Maintenance Planning

One of the main functions of maintenance is to ensure a high level of availability of the production systems in the long term. Preventive maintenance is the ideal way to avoid system breakdowns, which in addition to the basic repair costs often incur far higher subsequent costs as a result of the loss in production.

A further reason for preventive maintenance is the demand for quality assurance, since the quality of the products manufactured by a system is influenced by the condition in which the production system is maintained. **Quality Assurance**

In addition to these internal aspects there are also external influencing factors. An increase in the number of legal requirements has led to a greater need for monitoring and maintenance of technical systems. **Legal Requirements**

The PM System offers tools that are ideally suited for this purpose.

Work Scheduling

Maintenance task lists can be created to describe repetitive activities, in which the individual operations, times and resources required, for example work centers, production resources/tools or materials are defined.

Task lists can contain either periodic activities or activities which are used selectively, depending on the findings or the state of the operational system.

Maintenance Planning

The scheduling rules for regular activities are stored as maintenance strategies. These control the type and sequence of individual maintenance packages. **Strategies**

Maintenance items determine the objects, that is, functional locations, pieces of equipment, assemblies, at which activities are to be carried out. You can refer to previously created maintenance task lists when creating maintenance items. **Items**

Scheduling Maintenance plans combine information from strategies and maintenance items and trigger regular maintenance orders via their scheduling. A maintenance order is created for each maintenance item.
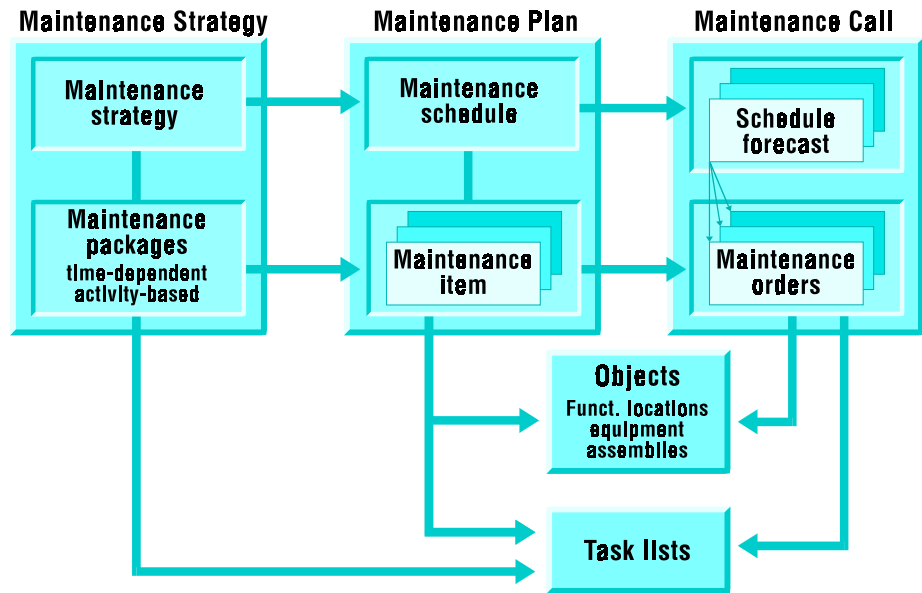

Figure 7-1: Elements in Maintenance Planning

Maintenance Task Lists

Maintenance task lists represent a series of individual operations and describe a task with the work centers, production resources/tools and materials required.
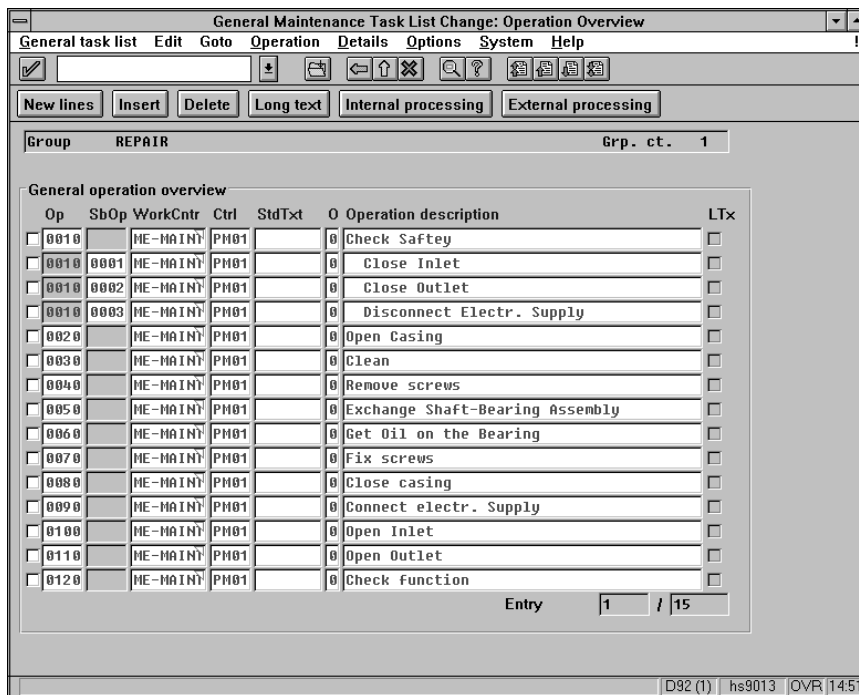

Figure 7-2: Task List Operation Overview

Task lists are used as a model and entry aid when processing maintenance orders and considerably reduce the amount of work preparation required. In many cases the manufacturers deliver task lists to accompany their systems, or the task lists are created by the company, depending on the level of experience within the company.

Using Task Lists

Types of Task Lists - Object Perspective

Task lists can be created as neutral general maintenance task lists. In this case, the task list can be used for general applications.

Assembly-specific task lists are associated with a maintenance assembly and are valid for all technical objects containing this type of assembly as a structural element.

Object-specific task lists (for example, ETA-M Pumps) are created with the material number in the maintenance assembly field. They are valid for all pieces of equipment and functional locations of this type.

Equipment-specific task lists are only valid for an individual piece of equipment.

Functional location-specific task lists (in preparation) are valid for individual functional locations. They contain the activities which are to be carried out at a functional unit of a technical system, irrespective of the piece of equipment installed there.

Types of Task Lists - Usage Perspective

Regular   Task lists for regular maintenance tasks are also equipped with the due intervals for the individual operations. This ensures that when maintenance plans are scheduled, only the operations assigned to the maintenance package that is due are copied to the maintenance order to be performed.

Prepared   Task lists for prepared repairs are used as required, depending on the inspection findings, as the basis for a maintenance order.

Task List Structure

Groups and Task lists   Similar task lists can be grouped in a task list group. A task list group can be created for any number of task lists, for example, for different maintenance strategies, or different types of damage.
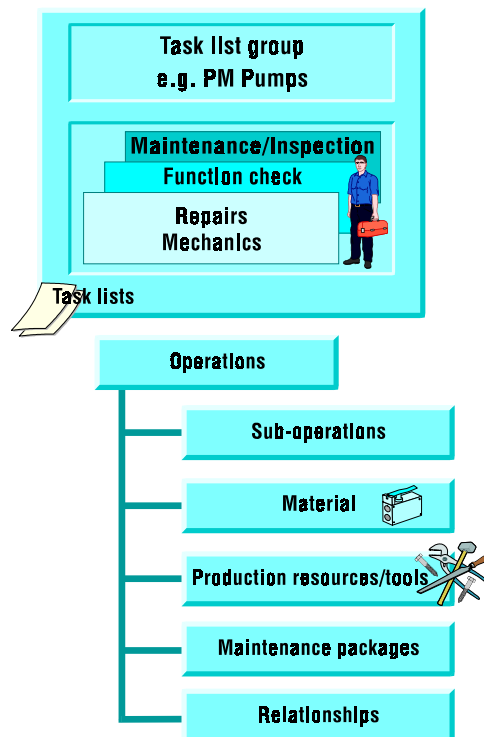
Figure 7-3: Task List Structure

Operations and Relationships

The individual task steps are represented as operations with times, work centers and control information. The dependencies between the individual operations is defined by the sequence of the operation numbers. A wide variety of temporal dependencies can be represented using relationships (planned).
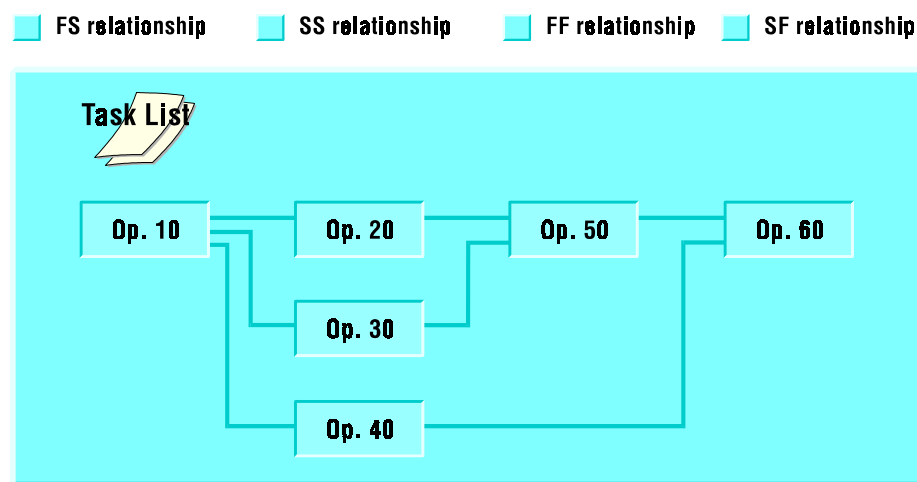
Figure 7-4: Operations and Relationships

Any number of sub-operations, materials, productions resources/tools can be allocated to an operation. Where-used lists are built up for the resources used in an operation, making it possible to trace where particular resources were implemented in task lists.

Maintenance Strategies

For the purpose of preventive maintenance, maintenance and inspection plans can be created for the technical objects in a company.
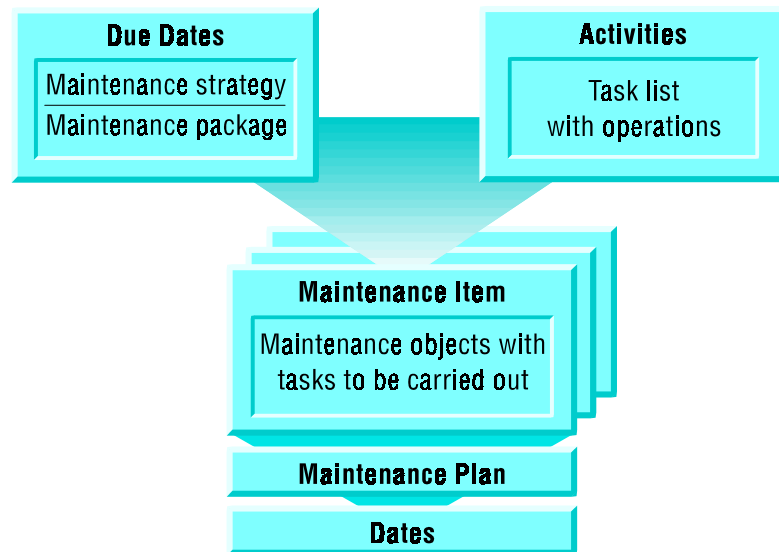

Figure 7-5: Link between Strategies, Task Lists and Maintenance Plans

Schedule Controlling   The scheduling of these maintenance and inspection plans is controlled using strategies. Whereas task lists describe the contents of the maintenance and inspection activities, the maintenance item allocates the activities to the technical objects. The maintenance items are then allocated to a maintenance schedule, which generates the due maintenance orders by means of scheduling. A maintenance order is generated for each maintenance item.

Maintenance Packages   A maintenance strategy represents the scheduling rules for regular maintenance tasks and describes the maintenance packages valid for a particular technical system or system category. The maintenance strategies are installed on a company-specific basis using the customizing function.

The type of scheduling used can be set using the scheduling rules:

❑   calendar scheduling

❑   factory calendar scheduling

❑   fixed (key date) scheduling on a monthly or yearly basis

❑   activity-based scheduling (in preparation)

The range of tasks due at the various dates are defined as maintenance pack-
ages. A maintenance package contains the following data:

❑   package number

❑   frequency of package

❑   unit of time or activity

❑   package hierarchy

❑   description

❑   package start offset

❑   float periods

The maintenance strategy STRATA contains the following maintenance   **Example**
packages:

```
┌─────────────────────────────────────────────────────────────────────────┐
│ ─     Display View "MaintPackages": Overview              ▼ ▲           │
│ Table view   Edit   Goto   Choose   Utilities   System   Help          ! │
│ ┌──┐ ┌──────────────────┐ ┌─┐ ┌──┐ ┌──┬─┬─┐ ┌──┬─┐ ┌──┬──┬──┬──┐        │
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│ │ Print StandList│ │ Select all │ │ Select block │ │ Deselect all │      │
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│ Strategy:    │A│    Scheduling by calendar                               │
│                                                                           │
│ ┌─MaintPackages─────────────────────────────────────────────────┐        │
│   Pk STx Package description        Hier HiStx                             │
│          Cycle length       Unit    LB   FB    Offset        OffStx        │
│  □│1│ │1M│ │monthly           │     │1│  │H1│                               │
│           │1                 │ │MO│ │2│  │2 │ │0            │  │  │         │
│                                                                           │
│                                                                           │
│  □│2│ │3M│ │3-monthly         │     │1│  │H1│                               │
│           │3                 │ │MO│ │5│  │5 │ │0            │  │  │         │
│                                                                           │
│                                                                           │
│  □│3│ │1Y│ │yearly            │     │2│  │H2│                               │
│           │12                │ │MO│ │10│ │10│ │0            │  │  │         │
│                                                                           │
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│                     ┌──────────────────┐                                  │
│                     │    Position...   │          Entry 1 of 3            │
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│                                                                           │
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└─────────────────────────────────────────────────────────────────────────┘
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Figure 7-6: Maintenance Packages

The task list to be performed for maintenance purposes contains the following operations with their corresponding allocations to the maintenance packages. This results in the following chronological distribution of maintenance work planning:
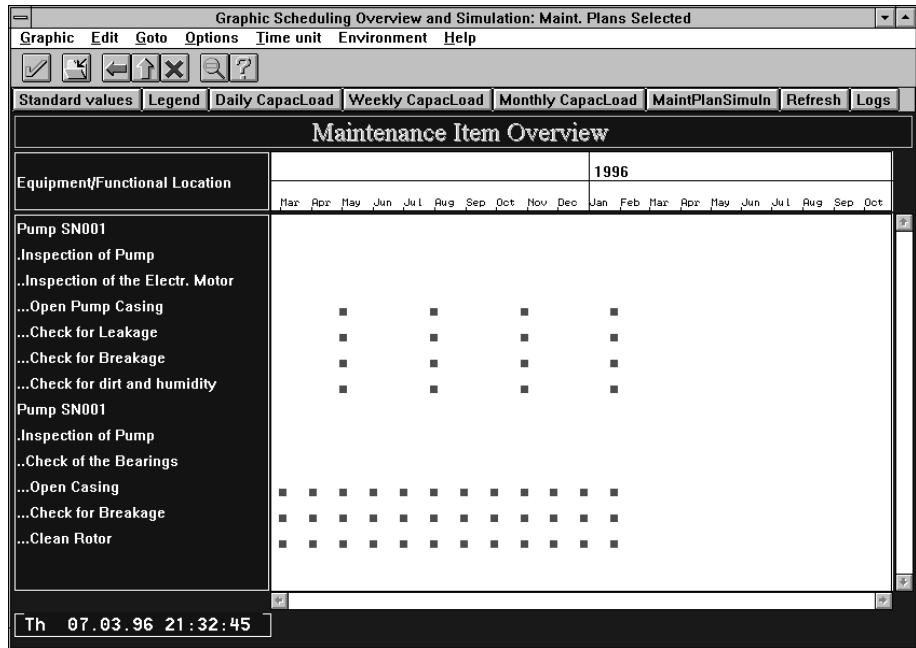

Figure 7-7: Task List and Scheduling Overview

Maintenance Items

A maintenance item describes the activities to be carried out on an object and their frequency. The objects can be specified in the form of an object list with an unlimited number of objects; the activities are described by general maintenance task lists or equipment-specific task lists included in the maintenance item.
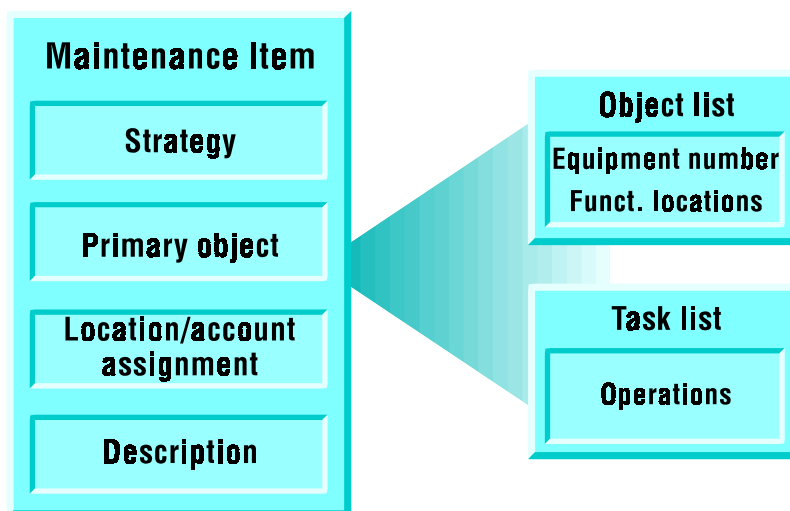
Figure 7-8: Contents of a Maintenance Item

General Data in a Maintenance Item

The maintenance item describes the type of maintenance or inspection activity to be carried out on a technical object, for example functional location or piece of equipment, using short and long texts. At the same time, it determines the account assignment data for settling the maintenance task.

Main Object and Object List

In addition to the main object entered in the maintenance item, you can combine any number of individual objects in a single maintenance item. This enables you, for example, to carry out central maintenance planning at a superior hierarchy level for all the elements at a lower level in the technical structure.

Example

A maintenance plan could be created for the mechanical purification system of a clarification plant, where the individual functional locations of the area, for example "Filter 1", "Filter 2", are listed as an appendix in the object list.

Figure 7-9: Maintenance Items

Task Lists   The maintenance or inspection operations can be described by reference to a task list. In addition to the allocation of the performing work center, further planning resources are specified, such as material or production resources/tools.

Maintenance Schedules and Scheduling

A maintenance schedule groups maintenance items together for joint scheduling. In addition to the strategy, it contains all the data required for scheduling the maintenance orders.

Start and Completion Dates for Maintenance Tasks

By entering a start date, the maintenance cycle is set in motion. The due maintenance dates and the pending tasks are determined on the basis of this date.
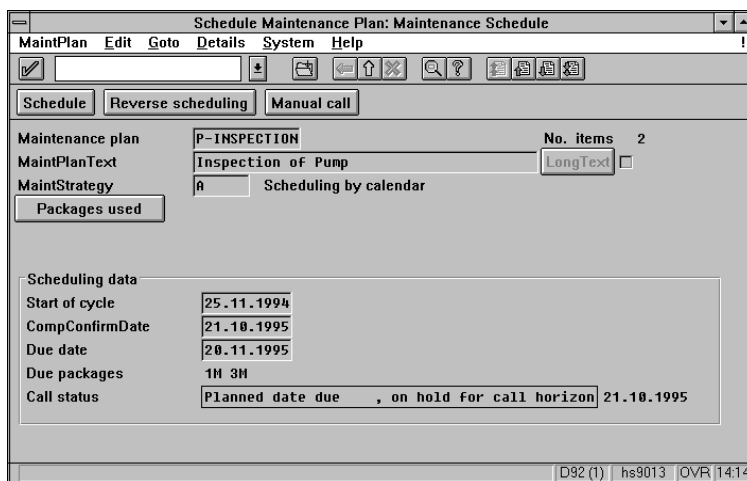

Figure 7-10: Maintenance Plan Dates

Using call intervals, you can freely define the time period for which you want to generate the maintenance schedules as orders, in other words the date up to which scheduling is to take place.
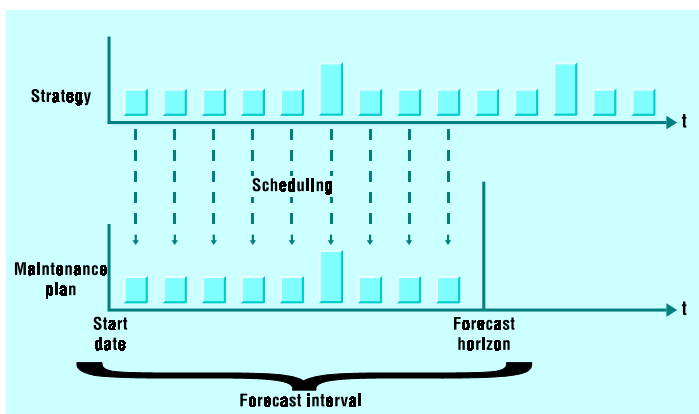
Call Intervals

Figure 7-11: Call Horizons and Scheduling

Scheduling Parameters   Using scheduling parameters such as cycle modification factors, shift factors, tolerances, lead or follow-up floats, the user can determine how a generally valid maintenance strategy is to be adapted for an individual case and how to react to deviations from the planned or actual situation if date variances occur.

Scheduling

Scheduling a maintenance plan can either be performed in accordance with the selected maintenance strategy, or using manual maintenance calls. This allows maintenance tasks outside the usual maintenance cycle to be inserted in special cases.

Automatic Scheduling   Based on the start or confirmation date, a maintenance plan is scheduled according to the strategy.

The planned dates calculated are shown in the maintenance schedule with the status 'released for call' or 'on hold' depending on the opening horizon.

Planned dates with the status 'released for call' are directly released as a maintenance order.

A date monitoring program ensures that the planned dates 'on hold' are released as soon as the opening horizon is reached.
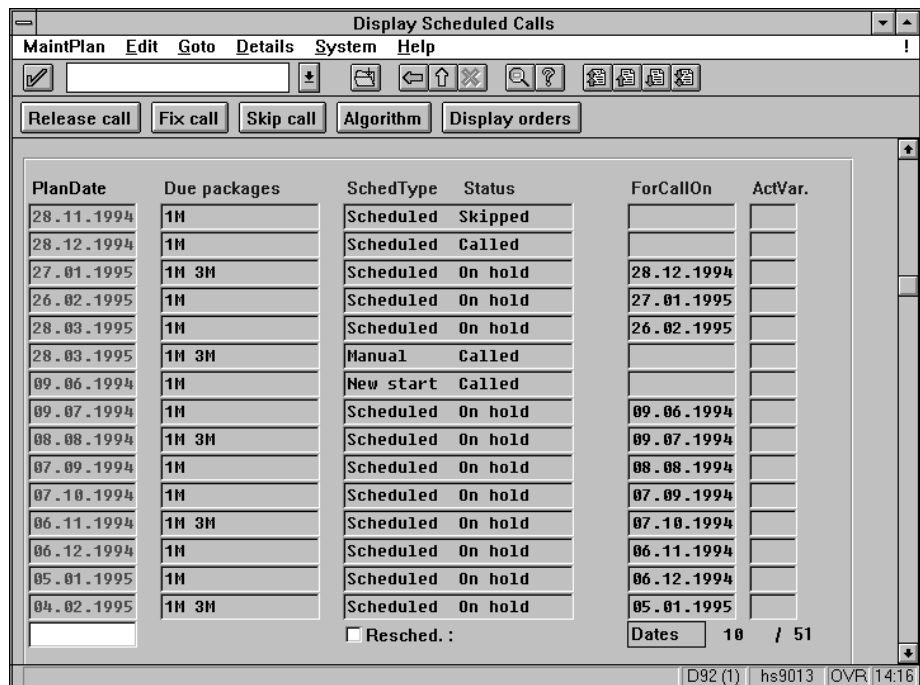

Figure 7-12: Scheduling a Maintenance Plan

You can fix planned dates to be performed on a particular date. Planned dates can also be skipped, if maintenance does not need to be performed at that time or if the maintenance work is superfluous because of another maintenance order that has been performed.

Influencing Planned Dates

Planned dates with the status 'on hold' can be released independently of the opening horizon, in other words they can be called as maintenance orders.

In addition to the normal maintenance cycle, any number of packages from the maintenance plan can be manually released. In this way, for example, you can release all the work in the three month package. These calls are also documented in the scheduling history.

Manual Maintenance Calls

You can schedule a maintenance plan for any period of time. All scheduled dates are documented in a scheduling history, which enables you to trace the dates at any time. Comprehensive documentation of the planning process is vital, particularly in the case of critical systems, for checking past maintenance dates in the case of unforeseen breakdowns or damage.

Scheduling Horizon

The scheduling history contains the actual dates of completion confirmation, as well as the planned dates, so that any deviations between the planned and the actual dates on which the work was carried out can be displayed in a scheduling Planned/Actual comparison. The extent to which deviations between planned and actual dates are to be taken into consideration for re-scheduling is determined using the scheduling parameters in the maintenance plan.

Scheduling History

Regular Maintenance Orders

On the basis of maintenance scheduling, the maintenance orders are created automatically for all the maintenance items involved when a maintenance package is due. By means of continuous planning, for example, the orders for the next periods can be called, so that a corresponding supply of orders is always available.

Automatic Control by Date and Scope

The maintenance orders contain only the operations of the maintenance items contained in the maintenance package that has been released.

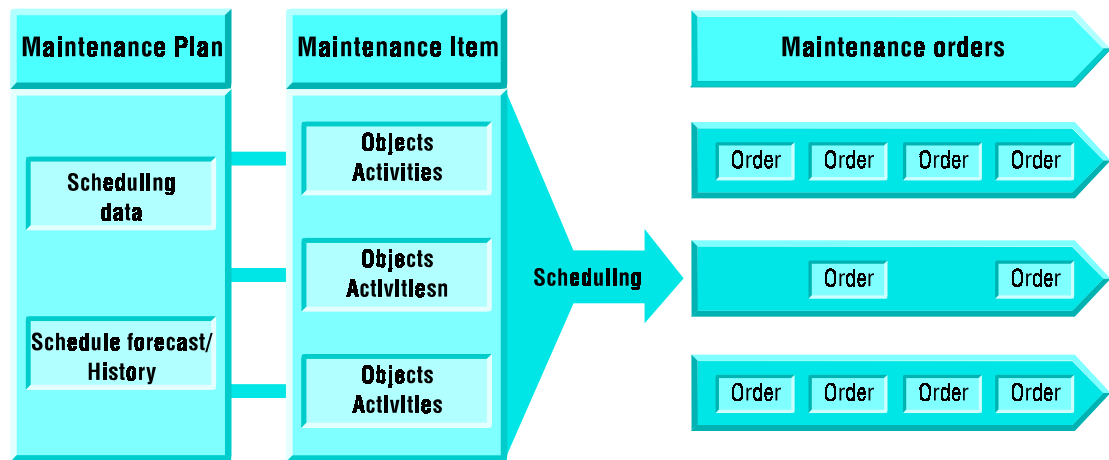Scheduling therefore automatically determines both the date and the scope of the maintenance work required.

Figure 7-13: Scheduled Maintenance Orders

What are the features of maintenance planning in the PM System?

❑   Task lists and maintenance plans, which form the basis for efficient maintenance preparation and planning

❑   Individual maintenance task lists and general task lists

❑   Function-based and object-based task lists

❑   Automatic order creation through maintenance scheduling

❑   Control of due dates, scope of tasks and resources required