uses the DDR planning characteristics maintained in the previous step of stock positioning to determine the decoupled lead times. These decoupled lead times are the basis for buffer level determination.

The second main task of the Schedule Lead Time Classification of Products (DD) app is to carry out a fourth classification method: the EFG classification by RLT. Unlike the three classification methods explained earlier, this classification can only be carried out after the DDR-dispatching characteristics have been maintained because the decoupling points aren't available in the system at the beginning of the process.

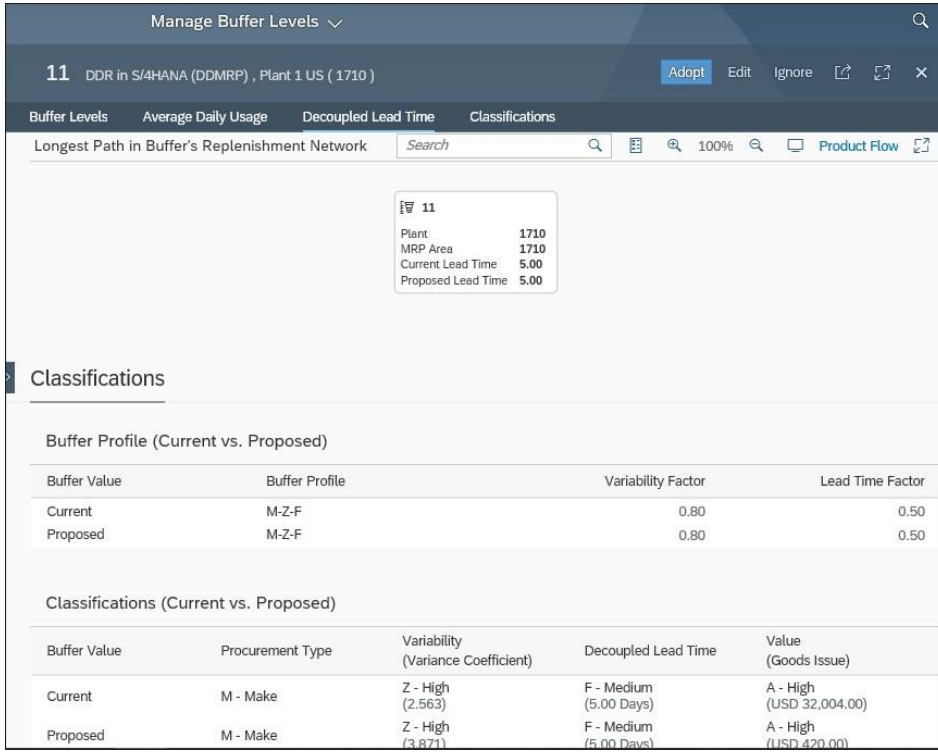


Figure 13.40 Classification of Products

After calling up the Schedule Lead Time Classification of Products (DD) app, a selection screen appears on which you can create a new analysis run. In addition to the job name and start time, you must define the objects for which the analysis is to be started. Another central setting is the horizon for historical RLT calculation. Figure 13.40 shows the overall settings of the app for an analysis run.

Note

The **Product Flow** option that you see in the far-right of the screen in Figure 13.40 is covered in Section 13.7.10. It's an institutive new SAP Fiori app called Buffer Positioning, which provides far greater visibility on a product structure and various classifications, such as ABC, XYZ, and EFG.

In addition, appropriate thresholds must be specified for the EFG classification. This classification methodology is executed for material/plant combinations with a DDR MRP type based on their decoupled lead times, which are also determined in this run together with the single-level RLTs. You can use different threshold values in calendar days for in-house production, external procurement, and stock transfers. In all three cases, the materials are divided into three groups:

E materials
Short RLTs according to the respective threshold value definition.

F materials
Average RLTs according to the threshold value definition.

G materials
Long RLTs according to the threshold value definition.

You can also select parallel processing to speed up the job run by using several processors at the same time and updating logs.

Figure 13.40 shows an overview of the possible settings regarding the classification thresholds of the EFG analysis. While the EFG classification and, by its very nature, the determination of the decoupled lead times, are only carried out for decoupled materials with a DDR MRP type, the single-level RLTs are determined for all selected objects, including those for which no buffering is planned.

In the in-house production case, the system determines the production or process orders in the selected analysis horizon. For all identified objects, the time period between order

creation and final confirmation is determined as a single-level RLT and then aggregated as an average value on the material/plant combination. If no element is found in the selected horizon, the system uses the in-house production time of the material master, which is independent of lot size.

The procedure for external procurement is the same, which means the POs within the horizon are selected accordingly, and the period between PO creation and the date on which the final delivery indicator is set are determined. As is true for inhouse production, there is a fallback scenario for external procurement in case no element is found within the selected horizon. In this instance, the system first uses the planned delivery time of the info record or contract that the MRP run selects as the preferred source of supply according to the settings. The system uses an explosion with lot size 1 and the explosion date of the run. If no RLT can be determined, the planned delivery time of the material master is used. The determination of the decoupled lead times is based on the single-level RLTs determined as described earlier, by using the multilevel sum of the longest critical path in each case.

In SAP S/4HANA, the values aren't written back to the material master. An active business add-in (BAdI) implementation is delivered that enables the automated maintenance of the values into the material master. Maintenance takes place in the master data fields that were specified previously as a fallback option for determining RLTs, that is, into the lot-size-independent in-house production time in the case of inhouse production, and into the planned delivery time of the preferred source of supply or the material master in the case of external procurement. The decoupled lead time is updated in the total replenishment lead time (TRLT) of the material master. If you don't want to impact the master data in SAP S/4HANA, you can deactivate the BAdI implementation.

13.7.7 Buffer Level Determination

Now that we've discussed how to define stock positioning and determine decoupled lead times, let's discuss how to determine buffer levels on this basis. The SAP Fiori app Schedule Buffer Level Calculation performs the calculation of the buffer zones according to the DDR logic, which means the central buffer zones and levels are calculated.

After calling up the Schedule Buffer Proposal Calculation app, you can configure an analysis run. Here you have to select whether the average daily usage is to be calculated, that is, the average demand per day. It's based on the previous step of classification, in which the material movements (GRs and GIs) were used. Figure 13.41 shows the possible settings in the Schedule Buffer Proposal Calculation app. You must also specify here whether the results are to be saved or adopted. Further, the option to adopt decoupled lead time from the material master can be used or even can also be recalculated by selecting the

relevant radio button located on the bottom right-hand side of the screen. For this example, choose **Do Not Adopt Proposals** so that you can evaluate the buffer proposal in detail as well as manually adopt these proposals. After clicking on **Check** and then finally **Schedule**, the system will create a log for the scheduled job, which for this example is **DDR5**.

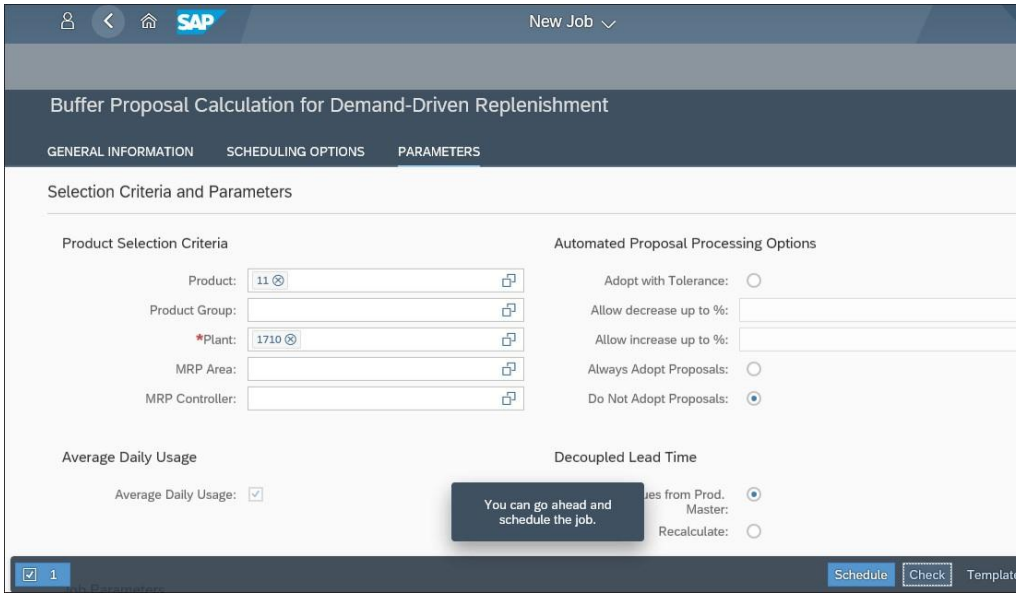


Figure 13.41 Schedule Buffer Level Calculation App

Next, use the Manage Buffer Levels app to evaluate the results. Figure 13.42 shows an example of buffer level management by manual intervention. The system proposes to increase the **Current** stock of **91 PC** to **Proposed 130 PC**. The **Buffer Levels** field first shows the current buffer levels followed by showing the proposed buffer levels right below (in two tricolor horizontal bars). Select the checkbox next to material 11, and click on the forward arrow (**Navigation**) located on the far right-hand side of the screen to go to the next screen shown in Figure 13.43.

Figure 13.43 shows the current a slightly lower buffer levels and the system-proposed increased buffers to be maintained on a daily basis. Select another view from the **Planning View** dropdown, such as the **Comparison View**, and the system will show comparisons of various stock levels. Use the **Settings** icon to switch between viewing the details as zones or as stocks, while the **Legends** icon can provide details of this visual representation. These icons are located on the top right hand side of the screen. Go ahead and adopt the buffers proposal by clicking the **Adopt** icon.

Figure 13.42 Buffer Calculation

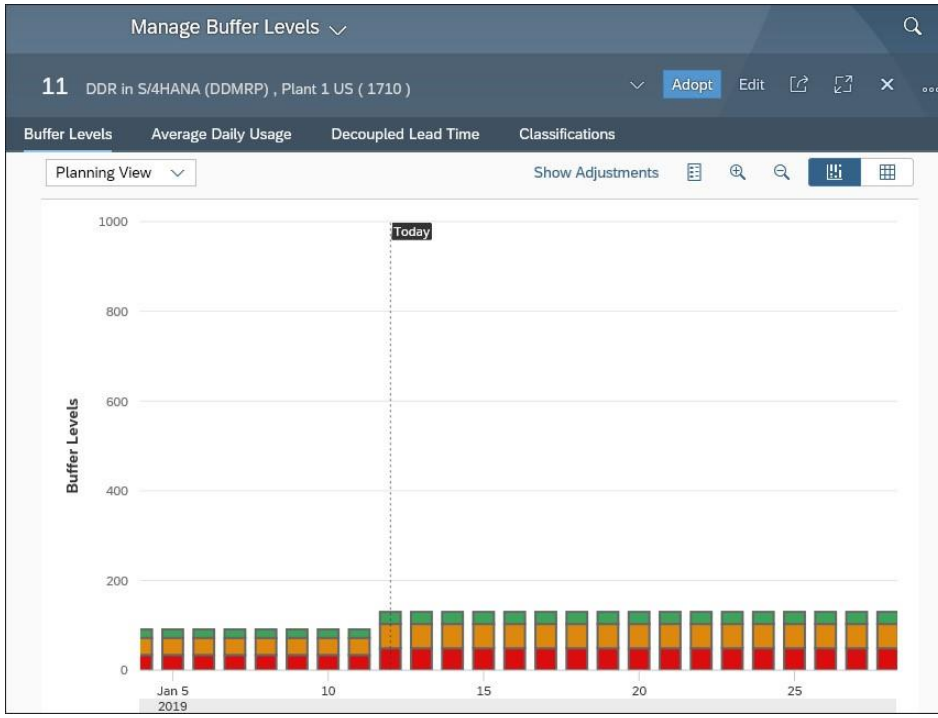


Figure 13.43 Planning View of Redefined Buffer Levels

Figure 13.44 shows the **Proposal Status** as **Adopted**.

Figure 13.44 Buffer Proposal Adopted

As soon as the buffer proposal is accepted, the next step is to run MRP Live (Transaction MD01N) so that the system creates replenishment proposals. After MRP Live runs, the stock/requirements list (Transaction MD04) is updated accordingly, as shown in Figure 13.45. All stock figures, such as **Maximum Stock**, **Reorder Point**, and **Safety Stock**, are updated along with other demand-driven fields. Recall from Figure 13.34 that all these fields were blank when the DDR process wasn't initiated on material 11 and for plant 1710, but now the fields have values. Further, **Planned Order 128** is also created that ensures a **Net Flow Position** of 103 PC.

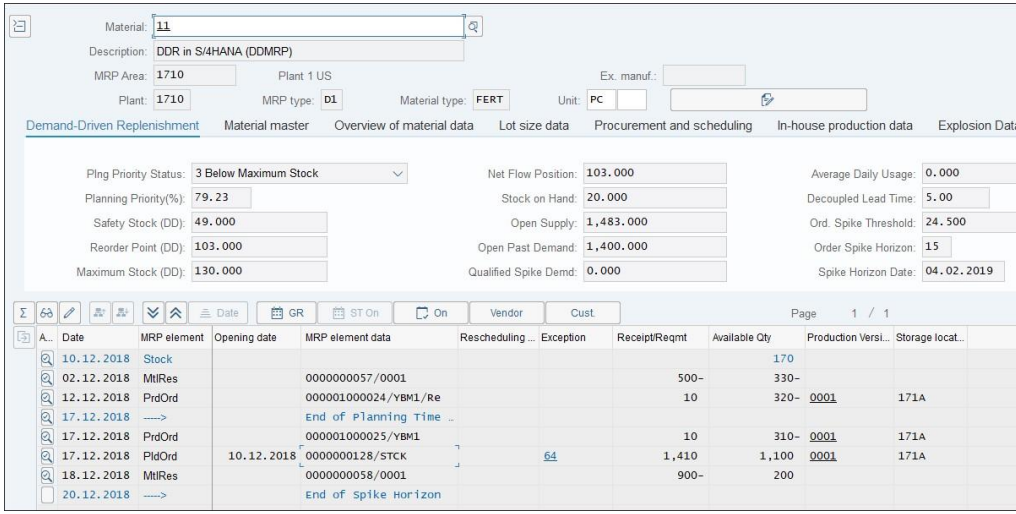


Figure 13.45 Buffer Levels Redefined

It's important to note that running MRP Live is one way of replenishing the stock. The next section shows how to interactively manage all DDR planning with SAP Fiori apps and without needing to run MRP Live.

13.7.8 Planning and Execution

In the previous sections, we've shown you how to determine decoupled lead times based on strategic inventory positioning and how to use this as input for the buffering. In this section, we'll explain how to include these functions in planning.

In both cases, a three-part division is assumed. First of all, we'll discuss the procedures that have been defined in SAP's automated planning to generate procurement proposals such as purchase requisitions and planned orders. This is followed by interactive planning executed by the user to postprocess the results of the planning run. Here you can see two substeps: First, priority key figures support the decision to convert a procurement proposal (e.g., a planned order) into a fixed element (a production order or a process order) or to convert a purchase requisition into a PO. Second, a production order is released for production again on the basis of a priority key figure in a comparable step.

This means that the planning and execution procedure for DDR doesn't differ from the process flow of a classic MRP run. However, as already described in the previous sections, there is a significant difference in the control logic for the elements to be buffered, and the planning and execution part of the DDR process is now also characterized by specific features.

Using the MRP type previously maintained, the planning run identifies the materials for which the DDR logic is to be used. These must have planning procedure C indirectly via the MRP type.

The net flow equation is used for generating receipt elements:

> *On-hand stock + Open supply – Open past (including today's) demand – Qualified spike demand*

In the planning run, the net flow position calculated as described is compared with the buffer level TOY. If the net flow position is lower than TOY, a receipt element is created that raises the stock quantity to TOG. Forward scheduling is applied by using the decoupled lead time, whereby the GR processing times and the safety times of the horizon key are also included in the same way as for normal MRP. It's recommended to eliminate these times to avoid multiple considerations.

To calm down the planning result, you can use a planning time fence with firming type 1, so that a new element that has been moved by one day can't be created in the subsequent planning run.

Replenishment Execution by On-Hand Status

Execution according to the DDR logic is performed with the SAP Fiori app Replenishment Execution by On-Hand Status. In this app, the current warehouse stock situation is displayed, and the on-hand status is used for prioritization, which is calculated as follows:

On-hand stock (without receipt and requirement elements) compared to TOR (in %)

Figure 13.46 shows the Replenishment Execution by On-Hand Status app as an example, wherein planned orders can be edited, deleted, or converted into production orders, as shown in the dropdown list. Click on the **Chart** icon to open the screen shown in Figure 13.47 appears.

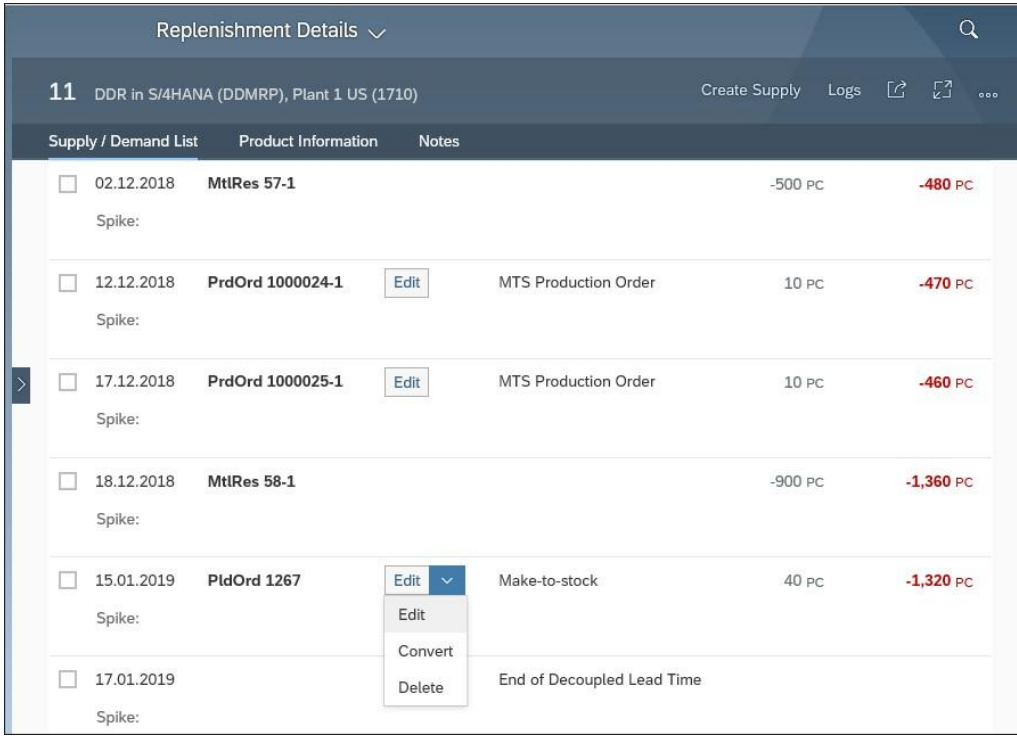


Figure 13.46 Replenishment Execution by On-Hand Status App

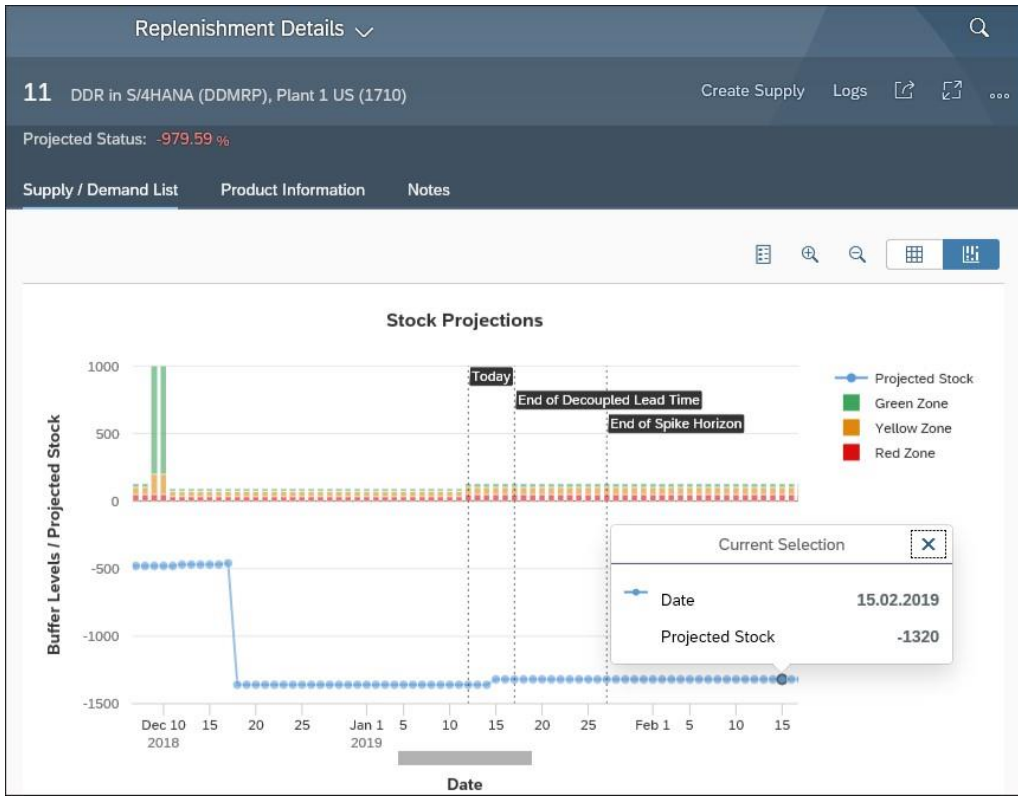


Figure 13.47 Buffer Zones and Stock Situation

Figure 13.47 shows the situation of buffers and stock over a short horizon and *before* the creation of a supply order. On the far left hand side of the screen, notice the very high buffer levels (tallest two bars) that reflect the estimated or hypothetical buffers we initially set in the beginning of this DDR example. But, based on the actual average daily usage (or consumption), the buffer levels are accordingly reduced (or increased) over time.

Figure 13.48 shows the situation of buffers and stock over a longer horizon and *after* a supply order creation.

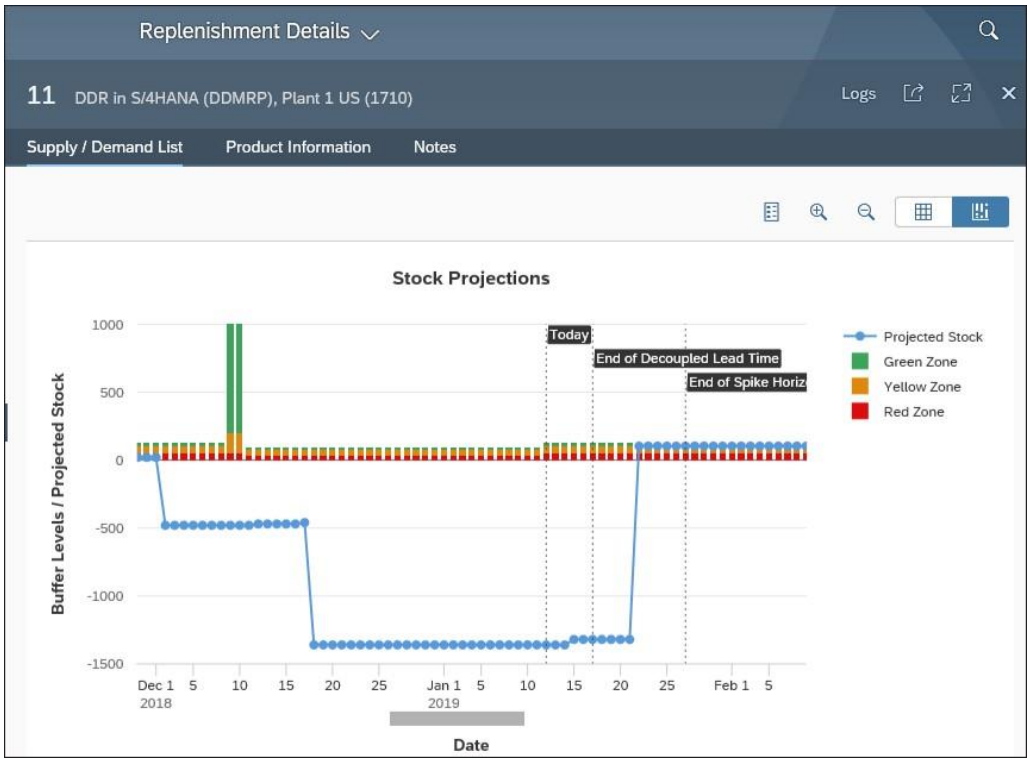


Figure 13.48 Buffers and Stock Situation over a Longer Time Horizon

Replenishment Planning by Planning Priority

The planning run is postprocessed using the SAP Fiori app Replenishment Planning by Planning Priority. After calling up the app, a buffer level overview is displayed. The planning priority is used for sorting, which results in a percentage comparison of TOG with the following value:

On-hand stock + Receipts – Relevant requirement elements

The results displayed are used to convert planned orders into production orders and process orders, or to convert purchase requisitions into POs (see Figure 13.49).

Next, remove all filters from Figure 13.49 (filters can be displayed or even permanently pinned by clicking on the downward arrow located at the center of Figure 13.49). Available filters are shown in Figure 13.50.

Figure 13.50 shows an example of a planning run result sorted according to planning priority, where the first three materials are **Below or at Maximum Stock level**, including material **11**. Click on the **Settings** icon to hide or display the desired columns.

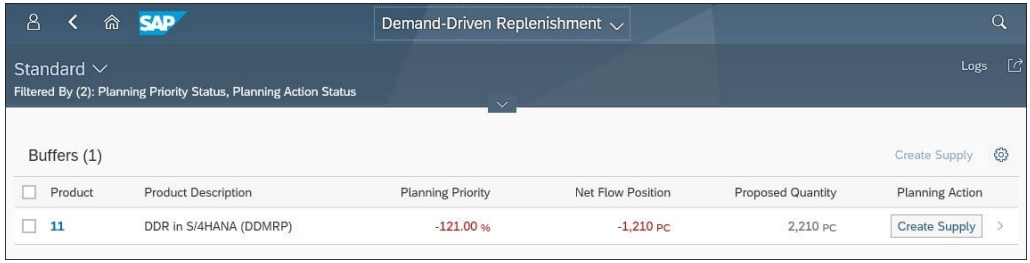


Figure 13.49 Replenishment Planning by Planning Priority App

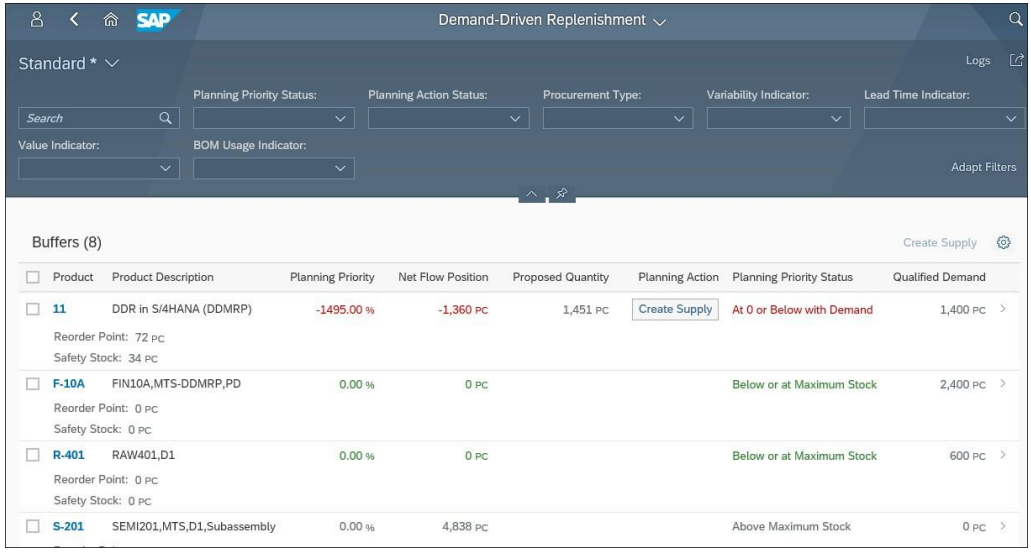


Figure 13.50 Replenishment Planning by Planning Priority

13.7.9 Planner Overview

The SAP Fiori app Planner Overview displays an overview for all materials that need to be treated manually. Therefore, one or both of the following is true:

Buffer level calculation results need to be analyzed.

Planning status/on-hand status needs to monitored.

With this app, it's possible to select and jump into three associated apps:

Buffer Level Management

Replenishment Planning

Replenishment Execution

Figure 13.51 shows the Planner Overview app.

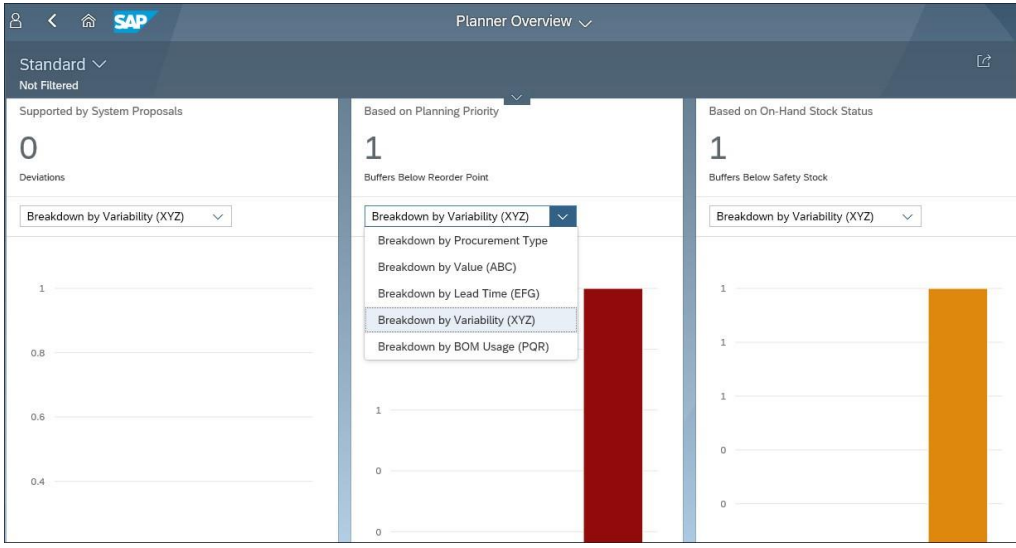


Figure 13.51 Planner Overview App

13.7.10 Buffer Positioning

One of the key aspects of DDMRP is to position the buffers correctly: buffering too many materials will end up with excess inventory, while not buffering enough materials or buffering the wrong materials may lead to material shortages and longer lead times. The SAP Fiori app Mass Maintenance of Products (DD), while effective in allowing a DDR type "D1" to be set for several materials at the same time, isn't exactly intuitive because the whole product structure isn't visible when choosing to buffer a material.

A new SAP Fiori app called Buffer Positioning supports materials planners in choosing which specific materials within the product structure should be buffered. Figure 13.52 shows the Buffer Positioning app in which you can apply filters or select one or several materials to work with. By marking one or several materials from the list, you can immediately see the options to **Calculate DLT** (decoupled lead time), **Buffer** (set a DDR type "D1"), or **Unbuffer**.

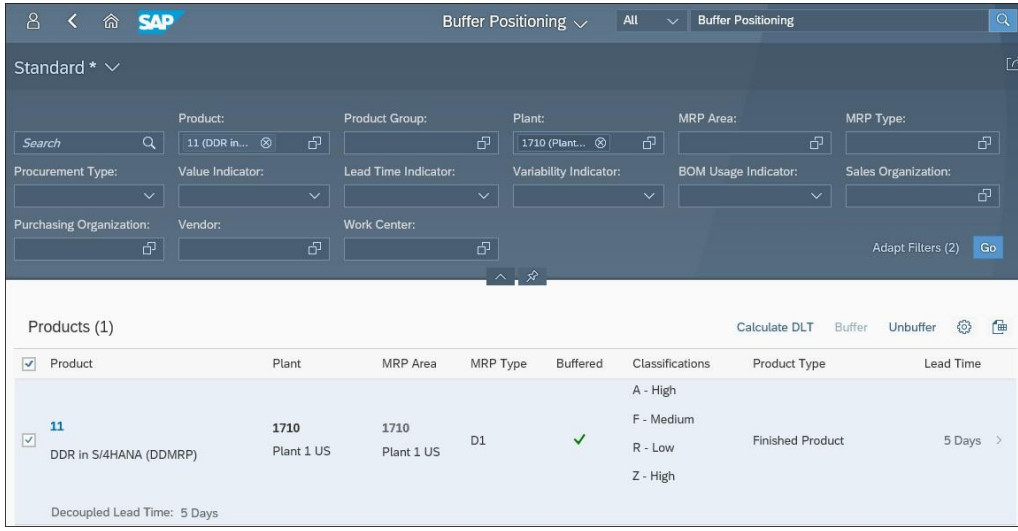
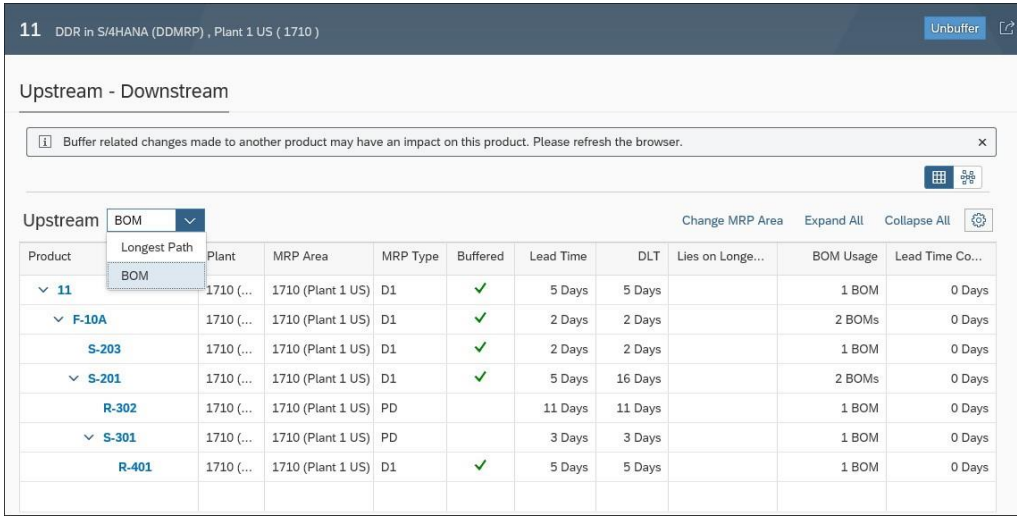


Figure 13.52 Buffer Monitoring App

Besides these options immediately available in the initial screen, you also have the option to click on a specific line and branch into a detailed buffer analysis view for the selected material, as shown in Figure 13.53.

Figure 13.53 shows the **Upstream** and **Downstream** areas with details of the child and parent materials. By default, in the **Upstream** area, the **Longest Path** within the product structure is displayed. This isn't the longest path within the whole product structure but the longest path until reaching the next buffered material (with a **MRP Type** "D1").

In the **Downstream** section, the default display is the **Immediate Parent** material. In both cases, however, you have options to switch between different views. In the **Upstream** view, you can see the whole BOM, while in the **Downstream** view, you can see the next buffers or the finished products above the selected material. Figure 13.53 shows the BOM in the **Upstream** view.



Product	Plant	MRP Area	MRP Type	Buffered	Lead Time	DLT	Lies on Longe...	BOM Usage	Lead Time Co...
11	1710 (...	1710 (Plant 1 US)	D1	✓	5 Days	5 Days		1 BOM	0 Days
F-10A	1710 (...	1710 (Plant 1 US)	D1	✓	2 Days	2 Days		2 BOMs	0 Days
S-203	1710 (...	1710 (Plant 1 US)	D1	✓	2 Days	2 Days		1 BOM	0 Days
S-201	1710 (...	1710 (Plant 1 US)	D1	✓	5 Days	16 Days		2 BOMs	0 Days
R-302	1710 (...	1710 (Plant 1 US)	PD		11 Days	11 Days		1 BOM	0 Days
S-301	1710 (...	1710 (Plant 1 US)	PD		3 Days	3 Days		1 BOM	0 Days
R-401	1710 (...	1710 (Plant 1 US)	D1	✓	5 Days	5 Days		1 BOM	0 Days

Figure 13.53 Upstream and Downstream Details

Switch to the **Network** analysis by clicking the **Network** icon located at the top right hand side of Figure 13.53 and Figure 13.54 appears. Here, a graphical view of the whole product structure is displayed, making it easier to identify decoupling points to position the buffers. There are many options to improve visualization, such as highlighting specific materials within the product structure. Figure 13.54 shows all the buffered materials within the complete product flow. For products with a larger BOM, a switch to a **Top-Down** visualization is possible by clicking on **Settings**.

Tips & Tricks

To expand or collapse details of materials in a network, simply select the relevant material, and click on the left-facing or right-facing arrow, respectively (see Material **S-201** in Figure 13.54 and the arrow→).

Note

To learn more about the DDR solution by SAP, visit *http://bit.ly/DDRS4HANA*. In addition, refer to the E-Bite *Introducing Demand-Driven Replenishment (DDMRP) in SAP S/4HANA* (*www.sap-press.com/4569*, SAP PRESS, 2017).

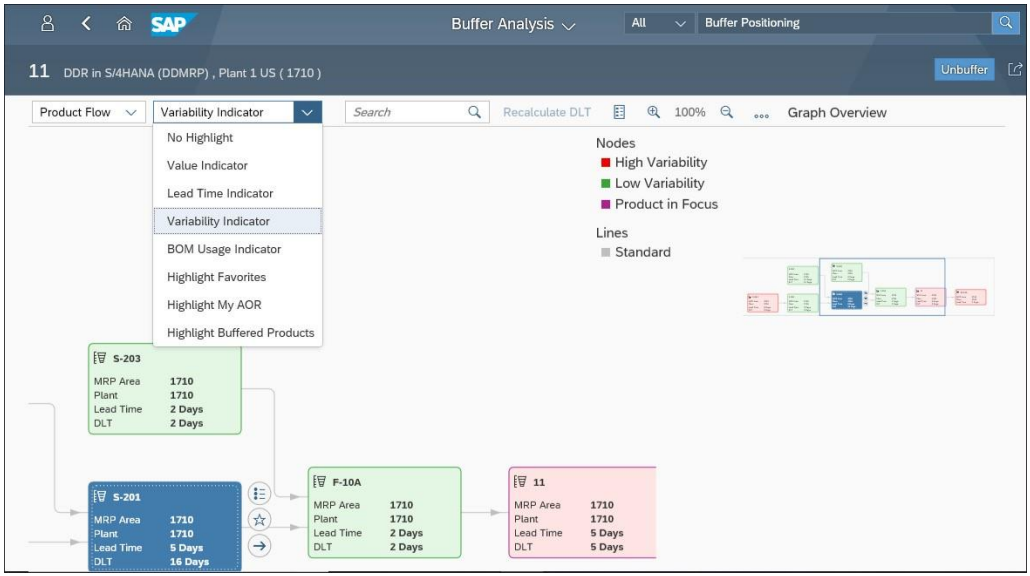


Figure 13.54 Network Graph View

13.8 Summary

This chapter focused on some of the latest planning innovations available in SAP S/4HANA. MRP Live provides far more options for an improved planning and scheduling of materials and capacity. DDR shifts the entire paradigm from the "supply" side of planning to the "demand" side, wherein only the materials in demand are procured and produced to reduce stock-outs and overstock situations.

The next chapter covers long-term planning (LTP), a materials and capacity planning simulation tool to help improve logistics and supply chain management.

Chapter 14

Long-Term Planning

Long-term planning allows you to test various business models to make the best choices without affecting the standard planning database. The beneficiaries of long-term planning are various stakeholders in the

company—the production planner, the procurement in-charge, the inventory controller, and the capacity planner.

Long-term planning (LTP) is used to simulate various business scenarios to help in production and procurement planning by using existing master data and other information. Companies can use this tool to test various hypothetical assumptions affecting business decisions. When compared with material requirements planning (MRP), LTP doesn't affect the database of results that was created while running normal (operative) MRP. However, you can use simulation mode in operational MRP to get similar results as in LTP.

LTP is a separate planning area where you can undertake all simulation-related planning. However, if the results from simulative planning of LTP are satisfactory, you can also transfer them to operative planning in standard MRP. While it's easy to set up LTP, it's equally easy to delete the planning scenarios when you no longer need them. For example, you quickly set up a planning scenario to test procurement quantities of materials that you need for the next six months, including the associated financial values (capital tie-up). When you no longer need this information, you can delete the planning scenario from the system.

LTP results in the following benefits for specific business roles:

Capacity planners are better able to plan their machine resources and manpower resources.

The purchasing department uses the information on the future requirements quantities to estimate and plan future procurement orders.

The inventory controller gains greater comprehension of warehousing requirements.

Vendors are able to get a preview of a company's future procurement needs, which enables them to foresee and take action to meet impending demands of the company.

The product costing team can get a preview of the associated costs of producing products.

In this chapter, we show the steps you need to take to prepare the master data and planning data for LTP using a real-life business case from the glass manufacturing industry. We also cover the logistics information system (LIS) with particular reference to LTP, focusing on the purchasing and inventory controlling subsets of the LIS. Finally, we also discuss further planning options offered by LTP to cater to various business scenarios.

Note

LTP isn't confined to just the long-term planning needs of the company but can be equally beneficial for short-term to medium-term planning.

For short-term simulation, you have the option to include sales orders, firm receipts from production, or purchase orders, whereas for long-term simulation, you can switch off scrap calculations and other checks to gain a broader view of the planning.

14.1 Long-Term Planning Master Data and Planning Data

LTP derives its detail from existing information in the SAP system, including the planning data in the four different MRP views of the material master. Similarly, when you perform multilevel planning of the material in LTP, the system uses bills of materials (BOMs) and routing. To run an LTP simulation, you need to ensure that the planning data is set up in the SAP system on which you intend to run the simulation. For example, you need to enter month-wise planning quantities of a finished or a semifinished good as planned independent requirements (PIRs). You define all of these quantities in a specific planning version number. The same material can have different month-wise planning quantities separately defined in different version numbers. Using inactive versions in LTP, you can execute various simulative LTP scenarios and evaluate the results separately. You need the following data in your SAP system before you can run LTP: **Master data**

Material for LTP (i.e., material to be planned using LTP), BOM, and routing of the material. The planning scenarios are also part of master data that you need to set up. **Planning data**

The planning quantities of the material that you'll enter as PIRs.

Planning scenario

The planning scenario that forms an integral part of master data setup for LTP.

We'll now cover master and planning data in detail.

14.1.1 Master Data

In the example, you'll perform LTP on molten glass bulk, which is the main material, and its associated components in the BOM, as shown in Table 14.1. Molten glass bulk, which is a semifinished product, is eventually used in finished products, such as the windows of an office or a building, windshields, goblets, wine bottles, and injection vials, among endless other uses. All of these materials and their planning data in the MRP views must already be maintained in the system, including the material BOM and routing. Table 14.1 also lists the details of some of the BOM components for molten glass bulk. As previously explained, LTP uses the same planning data that you had defined in the MRP views of materials, so you don't need to define any additional data.

Number	Material Number	Material Description	BOM Components
1	30000038	Molten Glass – Bulk	1 MT
2	10000068	Soda Ash (NaHCO3)	191.625 KG
3	10000069	Limestone (CaCO3)	76.650 KG
4	10000070	Silica Sand (SiO2)	498.225 KG
5	10000071	Iron(III) Oxide Fe2O3	0.050 KG

Table 14.1 Unpacked Urea Bulk and Its Components in a BOM

Example

For BOM components that aren't planned, the **MRP Type** defined in the **MRP 1** view of the material master is **ND**, which means **No Planning**. Therefore, the system will eliminate them from all planning activities in LTP. They won't be part of the operational MRP run either. Only in exceptional circumstances would you not plan material in MRP or LTP; otherwise, we suggest that you ensure your data modeling for MRP or LTP to include all components of a material. For example, in the caustic soda production, one of the raw materials is raw salt. The raw salt is not only very cheap but also readily available in countries with huge salt mines. Further, there's no specific warehousing requirement for raw salt so it can be placed in open space. With no significant capital tie-up and no inventory controlling requirement, it makes sense not to plan this material (raw salt).

Other planning parameters that you've defined in the MRP views are applicable in LTP. For example, if you've defined a fixed lot size or minimum lot size for a material, then the system will consider the lot-sizing procedures during LTP. This also applies if, for example, you've defined a planning calendar for external procurement.

The BOM for molten glass bulk was also previously defined, and once again LTP uses this information. For the rest of this example, we'll focus on two materials for LTP: molten glass bulk and soda ash.

Tip

We recommend that you consider creating a new BOM exclusively for LTP simulation. This provides greater visibility from a planning perspective. A dedicated BOM for LTP not only eliminates the chances of error while creating a normal production BOM of a material but also ensures that it's used for LTP purposes only. It then becomes easier for the person managing the production planning master data to segregate the normal production BOM from the LTP BOM. BOM usage is maintained in configuration. The selection ID enables you to use separate BOMs for LTP purposes. To do this, you must create a separate BOM usage and assign it to a selection ID by using the order of priority for BOM usages (Transaction OS31).

In Section 14.1.4, we address the significance of defining a separate BOM usage for LTP. Refer to Chapter 3, in which we explain how to define and set up BOMs (Section 3.2) and routing selection (Section 3.4).

Figure 14.1 shows the initial screen for BOM display. It includes a **BOM Usage** field, which indicates the application of the BOM, whether it's a production BOM, a costing BOM, an engineering/design BOM, or another usage. For this example, enter **BOM Usage** "1", which indicates **Production** use. To display the BOM, follow the menu path, **LogisticsProductionMaster DataBill of MaterialBill of MaterialDisplay**, or use Transaction CS03.

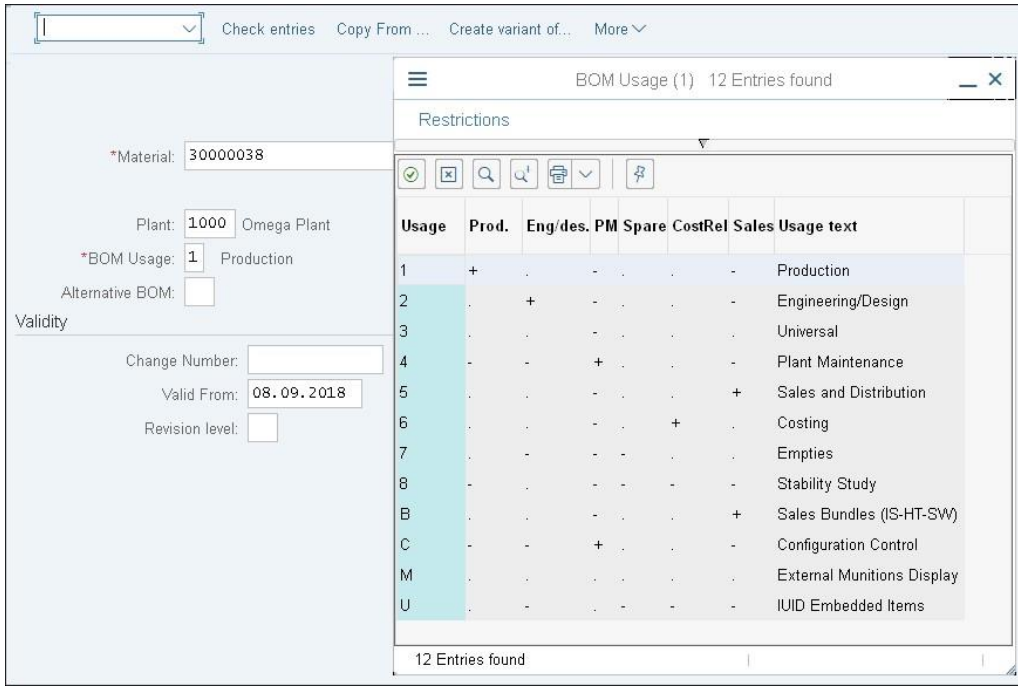


Figure 14.1 Production BOM with Usage 1

14.1.2 Planning Data: Planning Quantity

Table 14.2 presents the monthly planning quantities for the main material (molten glass bulk). You'll enter these quantities in the PIRs for this example. LTP will simulate the production and procurement requirements based on this information (PIRs).

Number	Month/Year	Quantity (Metric Tons)

1	09.2018	1,000
2	10.2018	1,200
3	11.2018	1,500
4	12.2018	1,200
5	01.2019	1,800
6	02.2019	1,600

Table 14.2 Planning Quantities of Molten Glass Bulk

14.1.3 Planning Data: Planned Independent Requirements

The purpose of having multiple versions of PIRs in the SAP system is to account for various planning situations and scenarios, each of which is identified by its version number. A simulation version is the identified demand plan. One demand plan can be a sales plan while another can be a production plan, each having its own planning quantities of the same material. There can be several inactive versions available for simulation and comparison, but we recommend only having one active (operational) version.

Note

Although the standard SAP system provides several PIR versions, you can create more versions if you need them to attend to specific business processes in configuration Transaction OMP2.

For this example, use **Version 02** (simulation 2) for LTP (see Figure 14.2). To enter planning quantities in the PIR, follow the menu path, **LogisticsProductionProduction PlanningDemand ManagementPlanned Independent RequirementsCreate**, or use Transaction MD61.

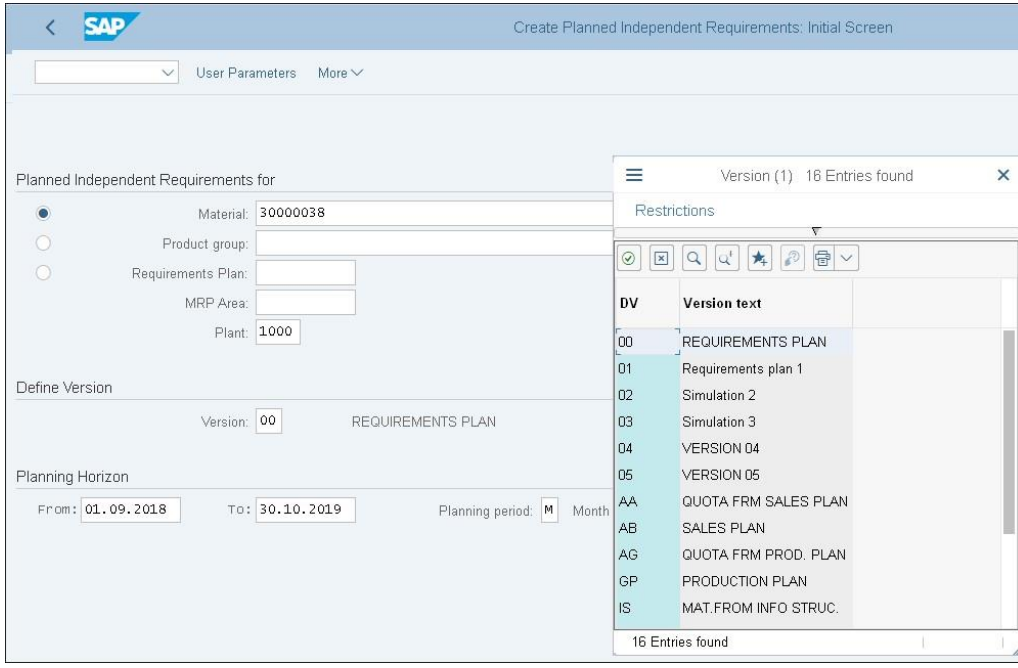


Figure 14.2 Standard Versions Available in the SAP System

Figure 14.3 shows the monthly PIR figures of the molten glass bulk as maintained in Table 14.2.

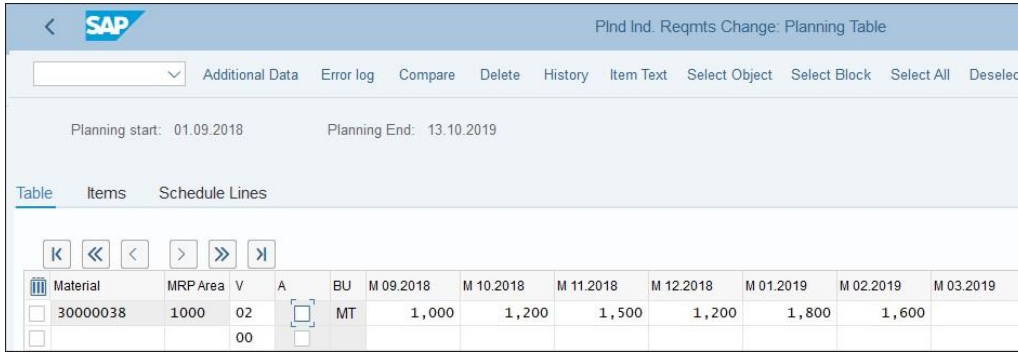


Figure 14.3 Planned Independent Requirements of Molten Glass Bulk

14.1.4 Create a Planning Scenario

To create a planning scenario, follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningPlanning ScenarioCreate**, or use Transaction MS31. These are the important steps in creating a planning scenario:

1. On the first screen that appears, define the planning scenario. For this example,define the **Planning Scenario** as "110", and also provide a short description.
2. Choose the **Long-term planning** radio button to denote that it's LTP, and press (Enter) so that the screen shown in Figure 14.4 appears.

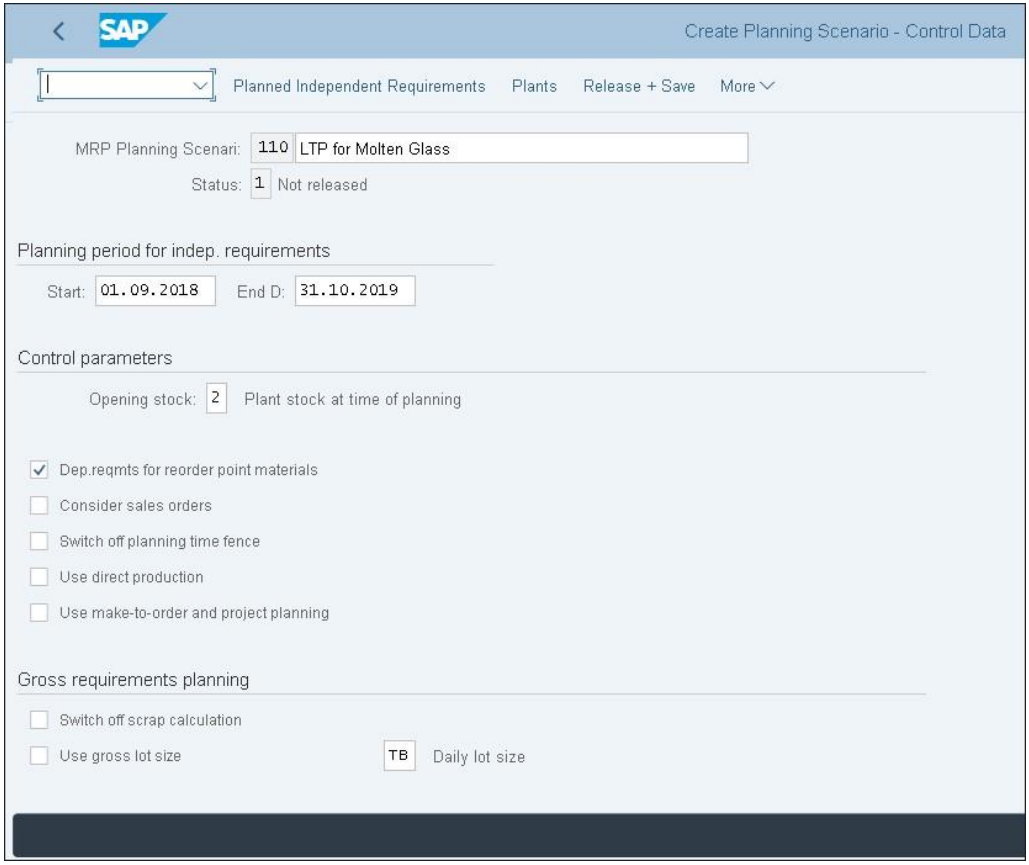


Figure 14.4 Creating a Planning Scenario

We'll now explain the step-by-step procedure for running the LTP process, which you'll also find in more detail in upcoming sections:

1. In the screen shown in Figure 14.4, enter “01.09.2018” and “31.10.2019” in the **Planning period for indep. requirements** area of the screen. The system will carry out LTP for the specified period only.
2. Enter “2” (**Plant stock at the time of planning**) in the **Opening stock** field.
3. Select other parameters as deemed appropriate.
4. Select the **BOM selection ID 01**, which is the production BOM for this example. If you’ve configured an LTP-specific BOM usage, then assign it here.
5. Click on the **Planned Independent Requirements** button located on the top section of the **Create Planning Scenario** screen (refer to Figure 14.4). Assign the simulative **Version** (use **02** for this example) in the screen shown in Figure 14.5.
6. Click on the **+** icon to add the version entry, add the **From** and **To** dates, and then choose **Confirm**.
7. Select the plants for which the LTP will be applicable. The **Plants** button shown earlier in Figure 14.4 is located on the top section of the **Create Planning Scenario** screen. Click on the **+** icon to add the plant entry, and then choose **Confirm**. For this example, use plant **1000**.

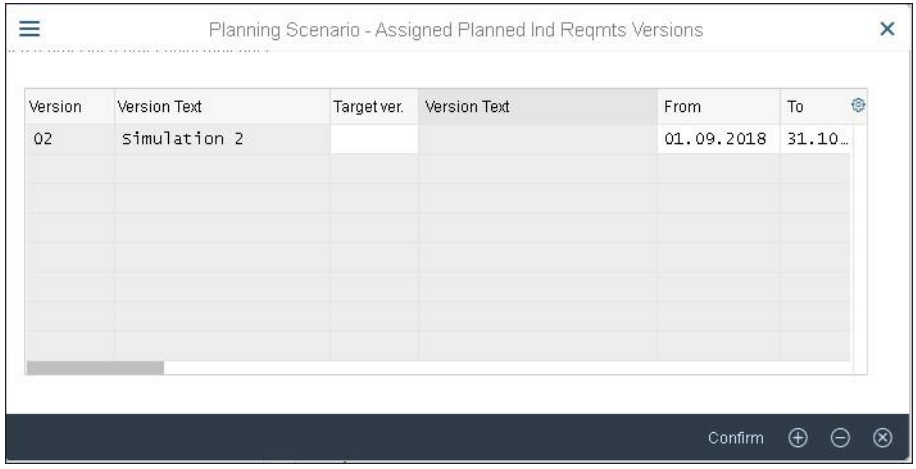


Figure 14.5 Planning Scenario Creation Screen to Define Parameters

8. Choose the **Release + Save** button shown earlier in Figure 14.4 to save the planning scenario. After a planning scenario has been released, you can no longer change its parameters. However, you can undo the release within the planning scenario.

9. The system automatically creates planning file entries in due course. When yourelease the planning scenario, the system creates entries in the planning files. However, when you cancel the release of the planning scenario, the system correspondingly deletes the entries from the planning file.

14.2 Long-Term Planning: Business Process

Having covered the master data as well as the planning data that you need to set up for LTP, we'll now cover the business processes involved in LTP. After you create the planning scenario, you need to perform the following series of activities in sequential order:

1. Enter the PIR in a simulative version (already covered in Section 14.1.3).
2. Run LTP (simulative MRP), and save the results.
3. Evaluate the LTP stock/requirements list.

Note

When you're working with LTP in your system, it may take several rounds to achieve a satisfactory production plan. It's helpful, then, to know that the basics and the underlying principles involved in LTP are very similar to MRP—adjusting, planning, evaluating, and comparing until the results are satisfactory.

The LTP example that we present in this chapter is a straightforward one, and the objective is to help you understand the sequence of steps involved in running LTP. For example, you can set up the planning quantities in the PIR much earlier than setting up LTP. We present it here to show that creating a PIR is one of the several steps that you need to undertake in the initial stages of master data setup for LTP.

14.2.1 Run Long-Term Planning (Simulative MRP)

To run the LTP interactively (simulative MRP), follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningLong-Term PlanningSingle Item, Multi-Level**, or use Transaction MS02. Here, you define the initial parameters to

run the LTP. Enter the **MRP Planning Scenario** as "110", as well as the **Material** code of the molten glass bulk and the **Plant** (see Figure 14.6).

Just like the MRP, you can define the parameters, which eventually influence the results of LTP. For this example, define that during LTP, the system should re-explode the BOM and routing to read the latest data and perform lead time scheduling to account for capacity planning (see Figure 14.6).

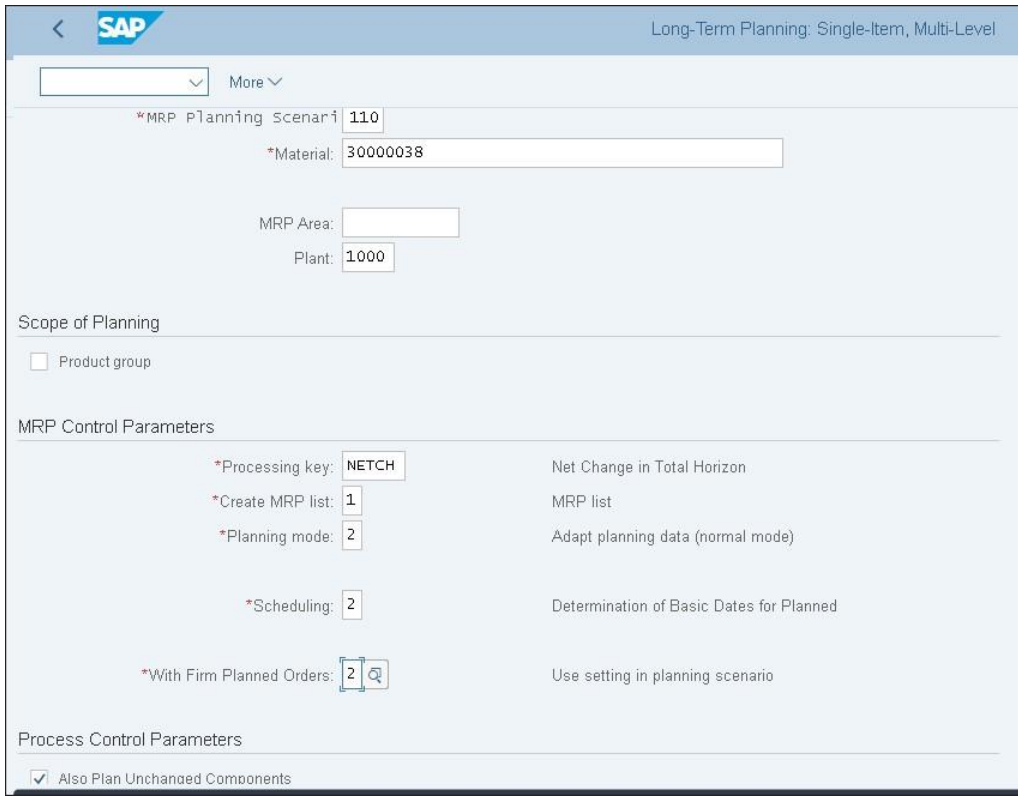


Figure 14.6 Initial Screen to Run LTP

Press (Enter), and the system issues a warning message to check all of the planning parameters. Press (Enter) again to confirm, and the system runs the LTP.

Figure 14.7 shows the planning results of **Molten Glass - Bulk**, **Material 30000038**, which is the first of the BOM materials selected for LTP planning. Click on **Save and continue** so that Figure 14.8 appears.

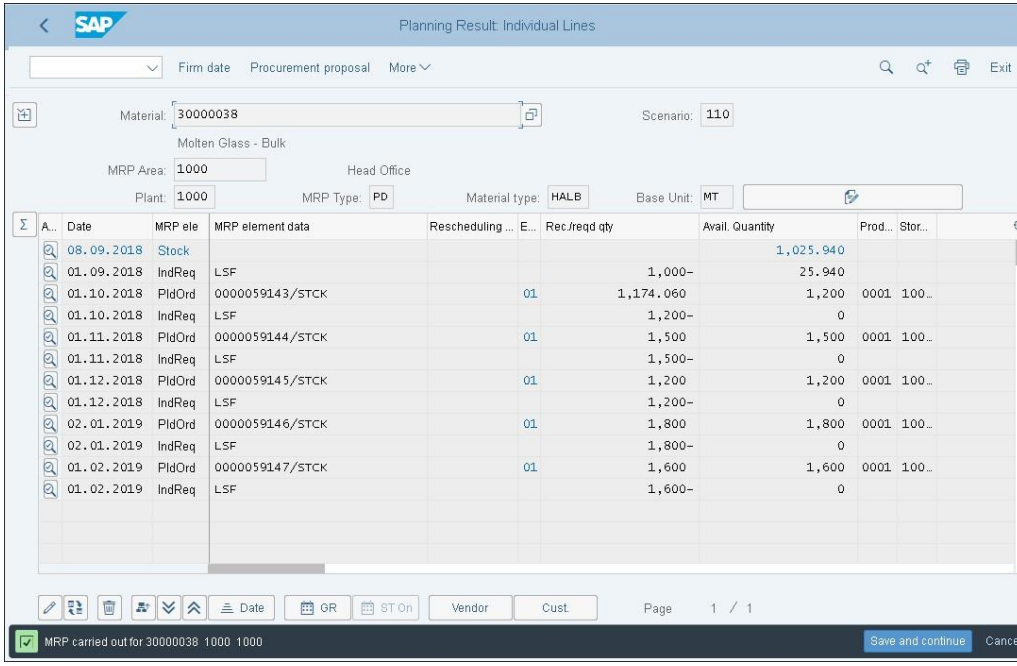


Figure 14.7 LTP List (Simulative MRP List) Generated

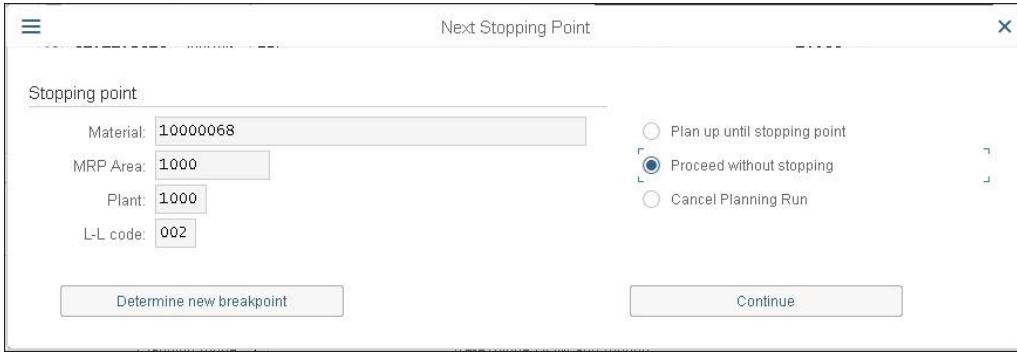


Figure 14.8 LTP of a BOM Component

After the LTP planning of molten glass bulk, Figure 14.8 shows the next BOM component, **Material 10000068**, is ready to be planned. You can choose the **Proceed without stopping** radio button and then choose **Continue** so that the system plans all BOM components without stopping at each breakpoint.

Figure 14.9 shows the LTP report of single material, multilevel LTP in which a total of nine materials were planned via LTP.

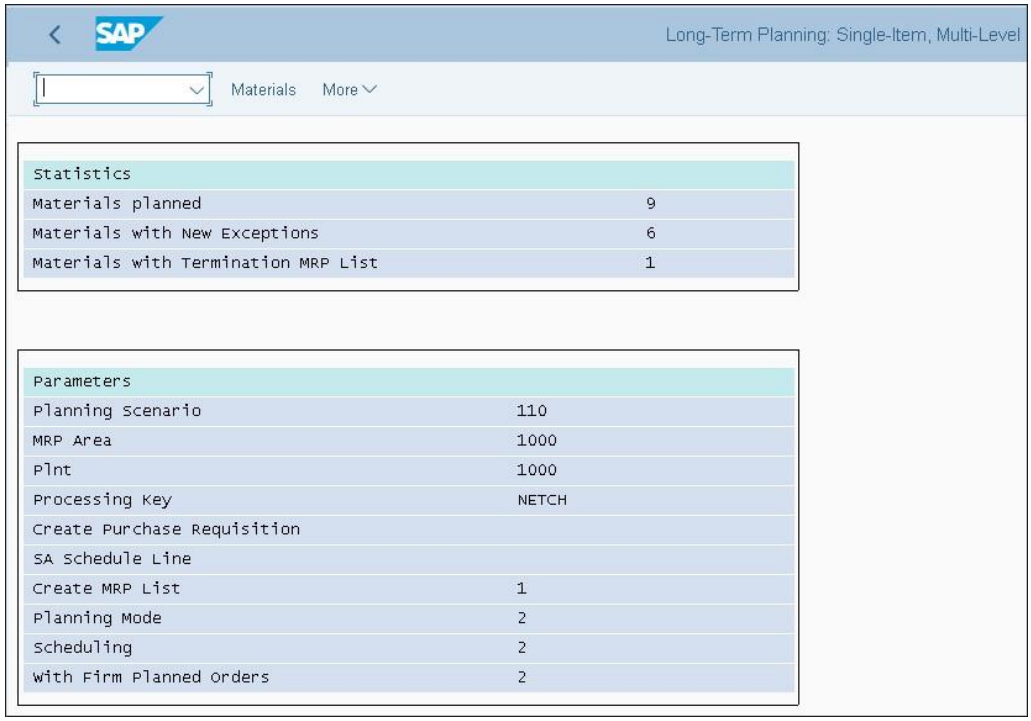


Figure 14.9 Results of LTP for Planning Scenario "110"

14.2.2 Evaluate the Long-Term Planning Stock/Requirements List

It's now time to evaluate the results and outcome of the LTP in the form of an LTP stock/requirements list. Follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningEvaluationsStock/Requirements List**, or use Transaction MS04. Figure 14.10 appears after you've entered parameters for planning scenario 110, material number, and plant.

Note

In the standard display layout of a stock/requirements list, the system shows individual planning elements, including independent requirements, planned orders, and so on. However, we've changed the layout to show how the monthly quantities entered

in the PIR are shown in the stock/requirements list. Notice that the first column is the monthly **Period/segment**, whereas the second column is the **Plnd ind.reqmts**.

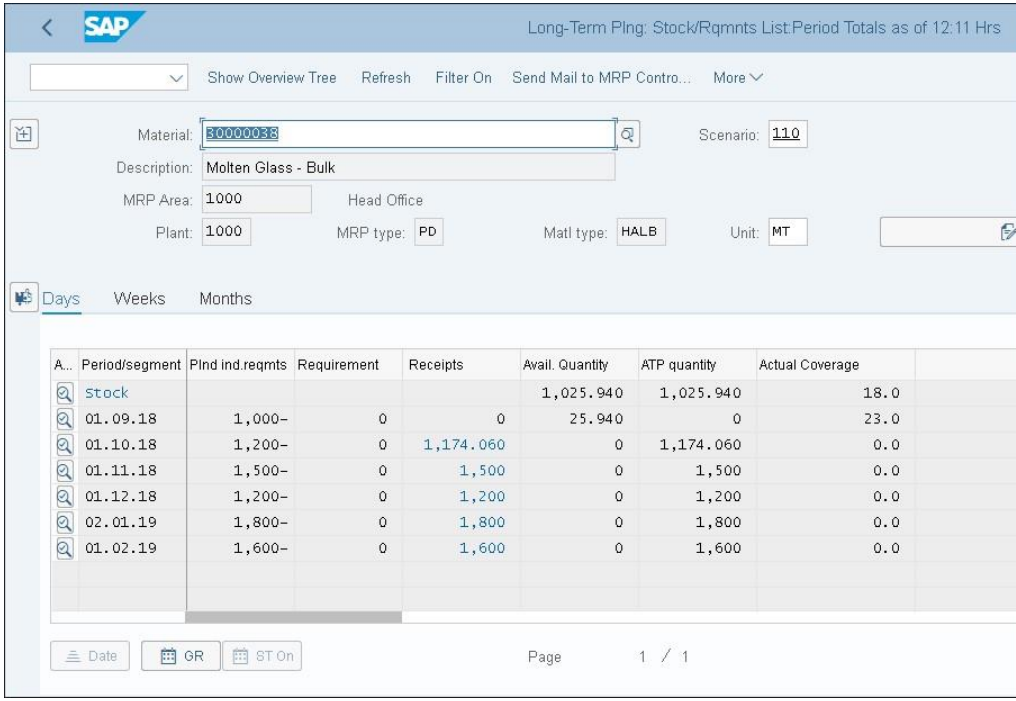


Figure 14.10 Stock/Requirement List of Urea Bulk Unpacked

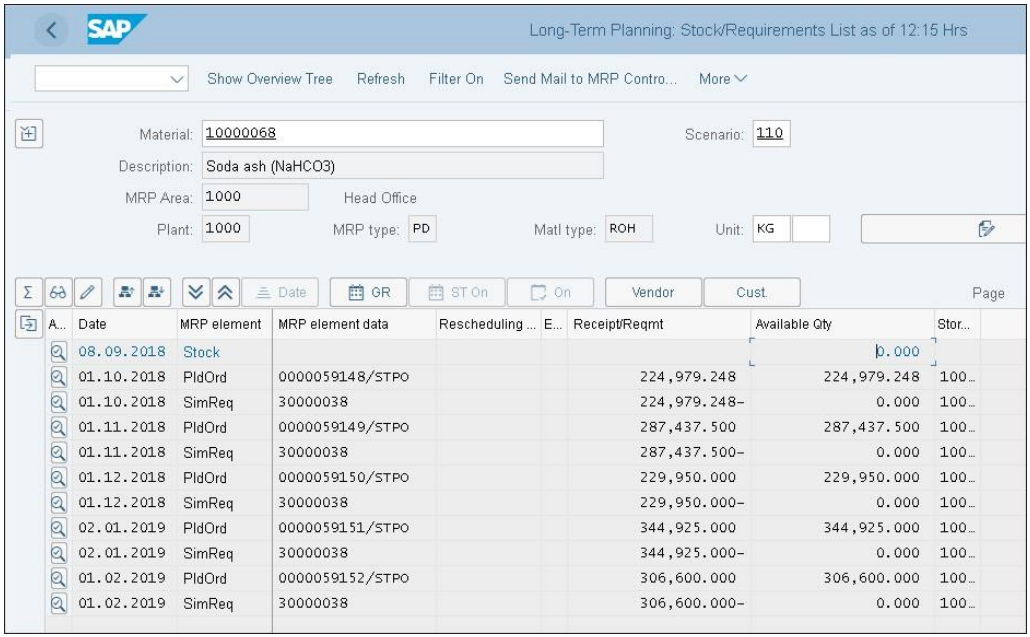
Tip

You can aggregate the layout to period total in the stock/requirements list by choosing the **Aggregate** icon. You can also click on the **Days**, **Weeks**, or **Months** tabs to view the aggregate details. Refer to Chapter 12 and Chapter 13 on MRP for more information.

Figure 14.10 has an opening stock of 1,025.940 metric tons. This is because we selected the existing stock as the opening stock balance while creating planning scenario 110. All figures are available as shown in Table 14.2, which shows the planning quantities for molten glass bulk.

Figure 14.11 shows the results of component soda ash of the finished product (molten glass bulk). The dependent requirements of soda ash calculated by LTP are based on the PIRs and

the BOM explosion details given in Table 14.2. The calculated quantities are shown in the **Receipt/Reqmt** column.



A...	Date	MRP element	MRP element data	Rescheduling ...	E...	Receipt/Reqmt	Available Qty	Stor...
	08.09.2018	Stock					0.000	
	01.10.2018	PldOrd	0000059148/STPO			224,979.248	224,979.248	100...
	01.10.2018	SimReq	30000038			224,979.248-	0.000	100...
	01.11.2018	PldOrd	0000059149/STPO			287,437.500	287,437.500	100...
	01.11.2018	SimReq	30000038			287,437.500-	0.000	100...
	01.12.2018	PldOrd	0000059150/STPO			229,950.000	229,950.000	100...
	01.12.2018	SimReq	30000038			229,950.000-	0.000	100...
	02.01.2019	PldOrd	0000059151/STPO			344,925.000	344,925.000	100...
	02.01.2019	SimReq	30000038			344,925.000-	0.000	100...
	01.02.2019	PldOrd	0000059152/STPO			306,600.000	306,600.000	100...
	01.02.2019	SimReq	30000038			306,600.000-	0.000	100...

Figure 14.11 Stock/Requirements List for the Soda Ash Component

Because the soda ash component is planned, its LTP results reflect the calculated results based on the BOM for molten glass bulk, which is 191.625 kg. Table 14.3 represents some of the calculated value of the soda ash component in LTP based on the BOM of molten glass bulk. These numbers match the details shown in Figure 14.11.

Month/Year	Molten Glass Bulk (Quantity in Metric Tons)	Soda Ash (Quantity in KG)
09.2018	1,000	191,625 (1,000 × 191.625 = 191,625)
10.2018	1,200	229,950

Table 14.3 Results of LTP for Soda Ash Component of Molten Glass Bulk

Month/Year	Molten Glass Bulk (Quantity in Metric Tons)	Soda Ash (Quantity in KG)
11.2018	1,500	287,437.5

Table 14.3 Results of LTP for Soda Ash Component of Molten Glass Bulk (Cont.)

14.3 Additional Features in Long-Term Planning

You now know how to successfully run LTP. The following are further options that are available in LTP:

Manually creating a simulative planned order

Firming the simulative planned order using a firming date

Calculating average plant stock

Copying PIRs or firmed planned orders from LTP to operative planning

Some of these options aren't commonly known; we'll explain these in the following sections.

14.3.1 Manually Create a Simulative Planned Order

While LTP provides complete automation in planning and proposal generation, including the creation of planned orders, it's often necessary to manually create a simulative planned order to meet any additional requirements during the simulation phase. For example, while evaluating results from LTP, you realize that you need to account for additional demand for a specific component. Instead of making changes to the PIR of a finished product and then re-exploding the BOM to come up with the component's quantity, you can quickly create a simulative planned order for that specific component. This simulative planned order then becomes available in all evaluations (e.g., the stock/requirements list) and information systems (e.g., purchasing and inventory controlling) and is also firmed. The system won't make changes during the next LTP run to this manually created simulative planned order.

To create a simulative planned order, follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningSimulative Planned OrderCreate**, or use Transaction MS11. Figure 14.12 shows the screen for the creation of a simulative planned order. For this example, create a simulative planned order for molten glass

bulk for a quantity of 100 metric tons and also associate it with planning scenario 110. In addition, set the **Firming** indicator so that during the next LTP run, the details of this simulative planned order aren't changed.

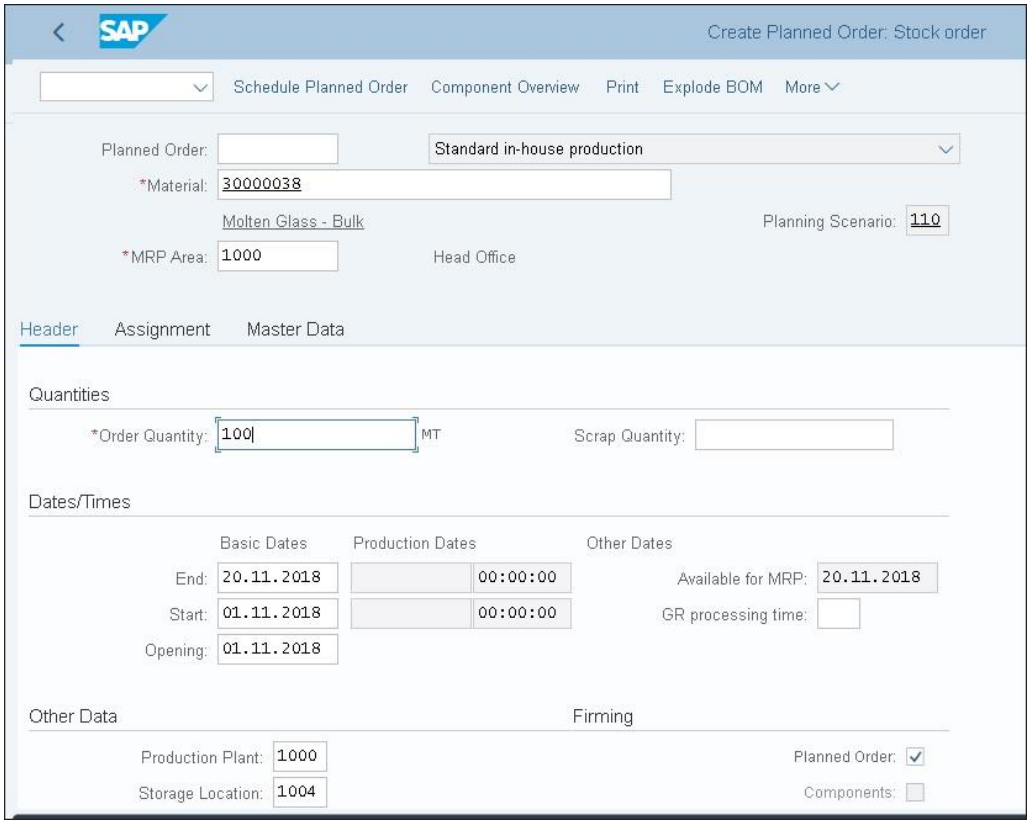


Figure 14.12 Manual Creation of a Simulative Planned Order

14.3.2 Firm the Simulative Planned Order Using a Firming Date

The process of manually firming planned orders ensures that all future LTP runs don't impact or overwrite the existing simulative planning data. In firming, a date is specified, and all of the simulative planned orders generated from LTP are then firmed until that date. During the next LTP run, these manually firmed simulative planned orders aren't changed or deleted. While remaining in the stock/requirement list (Transaction MS04), choose **EditManual Firming Date**.

Note

In the stock/requirements list for operative MRP (Transaction MD04), the system displays the manual firming date when it's active.

14.3.3 Calculate Average Plant Stock

Based on the period under evaluation, LTP offers the option to calculate the average plant stock of all the materials that went through the LTP process. The average plant stock is calculated by adding up the total stock for the period under evaluation divided by the number of periods (months) under evaluation. The benefit of providing the average plant stock to purchasing and inventory management departments is that they can better coordinate with vendors for timely deliveries, while warehouses have an advanced preview of space to be made available for this incoming stock.

To calculate average plant stock, follow menu path, **LogisticsProductionProduction PlanningLong-Term PlanningLong-Term PlanningAverage Plant Stock**, or use Transaction MS29. Figure 14.13 and Figure 14.14 shows the average plant stock of molten glass bulk (**Material 30000038**) and one of its components, soda ash (**Material 10000068**).

The average plant stock for molten glass bulk was calculated by the system to be 985.185 metric tons for the period under evaluation. The average plant stock for soda ash is 1660.327 metric tons for the period under evaluation.

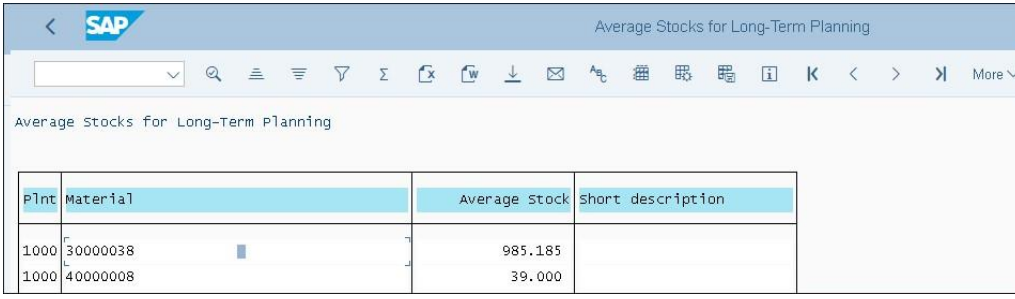


Figure 14.13 Average Plant Stock of Molten Glass Bulk (Material: 30000038)

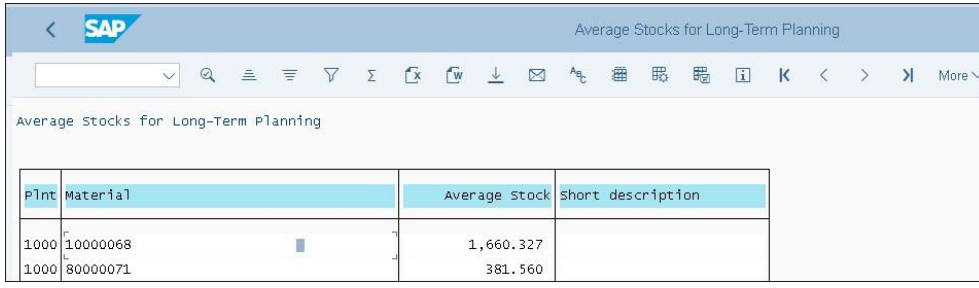


Figure 14.14 Average Plant Stock of Soda Ash (Material: 10000068)

14.3.4 Copy Long-Term Planning Results to Operative Planning

After all of the necessary simulations (LTP) have been completed, the business often needs to move the results of one of the simulations of LTP to operative planning, on which the actual MRP run can be executed. For this example, proceed with the understanding or assumption that you're satisfied with the results of LTP and want to copy the PIR to operative planning. In an actual business scenario, there may be several rounds of PIR updating and planning simulations within LTP before you copy the agreed-upon PIR into operative planning. The agreed-upon PIR for transfer to operative planning will be the one with which you're satisfied with the LTP simulation results. While this example focuses on copying PIRs, you can also copy firmed (simulative) planned orders to operative planning.

The option to copy a PIR of simulative planning to operative planning saves an enormous amount of work already done during the LTP process and eliminates redundancy in data entry. Further, during the copy function, you have the flexibility to make changes in operative planning with respect to LTP. After the PIR is in operative planning, assign the **Active** status to it, and run the MRP.

To copy the LTP's PIR to operative planning, follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningPlanned Independent RequirementsCopy Version**, or use Transaction MS64. Figure 14.15 shows the initial screen to define parameters to transfer the results of the simulative planning of version 02 to the operative planning in version 03.

Tip

Although we're deliberately taking the longer route in this example to show the steps involved in the copy function, you can use Transaction MS32 (Change Planning Scenario) and the **Active Independent Requirements** icon to activate PIRs.

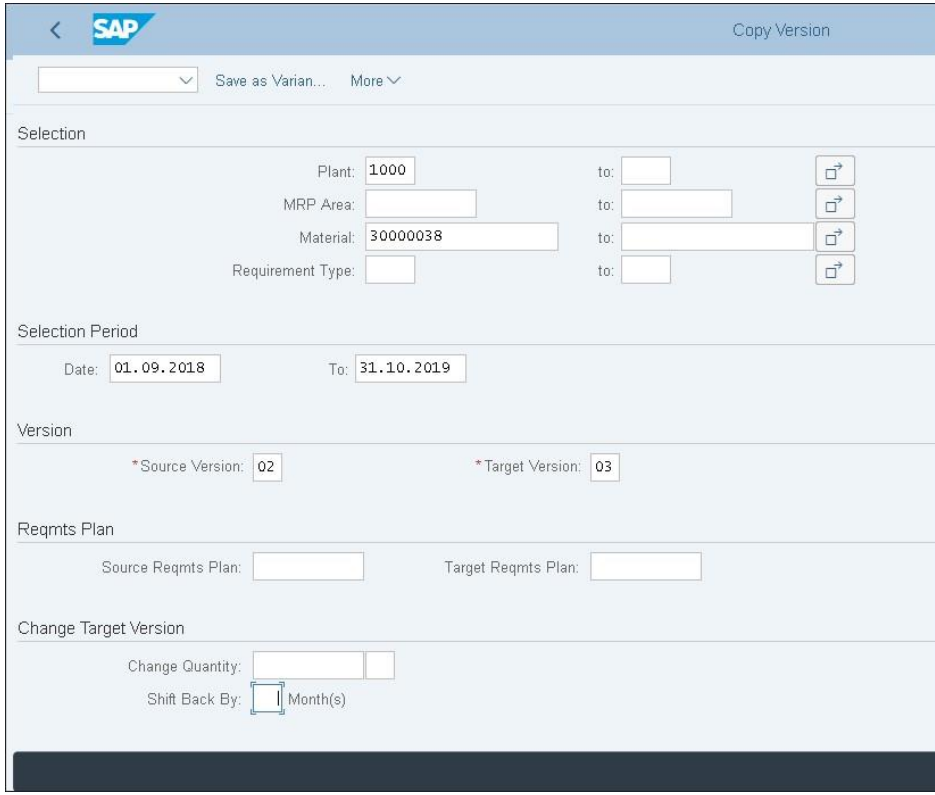


Figure 14.15 Copying Source Version 02 to Target Version 03 of a PIR

You specified that source version 02 should be copied to target version 03 for the material molten glass bulk. Other parameters to define include dates of transfer from version 02 to 03. You can also make changes in quantities between the source and target versions as well as the number of months by which you want to displace the planning data to operative data during transfer. Displacement refers to the moving of quantities forward or backward in time from version 02 to version 03 during copying of simulative data to operative data. Also select the **No database changes (simulation)** checkbox to enable the copy function in the simulation mode and to check for any errors or other deviations before performing the actual transfer.

After execution (by pressing F8), Figure 14.16 shows the simulated copied results to target version 03 with all of the urea bulk quantity successfully transferred to version 03. If you go

back to the previous screen, deselect the **No database changes (simulation)**, and press (F8) again, this time the copied results are available in the PIR under version 03.

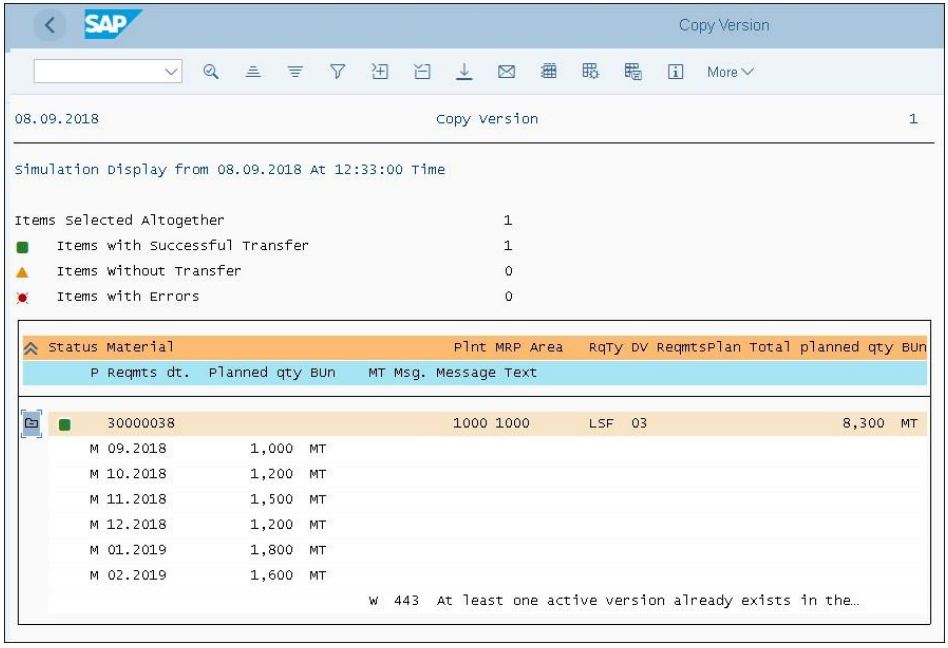


Figure 14.16 Results after Using the Copy Version Functionality

Note

While this example shows the transfer of a PIR from version 02 to version 03, we suggest that you use version 00, which is the active version in the system, to transfer LTP PIRs to operative planning (MRP).

After copying the LTP planning results of source version 02 to operative planning in version 03, check to see if the outcome of the copy function is that the LTP PIR data of version 02 is now available in version 03. To check the PIR, follow the menu path, **LogisticProductionProduction PlanningLong-Term PlanningPlanned Independent RequirementsChange**, or use Transaction MD62. You can confirm that the system successfully executes the copy function, and the simulative figures of version 02 are now transferred in 03. Refer to the third column (with the heading **V**) to note that it's version 03, and consider the activated **Active** field (the checkbox) right next to it.

Tip

You can use Transaction MD74 to delete or reorganize old or inactive PIRs on a regular basis.

14.4 Evaluate Information Systems

The logistics information system (LIS) is available for all core logistics areas in the SAP system. The LIS for each area provides a multitude of standard analysis reports. It derives the data and information from all of the transactions performed in the system, thus ensuring the availability of comprehensive information for evaluation and decision-making purposes. An information system is a reporting option available in the system to display the desired information based on the user-defined criteria. Therefore, there is also a comprehensive information system for LTP, catering to both the purchasing as well as inventory controlling functions.

In the following sections, we'll explain how to set up and evaluate the results of the information systems for purchasing and inventory controlling in LTP. You have to first set up the data for these two information systems before the system displays the planning results of a planning scenario. You don't have to set up any data for capacity requirements for work centers for a given planning scenario.

14.4.1 Setting Up a Purchasing Information System for LTP

You have to set up data before the purchasing information system for LTP is ready for use and evaluation. To get to the initial screen for the data setup (Figure 14.17), follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningEvaluationsPurchasing Information SystemSet Up Data**, or use Transaction MS70.

To set up the data, select the relevant parameters (e.g., **MRP Planning Scenario**). For this example, select **MRP Planning Scenario 110**. For order value calculation, choose **Standard/moving avg.price**, which the system will read from the material master. If you want the planned prices of the material to form the basis for purchasing value calculation, then you can choose **Plnd** (planned) **price** and enter from one of the three planned prices available. Press (F8) to execute.

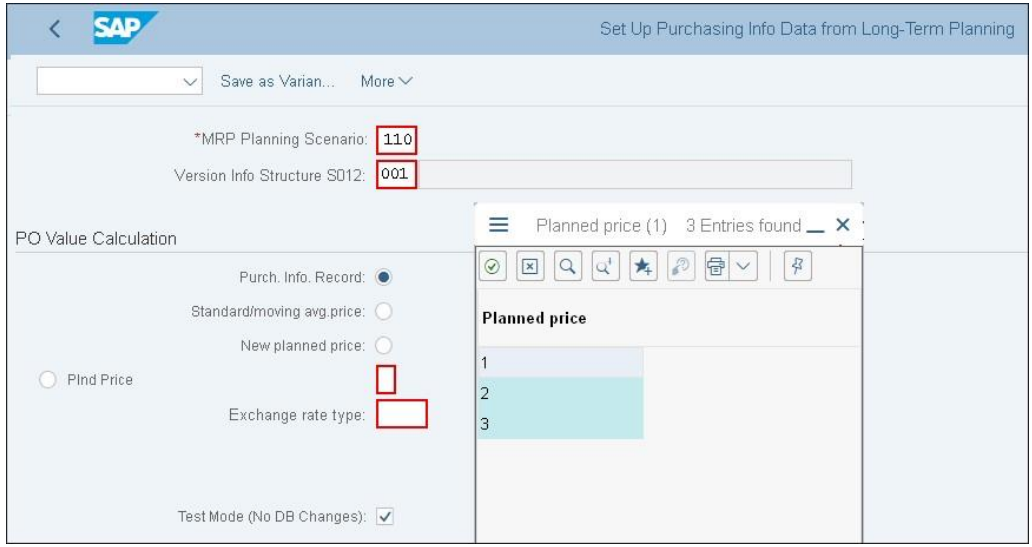


Figure 14.17 Set Up Screen for the Purchasing Information System for LTP

Warning

Make sure you deselect the **Test Mode (No DB Changes)** checkbox shown in Figure 14.17 to execute in the system.

14.4.2 Evaluating with the Purchasing Information System for LTP

The purchasing information system for LTP is now ready for use for evaluation purposes. Follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningEvaluationPurchasing Information SystemMaterial**, or use Transaction MCEC. Enter the relevant parameters for the soda ash component, as shown in Figure 14.18. These parameters are **MRP Planning Scenario**, **Standard/moving avg.price** (or other value calculation), **Material** number, **Plant**, and the **Period to analyze**.

Note that **Planning Scenario 110** , and the results for material soda ash are shown in Figure 14.19. Monthly order quantities along with values are reflected. The monthly purchase order quantity as well as the monthly total value in local currency is shown as well. You can also see the per unit price in local currency of soda ash.

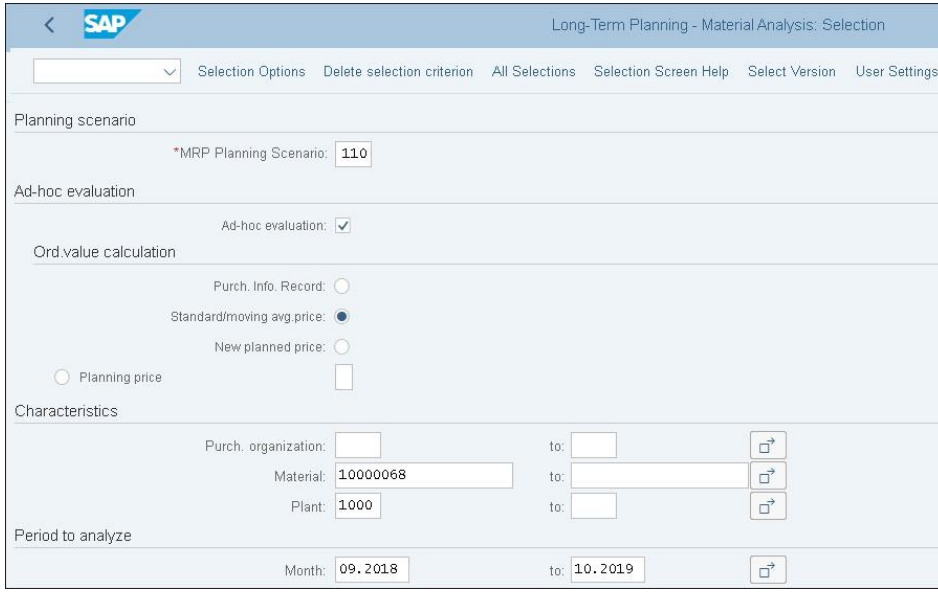
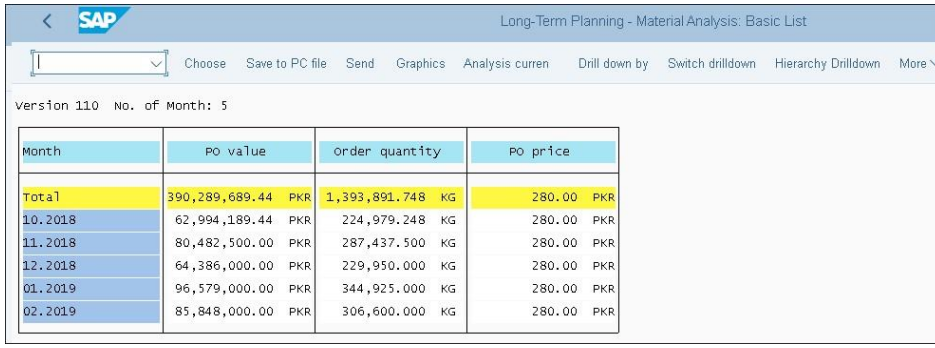


Figure 14.18 Material Analysis in LTP



Month	PO value	Order quantity	PO price
Total	390,289,689.44 PKR	1,393,891.748 KG	280.00 PKR
10.2018	62,994,189.44 PKR	224,979.248 KG	280.00 PKR
11.2018	80,482,500.00 PKR	287,437.500 KG	280.00 PKR
12.2018	64,386,000.00 PKR	229,950.000 KG	280.00 PKR
01.2019	96,579,000.00 PKR	344,925.000 KG	280.00 PKR
02.2019	85,848,000.00 PKR	306,600.000 KG	280.00 PKR

Figure 14.19 Evaluation of the Soda Ash Component in the Purchasing Information System for Materials

You can use the results of your simulative planning data of the planning scenario with operative planning for comparison purposes. You use Transaction MS44 to bring up the material-specific or plant-specific comparison. You can choose whether you want to run a comparison with the current operative planning situation (corresponding to the stock/requirements list) with the last operative planning run (corresponding to the MRP list) or with another planning scenario. You can define the presentation of the comparison by

means of a layout; in this case, we chose the standard layout, SAPSOP. This layout displays the issues, receipts, and available quantity for LTP and operative planning (indicated by comparative data in this case).

14.4.3 Setting Up an Inventory Controlling Information System for LTP

Similar to setting up a purchasing information system for LTP, you have to set up data before the inventory controlling information system for LTP is ready for use. To set up the data, follow the menu path,**LogisticsProductionProduction PlanningLong-Term PlanningEvaluationsInventory ControllingSetup Data**, or use Transaction MCB&.

In Figure 14.20, the selection parameters are **Plant**, **Material**, **Period to analyze**, and **MRP Planning Scenario** (which is **110** for this example). After the parameters are defined, choose the **Execute** icon or press (F8). This is all you have to do to set up data for the inventory controlling information system for LTP.

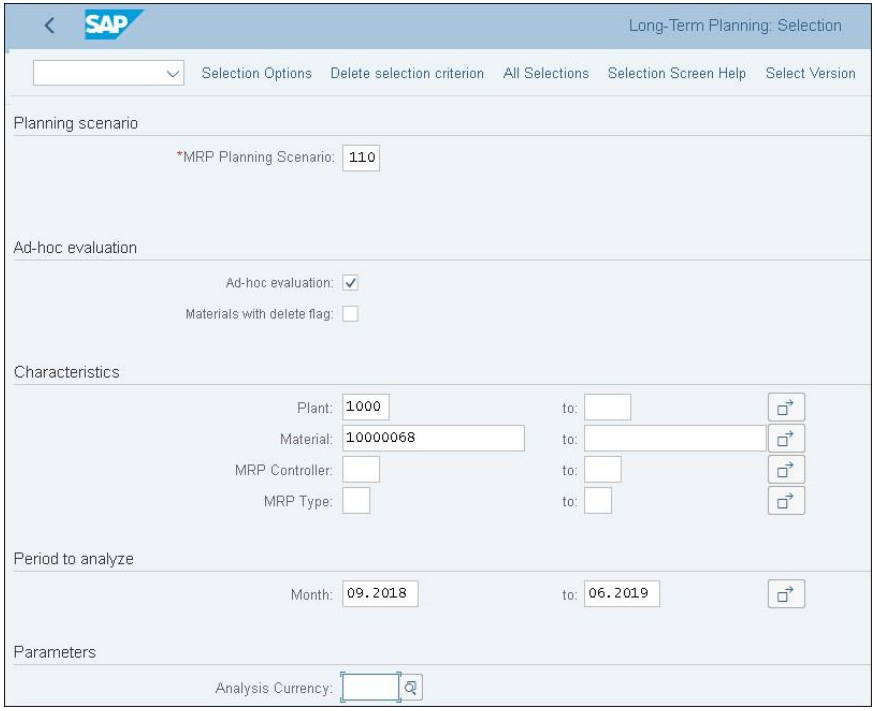
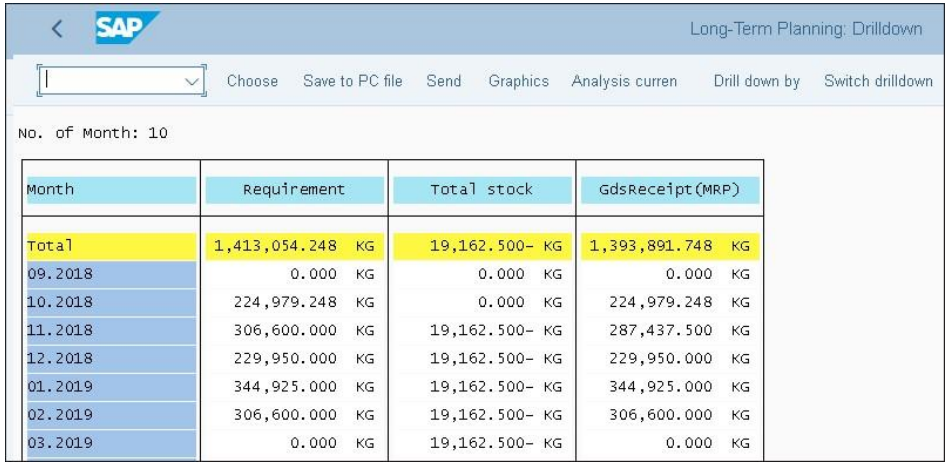


Figure 14.20 Setup of Inventory Controlling Information System for LTP

14.4.4 Evaluating the Inventory Controlling Information System for LTP

The inventory controlling information system for LTP is now ready for use for evaluation purposes. To get to the **Inventory Controlling** screen, follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningEvaluationsInventory ControllingEvaluation**, or use Transaction MCB). Figure 14.21 reflects the inventory situation of the soda ash component for individual months. The total monthly requirement of soda ash is shown first, followed by the stock situation, and finally by how much quantity must be received per month against procurement proposals generated by MRP/LTP (as shown in the **GdsReceipt (MRP)** column).



Month	Requirement	Total stock	GdsReceipt(MRP)
Total	1,413,054.248 KG	19,162.500- KG	1,393,891.748 KG
09.2018	0.000 KG	0.000 KG	0.000 KG
10.2018	224,979.248 KG	0.000 KG	224,979.248 KG
11.2018	306,600.000 KG	19,162.500- KG	287,437.500 KG
12.2018	229,950.000 KG	19,162.500- KG	229,950.000 KG
01.2019	344,925.000 KG	19,162.500- KG	344,925.000 KG
02.2019	306,600.000 KG	19,162.500- KG	306,600.000 KG
03.2019	0.000 KG	19,162.500- KG	0.000 KG

Figure 14.21 Inventory Controlling of the Soda Ash Component

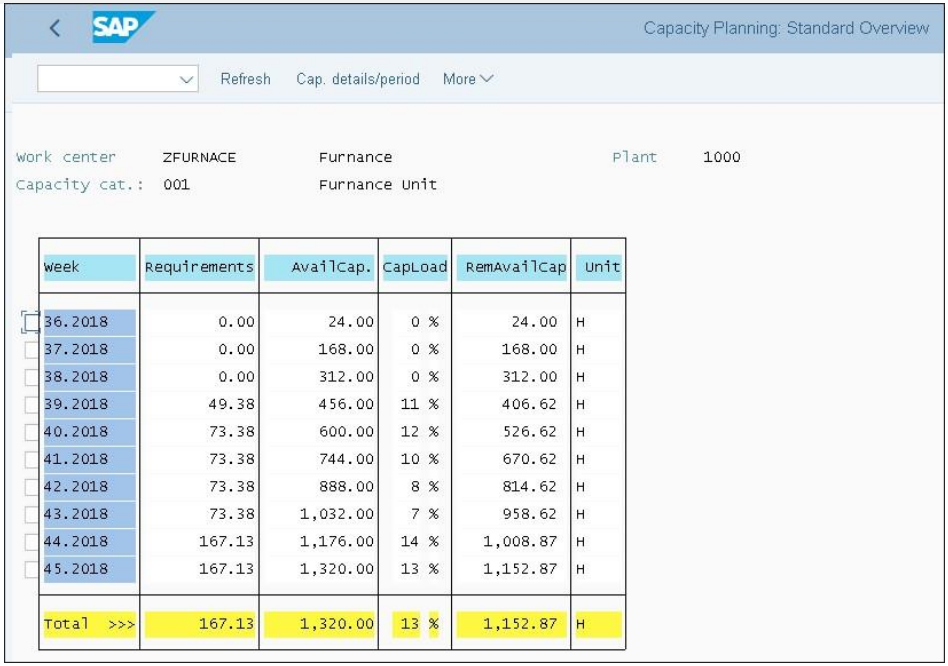
14.4.5 Capacity Planning

You can gain greater visibility of the capacity situation for various planning scenarios, and you don't have to set up any data for it. Further, the simulated capacity planning functionality helps you plan for future capacity expansions in case the existing capacity setup is unable to meet the impending capacity requirements.

To access the **Capacity Planning** screen, follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningEvaluationsCapacity RequirementsWork Centers**, or use Transaction CM38. On the initial screen, enter the planning scenario for which you want to evaluate the planning situation. Press (Enter), and the system brings up comprehensive capacity details for you to evaluate as you can see in Figure 14.22.

Note

Refer to Chapter 15 on capacity requirements planning (CRP) for more information.



week	Requirements	AvailCap.	CapLoad	RemAvailCap	Unit
36.2018	0.00	24.00	0 %	24.00	H
37.2018	0.00	168.00	0 %	168.00	H
38.2018	0.00	312.00	0 %	312.00	H
39.2018	49.38	456.00	11 %	406.62	H
40.2018	73.38	600.00	12 %	526.62	H
41.2018	73.38	744.00	10 %	670.62	H
42.2018	73.38	888.00	8 %	814.62	H
43.2018	73.38	1,032.00	7 %	958.62	H
44.2018	167.13	1,176.00	14 %	1,008.87	H
45.2018	167.13	1,320.00	13 %	1,152.87	H
Total >>>	167.13	1,320.00	13 %	1,152.87	H

Figure 14.22 Capacity Evaluation with LTP

14.4.6 Long-Term Planning Evaluation for Range of Coverage

Range of coverage reflects the number of days during which the current stock will cover future stock issues, and it's based on past stock and issue values. In other words, the range of coverage indicates how long existing inventory will last, assuming that the average future stock issues will be the same as those in the past. The usage-based range of coverage is calculated as follows:

Current stock ÷ Average usage per day

The requirements-based range of coverage is calculated as:

Current stock ÷ Average requirement per day

Using the range of coverage in LTP, a company can identify materials with excess coverage and take action to reduce unnecessary inventory. The opposite is also true when it comes to identifying a potential shortage situation early on to take corrective measures. Using Transaction MSDO, access Figure 14.23 for LTP evaluation of one of the components of molten glass bulk (silica sand), for which there isn't adequate coverage.

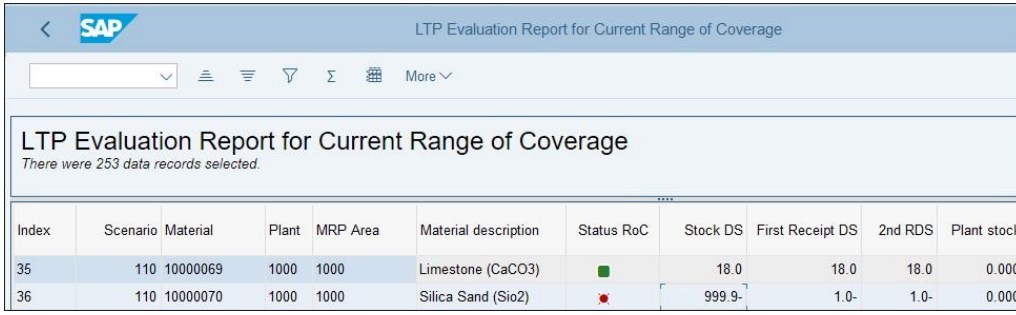


Figure 14.23 LTP Range of Coverage for Silica Sand

14.4.7 Activity Report

Because PP completely integrates with the product costing functionality, you can also leverage LTP to evaluate and transfer planned activity requirements to production. Similarly, you can transfer scheduled activities to PP business processes. To access the **Activity Requirement** submenu, follow the menu path, **LogisticsProductionProduction PlanningLong-Term PlanningEnvironmentActivity Requirement**.

14.5 Summary

LTP is able to attend to several of the business scenarios in simulation mode, as well as to attend to questions such as the average plant stock, the production quantities, the procurement quantities and values, and the capacities over a given period of time. LTP uses the same concepts and fundamentals as MRP. Even the system navigation and functions of LTP and MRP offer great similarities.

The next chapter covers capacity requirements planning (CRP).

Chapter 15

Capacity Requirements Planning

Apart from materials availability, capacity availability plays a central role in the entire production process. Capacity requirements planning helps companies ensure that the relevant resources become available at the required time for optimum and uninterrupted production.

Building on the concepts and understanding that you developed in Chapter 3 and Chapter 6 on capacity requirements planning (CRP), this chapter focuses on the *shortterm* capacity planning after the creation or release of production orders. We've covered the medium- to long-term capacity planning, vis-à-vis sales and operations planning (S&OP) (Chapter 10) and long-term planning (LTP) (Chapter 14). The CRP details for discrete manufacturing that we cover in this chapter are equally relevant and applicable to the process and, to a certain extent, in repetitive manufacturing (REM) types. For example, when deciding to assign relevant profiles for a capacity evaluation or capacity leveling, the system offers profiles with "REM" in their naming conventions for REM and with "PI" in their name for process manufacturing. For discrete manufacturing, the profiles have a naming convention with "SFC" (for shop floor control). Because the system uses the same principles that we cover in this chapter in plant maintenance (PM) and project system (PS), the available profiles have naming conventions of "PM" or "PS," respectively.

We'll start this chapter with an overview of the processes involved in capacity planning and then cover the capacity requirements and capacity evaluations. We cover both the standard as well as variable capacity evaluations. Next, we cover how you can cumulate capacity requirements at different work centers and also perform real-time checks on capacity availability, either during order creation or order release.

The chapter then moves on to cover dispatching and the associated profiles, the dispatching sequence, sequence-dependent setup, and finally the midpoint scheduling. We also cover how you can use the mass processing function to expedite the business processes, such as dispatching or deallocation. Finally, we cover some of the more important features available in both the graphical and tabular versions of capacity planning tables.

15.1 Process Overview

The objective of CRP is to schedule operations within the availability capacity and to check their feasibility when creating logical sequences of operations.

CRP can be implemented for production orders and also for planned orders from material requirements planning (MRP) and LTP. You can make the relevant configuration settings to enable the system to also consider planned orders in capacity planning. This option works best if your company's business processes are mature enough, and you have significantly high confidence in the planning results that MRP creates. Because there are often frequent and at times high numbers of last-minute changes between the planning and actual production and execution, it may not be wise to book capacities based only on planning results. In doing so, you're compromising the capacity availability, which in turn may have an impact on the actual production schedule. At the same time, there may be a genuine business need that entails converting planned orders earlier on into production orders to book the capacities based on production orders. Still others prepare a comprehensive and feasible production plan based only on planned orders.

Apart from scheduling operations, CRP involves two important processes:

Capacity evaluation

The *capacity evaluation* provides a comparison between available capacities with capacity requirements, with reference to the work center or specific production order.

Capacity availability check

The *capacity availability check* uses the same information to check whether the available capacity at the requisite work center is sufficient to manage the operation of the production order. Depending on the configuration settings, the system can perform the capacity availability check during production order creation or during its release. If there is insufficient capacity, three options are available:

- The system won't create or release the production order.
- The system will create or release the production order.
- The system prompts you to decide if you still want to create or release the production order, despite the capacity shortage.

Note

Refer to Chapter 6 in which we covered available capacity.

If there is insufficient capacity or to account for capacity restrictions, the system performs *finite scheduling* to look for periods when sufficient capacity is available. Insufficient capacity at the work center leads to rescheduling the operation, but you still have to perform the *dispatch* function to give a formal go-ahead to proceed with production on the given work center. You can perform the dispatch function either from the capacity planning table or from the tabular capacity planning table. If you have an incorrect or inadvertent dispatch, you can interactively *deallocate* the operation.

On dispatch, the system performs the following four functions:

Determines the dispatch dates

Creates the dispatching sequence

Performs finite scheduling of the operation to be dispatched

Performs midpoint scheduling of nondispatched operations of the production order

On dispatch of an operation, the system assigns it the status **DISP** (dispatched) and no longer schedules the operation automatically.

Note

Implementing CRP makes greater sense in companies that have a diverse range of products and also want to ensure that all of its products are produced in sufficient quantities for availability in the market. If a company produces products that use up all of its available capacities or where there are single products such as fertilizer, cement, caustic soda, or iron bars, then implementing CRP doesn't add much value to business processes.

During SAP system implementation, it's best to discuss and evaluate how implementing CRP will improve business processes and then decide on whether to implement CRP.

Capacity management describes a sequenced system of repeatable tasks. Each of these tasks serves to balance resource availability with the capacity load it has to cope with. To do so,

capacity management can be broken down into the following phases (see Figure 15.1 where the green arrows denote the capacity management process):

- Planning
- Scheduling
- Sequencing
- Evaluation
- Leveling

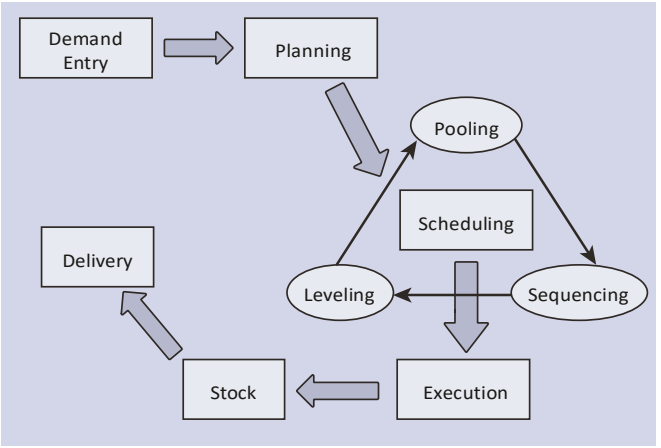


Figure 15.1 Capacity Management

A production scheduler is tasked with scheduling a pool of orders within a certain time frame. To do so, the orders first have to be put into a sequence according to some sort of criteria (maybe heijunka or setup optimization) and then leveled on the work centers or production line as available hours permit. For sequencing, many options are preconfigured and available in the SAP system. You can sort according to setup optimization, first in first out (FIFO), or heijunka, and there are many more that can be customized. For any given period, a sequence record is saved, which is used in the next step for the distribution within available capacity. Leveling uses the order's load and the work center's availability to figure out at what specific point in time the order will be placed.

Two Invaluable Rules of Planning

The following two rules in capacity planning will bring tremendous sanity to the production process.

There is a point in time at which planning activities must end.

Plan your resources in the medium and long term, and manage demand. Plan your resources and sequence in the short term. Then, schedule and manage supply of materials required for production.

Now that you have a basic understanding of how CRP works, let's delve into the details you'll need to know to understand how it works in your system, alongside your business requirements.

15.2 Capacity Requirements and Capacity Evaluation

The system reflects the day-to-day business processes in place, including creation and release of production orders, their confirmations, the delays in production, and the extra time it takes to set up or process the product in capacity requirements. The capacity evaluation enables you to view the capacity load or overload at various work centers in a large number of standard and variable evaluation options. These two business processes, that is, capacity requirements and capacity evaluation, are essential before getting started with the actual CRP process, and we'll discuss them in more detail in the following sections.

In the following sections, we'll cover how to understand the capacity requirements that the system creates, their evaluations, and the steps you can take for capacity leveling.

15.2.1 Capacity Requirements

As already mentioned, the system uses the settings that you've already configured in Chapter 3 for CRP and also the information that you entered in the production planning (PP) master data, such as work center and routing from Chapter 6. Here, we briefly cover these details.

The system determines the capacity requirements during lead time scheduling if you've set the **Det. Cap. Reqmnts** option in the control key. Furthermore, the system takes into consideration the formulas that you entered in the work center, the default values in the routing, and the order quantity. It's important to emphasize that the formulas for scheduling aren't used in CRP. For each component of an operation, such as setup, processing, and wait times, there is an earliest and latest date. The schedule formula is set to one of the operation dates. In the standard settings, this is the latest setup start date or processing start date, if the operation doesn't provide for any setup time. An operation can span several periods, and because the system bases the capacity evaluation on this information, the distribution key determines how the system distributes capacity to different periods.

The *distribution key* itself consists of the distribution strategy and the distribution function. The distribution key defines the operation dates and on what basis it carries out the distribution, for example, on the factory calendar, Gregorian calendar, or operation time.

You can maintain the distribution key, distribution strategy, and distribution function through the menu path, **SAP IMG Production Capacity Requirements Planning Operations Capacity Requirement Distribution**.

The system determines the capacity requirement during lead time scheduling and has to go through the capacity availability check and finally the dispatching process. If the system confirms the operation during the capacity availability check, it assigns the capacity requirement with the system status **BSTKZ**. It does the same when you dispatch the operation. In this way, the system converts the capacity requirement into a component called a *basic load*.

The basic load has an important role to play in the capacity availability check because available capacity represents the difference between the available capacity and the basic load. The system reduces the capacity requirements when you perform any of the following:

Confirm an operation.

Set the status of a production order as technically complete.

Lock the production order.

Set the deletion flag in the production order.

The system also updates the capacity requirements when you partially confirm an operation, and it correspondingly reduces part of the capacity requirements for the operation.

15.2.2 Standard Evaluation of Capacity Utilization

The SAP system offers several methods of *capacity evaluation*. Each standard evaluation has its own transaction code, whereas for variable evaluation, you select the relevant profile to enable the system to display the requisite information.

In standard evaluations, the system displays the capacity requirements in direct comparison to the available capacities. Following are some of the standard capacity evaluations:

Standard overview(Transaction CM01)

The system aggregates the load on a weekly basis.

Detailed capacity list(Transaction CM02)

The system shows the load per order and week.

Pool of orders/operations(Transaction CM03)

The system presents only the load of released operations.

Overload(Transaction CM05)

The system only shows work centers with overload. **Extended selection, work center view (Transaction CM50)** The system displays an aggregated view of the daily load. **Extended selection, order view (Transaction CM52)**

The system displays an aggregated view of the weekly load for all work centers that the selected orders occupy.

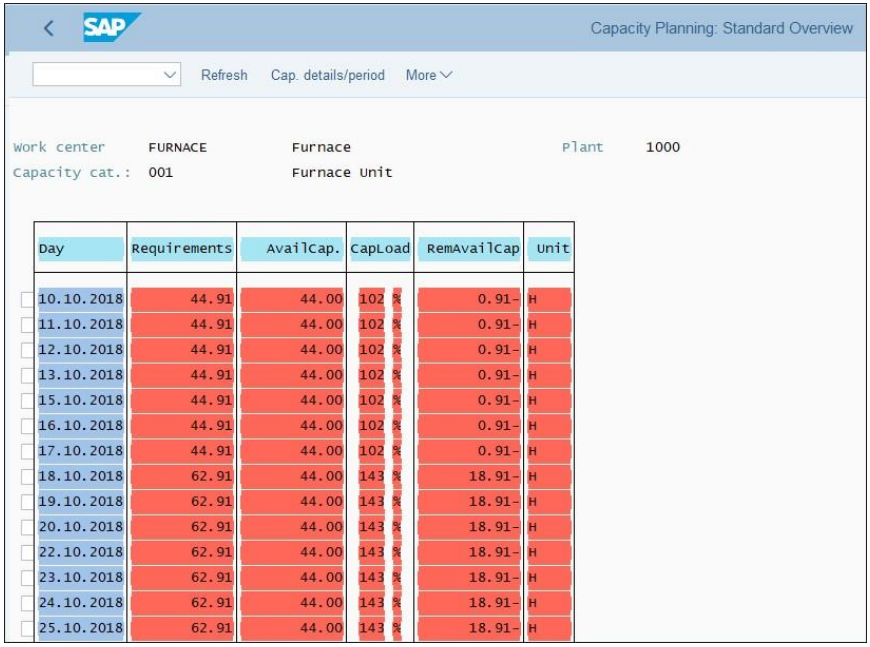
To access the screen where you can work with the capacity planning evaluation, follow the SAP menu path, **Logistics Production Capacity Planning Evaluation Work Center View Load**, or use Transaction CM01. Figure 15.2 shows the standard overview (load) of the **Work center FURNACE** and **Plant 1000** combination. It shows the capacity requirements for each calendar week that result from the creation or release of production orders. The screen also shows the available capacity (**AvailCap.**) of the work center and the resulting percentage of load (**CapLoad**), as well as the remaining available capacity (**RemAvailCap**).

For example, in calendar day 10.10.2018 (October 10, 2018), a capacity requirement of **44.91** hours (**H**) leads to a utilization (or an overload) of **102%** based on an available capacity of **44.00 H**. The system displays the periods with an overload in red. Because a 5% overload at this work center is allowed, the system still shows an available capacity of **0.91 H** in the **RemAvailCap** column.

[!]

Warning

The utilization rate on the production lines should never exceed 100% for an extended period of time. It shouldn't even get close because the closer you get to a full utilization (100%), the less you'll be able to cope with variability in the process. It's a fact that when capacity utilization approaches 100%, variability multiplies. The urge to do this, however, comes from the standard model of finance or costing department that asks for maximum utilization of resources because the business should make as many products or units as possible with the available capacity to spread the overhead costs thinner over more units and make the individual product cheaper.



Day	Requirements	AvailCap.	CapLoad	RemAvailCap	Unit
10.10.2018	44.91	44.00	102 %	0.91-	H
11.10.2018	44.91	44.00	102 %	0.91-	H
12.10.2018	44.91	44.00	102 %	0.91-	H
13.10.2018	44.91	44.00	102 %	0.91-	H
15.10.2018	44.91	44.00	102 %	0.91-	H
16.10.2018	44.91	44.00	102 %	0.91-	H
17.10.2018	44.91	44.00	102 %	0.91-	H
18.10.2018	62.91	44.00	143 %	18.91-	H
19.10.2018	62.91	44.00	143 %	18.91-	H
20.10.2018	62.91	44.00	143 %	18.91-	H
22.10.2018	62.91	44.00	143 %	18.91-	H
23.10.2018	62.91	44.00	143 %	18.91-	H
24.10.2018	62.91	44.00	143 %	18.91-	H
25.10.2018	62.91	44.00	143 %	18.91-	H

Figure 15.2 Capacity Evaluation of the Work Center

Note

In SAP S/4HANA, most icons are replaced with the corresponding icon texts. Whenever a particular option isn't available or displayed in the menu bar, check out **More** (as shown in Figure 15.2) that contains additional options.

Select the checkbox for **10.10.2018**, and choose **Cap. details/period** (or use Transaction CM02). The screen shown in Figure 15.3 appears, showing the evaluation list of the capacity requirement of each operation, including the production order number, the header material, and the order quantity. The **Choose fields** button enables you to display additional fields of the operation, such as its start time. You can also directly jump into the production order from here.

In the **Select fields** screen shown in Figure 15.4, the system lists already-displayed fields on the left-hand hand side of the screen, whereas you can choose from a large number of fields available on the right-hand side. Simply select the fields that you want to show in the

standard capacity evaluation, choose the **Display** button to move them from the right-hand side to the left-hand side, and then choose the **Continue**.

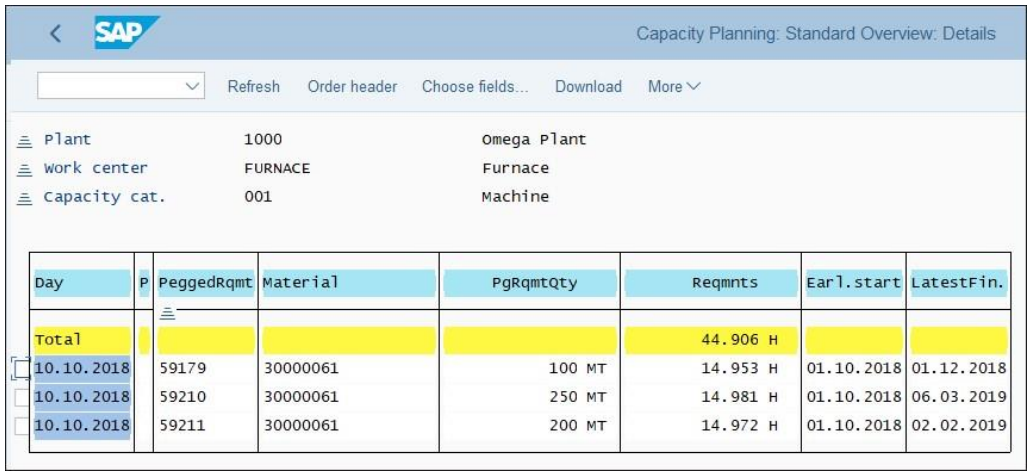


Figure 15.3 Detailed Capacity Evaluation for a Week

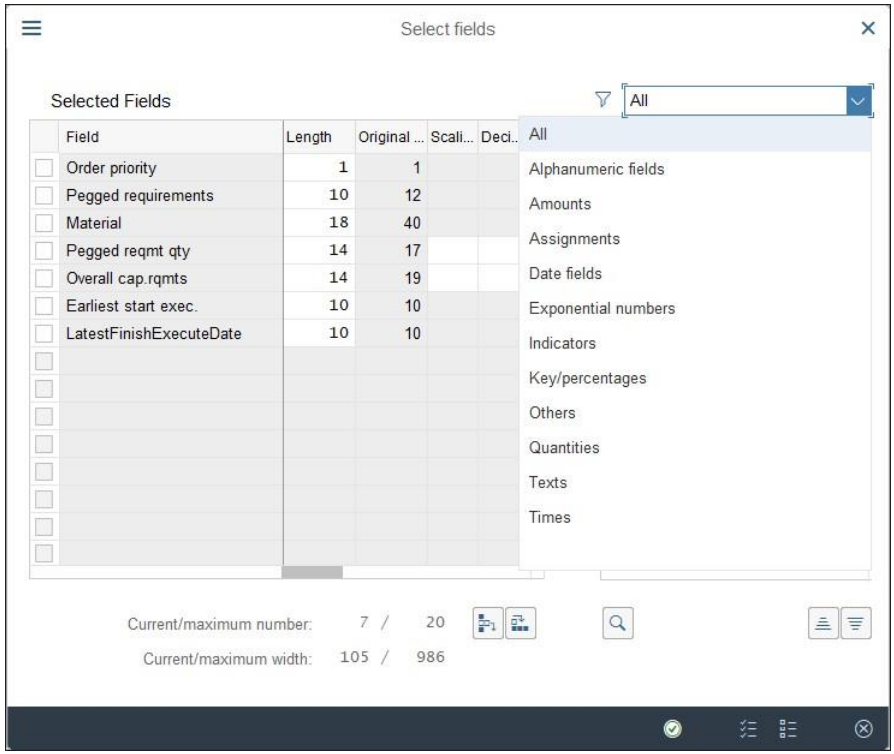


Figure 15.4 Fields for Selection in Capacity Evaluation

Because you can select many fields, you can use the filter option to narrow down the available choices. For example, if you use the **Quantities** filter available in the dropdown on the right-hand side of the screen, the system brings up the quantities fields for you to choose from and eventually displays them in the standard capacity evaluation.

15.2.3 Variable Evaluation of Capacity Utilization

In *variable evaluations*, you can base the capacity evaluation on individual requirements. In this process, the system requires an overall profile that defines the evaluation. Standard profiles are available for this purpose, or you can define your own profiles.

For a variable evaluation of capacity utilization, follow the SAP menu path, **LogisticsProductionCapacity PlanningEvaluationVariable**, or use Transaction CM07. The **Planning** screen in Figure 15.5 shows the variable evaluation using overall profile **SAPSFC010**. In contrast to the standard overview (Transaction CM01 or overall profile SAPX912), this profile displays only the requirements of the basic load.

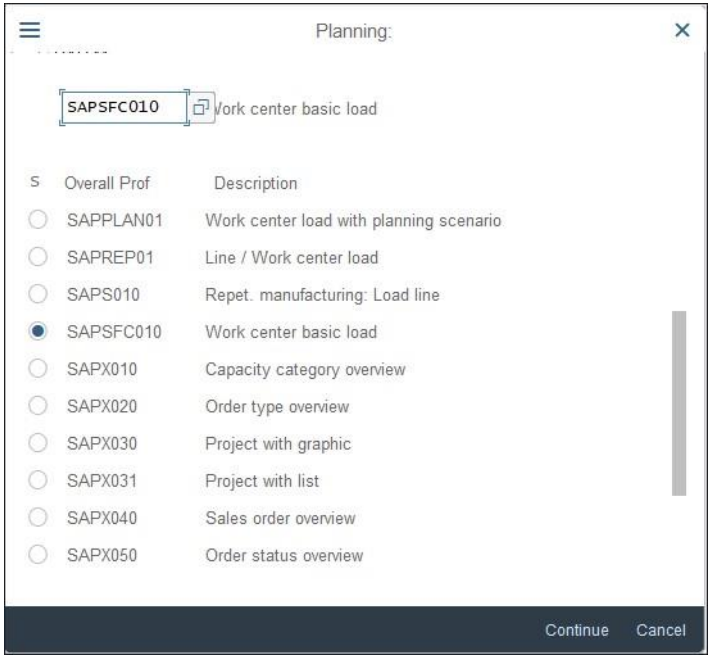
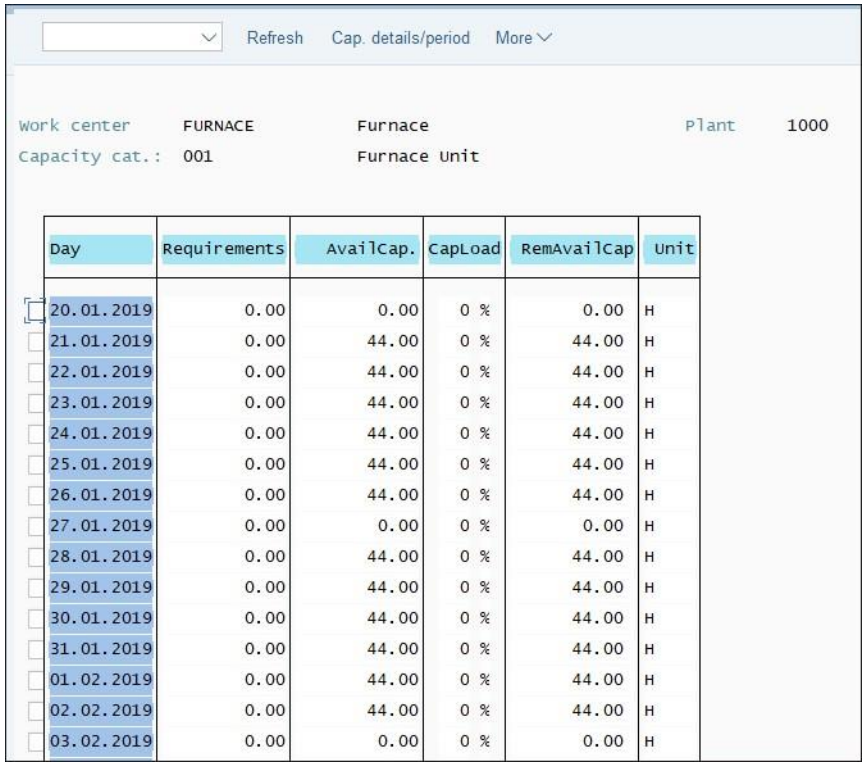


Figure 15.5 Selection of the Variable Evaluation Overall Profile SAPSFC010

Here, select **Overall Prof SAPSFC010**. In the ensuing screen, enter the **Work Center** "Furnace" and **Plant** "1000", and then press (Enter) or choose the **Variable overview**.

The **Variable Overview** screen that appears (see Figure 15.6) is similar to the standard evaluation, but it displays only those requirements that affect the basic load. The system shows the capacity requirements that have been dispatched.



Day	Requirements	AvailCap.	CapLoad	RemAvailCap	Unit
20.01.2019	0.00	0.00	0 %	0.00	H
21.01.2019	0.00	44.00	0 %	44.00	H
22.01.2019	0.00	44.00	0 %	44.00	H
23.01.2019	0.00	44.00	0 %	44.00	H
24.01.2019	0.00	44.00	0 %	44.00	H
25.01.2019	0.00	44.00	0 %	44.00	H
26.01.2019	0.00	44.00	0 %	44.00	H
27.01.2019	0.00	0.00	0 %	0.00	H
28.01.2019	0.00	44.00	0 %	44.00	H
29.01.2019	0.00	44.00	0 %	44.00	H
30.01.2019	0.00	44.00	0 %	44.00	H
31.01.2019	0.00	44.00	0 %	44.00	H
01.02.2019	0.00	44.00	0 %	44.00	H
02.02.2019	0.00	44.00	0 %	44.00	H
03.02.2019	0.00	0.00	0 %	0.00	H

Figure 15.6 Variable Evaluation Using Overall Profile SAPSFC010

You can define the variable evaluation using profiles, which we'll discuss next.

Overall Profile

The *overall profile* consists of four profiles: the *selection profile, option profile, list profile,* and *graphic profile*. These profiles, in turn, contain additional profiles. Figure 15.7 provides an overview of the profile structure. We'll discuss the first two profiles, while the remaining two profiles (list profile and graphic profile) contain additional settings to display a standard evaluation.

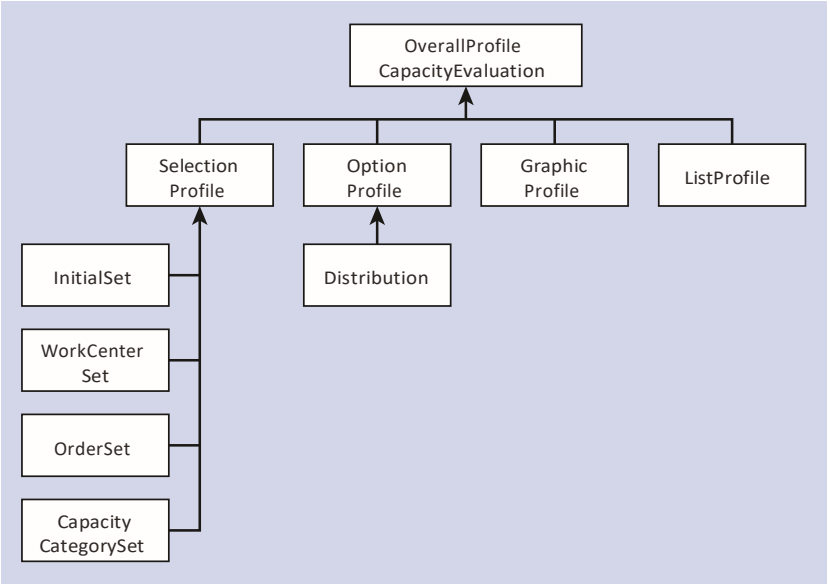


Figure 15.7 Profiles for Variable Evaluation

To create or make changes to an overall profile, follow the menu path, **SAP IMG Production Capacity Requirements Planning Evaluation Profiles Define Overall Profiles**, or use Transaction OPA6. Figure 15.8 shows the assignment for **Overall prof. SAPSFC010**.

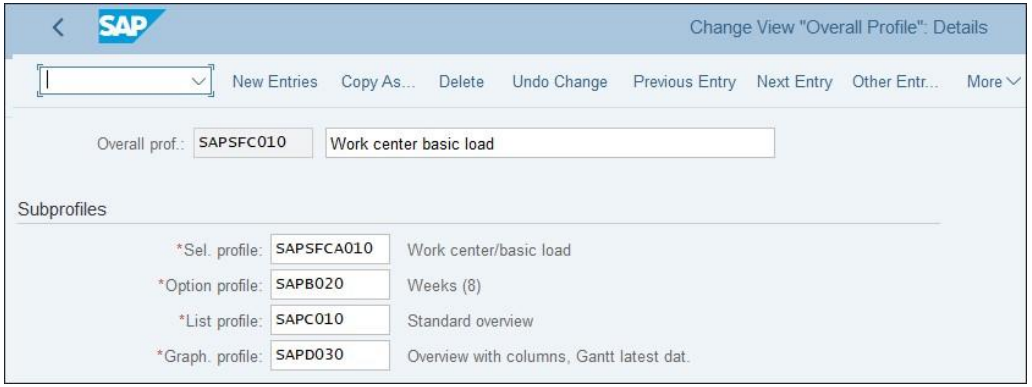


Figure 15.8 Overall Profile for Variable Evaluation

Selection Profile

The *selection profile* determines which capacity requirements the system should read. To create or make changes to a selection profile, follow the menu path, **SAP IMG Production Production Capacity Requirements Planning Evaluation Profiles Define Selection Profiles**, or use Transaction OPA2. Figure 15.9 shows **Sel. profile SAPSFCA010**, which it then assigns to an overall profile SAPSFC010.

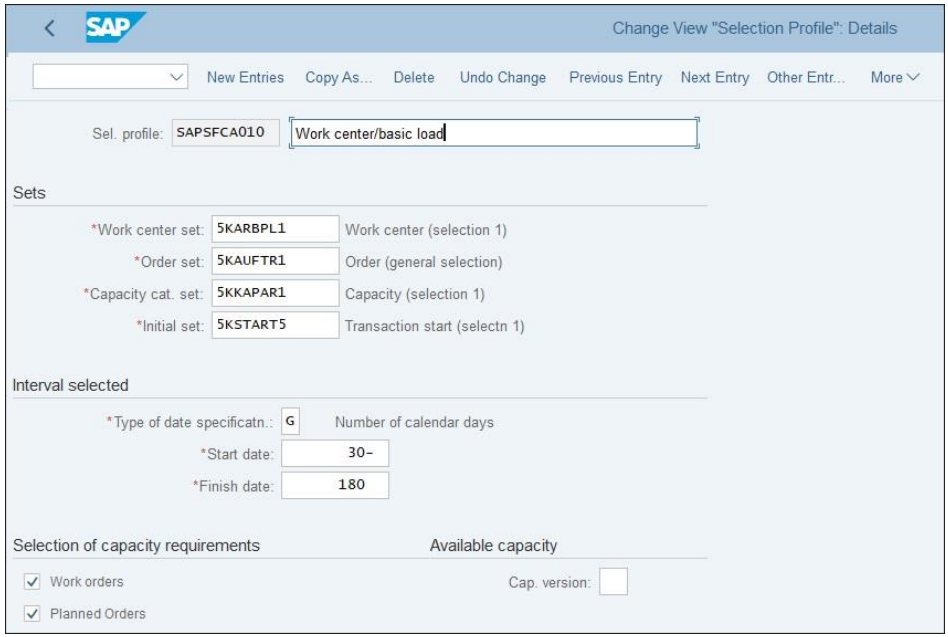


Figure 15.9 Selection Profile for Variable Evaluation

The objects for which the system reads the capacity requirements are determined on the basis of the set combinations for the work center, capacity category, and the order. You can also determine them on the basis of the *order categories*, that is, whether it's a production order or a planned order. The initial set determines which restrictions the system makes during the call. This information is output in the **Selection Profile** screen just shown in Figure 15.9.

You can create or change the set combinations using either the menu path, **SAP IMG Production Capacity Requirements Planning Evaluation Selection Set Define Sets**, or Transactions CMS1 or CMS2, respectively. The sets often use input variables that you can create or change using menu path, **SAP IMG Production Capacity Requirements Planning Evaluation Selection Set Define Variables**, or Transactions CMV1 or CMV2, respectively.

Option Profile

The *option profile* contains items to include in backlogs, to cumulate the capacity requirements and the available capacity (Section 15.2.4), and to distribute the capacity requirements. To create or make changes to an option profile, follow the menu path, **SAP IMG Production Capacity Requirements Planning Evaluation Profiles Define Options Profiles**, or use Transaction OPA3. Figure 15.10 shows **Option profile SAPB020**, which is also used for standard evaluation.

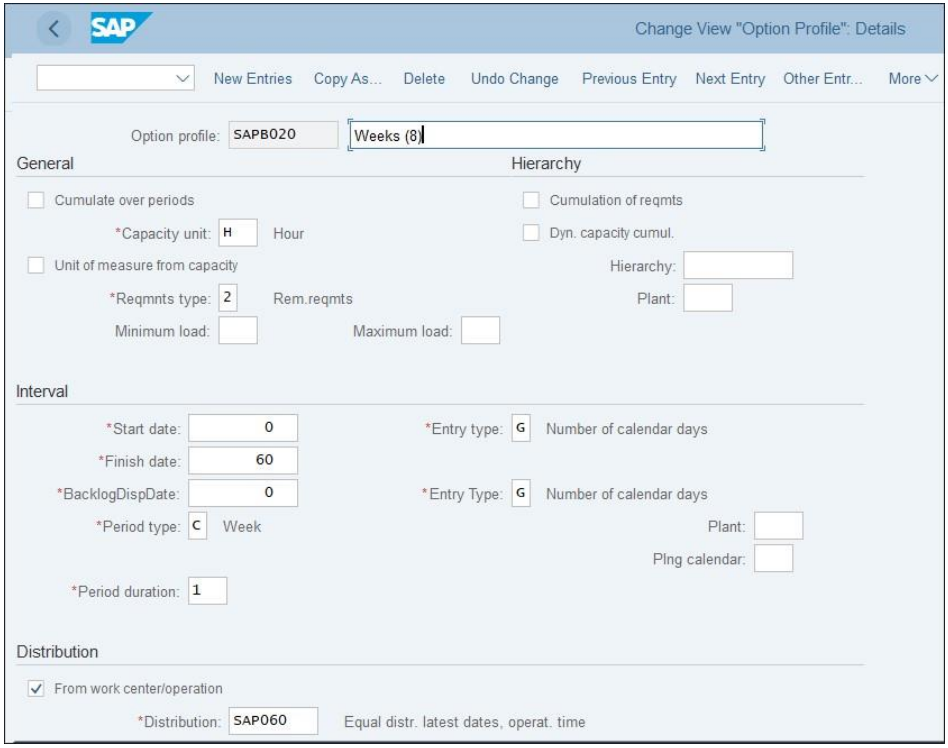


Figure 15.10 Option Profile for Variable Evaluation

The *list profile* can be set up by using Transaction OPA4, and the *graphic profile* can be set up using Transaction OPA5. Both profiles contain additional settings to display the standard evaluation.

15.2.4 Cumulating the Capacity Requirements

For evaluation purposes, especially when large numbers of orders at various work centers are taken into consideration, it's often helpful to cumulate the capacity requirements. This provides a broader overview of the capacity situation at each work center. You can

cumulate capacities either statically or dynamically from work center hierarchies. When you're statically cumulating the capacity, the system only refers to the work center and its available capacity. To carry out capacity evaluation in cumulated form, that is, to cumulate both available capacity and capacity requirements, you must cumulate capacity requirements planning dynamically.

In the **Hierarchy** area shown previously in Figure 15.10, the options to cumulate capacities dynamically as well as the **Hierarchy** work center for the plant are available.

15.2.5 Checking Capacity Availability

When you create a production order, you can check for capacity availability in the order before dispatching it. This step helps you decide whether it's possible to dispatch the order or not. The system considers period-based information by checking it to find out whether the available capacity in the period of operation is bigger than or equal to the capacity requirement of the operation. The length of the period is set in the period profile, which we'll cover later in this chapter. The shortest possible period is one day. When the system performs a period-based check, it only informs that the capacity is available (or unavailable) within the given period and not the planned operation date.

The available capacity represents the difference between the permitted capacity overload defined in the work center and the basic load. The basic load doesn't contain all of the capacity requirements. By default, only dispatched operations and those for which the capacity has been confirmed affect the basic load. You can display the basic load using the variable evaluation (Transaction CM07) and profile SAPSFC010.

Tips & Tricks

If no capacity availability check has been carried out over a long period of time, or if it's being used for the first time, you can create the basic load on the basis of the existing (unchecked) capacity requirements using Transaction CM99. In this case, all capacity requirements will be confirmed.

Often due to delays in actual production, the system creates a backlog (e.g., nonconfirmed operations from the past). You can use the **Overall capacity load** checkbox in the strategy

profile and the backlog dispatching date (**BacklogDispDate 0**; refer to Figure 15.10) to define whether you want to include them in the determination of the available capacity. We cover strategy profiles a bit later in this chapter. If you do include them, the capacity requirements of the past are temporarily scheduled forward into the current period and, if necessary, into subsequent periods and added to the basic load.

An operation can last for several periods. In this case, the distribution key determines the way in which the system distributes the capacity requirement to different periods. The capacity check uses the distribution key that is assigned to the *evaluation profile* (Section 15.4.2). The capacity availability check is carried out for each individual order, and all operations are checked one after the other, according to their numerical order. A restriction on this capability is that only those operations are checked that exist in work centers relevant to finite scheduling. Therefore, it makes sense to define critical work centers (work centers with bottleneck capacities) as finite to ensure there are enough degrees of freedom in the capacity planning.

You can carry out the capacity availability check interactively at the production order creation or release. Alternatively, you can perform an interactive capacity availability check from the production order, as shown in Figure 15.11. The **Capacity Availability** popup appears when you choose the **Capacity** button in the production order header. The system checks for capacity during production order creation of the steel sheet rerolling process.

In this example in Figure 15.11, there is at least one operation where the work center doesn't have sufficient capacity. More detailed information is available as well as the option to use finite scheduling to shift the operations into periods with sufficient capacity. Choose the **Detailed info** button to see the detailed information for this capacity availability check provided in the **Capacities with Overload** screen that appears (see Figure 15.12).

Here, the capacity problem exists in the first **Operation** at **Work center Zfurnace**, and in the **Period 18.10.2018** (October 18, 2018) because the requirement of **40.00** hours far exceeds the available capacity of **24.00** hours. Because this situation leads to a load of 166.7%, the system can't confirm the operation. Notice that there are days when the availability capacity meets the capacity required.

The system determines the load threshold on the basis of the permitted overload specified in the capacity master data and can exceed 100%.

However, it's possible to confirm the capacity requirement interactively by setting the **Capacity confirmed** checkbox (left-hand side of the screen) if the planner wants to do that, and then choosing **Adopt**.

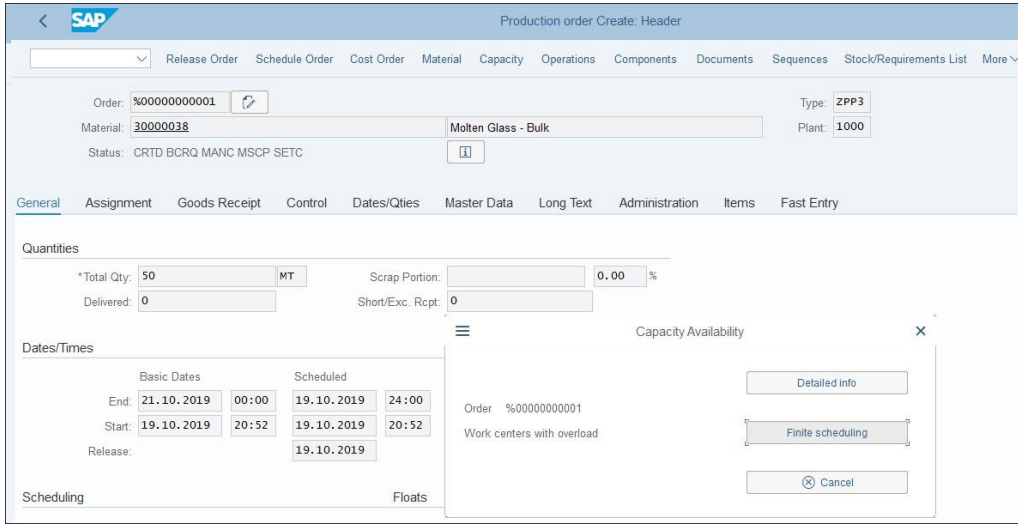


Figure 15.11 Interactive Capacity Availability Check

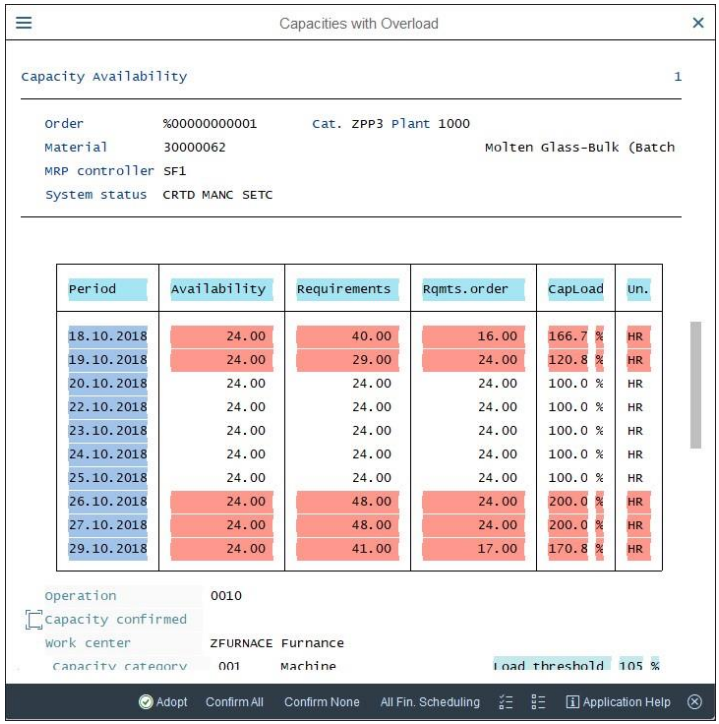


Figure 15.12 Detailed Information on Available Capacities, Including Overload

Category-Specific Check Control

In Chapter 3, we covered that the check control settings specific to the plant and order category determine whether the system carries out the capacity availability check at the creation and/or the release of the production order (use Transaction OPJK). We briefly cover it again here.

The availability checks during order creation and release represent different availability operations (business function 1 for order creation, 2 for order release), which is why different sets of parameters exist for the creation and release functions. In addition to deciding whether the system carries out the capacity availability check, you also need to assign the overall profile for the capacity availability check. If you don't make any overall profile at this stage, the system uses the standard profile SAPSFCG013. Further, you also need to define whether the production order creation or release is possible with unconfirmed capacity requirements.

The screen shown in Figure 15.13 displays the check control at order creation (use Transaction OPJK) in the **Capacity availability** area of the screen. If you don't want the system to perform any availability check during order creation, you can select the **No check** checkbox.

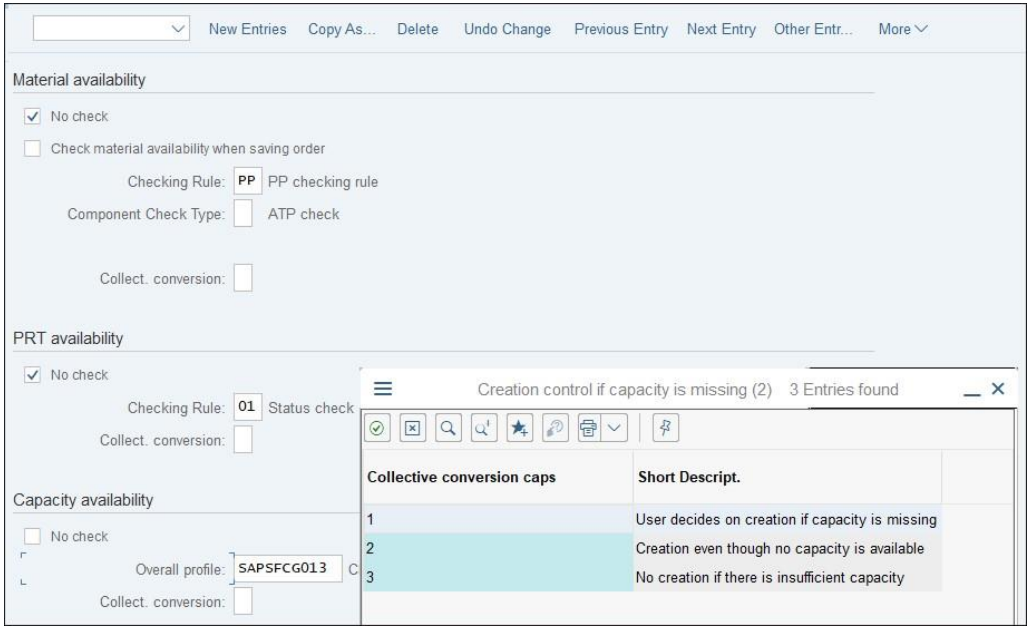


Figure 15.13 Check Control for the Capacity Availability Check

If the system is unable to confirm the capacity requirement of an operation, then you need to make the following settings in the production scheduling profile (Transaction OPKP) and assign it in the **Work Scheduling** view to the material master: Define whether the confirmed capacity requirements are transferred to the basic load or whether all capacity requirements are discarded.

Define whether finite scheduling should be carried out. Figure 15.14 displays the corresponding fields in the production scheduling profile (**Prod. Sched. Profile**) **000001** for **Plant 1000**. These settings are only relevant to collective processing. Here you set the **Overall Profile** for capacity leveling and define the parameters for **Availability Check**.

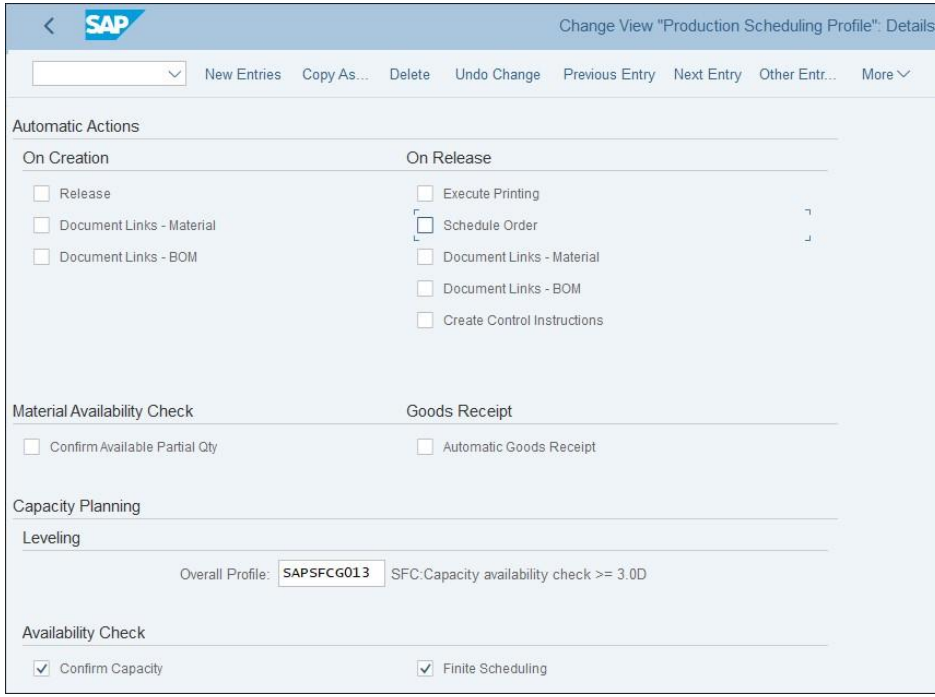


Figure 15.14 Production Scheduling Profile

Profiles

Note that the system doesn't use the overall profile for capacity leveling for the capacity availability check but instead uses it for dispatching. The overall profile for the capacity availability check has the same structure as the overall profile for dispatching.

In contrast to dispatching, however, the capacity availability check doesn't use the overall profile from the production scheduler. Instead, it uses the overall profile from the capacity

check control, and if there is no profile available there, it uses the **Overall Profile SAPSFCG013**.

Figure 15.15 provides an overview of the profiles involved in the capacity availability check. Because we cover individual profiles in greater detail in Section 15.4.2, which deals with dispatching, we'll only briefly explain each profile here:

Selection profile

Defines the selection of objects for the capacity availability check. These include the work centers of the selected operations and the capacity requirements of the basic load.

Control profile

Defines the preparation of the data.

Evaluation profile

Assigns the distribution key for distributing the capacity requirements, among other parameters. **Strategy profile**

Contains the sequence and search direction for finite scheduling, among other parameters. **Period profile**

Defines the length of the period for the check.

Time profile

Defines the time fences for the capacity requirements in question.

List profile

Contains settings for the result output.

The result of the capacity availability check is the confirmation of the capacity requirements, if the available capacity is sufficient. If the available capacity within the period is insufficient, you can trigger the finite scheduling process to find a period with a sufficient capacity and to confirm the capacity requirement in that new available period. The system doesn't automatically dispatch the operation by either the capacity availability check or by finite scheduling. You have to manually dispatch the operation, either individually or in the mass processing step. We'll cover both later in Section 15.4.1 and Section 15.4.6, respectively.

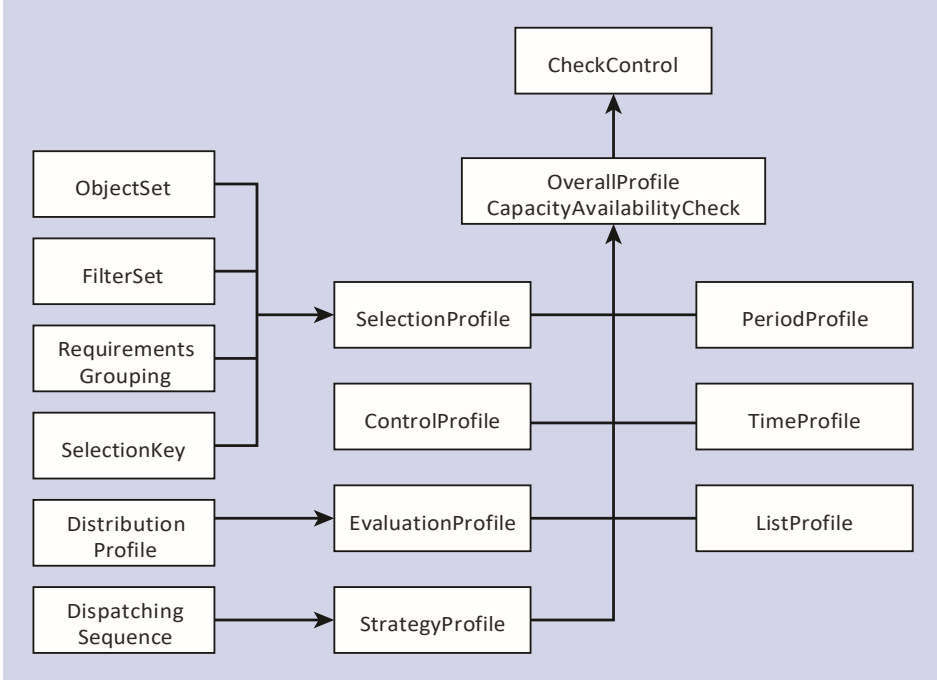


Figure 15.15 Profiles for Capacity Availability Check

15.3 Finite Scheduling

If the available capacity is insufficient to meet the capacity requirement of an operation on the requested date, you can use the *finite scheduling* option to find the next possible date on which the available capacity is sufficient for the operation. You can perform finite scheduling either in the capacity availability check or during dispatching.

While performing finite scheduling, the system refers to the strategy profile to search for the direction in which to perform the scheduling (backward or forward scheduling). A search in the direction of today's date is based on backward scheduling and represents the standard case, whereas a search into the future is based on forward scheduling. However, much of this also depends on the company's business processes and needs, where only forward scheduling is considered to look for free or available capacity in the future. If insufficient capacity is found in one direction, then you can also reverse the search direction.

The screen shown in Figure 15.16 appears during the capacity availability check, and then in the next capacity overload popup, you click on the **Finite scheduling** icon (not shown). The system proposes the new latest date (**NewLtStart**) and time (**NewStTim**), after it performs finite scheduling. At this stage, you can confirm the capacity by selecting the **Cap. confirm.** checkbox and then choosing **Adopt**.

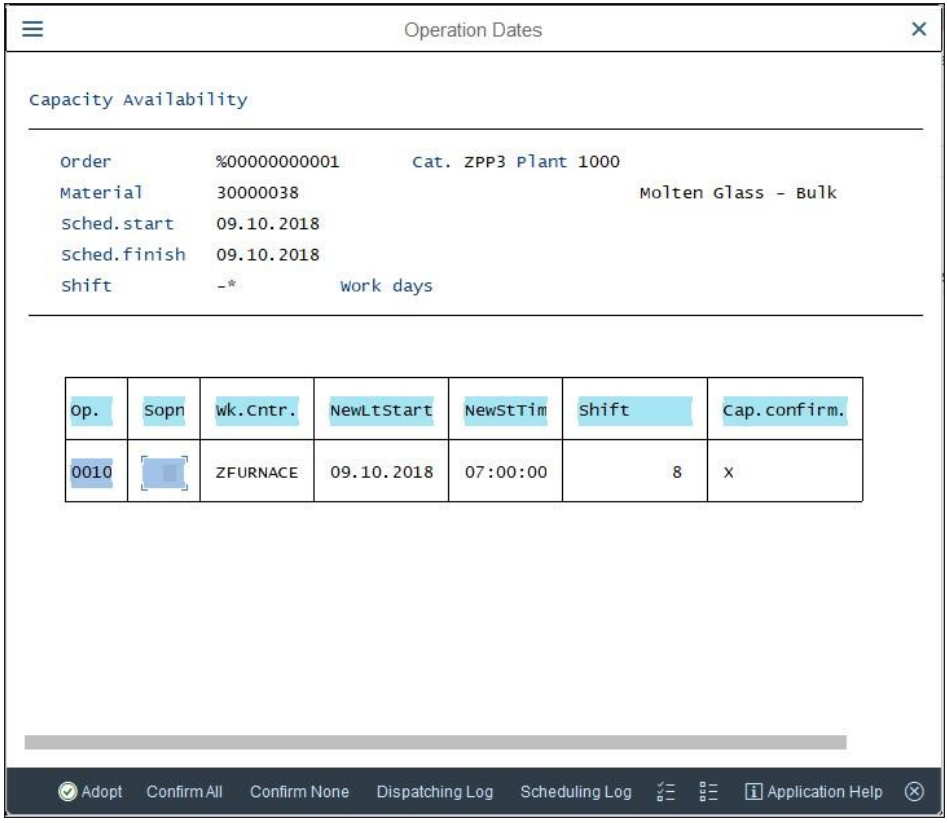


Figure 15.16 Finite Scheduling Results (after the Capacity Availability Check)

When an operation (see Figure 15.171) is dispatched at the work center 2, the system automatically performs finite scheduling and assigns the operation immediately next to the already assigned operation.

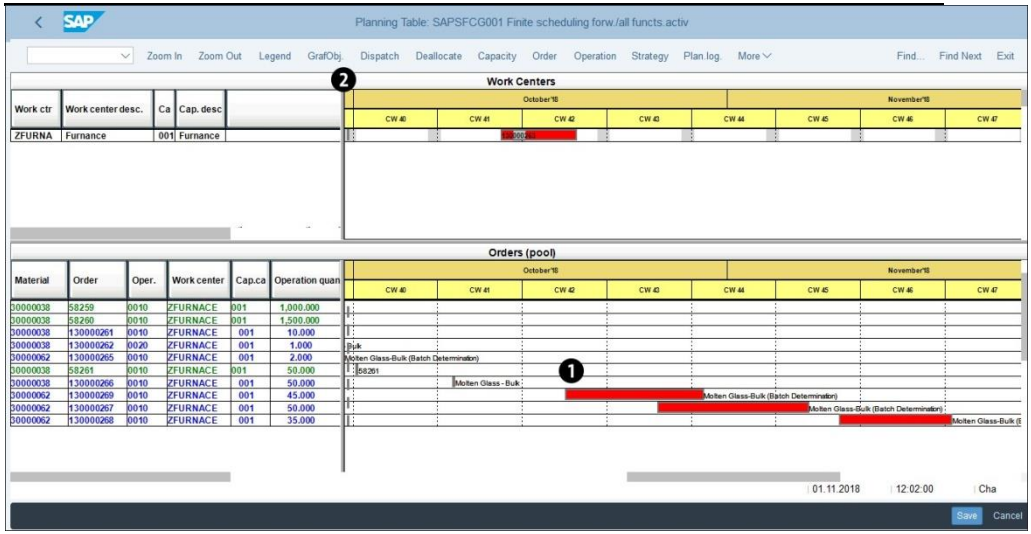


Figure 15.17 Dispatching Orders in the Capacity Planning Table

15.4 Dispatching

In the *dispatching* process, the system creates a workable or feasible production plan in which the capacity is available. To achieve this objective, there should be a sequence of dates set up for the individual operations in the work centers. The nondispatched operations form the pool of orders/operations for the capacity planner/ production scheduler to work on. To dispatch an operation, the capacity planner selects the operation, which is ready for dispatch from the capacity planning table or from the tabular capacity planning table, and initiates the dispatching function.

In this section, we'll go over the process steps of dispatching and then get into the details of the different profiles, sequencing, and setup.

15.4.1 Process Steps

When dispatching takes place, the system carries out the following steps:

Determine dispatching dates

The standard setting uses the operation dates as dispatching dates. However, you can also enter dates interactively or define the dispatching date using drag and drop in the capacity planning table.

Create dispatching sequence

If you want to dispatch several operations in one step, you must create a dispatching sequence based on specific sorting criteria (Section 15.4.3) or on optimal setup times. The default settings stipulate dispatch at the latest date.

Finite scheduling if no capacity is available

If no capacity exists on the dispatching date, the system needs to run finite scheduling to come up with a feasible dispatching date.

Dispatch operation

The system dispatches the operation and assigns it the status **DISP** (if successful).

Midpoint scheduling

You need to adjust the dates of the nondispatched operations in such a way that the system carries out the midpoint scheduling process for them. In midpoint scheduling, the system schedules the nondispatched operations so that earlier ones are scheduled backward and later ones forward. We cover midpoint scheduling later in Section 15.4.5.

Note

It may be impractical from your particular practice or business point of view, but you can also base the dispatching processing on an infinite capacity assumption. To do this, you need to deselect the finite scheduling option in the strategy profile. However, with bottleneck capacities at critical, work centers hardly permit this option.

During dispatching, you may realize that it's not possible to meet the basic dates of the order. Because the system carries out dispatching for each operation, it's also possible to compromise on the sequence of operations for the dispatch. You can use the strategy profile to define the extent to which the system allows inconsistencies within the operations of an order. However, the capacity planner needs to monitor the external dependencies, such as the date-based dependency between orders and customer requirements, to ensure timely production.

Whenever you perform the dispatch or the deallocate function, the system updates the planning and the scheduling logs. In fact, it issues a message to inform the capacity planner to check the planning and/or scheduling logs. You can call the planning log from the respective application, for instance, from the capacity planning table or from finite scheduling in the interactive capacity availability check. Figure 15.18 displays a sample planning log that contains two information messages and a warning.

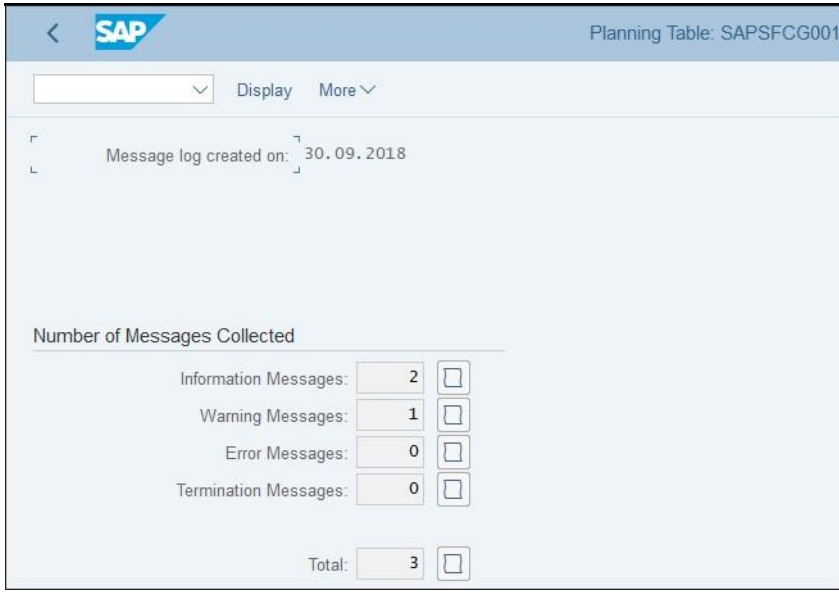


Figure 15.18 Planning Log Summary after Finite Scheduling

Double-click on the information or warning messages, and you'll see a log that displays information messages, for instance, that the system successfully dispatched operation 0010, and provides the dispatching date and time as well (in the second information message).

Figure 15.19 shows the scheduling log that appears when you use the menu path, **ExtrasLogScheduling**, in the capacity planning table.

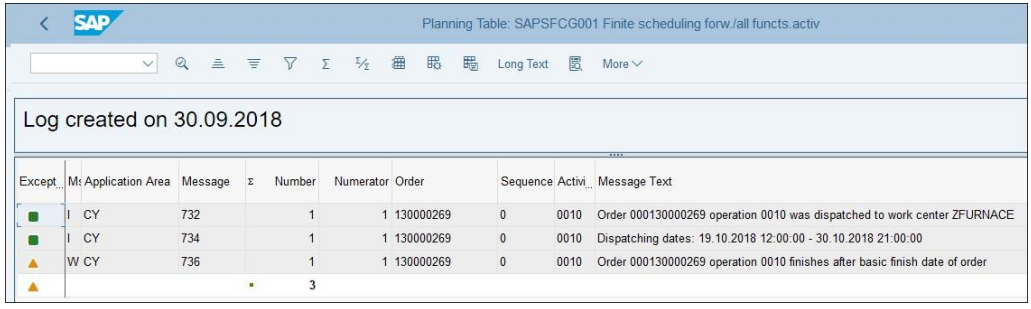


Figure 15.19 Detailed Scheduling Message Log after Finite Scheduling

15.4.2 Profiles for Dispatching

Capacity leveling uses a large number of profiles, which are primarily interconnected, to perform capacity leveling and differentiate between different tasks. In this section, we

briefly cover some of the most-used profiles and the associated settings in each. Later in this chapter, when we cover the business processes of capacity leveling, we'll cover greater details of the associated profiles and explain their roles where necessary.

Building on the same principles for profiles in capacity evaluation, the system cumulates profiles for capacity leveling in an overall profile. Figure 15.20 illustrates the relationships of various profiles with each other. We explain some of the more important profiles in the following sections.

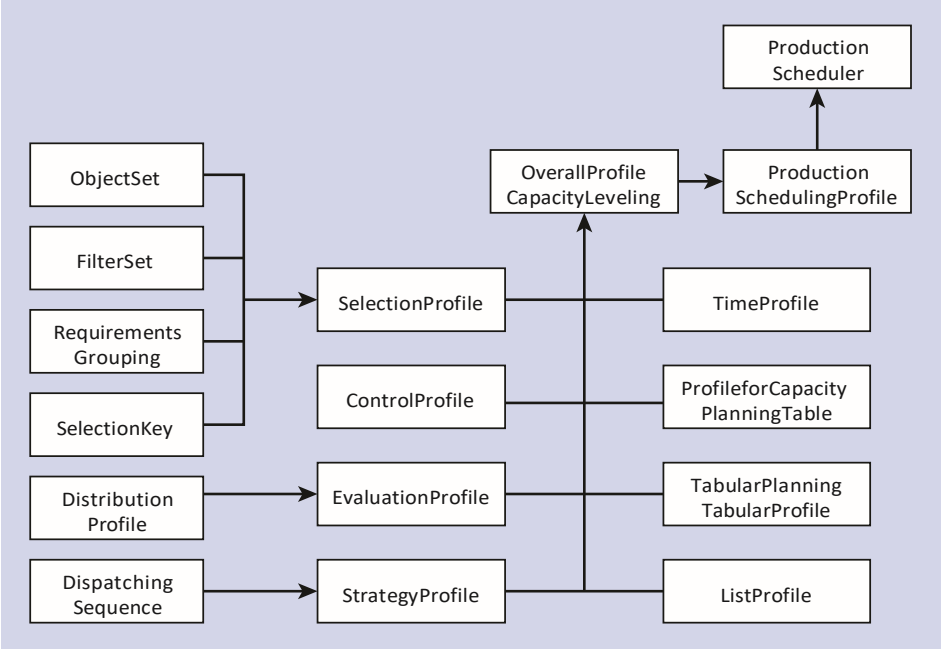


Figure 15.20 Finite Scheduling Results (Triggered by Dispatching)

Overall Profile

To create or make changes to an overall profile in capacity leveling, follow the menu path, **SAP IMG Production Capacity Requirements Planning Capacity Leveling and Extended Evaluation Define Overall Profile**, or use Transaction OPD0.

The screen shown inFigure 15.21 displays the standard **Overall profile SAPSFCG011** as well as different subprofiles.

You don't have to maintain the **Period profile** in the overall profile because it's relevant for a capacity availability check only. The following sections describe some of the individual profiles shown in this screen.

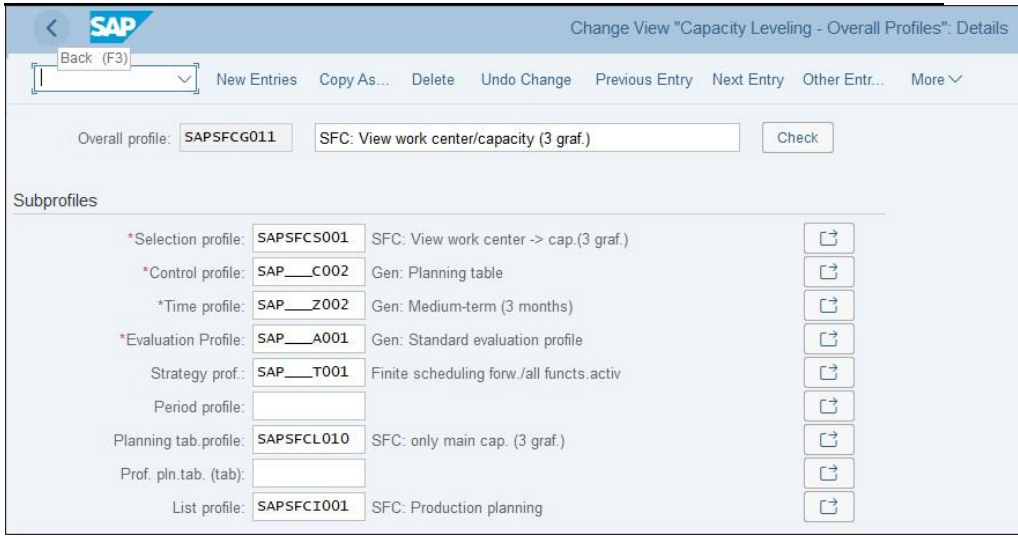


Figure 15.21 Overall Profile for Dispatching

Strategy Profile

It's very important to comprehensively maintain the *strategy profile* because the system refers to it during dispatching and rescheduling functions. To create or make changes to the strategy profile, follow the configuration menu path, **SAP IMG Production Capacity Requirements Planning Capacity Leveling and Extended Evaluation Strategy Define Strategy Profile**, or use Transaction OPDB.

Figure 15.22 displays strategy profile **SAP__T001,** including its numerous parameters. The important parameters of the strategy profile control the functions for dispatching, scheduling, and creating a sequence of operations.

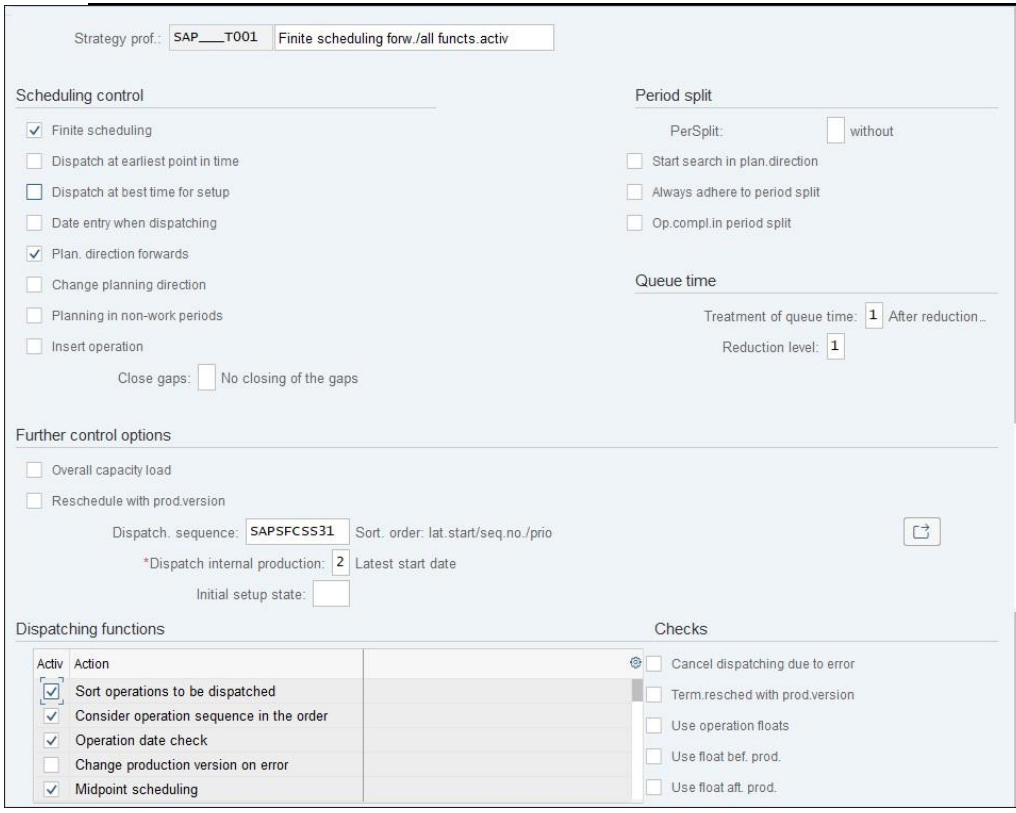


Figure 15.22 Strategy Profile

The **Scheduling control** parameters shown at the top of the screen allow you to make the following settings, for example:

You can set whether you want to carry out finite scheduling during dispatching. If the **Finite scheduling** parameter isn't set, the dispatch process assumes that unlimited capacity is available. If there is insufficient available capacity, the dispatching attempt becomes unsuccessful.

When you use the **Dispatch at earliest point in time** parameter, the system doesn't consider interdependencies with other operations and dispatches the operation as early as possible.

The parameter **Dispatch at best time for setup** chooses the dispatch date on the basis of the existing setup sequence in such a way that the increase in the overall setup time is kept as small as possible. This entails the system having the provision

to shift the already-dispatched operations. To attend to this need, you also need to set the **Insert operation** parameter. The system supports this function in the capacity planning table, and it makes sense only if setup matrices for sequence-based setup are in place. We explain the setup matrices later in Section 15.4.4.

The **Date entry when dispatching** parameter ensures that instead of using the operation date during dispatching, a popup window appears and prompts the user for an interactive date entry. The default setting for the planning direction is backward of the dispatch date. However, you can change this setting when you activate the **Plan. direction forwards** parameter. When the system is unable to find available capacity within the planning horizon, and you've also set the **Change planning direction** parameter, the system continues to search for available capacity in the opposite direction.

The **Planning in non-work periods** parameter overrides the nonwork periods in the work center and suggests 24-hour capacity availability with a full rate of capacity utilization to the dispatch process.

The **Close gaps** parameter enables you to automatically close gaps that are caused by deallocations or rescheduling. This again entails rescheduling of already-dispatched operations and is only possible in the capacity planning table.

The parameters in the **Dispatching functions** area at the bottom of the screen define which options are available for dispatching:

Sort operations to be dispatched determines how to create the right sequence of operations if you want the system to dispatch several operations simultaneously.

The **Consider operation sequence in the order** parameter enables the system to adhere to the sequence of operations in the production order. When you use this parameter with forward scheduling, the system doesn't dispatch the operation prior to its predecessor. Similarly, with backward scheduling, the system makes sure that it doesn't dispatch the operation after its successor.

If you use **Operation date check**, you can check whether the new operation dates lie within the floats that can be selected using the following parameters:

- **Use operation floats**
- **Use float bef. prod.** (use before production)
- **Use float aft. prod.** (use after production)

If you want the system to immediately perform the midpoint scheduling process, then you need to select the **Midpoint scheduling** parameter. When you select this parameter,

depending on the operations, the system immediately carries out the midpoint planning function; otherwise, it carries it out when you save the planning results.

Setup time optimization creates the dispatching sequence according to the setup time minimization criterion.

If you set the **Cancel dispatching due to error** parameter, the system doesn't allow dispatch of operations outside the floats.

Selection Profile

The *selection profile* enables you to define which capacity requirements the system should consider for dispatch. To create or make changes to the selection profile, follow the configuration menu path, **SAP IMG Production Capacity Requirements Planning Capacity Leveling and Extended Evaluation Define Selection Profile**, or use Transaction OPD1 (see Figure 15.23).

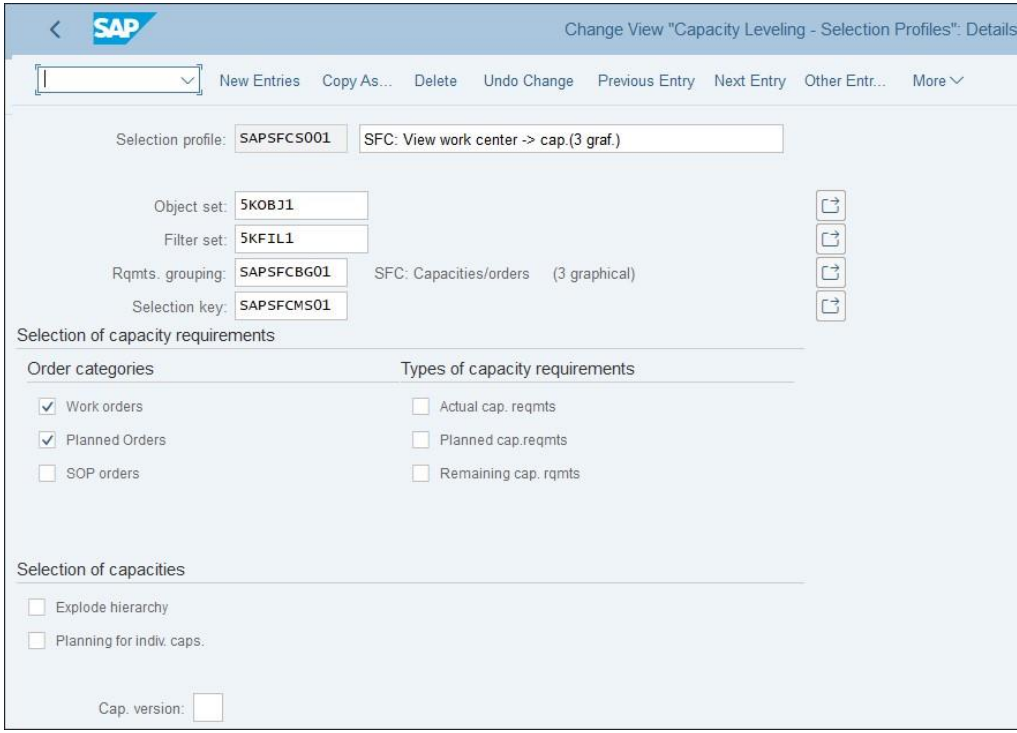


Figure 15.23 Selection Profile for Dispatching

Control Profile

The *control profile* defines how the system presents the data. It can be presented continuously over time for the capacity planning table, or it can be based on periods for the tabular capacity planning table. An important parameter of the control profile defines whether you can modify the operations and at which stage the system should set the locks to avoid any further changes to the operations.

To create or make changes to the control profile, follow the configuration menu path, **SAP IMG Production Capacity Requirements Planning Capacity Leveling and Extended Evaluation Define Control Profile**, or use Transaction OPDE (see Figure 15.24).

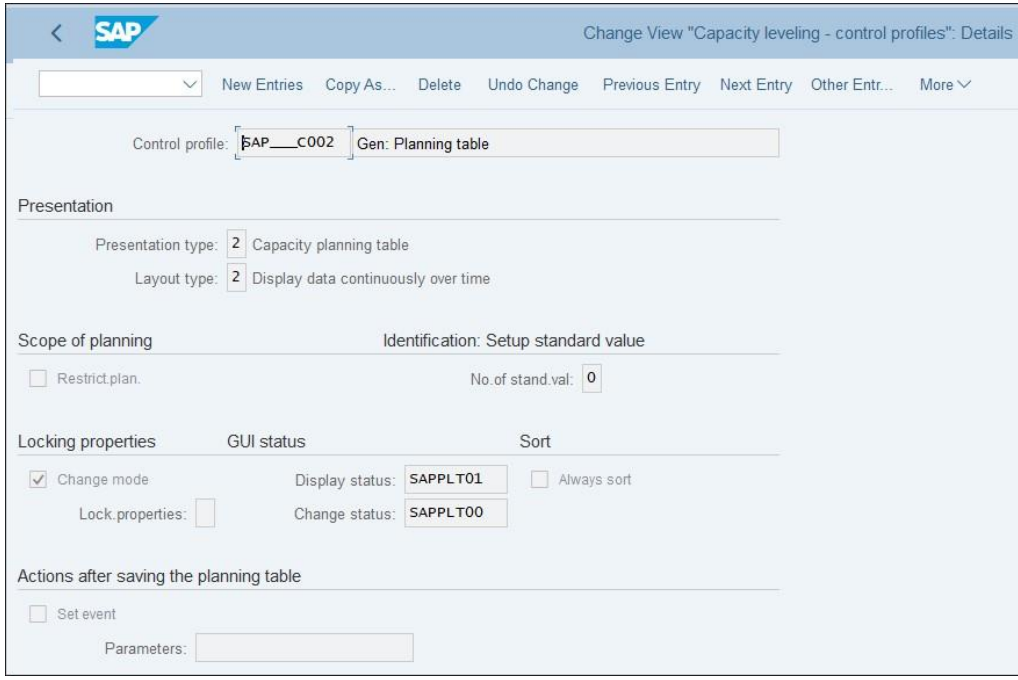


Figure 15.24 Control Profile for Dispatching

Evaluation Profile

The *evaluation profile* enables you to maintain the distribution keys for the capacity requirements, the units of measure, and the details to cumulate the capacity requirements. To create or make changes to the evaluation profile, follow the menu path, **SAP IMG Production Capacity Requirements Planning Capacity Leveling and Extended Evaluation Strategy Define Evaluation Profile**, or use Transaction OPD3.

Time Profile

The *time profile* contains the time horizons for importing the data records as well as for evaluation and planning. The planning horizon must be smaller than or equal to the evaluation period, which in turn must be smaller than or equal to the database read period. Another entry concerns the date for dispatching the backlog on which the system dispatches all backlog capacity requirements—provided it considers the backlog.

To create or make changes to the time profile, follow the menu path, **SAP IMG Production Capacity Requirements Planning Capacity Leveling and Extended Evaluation Define Time Profile**, or use Transaction OPD2. Figure 15.25 displays **Time profile SAPSFCZ002**.

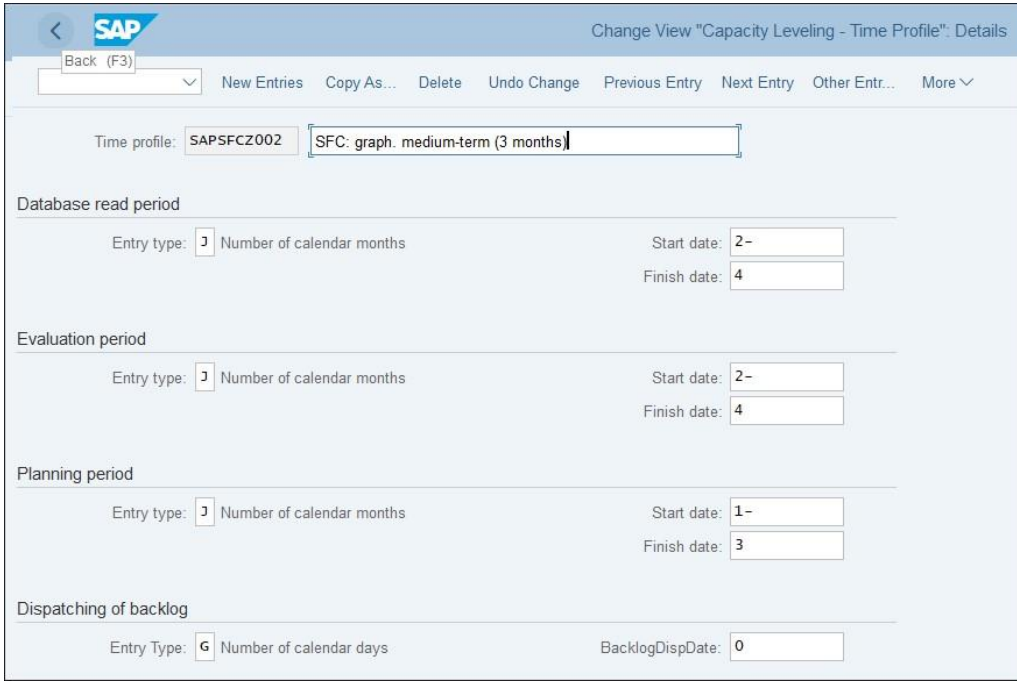


Figure 15.25 Time Profile for Dispatching

15.4.3 Dispatching Sequence

Generally, you'll carry out the dispatching function manually, individually, and interactively. But when you have a large and drastic change in the production plan, which also greatly impacts the operations involved, it makes sense to dispatch several operations according to specific rules. The easiest and most straightforward rule that most companies follow in dispatching is according to the start dates and times of operations. You can

implement similar rules by using the sorting function, whereas the layout key enables you to implement sorting from a large number of available fields.

You can create the layout key using Transaction CY39 in Customizing (see Figure 15.26). On this screen, you can select the fields that you want to sort and then eventually make available in dispatching. After you select the fields, choose the **Sequence/Heading** button.

The field details allow you to select sorting in ascending or descending order. You then assign the layout key to the strategy profile.

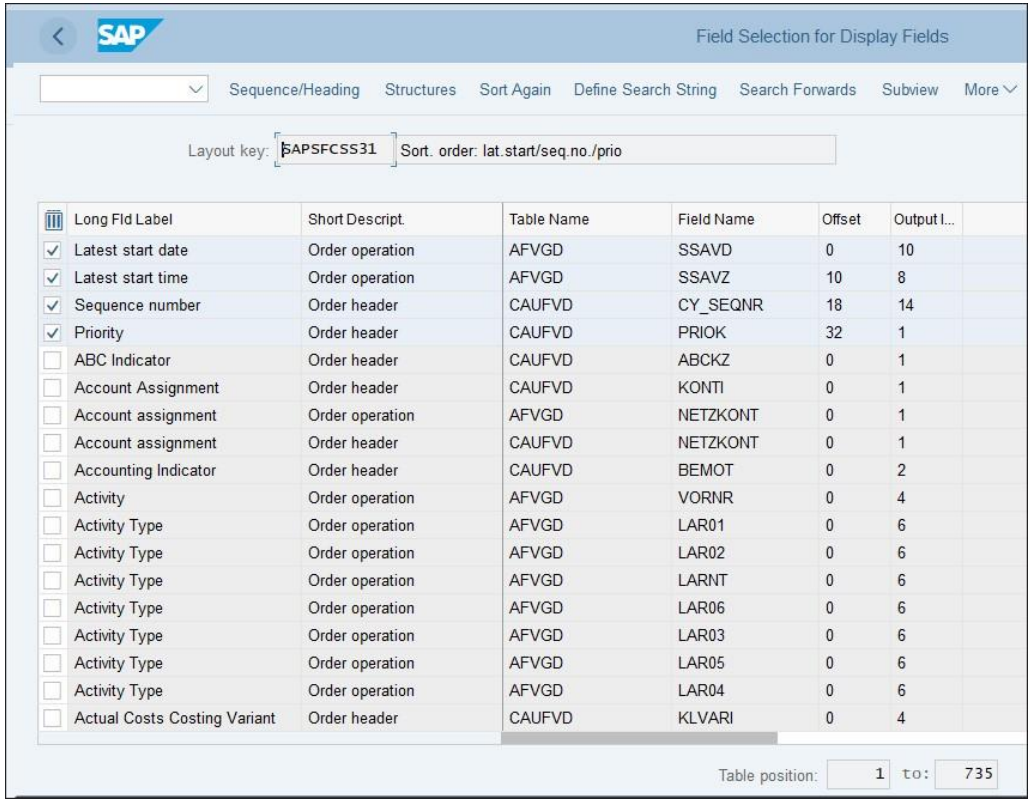


Figure 15.26 Layout Key for Sequence Creation during Dispatching

Tips & Tricks

In addition to the layout key, you can also use user exit CYPP0001 to sort the capacity requirements. You'll need to engage an ABAP resource to define the parameters in the user exit.

The sequence in which the operations are dispatched may not necessarily match the sequence in the work center, as certain conditions of the dispatching process can trigger the system to dispatch some operations differently. For example, if a longduration operation doesn't fit into any gap that has been created on the basis of operations already dispatched, the system dispatches that long-duration operation further in the planning horizon.

15.4.4 Sequence-Dependent Setup

In some production processes, the setup time depends on the sequence in which the product is produced or the physical state of the machine left behind after an operation. For example, if you have a paint shop and paint yellow first and then a dark color, this might not be that critical because the setup time for dark might be of standard length. But if you first paint the dark color and yellow afterwards, the setup time for yellow might be much higher because the paint shop machines need to be cleaned very thoroughly from the dark color.

You can configure the dependency of setup work on a processing sequence by assigning the setup groups in respective operations of the routing. The assignment takes place at two levels: the setup group category and the setup group key. A setup group category can contain several setup group keys; for example, a setup group category can be color, and the setup group keys can be black, white, and yellow. The fact that the assignment occurs at two different levels has the advantage of enabling both a detailed maintenance between setup group keys and a less detailed maintenance between setup group categories.

Setup Group Categories

You can configure group categories and set up group keys using Transaction OP43.

Figure 15.27 shows the list of setup groups available for **Plant 1000**.

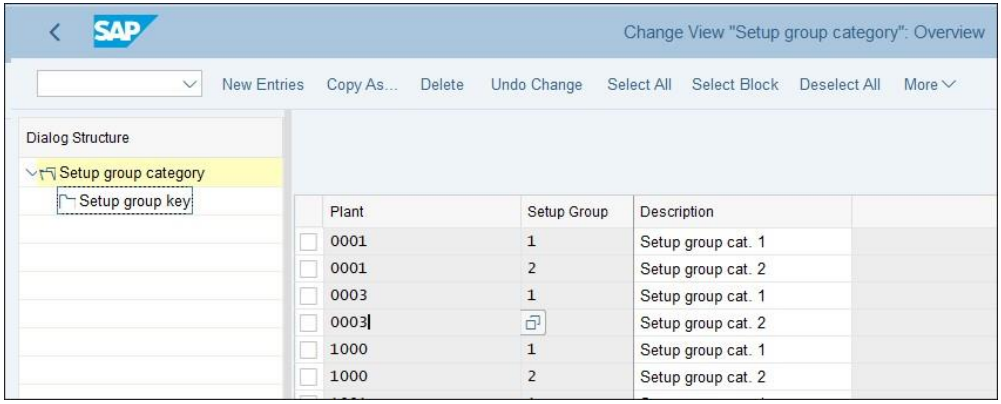


Figure 15.27 Setup Group Category

Select the **Setup group category** folder, and double-click on the **Setup group key** folder on the left-hand side of the figure.

Finally, in the operations details of the routing (Transaction CA02), you assign the setup group categories and keys (see Figure 15.28).

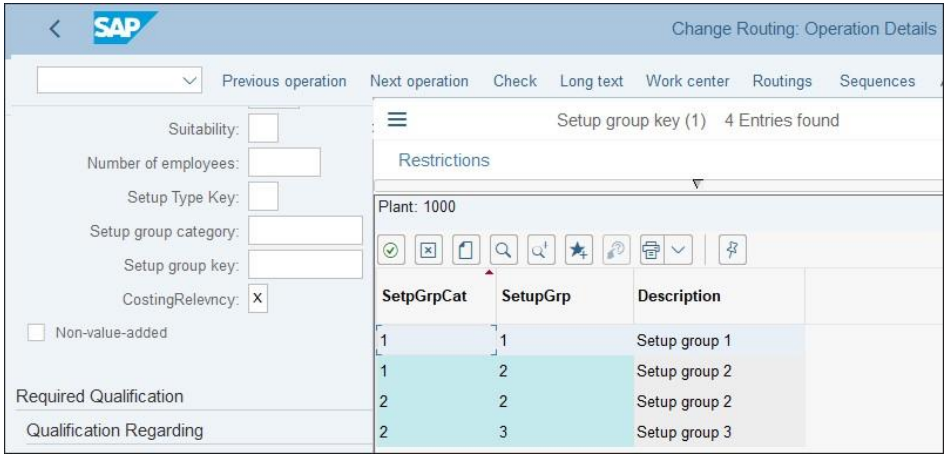


Figure 15.28 Assignment of Setup Group Category and Setup Group Key in Routing

You can maintain the setup time between the setup group categories and the setup group key in a setup matrix through the menu path, **SAP IMG Production Capacity Requirements Planning Master Data Routing Data Define Setup Matrix**, or by using Transaction OPDA. The setup matrix is unique for each plant.

Figure 15.29 illustrates an example in which the setup time from a previous operation with setup group category 1 and setup group key 10 to a subsequent operation with setup group category 1 and setup group key 20 is 100 minutes. However, the setup time for the opposite direction; that is, from setup group category 1 and setup group key 20 to setup group category 1 and setup group key 10 amounts to 25 minutes. Maintaining a setup matrix enables you to assign them to individual operations in the routing, saving time and effort in master data maintenance. The last column (not shown) shows the standard value (activity type) that the system can use for setup time. Examples of activities in the standard value key (SVK) are setup time, machine time, and labor time. Note that we covered SVK in Chapter 3.

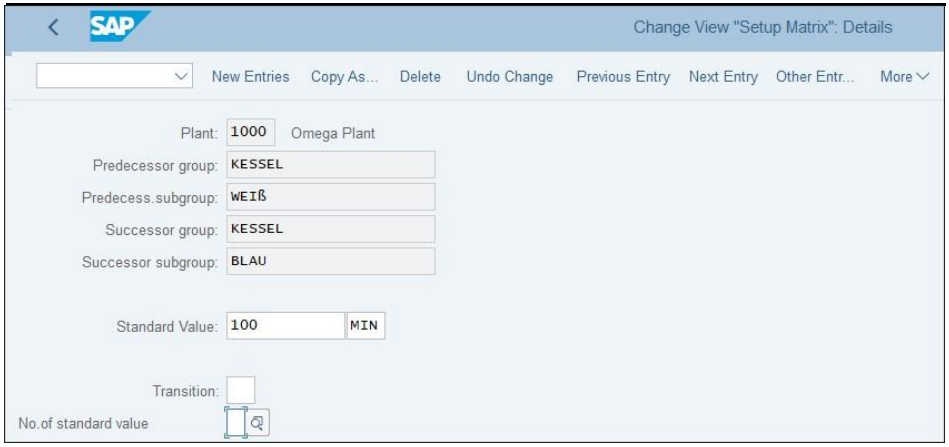


Figure 15.29 Setup Matrix

Setup Time

When you're in the capacity planning table, the system offers the following planning functions for planning with sequence-dependent setup times:

Interactive change of default values

Automatic adjustment of default values

Dispatch at best time for setup

Setup time optimization

In the capacity planning table, you can also make automatic or manual changes to the setup time by following the menu path, **FunctionsAdjust Setup TimeManually**. In the screen that appears, you can make changes to the setup time in the **Setup** field.

You can increase or decrease the setup time. When you make this setup time adjustment, the system carries out a new scheduling process. If an operation was already dispatched, the system deallocates it when the setup adjustment takes place. With automatic setup time adjustment, the system calculates the setup times of operations on the basis of their sequence and reschedules them accordingly. To carry out the automatic setup function, you must first set the **Plan. direction forwards** and **Insert operation** parameters in the strategy profile. To close gaps that occur when the system reduces the setup times, you also need to set the **Close gaps** parameter in the strategy profile.

When you use the **Dispatch at best time for setup** function, the system doesn't try to dispatch the operation at the predefined dispatch date. It will do this at a point when the overall setup time is minimal for all operations increases. To use this function, you must set

the **Dispatch at best time for setup** and **Insert operation** parameters in the strategy profile and make sure that the parameter for the **Setup time optimization** dispatch function is *not* set.

To enable the system to propose an optimum time for setup, it compares the dispatch times of operations with each other. If several optimal setup times exist, the system uses the latest of the optimal setup times. During dispatch, the system doesn't adjust the setup time of operations according to the sequence of operations. Instead, it requires an automatic setup time adjustment in the next step. To dispatch several operations at the same time, the system uses the dispatch sequence defined in the strategy profile.

The setup time optimization establishes an optimal setup sequence for a group of operations. The system dispatches the sequence in the work center without gaps and also automatically adjusts the setup times. The setup time optimization function is useful to redesign the planning because it ensures that the sequence of operations is optimal even after the dispatch. But if the dispatch period contains operations that have already been dispatched, the system deviates the new sequences from the previously determined optimal sequence.

For setup time optimization, you need to select the **Setup time optimization** and the **Plan. direction forwards** parameters in the strategy profile.

15.4.5 Midpoint Scheduling

Midpoint scheduling behaves in the same way as lead time scheduling, except that the basis of scheduling isn't on order start or finish dates. Instead, it starts with the date of the dispatched operation of the order and carries out a backward or forward scheduling process from the operation, according to the planning direction that you've defined in the strategy profile. The system considers the other dispatched operations of the order as fixed. The dispatch occurs for each individual operation. During the dispatch of an operation, the dates of the operation can change. In such cases, you can use *midpoint scheduling* to adjust the dates of nondispatched operations to the changed dates of a dispatched operation.

For example, out of three operations, if the dispatch of the second operation took place, then midpoint scheduling can adjust the date of the nondispatched operations, which are the first and third ones. See Figure 15.30 for midpoint scheduling of three operations of an order.

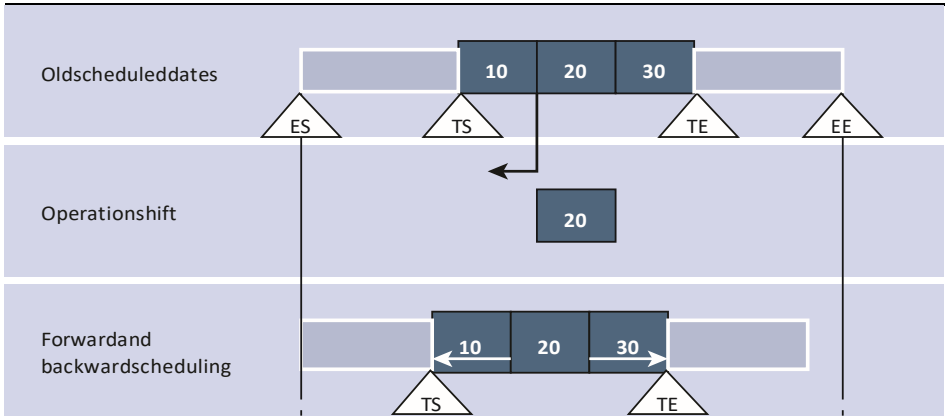


Figure 15.30 Midpoint Scheduling

15.4.6 Mass Processing

Often where there are several operations or orders for which you want to perform a mass function, such as dispatch or deallocation, you can use the mass processing functionality available in capacity planning. To maintain the mass processing settings, follow the SAP menu path, **LogisticsProductionCapacity PlanningLevelingVariableBackgroundExecute**, or use Transaction CM40.

In the initial screen that appears, you can assign, for example, the **Overall profile SAPSFCG011** for capacity leveling. Enter the **Job name** as "PP10", and choose **Save parameters** in the **Call up function** area of the screen. Next, click on **Save**, or press (Ctrl)+(S). On saving parameters for the first time, the system prompts you to enter

work center parameters, in which you can enter text in the **Work center**, **Plant**, **Capacity category**, or **Capacity planner grp** fields.

Next time, when you use Transaction CM40, you can use one of the three available actions, such as **Dispatch**, **Deallocate**, or **User exit** (i.e., user exit CY190001) in the **Action** area of the screen**.** In the **Call up function** area of the screen, you can define whether you want to dispatch the job at a later stage (**Save parameters**), dispatch it directly, or execute it directly.

You can use Transaction CM41 to display the logs of the dispatch jobs.

15.5 Capacity Planning Table

Two types of capacity planning tables are available in the system: graphical and tabular. Our focus will primarily remain on the graphical capacity planning table, but all of the concepts and functions available in the graphical capacity planning table are also available in the tabular capacity planning table.

The highly interactive and intuitive nature of the graphical capacity planning table enables a capacity planner to perform several activities and functions:

Make changes to an order.

Make changes to an operation.

Make changes to capacity.

Dispatch operations.

Deallocate operations.

While we'll discuss the final two functions in the preceding list in individual sections, there are relevant options available in the graphical capacity planning table for all the remaining "change" functions. Some of these change functions that we'll discuss in the following sections are making real-time changes to production or process orders, making changes to operations, or making changes to available capacities.

15.5.1 Changing Orders, Operations, or Capacity

To provide an example of the "change" functions, let's say you want to make changes to a specific order. First, choose the **Change order**, and the system navigates to the production

order change screen (Transaction CO02) in which you can then make the desired changes. The options to change operations and capacity details are also available.

You can also make changes in the strategy profile in the capacity planning table to perform the desired functions and achieve the requisite planning results.

To access the capacity planning table, follow the SAP menu path, **LogisticsProductionCapacity PlanningLevelingWork Center ViewPlanning Table (Graphical)**, or use Transaction CM21. Figure 15.31 shows the capacity planning table that

[+]

appears after you enter the initial parameters, such as the **Work Center** and **Plant**, and choose **Execute**.

Tips & Tricks

You can also use Transaction CM25 that offers even greater options for capacity leveling.

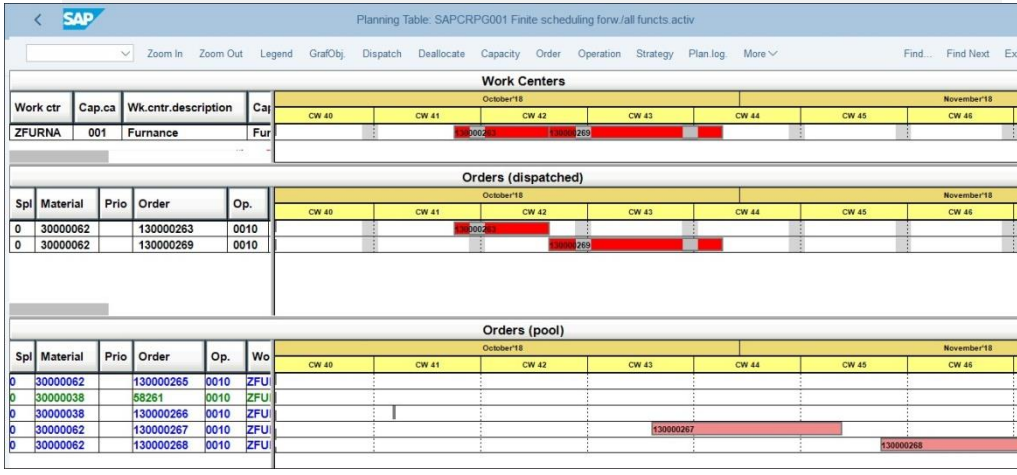


Figure 15.31 Capacity Planning Table

If the system is able to find capacity requirements in the given period for work centers or orders, it displays the capacity information. The upper-left pane displays the work centers, whereas the upper-right pane displays the dispatched operations. The lower-left pane

displays the pool of operations and the corresponding production orders. The lower-right pane displays nondispatched operations.

You can define the sort profile of the pane to enable the system to sort from the pool of orders/operations. The system uses the order start date in the standard setting for sorting. However, the sort sequence gets disturbed when you deallocate the operations because the system adds new objects to the end of the list. You can choose **EditSort New** to reestablish the previous sort sequence.

You can modify the *time-based scaling* of the planning table by choosing **SettingsScale** or by pressing the (Ctrl) key and simultaneously dragging a section of the screen.

The search function is helpful in navigating through the planning table, especially in finding relevant information where there is a large amount of data or information available. You can call the search window via **EditSearch** or by pressing the key combination (Ctrl)+(F). Then you must enter the production order number in this window.

The system facilitates your navigation in the capacity planning table by highlighting objects that belong together. Let's say you want the system to highlight the orders that belong to the same material (in this example, 30000061). To do this, choose **More Edit Highlight Objects That Belong Together** (see Figure 15.32).

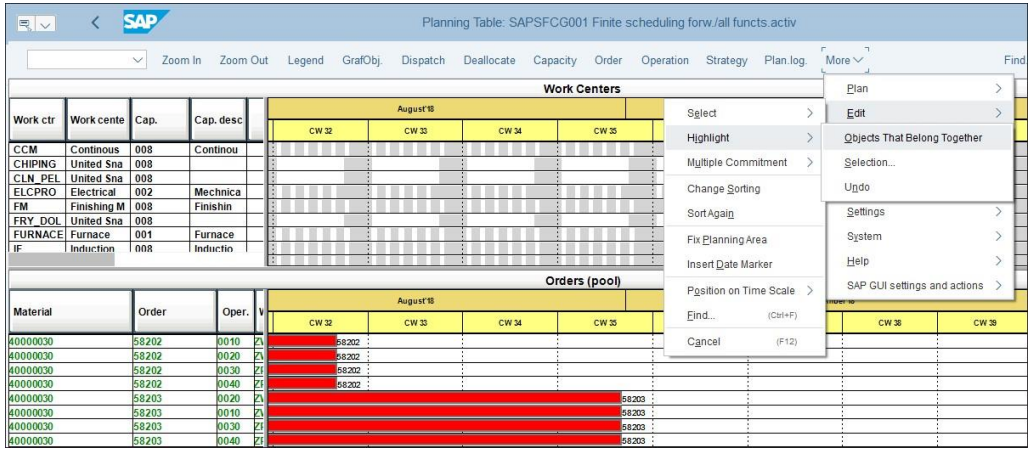


Figure 15.32 Highlighting All Objects Belonging Together

The lower-right pane now shows all the objects belonging together have turned dark green (see Figure 15.33).

You can also highlight the objects that belong together with other criteria, such as order start date, target quantity, or planner group. To do this, choose **EditHighlightSelection**. In the resulting screen, you can check the selection field you want to group and enter the field value that matches your purpose. Choose **Continue**, and you'll see the groupings, again in dark green.

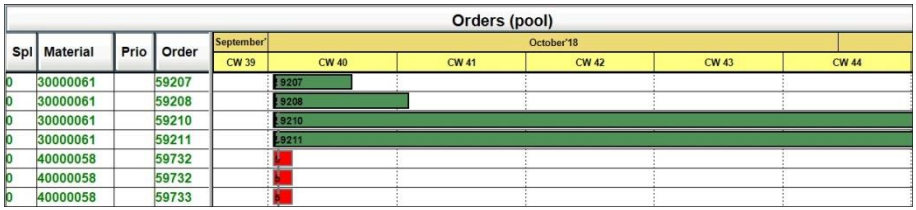


Figure 15.33 Objects That Belong Together

15.5.2 Dispatch Operations

In the capacity planning table, there are two ways to dispatch operations. You can call the dispatch function by clicking on **Dispatch** from the menu bar, or you can drag and drop the operation using the mouse. In both cases, you need to first select the operations that you want to dispatch from the pool of orders/operations. The screen shown in Figure 15.34 displays the dispatch using the dispatch function in the menu bar. From the lower-right pane, select the operation 1 that you want to dispatch, and then click on **Dispatch**2, and the system moves it to the upper-right pane.

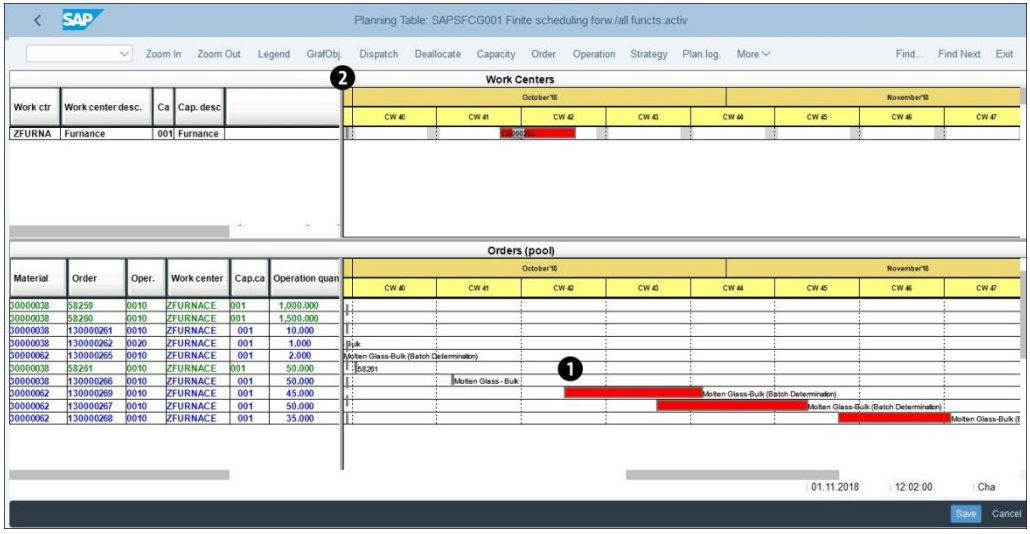


Figure 15.34 Dispatching in the Capacity Planning Table

Figure 15.35 shows the production order **130000269** (in light blue 1) that has just been dispatched from the orders (pool) and is scheduled immediately after the operation for production order 130000263 ends.

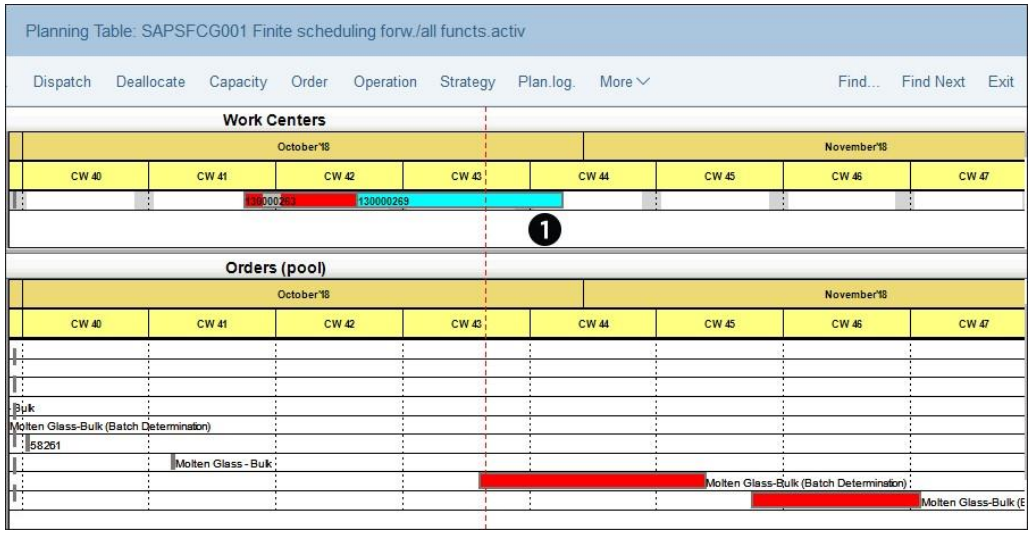


Figure 15.35 Dispatched Operation

The dispatch date is the scheduled operation date, which by default is the latest start date. If capacity is available on that date, the system dispatches the operation on the dispatch date. If capacity is unavailable on the dispatch date, finite scheduling determines the next possible date on which capacity is available, and the system then accordingly dispatches the operation on that date. If you use the drag-and-drop method for dispatching the operation, the "drop" date represents the dispatch date.

15.5.3 Deallocate

The *deallocation* process is similar to the dispatching process. You can deallocate either through **Deallocate** in the menu bar or by using drag and drop in the pool of orders/operations pane.

15.5.4 Options in the Graphical Planning Table

We've already covered in the sequence-dependent setup that the system requires specific settings in the strategy profile to enable it to plan effectively in the capacity planning table. The capacity planning board allows you to change the strategy profile when you click on **More Settings Strategy**. You also can make temporary changes to the selected strategy profile. These changes then apply to the dispatches that you carry out immediately after that, but the system won't store these settings when you leave the capacity planning table.

If the available capacity is insufficient, you can increase it from within the capacity planning table, for example, by adding another shift or an interval. You can adjust the available capacity from the capacity planning table by choosing **GotoCapacityChange**. Similarly, you can also make changes to the production order or to the operations from within the capacity planning table by clicking on the relevant options available in the menu bar.

You can display the planned increase in material stock in the capacity planning table. To display the **Material Stock** pane for selected materials (Figure 15.36), choose **ExtrasMaterial StockShow**. This pane appears toward the bottom of the capacity planning table.

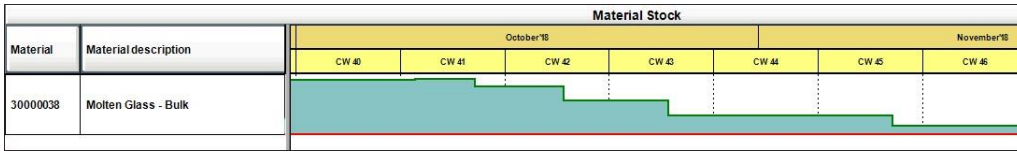


Figure 15.36 Material Stock Pane

Depending on how you've set up the capacity master data, several operations can occupy a work center at the same time. In such cases, a green line below the operations indicates a multiple commitment. You can choose **More Edit Multiple Commitment Show** to display the multiple commitments of the selected work centers.

Note

The system enables you to leverage the objects and layouts for display in the capacity planning table. We encourage you to explore these options, especially from the **Settings** menu**.** Here you'll find options for **Scale**, **Increment**, **Shift Calendar**, and **Time Line**, among others.

15.5.5 Material Availability before Dispatching

As an additional check to ensure a smoother production, you can also check to see if the components required to produce a product are available beforehand prior to dispatching an operation to a work center. Figure 15.37 shows that the production order **130000263** has no missing parts (components).

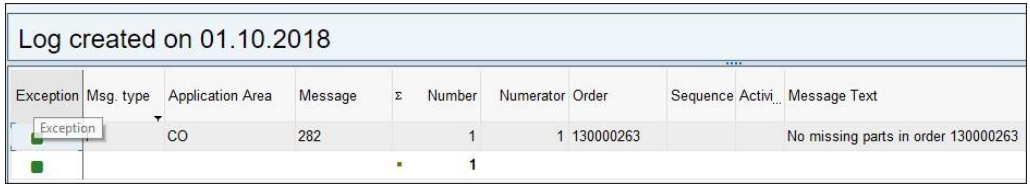


Figure 15.37 Material Availability in the Capacity Planning Table

As mentioned earlier, in addition to the graphical capacity planning table, the system also provides a tabular capacity planning table that contains nearly all functions of the capacity planning table. The only exceptions are the functions for sequencedependent setup and the associated settings for the planning strategy. Figure 15.38 displays the initial screen of the tabular capacity planning table.

To access the tabular capacity planning table, use the SAP menu path, **LogisticsProductionCapacity PlanningLevelingWork Center ViewPlanning Table (Tabular)**, or use Transaction CM22.

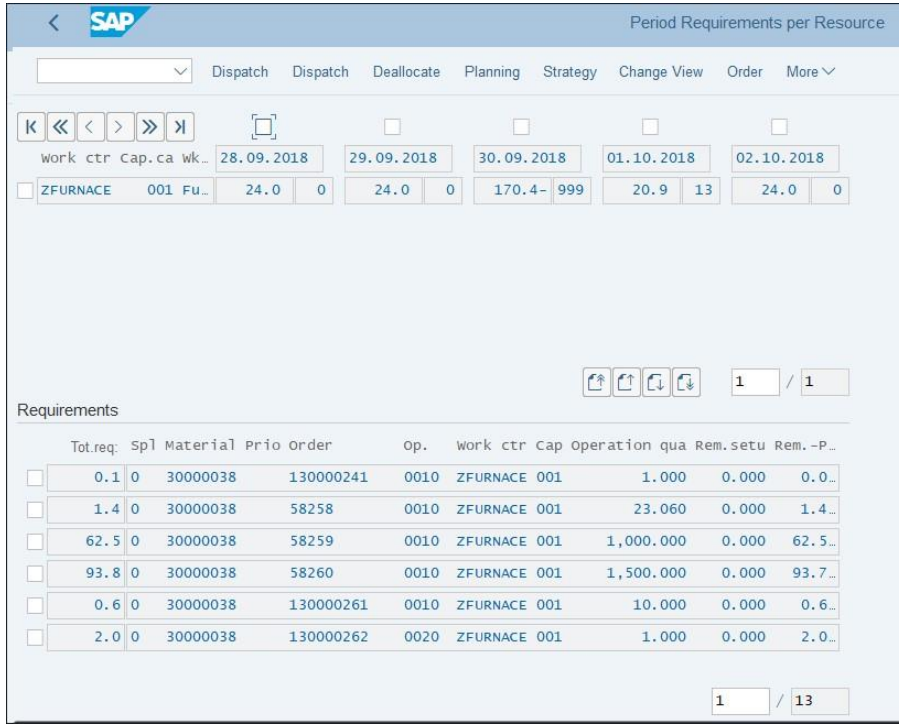


Figure 15.38 Tabular Capacity Planning Table

Due to the extensive similarities between the capacity planning tables in graphical form and tabular form and now that you've learned about all of the properties and functions, you can easily conduct your planning process in the tabular capacity planning table, if necessary.

15.6 Summary

CRP helps the planner ensure that the system plays its part in making important business decisions, from dispatching the right operation at the right work center to evaluating the possibilities of increasing a shift or an interval. You can also ensure that the system performs finite scheduling if there is a capacity shortage, or you can perform midpoint scheduling to account for on-ground production and capacities realities.

The next chapter discusses the production planning and detailed scheduling functionality.

Chapter 16

Production Planning and Detailed Scheduling

Production planning and detailed scheduling in SAP S/4HANA enables extensive production, procurement, and sales planning of materials by taking capacity and scheduling considerations and constraints into account.

SAP S/4HANA offers a new embedded production planning and detailed scheduling (PP-DS) area, which means that the PP-DS functionality is now part of the SAP S/4HANA core and there's no longer a need for an SAP Advanced Planning and Optimization (SAP APO) system to use the PP-DS component. The embedded PP-DS functionality offers most of the features present in PP-DS of SAP APO. All PP-DS transactions can be accessed directly in SAP S/4HANA. In addition, the new SAP Fiori apps for capacity monitoring and capacity planning are available, and most existing PP-DS transactions can also be accessed through the SAP Fiori launchpad. Embedded PP-DS also ensures master data harmonization. In addition, creating sources of supply has also been simplified.

In embedded PP-DS, the Core Interface (CIF) has also been simplified. The CIF is responsible for integration between PP-DS and SAP S/4HANA. The CIF integration occurred through remote function calls (RFCs) and inbound and outbound queues where data was processed when received or sent. Because PP-DS runs on an SAP S/4HANA core, there's no longer a need to use RFCs to integrate data between systems, which means simplified integration, synchronous commits, and consistent data between both systems. Immediate error handling in most situations is possible. The new MRP Live, introduced in SAP S/4HANA and already covered in Chapter 13, is now also capable of planning with PP-DS heuristics. Due to the embedded nature of PP-DS in SAP S/4HANA, the material master and work center creation is also synchronous. In other words, a material or a work center that has just been created in SAP S/4HANA can be immediately available for planning in PP-DS.

As you read along the following sections on PP-DS, you'll instantly notice that many of the concepts, foundations, and knowledge you've developed in this book will equally be

applicable to PP-DS processes. For example, by now, you already know about work centers, bills of materials (BOMs), routings, and production versions. You've also gained familiarity with pegging, planned independent requirements (PIRs), demand management, stock/requirements lists, and MRP Live, among other concepts and their workings. So, in the interest of giving maximum coverage to the topic under discussion, that is, PP-DS, these already-covered topics or topics covered a bit later in this book aren't repeated here. Only topics or definitions relevant to PPDS that need more detailed coverage for understanding purposes are discussed.

Further, while it's true that now PP-DS is "embedded" in SAP S/4HANA, the CIF still needs to be configured and set up even when the source and the target SAP systems are both the same, that is, SAP S/4HANA. Similarly, to use the PP-DS optimizer tool to optimize the production flow, it still needs to be set up in SAP S/4HANA. Finally, due to the same or similar terminologies, such as planned orders and PIRs, used in both SAP S/4HANA and PP-DS, the following sections will specifically mention when an element belongs either to SAP S/4HANA or to PP-DS.

The following sections will adopt the same approach to cover PP-DS in SAP S/4HANA that has been followed throughout. We'll cover the basic configuration needed to set up PP-DS, which will then be followed by covering master data specific to PP-DS. Next, the PP-DS master data is put to use by covering the associated PP-DS business processes. We'll also be discussing heuristics as well as production planning run. The last section covers the alert monitor as well as the plan monitor. The chapter will conclude with discussion on reporting including SAP Fiori apps relevant to PP-DS.

Let's begins with the necessary PP-DS configuration.

16.1 Configuration

A number of steps are necessary to start using embedded PP-DS in SAP S/4HANA, such as checking the relevant business functions and other Customizing settings.

Embedded PP-DS was introduced as a business function SCM_PPDS_ON_ERP, and it should be active by default on an SAP S/4HANA system. You can confirm if the business function is active by executing Transaction SFW5 and checking if the traffic light is green in the screen the system displays. To activate the embedded PP-DS, the **Advanced planning** checkbox must be activated by following the configuration path, **SAP IMGAdvanced Planning Basic SettingsActivate Advanced Planning and Scheduling**.

Note

All PP-DS configuration options are available via the menu path, **SAP IMGAdvanced Planning**.

With embedded PP-DS, you won't need to create integration models to transfer transaction data between SAP S/4HANA and PP-DS, or vice versa. You'll activate the transfer of the transaction data by following the configuration path, **Advanced PlanningBasic Settings Activate Advanced Planning and Scheduling Settings For Data Transfer**. The order types relevant for advanced planning can be set as relevant for transfers between PP-DS and SAP S/4HANA (see Figure 16.1).

Figure 16.1 Order Types for Transfer

Embedded PP-DS needs the model and version set up. Model 000 and version 000 are the locations in which the active planning data products and resources relevant to advanced planning are stored. You can also create additional, simulated planning versions for assessing

the planning situation. The model and version are created via Transaction /SAPAPO/MVM (see Figure 16.2).

Tips & Tricks

If the system doesn't recognize a PP-DS transaction you've entered in the command bar, then always first enter "/n" followed by entering the PP-DS transaction. For example, enter "/n/SAPAPO/MVM" in the command bar instead of Transaction "/SAPAPO/MVM".

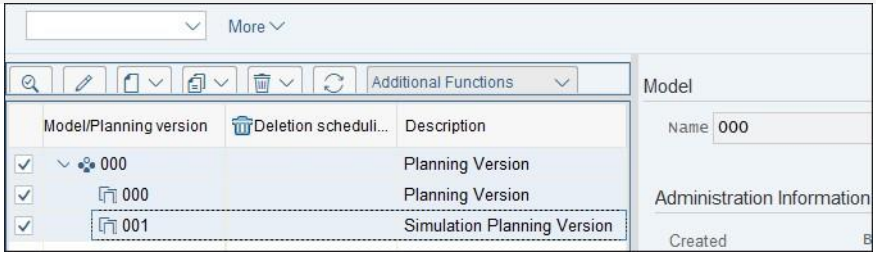


Figure 16.2 Model and Planning Versions Combination

Activate the business transfer event (BTE) application indicator. This indicator is required to trigger the transfer of the relevant data into the embedded PP-DS. In Transaction BF11, select the **ND-APO** checkbox to set the flag (see Figure 16.3).

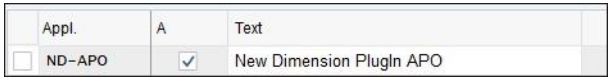


Figure 16.3 Making the ND-APO Checkbox Active

Although creating integration models for the transaction data transfer isn't required, basic settings for the CIF still need to be maintained. Additionally, for certain master data objects such as purchasing contracts, info records, and scheduling agreements, you'll still need to create an integration model to send these objects to the PP-DS side. Therefore, maintaining the basic CIF settings is an important step to using embedded PP-DS. You can change basic settings for creating the system landscape and for including SAP S/4HANA with system type SAP_APO and the corresponding release so that an integration model can point to itself (act as its own system and client), and logical system and queue types can be maintained. You

can maintain basic CIF settings by following the Customizing path, **SAP IMG Advanced Planning Integration Via Core Interface**.

Global settings and defaults for PP-DS must be maintained via Transaction /SAPAPO/RRPCUST1 or by following the configuration path, **SAP IMG Advanced Planning Global Settings Maintain Global Parameters and Defaults** (see Figure 16.4).

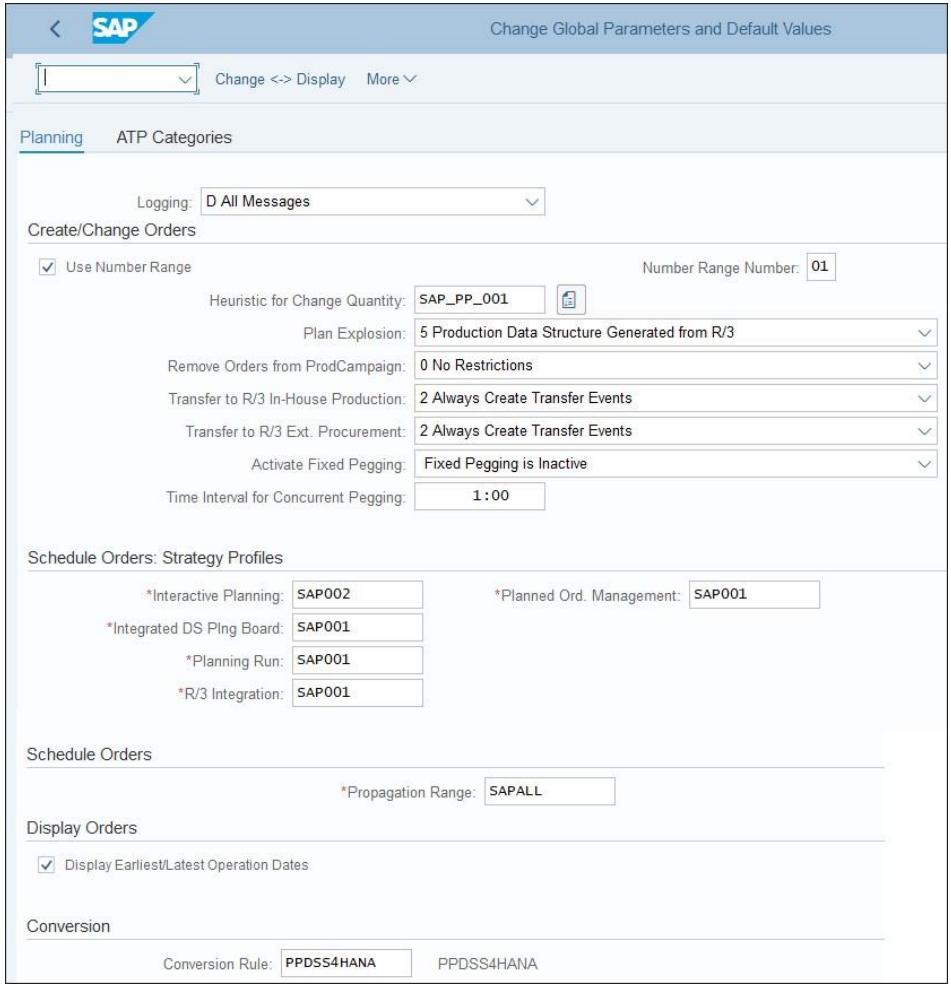


Figure 16.4 Global Parameters and Default Values

Let's discuss some of the important fields or data transfer options of Figure 16.4:

Number Ranges Number

This optional setting determines whether orders created in PP-DS contain a number that corresponds to the PP-DS number range. As soon as an order is transmitted to SAP S/4HANA via CIF, it receives an order number in SAP S/4HANA that is based on the SAP S/4HANA number range. The order number is then transferred to PP-DS. A number range for PP-DS orders need to be defined in advance that can then be assigned here. **Transfer to In-House Production**

You can define whether planned orders or purchase requisitions are transferred to SAP S/4HANA or whether the transfer occurs only after conversion in production orders or purchase orders (POs).

Planning Run

The settings made here are relevant if no other explicit settings are made within specific applications.

Note

Notice the *available-to-promise (ATP) categories* for PP-DS. They are used to define the receipt and requirement elements of production and detailed planning. They are already present in the delivery system, so specify a category only if the executing system isn't an SAP S/4HANA system (see the **ATP Categories** tab in Figure 16.4).

The *MRP-based DS scenario* is the special form of process modeling that uses PP-DS in the context of production order processing in a targeted manner. Before the advent of embedded PP-DS in S/4HANA, the basic material requirements planning (MRP) was supposed to be done in SAP S/4HANA, while PP-DS was supposed to be used only for detailed scheduling. Against this background, the MRP-based DS in master data modeling doesn't require a transfer and mapping of routings and BOMs in production data structures (PDSs) or production process models (PPMs) and can omit the associated implementation effort (production versions and associated integration with change transfers).

It's possible to consider manufacturing order networks from SAP S/4HANA (direct procurement/in-house production special procurement key) in the PP-DS capacity planning with this scenario. Within the scope, you implement a scheduling and a retransfer of the new time schedule to SAP S/4HANA when you convert planned orders into production orders. A

special feature is that this conversion is done locally in SAP S/4HANA by way of exception; however, when the production orders are posted, the earlier PP-DS scheduling takes effect nevertheless. Additional changes and transfers can follow iteratively. To make the relevant configuration settings, access Figure 16.5 via Transaction CFDS, and select the relevant options to automatically transfer or not transfer some or all planning and scheduling data from PP-DS to SAP S/4HANA.

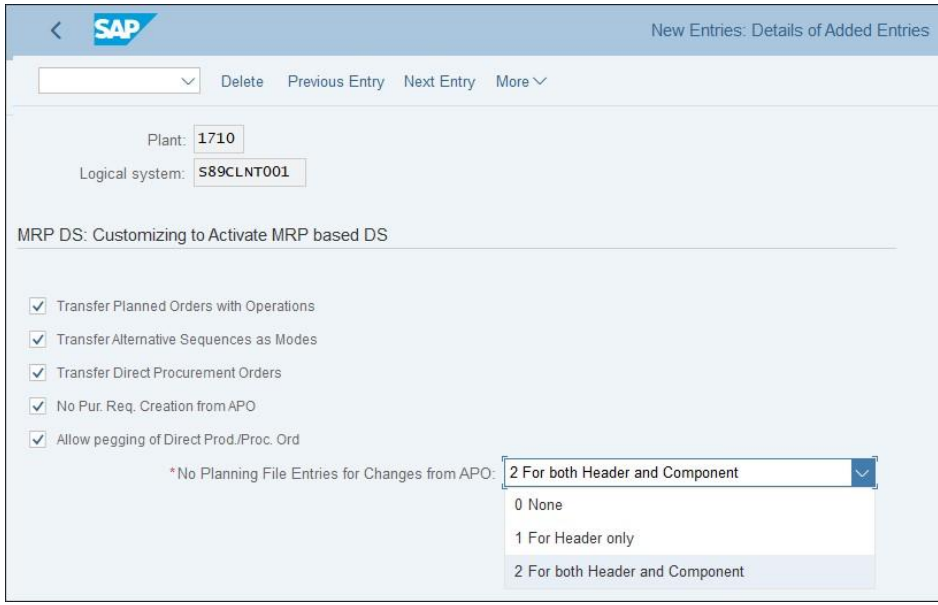


Figure 16.5 Activate MRP-Based DS

Another *retransfer of the planning result* can be set between PP-DS and SAP S/4HANA. These settings are relevant if the quantity of a production order (or any other data changes) that originates from PP-DS is changed in SAP S/4HANA, for example. The changed quantity is transferred to PP-DS, where the order is rescheduled. The new dates are retransferred to SAP S/4HANA only if this is configured in Transaction /SAPAPO/CP3 (see Figure 16.6). Here you can choose the elements, such as in-house production, external procurement, PIRs, or reservations' data to retransfer between PP-DS and SAP S/4HANA in a bidirectional manner.

This brings an end to the minimal configuration required to set up and run PP-DS in SAP S/4HANA. The next section is on maintaining the necessary PP-DS master data to be able to run the associated business processes.

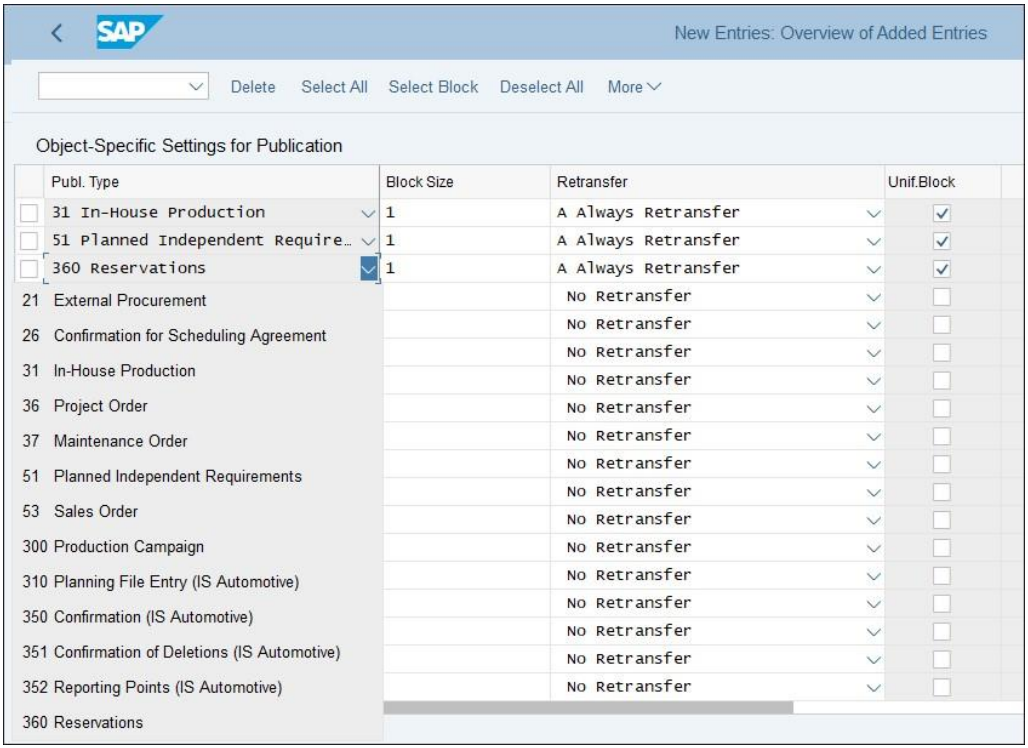


Figure 16.6 Retransfer of Data

16.2 Master Data in PP-DS

In the following sections, we'll cover the master data required to run PP-DS in SAP S/4HANA.

16.2.1 Location

A location can represent a plant, a business partner, a shipping or receiving point, or an MRP area. You can create locations in PP-DS by using Transaction SE38 followed by executing report /SAPAPO/CREATE_LOCATION. With this report, a location is immediately created, with no integration queues, and an error message will be displayed immediately if an error occurs (see Figure 16.7).

Note

Transactions pertaining to the master data, business processes, and reporting of PPDS can be accessed via **SAP Menu Logistics Advanced Planning**.

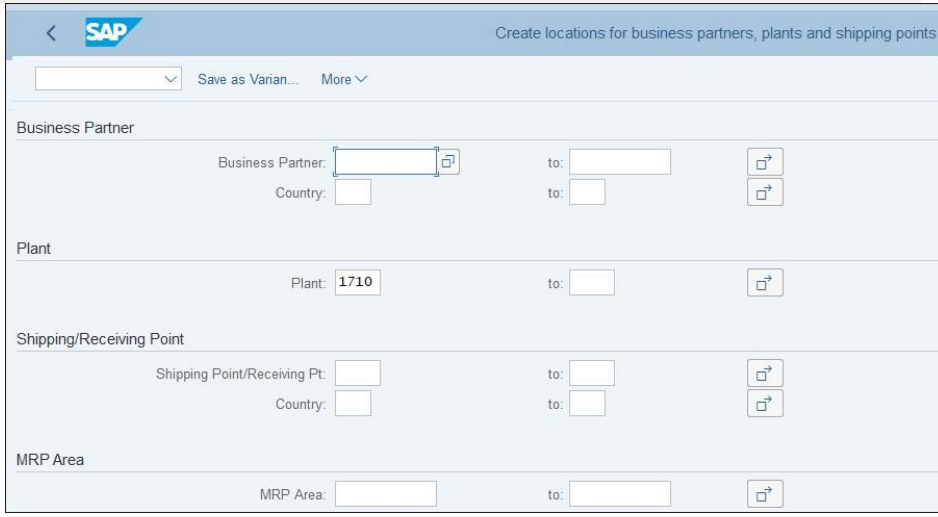


Figure 16.7 Create Locations, Business Partners, Plants, and Shipping Points

16.2.2 Material Master

When an advanced planning material is planned in MRP Live, the system uses the default heuristic and further settings defined in the **Advanced Planning** tab of the material master. For materials to be planned with PP-DS heuristics, you need to define MRP type "X0" in the **MRP1** tab. Whenever a semifinished material is to be planned with PP-DS heuristics, the parent material should also be planned with PPDS. Therefore, when designing a BOM, you must ensure that the parent material is an advanced planning material if at least one of its components is an advanced planning material. This design is necessary to ensure that all the dependent requirements are relevant for PP-DS.

In the new SAP S/4HANA embedded PP-DS, an additional tab called **Advanced Planning** has been introduced in the material master. In this new tab, you can define a material as

relevant to the PP-DS planning process by simply selecting the **Advanced Planning** checkbox, as shown in Figure 16.8.

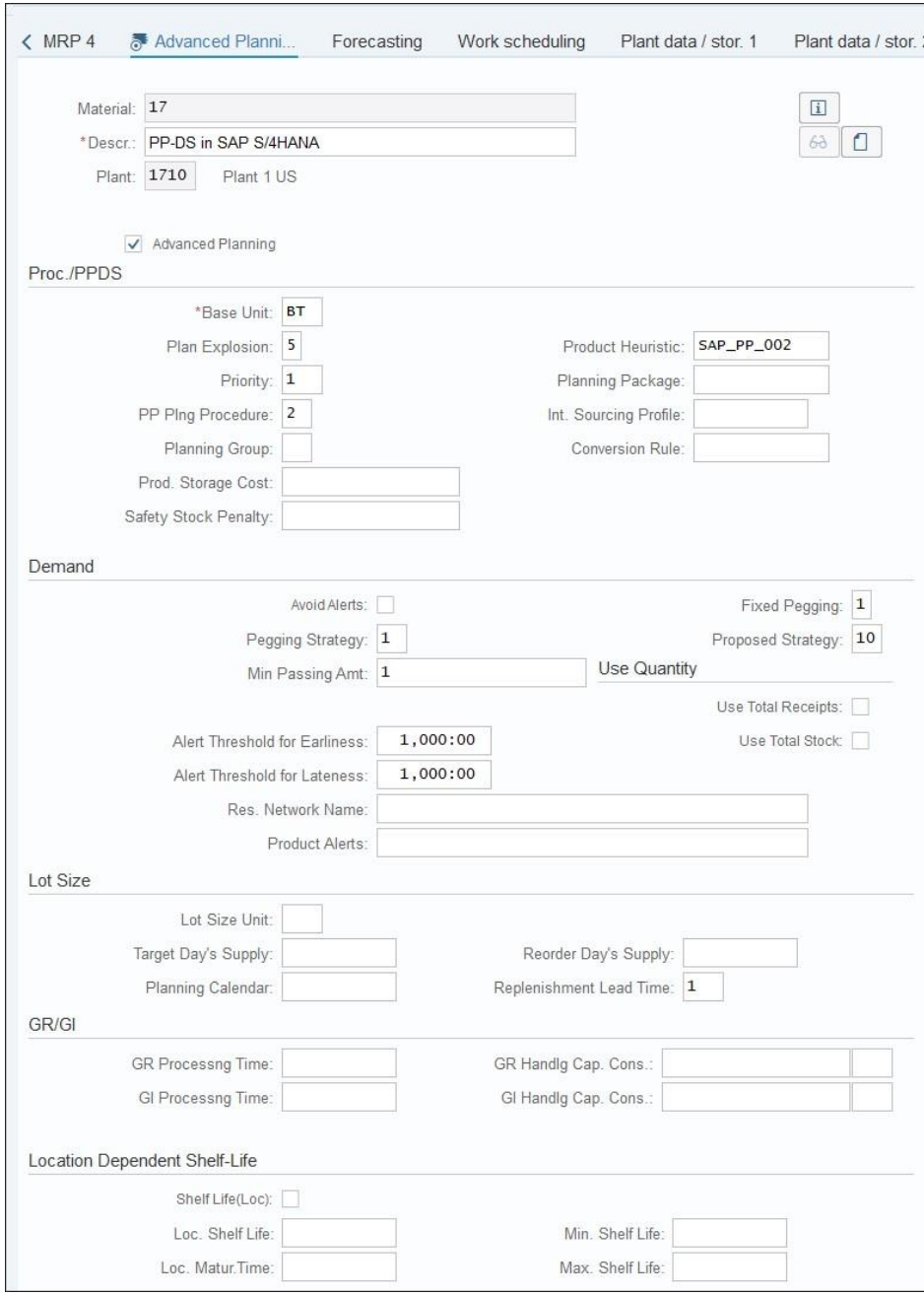


Figure 16.8 Advanced Planning Tab in Material Master

Note

We'll be using the material "17" and plant "1710" combination throughout this chapter while discussing PP-DS. In addition, the example here is based on discrete manufacturing, but the same concepts and understanding on PP-DS apply if the manufacturing type is either process or repetitive. Further, as the focus of this chapter is covering the production processes in PP-DS, procurement and sales processes specific to PP-DS are beyond the scope of this discussion.

Let's now cover some of the important fields of PP-DS. Figure 16.8 shows the **Advanced Planning** view of the material master. Some of the important fields are as follows:

PP Plng Procedure

This defines that for each planning-relevant material, an event occurring for a location product (which is a material), an action is triggered by PP-DS. For customer requirements, the PP planning procedure also determines whether the desired quantity or the confirmed quantity of a schedule line is relevant for pegging. For example, a planning-relevant event such as a goods movement for a product or a change in the product master takes place. Possible actions by the PPDS can be immediately calling up a product heuristic for the product or creating a planning file entry. A *heuristic* is a planning function in PP-DS that executes planning for selected objects, such as products, resources, operations, or line networks.

Tips & Tricks

Planning in Planning Run (planning procedure **4**) should always be the standard procedure for planning products in PP-DS. It corresponds to the procedure used in SAP S/4HANA. When a planning-relevant change occurs, a planning file entry is written that is processed in the planning run with the planning of the product. Planning procedure 4 contains heuristic **SAP_PP_002** (**Planning Standard Lots**). This heuristic corresponds to the net requirements and lot-size calculation familiar from SAP S/4HANA.

Plan Explosion

This field specifies the task list type, such as a BOM and routing, that the system uses to create receipts in PP-DS.

Product Heuristic

Just as there are MRP types in SAP S/4HANA that control the type of planning a material will have, product heuristics are the planning methods for PP-DS.

Avoid Alerts

On setting this checkbox, the system will attempt to create the pegging relationships between requirements and receipts, if possible, without the quantity or date alerts. First, the system links receipts and requirements that are compatible on a time and quantity basis, then the remaining receipts and requirements in a second step.

[!] **Warning**

This method can reduce system performance.

Alert threshold for earliness

The system creates a date/time alert for a fixed or a dynamic pegging relationship if the earliness exceeds the alert threshold; that is, if the availability date/time is earlier than the specified time frame before the requirements date. To specify the time frame, use format HHHHHH:MM (hours:minutes). For example: 1000:10 means 1,000 hours and 10 minutes, 20:20 means 20 hours and 20 minutes. If you don't specify a value, the system uses the value 100000:00. Therefore, the system only creates an alert if an availability date/time is more than 100,000 hours before the requirements date. **Alert threshold for lateness**

Similar to the alert threshold for early receipt, the system creates a date/time alert for a fixed or a dynamic pegging relationship if the delay exceeds the alert threshold, that is, if the availability date/time is later than the specified time frame after the requirements date.

Pegging strategy

Using the pegging strategy, you can determine in which time sequence the system should cover requirements for the product with dynamic pegging and in which time sequence the system should use the product receipts in the *pegging interval* to cover a requirement. Thus, the pegging strategy controls the following:

– Which requirement the system should cover first

– Which receipts the system should use first

Generally, for dynamic pegging, the system begins by covering the earliest requirement, and then processes the next requirement, and so on. Because there may be several receipts for the availability dates/times within the pegging interval, you must specify which receipt the system should use first. The following options exist:

– **Use current receipts**
  Here the system uses the current receipt where possible to cover a requirement. Starting from the requirement date, the system first searches to the beginning of the pegging interval. If there are no receipts in this direction, the system will search to the end of the pegging interval.

– **Use the earliest receipt (first in first out [FIFO])**
  Here the system uses the earliest receipts in the pegging interval to cover a requirement, that is, first the first receipt in the pegging interval, then the second, and so on. With this strategy, excess receipts only become available later.

Res. Network Name

This indicates the name of the resource network. A resource network describes the physical links between resources in a plant, such as processing units, reactors, vessels, and so on. It explains the flow of materials through a plant.

Product Alerts

In this field, you specify whether:

– The system determines direct alerts for a requirement or a receipt of a product. – The product is relevant to network alerts.

If a product is relevant to network alerts, the system evaluates the direct alerts that it determines for this product for receipts or requirements at the superordinate levels of the pegging structure as well.

You can hide alerts for less critical components and thus:

– Increase the clarity and transparency of the network alerts

– Improve performance

If you choose the **Avoid Alerts** option, the system won't determine any direct alerts for the product. Thus, the product also isn't relevant regarding the network.

Note

You need to specify whether and which alerts are actually displayed by the system in the planning interface or in the **Alert Monitor** in the PP-DS alert profile that you use for planning. Alert monitor is discussed in detail in Section 16.7.

Lot Size Unit

This indicates the valid unit of measure (UoM). The following options are available:

- No lot size units maintained: The base UoM maintained for the product applies.
- A unit of measure (alternative or base UoM) can be maintained which can be converted to the base UoM. If you enter an alternative UoM, the conversion to the base UoM must be maintained on the **Units of Measure** tab (refer to Chapter 4). The alternative units of measure must be able to be converted to the base UoM for the product; otherwise, the unit won't be accepted. For example, the alternative UoM is kilogram (kg). The base UoM is piece (pc). In this case, 5 kg correspond to 3 pieces.

Target Days' Supply

The PP-DS standard heuristic SAP_PP_002 (Planning of Standard Lots) and the Supply Network Planning (Supply Network Planning) heuristic takes into account the target days' supply if you've selected on of the following target stock level methods:

- **No entry**: Target days' supply from the product master.
- **4**: Target stock level equals maximum stock level + safety stock.
- **5**: Maximum from maximum stock level/target days' supply (product master).
- **6**: Total from maximum stock level/target days' supply (product master).
- **7**: No target stock level.

To plan location products using target stock level methods, use the standard heuristic SAP_PP_002 (planning of standard lot sizes).

The heuristic-based planning uses the SNP heuristic. The SNP heuristic plans the demand over the entire supply chain network (cross-location planning) and creates a medium-term production and distribution plan. It doesn't take into account any constraints or costs, so the plan created won't necessarily be feasible. In a second step, after the heuristic run, the planner can then adjust the plan using capacity leveling in interactive SNP planning to create a plan that is feasible.

Reorder Days' Supply

Specify the reorder days' supply if you've defined **Reorder point method 2** for the location product. **GR Processing Time**

This is the time in between the delivery or the production of a product and its availability as stock. This time is used, for example, as handling time or time for quality checks and is added to the transportation duration or the production time of a product. **GR Handling Cap. Cons.**

This is used by the heuristic and PP-DS optimizer to calculate how much handling resource capacity is consumed by the product for a particular plan. For example, if the

handling resource can handle 1,000 liters per day, and you define the handling capacity consumption as 10 liters per piece, the maximum rate is 100 pieces per day. **Loc. Shelf Life**

In this area, you can control if the system should consider the resource locationdependent shelf life of a product and, if so, then the standard, minimum and maximum shelf lives a product needs to have. A location in PP-DS can be a plant, a distribution center, storage location, MRP area, customer, transportation lane, or a business partner (vendor). **Proposed Strategy**

The **Strategy group** that you maintain in the **MRP 3** view of the material master is directly linked to the PP-DS strategy, as shown in Table 16.1. If other strategies or keys are entered in SAP S/4HANA, the relevant field in the PP-DS product master remains blank or is unchanged.

Strategy Description	SAP S/4HANA Strategy Group	PP-DS Strategy
Anonymous make-to-stock (MTS)	10	10
Planning with final assembly	40	20
Subassembly planning	70	20
Planning without final assembly	50	30
Planning with planning product	60	40
Make-to-order (MTO) production	20	Blank

Table 16.1 Different Strategy Keys in SAP S/4HANA and PP-DS

After selecting the **Advanced Planning** checkbox for an existing material, use Transaction SE38 to execute report /SAPAPO/PPDS_DELTA_ORD_TRANS for this material.

This report allows the integration of existing planning elements for this material into PP-DS without the creation of an integration model. The only input parameters to add are the material and the plant. Enter these parameters in the **Material** and **Plant** fields shown in Figure 16.9.

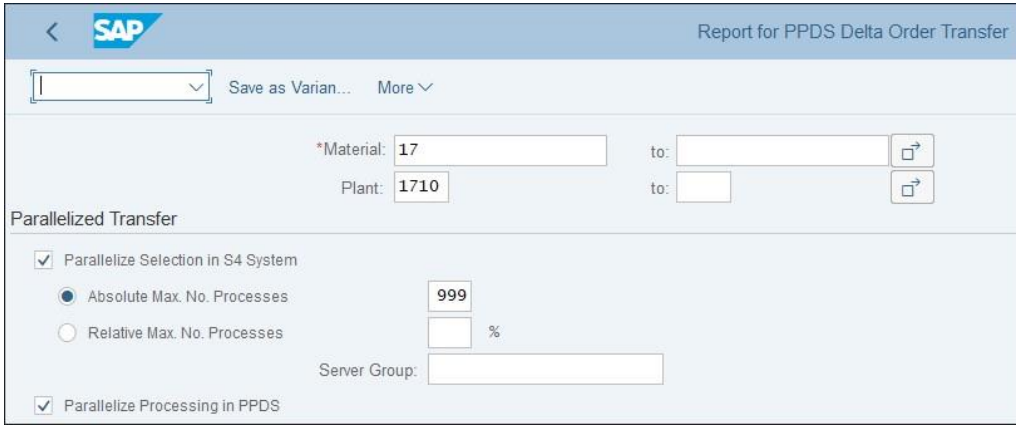


Figure 16.9 PP-DS Delta Order Transfer

Tips & Tricks

You can also use the mass maintenance transactions available for the material master, such as Transactions MASSD or MM17, to maintain the PP-DS fields in the material master.

After you save a material master for which the **Advanced Planning** option has been selected, the changes will be immediately reflected in the product master. Review the product master with Transaction /SAPAPO/MAT1; Figure 16.10 shows the product master "17" created for our material. Recall that these same details were maintained in the material master and are now visible in the product master.

Note

Directly creating a material in PP-DS isn't supported, which means that the product master should always be generated by setting the **Advanced Planning** checkbox in the material master. However, limited PP-DS specific changes can be made in the product master as shown in the various available tabs in Figure 16.10.

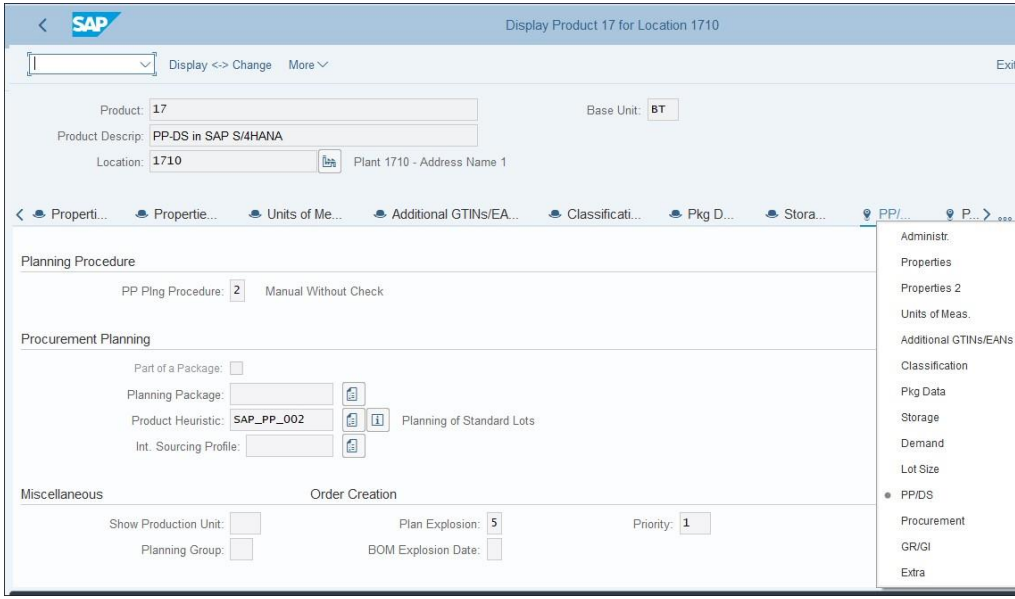


Figure 16.10 Product Master in PP-DS

16.2.3 Work Center/Resource

The work center or a resource is also simplified in embedded PP-DS. Similar to maintaining settings in the material master, you need to define that a work center is relevant for capacity planning in PP-DS. You don't need to create an integration model to generate the resource in PP-DS. During the work center creation or maintenance (Transaction CR01), simply select the **Advanced Planning** flag as shown in Figure 16.11, and a corresponding PP_DS resource is then automatically created. Figure 16.11 shows a work center "PPDSWC" for Plant "1710" with the **Advanced Planning** option selected in the **Basic Data** tab.

Note

We'll be using the same work center "PPDSWC" and plant "1710" combination throughout this chapter while discussing PP-DS.

Just as the material master created in SAP S/4HANA is reflected as a product master or a product in PP-DS, each work center created in SAP S/4HANA with the **Advanced Planning** checkbox selected is reflected as a resource in PP-DS.

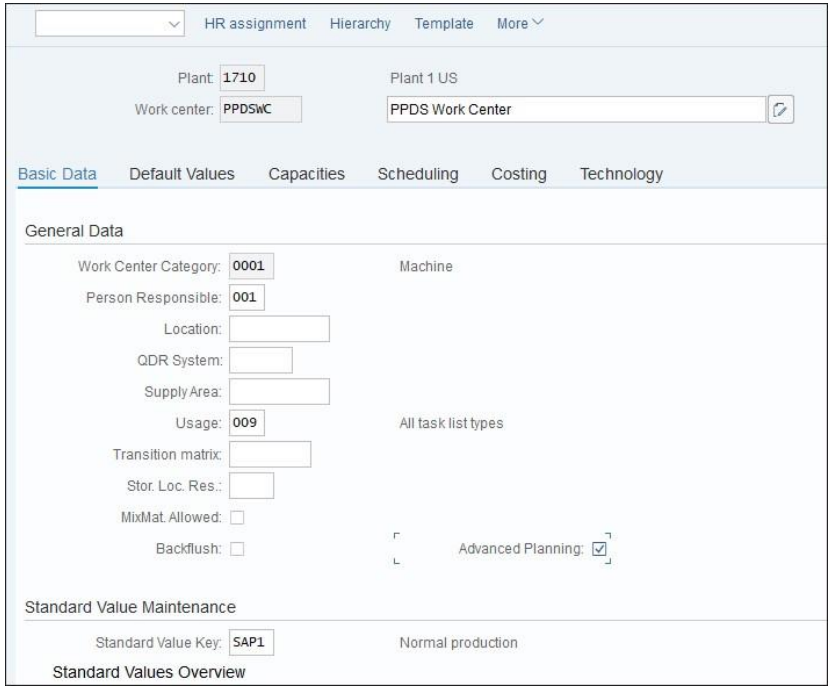


Figure 16.11 PP-DS Work Center

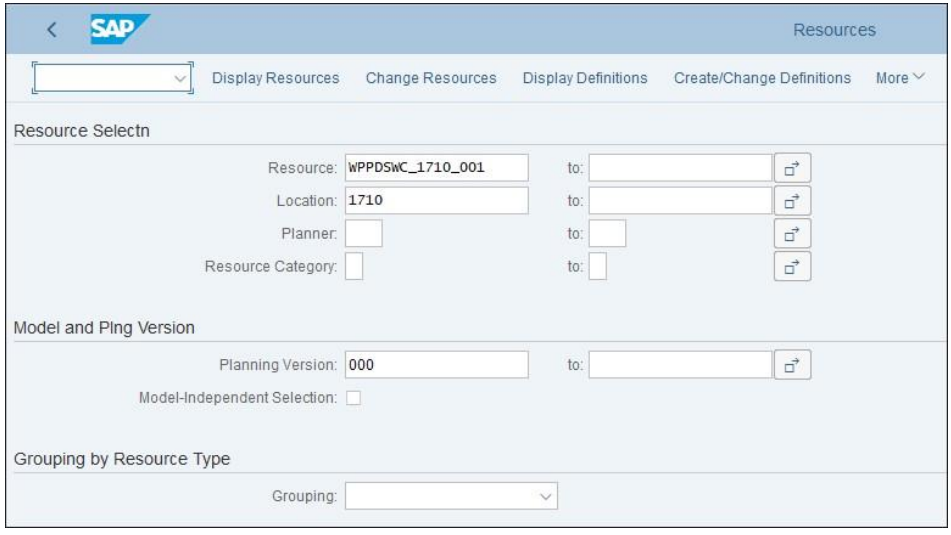


Figure 16.12 Resources in PP-DS: Initial Screen

The PP-DS resource created as a work center has the prefix “W”, followed by the resource name, then the associated plant for the resource, and finally the associated resource category, such as machine or labor. So, for this example, the just-created work center “PPDSWC” for plant “1710” and with a resource category “001” (machine) in SAP S/4HANA, the corresponding resource automatically created in PP-DS is “WPPDSWC_1710_001”.

Access the newly created PP-DS resource shown in Figure 16.12 via Transaction /SAPAPO/RES01, and enter the details as shown followed by clicking **Display Resources** so that Figure 16.13 appears.

As already mentioned, embedded PP-DS provides synchronous commit; that is, the PP-DS resource information will be always consistent with the SAP S/4HANA work center information. As shown in Figure 16.13, the PP-DS resource is created immediately after the creation of the work center. In the resource, the **Planner Gr (group)** field is important. The PP-DS planner is location independent and is created in the **Specify Person Responsible (Planner)** configuration activity. The planner is also used to select the area of responsibility for PP-DS reporting, including in SAP Fiori apps.

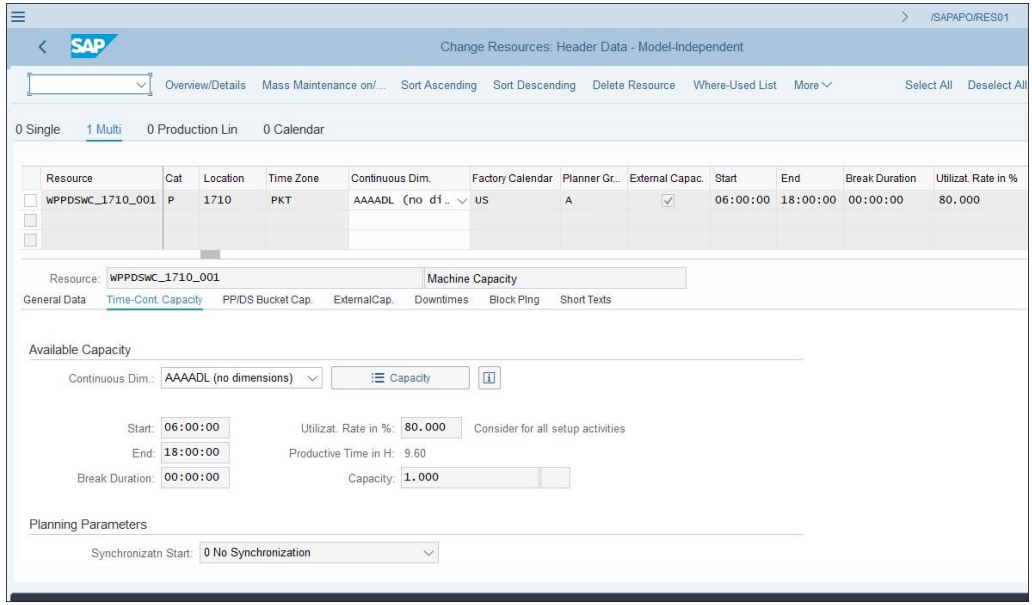


Figure 16.13 Resource in PP-DS

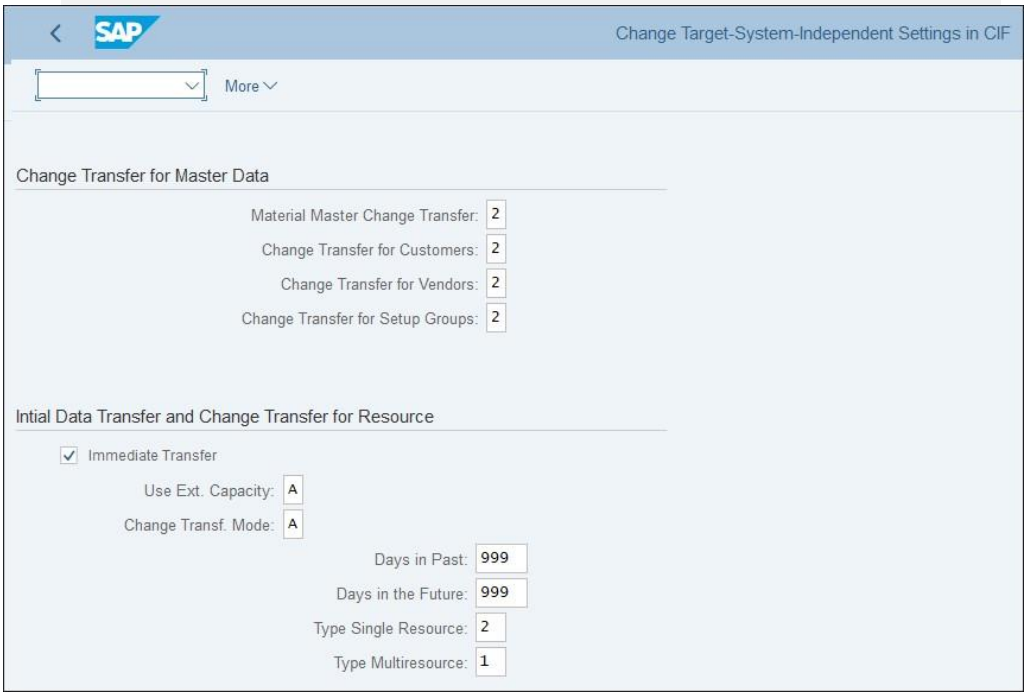


Figure 16.14 Configuration Settings for Data Transfer

Note

Just like the material master–product combination, manually creating PP-DS resources also isn't allowed, and a PP-DS resource can only be created together with a work center. However, deleting a PP-DS resource should be handled manually when the respective work center is deleted. Creating a work center won't be allowed if the respective resource already exists in the PP-DS side.

You need to enable target system-independent settings in the CIF for the resource transfer in Transaction CFC9. Values defined for the **Days in Past** and **Days in the Future** fields and resource type will be used when a PP-DS resource is created. In addition, **Change transfer mode** "No Change Transfer" isn't supported in embedded PP-DS (see Figure 16.14).

Note

Don't forget to also create the remaining PP master data, such as the BOM of material "17" and its routing that uses this work center "PPDSWC". Finally, also create a production version that combines the routing and BOM details of material "17".

16.2.4 Sources of Supply

Sources of supply define how the materials are procured. The sources of supply for materials produced in-house (**Internal procurement**) and sources of supply for the materials sourced from a vendor or another plant (**External procurement**) are examined.

Internal Procurement

For a material produced internally, the PP-DS source of supply is the PDS, which represents a combination of BOM, routing, and production version.

Even though the creation of the PDS in PP-DS isn't as simple as the creation of the product (i.e., material in SAP S/4HANA) and the resource (i.e., work center in SAP S/4HANA), you still don't have to create an integration model to do it. By using Transaction SE38 and executing report PPDS_ERP_CUSLNTRTO_CIF_REPORT, you can generate the PDS based on the production versions. Figure 16.151 shows the selection screen of report PPDS_ERP_CUSLNTRTO_CIF_REPORT, and you can see the results of the report execution 2, showing a successful transfer of the PDS.

As shown in Figure 16.151, this transaction offers flexible selection criteria, allowing us to choose, for example, which materials or plants for the PDS will be generated. We can also choose between an **Absolute Transfer**, in which everything will be transferred or **Change Transfer** in which only the PDS for which the master data was changed since the last transfer will be transferred. Because PDS transfers are synchronous, the results are visible immediately after running the transaction. Any errors that may have occurred during the transfer are also revealed. Figure 16.152 shows the results screen of PDS generation of **Material** "17", **Plant** "1710", and **Production Version** "0001".

Note

You can also use Transaction CURTOADV_CREATE to generate the PDS.

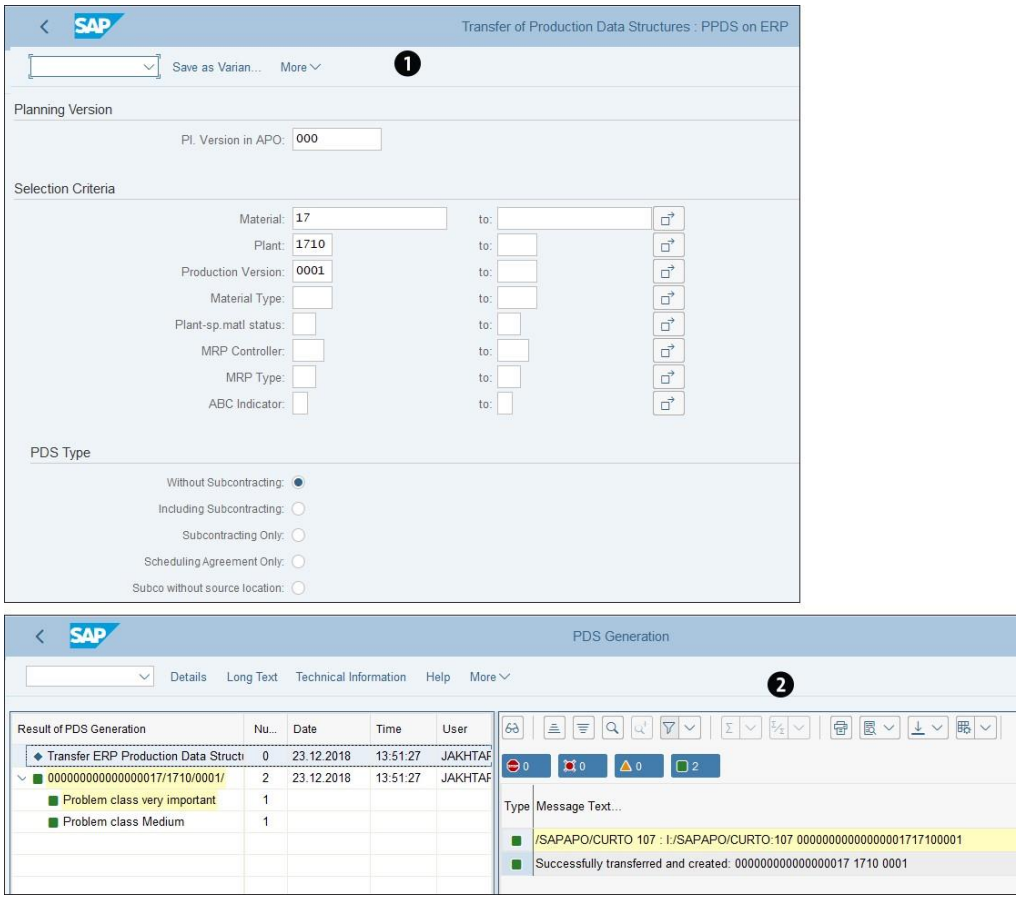


Figure 16.15 Product Data Structure

External Procurement

For external procurement, you'll need to generate integration models for scheduling agreements, contracts, and info records to be integrated to PP-DS, and an integration queue will still exist. You can generate an integration model via Transaction CFM1 (or execute report RIMODGEN via Transaction SE38) and then activate the integration model via Transaction CFM2 (or execute report RIMODAC2 via Transaction SE38).

Figure 16.161 shows the initial screen for creating integration models via Transaction CFM1 while the lower screen 2 shows the successful creation of an integration model that lists scheduling agreements, contracts, and purchasing info records for external procurement.

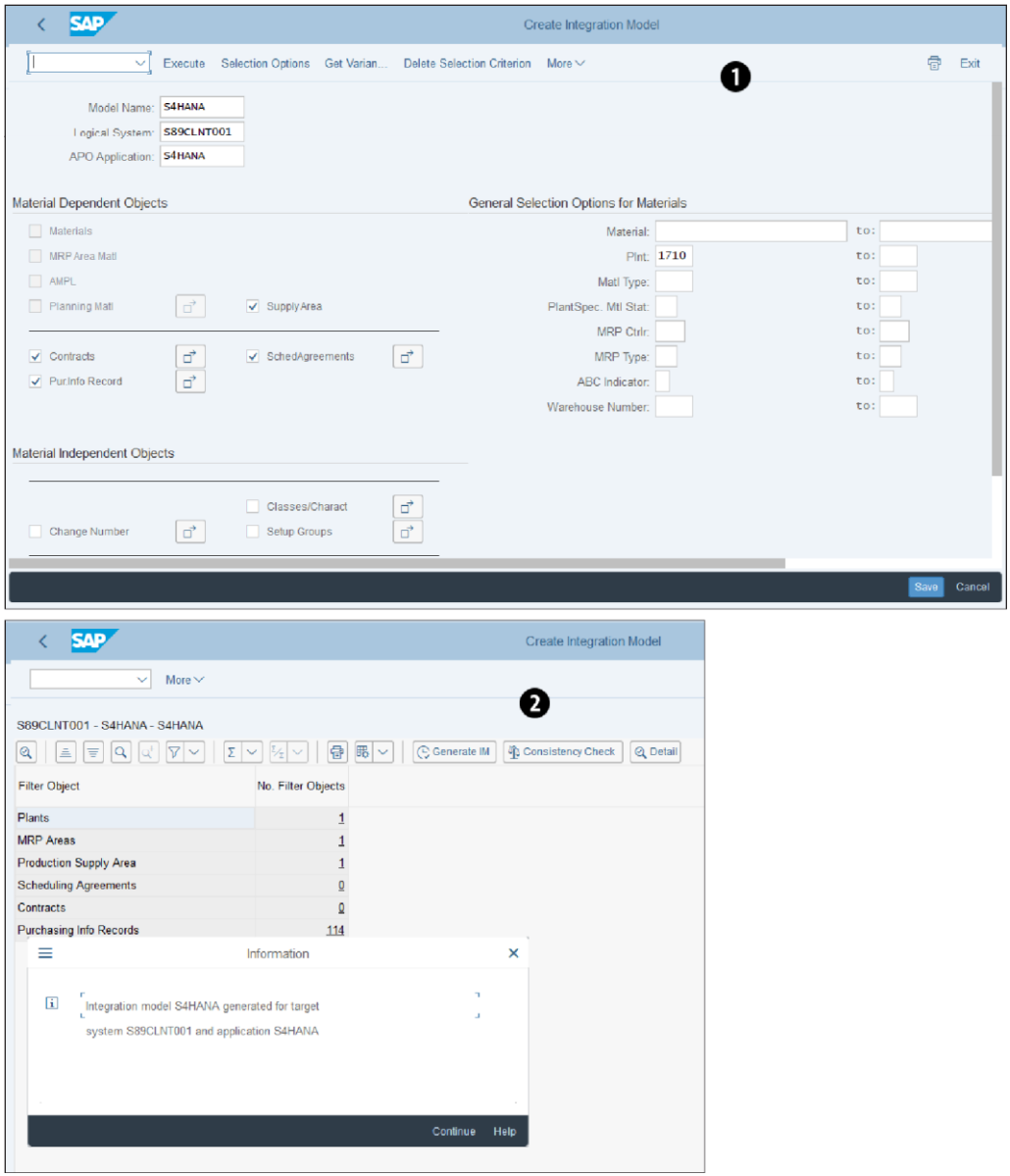


Figure 16.16 Creating an Integration Model

After creating the integration model in Transaction CFM1, you need to activate the model via Transaction CFM2 (see Figure 16.171 and 2).

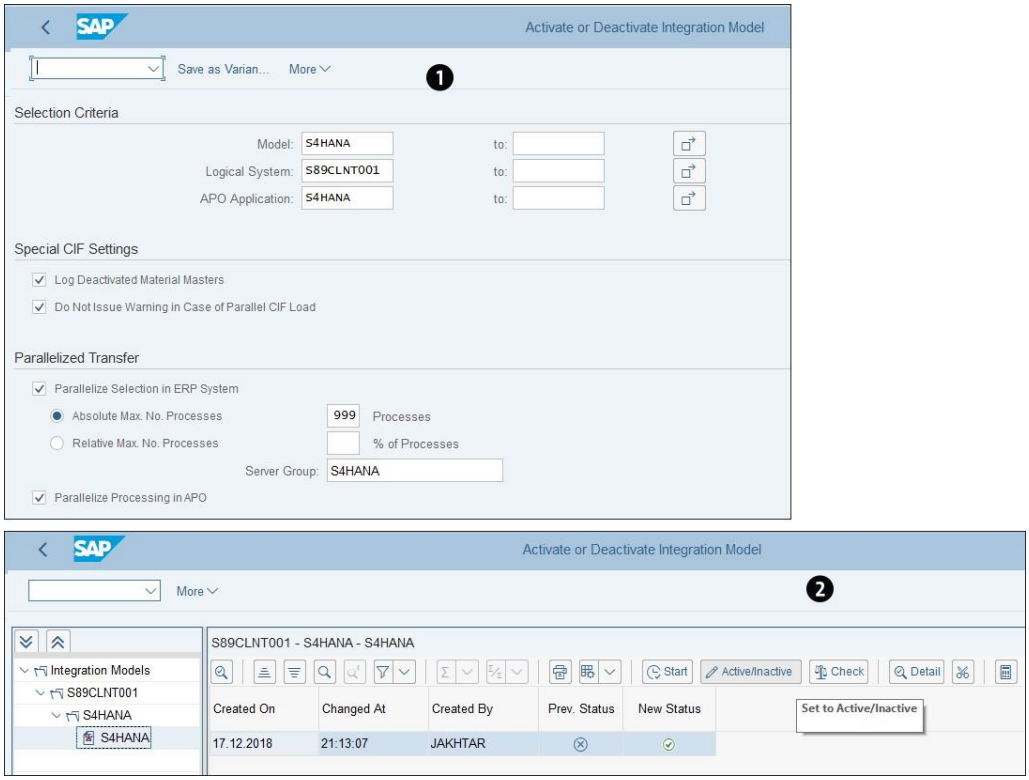


Figure 16.17 Activating or Deactivating the Integration Model

Note

Due to the highly integrated nature of working between production and procurement, we recommend engaging an MM consultant to ensure that the necessary master data is correctly created for a correct and smooth planning and scheduling of procured materials that are planned through PP-DS.

Table 16.2 summarizes the master data mapping between SAP S/4HANA and PP-DS.

Master Data in SAP S/4HANA	Master Data in PP-DS
Plant, business partner (customer, vendor)	Location (with location type)
Purchasing info record, scheduling agreement, outline agreement	External procurement relationship, including transportation lane
Special procurement key in material master	Transport relation or interpretation as a special scenarios
Material master	Product master
Work center, resource (in production planning for process industries [PP-PI])	Resource
Class and characteristics	Class and characteristics
Production version with BOM and routing or master recipe (in PP-PI)	PDS or runtime object (RTO), or PPM

Table 16.2 Master Data Mapping in PP-DS

This brings an end to the discussion on PP-DS master data. In the following sections, we'll discuss the important business processes of PP-DS.

16.3 Business Processes

The PP-DS product view is the equivalent of an MRP Transaction stock/requirements list (Transaction MD04) already covered in Chapter 13, Section 13.2. The demand/supply situation for one specific product can be monitored in the product view. You can also create different planning versions for simulation purposes.

To access the product view, use Transaction /SAPAPO/RRP3, and in the popup that appears asking to enter a variant, simply enter a dummy number such as "1", and press (Enter). The initial screen of Figure 16.18 shows the product view featuring the planning version (**Plng Version**), **Product**, and **Location** fields as the main selection fields. Enter the details as shown, and click **Continue** to get to the screen shown in Figure 16.19.

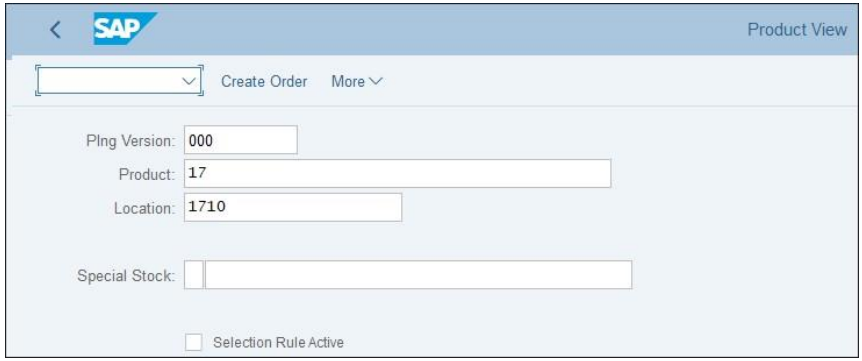


Figure 16.18 Product View

Figure 16.19 shows the available features and functionalities of the product view in PP-DS. Click on the **Change** button in the top menu bar to enable data entry. When you click this button, it will change to **Update**.

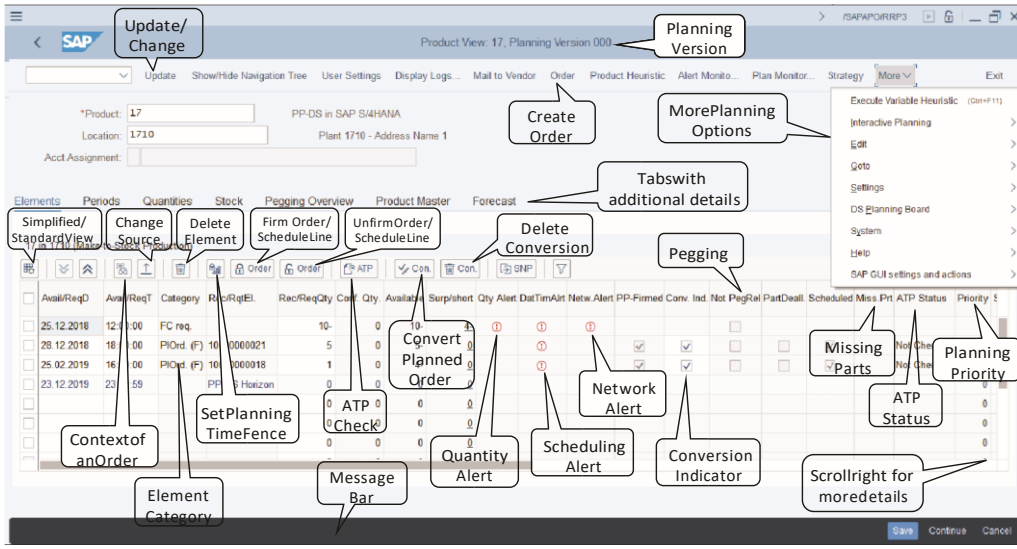


Figure 16.19 Features and Functionaities of the Product View

Note

While our example is mostly focused on using the product view (Transaction /SAPAPO/RRP3), following are the other available views:

Transaction /SAPAPO/RRP4: Receipts View

Transaction /SAPAPO/RRP1: Requirements View

Transaction /SAPAPO/RRP2: Order Processing

Transaction /SAPAPO/PCMT: Production Campaign

Transaction /SAPAPO/PPT1: Product Planning Table

Transaction /SAPAPO/POV1: Product Overview

Transaction /SAPAPO/PEG1: Pegging Overview

As always, we encourage you to explore these PP-DS views after you've read the chapter.

Because the product view is an interactive planning transaction, options for making changes in the product planning version are available, such as the following:

Generating a new forecast requirement

Creating a new PP-DS planned order

Executing the product heuristic

Executing a variable heuristic

Checking logs and alerts

Changing the planning strategy

To start the planning activity in the product view, for example, enter the date "24.12.2018" (December 24, 2018) in the **Avail/ReqD** column, and enter the quantity "200" in the **Rec/RqtQty** column, as shown in Figure 16.20. Entering a positive quantity means this quantity will eventually be *received* against the production process (it's a receipt), whereas a negative quantity entered, such as "–100" means that it's a *requirement* quantity, which is the same as PIRs, forecasts, or even customer requirements. Notice the first row in Figure 16.20 shows a negative quantity of **10-**, which is a requirement quantity and is required on **25.12.2018** (December 25, 2018).

As soon as you select the row with a quantity of 200, and perform some other planning functions such as **ATP check** or even selecting the **Conv. Ind.** (conversion indicator) checkbox, the system will create a relevant planning element, which in this case is a planned order number (**PlOrd. (F)**) **10000000023**, as shown in Figure 16.21.

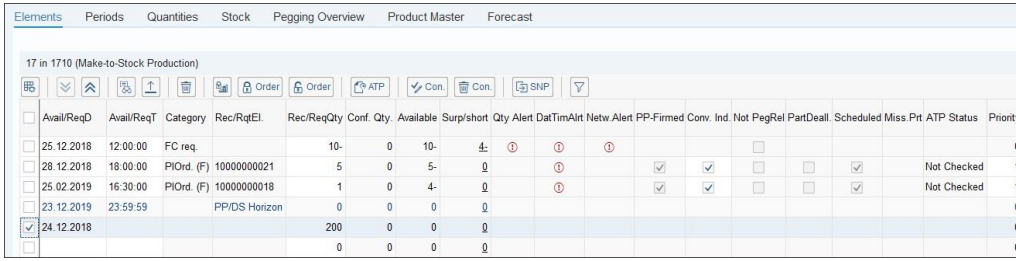


Figure 16.20 Product Master in PP-DS

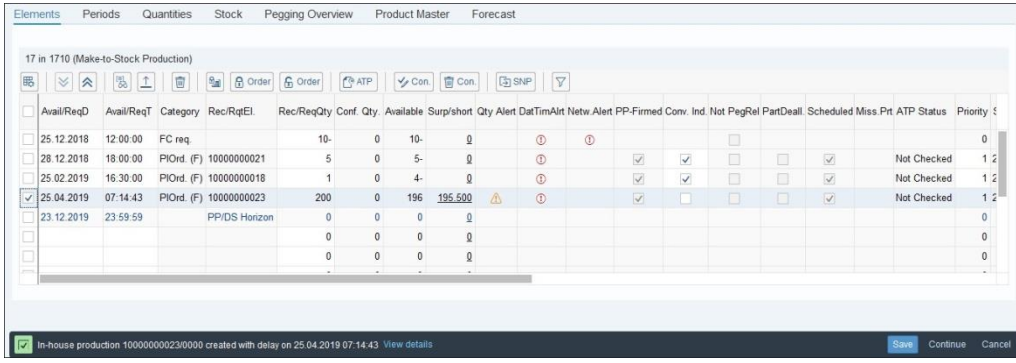


Figure 16.21 Planning Elements

In Figure 16.21, either double-click the PP-DS planned order **10000000023** or select the relevant line item, and click on the **Context of an order** icon so that the screen shown in Figure 16.22 appears.

Tips & Tricks

You can always double-click any element in not just the product view but any view of PP-DS to navigate to the detailed view of the element. In other words, you don't have to always select an element and click on the **Context of an order** icon as simply a double-click will lead to a detailed screen.

Figure 16.22 shows order **10000000023**. The left-hand side of the screen shows the entire product structure, that is, the components **2** and **4** (which is the BOM for product **17**) in the form of **Requirements**, and the various **Operations**, such as the **Setup** and **Produce**. These operations are basically the routing of material **17**, including the previously created PP-DS resource **WPPDSWC_1710_001**.

You can firm individual orders manually. When you change orders manually, the associated firming flags are set automatically. You can cancel firming at any time. The **Output Firmed** checkbox prevents the quantities of an order from being changed during automatic planning. The status corresponds to freezing the order header of an SAP S/4HANA planned order. The **Input Firmed** checkbox freezes the dependent requirements of an order. The PDS can no longer be changed for this order. This status corresponds to the **Components** flag in the SAP S/4HANA planned order. The **Date Fixed** checkbox fixes an operation of an order in the DS planning board. A fixed operation can't be shifted during optimization.

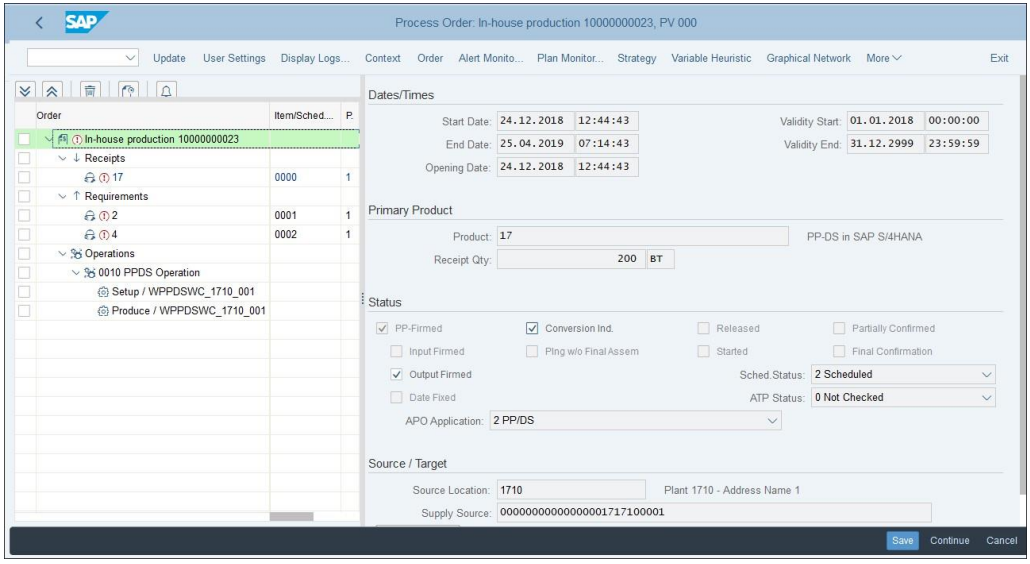
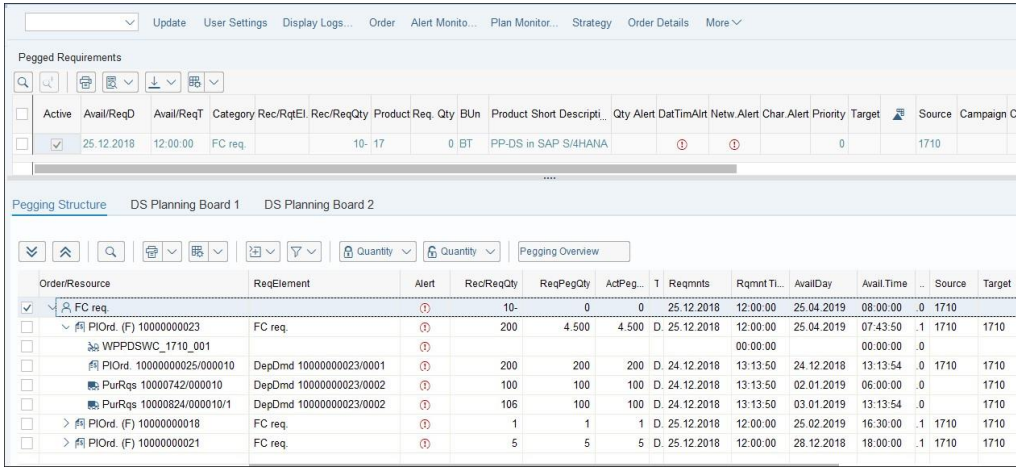


Figure 16.22 Detailed View of the PP-DS Planned Order

Click **Back** to return to the screen shown earlier in Figure 16.21. Other tabs in the product view, such as **Periods**, **Quantities**, **Forecast**, or **Pegging Overview**, will provide more detailed insight into the planning situation. Let's review these tabs one by one in detail.

Figure 16.23 shows the **Pegging Structure** of the order 10000000023 and how these are all interlinked through procurement and production processes. Two purchase requisitions (**PurRqs**) **10000742** and **10000824** are automatically created for external procurement of two corresponding components (materials **2**and **4**). You can also check the details of these automatically created purchase requisitions via Transaction ME53N.



Active	Avail/ReqD	Avail/ReqT	Category	Rec/RqtEl.	Rec/ReqQty	Product	Req. Qty	BUn	Product Short Descripti...	Qty Alert	DatTimAlrt	Netw.Alert	Char.Alert	Priority	Target	Source	Campaign
	25.12.2018	12:00:00	FC req.		10-	17	0	BT	PP-DS in SAP S/4HANA		①	①		0		1710	

Order/Resource	ReqElement	Alert	Rec/ReqQty	ReqPegQty	ActPeg...	T	Reqmnts	Rqmnt Ti...	AvailDay	Avail.Time	..	Source	Target
FC req.		①	10-	0	0		25.12.2018	12:00:00	25.04.2019	08:00:00	.0	1710	
PlOrd. (F) 10000000023	FC req.	①	200	4.500	4.500	D.	25.12.2018	12:00:00	25.04.2019	07:43:50	.1	1710	1710
WPPDSWC_1710_001		①						00:00:00		00:00:00	.0		
PlOrd. 10000000025/000010	DepDmd 10000000023/0001	①	200	200	200	D.	24.12.2018	13:13:50	24.12.2018	13:13:54	.0	1710	1710
PurRqs 10000742/000010	DepDmd 10000000023/0002	①	100	100	100	D.	24.12.2018	13:13:50	02.01.2019	06:00:00	.0		1710
PurRqs 10000824/000010/1	DepDmd 10000000023/0002	①	106	100	100	D.	24.12.2018	13:13:50	03.01.2019	13:13:54	.0		1710
PlOrd. (F) 10000000018	FC req.	①	1	1	1	D.	25.12.2018	12:00:00	25.02.2019	16:30:00	.1	1710	1710
PlOrd. (F) 10000000021	FC req.	①	5	5	5	D.	25.12.2018	12:00:00	28.12.2018	18:00:00	.1	1710	1710

Figure 16.23 Pegging Structure in the Product Overview

Pegging involves a link that creates a logical relationship between the receipt elements and requirements elements of a product within a location. The system uses these pegging relationships to assign requirements to receipt elements. The links always result from availability and requirements dates within a pegging area, in which product, location, and account assignment (MTS or MTO, etc.) correspond to each other. Pegging involves an analysis that refers to existing orders and requirements. It occurs independently of requirements planning. The primary applications of pegging include the analysis of production planning, capacity planning, and optimization.

Click on **DS (Detailed Scheduling) Planning Board 2** in Figure 16.23 to open the screen showing the PP-DS resource WPPDSWC_1710_001 and the operations details of the PP-DS planned order 1000000023 (Figure 16.24).

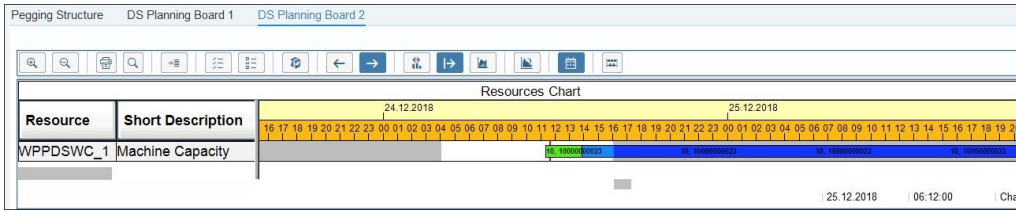


Figure 16.24 DS Planning Board in the Product Overview

Figure 16.25 shows the **Quantities** tab of the product view of product 17 and plant 1710. Cumulated requirements and receipts along with available quantity are shown in a graphical representation.

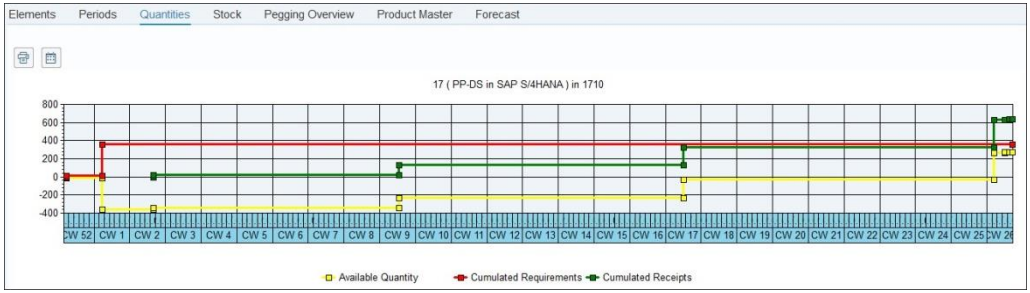


Figure 16.25 Quantities in the Product Overview

The **Strategy Settings Expert View** screen shown in Figure 16.26 appears when you click on the **Strategy** button in the product view. Here, you can set the scheduling sequence, scheduling mode, and planning direction. Be sure to also check out the scheduling options available in the **Strategy Parameters f. Dependent Objects** tab.

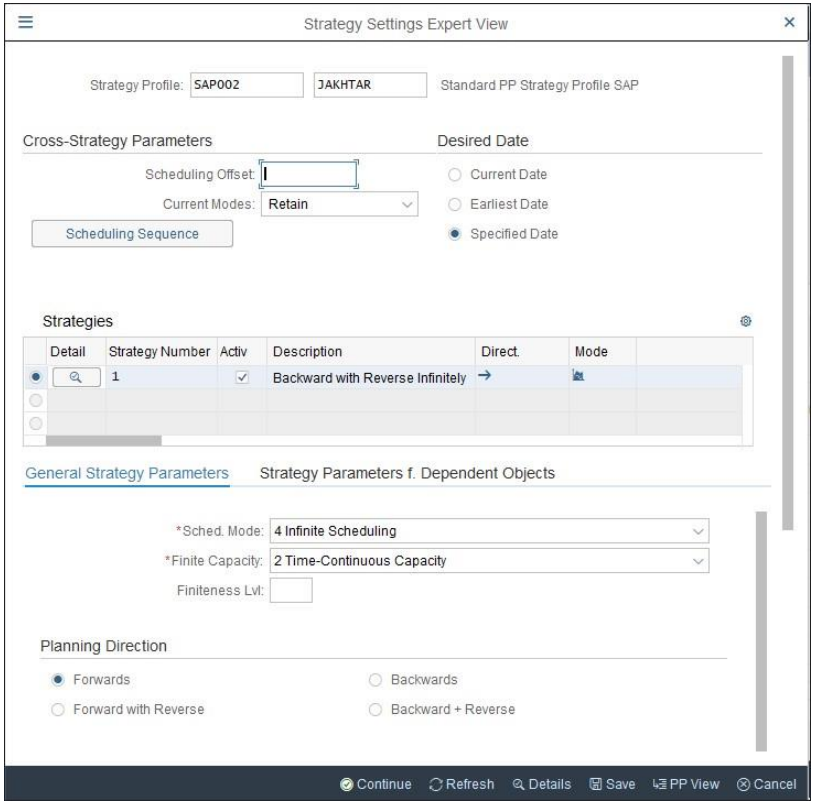


Figure 16.26 Strategy Settings

Figure 16.27 shows the **User Settings** details of a product view. Here, you can assign relevant profiles so that the system is able to perform necessary planning functions. Be sure to check out several tabs available in the user settings and maintain necessary information, as required.

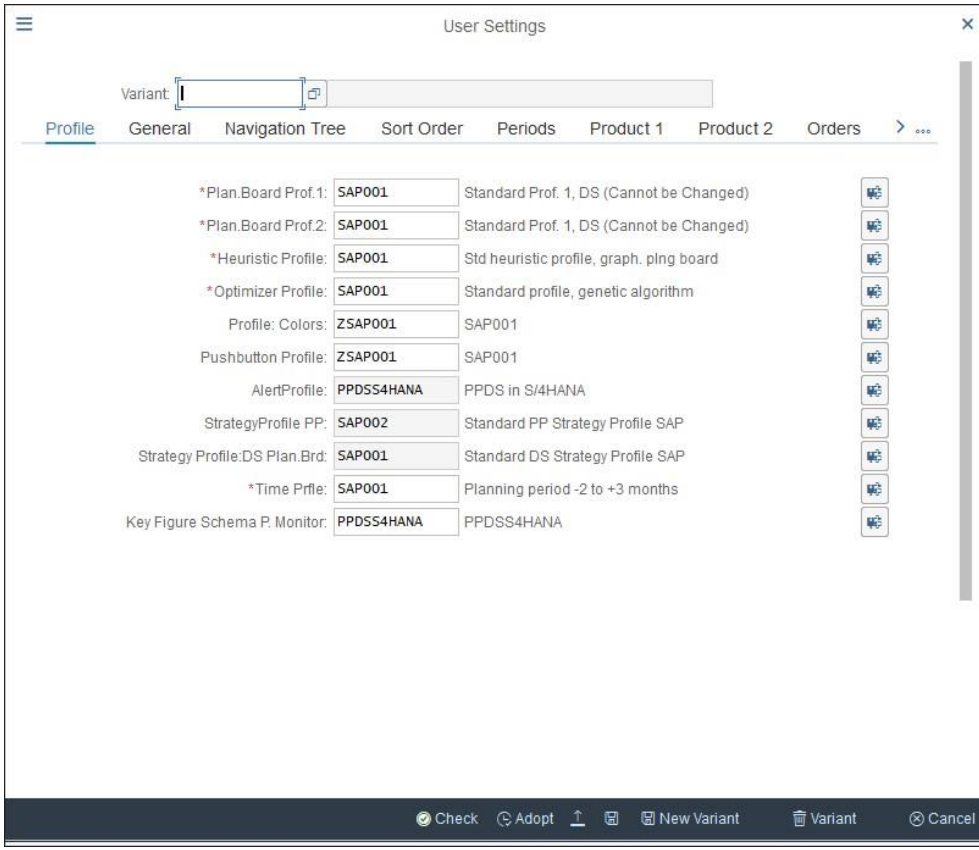


Figure 16.27 User Settings

Figure 16.28 appears when you click on the **Display Logs** button in the product view. The maintained log keeps a record of all the planning activities performed and any information, warning, or error messages generated during the planning process. Refer to the **Logging** field in Figure 16.4 to choose the relevant option on how the system maintains logs of all the steps and activities performed

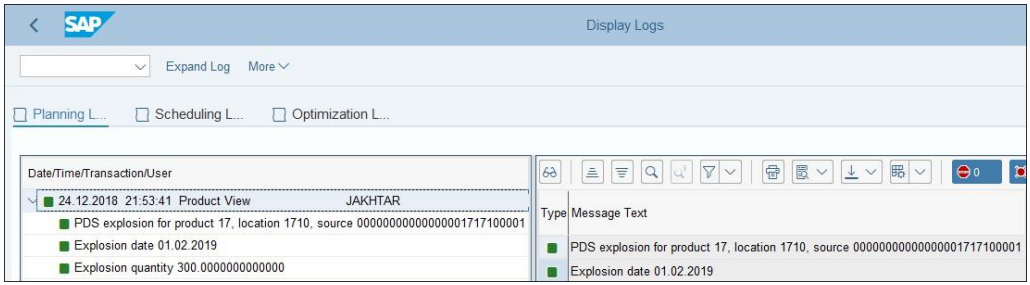


Figure 16.28 Display Logs Screen

16.4 Heuristics

A *heuristic* is a planning function that can be parameterized and used to execute planning or a planning step for selected objects. The planning objects of heuristics can be products, resources, orders, or operations. The concept of heuristics is a central concept in planning with PP-DS. A number of planning steps can be executed by heuristics. Accordingly, the planning steps can be easily designed variably—by selecting the appropriate heuristic. In PP-DS, you simply have to select a different heuristic or create a new heuristic that then becomes part of the overall planning process. The heuristics of a given group can be used for the same task or issue—they represent different planning and scheduling alternatives.

Two heuristic options are available:

Product heuristic

Product heuristic is used to plan products with heuristics that are defined via the planning procedure or product masters.

Variable heuristic

With the variable heuristic, you can perform planning interactively with a heuristic other than that stored in the product master and without having to change the entry in the product master. You can also change the heuristic settings before executing planning.

In any case, execution of the heuristic first treats data only in a transactional simulation. The data is written to the database only when you save the planning results. Use the heuristic profile (configuration of PP-DS) to define which variable heuristics can be selected. Three standard heuristic profiles are available:

Profile SAP001 for the detailed planning board

Profile SAP002 for the product view

Profile SAPREM for the product planning table

With interactive heuristic planning, you execute planning for a product. You can perform this function from the product view, the product planning board, the detailed planning board, and so on. You use it when the planning situation of a product was changed manually, and you want to determine the effects of the change on planning right away.

Selecting the **Product Heuristic** option will run the heuristic assigned to the product master; however, other heuristics assigned to the heuristics profile can be directly executed within the product view by selecting the **More Variable Heuristic** option.

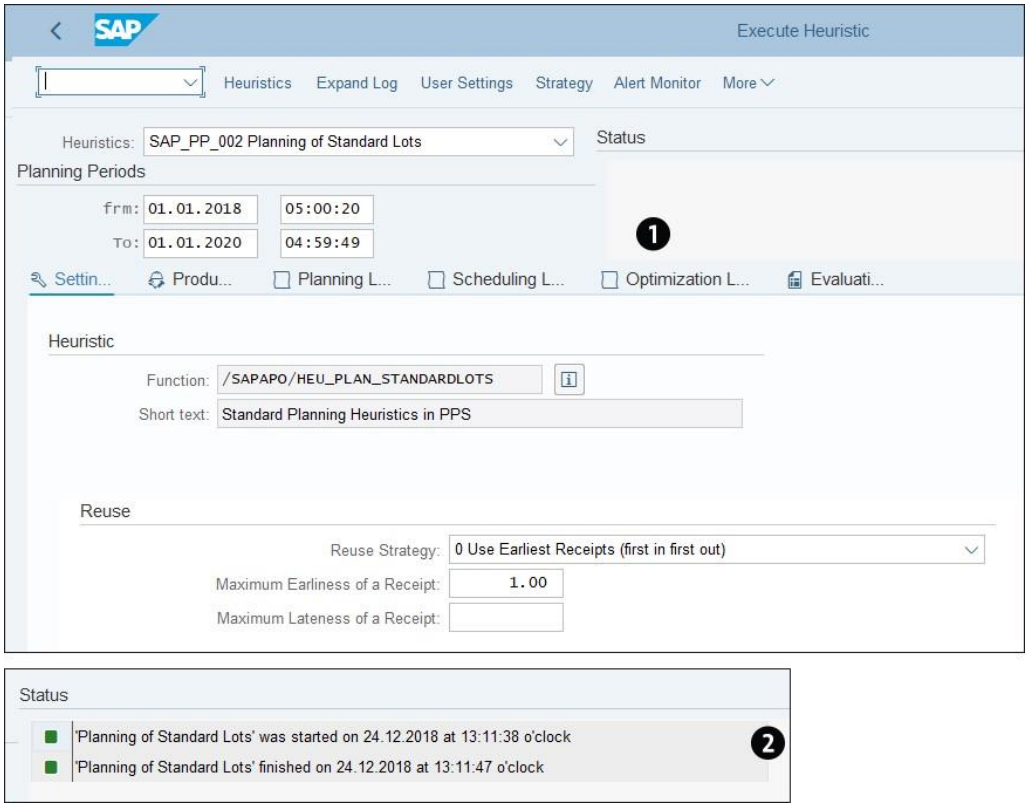


Figure 16.29 Executing Variable Heuristic in PP-DS

To execute the variable heuristic, refer to Figure 16.19, and click on **More Execute Variable Heuristic** from the top menu bar. In the screen that appears (Figure 16.291), select the relevant heuristic, which in this example is **SAP_PP_002 Planning of Standard Lots**. Make any other desired planning or scheduling changes by scrolling down the screen and choosing relevant options. In addition, to cross-check which materials are being planned via a heuristic, click on the **Products** tab. Next, click on the **Heuristics** button from the top menu bar to see the heuristic results 2.

As already mentioned, product heuristics define the planning of a product. They can be entered explicitly in the PP-DS tab in the product master. If no entry is present in the product master, the standard heuristic of the planning procedure is used.

Table 16.3 lists some typical product heuristics.

Heuristic	Short Description
SAP_PP_002	Planning of Standard Lots: "Normal" planning of the product based on the lot size stored in the product master
SAP_PP_003	Planning of shortage quantities: Planning only of shortage quantities; existing orders remain as is; relevant for capable to promise (CTP)
SAP_PP_004	Planning of standard lots in three horizons: Planning with various lot sizes in three time horizons
SAP_PP_005	Part-Period Balancing: Optimizing lot-sizing procedure
SAP_PP_013	Groff Procedure: Optimizing lot-sizing procedure
SAP_PP_007	Reorder Point Planning: Reorder point planning with a reorder point from the product master
SAP_PP_C001	Planning of Standard Lots for Continuous I/O (input/output): Planning that considers continuous input/output in PDS/PPM

Table 16.3 Typical Product Heuristics

16.5 Production Planning Run

A production planning run initiated via Transaction /SAPAPO/CDPSB0 is used to execute planning in interactive (foreground) mode or in batch (background) mode. Depending on the complexity of the planning or sequencing required, the heuristics, PP-DS optimization, or DS functions can be executed.

In the production planning run, various planning steps can be executed in several consecutive processing phases using different heuristics or functions. For example, MRP heuristics can be executed followed by bottom-up rescheduling heuristics.

The planning run can be executed for the active version **000** or for any inactive version you specify in the **Planning Version** field. In the **Time Profile** field, you'll define the planning period, which can be a period in the past or the future. The **Propagation Range** defines the restrictions on the products and resources that are included in the planning run. You can

also execute the planning run on a simulation version. In the various step tabs, you'll maintain the sequence of functions or heuristics to be executed. Functions such as firming/unfirming orders, the DS optimizer, and all the permitted heuristics can be selected. Based on the functions or heuristics you select, the relevant products and resources are controlled. For example, if you select the schedule sequence heuristic, then the system is forced to use resources or order selections instead of products when applying the heuristic.

The results of the planning run can be analyzed immediately and examined interactively by selecting the **Display Logs** checkbox in the selection screen. The log output is shown in Figure 16.30.

Tips & Tricks

After the planning run has been executed in interactive mode or in background processing, the logs are stored and can be analyzed in evaluation transactions, such as Transaction /SAPAPO/RRPLOG1. The selection variants saved in the PP-DS production planning run can be used in a background planning run executed via Transaction /SAPAPO/ CDPSB1.

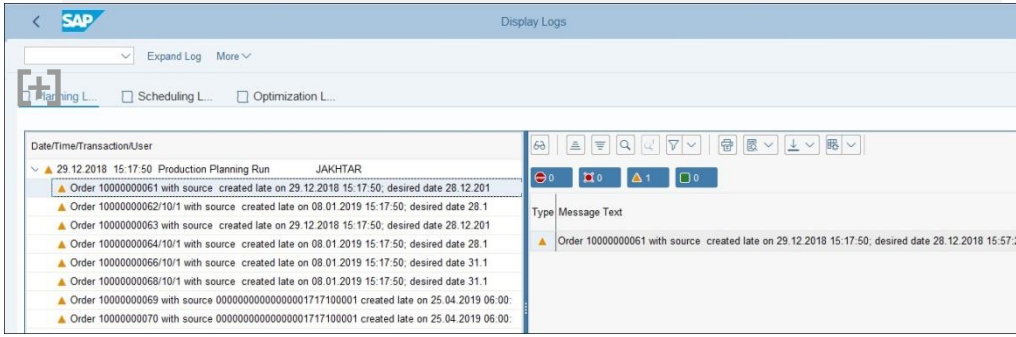


Figure 16.30 Planning Several Heuristics

Note

Heuristic SAP_PP_002 (Planning of Standard Lots) is particularly important and corresponds to the normal planning of a product with the use of the lot size defined in the product master. It's the standard heuristic in planning procedure 4 (Planning in the Planning Run) and therefore represents the normal case for product planning. In heuristic SAP_PP_002, you can set a reuse mode (e.g., for new planning or change planning). If nothing is specified, the reuse mode from the planning file is used. Normal planning of a product with the lot sizes defined in the product master occurs with heuristic SAP_PP_002.

In the following sections, we'll discuss how MRP Live creates either a SAP S/4HANA planned order that links the PP-DS planned order or even direct creation of a production based on the PP-DS planned order. Further, we'll discuss the PP-DS scheduling and capacity planning options available either in the tabular form or DS planning board. Finally, we'll also discuss PP-DS optimizer, which strives to maintain a balance among various production, procurement, and capacity constraints.

16.5.1 Executing Planning in SAP S/4HANA

The basic rule for planning in SAP PP-DS is that detailed production *planning* and scheduling occurs in PP-DS while this planning is *executed* in SAP S/4HANA. The planned order or the purchase requisition is converted into a manufacturing order or PO respectively in PP-DS to execute PP-DS planning. Unlike SAP S/4HANA planned orders, the PP-DS planned orders already contain all the production dates. If a PP-DS planned order is transferred to SAP S/4HANA, the SAP S/4HANA planned order contains only the basic dates and all dependent requirements. The production start and end dates are transferred as basic dates.

Integration at the DS level isn't realized for the SAP S/4HANA planned orders. For this reason, the conversion of planned orders must occur in PP-DS. The conversion of a PP-DS planned order corresponds only to setting the conversion flag (manually for one order or via mass conversion for orders and purchase requisitions). If a PP-DS planned order with the conversion flag is transferred to SAP S/4HANA, a corresponding manufacturing order is created in SAP S/4HANA. The S/4HANA planned order assumes the production dates determined in the PP-DS planned order. The integration of the orders is maintained.

Status information or production confirmations that are created in SAP S/4HANA and are relevant to planning are transferred from SAP S/4HANA to the PP-DS order. All data relevant to planning must remain consistent. In addition, the SAP S/4HANA production order also contains a variety of functions to execute production—functions that don't require integration with the PP-DS order—such as printing of the order papers and consumption.

We've now covered the PP-DS side of the product view of product "17" and the receipt quantity of 200. The next step is to run MRP Live (Transaction MD01N) and see how the planning results of product "17" from PP-DS transfer to create a planned order in SAP S/4HANA so it can be converted into a production order.

Figure 16.31 shows the MRP results from MRP Live (Transaction MD01N). After the planning run, the performance log is displayed, showing information about the number of materials planned, the number of materials with errors, and the time spent in each step

Figure 16.31 Results of MRP Live for PP-DS Material

Tips & Tricks

The standard system lacks the option to plan only PP-DS materials or to exclude PPDS materials from the planning run. However, you can create an implementation of the business add-in (BAdI) MRP_DISPATCHER_BADI to bring additional selection fields into the MRP Live selection screen. We can add, for example, the MRP type as selection criteria and filter for materials with MRP type X0.

Access the **Stock/Requirements List** screen shown in Figure 16.32 via Transaction MD04, and notice the system created a planned order 989 for a quantity of 200.

Figure 16.331 shows that when the planned order is converted into a production order 1000068, it's accorded the status **EXPL** (**External Conv.of Planned Order**), whereas any changes made from the PP-DS side will reflect a production order status of **EXTS** (**Changed by external system**), as shown in Figure 16.332.

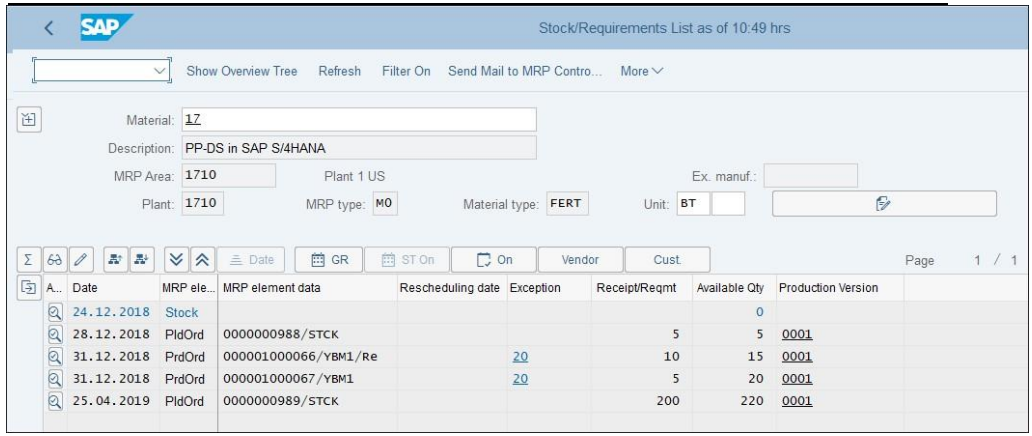


Figure 16.32 Stock/Requirements List

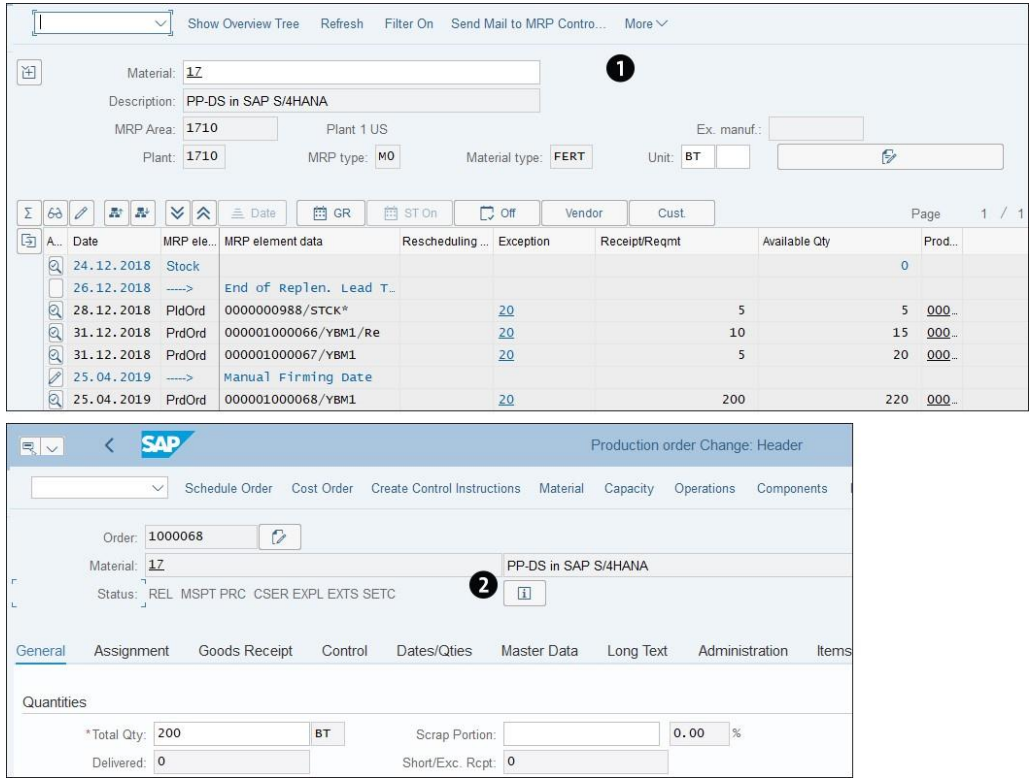


Figure 16.33 PP-DS Production Order after Running MRP Live

Note

We've deliberately discussed both options to cater to different business needs. In the first option, a PP-DS planned order 10000000023 for quantity was created after running MRP Live and this resulted in creation of SAP S/4HANA planned order 989, which was eventually converted into a production order 1000068. The second option entails automatic and direct creation of a SAP S/4HANA production order as soon as PP-DS planned order is assigned a conversion indicator (the settings are controlled via PP-DS configuration. Refer to the control functions available for field **Transfer to R/3 In-House Production** in Figure 16.4).

16.5.2 Conversion of PP-DS Planned Orders

You can also use a conversion rule to define which planned orders should be converted into manufacturing orders. During a collective conversion of planned orders using Transaction /SAPAPO/RRP7 (Conversion of Orders and Purchase Requisitions), the conversion rule lets you convert only specific orders into production orders. Conversion rules are defined in PP-DS Customizing (**SAP IMG Advanced Planning Transfer to Execution Define Conversion Rules**) and assigned in the **Conversion Rule** field shown previously in Figure 16.4.

For example, you can specify that only planned orders that have successfully undergone an ATP check (confirmed orders) or that only planned orders linked to a sales order should be converted into planned orders (requirements check). In addition, you can use a BAdI for special requirements. If a conversion rule for a specific product is used, it's entered in the product master. You can also store a rule that applies to all products in the global parameters. Conversion rules are considered during interactive and collective conversion (see Figure 16.34). You can also override the rules manually.

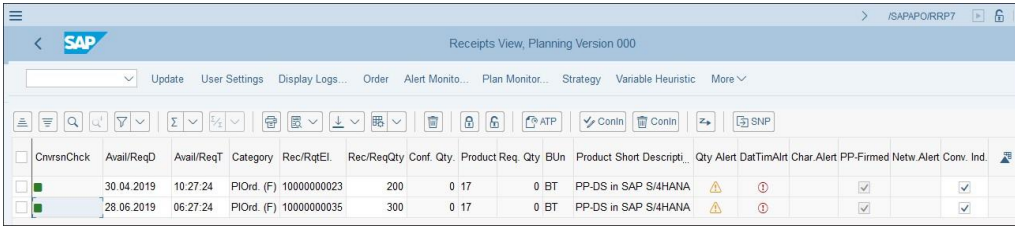


Figure 16.34 Conversion of Planned Orders into Manufacturing Orders

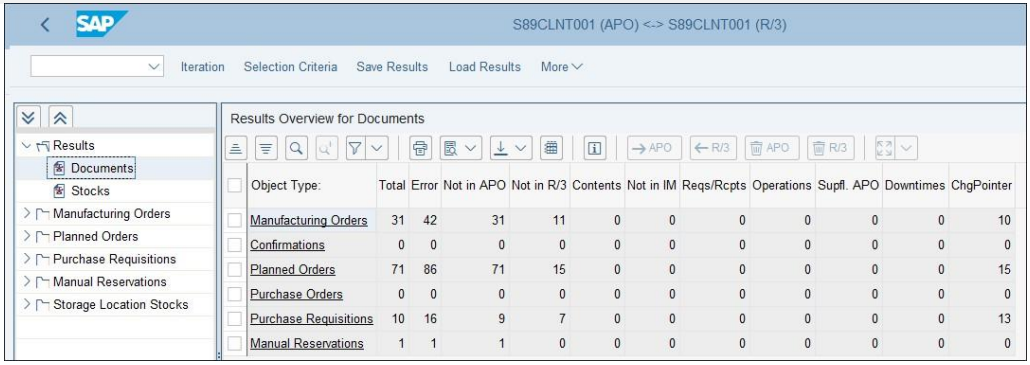
Note

With SAP S/4HANA's embedded PP-DS, a single report can used to convert both PPDS planned orders and SAP S/4HANA planned orders created by MRP Live. The mass conversion of SAP S/4HANA planned orders to production orders in SAP S/4HANA's embedded PP-DS can be executed using report /SAPAPO/PROD_ORDER_CONVERT, while mass processing of converted orders is executed by report /SAPAPO/PROC_ORDER_CONVERT via the Transaction SE38.

Tips & Tricks

To resolve such a transactional data inconsistency between SAP S/4HANA and PP-DS, use Transaction /SAPAPO/CCR (CIF Comparison/Reconciliation Function).

Figure 16.35 shows the difference between the number of various elements, such as manufacturing orders or purchase requisitions, that exist between SAP S/4HANA and PP-DS. For example, nine **Purchase Requisitions** don't exist in PP-DS (**Not in APO**), whereas seven purchase requisitions don't exist in SAP S/4HANA (**Not in R/3**). To transfer the data between SAP S/4HANA and PP-DS, select the **Purchase Requisitions** folder from the left-hand side of the screen so that a complete list of purchase requisitions appear. Then, select all the purchase requisitions, and click on the relevant icon (→**APO** or ←**R/3**) to transfer elements to the relevant systems (either SAP S/4HANA or PP-DS).



Object Type:	Total	Error	Not in APO	Not in R/3	Contents	Not in IM	Reqs/Rcpts	Operations	Supfl. APO	Downtimes	ChgPointer
Manufacturing Orders	31	42	31	11	0	0	0	0	0	0	10
Confirmations	0	0	0	0	0	0	0	0	0	0	0
Planned Orders	71	86	71	15	0	0	0	0	0	0	15
Purchase Orders	0	0	0	0	0	0	0	0	0	0	0
Purchase Requisitions	10	16	9	7	0	0	0	0	0	0	13
Manual Reservations	1	1	1	0	0	0	0	0	0	0	0

Figure 16.35 Data Transfer Comparison and Reconciliation between SAP S/4HANA and PP-DS

In the following sections, we'll discuss the scheduling options available via the resource planning table and the DS planning board, as well as the large number of material and capacity planning options they offer.

Scheduling in Production Planning-Detailed Scheduling

DS in PP-DS helps you schedule order operations while considering constraints such as material and resource availability. The basic functions of the scheduling tools are to

schedule, reschedule, and deallocate operations. Other parameters, such as scheduling direction (forwards/backwards), and order relationships also can be used to influence DS behavior. DS can be performed interactively from the scheduling tools or can be executed in the planning run as a step.

Scheduling via the Resource Planning Table

A resource planning table is an alternative to the DS planning board that displays scheduling data in tabular format. A resource planning table can be used to handle sequencing or scheduling problems on resources. The selection screen for data to be included in the resource planning table is similar to the selection screen for the DS planning board. Additional tools, such as the alert monitor, plan monitor, and the PPDS optimizer, are integrated into resource planning tables, as shown in Figure 16.36. A clipboard function is available in the resource planning table so you can copy a list of operations and sequence and schedule them on the resource. Operations and activities can be interactively sequenced using drag-and-drop or pick-and-drop options. The scheduling heuristic assigned to the heuristics profile used in the resource planning table enables you to execute the scheduling heuristic. Planning multiple resources or bucket resources isn't supported by the resource planning table. However, **Alert Monitor** and **Plan Monitor** functions are available in the resource planning table.

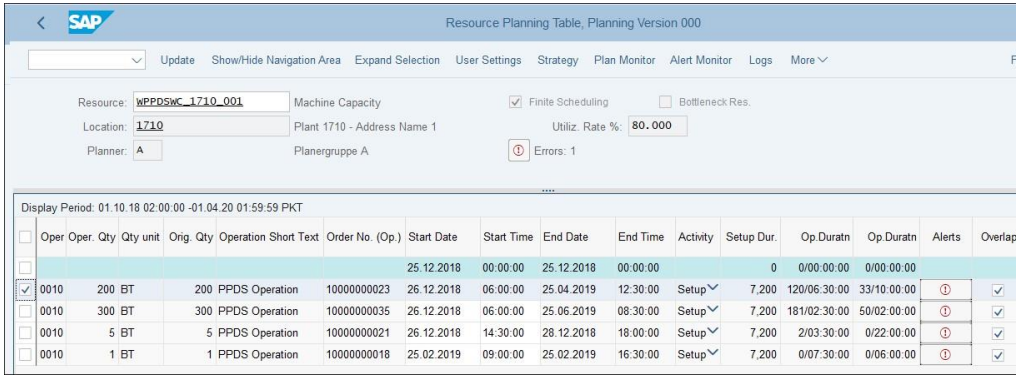


Figure 16.36 Resource Planning Table

Detailed Scheduling Planning Board

The DS planning board is a widely used scheduling tool in PP-DS. From the DS planning board, all scheduling options, including executing various DS heuristics, PP-DS optimizer, and manual scheduling, are possible. DS is launched with a time profile that determines the time period during which data is displayed (**Display Start** and **End of Display** fields) and the data available for DS (**Planning Start** and **Planning End** fields).

You can manually select resources, products, and orders via Transaction /SAPAPO/ CDPS0 (see Figure 16.37). In the DS planning board, graphical objects represent the different statuses of the scheduling of the planning objects, such as orders and operations. A work area can also be used to determine the resources and products and is defined in Transaction /SAPAPO/CDPSC3.

The user settings and the DS planning board profile settings determine the charts displayed in the DS planning board and also the availability and behavior of the scheduling and monitoring tools loaded into the DS planning board. Apart from the charts within the DS planning board, such as the **Resources Chart**, the **Product Chart**, and the **Product Stock**, you'll see a graphical representation of the network view of the orders as well as the pegging relationships among activities, operations, and orders (see Figure 16.37). On this screen, notice that you can **Reschedule** and **Deallocate** operations in similar ways as is possible with capacity requirements planning in SAP S/4HANA (Transactions CM21 and CM25), which is covered in Chapter 15.

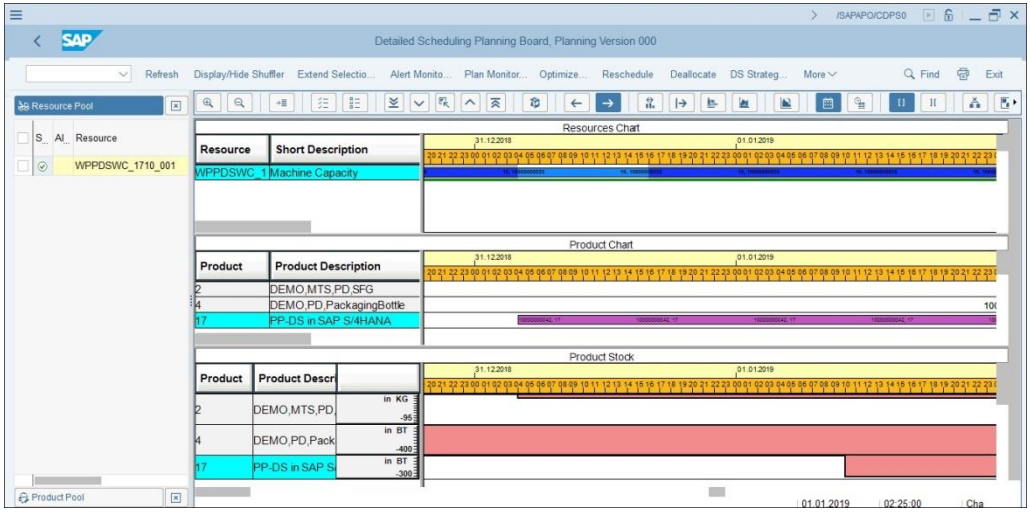


Figure 16.37 DS Planning Board

A DS strategy drives how the scheduler treats operations and orders. The scheduling mode, planning direction, and other parameters (e.g., the consideration of block planning and error handling) are defined in the strategy profile. Within the strategy profile, the parameters for dependent objects (the orders and operations that depend on other objects scheduled within

the DS planning board) are also defined, as shown in Figure 16.38.

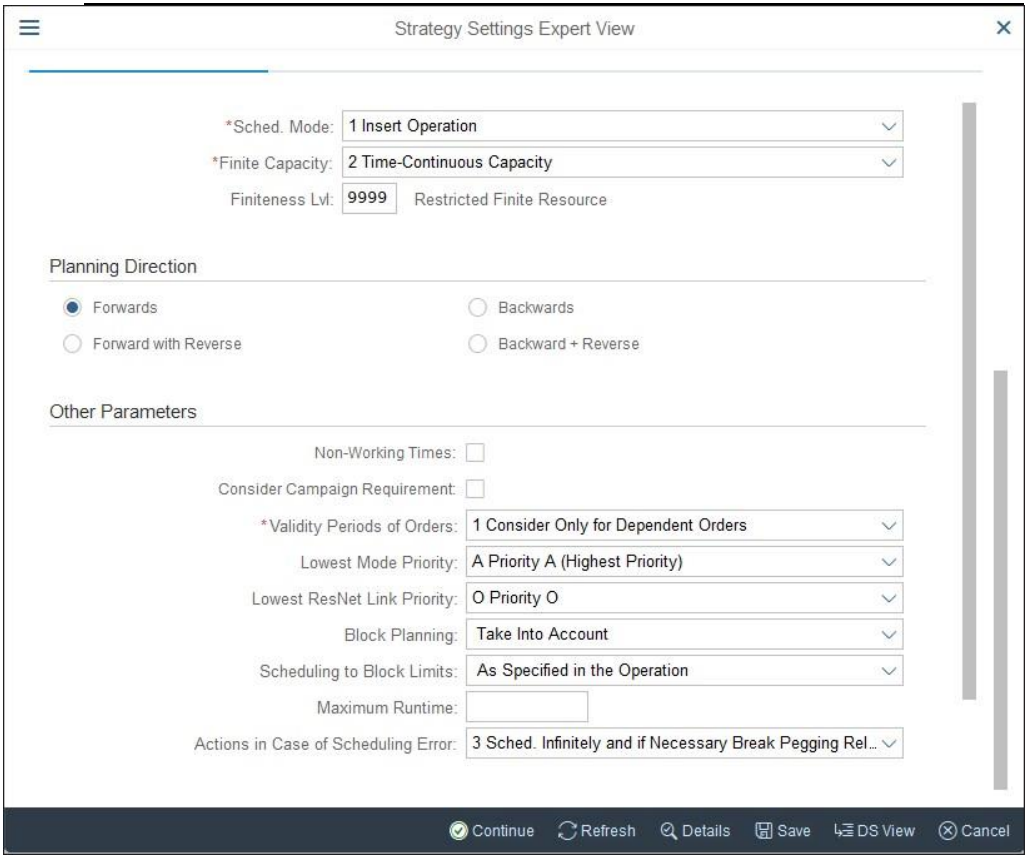


Figure 16.38 Strategy Settings

Tips & Tricks

When launching the DS planning board, the system generates a simulation version by copying the planning data from the current version. As a result, you can simulate multiple scheduling options; after a desirable scheduling situation is achieved, you can save the data to the current planning version. Simulation versions can be accessed via Transaction /SAPAPO/CDPSS0. These simulation versions can be processed further in both graphical and tabular options and can also be adopted into the active version.

16.5.3 Production Planning-Detailed Scheduling Optimizer

The PP-DS optimizer has specific properties that distinguish it significantly from the calculation procedure of heuristics. The solution of complex scheduling problems requires consideration of several constraints that the PP-DS optimizer is able to address. The effort needed to find an exact solution to the problem increases with the number of possible permutations. To put it more exactly, the effort needed increases by the factorial of the orders to be planned. In this case, even a small, two-digit number of orders to be planned would require hundreds of years of computer time to find an exact analytical solution. Therefore, the PP-DS optimizer uses selective procedures that lead to realistic computing times (in minutes)—but without a guarantee that the absolutely optimum solution for the problem has been found. From the set of possible solutions, it's very likely that some solutions are found by the PP-DS optimizer but not all of them. In comparison, a heuristic leads to exactly one solution. Using the same constraints, several optimization runs can produce different results. Based on these properties, it's clear that the computing time entered by the user as a termination criterion for the optimization run is extremely important. In general, the higher the amount of computing time, the higher the quality of the solution. However, the reverse isn't always true—more computing time isn't a guarantee for the improvement of a solution that has already been found.

The PP-DS optimizer isn't called as an independent transaction; instead, it's called from within corresponding applications. It can be called interactively in the DS planning board or product planning table. The PP-DS optimizer can also be run with specification of an optimization profile in the production planning run. The PP-DS optimizer in embedded PP-DS can't create orders, but other functionalities are supported. The PP-DS optimizer can be executed in the background in a production planning run (Transaction /SAPAPO/CDPSB1) or via interactive scheduling tools such as the DS planning board (refer to Figure 16.37).

To use the PP-DS optimizer and referring to Figure 16.37 again, click on **Optimize**. In the ensuing popup, enter the start and end dates of optimization horizon, and choose **Optimize** again to open the **PP/DS Optimizer** screen shown in Figure 16.39.

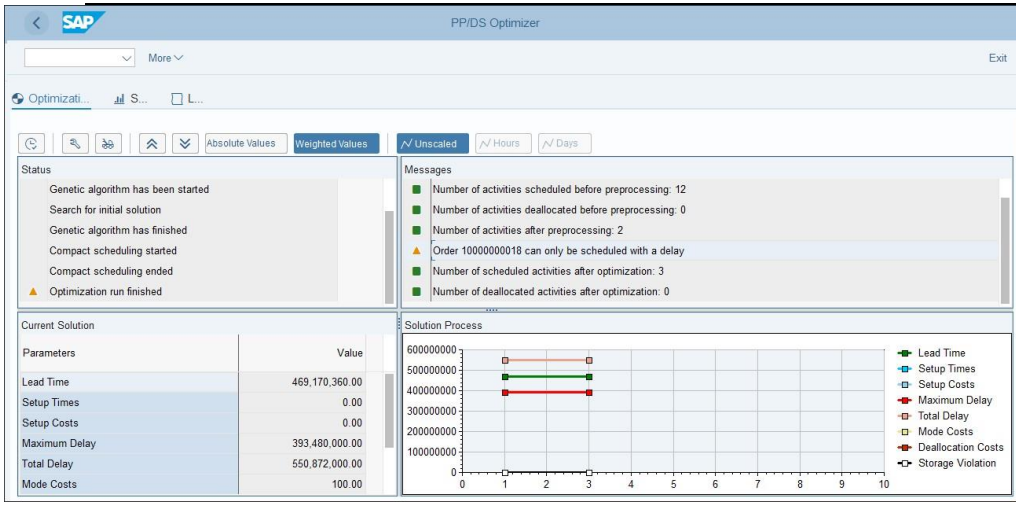


Figure 16.39 PP-DS Optimization Log

Before we discuss Figure 16.39 in detail, click on the **Optimization profile** icon (wrench) at the top of the screen to bring up the **Settings** box shown in Figure 16.40. Here, different information such as the total setup costs, the maximum delay costs, or the total mode costs can be maintained in relative terms. Various optimization settings can also be made in different tabs.

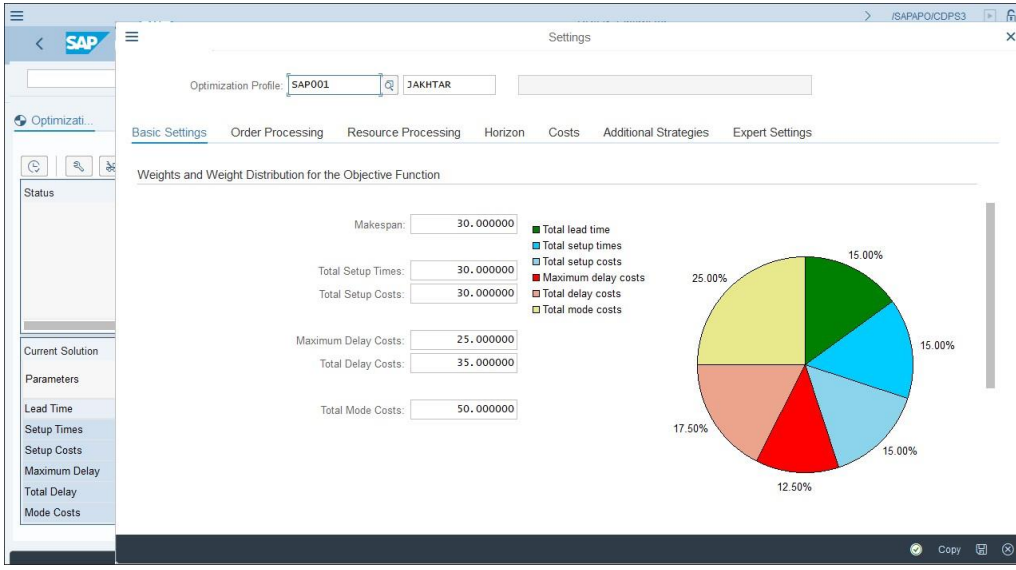


Figure 16.40 PP-DS Optimization Profile

You can select basic settings for the PP-DS optimizer through the optimization profile, by customizing the DS planning board or the product planning table, or using Transaction /SAPAPO/CDPSC5. When you start the PP-DS optimizer, you can adjust or change some of these basic settings based on the current planning situation (see Figure 16.40).

The PP-DS optimizer works based on costs, and therefore the objective of optimization is to minimize the overall production costs. This cost reduction is achieved with an *objective function* made up of individually weighted key figures. You can use the following weighting factors W_i (where $_i$= 1…6) to influence the orientation of optimization:

Production costs = (W_1 × Makespan) + (W_2 × Total of the setup times) + (W_3 × Total of the setup costs) + (W_4 × Maximum delay costs) + (W_5 × Total of the delay costs) + (W_6 × Total of the mode costs)

Now let's discuss the fields shown in Figure 16.40.

Makespan

Minimizing the *makespan,* or the overall lead time, aims at a maximum load on the optimized bottleneck resources in the short term. The system attempts to minimize the overall time needed to process orders and operations with consideration of the existing constraints.

Total Setup Times

Minimizing the total of the setup times is possible if the time needed to set up from one setup status to the next is dependent on exactly that sequence (setupstatus-dependent setup time with *dynamic setup*). In a paint shop, for example, the time required to set up from a dark color to a light one is likely longer than it is in the opposite direction. In such cases and in similar cases, an optimization objective can be to create an optimal sequence from the standpoint of the total of the required setup times. The result would be that the system summarizes the operations of similar setup statuses into blocks. Long setup times would then appear only when changing between two different setup statuses.

Total Setup Costs

Minimizing the total of the *setup costs* is necessary only when the system needs to have the costs and setup times described independently of each other. This can be the case when identical setup times differ on various resources in terms of costrelated evaluation and must therefore be decoupled from the setup time. Otherwise, the setup time criterion is sufficient.

Maximum Delay Costs

The PP-DS optimizer can penalize *delays* that occur in terms of the defined requirements date/time that lie within the optimization horizon with delay costs. Two approaches are available:

- Permit short delays in similar forms, which will help you avoid individual, significant delays, resulting in a minimization of the maximum delay costs.
- Formulate the total of the delays as a target value and calculate a minimum value across the overall delay for all orders. This approach doesn't exclude individual, obvious delays. In general, you can define delay costs as dependent on the order priority; you would use higher costs for sales orders with a higher priority. This approach should help to avoid delays for high-priority orders.

Total Delay Costs

This is the cost of delayed production and enables planners to decide which materials need to be produced first so as to minimize the associated costs.

Total Mode Costs

Mode costs penalize the frequent (via fixed costs) and long-lasting (as defined with variable costs) use of alternative work centers. The alternative work centers must already be available in the system in master data and contained in the propagation range. You can link them to optimization via *alternative modes*.

Trade-offs

It should be obvious that optimization usually works between somewhat contradictory constraints and different interests, such as sales interests and production interests. This is referred to as a *trade-off*.

It's also clear that the influencing factors have somewhat different natures (costs and times) and therefore possess different physical units. To enable a comparison of the individual totals within the formula for calculating the production costs, costs are converted into times. The following rule applies here: a standardized cost of 30 corresponds to 30 seconds.

Referring to Figure 16.39 again, it provides information on the quality of the solution that has been found both during and after successful optimization. The three charts shown here display information on the status of the optimization messages, the values of the related optimization parameters (including deallocation costs), and the solution process over time in a graphic (see Figure 16.39). From this evaluation view, you can use a button to view the parameters of the optimization, to change the parameters set by the optimization profile to some extent, and to start optimization (or restart it) interactively.

To start the PP-DS optimizer, click on the **Start Optimization Run** icon (the clock or the execute icon) at the top left-hand side of Figure 16.39 , and the system will start generating messages as shown in the top right-hand side of the screen. Notice that the optimization run shows that order 10000000018 can only be scheduled with a delay. The two bottom-half sections show the numerical as well as the weighted values of the optimized solution. Click on the **Disp. Solution** tab located on top left-hand side of Figure 16.39 to open the results screen shown in Figure 16.41.

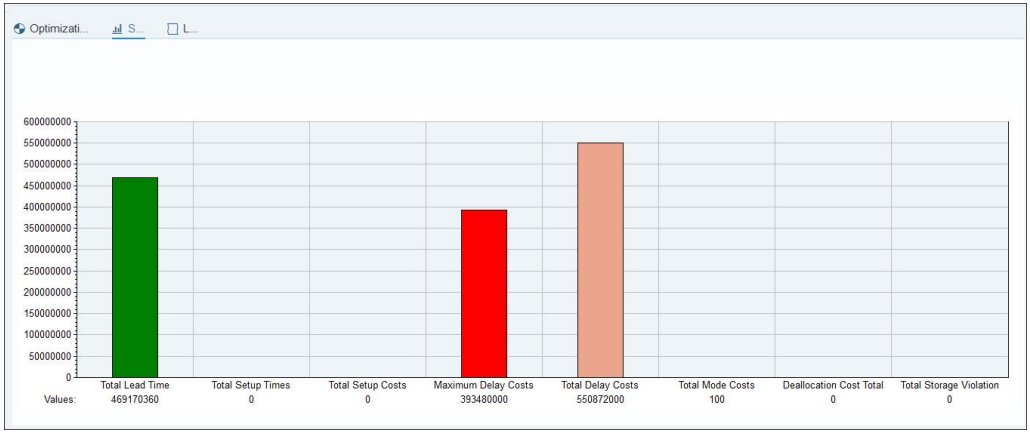


Figure 16.41 PP-DS Optimizer Results

Figure 16.41 is the graphical representation of the results of the PP-DS optimization run and shows the associated total delay costs (the tallest bar) due to a delayed start of order 10000000018. It's possible to carry out more optimization runs if needed. Alternatively, make changes to the settings in Figure 16.40 and then rerun the PP-DS optimizer.

Next, in the following sections, we'll cover some of the PP-DS reporting tools, including two new SAP Fiori apps.

16.6 Reporting and Monitoring Apps

Scheduling reports for PP-DS orders, operations, and resources can be accessed from Transaction /SAPAPO/CDPS_REPT. In these reports, the selection criteria are globally restricted by the planning version, time profile, or evaluation start and end dates. Based on the type of evaluation you select, you may be prompted to define more filters. For example, if you choose **Resource Utilization** in the **Evaluation List** area (see Figure 16.421), you'll be

prompted to make further selections for resources, periods, and views in the **Resource and Period Selection** dialog box 2.

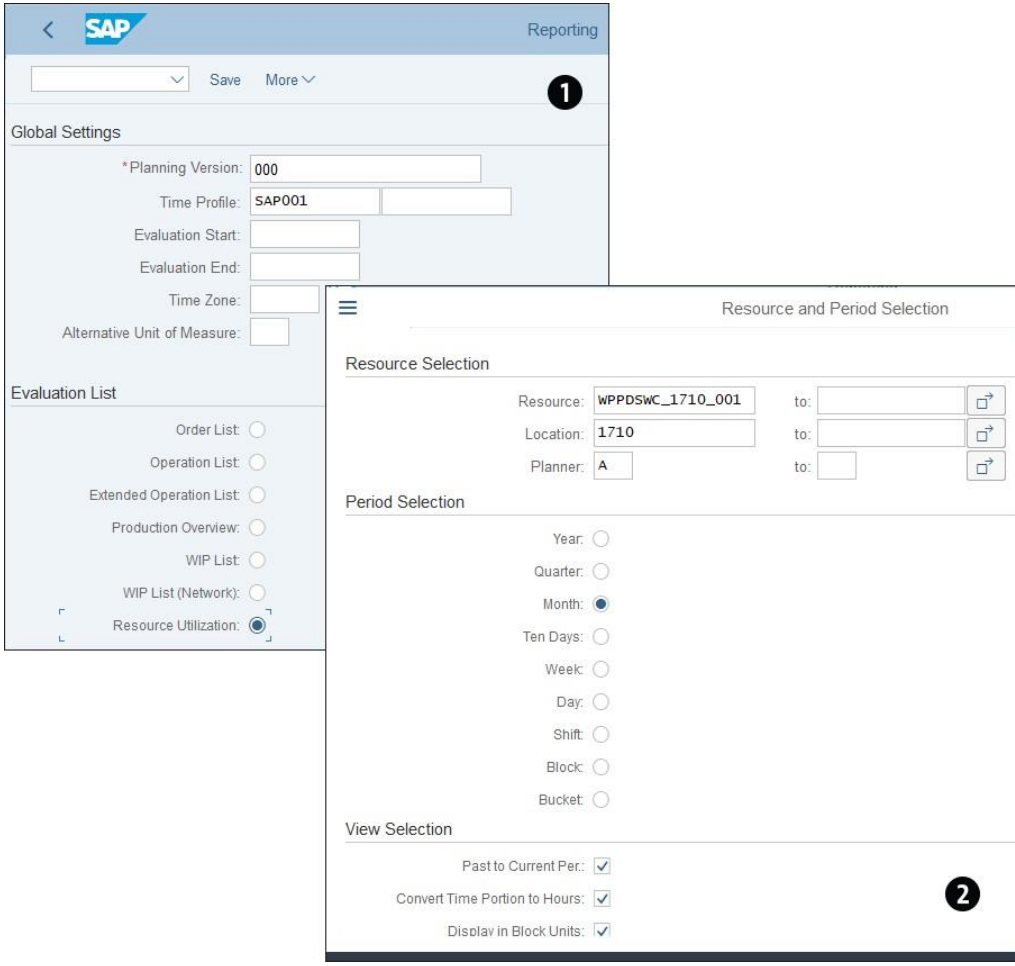
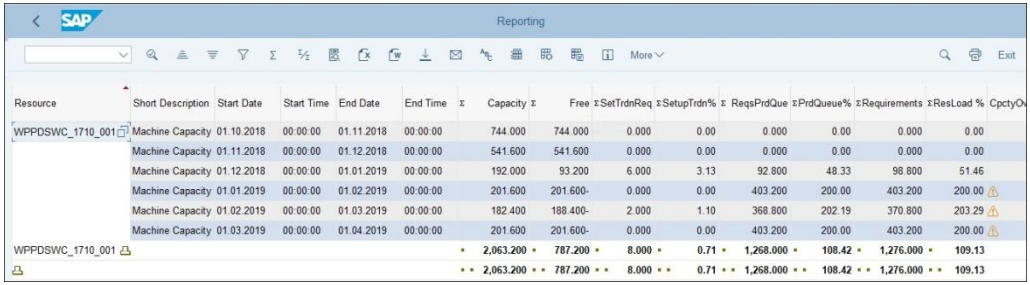


Figure 16.42 Parameters Selection Screens of Reporting

Figure 16.43 shows the month-wise capacity availability and its utilization of the **Resource** "WPPDSWC_1710_001". Notice the three alerts for capacity overloads shown in the last column of Figure 16.43.



Resource	Short Description	Start Date	Start Time	End Date	End Time	Capacity	Free	SetTrdnReq	SetupTrdn%	ReqsPrdQue	PrdQueue%	Requirements	ResLoad %	CpctyO
WPPDSWC_1710_001	Machine Capacity	01.10.2018	00:00:00	01.11.2018	00:00:00	744.000	744.000	0.000	0.00	0.000	0.00	0.000	0.00	
	Machine Capacity	01.11.2018	00:00:00	01.12.2018	00:00:00	541.600	541.600	0.000	0.00	0.000	0.00	0.000	0.00	
	Machine Capacity	01.12.2018	00:00:00	01.01.2019	00:00:00	192.000	93.200	6.000	3.13	92.800	48.33	98.800	51.46	
	Machine Capacity	01.01.2019	00:00:00	01.02.2019	00:00:00	201.600	201.600-	0.000	0.00	403.200	200.00	403.200	200.00	
	Machine Capacity	01.02.2019	00:00:00	01.03.2019	00:00:00	182.400	188.400-	2.000	1.10	368.800	202.19	370.800	203.29	
	Machine Capacity	01.03.2019	00:00:00	01.04.2019	00:00:00	201.600	201.600-	0.000	0.00	403.200	200.00	403.200	200.00	
WPPDSWC_1710_001						2,063.200	787.200	8.000	0.71	1,268.000	108.42	1,276.000	109.13	
						2,063.200	787.200	8.000	0.71	1,268.000	108.42	1,276.000	109.13	

Figure 16.43 PP-DS Reporting

In the following sections, we'll discuss three SAP Fiori apps of PP-DS—two of which are relevant to the production and capacity planning, while the third helps with an efficient procurement process.

16.6.1 Production Scheduling Board

The SAP Fiori app Production Scheduling Board is not only a report but also an interactive planning app that lists capacity requirements for each resource and where change to the operations schedule can be done interactively. Figure 16.44 shows all the operations assigned to resource "WPPDSWC_1710_001" within the time frame defined by the time profile. The time profile defines the start and end dates for the planning and display periods. The two dropdowns, **Scheduling** and **Order**, enable interactive production planning, scheduling, and operations management.

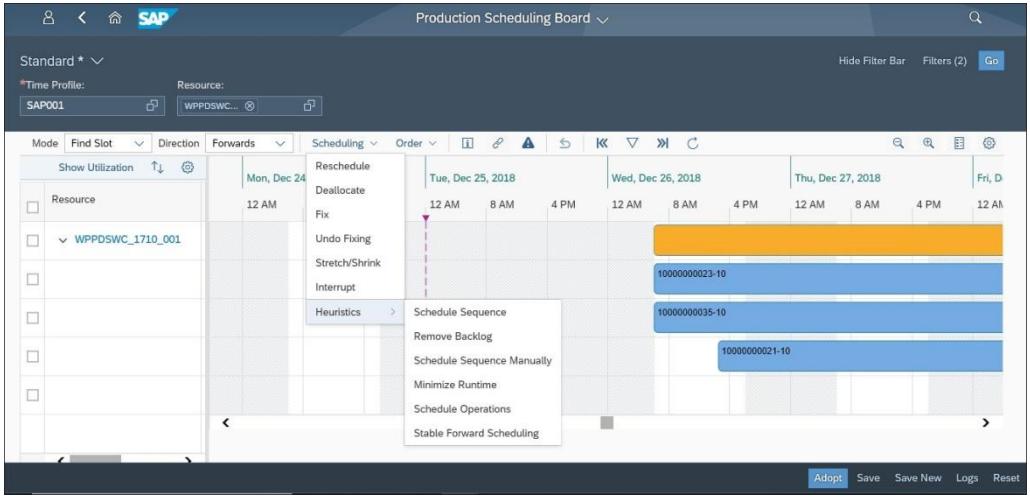


Figure 16.44 SAP Fiori App: Production Scheduling Board

Tips & Tricks

A new time profile can be configured and assigned to the user under the **Apps for Material Requirements Planning** folder located in the **Advanced Planning** configuration. The **Resource** and **Time Profile** are displayed as filters by default; however, by choosing the **Filters** button in the top right, you can add more filters, such as filtering by plant, planner, version, or product.

Within the Production Scheduling Board app, you can drag and drop operations to achieve the desired scheduling, or you can simply run a PP-DS heuristic and let the system automatically optimize the operation scheduling. The following heuristics are supported within the SAP Fiori app:

SAP001 - Schedule Sequence

SAP002 - Remove Backlog

SAP003 - Schedule Sequence Manually

SAP004 - Minimize Runtime

SAP005 - Schedule Operations

SAP_DS_01 - Stable Forward Scheduling

SAP_DS_02 - Enhanced Backward Scheduling

SAP_DS_03 - Change Fixing/Planning Intervals

SAP_DS_04 - Activate Seq.-Dependent Setup Activities

Within the SAP Fiori app, you can also create (using a template), change, or delete orders; check logs/alerts; and adopt, save, or reset results. However, campaign planning, block planning, creating downtimes, and fixing intervals aren't supported within the Production Scheduling Board app.

16.6.2 Monitor Capacity Utilization

Embedded PP-DS also offers SAP Fiori app Monitor Capacity Utilization. When you first access one of these SAP Fiori apps, you'll be prompted to select an **Area of Responsibility**, a combination of plant and planner.

The Monitor Capacity Utilization app provides a quick overview of the capacity utilization for all the resources within the selected area of responsibility. A graphical display of the resource capacity utilization within the **Evaluation Horizon**, which is 28 days by default, can be extended up to 26 weeks. The **Evaluation Profile** defines which elements will be considered for the capacity utilization assessment and the percentage of underutilization and full utilization (see Figure 16.45). Select the resource "WPPDSWC_1710_001" in Figure 16.45, and click on the **Navigation** icon located on the far right-hand side of the screen.

Note

This area of responsibility isn't the same as the one defined for MRP SAP Fiori apps, and the planner here isn't the same as the MRP controller. This planner is assigned to a PP-DS resource.

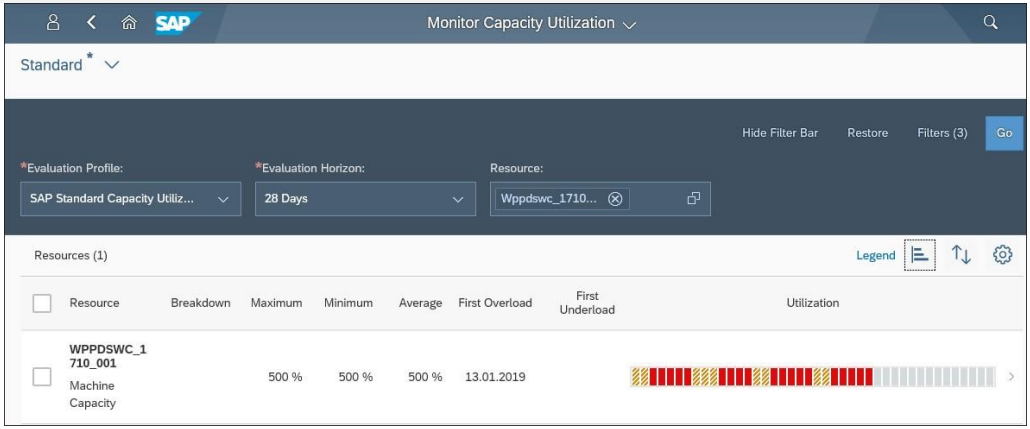


Figure 16.45 Monitor Capacity Utilization app

The detailed screen appears of resource "WPPDS_WC_1710_001" in a graphical form (Figure 16.461). Notice the **Operation Issues** column showing scheduling or material availability (missing parts) alerts 2. Further, if you click on **Edit** located on the top right-hand side of the **Capacity Utilization** screen 2, you can manually adjust the operations dates and other details of an individual order.

Tips & Tricks

It's possible to configure a new evaluation profile and assign the profile to a user under the **Apps for Material Requirements Planning** folder in the **Advanced Planning** configuration.

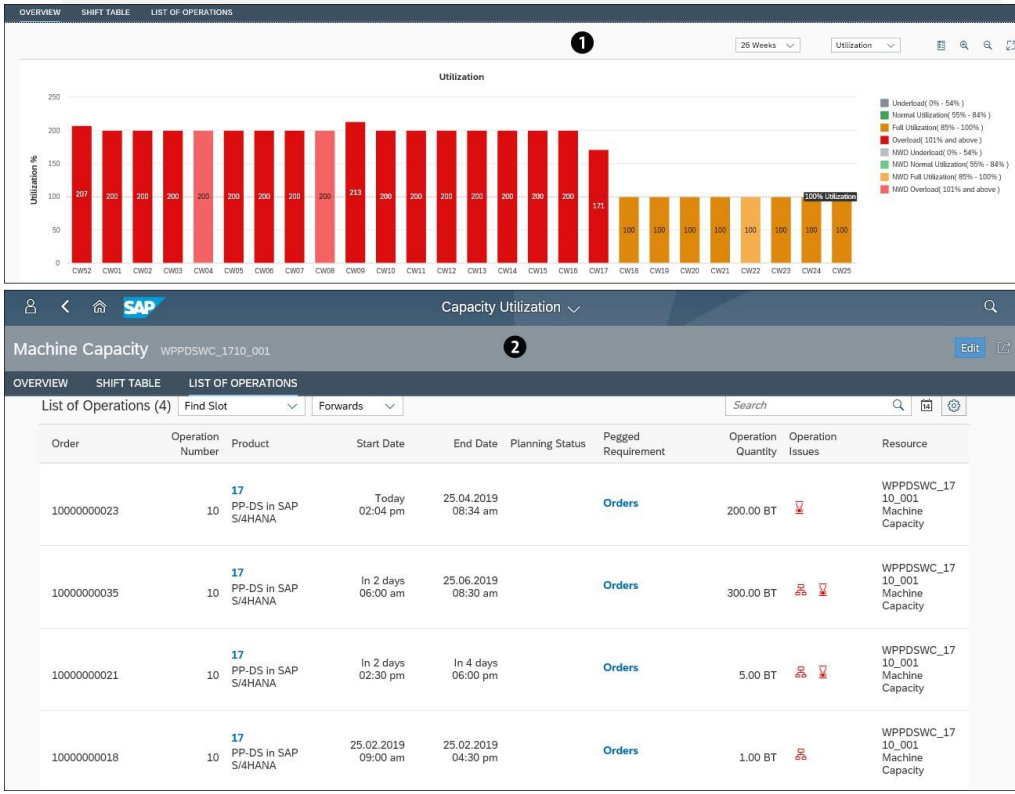


Figure 16.46 SAP Fiori App: Monitor Capacity Utilization

16.6.3 Create Optimal Orders for Shipment

Recall that in the beginning of this chapter, material/product "17" included the externally procured component "4". The SAP Fiori app Create Optimal Orders for Shipment can be used to identify shortages and to generate POs to cover these shortages (see Figure 16.47). In addition, visibility of other material shortages supplied by the same vendor is also available. It's possible to create optimal orders, which will maximize transport utilization and reduce transport costs. The **Order Date** column shows the date when a material is required (i.e., the shortage date), while under the **Stock Availability** column, you'll see a graphical overview of the material shortages. Under the **Create Order** column, for all those

materials with an external source of supply defined (e.g., an info record or contract), you have the option of creating a PO to replenish this material only or to create an order to replenish all the materials supplied by the same vendor.

Tips & Tricks

To define shortages, create a new shortage profile via Transaction OSDM1, and assign the shortage profile to a user via Transaction OSDM2.

If you choose the option of ordering several materials in any one of the materials with shortage, a screen will appear showing all the materials with shortages that are supplied by the same vendor. On this screen, you can define a capacity limit for the shipment. Then, by clicking the **Propose Quantities** button in the lower-right corner, the system will propose replenishment quantities, trying to clear the shortages while respecting the capacity limit.

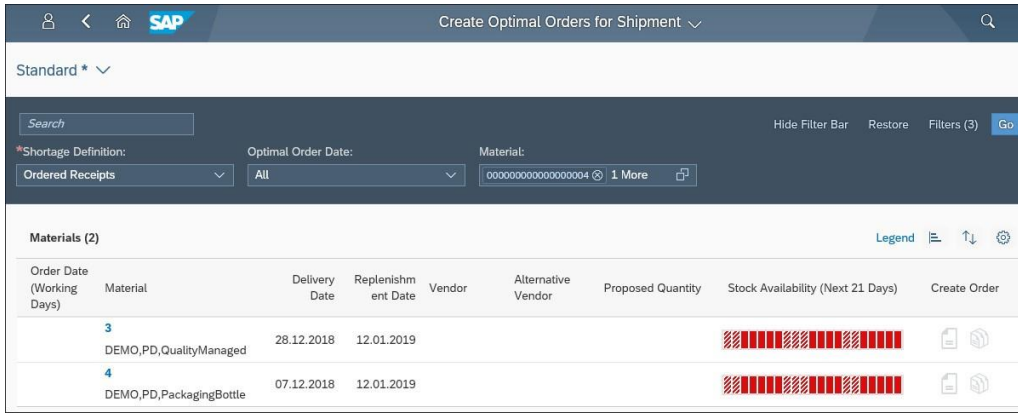


Figure 16.47 Optimal Order for Shipment

The next section discusses alert monitor in PP-DS.

16.7 Alert Monitor

The alert monitor in PP-DS is a tool that you can use during planning to manage and evaluate exception messages centrally. Messages about problems are transferred automatically from the application to the alert monitor. Each exception message relates to a specific problem situation. The primary task of the alert monitor is to list exception

messages in a structured manner. The messages correspond to the defined selection criteria. The alert monitor provides information on situations that require adjustments in planning. Note the distinction between the reason for the exception and its properties. Using exception messages, the alert monitor can provide general information on the problem situation itself but not necessarily on why the exception occurred.

Let's first discuss the how to set up the alert monitor before showing how it works in planning and scheduling.

To create a new alert monitor profile, use Transaction /SAPAPO/AMON1, and click **Alert Profile** on the initial screen. Figure 16.48 shows the **Alert Profile** "PPDSS4HANA" in which checking the relevant checkboxes in the **Selection** column will trigger relevant alerts. You can also define ranges or specific values so that the system brings up information, warning, or error alerts on meeting the specified values. In this example, the **Alert Type Product too early (fixed pegging)** shows alert thresholds for information, warning, and error alerts.

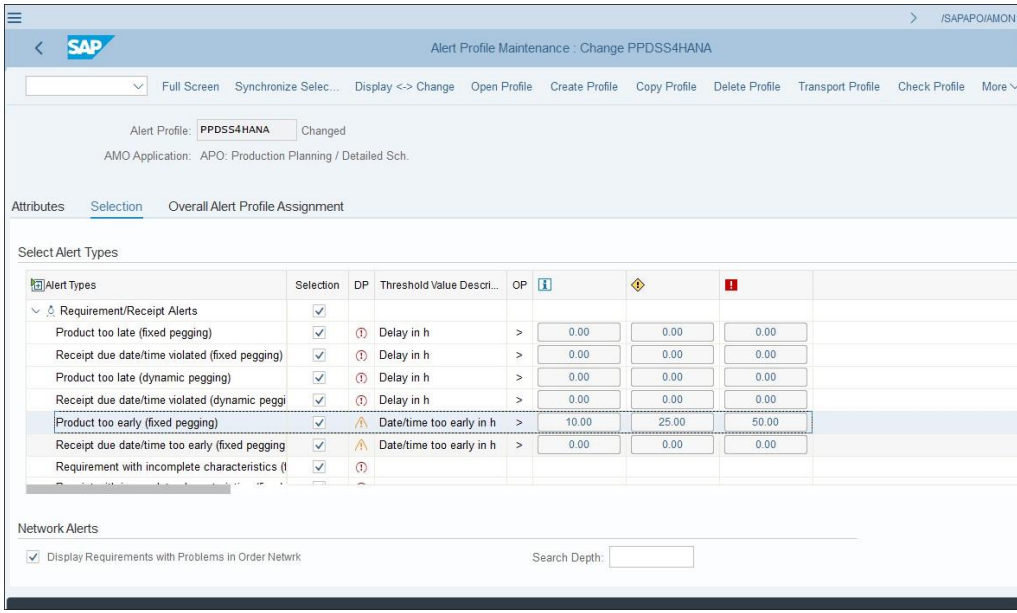


Figure 16.48 Alert Profile Maintenance

Note

After creating an alert profile, assign it to an overall profile so that the system is able to display alerts within an application (refer to Figure 16.27 to see how the defined **AlertProfile** "PPDSS4HANA" in Figure 16.48 is assigned to the **User Settings**).

Figure 16.49 is accessed via Transaction /SAPAPO/RRP3 (Product View) followed by clicking on the **Alert Monitor** icon. Notice a large number of error, warning, and information alerts in the top half of the screen. On clicking the relevant checkbox in the **Selection** column, details of each alert are displayed in the lower half of the screen. For this example, the resource "WPPDSWC_1710_001" has two error and six information alerts.

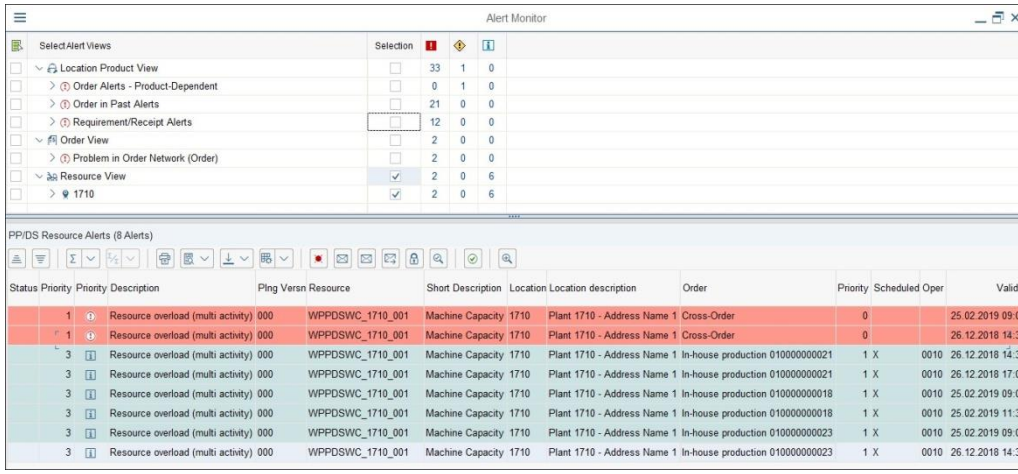


Figure 16.49 Alerts in Transaction /SAPAPO/RRP3

Note

Because the alert monitor tool is also available in several planning and execution functions in PP-DS, be sure to use it for better production or procurement planning.

The next section covers the plan monitor tool available in PP-DS.

16.8 Plan Monitor

The plan monitor evaluates the key figures for a plan in relation to specific objects, versions, and periods, and then assigns scores to the results. You can define your own

calculation rules, according to which the scores are to be calculated, or you can use standard aggregations (e.g., sum or mean value).

The plan monitor can be used to do the following:

Determine the quality of the current planning situation.

Compare various planning and simulation versions with each other.

Compare planning over different periods.

The plan monitor considers the key figures for which you've created key figure variants in the key figure schema. These key figures can be displayed in a tabular or graphical version, or both.

For example, a production planner plans in a three to four week horizon but is faced with new expectations every day that impact many areas of the plan over the upcoming weeks. Here, the plan monitor can help.

Key figures in the following areas of the plan monitor are available:

Key figures for order quantities

Key figures for order times

Key figures for pegging relationships

Key figures for stocks

Key figures for resources

Let's see how to put the plan monitor to use in a step-by-step way:

1. In the initial screen of Transaction /SAPAPO/PMON, choose **Definition: Key Figures Schema** to open the screen shown in Figure 16.50.
2. In the **General** tab, maintain initial details such as **Key figure schema**, which, in this example, is, "PPDSS4HANA", and add a short description.
3. In the **Display** area, choose relevant display options, such as to only display the grid, the graphic, or both. Choose whether individual values in the graphic can be displayed by checking the relevant checkbox.
4. Click on the **Key Figures** tab.
5. In the screen that appears (see Figure 16.51), first select the **Key Figure cat.** (category) from the dropdown (in this example, **9032 Orders: Quantities**) followed by choosing the relevant key figure (**Real open order quantity**). The lower left-hand side offers available calculations, such as using minimum, maximum, or average values of key figures.

Key figures can be displayed individually or collectively by choosing relevant options in the **Display area**. Further, you can check the correctness of a defined key figure by clicking the **Check** button before choosing **Adopt**.

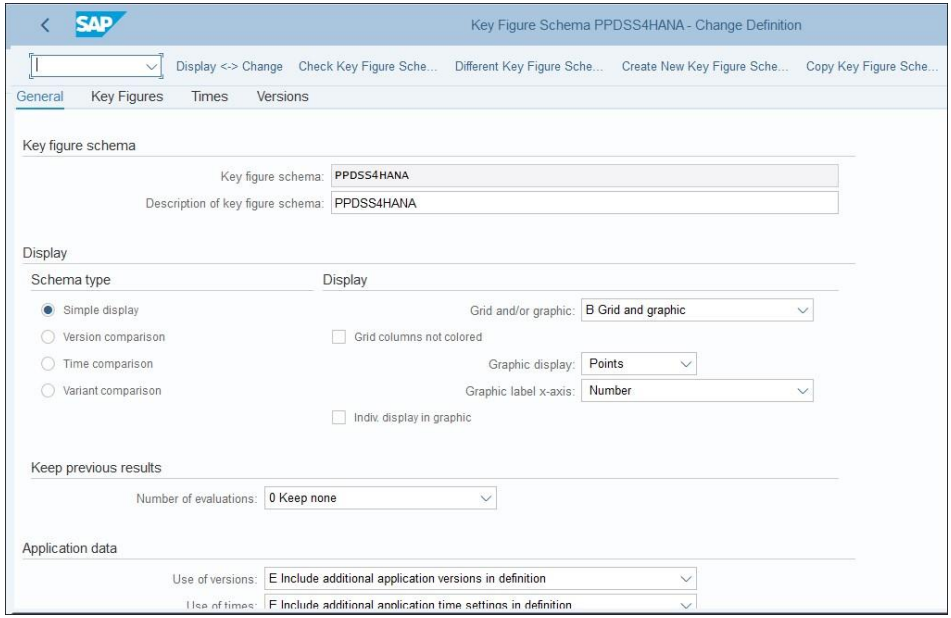


Figure 16.50 Key Figure Schema in Plan Monitor

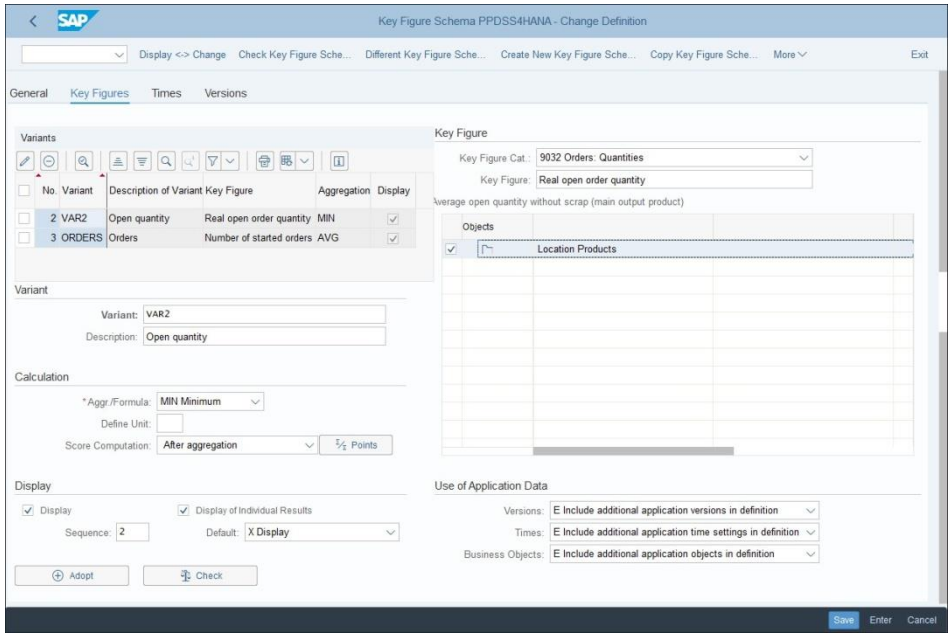


Figure 16.51 Key Figures in the Plan Monitor

6. Each key figure can be saved as an individual variant, and, in this example, twovariants **VAR2** and **Orders** are created for two different key figures. Be sure to select the **Location Products** checkbox on the right-hand side of the screen.
7. Click on the **Times** tab.
8. In the screen that appears (Figure 16.521), maintain the start and end of the evaluation horizons in the lower half so that the system displays key figures within the defined horizon.
9. Choose the **Versions** tab in Figure 16.521, and maintain the planning and the simulation versions as shown (see Figure 16.522). Save your settings.

Tips & Tricks

You can check the completeness and correctness of the defined key figure schema by choosing **Check Key Figure Schema** in the top menu bar of Figure 16.51.

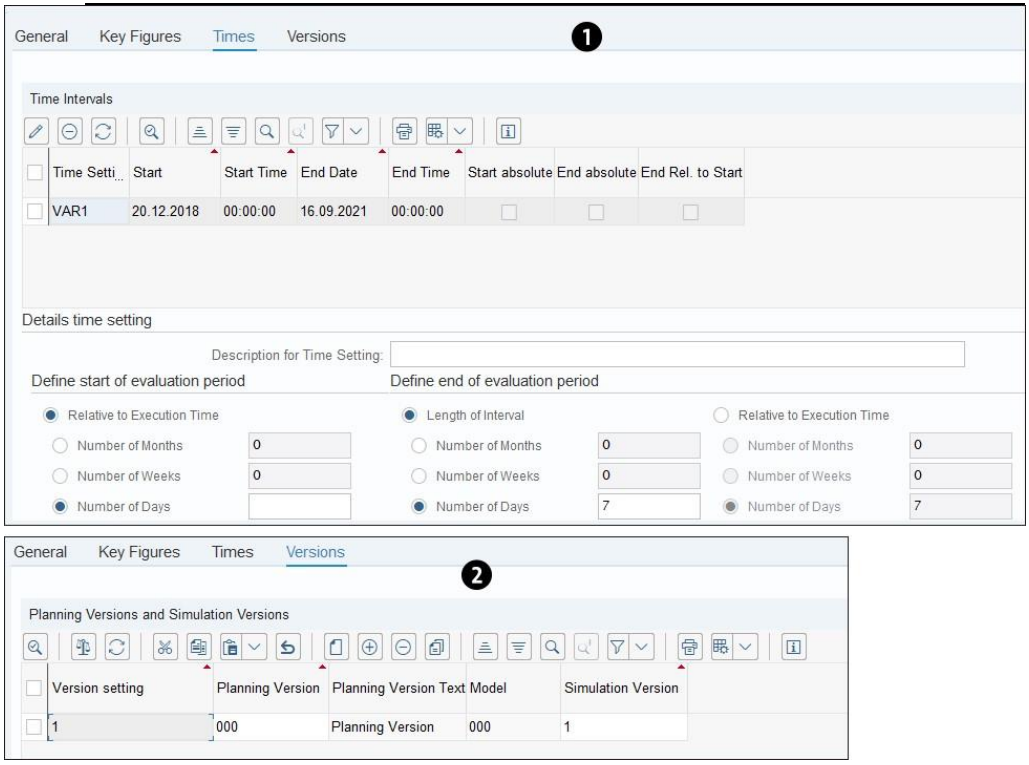


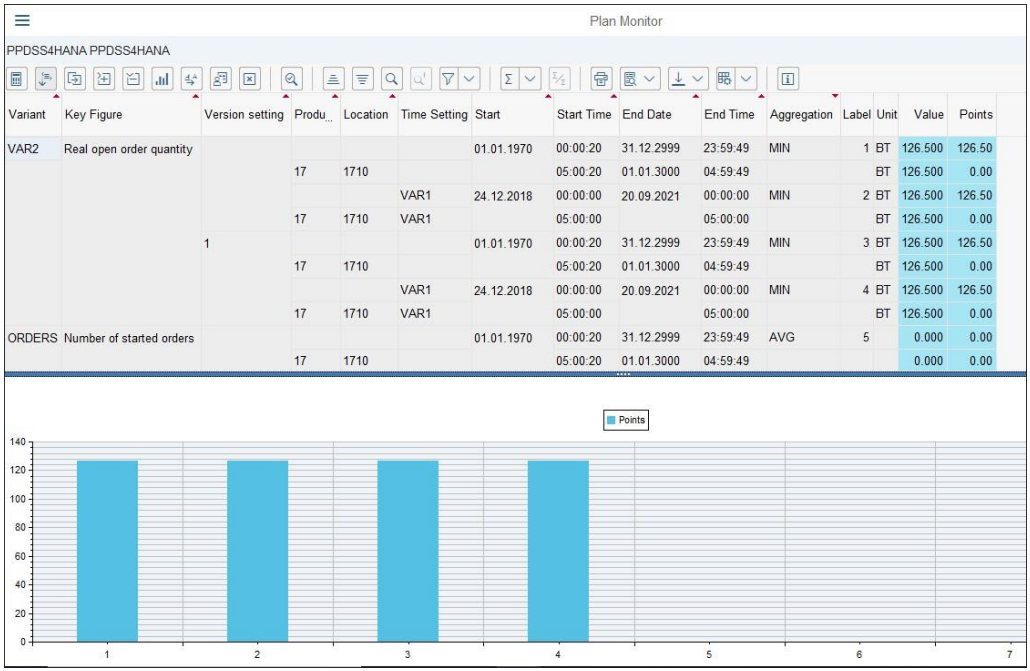
Figure 16.52 Times and Versions Setting in the Plan Monitor

Note

After creating the key figure schema, be sure to assign it to an overall profile so that the system can display the schemas within an application (see Figure 16.27 to see how the **Key Figure Schema P. Monitor** field is assigned the just-created key figure schema "PPDSS4HANA" in the **User Settings**).

10. Now, access the product view of product "17, plant "1710" and version "000" viaTransaction /SAPAPO/RRP3.
11. Click on the **Plan Monitor**, and the **Plan Monitor** screen shown in Figure 16.53 will appear in a separate window (a popup).

Here, you can see the two variants **VAR2** and **ORDERS** that were previously created as well as the associated values of the two key figures. Further, because the grid and graphic option were chosen, the lower half of the screen shows the corresponding graphic.



Variant	Key Figure	Version setting	Produ...	Location	Time Setting	Start	Start Time	End Date	End Time	Aggregation	Label	Unit	Value	Points
VAR2	Real open order quantity					01.01.1970	00:00:20	31.12.2999	23:59:49	MIN	1	BT	126.500	126.50
			17	1710			05:00:20	01.01.3000	04:59:49			BT	126.500	0.00
					VAR1	24.12.2018	00:00:00	20.09.2021	00:00:00	MIN	2	BT	126.500	126.50
			17	1710	VAR1		05:00:00		05:00:00			BT	126.500	0.00
		1				01.01.1970	00:00:20	31.12.2999	23:59:49	MIN	3	BT	126.500	126.50
			17	1710			05:00:20	01.01.3000	04:59:49			BT	126.500	0.00
					VAR1	24.12.2018	00:00:00	20.09.2021	00:00:00	MIN	4	BT	126.500	126.50
			17	1710	VAR1		05:00:00		05:00:00			BT	126.500	0.00
ORDERS	Number of started orders					01.01.1970	00:00:20	31.12.2999	23:59:49	AVG	5		0.000	0.00
			17	1710			05:00:20	01.01.3000	04:59:49				0.000	0.00

Figure 16.53 Plan Monitor

Note

To learn more about PP-DS in SAP S/4HANA, visit *http://bit.ly/PP-DSS4HANA*. In addition, refer *Production Planning with SAP APO* (*www.sap-press.com/3927*, SAP PRESS, 2016).

16.9 Summary

In this chapter, we covered important configuration, master data, business processes, and reporting of PP-DS in SAP S/4HANA. The PP-DS optimizer attempts to maintain a balance between costs and benefits for producing or not producing products and where trade-offs are necessary. The user-defined alerts in the alert monitor and monitoring key figures in the plan monitor keep various checks and balances in place for a smoother production and procurement planning. SAP Fiori apps for PP-DS not only report dashboards but also enable intuitive planning.

The next chapter discusses the Early Warning System (EWS) that enables userdefined alerts in SAP S/4HANA and is quite similar in functionality to the alert monitor covered in this chapter; however, the alert monitor is specific to PP-DS only.

PART V

Monitoring and Evaluating Production Planning

Chapter 17

Early Warning System

The Early Warning System informs you whenever any deviation or exception to an important business process occurs, allowing you to take timely action to optimize and monitor your business processes.

The Early Warning System (EWS) is built on the same SAP S/4HANA's logistics information structures as other standard analysis tools and reports, with added flexibility that allows you to monitor and receive alerts for only the specific exceptions that are important to your business processes. It provides real-time updates and can be tailored to individual needs without the involvement of any custom ABAP development.

EWS is delivered as part of the logistics functionality and can provide alerts to individual business process owners in all of the logistics functions, such as the logistics information system (LIS), shop floor information system, purchasing information system, and plant maintenance information system. The alerts help business process owners quickly make important decisions or take actions as deemed necessary.

In this chapter, we'll explain the benefits of EWS, and then provide the steps you need to get it up and running in your system.

17.1 Overview

There are many instances in production planning (PP) where EWS can come in handy, depending on what is important to the business. In this chapter, you'll learn how easy and intuitive it is to set up EWS by following the steps in logical and sequential order. If the business requirements change at any time, you can make changes or even delete the EWS that you had set up.

Some examples of where you can use EWS are listed here:

When you record production scrap at greater than 5% of total production When sales figures show a decreasing trend for a high-running, high-profit item for the past three months

When quality specifications of an important raw material are out by more than 3%

When a vendor continues to make late deliveries of critical components

When inventory of precious metal exceeds a certain value

In any of these situations, you can configure EWS to the individual exception so you'll receive alerts and can react immediately. While you can set up EWS in any of the logistics areas, we use an example in PP. The relevant information structures available for PP are listed in Table 17.1.

Information Structure	Description
S021	Production order
S022	Operation
S023	Material
S024	Work center
S025	Run schedule header
S026	Material usage
S027	Product costs
S028	Reporting point statistics
S029	Kanban
S225	Goods receipts (GR): Repetitive manufacturing
S226	Material usage: Repetitive manufacturing
S227	Product costs: Repetitive manufacturing

Table 17.1 Standard Information Structures Available for Production Planning

Note

When EWS is set up in logistics, the relevant information structures are automatically made available by SAP S/4HANA. For example, if EWS is set up for use with the materials management (MM) functionality, all MM-related information structures become available.

Setting up EWS entails the creation of an exception by selecting the desired information structure from Table 17.1, followed by the characteristics and key figures. The requirements of each key figure need to be defined next, and, finally, you configure the follow-up function. In summary, the required steps are as follows:

1. Create an exception.
2. Group the exceptions.
3. Create a periodic analysis.

Note

If there are several exceptions from the same information structure, they can be combined to create a *group exception*, which is a list of individual exceptions. Like the first step, the follow-up function for this step involves determining whether an email alert to an individual suffices or if it should be communicated to the entire distribution list.

The third and final step is periodic analysis, in which you define the frequency with which the system monitors the exceptions and issues alerts. Let's move on to discuss the first step in the following section: creating an exception.

17.2 Exceptions

An *exception* is important data that you want to monitor from a business point of view. The sequence of steps in creating an exception is as follows:

1. Choose the characteristics.
2. Define the key figures.
3. Define the characteristics values.
4. Choose the requirements.
5. Define the requirements.

6. Define the follow-up processing.

For this example, we've created an exception in PP (shop floor), ZPP01, using the information structure S021 (production order). In exception ZPP01, we specified that the system should issue an alert whenever the material 30000038 has the following characteristics:

Shows a negative trend of planned versus actual quantity deviation

Exceeds actual scrap quantity of the material by 10 MT

Quantity of goods received against a production order less than 80 MT

If the system records an exception in the SAP system, we want a popup message to appear, highlight the exception in red in EWS reporting, and send an email message to SAP Inbox. In the following sections, we'll cover the steps you need to perform to set up EWS in SAP S/4HANA.

17.2.1 Set Up Exceptions

Use the menu path, **LogisticsLogistics ControllingShop Floor Information SystemEarly Warning SystemExceptionCreate**, or use Transaction MC=1 to set up the exception (see Figure 17.1). Follow the step-by-step process for creating exception ZPP01:

1. For this example, enter the **Exception** "ZPP01", a short description, and **Info structure** "S021" (info structure S021 corresponds to the production order).

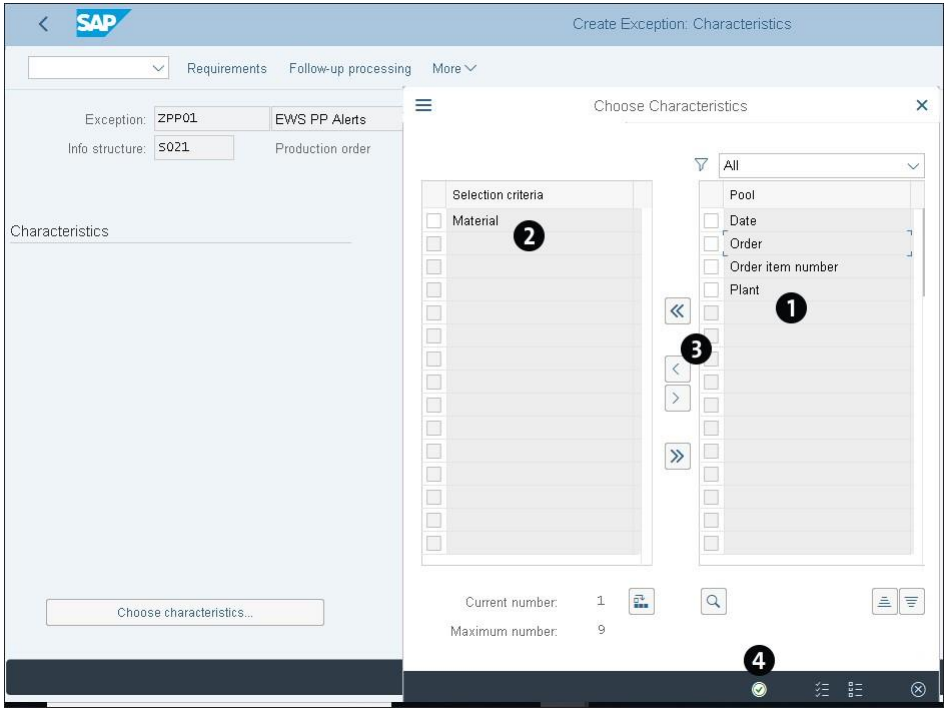


Figure 17.1 Characteristics Setup in EWS

2. In the selection screen, click **Choose characteristics** to select the characteristics on which you want to activate EWS.
3. In the popup screen that appears in Figure 17.11, move **Material**3 to the left column by choosing it from the available characteristics on the right-hand side column and clicking **Choose**2. Choose **Execute**4. You can choose more than one characteristics from the right-hand side column. The screen shown in Figure 17.2 appears.
4. For each characteristic in Figure 17.2, provide the corresponding value or a range from which to choose. Click the characteristic **Material**1, and click the **Charact. values**2 button at the top.
5. In the popup window that appears, enter the desired value or range for which thesystem should monitor EWS (Figure 17.2). For this example, enter "30000038" 3 for material. Choose **Copy** 4.

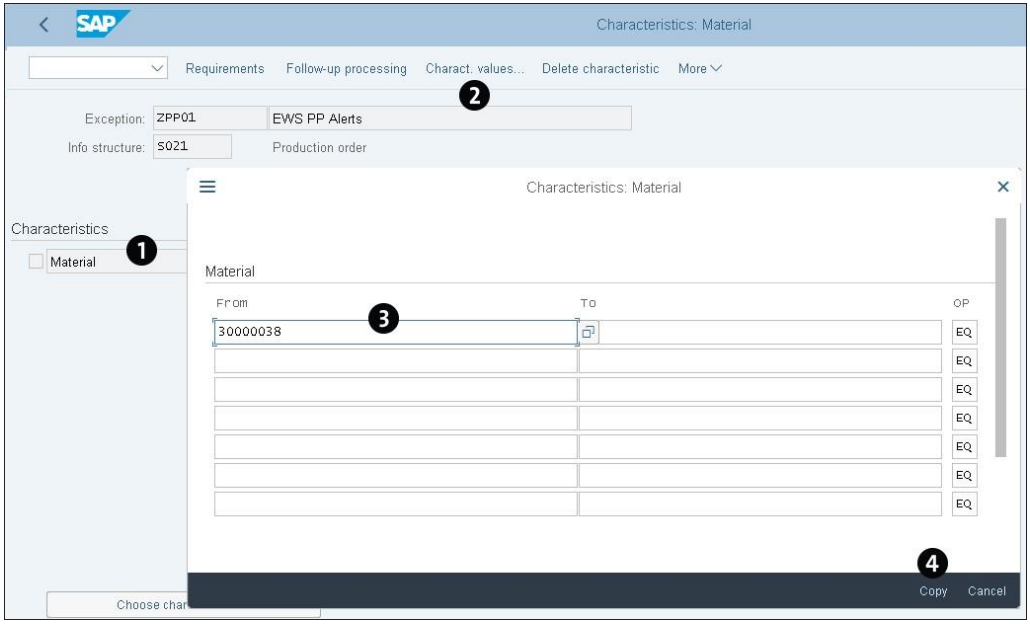


Figure 17.2 Characteristics Value for Material 30000038

Note

You can give a range of materials for EWS to monitor by filling out both the **From** and **To** fields in Figure 17.2. Alternatively, leaving these fields blank means EWS considers all materials in the alert.

17.2.2 Define Requirements

Now that the value for the characteristic material is defined, the next step is to define the requirements—that is, the information that you need EWS to monitor in day-to-day business processes. Select the **Requirements** button shown previously in Figure 17.2 to define requirements for the material.

For this example, choose three key figures for the material (Figure 17.3) by following these steps:

1. Define the **Period to analyze** fields 1, which stipulate the past and future periods on which the EWS must evaluate deviations. By defining **Previous periods** as "12", you

stipulate that all key figures for the past 12 months that meet the conditions must be considered during evaluation.

2. On the **Requirements** screen, click the **Choose key figures** button, and from the subsequent popup screen, select the key figures 3 that will form the basis of your EWS alerts. For this example, select the three key figures 3 by moving them from the right-hand side to the left-hand side 2.
3. Choose **Continue**4.

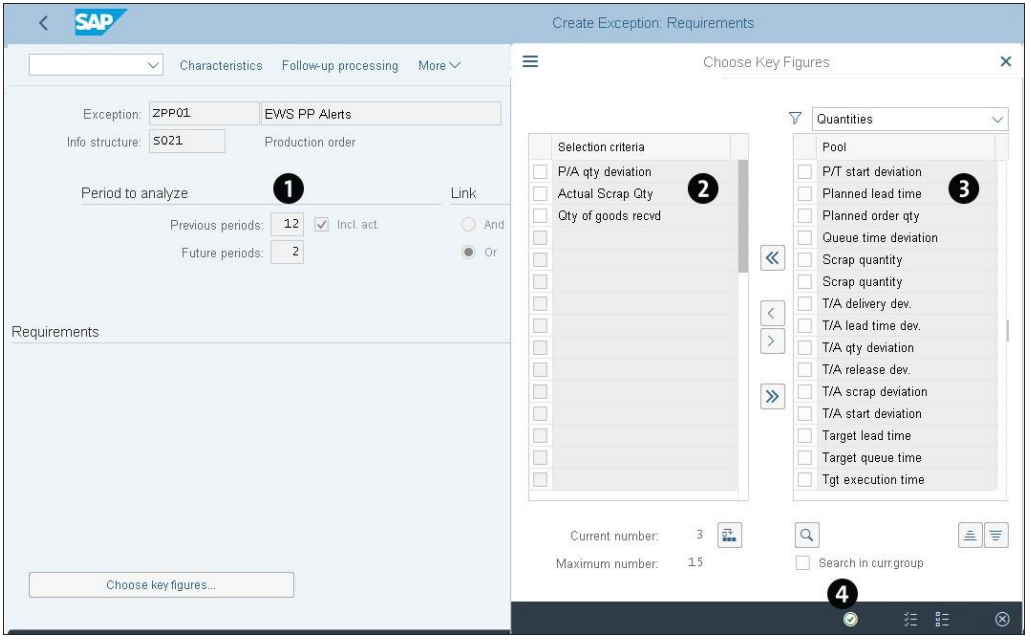


Figure 17.3 Key Figures for EWS

4. After selecting the key figures, click the **Define requirement** button to specify the limits or other details that form the basis for EWS alerts (Figure 17.4). The requirement has to be defined for each key figure. The options available are **Threshold val. anal.**, which requires a value to be specified, or **Trend analysis**, which is used to monitor positive or negative trends and requires you to specify the percentage of deviation in the trend.

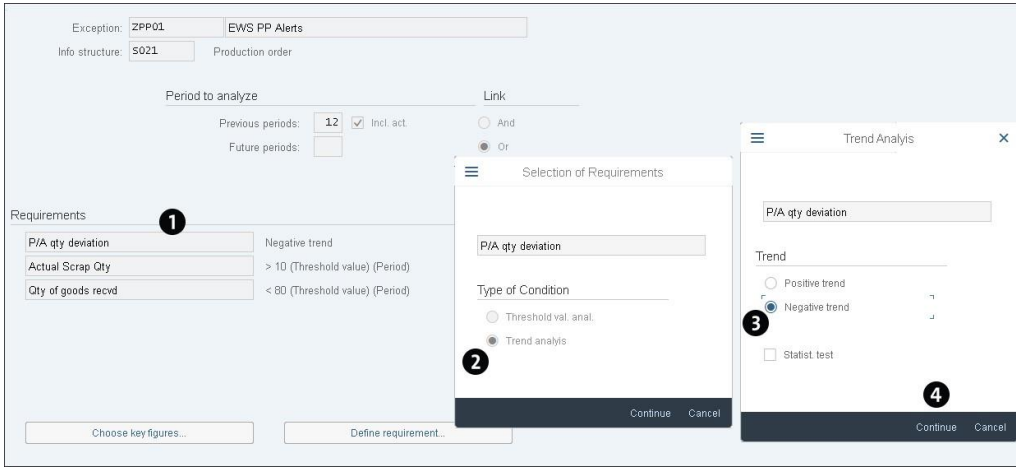


Figure 17.4 Define Requirements for Key P/A Qty Deviation

5. For the first key figure, **P/A qty deviation**1 in Figure 17.4, place the cursor on the key figure, and double-click it. Alternatively, you can also click on the **Define requirement** button, and a popup will appear.
6. In the popup window, select the **Trend analysis** radio button, and choose the **Continue** button. In the next popup window that appears, click the **Negative trend** radio button 3, and then choose the **Continue**4 button.
7. For the second key figure, follow the same steps as for the first key figure. Whenthe popup window appears, enter ">10" for **Actual Scrap Qty**, and then choose the **Continue** button.
8. Repeat the preceding step for the third key figure, **Qty of goods recvd**, with a threshold value of "<80".

Note

All other standard operands, such as less than, greater than, equal to, and not equal to, are available for use when setting threshold values.

Tip

Given that there are so many key figures available with similar names or descriptions while setting up EWS, it often gets confusing to choose the right key figure to ensure that an alert will be issued for deviation through EWS. For this example, the key figure **Actual Scrap Qty.** differs from its description in the confirmation screen, where it's mentioned only as **Scrap**. In such cases, you can ensure correct key figure selection in EWS through its technical names. In this example, the field name (technical) for scrap is XMNGA, and the field element is MC_XMNGA.

For example, you want to monitor scrap quantity during confirmation of an operation via EWS. To do so, and while in the confirmation (Transaction CO11N), place the cursor on the **Scrap** field and press (F1). The system will bring up the screen that explains what the field is all about and what business purpose it serves. Click on **Technical Information**, and you'll find the field name and data element that are specific to this field (in this example, it's scrap). Make a note of the technical information.

Back in the EWS setup and while choosing the key figure, place the cursor on the field that closely matches the description, and then press (F1). The system will bring up the screen that explains what the field is all about and what it's used for. Click on **Technical Information**, and there you'll find the field name and data element that are specific to this field. If this technical information matches with the details that you've previously noted down, then you've chosen the correct key figure. If not, continue the search for other key figures with similar names, and check their technical information until you find the right key figure.

17.2.3 Follow-Up Processing

The next step in defining an exception is to define the follow-up processing—that is, what and how the EWS informs you that an exception has occurred. For this example, select the **Follow-up processing** button to bring up the screen shown in Figure 17.5. Here we've specified that whenever the exception ZPP01 occurs, the details are to be marked in red and sent as a table to the entered mail recipient. Further, the same needs to be communicated by email to the corresponding SAP Inbox.

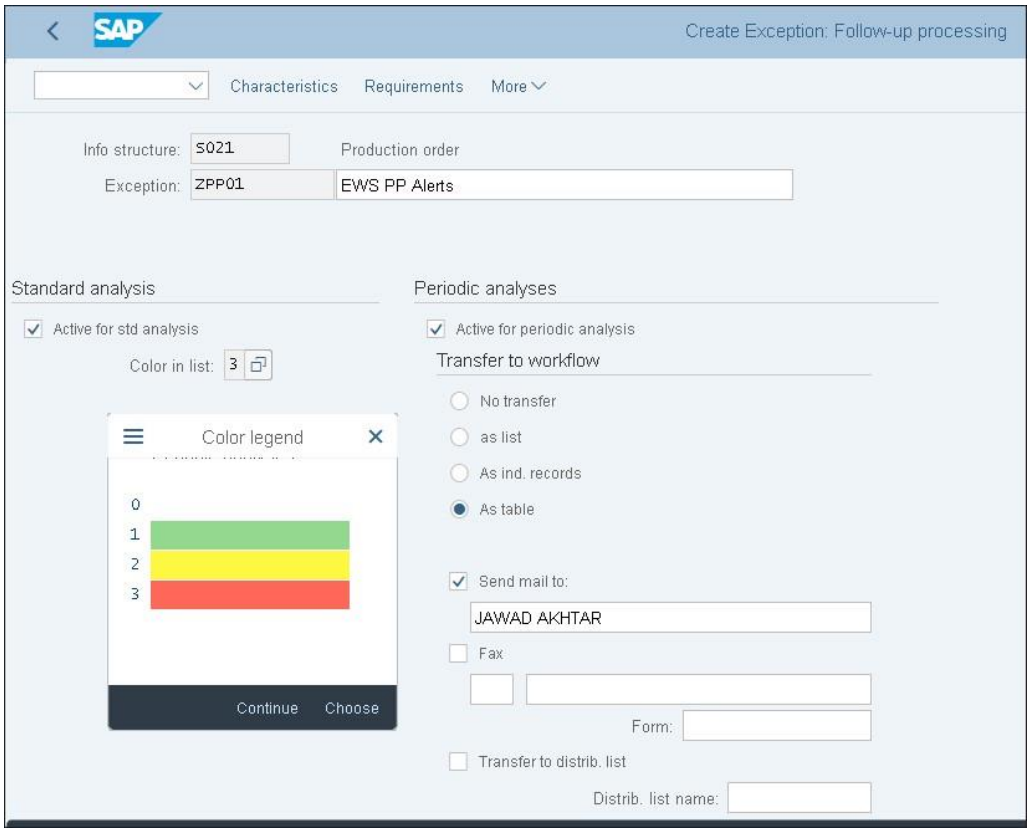


Figure 17.5 Follow-Up Processing to Define the Requisite Parameters

Tip

Select both the **Active for std** (standard) **analysis** and **Active for periodic analysis** checkboxes in Figure 17.5, as these will be subsequently checked whenever you run analysis reports in EWS.

17.2.4 Group Exceptions

If you want to monitor more than one exception from the *same* information structure in EWS, it's convenient and practical to group them together in exception groups for ease of reporting. For example, if the same material's scrap is monitored for its upper tolerance

limit with the color red and its lower tolerance limit with the color yellow, then grouping these two different exceptions provides details in one list or report in EWS. Let's clarify this further. You define that whenever the material scrap is exceeded by greater than 10% (upper tolerance limit), the system highlights it in red in EWS. When the material scrap is less than 10% (lower tolerance limit), the system highlights it in yellow in EWS.

If no such requirement exists, then you don't need to define the exception grouping.

Note

For this example, exception grouping isn't used. However, the concepts and other details covered in this chapter are sufficient for a user to quickly set up exception grouping. Exception grouping is found in the same menu path as EWS.

17.3 Set Up Periodic Analysis

Now that the exceptions have been defined, the last step in setting up EWS is to define the frequency with which the system should alert the person who set up EWS (e.g., every eight hours, daily, once a week, or once a month). For this example, we need to set up periodic analysis for exception ZPP01 by setting up the variant and defining the frequency of the analysis.

To get to the **Periodic Analysis** screen, follow the menu path, **LogisticsLogistics ControllingShop Floor Information SystemEarly Warning SystemPeriodic AnalysisArea to AnalyzeCreate**, or use Transaction MC=7. Then follow these steps:

1. Enter the **Exception** for periodic analysis, which is "ZPP01", and click the **Create** button (Figure 17.61). A popup window appears asking for the name of the variant to create 2.
2. Define "ZPP10" as the variant. Click the **Create** button in the popup window to open the **Variants: Change Screen Assignment** screen 3.
3. Define this variant as applicable for the individual screens (**For Indiv. Selection Screens**), which means that the parameters of variant ZPP10 and material 30000038 are automatically available for selection on the EWS screen for info structure S021, **Number 1000**. If you choose the **For All Selection Screens** radio button, then these parameters are available for all of the different screens of EWS by default. Click the **Continue** button 4.

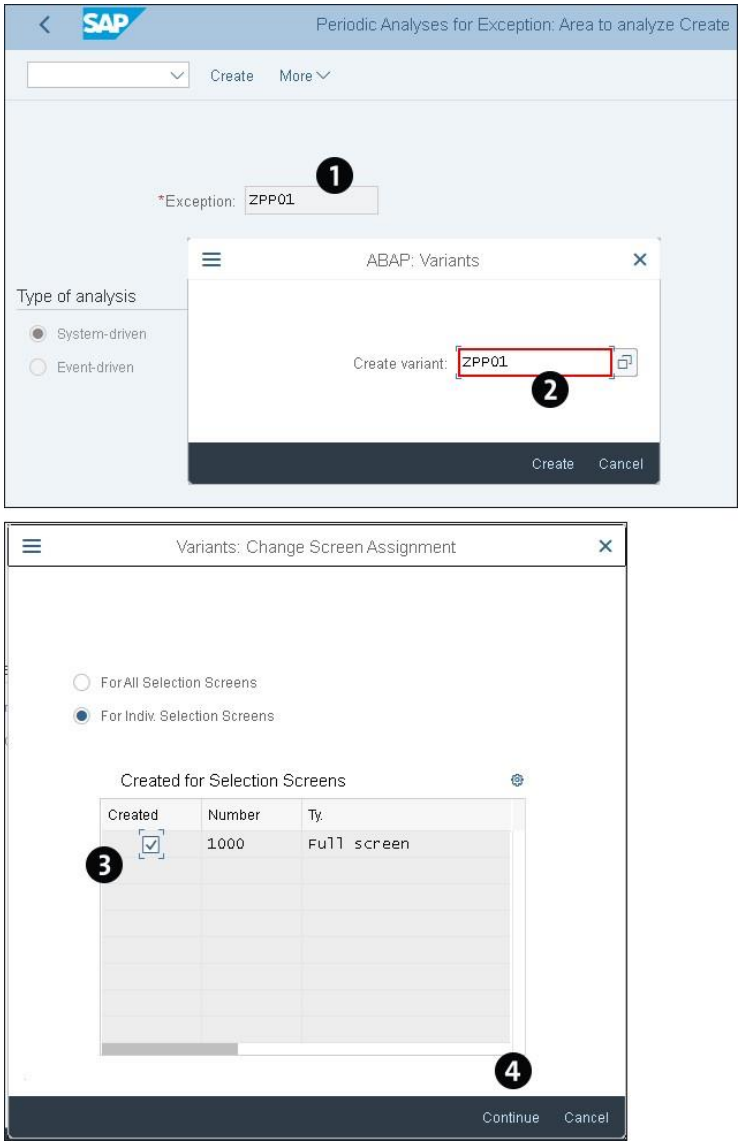


Figure 17.6 Setting Up Periodic Analysis

4. In Figure 17.71, you can define the initial screen parameters for your variant here. For this example, define that the system should automatically select **Material 30000038** 2 and make it available as the default.

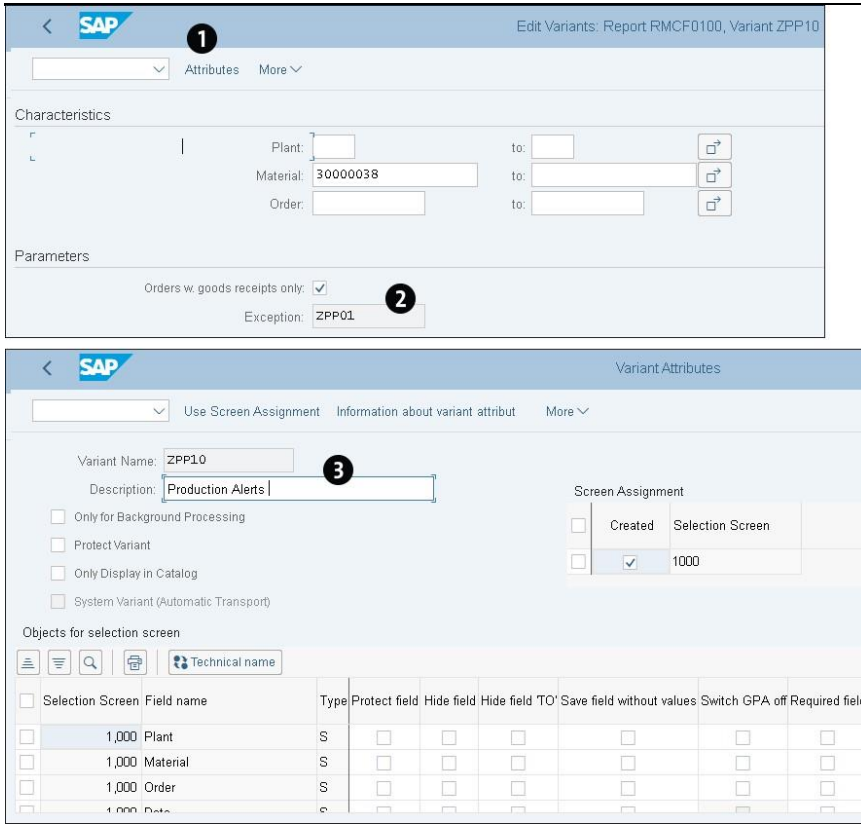


Figure 17.7 Maintaining the Variant in EWS

5. After defining the parameters, click the **Attributes** button 1, where you can provide a meaningful **Description** of the variant 3. This description is communicated whenever EWS needs to alert an exception, in both the form of a popup window and also when it's delivered to an SAP Inbox as a list or table. An example of a meaningful description is "Production material is out of specification," which immediately alerts the concerned person to respond instead of a more generic and vague descriptions such as "PP Specs. are out." This approach also helps if the same alert is sent to many people in the form of a distribution list. For this example, use the **Description** "Production Alerts" 3. Finally, click **Save** or press (Ctrl)+(S) to save the periodic analysis.

A message appears to confirm that variant ZPP10 is saved with all the values on the selection screen.

17.4 Schedule an Early Warning System

The next step is to define the scheduling information on exception ZPP01 to determine how frequently the system should analyze it for potential exceptions.

Use the menu path, **LogisticsLogistics ControllingShop Floor Information SystemEarly Warning SystemPeriodic AnalysisSchedule**, or use Transaction MC=B to bring up the initial screen for scheduling the exception ZPP01 (Figure 17.8). After defining **Exception ZPP01**1, click the **Schedule** button to schedule your analysis frequency.

Figure 17.8 shows two options: either schedule the analysis of the exception group immediately or define it as a periodic job 2, and then define the period values. Click on the **Other period** button 3, and enter "1" (**Minute(s)**) 4 in the ensuing popup.

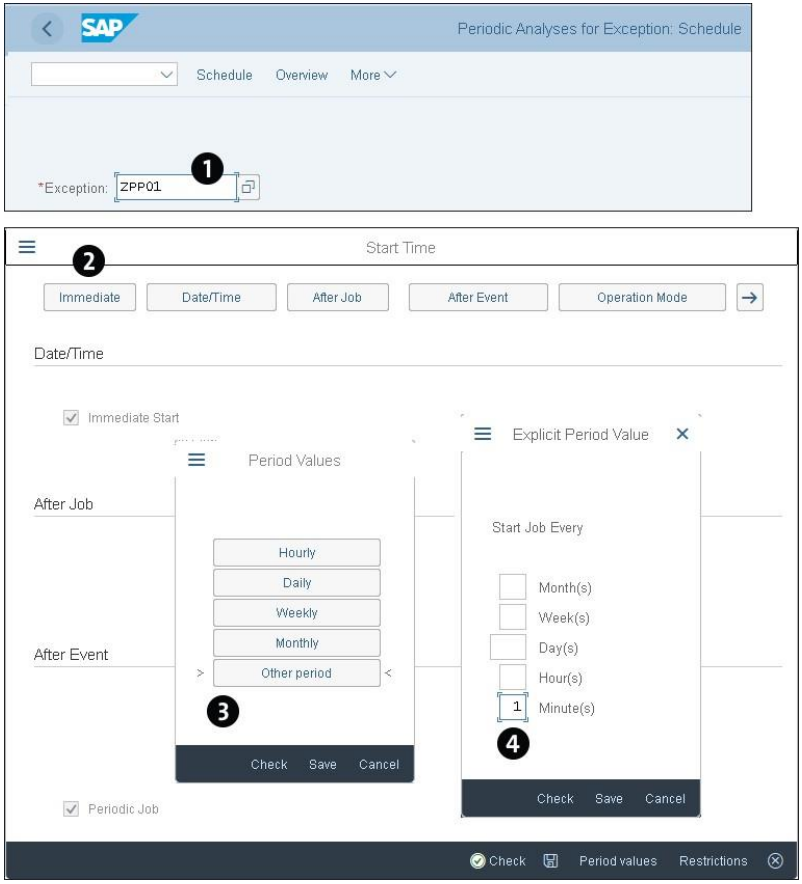


Figure 17.8 Define Schedule Details for EWS

The option to schedule the job immediately ensures that any new exception is immediately reported. However, if the **Date/Time** button is used, for example, then exception monitoring and reporting start on that specified date and time only, as a scheduled job.

The second option of scheduling a periodic job helps ensure that system resources aren't unduly overburdened.

Tips & Tricks

The scheduling frequency should be practical as well as within a reasonable gap, for example, daily. Under the **Daily** scheduling option, all exceptions for the entire day are consolidated into one issued alert. This allows the person who set up the alert to attend to all exceptions in one sitting.

Click the **Save** icon to save your scheduling details. After saving, a message appears to confirm that the background job for exception ZPP01 has been successfully planned.

This ends our discussion regarding how to set up EWS. The next section shows how EWS works in the system, when the user performs day-to-day business functions, and how the system alerts the user who sets up EWS when an exception occurs. The business users can continue to perform and report their daily activities in SAP, such as performing GRs against purchase orders, reporting daily production with scrap percentage, and recording the quality results of inspection lots. Actual monitoring occurs and alerts are triggered in EWS based on this day-to-day information.

17.5 Triggering an Early Warning System

For this example, the business process owner (the production supervisor) creates a production order for material 30000038. The production supervisor records the actual production as well as the scrap via the production confirmation transaction in SAP. The details recorded in confirmation form the basis of the EWS. Any negative trend in the production of material, that is, any scrap greater than 10 MT or quantity of the produced material below 80 MT, causes EWS to alert the person who set it up. For this example, the alert is sent as a popup, and an email is sent to the person's SAP Inbox.

To create a new production order, follow the menu path, **LogisticsProductionShop Floor ControlOrderCreateWith Material**, or use Transaction CO01 (see Figure 17.9).

If you've set up EWS for a process order, then use Transaction COR1 to create a new process order.

Enter the **Material** "30000038", **Production Plant** "1100", and **Order Type** "ZPP3" (not shown). Press (Enter). On the **Production order** screen, enter a **Total Qty** (planned) as "200 MT", and release the production order by clicking on the **Release Order**. Release and save the production order, and, for this example, the system then generates production order number 130000260.

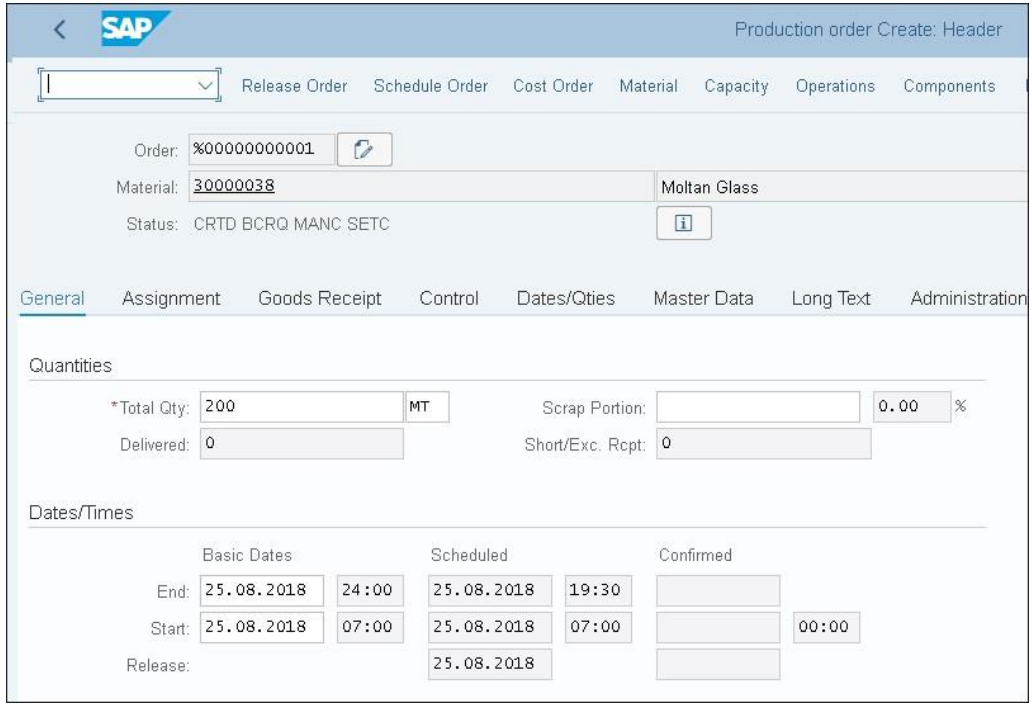


Figure 17.9 Production Order Creation

The next step is to record the production quantities as well as the scrap in confirmation of the production order. To record confirmation of the production order, follow the menu path, **LogisticsProductionShop Floor ControlConfirmationEnterFor Order**, or use Transaction CO15 (Figure 17.10).

Enter the production **Order** number "130000260", and press (Enter). In the **Confirmation of Production Order Enter: Actual Data** screen, enter the production quantity (**Yield Quantity**) as "150 MT" and **Scrap Quantity** of "50". Save the confirmation by pressing (Ctrl)+(S).

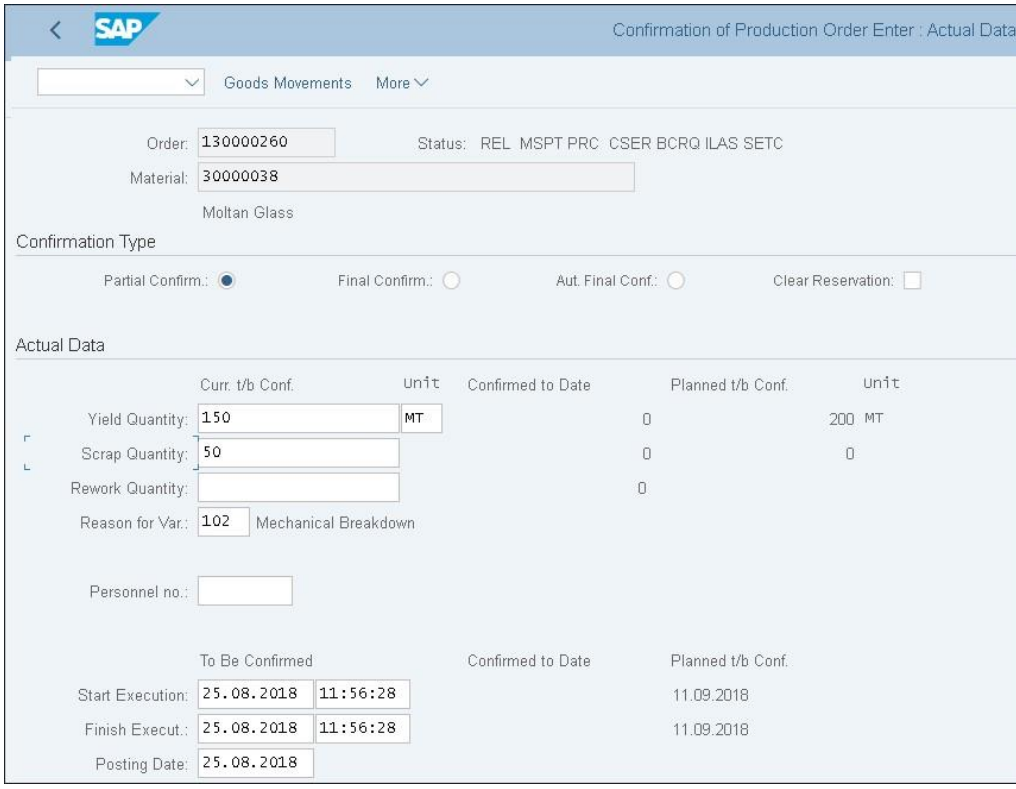


Figure 17.10 Production Order Confirmation with Scrap Quantity

As soon as you save the confirmation, the system issues a popup (see Figure 17.11) message to alert you of the deviation (exception).

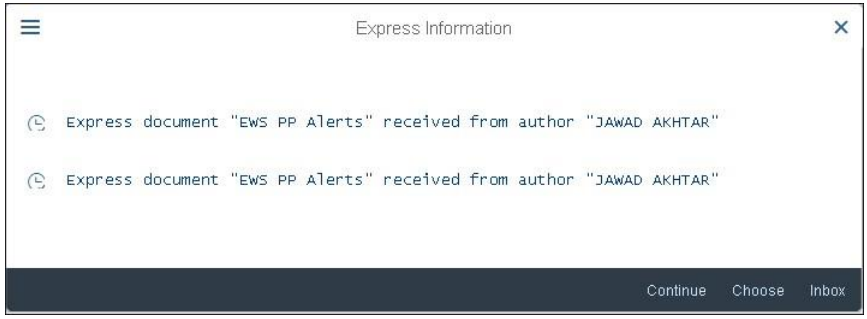


Figure 17.11 Popup Alert Issued by EWS as Soon as an Exception Takes Place

Figure 17.11 shows that two of the three exceptions (deviations) have occurred: The planned versus actual production shows a negative trend. That is, the planned production quantity of 200 MT had in fact actual production of 150 MT, hence the negative trend.

The production scrap recorded in the confirmation was 50 MT, which is greater than the 10 MT or more limit set to issue an EWS alert.

The third exception hasn't occurred, which is if the production quantity during confirmation was less than 80 MT. For this example, the produced quantity (yield) was 150 MT for production order 130000260.

The system also delivers the same exception message in the SAP Inbox.

Tips & Tricks

While maintaining scheduling to analyze for individual exceptions or exception grouping, make sure to eliminate duplication of information, so that the system doesn't present the same information repeatedly—first in an individual exception and then in an exception grouping. This is achieved by adopting a well-thought-out approach prior to setting up EWS, for example, making a list of all important materials for which you want to monitor parameters for deviations.

17.6 Exception Analysis

Finally, we'll show you how to analyze exceptions with EWS in the shop floor information system. While alert monitoring is certainly a valuable EWS tool to promptly alert you of any deviations and exceptions, you're often required to have detailed information on the exceptions. Fortunately, EWS is supported by PP, which ensures that comprehensive details related to all exceptions are instantly available.

Follow the menu path, **LogisticsLogistics ControllingShop Floor Information SystemEarly Warning SystemException Analysis**, or use Transaction MCYJ to get to the initial screen for exception selection (Figure 17.12). For this example, enter the **Exception** "ZPP01" 1 for analysis.

Click **Execute** in Figure 17.12, and the system displays the **Exception analysis: Selection** parameter screen. Define **Material** "30000038" 2, as well as a **Period to analyze** from "14.08.2018" to "25.08.2018" 3.

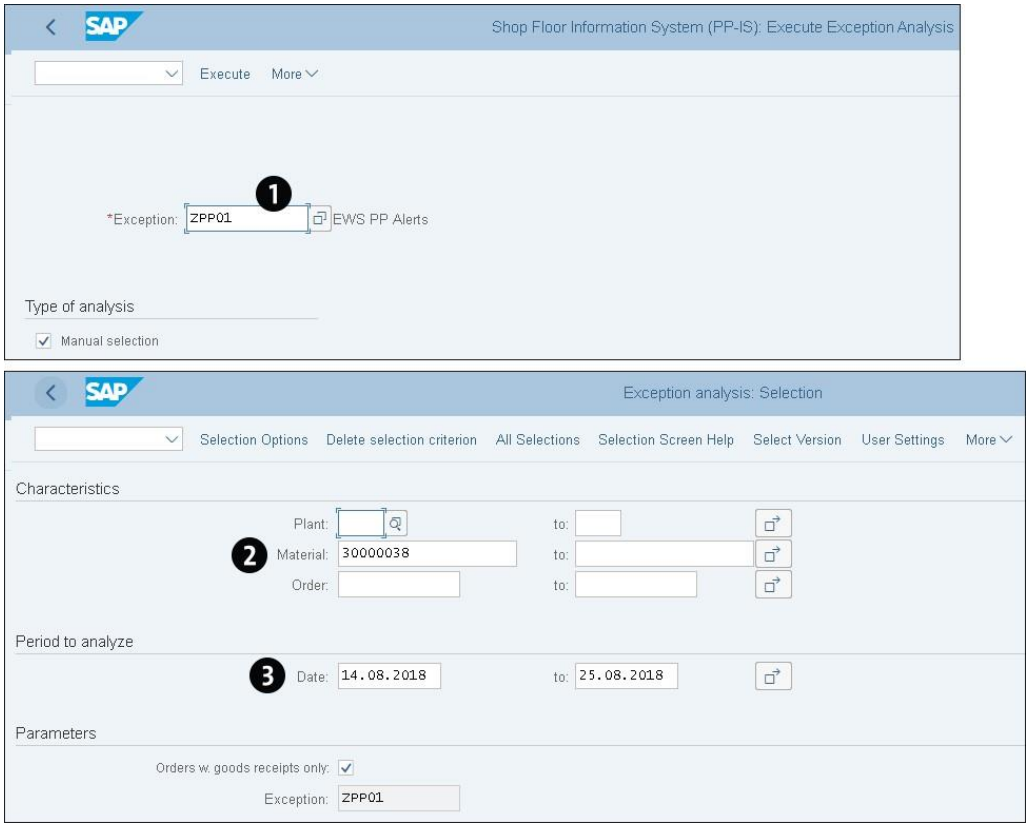


Figure 17.12 Shop Floor Information System: Exception Analysis

Select the **Order w. goods receipts only** checkbox to denote that the system should only take those production orders into account for which the GRs in the warehouse have been undertaken.

When you execute the exception analysis report (by pressing (F8) or clicking **Execute**) in Figure 17.12, the system displays the results as shown in Figure 17.13.

This exception analysis shows the three defined key figures 1 with data as separate columns. Further, the color is red for the entire row of the **Material** column, as we originally defined in Figure 17.5. Keep the cursor on a key figure, and click on **Choose**.

In the ensuing popup, not only will all key figures appear but also the key figures with exceptions will be highlighted in red.

As with all standard analyses reports, you can use the **Switch drilldown**2 to view details on a production order basis or on a day (date) basis. The lower half of the figure provides production order details. For this example, the production order **1300002603** contains all the correct details you previously entered in various business transactions, such as production order, confirmation, and GR for production order.

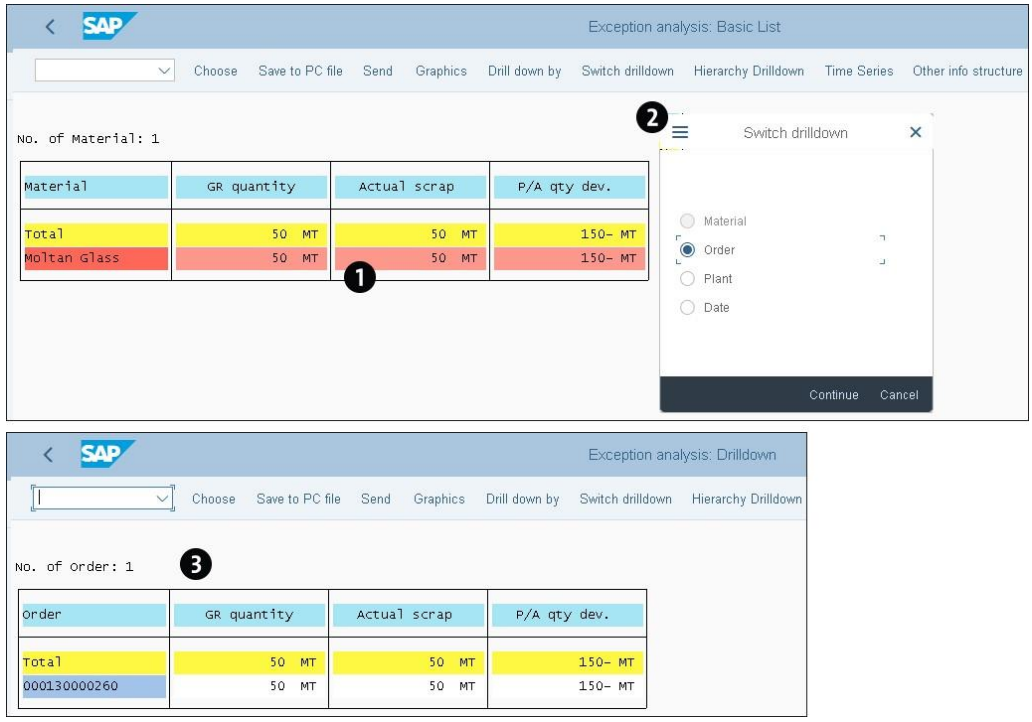


Figure 17.13 Exception Analysis Report of EWS for Material 30000038

Access Figure 17.14 via Transaction SBWP, which is the SAP Inbox, showing the two EWS alerts as well as the relevant details based on which the SAP system created those alerts.

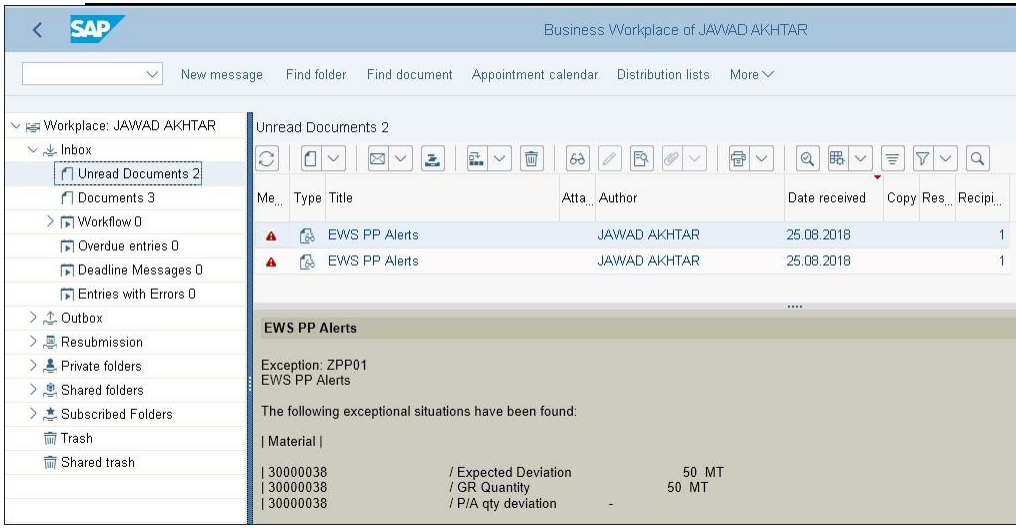


Figure 17.14 EWS Alerts in the SAP Inbox

17.7 Summary

This chapter explained how easily a business process owner in any relevant area of working can quickly set up EWS without any extensive functional or technical knowledge. EWS alerts can be modified, deleted, or updated anytime, as deemed necessary to reflect the business need.

The next chapter covers standard PP reporting in SAP S/4HANA.

Chapter 18

Production Planning Reporting

Timely, accurate, and comprehensive information helps you make better business decisions. You can immediately start to use a large number of information systems and standard reports available in SAP S/4HANA for production planning, as well as for logistics.

This chapter provides detailed guidance on how to leverage a large number of standard reports that are available in all the logistics areas of SAP S/4HANA. After you become familiar with the features and functions for reporting, including tools and icons, it becomes easier to navigate to unexplored areas of reporting.

18.1 The Basics of Reporting

To fully take advantage of SAP S/4HANA, it's essential that you become familiar with the icons and other features frequently available for use in reports. Because these icons and functions are the same in all the information systems and analyses, you'll begin to navigate faster and be able to quickly get to the desired information or even find tips and tricks to manage the display and availability of data, as needed.

Table 18.1 includes a selected list of icons that are available when you run information systems or standard analysis. The Details/Application column provides a brief description of what an icon does when clicked.

Note

The icons in Table 18.1 specifically refer to information systems, analyses (standard and flexible), and reporting tools such as QuickViewer or SAP Query in production planning (PP) and other logistics functions. It's important to note that you may find similar icons in master data and transactions such as the repetitive manufacturing (REM) planning table (Transaction MF50) or the stock/requirements list (Transaction

MD04), where these icons may have different meanings and functions. For example, in a standard business process, clicking the **Details** icon brings up the **Item** details of the object. In the reporting function, however, this icon brings up a comprehensive list of **All key Figures**.

Icon	Icon Name	Details/Application
	Maintain Selection Options	Select operands, such as greater than, less than, and so on
	Deselect All	Unselect all previously selected values
	Select All	Select all lines or key figures
	Check Entries	Check entered data before execution
	Cancel	Cancel and return to previous screen
Multiple selection..	**Multiple selection**	Checkboxes to make multiple selections
	Aggregation	Summation
	Sub-total	Apply subtotal after a total on a key figure is first performed
	Do Not Choose All	Deselect all
	Choose All	Select all
Switch drilldown...	**Switch Drilldown**	Switch key figures display
	Sort in Ascending Order	Sort selected column in ascending order
	Sort in Descending Order	Sort selected column in descending order
	Import from Text File	Import/upload from notepad
	Copy from Clipboard	Copy data from notepad
	Delete Entire Selection Line	Delete the selected entry

Table 18.1 Select List of Icons Used in Reporting

Icon	Icon Name	Details/Application

	Move	Move field from one location to another
	Download	Download the data in various formats
	Change Layout	Change or select layout
	Filter	Set or delete filter
	Print	Print or print preview of reports
	Multiple Selection	Available on every parameters selection screen
	Find/Search	Search for any term
	Search Again	Search the same details/values again

Table 18.1 Select List of Icons Used in Reporting (Cont.)

Information systems present a large amount of data and information into logically structured lists and sections. The following menu paths and transaction codes of both discrete manufacturing and process manufacturing are provided to make the information systems easier to use: **Discrete manufacturing**

Choose **LogisticsProductionShop Floor ControlInformation SystemOrder Information System**, or use Transaction COOIS.

Process manufacturing

Choose **LogisticsProduction – ProcessProcess OrderReportingOrder Information System**, or use Transaction COOISPI.

18.2 Report Parameters

When we talk about the *order information system*, it can be either the production order information system or the process order information system. The former is specific to discrete manufacturing reporting, while the latter is for process manufacturing reporting.

An information system consists of the most up-to-date information of the specific object and is based on the transactions that the user has performed as part of the business process. For example, when you execute the operations list in a production order information system, the

system displays the current status of various operations, including those that are completely or partially confirmed. If you run the same report again after six hours, for example, when the user has recorded more confirmations for production orders, at that time, the system shows up-to-date (and different) information. Another example is when the user first uses the sales information system (SIS), the system shows the creation of 10 sales order for a specific material. After six hours, when the user again runs the report (SIS), the number of sales orders has increased to 18. This information helps to reflect the accurate and up-to-date status of various activities and business processes.

In the order information system, we've divided the large number of available options for parameters selection into several figures in the following sections for ease of understanding and comprehension.

18.2.1 Selection Screen at the Header Level

In Figure 18.1, which shows the **Process Order Information System** screen (Transaction COOISPI), you need to first select the list from the **List**1 dropdown menu, so that further parameter selection directly relates to the list.

Based on the list option that you select, you can then define further selection parameters. If you select **Components** from the dropdown list 2, then you need to give selection parameters in the screen shown in Figure 18.2 (in the next section) at the **Selection at Component Level**2. If you select **Operations/Phases** from the dropdown list, then you provide greater details in the **Select. at Operation Level** area 1.

This all-in-one report caters to the reporting requirements of all major business processes of production. Notice that you can also provide the sales order number with a sales order item number, if you have a make-to-order (MTO) process order (or production order). Similarly, if a process order is with reference to any work breakdown structure (WBS) element, you can enter that information in the selection criteria at the header level.

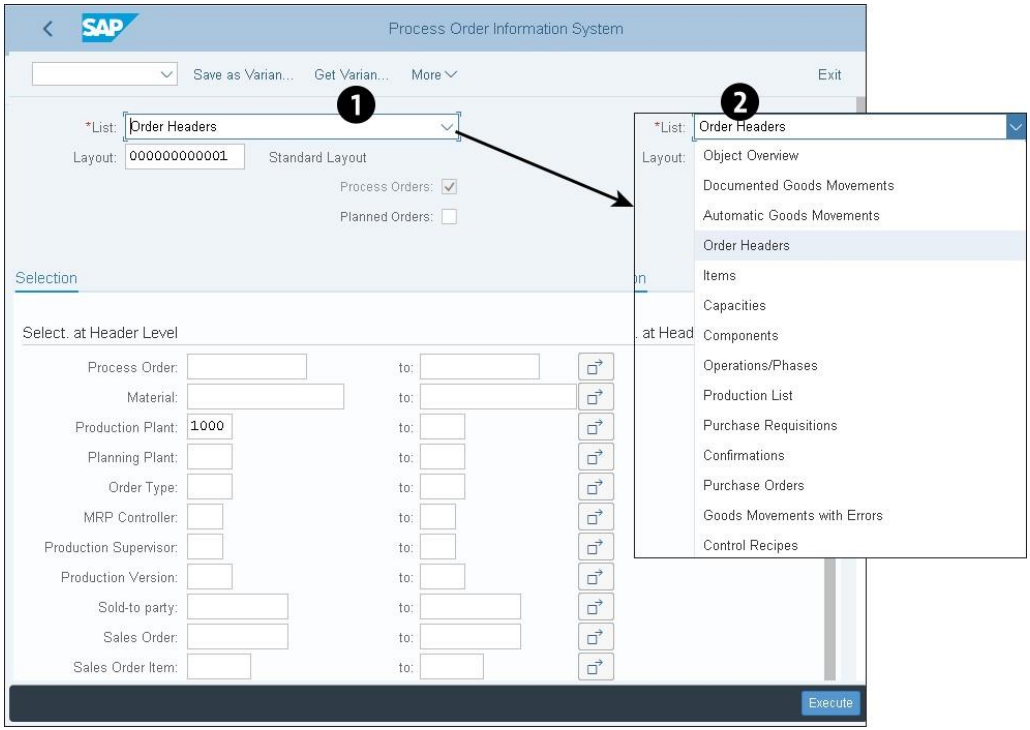


Figure 18.1 Selection Screen for the Process Order Information System

For the example shown previously in Figure 18.1, select **Order Headers**1 from the dropdown list, and then on the header level, define **Production Plant** "**1000"**.

You can select an option from 18 available lists in discrete manufacturing and 14 available lists from process manufacturing. In fact, selection of the list is the first step that you need to ensure before you can run the order information system.

Table 18.2 shows the available lists in the production order information system and in the process order information system.

List	Production Order Information System	Process Order Information System
Object Overview	X	X
Documented Goods Movement	X	X

Table 18.2 Comparison of Available Lists in Information Systems

List	Production Order Information System	Process Order Information System
Trigger Points	X	
Production Resource/Tool	X	
Automatic Goods Movement	X	X
Order Headers	X	X
Items	X	X
Capacities	X	X
Components	X	X
Operations	X	X (phases also)
Production List	X	X
Purchase Requisitions	X	X
Confirmations	X	X
Sequences	X	
Purchase Orders	X	X
Documents Links	X	
Goods Movements with Errors	X	X
Control Recipes	X	X (control recipe)

Table 18.2 Comparison of Available Lists in Information Systems (Cont.)

18.2.2 Selection at the Operations and Components Levels with Options

Scrolling down the screen shown previously in Figure 18.1 leads to several different views where you can enter selection details at the operation and component levels in the **Select. at Operation Level** view shown in Figure 18.2. You can also select a specific system status (**Syst. Status**) with the **Excl.** checkbox selected to exclude information having the specified status. For example, if you don't want to see partially confirmed operations/phases in the report, you can enter "PCNF" as **Syst. Status** and select the **Excl.** checkbox.

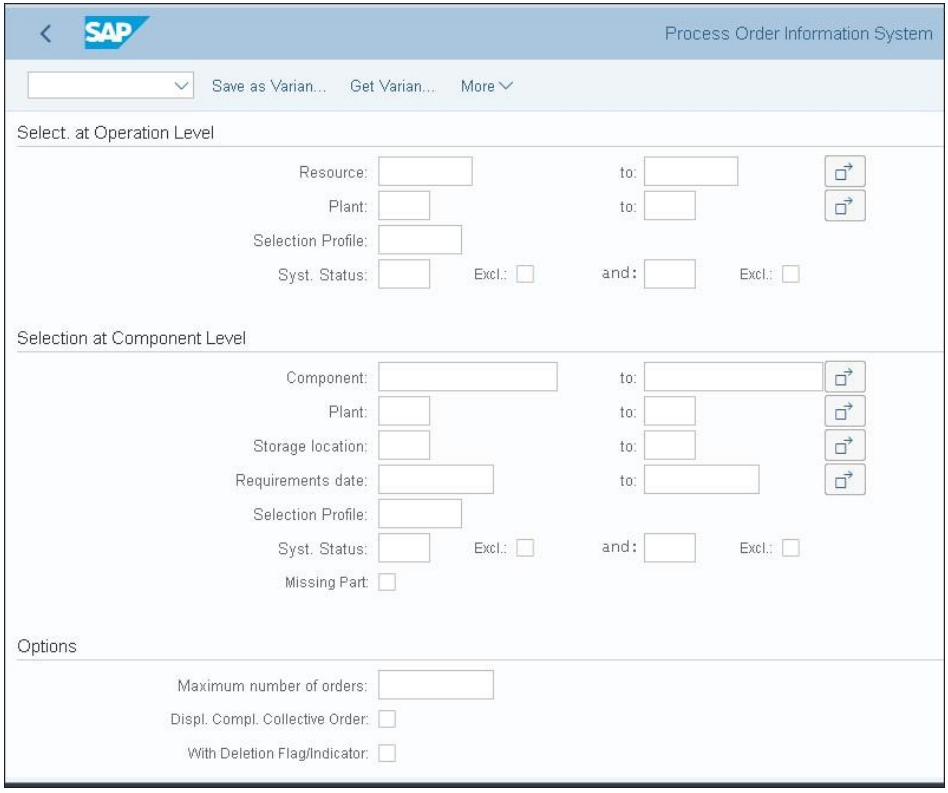


Figure 18.2 Selection Options at the Operation and Component Levels

You can select the **Missing Part** checkbox so that the system displays the components having the missing parts status in the process orders. The missing parts status is denoted by **MSPT**.

You can also limit the number of process orders that the system displays so that it's displaying only collective process orders or process orders with deletion flags by selecting the relevant checkboxes.

18.2.3 Selection Screen for Dates

Scrolling further down, you have a large choice of dates. So, if you want your report to show from a certain start date to end date in the process order, you define this in basic start dates, actual start dates, or even according to the release dates of the process orders.

The **Relative dates at header level** area (see Figure 18.3) corresponds to the time interval between today's date and any date, either in the past or future. For example, if you want to see all the process orders for the past 100 days, as well as for the next 50 days, then you enter "100–" in the **Relative Basic Start Date** field and "50" in the **to** field. Dates in the past are denoted by the negative sign, after entering the number (e.g., 100–).

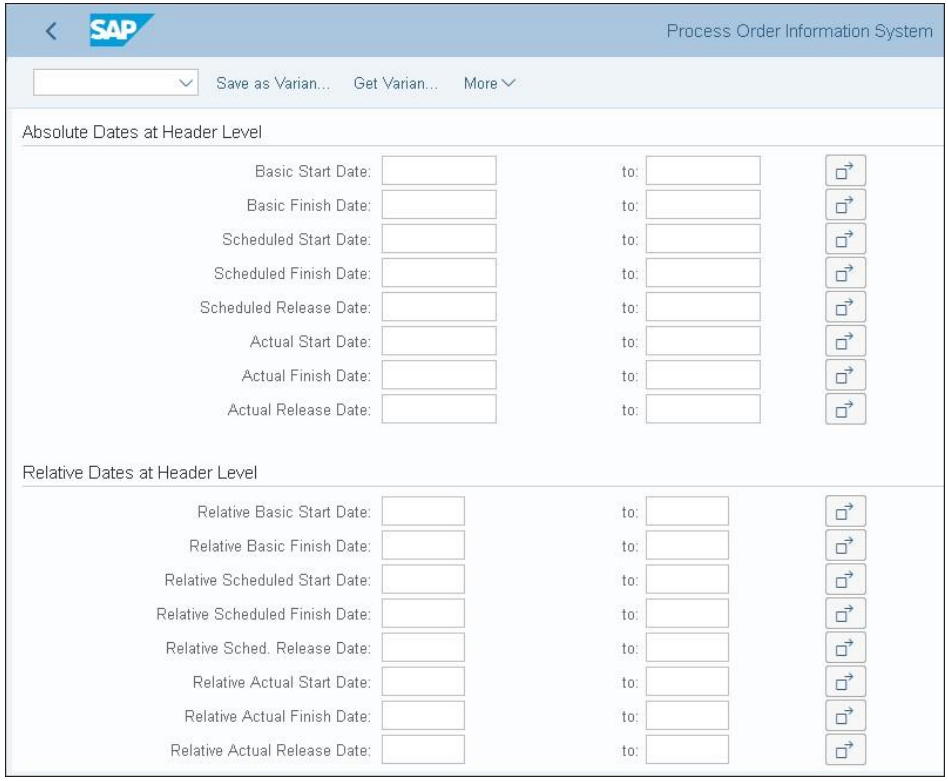


Figure 18.3 Absolute and Relative Dates in the Information System

18.2.4 Multiple Selection

So far, you may have noticed that on the selection screen of a report, the option is available to enter any parameter in a range or an interval. For example, for the **Relative Basic Start**

Date field in Figure 18.3, you can only enter a selection interval. But what if you want to exclude a certain period within the date range on the selection screen or include two specific dates, apart from the dates given in the dates' interval?

All this and several other options are available via the **Multiple Selection** option available in all information systems and reports of all components.

Click on the **Multiple Selection** icon in Figure 18.41 for **Process Order**. In the resulting screen, four tabs allow you to include or exclude single values or even an entire range. You can enter information in each of the four tabs, and the ensuing output (report) will show the desired results. You'll also find available icons to further facilitate the user, such as copying data from a clipboard, adding or deleting a line within the values, or using the **Multiple Selection** option. The **Multiple Selection** icon enables you to select multiple values by clicking on the requisite checkboxes. Refer to Table 18.1 for some of the functions of each of the icons.

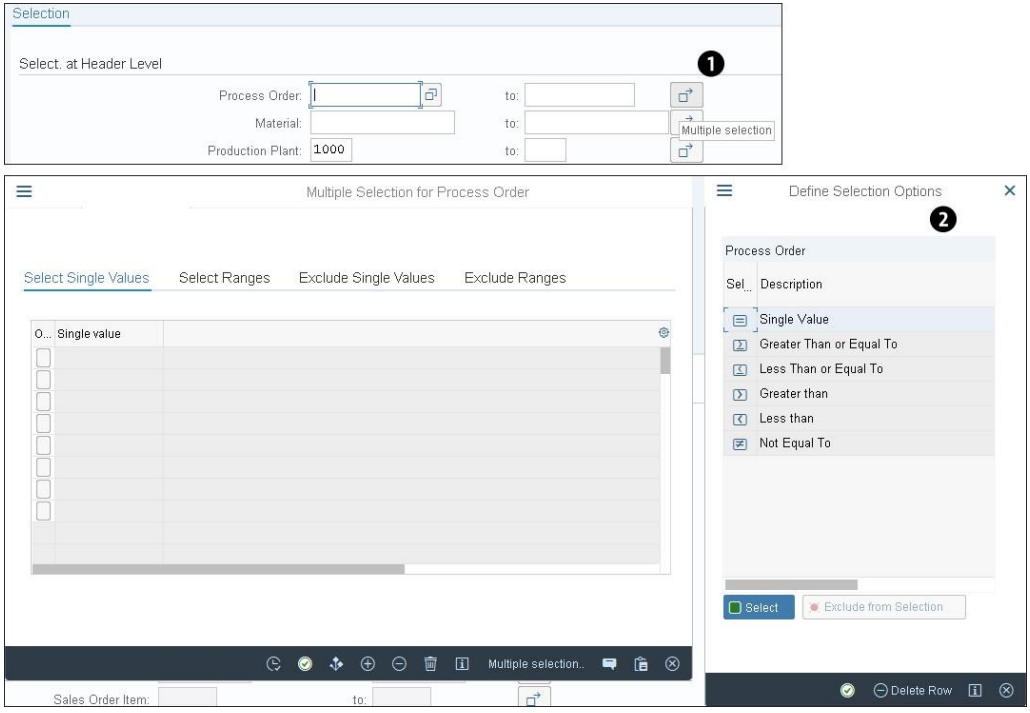


Figure 18.4 Multiple Selection and Maintain Selection Options in the Order Information System

18.2.5 Maintain Selection

A frequently used and available option is the **Maintain Selection** option. When you click the **Maintain Selection** icon , the **Maintain Selection Options** screen appears as shown earlier in Figure 18.42. You can use any of the available options in this screen. Alternatively, a shortcut to the **Maintain Selection Options** screen is to double-click on the relevant field of the selection screen of any report.

18.2.6 Maintain Variant

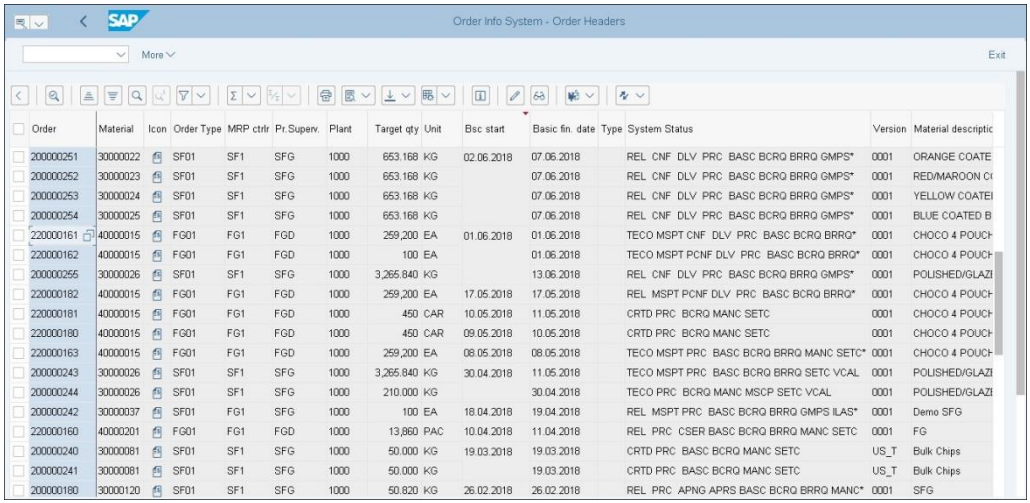
Maintaining a variant in SAP S/4HANA is similar to saving a layout, which is then available for repeated use when needed. You can also set a variant as default by managing your layout options. For example, when you use the order information system, you always use plant 1000, order type PI01, and the dates range of 30 days from today. Instead of entering all of these parameters every time you run the order information system, you can save these details as a variant, which you can then subsequently select.

There are two areas where you can maintain variants. The first one is on the **Initial Parameters Selection** screen of any report, information system, or analysis when defining the selection parameters. Simply enter the information once in the parameters selection screen, and then save the variant by choosing **GotoVariantsSave as Variant**. On the **Variant Attributes** screen that appears, give the variant a name and a short description, and then choose whether to make each field required, hidden, or protected from data entry. With the variant saved, next time you just need to choose **GotoVariantsGet** to get the variant. You can also delete incorrect or unwanted variants.

The second option to save a variant is when you've already executed an analysis report in the order information system. The system displays all list fields, and you've made the required changes; for example, any filter set, any sort or column in ascending or descending order performed, or aggregation. You can then choose the **Select Layout** icon and select the **Save Layout** option from the dropdown. In the ensuing popup, enter the name of the layout and a short description. Here again, you can change or delete the saved layouts, if needed.

18.2.7 Order Header in the Process Orders

When you execute the report by pressing (F8) or choosing **Execute**, a report such as the one shown in Figure 18.5 appears, which is the **Order Headers** report for the process order information system.



Order	Material	Icon	Order Type	MRP ctrlr	Pr.Superv.	Plant	Target qty	Unit	Bsc start	Basic fin. date	Type	System Status	Version	Material descriptic
200000251	30000022		SF01	SF1	SFG	1000	653.168	KG	02.06.2018	07.06.2018		REL CNF DLV PRC BASC BCRQ BRRQ GMPS*	0001	ORANGE COATE
200000252	30000023		SF01	SF1	SFG	1000	653.168	KG		07.06.2018		REL CNF DLV PRC BASC BCRQ BRRQ GMPS*	0001	RED/MAROON C(
200000253	30000024		SF01	SF1	SFG	1000	653.168	KG		07.06.2018		REL CNF DLV PRC BASC BCRQ BRRQ GMPS*	0001	YELLOW COATEI
200000254	30000025		SF01	SF1	SFG	1000	653.168	KG		07.06.2018		REL CNF DLV PRC BASC BCRQ BRRQ GMPS*	0001	BLUE COATED B
220000161	40000015		FG01	FG1	FGD	1000	259,200	EA	01.06.2018	01.06.2018		TECO MSPT CNF DLV PRC BASC BCRQ BRRQ*	0001	CHOCO 4 POUCH
220000162	40000015		FG01	FG1	FGD	1000	100	EA		01.06.2018		TECO MSPT PCNF DLV PRC BASC BCRQ BRRQ*	0001	CHOCO 4 POUCH
200000255	30000026		SF01	SF1	SFG	1000	3,265.840	KG		13.06.2018		REL CNF DLV PRC BASC BCRQ BRRQ GMPS*	0001	POLISHED/GLAZI
220000182	40000015		FG01	FG1	FGD	1000	259,200	EA	17.05.2018	17.05.2018		REL MSPT PCNF DLV PRC BASC BCRQ BRRQ*	0001	CHOCO 4 POUCH
220000181	40000015		FG01	FG1	FGD	1000	450	CAR	10.05.2018	11.05.2018		CRTD PRC BCRQ MANC SETC	0001	CHOCO 4 POUCH
220000180	40000015		FG01	FG1	FGD	1000	450	CAR	09.05.2018	10.05.2018		CRTD PRC BCRQ MANC SETC	0001	CHOCO 4 POUCH
220000163	40000015		FG01	FG1	FGD	1000	259,200	EA	08.05.2018	08.05.2018		TECO MSPT PRC BASC BCRQ BRRQ MANC SETC*	0001	CHOCO 4 POUCH
200000243	30000026		SF01	SF1	SFG	1000	3,265.840	KG	30.04.2018	11.05.2018		TECO MSPT PRC BASC BCRQ BRRQ SETC VCAL	0001	POLISHED/GLAZI
200000244	30000026		SF01	SF1	SFG	1000	210.000	KG		30.04.2018		TECO PRC BCRQ MANC MSCP SETC VCAL	0001	POLISHED/GLAZI
200000242	30000037		SF01	FG1	SFG	1000	100	EA	18.04.2018	19.04.2018		REL MSPT PRC BASC BCRQ BRRQ GMPS ILAS*	0001	Demo SFG
220000160	40000201		FG01	FG1	FGD	1000	13,860	PAC	10.04.2018	11.04.2018		REL PRC CSER BASC BCRQ BRRQ MANC SETC	0001	FG
200000240	30000081		SF01	SF1	SFG	1000	50.000	KG	19.03.2018	19.03.2018		CRTD PRC BASC BCRQ MANC SETC	US_T	Bulk Chips
200000241	30000081		SF01	SF1	SFG	1000	50.000	KG		19.03.2018		CRTD PRC BASC BCRQ MANC SETC	US_T	Bulk Chips
200000180	30000120		SF01	SF1	SFG	1000	50.820	KG	26.02.2018	26.02.2018		REL PRC APNG APRS BASC BCRQ BRRQ MANC*	0001	SFG

Figure 18.5 Order Headers in the Order Information System

In this report, we'll explore a few important options that are available, such as aggregation, setting a filter, or viewing the information in a graphical presentation. Some of the common and obvious options, such as sorting in ascending or descending order of information, and changing or displaying objects, aren't covered. Refer to Table 18.1 to gain a better understanding of the icons used.

Fields Selection

Figure 18.5, shown previously, displays only a limited number of columns and information, whereas you can display and manipulate an enormous amount of information and even save the display layout, if it's routinely used.

When you choose the **Change Layout** icon , the **Change Layout** screen appears as shown in Figure 18.6. The columns or fields already displayed in the report are shown on the left-hand side, whereas the fields or columns that you can display in a report are shown on the right-hand side. To further facilitate the user in selecting fields, you can use several filters to group together relevant fields, so it's easier for a user to choose and display the desired fields in the report. For this example, use the **Quantities** filter, and then only quantity-relevant fields are available for users to choose from. You can click on the relevant field in Figure 18.6 and move it with the left-arrow icon, so that the system displays the content in the report (see Figure 18.7).

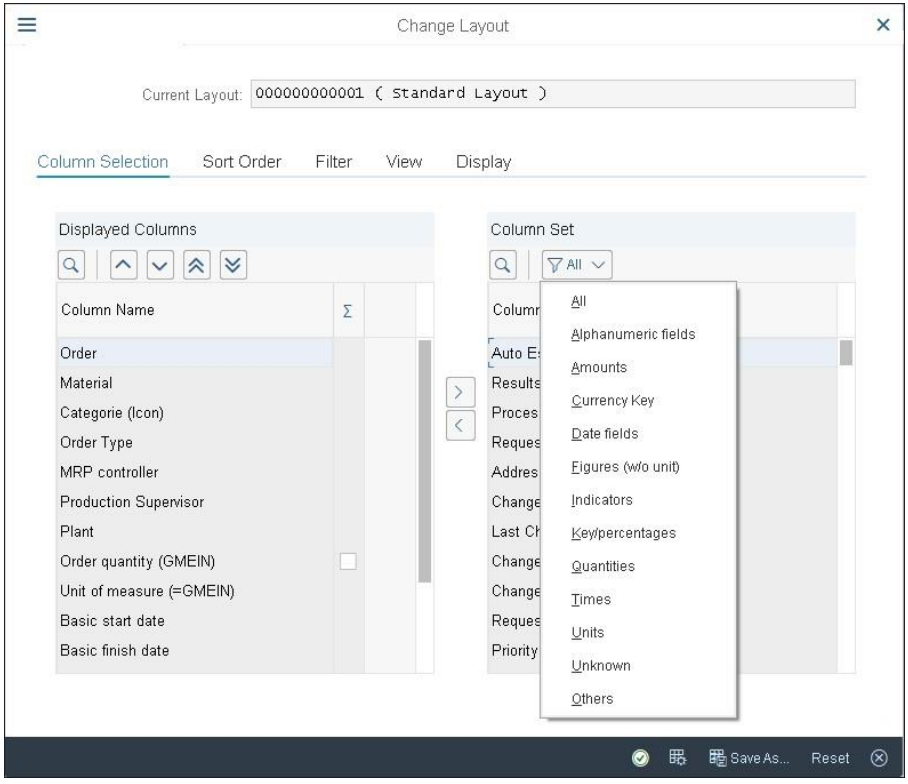


Figure 18.6 Layout and Fields Filter Options in the Order Information System

Order	Material	Icon	Order Type	MRP ctrlr	Pr.Superv.	Plant	Target qty	Unit	ExpcVarnce	Del. qty	Scrap	Conf.Yield	ExpYieldVr	Bsc start	Basic fin. date
220000220	40000052		FG01	FG1	FGD	1000	100	CAR	2	98	2	98	2-	10.08.2018	10.08.2018
220000204	40000058		FG01	FG1	FGD	1000	10	CRT	0	10	0	10	0	09.08.2018	09.08.2018
220000205	40000058		FG01	FG1	FGD	1000	10	CRT	0	0	0	0	0		09.08.2018
200000281	30000043		SF01	SF1	SFG	1000	500	L	10	490	10	490	10-		10.08.2018
220000203	40000052		FG01	FG1	FGD	1000	10	CAR	0	10	0	10	0	08.08.2018	09.08.2018
200000280	30000044		SF01	SF1	SFG	1000	6,000	L	500	5,500	500	5,500	500-		08.08.2018
200000267	30000041		SF01	SF1	SFG	1000	100.000	KG	0.000	100.000	0.000	100.000	0.000	07.08.2018	07.08.2018
200000265	30000041		SF01	SF1	SFG	1000	10,000.000	KG	200.000	9,800.000	200.000	9,800.000	200.000-	19.07.2018	12.09.2018
200000266	30000041		SF01	SF1	SFG	1000	10,000.000	KG	0.000	0.000	0.000	0.000	0.000		13.09.2018
200000264	30000041		SF01	SF1	SFG	1000	10,000.000	KG	0.000	10,000.000	600.000	9,400.000	0.000	18.07.2018	11.09.2018
220000202	40000030		FG01	FG1	FGD	1000	150	CAR	0	150	0	0	0	17.07.2018	17.07.2018
200000263	30000041		SF01	SF1	SFG	1000	375.000	KG	0.000	375.000	0.000	375.000	0.000		18.07.2018
220000201	40000030		FG01	FG1	FGD	1000	200	CAR	10	190	10	190	10-	16.07.2018	17.07.2018
200000262	30000041		SF01	SF1	SFG	1000	500.000	KG	15.000	485.000	15.000	485.000	15.000-		17.07.2018

Figure 18.7 Quantity-Related Fields in the Information System

The following sections will show some more reporting features, such as quick menu, aggregation, filter settings, and downloading data.

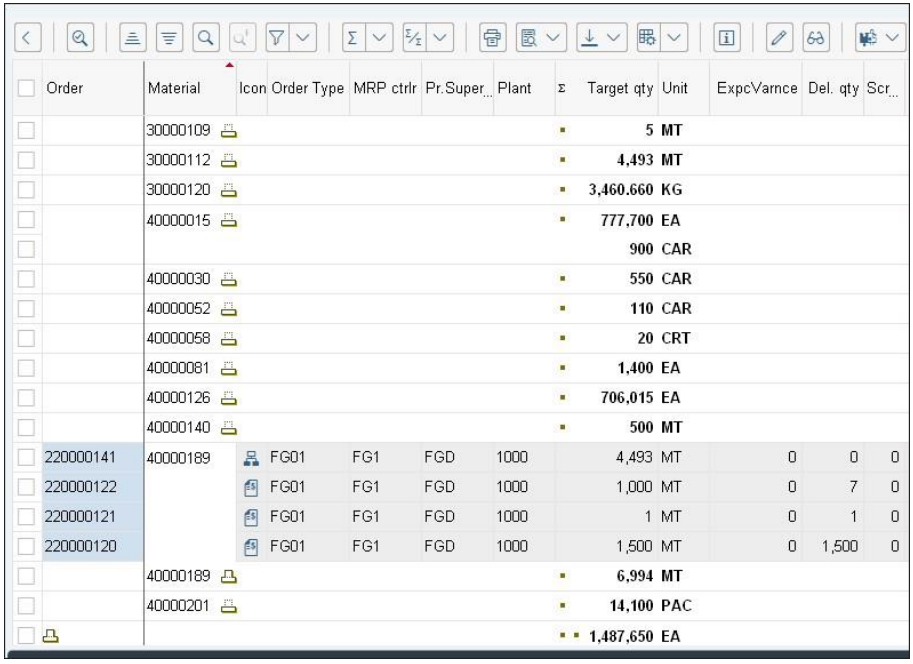
Quick Menu in Report

Referring back to Figure 18.5, place the cursor on any column, and right-click to display all the available options, not just for that column but for the entire report.

Aggregation

Referring to Figure 18.5 again, you can aggregate or sum up (total) any key figure or quantity. With the **Total** option in place for a key figure, you can then use the **Subtotal** option to subtotal any number of characteristics and key figures, as shown in Figure 18.8.

For this example, first use the **Total** option on the **Target qty** column by selecting it and then clicking on the **Total** icon. Hold down the (Ctrl) key, and then select the **Material** column followed by the **Target qty** column, and click on the **Sub-total** icon (see Figure 18.8). You can then also click on the individual summation level by clicking on the **Summation** icon located at the bottom of the screen.



Order	Material	Icon	Order Type	MRP ctrlr	Pr.Super...	Plant	Σ	Target qty	Unit	ExpcVarnce	Del. qty	Scr...
	30000109							5	MT			
	30000112							4,493	MT			
	30000120							3,460.660	KG			
	40000015							777,700	EA			
								900	CAR			
	40000030							550	CAR			
	40000052							110	CAR			
	40000058							20	CRT			
	40000081							1,400	EA			
	40000126							706,015	EA			
	40000140							500	MT			
220000141	40000189		FG01	FG1	FGD	1000		4,493	MT	0	0	0
220000122			FG01	FG1	FGD	1000		1,000	MT	0	7	0
220000121			FG01	FG1	FGD	1000		1	MT	0	1	0
220000120			FG01	FG1	FGD	1000		1,500	MT	0	1,500	0
	40000189							6,994	MT			
	40000201							14,100	PAC			
								1,487,650	EA			

Figure 18.8 Summation (Total and Subtotal) in the Order Information System

18.2.8 Filter Settings

While evaluating a report, sometimes it becomes important to filter out some information so that the system displays only the desired information.

Refer to Figure 18.5 once again. In Figure 18.9, select the **Target qty** column, click on the **Filter** icon, and choose **Set Filter** to set the filter. In the popup that appears, you can either double-click on the **Target quantity** field or use the **Maintain Selection** icon, which opens the popup window. Select **Greater than or Equal to**, and choose **Continue**. Enter "50" in the **Order quantity** field so that the report should now only show target quantities equal to or greater than 50. This screen shows that the filter is in place by a little black arrow pointing downward on the **Target qty** column. The red arrows denote the list is sorted in descending (upward red arrow) or ascending (downward red arrow) order.

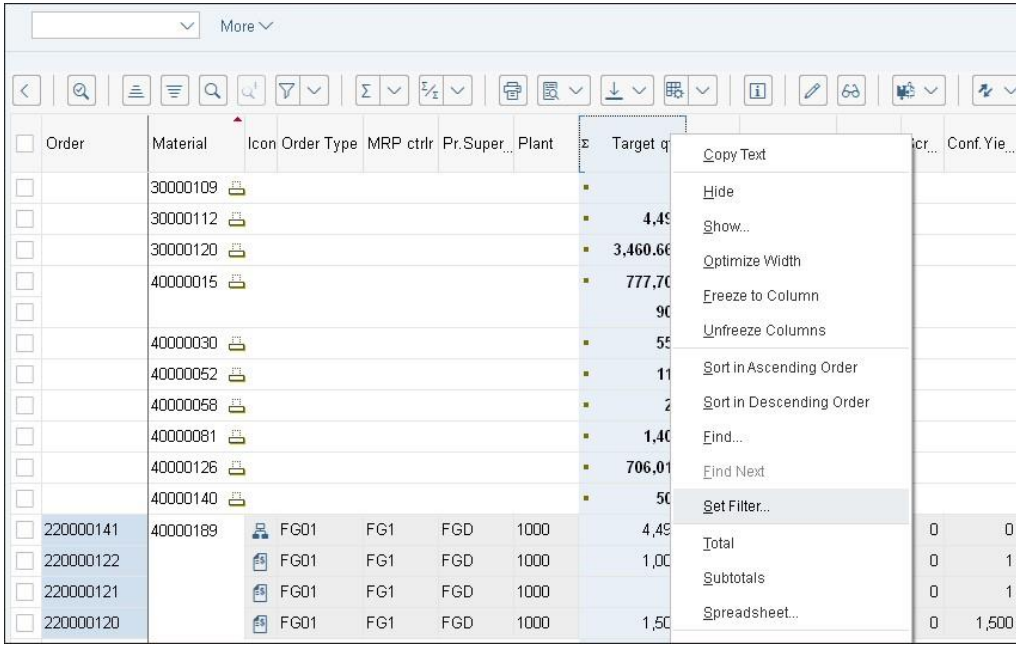


Figure 18.9 Setting a Filter in the Order Information System

Note

The system will interchangeably show the **Target qty** or **Order quantity** fields in this report. It's basically the production order quantity (**GMEIN** field).

18.2.9 Download

When you execute a report or conduct a standard analysis, you can also download the information in one of the several forms available by choosing the **Download** icon . You can also send the information as an email attachment or even perform an ABC analysis in the information system, although it's also available in the standard analysis reports.

18.2.10 Copy Selective Data to Microsoft Excel

You can copy selected data if you don't want to download the entire data of your SAP S/4HANA into Excel or a different format. Press (Ctrl)+(Y) to select the fields or content within the report. This enables block selection in which you select the block of fields you want to copy. Then press (Ctrl)+(C) to copy the data. In Excel or another program (Microsoft Notepad or Word), press (Ctrl)+(P) to paste the copied data.

18.2.11 Print

You can see the available options if you want to create a printout of the report. The print option is available by clicking on the **Print** icon within the report. All the parameters used in the generation of the report in the information system also become part of the printout, including filters, and so on.

Note

We encourage you to explore other features and functions of each icon as well as the options available on the menu of each report.

We've covered in general some of the features and functions available in the information systems as well as in analyses. Now let's discuss the order information system in more detail. The details covered so far were general in nature and enable you to make effective use of the information systems and analyses in any area of working with your SAP S/4HANA. We now move on to cover some of the actual lists (reports) of the order information system in the following sections and encourage you to explore the others available. You can access all of the following reports via Transaction COOIS.

18.3 Order Information System Reports

Now that the basic understanding of icons and features of standard reports is covered, the following sections will cover some of the actual order reports, such as automatic goods movement, capacities, document links, and execution steps.

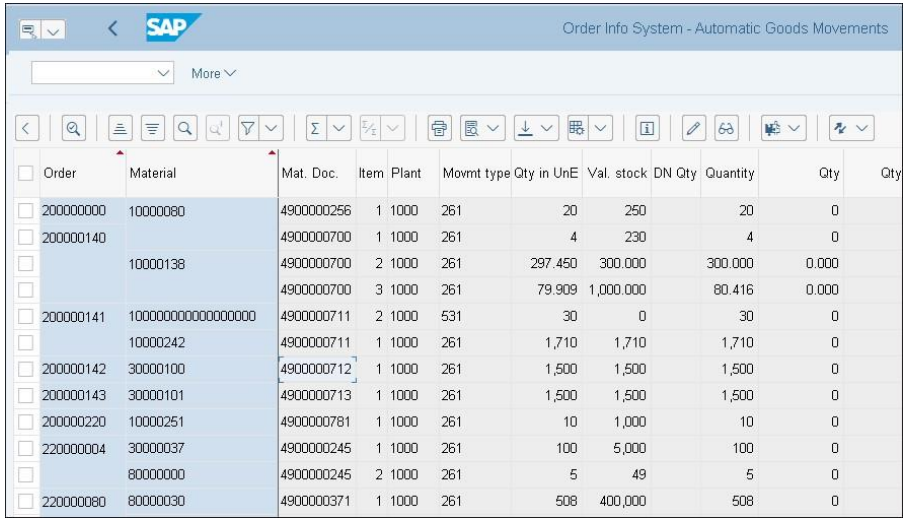
18.3.1 Automatic Goods Movement

In automatic goods movement, the system performs one or both of the following functions:

If the **Backflush** functionality is activated, the component's consumption or goods issue (GI) is automatically recorded at the time of confirmation against the process order. This is denoted by movement type 261.

If the **Auto-GR** functionality is activated, the system automatically performs the goods receipt (GR) for the process order of the confirmed production quantity when the user performs the confirmation for the process order. This is denoted by movement type 101.

From the **List** dropdown option shown earlier in Figure 18.1 (you'll be referring to this **List** dropdown for each of the report options discussed next), select **Automatic Goods Movements**. In Figure 18.10, see the **Mvmt type** (movement type) column for backflush and auto-GR.



Order	Material	Mat. Doc.	Item	Plant	Movmt type	Qty in UnE	Val. stock	DN Qty	Quantity	Qty	Qty
200000000	10000080	4900000256	1	1000	261	20	250		20	0	
200000140		4900000700	1	1000	261	4	230		4	0	
	10000138	4900000700	2	1000	261	297.450	300.000		300.000	0.000	
		4900000700	3	1000	261	79.909	1,000.000		80.416	0.000	
200000141	100000000000000000	4900000711	2	1000	531	30	0		30	0	
	10000242	4900000711	1	1000	261	1,710	1,710		1,710	0	
200000142	30000100	4900000712	1	1000	261	1,500	1,500		1,500	0	
200000143	30000101	4900000713	1	1000	261	1,500	1,500		1,500	0	
200000220	10000251	4900000781	1	1000	261	10	1,000		10	0	
220000004	30000037	4900000245	1	1000	261	100	5,000		100	0	
	80000000	4900000245	2	1000	261	5	49		5	0	
220000080	80000030	4900000371	1	1000	261	508	400,000		508	0	

Figure 18.10 Automatic Goods Movements in the Order Information System

18.3.2 Capacities

From the **List** dropdown option, select **Capacities**. Based on the information from the routing of the material, the system automatically calculates the required capacities when the user creates a production order. When the user confirms an operation of the production order, the system correspondingly reduces the capacity requirements of the work center.

This will display the work centers, the operation quantities, and the remaining processing time (in hours) for each of the production orders.

18.3.3 Production Resource/Tool

From the **List** dropdown option, select **Production resource/tool** (**PRT**). Although not directly involved in the production process, PRT plays a pivotal role in the manufacturing process.

The available **PRT** categories are material (**M**), equipment (**E**), document (**D**), or miscellaneous (**O**). The details in the **Usage Value** denote the duration a PRT is needed during the production process for a production order.

18.3.4 Items

From the **List** dropdown option, select **Items**. This will display the items of the production order quantities, the actual recorded scrap, the GR, and variance, if any. This screen also contains the overdelivery or underdelivery for the material, and columns containing fields such as **Quantity**, **Scrap**, and **ExpVarRcpt**.

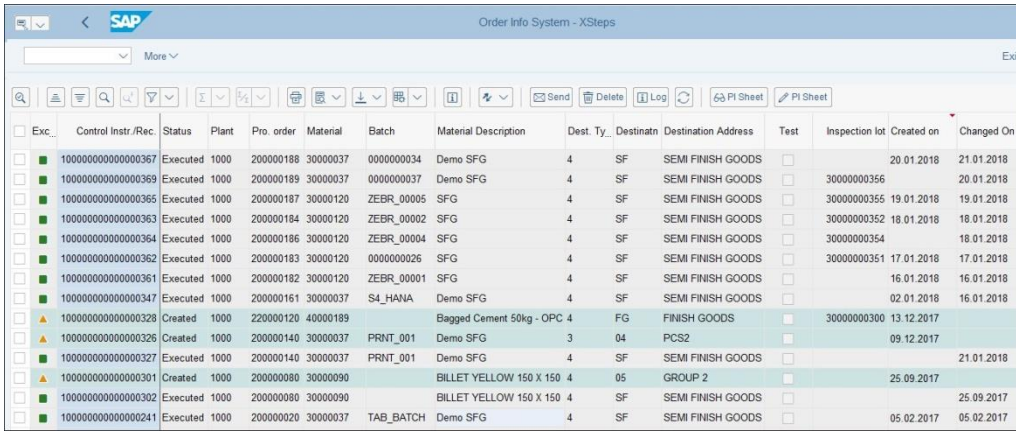
18.3.5 Document Links

From the **List** dropdown option, select **Document Links**. These documents were created in the Document Management System (DMS) and then attached to the object, such as the material master or bill of materials (BOM). When a production order for the material containing a DMS document is created or when a BOM containing a DMS document is used in the production order, the system automatically creates the document links. A DMS document consists of a document number, document type, document part, and document version.

18.3.6 Execution Steps

In the production order information system, you get to see the same information that you see in the **Control Recipe** list from the process order information system. Execution Steps (XSteps), or control recipes, are alternatively used in process manufacturing, depending on the option the company chooses as control instructions in process management. For discrete manufacturing, the company can only implement the XSteps option in process management.

From the **List** dropdown option, select **Control Recipe**. This screen shows the status of the control recipe for the specific process order (**Created**, **Sent**, **Executed**, or **Terminated**), the **Batch** details, the destination details (**Dest. Type**, **Destinatn**, **Destination Address** columns) of the control recipe, and the in-process (during production) **Inspection Lot** details (see Figure 18.11).



Exc...	Control Instr./Rec.	Status	Plant	Pro. order	Material	Batch	Material Description	Dest. Ty...	Destinatn	Destination Address	Test	Inspection lot	Created on	Changed On
	100000000000000367	Executed	1000	200000188	30000037	0000000034	Demo SFG	4	SF	SEMI FINISH GOODS			20.01.2018	21.01.2018
	100000000000000369	Executed	1000	200000189	30000037	0000000037	Demo SFG	4	SF	SEMI FINISH GOODS		30000000356		20.01.2018
	100000000000000365	Executed	1000	200000187	30000120	ZEBR_00005	SFG	4	SF	SEMI FINISH GOODS		30000000355	19.01.2018	19.01.2018
	100000000000000363	Executed	1000	200000184	30000120	ZEBR_00002	SFG	4	SF	SEMI FINISH GOODS		30000000352	18.01.2018	18.01.2018
	100000000000000364	Executed	1000	200000186	30000120	ZEBR_00004	SFG	4	SF	SEMI FINISH GOODS		30000000354		18.01.2018
	100000000000000362	Executed	1000	200000183	30000120	0000000026	SFG	4	SF	SEMI FINISH GOODS		30000000351	17.01.2018	17.01.2018
	100000000000000361	Executed	1000	200000182	30000120	ZEBR_00001	SFG	4	SF	SEMI FINISH GOODS			16.01.2018	16.01.2018
	100000000000000347	Executed	1000	200000161	30000037	S4_HANA	Demo SFG	4	SF	SEMI FINISH GOODS			02.01.2018	16.01.2018
	100000000000000328	Created	1000	220000120	40000189		Bagged Cement 50kg - OPC	4	FG	FINISH GOODS		30000000300	13.12.2017	
	100000000000000326	Created	1000	200000140	30000037	PRNT_001	Demo SFG	3	04	PCS2			09.12.2017	
	100000000000000327	Executed	1000	200000140	30000037	PRNT_001	Demo SFG	4	SF	SEMI FINISH GOODS				21.01.2018
	100000000000000301	Created	1000	200000080	30000090		BILLET YELLOW 150 X 150	4	05	GROUP 2			25.09.2017	
	100000000000000302	Executed	1000	200000080	30000090		BILLET YELLOW 150 X 150	4	SF	SEMI FINISH GOODS				25.09.2017
	100000000000000241	Executed	1000	200000020	30000037	TAB_BATCH	Demo SFG	4	SF	SEMI FINISH GOODS			05.02.2017	05.02.2017

Figure 18.11 Execution Steps

We've now covered a few reports from the process order information system and the production order information system, and the remaining reports follow the same pattern, while containing information pertaining to a specific area or application.

18.4 Missing Parts Information System

Having access to a standard SAP S/4HANA report that contains information on missing parts of components in the production or process order is highly valuable to a company's production planner. Production or process orders having missing components

are shown with the system status as **MSPT**. When you execute the report, the system not only shows the requirements quantity but also the committed or available quantity as well as the shortage quantity.

You can access the missing parts information system in all of the different production types, that is, discrete manufacturing, process manufacturing, or REM. The menu path/transaction for each is listed here:

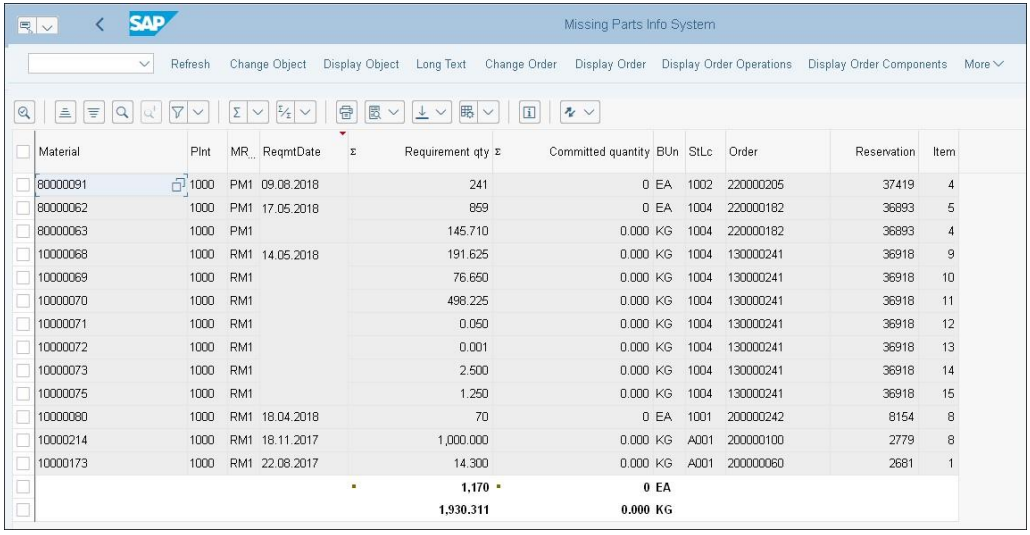
Discrete manufacturing

Choose **LogisticsProductionShop Floor ControlMissing Parts Info System**, or use Transaction CO24. **Process manufacturing**

Choose **LogisticsProduction** – **ProcessProcess OrderReportingMissing Parts Info System**, or use Transaction CO24. **Repetitive manufacturing**

Choose **LogisticsProductionRepetitive ManufacturingEnvironmentShop Floor Information SystemEnvironment SystemMissing Parts**, or use Transaction CO24.

Figure 18.12 shows the missing parts information system report for **Plant 1000**.



Material	Plnt	MR..	ReqmtDate	Σ	Requirement qty	Σ	Committed quantity	BUn	StLc	Order	Reservation	Item
80000091	1000	PM1	09.08.2018		241		0	EA	1002	220000205	37419	4
80000062	1000	PM1	17.05.2018		859		0	EA	1004	220000182	36893	5
80000063	1000	PM1			145.710		0.000	KG	1004	220000182	36893	4
10000068	1000	RM1	14.05.2018		191.625		0.000	KG	1004	130000241	36918	9
10000069	1000	RM1			76.650		0.000	KG	1004	130000241	36918	10
10000070	1000	RM1			498.225		0.000	KG	1004	130000241	36918	11
10000071	1000	RM1			0.050		0.000	KG	1004	130000241	36918	12
10000072	1000	RM1			0.001		0.000	KG	1004	130000241	36918	13
10000073	1000	RM1			2.500		0.000	KG	1004	130000241	36918	14
10000075	1000	RM1			1.250		0.000	KG	1004	130000241	36918	15
10000080	1000	RM1	18.04.2018		70		0	EA	1001	200000242	8154	8
10000214	1000	RM1	18.11.2017		1,000.000		0.000	KG	A001	200000100	2779	8
10000173	1000	RM1	22.08.2017		14.300		0.000	KG	A001	200000060	2681	1
					1,170		**0**	**EA**				
					1,930.311		**0.000**	**KG**				

Figure 18.12 Missing Parts Information System

18.5 Summary

In this chapter, we covered the large number of features and functions of standard reports as well as the standard analysis available. We also covered the actual order reports, such as automatic goods movement, capacities, document links, and execution steps. Finally, we discussed the missing parts information system, a helpful tool for the production planner.

The next chapter covers standard planning analysis.

Chapter 19

Standard Planning Analysis

Standard analyses in SAP S/4HANA provide great insight into many of the important logistics and supply chain management's key performance indicators to help companies make informed decisions. Standard analyses aren't just available in production planning but also in all logistics and supply chain management areas of SAP S/4HANA.

The standard analyses enable users to draw information from the available standard info structures in the SAP S/4HANA. The difference between the shop floor information system (reports) and standard analyses is the fact that in the information systems, the information is dynamic and changes when the user performs the relevant business functions. In standard analyses, the system draws from historical information to enable the user to make better business decisions. In other words, the data and information from information systems flows into analyses.

In this chapter, we cover some of the standard analyses for discrete manufacturing. We also show a few features and functionalities available only in analyses and not in information systems, such as time series analysis and ABC analysis. The concepts and understanding of standard analyses for discrete manufacturing that you'll gain in this chapter will enable you to explore standard analysis of process manufacturing and repetitive manufacturing (REM), for which we've provided the necessary menu paths as well as the associated transaction codes.

Note

Refer to Table 19.1 through Table 19.3 for transaction codes of various available standard analyses in discrete manufacturing, process manufacturing, and REM, respectively. We'll also provide the relevant SAP S/4HANA menu paths to access the standard analyses of each production type.

19.1 Discrete Manufacturing/Production Order

To access the standard analyses of discrete manufacturing, follow the menu path, **LogisticsProductionShop Floor ControlInformation SystemShop Floor Information SystemStandard Analyses**. Table 19.1 lists the transaction codes of various standard analyses available for discrete manufacturing, all of which we'll discuss in the following sections. Standard analysis for material consumption (Transaction MCRE) provides day-wise consumption figures (quantity and value) of components consumed in producing a product. After gaining an understanding of various standard analyses we cover in this chapter, as an exercise and to reinforce your learning, run the material consumption analysis and explore various options it offers.

Standard Analysis	Transaction Code
Work Center	MCP7
Operation	MCP1
Material	MCP5
Production Order	MCP3
Product Costs	MCRI
Material Consumption	MCRE

Table 19.1 Standard Analyses for Discrete Manufacturing

19.1.1 Work Center

Figure 19.11 shows a total of three plants in the list (Transaction MCP7). No information has been provided on the selection criteria screen for the standard analysis for work center; we simply executed the report. Choose **Switch drilldown**2 to open the **Drilldown** screen. Select the **Work Center** radio button to change from the plant-level to work center–level display of data. In the **Drilldown** screen 3, **55** work centers are listed along with target lead time (**TgtLeadTm.**) and actual lead time (**ActLeadTm.**) details. The smallest/minimum time unit (using shorter intervals can be derived via decimal format) is in days.

Tip

If you want to know more details about any field of standard analyses or the purpose or function of a field, simply place the cursor on the field in question and press (F1). You can use the tip while choosing the fields to display in standard analyses as you'll see in Figure 19.2.

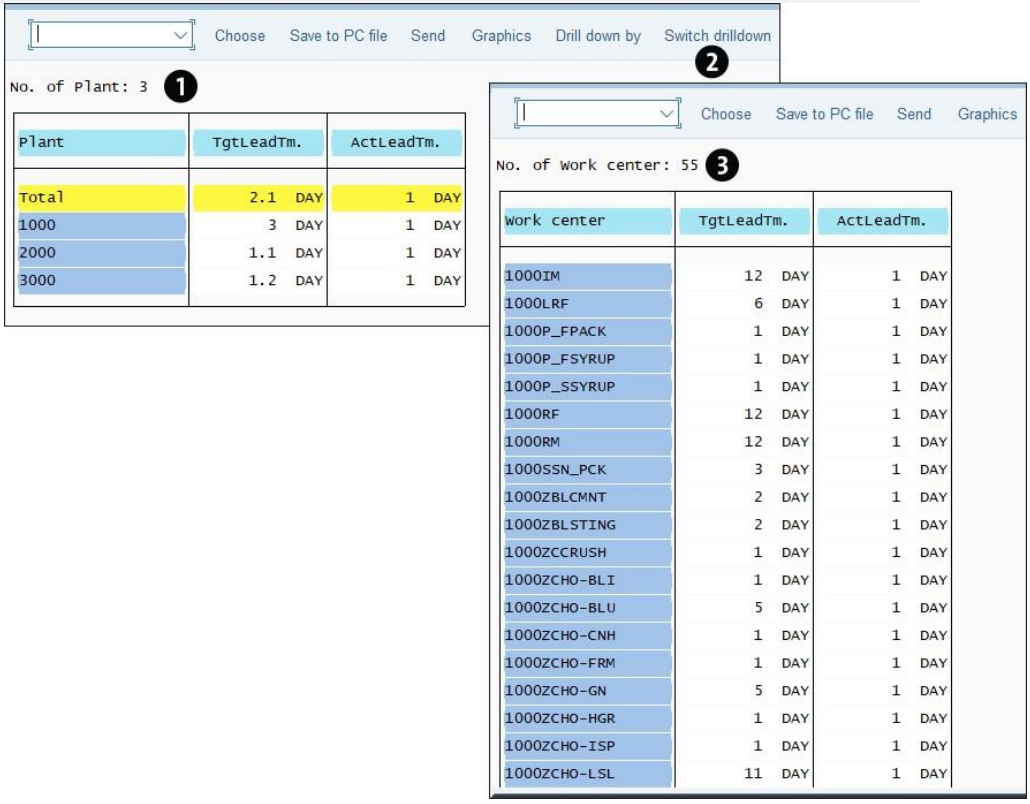


Figure 19.1 Switch Drilldown in Work Center Analysis

You can display a large number of fields in Figure 19.12, just as you were able to do so in the order information systems. To display hidden fields, choose **More Choose Key Figures** from the menu bar, and the popup screen shown in Figure 19.2 appears. The left-hand side of this screen shows the fields already displayed in Figure 19.1, whereas the right-hand side shows a large number of fields for you to choose from. Also notice that there are filters for key figures—**All**, **Figures (w/o unit)**, and **Quantities**—which help to quickly identify and select the desired fields in the report.

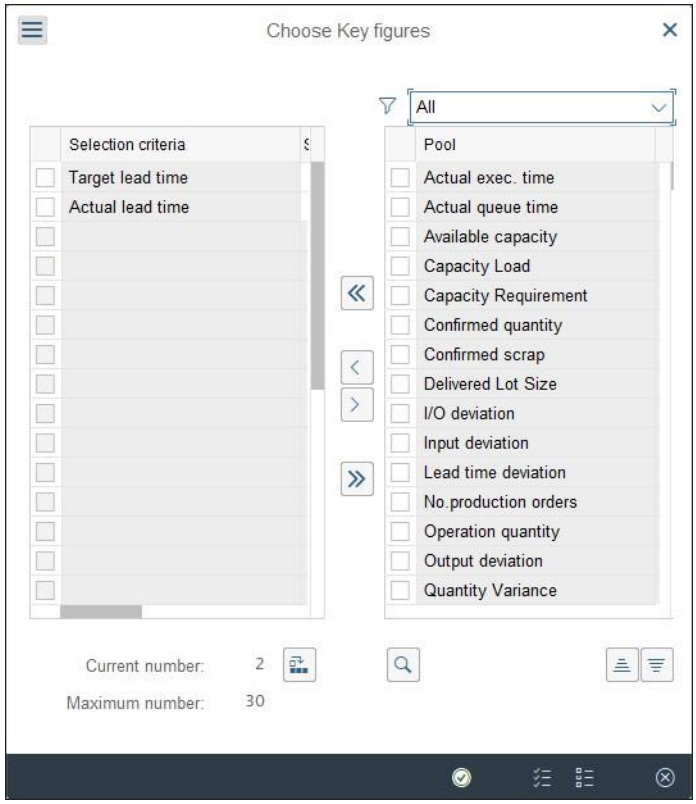
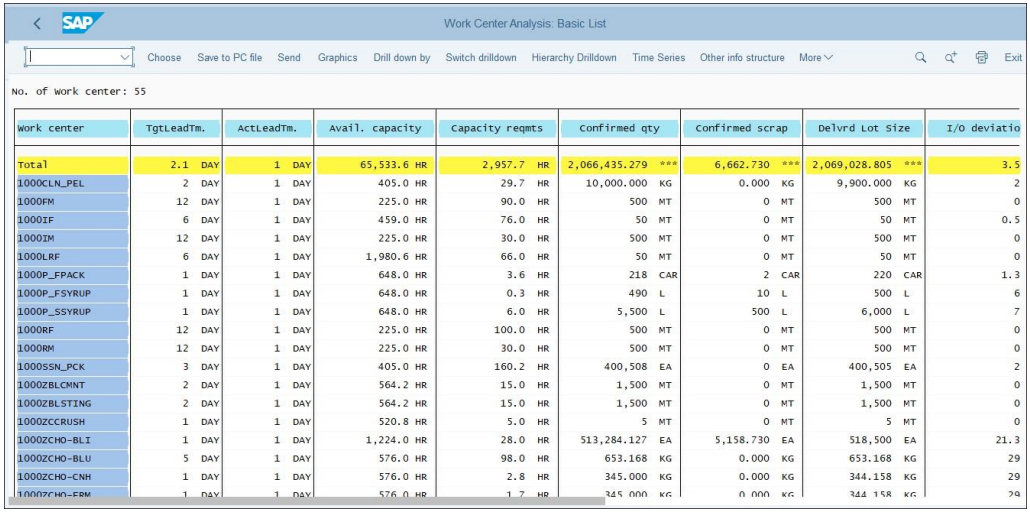


Figure 19.2 Selecting Key Figures in Standard Analysis

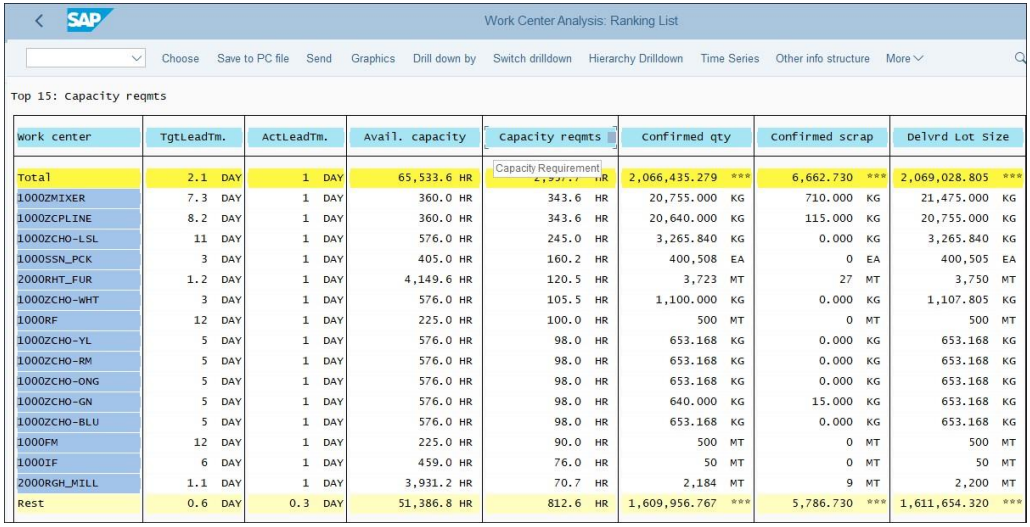
For this example, select a few key figures from Figure 19.2 for display. Here you see the input deviation of planned start dates of operation with actual start dates. The values are averaged out. The same concept applies for the output deviation, which is the deviation between the planned end date of operations at the work center and the actual end date entered in the confirmation of the operation (Figure 19.3). It also shows details about the available capacity versus the capacity requirements of different work centers.



Work center	TgtLeadTm.	ActLeadTm.	Avail. capacity	Capacity reqmts	Confirmed qty	Confirmed scrap	Delvrd Lot Size	I/O deviatio
Total	2.1 DAY	1 DAY	65,533.6 HR	2,957.7 HR	2,066,435.279 ***	6,662.730 ***	2,069,028.805 ***	3.5
1000CLN_PEL	2 DAY	1 DAY	405.0 HR	29.7 HR	10,000.000 KG	0.000 KG	9,900.000 KG	2
1000FM	12 DAY	1 DAY	225.0 HR	90.0 HR	500 MT	0 MT	500 MT	0
1000IF	6 DAY	1 DAY	459.0 HR	76.0 HR	50 MT	0 MT	50 MT	0.5
1000IM	12 DAY	1 DAY	225.0 HR	30.0 HR	500 MT	0 MT	500 MT	0
1000LRF	6 DAY	1 DAY	1,980.6 HR	66.0 HR	50 MT	0 MT	50 MT	0
1000P_FPACK	1 DAY	1 DAY	648.0 HR	3.6 HR	218 CAR	2 CAR	220 CAR	1.3
1000P_FSYRUP	1 DAY	1 DAY	648.0 HR	0.3 HR	490 L	10 L	500 L	6
1000P_SSYRUP	1 DAY	1 DAY	648.0 HR	6.0 HR	5,500 L	500 L	6,000 L	7
1000RF	12 DAY	1 DAY	225.0 HR	100.0 HR	500 MT	0 MT	500 MT	0
1000RM	12 DAY	1 DAY	225.0 HR	30.0 HR	500 MT	0 MT	500 MT	0
1000SSN_PCK	3 DAY	1 DAY	405.0 HR	160.2 HR	400,508 EA	0 EA	400,505 EA	2
1000ZBLCMNT	2 DAY	1 DAY	564.2 HR	15.0 HR	1,500 MT	0 MT	1,500 MT	0
1000ZBLSTING	2 DAY	1 DAY	564.2 HR	15.0 HR	1,500 MT	0 MT	1,500 MT	0
1000ZCCRUSH	1 DAY	1 DAY	520.8 HR	5.0 HR	5 MT	0 MT	5 MT	0
1000ZCHO-BLI	1 DAY	1 DAY	1,224.0 HR	28.0 HR	513,284.127 EA	5,158.730 EA	518,500 EA	21.3
1000ZCHO-BLU	5 DAY	1 DAY	576.0 HR	98.0 HR	653.168 KG	0.000 KG	653.168 KG	29
1000ZCHO-CNH	1 DAY	1 DAY	576.0 HR	2.8 HR	345.000 KG	0.000 KG	344.158 KG	29
1000ZCHO-FRM	1 DAY	1 DAY	576.0 HR	1.7 HR	345.000 KG	0.000 KG	344.158 KG	29

Figure 19.3 More Key Figures of Work Centers

Place the cursor on the **Capacity reqmts** key figure, and navigate to **More Top N**.
Enter **Number** as "15" to then see the **Top 15 Capacity reqmts**; the remaining deviations are shown as **Rest** at the bottom of the screen (Figure 19.4). You can enter any number to view the top numbers of key figures.



Work center	TgtLeadTm.	ActLeadTm.	Avail. capacity	Capacity reqmts	Confirmed qty	Confirmed scrap	Delvrd Lot Size
Total	2.1 DAY	1 DAY	65,533.6 HR	2,957.7 HR	2,066,435.279 ***	6,662.730 ***	2,069,028.805 ***
1000ZMIXER	7.3 DAY	1 DAY	360.0 HR	343.6 HR	20,755.000 KG	710.000 KG	21,475.000 KG
1000ZCPLINE	8.2 DAY	1 DAY	360.0 HR	343.6 HR	20,640.000 KG	115.000 KG	20,755.000 KG
1000ZCHO-LSL	11 DAY	1 DAY	576.0 HR	245.0 HR	3,265.840 KG	0.000 KG	3,265.840 KG
1000SSN_PCK	3 DAY	1 DAY	405.0 HR	160.2 HR	400,508 EA	0 EA	400,505 EA
2000RHT_FUR	1.2 DAY	1 DAY	4,149.6 HR	120.5 HR	3,723 MT	27 MT	3,750 MT
1000ZCHO-WHT	3 DAY	1 DAY	576.0 HR	105.5 HR	1,100.000 KG	0.000 KG	1,107.805 KG
1000RF	12 DAY	1 DAY	225.0 HR	100.0 HR	500 MT	0 MT	500 MT
1000ZCHO-YL	5 DAY	1 DAY	576.0 HR	98.0 HR	653.168 KG	0.000 KG	653.168 KG
1000ZCHO-RM	5 DAY	1 DAY	576.0 HR	98.0 HR	653.168 KG	0.000 KG	653.168 KG
1000ZCHO-ONG	5 DAY	1 DAY	576.0 HR	98.0 HR	653.168 KG	0.000 KG	653.168 KG
1000ZCHO-GN	5 DAY	1 DAY	576.0 HR	98.0 HR	640.000 KG	15.000 KG	653.168 KG
1000ZCHO-BLU	5 DAY	1 DAY	576.0 HR	98.0 HR	653.168 KG	0.000 KG	653.168 KG
1000FM	12 DAY	1 DAY	225.0 HR	90.0 HR	500 MT	0 MT	500 MT
1000IF	6 DAY	1 DAY	459.0 HR	76.0 HR	50 MT	0 MT	50 MT
2000RGH_MILL	1.1 DAY	1 DAY	3,931.2 HR	70.7 HR	2,184 MT	9 MT	2,200 MT
Rest	0.6 DAY	0.3 DAY	51,386.8 HR	812.6 HR	1,609,956.767 ***	5,786.730 ***	1,611,654.320 ***

Figure 19.4 Ranking List in Work Center Analysis

19.1.2 Operations

Using Transaction MCP1, you can view day-wise details of operations, including the capacity requirements in hours, the actual queue time, lead time, and execution time. It also shows the target processing time in hours, wait time in hours, and target setup time in hours, among other key figures. Other key fields include **Cap. Reqmts** (capacity requirements), **ActQueueTm** (actual queue time), and **Wait. time**.

19.1.3 Material

Using Transaction MCP5, you can view the material analysis, which covers the quantity and duration details of various materials. This includes the order quantity, the goods receipt (GR) quantity, the scrap, and also the deviations. The duration details consist of delivery time deviation, lead time deviation, and durations, such as target queue time and target execution time.

19.1.4 Production Order

Figure 19.5 displays the standard analysis production orders (Transaction MCP3). Select the first key figure **GR quantity** by placing the cursor on it and navigating to **More ABC Analysis** from the menu bar. In the popup that appears, choose the **Strategy** for ABC analysis as **Total GR quantity** (%), and choose **Continue**.

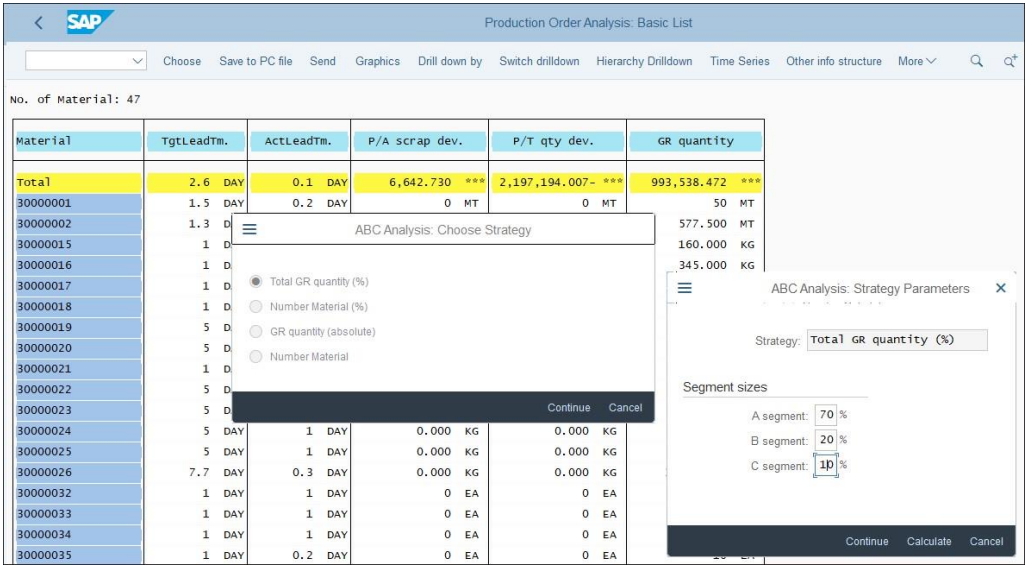


Figure 19.5 Production Order Analysis

Options in ABC analysis are listed here:

Total GR quantity (%)
The GR quantity is divided by the defined percentage.

Number Material (%)
The number of materials is divided by the defined percentage.

GR quantity (absolute)
The actual GR quantity is divided into A, B, or C segments.

Number Material
The number of materials is divided into A, B, or C segments.

ABC analysis enables you to select the right strategy and then divide the key figures into the top three groupings. You also have the flexibility to define what percentage of a key figure to be listed in the A, B, or C segments.

You can also overwrite the system-suggested segment sizes of A, B, or C. For this example, enter **A segment** as "70", **B segment** as "20", and **C segment** as "10". These three entries cause the system to divide and display the **Total GR quantity** (%) in such a way that the top 70% will be categorized in segment A, 20% in segment B, and the bottom 10% in segment C in a sequential order.

Click on **Calculate** to open **SAP Statistics Graphics** as a graphical representation of the ABC analysis. Click **Graphics** in the menu bar of Figure 19.5 so that Figure 19.6 appears.

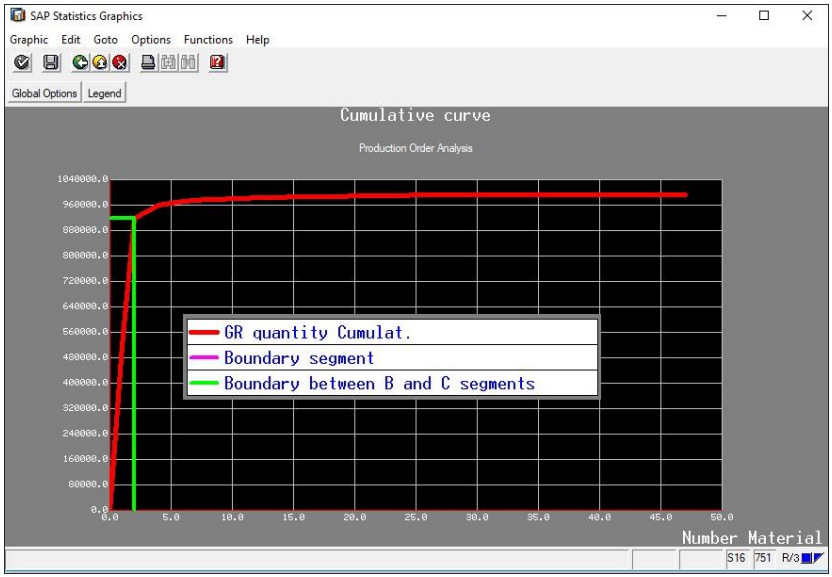
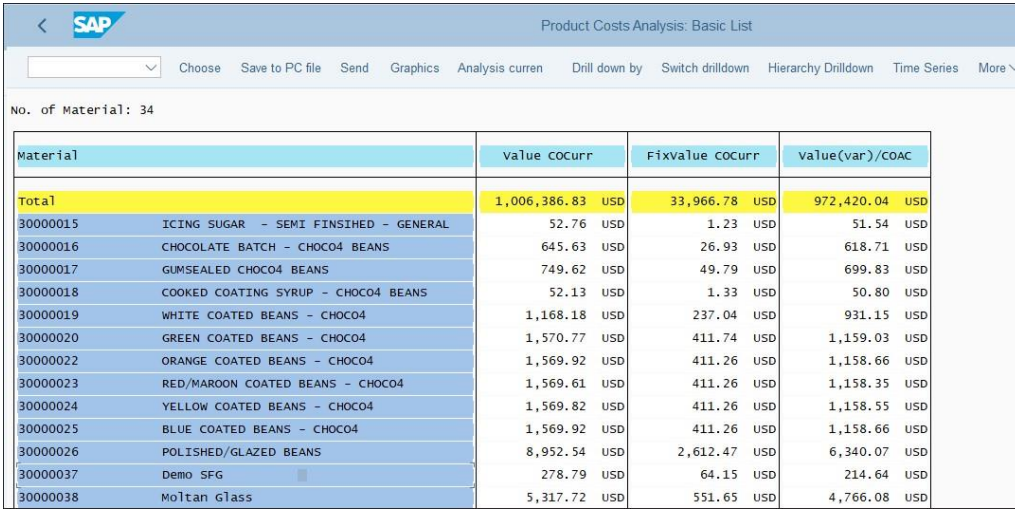


Figure 19.6 ABC Analysis

19.1.5 Product Costs

Using Transaction MCRI, the resulting screen in Figure 19.7 shows the standard analysis of the product cost. You can click on the **Value COCurr** field and choose **Time Series** to open the **Time series** dialog box. A *time series* denotes the breakdown of a key figure of a characteristic, which in this case, is **Material**.



Material		Value COCurr		FixValue COCurr		Value(var)/COAC	
Total		1,006,386.83	USD	33,966.78	USD	972,420.04	USD
30000015	ICING SUGAR - SEMI FINSIHED - GENERAL	52.76	USD	1.23	USD	51.54	USD
30000016	CHOCOLATE BATCH - CHOCO4 BEANS	645.63	USD	26.93	USD	618.71	USD
30000017	GUMSEALED CHOCO4 BEANS	749.62	USD	49.79	USD	699.83	USD
30000018	COOKED COATING SYRUP - CHOCO4 BEANS	52.13	USD	1.33	USD	50.80	USD
30000019	WHITE COATED BEANS - CHOCO4	1,168.18	USD	237.04	USD	931.15	USD
30000020	GREEN COATED BEANS - CHOCO4	1,570.77	USD	411.74	USD	1,159.03	USD
30000022	ORANGE COATED BEANS - CHOCO4	1,569.92	USD	411.26	USD	1,158.66	USD
30000023	RED/MAROON COATED BEANS - CHOCO4	1,569.61	USD	411.26	USD	1,158.35	USD
30000024	YELLOW COATED BEANS - CHOCO4	1,569.82	USD	411.26	USD	1,158.55	USD
30000025	BLUE COATED BEANS - CHOCO4	1,569.92	USD	411.26	USD	1,158.66	USD
30000026	POLISHED/GLAZED BEANS	8,952.54	USD	2,612.47	USD	6,340.07	USD
30000037	Demo SFG	278.79	USD	64.15	USD	214.64	USD
30000038	Moltan Glass	5,317.72	USD	551.65	USD	4,766.08	USD

Figure 19.7 Product Costs Analysis

19.2 Process Manufacturing/Process Order

To access the standard analyses of process manufacturing, follow the menu path, **LogisticsProduction** – **ProcessProcess OrderReportingShop Floor Information System**. Table 19.2 lists the transactions of various standard analyses available for process manufacturing.

Standard Analysis	Transaction
Resource	MCRW
Operation	MCRU
Material	MCP5

Table 19.2 Standard Analyses for Process Manufacturing

Standard Analysis	Transaction
Process Order	MCRV
Material Consumption	MCRX
Product Costs	MCRY

Table 19.2 Standard Analyses for Process Manufacturing (Cont.)

19.3 Repetitive Manufacturing

To access the standard analyses of REM, follow the menu path, **LogisticsProductionShop Floor ControlInformation SystemShop Floor Information SystemStandard AnalysesRepetitive Manufacturing**. Table 19.3 lists the transactions of various standard analyses available for REM.

Standard Analysis	Transaction Code
GR Statistics	MCP6
Reporting Point Statistics	MCRM
Material Consumption	MCRP
Product Costs	MCRK

Table 19.3 Standard Analyses for REM

19.4 Additional Analysis Functions

In the following sections, we'll cover some of the additional analysis functions, such as all key figures, the icon texts replacing the icons in SAP S/4HANA, and how to quickly navigate to other info structures in standard analysis.

Let's now discuss some of the standard analyses of PP.

19.4.1 Key Figures

Sometimes, you want to see all the key figures of one characteristic. Double-click any entry of the characteristic, and the system displays all the key figures of that characteristic, as shown in Figure 19.8.

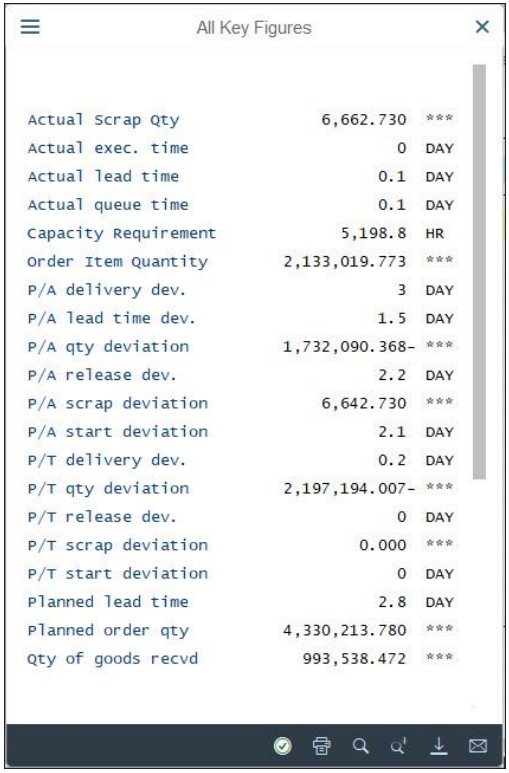


Figure 19.8 All Key Figures

19.4.2 Icons

In the new SAP Fiori-themed user interface (UI) of SAP S/4HANA standard analyses, SAP has mostly done away with icons in both the parameters selection screen (see Figure 19.9) as well as the standard analyses themselves (see Figure 19.10).

Icons are now mostly replaced with the icon texts to enable users to quickly find the relevant icons required to perform specific functions. With icon texts in place, users no longer have to hover over an icon to see an icon's text and then decide if this is the function they want to use.

Because icon texts take more screen space than the icons themselves, always look for **More** in the menu bar (usually located on the far right-hand side of the screen) to search for functions that aren't visible on the main menu bar or at the bottom of the screens.

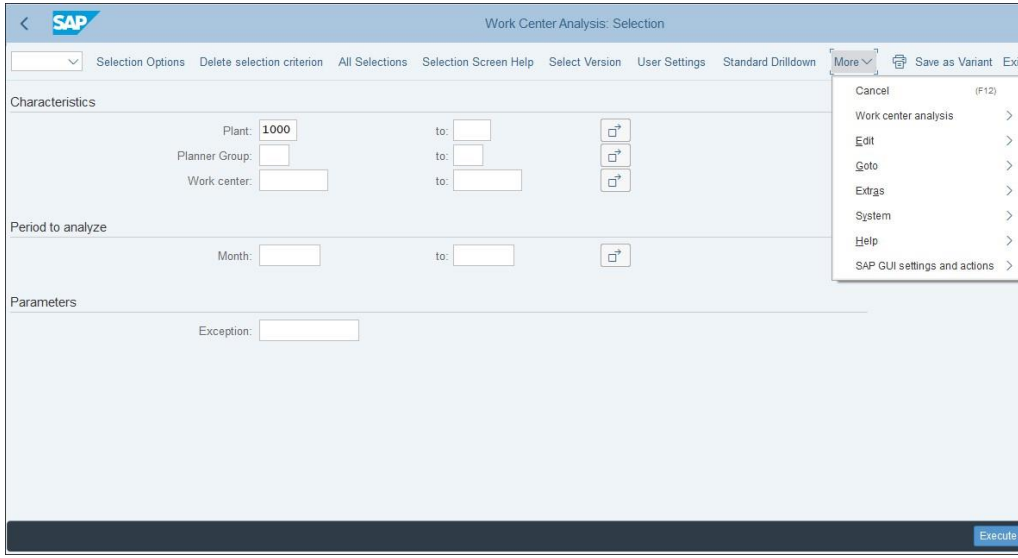


Figure 19.9 Parameters Selection Screen

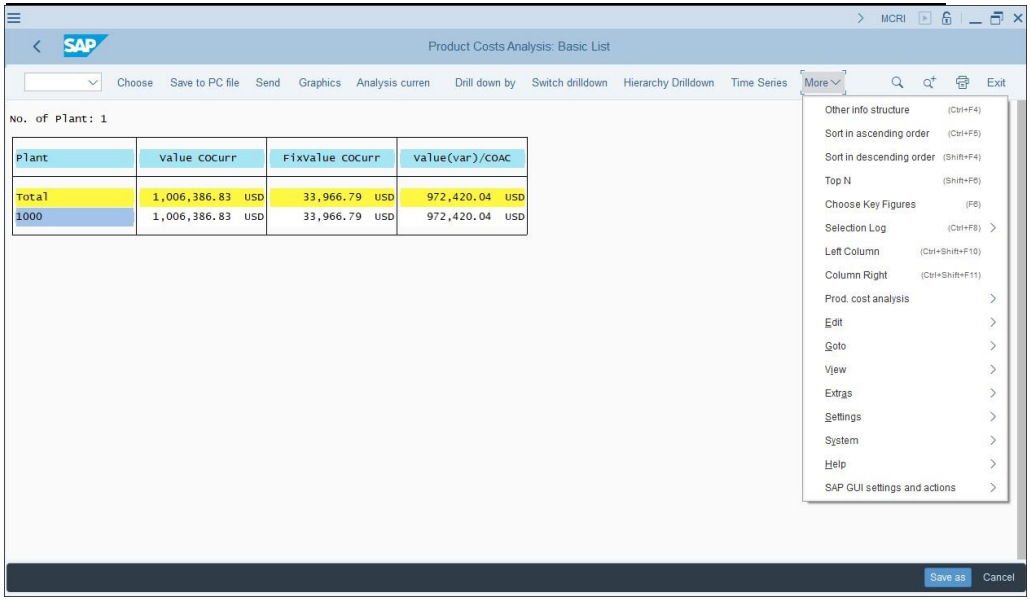
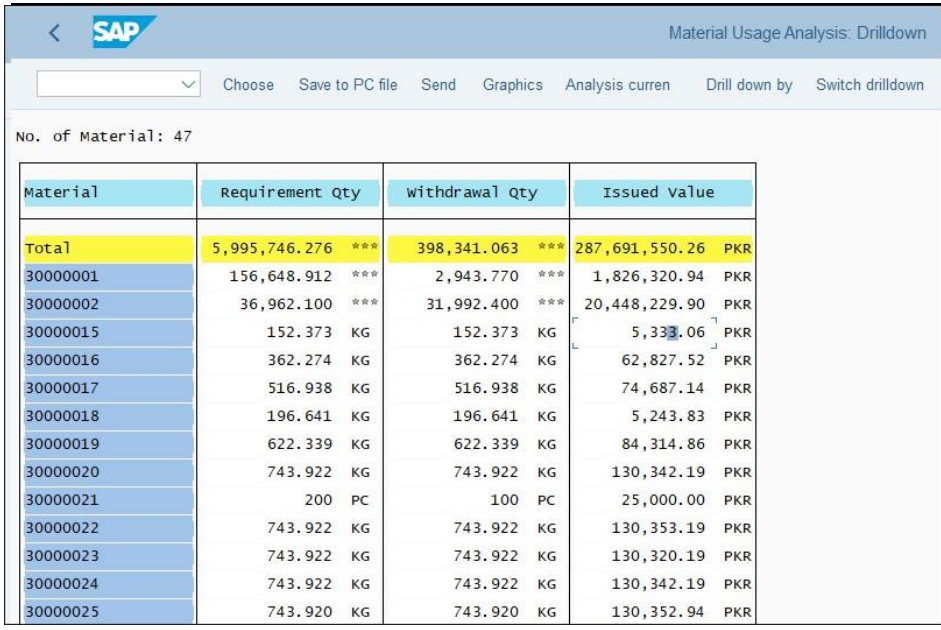


Figure 19.10 Standard Analysis

19.4.3 Other Info Structures

You can also navigate to the **Other info structure** screen within the standard analysis. To do so, choose **More Other info structure**, and in the ensuing popup, enter the name of the new info structure, or use the dropdown menu to select one. In this example, **Info structure S026** (not shown) for material usage analysis is selected (see Figure 19.11).



Material	Requirement Qty		Withdrawal Qty		Issued Value	
Total	5,995,746.276	***	398,341.063	***	287,691,550.26	PKR
30000001	156,648.912	***	2,943.770	***	1,826,320.94	PKR
30000002	36,962.100	***	31,992.400	***	20,448,229.90	PKR
30000015	152.373	KG	152.373	KG	5,333.06	PKR
30000016	362.274	KG	362.274	KG	62,827.52	PKR
30000017	516.938	KG	516.938	KG	74,687.14	PKR
30000018	196.641	KG	196.641	KG	5,243.83	PKR
30000019	622.339	KG	622.339	KG	84,314.86	PKR
30000020	743.922	KG	743.922	KG	130,342.19	PKR
30000021	200	PC	100	PC	25,000.00	PKR
30000022	743.922	KG	743.922	KG	130,353.19	PKR
30000023	743.922	KG	743.922	KG	130,320.19	PKR
30000024	743.922	KG	743.922	KG	130,342.19	PKR
30000025	743.920	KG	743.920	KG	130,352.94	PKR

Figure 19.11 Other Info Structure (Material Usage Analysis)

The standard info structures for PP are shown in Table 19.4.

Information Structure	Information Structure Description
S021	Production order
S022	Operation
S023	Material
S024	Work center

Table 19.4 Standard Information Structures Available for PP

Information Structure	Information Structure Description
S025	Run schedule header

S026	Material usage
S027	Product costs
S028	Reporting point statistics
S029	Kanban
S225	GR: REM
S226	Material usage: REM
S227	Product costs: REM

Table 19.4 Standard Information Structures Available for PP (Cont.)

Note

Now that you have a decent understanding of standard analyses in PP, we highly recommend that you explore the many hidden and latent features available that can bring ongoing improvements in business processes not just in logistics but in the entire supply chain.

19.5 Summary

This chapter covered some of the more frequently used standard analyses of PP. All analyses of logistics and supply chain are available in one node to facilitate quick and comprehensive access to the needed information.

The next chapter discusses SAP Fiori apps for PP in SAP S/4HANA.

Chapter 20

SAP Fiori Apps for Production Planning

Timely, accurate, and comprehensive information helps companies make better and faster business decisions. You can immediately start to use a large number of SAP Fiori apps available not just for production planning but also for logistics and supply chain management.

SAP Fiori is the next-generation web-based user experience of working with the SAP S/4HANA system, and each app is shown as a tile in the SAP Fiori launchpad. A large number of SAP Fiori apps are available in SAP S/4HANA, and the apps library is constantly expanding. Apps for master data, transactional data, reporting, and analytics of all SAP areas are available in the SAP Fiori library. We'll cover some of them in this chapter, after taking a quick look at the SAP Fiori launchpad and the library for all SAP Fiori apps.

20.1 SAP Fiori Launchpad and Apps Library

Figure 20.1 shows the initial screen of SAP Fiori launchpad wherein individual apps are represented as tiles. The apps can be group together based on different roles, such as materials planner, production planner, or inventory controller. They can also be grouped together based on functional areas such as production planning (PP), materials management (MM) or quality management (QM), as shown on different tabs in Figure 20.1. Due to the highly intuitive nature of apps, it's easier for an app user to quickly get up to speed when using it. Further, most master data and transactional data apps and even several reporting apps in SAP Fiori still give the look and feel of the SAP GUI by showing the same menu options, menu bars, buttons, and icons. The top right-hand corner of the screen provides an option to search for an app by its name or by transaction code, such as "COR2" (change process order).

Figure 20.2 shows two different apps and some of the more commonly used features. As always, it's recommended to explore several latent and hidden features in an app so that you can take maximum advantage of information and analytics available.

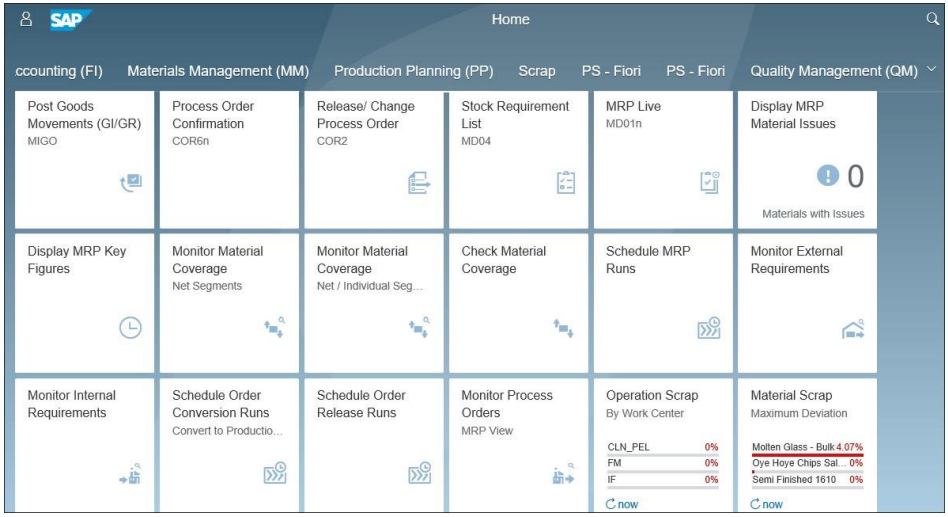


Figure 20.1 SAP Fiori Apps Homepage

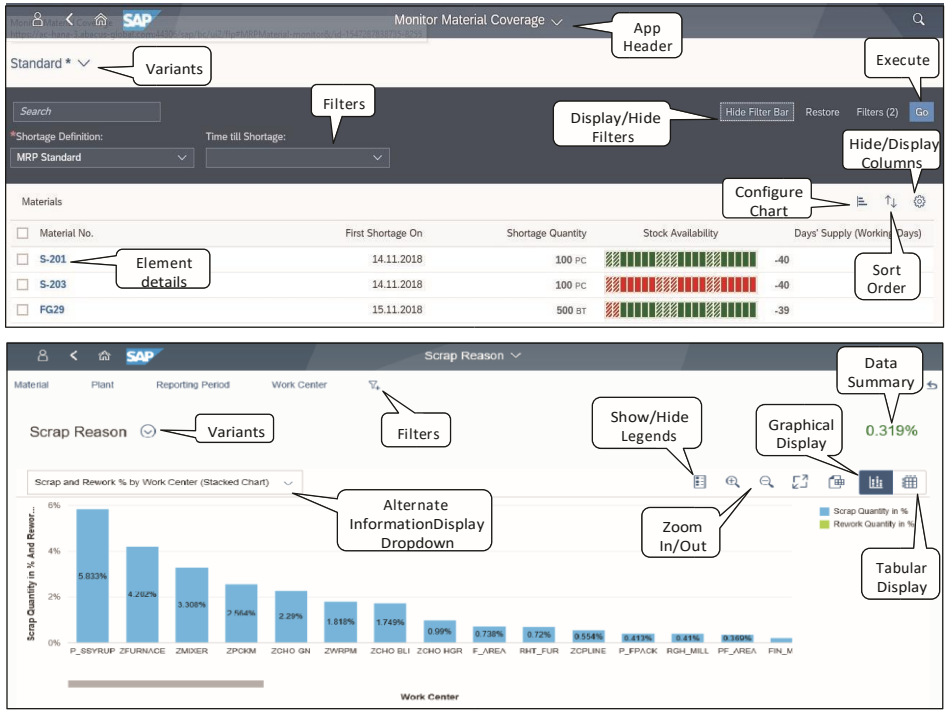


Figure 20.2 Features in SAP Fiori Apps

The library of SAP Fiori apps is constantly expanding at a rapid pace for both SAP S/4HANA and SAP S/4HANA Cloud.

To search for and explore the latest or relevant SAP Fiori apps, go to *http://bit.ly/SAPFioriAppsLibrary,* and click on the **Home** icon. Figure 20.3 shows the initial screen of the SAP Fiori apps library wherein the relevant app can be searched on the lefthand side and app details can be viewed on the right-hand side of the screen. To make relevant apps available for use, reach out to your SAP Fiori consultant with an app's details and the specific role or group to which these need to be assigned.

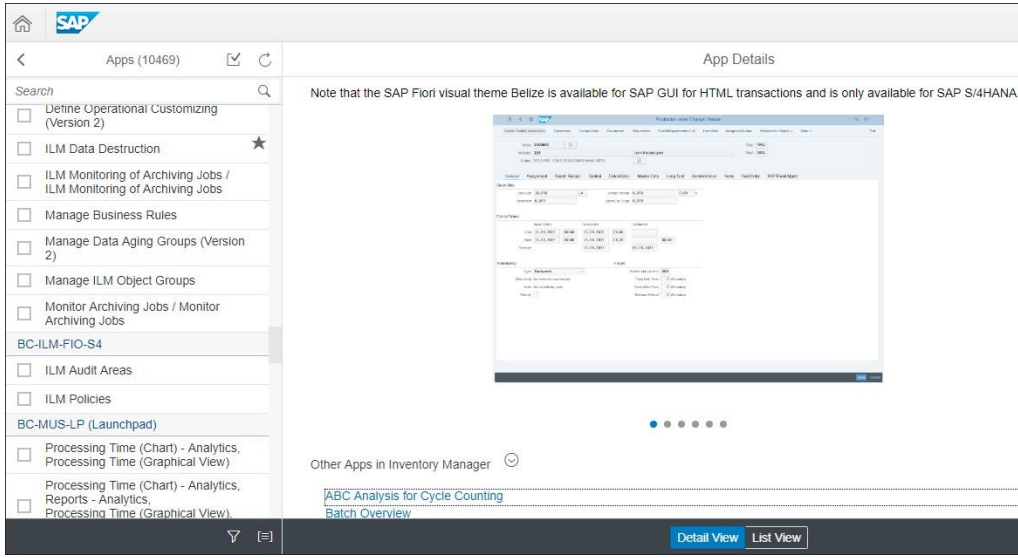


Figure 20.3 SAP Fiori Apps Library

20.2 SAP Fiori Applications

In the following sections, we'll cover some of the SAP Fiori apps of PP, such as Monitor Material Coverage, Monitor External or Internal Requirements, and Capacity Planning, among others.

20.2.1 Monitor Material Coverage

This app enables a production planner to monitor all the materials in a selected area of responsibility. This includes make-to-stock (MTS) and collective requirements materials, make-to-order (MTO) and engineer-to-order (ETO) materials, as well as materials for direct

production and direct procurement. The app also provides a list of all materials with a net requirement segment or individual segments. These materials might have coverage issues according to a specified shortage definition. The shortage definition you choose contains a set of rules that the system uses for calculating the material shortages. These rules define the scope of the shortage calculation, that is, the supply and demand elements to be considered and the conditions that have to be met to be a relevant shortage.

Figure 20.4 contains the Monitor Material Coverage app showing a few materials wherein the green bars represent a comfortable stock availability situation. The red bars represent a situation that the inventory or materials planner needs to pay greater attention to avoid stock-outs or unavailability of required material on the desired date. The displayed columns show the shortage quantity and when the first shortage is likely to happen. More columns can be displayed too. Multiple dropdowns on the left-hand side provide options to the materials or production planner to filter materials based on different criteria. After applying a new filter, click on **Go**. You can also use the default filters **Time till Shortage**, **Material**, and **Individual Segment** to narrow down the scope of your list.

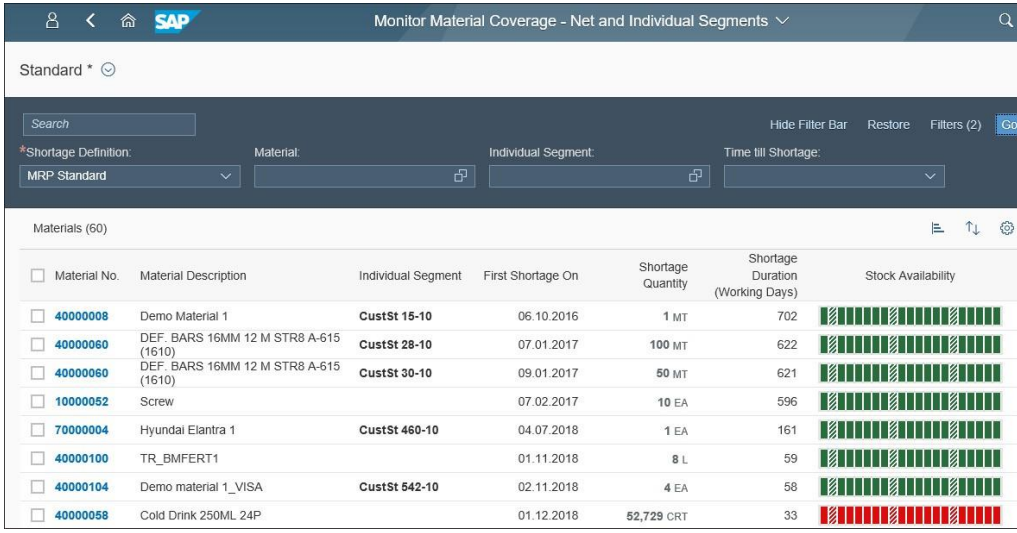


Figure 20.4 Monitor Material Coverage App

20.2.2 Monitor External Requirements

The Monitor External Requirements app offers monitoring of the uncovered requirements originating from sales orders and stock transport orders in a selected area of responsibility. You can use the default filter **Time till Requirement Date** to determine the period in which you want to check uncovered external requirements. Only one shortage definition is available for calculating uncovered requirements and is displayed for information purposes.

This app is helpful to a materials planner by providing necessary information to be able to react to the shortage situation and fulfill customers' demands on time. Click on a material code in Figure 20.4, for example, **40000058**, and the screen shown in Figure 20.5 appears.

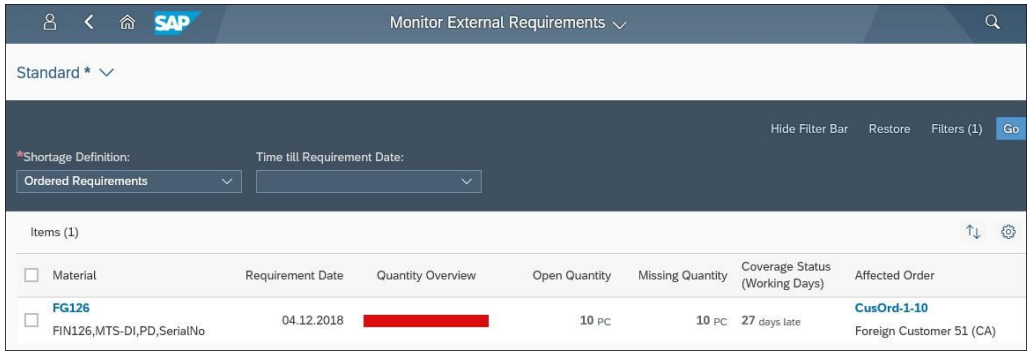


Figure 20.5 Monitor External Requirements App

Figure 20.6 is the detailed view of the material's stock or shortage situation and the time (in days) it will take to replenish the stock of material in question. Click on **OpenCheck Material Coverage** located on the bottom-right side of the screen in Figure 20.6, and the screen shown in Figure 20.7 appears.

Tips & Tricks

You can also directly navigate to the Manage External Requirements app (Figure 20.7) to view details of the selected delayed items and check different solutions by selecting an item in Figure 20.5 and clicking on **Manage item** at the bottom-right side of the screen.

Figure 20.7 is similar to the stock/requirements list (Transaction MD04) but offers more features, including the ability to run material requirements planning (MRP) interactively (see **Start MRP Run** at the bottom-right side of the screen). The **MATERIAL INFORMATION** tab contains the detailed material planning settings of a material

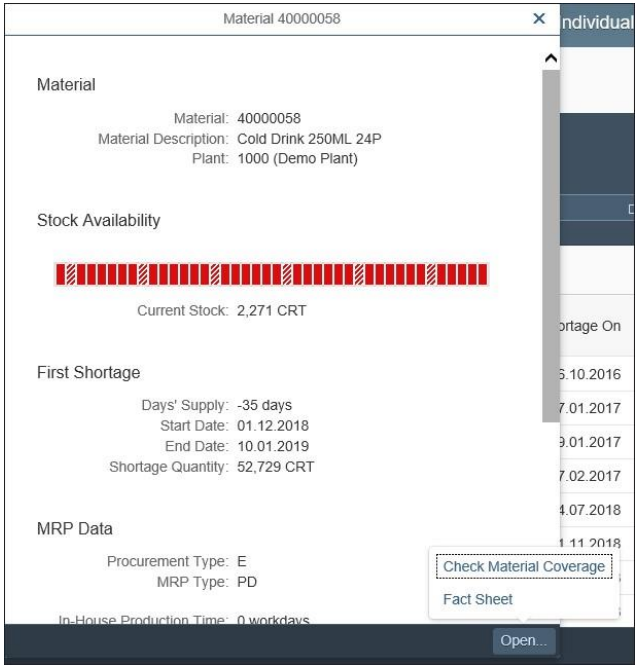


Figure 20.6 Details of an Individual Material Coverage

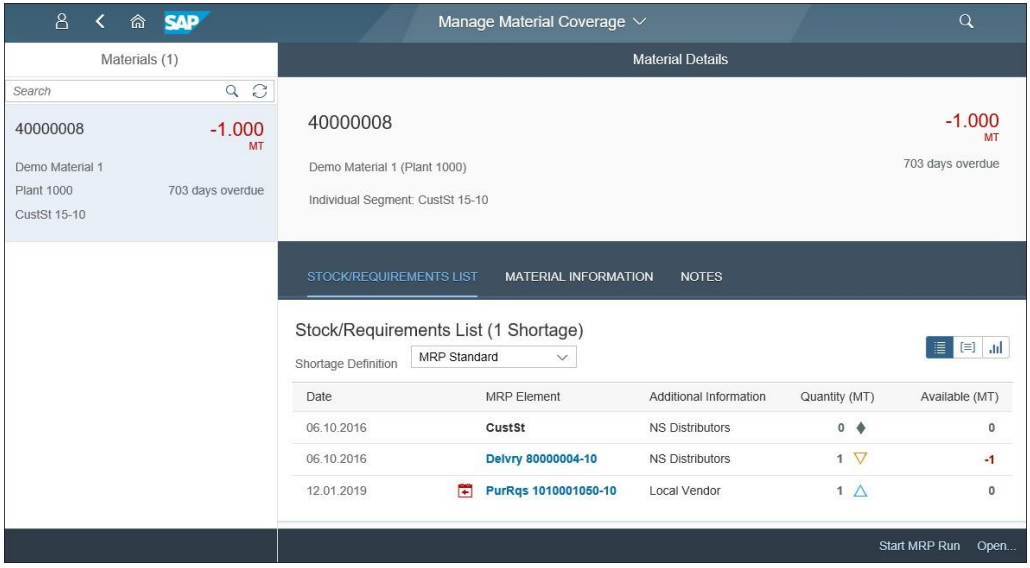


Figure 20.7 Manage External Requirements

20.2.3 Monitor Internal Requirements

With the Monitor Internal Requirements app, it's possible to ensure that components are available in the right quantity and in time so that internal requirements originating from production orders, process orders, maintenance orders, and network orders can be fulfilled. To determine which receipts and requirements are included in the coverage calculation, a shortage definition is available and displayed in the app. The app provides all the necessary information to react quickly to critical situations. From this app, you can directly navigate to the Manage Internal Requirements app to view details of the selected materials and check different solutions for the shortages Click on material **1000052** in Figure 20.8 to see the screen shown in Figure 20.9.

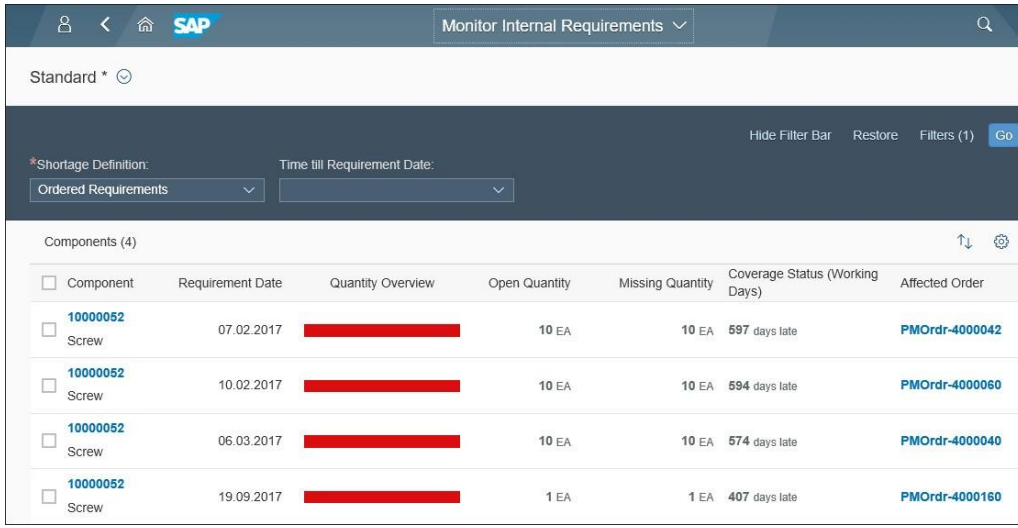


Figure 20.8 Monitor Internal Requirements App

Figure 20.9 has the look and feel of the stock/requirements list (Transaction MD04). Notice that at the bottom-right side of the screen, you can trigger the Start MRP Run app (not shown) that will then plan the material again.

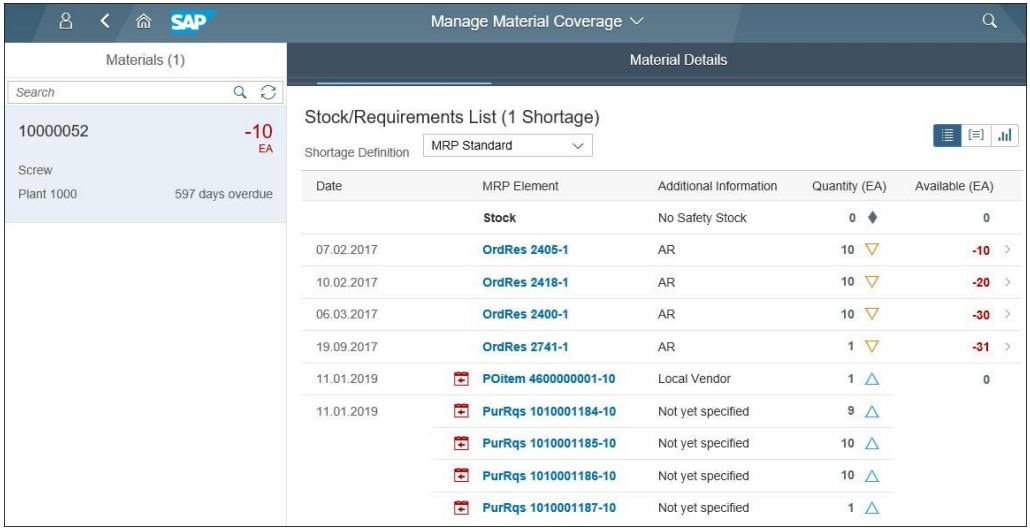


Figure 20.9 Manage Material Coverage App: Detailed Screen

20.2.4 Manage Production or Process Orders

With the Manage Production or Process Orders app, it's possible to manage those production orders or process orders that have issues based on the settings made in the Monitor Production Orders or Process Orders app. You can view details regarding delayed materials and missing components, as well as the status of operations and milestones. This app provides all the necessary information to react quickly to critical situations and avoid delays in production. The **Status** column in Figure 20.10 shows three important pieces of information—material shortage, scheduling delay, and material delay—and is denoted by respective icons turning red. The **Missing Components** column shows, for example, the number of missing components required to produce a product.

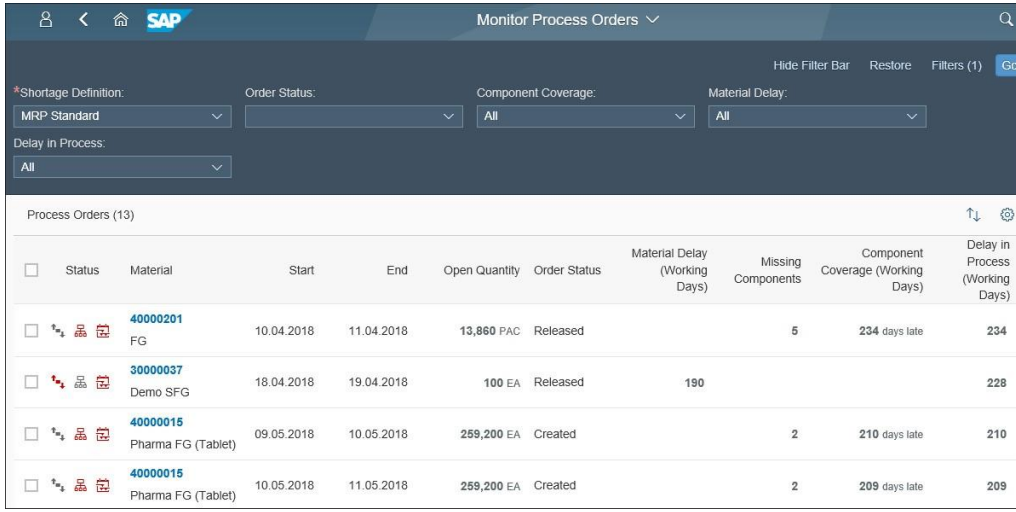


Figure 20.10 Monitor Process Orders App

20.2.5 MRP Master Data Issues

The MRP Master Data Issues app provides details of the materials in a specific plant for which an issue occurred in the last MRP run. Both types of information display are possible, that is, materials for which messages were created in the MRP run or those that may not have been planned at all. Information on the responsible MRP controller and the date and time that the last planning run was carried out is also displayed. After addressing the issues faced during materials planning, materials can be planned correctly in future planning runs. Figure 20.11 shows that the detailed view of the issue faced with planning the **ZF-10A** material. The associated **Message** that **No valid production version found; BOM explosion not possible** needs to be addressed before the system can plan this material.

Figure 20.11 Display MRP Master Data Issues App

20.2.6 Scrap Reason

The Scrap Reason app alerts users based on key performance indicators (KPIs) and enables a step-by-step data analysis from different perspectives to identify the root causes for scrap in the production process. The report shows information on the distribution of actual scrap recorded in production confirmations in the dimensions of time, work center, material, plant, and reason for variance. As a production planner, analyzing the confirmed scrap and rework makes it possible to work on the reasons or root causes of the greatest loss of production will help prevent problems in the future (see Figure 20.12).

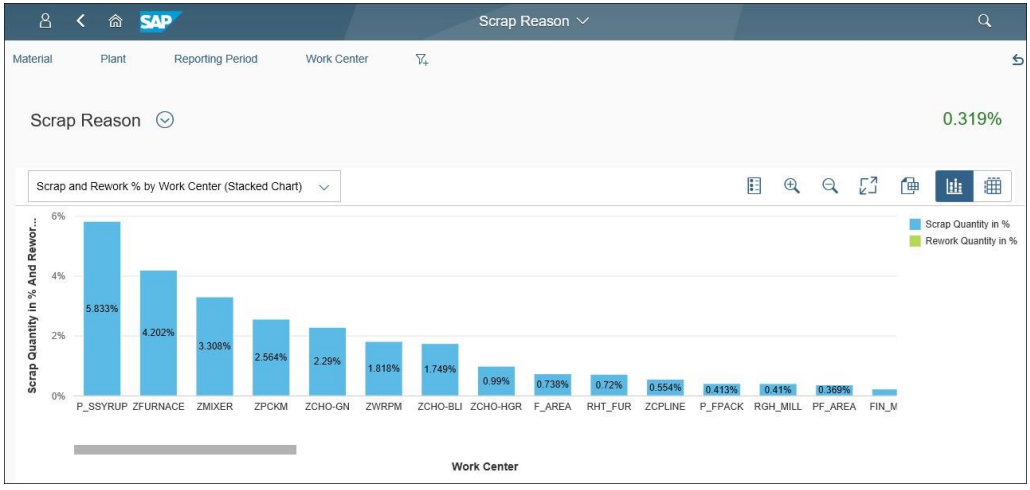


Figure 20.12 Scrap Reason App

20.2.7 Reprocess Failed Material Movements

The Reprocess Failed Material Movements app enables the viewing of and also processing of unsuccessful materials movements and also provides the reason these goods movement failed. From this app, it's possible to navigate to the root cause of the problem, such as missing storage location or incorrect posting period, and then correct the problem. To correct an issue of failed material movement, select a material, and choose **Reprocess**.

Figure 20.13 shows the SAP Fiori version of the Transaction COGI (Reprocess Failed Material Movements) screen that was covered in Chapter 6, Section 6.9.1. Here it shows that four goods movements failed due to the current posting period not being open for posting.

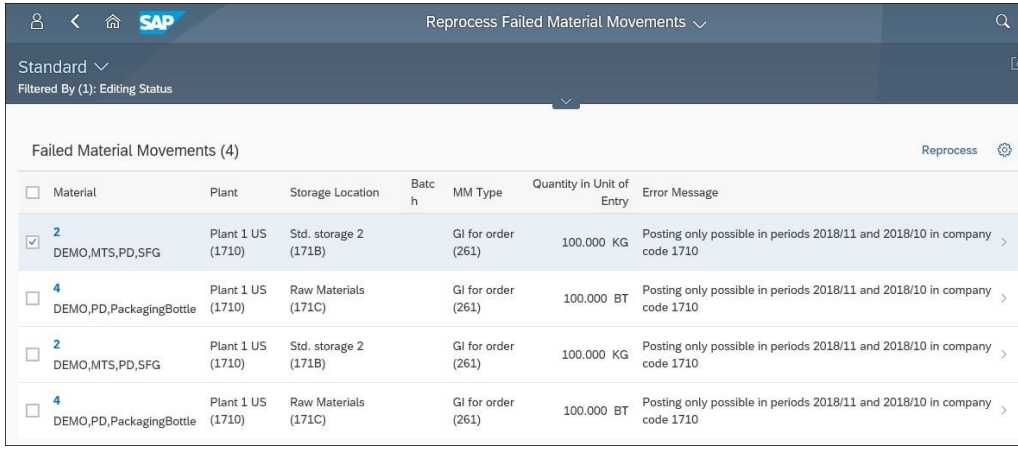


Figure 20.13 Reprocess Failed Material Movements App

20.2.8 Capacity Planning

With the Capacity Planning app, it's possible to get an overview of the capacities of work centers and the loads on work centers. The app offers an ability to detect overload situations across select evaluation horizons based on bucket (or grouping) types, such as days or weeks. For a work center, you balance several factors to ensure that you're optimally utilizing its capacity so that there are no overloads across your evaluation horizon, as well as no backlog in terms of orders or operations. With the information provided in the app, you can make informed decisions to achieve this balance.

Figure 20.14 shows the SAP Fiori version of the Transaction CM05 (Capacity Overload Situation) screen covered in Chapter 15, Section 15.2.2.

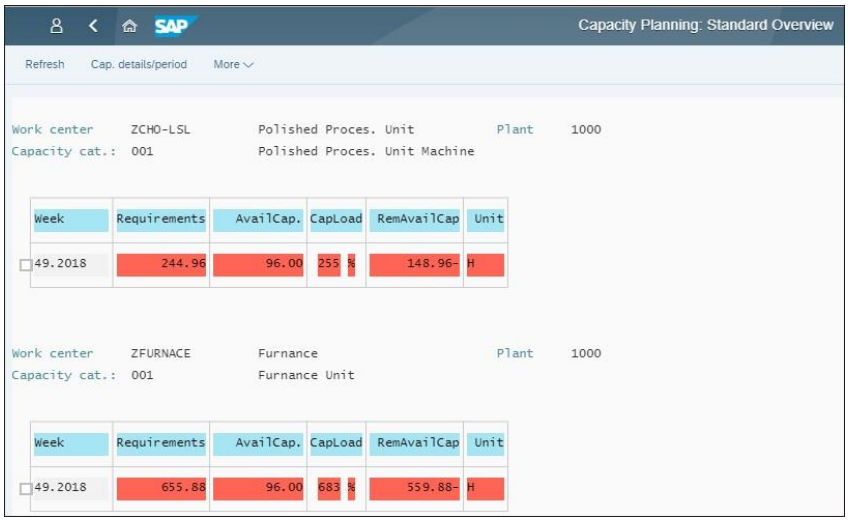


Figure 20.14 Capacity Planning App

20.2.9 Material Documents Overview

Figure 20.15 shows the Material Documents Overview app, which has a similar look and feel to the SAP GUI Transaction MB51. The top half of the figure offers several filters that can be used to display only the required information as shown in the lower half of the screen.

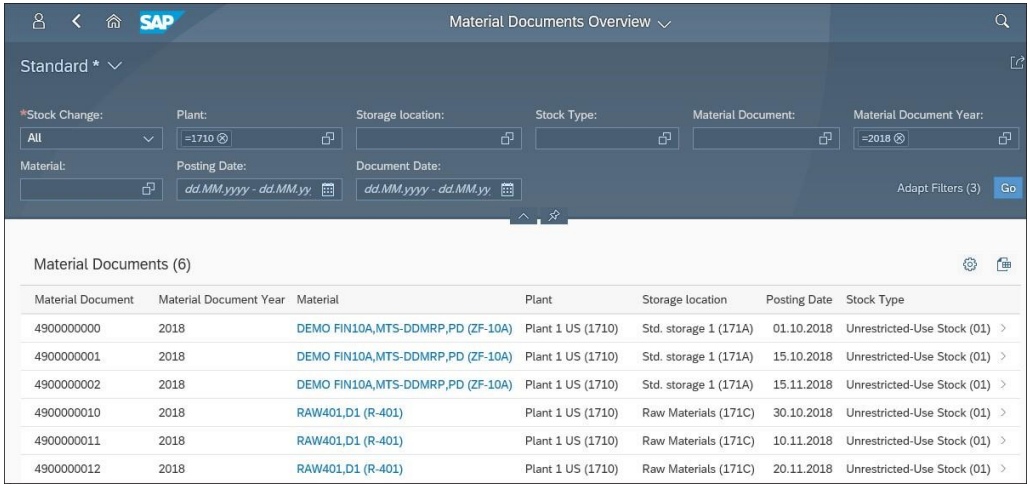


Figure 20.15 Material Documents Overview App

20.2.10 Process Order Confirmation

The Process Order Confirmation app enables process order confirmation or recording time tickets of a process order and has all the features and functions of Transaction COR6N, including the option to display the actual process order's confirmation data (via the **Actual Data** button) as well as an option to navigate to the **Goods Movement** screen (if the backflush functionality is active). Figure 20.16 shows the SAP Fiori version of the Transaction COR6N (Process Order Confirmation).

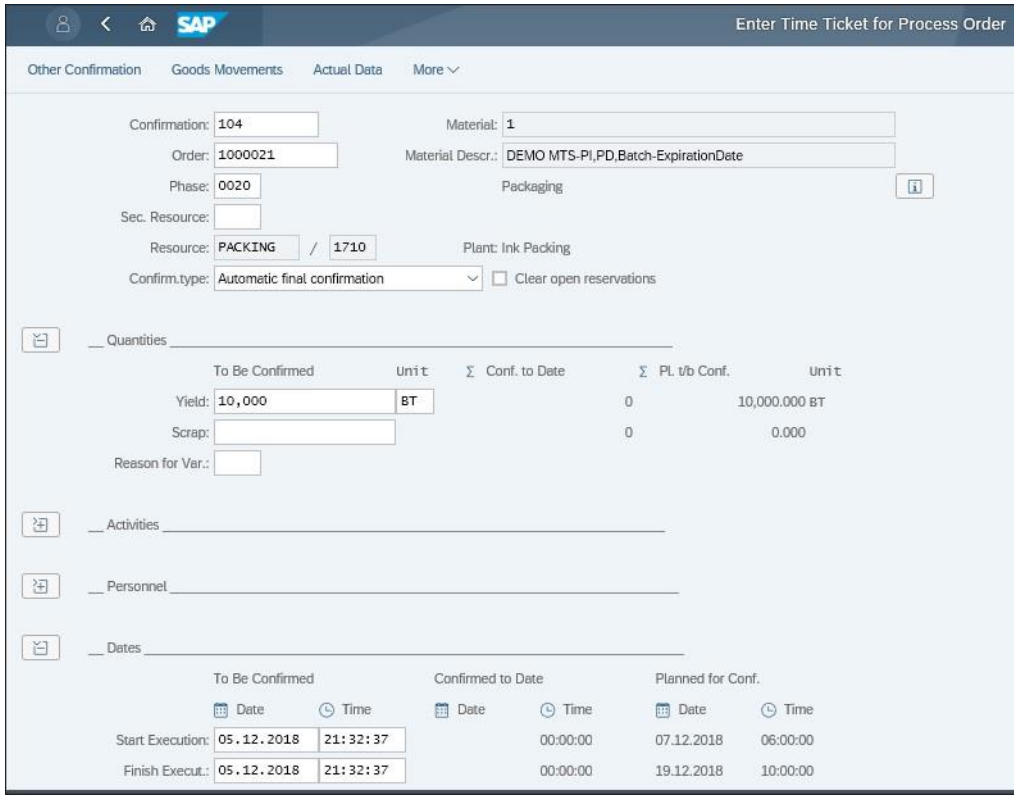


Figure 20.16 Process Order Confirmation App

20.2.11 Manage Production Version

A production version is the link between the BOM of a product and its routing, master recipe, or rate routing. It determines which BOM relates to the relevant routing or master recipe to produce a material or plan a material. There may be different production versions based on the lot sizes and validity dates. With the Manage Production Version app, you can

create, edit, copy, and delete various production versions. Figure 20.17 shows the SAP Fiori version of the Transaction C223 (Manage Production Version) screen covered in Chapter 6, Section 6.2.5.

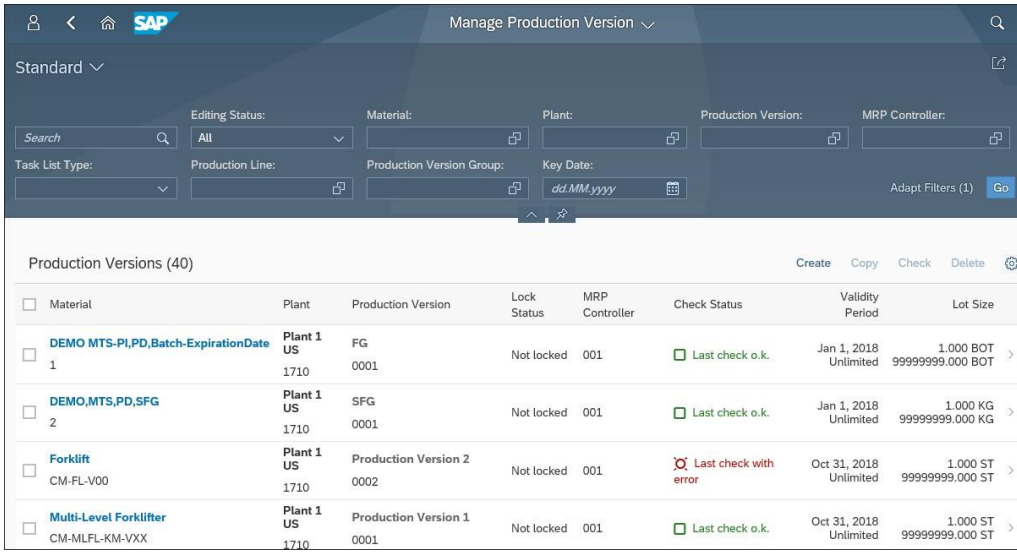


Figure 20.17 Manage Production Version App

20.2.12 MRP Live

The MRP Live app enables you to create, run, and schedule a job for executing MRP runs. To automate the planning process, the MRP run is carried out on a regular basis. Using this app to create a job that performs this task reduces the materials and production planner's workload by running this task in the background. During the MRP run, the system checks whether current material demand can be covered by current inventory and expected material receipts. In regenerative planning, the system plans all materials irrespective of whether they have been changed since the last MRP run. In net change planning, the system only plans materials that have changed since the last planning run. If current demand isn't covered, the system creates purchase requisitions. Figure 20.18 shows the SAP Fiori version of the Transaction MD01N (MRP Live) screen that we covered in Chapter 13, Section 13.1.

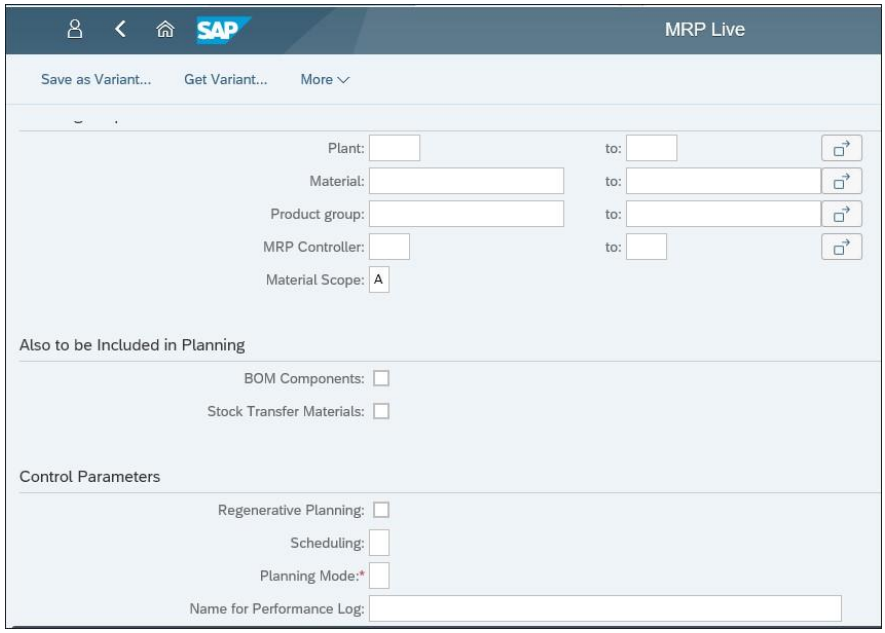


Figure 20.18 MRP Live App

20.3 Summary

In this chapter, you've learned how to leverage some of the next-generation SAP S/4HANA SAP Fiori apps for PP. The information covered in this chapter can certainly help you use the same reporting tools and features in other logistics and supply chain components of your SAP system.

As you've seen, PP in the SAP S/4HANA system is quite comprehensive and offers indepth and practical solutions to a large number of business processes and scenarios for a diverse range of industries. Not only that, it offers options that enable you to implement and integrate PP in all the important business processes. However, the actual return on investment for the SAP system implementation can be ensured only when you strive to understand the integration of various SAP system components with each other. To achieve flawless integration during an SAP system implementation, you need to maintain extensive collaboration and intense coordination among the various stakeholders of the company. In addition, those of you working in more supply chain management roles have seen how the PP function is vital to many processes in the logistics and supply chain.

The Author

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Jawad is also a technical advisor to SAPexperts, an ASUG speaker, and a contributor to SearchSAP, where his “Ask the Expert” column shares real-life lessons and best practices gleaned from SAP implementations, discusses ways to avoid common project pitfalls, and features various SAP products that solve key business issues.

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