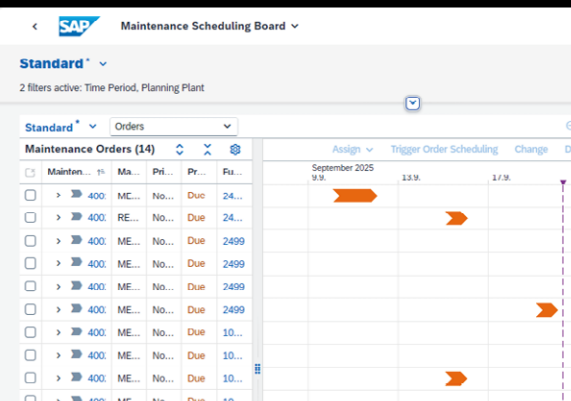




asset management  
work orders, re  
preventive main  
phase model, no  
checklists, str



SAP Maintenance Scheduling Board

Standard

2 filters active: Time Period, Planning Plant

Standard Orders

Maintenance Orders (14)

Mainten...	Ma...	Pri...	Pr...	Fix...	September 2025	13.9.	17.9.
>	400	ME...	No...	Due 24...		➔	
>	400	RE...	No...	Due 24...			➔
>	400	ME...	No...	Due 2499			
>	400	ME...	No...	Due 2499			
>	400	ME...	No...	Due 2499			
>	400	ME...	No...	Due 2499			➔
>	400	ME...	No...	Due 10...			
>	400	ME...	No...	Due 10...			
>	400	ME...	No...	Due 10...			➔
>	400	ME...	No...	Due 10...			



# Plant Maintenance with SAP®

## Business User Guide

- Run preventive maintenance, repairs, refurbishment, and more in SAP S/4HANA
- Explore AI capabilities and the latest SAP innovations for asset management
- Apply experts' real-world tips to improve usability

2nd edition, updated and expanded

Karl Liebstückel  
Markus Seidl

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# Chapter 5

## Preventive Maintenance

*This chapter presents the preventive plant maintenance options that SAP S/4HANA offers. You'll learn about different kinds of task lists. You'll also see various configuration levels of maintenance plans, from simple time-based single-cycle plans to time- or performance-based strategy plans and condition-based maintenance.*

The business process for preventive maintenance is characterized by the ability to plan required resources (work centers, materials, external companies, and so on) in advance, both in terms of content and scheduling. This type of business process is associated with the following example scenarios:

- A pump undergoes a visual and functional inspection every 6 months, and the mechanical seal is changed every twelve months.
- On a forklift truck, the hydraulic oil must be changed every 1,000 operation hours (OPH) and the brake fluid every 2,000 OPH.
- The fire extinguisher in a building is refilled every 2 years.
- Test equipment is recalibrated every 120 days.

The preventive maintenance process therefore differs from the work order cycle (Chapter 4) in terms of its ability to be scheduled. This is because only the scope of a planned repair can be defined in advance, not the date on which it will occur.

Preventive maintenance differs from an immediate repair (see Chapter 6, Section 6.1) because it can be planned in advance in terms of both scope and scheduling. An immediate repair, by contrast, is triggered by a malfunctions and cannot be planned in advance.

This chapter begins with a discussion of the basic principles of preventive maintenance and the SAP objects it relies on. Then it will cover the major aspects of preventive maintenance: task lists, time- and performance-based maintenance plans, multiple-counter plans, inspections rounds, and condition-based maintenance.

### 5.1 Basic Principles of Preventive Maintenance

Preventive maintenance always involves effort, both in its planning and execution. Nevertheless, there are many reasons why you must or should perform preventive maintenance in your company, including the following:

- **Legal requirements**

Legislation on plant safety or industrial health and safety may require you to inspect or maintain your technical system regularly.

- **Quality assurance**

The quality of a product depends largely on the condition of the production facility in which it is manufactured.

- **Fewer malfunctions**

One of the most important tasks in maintenance planning is to keep a production facility continuously available over the long term. Effective preventive maintenance helps ensure that a technical system does not fail and reduces unnecessary costs arising from repairs, system replacements, or production downtimes.

- **Environmental protection requirements**

Effective preventive maintenance can help prevent system breakdowns that lead to environmental impacts.

- **Manufacturer recommendations**

Your technical system's manufacturer may recommend certain procedures to ensure that the system always runs optimally.

- **Improved capacity utilization**

Preventive maintenance provides a work list that helps you use your workshops more consistently, for example, because you have fewer breakdown-related repair tasks to handle.

- **Lower maintenance costs**

Whether preventative maintenance can decrease your maintenance costs is debatable and depends largely on whether you've already reached the optimum intensity of preventive maintenance.

Preventive maintenance and repair costs are inversely proportional and depend on the intensity of preventive maintenance (see Figure 5.1), as follows:

- The higher the intensity level of preventive maintenance, the higher the preventive maintenance costs.
- The higher the intensity level of preventive maintenance, the lower the costs for repairs.

At the optimum intensity level,  $W_0$ , the overall costs of plant maintenance are minimal. Follow-up costs that may arise from inadequate preventive maintenance (for example, re-starting costs) are not included in this cost consideration, since they are considered opportunity costs only.

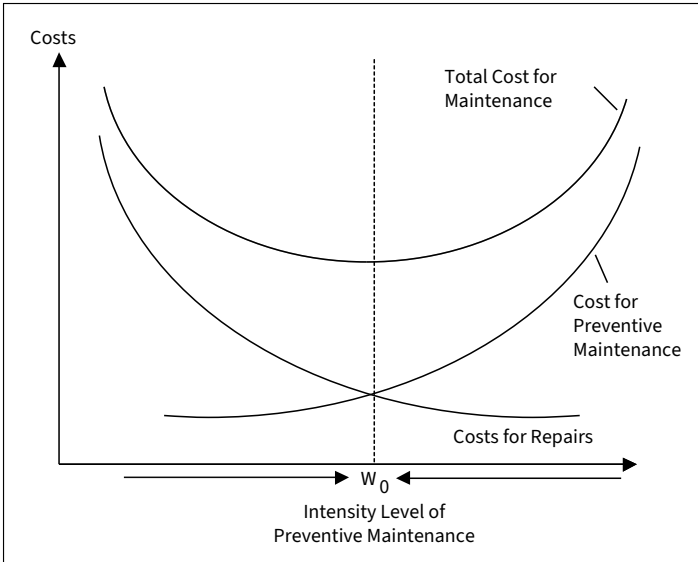


Figure 5.1: Plant Maintenance Costs

There are three different types of preventive maintenance (see Figure 5.2), as follows:

- **Time-based maintenance**

The preventive maintenance task is triggered after a certain period of time has expired (for example, every six months).

- **Performance-based maintenance**

The preventive maintenance task is triggered when a certain performance threshold is reached (for example, every 10,000 miles).

- **Condition-based maintenance**

The preventive maintenance task is triggered when a certain diagnostic value has not been reached or has been exceeded (for example, a pressure lower than 15 bar or temperature higher than 85°C).

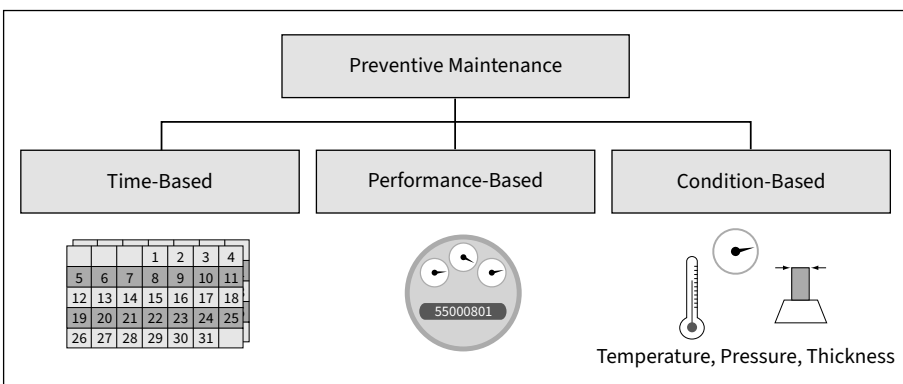


Figure 5.2: Types of Preventive Maintenance

## 5.2 Preventive Maintenance Objects

Preventive maintenance business processes in SAP S/4HANA Asset Management involve several objects, whose significance and interrelationships are outlined in the following list (see Figure 5.3):

### ■ Maintenance strategy

A maintenance strategy contains the chronological sequence of maintenance activities (for example, maintenance packages every three, 6, 12, or 24 months for time-based maintenance or every 1,000, 2,000, or 5,000 OPH for performance-based maintenance). It doesn't provide any details about the activity, object, or date and is only required for strategy-based maintenance plans (Section 5.4.2 and Section 5.5.2).

### ■ Maintenance task list

A maintenance task list describes activities (operations) to be performed and includes the required materials and deadlines (maintenance packages). Object-specific maintenance task lists consist of an equipment plan or a functional location plan, while neutral maintenance task lists contain instructions. Strategy-based maintenance plans must include a task list; in all other plans, a task list is optional.

### ■ Maintenance item

A maintenance item describes the activities to be performed, contains the reference object (or the object list), and has organizational data relevant for subsequent processing.

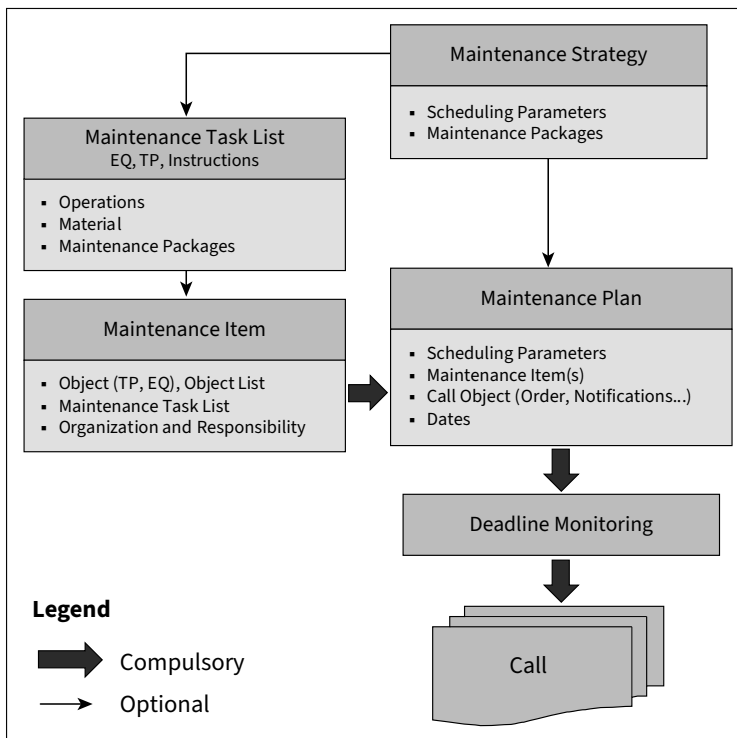


Figure 5.3: Objects of Preventive Maintenance

- **Maintenance plan**

A maintenance plan contains one or more maintenance items and determines the maintenance dates as well as the maintenance call object (order, notification, and so on).

- **Deadline monitoring**

Deadline monitoring (program RISTRA20H in SAP S/4HANA) runs automatically as a batch job and ensures that the maintenance call objects (for example, the orders) are automatically generated on the due date.

### **Preventive Maintenance in the Second Step of the Implementation**



When reimplementing SAP S/4HANA Asset Management, you should carefully consider whether you truly must include preventive maintenance in the initial phase. Preventive maintenance relies on various specialized functions and requires a high level of user acceptance.

SAP S/4HANA Asset Management provides you with maintenance plans that support preventive maintenance business processes. You can select from the following types of maintenance plans (see Figure 5.4):

- **Single-cycle plans**

You create single-cycle plans when you perform the same maintenance activities in full at regular intervals (time-based or performance-based). In this case, you can optionally include a task list.

- **Maintenance strategies and strategy plans**

You create maintenance strategies and strategy plans when you have to perform maintenance activities that are based on each other or supersede each other, either as a time-based strategy (for example, every 3, 6, or 12 months) or as a performance-based strategy (for example, every 10,000, 20,000, or 40,000 miles). In this case, you must include a maintenance task list, specifically, one with the same strategy as the maintenance plan.

- **Multiple-counter plans**

You create multiple-counter plans when determining the maintenance date depends on several influencing factors (for example, every 6 months, every 10,000 miles, or every 1,000 OPH). You can also optionally include a task list. Simple multiple-counter plans contain only one cycle (1,000 OPH or 1 year); use an extended multiple-counter plan if you have successive cycles (first cycle: every 2,000 OPH or 1 year; second cycle: every 4,000 OPH or 2 years).

- **Inspection rounds**

For inspection rounds, you do not process a single object as you do with other maintenance plan types. Instead, you move through several objects and either perform the same activities (simple inspection rounds) or different activities (extended inspection rounds).

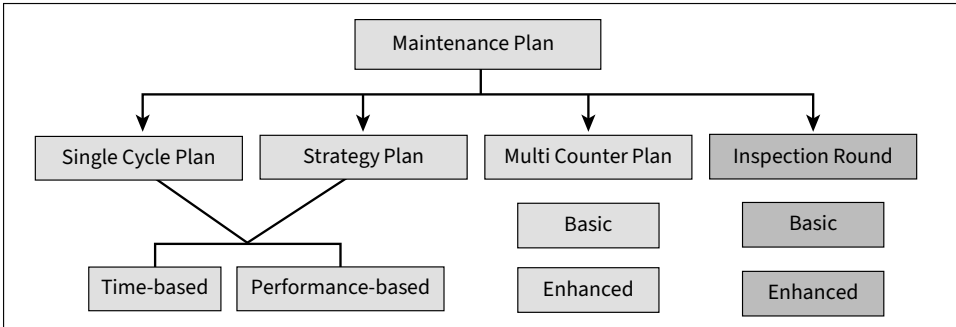


Figure 5.4: Maintenance Plan Types

You can use the Customizing function **Set Maintenance Plan Categories** to define which of the following maintenance call objects should be generated from the maintenance plan when due (see Figure 5.5):

- Select **Order** as the maintenance call object if you want to perform the maintenance plan exactly as specified, without additional planning.
- Select **Notification** as the maintenance call object if you want to perform additional detailed planning when the call is due, for example, if you want to combine several notifications into a single order based on the current capacity load utilization. In this case, several maintenance task lists are copied into the respective order as a single operation list.
- Select **Inspection Lot** as the maintenance call object if you want to perform a calibration inspection of test equipment. (For more information, refer to Chapter 6, Section 6.6.)
- Select the inspection lot as the call object when you want to initiate checklist processing. (For details, see Chapter 6, Section 6.10.)
- Select **Service Entry Sheet** as the maintenance call object if you have an outline agreement for regular services with an external company and want the system to automatically generate the service entry sheets required for acceptance at regular intervals.

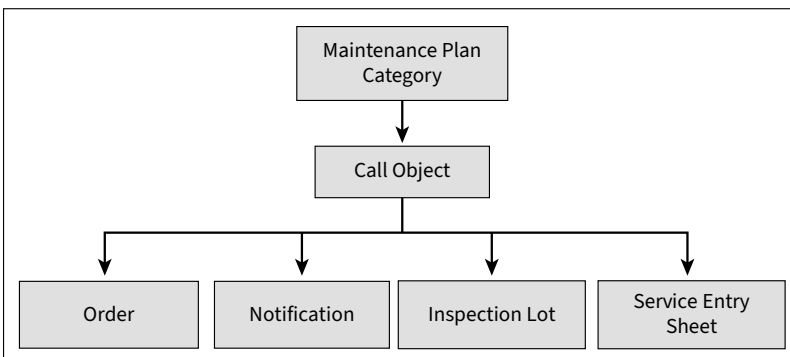


Figure 5.5: Maintenance Plan Categories and Call Object

Since the order maintenance call object represents the standard scenario in preventive maintenance, this chapter focuses primarily on this option while referring to other maintenance call objects where appropriate.

### 5.3 Maintenance Task Lists

A maintenance task list describes activities (operations) to be performed and contains a list of required materials during activity processing.

Maintenance task lists are used not only in plant maintenance but also in the following areas in the SAP system:

- In discrete manufacturing as routings or reference operation sets
- In process manufacturing as a planning recipe
- In project processing as a standard network
- In quality management as an inspection plan

In plant maintenance, maintenance task lists are primarily used for the following purposes:

- **Preventive maintenance**

In preventive maintenance, maintenance task lists are widely used to map maintenance and inspection tasks, inspections, legal obligations, and so on.

- **Checklists and calibrations**

If you want to initiate checklist processing or a calibration, the task list operations and their inspection characteristics form the basis for the calibration and reflect the content of the checklist. (For more details, see Chapter 6, Section 6.6 and Section 6.10.)

- **Repairs**

You can also use maintenance task lists in plant maintenance by predefining standard workflows for repair tasks or by defining a complete list of all possible maintenance tasks and then deciding, as the need arises, which of those tasks actually need to be performed.

The following sections provide you with an overview of maintenance task lists before diving into the specifics of order and task lists, the action log, task list costing, and mass changes.

#### 5.3.1 Task List Types

There are three distinct types of maintenance task lists:

- **Maintenance task lists for equipment**

You create an equipment maintenance task list for exactly one piece of equipment (Transaction IA01 [Create Equipment Task List]) when you want to map equipment-specific tasks. However, you can only use this task list with that single piece of equipment.

### ■ Maintenance task lists for functional locations

You create a functional location task list for exactly one functional location (Transaction IA11 [Create Functional Location Task List]) when you want to map tasks specific to that location. It is then available exclusively for that functional location.

### ■ General maintenance task lists

A general maintenance task list (Transaction IA05 [Create General Task List]) is not object specific and, as a result, is not assigned to any particular piece of equipment or functional location. However, you can indirectly make a general maintenance task list available for several pieces of equipment and/or functional locations. Use the **ConstType** field in the master record for the piece of equipment or functional location in the **Structuring** screen group. As shown in Figure 5.6, all equipment and functional locations for which a material number is entered in the **ConstType** field ❶ can access general maintenance task lists in which the same material number is entered in the **Assembly** field ❷ in the task list header.

The screenshot displays two SAP screens. The top screen, 'Structuring', has tabs for General, Location, Organization, Structure, and Warranty. The 'Structure' tab is active, showing fields for Functional loc. (ICD-TA-T1), Description (Tank 1), Superord. Equip., Position, TechIdentNo., and ConstType (IPMP1000). The bottom screen, 'Assignments to Header', shows fields for Work center (MANT1000 / DL00 Maintenance), Usage (4 Plant maintenance), Planner Group (D02 Mr. Sanchez), Overall Status (4 Released (general)), System Condition, Maintenance Strategy, Assembly (IPMP1000), Ref. Element PM/PS (WRKCTR), and a Deletion Flag checkbox. Red boxes and numbers 1 and 2 highlight the ConstType field in the Structuring screen and the Assembly field in the Assignments to Header screen.

Figure 5.6: Technical Object and General Task List



### Use General Maintenance Task Lists to Simplify Implementation

If you use maintenance task lists in plant maintenance, keep the following in mind:

- Equipment and functional locations may have their own individual maintenance task lists or may indirectly access general maintenance task lists.
- Create general maintenance task lists whenever possible to save time entering and maintaining data.
- Create maintenance task lists for equipment or functional locations only when you want to map tasks that apply exclusively to that object.

The numbers for equipment task lists and functional location task lists are assigned interally. When an equipment task list or a functional location task list is created, the system

displays the number under which it saved the task list. The first task list you create for a specific piece of equipment or functional location is identified by a task list group number and a group counter. Subsequent task lists for the same object are identified only by the sequential group counter within that group.

The numbers for general maintenance task lists can be assigned internally or externally.

**Use Meaningful Numbers for General Maintenance Task Lists** [+]

When you create general maintenance task lists, you can use the task list number to indicate the objects for which the individual general maintenance task lists are suitable (for example, B. PUMP\_MAN, FORK\_MAN, MOT\_REP). Using meaningful numbers will make selection easier later.

A task list is comprised of the following elements (see Figure 5.7):

- **Header data**  
Header data is information used to identify and manage the maintenance task list. This data is valid for the entire maintenance task list, including the number, group counter, plant, and main work center.
- **Operations**  
You can use operations to describe the work that you want to be performed when the maintenance task list is executed.
- **Material list**  
The material list contains the spare parts required and consumed when the task list is executed.

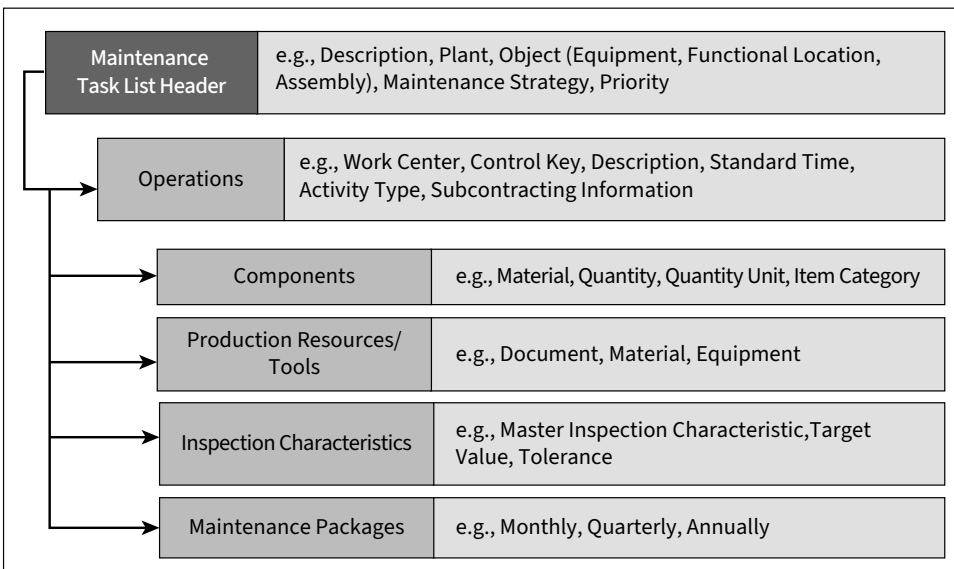


Figure 5.7: Task List: Structure and Content

- **Production resources/tools (PRTs)**

PRTs (for example, tools, protective clothing, and hand pallet trucks) are also required when the task list is executed. However, unlike a material, they are not consumed.

- **Inspection characteristics**

If an operation includes inspections (for example, inspections of length, weight, or function), you can define them as inspection characteristics. These elements are especially important for performing calibrations and processing checklists.

- **Maintenance packages**

If the task list is used in a strategy maintenance plan, you use maintenance packages to control how often the maintenance work is performed, either on a time-dependent basis (for example, once every 3 months) or on a performance-dependent basis (for example, once every 1,200 OPH).

Figure 5.8 shows an example of an operations list in a maintenance task list.

Act.	SOp	Work Ctr	Plnt	Ctrl	Operation Description	IT	VI	Work	Un.	No.	Duration	Un.	C	Pct	Int. distr	Fac	ActType	StText
<input type="checkbox"/>	0010	MANT1000	DL00	PM01	Switch off and carry out safety check	<input type="checkbox"/>	<input type="checkbox"/>	1	H	1	1	H	1	100		1	MLABOR	
<input type="checkbox"/>	0020	MANT1000	DL00	PM01	Visual inspection outside: leaks, rust	<input type="checkbox"/>	<input type="checkbox"/>	0.5	H	1	0.5	H	1	100		1	MLABOR	
<input type="checkbox"/>	0030	MANT1000	DL00	PM01	Visual inspection inside: moisture, rust	<input type="checkbox"/>	<input type="checkbox"/>	1	H	1	1	H	1	100		1	MLABOR	
<input type="checkbox"/>	0040	MANT1000	DL00	PM01	Remove the pump impeller and clean it	<input type="checkbox"/>	<input type="checkbox"/>	2	H	1	2	H	1	100		1	MLABOR	
<input type="checkbox"/>	0050	MANT1000	DL00	PM01	Measurement: Bearing play	<input type="checkbox"/>	<input type="checkbox"/>	0.5	H	1	0.5	H	1	100		1	MLABOR	
<input type="checkbox"/>	0060	MANT1000	DI00	PM01	Replacement: Sealing rings for gearbox	<input type="checkbox"/>	<input type="checkbox"/>	1	H	1	1	H	1	100		1	MLABOR	
<input type="checkbox"/>	0070	MANT1000	DL00	PM01	Safety check and pump in operation	<input type="checkbox"/>	<input type="checkbox"/>	1	H	1	1	H	1	100		1	MLABOR	
<input type="checkbox"/>	0080	MANT1000	DL00	PM02	external technical acceptance	<input type="checkbox"/>	<input type="checkbox"/>								1	MLABOR		
<input type="checkbox"/>	0090	MANT1000	DL00	PM01		<input type="checkbox"/>	<input type="checkbox"/>											

Figure 5.8: Task List: Operation Overview

You can assign components to a maintenance task list in one of the following ways:

- You assign material components from the bill of materials (BOM) of the maintenance object (equipment, functional location, or header assembly) that is assigned to the maintenance task list; in this case, the BOM matches the content of the structure list exactly.
- Alternatively, you assign stock materials that are not in the BOM of the maintenance object to the maintenance task list directly. This method is referred to as *free material assignment*. In this case, the materials are assigned by their material numbers. As a prerequisite for using free material assignment, you must specify a BOM usage (usually **Plant Maintenance Usage**) in Customizing. In this case, use the Customizing function **Define Default Setting for Free Material Assignment**. The SAP system creates an internal BOM in the case of a free assignment. This BOM cannot be edited by the application.

- A long-awaited innovation was introduced with business function LOG\_EAM\_CI\_22: It is now possible to assign non-stock materials directly to a task list operation, including all relevant purchasing information such as price and supplier (see Figure 5.9).

Group PUMP\_WTG Periodic maintenance pump Etanorm GrpCounter 6

Activity 0070 Safety check and pump in operation

Component Selection Catalog

Component Assignments

Material	Quantity	Un	B	Component Description	I	PGp	Purch.Org.	Price	Crcy	PUn	Cost elem.	Mat. Group	Supplier
<input type="checkbox"/> HOUS1000	1.000	PC	<input type="checkbox"/>	Housing pump normal self-priming	L			0.00		0		RAW	
<input type="checkbox"/> DRCK1000	1.000	PC	<input type="checkbox"/>	Pressure cover pump housing	L			0.00		0		RAW	
<input type="checkbox"/> FLAT1000	6.000	EA	<input type="checkbox"/>	Flat seal 300/275	L			0.00		0		SPARE	
<input type="checkbox"/>	10.000	LB	<input type="checkbox"/>	Special adhesive	N	N00	US00	10.00	USD	1		SPARE	102006
<input type="checkbox"/>			<input type="checkbox"/>										
<input type="checkbox"/>			<input type="checkbox"/>										

Figure 5.9: Task List: Stock and Non-Stock Material

### 5.3.2 Maintenance Order and Task List

We will discuss the most common application of maintenance task lists—the use of task lists and maintenance plans in preventive maintenance—later in this chapter. However, you can also use maintenance task lists for maintenance tasks by assigning a task list directly to a maintenance order. The following options are available in SAP GUI (Transaction IW31/32 [Create/Change Order], menu option **Extras • Task List Selection**):

- **Direct entry**  
If you know the task list group and group counter, you can use direct entry to select the maintenance task list.
- **General maintenance task lists**  
When using this selection procedure, you can select general maintenance task lists from a list. The selection criteria **Task list type (A)**, **Plant**, and **Status** (released for order) are set by default. Individual criteria can still be added.
- **For object structure**  
This option displays all maintenance task lists that were created for the objects that, in turn, are sub-objects of the reference object.
- **For assembly**  
This selection procedure selects all maintenance task lists that were created for the object entered in the **Assembly** field.
- **For reference object**  
This selection procedure is the simplest because it allows you to select maintenance task lists based on the reference object. If a piece of equipment with a construction type is specified as the reference object, all equipment task lists for that piece of equipment are

displayed, as well as all general maintenance task lists whose assembly in the task list header matches the piece of equipment’s construction type. The same applies to functional locations.

How the system responds when you select a maintenance task list depends on the personal settings you defined under **Extras • Settings • Default Values** (see Figure 5.10).

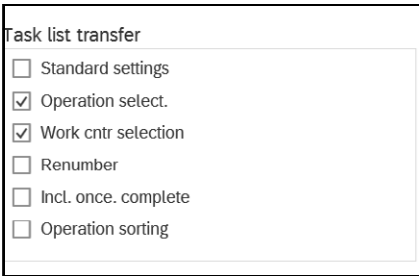


Figure 5.10: Maintenance Order: Task List Settings

If you check the **Operation select.** checkbox, when the maintenance task list is transferred, a dialog box appears in which you can select specific operations. Selecting operations is useful, for example, if you don’t need all the operations in a maintenance task list for a specific scenario (see Figure 5.11). Additionally, this checkbox allows you to execute operations multiple times in the dialog box (the **Fct** [factor] field), which may be necessary if, for example, you added an object list to the relevant order.

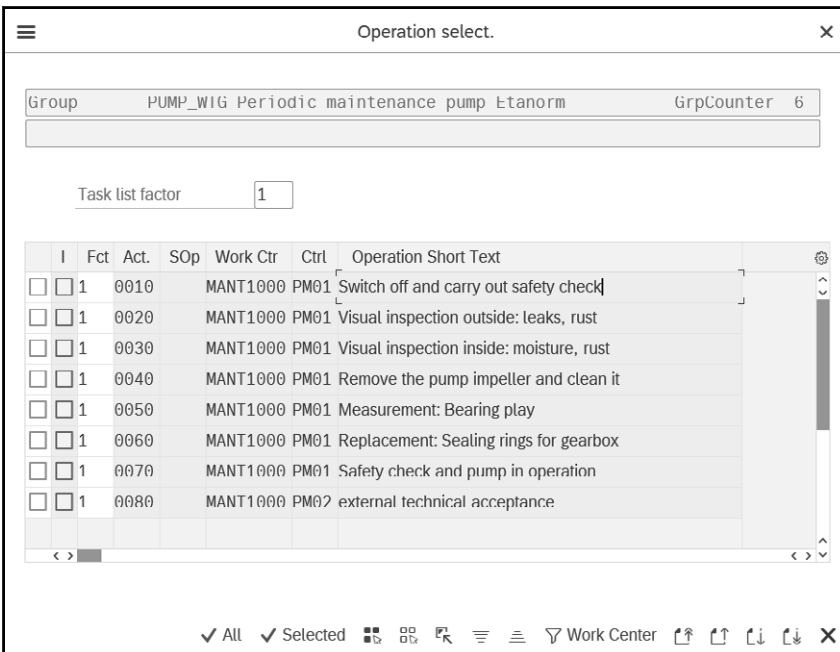


Figure 5.11: Maintenance Order: Select Operations



### Activating Operation Select.

If you check the **Operation select.** checkbox in your personal settings, you not only have the option of selecting specific operations when a maintenance task list is transferred into an order; you can also execute individual operations multiple times using the execution factor (for example, if an object list exists).

If you check the **Work cntr selection** checkbox, you can replace the work centers from the maintenance task list with other work centers in the order (see Figure 5.12). You may need to choose work centers, for example, if the ones you originally planned to use are already utilized to their maximum capacities.

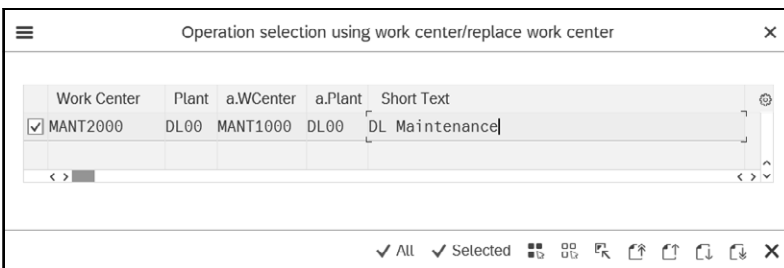


Figure 5.12: Maintenance Order: Select and Replace Work Center

When using the Web Dynpro apps Create Maintenance Order or Change Maintenance Order, similar functionalities are available. On the **Operation Data** tab, the **Assign Task List** button allows you to assign a maintenance task list (e.g., general task list) to the maintenance order (see Figure 5.13).

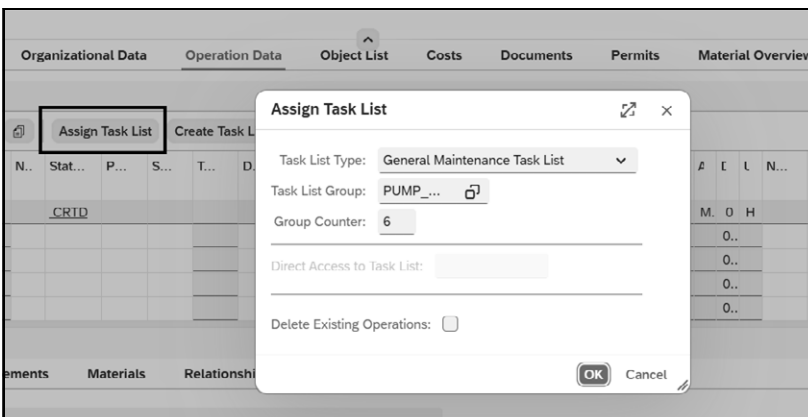


Figure 5.13: Create Maintenance Order: Assign Task List

When using the Web Dynpro app Create Maintenance Order or Change Maintenance Order, you gain access to a feature that is not available in the same form in the corresponding SAP GUI transaction. If an operation list has been created within the maintenance order (e.g., to

perform a repair), a new task list can be generated directly from this operation list using the **Create Task List** button (see Figure 5.14).

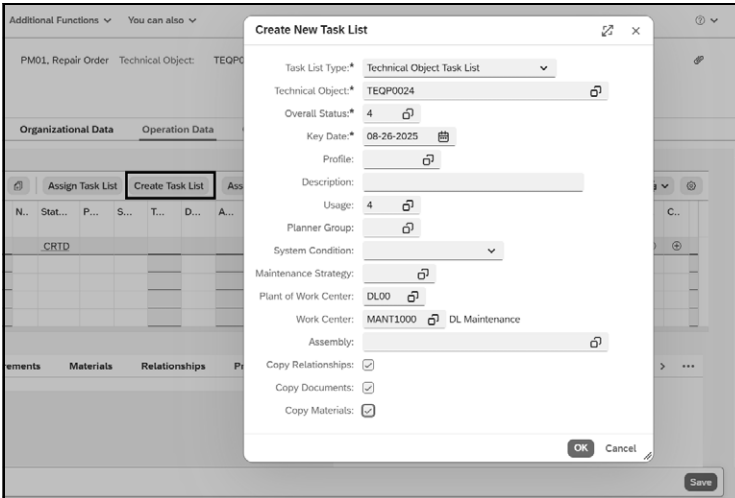


Figure 5.14: Create Maintenance Order: Create New Task List

### 5.3.3 Action Log

Change documentation can now be used for maintenance task lists. Select **Extras • Action Log** in a maintenance task list to display the changes (see Figure 5.15) or start Transaction IA21 (Display Task List Change Documents), where you can display the changes across several maintenance task lists.

Action Log									
TL Type A									
TL Group PUMP_WTG									
.....									
Chngd	Changed at	GrC	Change to	Number	Operation Short Text	Change Type	By	Long Field Label	Old ...
08-23-20...	07:11:21	6	Header		Periodic maintenance pump Etanorm	Added	KARL		
			Operat.	0010	Switch off and carry out safety check	Added	KARL		
				0020	Visual inspection outside: leaks, rust	Added	KAHL		
				0030	Visual inspection inside: moisture, rust	Added	KAHL		
				0040	Remove the pump impeller and clean it	Added	KARL		
				0050	Measurement: Bearing play	Added	KARL		
				0060	Replacement: Sealing rings for gearbox	Added	KARL		
				0070	Safety check and pump in operation	Added	KARL		
				0080	external technical acceptance	Added	KARL		
08-26-20...	11:26:02	6	Material Component			Added	KARL		
				DRCK1000	Pressure cover pump housing	Added	KARL		
				FLAT1000	Flat seal 300/275	Added	KARL		
				HOUS1000	Housing pump normal self-priming	Added	KARL		
	11:42:57	6	Operat.	0080	external technical acceptance	Changed	KARL	Purchasing Organization	
						Changed	KARL	Account Number of Supplier	116...
	16:28:10	6	Maintenance Packages	12	annually	Added	KARL		
						Added	KARL		

Figure 5.15: Task List: Action Log

The business function LOG\_EAM\_CI\_3 must be activated to use the action log for maintenance task lists.

### 5.3.4 Task List Costing

Using Transaction IA16 (Task List Costing), you can calculate task lists without having to create a maintenance order. Transaction IA16 answers the question of what this maintenance task list would cost if executed. The cost breakdown (see Figure 5.16) is displayed separately by item category:

- E: Internal labor
- F: External services
- M: Materials
- G: Overhead surcharges

Other item categories such as co-products or reference calculations are not relevant in the context of maintenance.

Item N.	L.	Resource	CstElement and Txt	Total Value	Fixed Value	COCr	Quantity	Un
1	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	56.25	18.75	USD	5.0	HR
2	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	28.13	9.38	USD	2.5	HR
3	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	56.25	18.75	USD	5.0	HR
4	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	112.50	37.50	USD	10.0	HR
5	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	28.13	9.38	USD	2.5	HR
6	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	56.25	18.75	USD	5.0	HR
7	E	NAPM1000 MANT1000 MLABOR	8004000 EAM Cost Allocation	56.25	18.75	USD	5.0	HR
8	M	DL00 HOUS1000	5001000 Raw Material Consumption Expense	434.40	0.00	USD	5	PC
9	M	DL00 DRCK1000	5001000 Raw Material Consumption Expense	434.40	0.00	USD	5	PC
10	M	DL00 FLAT1000	5002000 Finished Product Consumption Expense	2,606.40	0.00	USD	30	EA
11	M	DL00		500.00	0.00	USD	50	LB
12	F	102006	7510000 Utilities (electricity & phone) Expense	4,072.50	0.00	USD	5	AU
13	G	NAAD1000 8013000	8013000 Admin. Overhead	59.06	19.69	USD		
				<b>8,500.52</b>	<b>150.95</b>	<b>USD</b>		

Figure 5.16: Transaction IA16: Task List Costing

### 5.3.5 Mass Changes

Using Transactions IA38 and IA39, you can now display task lists and their associated operations in a results list and perform mass changes. Selection criteria can be specified for both task lists and operations. For task lists, you can display indicators such as long text

flags and document assignments. For operations, you can display maintenance packages and indicators for long texts, document assignments, components, and inspection characteristics.

Additionally, Transaction IA38 allows you to perform mass changes to both the task list header data and the operation data by selecting **Goto • Mass Change** (see Figure 5.17).

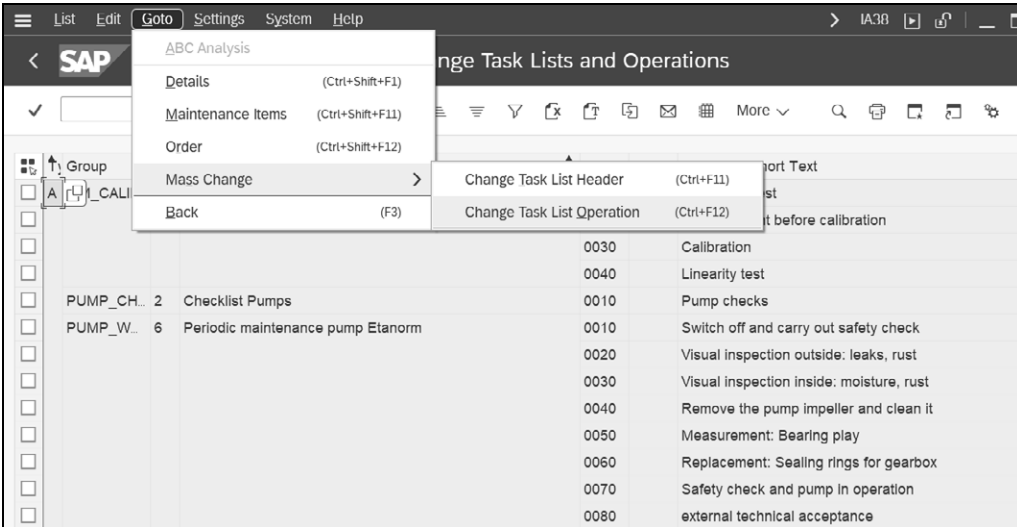


Figure 5.17: Transaction IA38: Task List Mass Change

To use Transactions IA38 and IA39 with the full range of described functionality, you need to activate business functions LOG\_EAM\_CI\_14 and LOG\_EAM\_CI\_17.

In addition, by activating business function LOG\_EAM\_CI\_18, you gain the ability to search within Transactions IA38 and IA39 for routing operations that use a specific component, based on its material number.

Two transactions have long been available for performing substitutions in task lists:

- Transaction CA87 to replace work centers (see Figure 5.18)
- Transaction CA77 to replace PRTs

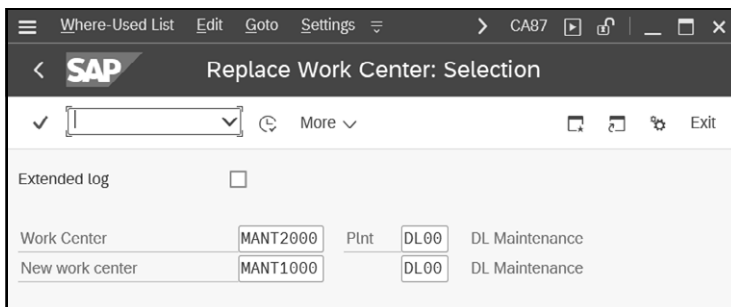


Figure 5.18: Transaction CA87: Replace Work Center

In both cases, after you execute the selection, the system displays an overview of the maintenance task lists or operations that have been found. From this overview, you can select the maintenance task lists involved in the replacement.

Next, we'll turn our attention to other elements that are essential to preventive maintenance, specifically, the maintenance plan.

## 5.4 Time-Based Maintenance Plans

For time-based maintenance, the maintenance dates are calculated solely from the calendar (for example, every 6 months). Performance-based values (such as operating hours) have no effect. This section will cover both time-based single-cycle plans and time-based strategy plans.

### 5.4.1 Time-Based Single-Cycle Plan

You should create time-based single-cycle plans when the same maintenance activities must be performed in full at regular intervals. This section first covers the initial steps for creating and scheduling a single-cycle plan. Because several factors influence the calculation of the planned date, the next section explains scheduling parameters in more detail. After that, we walk through deadline monitoring, mass changes, and cost displays, and conclude with the scheduling overview and change documents.

#### Creating a Single-Cycle Plan

You can create a single-cycle plan via Transaction IP41 (see Figure 5.19). You have the option to choose between internal and external number assignment.

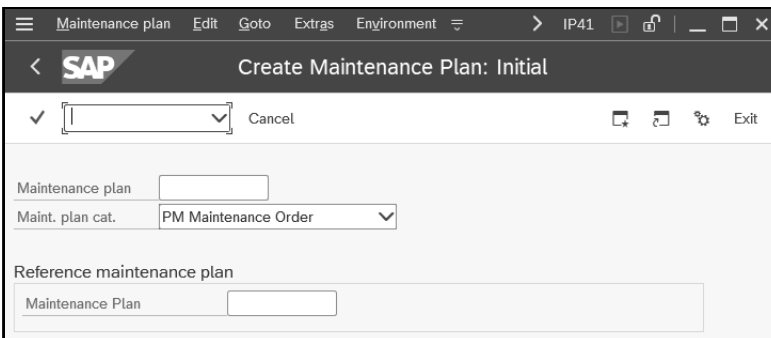


Figure 5.19: Transaction IP41: Single-Cycle Plan—Start Screen

If you want to copy maintenance plans, you must activate business function LOG\_EAM\_CI\_10. Then, you can proceed in one of two ways:

- First, you can copy only those maintenance plans that you have characterized as a **Reference Maintenance Plan** (Transactions IP41/42/43) via the menu path **Create Maintenance Plan • Functions • Copy Template • Allow**).

- Second, the Customizing function **Configure Special Functions for Maintenance Planning** allows you to activate non-template-based copying so that all maintenance plans can be copied.



### Enable Non-Template-Based Copying

It's much easier to allow all maintenance plans as reference plans than to characterize individual plans manually.

Specify the cycle in which the maintenance is to take place directly in the maintenance plan, just as you do for all other data required for a maintenance task (see Figure 5.20).

The screenshot displays the SAP transaction IP41: Create Maintenance Plan: Single cycle plan. The interface includes a menu bar (Maintenance plan, Edit, Goto, Extras, Environment, System, Help) and a title bar (IP41). The main content area is divided into several sections:

- Maintenance plan header:** Maintenance plan (Hydraulic maintenance forklift Still), Maint. plan header.
- Maintenance plan cycle:** Cycle/Unit (6 MON), Cycle text, Offset/Unit (0 MON), Counter.
- Maintenance Item:** Hydraulic maintenance forklift Still.
- Reference object:** Functional loc., Equipment (ESTP1000), Assembly.
- Planning Data:**

Planning Plant	DL00	Plant Dallas	Maint. Planner Group	D00	Dallas Group
Order Type	PM02	Preventive Maintenance	MaintActivityType	002	Preventive maintenance
Main WorkCtr	MANT1000 / DL00 DL Maintenance				
Priority					
Sales Document					

Figure 5.20: Transaction IP41: Single-Cycle Plan—Content

This data includes the following information:

- Short description (possibly with a long text)
- Reference object
- Order type and maintenance activity type that the subsequent orders will receive

- Organizational responsibilities (planner group, work center)
- Maintenance task list, if a maintenance task list will be executed (see Figure 5.21)



Figure 5.21: Transaction IP41: Single-Cycle Plan—Task List Assignment

To create a single-cycle plan using SAP Fiori, launch the Manage Maintenance Plans app and select the **Create** function (see Figure 5.22).

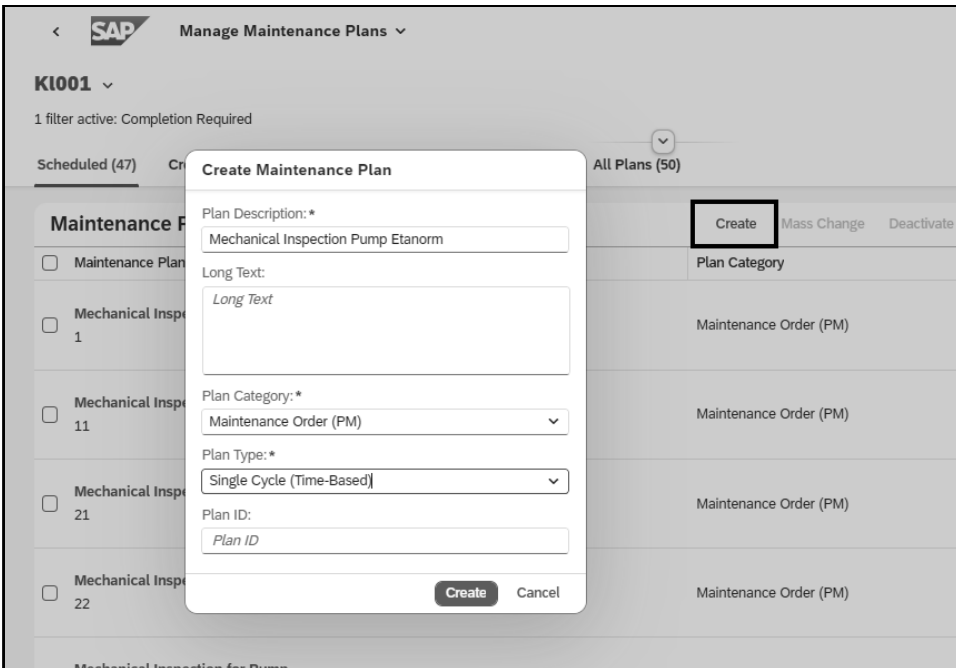


Figure 5.22: Manage Maintenance Plans App: Create Single-Cycle Plan

Within the maintenance plan, you can create a maintenance item that includes the technical object and, if applicable, a task list (see Figure 5.23). The remaining data, such as order type, responsible work center, or planner group, corresponds to those found in the SAP GUI transaction.

**Simplest Case: Time-Based Single-Cycle Plan**

The time-based single-cycle plan requires the least effort of all maintenance plan types in terms of entering and maintaining data, and our experience shows that this approach is used most frequently. You should therefore aim to map as many of your maintenance activities as possible using this plan type.



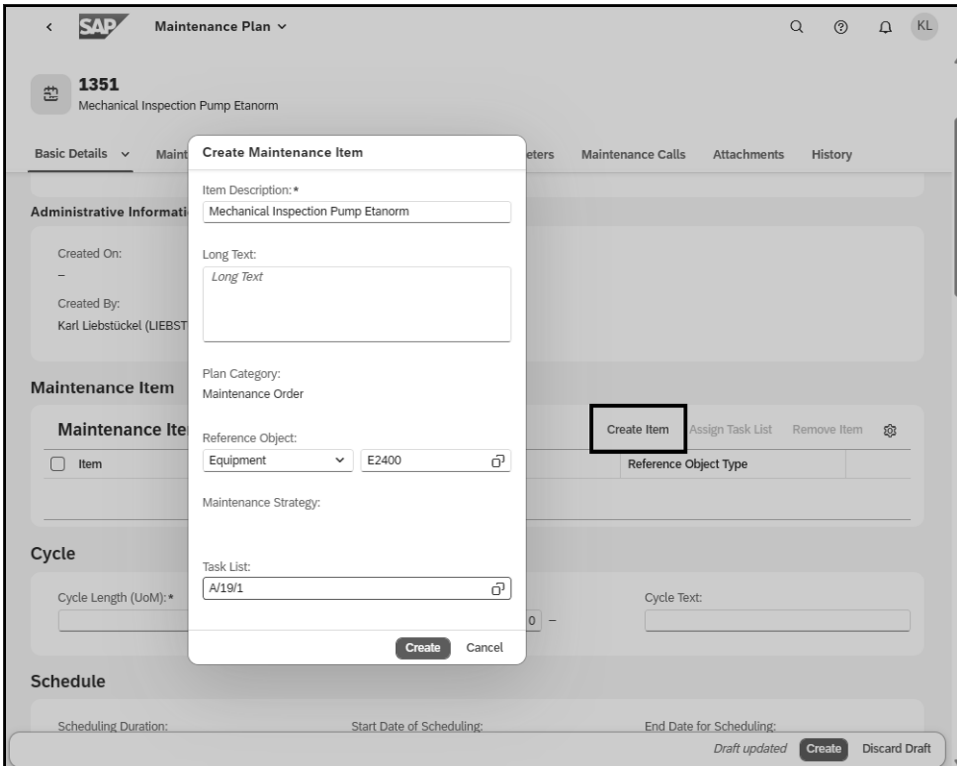


Figure 5.23: Manage Maintenance Plans App: Create Maintenance Item

To start an individual maintenance plan in SAP GUI, use Transaction IP10 or click the **Start** button to start the maintenance plan and create the first maintenance order. The system asks you for a **Start of cycle** date (see Figure 5.24), which is the date when you last performed maintenance.

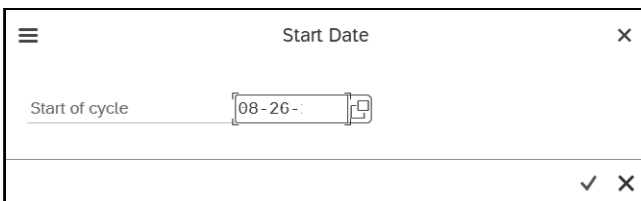


Figure 5.24: Transaction IP10: Schedule Maintenance Plan

The system calculates the first planned date based on the start of cycle and scheduling parameters and creates the first maintenance order when you save your data (see Figure 5.25).

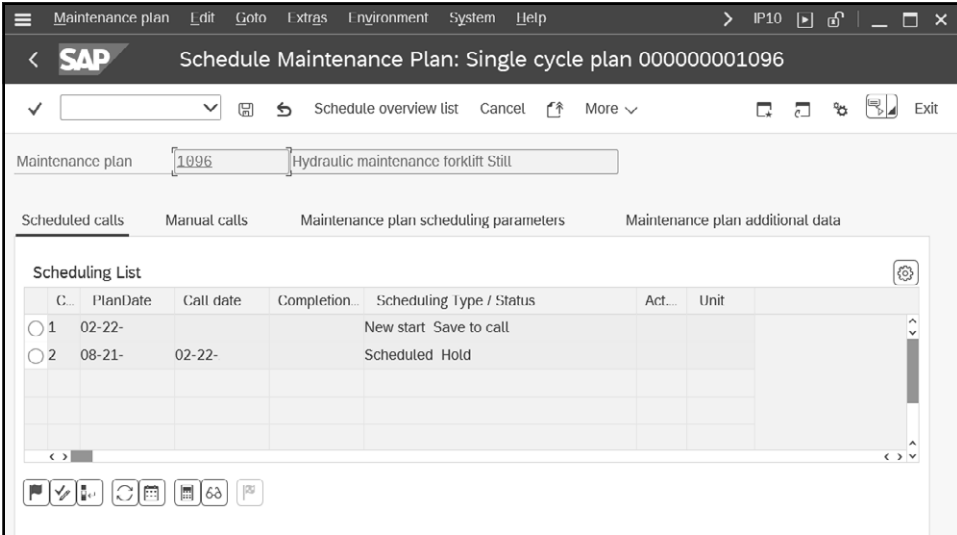


Figure 5.25: Transaction IP10: Maintenance Plan Scheduled

Unfortunately, SAP Fiori does not provide a direct option to schedule an individual maintenance plan. Instead, scheduling is generally handled via a background job (see the Deadline Monitoring and Mass Scheduling Maintenance Plans section).

### Scheduling Parameters

You can also maintain the scheduling parameters for the single-cycle plan directly in the maintenance plan (see Figure 5.26). We'll go through the key fields in the following sections.

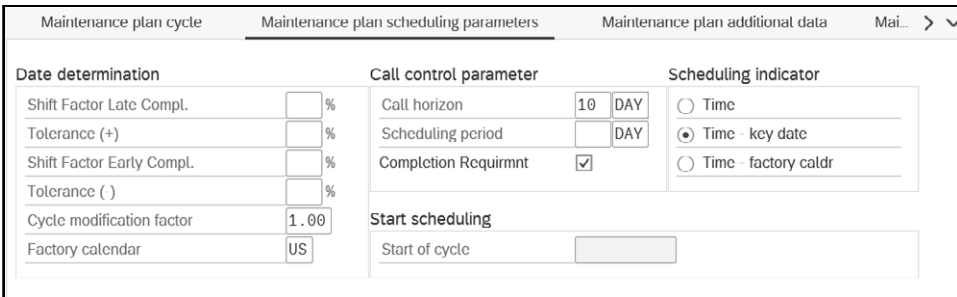


Figure 5.26: Maintenance Plan: Scheduling Parameters

### Scheduling Indicator

Use the **Scheduling indicator** to define the basis for calculating the planned dates, as follows:

- **Time**

A month is always calculated as 30 days, with all calendar days counted. For example, a 3-month cycle beginning on April 1 results in June 30 as the planned date.

- **Time—factory calendar**

A month is always calculated as 30 days, but only the days in the factory calendar are counted. For example, with a 3-month cycle and a factory calendar that omits Saturdays, Sundays, and public holidays, a cycle starting on April 1 results in a planned date of roughly August 10, depending on when the public holidays fall.

- **Time—key date**

The calculation uses the actual number of days in each month. For example, a 3-month cycle starting on April 1 results in July 1 as the planned date.



### **Scheduling Indicator: Key Date**

Of the three potential scheduling types, **Time—key date** is the one most frequently used in practice.

### **Shift Factor**

You use the shift factor to control what percentage of the early completion date (**SF Early Completion** field) or late completion date (**SF Late Completion** field) will be transferred to the next planned date. Consider the following examples of this scenario:

- Planned date: April 1; completion date: April 10; cycle: 3 months, key date scheduling; shift factor: late completion of 0% results in July 1 as the next planned date.
- Planned date: April 1; completion date: April 10; cycle: 3 months, key date scheduling; shift factor: late completion of 50% results in July 1 as the next planned date.
- Planned date: April 1; completion date: April 10; cycle: 3 months, key date scheduling; shift factor: late completion of 100% results in July 10 as the next planned date.



### **Shift Factor: 0% or 100%**

Set the shift factor to either 0% or 100% for time-based maintenance plans, regardless of whether a single-cycle plan or strategy plan is used. In practice, other values are not normally important.

### **Tolerance**

In reality, you may not be able to accept the calculated planned date and instead need to shift it by a few days—for example, if the planned date falls on a non-working day, if workshop utilization needs slight adjustment, or if production can release the technical system for maintenance only at a later time. Such small shifts will not normally affect the follow-up dates immediately. You can therefore use the tolerance value to specify the deviation—expressed as a percentage of the cycle—at which the shift factor should take effect. Consider the following examples of this scenario:

- Planned date: April 1; completion date: April 10; cycle: 3 months, key date scheduling; shift factor: late completion of 0%; tolerance: 10% results in July 1 as the next planned date.

- Planned date: April 1; completion date: April 5; cycle: 3 months, key date scheduling; shift factor: late completion of 100%; tolerance: 10% results in July 1 as the next planned date (tolerance = 10% of 90 days = 9 days not yet reached; shift factor does not take effect).
- Planned date: April 1; completion date: April 12; cycle: 3 months, key date scheduling; shift factor: late completion of 100%; tolerance: 10% results in July 12 as the next planned date (tolerance = 10% of 90 days = 9 days exceeded; shift factor takes effect).

### Setting an Appropriate Tolerance (Around 10%)

Only set a tolerance value if you have activated the shift factor (that is, a value greater than 0%). In practice, tolerance values of around 10% have proven effective.

### Completion Requirement

Set the **Completion Requirement** parameter if you want the system to generate subsequent orders only after the previous order has been completed.

### Decide on Completion Requirements Individually

Determine in each individual case whether the completion requirement should be set. Both scenarios (setting it or leaving it unset) occur regularly in practice.

### Scheduling Period

You can define a scheduling period in the maintenance plan to generate a preview of the pending maintenance dates. The scheduling period specifies the period of the preview in days, months, or years. If you want to have a preview for a maintenance plan for the entire year, for example, set the scheduling period to 365 days or 12 months.

Figure 5.20 showed a maintenance plan with a 6-month cycle, a start date of April 24, and a scheduling period of 2 years.

### Typical Scheduling Periods

In practice, it's quite common to define a scheduling period that shows the next three to five planned dates. This length provides a long-term preview of the pending maintenance plan dates.



### Call Horizon

Use the call horizon to specify, either as a percentage or in days, when an order should be created for a calculated maintenance plan date. This defines how much time should elapse between the two planned dates until the order is created in the system. The date from which the order can be created is known as the *maintenance call date*.

Let's look at the following example of this scenario: the maintenance cycle is 1 year; January 1 is specified as both the planned date and the completion date of the predecessor. The call horizon is as follows:

- **0%**  
The order can be created immediately once the previous order has been completed; in this case, the maintenance call date is January 1.
- **100%**  
The order can be called only once the next planned date is reached; in this case, the maintenance call date is January 1 of the following year.
- **75%**  
The order can be called once 75% of the time between January 1 of the previous year and January 1 of the following year has elapsed; in this case, the maintenance call date is October 2.

If calculating percentages feels too cumbersome, you can instead specify using factory or calendar days how many days before the planned date the order should be called in the SAP system. For this function to be available, you must have activated the business function LOG\_EAM\_CI\_6.

### **End Date of Scheduling**

By activating business function LOG\_EAM\_CI\_13, you can assign an end date for scheduling to the maintenance plan (see **End Date for Sched.** in Figure 5.27). Once this date is reached, no further maintenance calls will be generated from the maintenance plan. Manual deactivation, setting a deletion flag, or assigning a user status to prevent further maintenance calls is no longer necessary.

Maintenance plan cycle	Maintenance plan scheduling parameters	Maintenance plan additional data	Mai... > ▾
Sort field	<input type="text"/>		
Authorization Group	<input type="text"/>		
Maint. plan cat.	PM Maintenance Order		
End Date for Sched.	12-31-2032		

Figure 5.27: Maintenance Plan: End Date for Scheduling

### **Copying Maintenance Plans**

By activating business function LOG\_EAM\_CI\_10, you can copy maintenance plans. A new field, **Reference maintenance plan**, appears on the initial screen for all maintenance plan types (see Figure 5.28).

Figure 5.28: Copy Maintenance Plan: Start Screen

After entering the maintenance plan, a window opens in which you can select the objects to be copied from the reference maintenance plan (see Figure 5.29).

Figure 5.29: Copy Maintenance Plan: Objects

The question that now arises is: What qualifies as a reference maintenance plan, and which maintenance plans can be copied? You have two options:

- If you want to allow only specific maintenance plans to be used as reference plans for copying, you can mark them using the menu path **Maintenance Plan • Functions • Copy Template • Allow**.
- If you want to allow all maintenance plans to be copied, you can activate the **Enable Non-Template-Based Copying** switch in the Customizing activity **Configure Special Functions for Maintenance Planning**.

### Classifying Maintenance Plans

By activating business function LOG\_EAM\_CI\_12, you can classify maintenance plans (see Figure 5.30).

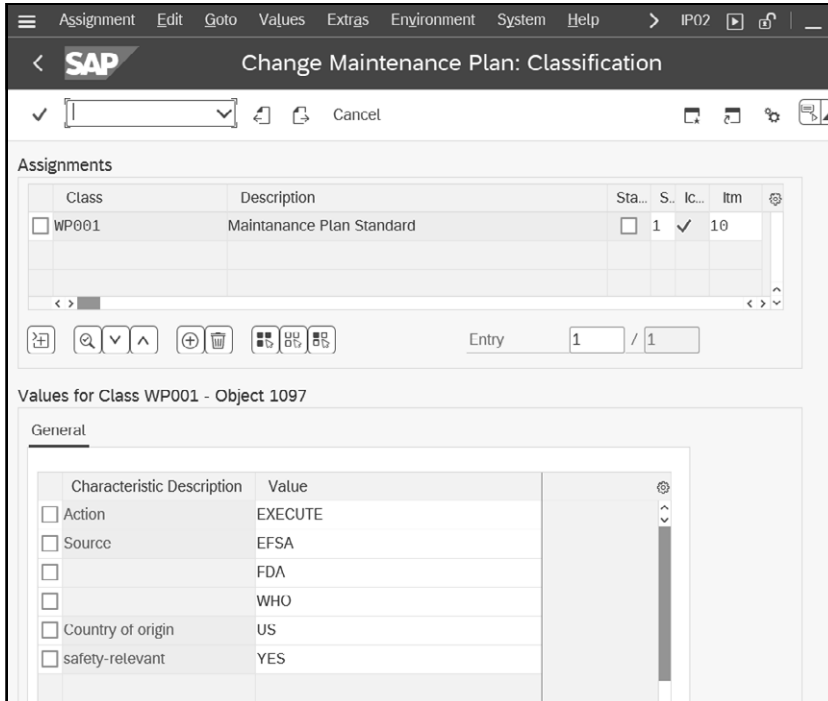


Figure 5.30: Maintenance Plan: Classified

To classify a maintenance plan, proceed as follows:

- Use Transaction CT04 to create characteristics for the attributes you want to assign to the maintenance plan (e.g., **Source**).
- Use Transaction CL02 to create a class with class type 080 (e.g., maintenance plan class “WP001”) in which you group the relevant attributes.
- Using the creation transactions (Transactions IP01, IP41, IP42, and IP43) or the change transaction (Transaction IP02), you can then assign the class to the maintenance plan and maintain the characteristic values.

Classification via SAP Fiori is unfortunately not supported.

### Deadline Monitoring and Mass Scheduling Maintenance Plans

Once you have started the maintenance plans, we recommend that you do not monitor them and create subsequent orders manually. Instead, allow the system to monitor the deadlines and generate the orders automatically. You can either start this in SAP S/4HANA online using Transaction IP30H or by scheduling an automatic batch job for program RIS-TRA20H (Mass Schedule Maintenance Plans; see Figure 5.31).

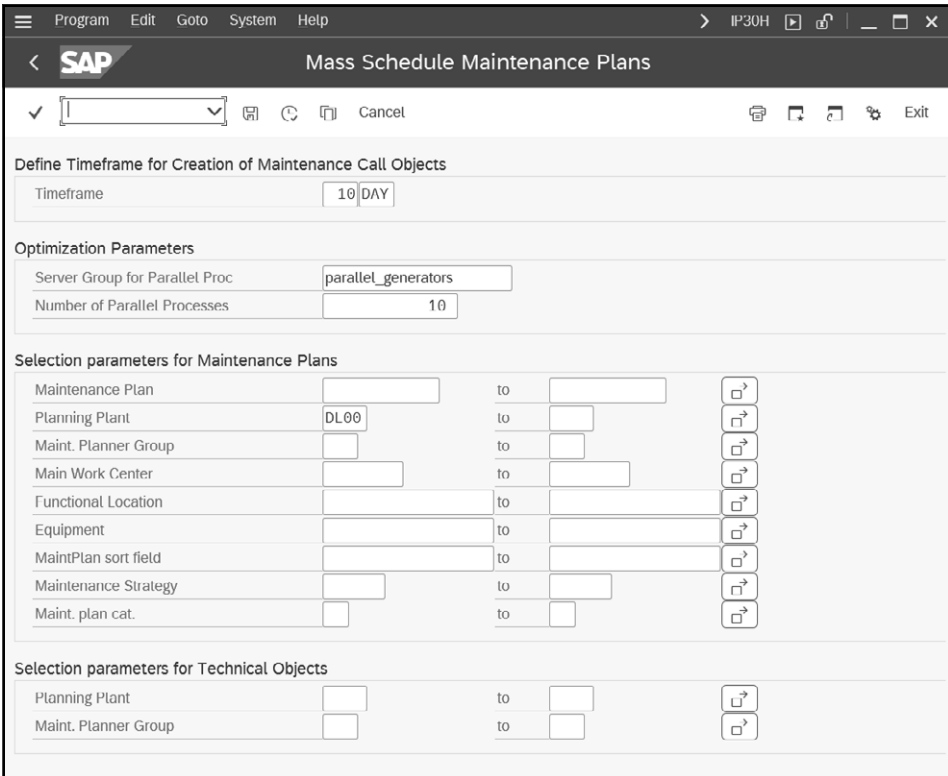


Figure 5.31: Mass Schedule Maintenance Plans: Start Screen

If you want to schedule several batch jobs (e.g., per plant), there are several ways to do so. The first option is via the scheduling log that is automatically displayed after scheduling (see Figure 5.32).

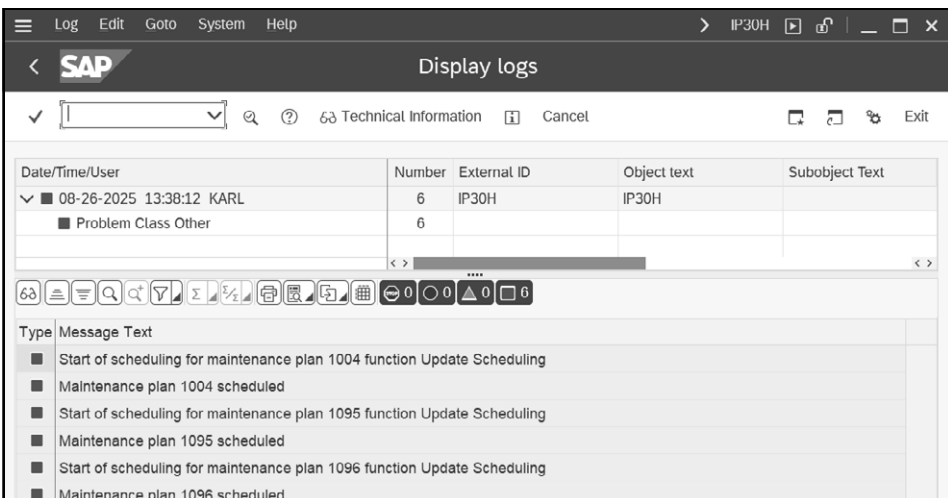


Figure 5.32: Mass Schedule Maintenance Plans: Log

To schedule maintenance plans using SAP Fiori, use the Mass Schedule Maintenance Plans app and set up a recurring background job as well (see Figure 5.33). Once jobs are completed, you can view the results, which correspond to the scheduling log.

Status	Log	Results	Steps	Job Name	Planned ...	Created By	Job ID
Scheduled			1	Mass Schedule Maintenance Plans	09-15-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	10-04-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	10-03-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	10-02-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	10-01-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Finished			1	Mass Schedule Maintenance Plans	08-26-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	09-30-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	09-29-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	09-28-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	09-27-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	09-26-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F
Scheduled			1	Mass Schedule Maintenance Plans	09-25-20...	Louis Karl	00505699DA641FD0A0CFA90F86AD1F

Figure 5.33: Mass Schedule Maintenance Plans App



### Automate Deadline Monitoring

Schedule a batch job for program RISTRA20H or the Mass Schedule Maintenance Plans app. Because SAP S/4HANA is highly performant, you can safely run this job across all maintenance plans.



### Ensure Your Timeframe Isn't Too Short

Use the timeframe to control how many days before the call date the order should be generated. If you set the call horizon to 100%, this value must be sufficiently large; otherwise, the orders will be generated too late.

### Mass Changes

In your daily work, it's quite common to assign identical information to several maintenance plans or maintenance items. This information is necessary, for example, in the following cases:

- You want to change the cycle for several maintenance plans at the same time.
- You want to provide an identical sort field for several maintenance plans because they are supposed to be scheduled simultaneously.
- You want to enter a new order type for several maintenance items.

In these or similar scenarios, proceed as follows:

1. Start Transaction IP15 for list change maintenance plans or Transaction IP17 for list change maintenance items. Alternatively, you can launch the Manage Maintenance Plans or Manage Maintenance Items apps.
2. Restrict the worklist (for example, by maintenance plan number or maintenance plant).
3. In the displayed list, select the maintenance plans or maintenance items you want to change simultaneously.
4. In SAP GUI, follow the menu path **Goto • Perform Mass Change**. Alternatively, you can use the **Mass Change** feature in SAP Fiori apps.

Enter the relevant new information and then implement the changes (see Figure 5.34).

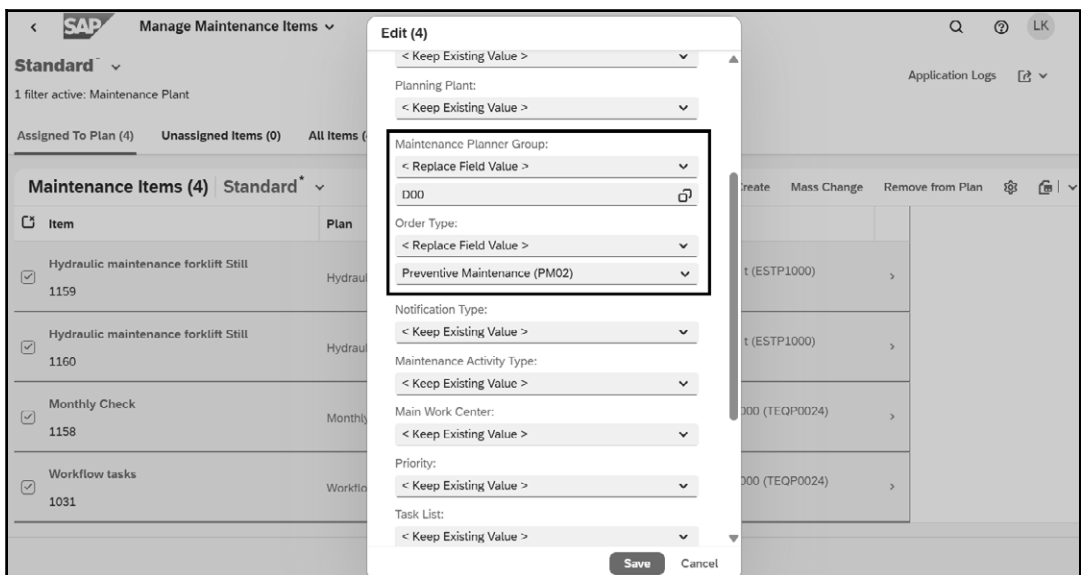




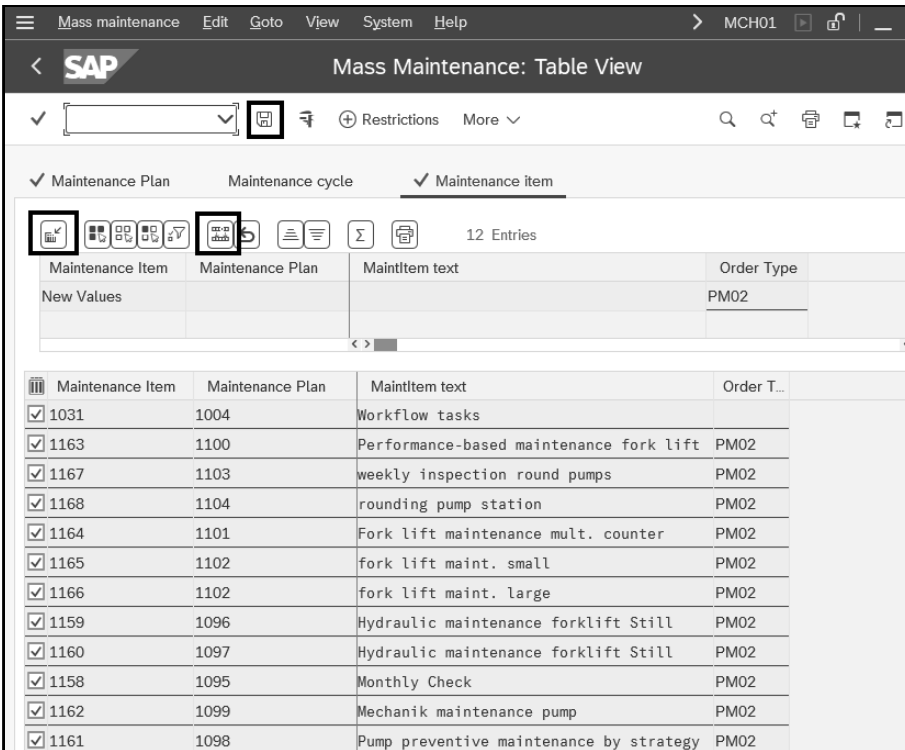
Figure 5.34: Manage Maintenance Items App: Mass Change

To perform a mass change, business function LOG\_EAM\_CI\_7 must be enabled, and the I\_MASS authorization object must have been assigned to the MP authorization value.

Another option for changing multiple maintenance plans or items at the same time is Transaction MCH01 (Mass Changes for Maintenance Plans; see Figure 5.35):

1. Start Transaction MCH01 and restrict the worklist (for example, by maintenance plan number or maintenance planning plant).
2. In the displayed list, select the maintenance plans or maintenance items you want to change simultaneously.
3. Click the  (Select Fields) icon to determine the field(s) that you want to change. In Figure 5.35, the field **Order Type** on the maintenance item level is selected.
4. Enter the new value (e.g., order type **PM02**).

5. Click the  (Perform Mass Change) icon to copy the new value to the rows.
6. Save the new values.



The screenshot shows the SAP Mass Maintenance interface in Table View. The top toolbar contains a 'Perform Mass Change' icon (a square with a grid and a plus sign) which is highlighted with a red box. Below the toolbar, the table has columns for Maintenance Item, Maintenance Plan, MaintItem text, and Order Type. A 'New Values' row is visible at the top of the table data. The table contains 12 entries, each with a checkmark in the first column.

Maintenance Item	Maintenance Plan	MaintItem text	Order Type
New Values			PM02
<input checked="" type="checkbox"/>	1031	Workflow tasks	
<input checked="" type="checkbox"/>	1163	Performance-based maintenance fork lift	PM02
<input checked="" type="checkbox"/>	1167	weekly inspection round pumps	PM02
<input checked="" type="checkbox"/>	1168	rounding pump station	PM02
<input checked="" type="checkbox"/>	1164	Fork lift maintenance mult. counter	PM02
<input checked="" type="checkbox"/>	1165	fork lift maint. small	PM02
<input checked="" type="checkbox"/>	1166	fork lift maint. large	PM02
<input checked="" type="checkbox"/>	1159	Hydraulic maintenance forklift Still	PM02
<input checked="" type="checkbox"/>	1160	Hydraulic maintenance forklift Still	PM02
<input checked="" type="checkbox"/>	1158	Monthly Check	PM02
<input checked="" type="checkbox"/>	1162	Mechanik maintenance pump	PM02
<input checked="" type="checkbox"/>	1161	Pump preventive maintenance by strategy	PM02

Figure 5.35: Transaction MCH01: Maintenance Plan Mass Change

### Maintenance Plan Costing

You can use maintenance plan costing (Transaction IP31 [Maintenance Plan Costing]) to determine the expected costs of one or more maintenance plans for any period.

The following prerequisites must be met:

- You have scheduled the maintenance plans. The cost display for a maintenance plan does not work if the plan has been created but not yet started.
- You have created orders from the maintenance plan. The cost display for maintenance plan does not work if you call notifications or service entry sheets.
- The maintenance plan doesn't have the **Inactive** or **Deletion flag** status.
- You must specify a maintenance task list in the maintenance plan and store costing-relevant data in that task list, for example, work center, activity type, standard time, and material. You have assigned prices to the activity type, and the materials have been valued.

The system determines the expected costs for the specified period as follows (see Figure 5.36):

- By calculating the existing calls (i.e., orders)
- By simulating maintenance calls for the next period and determining expected costs

Itemization		Values inUSD		US Dollar	
Cost Elements/Items		Total Value	Fixed Value	Vbl. Value	Quantity
*		37,268.00		37,268.00	*
2 M	HD00 GMDG1000	169.17		169.17	151 PC
3 M	HD00 HOUS1000	6,800.00		6,800.00	85 PC
4 M	HD00 DRCK1000	825.00		825.00	66 PC
26 M	HD00 TRHB1000	158.36		158.36	4 EA
229 M	DL00 DRCK1000	173.76		173.76	2 PC
231 M	DI 00 HOUS1000	173.76		173.76	2 PC
* 5001000	Raw Material Consumption Expense	8,300.00		8,300.00	*
5 M	HD00 FLAT1000	11,008.80		11,008.80	396 EA
27 M	HD00 WAVL1000	463.16		463.16	4 EA
28 M	HD00 PROT1000	726.40		726.40	32 EA
230 M	DL00 FLAT1000	1,042.56		1,042.56	12 EA
* 5002000	Finished Product Consumption Expense	13,240.92		13,240.92	444 EA
7 F	0000116418 *	5,250.00		5,250.00	7 AU
23 F	0000116418 *	750.00		750.00	1 AU
29 F	0000116418 *	3,000.00		3,000.00	4 AU
31 F	0000116418 *	3,000.00		3,000.00	4 AU
33 F	0000116418 *	3,000.00		3,000.00	4 AU
35 F	0000116418 *	750.00		750.00	1 AU
59 F	0000116418 *	750.00		750.00	1 AU
224 F	0000116418 *	750.00		750.00	1 AU
232 F	0000102006 *	1,629.00		1,629.00	2 AU
* 7510000	Utilities (electricity & phone) Expense	18,879.00		18,879.00	25 AU
8 E	LABOR EUPR1000 INSP1000 *	6,300.00		6,300.00	120.0 HR
10 E	LABOR EUPR1000 PACK1000 *	13,023.78		13,023.78	248.1 HR
* 8000000	Labor	19,323.78		19,323.78	368.1 HR
1 E	MLABOR EUPM1000 MANT1000 *	83,806.25	72,875.00	10,931.25	1,457.5 HR
9 E	MLABOR EUPM1000 ME *	2,830.15	2,461.00	369.15	49.2 HR
25 E	MLABOR EUPM1000 EL *	460.00	400.00	60.00	8.0 HR
228 E	MLABOR NAPM1000 MANT1000 *	157.52	52.52	105.00	14.0 HR
* 8004000	FAM Cost Allocation	87,253.92	75,788.52	11,465.40	1,528.7 HR
**	Operations	184,265.62	75,788.52	108,477.10	*

Figure 5.36: Transaction IP31: Maintenance Plan Costing

### Scheduling Overview

The following functions are available in the scheduling overview (see Figure 5.37), which you can reach via Transaction IP19 (Maintenance Scheduling Overview and Simulation):

- You can display when certain maintenance dates are expected for a particular reference object. The system displays both the dates that have already been calculated and the dates simulated for the period you specified.
- You can shift maintenance dates.
- You can use the simulation function to edit the maintenance dates (e.g., release, shift, or fix).

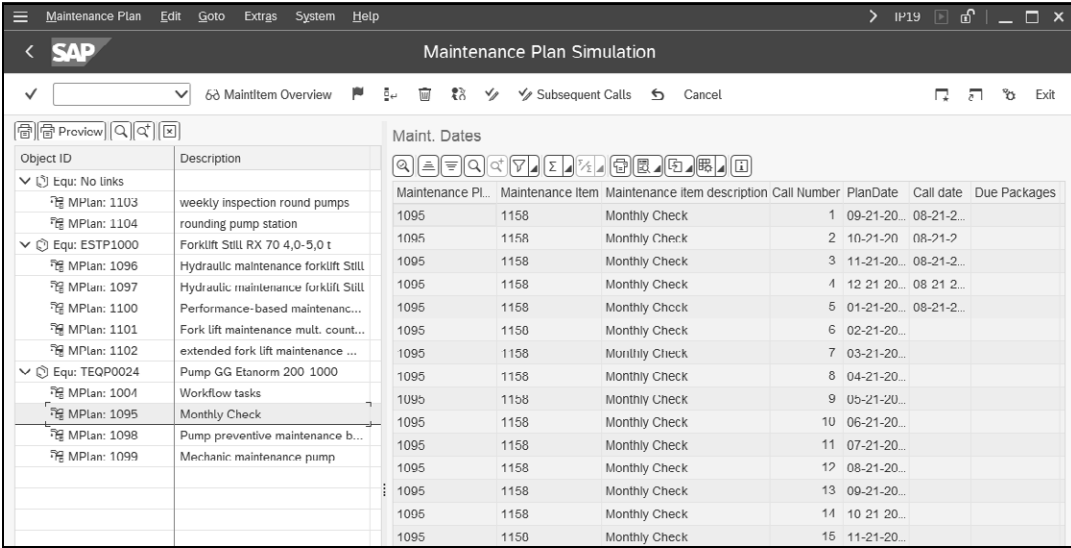


Figure 5.37: Transaction IP19: Maintenance Plan Scheduling Overview and Simulation

### Change Documents

As with many other objects in the SAP system, you can also display change documents for maintenance plans, maintenance items, and maintenance calls (see Figure 5.38). To do this, open Transaction IP03 (Display Maintenance Plan) for a single maintenance plan and follow the menu path **Extras • Change Documents**.

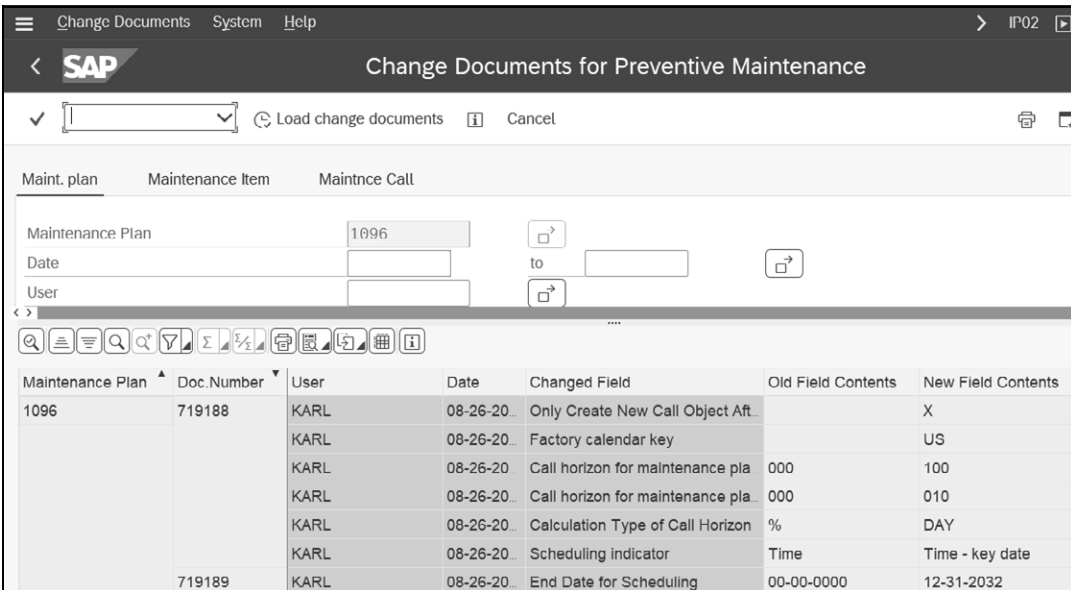


Figure 5.38: Maintenance Plan: Change Documents

A similar function is available in the Manage Maintenance Plans app. When you start a maintenance plan, the **History** section displays all changes made to the maintenance plan. Unfortunately, SAP Fiori does not provide a change history for maintenance items or maintenance calls.

### 5.4.2 Time-Based Strategy Plan

You create time-based strategy plans when maintenance activities depend on one another or supersede each other, for example, when a manufacturer’s service manual specifies activities with different intervals, such as every 3, 6, or 12 months.

In this case, you must include a maintenance task list that uses the same strategy as the maintenance plan. A maintenance strategy and a suitable task list are required for this type of business process to work.

#### Maintenance Strategy

You define maintenance strategies using Transaction IP11. A maintenance strategy contains the chronology of maintenance packages (see Figure 5.39).

P...	CycLength	Unit	Maintenance cycle text	C...	Hi...	Hi...	Offset	Of...	Initial	Subseqnt
<input type="checkbox"/> 10	1 MON	monthly		1M	1	H1			1	
<input type="checkbox"/> 20	3 MON	quarterly		3M	2	H2			2	
<input type="checkbox"/> 30	6 MON	semi annually		6M	3	H3			3	
<input type="checkbox"/> 40	12 MON	annually		12	4	H4			5	
<input type="checkbox"/> 50	24 MON	2 annually		24	5	H5			10	

Figure 5.39: Transaction IP11: Maintenance Strategy

A maintenance strategy does not contain the following elements:

- Reference object
- Tasks
- Dates

The hierarchy indicators (the offset and the initial/subsequent phase) were described earlier in this section.

#### Subsequent Items

If you later determine that you need additional packages, the procedure depends on the package numbers assigned so far.



If you numbered your package numbers in increments of one (1, 2, 3...), always append new packages in the same consecutive sequence. Otherwise, the maintenance plan will eventually populate your orders with incorrect operations from the maintenance task list. Alternatively, you can assign item numbers in increments of ten (10, 20, 30, and so on) from the outset. Using increments of ten enables you to insert additional maintenance packages between existing numbers (for example, 10, 15, 20, 30, and so on). However, do not reuse item numbers that already exist.

**Task List**

To perform strategy-based preventive maintenance, you need a maintenance task list in addition to a maintenance strategy. Perform the following steps:

1. At the header level of the maintenance task list, assign the same strategy that you intend to use in the maintenance plan.
2. Assign the maintenance packages to operations that are due (see Figure 5.40).

Group		PUMP WTG Periodic maintenance pump Etanorm			GrpCounter 6				
<input type="checkbox"/> Components		<input type="checkbox"/> Rel		<input type="checkbox"/> PRT		<input type="checkbox"/> Insp.Char			
Operat. Overview Maint. Packages									
Op.	SOp	Operation Description			1M	3M	6M	12	24
<input type="checkbox"/> 0010		Switch off and carry out safety check			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0020		Visual inspection outside: leaks, rust			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0030		Visual inspection inside: moisture, rust			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0040		Remove the pump impeller and clean it			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0050		Measurement: Bearing play			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0060		Replacement: Sealing rings for gearbox			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0070		Safety check and pump in operation			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 0080		external technical acceptance			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>									

Figure 5.40: Task List: Maintenance Packages

**Strategy Plan**

You can create a strategy plan in Transaction IP42 or with the Manage Maintenance Plans app. Choose between an internal and external number assignment. Rather than specifying the cycle directly in the maintenance plan, you create the maintenance packages in the maintenance task list that will be included in the plan (see Figure 5.41).

Maintenance plan 1098 Pump preventive maintenance by strategy

Maint. plan header

Maintenance plan cycle 08-26-2025 Maintenance plan scheduling parameters Maintenance plan additional data

**Cycles**

Cycle	Unit	Maintenance cycle text	Offset
1 MON	monthly		0
3 MON	quarterly		0
6 MON	semi-annually		0

Item Object list item Item location Cycle item 08-26-2025

Maintenance Item 1161 Pump preventive maintenance by strategy

**Reference object**

Functional loc.	PD-001-02	Handlebar assembly station
Equipment	TEQP0024	Pump GG Etanorm 200-1000
Assembly		

**Planning Data**

Planning Plant	DL00	Plant Dallas	Maint. Planner Group	D00	Dallas Group
Order type	PM02	Preventive Maintenance	Maint/Activity type	002	Preventive maintenance
Main WorkCtr	MANT1000 / DL00	DL Maintenance	Business Area		
Priority			Settlement Rule		
Sales Document					

Do Not Rel.Immediately

**Task List**

Typ	Task LstGrp	GrpCr	Description
A	PUMP_WTG	6	Periodic maintenance pump Etanorm

Figure 5.41: Transaction IP42: Strategy Plan

**Scheduling Parameters**

You already know most of the scheduling parameters for a strategy plan from the single-cycle plan; the same principles apply here.

The maintenance strategy proposes the following values, which you can change in the strategy plan:

- Shift factors
- Tolerances
- Scheduling indicators
- Call horizons

You define the scheduling period and completion requirement individually for each strategy plan.

However, the strategy plan includes some scheduling parameters that either do not exist in the single-cycle plan or are not relevant there.

### **Cycle Modification Factor**

In the live system, you may discover that your maintenance intervals need to be adapted because maintenance is being performed either too frequently or too infrequently. In this case, you can change the *cycle modification factor*. The default value is always set at 1.00. When you specify a cycle modification factor (values from 0.01 to 9.99), you can use it to extend or shorten the cycles specified in the maintenance strategy. A cycle modification factor greater than 1 extends the cycle, whereas a cycle modification factor less than 1 shortens it.



#### **Cycle Modification Factor: Dynamic**

You can use the cycle modification factor to extend or shorten the maintenance cycles individually for each strategy plan. This allows you to adjust the intensity without having to change the maintenance strategy.

In principle, a cycle modification factor also exists in a single-cycle plan. However, it plays only a minor role there because you can adjust the cycle directly by changing the cycle itself.

### **Hierarchy**

You maintain the hierarchy of maintenance packages in the maintenance strategy (see Figure 5.39). The hierarchy determines which maintenance packages are executed when several are due at the same time:

- **Same hierarchy number**

If you want to execute the maintenance packages together on a given date, assign them the same hierarchy number, for example, if an oil change is due every 6 months and a filter change every 12 months. SAP S/4HANA Asset Management then combines the maintenance packages into one order with several operations.

- **Different hierarchy numbers**

If you want to execute only specific maintenance packages on a given date, those packages must have a higher hierarchy number than the others. SAP S/4HANA Asset Management always selects the packages with the highest hierarchy number. For example, if spark plugs are cleaned every 6 months and replaced every 12 months, it would make no sense to first clean them at month 12 and then replace them. The package with the higher hierarchy (replace spark plugs) therefore overrides the package with the lower hierarchy (clean spark plugs).



#### **Different Maintenance Package Hierarchies**

You can achieve the most sophisticated control of maintenance activities by assigning different hierarchy numbers to all maintenance packages and, if necessary, making multiple assignments of packages in the maintenance task list. You would typically assign the hierarchy indicator in ascending order according to the interval.

**Lead Float and Follow-Up Float**

You assign the **Lead Float** and **Follow-up Float** fields in the maintenance strategy at the level of the maintenance packages; these values are always expressed in days. SAP S/4HANA Asset Management uses them to determine the order’s basic start date and basic end date based on the planned date.

For example, maintenance package 40 in Figure 5.39 with a lead float of 5 days, a follow-up float of 0 days, and a calculated planned date of May 15 results in a basic start date of May 10 and a basic end date of May 15 in the order.

What is the business background? Maintenance activities take time, and longer activities in particular cannot typically be completed in one day. The lead-up and follow-up buffers allow you to specify a *from/to* time span from the outset.

**Setting One Float to Zero**

Always set at least one of the buffers to 0; otherwise, you will no longer be able to recognize the actual planned date by the basic dates of the order. We recommend that you always set the follow-up buffer to 0 because the required basic end date will then correspond to the planned maintenance date.



**Offset**

An offset ensures a one-off time shift. You assign offsets in the maintenance strategy at the maintenance package level; offsets are always expressed in the unit of the maintenance package. You use offsets in the following cases:

- The maintenance package is to be executed once only. In this case, only set the offset in the maintenance package.
- The cyclical work is to start only after a certain time. In this case, set a cycle duration and an offset.

Consider the following example. A customer approached us with the following requirement: in their organization, a maintenance plan must trigger multiple operations that occur within the same time interval but should be generated as orders with staggered execution dates along the timeline (see Table 5.1).

Interval Due	1Y	2Y	3Y	4Y	5Y	6Y
Operation1 3Y	•			•		
Operation2 3Y		•			•	
Operation3 3Y			•			•

Table 5.1: Operation Time Interval

In this case, we'll implement the customer's requirement using a maintenance strategy with three packages. All three packages include a cycle duration of 3 years. By setting an offset of 1 year in the second maintenance package and of 2 years in the third maintenance package, you achieve the required chronological sequence (see Figure 5.42).

Name	0										
Description	offset strategy										
Scheduling indicator	1 Time - key date										Pack. seq.
	P...	Cycl.Length	Unit	Maintenance cycle text	C...	Hi...	Hi...	Offset	Of...	Initi...	Su...
<input type="checkbox"/>	10		3 YR	every 3 years	30	1	H1			5	
<input type="checkbox"/>	20		3 YR	every 3 years with 1 year offs	31	1	H1		1 31	5	
<input type="checkbox"/>	30		3 YR	every 3 years with 2 year offs	32	1	H1		2 32	5	

Figure 5.42: Transaction IP11: Maintenance Strategy with Offsets



### Offsetting Maintenance Packages

By setting offsets, you achieve a chronological offsetting of maintenance packages.

### Strategy Plan Scheduling

When starting a strategy plan, you must decide whether you are performing a new start (for example, if a new machine is purchased) or starting in the current cycle (for example, when an existing machine already has established maintenance dates):

#### ■ New start

Start the maintenance and create the first order via one of the following options:

- The **New Start** function in Transaction IP10 (Schedule Maintenance Plan)
- Program RISTRA20H (Transaction IP30H [Mass Schedule Maintenance Plans])
- Mass Schedule Maintenance Plans app

The system then prompts you for a **Start of cycle** date, which represents the date the reference object was put into operation or shortly thereafter.

#### ■ Start in cycle

If you already implemented preventive maintenance dates for the reference object, use the **Start in cycle** function in Transaction IP10. As shown in Figure 5.43, SAP S/4HANA Asset Management prompts you not only for the **Completion date** (the date on which you last performed maintenance) but also for an offset. Don't confuse this offset with the offset from the maintenance strategy; this one determines which maintenance package you executed last. Use the **Select package** button to open the the table for selecting packages (see Figure 5.44) and then set the start offset using the **Set start offset** button.

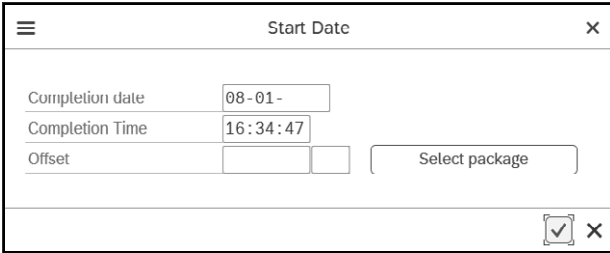


Figure 5.43: Start in Cycle: Completion Date

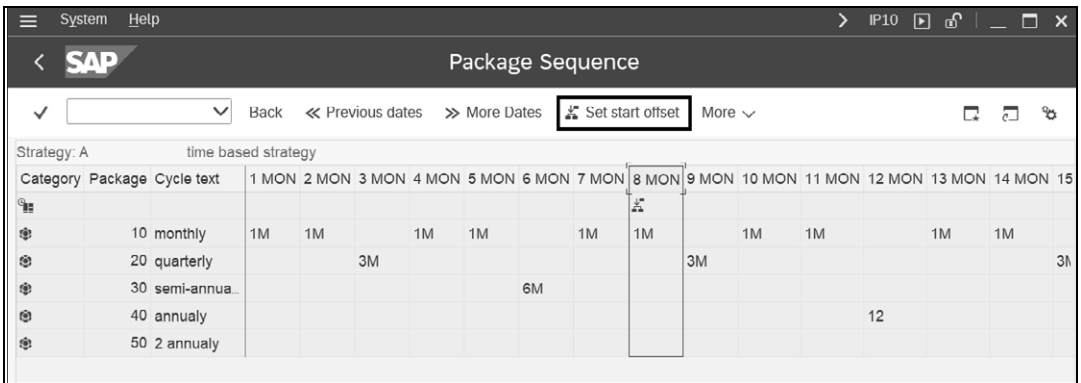


Figure 5.44: Start in Cycle: Start Offset

The system calculates the first planned date based on the start of cycle and scheduling parameters and creates the first maintenance order when you save your data. Unfortunately, SAP Fiori does not offer a comparable function for manually starting a strategy plan.

**Manually Start Strategy Plans with Transaction IP10** [+]

Since most strategy-based maintenance plans are already running, you always start a strategy plan manually using the SAP GUI Transaction IP10, as SAP Fiori does not offer a comparable function.

In all other functions, including deadline monitoring, simulation, maintenance plan costing, and so on, the strategy plan does not differ from the single-cycle plan.

**Time-Based Maintenance Plans Require Little Administrative Effort** [+]

The system can calculate the planned dates as automatically as possible using the calendar for time-based maintenance plans, whether they're single-cycle plans or strategy plans. Performance-based plans, however, require ongoing effort because counter readings must be entered continuously. You should therefore use time-based maintenance plans whenever possible.

We now move to preventive maintenance processes that cannot be scheduled by calendar alone. These require counters and counter readings and therefore involve the performance-based maintenance processes.

## 5.5 Performance-Based Maintenance Plans

In performance-based maintenance, dates are determined exclusively by performance values (such as operating hours, kilometers, or quantities). Calendar-based cycles (for example, a 6-month cycle) do not apply. This section will cover both performance-based single-cycle plans and performance-based strategy plans.

### 5.5.1 Performance-Based Single-Cycle Plan

A performance-based single-cycle plan has one maintenance cycle (for example, every 2,000 operating hours), and the maintenance dates are scheduled based on counter readings. An order is created whenever the counter reading reaches the cycle—or shortly before it.

To enable performance-based maintenance, you must first meet several prerequisites, which the following sections will discuss.

#### Counter

You must assign a counter to the reference object using the **Measuring points/counters** function. To do this, use the corresponding transactions (for example, Transaction IE02 for equipment or Transaction IL02 for functional locations). As an alternative, you can use the Web Dynpro app Process Measuring Point. Define the counter itself as follows (see Figure 5.45):

- **Characteristic**

The counter refers to a characteristic (for example, **OPH** here). You can maintain this characteristic using Transaction CT04; note that in the **Characteristic** field the characteristic has the *numeric format* data type and the relevant unit (for example, h, mls, or l).

- **Counter overflow reading**

The counter overflow reading represents the first value that the counter can no longer display. If you had a 6-digit counter, for example, you would have to enter the value 1,000,000 in the **CntrOverReadg** field; the system needs this value to schedule the maintenance plans.

- **Annual estimate**

The **AnnualEstimate** field represents your estimate of how much the reference object is used each year in relation to the counter. The system also needs this value for scheduling.

- **Measurement reading transfer**

If you have constructed a measuring point hierarchy, check the **MeasReadTransf.** checkbox and define the measuring point/counter from which the value is to be transferred.

### ■ Decreasing counter reading

A continuously growing counter reading is without doubt the normal situation for performance-based maintenance. However, you may have situations (for example, for a decreasing tire diameter) where the counter reading continuously decreases and the maintenance is initiated when the counter reading goes below a limit. You can check the **Count backwards** checkbox in such cases. However, you must then set up an additional counter that counts forward for which you activate a measurement reading transfer from the backward-counting counter. Refer the maintenance plan to the forward-counting counter.

Measuring point	8136	Cat. M	MeasPoint (general)
MeasPosition			
Description	Operating Hours		
Equipment	TEQP0024		
Description	Pump GG Etanorm 200-1000		
<b>General data</b>			
Characteristic	OP	Operating Hours	
CharactUnit	h	Hour	<input checked="" type="checkbox"/> MeasPoint is counter
Decimal places		FloatPointExp.	
Code group			
Assembly			
AuthorizGroup			
MeasReadTransf.	<input type="checkbox"/> Supported	Transfer of	
<b>Counter data</b>			
CntrOverReadg	100000	h	<input type="checkbox"/> Count backwards
AnnualEstimate	1250		
Text			

Figure 5.45: Counter for Technical Object

### Initial Counter Reading

You must enter an initial counter reading using Transaction IK11 (Create Measurement Document; see Figure 5.46) or Web Dynpro app Process Measurement Document. This counter reading represents when the reference object was put into operation with a particular counter reading.

Like the time-based single-cycle plan, you create the performance-based single-cycle plan using Transaction IP41 or the Manage Maintenance Plans app. Specify the counter, the cycle, and where you want the maintenance to take place directly in the maintenance plan (see Figure 5.47). Based on the cycle unit, the system suggests the next step: If multiple counters with the same unit exist, a dialog box is displayed in which you can select the relevant

counter. If only one counter with a suitable unit exists, SAP S/4HANA Asset Management enters it directly.

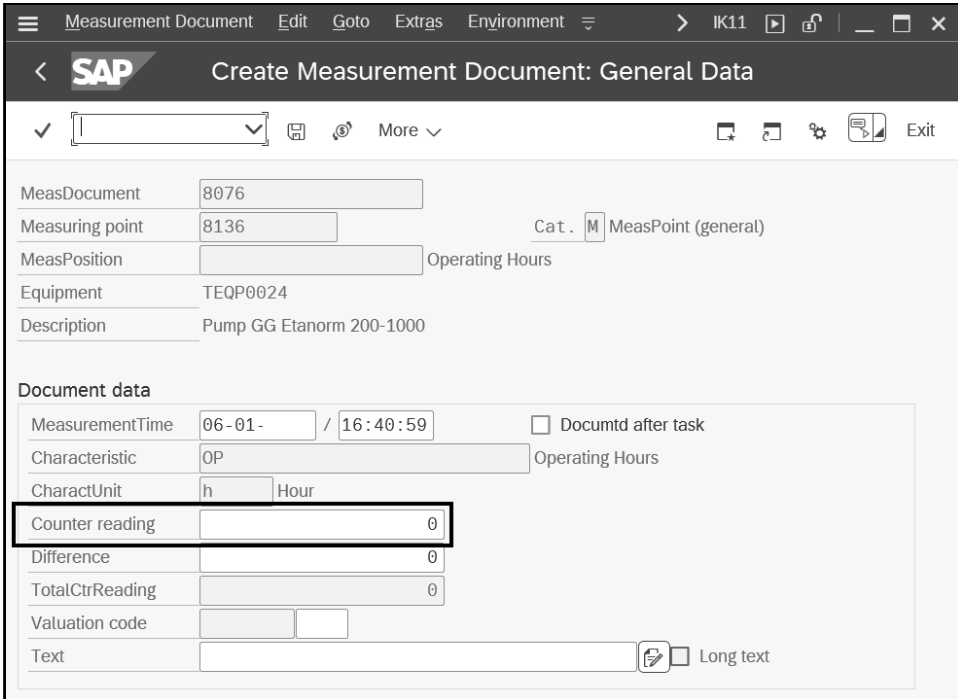


Figure 5.46: Transaction IK11: Initial Counter Reading

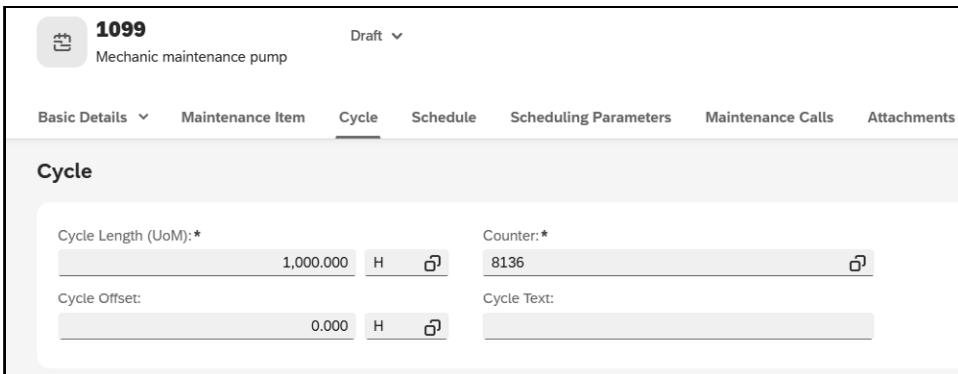


Figure 5.47: Manage Maintenance Plans App: Performance-Based Single Cycle Plan

You can use the scheduling parameters for a performance-based single-cycle plan as described in that section, but with one exception: in performance-based maintenance, the call horizon becomes significantly more important.



### Call Horizon Greater Than 90% or Less Than 5 Days

For all performance-based maintenance plans, set the call horizon to more than 90% (if using a percentage) or to less than 5 days (if using days). Otherwise, SAP S/4HANA Asset Management will create the maintenance orders too early.

### Scheduling

Let's now use a specific numerical example to demonstrate how performance-based maintenance is scheduled. Say a piece of equipment is equipped with an operating-hour counter with an annual estimate of 2,500 OPH per year and contains a single-cycle plan with a maintenance cycle of 2,000 OPH and a call horizon of 95%. An initial counter reading of 0 OPH was entered on March 1.

The geometric solution (see Figure 5.48) is as follows: If the equipment were utilized exactly as estimated in the annual estimate, it would result in the counter being linear, and 2,500 OPH would be reached after 1 year. The intersection between the linear gradient and the maintenance cycle would now determine the maintenance date ①.

The arithmetic solution is as follows:

$$\begin{aligned} &03-01 \text{ (March 1)} + 2,000 \div 2,500 \times 365 \text{ days} \\ &= 03-01 \text{ (March 1)} + 292 \text{ days} \\ &= 12-17 \text{ (December 17)} \end{aligned}$$

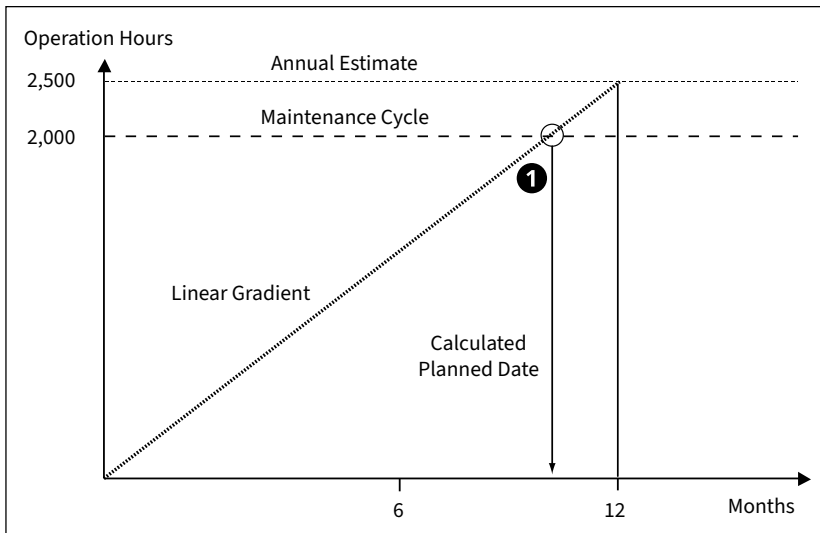


Figure 5.48: Initial Scheduling

A counter reading of 500 OPH is reached on April 1, which indicates that the equipment was used more extensively than was planned in the annual estimate.



### Date Calculation for Each Entry of Counter Readings

Every time you enter a measurement document, the system reschedules the maintenance plan and determines a new maintenance date.

The geometric solution is as follows (see Figure 5.49): An equivalent to the annual estimate is drawn from the measurement document, and the intersection with the maintenance cycle determines the new maintenance date ②.

The arithmetic solution is as follows:

$$\begin{aligned}
 &04-01 \text{ (April 1)} + (2,000 - 500) \div 2,500 \times 365 \text{ days} \\
 &= 04-01 \text{ (April 1)} + 1,500 \div 2,500 \times 365 \text{ days} \\
 &= 04-01 \text{ (April 1)} + 219 \text{ days} \\
 &= 11-06 \text{ (November 6)}
 \end{aligned}$$

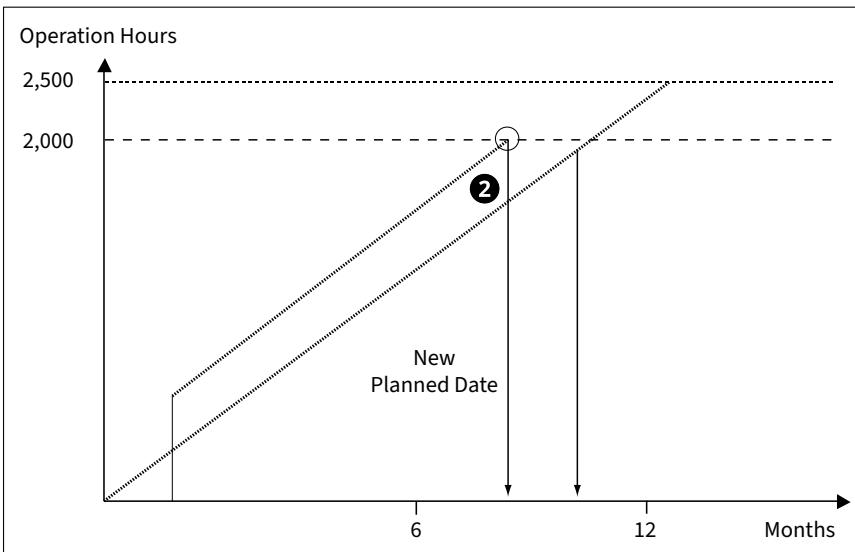


Figure 5.49: Scheduling Based on Counter Reading

If you did not set a call horizon, the system would immediately create an order the moment you enter the first measurement document. Creating the order now is problematic because the first measurement document is still far from the maintenance cycle. As noted earlier in this section, you should assign a high call horizon to the maintenance plan to ensure that the order is created only when the planned date is actually reached. In our example, the call horizon was set to 95%, or 1,900 OPH.

The geometric solution in this case is as follows (see Figure 5.50): The intersection of the measurement document projection line with the line of the call horizon determines the maintenance call date ③.

The arithmetic solution looks like this:

$$\begin{aligned}
 &04-01 \text{ (April 1)} + (1,900 - 500) \div 2,500 \times 365 \text{ days} \\
 &= 04-01 \text{ (April 1)} + 1,400 \div 2,500 \times 365 \text{ days} \\
 &= 04-01 \text{ (April 1)} + 204 \text{ days} \\
 &= 10-22 \text{ (October 22)}
 \end{aligned}$$

In this combination, the system calculates a planned date of November 6 and a corresponding maintenance call date of October 22.

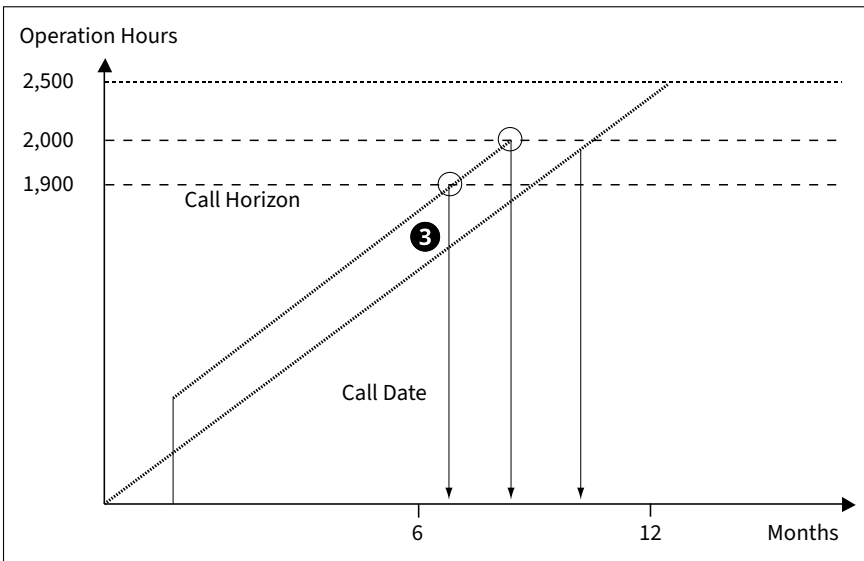


Figure 5.50: Scheduling Based on Counter Reading and Call Horizon

### Maintenance Calls with Orders

When is an order actually created? To continue our example, if you don't enter another measurement document, program RISTRA20H deadline monitoring would create the maintenance call with an order the first time it runs on or after October 22.

However, this scenario is quite unrealistic. In performance-based maintenance, you should enter measurement documents continuously. The system creates the maintenance call—and the order—as soon as a measurement document exceeds the call horizon (in this example, more than 1,900 OPH) and deadline monitoring runs for the first time.

### Entering Counter Readings Regularly

To ensure that performance-based maintenance works as intended, enter counter readings regularly. Whether you do this daily, weekly, or at another interval depends on your unique situation.



Plan for at least ten measurement documents between two maintenance sessions. For a 2,000 OPH cycle, for example, you should record the counter reading at least every 200 OPH.

If you don't maintain this frequency, performance-based maintenance will not serve its purpose, and you should consider switching to time-based maintenance instead.



**Enter Counter Readings Even When Objects Are Out of Operation**

Even if you temporarily take a technical object out of operation, you must continue to enter counter readings. Although the readings will stay the same, they will have a more current date each time.

If you activate the business function LOG\_EAM\_CI\_13, you can assign an **End Date for Scheduling** or an **End Counter Reading for Scheduling** to a maintenance plan (see Figure 5.51). Once this date or counter reading is reached, no further calls will be generated from the maintenance plan. In this case, manual deactivation, setting a deletion flag, or assigning a user status to prevent further calls is no longer necessary.

The screenshot shows the configuration for a maintenance plan with ID 1099, titled 'Mechanic maintenance pump'. The status is 'Draft'. The 'Schedule' tab is active, showing the following fields:

- Scheduling Duration:** 6 Years
- End Date for Scheduling:** 12-31-2039
- End Counter Reading for Scheduling:** 30,000,000
- Start Counter Reading for Scheduling:** 0.000

Figure 5.51: End of Scheduling

**5.5.2 Performance-Based Strategy Plan**

You create time-based strategy plans when maintenance activities build on or replace one another, for example, when a manufacturer's service manual specifies activities at different performance levels, such as every 1,000 OH, 2,000 OH, 5,000 OH, and so on. In such cases, you must include a maintenance task list with the same strategy as the maintenance plan. You need a performance-based maintenance strategy and a suitable maintenance task list to ensure that this business process functions properly. This section will discuss both of those topics, in addition to the strategy plan and scheduling.

## Maintenance Strategy

You can maintain performance-based strategies using Transaction IP11. The only differences compared to a time-based strategy are the scheduling indicator and unit (see Figure 5.52):

- Set the **Scheduling indicator** to **3 Activity**.
- Use a service unit (OH, miles, number of pieces, tons, flow rates, and so on) as the unit.

Name	B									
Description	performance based strategy									
Scheduling indicator	3 Activity								Pack. seq.	
P...	Cycl.length	Unit	Maintenance cycle text	C...	Hi...	Hi...	Offset	Of...	Initi...	Su...
<input type="checkbox"/> 10	500 H	500 operating hours	05	1	H1			1		
<input type="checkbox"/> 20	1000 H	1000 operating hours	10	2	H2			3		
<input type="checkbox"/> 30	2000 H	2000 operating hours	20	3	H3			5		

Figure 5.52: Transaction IP11: Performance-Based Strategy

All other control options (shift factor, call horizon, hierarchy, offset, and so on) correspond to the time-based maintenance strategy.

## Task List

The only difference between the maintenance task list for a performance-based strategy plan and one for a time-based strategy plan is that you assign a performance-based strategy to the task list header and performance-based maintenance packages to the operations.

## Strategy Plan

Creating a strategy plan combines elements of a time-based strategy plan and a performance-based single-cycle plan:

1. Use Transaction IP42 or the Manage Maintenance Plans app.
2. Assign the reference object and a maintenance task list.
3. Accept the counter proposed by SAP S/4HANA Asset Management or assign one manually.
4. Let the system enter the maintenance packages automatically.

Figure 5.53 displays the result of a completed performance-based strategy plan.

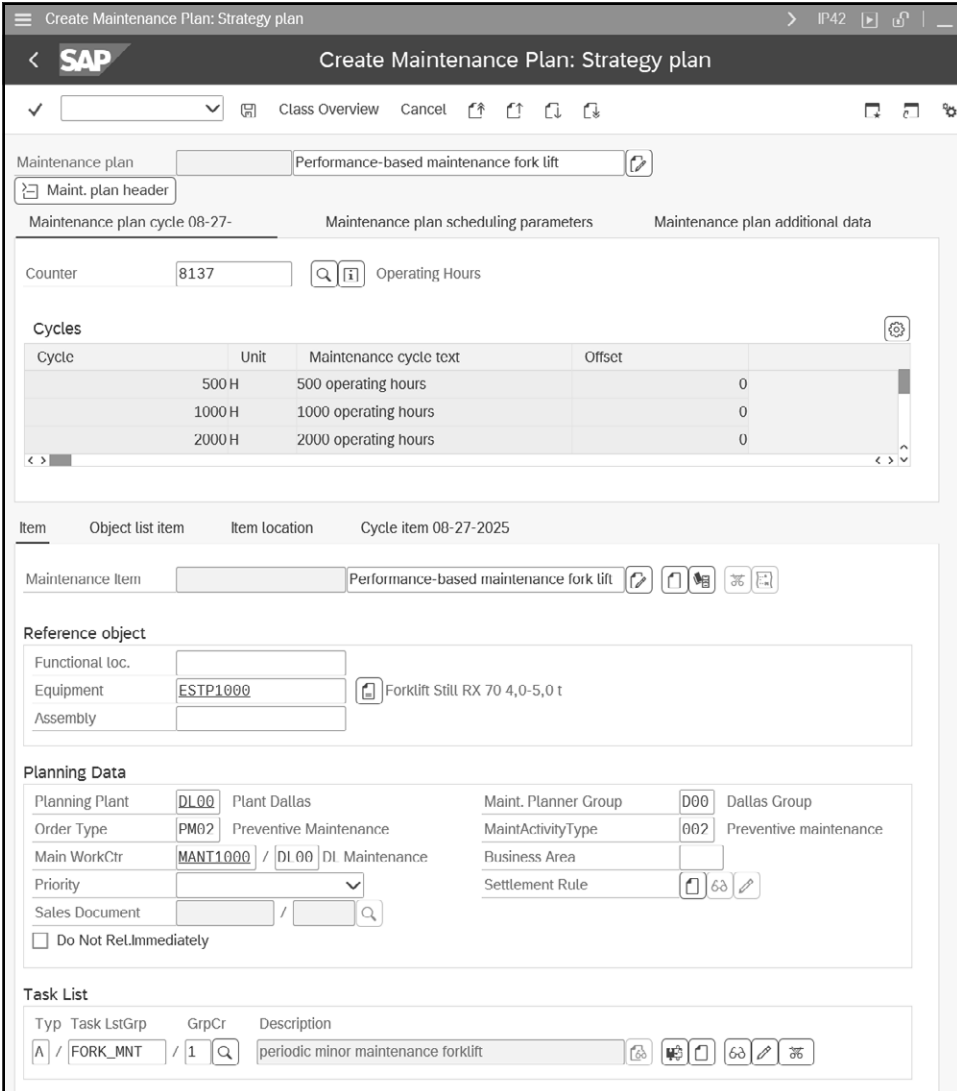


Figure 5.53: Transaction IP42: Performance-Based Strategy Plan

### Scheduling

Starting the strategy plan also combines elements of time-based strategy plans and performance-based single-cycle plans:

1. Enter an initial counter reading for the reference object.
2. Use the **Start** function in Transaction IP10 (Schedule Maintenance Plan) when you want to start a new maintenance cycle. In this case, you specify a start counter reading for when the cycle began (for example, 0 OPH).

- Use the **Start in cycle** function in Transaction IP10 when you want to proceed in an existing maintenance cycle. In this case, you specify a completion counter reading in the **CountReading** field for when maintenance was last performed and select the last executed package (see Figure 5.54).

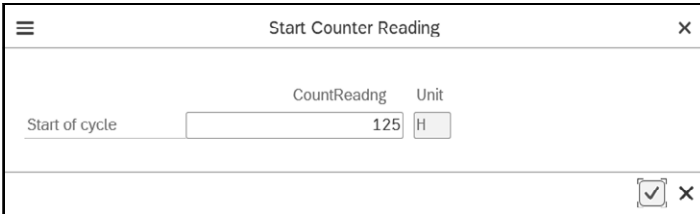


Figure 5.54: Transaction IP10: Start Performance-Based Maintenance Plan with Counter Reading

Unfortunately, SAP Fiori does not offer a comparable function for manually starting a performance-based strategy plan.

The SAP system then calculates the next packages due, the next planned date, and the associated call date based on the maintenance strategy, current counter reading, annual estimate, completion counter reading, and start counter reading (see Figure 5.55).

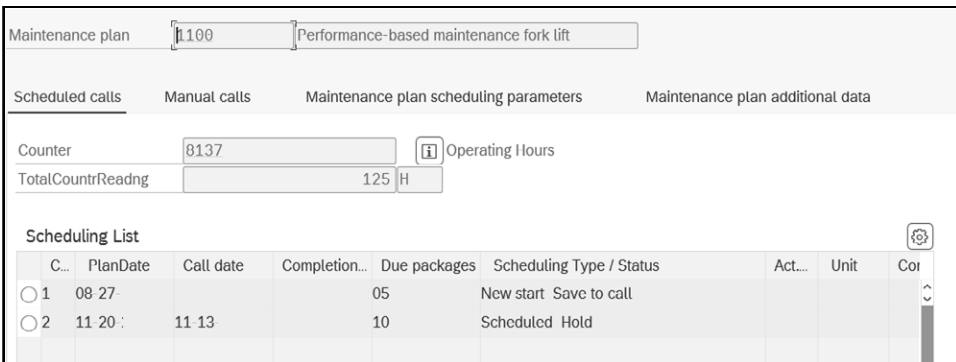


Figure 5.55: Started Performance-Based Strategy Plan

Other procedures (such as processing orders, monitoring deadlines, and so on) and functions (such as cost display for maintenance plan and scheduling overviews) are identical to the procedures and functions for all other maintenance plans.

### 5.6 Multiple-Counter Plans

For time-based and performance-based maintenance, maintenance dates are calculated both via the calendar (for example, in a 6-month cycle) and based on performance (for example, OPH, kilometers, or produced quantities). This section will discuss both basic and enhanced multiple-counter plans.

### 5.6.1 Basic Multiple-Counter Plan

You can define maintenance cycles with different dimensions when using multiple-counter plans. Multiple-counter plans enable you to integrate performance and time dimensions into a maintenance plan, for example, every 1,000 OPH, every 3,000 miles, and every 12 months (see Figure 5.56).

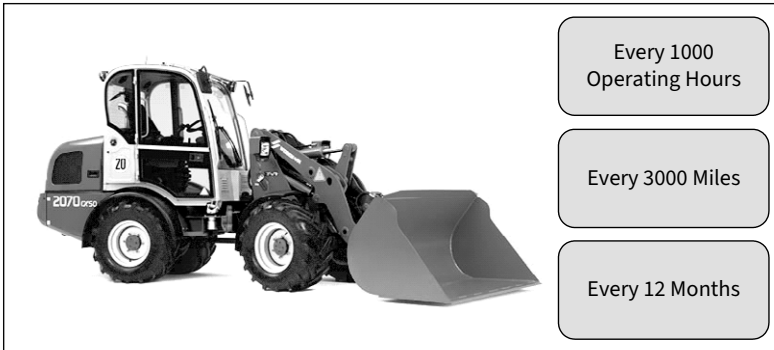


Figure 5.56: Multiple Counters: Example

You can create cycle sets to reduce the effort of entering multiple-counter plans. Cycle sets are similar to maintenance strategies but are not a mandatory prerequisite for basic multiple-counter plans. The following sections discuss cycle sets, the key components of a multiple-counter plan, scheduling parameters, and scheduling itself.

### Cycle Sets

You create cycle sets in Transaction IP11Z (Change Cycle Sets). SAP Fiori does not provide an equivalent app for this functionality. Figure 5.57 shows the cycle set for the example shown in Figure 5.56.

Name		FRK					
Description		Fork Lifters					
	P...	Cycl.length	Unit	Maintenance cycle text	C...	Offset	OffsetShortText
<input type="checkbox"/>	10	3000 MI	3000 Miles	3000 Miles	30		
<input type="checkbox"/>	20	12 MON	12 months	12 months	12		
<input type="checkbox"/>	30	1000 H	1000 operating hours	1000 operating hours	10		

Figure 5.57: Transaction IP11Z: Cycle Set

### Multiple-Counter Plan

If you create a basic multiple-counter plan with Transaction IP43 [Create Multiple Counter Plan] or with the Manage Maintenance Plans app, you can either create cycles directly in the maintenance plan or reference an existing cycle set when you open it (see Figure 5.58). Based on the units specified in the cycle set, SAP S/4HANA Asset Management searches for

suitable counters and proposes those that match the required units. If the system does not suggest a counter, or if it suggests an incorrect one, you can also change them manually.

The screenshot displays the SAP transaction IP02, titled "Change Maintenance Plan: Multiple cntnr plan 00000001101". The interface includes a menu bar at the top with options like "Maintenance plan", "Edit", "Goto", "Extras", "Environment", "System", and "Help". Below the menu, there are navigation icons and a search field. The main content area is divided into several sections:

- Maintenance plan header:** Shows "Maintenance plan" 1101 and "Fork lift maintenance mult. counter".
- Maintenance plan cycle table:** A table with columns for "Cyc...", "Re...", "Cycle", "U...", "Maintenance cycle text", "Counter", and "Description". It lists three cycles:
 

Cyc...	Re...	Cycle	U...	Maintenance cycle text	Counter	Description
<input type="checkbox"/>	1		3000 MI	3000 Miles	8138	Miles counter
<input type="checkbox"/>	1		12 M...	12 months		
<input type="checkbox"/>	1		1000 H	1000 operating hours	8137	Operating Hours
- Item section:** Shows "Maintenance Item" 1164 and "Fork lift maintenance mult. counter".
- Reference object:** Includes fields for "Functional loc.", "Equipment" (ESTP1000), and "Assembly".
- Planning Data:** Contains fields for "Planning Plant" (DL00), "Plant Dallas", "Order Type" (PM02), "Preventive Maintenance", "Main WorkCtr" (MANT1000 / DL00), "DL Maintenance", "Priority", "Sales Document", "Maint. Planner Group" (D00), "Dallas Group", "MaintActivityType" (002), "Preventive maintenance", "Business Area", and "Settlement Rule".
- Task List:** Shows a table with columns for "Typ", "Task LstGrp", "GrpCr", and "Description". It lists a task "A / FORK\_MNT / 1" with description "periodic minor maintenance forklift".

Figure 5.58: Transaction IP43: Create Multiple Counter Plan

### Scheduling Parameters

You should already be familiar with most of the scheduling parameters in a multiple-counter plan. However, two new scheduling parameters have been added: the **Operation Type** parameter and the **Lead float (days)** parameter (see Figure 5.59):

- If you select the **OR - Link** radio button, an order will be created for the earliest planned date. The case that occurs first is crucial. This represents the standard scenario in multi-dimensional performance-based maintenance.

- If you select the **AND - Link** radio button, an order will be created for the last planned date. The case that occurs last is crucial, as it represents the exceptional scenario in multidimensional performance-based maintenance.
- The **Lead float (days)** field specifies how many days before the planned date the order's basic start date should be. The order's basic end date is always created using the planned date.

Maintenance plan 1101 Fork lift maintenance mult. counter

Maint. plan header

Maintenance plan cycle Maintenance plan scheduling parameters Maintenance plan additional data Mai... > v

**Date Determination**

SF Later Confirmation 100 %

Tolerance (+) %

SF Earlier Confirmation 100 %

Tolerance (-) %

Cycle Modification Factor 1.00

Lead float (days) %

**Operation Type**

OR - Link

AND - Link

**Start Data**

Start Date %

Start Time 00:00:00

**Call Control Parameter**

SchedPeriod % DAY

Completion Requirement %

Figure 5.59: Multiple Counter Plan: Scheduling Parameters

## Scheduling

Starting the basic multiple-counter plan combines elements of time-based single-cycle plans and performance-based single-cycle plans:

1. Enter the initial counter readings in the reference object.
2. Use the **Start** function Transaction IP10 when you want to start a new maintenance cycle. In this case, you specify a start date to denote when the cycle began.
3. The SAP system calculates the various planning data based on the current counter readings, relevant annual estimate, and start date.
4. If you selected **OR - Link**, the system suggests the first planned date in the **PlanDate** field; if you selected **AND - Link**, it suggests the last planned date in the **PlanDate** field of the order (see Figure 5.60).

All other procedures (such as monitoring deadlines, processing orders, and cost display in the maintenance plan and scheduling overviews) function the same as in any other maintenance plan.

Be aware that you must not set a call horizon for multiple-counter plans. Instead, the SAP system sets the maintenance call date equal to the planned date, and deadline monitoring then generates the order.

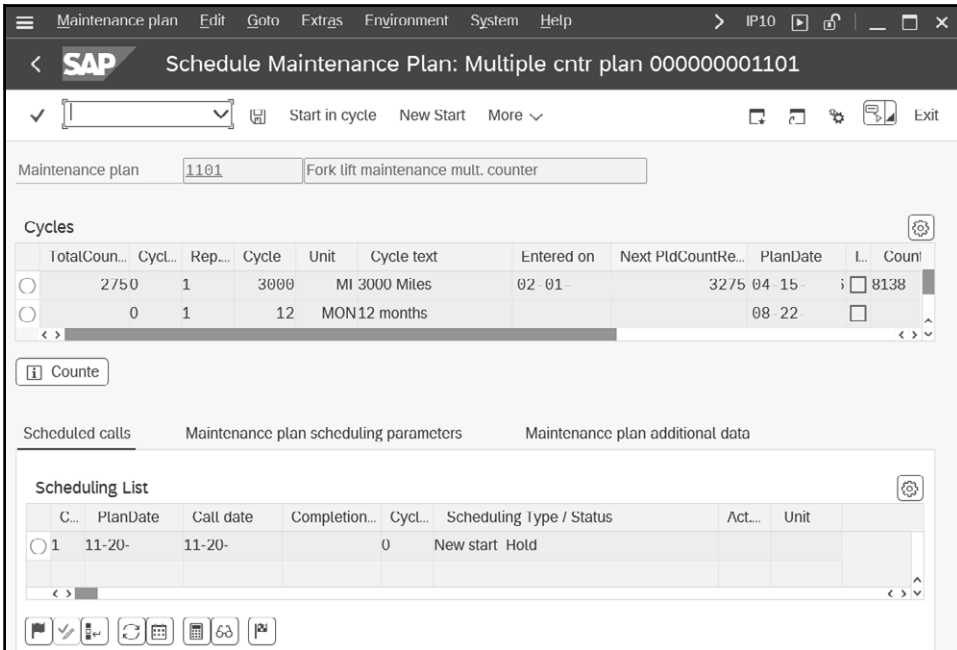


Figure 5.60: Started Multiple Counter Plan

### 5.6.2 Enhanced Multiple-Counter Plan

Unlike the basic multiple-counter plan, enhanced multiple-counter plans enable you to define several cycles that are based on each other, as in the following examples:

- Cycle 1 for small inspection (A): every 1,000 OPH or every 3,000 miles or every 12 months
- Cycle 2 for large inspection (B): every 3,000 OPH or every 9,000 miles or every 36 months

To put it another way, the enhanced multiple-counter plan combines elements of a performance-based strategy plan and a time-based strategy plan. The following sections will discuss the prerequisites for this type of plan, the plan itself, and scheduling.

#### Prerequisites

To enable an enhanced multiple-counter plan, you must meet the following prerequisites:

- In the Customizing function **Set Special Functions for Maintenance Planning**, activate the **Enhanced Multiple Counter Plan** option. Be aware that once you activate this option, you cannot deactivate it.
- Define cycle sets using Transaction IP11Z. In the present example, one cycle set is sufficient. Why? First, the small inspection (maintenance position A) takes place at 2,000 OPH/3,000 miles/12 months (whichever comes first) and at 4,000 OPH/6,000 miles/24

months. The large inspection (maintenance position B) then takes place at 6,000 OPH/9,000 miles/36 months; that is, another 2,000 OPH/3,000 miles/12 months after the last small inspection. This corresponds to the existing cycles, so one cycle set is sufficient.

- You need two different maintenance task lists, one of which must be executed on the date when cycle set 1 is due and the other when cycle set 2 is due. Unlike the strategy maintenance plan, the maintenance task list header is not assigned the cycle set, and the operations are not assigned maintenance packages.

Figure 5.61 displays the basic structure and the resulting schedule.

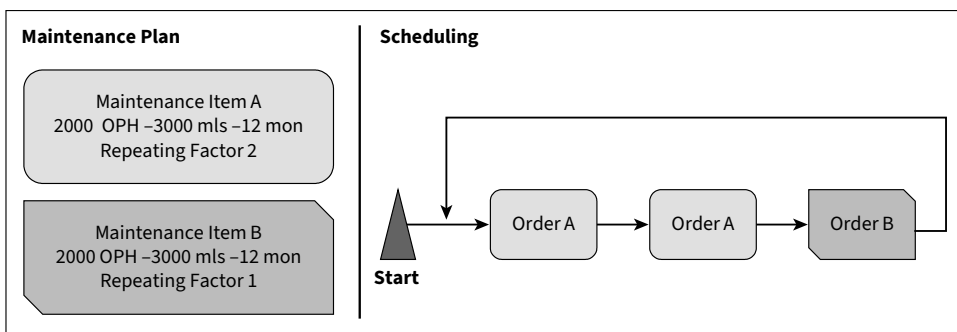



Figure 5.61: Enhanced Multiple Counter Plan: Structure

### Enhanced Multiple-Counter Plan

Proceed as follows to define an enhanced multiple-counter plan (see Figure 5.62):

1. Create a multiple-counter plan using Transaction IP43 (Create Multiple Counter Plan).
2. Assign cycles 1 and 2 to the maintenance plan.
3. Create two maintenance items. Assign cycle set sequence 1 to the first item and cycle set sequence 2 to the second item.
4. Click the  (**Change Repeat Factor**) icon to change the repetition factors. Set the repetition factor (**Rep. Fact.**) to **2** for cycle 1 and to **1** for cycle 2. Thus, the first item is first performed twice, then the second item once, then the first position twice again, and so on.
5. Based on the units specified there, SAP S/4HANA Asset Management searches for suitable counters and proposes those that match the relevant units. If the system does not suggest a counter or suggests an incorrect one, you can also change it manually.
6. The scheduling parameters (for example, **OR - Link** or **AND - Link**) are identical to the scheduling parameters of the basic multiple-counter plan.

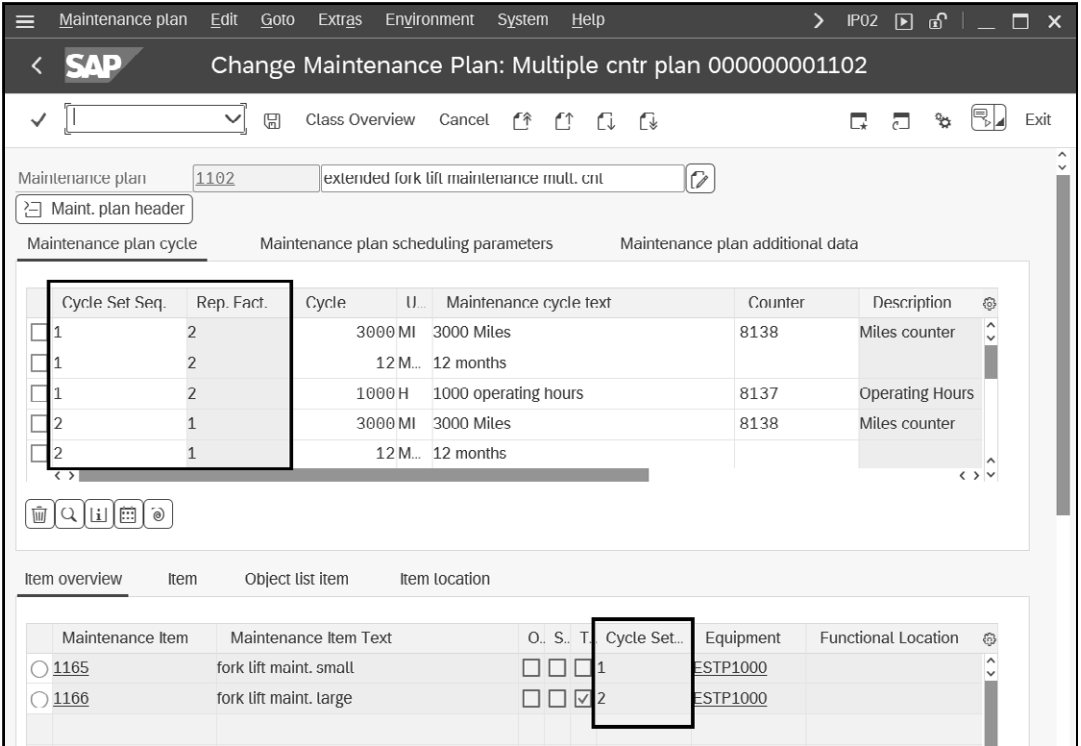


Figure 5.62: Transaction IP43: Create an Enhanced Multiple Counter Plan

**Scheduling**

Starting the enhanced multiple-counter plan combines elements of time-based strategy plans and performance-based strategy plans:

- Use the **Start** function in Transaction IP10 (Schedule Maintenance Plan) when you want to start a new maintenance cycle. In this case, you specify a start date on which the cycle began.
- Use the **Start in cycle** function in Transaction IP10 when you want to continue an existing maintenance cycle. Here, you specify the **Cycle Set Sequence** and **Completion date** on which the last maintenance was performed (see Figure 5.63).

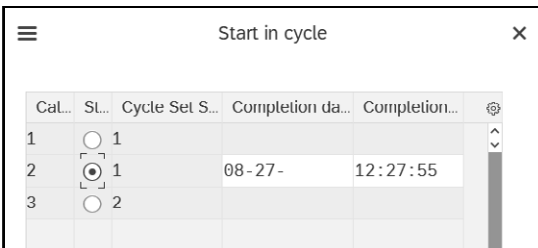


Figure 5.63: Enhanced Multiple Counter Plan: Start in Cycle

- The system then calculates the various planning data based on the current counter readings, relevant annual estimate, and start date.
- If you selected **OR - Link**, the system suggests the first planned date as the order's planned date (**PlanDate**); if you selected **AND - Link**, it suggests the last planned date. The system also shows which cycle set sequence is due next (see Figure 5.64).

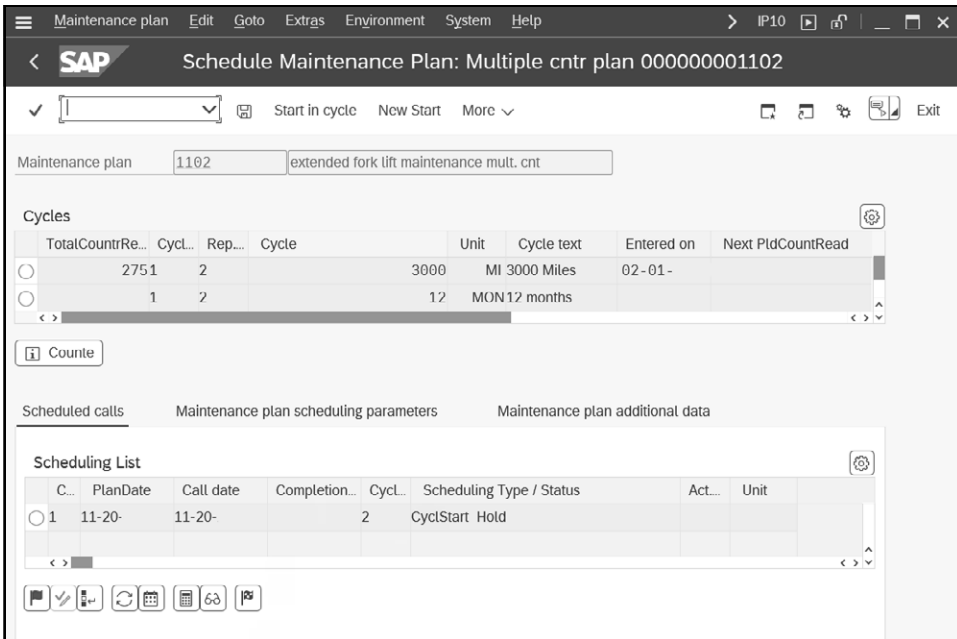


Figure 5.64: Enhanced Multiple Counter Plan: Scheduled

All other procedures (for example, monitoring deadlines, processing orders, and cost display in the maintenance plan and scheduling overviews) function the same as all other maintenance plans.

You must activate the business function LOG\_EAM\_SHIFTFACTORS to enable multiple-counter plans in the displayed form.

## 5.7 Inspection Rounds

How do the functions for inspection rounds differ from those for maintenance planning? Maintenance planning typically involves a single object and requires a sequence of (often complex) activities. Inspection rounds work the other way around: you process many objects and carry out the same activities on each one. These activities are usually simple and require the same tools, spare parts, and qualifications. Examples include the following:

- Lubrication services
- Visual checks

- Counter readings
- Oil level checks
- Minor part replacements

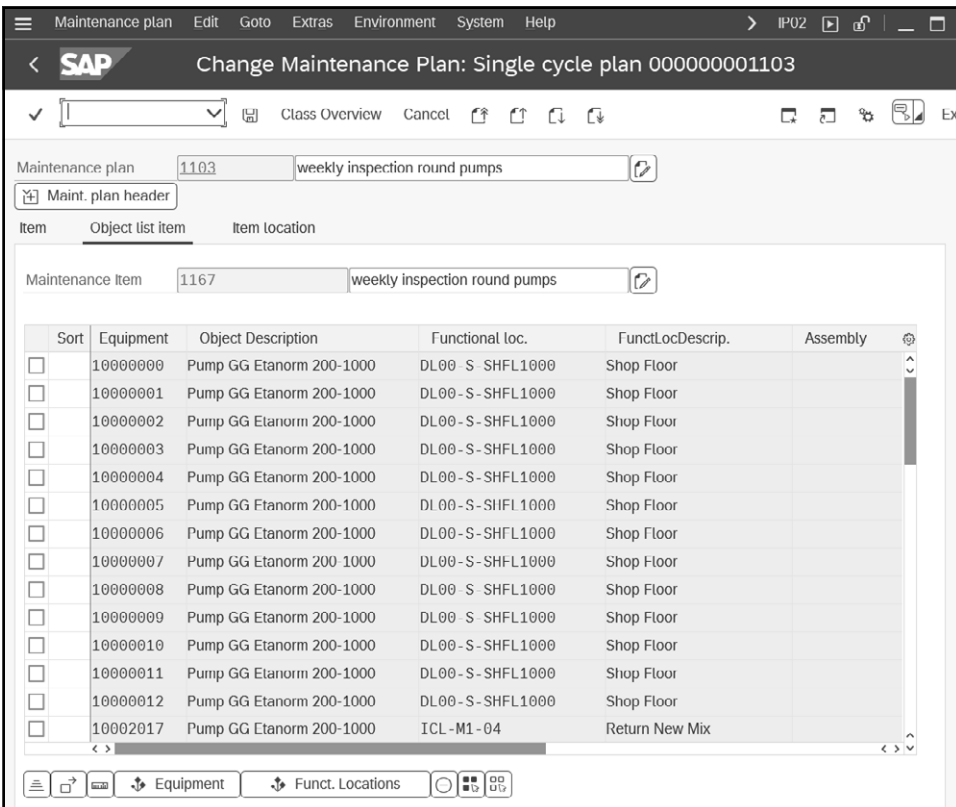
You can map inspection rounds in the SAP system in two ways:

- Inspection rounds using an object list (basic inspection rounds)
- Inspection rounds using maintenance task list (enhanced inspection rounds)

### 5.7.1 Basic Inspection Rounds Using the Object List

If you always perform the same activities on the objects on the inspection round (for example, checking the lubrication condition of all objects and relubricating them if necessary), use the following elements (see Figure 5.65):

- A single-cycle plan to store the organizational data (such as plant, order type, and so on) and to describe the content as maintenance plan text or maintenance plan item text
- An object list to define the technical objects that will be inspected on the inspection round



Maintenance plan: 1103 weekly inspection round pumps

Maintenance Item: 1167 weekly inspection round pumps

Sort	Equipment	Object Description	Functional loc.	FunctLocDescrip.	Assembly
<input type="checkbox"/>	10000000	Pump GG Etanorm 200-1000	DL00 S SHFL1000	Shop Floor	
<input type="checkbox"/>	10000001	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000002	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000003	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000004	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000005	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000006	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000007	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000008	Pump GG Etanorm 200-1000	DL00 S SHFL1000	Shop Floor	
<input type="checkbox"/>	10000009	Pump GG Etanorm 200-1000	DL00 S SHFL1000	Shop Floor	
<input type="checkbox"/>	10000010	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000011	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10000012	Pump GG Etanorm 200-1000	DL00-S-SHFL1000	Shop Floor	
<input type="checkbox"/>	10002017	Pump GG Etanorm 200-1000	ICL-M1-04	Return New Mix	

Figure 5.65: Basic Inspection Round: Object List

### Order

When you start the maintenance plan, an order will be generated that usually contains an operation and an object list (see Figure 5.66).

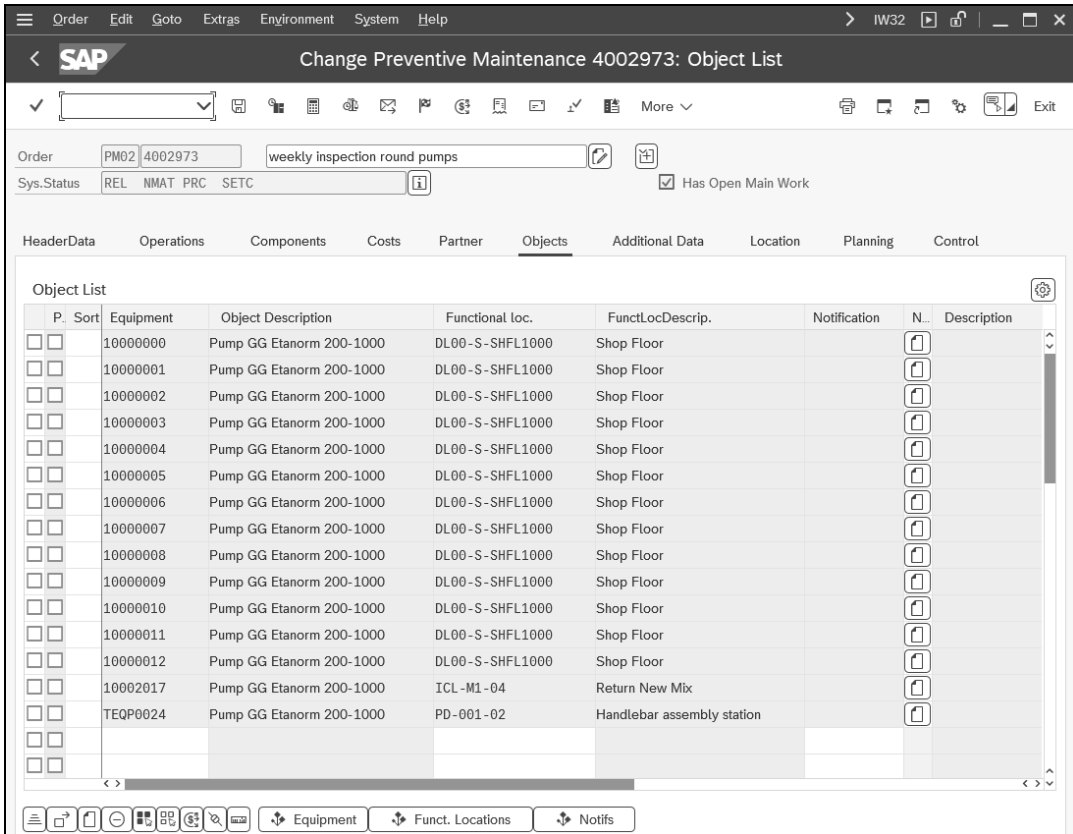


Figure 5.66: Basic Inspection Round: Order

### Confirmation

To confirm the basic inspection round, it's best to use Transaction IW42 for the overall completion confirmation. First report the times there. Then select **Environment • Object List** and navigate to the object list confirmation (see Figure 5.67). In the processing indicator column (P), select the objects that have been processed.

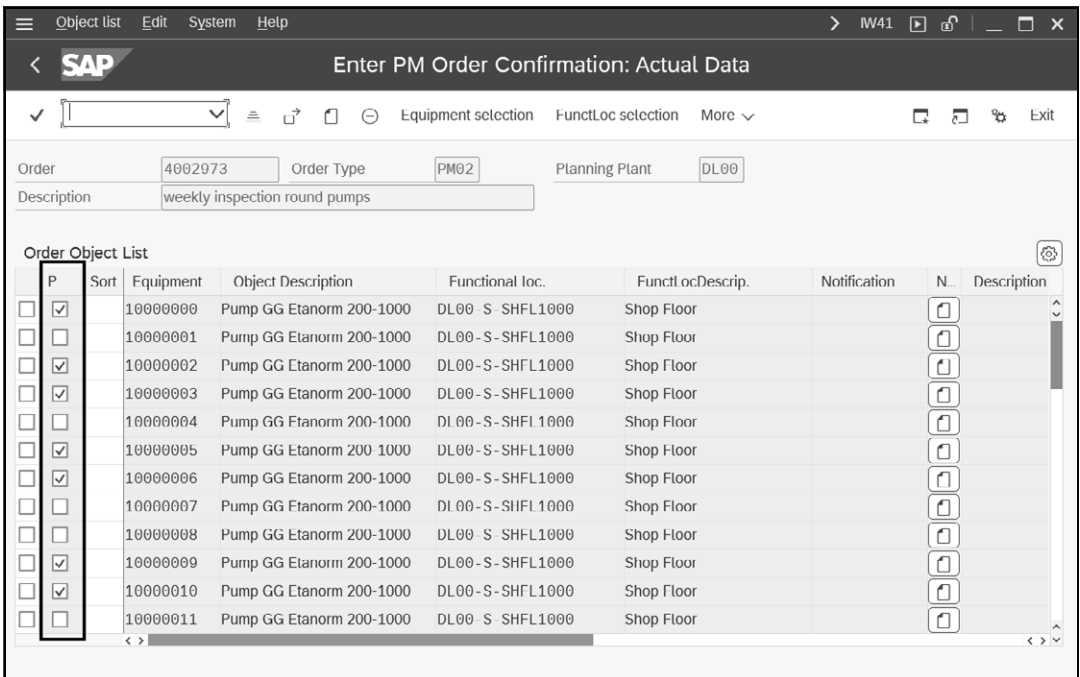


Figure 5.67: Basic Inspection Round: Confirmation

### 5.7.2 Enhanced Inspection Rounds Using the Maintenance Task List

You can use the enhanced inspection round with a maintenance task list if you perform different activities on the objects of the inspection round. These activities could include, for example:

- Object 1: Check lubrication condition
- Object 2: Record noise levels
- Object 3: Read counter reading

#### Enhanced Inspection Rounds: Elements

You can map the enhanced planning and execution of inspection rounds in SAP S/4HANA Asset Management as follows:

1. Define the content of inspection rounds in maintenance task lists.
2. Define the frequency of inspection rounds in a maintenance plan.
3. Control the execution of inspection rounds using orders generated by the maintenance plan.
4. Document the confirmation of inspection rounds with the overall completion confirmation, which is the recommended approach.



The following sections discuss how to use task lists, maintenance plan, orders, and confirmation for enhanced inspection rounds. The section also discusses some prerequisites for using enhanced inspection rounds.

### Task List

Maintenance tasks lists used for enhanced inspection rounds differ from other maintenance tasks lists in the following ways (see Figure 5.68):

- You use the sequence of operations to define the sequence of stations and the individual steps that make up the inspection round.
- You assign the technical object that will be inspected to the operations (functional location, equipment, and, if necessary, an assembly).
- You can also assign any measuring points/counters, documents, lubricants, or test equipment you require for an operation to that operation.
- If the inspection round will be executed on a regular basis (daily, weekly, or monthly), you can specify this frequency in a maintenance plan.
- You can execute the inspection round if certain events occur (for example, before/after a production start or before/after a shutdown). In this case, execute the maintenance task list using a manual order (Transaction IW31).

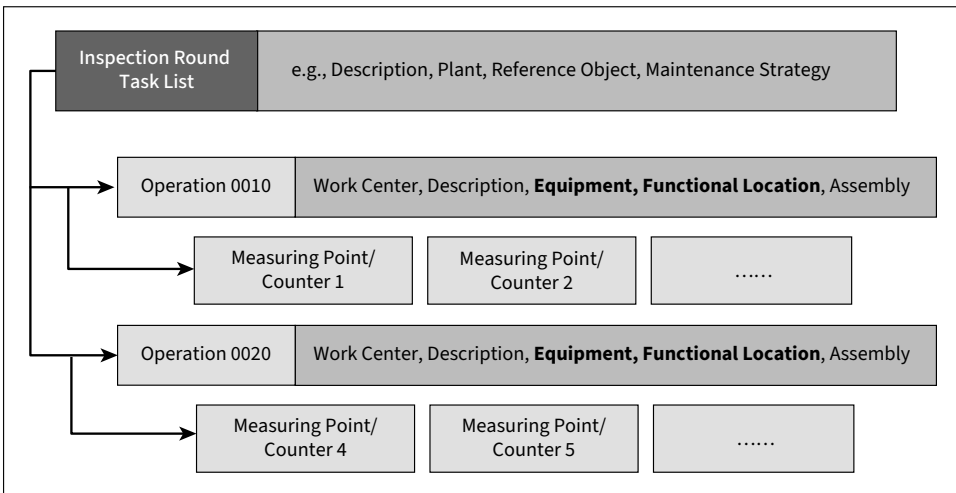


Figure 5.68: Enhanced Inspection Round: Maintenance Task List Structure

Figure 5.69 shows a maintenance task list with various technical objects for which lubrication services are to be executed and counter readings taken.

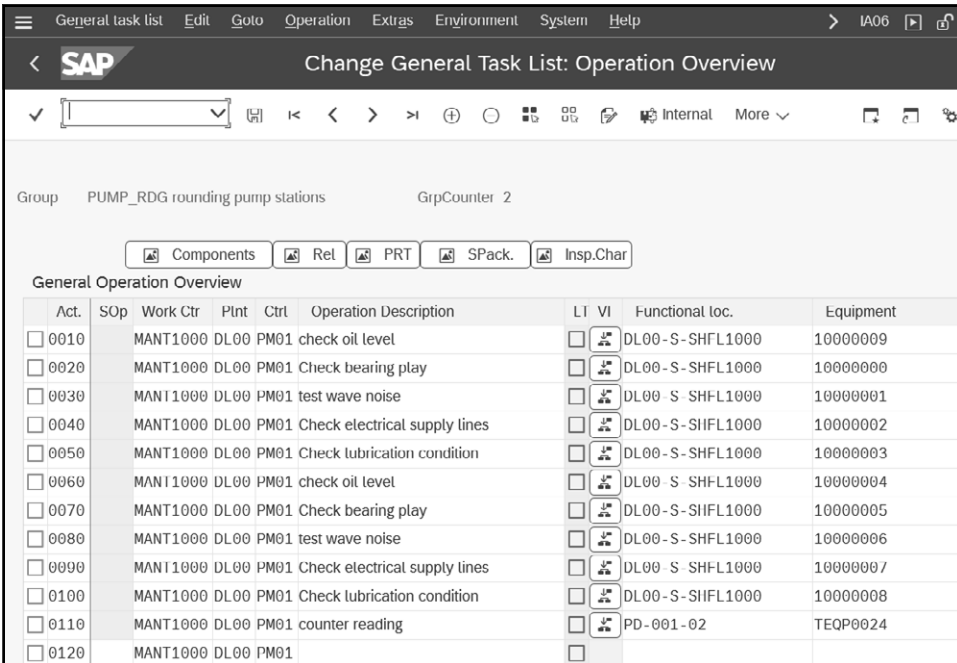


Figure 5.69: Enhanced Inspection Round: Maintenance Task List Example

You define the counters as PRTs for the operation (see Figure 5.70).

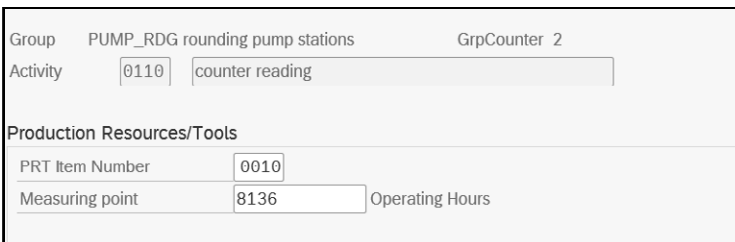


Figure 5.70: Enhanced Inspection Round: Counter

### Enhanced Inspection Rounds: Which Maintenance Plan Category Should You Use?



You can use a maintenance plan to define how often the inspection round task list will be executed:

- Use the time-based, single-cycle plan if you want the entire inspection round to be executed at defined intervals.
- Use the time-based strategy plan if the inspection of individual stations takes place in different cycles.

Performance-based maintenance plan categories are not relevant for inspection rounds because you'll want to inspect several objects with different counter readings.

### Maintenance Plan

Figure 5.71 shows a single-cycle plan that executes the inspection round task list once a month.

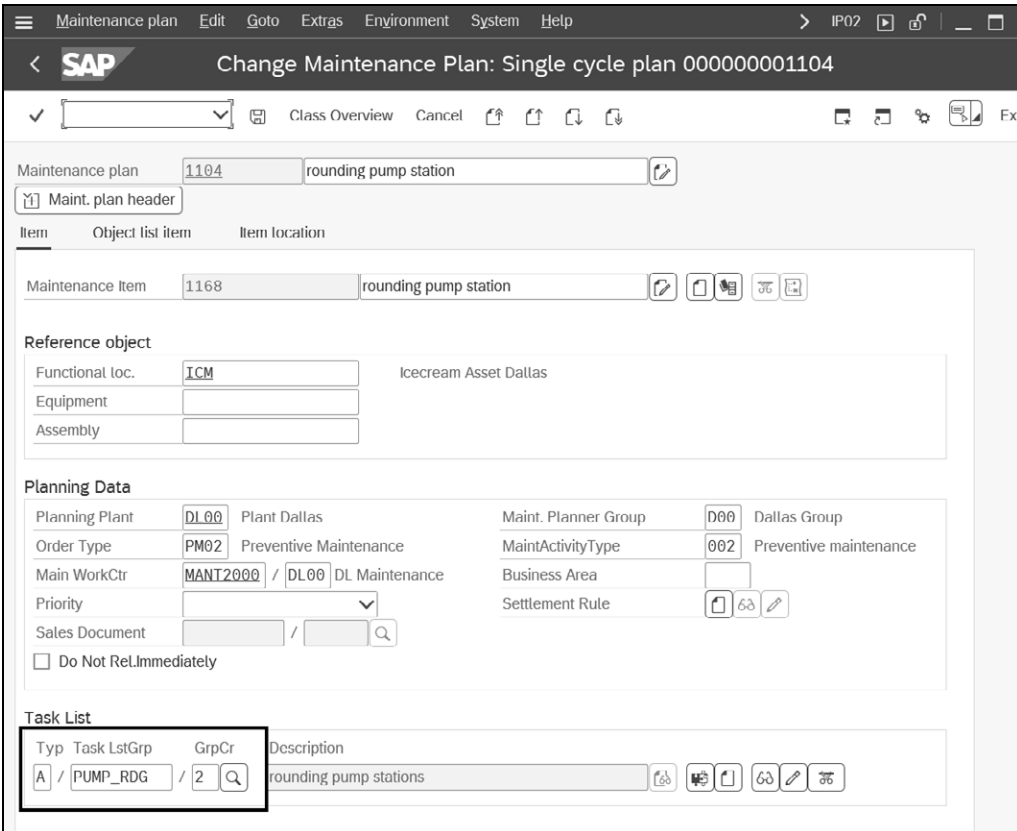


Figure 5.71: Enhanced Inspection Round: Maintenance Plan

### Order

When you start the maintenance plan, the system generates an order that contains the technical objects (functional locations and equipment) and the measurement points as PRTs at the operation level (see Figure 5.72).

For the process to function properly, you must select the Customizing function **Define Notification and Order Integration** and deactivate the **Enhanced Object List for Assignment of Operations to Object List Entries** indicator.

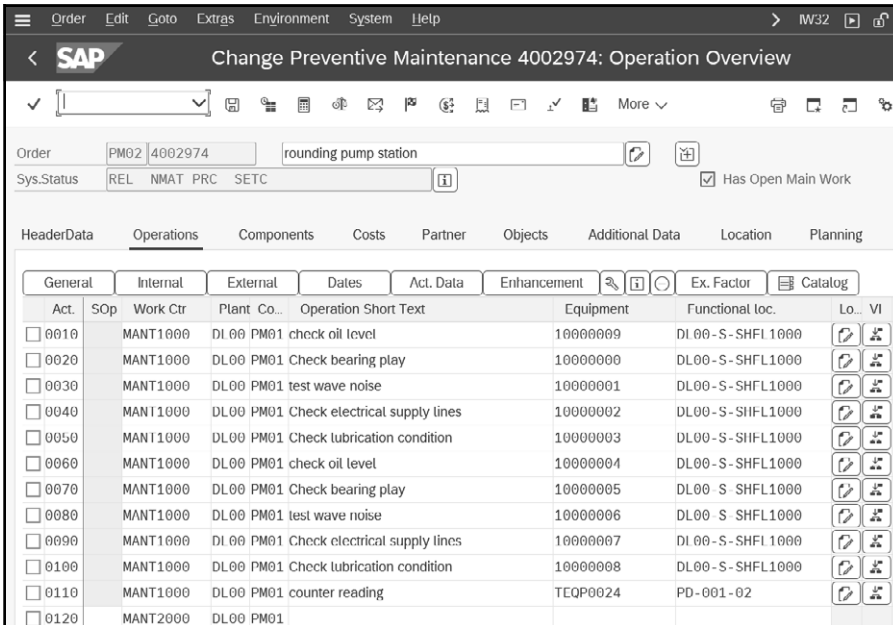


Figure 5.72: Enhanced Inspection Round: Order

**Confirmation**

To confirm the order for the inspection round, we recommend using Transaction IW42 (Overall Completion Confirmation). This transaction not only allows you to confirm the operations but also enables you to record measurement/counter readings (see Figure 5.73).

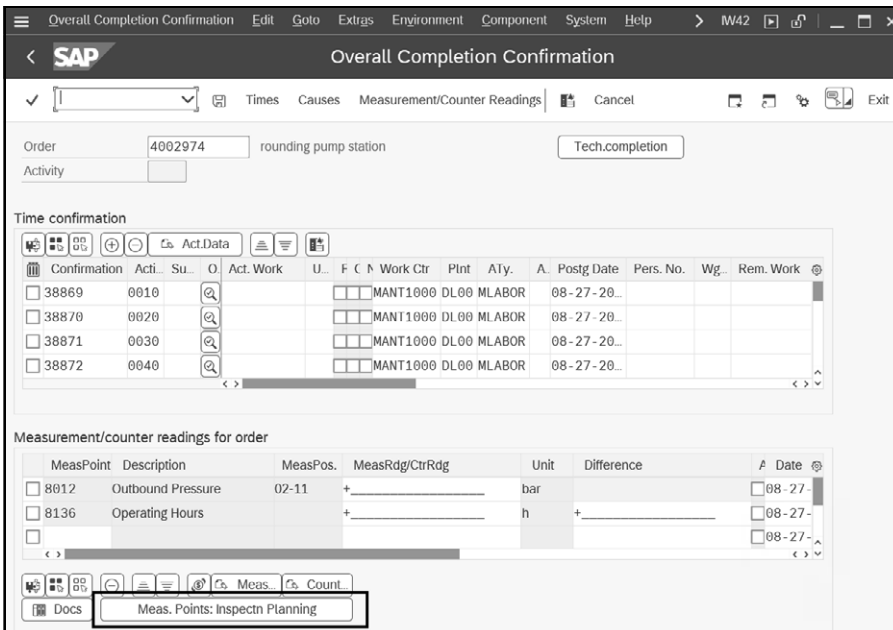


Figure 5.73: Enhanced Inspection Round: Confirmation

Use the **Meas. Points: Inspectn Planning** button for this. You can also create a new notification for technical confirmation directly from the overall completion confirmation for each operation that has an assigned object.

As a prerequisite for confirmations, you must have defined data entry profiles using the Customizing function **Set Screen Templates for the Completion Confirmation** and assigned a data entry profile (**Extras • Settings** in Transaction IW42). When you define screen templates, you must activate the **Measurement/counter readings** screen area.

To use inspection rounds in full, you must activate the business functions LOG\_EAM\_CI\_3 and LOG\_EAM\_CI\_4.



### **Overall Completion Confirmation with Layout for Advanced Inspection Rounds**

Define a screen layout for the overall completion confirmation of orders for advanced inspection rounds. This layout should include the operations and the measuring points/counter readings and allow you to confirm all inspection-round information from a single screen template.

## **5.8 Condition-Based Maintenance**

Condition-based maintenance is a maintenance strategy in which a maintenance task is triggered when the actual condition of a technical system (or part of it) deviates from the target condition. The following definitions apply:

- *Counters* are the tools you use in SAP S/4HANA Asset Management to represent the wear and tear of an object, consumption, or reduction in useful life, for example, an odometer, OPH counter, number of pieces, or output in tons. Counters have a continuous counter reading that increases or decreases over time.
- *Measuring points* in SAP S/4HANA Asset Management represent locations where the current condition of a technical system is described, for example, temperature, number of revolutions, pressure, level of contamination, and viscosity. You can specify target values and upper or lower limits on measuring points. Measuring readings have a discontinuous progression.

While counters are the basis for performance-based maintenance, measuring points and measurement readings form the basis of condition-based maintenance.

You must meet the following prerequisites for condition-based maintenance:

- Define the target conditions of the technical systems and their components.
- Monitor the technical system and its parts regularly or continuously with respect to its target conditions.

You are not required to define any maintenance plans for condition-based maintenance.

While time-based maintenance tasks are triggered on a certain date and a performance-based maintenance tasks are triggered by a specific counter reading, tasks for condition-based maintenance are triggered by the following events, for example:

- The temperature has risen too high or fallen too low.
- The flow rate is too quick or too slow.
- The oil shows too high a level of pollution.
- The voltage has dropped too low or has built up too far.
- The viscosity of the lubricant is too high or too low.

Table 5.2 contains an overview of the differences between time-based, performance-based, and condition-based maintenance.

	Time-Based Maintenance	Performance-Based Maintenance	Condition-Based Maintenance
Basis	Calendar	Counters	Measuring point
Readings	N/A	Sporadic to regular	Regular to permanent
Run chart	N/A	Continuous increase or decrease	Discontinuous
Maintenance plan	Yes	Yes	No
Task is triggered	When a date is reached	When a counter reading is reached	When target values have been exceeded or have not been reached

Table 5.2: Maintenance Strategies

How does condition-based maintenance work in the SAP system? Figure 5.74 provides an overview.

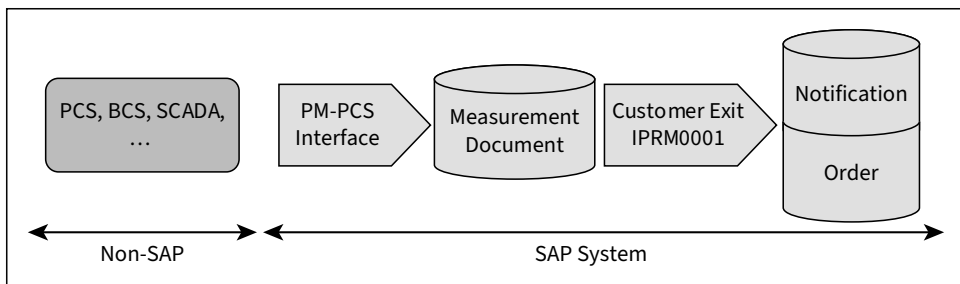


Figure 5.74: Condition-Based Maintenance: Overview

You use an upstream system to obtain data regularly or permanently about the current condition of the technical system. This can include:

- Process control systems
- Building control systems (BCS)
- Supervisory control and data acquisition (SCADA) systems
- Electronic control stations
- Network monitoring systems
- Systems for plant data collection and machine data acquisition (PDC/MDA)
- Warehouse computers
- Systems for sound or vibration analysis
- Diagnostic systems
- Mobile data entry systems

For more information about the way these systems work and how data is transferred to SAP S/4HANA Asset Management, refer to Chapter 7, Section 7.3.

You can use the plant maintenance-production control system (PM-PCS) interface to transfer measurement readings from upstream systems to SAP S/4HANA Asset Management. The data is saved in measurement documents for further processing.

In customer exits, you define how the subsequent processing should take place. Customer exit IMRC0001 is particularly important in this context because it can automatically trigger actions in SAP S/4HANA Asset Management when certain thresholds are exceeded (see Figure 5.75). For each technical object, you can define a target value and measurement range limits; that is, the value range within which the measurement results must lie.

Target value	
Target value	185 °F
Text	

↓

Measurement Range Limits	
Upper range limit	195
Lower range limit	165
MeasurmntRangeUnit	°F Fahrenheit

Figure 5.75: Measuring Point: Target Value and Ranges

You can use the Customizing function **Define Measuring Point Categories** to specify that the SAP system must issue a warning or an error message if measurement ranges are exceeded or not reached. You can also define that a malfunction report is automatically triggered when a certain threshold is exceeded. Other tasks can be triggered through customer exits in the report (for example, orders can be created).

A more advanced alternative to basic condition-based maintenance in SAP S/4HANA Asset Management is the cloud-native solution SAP Asset Performance Management (SAP APM). SAP APM enables enhanced condition-based maintenance strategies by leveraging real-time asset health data, risk assessments, and historical performance insights. For a detailed overview, refer to Chapter 9, Section 9.3.

## 5.9 Summary

SAP S/4HANA Asset Management provides a wide range of functionality for preventive maintenance. In this chapter, you learned about the most important functions of maintenance task lists and maintenance plans, as well as how to use them. Section 5.3 covered the following:

- The different types of task lists (equipment, functional location, and general task lists)
- The content of maintenance task lists (e.g., operations and components)
- How to create a task list
- How to assign a task list to an order
- How to perform additional functions (e.g., mass change or costing)

Section 5.4 through Section 5.8 covered maintenance plan-related topics, as follows:

- The different types of maintenance plans (single-cycle plans, strategy plans, multiple-counter plans, and inspection rounds)
- The fact that they are based on time or performance units
- The content of maintenance plans (e.g., items and task lists)
- How to create the different types of maintenance plans, either with SAP GUI transactions or with SAP Fiori apps
- How to schedule maintenance plans
- The fact that you must run deadline monitoring (Transaction IP30H or the Mass Schedule Maintenance Plans app) on a regular basis
- How the system determines plan dates and call dates based on the scheduling parameters
- How to perform additional functions (e.g., mass change or costing)



Karl Liebstückel, Markus Seidl

# Plant Maintenance with SAP

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