



Integrated Business Processes with SAP ERP
Script 10: Enterprise Asset and Service
Management in SAP ERP

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1 Enterprise Asset and Service Management in SAP ERP

This teaching unit aims at giving you an understanding of enterprise asset management in the SAP ERP system.

Educational objectives in this unit:

After this teaching unit, you will be able to:

- List the organizational levels used in Enterprise Asset Management and Customer Service
- Define the various organizational units in a Plant and Cross-plant Maintenance system and in Customer Service
- Define maintenance work centers and their role and functions in Enterprise Asset Management and Customer Service
- Define functional locations
- Identify functional locations by using the structure indicator
- Define equipment
- Identify the application of bills of material in Enterprise Asset Management
- Identify and perform the phases of the Corrective Maintenance process
- Identify the integration points with other SAP ERP modules
- Understand the tools involved in analyzing maintenance history
- Process reports by using the Plant Maintenance Information System
- Identify and perform the phases of the Customer Service Order business process
- Identify the integration points with other SAP ERP modules

Scenario for the Case Study

In the practical application section of this unit, you will first focus on the master data in plant maintenance (SAP PM – Plant Maintenance). Subsequently, you will carry out an entire maintenance process from the maintenance request to the conclusion of the maintenance order.

You will create a standard report and a standard analysis in the reporting and analysis tools section.

To finalize the case study, you will process a service order in Customer Service Management (SAP CS – Customer Service).

The following figure visualizes the entire process that you will carry out independently on the SAP ERP system. You will focus on the functional areas SAP PM and SAP CS. Both functional areas are part of the SAP module SAP logistics (SAP LO).

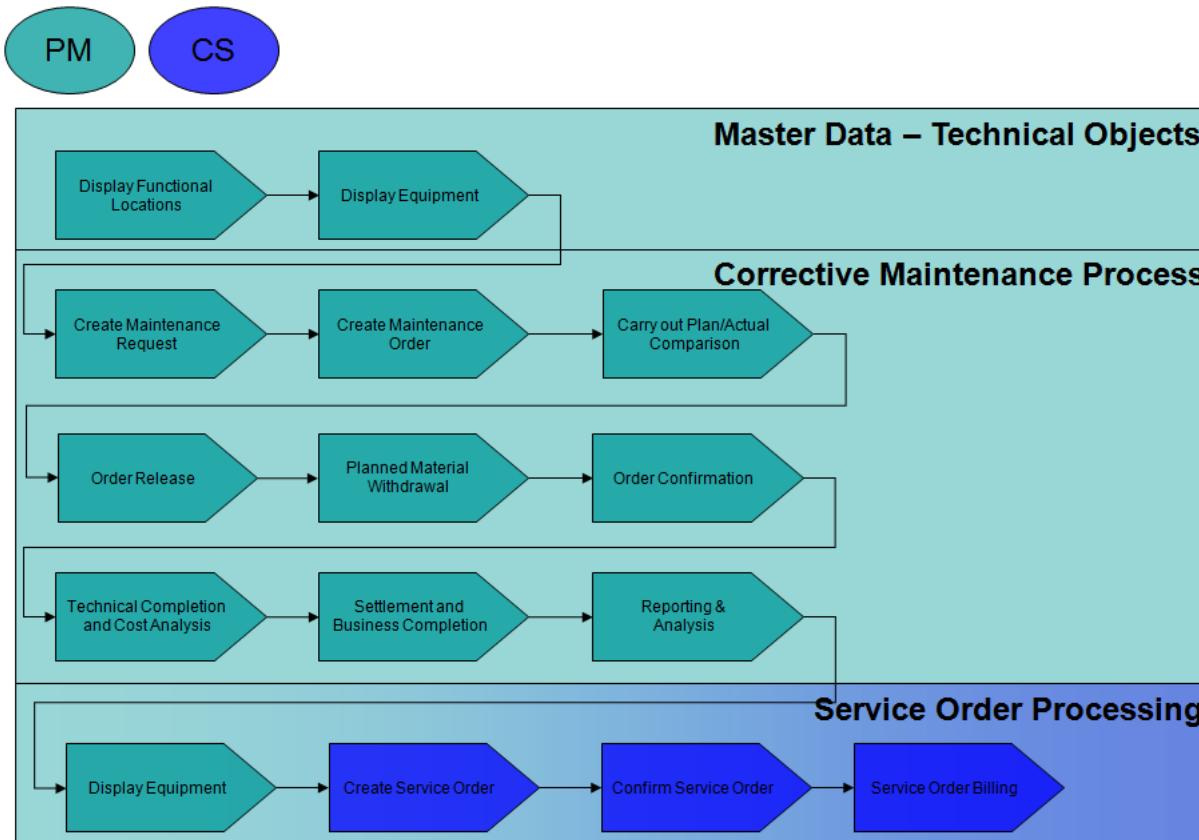


Figure 1: Process Overview: Enterprise Asset Management

2 Overview of Enterprise Asset and Service Management

This section gives you an overview of the organizational levels, structures and master data used in Enterprise Asset Management and Customer Service Management of the SAP ERP system.

2.1 Theory: Organizational Levels in SAP PM and SAP CS



Theory

The following organizational levels are primarily used in Enterprise Asset Management but are also relevant to Customer Service Management. These two SAP components are closely linked to each other.

The organizational configuration in Enterprise Asset Management is structured as follows:

- The **client** is the highest organizational level of all organizational units. It corresponds, for example, to a group with several sub-companies. Within a client, the system always accesses the same database. The subsidiaries with their own financial statements and balance sheets are defined as company codes. Within Logistics, the plant is one of the most important organizational units. It usually represents a production unit of a company.
- **Company codes** are independent accounting units. Subsidiaries of a group can, for example, be represented by using company codes.
- The most important organizational unit in logistics is a **plant**. It usually represents a production facility within a company.
 - o The plant in which the *operational systems* (technical objects) of a company are *installed* is referred to as **maintenance plant**.
 - o If, furthermore, maintenance tasks are *planned* and *prepared* in this maintenance plant, then this maintenance plant is simultaneously a **maintenance planning plant** (in short: planning plant). These tasks can relate to technical objects in your plant or in other plants. Maintenance planning plants are standard plants that are indicated as maintenance planning plants in Customizing. Other maintenance plants that do not plan their maintenance tasks are assigned to a maintenance planning plant. The maintenance planning plant then has the planning responsibility for a maintenance order and coordinates the assigned maintenance plants.
 - o A maintenance plant can be divided in **locations**, which structure the plant according to location-based criteria such as building, site or coordinates. A maintenance plant can be structured into individual plant sections according to the responsibilities for production. The employee in charge for a particular plant section is the contact person responsible for production and maintenance (e.g., plant engineer).

- The units of capacity for different tasks in plant maintenance are managed as **maintenance work centers**. Maintenance work centers are assigned to the respective maintenance plants as workshops.
- The **maintenance planning plant** is the organizational unit in charge of planning maintenance requirements. These requirements can come either from your own plant or from another maintenance plant, which is assigned to your maintenance planning plant. The employees in charge of planning within a maintenance planning plant are defined by using **maintenance planner groups**.

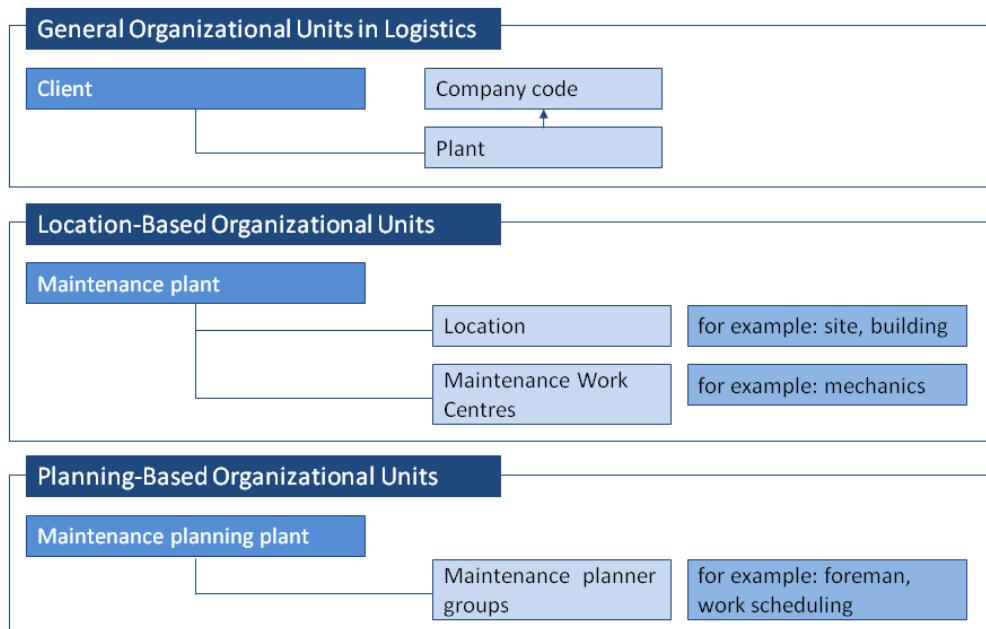


Figure 2: Organizational Levels in Enterprise Asset Management

2.1.1 Cross-Plant Maintenance

In **plant-specific maintenance**, the planning plant equals the maintenance plant. In general, the maintenance requirements are planned in the same plant where they occur. Correspondingly, maintenance orders are carried out by workshops of the same plant and spare parts are stored in the same plant (e.g., plant 1000).

In **cross-plant planning**, several maintenance plants are assigned to a maintenance planning plant.

Example: A maintenance requirement occurs in a plant (e.g., plant 1200), for instance, a technical system needs to be maintained. Thus, plant 1200 is the maintenance plant. For all other functions (maintenance planning, order execution, spare parts storage), however, a different plant is responsible (e.g., plant 1300).

Moreover, the following constellations are conceivable: planning requirements of a plant (e.g., plant 1300) as well as procuring spare parts are carried out in a different plant (plant 1000). However, maintenance operations (tasks) themselves are carried out by locally available workshops.

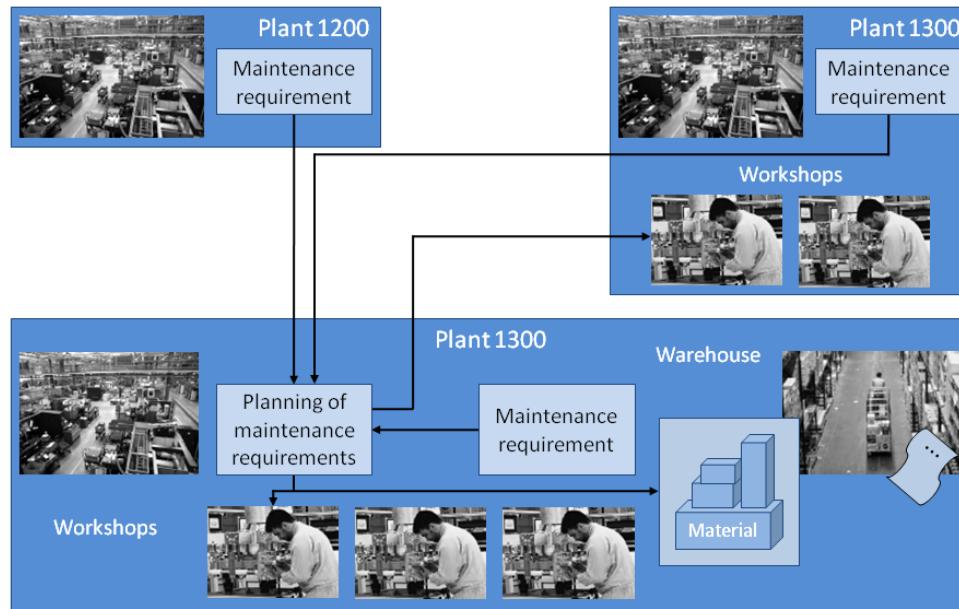


Figure 3: Cross-Plant Maintenance

2.1.2 Maintenance Work Centers

A **work center** is an organizational unit within an operational system. One of the following can, for example, be defined as a work center:

- a machine
- a group of machines
- a person
- a group of people



Figure 4: Maintenance Work Centers

In **plant maintenance**, work centers are used as one of the following:

- main work center in the master record of equipment or of a *functional location*
- main work center in a maintenance item
- main work center in the task list header

- performing work center in the operations of a task list
- main work center in the order header
- performing work center in the operations of an order

Work centers belong to the **master data** and represent the required capacity for executing an operation.

2.1.3 Organizational Structure in Service

The organizational levels for Customer Service are similar to Enterprise Asset Management. Service center and each service branch in a company can be defined as **plants** in SAP. The plant can represent a **maintenance planning plant** at the same time.

Services are planned and scheduled in a planning plant. The **planning plant** does not necessarily have to be the plant which performs the service. A service order is assigned to exactly one planning plant. However, several plants (maintenance plants) can be involved in processing one service order. This is particularly applicable to central planning (one planning plant, several operating plants).

In decentralized planning, each plant performing a service represents a planning plant as well. **Planners** (person in charge of planning) or stock planners can be combined to **planner groups**. These groups that process a service order are defined as **work center** within a plant. The plant represents the location at which these work centers are located geographically. You can assign one or multiple **employee(s)** (individuals) to each work center.

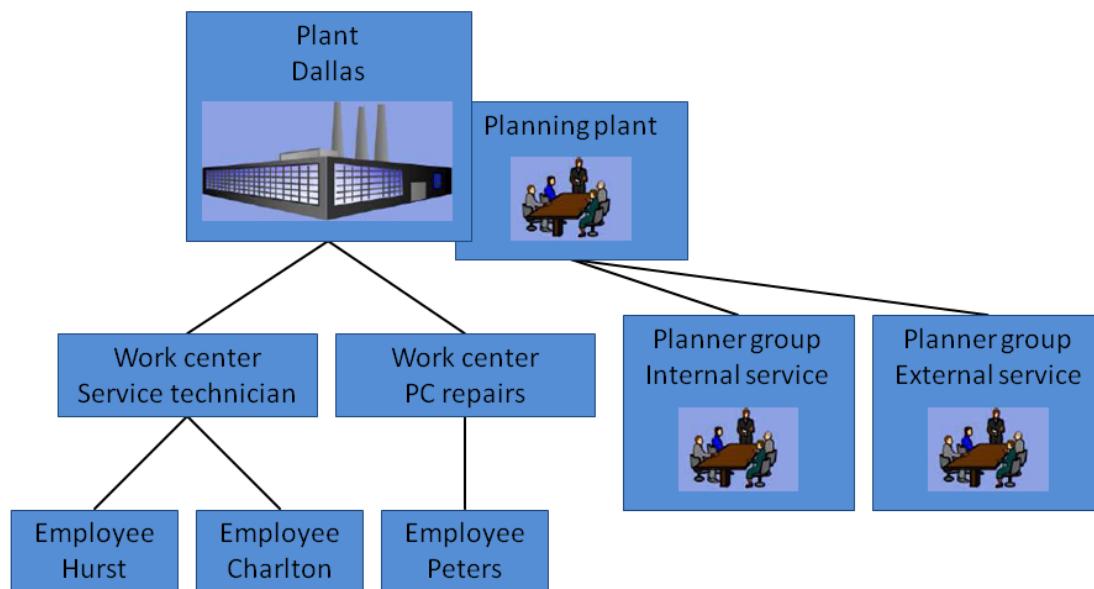


Figure 5: Organizational Structure in Service

2.2 Theory: Technical Objects



To set up maintenance properly at a company, it is necessary to properly structure the existing technical systems of the company. Therefore, technical objects are used in SAP ERP. Advantages of this structuring are the reduction of time required for managing the technical objects, the maintenance processing is simplified and faster evaluation of maintenance data is enabled.

2.2.1 Types of Technical Objects

In SAP ERP, there are four types of *technical objects*:

- **Functional locations** are elements within a *technical structure* and represent areas of a system in which objects can be installed. *Technical structures* can be subdivided according to functional, process-oriented or spatial criteria.
- **Pieces of equipment** are individual objects that are supposed to be regarded as autonomous units.
- **Serial numbers** are assigned to materials to differentiate them from other items. They enable the pieces of material to be regarded as individual items. Inventory management can be carried out for serial numbers.
- **Bills of materials** can be used to structure *functional locations* and pieces of equipment in more detail. They may be referred to as assemblies.

Functional locations, pieces of equipment and serial numbers can be used as reference objects for service notifications and service orders. Assemblies can only be used in relation with a piece of equipment or a functional location.

2.2.2 Functional Location

Functional locations are hierarchically ordered structures that represent a piece of equipment, a building or a part of them.

Functional locations can be structured according to spatial (e.g., building 1, building 2), technical (e.g., press, press rack, press hydraulics) or functional, i.e., process-oriented criteria (e.g., polymerization, condensation). *Functional locations* are created to subdivide a technical system or a building into units relevant for plant maintenance.

In doing so, the functional location very often takes on the function of the location where individual objects (engines, gearboxes, pumps, etc.) can be installed. In such cases, it is possible to view removal and installation locations both from the point of view of the installation **location** and also from the point of view of the individual installation or removal object.

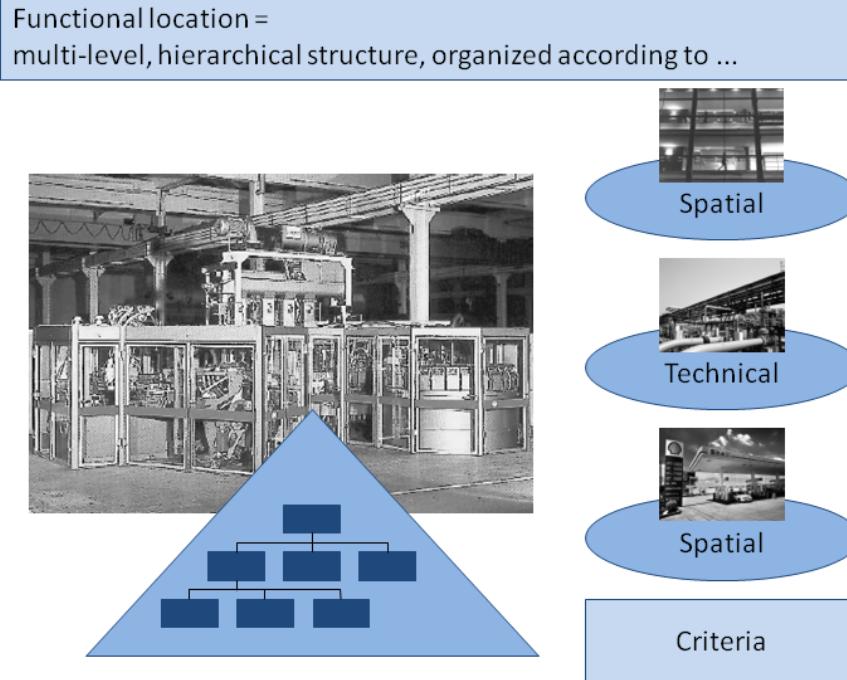


Figure 6: Functional Location

2.2.2.1 Criteria for the Creation of Functional Locations

Functional locations are used to structure *technical systems*. *Functional locations* should be created if:

- the structure of the technical systems in a company is supposed to be represented according to functional criteria
- maintenance operations are supposed to be carried out for particular areas of technical systems and this work should or must be recorded
- technical data are supposed to be stored for particular parts of technical systems and these data must be evaluated over a longer period of time
- maintenance costs are supposed to be monitored for particular parts of technical systems
- you want to analyze what effects the usage conditions have on the likelihood of damage to the installed equipment.

For what purpose is a functional location created?

- Execution of maintenance tasks
- Recording of maintenance tasks
- Data collection over long periods of time
- Cost monitoring by area
- What affect do the usage conditions have on the likelihood of damage to the installed aggregates

Figure 7: Criteria for the Creation of Functional Locations

2.2.2.2 Master Record of a Functional Location

The master record of a *functional location* consists of the following main views:

- **General:** classification, object type, reference data, manufacturer, etc.
- **Location:** location data, address
- **Organization:** account assignment (e.g., company code, cost center) and responsibilities (e.g., maintenance planning plant)
- **Structure:** e.g., structure indicator, higher-level *functional location*, equipment

Additional data or links (see figure) in the master record of the functional location can be activated as tabs or called up with pushbuttons.

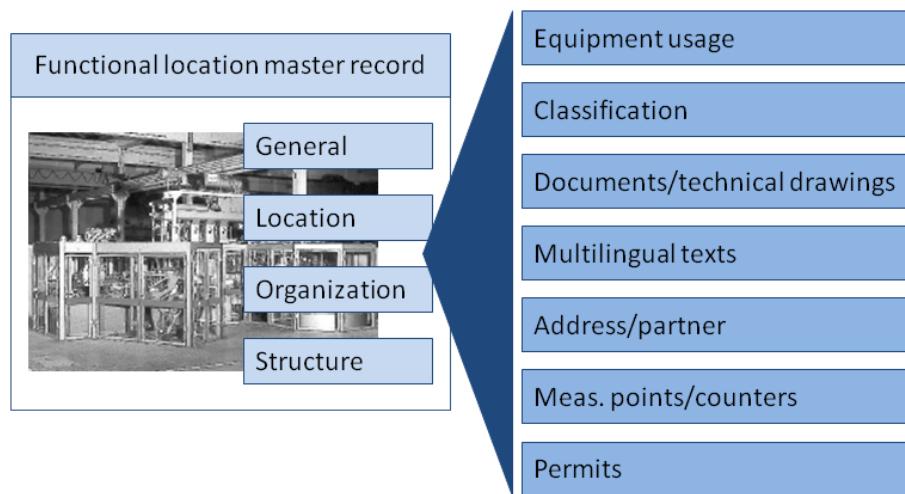


Figure 8: Master Record of a Functional Location

2.2.2.3 Structure Indicator

To uniquely identify a *functional location*, the structure indicator is created. The structure indicator is comprised of two entry fields: coding template and hierarchy levels.

Using the coding template, you can control which types of characters can be used for identification (letters and/or numbers) and how these characters can be combined or splitted. Using hierarchy levels, you can determine which levels ends at which character and how many levels the structure may contain.

The identification of a *functional location* can contain up to 40 characters, which is the maximum length of the coding template.

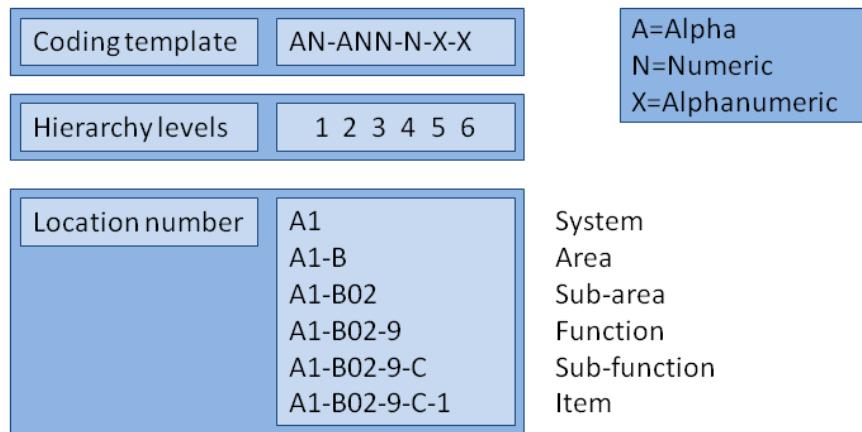


Figure 9: Structure Indicator

The following figure displays the hierarchical structure of a functional location with its components. The hierarchy of this structure is also contained in the structure indicator itself. That is, you can tell at what position a technical object is installed in the functional location by its structure indicator.

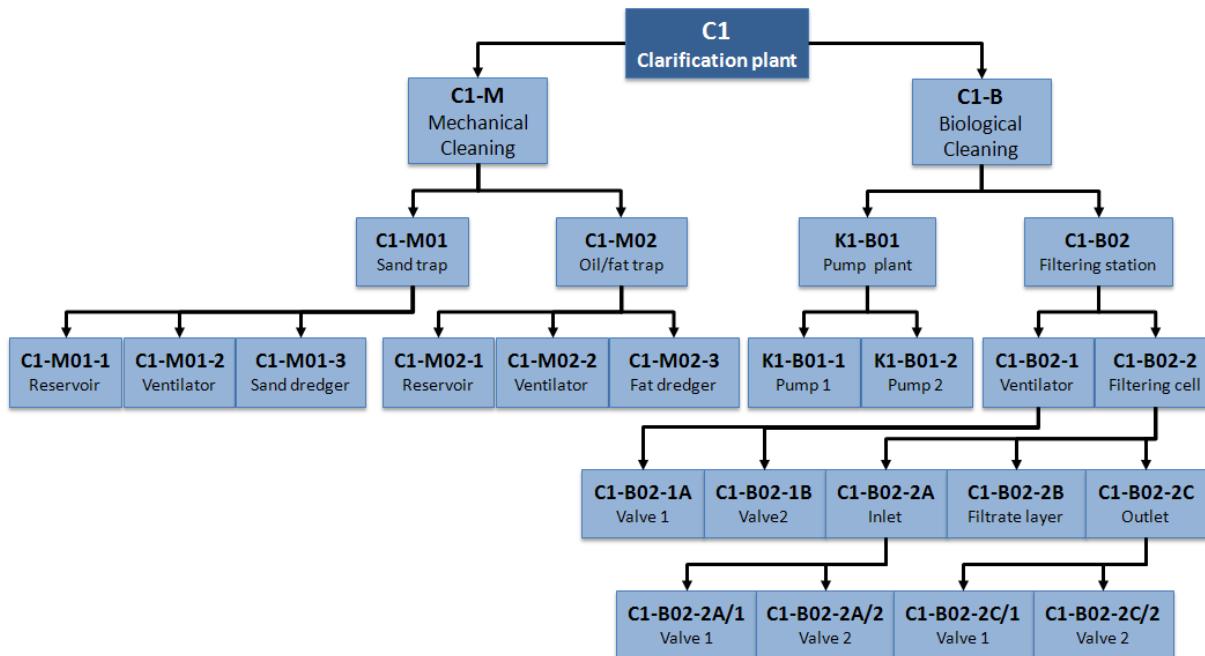


Figure 10: Example of Functional Location Structure

2.2.3 Equipment

A piece of equipment is an individual physical object that is to be maintained as an autonomous unit. A piece of equipment usually represents an individual object (e.g., a pump, an engine, a vehicle) for which maintenance operations are carried out and recorded.

Equipment can be installed at *functional locations*. A piece of equipment can be linked with a material (if the object features inventory management in the sense of materials management).

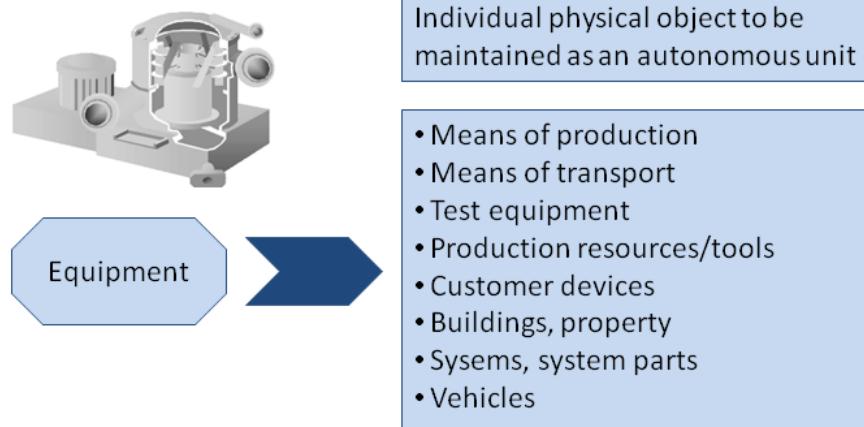


Figure 11: Equipment

2.2.3.1 Criteria for the Equipment Master Record

An equipment master record contains all data to describe a piece of equipment. An equipment master record should be created for a *technical object* only if:

- individual data for the object are supposed to be managed
- breakdown, prepared or preventive maintenance tasks are supposed to be carried out and recorded for the object
- technical data for the object are supposed to be collected and analyzed over a longer period of time
- the costs of maintenance task for this object are supposed to be monitored
- usage time at *functional locations* is supposed to be recorded for this object

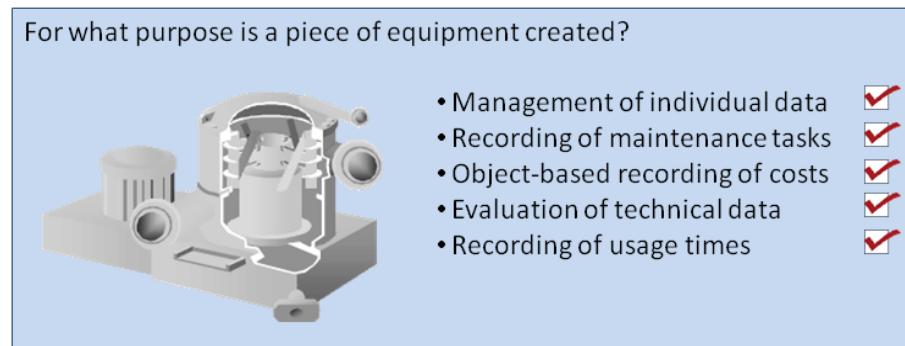


Figure 12: Criteria for the Equipment Master Record

2.2.3.2 Equipment Master Record

In the standard version, the equipment master record consists of the following main views:

- **General:** class, object type, reference data, manufacturer, etc.
- **Location:** location data, address
- **Organization:** account assignment (e.g., company code, cost center) and responsibilities (e.g., maintenance planning plant)
- **Structure:** e.g., higher-level *functional location*, equipment

Additional data or links (see figure) in the equipment master record can be activated by using tabs or called up by using pushbuttons.

Using time-based data, equipment can be monitored dynamically. This means that changes to the equipment can be tracked over a specific period of time. If the system is configured accordingly, a new time segment is created whenever a change is made to the master record. The time segment describes the equipment usage.

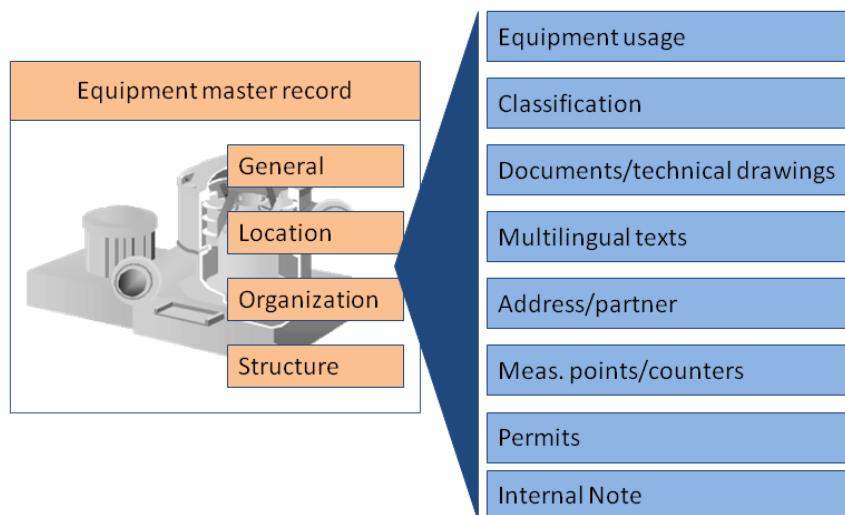


Figure 13: Equipment Master Record

2.2.4 Serial Numbers

A material master record contains all data that are required for defining and managing a material. It can be used to describe a particular asset or device category. However, it does not allow for the determination of individual items of this particular category. Therefore, serial number management is used in the SAP ERP system. Serial numbers allow for tracking individual items for a given material number.

Thus, you can perform inventory management for individual items. The combination of material number and serial number is always unique. You can assign several serial numbers to a material number. The same serial number can appear several times for different material numbers.

The serial number can be used to track and represent the company-own serial numbers or those of the manufacturer. If no serial numbers exist for a material, you can use a number of your choice as serial number.

Since SAP R/3 Enterprise, it is possible to use the material master record to ensure that serial numbers and equipment numbers are managed synchronously when creating master records for serial numbers.



- The serial number is a number that is assigned to an individual material item in addition to its material number
- The combination of material number and serial number is always unique

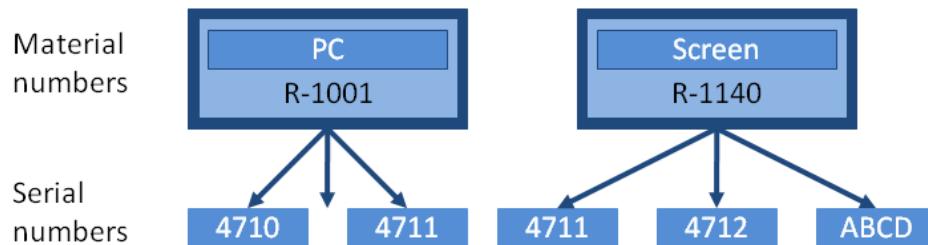


Figure 14: Serial Number

Equipment and Serial Numbers

An equipment master record is created for each serial number. Depending on the serial number profile either only the *serial data view* is visible or all views of the equipment master record.

Stock information such as plant, storage location, batch, special stocks or customer is displayed in the *serial data view*. You can also display the *serial number history* here. In addition, all documents to which the serial number is assigned can be found here.

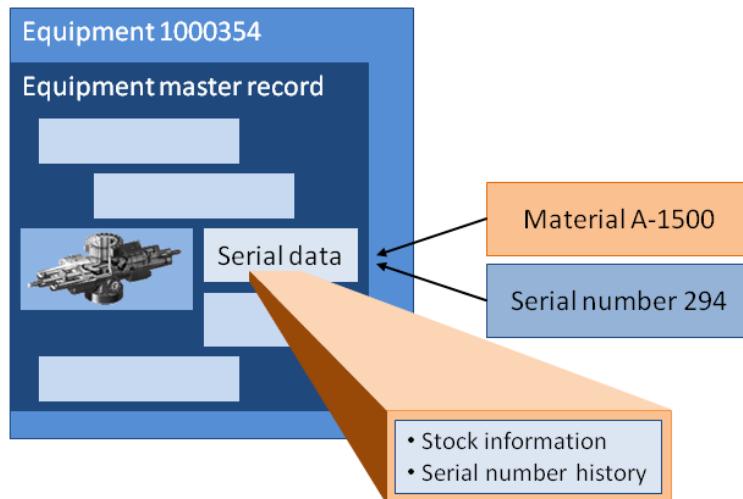


Figure 15: Equipment and Serial Numbers

2.2.5 BOMs in Plant Maintenance

A maintenance bill of material (BOM) is a complete, formally structured list of the components making up a technical object or an assembly. The list contains the object numbers of the individual components together with their quantity and unit of measure. The components can be stock or non-stock spares or assemblies, which in turn can be described by using maintenance BOMs. Using maintenance BOMs allows you to describe the structure of a technical

object, to specify exactly where maintenance tasks are performed and to assign spare parts to a technical object.

The maintenance bill of materials contains, in contrast to a common BOM, only maintenance-relevant items. Moreover, the maintenance BOM has three important functions:

- **Structuring of the object:** The structure of an object from a maintenance point of view should be displayed as clearly as possible.
- **Spare parts planning in the order:** If a *technical object* features a BOM, the BOM can be used for planning spare parts during the execution of a planning or maintenance order.
- **Spare parts planning in the task list:** Spare parts can be planned in the task list according to the bill of materials.

There are three categories of maintenance BOMs in the SAP system:

- Material BOM
- Equipment BOM
- Functional location BOM

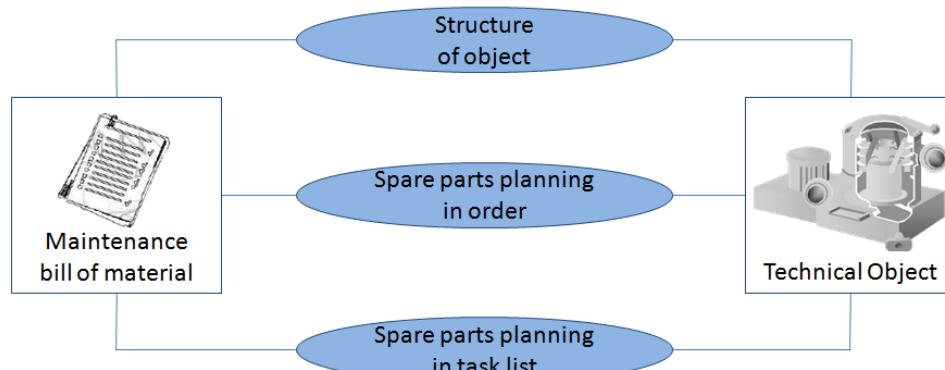


Figure 16: BOMs in Plant Maintenance

Example of a Material BOM

Material BOMs are used in maintenance if several similarly constructed objects are supposed to be maintained. Thus, you do not have to create an own BOM for each *technical object*. It is sufficient to create one single BOM, which is then assigned to the *technical objects*. Accordingly, you avoid redundancies in BOM usage.

A material BOM is a BOM for a particular material that is at first created independently of a *technical object*. To do this, complete the following steps:

- creation of material
- creation of material BOM for the material

The BOM can then be assigned to one or to several *technical objects* (equipment or *functional location*). The assignment(s) can be carried out via the **structure view** in the master record of the corresponding *technical object*. The number of the corresponding material is entered in the **construction type** field (see figure).

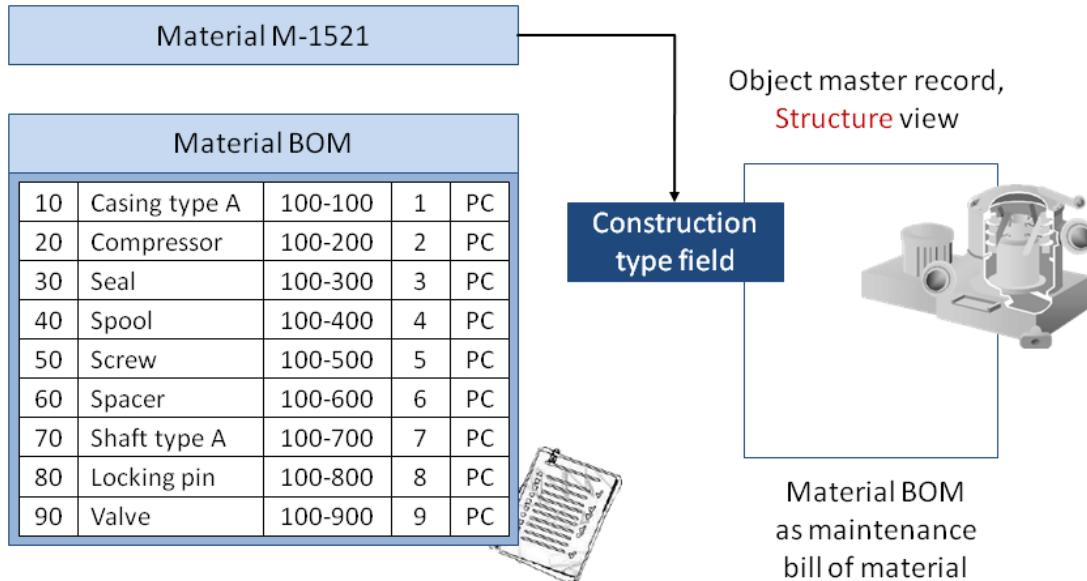


Figure 17: Example of a Material BOM

2.3 Practice: Technical Objects



After you improved the bicycle division of IDES AG, the management presented your new tasks. You were promoted within the company and you are now in charge of Enterprise Asset Management. Your tasks include working in managing technical systems and in the service department of the IDES AG. The IDES AG operates, among others, clarification treatment plants for water preparation. Your first task is to take care of the company's division clarification treatment plants. Therefore, focus on the structures of these *technical objects*.

The *functional location* is used to represent complex technical systems of a company such as departments for welding engine- and vehicle parts. The representation is based on a hierarchical collection of *technical objects*, which are defined by structure indicators. The company maintains an equipment master record to uphold movement data for the individual business objects such as pumps, engines, welding machines. You are part of the project team and you need to be familiar with the structure and the functional of the *technical objects* in maintenance.

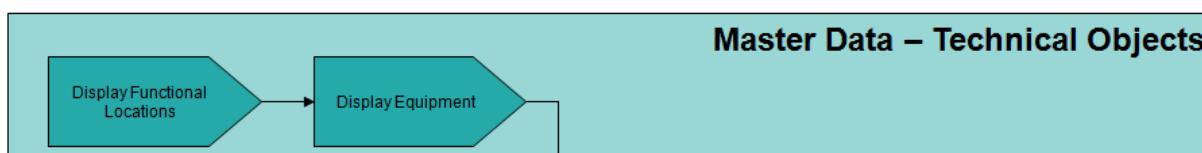


Figure 18: Process Overview: Technical Objects

2.3.1 Display Functional Locations

First, display the **entire structure** of the *technical objects* of IDES AG. As you might have noticed, there are list display functions in addition to the item view in the SAP system, which can be used to display multiple objects by using selection criteria.

Display a list of all *functional locations* in the SAP ERP system. Therefore, choose

Logistics → Plant Maintenance → Management of Technical Objects → Functional Location → List Editing → Display (IH06)

1. Enter **1000** as only selection criteria into the **planning plant** field.
2. Press **Execute (F8)**.
3. A list of all functional locations assigned to planning plant 1000 is displayed. The following figure shows an excerpt of the hierarchically structured list. You should recognize the alphanumeric names of the hierarchical levels from the theoretical chapter. These are the **structure indicators**.

For example, you can see that **system 00** is a Clarification plant. Amongst others, it contains **area 00-B (biological cleaning)**. A **sub-area** of 00-B is the pump plant **00-B01** with the **function** pump set 1 (**00-B01-1**). In turn, the pump set contains the **sub-function** **00-B01-1A** (valve 1). The last hierarchical level of **items** is not visible in this figure.

Hierarchical order is displayed in the structure indicator. For instance 00 is the top level functional location (Clarification plant), 00-B is the subsequent lower level (Biological cleaning)...

Hierarchical order
of functional
locations in
planning plant 1000

Display Functional Location: Functional Location List		
S Functional location	Description of functional location	PIPI
00	Clarification plant	1000
00-B	Biological cleaning	1000
00-B01	Pump station	1000
00-B01-1	Pump set 1	1000
00-B01-1A	Valve 1	1000
00-B01-1B	Valve 2	1000
00-B01-2	Pump set 2	1000
00-B01-2A	Valve 1	1000
00-B01-2B	Valve 2	1000
00-B02	Filter building	1000
00-B02-1	Compressor	1000
00-B02-1A	Valve 1	1000
00-B02-1B	Valve 2	1000
00-B02-2	Filter cell	1000
00-B02-2A	Inlet	1000
00-B02-2A/1	Valve 1	1000
00-B02-2A/2	Valve 2	1000

00-B01-2A and
00-B01-2B are on
the same level

Figure 19: List of Functional Locations: SAP-System-Screenshot

4. Since you are especially interested in **clarification plant 00**, double-click on the row with the entry 00.
5. On the **display functional location: master data** screen, you can now see the master data of functional location 00.
6. **Functional location 00** is assigned to plant 1000 (Hamburg). In the **organization** tab, you can access additional organizational assignments of the clarification plant.
7. Answer the following questions and list the answers on your data sheet:

To which **company code** of IDES AG is the clarification plant assigned? _____

Which **cost center** is responsible for the clarification plant? _____

Which is the **work center** in charge? _____

8. To display the structure of the clarification plant, click the **structure lists symbol** (). Drill down the list with the path **biological cleaning → station** until you can see the piece of equipment **TEY-00**.

What is the construction type of **TEY-00**? List the answer on your data sheet.

Construction type for TEY-00: _____

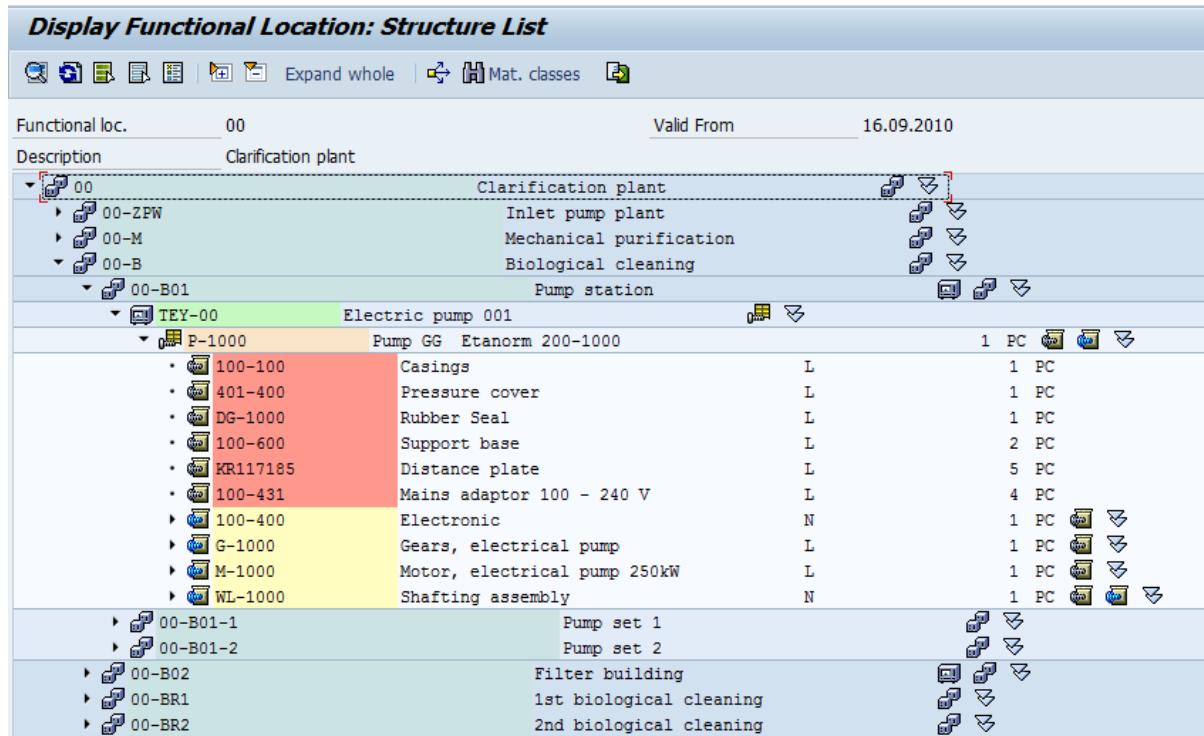


Figure 20: Structure List Functional Location: SAP-System-Screenshot

9. On the lowest level of the **structure list**, you can, for example, see the corresponding BOM for construction type **P-1000** with the items of which the pump consists of (frame, pressure lid, etc.).
10. Next, expand the **biological cleaning** → **pump station** → **pump set** to determine which valves are installed in the clarification plant. Note the Structure indicators.

Pump set 1 → valve 1: _____

Pump set 1 → valve 2: _____

Pump set 2 → valve 1: _____

Pump set 2 → valve 2: _____

11. Leave the structure display.

2.3.2 Display Equipment

Next, display the master data for equipment **TEQ-00**. Therefore, choose

Logistics → Plant Maintenance → Management of Technical Objects → Equipment → Display (IE03)

1. Enter Equipment **TEQ-00** and choose **Enter**. Answer the following questions:

What is the description of the equipment? _____

Which is the assigned maintenance plant? _____

To which cost center is the equipment assigned? _____

What is its construction type? _____

Which functional location is assigned? _____

2. Next, click the **structure list symbol** (). Once again, the structure list is displayed, this time, focusing on equipment.

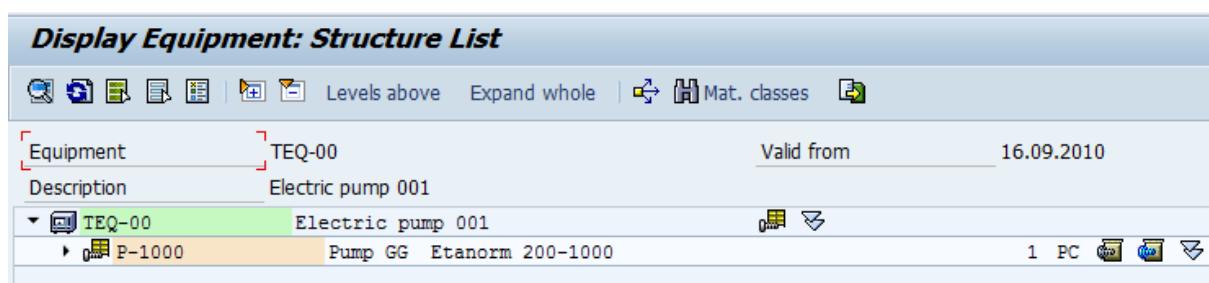


Figure 21: Structure List Equipment: SAP-System-Screenshot

3. Push the (**Levels above**) button several times to climb the structure list until you get to the structure list of the top-level *functional location*.
4. What are the structure indicator and the name of the next higher level from TEQ-00?

Structure indicator next higher level: _____

Name next higher level: _____

5. Leave the structure list and the equipment master record.

Now that you are familiar with the functional locations of the IDES group, take a look at the maintenance process. Theory is first.

2.4 Elucidation



What have we learned so far?

The major outcome of this section was supposed to be the organizational levels that are relevant for asset management and service processing in SAP ERP. Furthermore, the structures and master data involved have been introduced.

What is Maintenance?

Companies have multiple facilities that need to be maintained in the sense of repairing, upholding, maintaining, etc. SAP PM is used to map these facilities in the SAP system as technical objects and manage the works needed to be performed in order to keep these facilities up and running. Maintenance management is generally company internal. That is, a company uses SAP PM to maintain their own facilities generally.

What is Customer Service?

SAP CS is in part comparable to SAP PM. Thereby, a company can maintain, repair and provide further services to customer facilities in the same way it does in SAP PM. In this case, the customer facilities are mapped in the company's ERP system as installed base.

You use installed base management to represent and manage products at the customer site and products that are used internally. You can assign pieces of equipment, materials, serial numbers and documents that belong together as installed base components (components) of a common installed base. You can also use installed base management if you want to record for documentation purposes, which parts belong to an installed base.

However, SAP CS comprises more service processes apart from facility maintenance only. You can actually use SAP CS for any service processes there are (return management, complaint management, regular services, service agreements, etc.)

In general, however, SAP CS is only used for company external purposes.

2.4.1 Organizational Levels of SAP PM and SAP CS

Organizational levels relevant for SAP PM and SAP CS:

Client: should be clear by now;-)

Company codes: should be clear by now;-)

Plant:

The plants used in SAP PM and SAP CS are exactly the same plants as in the logistic components. For instance, plant 1000 in Hamburg can carry out maintenance work as well. Regarding the maintenance process, plants have additional characteristics:

- Generally, a company has several facilities that need maintenance, e.g., servers, factory machines, robots, buildings, etc. These assets are referred to as **technical objects** in SAP PM (and SAP CS). There are several ways to map these objects in the SAP System (we will discuss that later.). Plants in which these technical objects (*operational systems*) reside are called **maintenance plant**.
- A maintenance plant

- is structured according to particular criteria (e.g., location, building, coordinates)
- can be structured into individual plant sections according to the responsibilities for production. Thereby, the employee in charge for a particular plant section is the contact person responsible for production and maintenance (e.g., plant engineer)
- Furthermore, plants have the option to **plan** a maintenance process. That is, a plant is chosen as the responsible plant for maintenance work. If a plant can be used for planning maintenance work, it is referred to as **maintenance planning plant** (in short: planning plant).
- The employees in charge of planning within a maintenance planning plant are defined by using **maintenance planner groups**.

Work center:

A **work center** is an organizational unit within an operational system. Work centers belong to the **master data** and represent the required capacity for executing an operation.

The work centers used in SAP PM and SAP CS are exactly the same work centers as in the logistic components. For instance, work center 1420 in Hamburg can carry out maintenance work as well.

- Regarding the maintenance process, work centers have additional characteristics:
 - In plant maintenance work centers are referred to as **maintenance work centers**.
 - Maintenance work centers are assigned to the respective maintenance plants as **workshops**.
- In plant maintenance, **work centers** are used as one of the following:
 - main work center in the master record of equipment or of a functional location
 - main work center in a maintenance item
 - main work center in the task list header
 - performing work center in the operations of a task list
 - main work center in the order header
 - performing work center in the operations of an order
- **Work centers: Main functions in SAP PM and SAP CS**
 - Costing
 - Scheduling
 - Capacity planning

2.4.1.1 Cross-Plant Maintenance

When planning a maintenance process you have several options:

- **Plant-specific maintenance:**
 - planning plant = maintenance plant
 - In this scenario, a maintenance requirement occurs for a technical object. The plant in which this requirement occurs is not only the plant where this object resides, but it is also the plant that plans the maintenance order. The order is

then carried out by workshops (work centers) of the same plant. Spare parts (materials required) are also stored in the same plant.

- **Cross-plant planning:**
 - o There is a planning plant that is responsible for several maintenance plants regarding maintenance processes.
 - o In this scenario a maintenance requirement occurs for a technical object. The plant in which this requirement occurs is only the plant where this object resides. All other work processes (maintenance planning, order execution, spare parts storage) of the maintenance process are carried out in a different plant. That is, the work processes are also carried out by work centers of the planning plant.
- **Miscellaneous:**
 - o Planning and procuring spare parts are carried out in the planning plant. The maintenance operations (tasks) themselves are carried out by workshops of the maintenance plant. That is, the planning plant schedules the work for the work centers in the maintenance plant and procures/delivers materials (spare parts).

2.4.1.2 Organizational Structures in Service

Service plant:

- Service centers and service branches of a company can be defined as **plants** in SAP.
- A "service" plant can be a regular plant and a **maintenance (planning) plant** at the same time.
- **Services** are planned and scheduled in a planning plant
- A service order is assigned to exactly one planning plant.
- **Centralized planning:** The planning plant does not necessarily have to be the plant which performs the service. Several plants (maintenance plants) can be involved in processing one service order (one planning plant, several operating plants).
- **Decentralized planning:** Each plant performing a service represents a planning plant as well.

Service work center:

- **Planners** (person in charge of planning) or stock planners can be combined to **planner groups**.
- These groups that process a service order are defined as **work center** within a plant. The plant represents the location at which these work centers are located geographically.
- You can assign one or multiple **employee(s)** (individuals) to each work center.

2.4.2 Technical Objects

Generally, a company has several facilities that need maintenance, e.g., servers, factory machines, robots or buildings. On the other hand customers that have purchased any assets or products from the company can be provided with customer service. These assets are referred to as **technical objects** in SAP PM (and SAP CS). There are several ways to map these objects in the SAP System. The general term is technical objects. In SAP ERP, there are four types of **technical objects**:

- **functional locations**
- **pieces of equipment**
- **serial numbers**
- **bills of materials**

2.4.2.1 Functional Location

- Multi-level organizational unit within SAP PM that structures the maintenance objects of a company hierarchically according to functional, process-related or spatial criteria.
- A functional location represents the place at which a maintenance task is to be performed.
- Objects that can be installed at functional locations are called **pieces of equipment**.

Criteria for the Creation of Functional Locations

- Functional locations are created to subdivide a technical system or a building into units relevant for plant maintenance.
- You implement a functional location if:
 - o you want to represent systems or operational structures within your company according to functionality
 - o maintenance tasks (in the broadest sense) are to be performed for the individual areas of your system or operational structure
 - o records are to be kept of the maintenance tasks that are performed for the individual areas of your system or operational structure
 - o technical data is to be collected and evaluated over long periods of time for the individual areas of your system or operational structure
 - o the costs of maintenance tasks are to be monitored for the individual areas of your system or operational structure
 - o you want to perform analyses on the influence of usage conditions on the damage susceptibility of the pieces of equipment installed
 - o you require different views of a location structure (for example, a technical procedure view and a measurement/control technique view)

Master Record of a Functional Location

The master record of a *functional location* consists of the following views:

- General
- Location
- Organization

- Structure
- Class and Docs
- Serial Data
- Warranty and Partner
- Other

Structure Indicator

- uniquely identifies a *functional location*
- contains two entry fields:
 - o Coding template: Using the coding template, you can control which types of characters can be used for identification (letters and/or numbers) and how these characters can be combined or splitted.
 - o Hierarchy levels: Using hierarchy levels, you can determine which level ends at which character and how many levels the structure may contain.
- The identification of a *functional location* can contain up to 40 characters, which is the maximum length of the coding template.
- When creating a new functional location, you enter the structure indicator. The system checks whether a hierarchy with this structure indicator is already available and integrates it into the existing structure upon creation.

2.4.2.2 Equipment

- A piece of equipment is an individual object that is to be maintained independently. Each piece of equipment is managed independently in the system, so that you can:
 - o manage individual data from a maintenance perspective for the object
 - o perform individual maintenance tasks for the object
 - o keep a record of the maintenance tasks performed for the object
 - o collect and evaluate data over a long period of time for the object
- Pieces of equipment can be installed and dismantled at functional locations. The usage times for a piece of equipment at a functional location are documented over the course of time.

Criteria for the Equipment Master Record

- You should always create an equipment master record for a technical object if:
 - o individual data is to be managed for the object (for example, year of construction, warranty period, usage sites)
 - o maintenance tasks are to be performed for the object, either regular, planned or resulting from damage
 - o a record of the maintenance tasks performed for the object must be kept (for example, for insurance or compulsory annual inspection purposes)
 - o technical data on the object is to be collected and evaluated over a long period of time
 - o the costs of maintenance tasks are to be monitored for the object
 - o records of usage times at functional locations are required for the object

Equipment Master Record

The master record of equipment consists of the following views:

- General
- Location
- Organization
- Structure
- Class and Docs
- Serial Data
- Warranty and Partner
- Other

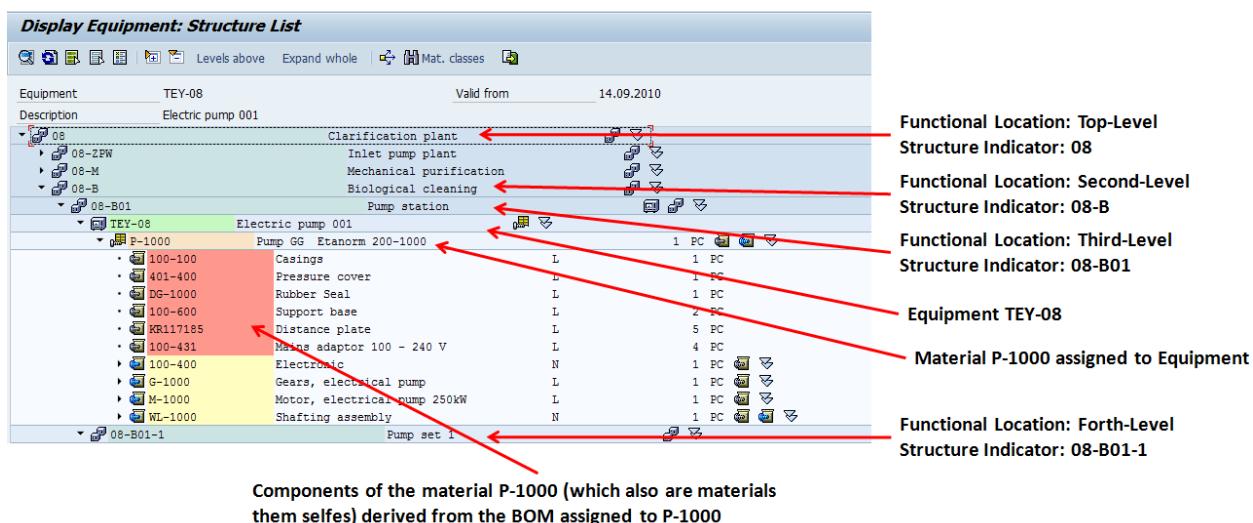


Figure 22: Functional Location - Equipment - Material: SAP-System-Screenshot

2.4.2.3 Serial Number

Serial numbers are identification keys assigned to individual material items. The material number (e.g., Speedstar) only identifies the material but not each Speedstar produced. For this matter you can use serial numbers.

In Inventory Management, serial numbers are used to differentiate single items in storage location. That is, you can differentiate between 2 different Speedstars produced when processing inventory counts, for instance.

Example:

IDES manufactures bicycles. They produce two different types: Speedstar and Speedstarlett. A material master record exists in the company's system for each type. For quality control reasons, the company wants to know for each bicycle delivery which customer has received which type of bicycle and which serial numbers of the bicycle type were delivered to the customer.

For this purpose, each bicycle that is produced is assigned a serial number that, together with the material number, uniquely defines it.

Object	Material number	Serial number
Bicycle	Speedstar	99-01-01
Bicycle	Speedstar	99-01-02
Bicycle	Speedstar	99-01-03
Bicycle	Speedstar	99-01-04
Bicycle	Speedstarlett	99-01-01
Bicycle	Speedstarlett	99-01-02
Bicycle	Speedstarlett	99-01-03
Bicycle	Speedstarlett	99-01-04

As you can see from the example, you can assign several serial numbers to one material number. For instance, the serial numbers from 99-01-01 to 04 are assigned to the Speedstar. Furthermore, the same serial number can appear several times for different material numbers. In the example, 99-01-01 is assigned to Speedstar and Speedstarlett. However, both are unique in the system, since you could read it like "Speedstar-99-01-01" vs. "Speedstarlett-99-01-01".

Consider that you cannot assign the same serial number to the same material multiple times. For instance, the assignment "Speedstar-99-01-01" and "Speedstar-99-01-01" is not possible.

The serial numbers used in SAP ERP could be company own or you could use serial numbers of suppliers or customers. However, you can use the serial number field to track any individual material item.

If a material does not have any serial number assigned, you can use a number of your choice as serial number. That is, you can enter a serial number of your choice in the serial number field.

Equipment and Serial Numbers

If you want to manage a piece of equipment not only as an independent and individual object, but also as a piece of material within the framework of inventory management, you must provide it with serialization data. This comprises:

- a unique combination of material and serial number
- stock information
- warehouse information

By using this data, you describe the piece of equipment as an individual item of a particular material.

Transaktion IE03: Equipment TEY-08

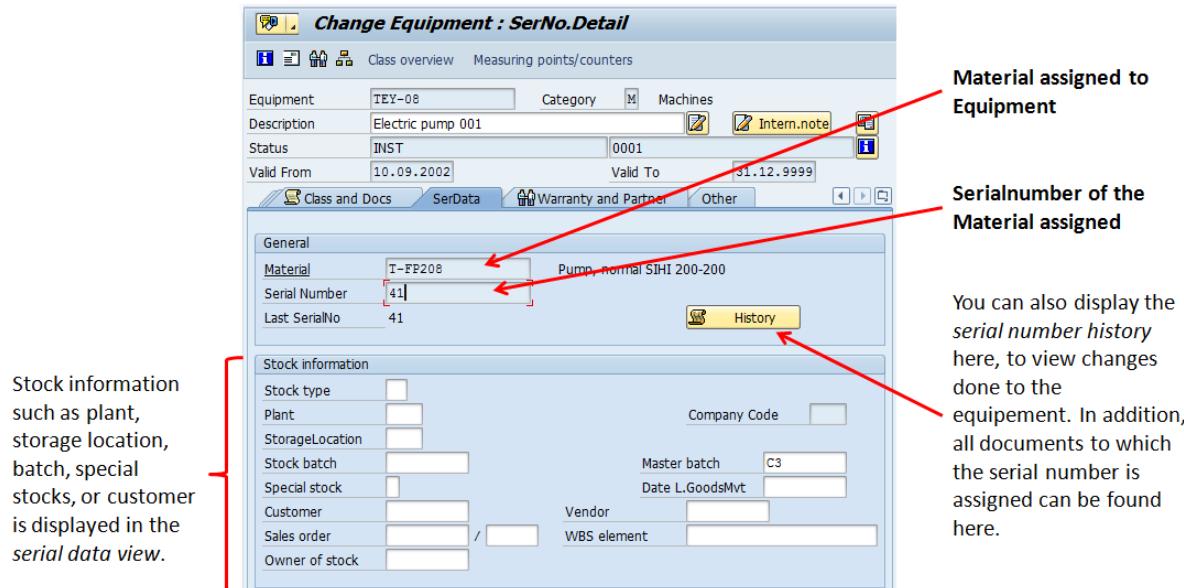


Figure 23: Equipment and Serial Number (1): SAP-System-Screenshot

To make this clear: A Serial number can also be assigned to equipment. In that case, this is done indirectly by using a material master record created for the equipment. Thereby, the serial number specifies the serial number of a serialized material. You can use the serial number to identify individual instances of a material for individual tracking purposes. Since you create the equipment master record for the serial number (and not the other way around), it depends on the *serial number profile* whether only the *serial data view* is visible or all views of the equipment master record. You must enter the serial number profile in the material master record for materials that need serial numbers.

Transaction IQ09: Material T-FP208

Unique combination of Serial number and Material assigned to Equipment

Material T-FP208 is assigned to multiple Equipments each with a different Serial number

Material	Serial number	Plant	SLoc	Equipment	Description	SysStatus	Batch	PP	S
T-FP208	41	1000	0001	TEY-08	Electric pump 001	INST	C3	01	
T-FP208	40	1000	0001	10004654		ESTO	C3	01	
T-FP208	39	1000	0001	10004653		ESTO	C3	01	
T-FP208	38	1000	0001	10004652		ESTO	C3	01	
T-FP208	37	1000	0001	10004651		ESTO	C3	01	
T-FP208	36	1000	0001	10004650		ESTO	C3	01	
T-FP208	35	1000	0001	10004649		ESTO	C3	01	
T-FP208	34	1000	0001	10004648		ESTO	C3	01	
T-FP208	33	1000	0001	10004647		ESTO	C3	01	
T-FP208	32	1000	0001	10004646		ESTO	C3	01	
T-FP208	31	1000	0001	10004645		ESTO	C3	01	
T-FP208	30	1000	0001	10004644		ESTO	C2	01	
T-FP208	29	1000	0001	10004643		ESTO	C2	01	
T-FP208	28	1000	0001	10004642		ESTO	C2	01	
T-FP208	27	1000	0001	10004641		ESTO	C2	01	
T-FP208	26	1000	0001	10004640		ESTO	C2	01	

Figure 24: Equipment and Serial Number (2): SAP-System-Screenshot

2.4.2.4 BOMs in Plant Maintenance

You already know BOMs from the Material Management and Manufacturing Execution teaching unit. A maintenance bill of material (BOM) is a complete, formally structured list of the components making up a technical object (functional location, equipment) or an assembly. The list contains the object numbers of the individual components together with their quantity and unit of measure. The components can be stock or non-stock spares or assemblies, which in turn can be described by using maintenance BOMs.

There are three categories of maintenance BOMs in the SAP system:

- Material BOM
- Equipment BOM
- Functional location BOM

Maintenance BOMs are primarily used for the following purposes:

- **Structure description:** A Maintenance BOM describes the structure of a technical object or material. Using Maintenance BOMs, you can specify exactly where maintenance tasks are to be performed on a technical object.
- **Assignment of spare parts:** A Maintenance BOM is used in plant maintenance to assign spares for a technical object or material.

Using Maintenance BOMs presents the following advantages:

- **Materials planning** (when using maintenance task lists): The use of Maintenance BOMs is advantageous for material planning because you can perform material planning when creating a maintenance task list. The link between the task list and the Maintenance BOM is created as follows:
 - o Using the technical object BOM for maintenance task lists for technical objects.
 - o Using the assembly in the header for general task lists.

The link to a Maintenance BOM enables you to assign materials that have already been planned for the technical object or the assembly to the individual operations in the task list. You can use the structure list or the structure graphic to do this. As both display options provide a detailed overview of all the materials of the BOM, material planning is simplified considerably.

- **Materials/spares planning** (when using maintenance orders): Maintenance bills of material support you during materials or spares planning by providing you with an overview of all materials/spare parts that could be required in the maintenance order. This enables you to assign to the order all the materials you require and makes materials/spares planning considerably easier.
- **Locating malfunctions** (when using maintenance notifications): Maintenance bills of material support you when locating malfunctions by providing you with an overview of all components that make up a technical object. From this overview, you can easily select the object for which you want to create a malfunction report. This enables you to locate the malfunction in the technical object more precisely.

3 Corrective Maintenance Process

The following section delivers insight into the corrective maintenance process in SAP PM.

3.1 Theory: Corrective Maintenance Process in SAP PM



Theory

Maintenance processing encompasses all the activities necessary to maintain company own facilities or facilities of customers. Thereby, the maintenance process comprises several levels, which do not necessarily all have to be implemented in full.

Therefore, it is possible to process a repair by using many planning stages such as preliminary costing, work scheduling, material provision, resource planning and permits. However, it is also possible to react immediately to damage events causing production shutdown and to produce the required orders and shop papers with the minimum of entries in the shortest possible time.

3.1.1 Maintenance Process

The corrective maintenance process contains the steps notification, planning, scheduling, execution and completion.

- **Step 1 - Notification:** Malfunctions and other requirements are listed in the notification and entered into the system. You can search and process notifications by using the notifications list.
- **Step 2 - Planning:** In planning, orders are created correspondingly to the requirements listed in the notification. An order contains the tasks to be executed and the required materials as well as any utilities that may be necessary such as measurement devices, cranes, etc.
- **Step 3 - Control:** In the scheduling step, the order is checked in many ways (e.g., availability checks, capacity checks) that are important for the subsequent order release. If no serious problems occur (e.g., a spare part is not available at a desired date), the order is put into process. Generally, the shop papers are printed in the same step.
- **Step 4 - Execution:** The maintenance operation is carried out on site. The materials required for order execution are withdrawn from the warehouse with reference to the order. Unplanned withdrawals, i.e., withdrawals of materials not being reserved through the order, are also possible.
- **Step 5 - Completion:** The completion step contains the following partial steps: *time confirmation* (entering actual worked times), *technical confirmation* (completion of *technical results*) and *technical completion*. Order settling by the CO department can be carried out at the same time.
- **History:** All data created and changes to the technical objects applied during maintenance processing are stored in the objects history and can be analyzed by using the Plant Maintenance Information System (PM-IS)

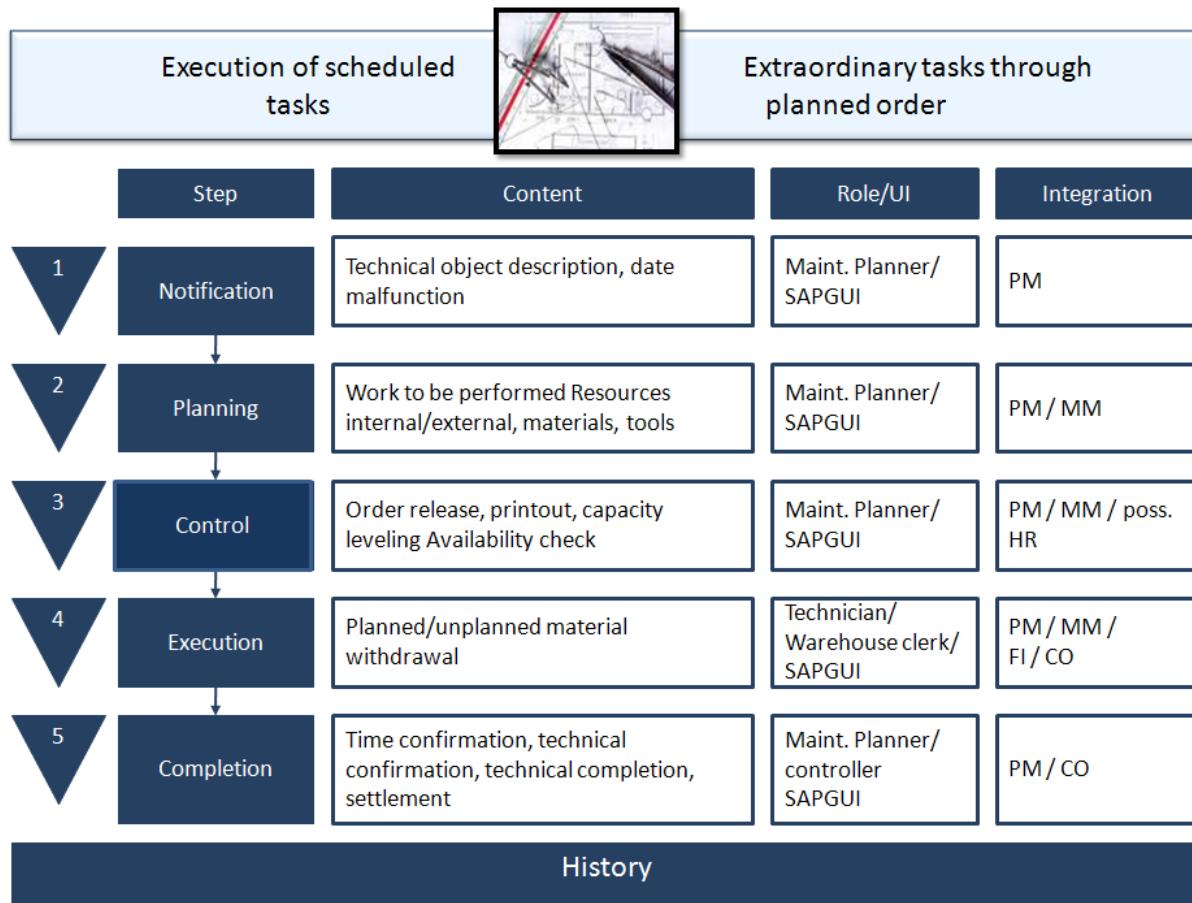


Figure 25: Corrective Maintenance Process

The five phases of this business process can be controlled and partly automated by using **SAP Workflows** functionality.

SAP Business Workflow is a standard functionality in SAP systems, which allows representing business processes in the SAP System and run them (repeatedly) by using the workflow system. Thereby, a "Workflow Management System" can control and process particularly structured processes which:

- comprise a series of activities
- often recur in the same or similar forms
- involve several people or groups of people
- require a high level of coordination

In the SAP standard, various standard workflows (workflow models and tasks) are provided for Enterprise Asset Management (PM component). These workflows can be activated and configured or be used in their standard version. They can also be adapted and expanded according to customer requirements.

3.1.2 Step 1: Maintenance Notification

Notifications are used in maintenance processing when a malfunction or exceptional situation occurs, to describe the exceptional technical condition at an object, request the maintenance

department to perform a necessary task and to document work that has been performed. Thereby, you can record maintenance tasks completely with the help of a maintenance notification and make these documentations available for analysis in the long term. You use maintenance notifications mainly for preliminary planning and execution of tasks.

Each maintenance notification contains **header data** that apply to the entire notification. The information in the header data is used for identification and managing the maintenance notification.

The **notification items** contain data to describe an issue, a malfunction or a performed activity in detail. A notification can contain several items.

Activities document the tasks *performed* in the framework of a notification. They are especially important for inspections, since they prove that certain tasks have been performed.

Task data describe activities that are planned within the framework of a notification, that is, they are yet to be performed. These tasks such as creating a report might arise only after performing maintenance tasks. In some cases, you can use these tasks for planning purposes as well (e.g., if order processing is not active yet). In this case, different persons can be planned for processing the notification and monitor the execution of activities for specific periods of time. Cost monitoring, materials requirements planning or capacity planning is, however, not possible for this processing type.

The notification interface is configurable. You can adjust the number of registers and their values according to requirements by using Customizing.

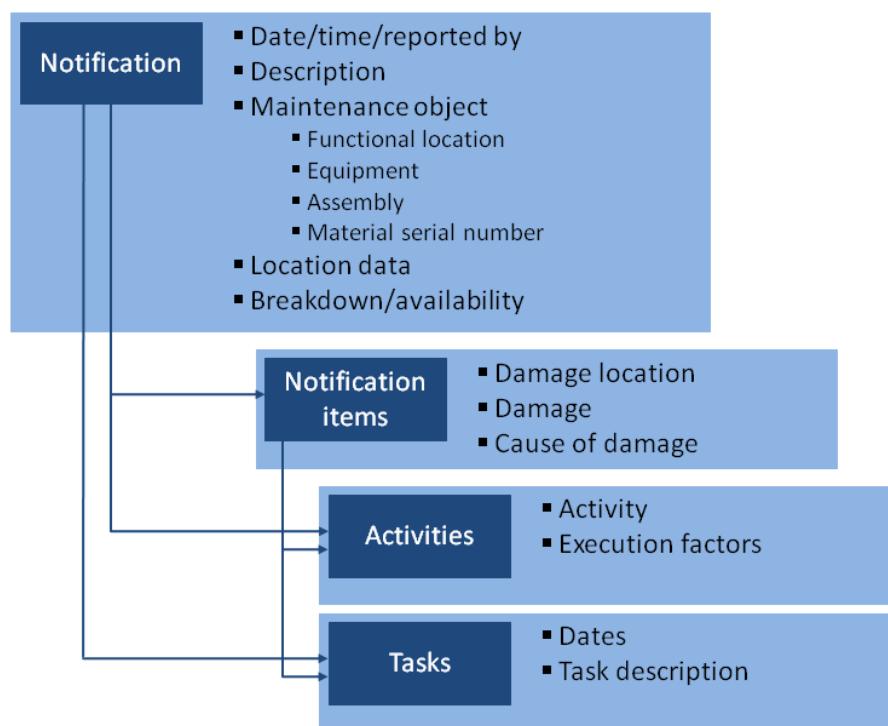


Figure 26: Maintenance Notification

Reference Objects in the Maintenance Notification

A notification can be created for both a functional location and a piece of equipment with or without an assembly. A notification can also be created for a material with a serial number. However, a notification can also be created without an object.

All notification types can be entered for a functional location and for a piece of equipment, in each case with or without assembly or for a material with serial number. The object hierarchy corresponds to the sequence specified. For example, if a maintenance notification is entered for an assembly on a piece of equipment, which is assigned to a *functional location*, the system transfers all relevant data for the piece of equipment and the *functional location*.

These maintenance notifications can also be entered without specifying an object number if the malfunction report refers to an object that is not managed in the system under a particular number or if a maintenance request refers to a new object that is supposed to be provided for investment program.

A view for the reference object can be chosen for an individual notification or for a notification type as follows:

- *Functional location* + equipment + assembly (standard setting)
- *Functional location* + equipment + assembly (for functional locations with exactly one piece of equipment installed, the equipment is set automatically)
- *Functional location*
- Equipment (with or without assembly)
- Material number + serial number (with or without equipment number)
- Without entering a reference object

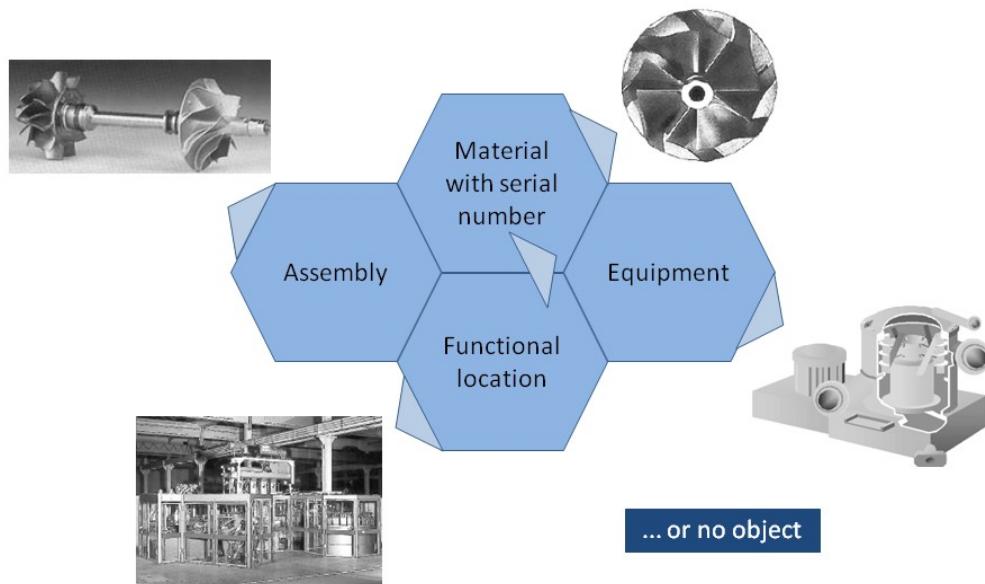


Figure 27: Objects in the Maintenance Notification

3.1.3 Step 2: Planning

In planning, orders are created correspondingly to the requirements listed in the notification. An order contains the tasks to be executed and the required materials and tools.

3.1.3.1 Creation of Maintenance Orders

We differentiate five cases when creating maintenance orders:

1st case: The maintenance order is created directly (e.g., breakdown order).

2nd case: The maintenance notification is not entered centrally. The responsible person creates the maintenance order from the maintenance notification.

3rd case: In a maintenance order, several maintenance notifications are combined into one or more objects.

4th case: An activity report for an existing maintenance order is entered subsequently as a *technical confirmation*.

5th case: A maintenance order is generated automatically from a maintenance item by the maintenance plan.

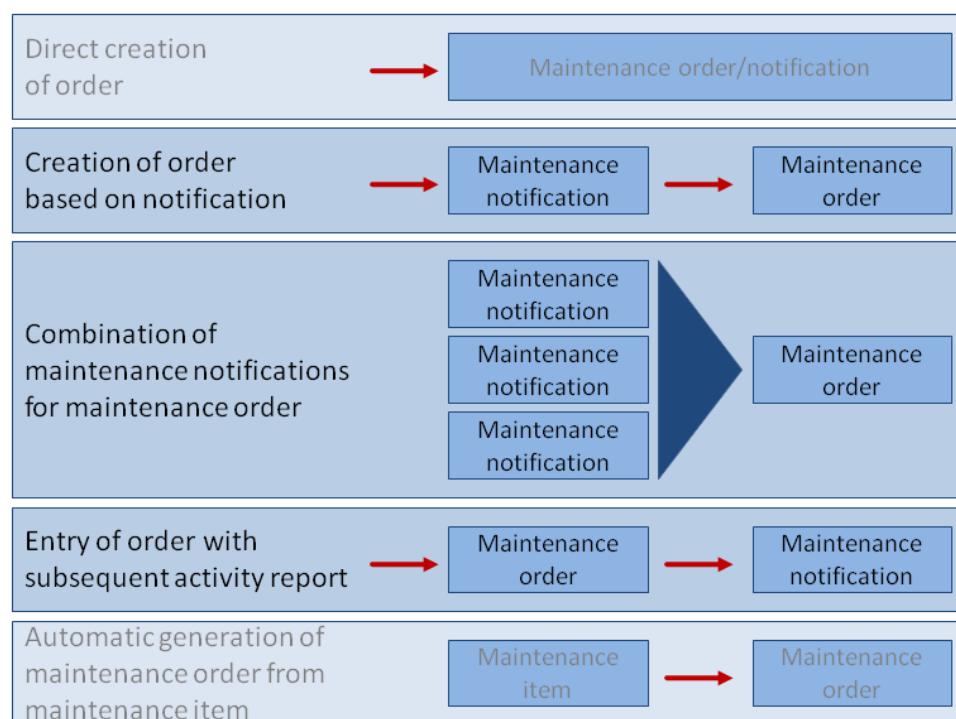


Figure 28: Creation of Maintenance Orders

3.1.3.2 Elements of the Maintenance Orders

The **header data** contains information valid for the entire maintenance order. They are used for identifying and managing the maintenance order; amongst others, the header data include the number, the description and the type of the order, the scheduled dates for processing the order, the priority of the individual tasks, the creator of the order, the last person modifying the order, etc.

The **object list** includes the objects to be processed (*functional locations*, equipment, assemblies, serial numbers). It is used if the same activity is supposed to be carried out for several objects of the same type.

The **orders operation** describes tasks that are supposed to be performed for the maintenance order. Moreover, it states who performs them with what guidelines.

The **material list** (component list) contains the required spare parts necessary to process the order.

Production resources/tools (e.g., tools, protective clothing, trucks) are used during the maintenance order, but they are not consumed.

Using data from the **settlement rule**, the system determines who bears the order costs. They are included in the master record of the reference object as default and can be changed when the first settlement rule for the order is maintained.

The **cost view** features estimated costs as well as planned and actual costs in the value categories of this order. Therefore, a technical view and a controlling view are available.

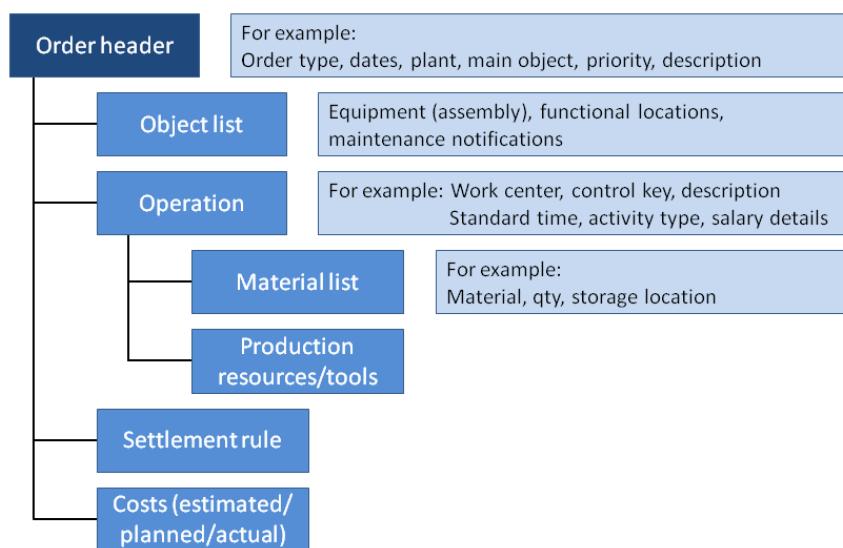


Figure 29: Elements of the Maintenance Orders

3.1.3.3 Maintenance Order: Object List

A core part of a maintenance order is the object list. Several notifications are compiled in the object list and different technical objects are assigned to the order. Even if there was no reference specified on the header data screen for the maintenance order, you can assign technical objects and/or maintenance notifications in the object list to the maintenance order.

When **assigning notifications to an order via the object list**, the first notification appears in the order header in the “notification” field. The first notification is indicated as header notification. Header notification and all other notifications in the object list can also be separated from the order again.

The object list does not "control" the order. This means that the work to be performed is not adjusted, the history is not updated and there is no cost distribution.

Using the customer exit IWO10027, you can assign the order costs *proportionately* to the objects included in the list.

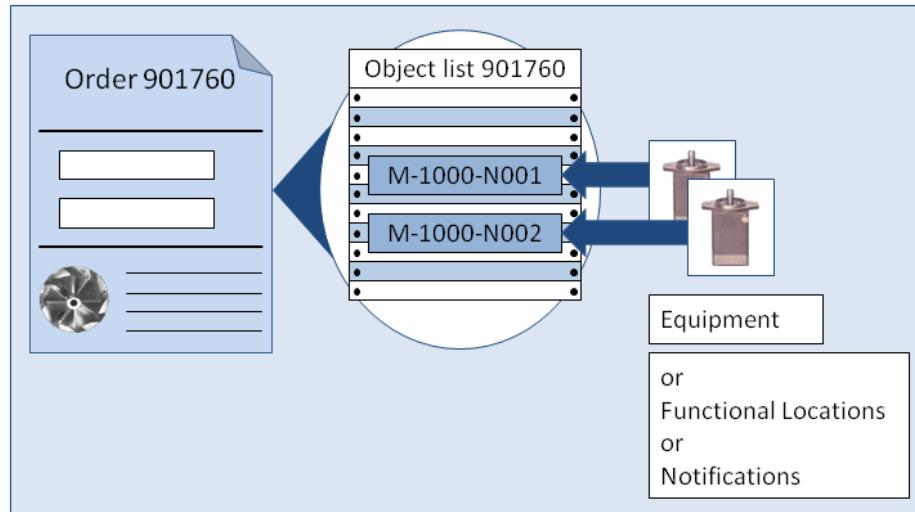


Figure 30: Maintenance order: Object list

3.1.3.4 Material Planning

You can assign any number of material components to an operation. A component can be a spare part or repairable spare or describe an activity. The material that you schedule for an order is reserved for the order in the warehouse. As soon as the order is released, the materials can be withdrawn from the warehouse and delivered to the customer. The following applies for planned material:

- For stock material, the system generates a reservation.
- For non-stock material or where external services are involved, the system generates a purchase requisition for external procurement.

Stock Material: Process Flow

Materials required for performing a task can be planned for each operation in the maintenance order. These materials can be BOM components of the reference objects or freely assigned materials.

If the planned materials for the maintenance order are in stock, a reservation in the warehouse is carried out. Using the customizing function, you can determine for each order type, whether the material reservation or the purchase requisition (if a material is not in stock) is supposed to be carried out immediately or at the time of order release.

When assigning components in the order, you can call up an availability check. At the time of order release, an automatic availability check is executed. However, the order can also be released if availability is not given.

In combination with the order papers, the material provision list as well as the material withdrawal documents can be printed.

Planned goods issues are entered with reference to the reservation (reservation number), unplanned goods issues are entered with reference to the order number. Entered goods issues appear in the document flow of the order.

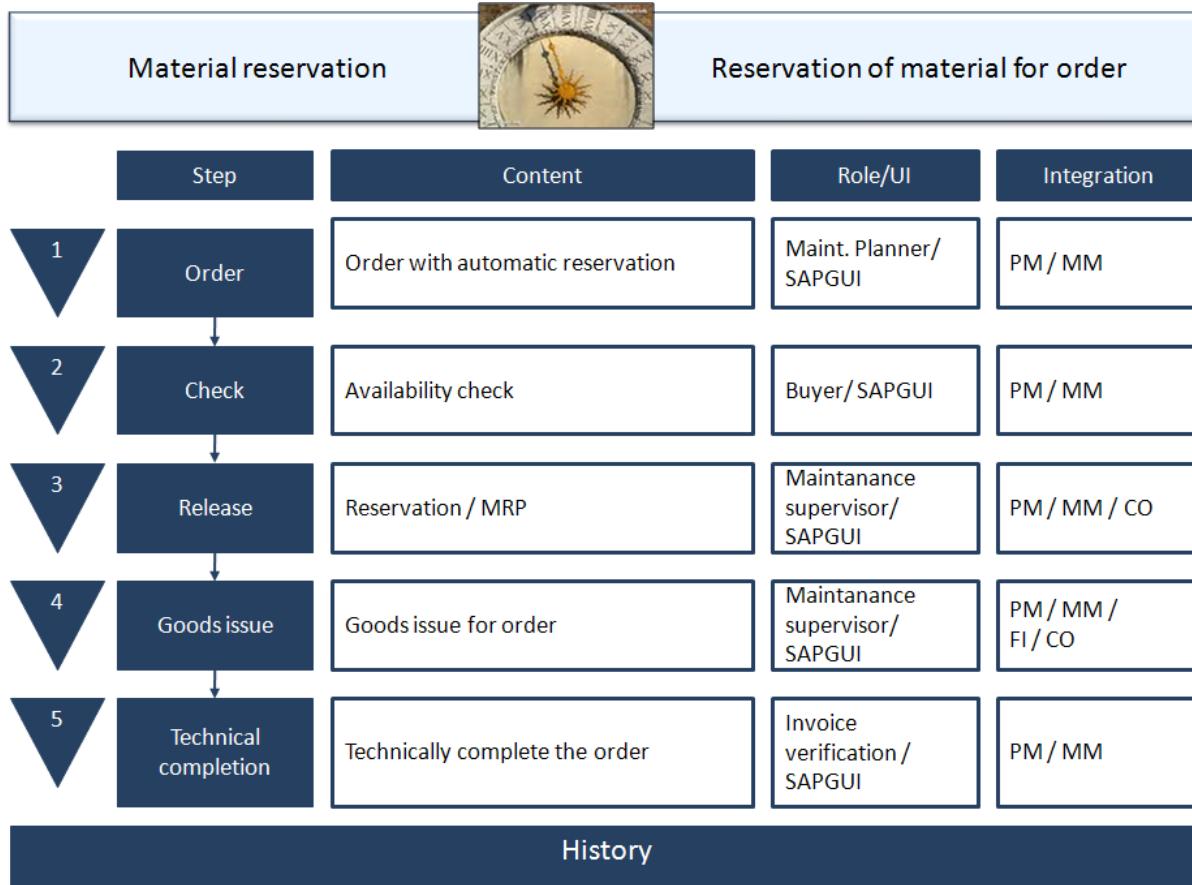


Figure 31: Stock Material: Process Flow

Non-Stock Material: Process Flow

If your company does not keep stocks of the required spare parts, Purchasing has to procure the material from a vendor. From the Plant Maintenance perspective, material procurement is a support process that integrates Plant Maintenance with **Purchasing** (Materials Management).

When assigning components (materials) in an order, you can enter additional information concerning the order. Depending on the order type and the corresponding settings in customizing for this order type, purchase requisitions are created when either saving or releasing the order.

In purchasing (MM), orders are created based on purchase requisitions. The order items are assigned to the maintenance order.

Goods receipts are entered with reference to the purchase order after the order has been put in process. The account assignment of the purchase order to the order instigates the posting to the order. When goods receipts are entered, the maintenance order is debited with the purchase order value. The goods receipts entered appear in the document flow of the order.

When the invoice is received, any invoice differences are automatically credited to or debited from the maintenance order.

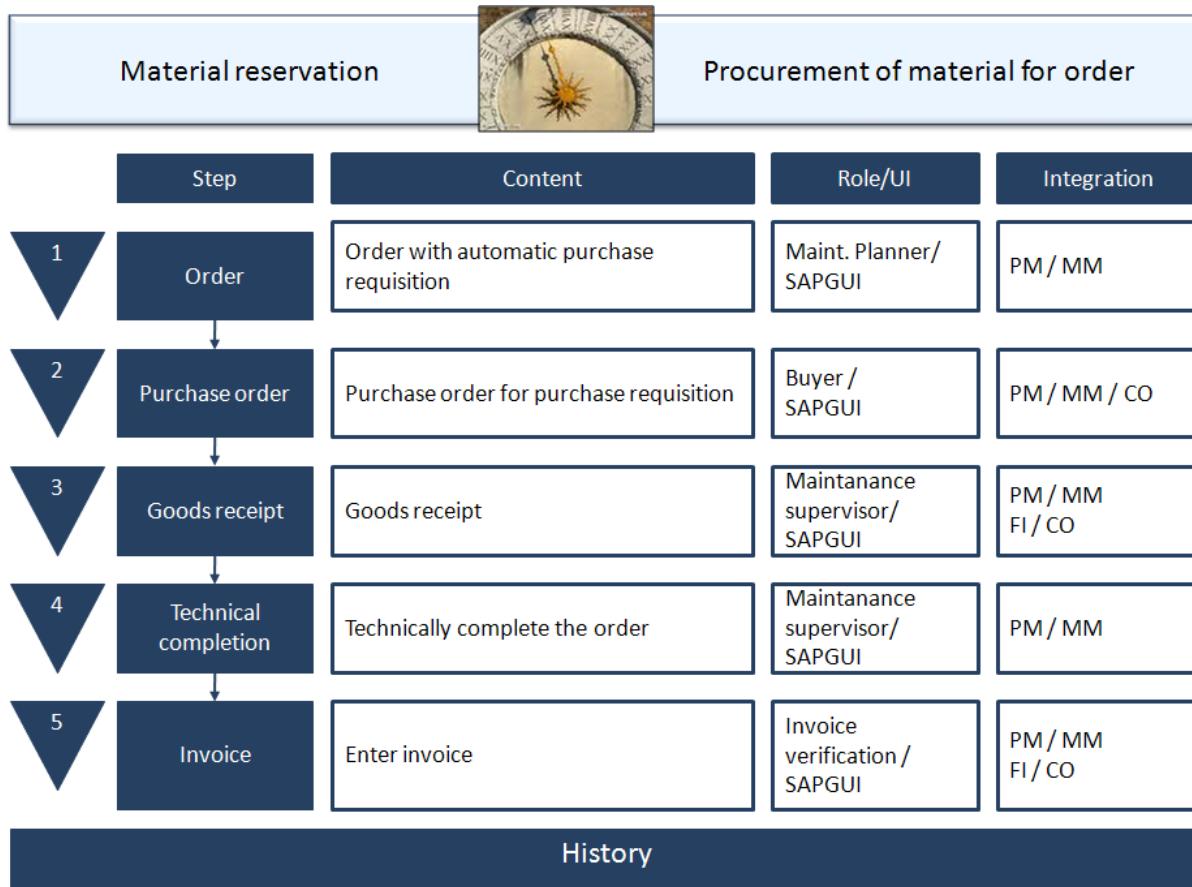


Figure 32: Non-Stock Material Procurement: Process Flow

Material Planning Through Internet Catalog

Planning materials for a maintenance order can also be carried out on the basis of an **Internet catalog** as well as on direct material assignment and the use of BOMs.

To use the internet catalog functionality, you access an external catalog directly from an order's components screen. Thereby, you use what is known as the **OCI interface** (Open Catalog Interface). This can be set up for the order type and planning plant in Customizing.

If a company is using **SAP Enterprise Buyer** (previously known also as EBP – Enterprise Buyer Professional), catalog access and in some cases also the entire purchasing procedure can be processed by using Enterprise Buyer.

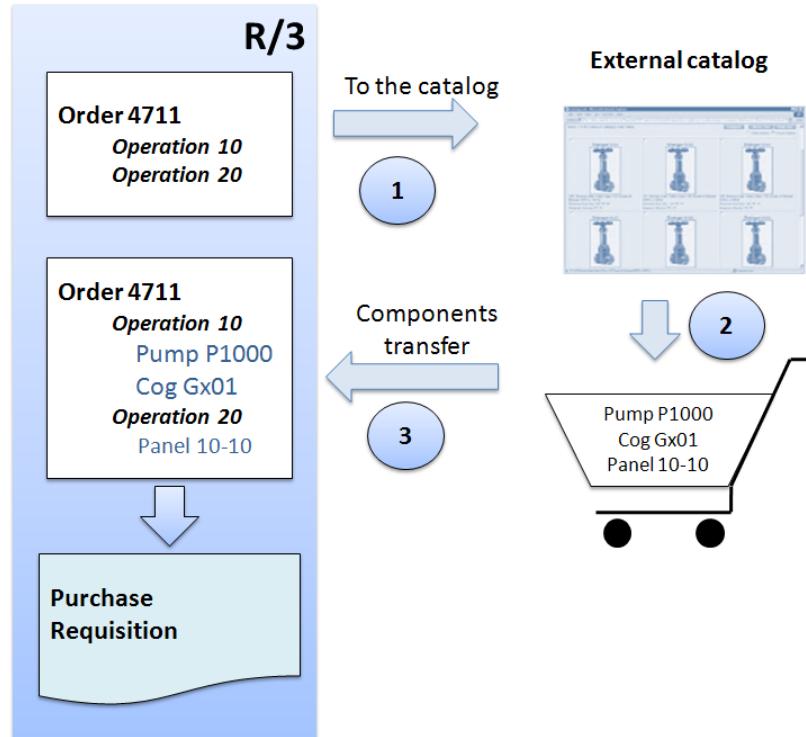


Figure 33: Material Planning Through Internet Catalog

3.1.4 Step 3: Control

In the control step, the order is checked in many ways (e.g., availability checks, capacity checks) that are important for the subsequent order release. If no serious problems occur (e.g., a spare part is not available at a desired date), the order is put into process. Generally, the shop papers are printed in the same step

Order Release

When releasing a maintenance order, the system checks the availability of materials and production resources/tool as well as the required permits. At the time of release (at the latest), the material reservations become relevant to material planning. Materials can be withdrawn and purchase requisitions can be created.

The following actions can only be carried out when the order was released:

- print shop papers
- withdraw material
- post goods receipts
- enter time confirmations
- complete tasks

It is possible to release a maintenance order at the time of its creation. This option is available for maintenance orders automatically created by the system (e.g., orders created by using maintenance plans).

To release these orders immediately when they are created, the **release immediately** flag must be set in customizing by the system administration for the desired order types.

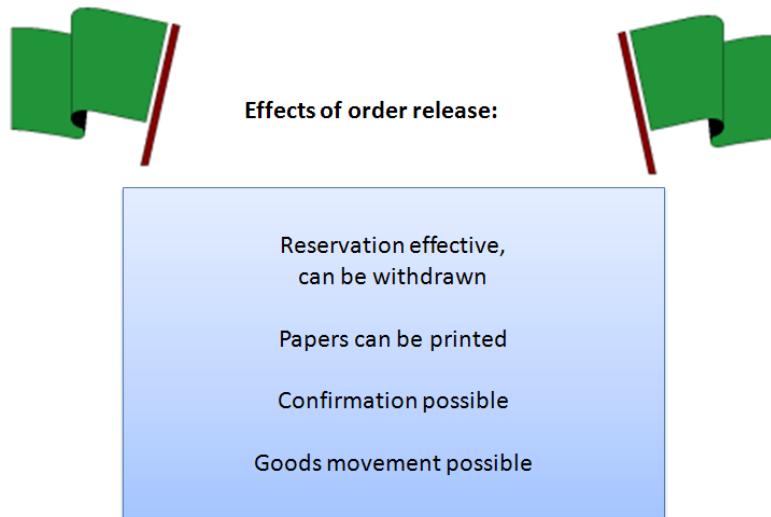


Figure 34: Order Release

3.1.5 Step 4: Execution

In this phase, the maintenance operation is carried out on site. The execution phase involves the withdrawal of spare parts from the warehouse and the actual execution of the order. The materials required for order execution are withdrawn from the warehouse with reference to the order. Unplanned withdrawals, i.e., withdrawals of materials not being reserved through the order, are also possible.

Material Withdrawal

Workers withdraw materials from the warehouse to execute maintenance tasks. There are two types of material withdrawals:

- planned withdrawal of stock material
- unplanned withdrawal of stock material

Moreover, materials can be procured externally. The goods movements for a maintenance order are displayed in the document flow of the order. Using the material where-used list (IW13), you can check which material withdrawals were planned and unplanned.

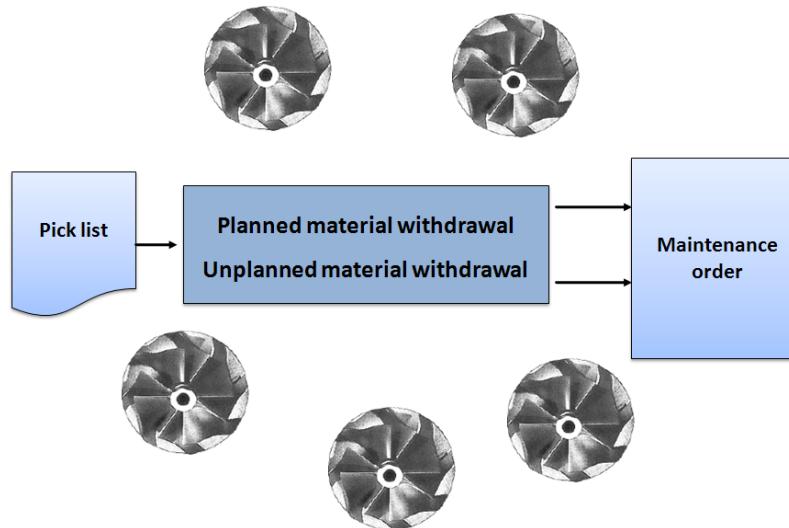


Figure 35: Material Withdrawal

3.1.6 Step 5: Completion

A completion confirmation documents the status of the processing of operations and sub-operations for a maintenance or service order. It is a part of order monitoring. In addition to recording working times, you can also enter the activities performed in the notification, and enter measurement readings for the reference object.

The completion step contains the following partial steps: time confirmation (entering actual worked times), technical confirmation (completion of technical results) and technical completion. Order settling by the CO department can be carried out at the same time.

3.1.6.1 Order Confirmation: Times/Activities

There are four different options to confirm the time required for executing a maintenance order:

- individual entry of times for each order operation
- collective entry using direct entry or an operation list
- overall completion confirmation: times, activities, measurement values, etc., are entered on a collective screen
- entry using the cross-application time sheet (CATS)

Upon entering conformations for individual operations/sub-operations of a maintenance order, the system automatically assigns the PCNF (partially confirmed) status to these operations/sub-operations, given that no settings were made in customizing that a final completion confirmation should be proposed automatically. Once all operations/sub-operations of a maintenance order are confirmed, the order itself receives the status CNF (finally confirmed).

It can happen that confirmations are assigned to the wrong operations/sub-operations or that conformations are entered with wrong data. Therefore, confirmations can be reversed if required.

Executed activities are entered as maintenance notification with the notification type “activity report” and they are assigned to the corresponding order. Alternatively, you can enter confirmation text when entering time confirmations. However, they are not as easy to structure and evaluate as activity reports.

Measurement values are entered as measurement notifications for the reference object.

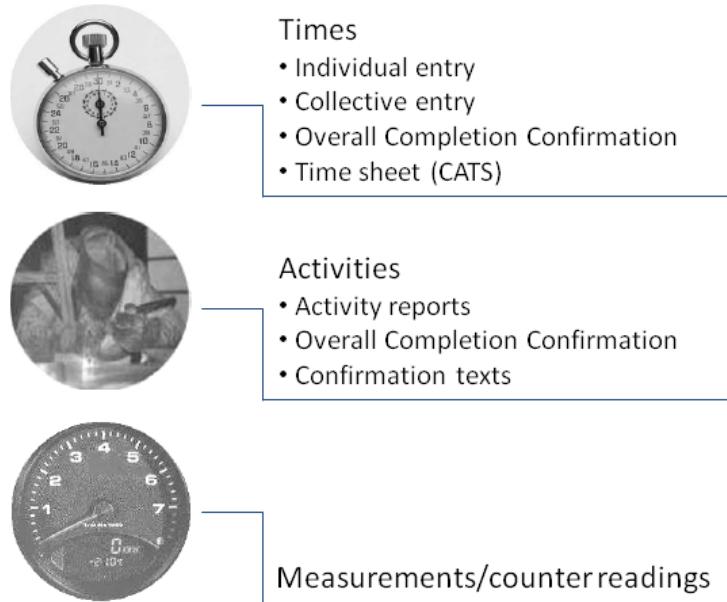


Figure 36: Order Confirmation: Times/Activities

3.1.6.2 Overall Completion Confirmation

Using an overall completion confirmation, you cannot only confirm working times, but also all relevant details concerning an order on a single screen, configured according to the individual requirements of the users. Thereby, you can confirm, in addition to the work time required, other data such as materials used, information about damage, the work and services performed (tasks, activities) or measurement and counter readings.

With the overall completion confirmation, time confirmations and *technical confirmations* can be processed in the same way.

You also have the option of confirming an **inspection round** within the overall completion confirmation (also see **Inspection Round Planning** in the planning phase). If an activity has a technical object and the corresponding counter (as PRT) assigned, you can also record the counter readings (or measurement values) for the activity along with the actual times.

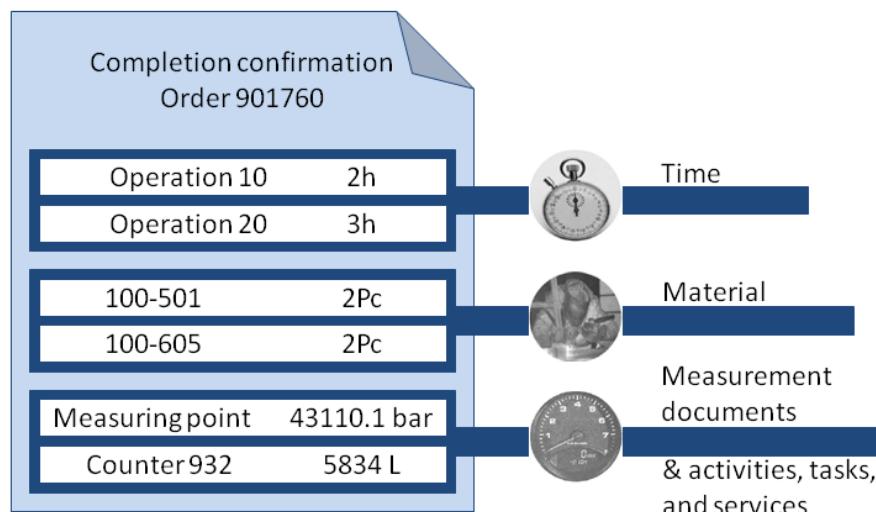


Figure 37: Overall Completion Confirmation

3.1.6.3 Maintenance Order: Technical Completion Option

You have two options to carry out the technical completion of a maintenance order:

- complete the maintenance order and notification separately
- complete the maintenance order together with assigned notifications

For completing the maintenance order and the original notifications together, there must not be any outstanding tasks any of the notifications assigned to the order. In case any outstanding tasks (status **OSTS**) in a notification exist, the notification cannot be completed. The tasks must first be marked as finished. The order belonging to the notification can, however, be completed, as the outstanding tasks must not necessarily belong to the order performed (in certain circumstances, a new order may be required for this).

All notifications with outstanding tasks can be identified easily from their status (**OSTS**) and then processed.

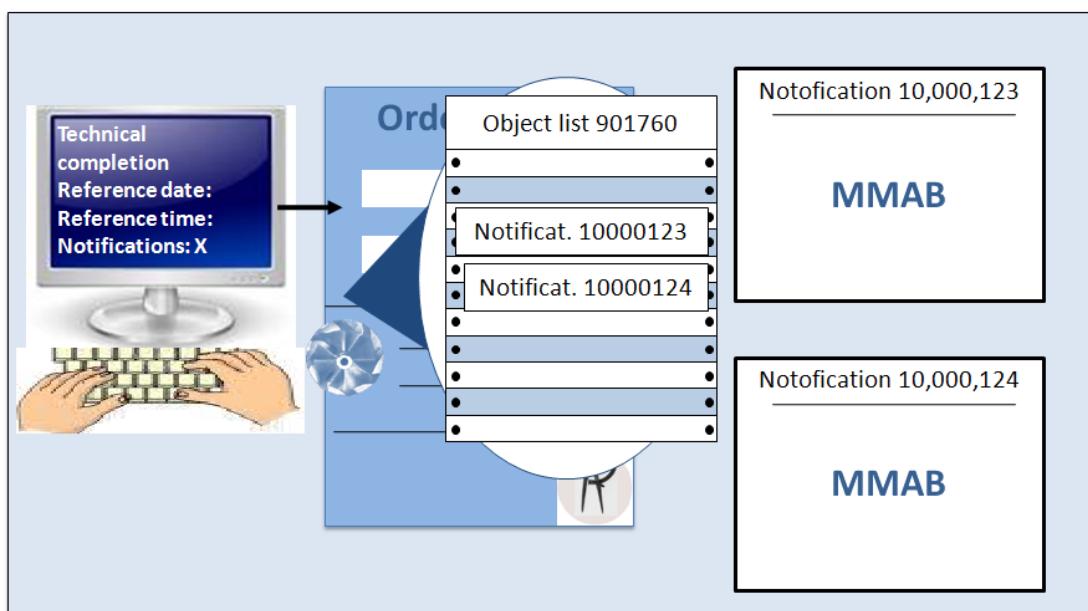


Figure 38: Maintenance Order: Technical Completion Options

After executing the *technical completion*, the maintenance order receives the status TECO (technically completed). This means that the maintenance work required in this order is completed.

After that, only the following changes can be made to a maintenance order:

- it can be locked or unlocked
- the deletion flag can be set
- Goods movements that are still outstanding and confirmations and invoice receipts can be entered.
- You can still change the settlement rule.

If the status TECO is set, the order still can receive costs. For example, you can assign costs from invoice receipt for delivered or consumed goods or costs from delayed time confirma-

tions. If there is no settlement rule maintained for the order, the system creates it automatically. If this is not possible due to missing data, the system prompts you to maintain the settlement rule.

All purchase requisitions without corresponding purchase order that are still existent in the system for the maintenance order are marked with a deletion flag as soon as the TECO status is set. All open reservations and capacities for the maintenance order are closed.

When executing the technical completion, a reference date and time must be entered. This depends on what periods are assigned to the order in the Plant Maintenance Information System (PMIS).

However, the reference date does not affect the determination of location- and account assignment data. Location- and account assignment data are determined at the time of order creation and are copied to the order. For example, if the cost center of the equipment changes during processing the order, the order can be updated by using the “update reference object data” function (right mouse button) when required.

The order data and the data from the maintenance notifications and usage histories are available from the maintenance history and can be used for evaluation past work and for planning future work.

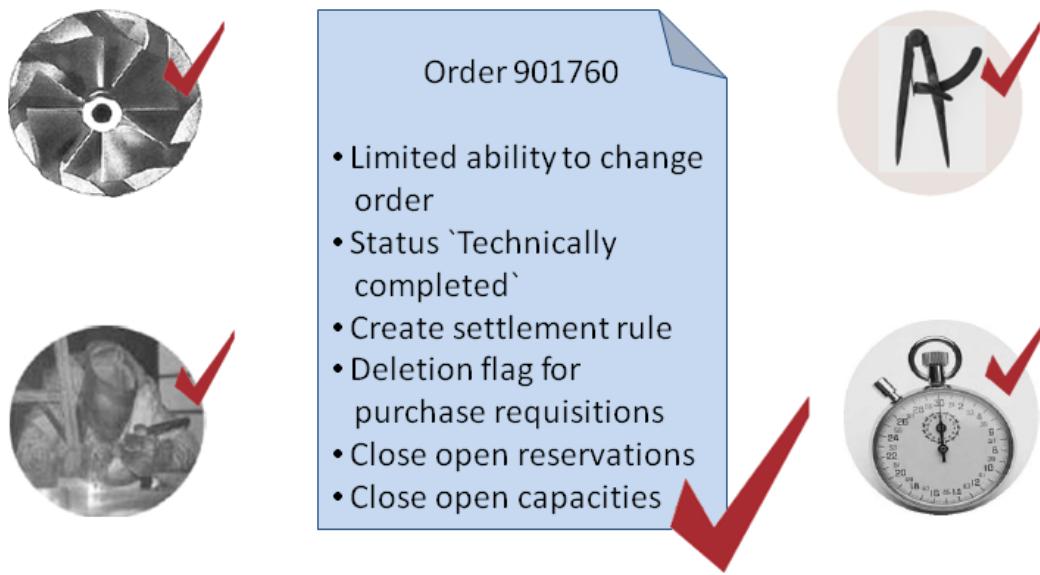


Figure 39: Maintenance Order: Technical Completion

3.1.6.4 Reverse Technical Completion

If necessary, the status TECO (technically completed) can be reversed.

After that, the order receives the status that it had prior to *technically completed*. Thus, capacity requirements and reservations are set and deletion flags are reset for purchase requisitions, which were not converted to purchase orders.

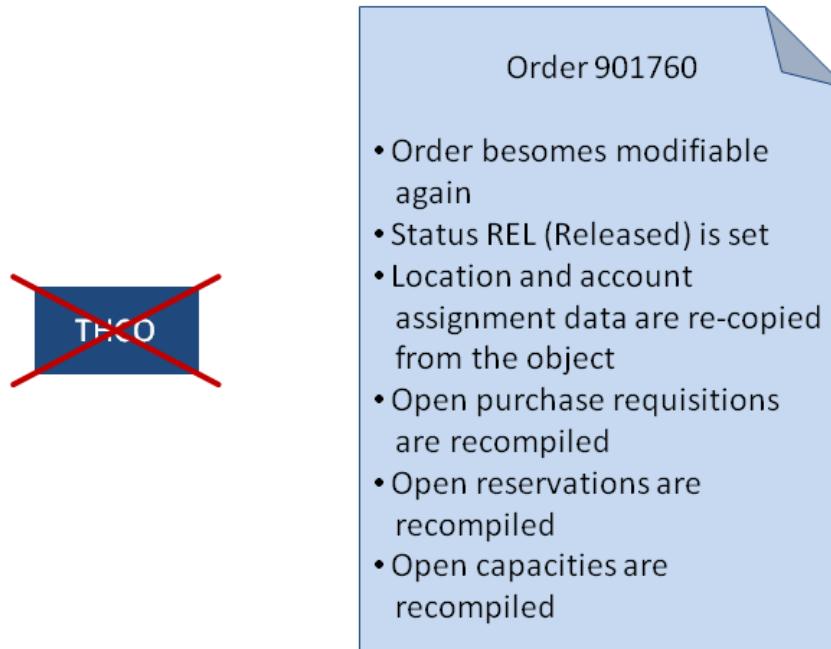


Figure 40: Reverse Technical Completion

3.1.6.5 Maintenance Notification – Completion

You can also complete a maintenance notification separately from the maintenance order. Before a maintenance notification can be completed, the following must be checked:

- All data, which refers to the reference object for the maintenance notification, is available and correct.
- All the relevant item data is available and correct.
- All the relevant task data is available and correct.
- All tasks have been completed or released; there are no more outstanding tasks.
- All technical data related to the breakdown and availability of the technical system is available and correct.

When you complete a maintenance notification, the following occurs:

- Reference date and -time determine what periods are assigned to the notification in the Plant Maintenance Information System (PMIS).
- The maintenance notification is locked for changes, which means that you can no longer change notification data.
- The notification is assigned to the status NOCO (Notification completed).

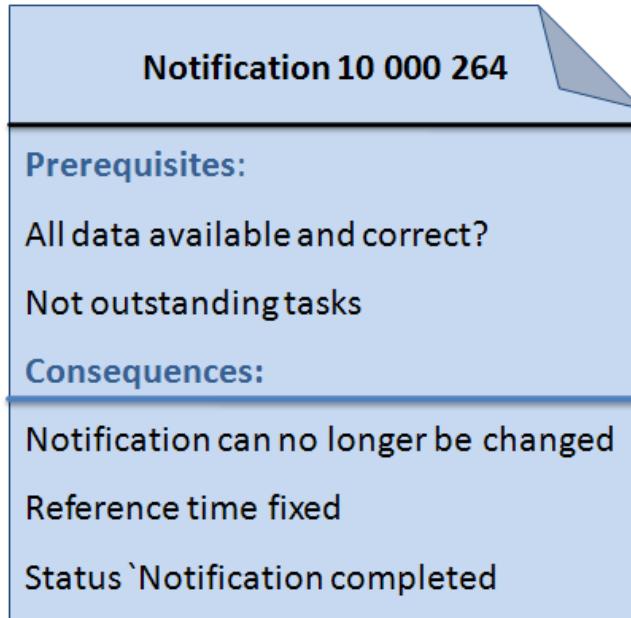


Figure 41: Maintenance Notification – Completion

3.1.7 Integration

The whole maintenance process is fully integrated. That is, you can access each document (notification, order, goods receipt, etc.) created in the process from the document flow. All changes to the documents are recorded in the action log. Furthermore, the SAP PM application is integrated with various other SAP ERP components.

3.1.7.1 Corrective Maintenance and Management Accounting

Since your company wants to be able to calculate the costs for personnel and materials at any phase in a maintenance order, sub-processes of the internal accounting system such as **Costing** and **Settlement** have to be integrated with order planning. From the perspective of Plant Maintenance, they are also support processes. You can run a cost analysis based on the costs calculated (automatically) in the maintenance order.

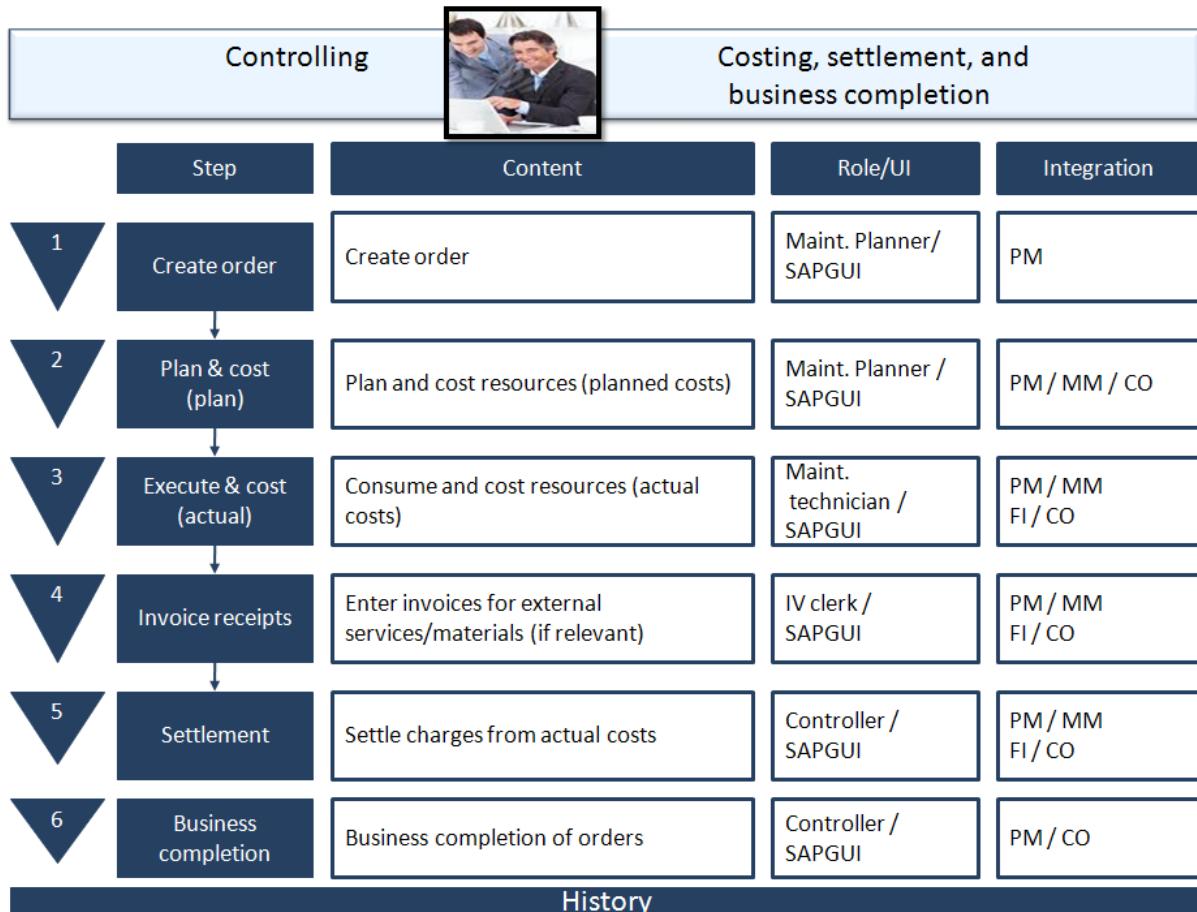


Figure 42: Support Process: Controlling

Cost Analysis in the Maintenance Order

The expected costs of a maintenance order can be displayed in two different ways:

- at cost element level (controlling view)
- at value category level (maintenance view)

In customizing, the cost elements are assigned to the value categories.

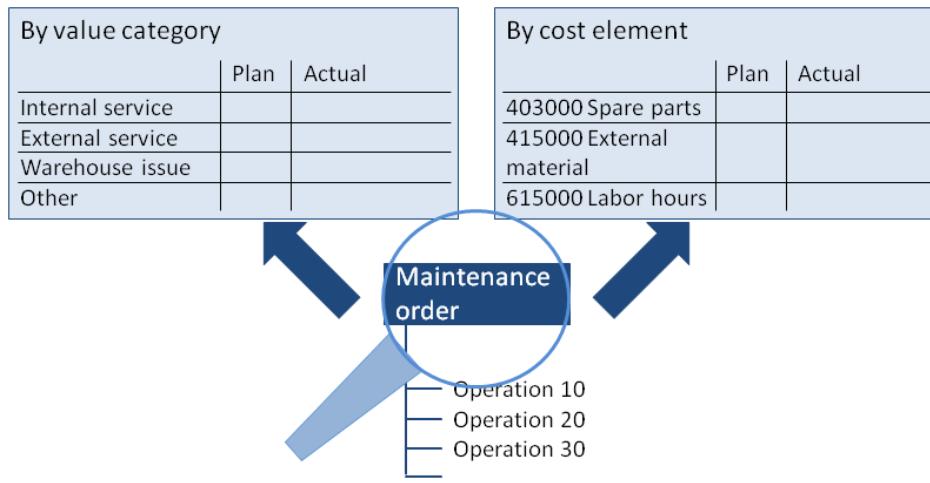


Figure 43: Cost Analysis in the Maintenance Order

3.1.7.2 Document Flow

All document types created during processing the maintenance order can be displayed in the document flow. This includes:

- Notification
- Confirmation
- Goods movement
- Purchase requisition
- Purchase order

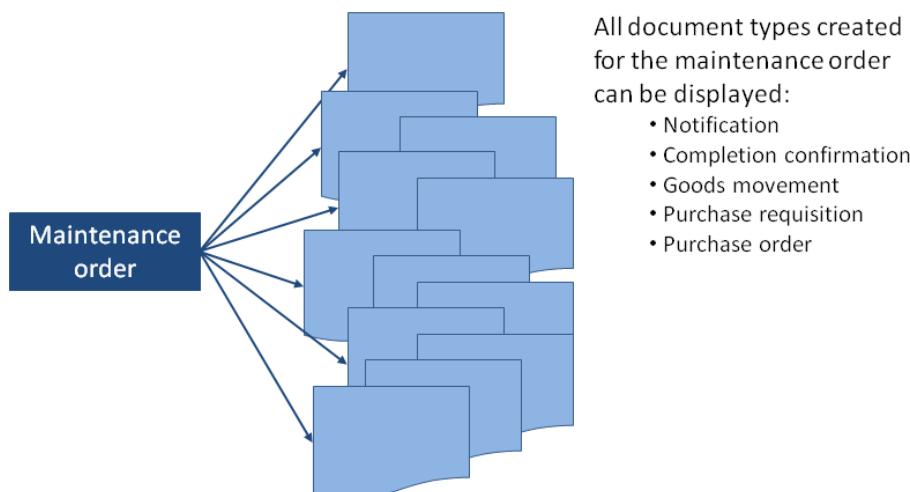


Figure 44: Document Flow

3.1.7.3 Action Log

The **action log** records all changes to notifications, orders, equipment and *functional locations* chronologically. Using the action log, you can track who changed data or status for which fields. To use this function, the change documents for the respective objects must be activated.

Who changed what and when?

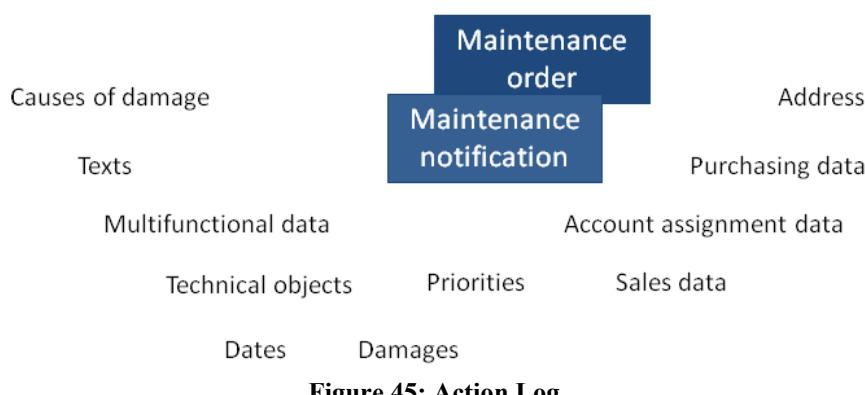


Figure 45: Action Log

3.1.7.4 Integration of SAP PM with other Components

Enterprise Asset Management has many integration aspects. Executing maintenance tasks is always embedded in the overall context of a company and must, therefore, consider accounting, production, materials management and other areas.

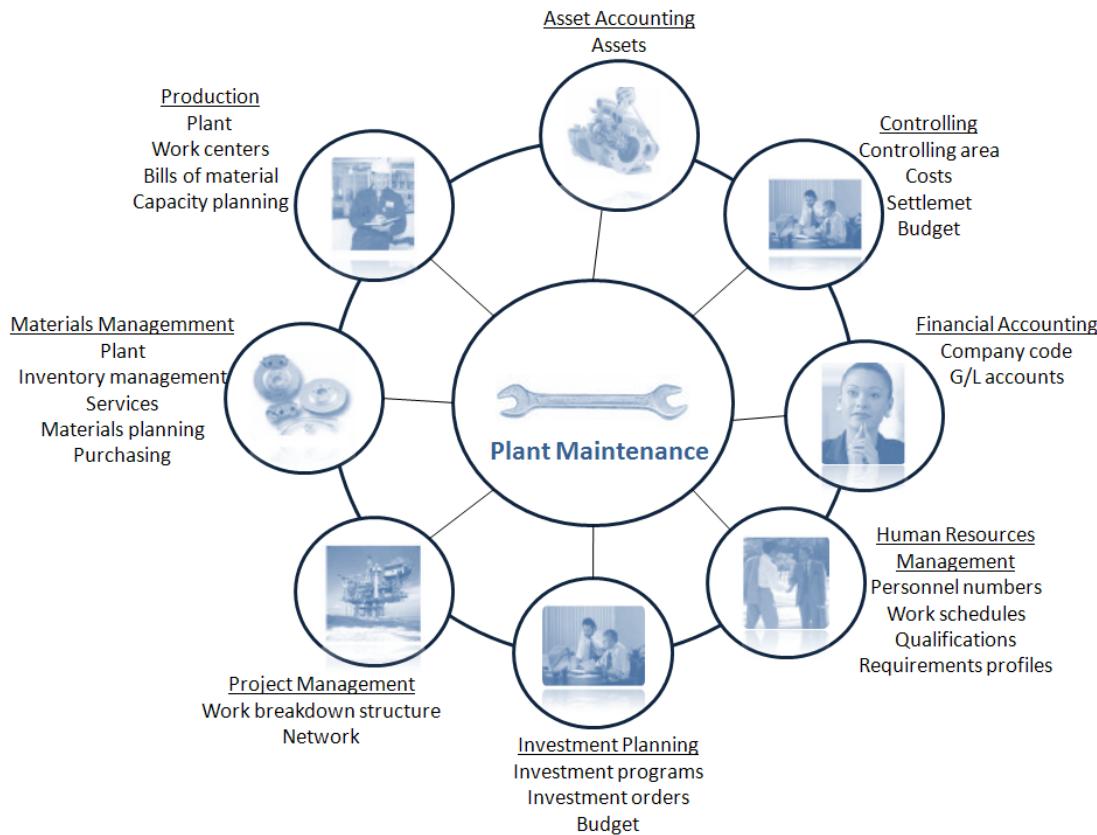


Figure 46: Integration of Plant Maintenance

3.1.8 History: Reporting and Analysis

When managing technical systems, you not only want to document and support the planning of maintenance processing, you also want long-term verification documents in the form of a maintenance history. Furthermore, the Reporting component comprises the standard analyses and flexible analyses for the Plant Maintenance Information System. The standard and flexible analyses enable you to analyze and evaluate data which is written to the Plant Maintenance Information System.

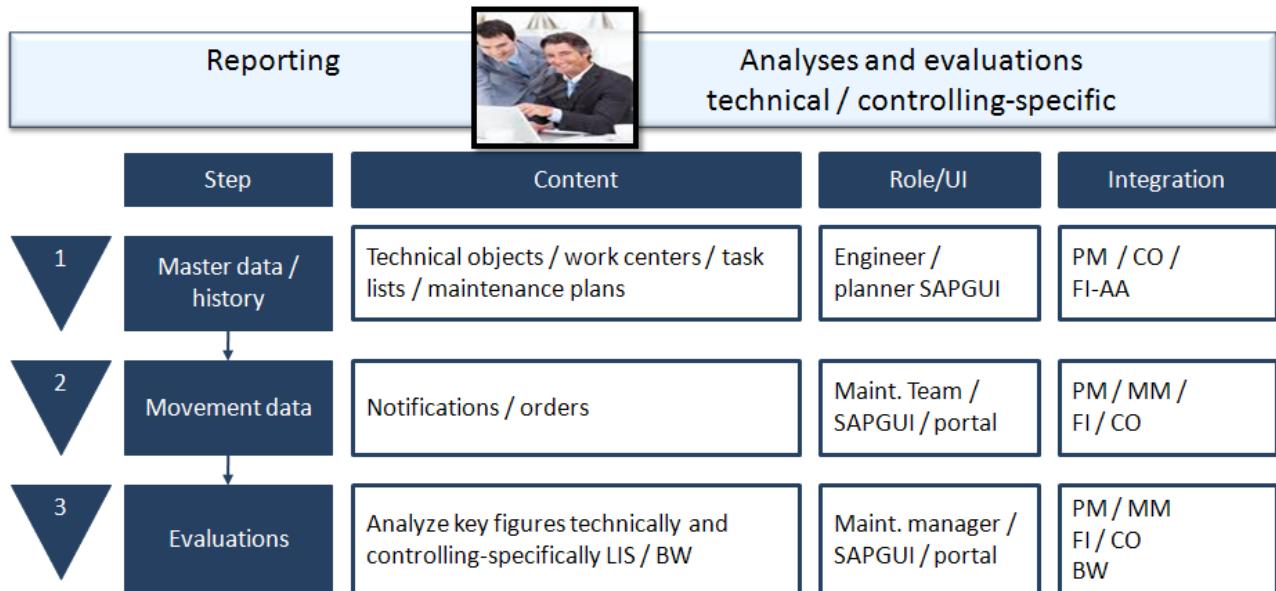


Figure 47: Support Process: Reporting

3.1.8.1 Maintenance History

The execution of analyses in maintenance processing is based on completed notifications or orders and historical orders.

Completed notifications and orders: You can carry out medium-term evaluations based on completed notifications and order. After its completion, a notification is transferred to the notification history. In contrast, an order is transferred to the section for completed orders. The data of completed notifications and orders can be analyzed completely.

Evaluations can be performed via the corresponding list editing function. Each time, the ***completed*** status has to be selected.

Historical orders are created when archiving completed orders. They are the basis of long-term analyses and are transferred to the ***order history***. Historical orders contain the most important order data in condensed form. You can perform analyses in the list editing function for the orders, where the status ***historical*** must be set.

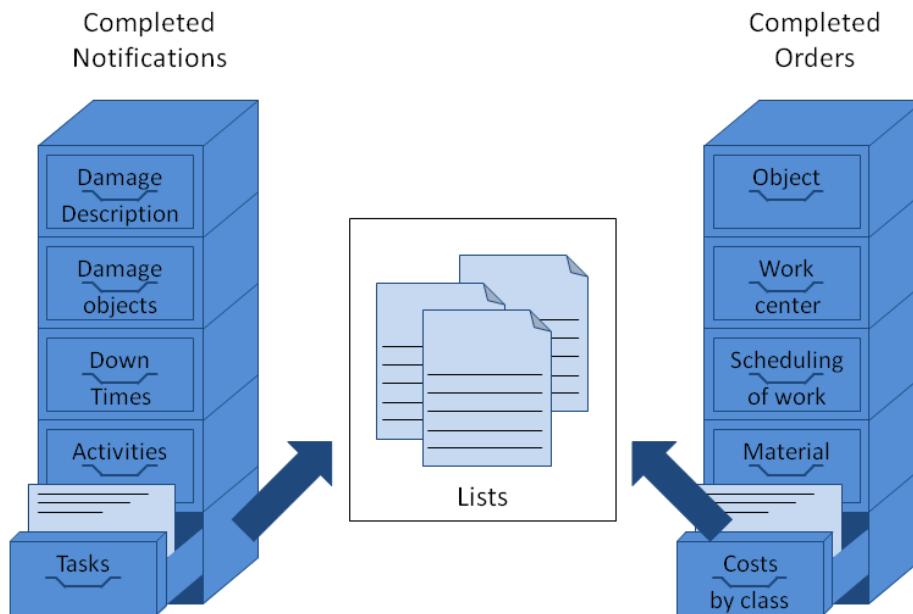


Figure 48: Maintenance History

3.1.8.2 Material Usage

Using the *material where-used list*, you can check the material usage concerning maintenance orders within a particular period. Orders can be selected according to different criteria, e.g., order number, order type or piece of equipment.

The *material where-used list* also states which materials were planned withdrawals (with reference to a reservation) and which withdrawals were unplanned (without reference to a reservation).

Example: Use of material 100-200 from 01/01/01 to 01/01/02

Material	Order	Notification	Funct. location	Equipment	Work ctr	Reserved	Unit	Reserv. reference	Unit
100-200	901021			1000253	MECHMNT	2	PC	2	PC
	901021			1000255	MECHMNT	1	PC	1	PC
	901118			1000255	MECHMNT	2	PC	2	PC
	901234	1000056		1000253	MECHMNT	1	PC	1	PC
	901256			1000255	MECHMNT	2	PC	2	PC
100-200	904051	1000083		1000258	MECHMNT	18	PC	18	PC
						18	PC	18	PC

Figure 49: Material Usage

3.1.8.3 Options for the Standard Analysis

Standard analyses contain many functions that allow for a detailed evaluation of specific information. Thereby, information structures provide the main data for standard analyses.

- You can set the data range to be evaluated.

- You can specify key figures or choose them online during the analysis.

Using the drill-down function, you can vary information details:

- You can specify the sequence in which information is displayed. Alternatively, you can call up a standard drill-down sequence.
- There are different functions on each level (e.g., cumulative frequency curves, ABC analyses, correlation, classification, dual classification and ranking lists).
- All results can be displayed graphically.

Data selected for the standard analysis can be saved as selection version.

- Using the selection version, you can determine how data are displayed.
- Data selection in the background is possible at any time.

You can access summary information in the information structure and branch to display master data and movement data.

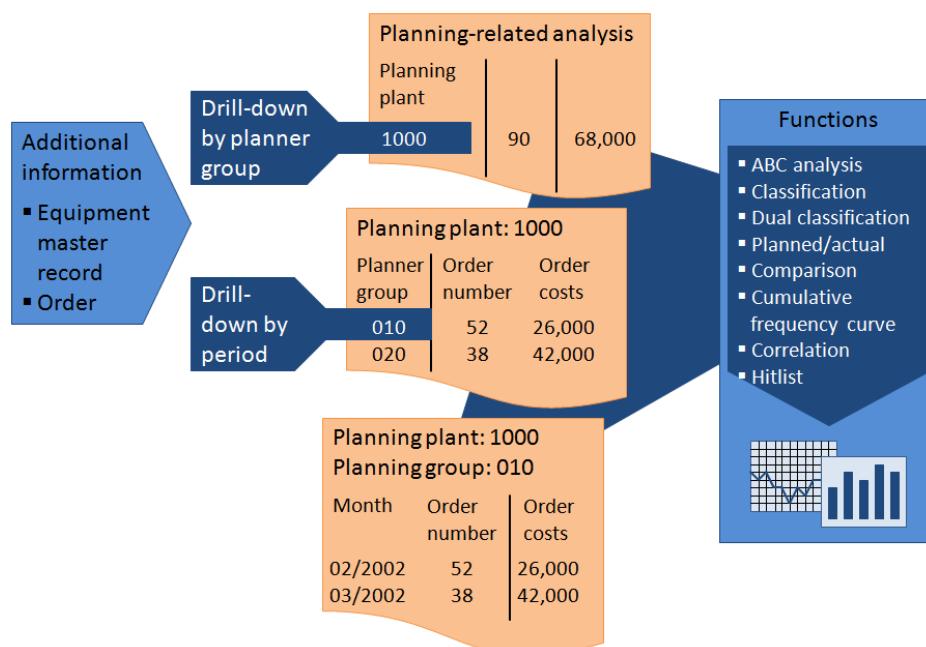


Figure 50: Options for the Standard Analysis

In addition to the PMIS analyses, from the Controlling perspective, you also have the various CO reports for evaluating maintenance orders. Since maintenance orders are part of overhead controlling, they can be used directly in Controlling without any other pre-settings.

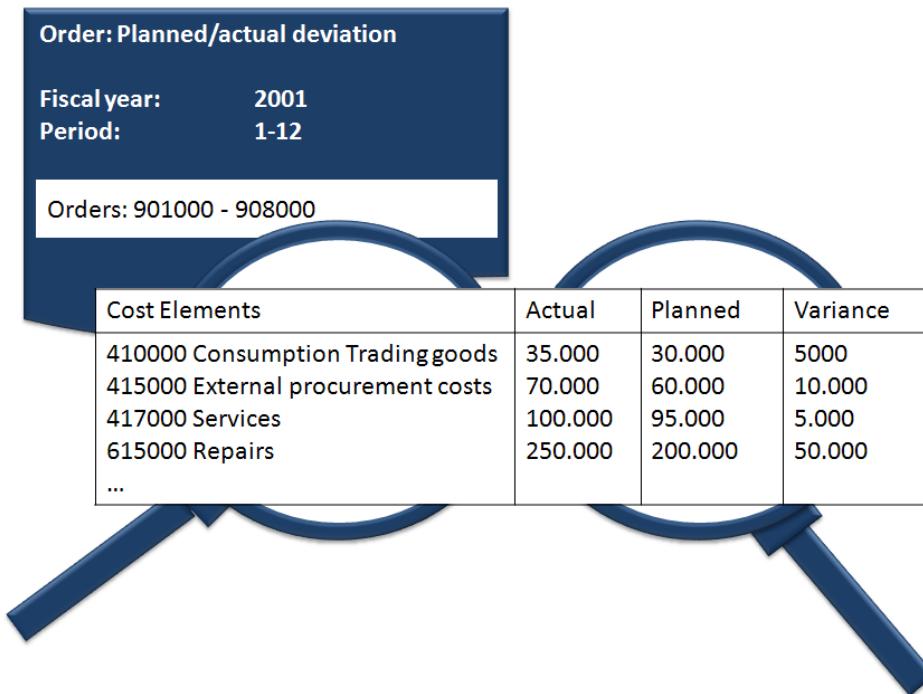


Figure 51: Standard Report in CO

3.2 Practice: Corrective Maintenance Process in SAP PM



You receive a notification saying that the *frame* of the *electronic pump TEY-00* in pump set *00-B01* of *clarification plant 00* is broken. To ensure that the clarification plant can continue its work, the weld must be replaced as soon as possible. Carry out maintenance operations immediately.

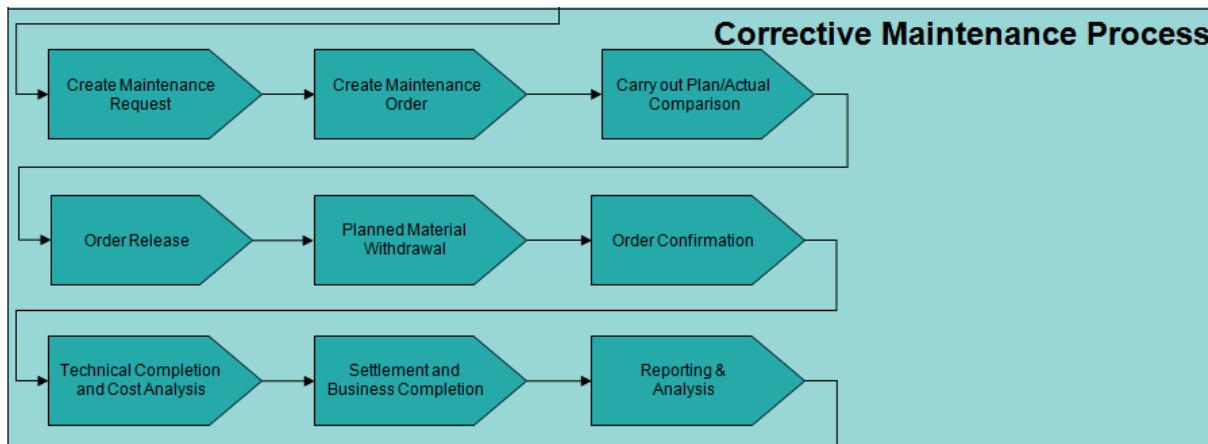


Figure 52: Process Overview: Corrective Maintenance Process

3.2.1 Create Maintenance Request

The corrective maintenance process commences with the maintenance request. Create a maintenance request by choosing

Logistics → Plant Maintenance → Maintenance Processing → Notification → Create (Special) → Maintenance Request (IW26)

1. Enter the reason for the maintenance request into the **description** field (right next to the notification): **weld broken xxxy**
2. Enter electronic pump **TEY-00** as reference object into the equipment field.
3. Press *Enter*. The system automatically fills in the **functional location, planner group, responsible work center**, etc. fields by using data from the master record of the **technical objects** (in this case: of the equipment).

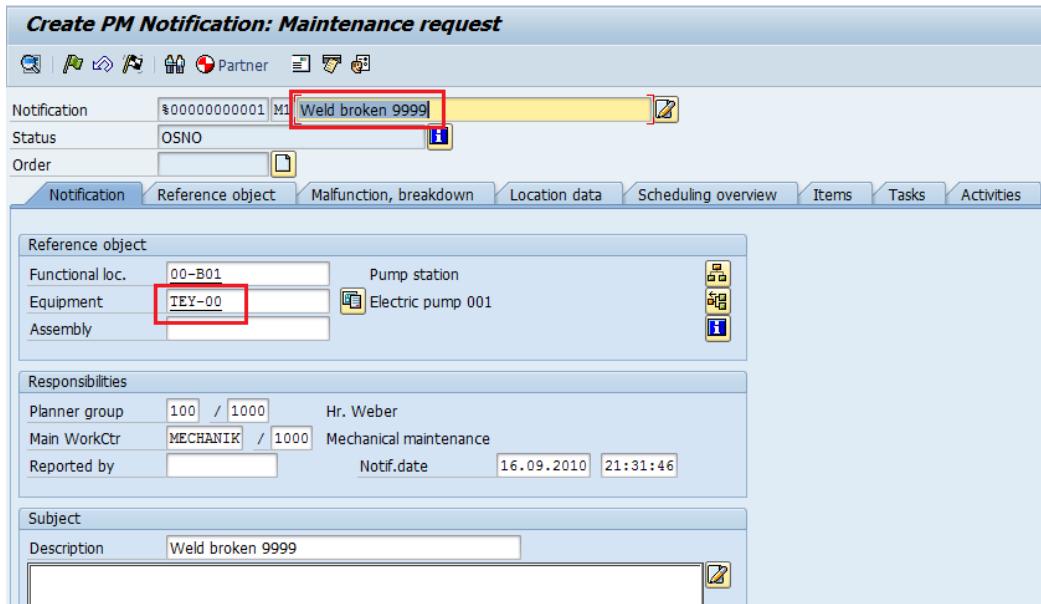


Figure 53: Create Maintenance Request: SAP-System-Screenshot

- Choose *Save* and list the number of your maintenance request on your data sheet.

Maintenance request: _____

Leave the transaction and answer the question **after** saving with **No**.

3.2.2 Create Maintenance Order

Now that the notification is entered as maintenance request, you can turn the request into a **maintenance order** to start operations at the pump. Choose

Logistics → Plant Maintenance → Maintenance Processing → Notification → Change (IW22)

- Enter the **number** of the notification you just listed (**maintenance request**) and choose **Enter**.
- In the next step of the corrective maintenance process, you will create a maintenance order with order type **PM01**. You will convert the notification you created in the previous task into an order with the transaction to change a notification. Therefore, choose the **create** button (yellow icon) on the right beneath the **order** field.
- Check the entries:
 - Order type **PM01**
 - Planning plant **1000**
 - Business area **9900**
 - Responsible work center **MECHANIK/1000**
 - Confirm your entries.

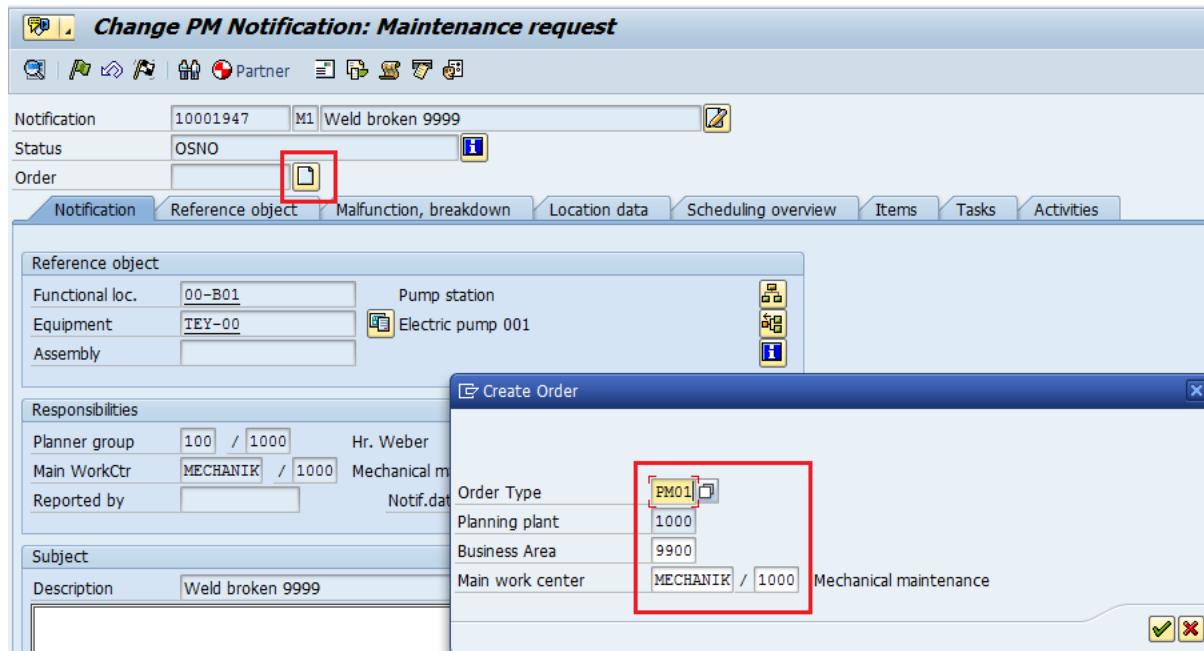


Figure 54: Create Maintenance Order: SAP-System-Screenshot

- The request is now converted into an order. The order status is set to created (CRTD).

Since the frame of the pump is damaged, you need to install a new support base to repair the damage and to renew the weld.

- Therefore, assign the material **support base** from the BOM to the order by clicking the **Components** tab and then clicking the **list** button () on the bottom part of the screen. Thus, you branch to the structure list of the piece of equipment **TEY-00**.
- Expand the node of construction type **P-1000** and select the row with the material name **100-600** (support base). Double-click on the material.

Change PM Notification: Structure List					
				Valid from	
Equipment	Description			Mat. classes	
TEY-00	Electric pump 001			16.09.2010	
TEY-00	Pump GG Etanorm 200-1000				
P-1000	100-100 Casings	L	1 PC		
P-1000	401-400 Pressure cover	L	1 PC		
P-1000	DG-1000 Rubber Seal	L	1 PC		
P-1000	100-600 Support base	L	2 PC		
KR117185	Distance plate	L	5 PC		
100-431	Mains adaptor 100 - 240 V	L	4 PC		
100-400	Electronic	N	1 PC		
G-1000	Gears, electrical pump	L	1 PC		
M-1000	Motor, electrical pump 250kW	L	1 PC		
WL-1000	Shafting assembly	N	1 PC		

Figure 55: Select Material: SAP-System-Screenshot

7. Thus, the material is transferred to the maintenance order. Since you require only one support base, change the **quantity** to **1**.

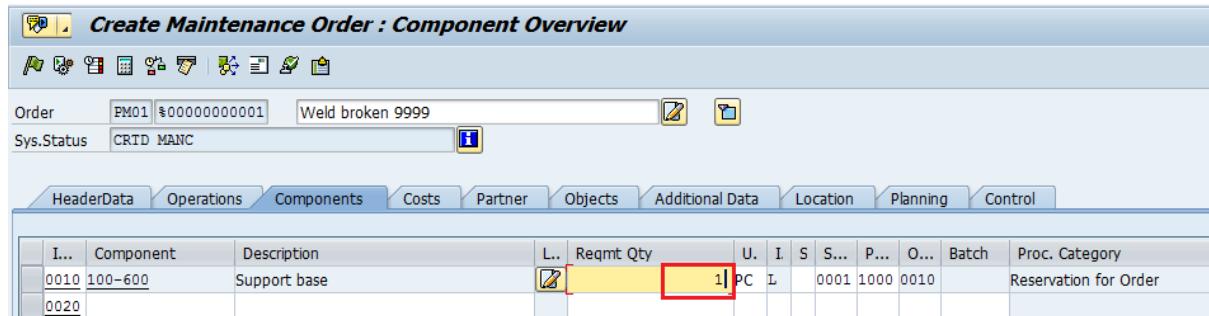


Figure 56: Plan Components: SAP-System-Screenshot

8. Execute an availability check to ensure sufficient stock of the component to cover the required quantity. Therefore, select the line with the component (support base) and choose the **check material availability** (symbol from the bottom of the screen.

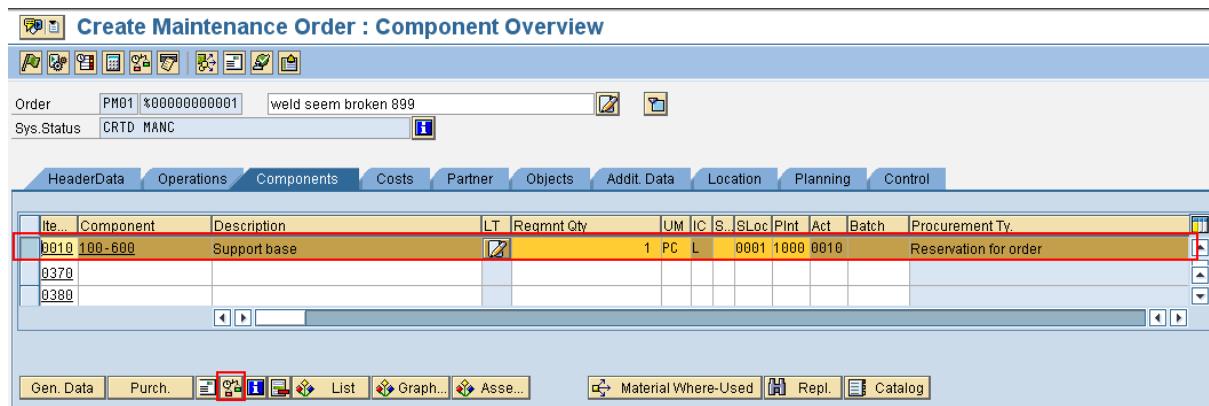


Figure 57: Check Material Availability: SAP-System-Screenshot

9. The system issues a confirmation proposal including the date of material availability. Since the material is in stock, the date should be the present date. Confirm with **Continue**.
10. Save the maintenance order and list the order number.

Maintenance order number: _____

3.2.3 Carry out Plan/Actual Comparison

You want to carry out a plan/actual comparison to receive a detailed cost analysis. Choose

Logistics → Plant Maintenance → Maintenance Processing → Order → Change (IW32)

1. Enter your **maintenance order number** and confirm with **Enter**.
2. Choose **Extras → Cost Reports → Planned/Actual Comparison** from the menu
3. What are the costs for material consumption (cost element 400000 raw materials)?

Costs raw materials: _____

- What are the overhead costs (cost element 655901 overhead costs)?

Overhead costs: _____

3.2.4 Order Release

Now that preparations for the order are completed, you can release the order so that the worker in charge can execute it.

- From the *Planned/actual comparison* return () to the previous step.
- Choose *release order* by clicking the button. The system status changes to *released* (REL).
- Save* the order.
- Now go to the *Stock/ Requirements List (MD04)*. Your released order should have reserved the material required for the maintenance work.

The screenshot shows the SAP Stock/Requirements List (MD04) interface. At the top, there's a toolbar with various icons. Below it, a search bar and filter buttons. The main area has several input fields: Material (100-600), MRP area (1000), Plant (1000), and others like Support base, MRP type (PD), Material Type (ROH), Unit (PC), and a pencil icon. Below these is a table with columns: A, Date, MR..., MRP element data, Resched..., E, Receipt/Reqmt, Available Qty, and S... . Two rows are visible: one for 'Stock' (Date 16.09.2010, Available Qty 6.746) and one for 'OrdRes' (Date 16.09.2010, Available Qty 6.745). The 'OrdRes' row is highlighted with a red border.

Figure 58: Order Reservation: SAP-System-Screenshot

3.2.5 Planned Material Withdrawal

To fulfill the order, the worker needs to withdraw the corresponding material from the warehouse. Carry out a planned material withdrawal. Choose

Logistics → Plant Maintenance → Maintenance Processing → Completion Confirmation → Goods Movements → Goods Movement (MB11)

- Enter the following data:
 - Movement type **261**
 - plant **1000**
 - storage location **0001**
- Choose the **To Order...** button.

3. In the first line of the **order** field, enter your **maintenance order** number.
4. Confirm with *Enter*. The system proposes the correct item (material 100-600).
5. Post the goods issue by **saving** the document.
6. List the material document number

Material document 100-600: _____

3.2.6 Order Confirmation

The worker renewed the weld and, thus, the order is completed. Next, he must enter this into the system by confirming the order. To enter the confirmation, choose the following transaction:

Logistics → Plant Maintenance → Maintenance Processing → Completion Confirmation → Entry → Overall Completion Confirmation (IW42)

1. Choose **extras → settings** from the menu.
2. Enter profile **PM0002**. The entered profile controls the structure of the confirmation screen. Choose *Save*.
3. Enter your **order number** into the order field and press *Enter*.



If you should receive the message "Customizing incorrectly maintained", then you can ignore it.

4. It took the worker 2 hours; correspondingly, you have to debit the order with 2 hours. The working times are entered on the **time confirmation** screen. Moreover, enter that the order is confirmed overall, thus, open reservations (e.g., for materials) are deleted and there is no additional work left:

- Actual work	2
- F (final confirmation)	<i>select</i>
- C (clearing reservations)	<i>select</i>
- No rem. work (no remaining work)	<i>select</i>

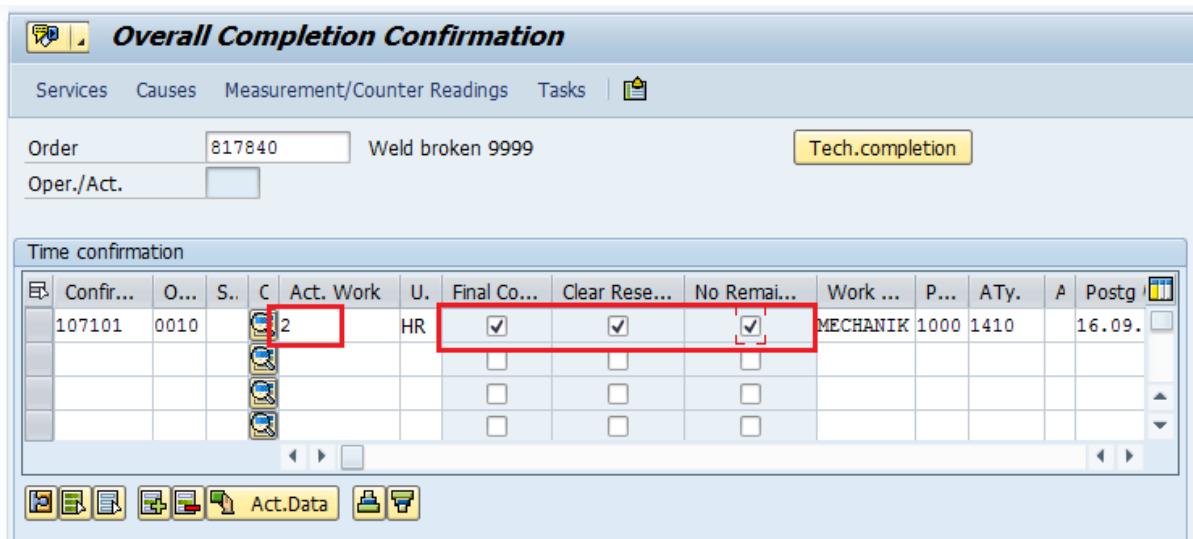


Figure 59: Carry out Confirmation: SAP-System-Screenshot

- Save the confirmation of the order.

3.2.7 Technical Completion and Cost Analysis

The work for the pump is completed. Therefore, you have to complete both the order and the notification technically. With this,

- reservations in the system for the order are cleared (e.g., materials or capacities),
- open purchase requisitions get a deletion flag, since they are no longer required and
- changes to the order are no longer permitted.

If required, this status can be reversed.

Carry out the *technical completion* by calling up the following transaction

Logistics → Plant Maintenance → Maintenance Processing → Order → Change (IW32)

- Enter your **maintenance order number** and confirm with *Enter*.
- Choose **Order → Functions → Complete → Complete (technically)** from the menu.
- Make sure that the **complete notifications** checkmark is set in the **completion** dialog window. By setting this flag, the **maintenance notification** is also completed technically.
- Confirm with *Enter*.

Choose again

Logistics → Plant Maintenance → Maintenance Processing → Order → Change (IW32)

- Enter your **maintenance order number** and confirm with *Enter*.
- The order status changed to TECO (*technically completed*).
- Press to see the document flow.

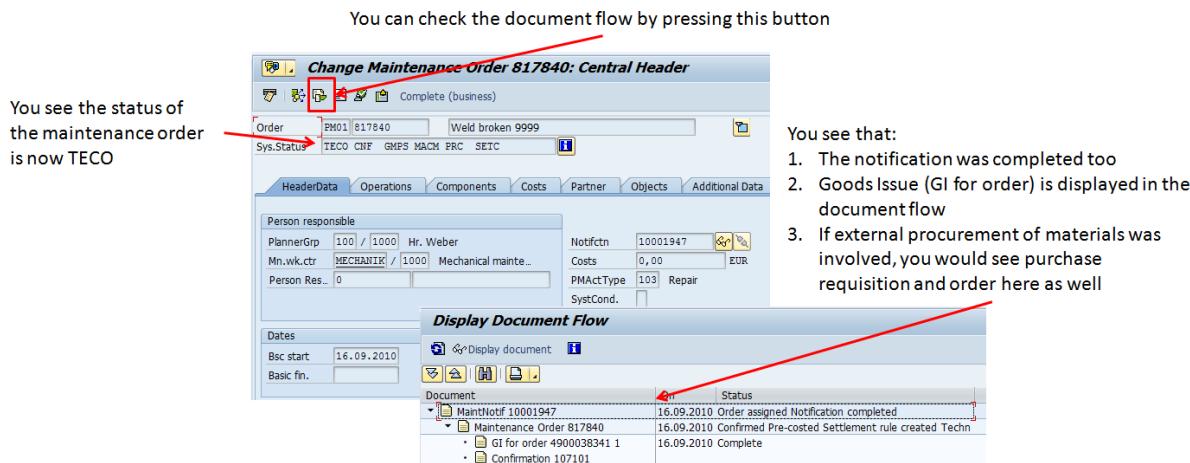


Figure 60: Technical Completion/ Document Flow: SAP-System-Screenshot

8. Go one step back and take a look at the *order costs* by switching to the **costs** tab.
9. For which **value categories did actual costs** incur? List the answers on your data sheet.

Value categories for actual costs: _____

10. Complete the maintenance order from business perspective. Therefore select **Order → Functions → Complete → Complete (business)** from the menu.
11. You should get an error message. Display the **Log**. What does the error message say?

Error message Business Completion: _____

12. Don't leave the transaction.

3.2.8 Settlement and Business Completion

Before the maintenance order can be completed from business point of view, you need to settle the costs of the order and, thus, balance it out.

3.2.8.1 Settlement Rule

Check how the costs of the maintenance order are settled.

1. Select **Goto → Settlement Rule** from the menu.
2. What is the Account Assignment Category of the settlement rule?

Category Settlement: _____

3. Who is the cost receiver?

Cost Receiver: _____

- Leave the transaction and **save** the order.

3.2.8.2 Settle Order Costs

Settle the costs. Therefore, select transaction K.....

You already know how to settle costs of a controlling object in SAP CO. You did that for your production order in teaching unit 4 and for your internal order in teaching unit 9.

Settle the costs **on your own!**

3.2.8.3 Business Completion

After you have settled the costs, the costs (Cost report Planned/Actual) should have a balance of 0 in the column Total actual costs.

Now, you can accomplish the business completion.

- Accomplish the business completion **on your own!**
- After Business Completion is accomplished, the status should be **Closed (CLSD)**.

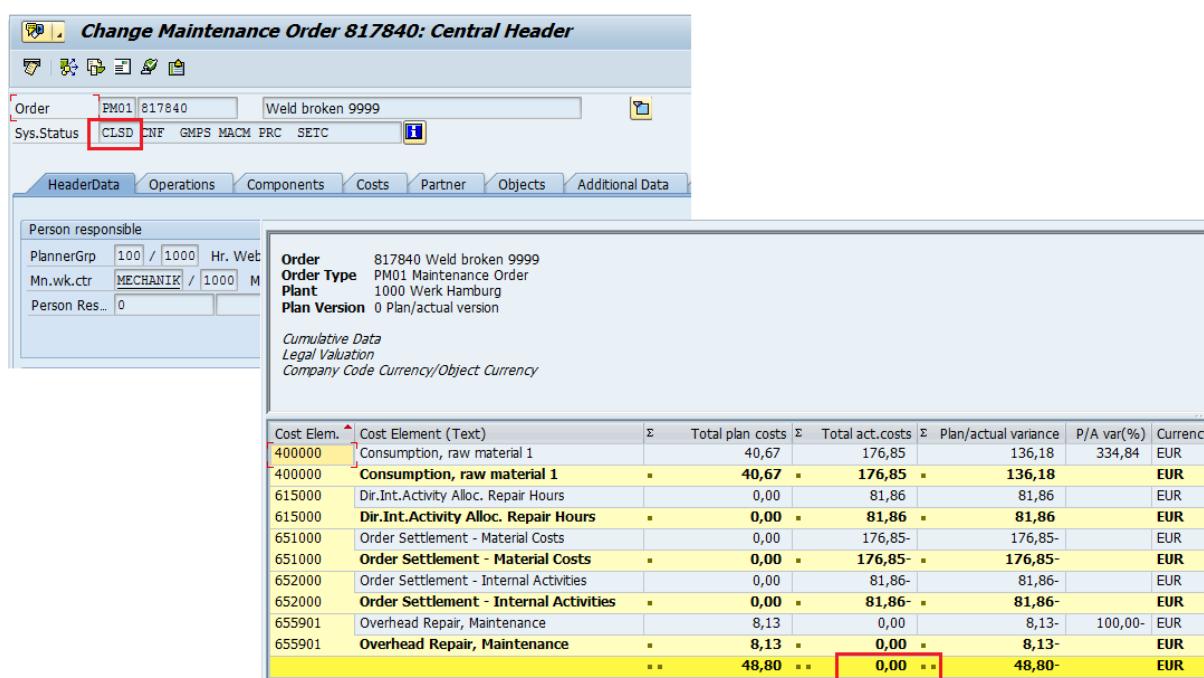


Figure 61: Business Completion: SAP-System-Screenshot

3.2.9 Reporting and Analysis

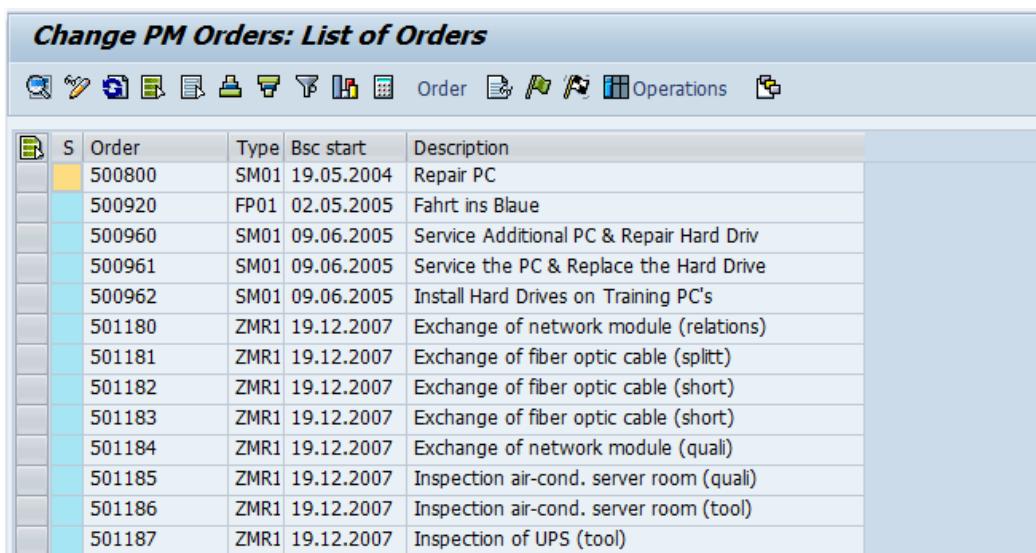
You want to execute a standard report including all maintenance orders of the past years.

3.2.9.1 Execute Standard Report

To call up the standard report, choose

Logistics → Plant Maintenance → Maintenance Processing → History → List of Orders → Change (IW38)

1. Select the order status **open, in process, completed** and **historical**. Thus, all orders in the system are displayed.
2. Enter the period from **01.01.2004** until **today**.
3. Choose **Execute**.
4. You receive a list containing all maintenance orders of the past years that are similar to the one below.



The screenshot shows a SAP application window titled "Change PM Orders: List of Orders". The interface includes a toolbar with various icons and a menu bar with "Order" and "Operations" options. Below the toolbar is a table with the following data:

S	Order	Type	Bsc start	Description
	500800	SM01	19.05.2004	Repair PC
	500920	FP01	02.05.2005	Fahrt ins Blaue
	500960	SM01	09.06.2005	Service Additional PC & Repair Hard Driv
	500961	SM01	09.06.2005	Service the PC & Replace the Hard Drive
	500962	SM01	09.06.2005	Install Hard Drives on Training PC's
	501180	ZMR1	19.12.2007	Exchange of network module (relations)
	501181	ZMR1	19.12.2007	Exchange of fiber optic cable (splitt)
	501182	ZMR1	19.12.2007	Exchange of fiber optic cable (short)
	501183	ZMR1	19.12.2007	Exchange of fiber optic cable (short)
	501184	ZMR1	19.12.2007	Exchange of network module (quali)
	501185	ZMR1	19.12.2007	Inspection air-cond. server room (quali)
	501186	ZMR1	19.12.2007	Inspection air-cond. server room (tool)
	501187	ZMR1	19.12.2007	Inspection of UPS (tool)

Figure 62: Maintenance Order List: SAP-System-Screenshot

5. You want to display **planned** and **actual costs** in the report and sort the orders descendingly according to their order numbers. Therefore, choose the **current** () button.
6. On the right hand side, choose **total costs planned** and **total costs actual** (hold down the shift key when you want to select both). Choose **show selected fields** () and then **Enter** (green tick).

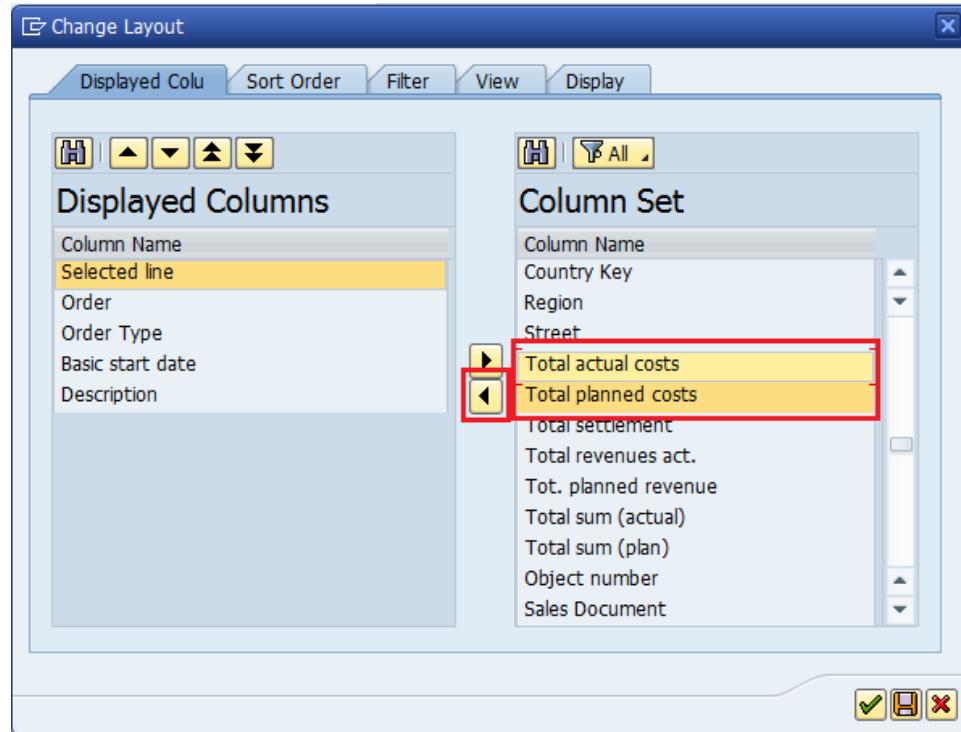


Figure 63: Column Selection: SAP-System-Screenshot

7. To **sort** the orders **in descending order**, select the order column and then the **sort descending** symbol.
8. You want to display the order details for the maintenance order that you created, but you are not sure about the order number. To identify your order, you can add the field **entered by** to your report. Choose again and add the **entered by** column to your report. Confirm the modification.

Change PM Orders: List of Orders							
	S	Order	Type	Bsc start	Description	Total actual costs	Total planned costs
		900006	PM01	20.12.1994	Pumpe vibriert beim Lauf	913,15	1.148,49
		817840	PM01	16.09.2010	Weld broken 9999	328,56	61,98
		817822	PM03	11.05.2009	3) Wartungsmaßnahmen am Pumpenmotor	0,00	195,60
		817821	PM03	11.05.2009	2) Wartungsmaßnahme am Pumpengetriebe	0,00	164,47
		817820	PM03	11.05.2009	1) Wartungsmassnahmen an Pumpe Etanorm	237,79	234,67
		817800	PM03	09.05.2009	Regelmäßige Inspektion der Kläranlage	747,66	767,60
		817780	PM03	29.04.2009	Vierteljähriges Inspektion Feuerlöescher	299,06	285,93
		817761	PM03	24.04.2009	Druckprüfung der Gasanlage	8.233,60	9.880,39
		817760	PM01	20.04.2009	PM Order - Push to MRS	0,00	0,00

Figure 64: Sort List with Additional Columns: SAP-System-Screenshot

9. Use the drill-down function to display the details concerning your order. Therefore, select the order with a double-click.

Can you change your maintenance order? Why not?

10. Leave your order and close the report.

3.2.9.2 Execute Location Analysis

Finally, you want to carry out a location analysis for **maintenance plant 1000** for the past few years. Choose

Logistics → Plant Maintenance → Information System → Standard Analyses → Location (MCI3)

1. Enter maintenance plant **1000**.
2. Enter the month from **01.2004** until **the current period of the current fiscal year**.
3. Choose **Execute**. You receive the basic list of the location analysis similar to the picture below.

The screenshot shows a SAP application window titled "Location Analysis: Basic List". At the top, there are several icons and buttons, including a magnifying glass, a search bar, and a "Switch drilldown..." button. Below the title, it says "No. of Maintenance plant: 1". The main area is a table with the following data:

Maintenance plant	NotifCreat	BrkdnReptd	OrdsCrted	TotalPlnndCosts	Total act. costs	Int. wage costs	Ext. wage costs	Int. mat. costs
Total	617	19	922	15589133,23 ***	284.836,48 ***	137.471,27 ***	138.864,99 ***	8.500,22 ***
Werk Hamburg	617	19	922	15589133,23 ***	284.836,48 ***	137.471,27 ***	138.864,99 ***	8.500,22 ***

Figure 65: Basic List Location Analysis: SAP-System-Screenshot

4. You want to know for which piece of equipment the **second highest actual costs** incurred. Choose the **Switch drilldown...** button.
5. Select **Equipment** and confirm with **Enter**.
6. Select the **total actual costs** column and sort the column in **descending order**. To add the number and the name of the equipment, choose **Settings → Characteristic Display → Key and Description**.
7. To increase the column width, choose **Settings → Column Width → Characteristic**. Enter **width 40**.

For which equipment at location 1000 incurred the second highest total costs?

-
8. Leave the report **without** saving.

3.3 Elucidation



What have we learned so far?

You have learned how a standard maintenance process in SAP ERP looks like, what elements are involved in it and how master data records and technical objects are used in a maintenance process.

3.3.1 Maintenance Process

The corrective maintenance process contains the following steps:

- **Step 1 - Notification**
 - o Malfunction or exceptional situation is entered in a notification.
 - o Description of the exceptional technical condition at an object is entered.
 - o Request the maintenance department to perform a necessary task.
 - o You document work that has been performed.
 - o You can use notification for preliminary planning and execution of tasks.
- **Step 2 - Planning:**
 - o You create maintenance orders with or without reference to a notification.
 - o Requirements listed in the notification are transferred to the order.
 - o An order contains the tasks to be executed and the required materials and tools.
- **Step 3 - Control:**
 - o The maintenance order is checked regarding availability of materials, capacity of work centers, etc.
 - o Order is put in process (released).
 - o The shop papers are printed in the same step.
- **Step 4 - Execution:**
 - o The individual operations of the maintenance order are carried out.
 - o The materials required for order execution are withdrawn from the warehouse with reference to the order.
 - o Unplanned withdrawals are also possible.
- **Step 5 - Completion:**
 - o Time confirmation
 - o Technical confirmation
 - o Technical completion
 - o Order settling by SAP CO

All phases can be controlled and partly automated by **SAP Business Workflow**.

3.3.2 Step 1: Maintenance Notification

You use notifications in maintenance processing in the event of a malfunction or exceptional situation to:

- describe the exceptional technical condition at an object
- request the maintenance department to perform a necessary task
- document work that has been performed

When you enter a notification for a maintenance object, the system automatically copies all the relevant object data (for example, installation location cost center). You can use maintenance notifications as the basis for creating maintenance orders, in order to:

- plan tasks in detail
- track work progress
- enter and settle costs for the maintenance tasks

When planning concrete tasks in a maintenance order, you can make reference to several maintenance notifications. If one or more notifications already exist for a maintenance order, you can also enter the technical data for the assigned object retrospectively for these notifications.

During processing or upon completion of a maintenance order, you can also create maintenance notifications as completion confirmations in the form of activity reports. Follow-up tasks can result from maintenance notifications such as printing a certain paper, triggering a SAP function or initiating a workflow. When a maintenance notification is technically completed, its data is entered in the maintenance history.

You can enter notifications for the following reference objects:

- Functional location
- Equipment
- Material and serial number

If functional locations or equipment are further sub-divided into assemblies and materials (with the help of a maintenance BOM), these assemblies can also serve as reference objects for the notification. If you use object hierarchies, the system copies all data from the higher-level technical object to the respective reference object for the notification.

However, you can also create maintenance notifications **without** entering an object number. This is the case, for example, when a problem notification refers to an object that is not managed under a number in the system or when a maintenance request refers to an object that is to be set up within the framework of an investment.

The data of the maintenance notification is transferred to the history and is of great importance when performing evaluations and future planning.

A notification consists of the following elements:

- **Header data:**
 - o apply to the entire notification
 - o general data: date, time, responsible person, description
 - o tasks, activities
- **Item data:**
 - o describe an issue, a malfunction or a performed activity in greater detail
 - o A notification can contain several items.
- **Activities:** Work that is performed within the framework of a notification. In contrast to the task, the activity describes what has already been performed within the frame-

work of solving the problem. You can enter the following data for each individual activity:

- key for the activity that was performed and a short text that can be changed individually
- start and end of the activity
- quantity factor for the activity

An activity can relate both to the header of a notification as well as to the individual items.

- **Task data:** Work that is planned within the framework of a notification. In contrast to an activity, the planning and organizational aspects of a notification are the most important. Using tasks, you can plan the way in which various persons work together to process the notification and perform the activities within a specified period of time. You can enter the following data for each task:

- key for the task to be performed and a brief instruction of how the work is to be performed
- planned start and end of the task
- task status
- A task can relate both to the notification header as well as to the individual items. They can have different statuses.

3.3.3 Step 2: Planning

Orders form an important part of the detailed planning of tasks and their accompanying documentation in Plant Maintenance.

3.3.3.1 Creation of Maintenance Orders

There are five cases when creating maintenance orders:

- The maintenance order is created directly without reference to a notification.
- Maintenance order is created based on an existing maintenance notification.
- Multiple maintenance notifications are combined in one maintenance order.
- An activity report for an existing maintenance order is entered subsequently as a technical confirmation.
- In planned maintenance, when you are using maintenance plans, orders are automatically generated at regular intervals from scheduled maintenance plans.

3.3.3.2 Elements of the Maintenance Orders

A maintenance order is used for detailed planning assistance for maintenance tasks to be performed. An order consists of:

- **Order header**
 - information valid for the entire maintenance order
 - general data: number, the description and the type of the order, the scheduled dates for processing the order, the priority of the individual tasks, the creator of the order, the last person modifying the order, etc.

- **Object list**
 - o List of objects (equipment, functional locations, notifications, materials with serial number), which have been assigned to a notification, order or a maintenance item.
 - o used when same operation is to be carried out for multiple objects
- **Operation**
 - o You use operations to describe the individual maintenance tasks to be performed.
 - o The operation includes the time, the work center and other controlling information for an individual maintenance task. In the operation text, you can describe how the work should be done.
 - o **Material list**
 - You can assign any number of material components to an operation.
 - A component can be a spare part or repairable spare or describe an activity.
 - The material that you schedule for an order is reserved for the order in the warehouse.
 - As soon as the order is released, the materials can be withdrawn from the warehouse and delivered to the customer.
 - o **Production resources/tools**
 - The utilities, which you need to execute an operation, are saved in the system as production resources/tools (PRTs).
 - Examples of production resources and tools include: tools for repairing an object, measurement and calibration devices, NC programs, drawings
 - You can represent PRTs by using one of the following: Material master record, Document master record, Master record for other PRTs, Equipment master record.
- **Settlement rule**
 - o defines what proportion of the costs on the sender (order or notification) should be settled to which receiver(s) (e.g., cost center, customer, technical object). For this, one or more distribution rules are assigned to each settlement sender.
 - o Settlement rules are either derived from the settings of the order type or you enter them manually.
 - o Cost receivers are derived either from the involved technical objects master data (e.g., assigned cost center) or you can enter them manually
- **Costs**
 - o Value of use of materials, work hours and so on, which are required to execute maintenance tasks.
 - o Costs are distinguished according to estimated, planned and actual costs.
 - You can enter estimated costs manually for an entire order.
 - Planned costs are calculated automatically by the system during order planning.

- Actual costs for goods issues and goods receipts are calculated automatically by the system whilst the order is being executed. The actual costs for the work performed can only be calculated once the work has been confirmed.
 - You can display the costs entered or incurred in an overview.

3.3.3.3 Maintenance Order: Object List

The object list is a central part of the order. You use it to assign technical objects, notifications or objects, which are identified by a combination of material and serial numbers, to the order.

When you make entries in the object list for an order, you are linking it to the objects you enter.

Even if no reference object has been entered for the order on the header data screen, you can still assign technical objects, notifications or objects, which are identified by a combination of material and serial numbers, to the order in the object list.

Two features are available for the object list:

- an object list in which you can enter technical objects (equipment, functional locations, assemblies) and notifications
- an object list in which you can enter objects, which are identified by a combination of material and serial numbers and notifications

Which of these two versions is used in the order depends on:

- the choice of reference object in the notification/order
- the view setting for the reference object frame in the notification/order

If you create the order with reference to a notification, for which a reference object has been entered, the system copies the reference object from the notification as the reference object for the order. The system writes the notification number in the order header and in the object list for the order.

You can group together several notifications that can be processed together by using a "work-list for notifications" for a maintenance or service order. In this case, the notifications are also included in the object list of the order.

Operations in an order that have not been assigned to an object in the object list can be assigned or existing assignments can be changed.

3.3.3.4 Material Planning

Stock Material: Process Flow

Note that only the first step "Order Creation (Material Planning)" (or if manually executed the second step, too) is part of the Planning step of the maintenance order process. The subsequent steps are carried out in later process steps.

- **Order Creation (Material Planning):**

- You plan materials required for performing a task for each operation.

- Materials can be BOM components of the reference objects (technical object) or they can be freely assigned.
- An order can reserve materials automatically upon order release.
- **Availability Check:**
 - The availability check for the assigned materials can be carried out manually.
 - At the time of order release, an automatic availability check is executed.
 - An order can also be released if availability is not given.
- **Order Release (Material reservation):**
 - If the planned materials for the maintenance order are in stock, a reservation in the warehouse is carried out.
 - Depending on customizing settings, an order type can execute material reservation immediately (upon creation/ material assignment) or at the time of order release.
- **Goods Issue (Material Withdrawal from Stock):**
 - In combination with the order papers, the material provision list as well as the material withdrawal documents can be printed.
 - Planned goods issues are entered with reference to the reservation (reservation number).
 - Unplanned goods issues are entered with reference to the order number.
 - Entered goods issues appear in the document flow of the order.
- **Technical Completion**

Non-Stock Material: Process Flow

Note that only the first step "Planning materials" (or if manually executed the second step, too) is part of the Planning step. The subsequent steps are carried out in later process steps.

- **Order Creation (Material Planning):**
 - You plan materials required for performing a task for each operation.
 - Materials can be BOM components of the reference objects (technical object) or they can be freely assigned.
 - The maintenance order can automatically create purchase requisitions in SAP MM upon order release.
 - **Availability check:**
 - The availability check for the assigned materials can be carried out manually.
 - At the time of order release, an automatic availability check is executed.
 - An order can also be released if availability is not given.
- **Purchase Order:**
 - If the planned materials for the maintenance order are **not** in stock, a purchase requisition is created.
 - Depending on the order type and the corresponding settings in customizing for this order type, purchase requisitions are created when either saving or releasing the order.
 - Based on the purchase requisition, a purchase order is sent to a vendor. The order items are assigned to the maintenance order.

- When the order is released, incoming deliveries of the material (goods receipts) will be entered with reference to the purchase order.
- Since the purchase order is created with reference to the maintenance order (account assignment) the goods receipt will be posted to the order.
- **Goods Receipt:**
 - Upon delivery, the goods receipt is posted directly to the order for which the material was requested, that is, the order is immediately debited with the corresponding costs upon goods receipt.
 - The goods receipts entered appear in the document flow of the order.
- **Technical Completion**
- **Invoice:**
 - When the invoice is received, any changes to costs incurred are settled to the order.

Material Planning Through Internet Catalog

If an **Internet catalog** is implemented in SAP MM, you can access it directly from the purchase order document to enter the materials to be procured.

You also can access the Internet catalog directly from the material assignment tab in the maintenance order. Thereby, you can also select the material to be procured from the BOM assigned to the maintenance order and then navigate directly to the internet catalog, where you can select the material.

Accessing external Web catalogs from an order's components screen, you must set up the **OCI interface** (Open Catalog Interface). This can be set up for the order type and planning plant in Customizing.

If the component **SAP Enterprise Buyer** is implemented in SAP ERP, catalog access and in some cases also the entire purchasing procedure can be processed by using Enterprise Buyer.

3.3.4 Step 3: Control

- Order release
- Automatic availability and capacity checks (depending on order type settings in customizing)
- Print of shop papers

Order Release

When you have finished planning with all the necessary specifications, you can release the order. Only then can the employees on site start the activities described. You also have the option of releasing orders immediately when they are created. This option is available for orders created automatically by the system, that is, for orders which are created based on a notification or created automatically from a maintenance plan.

Upon maintenance order release:

- The system checks the availability of materials, production resources/tool and required permits.
- At the time of release (at the latest), the material reservations become relevant to material planning.
- Materials can be withdrawn and purchase requisitions can be created.

The following actions can **only** be carried out when the order was released:

- print shop papers
- withdraw material
- post goods receipts
- enter time confirmations
- complete tasks

3.3.5 Step 4: Execution

You use the function for processing an order after you have completed the control phase. Once the order has been executed fully, you can complete it.

This process step generally contains only the material withdrawal for maintaining or repairing a technical object, since the withdrawal takes place during the time between order release and order completion.

Of course, in this step, all the works (operations/activities) are executed by the employees. However, from the point of view of the ERP system, all activities performed become relevant when they are completed and, thus, entered in the system. Operation/Order completions are carried out in Step 5.

Material Withdrawal

This process was described in detail previously. There are two types of material withdrawals:

- planned withdrawal of stock material
- unplanned withdrawal of stock material

The goods movements for a maintenance order are displayed in the document flow of the order.

Using the material where-used list (transaction IW13), you can check which material withdrawals were planned and unplanned.

3.3.6 Step 5: Completion

- Time confirmation
- Technical confirmation
- Technical completion
- Order settling by the CO department

3.3.6.1 Order Confirmation: Times/Activities

Time Confirmation

You can confirm the following time data:

- who processed the operation/sub-operation
- how long the work took and the period in which it occurred
- what activity was performed
- how much longer work must continue
- when is the operation expected to be completed
- whether the work for this operation/sub-operation is completed
- whether the reservations still outstanding should be cleared
- a free text

Four different options for time confirmation:

- individual entry of times for each order operation
- collective entry by using direct entry or an operation list
- overall completion confirmation: times, activities, measurement values, etc. are entered on a collective screen
- entry by using the cross-application time sheet (CATS)

Technical Confirmation

Technical data is very important for the customer service and maintenance of technical objects. This is particularly the case if evaluations are to be created concerning customer service or maintenance. Technical data can provide information about:

- cause of damage
- exact damage location on the object
- work/activities performed and findings
- machine breakdowns
- system availability during and after the task

You can confirm technical data for different parts of the order. Depending on the type of entry, you can:

- enter Notification Data Valid for the Whole Order
- enter Notification Data Valid for the Operation
- enter Notification Data for an Object in the Object List
- assign Notifications to the Order and Confirming Data

The data from the notification is entered into the notification history when you close the notification. It is part of the history and contains data for each technical object on damage, malfunctions, causes, findings and the tasks performed.

Status of operations/sub-operations/order:

- Confirmed operations/sub-operations are assigned with the PCNF (partially confirmed) status.
- Depending on customizing settings, final completion confirmation can be proposed automatically.
- Once all operations/sub-operations of a maintenance order are confirmed, the order itself receives the status CNF (finally confirmed).

Further action:

- You can **reverse** confirmations.
- When you create an **activity report**, you have already performed an activity. You want to document this activity using an activity report. An activity report describes maintenance or service activity already performed, or one that was not the result of a malfunction or damage. It simply provides technical documentation of which activities were performed when and with what results. Activity reports are, therefore, used for the technical confirmation of maintenance or service activities. A typical activity report, for example, is the inspection findings, since it describes the results of an inspection to test the actual condition of the object. In most cases, the inspection task is based upon an inspection order. Typical examples of the activities documented in activity reports are "Fill up oil", "Check pressure" or "Tighten screws".
- Measurement values are entered as measurement notifications for the reference object.

Overall Completion Confirmation

Overall completion confirmation provides a single screen for

- confirming working times
- confirming materials
- confirming measurement documents
- confirming activities, tasks and services

3.3.6.2 Maintenance Order: Technical Completion

You usually complete an order technically once the maintenance work planned in the order has been performed. You use the technical completion of an order to define the following information for the order:

- The order obtains the status Technically completed (TECO). The order is marked as complete for Plant Maintenance.
- Now you can only make the following changes:
 - o lock and unlock the order
 - o set the deletion flag
 - o Goods movements that are still outstanding and confirmations and invoice receipts can be entered.
 - o You can still change the settlement rule.
- You can still enter confirmations for a technically completed order. In order to prevent this, you must create a user status that does not permit confirmations.
- The storage location and account assignment data entered for the order are fixed and can no longer be changed. However, the order can still receive costs, for example, through incoming invoices for materials delivered and used.
- If no settlement rule has yet been maintained for the order, the system creates one automatically. If missing data makes this impossible, the system takes you to the screen for maintaining the settlement rule.
- All the existing purchase requisitions for the order are flagged for deletion.
- All the existing reservations for the order are cleared.

- All outstanding capacities which have been scheduled for the order are cleared.
- All the notifications for the order are also completed, unless prevented for one of the following reasons:
 - o The Complete notifications indicator was not set in the *Complete* dialog box.
 - o One or more tasks have not been completed.
 - o A user status in the notification prevents it from being completed.

You have two options to carry out the technical completion of a maintenance order:

- complete the maintenance order and notification separately
- complete the maintenance order together with assigned notifications

For completing the maintenance order and the original notifications together, there must not be any outstanding tasks of the notifications assigned to the order. In case any outstanding tasks (status **OSTS**) in a notification exist, the notification cannot be completed. First of all, the tasks must be marked as finished. The order belonging to the notification can, however, be completed as the outstanding tasks must not necessarily belong to the order performed (in certain circumstances, a new order may be required for this).

3.3.6.3 Reverse Technical Completion

- The status TECO (technically completed) can be reversed.
- After that, the order receives the status that it had prior to TECO:
 - o order becomes modifiable again
 - o status REL (Released) is set
 - o location and account assignment data are re-copied from the object
 - o open purchase requisitions are recompiled
 - o open reservations are recompiled
 - o open capacities are recompiled

3.3.6.4 Maintenance Notification – Completion

You can also complete a maintenance notification separately from the maintenance order. Before a maintenance notification can be completed, the following must be checked:

- All data, which refers to the reference object for the maintenance notification, is available and correct.
- All the relevant item data is available and correct.
- All the relevant task data is available and correct.
- All tasks have been completed or released; there are no more outstanding tasks.
- All technical data related to the breakdown and availability of the technical system is available and correct.

When you complete a maintenance notification, the following occurs:

- Reference date and -time determine what periods are assigned to the notification in the Plant Maintenance Information System (PMIS).
- The maintenance notification is locked for changes, which means that you can no

longer change notification data.

- The notification is assigned the status NOCO (Notification completed).

3.3.7 Integration

3.3.7.1 Corrective Maintenance and Management Accounting

As with every component of SAP ERP, SAP PM is also highly integrated with SAP CO.

When processing a maintenance order, various costs are generated. Costs of a maintenance order might be material costs, personnel costs (work hours), overhead costs from involved cost centers, etc. The cost accumulation on the maintenance order is just the same like for any other order in SAP ERP (compare with production order or internal order). Thereby, the maintenance order serves as cost collector and accumulates all the costs incurred during order processing when they occur. These costs must be settled before the order can be closed.

Cost Analysis in the Maintenance Order

You can run a cost analysis based on the costs calculated (automatically) in the maintenance order.

The expected costs of a maintenance order can be displayed in two different ways:

- at cost element level (controlling view)
- at value category level (maintenance view)

In customizing, the cost elements are assigned to the value categories.

3.3.7.2 Document Flow

All document types created during processing the maintenance order can be displayed in the document flow. This includes:

- Notification
- Confirmation
- Goods movement
- Purchase requisition
- Purchase order

3.3.7.3 Action Log

- **Notification:** Changes to notifications are documented in the action log. You can use the action log to track:
 - o which data or statuses were changed for selected fields
 - o who made the changes
 - o when the changes were made

The action log also records the changes that were made to tasks, items, activities and partners during notification processing.

- **Maintenance Order:** You use the action log function if you want to obtain an overview of all the changes that were made to fields during the processing of an order. The action log shows you:
 - o when changes were made (date and time)
 - o who made the changes
 - o the sub-object to which changes were made
 - o which fields were changed
 - o which data the fields contained *before* the change
 - o which data the fields contain *after* the change
- Changes made to **pieces of equipment** and **functional locations** are recorded in the action log. This enables you to trace who has made status or data changes to which fields at what time. In contrast to the administrative information, the action log does not only display the last change but *all* changes.

3.3.7.4 Integration of SAP PM with other Components

Through integration with other SAP ERP applications, the data in SAP PM and SAP CS is always kept current and processes that are necessary for plant maintenance and customer service are automatically triggered in other areas.

Examples of integration points:

- **Materials Management:** Purchase requisitions/purchase order creation for non-stock materials
- **Sales and Distribution:** Service and sales order creation for customer service
- **Personnel Management:** Employee work hours
- **Controlling:** Cost accounting and cost settlement

3.3.8 History: Reporting and Analysis

Maintenance History

Data concerning past problems and malfunctions arising at a technical object, and maintenance activities that were performed on a technical object, can be very important for future maintenance activities. For this reason, it is important that this information is stored on a long- and medium-term basis and can be called up at any time. You can find this historical data in the maintenance history in the PM application component.

There are three different types of historical data regarding maintenance history that can be analyzed:

Completed Notifications:

- The notification history documents complete maintenance notifications. As soon as you have completed maintenance notification, the systems transfers it into the notification history together with important object-related data. This data contains:
 - o Notification number
 - o Notification header text
 - o Reference object

- Item data
- Task data
- Activity data
- Object list
- These findings enable you to answer questions such as:
 - At which functional locations or pieces of equipment was a particular problem or type of damage established in recent years?
 - What were the causes of a particular type of damage?
 - How long were the downtimes for particular problems?
 - What activities were performed to rectify the problem?

Completed Orders and Historical Orders:

- Certain data from completed and historical maintenance orders is particularly important for a meaningful analysis of the performance of past maintenance activities and for effective and well-founded planning of future maintenance activities. This data is stored in two places in the PM application component:
 - completed maintenance orders in the order database
 - historical maintenance orders in summarized form in the order history
- **Completed orders** are important for medium-term evaluations, since they contain all the order data.
- **Historical orders** contain a summarized dataset and are important for long-term evaluations.
- The order history documents **historical maintenance orders**. You can only archive the maintenance orders that have already been completed. The order history stores a condensed dataset from the completed orders. This dataset comprises the following information:
 - Order header data
 - Object list
 - Location and account assignment data
 - Task list data
 - Operations and sub-operations
 - Planned and unplanned material components, condensed to material number
 - Costs, condensed to value categories
 - The following are not stored in the order history: status, settlement rule, relationships, production resources/tools, planned and unplanned material with material number 0.
- This data enables you to answer questions such as:
 - What resources were used to perform a particular maintenance task?
 - What costs were incurred by a particular type of maintenance task?
 - How much time was needed to perform a particular type of maintenance task?
 - How often were particular pieces of equipment or functional locations processed by maintenance tasks?

Material Usage

Material where-used list allows you to

- check the material usage concerning maintenance orders within a particular period
- check which materials were planned withdrawals and which withdrawals were unplanned

Options for the Standard Analysis

- Plant Maintenance Information System (PM-IS) is part of the Logistics Information System (LIS). Thus, it also provides Standard analyses and Flexible analyzes.
- Standard analyses contain multiple functions for analyzing maintenance data:
 - o ABC analysis
 - o Classification
 - o Planned/actual comparisons
 - o Correlation
 - o ...
- Information structures provide the main data for standard analyses (data range, key figures, characteristic). In the standard system, the following information structures are available in the Plant Maintenance Information System, each providing the data basis for the respective standard analysis of the same name:
 - o S061 Location- and Planning Group Analysis
 - o S062 Object Class- and Manufacturer Analysis
 - o S063 Single Object-Damage Analysis
 - o S065 Object Statistics
 - o S070 Breakdown Analysis
 - o S114 Vehicle consumption analysis
 - o S115 Cost Analysis
 - o S116 Sales Notification Analysis
- drill-down function for reports available (you can display details in the report by double-clicking on a report row)
- Data selected for the standard analysis can be saved as selection version.
- You can branch to the master data or movement data of an analyzed object.
- In addition to the PMIS analyses, from the Controlling perspective, you also have the various CO reports for evaluating maintenance orders. Since maintenance orders are part of overhead controlling, they can be used directly in Controlling without any other pre-settings.

4 Service Order Process

The following section delivers insight into the service order processing in SAP CS.

4.1 Theory: Service Order Process in SAP CS



This component supports a company when representing, managing and processing all services that are provided to its customers. There are parallels between service order processing and the maintenance process as well as close integration to SAP PM.

4.1.1 Service Order Processing

The service process visualized in the following figure shows the maximum scope of operations in service order processing. It is possible to skip particular steps or to carry out particular steps simultaneously. Moreover, steps like billing, settlement and conclusion can be processed by the system automatically. These steps can also be executed in a collective run. Like the maintenance process, you can assign the single process elements into several steps:

Step 1 - Creation:

A customer might complain about a defect at some product he purchased from your company, he could request for a product return or exchange or he could ask for a service technician to be sent out to the customer's site, etc. Usually, an employee enters a **service notification** after a customer call. In this notification the assignment to the damaged object is established. This object could be a product you sold to the customer or a technical object installed at the customer's site.

If a technician is required for processing the service request, the responsible employee creates a **service order** based on the notification. Data from the notification are copied to the order. Notification and order are assigned to each other and can be processed together.

Step 2 - Planning:

Each order must contain at least one **operation**. The data of the first operation can therefore be maintained on the order header screen and are proposed from the order header data. You use operations to describe the individual service tasks to be performed. The operation includes the time, the work center, and other controlling information for an individual service task. In the operation text you can describe how the work should be done.

Furthermore, you plan **materials**, **employees** and **cost settling**. After you have planned an order with all its operations and components, you can use the **scheduling** function to determine the following data:

- the actual execution dates based on the dates specified in the order and the time specifications in the operations
- the capacity requirement needed to execute the order based on the data in the operations
- the date at which a particular material should be available

Step 3 - Control:

You use the functions for controlling an order after you have completed the planning phase and before you begin the execution phase. This phase is also described as "detailed planning". It concludes the following functions

- Material availability check
- Capacity leveling
- Scheduling using the planning board
- Order release
- Printing and faxing of shop papers

Step 4 - Execution:

You use this step for processing an order after you have completed the control phase. Once the order has been fully executed, you can complete it. Here, you basically post the usage of stock and non-stock materials. Thus, purchasing of materials and probably external services are part of this step.

Step 5 - Completion:

When the technician completes the service order, the number of working hours and the used materials are **confirmed** by the technician. He can add activities, damages and causes to the notification and complete the order technically. Simultaneously, he completes the notification. The employee in order settlement creates a **billing request** from the service order. This is the basis for creating a **billing document**. After order costs have been settled by the controlling department to the true cost originator(s), the service order can be completed.

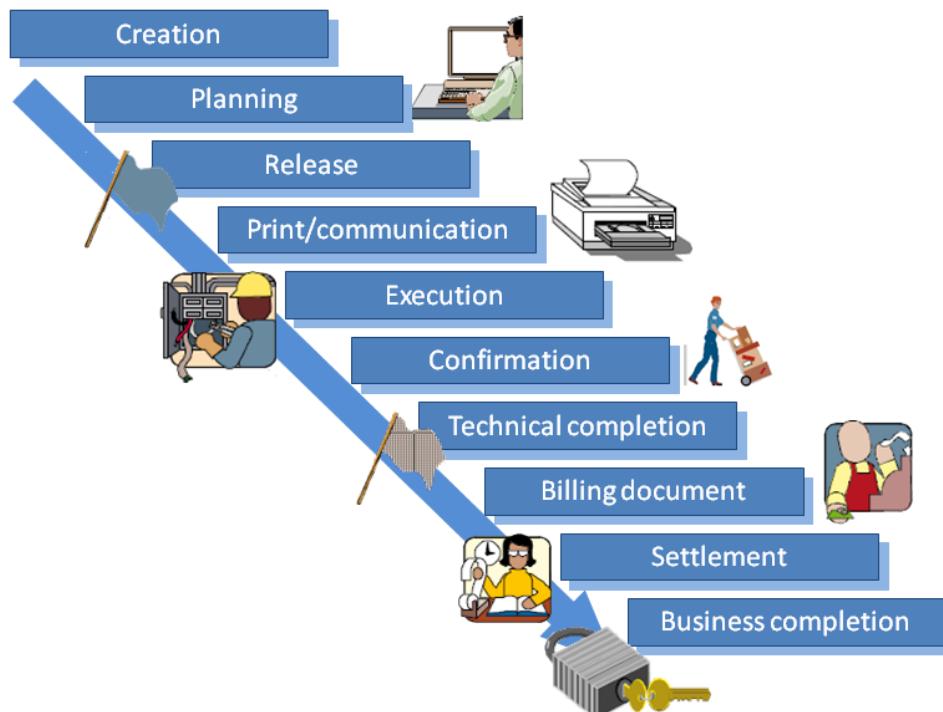


Figure 66: Process Flow in Service Order Processing

Since the process is pretty similar to the maintenance process, in the following, only some aspects will be discussed.

4.1.2 Step 1: Creation

The service order is the central object in service order processing. The options for creating a service order and the structure of the service order are pretty comparable to the maintenance order.

4.1.2.1 Order Creation Options

Service order can also be created **directly** without a service notification. Therefore, you need to enter at least the *order type* and the *planning plant*. Other methods of creating service orders are:

- creating a service order from a service notification
- generating for an existing notification
- merging several notifications in one order
- creating from a sales order item
- creating order automatically from a maintenance item

When creating or changing a **service notification**, a service order can be created from the notification. Notification and order are then assigned to each other.

Notification and order are also assigned to one another when you create an order by using the *create for notification* function. When several notifications are combined to one order, they are listed in the order object list.

You can automatically create a service order from a **sales order item** to plan, execute and confirm services sold within the framework of this sales order. This option is also available for returns and repairs. However, in that case, the service order is controlled via the requirements type and the requirements class of the sales order item. The material entered in the sales order item must also have an entry in the *service products* table.

In **maintenance planning**, you can also create service orders from maintenance items in regular intervals.



- Direct entry
- Generate a service order from a service notification
- Create for an existing notification
- Combine several notifications in one order
- Generate from a sales order item
- Automatically generate the order from a maintenance item

Figure 67: Order Creation Options

4.1.2.2 Service Order Structure

A service order is structured as follows:

- **Order header** with description (short and long text), status information, customer and address data, service data (e.g., service product), responsibilities, dates and reference object. Header data include cost and revenue data, partner data and the object list as well.
- An order contains one or more **operations**. They are individual work steps that are carried out by internal or external employees. If a more detailed structure is required, each operation can be divided into **sub-operations**.
- You can assign **components** to each operation. These components can be stock or non-stock materials required for executing the work. In addition, **production resources/tools** required for processing the operations are assigned to an operation.
- The **cost overview** records and displays estimated costs. Moreover, **planned costs**, **actual costs** and **actual revenues** for the entire order can be displayed.
- You can maintain internal and external partners (e.g., responsible employees) in the **partner overview** of the order.
- If the order features several reference objects, they are entered in the **object list**. If there are several notifications concerning an order, they are entered into the object list as well.

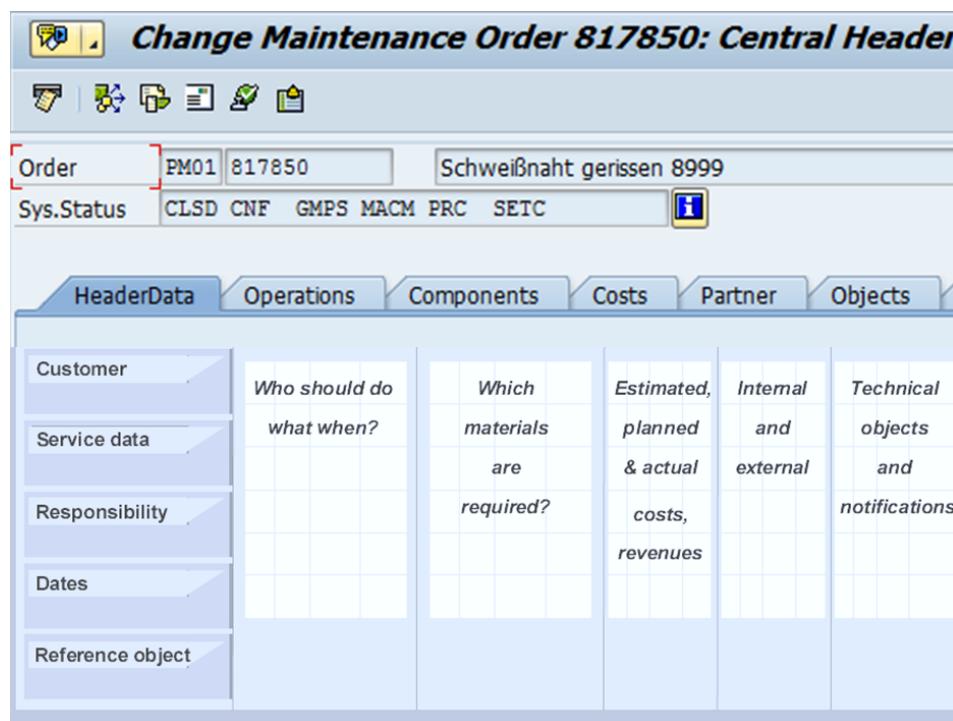


Figure 68: Service Order Structure

4.1.3 Step 3: Control

Order Release is the central function in the control step. Only when the “**put in process**” function in a service order is performed, you can print the shop papers. Moreover, the order status changes to released (REL) status and the order is saved simultaneously. The **release** function is used to release the order without a printout (without automatic saving).

The following functions can only be performed after releasing an order:

- printing shop papers

- posting costs to the order, time confirmations, material withdrawals, goods receipts postings, etc.
- revenue postings to the order by creating billing documents
- technical and business completion of the order

Depending on the settings in customizing for the order type, the **availability** of capacities, materials and production resources/tools can be checked. In case of non-availability, the system reaction can also be configured. The system reaction can either be no reaction, issue of a warning or issue of an error message.

Moreover, you can automatically create a **settlement rule** containing details regarding settlement receiver when releasing an order.

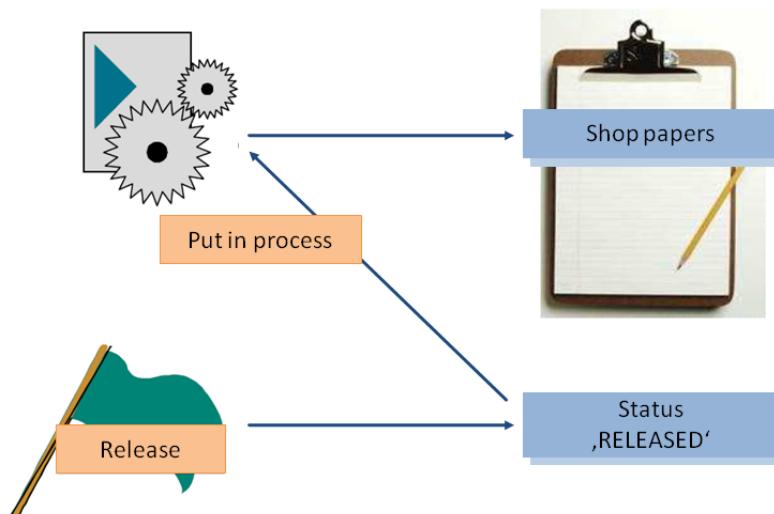


Figure 69: Order Release

4.1.4 Step 4: Execution

You already know from the maintenance process, how materials are procured externally or withdrawn from warehouse. However, you can also procure services externally.

4.1.4.1 Procurement of External Services with Goods Receipt

Depending on the order type, the system creates one or several **purchase requisitions** per external operation when an order is saved or released.

In purchasing, orders are created based on **purchase requisitions**. The purchase order items are assigned to the account for the service order. Thus, the service order is debited with the costs of the procurement process. In the service order's document flow, purchase requisitions and purchase orders are listed. After releasing an order, **goods receipts** can be entered with reference to the purchase order.

When entering valued goods receipts for external services, the service order is debited with the order value. On **invoice receipt**, the service order is automatically credited or debited with possible invoice variances. The entered goods receipts are listed in the goods movement list of the service order and in the document flow.

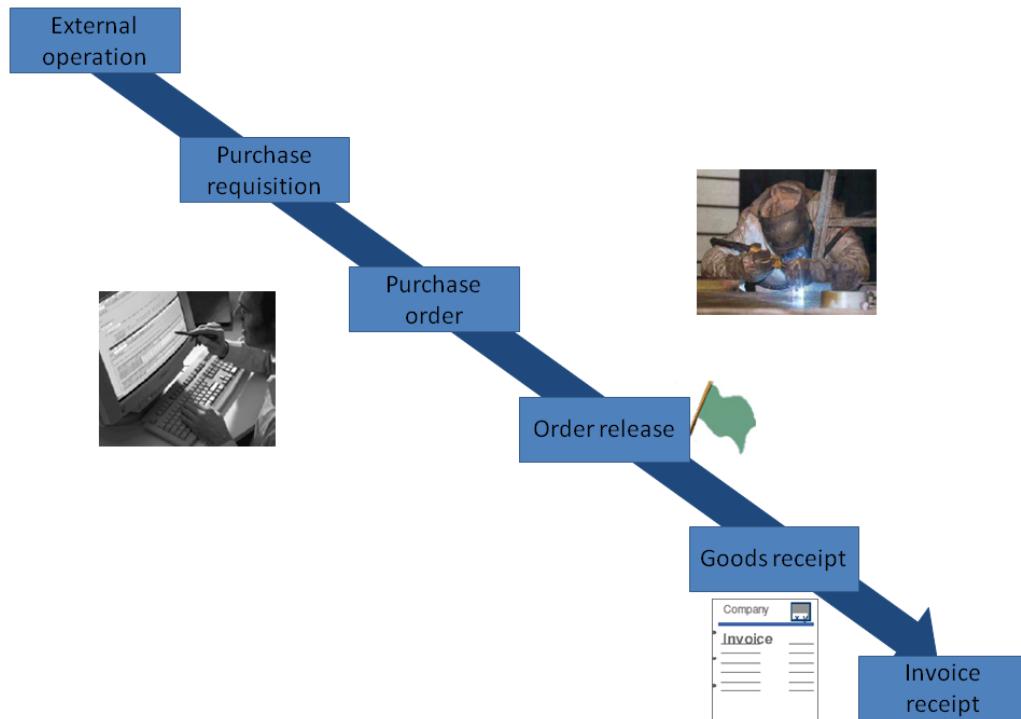


Figure 70: Procurement in the Service Process

4.1.4.2 Procurement of External Services with Service Sheet

The following figure displays the flow for procuring external services for an order by using a service sheet. Note the differences between this flow and the previous flow. A Service Entry is used, instead of a goods receipt. Once the service entry is accepted, the order will be debited with the costs.

When entering external operations in the system, you must create **service specifications** for an operation. These specifications contain one or several service numbers with information regarding service quantity or text items.

Depending on the order type, the system creates one or several **purchase requisitions** per external operation when an order is saved or released.

In purchasing, **service purchase orders** are created based on purchase requisitions. The purchase order items are assigned to the account for the service order. Thus, the service order is debited with the costs of the procurement process. In the service order's document flow, purchase requisitions and purchase orders are listed.

The services performed are entered in the function **Service Entry** by using service entry sheets. When the services performed have been **accepted**, the service order is debited with the order value. The service order is automatically credited or debited with invoicing differences on **invoice receipt**.

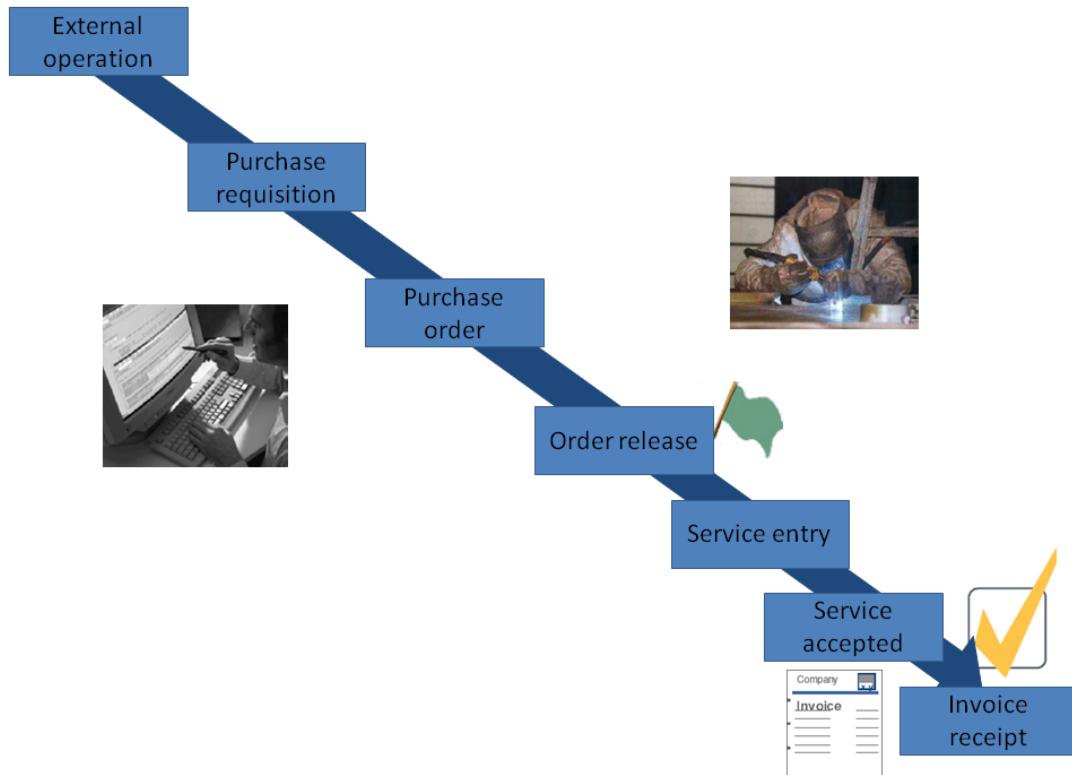


Figure 71: Service – External (with Service Sheet)

4.1.5 Step 5: Completion

After all the service work is done, you confirm the work time, the work activity, the materials used and generate the billing. After cost settlement, the service order can be fully completed.

4.1.5.1 Order Confirmation

All relevant information that has been created when executing the order is entered during order confirmation. This also includes the work hours performed by technicians.

Depending on the type of sales order, services provided by third parties are documented as **goods receipts** or **service entry sheets**.

The performed **activities** are described in one or more notifications for the order. Completion confirmation texts can also be created when entering time confirmations. The system posts **material withdrawals** from the warehouse as well as **goods receipts** of materials that were ordered form the vendor directly.

Object changes such as conversion tasks or installation and dismantling of equipment are documented as changes to the master data for the corresponding *technical object*. **Measurement values** and **counter readings** are entered as measurement documents for the corresponding technical object.

Confirming internal services, material withdrawals, notification data and measurement documents can be performed on a single screen by using the *overall completion confirmation function*.

In the **travel expenses** component travel, costs are entered and assigned to a service order. Thus, travel expenses are posted to a service order and can be charged to the customer.



- Working time: Internal activity
- External services
 - Goods receipt
 - Service entry sheet
- Activities
 - Activity reports
 - Completion confirmation texts
- Material postings
 - Planned withdrawals
 - Unplanned withdrawals
 - Goods receipt for purchase order
- Object changes
- Measurement values/counter readings

Figure 72: Order Confirmation

4.1.5.2 Value Flow

You can control via the service order type whether the service order is **revenue-bearing** or **not**. The following order types are available in the standard setting:

- SM01: service order with assignment to a sales order item (i.e., item of a service contract or a sales order) – non revenue-bearing
- SM02: service order without assignment to a sales item – revenue bearing
- SM03: service order for return and repairs (assigned to an item of the customer repairs order) – non revenue-bearing

The value flow in a **service order that is revenue-bearing** is comprised as follows:

- When **confirmations** are posted, the posting of **costs** to the service order is carried out.
- If a **billing document** is created for a service order that is a revenue object, **revenues** are posted to the service order.
- The **result** of a revenue-bearing service order is the difference between revenue and costs.
- The settlement receiver is debited with this result during **settlement**. The settlement receiver is, for example, a result object from profitability analysis (CO-PA).

The value flow in a **service order that is non revenue-bearing** is comprised as follows:

- When **confirmations** are posted, the posting of **costs** to the service order is carried out.
- If a **billing document** is created for a service order that is *non revenue-bearing*, **revenues** are posted directly to the **superior** sales document item.
- The superior sales document item is debited with the costs when **settlement** of the service order is carried out.
- The **result** can be evaluated on sales document item level.
- When settlement is carried out for the sales document, the settlement receiver of the superior sales document item (e.g., result object) is debited with the result.

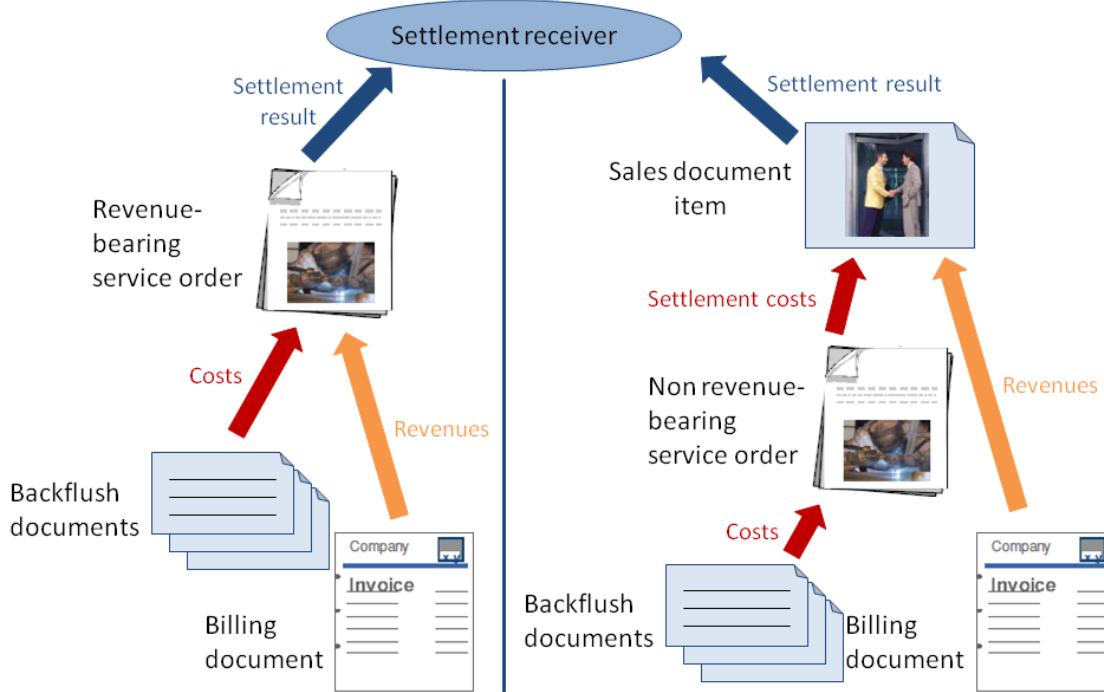


Figure 73: Value Flow

4.1.5.3 Resource-related Billing

The price for customer-specific services is not always defined in a contract as fixed prices, nor can they always be determined by using standard pricing. This is the case if, for example, no empirical values exist for specific services and, therefore, the services cannot be calculated adequately before conclusion of a contract. Typical examples of this are:

- Make-to-order production
- External plant maintenance in the service company
- Specific services such as consulting

You carry out resource-related billing for these orders. In the billing document, single material, internal activities and costs are assigned to the customer afterwards. The basis for creating a billing document is the billing request. With resource related billing, a billing request is first created.

Using the service order, the system creates **dynamic items** from the expense information (e.g., material and personnel costs) during the billing process.

Dynamic items are the data summarized according to defined criteria, from a project, sales order or service order. They occur during quotation creation or sales pricing and during billing. Data is summarized - from defined sources such as planned cost totals records or actual cost line items - using the dynamic item processor (DI processor) and is regulated by the settings you enter in the dynamic item processor profile (DIP profile). The billing document is then created as a result of the billing request.

Prior to creating the actual billing request, a modifiable overview screen is displayed and you can determine what the billing request is supposed to look like. Moreover, you can determine which amounts are calculated, postponed or cancelled at this point. From this overview screen, the billing request is created. You can, for example, simulate prices or save dynamic items on this screen.

There are two **summarization levels**:

- First level: The system summarizes data for the overview screen of the dynamic items.
- Second level: Using data from the dynamic items, the system creates a billing request. If required, the system summarizes the data again. Summarization depends on the settings in the dynamic item processor profile.

The **billing request** is a special form of sales/service order that is the basis of the billing document. Each item of the billing requisition contains a material number that is determined via the material determination procedure by using the dynamic item processor profile.

Creating a billing request can be carried out by using single or collective processing. The “create billing document,” “process billing due list” and “batch billing” functions are available for creating **billing documents**.

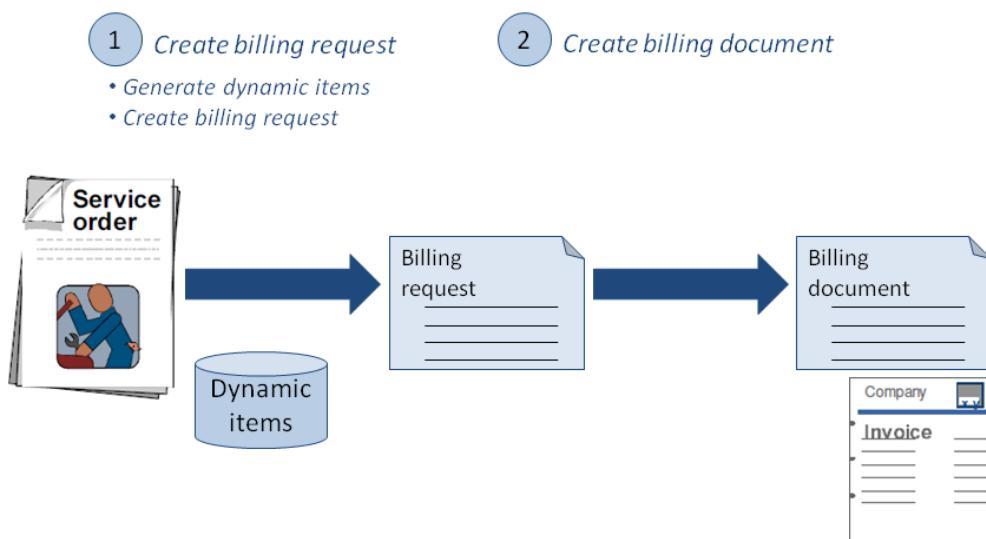


Figure 74: Resource-related Billing

4.1.5.4 Order Settlement

Settlement is the further allocation of costs and revenues regarding an order. This settlement can refer to one or several invoice receivers, who are included in the settlement rule.

The settlement rule can be determined automatically by using the entered order header data. Manual changes to the settlement rule are also possible.

The prerequisites for settling a service order are:

- The order must be released.
- A settlement rule must exist.
- The order must contain costs or revenues that have not been settled yet.

Settlement can be carried out as often as required. The order type determines which **settlement receiver types** are possible and which are proposed by default. Possible settlement receiver types are:

- G/L account
- Cost center
- Order
- WBS Element
- Asset
- Network
- Profitability segment
- Sales order
- Business process

A **profitability segment** is a combination of account assignment characteristics such as company code, sales organization, division, customer and article. It is used in profitability analysis (CO-PA).

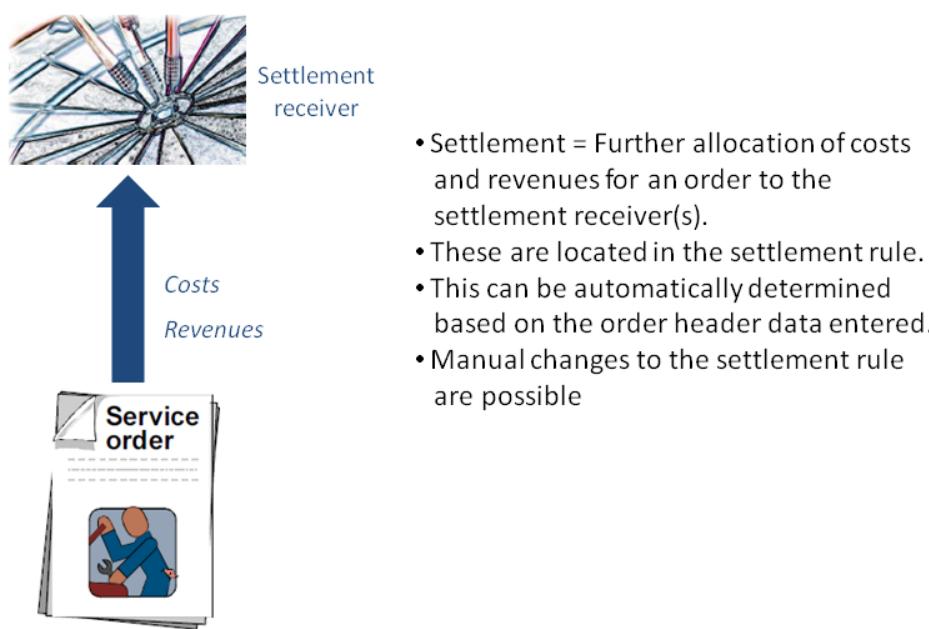


Figure 75: Order Settlement

4.1.5.5 Cost and Revenue Analysis in the Service Order

Within a service order, you can view costs and revenues by value category and/or by cost element. A value category is a grouping of one or more cost elements.

Costs and revenues from a service order are collected during order processing and displayed on order header level. Revenues can only be posted to an order if it is classified as revenue-bearing. There are two views for costs and revenues.

- Estimated costs, planned costs and actual costs as well as quantities are displayed in the **value category** overview. A value category contains one or more cost elements.

- The planned and actual costs as well as quantities are structured according to cost elements and displayed in the cost report **planned/actual comparison** (CO report).

Expected costs can be entered manually as long as the order has not been released.

Planned costs are determined by using plan data for the order, operations and components.

This occurs every time when the order is saved or the costing function is called up.

Revenues cannot be estimated. Planned revenues occur when a billing request is created.

Actual costs are the result of confirmations and other cost postings to an order. Actual revenues result from creating a billing document for the order.

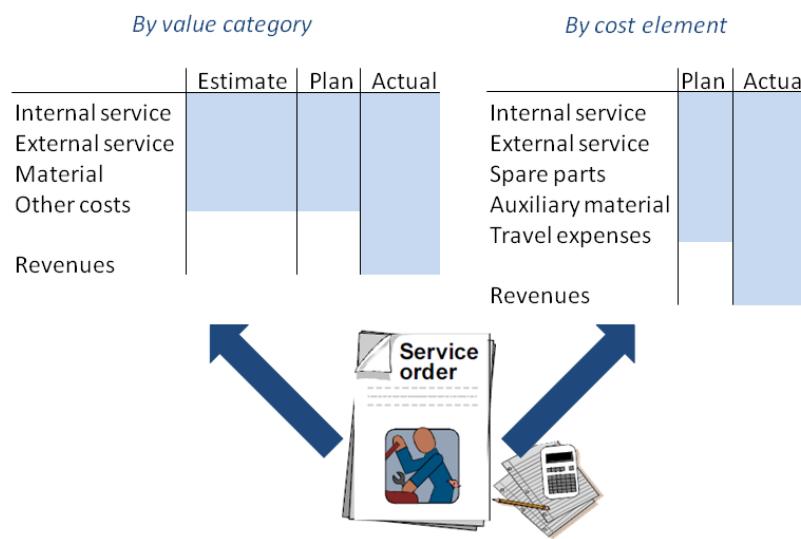


Figure 76: Cost and Revenue and Analysis in the Service Order

4.2 Practice: Service Order Process in SAP CS



You work in Enterprise Asset Management and are concerned with a customer request. The customer (**T-CSD00**) reports a breakdown of a server (**T-CSE100**) maintained by IDES AG. A technician must be sent to the customer to solve the problem. The technician needs material for the service. The customer is charged with the service. Your task is to initiate the corresponding service order and to process it. First, focus on the equipment in your system that bothers the customer.

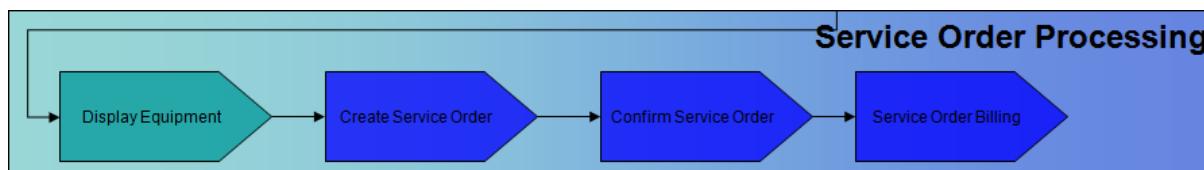


Figure 77: Process Overview: Service Order Processing

4.2.1 Display Equipment

The server of the customer maintained by your company is recorded in asset management of the SAP ERP system. To display the equipment, call up the following transaction

Logistics → Plant Maintenance → Management of Technical Objects → Equipment → Display (IE03)

1. Enter piece of equipment **T-CSE100** and confirm with *Enter*.
2. Select the **Partner** tab. You can see that piece of equipment **T-CSE100** is linked to the customer master of customer **T-CSD00**.
3. Choose the structural display and select the **Levels above** button twice.

Display Equipment: Structure List					
					Expand whole Mat. classes
Equipment	T-CSE100		Valid from	16.09.2010	
Description	Network Server				
- TCST00	Hitech				
TCST00-ADMI	Hitech Administration				
T-CSE100	Network Server				
DPC9021	Pentium Processor 750 MHz	L		1 PC	
C-1112	Motherboard Pentium PC 75Mhz	L		1 PC	
C-1212	PROCESSOR CHIP, 75 MHZ	L		1 PC	
R-1230	BIOS	L		1 PC	
R-1120	Cable with grounded plug	L		1 PC	
R-1131	Keyboard, English US	L		1 PC	
R-1160	Harddisk, 20 GB	L		1 PC	
R-1240	Coolant Unit	L		1 PC	
C-1230	MEMORY, 4MB (CO-PC)	L		1 PC	
DPC9005	HD-Controller SCSI	L		1 PC	
DPC9028	ISDN Card 16 bit passiv ISA	L		1 PC	
T-CSE200	Modem	L		1 PC	
TCST00-PROD	Hitech Production				

Figure 78: Display Equipment: SAP-System-Screenshot

4. You can see that the server is assigned to technical objects (functional locations) and the BOM of the server is displayed.

Now that you have gained an overview of the customer, the equipment and the other *technical objects*, you can start processing the service order.

4.2.2 Create Service Order

Enter the notification of the customer and create a service order in the SAP system. Choose

Logistics → Customer Service → Service Processing → Notification → Create (Special) → Problem Notification (IW54)

1. Immediately list the **notification number** displayed in the notification field.

Notification: _____

2. In the **notification short text** field, enter the description **Server down xxxy**.
3. Enter the server (**T-CSE100**) into the **equipment** field. Confirm with **Enter**. The system again fills in the corresponding *functional location* and the customer to whom the server belongs from the information of the equipment master record.

The screenshot shows the SAP interface for creating a service notification. The top bar has various icons and the title 'Create Service Notification: Service Notification'. Below the toolbar, there are tabs for 'Serv.order', 'Sales ord.', and 'Tasks'. The main area has several sections: 'Cust. address' (Sold-to party: T-CSD00, Hitech AG), 'Contact person address', 'Message address', 'Obj. address', 'Additional Data' (Reported by, Date: 16.09.2010, 23:14:50), 'Reference object' (Functional loc.: TCST00-ADMI, Equipment: T-CSE100, Assembly), and a 'Determine tasks' button.

Figure 79: Service Notification: SAP-System-Screenshot

- In the **priority** drop-down field, select the entry **2 high**. Confirm with *Enter* and answer possible questions regarding new scheduling with **No**.

To send the technician to the customer, you need to transform the notification into a **service order**. Choose the **Serv.order** button.

- Enter the following data:

- Order type	SM02
- Planning plant	1200
- Business area	8000
- Responsible work center	PC-SERV

Confirm with *Enter*.

You want to plan the expected work time of the technician.

- Choose the **Operations** tab. Enter the value **4** into the **work** field for **operation 10**. Press *Enter*.

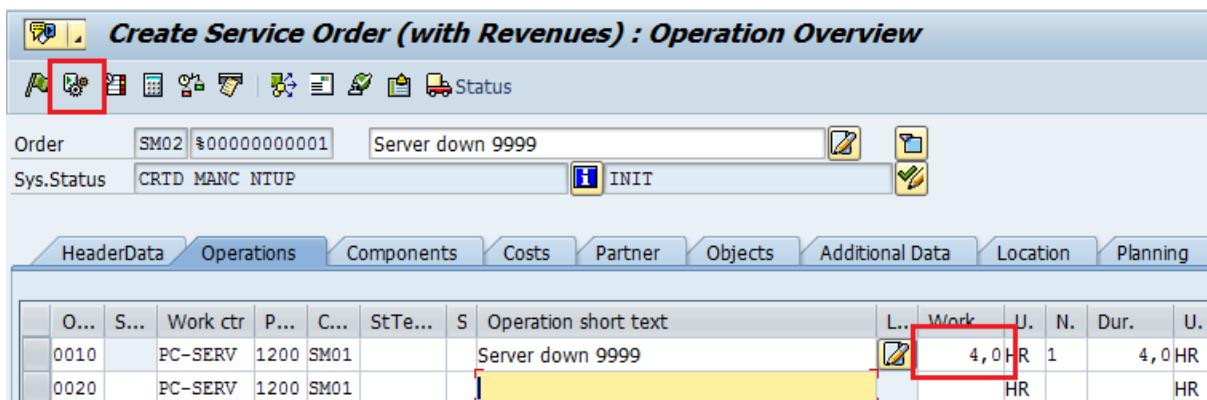


Figure 80: Plan Technician Work Time: SAP-System-Screenshot

- Set the order status to **in process** by clicking the **put in process** () button. Choose **w/o print** from the next screen and confirm with *Enter*.
- List the number of your service order (first number).

Service order: _____

4.2.3 Confirm Service Order

Your technician successfully completed the order and he wants to confirm it. Therefore, choose

Logistics → Customer Service → Service Processing → Completion Confirmation → Entry → Overall Completion Confirmation (IW42)

- Select **Extras → Settings** to choose profile **CS0001**. Save the profile entry.

2. In the **order field**, enter the **number of your service order** and confirm with *Enter*.



If you should receive the message "**Customizing incorrectly maintained**", then you can ignore it.

The technician worked **3** hours and it took him **another** hour driving time. Moreover, he used a cable with a safety plug to solve the problem (**R-1120**).

3. Therefore, enter **3 hours** into the **actual work time** field.

4. In the second line enter the following data:

- **activity** **10**
- **activity type** **1413** (drive time)
- **actual work time** **1**
- **Final Confirmation** **select**
- **Clear Open Reservations** **select**
- **No Remain Work** **select**
- Confirm with *Enter*.

5. To account for the material consumption, enter the following data into the **goods movement sections**

- **Material** **R-1120**
- **Quantity** **1**
- **Plant** **1200**
- **Storage location** **0001**
- **Movement type** **261**
- Confirm with *Enter*.

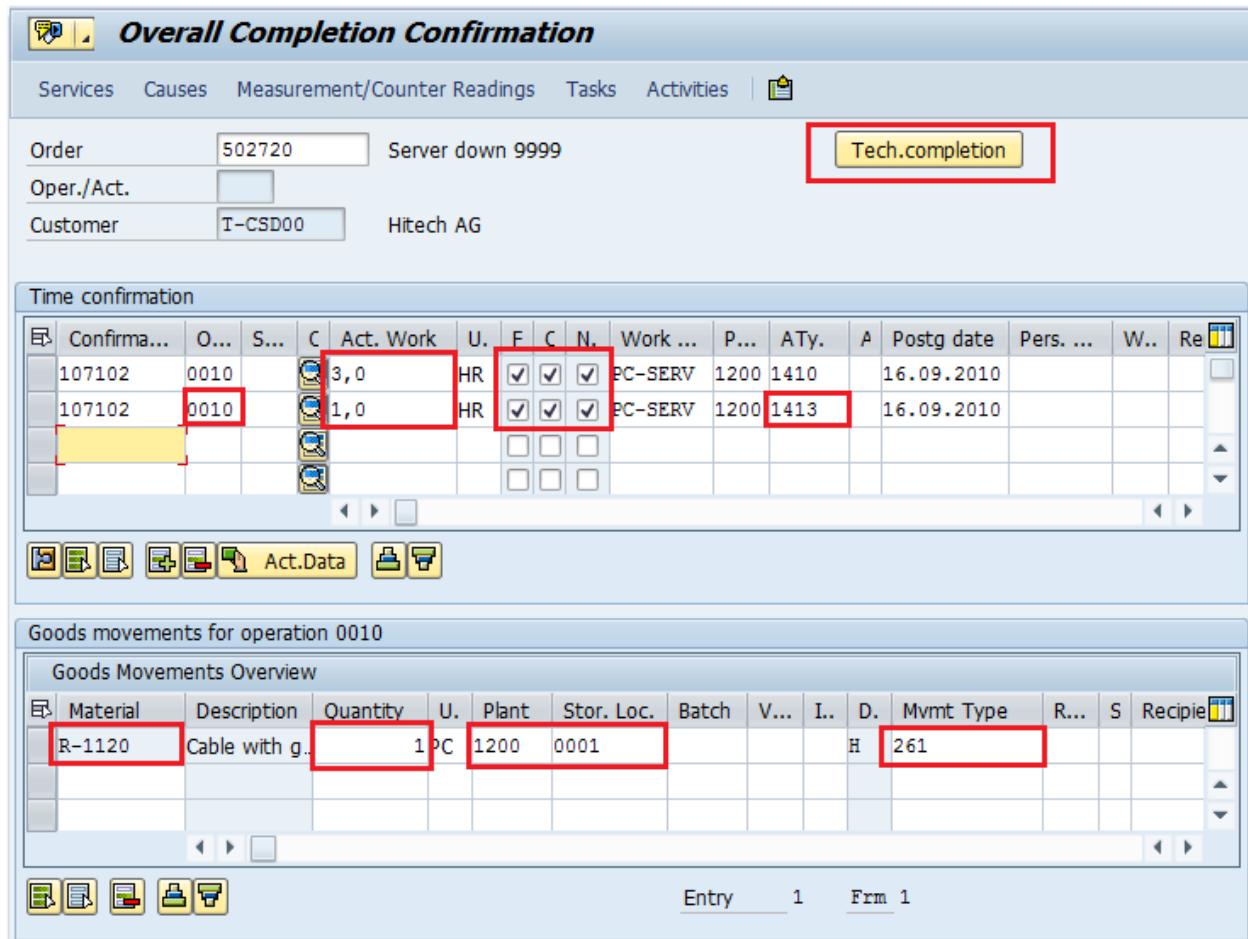


Figure 81: Confirm Service Order: SAP-System-Screenshot

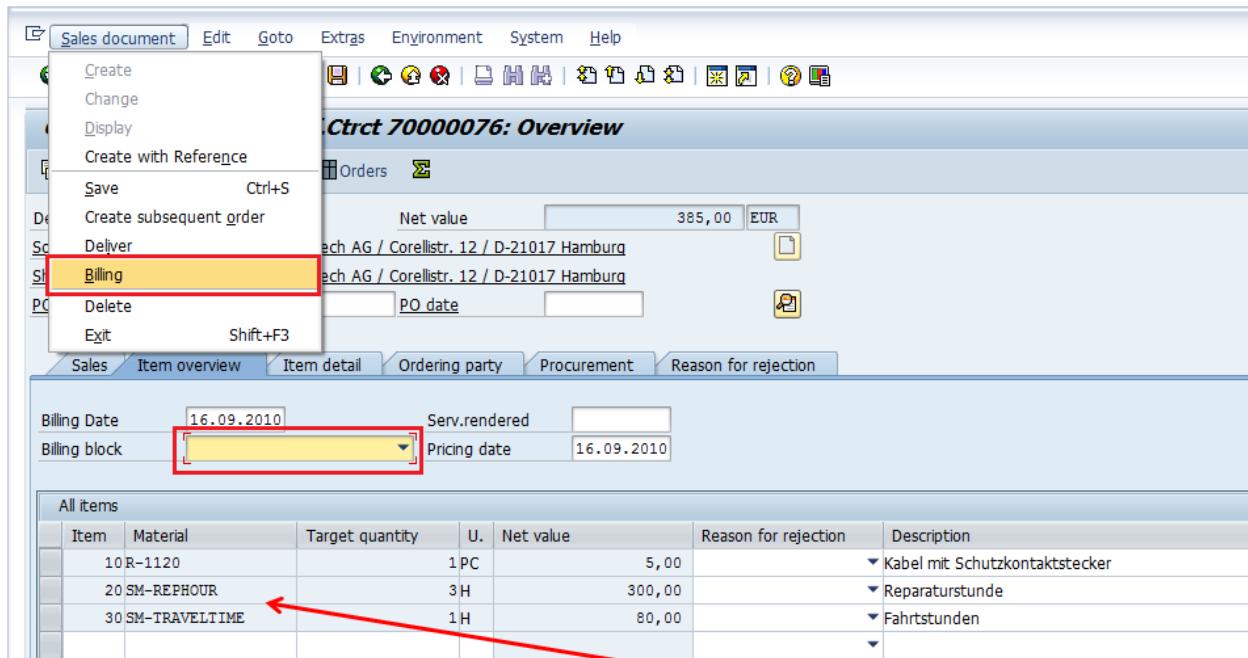
6. Choose **Tech.completion** to complete the order and **save** the confirmation.
7. The system issues a notification that the goods movement was processed successfully. Leave the transaction.

4.2.4 Service Order Billing

Finally, you want to settle the performed service order with the customer. Therefore, choose

Logistics → Customer Service → Service Processing → Completion → Billing Request → Individual Processing (DP90)

1. Enter the **number of your service order** in the field **Service order**. Press **Billing request** to display the billing request.
2. You can see that the customer is charged with 385 € net. Delete the entry in the **billing block** field and select **Sales Document → Billing** from the menu.



Dynamic Items summarized at second level. You could delete, add, postpone items here.

Figure 82: Service Order Billing: SAP-System-Screenshot

- Save the document and list the number of the billing document.

Billing document: _____

- Finally, display the print version of the bill. Choose

Logistics → Customer Service → Service Processing → Completion → Billing Document → Display (VF03)

Enter the number of your billing document and select **Billing Document → Issue Output to** from the menu. Choose the button to display the print preview screen. You should receive the following image:



Depending on your local software, operating system or printer settings you might not get any output.

IDES Holding AG, Postfach 16 05 29, D-60070 Frankfurt/M	Lastschrift
	Nummer/Datum 90036523 / 14.09.2009
	Kundennummer T-CSD00
Hitech AG 00 Corellistr. 12 21017 Hamburg	

Bedingungen Währung EUR
Zahlungsbedingungen Bis zum 28.09.2009 erhalten Sie 3,000 % Skonto
 Bis zum 14.10.2009 erhalten Sie 2,000 % Skonto
 Bis zum 29.10.2009 ohne Abzug

Lieferbedingungen CPT Hamburg

Gewichte (Brutto/Netto) - Volumen - Markierung
 Bruttogewicht 0,020 KG Nettogewicht 0,015 KG

Pos.	Material	Bezeichnung	Preis	Preiseinheit	Wert
	Menge				
Lastschriftsanforderung :					
	000010 R-1120	Kabel mit Schutzhülle	5,00	EUR	5,00
	1 ST				
	000020 SM-REPHOUR	Reparaturstunde	100,00	EUR	300,00
	3 H				
	000030 SM-TRAVELTIME	Fahrtstunden	80,00	EUR	80,00
	1 H				
Summe Positionen					385,00
Ausgangsteuer					73,15
Endbetrag					458,15

Figure 83: Billing Document – Print Preview: SAP-System-Screenshot

We will do without entering the customer payment to the account of your company at this point. You can, however, perform this step independently if you wish to. Proceed analogously to the **sales order management** case study. Bear in mind that your customer is **T-CSD00** this time.

4.3 Elucidation



What have we learned so far?

You have learned what a service process looks like in SAP CS and witnessed the parallels to the maintenance process.

4.3.1 Service Order Processing

Step 1 - Creation:

- Service notification (optional)
- Service order (based on notification(s), sales item, maintenance item, other service order)

Step 2 - Planning:

- Operations (time, work center and other controlling information for an individual service task, text)
- Materials
- Employees
- Cost settlement rule
- Scheduling (execution dates, capacity requirement, availability dates for materials)

Step 3 - Control:

- Material availability check
- Capacity leveling
- Scheduling by using the planning board
- Order release
- Printing and faxing of shop papers

Step 4 - Execution:

- Usage of stock and non-stock materials
- Purchasing external services

Step 5 - Completion:

- Completion Confirmation (work time, materials, etc.)
- Billing request, billing document, resource-based Billing
- Technical completion
- Settlement of the order
- Business completion

4.3.2 Step 1: Creation

Order Creation Options

You have the following option when creating a service order:

- Create service order directly:
 - o For this option, you use transaction IW31.
 - o At least the *order type* and the *planning plant* must be entered.
- Create a service order from a service notification:
 - o You create (IW51) or change (IW52) a service notification and create a service order as subsequent document.
 - o Notification and order are then assigned to each other.
- Generate for an existing notification:
 - o You create a service order in transaction IW34.
 - o When you create an order by using this function (*create for notification*), you are prompted to enter the notification in the service order.
 - o Notification and order are assigned to one another.
- Merge several notifications in one order:
 - o You can combine multiple notifications in one order
 - o The individual notifications are then listed in the order object list.
- Create from a sales order item:
 - o You can automatically create a service order from a sales order item.
 - o This option is also available for returns and repairs.
 - o The service order is then controlled via the requirements type and the requirements class of the sales order item.
 - o The material entered in the sales order item must also have an entry in the *service products* table. That is, the material must be service or have a service assigned.
- Create order automatically form a maintenance item

Service Order Structure

A service order is structured as follows (tabs):

- **Order header**
 - o Description (short and long text), status information, customer and address data, service data (e.g., service product), responsibilities, dates and reference object.
 - o Header data include cost and revenue data, partner data and the object list as well.
- **Operations** (at least one!)
 - o Individual work steps that are carried out by internal or external employees.
 - o Each operation can be divided into ***sub-operations*** with higher detail level.
- **Components**
 - o can be assigned to each operation
 - o can be ***stock*** or ***non-stock materials*** required for executing the work
 - o can be ***production resources/tools required*** for processing the operations

- **Cost overview**
 - o records and displays *estimated costs*
 - o *planned costs*, *actual costs* and *actual revenues* for the entire order can be displayed
- **Partner overview**
 - o Internal and external partners (e.g., responsible employees) are entered here.
- **Object list**
 - o If the order features several *reference objects* (e.g., functional locations, products, equipment), they are entered in the object list.
 - o If there are several *service notifications* concerning an order, they are entered into the object list.

4.3.3 Step 3: Control

Order Release is obtained by using the functions

- ***put in process***
 - o The order status changes to released (REL) status.
 - o automatic printing of shop papers
 - o automatic saving of the service order
- ***release***
 - o The order status changes to released (REL) status.
 - o no automatic printing of shop papers
 - o no automatic saving of the service order

The following functions can only be performed after releasing (status REL) an order:

- print shop papers
- post costs to the order, time confirmations, material withdrawals, goods receipts postings, etc.
- revenue postings to the order by creating billing documents
- technical and business completion of the order

Depending on the order type, upon order release, the system can

- check **availability** of capacities, materials and production resources/tools
- issue a warning or error in case of non-availability
- automatically create a **settlement rule** containing details regarding settlement receiver

4.3.4 Step 4: Execution

In addition to their own workforce, many firms employ external service providers to do work of various kinds. This may be due to a number of reasons: for example, their own staff may lack either the capacity or the qualifications to perform certain tasks.

Procurement of External Services with Goods Receipt

A service can be created in the SAP ERP system as a material (material type = service; transaction type MMS1). You can purchase this service then in the same way you purchase materials. However, materials that have the material type *service* cannot be stored in the warehouse (kind of logical), hence, a service is not subject to inventory management and, thus, is procured with direct account assignment (like consumable materials).

1. Depending on the order type, the system creates one or several **purchase requisitions** per external operation when an order is *saved* or *released*.
2. In SAP MM **purchased orders** are created based on the **purchase requisitions**.
3. The **purchase order items** are assigned to the account of the **service order**. Thus, the service order is debited with the costs of the procurement process.
4. **Goods receipts** for the material can be entered with reference to the purchase order. Goods receipt is only possible after the service order is *released*.
5. After goods receipt is posted, the service order is debited with the purchase order value.
6. **Invoice receipt** posting debits or credits the service order with possible invoice variances.
7. Goods receipts are listed in the **goods movement list** of the service order.
8. Goods receipt, purchase requisitions and purchase orders are listed in the service order's **document flow**.

Procurement of External Service (with Service Sheet)

Services can also be procured without a service material master. In that case, you use service specifications and service entry lists.

1. **Service specification:** To use an external service, the service must be included in a service specification. A service specification contains detailed information on a service. The operation in the service order, which requires the external service, must create this service specification first. These specifications contain one or several service numbers with information regarding service quantity or text items.
2. Depending on the order type, the system creates one or several **purchase requisitions** per external operation when an order is *saved* or *released*.
3. In SAP MM, **service purchased orders** are created based on the **purchase requisitions**.
4. The **purchase order items** are assigned to the account of the **service order**. Thus, the service order is debited with the costs of the procurement process.
5. The services performed are entered in the function **Service Entry** by using service entry sheets.

A service entry sheet is a list of services performed by a vendor on the basis of a purchase order, containing service descriptions and details of quantities and values. The descriptions of planned services deriving from the purchase order are used as default descriptions in the service entry sheet. Unplanned services that were entered in the purchase order without descriptions by using value limits are precisely specified in the entry sheet.

6. When the services performed have been **accepted**, the service order is debited with the order value.
7. **Invoice receipt** posting debits or credits the service order with possible invoice variances.
8. Purchase requisitions and purchase orders are listed in the service order's **document flow**.

4.3.5 Step 5: Completion

Order Confirmation

All relevant information that has been created when executing the order is entered during order confirmation. This includes:

- **Working time**: internal activity performed by field employees
- **External services** (depending on the service order type) post
 - o goods receipt (material type service) or
 - o service entry sheet (service specification)
- **Activities**: The performed **activities** are described in one or more notifications for the order by using either
 - o activity reports or
 - o completion confirmation texts
- **Material postings**
 - o planned withdrawals
 - o unplanned withdrawals
 - o goods receipt for purchase order
- **Object changes** such as conversion tasks or installation and dismantling of equipment are documented as changes to the master data for the corresponding *technical object*.
- **Measurement values/counter readings** are entered as measurement documents for the corresponding technical object.

Value Flow

The service order type controls whether the service order is **revenue-bearing** or **not**:

- SM01: service order with assignment to a sales order item (i.e., item of a service contract or a sales order) – non revenue-bearing
- SM02: service order without assignment to a sales item – revenue bearing
- SM03: service order for return and repairs (assigned to an item of the customer repairs order) – non revenue-bearing

The value flow in a **service order that is revenue-bearing** is comprised as follows:

- When **confirmations** are posted, the posting of **costs** to the service order is carried out.
- If a **billing document** is created for a service order that is a revenue object, **revenues** are posted to the service order.
- The **result** of a revenue-bearing service order is the difference between revenue and costs.

- The settlement receiver is debited with this result during **settlement**. The settlement receiver is, for example, a result object from profitability analysis (CO-PA).

The value flow in a **service order that is non revenue-bearing** is comprised as follows:

- When **confirmations** are posted, the posting of **costs** to the service order is carried out.
- If a **billing document** is created for a service order that is *non revenue-bearing*, **revenues** are posted directly to the **superior** sales document item.
- The superior sales document item is debited with the costs when **settlement** of the service order is carried out.
- The **result** can be evaluated on sales document item level.
- When settlement is carried out for the sales document, the settlement receiver of the superior sales document item (e.g., result object) is debited with the result.

Resource-related Billing

1. Based on the expenses occurred (material costs, activity costs, etc.) during service order processing, the system creates **dynamic items** when creating the billing request. Use of dynamic items is important in billing a service, since the costs depend on the resources really employed and the bill should only contain the items that you want / can charge to your customer.
2. Which costs are identified as dynamic items, which dynamic items are used to create the billing request and how the amount and prices are calculated is defined in the system's customizing in the Dynamic Items Processor Profile (DIPP). You can create DIPs for several billing purposes (Sales & Distribution, Project, Service, etc.).
3. Data is summarized - from defined sources such as planned cost totals records or actual cost line items - using the dynamic item processor (DI processor) and is regulated by the settings you enter in the DIPP. There are two summarization levels:
 - First level: The system summarizes the data records from the stipulated sources. The DIP profile you maintained in customizing regulates the type of summarization.
 - Second level: The system summarizes the data from the dynamic items on the basis of the materials assigned to the items in a sales and distribution document (such as a quotation or billing request). The second level of summarization is also dependent on the settings in the DIP profile.
4. Before you create the actual billing request, a modifiable overview screen is displayed. In this overview you can determine what the billing request is supposed to look like and which amounts are calculated, postponed or cancelled at this point.
5. From this overview screen, the billing request is created. You can, for example, simulate prices or save dynamic items on this screen.
6. From the billing request, you can create the billing document by using single or collective processing. The “create billing document,” “process billing due list” and “batch billing” functions are therefore available.



Okay, that was pretty complicated. But don't worry, you will get a detailed example of a DIP and Resource-based Billing in teaching unit 11.

Order Settlement

- Further allocation of costs and revenues regarding an order to one or several invoice receivers, who are included in the settlement rule.
- Settlement rule can be determined automatically by using order header data or set manually
- Prerequisites for settling a service order are:
 - o The order must be released.
 - o A settlement rule must exist.
 - o The order must contain costs or revenues that have not been settled yet.
- Settlement can be carried out as often as required.
- The order type determines which settlement receiver types are possible and which are proposed by default:
 - o G/L account
 - o cost center
 - o order
 - o WBS Element
 - o asset
 - o network
 - o profitability segment
 - o sales order
 - o business process
- A profitability segment can also be a settlement receiver.

Cost and Revenue Analysis in the Service Order

Costs and revenues from a service order are collected during order processing and displayed on order header level. There are two views for costs and revenues:

- **Value category** overview:
 - o estimated, planned and actual costs and quantities
 - o Each value category contains one or more cost elements.
- **Planned/actual comparison (CO report):**
 - o Planned and actual costs and quantities are structured according to cost elements and displayed in the cost report

Estimated costs can be entered manually as long as the order has not been released.

Planned costs are determined by using plan data for the order, operations and components.

Actual costs are the result of confirmations and other cost posting to an order.

Planned revenues occur when a billing request is created.

Actual revenues result from creating billing document for the order.

5 Data Sheet

Congratulations! You completed the **Asset and Service Management** case study.

The subsequent case studies are based on the results of this case study. In case your data differs from the description in the script, please contact your tutor prior to processing another case study.

Finally, please **submit the carefully completed data sheet** to your tutor (use support email address from the welcome mail) for the case study **Enterprise Asset and Customer Service Management**.

Please comply with the naming rules. Non-compliant data sheets will not be accepted; i.e., rename the document that you downloaded from this course's download area as follows:

10-asset_service-xxyy-zzz-surname.doc

Thereby, you need to replace **xxyy** with your user number **without** the “**WIP**“ and without the hyphen (WIP-xx-yy) and replace **zzz** with the number of the client you are working on.

Example:

Your name is **Max Mustermann**, you are working on **client 901** and your **user number** is **WIP-99-99**. Then, name the document as follows:

01- asset_service-9999-901-Mustermann.doc

6 Reflexion



Test your knowledge. In this section you are confronted with some question regarding the theoretical chapters of this teaching unit. Try to answer the questions on your own before taking a look at the standard solutions.

6.1 Questions

Comprehension Questions

1. What is the difference between “putting an order in process” and “releasing” an order?

2. What are the phases in the corrective maintenance process?

3. Why would you create *functional locations* to structure your systems?

4. The _____ displays an overview of objects involved in the order.

True/False

5. The usage list displays all the pieces of equipment that have been installed in chronological order.
6. Equipment is defined as a collection of physical objects that are maintained as individual autonomous units.
7. In the corrective maintenance process, maintenance requirements are collected within notifications and then dealt with during order processing.

8. When you assign a coding mask to equipment it is automatically assigned to a functional location.

Multiple Choice Questions

9. Which of the following are organizational elements used by Enterprise Asset Management?

(3 correct Answers)

- a. Plant
- b. Maintenance Plant
- c. Maintenance Planning Plant
- d. Purchasing Organization
- e. Production Plant

10. A work center can represent which of the following?

(2 correct Answers)

- a. Person
- b. Vendor
- c. Machine
- d. Cost Center
- e. G/L Account

11. A Maintenance Notification can be created for which of the following?

(3 correct Answers)

- a. Functional Location
- b. Equipment
- c. Work Center
- d. No Object
- e. Plant

12. Which of the following documents can be referenced on a Maintenance order?

(3 correct Answers)

- a. Notification
- b. Purchase Order
- c. Purchase Requisition
- d. Sales Order
- e. Production Order

13. What are the elements of a notification?

(2 correct Answers)

- a. Tasks
- b. Settlement rule
- c. Maintenance costs
- d. Items

14. Which objects are technical objects?

(3 correct Answers)

- a. Work Centers
- b. Functional Location
- c. Construction Type
- d. Bill of Material
- e. Equipment

15. Which of the statements about Functional Locations are correct?

(2 correct Answers)

- a. Are not hierarchically structure to define technical system.
- b. More than 1 equipment can be assigned.
- c. Plant maintenance tasks can be performed with assignments to or for functional location.

16. Which of the following statements are correct regarding how a Plant Maintenance order is created?

(2 correct Answers)

- a. generated automatically from WBS element
- b. scheduled maintenance
- c. direct entry

17. Which of the following statements are correct regarding Plant Maintenance orders?

(2 correct Answers)

- a. By use of object list, you can maintain or repair more than one piece of equipment.
- b. PM work order offers planned costs and actual costs.
- c. Shows activities and tasks.
- d. Only created with reference to notification.

18. Which of the following statements are correct when you set a PM work order to TECO?

(3 correct Answers)

- a. TECO can be set separately for order notification.
- b. You can change order data.
- c. When your notification and order are closed together – tasks need to be closed.
- d. Open reservations and purchase requisitions are left open until final settlement.
- e. Settlement rule can be created automatically.

19. Which of the following statements about functional locations are correct?

(4 correct Answers)

- a. Functional locations are hierarchically ordered structures that could represent a technical system or building.
- b. Maintenance tasks can be performed at a functional location.
- c. By assigning a structure indicator to a functional location, it is automatically included in the existing structure.
- d. Only one piece of equipment can be assigned to the same functional location.
- e. Functional locations allow you to analyze the effects that usage conditions have on the likelihood of damage to the installed equipment.

20. What additional process flow steps are performed when external operations for services are entered in a service order for an operation?

(2 correct Answers)

- a. Service Entry Sheet
- b. Goods Receipt
- c. Invoice Receipt
- d. Service Acceptance

21. Which of the following statements about serial numbers are correct?

(3 correct Answers)

- a. The same serial number can exist for different materials.
- b. A serial number can be the same as the equipment number.
- c. Serial numbers can be assigned to functional locations and materials.
- d. The combination of the material number and serial is always unique.

22. What is the additional document created during resource related billing?

(1 correct Answer)

- a. Settlement Document
- b. Billing Request
- c. Billing Document
- d. Sales Order

6.2 Standard Solution

Comprehension Questions

1. What is the difference between “putting an order in process” and “releasing” an order?
Both of them result in the release of the maintenance order. The difference is that there are additional functions immediately performed for the order when it is “put in process”. When you “put the order in process”, it will trigger the printing of shop floor documents and save the order immediately. These activities will be manually triggered when you just “release” the order.

2. What are the phases in the corrective maintenance process?

Answer: **Notification**
Planning
Scheduling
Execution
Completion

3. Why would you create *functional locations* to structure your systems?
- **Maintenance tasks have to be performed and recorded at this location.**
 - **Technical data has to be stored and evaluated over a longer period of time.**
 - **Effects of the usage conditions on the installed equipment have to be monitored.**
 - **Costs of maintenance tasks need to be monitored.**
4. The **object list** displays an overview of objects involved in the order.

True/False

5. The usage list displays all the pieces of equipment that have been installed in chronological order.

True. The usage list displays all the pieces of equipment that have been installed in chronological order.

6. Equipment is defined as a collection of physical objects that are maintained as individual autonomous units.

False! Equipment is defined as an individual physical object that should be maintained as an autonomous unit.

7. In the corrective maintenance process, maintenance requirements are collected within notifications and then dealt with during order processing.

True. In the corrective maintenance process, maintenance requirements are collected within notifications and then dealt with during order processing.

8. When you assign a coding mask to equipment, it is automatically assigned to a functional location

False – Equipment does not have a coding mask.

Multiple Choice Questions

9. Which of the following are organizational elements used by Enterprise Asset Management?

(3 correct Answers)

- a. Plant
- b. Maintenance Plant
- c. Maintenance Planning Plant
- d. Purchasing Organization
- e. Production Plant

Answers: a, b, c

10. A work center can represent which of the following?

(2 correct Answers)

- a. Person
- b. Vendor
- c. Machine
- d. Cost Center
- e. G/L Account

Answers: a, c

11. A Maintenance Notification can be created for which of the following?

(3 correct Answers)

- a. Functional Location
- b. Equipment
- c. Work Center
- d. No Object
- e. Plant

Answers: a, b, d

12. Which of the following documents can be referenced on a Maintenance order?

(3 correct Answers)

- a. Notification
- b. Purchase Order
- c. Purchase Requisition
- d. Sales Order
- e. Production Order

Answers: a, b, c

13. What are the elements of a notification?

(2 correct Answers)

- a. Tasks
- b. Settlement rule
- c. Maintenance costs
- d. Items

Answers: a, d

14. Which objects are technical objects?

(3 correct Answers)

- f. Work Centers
- a. Functional Location
- b. Construction Type
- c. Bill of Material
- d. Equipment

Answers: b, d, e

15. Which of the statements about Functional Locations are correct?

(2 correct Answers)

- a. Are not hierarchically structure to define technical system.
- b. More than 1 equipment can be assigned.
- c. Plant maintenance tasks can be performed with assignments to or for functional location.

Answers: b, c

16. Which of the following statements are correct regarding how a Plant Maintenance order is created?

(2 correct Answers)

- a. generated automatically from WBS element
- b. scheduled maintenance
- c. direct entry

Answers: b, c

17. Which of the following statements are correct regarding Plant Maintenance orders?

(2 correct Answers)

- e. By use of object list, you can maintain or repair more than one piece of equipment.
- a. PM work order offers planned costs and actual costs.
- b. Shows activities and tasks.
- c. Only created with reference to notification.

Answers: a, b

18. Which of the following statements are correct when you set a PM work order to TECO?

(3 correct Answers)

- a. TECO can be set separately for order notification.
- b. You can change order data.
- c. When your notification and order are closed together – tasks need to be closed.
- d. Open reservations and purchase requisitions are left open until final settlement.
- e. Settlement rule can be created automatically.

Answers: a, c, e

19. Which of the following statements about functional locations are correct?

(4 correct Answers)

- a. Functional locations are hierarchically ordered structures that could represent a technical system or building.
- b. Maintenance tasks can be performed at a functional location.
- c. By assigning a structure indicator to a functional location, it is automatically included in the existing structure.
- d. Only one piece of equipment can be assigned to the same functional location.
- e. Functional locations allow you to analyze the effects that usage conditions have on the likelihood of damage to the installed equipment.

Answers a, b, c, e

20. What additional process flow steps are performed when external operations for services are entered in a service order for an operation?

(2 correct Answers)

- a. Service Entry Sheet
- b. Goods Receipt
- c. Invoice Receipt
- d. Service Acceptance

Answers: a, d

21. Which of the following statements about serial numbers are correct?

(3 correct Answers)

- a. The same serial number can exist for different materials.
- b. A serial number can be the same as the equipment number.
- c. Serial numbers can be assigned to functional locations and materials.
- d. The combination of the material number and serial is always unique.

Answers: a, b, d

22. What is the additional document created during resource related billing?

(1 correct Answer)

- a. Settlement Document
- b. Billing Request
- c. Billing Document
- d. Sales Order

Answers: b