

Maintenance Orders

A maintenance task is processed using a maintenance order, in which the type, scope, dates and resources for carrying out the work are described, together with the rules for account assignment and settlement. Maintenance orders can be distinguished by degree of planability into

Degree of Planability

- regular PM orders
- planned PM orders
- unplanned PM orders

Regular maintenance orders are released by maintenance schedules at due dates. They are determined in advance by the maintenance schedule in terms of scope and dates. These orders represent a regular workload for the PM workshops.

Regular PM Order

In addition to regular maintenance orders, maintenance requirements may arise for planned repairs from maintenance notifications. If, for example, in the course of an inspection a system is seen to be in a condition that will require repair in the foreseeable future, then these findings can be entered as a maintenance notification and passed on to the planning group responsible. At this stage the maintenance notifications are converted to maintenance orders.

Planned PM Order

Sometimes the maintenance work centers need to take immediate action, due to unforeseen machine breakdowns, accidents or other malfunctions, even though neither the type nor the scope of the activities required are known. In this case a rush order is created, which requires no additional planning, but is used simply as a trigger for maintenance activities. Further information is only added to this type of order during processing or completion confirmation.

Unplanned PM Order

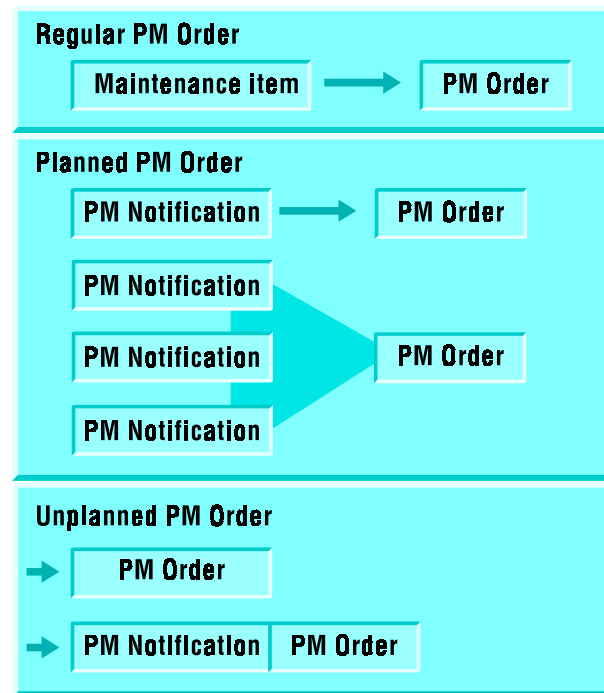


Figure 5-1: Creating Maintenance Orders

Flexible Order Processing

A maintenance system must be constructed flexibly, so that it covers the various forms of order processing. It must allow detailed preliminary planning in terms of technical, scheduling and cost-related factors, together with a rapid, simple and direct order creation function. Particularly in the case of unplanned maintenance orders, it must be possible to start maintenance tasks initially on the basis of elements of a technical system structure that are not yet precisely defined, and only specify the technical objects actually affected later on at the completion confirmation stage. Only in this way can you react quickly to exceptional situations whilst retaining a detailed maintenance history covering individual functional locations, pieces of equipment and assemblies.

Referencing Objects in PM Orders

An important criterion in order processing is the reference to a technical object.

Individual Object Object Groups

In addition to individual tasks that need to be performed on an individual object, a typical maintenance activity will need to be performed for several objects. You can create a maintenance order in the PM system for several technical objects. These technical objects are allocated to an order in the form of an object list.

This provides a solution which fulfills both the expectations of a simple processing function for the work centers and the requirement for a detailed record from the technical perspective.

Temporal Validity of Orders

The length of time for which an order is valid is an important factor in differentiating between maintenance orders.

As a rule, you create an individual order for each maintenance task once it has reached a certain scope, to provide transparency of costs in maintenance processing and in the history. For frequent routine activities, for which you do not want to create an individual order, you can create a standing order. Standing orders are valid for a longer period of time and are confirmed on a running basis. (The standing order functionality is planned in the PM System, but is not currently realized).

Individual Orders Standing Orders

Executing Maintenance Orders

Maintenance orders can either be carried out by your own maintenance workshops, or in some cases by external service companies. Reasons for having maintenance activities processed externally can include cost-effectiveness, specialized knowledge of a third party, or temporary bottlenecks in internal workshop capacity.

Internal and External Processing

Elements of a Maintenance Order

The maintenance order describes the type, scope, dates and resources of a maintenance task. A maintenance order consists of the following:

- Order Structure**
- order header
 - PM order object list
 - operations and sub-operations
 - material list for the order
 - production resources/tools

Order Header The order header contains general order data:

The order type determines, for example, whether a repair or regular maintenance is to be performed. The task is described in the text. The order header also contains the persons responsible, dates, priorities and the reference object.

Figure 5-2: Creating a Maintenance Order

PM Order Object List

If the order refers to several reference objects, any number of these can supplement the main object as items of an object list. If, for example, a complete technical system is being inspected, then either the whole system or a sub-system is specified as the main object, and the individual functional locations, pieces of equipment and assemblies are listed in the object list.

Order: Inspection clarification plant

Main object: K1-M - Mechanical purification

Object list: K1-M01 - Sand trap

K1-M01-1 - Reservoir

K1-M01-2 - Ventilator

K1-M01-3 - Sand dredger

Example

The scope of the work is described using operations and sub-operations. Operations represent the individual work steps to be carried out for the maintenance tasks.

Operations and Sub-operations

An operation must contain a description, the performing work center and the amount and duration of the work. Controlling information determines whether, for example, the operation is to be processed internally or by a third party.

The sequence of operation numbers determines the order in which they are to be performed. Different temporal dependencies can be represented using relationships (planned).

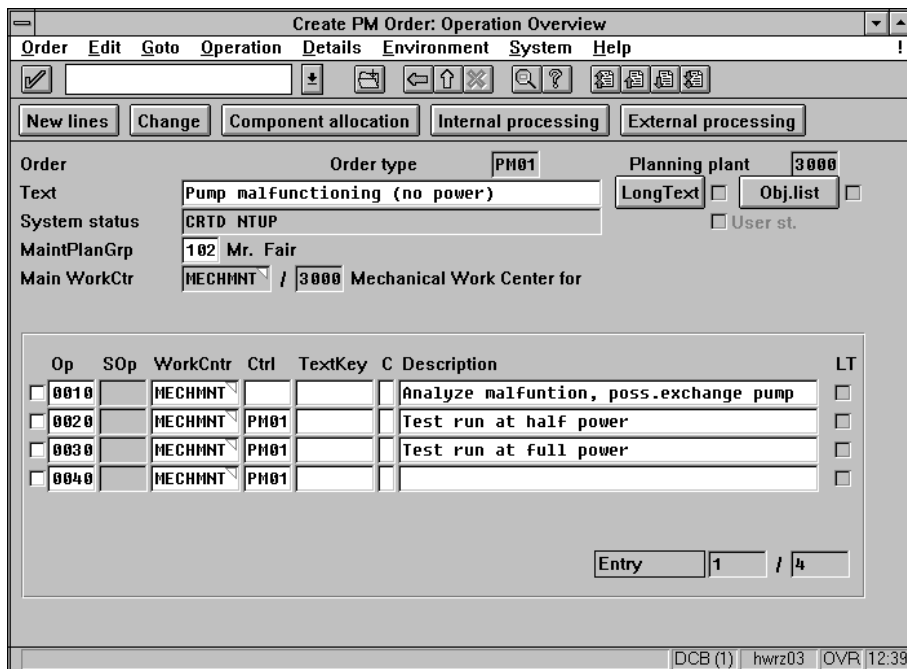


Figure 5-3: PM Order Operation Overview

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Maintenance Orders

Material List for the Order Materials can be either allocated directly to each operation or by including maintenance bills of material. This can involve stock material or non-stock material, with or without a master record. Either material reservations (in the case of stock material) or purchase requisitions are subsequently generated for these materials.

The important data in a material list comprises the material number, quantity and prices.

Production Resources/Tools Any necessary maintenance resources (tools, measuring equipment, and so on) are managed in the system as production resources/tools. They can be assigned in any quantity to the operations.

Processing Maintenance Orders

Maintenance orders can result from:

- ❑ scheduling maintenance plans
- ❑ conversion of PM notifications to PM orders
- ❑ direct creation

Regular orders are created automatically for the call horizon by scheduling a maintenance plan. They contain the tasks due, the objects concerned and the execution dates based on the maintenance strategy and scheduling parameters.

These orders are therefore completely generated when released and are ready to be carried out.

Maintenance notifications determine the maintenance requirement in respect of the objects involved, the execution dates required and the content, or purpose of the task. In the case of notifications that are processed as individual orders, the data is already available as a basis for the order header and only supplemented with the execution data. If, however, several notifications are bundled for one order, the order can refer to a main object (technical system or sub-system, piece of equipment, cost center or location) and link the notifications with the order as items in the object list.

**Scheduled
Maintenance Orders**

**Orders Based on
PM Notifications**

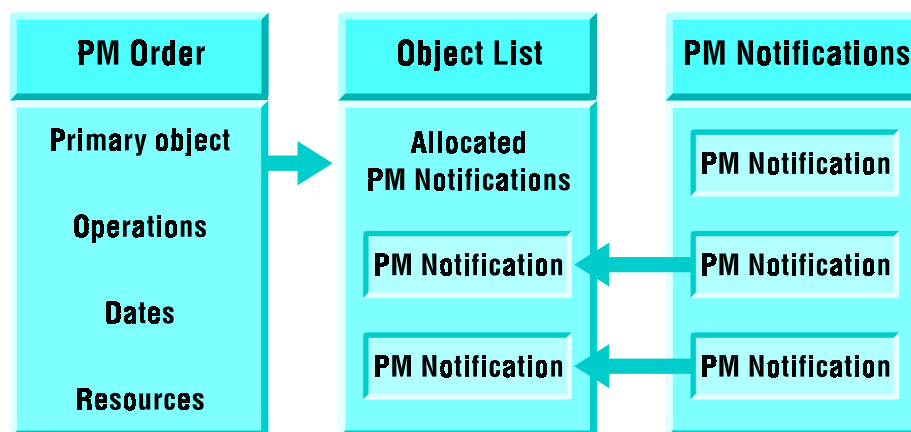


Figure 5-4: Allocating PM Notifications to a PM Order Using the Object List

Orders can also be created without reference to a notification for direct tasks. In this case the order is initially only roughly described and then supplemented with details in the course of subsequent planning or processing.

Direct Orders

Steps in the Order Cycle

The order cycle contains the following main steps:

- order creation
- order release
- order confirmation
- order completion

These steps need not all be carried out; steps may be left out or combined.

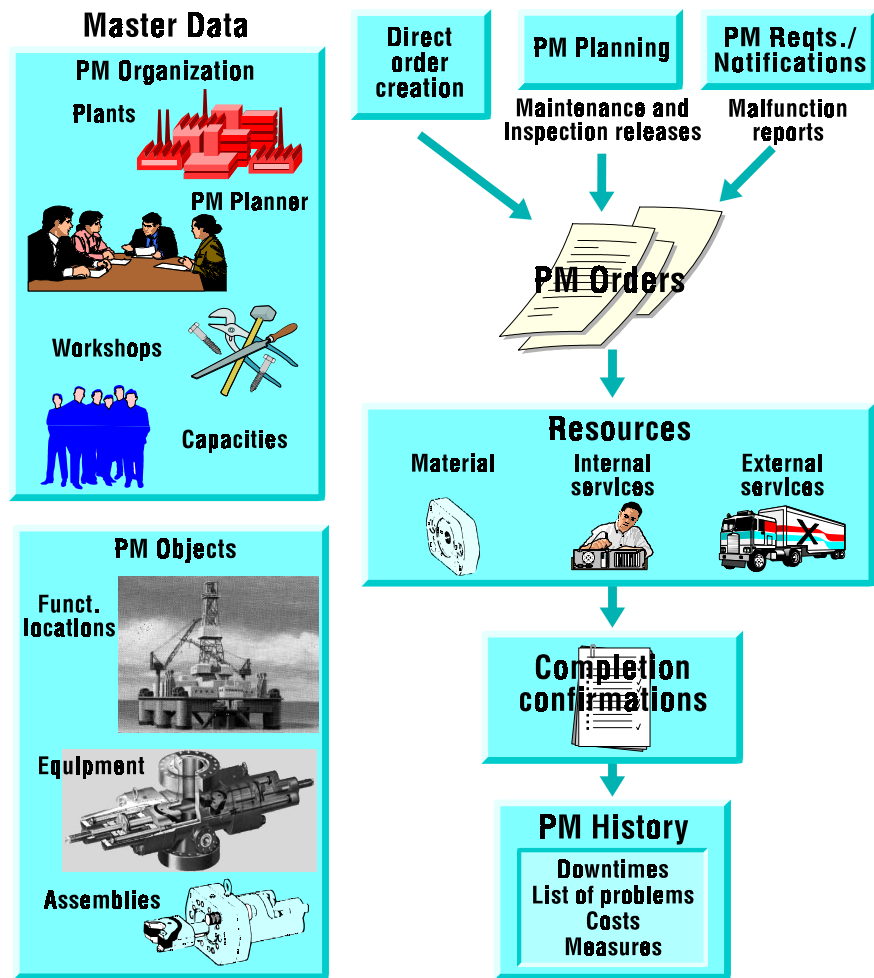


Figure 5-5: Functional Processes in the PM System

The individual steps are documented by means of the order status. In addition to the general status for order processing, further statuses are possible, which are either set automatically, when caused by exceptional circumstances (for example, holding up an order due to a wrong component), or manually (for example, interrupting an order due to changes in priority).

Order Status

The order statuses are controlled automatically, through processing steps: with the order release, for example, the status is set to "Released", or with printing, the status is set to "Printed". In addition to the internal system statuses, individual statuses can be defined using the customizing function.

The order status does not only describe the current condition of an order, it also controls which actions are allowed for or excluded from this particular order. For example, you cannot confirm the completion of an order that has only been created, and the printing process requires the release status.

PM Order Costs

The costs for an order are calculated at the planning stage. The order is charged with the actual costs through the completion confirmation of times, internal work shop activities or external services. All the costs are displayed by cost element and period and debited to the appropriate target account within order settlement.

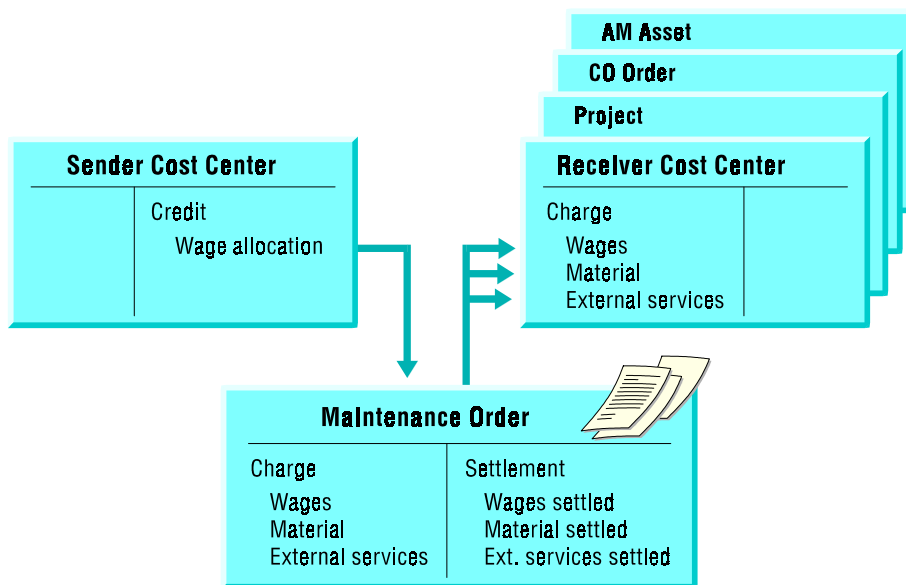


Figure 5-6: PM Order Settlement

External Processing of PM Orders

Both internal labor and external services can be planned in order processing. External services can either be contracted selectively for individual operations, or for a total order. In this case the external processing is carried out using purchase requisitions/activity releases.

The screenshot shows the SAP 'Change PM Order: External Processing Operation' dialog box. The window title is 'Change PM Order: External Processing Operation'. The menu bar includes 'Order', 'Edit', 'Goto', 'Operation', 'Details', 'Environment', 'System', and 'Help'. Below the menu bar is a toolbar with various icons. The main area is divided into several sections:

- Component allocation:** Internal processing, External processing (selected), Operation dates.
- Order:** 900014, Pump malfunctioning (no power) LT
- Operation:** 0050 Sub-operation
- Work ctr. / Plnt:** MECHMNT / 3000 Mechanical Work Center for Maintenance
- Control key:** PM02 Plant maintenance - external
- StdTextKey/ShrtText:** Safety check Long text
- Assembly:** (empty)
- System condition:** (empty)
- Status:** CRTD
- External processing:**
 - Operation quantity: 1,000 Un ACT
 - Price: 80,00 Currency USD per 1
 - Planned delivery: 3
 - Cost element: 415000
 - Material group: 011
- Procurement options:**
 - Purchasing group: 008 Vendor: 3940
 - Purchasing info rec. (empty) Purch. organization (empty)
 - Sort string (empty)

The status bar at the bottom right shows 'DCB (1) | hwrz03 | OVR 13:31'.

Figure 5-7: External Processing of Operations

Order Completion Confirmation

The order completion comprises completion confirmations of the execution times required, the allocation of material issued from stock and a confirmation of external deliveries and services.

Time Confirmations

The maintenance operations undertaken, which represent the capacity load of the maintenance work centers, are confirmed online as being completed. Completion confirmation can be carried out either as a partial completion confirmation or after completion of a task as a final confirmation. The com-

pletion confirmations result automatically in a change of status at order operation and order level. In addition to the completion confirmation of work times, separate status completion confirmations, such as "Work interrupted" or "Work recommenced" can also be entered.

The screenshot displays two SAP windows. The top window, titled 'Confirm Completion by Operation List: List of PM Order Operations', shows a table of operations:

Order	Op	WorkCntr	Plnt	Description
900014	0010	MECHMNT	3000	Analyze malfunction, poss. exchange pump
900014	0020	MECHMNT	3000	Test run at half power
900014	0030	MECHMNT	3000	Test run at full power
900014	0040	MECHMNT	3000	
900014	0050	MECHMNT	3000	Safety check

The bottom window, titled 'Confirm PM Order: Actual Data', shows the details for the selected operation:

Order: 900014 Pump malfunctioning (no power)
 Operation: 0010 Analyze malfunction, poss. exchange pump

System status: REL

Confirmation data:

Confirmation: 13873
 Work center: MECHMNT 3000 Mechanical Work Center for Maintenance
 Personnel no.:
 Actual work: 5 hrs Activity type: HST Posting date: 22.02.1995
 Final confirm. No remain. act. Forecast work

Work start: 22.02.1995 07:00:00
 Work end: 22.02.1995 13:33:54 Forecast end: 24:00:00

Confirm. text: Pump exchanged LongText

Total confirmation data:

Cum. actual work	0,000 H	ActualDuration	0,0
Work planned	0,0 H	PlannedDuration	0,0
Actual start	00:00:00	Actual end	00:00:00

DCB (1) hwrz03 OVR 13:40

Figure 5-8: Completion Confirmation of Actual Data

Reservations are automatically created for planned materials, which can be used to trigger the material issues. Unplanned material issues can also be posted to the order.

Purchase requisitions are automatically generated for both non-stock materials and activities to be assigned externally, which are converted via Purchasing into purchase orders. The purchase orders are settled directly to the maintenance order and result in the information in the order being completely updated upon goods receipt and invoice receipt.

Material Issues

External Deliveries and External Services

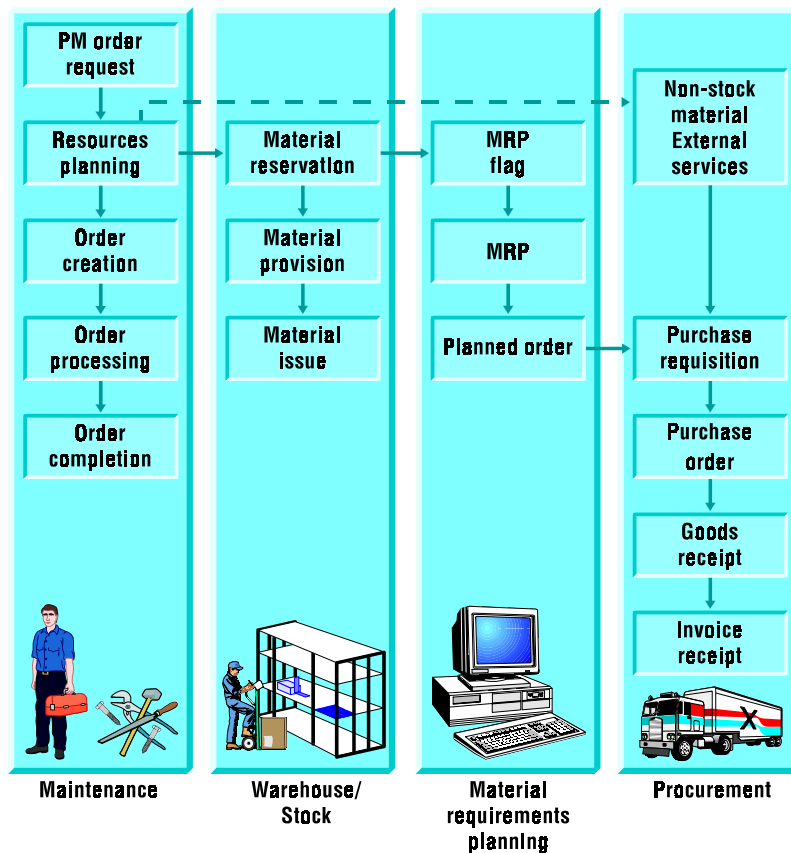


Figure 5-9: Plant Maintenance Integration

Technical Confirmations

You can create technical confirmations as well as completion confirmations for the resources used. If a maintenance order is already based on notifications, these are supplemented with completion confirmation data such as the type or cause of damage. Further maintenance notifications can also be created when confirming the completion of a maintenance order.

What are the performance features of order processing in the PM System ?

- PM orders created by scheduling maintenance plans, converting PM notifications or by direct creation
- Allocation of any number of functional locations, pieces of equipment and PM notifications to an order
- Case-specific order planning or support from task lists
- Automatic preliminary calculation
- Cost element-adjusted and period-adjusted update of actual costs
- Integration of material storage management and purchasing
- Graphic navigation in technical system structures for specification of technical objects and assemblies