

**SAP Manufacturing Execution
How-To Guide**



How To Set Up and Use the SAP ME Sampling Feature

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SAP ME How-To-Guide for Sampling

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Document History

<u>Document Version</u>	<u>Description</u>
1.0	Initial version
1.1	Updated based upon feedback from the Field

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1 Introduction

1.1 Purpose

This ME Help How-To-Guide for the Sampling feature is intended to provide sufficient information to enable the user to easily configure and readily utilize Sampling feature making use of available best practices.

2 Sampling Overview

This overview provides a high level description of the Sampling feature.

2.1 Description and Applicability

The Sampling feature allows you to detect possible process problems and identify nonconforming product early in the manufacturing process to prevent excess rework or scrap cost.

A sample-based approach to in-process inspection balances the risk to quality against the costs of performing inspections. Inspection is conducted at certain process points to detect and eliminate problems at minimum cost.

You can perform sampling on both serialized and non-serialized SFC numbers. Non-serialized SFC numbers selected for sampling are split, if only partial quantity is selected for sampling.

The decision about the quality of the sample (whether the sample is accepted or rejected) depends on the total severity of the NC codes that were logged for the sample SFC numbers.

SFC accept/reject decision depends on total severity of logged NC codes and NC severity threshold defined in the sample plan. The severity of each NC code logged against an SFC number at the sample routing is summed and then total is compared to the NC Severity Threshold value defined in the sample plan. If this total value equals or exceeds the threshold, SFC number is rejected.

SFC group accept/reject decision depends on the quantity of rejected SFC numbers in the group and the reject number defined in the sample plan. If the quantity of rejected SFC numbers equals or exceeds the reject number defined in the sample plan, the whole group is rejected.

When you set up sampling for your site, you decide the following:

- Whether your sampling process should confirm to ANSI standards or have custom settings
- How strict the sampling procedure should be
- When the sampling should occur
- What messages will be displayed to the operator and whether the operator is allowed to skip the sampling process

2.2 Business Purposes / Functions

Sampling feature provides the following functions:

- Providing two types of sample plan

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A flexible approach to defining a sample plan needs to accommodate various quality policies and inspection strategies. You define a sample plan in *Sample Plan Maintenance*.

- Attaching a sample plan to objects representing the material for which, and when in the process, sampling shall occur

You can attach one or more sample plans to any operation for operators to perform sampling at this operation and to the material (or group of materials) to be sampled.

- Working in the Production Operator Dashboard (POD)

At the defined sampling operation, the user selects SFC numbers for the defined material in the POD Work list and performs sampling for these SFC numbers. The system checks that there is a sample plan defined for the SFC numbers selected and creates the SFC group that meets the SFC Group Size value. For more information, see *Inspecting Sample on the Sample Routing*.

- Processing sample SFC numbers on the sample routing

All sample SFC numbers are moved to the sample routing defined in the sample plan (see *Inspecting Sample on the Sample Routing*).

All non-sample SFC numbers of the group remain on the production routing and await the group result.

- Logging NC codes for any sample SFC number

In the *Log NC* activity, the operator can log NC codes when working with sample SFC numbers on the sample routing. When the sample SFC numbers are done at the sample routing, each sample SFC number is either accepted or rejected based on the total NC severity of the NC codes logged for this SFC number at the sample routing. Then sample SFC numbers are dispositioned to the next operation on the production routing.

- Accepting or rejecting sample SFC numbers

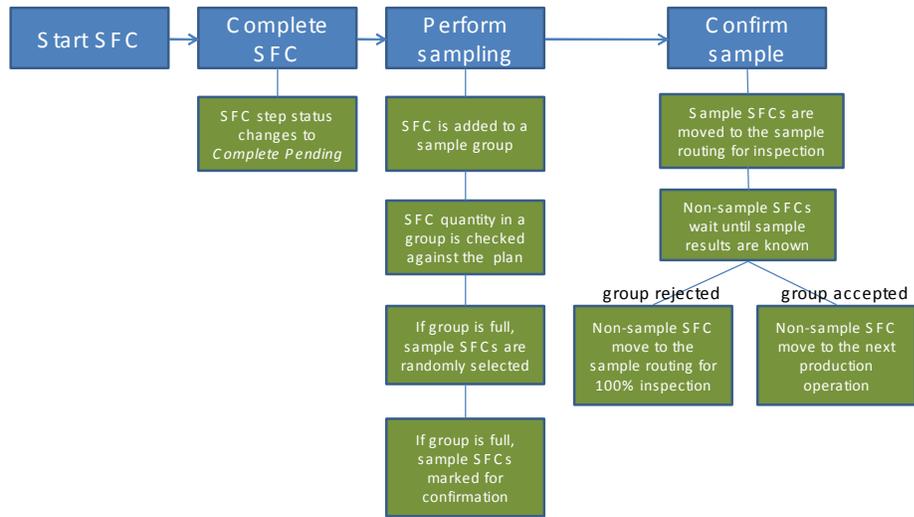
Once the SFC group's reject number is reached, the entire SFC group is considered as rejected and all non-sample SFC numbers are also dispositioned to the sample routing where all SFC numbers in this group are inspected. If the SFC group is accepted, then all members of this group are automatically moved to the next operation on the production routing.

- Viewing the SFC Group Report to keep track of sample plan editing (see *SFC Group Report*)

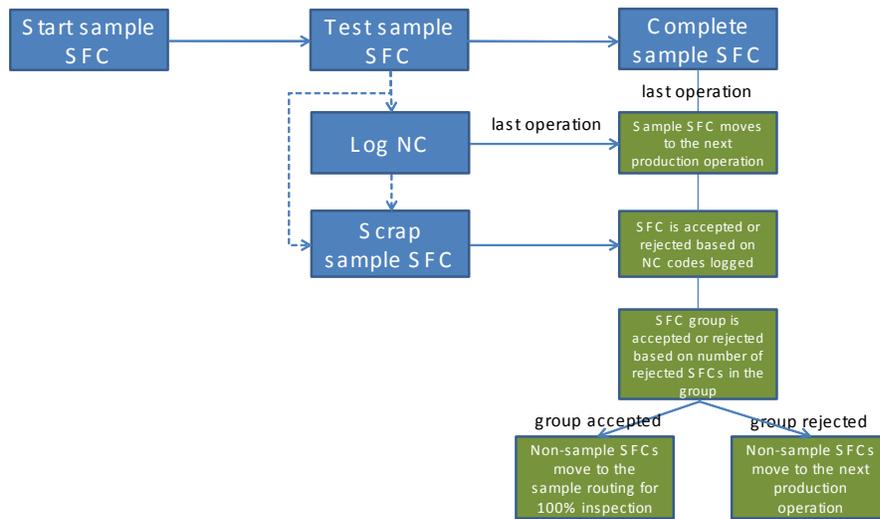
2.3 High-Level Process Flow

This figure illustrates the primary flow of user actions when performing Sampling on the production routing:

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The next figure illustrates the detailed flow of user actions when inspecting sample on the sample routing (see Inspecting Sample on the Sample Routing):



3 Sampling Functions

3.1 Product Sampling

3.1.1 Description and Applicability

You can use this function to perform product sampling at defined points in the manufacturing process based on the defined sample plan.

3.1.2 Prerequisite

You have configured product sampling as defined in the Sampling Setup section of this document.

3.1.3 Features

A flexible approach to executing sampling needs to accommodate various quality policies and inspection strategies. It provides you with the ability to associate a sample plan with specific materials or material groups to control the heterogeneity of the sample population. In SAP ME sampling settings are defined in sample plan.

3.1.3.1 Sample Plan Concept

In SAP ME, sample plan is a set of ANSI-based or custom settings defining sampling process details and accept/reject decision criteria.

You define a sample plan in *Sample Plan Maintenance* and attach it to a specific combination of material (material group) and operation.

You can attach multiple sample plans to one material or operation. In this case, a sample plan for each selected SFC number is chosen by the lowest sequence number. If the sequence number is a tie, the sample plan is chosen alphabetically by sample plan name.

Note: For sampling operation, define the resource as a process resource to assure that different users can process the sample.

You can also define the resource for sampling. If a resource is not defined, sampling can be performed on any resource at a defined operation.

Note that you cannot attach sample plan to operation that has attached buyoffs or is a member of Simultaneous Group or Any Order Group.

You have to define the following required key attributes for a sample plan:

- *Type*
- *Status*

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Note: The status of a sample plan has to be *Releasable* for an operator to work with this sample plan.

- *Version*
- *Sample Routing*
- *NC Severity Threshold*
- *SFC Group Size*
- *Acceptance Quality Limit*

When the *ANSI* type is used to define a sample plan, the accept and reject numbers are determined by the system based on the ANSI standard.

With the *Custom* type, the user can enter values for accept and reject numbers.

Example: If the reject number is 3, it means that the sample is rejected if three or more pieces of sample SFC numbers fail inspection.

Note that the accept number is always smaller than reject number.

You can define the following optional settings for a sample plan:

- Which SFC numbers to include in an SFC group
- Sample reject message type
- Sample skip message type

3.1.3.2 SFC Group Concept

When you define a sample plan, one of the key settings is the SFC group size. In SAP ME, SFC group is a collection of SFC numbers from which the sample is selected for inspection. At defined operation, the SFC group is created automatically based on the number you enter in the *SFC Group Size* field to indicate how many pieces of an SFC number will be selected to create this group.

Note: If the selected SFC number has a quantity greater than the SFC group size, the entire SFC quantity is placed in the SFC group on the *Perform Sampling* action.

In sample plan, you can specify to include the following in the SFC group:

- Any SFC number in the SFC group
- Only SFC numbers that are being processed at this operation for the first time
- RMA and non-RMA SFC numbers in the same SFC group
- SFC numbers from all materials/material groups in the same SFC group

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The system automatically creates an SFC group from the SFC numbers in the *Complete Pending* status which are selected in the POD every time an operator chooses the *Perform Sampling* button to indicate that this SFC number is to be inspected. When the quantity of pieces in SFC group equals the SFC group size, the *Perform Sampling* plug-in opens.

When an operator performs sampling in the POD, the SFC numbers selected for sampling from the entire SFC group are listed in the table. The system randomly selects SFC numbers from the SFC group to inspect them and marks them with *Y* (yes). Note that if only partial quantity of SFC number is selected for sampling, it is left unmarked.

The quantity of the SFC numbers to inspect (sample size) depends on the following values:

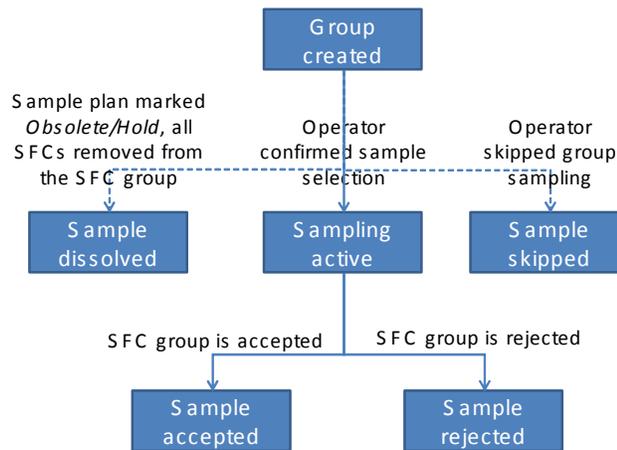
- For a *Custom* sample plan, the sample size is defined by the values set in the *Fixed Number* or *Fixed Percentage* fields.
- For an *ANSI* sample plan, the sample size is defined according to the ANSI standard based on values set in the *SFC Group Size*, *Inspection Level* and *Inspection Procedure* fields.

SFC group can have the following statuses:

Status	Description
<i>Group Created</i>	The SFC group has been created but sampling has not yet occurred.
<i>Sampling Active</i>	The SFC group has been created, sampling has occurred, and the sample SFC numbers have been sent to the sample routing.
<i>Sample Accepted</i>	The SFC group is accepted and the SFC numbers are no longer members of the SFC group.
<i>Sample Rejected</i>	The SFC group is rejected and all the SFC numbers from the SFC group are dispositioned to the sample routing. The SFC numbers are no longer members of the SFC group.
<i>Sample Skipped</i>	The SFC group has been created, but the sampling of the group was skipped by an operator. All SFC numbers from the SFC group are automatically completed and moved to the next operation on the production routing.
<i>Sample Dissolved</i>	The SFC group was created, but the plan was subsequently marked as <i>Obsolete</i> or <i>Hold</i> and all members were removed from the SFC group.

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The figure below illustrates the changes of SFC group status during sampling:



Note: The history of the SFC groups in the *Sample Accepted* or *Sample Rejected* statuses and their members is tracked but this does not prevent an SFC number from becoming a member of another SFC group further on in the manufacturing process.

You can remove SFC numbers from the SFC group by changing the SFC status in the *SFC Step Status* activity. This is only possible if the sample plan status is *Obsolete* or *Hold* and the SFC group status is *Group Created*.

3.2 Inspecting Sample on Sample Routing

3.2.1 Description and Applicability

You can use this function to work with product sample on sample routing.

3.2.2 Prerequisites

1. You have configured product sampling as defined in the Sampling Setup section of this document.
2. Operator has performed and confirmed product sampling at defined point on the production routing.

3.2.3 Features

SFC numbers selected for sampling from the SFC group are dispositioned to a sample routing for further quality inspection. Additionally, if the SFC group is rejected, all non-sample SFC numbers from this SFC group are dispositioned to the sample routing.

You start, work on and complete your sample SFC numbers on the sample routing. You can log NC codes to indicate defects when necessary.

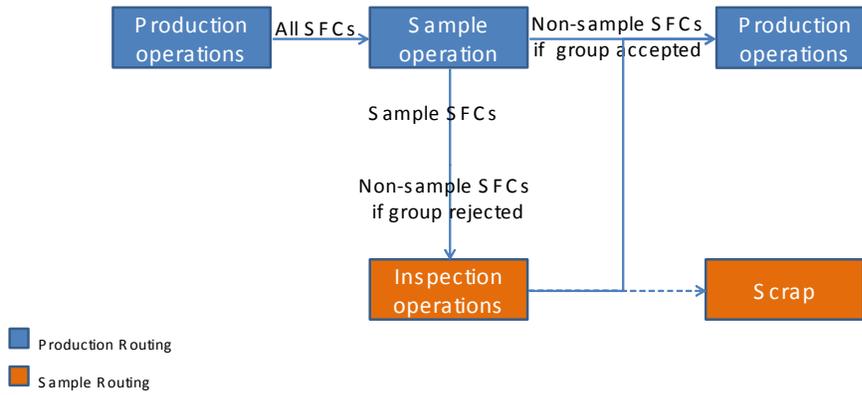
Note: For non-serialized SFC numbers, you must log only NC codes configured with NC data type containing the *Defect Count* data field. You must enter the *Defect Count* value when logging NC code against non-serialized SFC numbers on the sample routing.

You can scrap an SFC number on the sample routing in the *Scrap/Delete* activity. If there are no NC codes logged against this SFC number, or if the total severity of NC codes logged against this SFC number is lower than the *NC Severity Threshold* value defined in the sample plan, such scrapped SFC number will be accepted.

Note: You cannot unscrap an SFC number that has been scrapped on the sample routing. You cannot apply any change production action to the SFC number, archive or delete it if it is a member of an SFC group whose status is either *Group Created* or *Sampling Active*. Upon completion of the sample routing, each SFC number is returned to the next step on the production routing or scrapped, depending on the Sample routing configuration.

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The figure below illustrates the primary flow of user actions when working with SFC numbers on the sample routing:



4 Sampling Setup

4.1 Description and Applicability

You can use this process to set up product sampling and define sampling process characteristics.

4.2 Configuration

1. In *Routing Maintenance*, define sample routing where sample SFC numbers will be inspected.
 - The type of the sample routing must be *Sample*.
 - Sample routing may contain one or multiple operations. It can also include *Return (Next)* and/or *Scrapped* as a last step.
2. In *Sample Plan Maintenance*, define sample plan and attach it to specific material or material group and operation where the sampling will be triggered.
 - Along with the sample plan name and version, specify plan type. The type selection depends on whether you need your sampling to confirm to the American National Standards Institute (*ANSI*) Standard.

The *ANSI* type assures your sampling characteristics confirm to the standard. Custom type allows you to define any custom characteristics and they will not be checked against the standard.

- On the *Main* tab page, define sample routing and NC severity threshold.

NC severity threshold here is used to compare the total severity of logged NC codes to define SFC group accept/reject decision. You need to consider the severity of NC codes that shall fail sample tests and the acceptable quantity of minor defects to identify the appropriate severity threshold. For example, you have failure NC codes that shall fail the test (marked with the *High (5)* severity in *NC Code Maintenance*), and NC codes that indicate minor defect (marked with the *Low (2)* severity in *NC Code Maintenance*). NC severity threshold of 5 indicates that SFC number will fail the inspection if operator logs one failure NC code or 3 minor failure NC codes. To allow only one minor defect, set up the NC severity for appropriate code to *Medium (3)*.

- On the *Main* tab page, you can also indicate whether the operator can skip sampling of the group and what message to display in this case. Additionally, a message to be sent to the message board when sample group is rejected is defined here.
- On the *Details* tab page, define SFC group size, inspection level procedure and acceptance quality limit if the sample plan is of the *ANSI* type. Depending on these values, the sample size, accept and reject numbers are calculated by the system according to the American National Standard.

If sample plan is of the *Custom* type, you need to enter the accept/reject numbers and sample size directly. In this case the system will not check if the values confirm to any standard.

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- On the *Attachment* tab page, define the material (or material group) to be sampled, and the operation at which sampling shall take place. You can also define the resource for sampling. If a resource is not defined, sampling can be performed on any resource at a defined operation.
 - You can attach multiple sample plans to one material or operation. In this case, a sample plan for each selected SFC number is chosen by the lowest sequence number. If the sequence number is a tie, the sample plan is chosen alphabetically by sample plan name.
3. In *NC Code Maintenance*, define NC codes and their *NC Severity* level.

We recommend setting a high severity for any NC code that is used to indicate test failure.

The code that indicates the minor defect and not intended to influence the accept/reject decision significantly should be set up with low severity.

Note: If the operator logs many NC codes with the low severity, SFC number can still be rejected. This is because the severity values of all logged NC codes are summed and compared to the defined threshold. If you want the minor defect to never fail the test, set up the NC severity for the code to *None*.

4. In *POD Maintenance*, create a pushbutton associated with *Perform Sampling* activity (QM020) and assign it to your layout.

We recommend attaching the *Perform Sampling* activity (QM020) to the *Complete* button with the following sequence:

Sequence	Activity ID
10	PR510
20	QM020

If you do not plan to perform any manufacturing processes at the sampling operation except for sampling, you can have one button for the *Start*, *Complete*, and *Perform Sampling* activities as following:

Sequence	Activity ID
10	PR500
20	PR510
30	QM020

We also recommend defining a separate button with only the *Perform Sampling* (QM020) activity. It can be used to open the *Perform Sampling* plug-in, if there are enough SFC numbers in the group. This may be useful if operator has closed this plug-in previously without confirming the sampling and wants to open it again to perform it.

It is required to define the layout for the *Perform Sampling* (QM020) activity on the *Layouts* tab page. For example, you can define this activity as the *Other Plug-In* to make it substitute for the default one (for example, *Work List*) in POD.

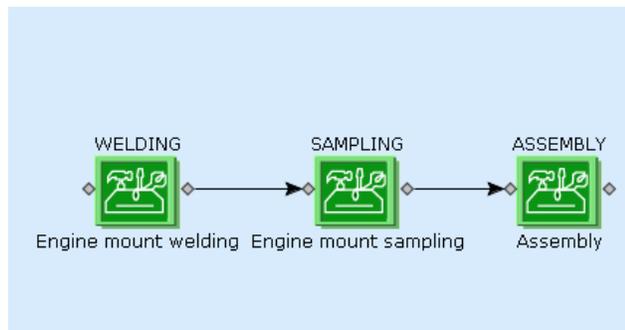
5 Usage Scenario Examples

5.1 Product Sampling for Quality Control

In the following example, engine mounts are welded and then sent to assembly operation. To control the quality of welding process, sampling operation is set up between the welding and assembly. At this operation, 5 mounts are randomly selected from every group of 25 pieces and sent to the nondestructive test. If two or more mounts fail the test, then all mounts in the group are sent to the test for 100% inspection.

5.1.1 Prerequisites

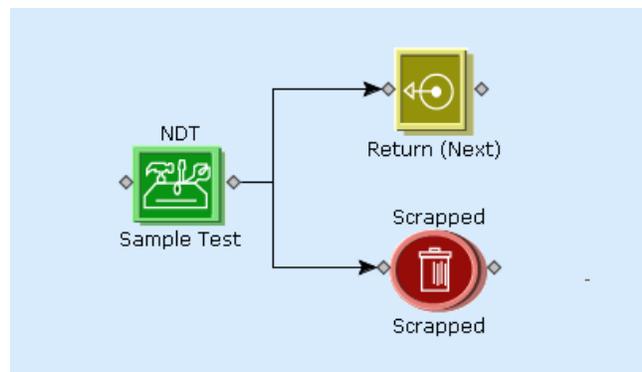
1. The following routings are created in *Routing Maintenance*:
 - Routing for production with the operations WELDING, SAMPLING, and ASSEMBLY



Note: This routing is defined for the ENGINE_MOUNT material in Material Maintenance.

- Routing for sample inspection

Sample inspection routing is of the *Sample* type and contains one test operation (NDT) and two possible dispositions: returning to the next production operation (ASSEMBLY) and scrapping the tested piece.



Note: The scrap itself does not mean the SFC number fails the test. Only the total severity of logged NC codes defines if the SFC group is accepted or rejected.

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- NC codes to be used during the NDT test operation are defined in *NC Code Maintenance*. NC code that is used to indicate test failure is set up with the high severity. The code that indicates the minor defect and is not intended to influence the accept/reject decision significantly is set up with the low severity.

The screenshot shows the SAP NC Code Maintenance configuration interface. The title bar reads "NC Code Maintenance". Below the title bar are navigation icons: Retrieve, Save, Clear, Delete, and Tree View. The site is set to "MARYA" and the NC Code is "TEST_FAIL". The "Main" tab is selected, showing the following configuration fields:

- Description: NDT test failure
- Status: Enabled
- Assign NC to Component: Stay
- NC Category: Failure
- DPMO Category: None
- NC Data Type: SIMPLE
- Collect Required NC Data on NC: Open
- Message Type: (empty)
- NC Priority: 500
- Maximum NC Limit (SFC): 0
- NC Severity: High (highlighted with a red box)
- Secondary Code Special Instruction: (empty)

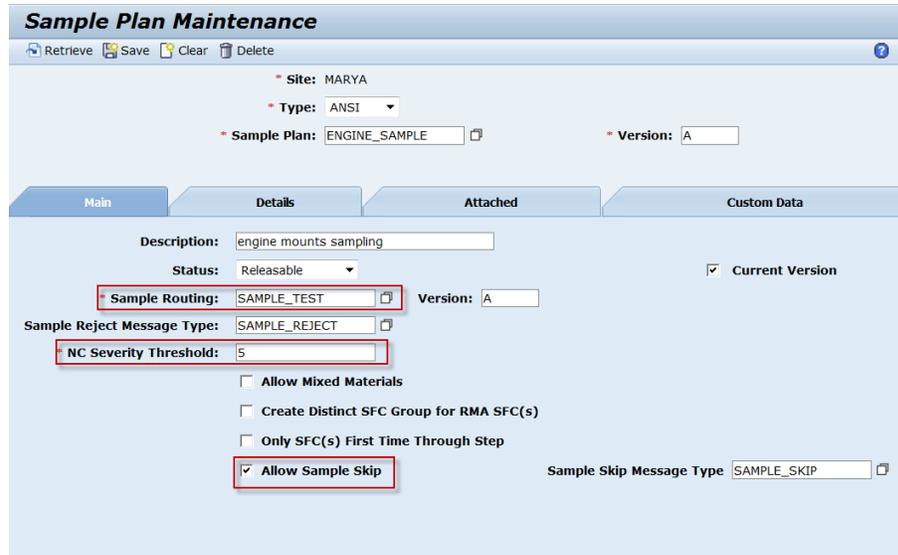
On the right side, there are several checkboxes:

- Can Be Primary Code
- Closure Required
- Auto Close Primary NC
- Auto Close Incident
- Secondary Required for Closure

Note: If the operator logs many NC codes with the low severity, SFC number can still be rejected. This is because the severity values of all logged NC codes are summarized and compared to the defined threshold. If you want the minor defect to never fail the test, set up the NC severity for the code to *None*.

- Sample plan that defines sampling characteristics is set up in *Sample Plan Maintenance*. Selection of sample plan type depends on whether you need your sampling to confirm to the American National Standard (ANSI Standard).
 - On the *Main* tab page, sampling routing and NC severity threshold are defined. NC severity threshold is used to compare the total severity of logged NC codes to defined SFC group accept/reject decision. Here you can also indicate whether the operator can skip sampling of the group and what message to send in this case. Additionally, a message to be sent to the message board when sample group is rejected is defined here.

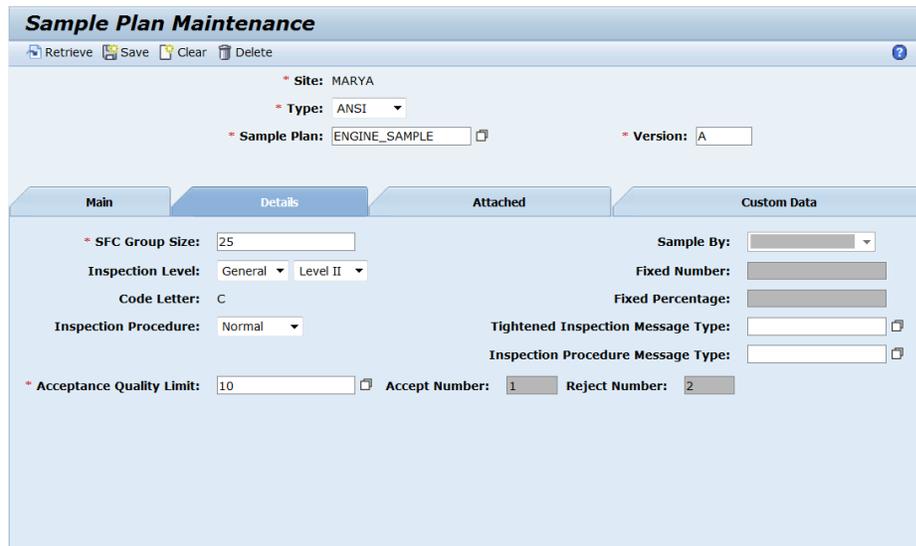
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The screenshot shows the 'Sample Plan Maintenance' interface in SAP. The 'Details' tab is active. The form contains the following fields and values:

- Site: MARYA
- Type: ANSI
- Sample Plan: ENGINE_SAMPLE
- Version: A
- Description: engine mounts sampling
- Status: Releasable
- Current Version:
- Sample Routing: SAMPLE_TEST (highlighted with a red box)
- Version: A
- Sample Reject Message Type: SAMPLE_REJECT
- NC Severity Threshold: 5 (highlighted with a red box)
- Allow Mixed Materials:
- Create Distinct SFC Group for RMA SFC(s):
- Only SFC(s) First Time Through Step:
- Allow Sample Skip: (highlighted with a red box)
- Sample Skip Message Type: SAMPLE_SKIP

- On the *Details* tab page, the *SFC Group Size* value is set to 25, the *Inspection Level Procedure* value is set to *General*, and the *Acceptance Quality Limit* value is set to 10. Depending on these values, the system calculates the sample size value (5), accept (1) and reject (2) numbers according to the American National Standard for the sample plan of the *ANSI* type.



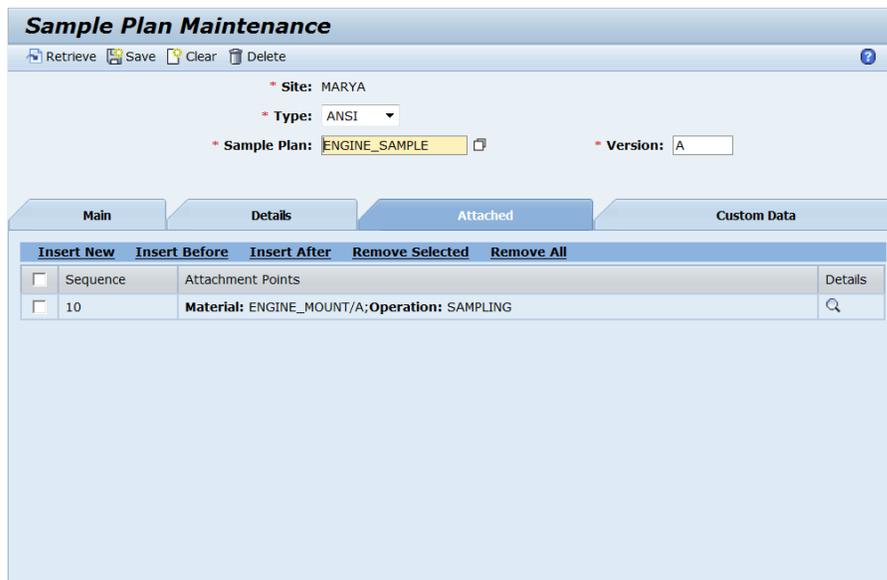
The screenshot shows the 'Sample Plan Maintenance' interface in SAP. The 'Details' tab is active. The form contains the following fields and values:

- Site: MARYA
- Type: ANSI
- Sample Plan: ENGINE_SAMPLE
- Version: A
- SFC Group Size: 25
- Inspection Level: General (Level II)
- Code Letter: C
- Inspection Procedure: Normal
- Acceptance Quality Limit: 10
- Accept Number: 1
- Reject Number: 2
- Sample By: [Dropdown]
- Fixed Number: [Input]
- Fixed Percentage: [Input]
- Tightened Inspection Message Type: [Input]
- Inspection Procedure Message Type: [Input]

Note: If sample plan is of *Custom* type, the user can enter the accept/reject numbers and sample size directly. In this case, the system will not check if the values conform to any standard.

- On the *Attachment* tab page, define the material and the operation at which sampling shall take place. In this example, SFC numbers of ENGINE_MOUNT material are sampled at the SAMPLING operation.

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- PODs required for sampling are configured in *POD Maintenance*. For this example, you can configure four PODs, one for each operation. Another option is to configure one POD to be used at all operations.

- For the sampling operation, configure a button (PASS) with three activities attached to perform start (PR500), complete (PR510) and sampling (QM020) of SFC numbers.

We also recommend to configure a separate button, with only the *Perform Sampling* (QM020) activity. It can be used for opening *Perform Sampling* plug-in if there are enough SFCs in the group. This may be useful if operator has closed the plug-in previously without confirming the sampling and wants to open the plug-in again to perform it.

On the Layouts tab page, the layout for the *Perform Sampling* (QM020) activity is required to be defined. For example, you can define this activity as the *Other Plug-In* to substitute it for the default one (for example, *Work List*) in POD.

- For other operations of production routing, you can use the standard *Operation* or *Work Center* POD configurations.
- SFC numbers are released for processing on the production routing. Quantity of SFC numbers in queue on the first step of the routing is equal to or greater than SFC group size defined in the sample plan (in this example, 25).

5.1.2 Procedure

5.1.2.1 Performing Sampling

Proceed as follows to perform sampling:

- Start, perform work, and complete 25 SFC numbers on the first production operation (WELDING). All 25 engine mounts are moved to the next operation (SAMPLING) for sampling.

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2. On the sampling operation, select 25 SFC numbers and perform start, complete, and sampling using the single button (PASS) defined in POD. The system randomly selects 5 mounts out of 25 pieces and displays them to you.
3. Take these 5 pieces for testing and press the *OK* button to confirm the sampling. 5 sample SFC numbers are moved to the NDT operation for a nondestructive test. Other 20 SFC numbers remain on the sampling operation (SAMPLING) until the test results are known.

5.1.2.2 Inspecting the Sample

Proceed as follows to inspect the sample:

1. On the first operation of the sampling routing (NDT), start 5 SFC numbers you have in queue and perform the test.
2. If the engine mount passes the test, complete it. At this point you can indicate whether this SFC number shall go to the assembly operation (ASSEMBLY) or shall be scrapped. If the test is nondestructive and SFC number successfully passes it, select to send it to the next operation.
3. Choose the next SFC number and perform the test. If the SFC number fails the test, log the test failure NC code against it. As this NC code indicates the test failure, it must be setup with a high severity. In this case, when you press *Done* in the *Log NC* plug-in and select whether to scrap this SFC number or send it to the ASSEMBLY operation, this SFC number will be rejected.

Note: You can check the result of sample inspection in *SFC Group Report* at any point. To view this information, select the material and/or operation in the *SFC Group Report*. You will see all the SFC groups that have been created for engine mount inspection. Against the current SFC group you will see that 2 SFC numbers have already been inspected: one of them passed the test and another one failed. If in your setup one failure is considered acceptable, the SFC group is still in the *Sampling* status. This means that the sample inspection result for the SFC group is not known at this point. If all the remaining SFC numbers will pass the inspection, the group will be accepted. But if at least one more SFC number fails the test, the whole SFC group will be rejected and passed to 100% inspection.

4. Start and examine the next SFC number as passing the test. If you see a minor defect that does not cause the test failure, log an NC code with low severity. This will indicate that there is a minor issue but the welding quality is acceptable and SFC number can proceed to assembly. Complete the SFC number.

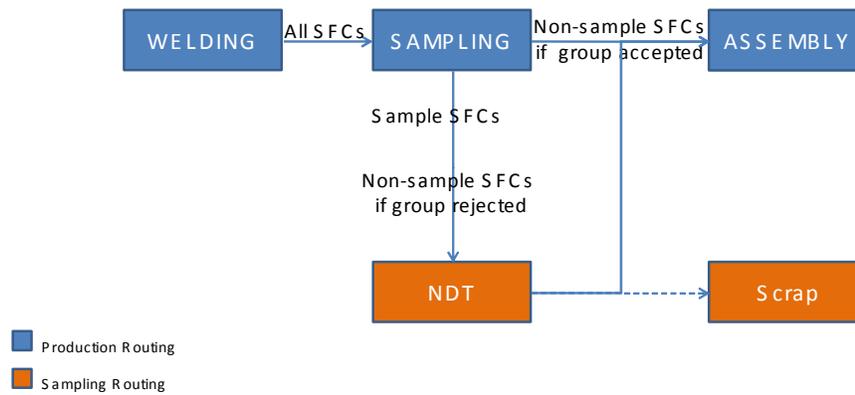
Note: An NC code with low severity does not exceed the severity threshold, which is why the SFC number is accepted. You can see this in the *SFC Group Report*.

5. Start, test and complete the remaining SFC numbers. Now the whole SFC group is accepted and all SFC numbers waiting for the group inspection result at the sampling operation (SAMPLING) are moved to the next operation on the production routing (ASSEMBLY).

Note: When the group is rejected, the SFCs are dispositioned differently. In this case, all the engine mounts waiting on the sampling operation are moved to NDT test operation for the 100% inspection.

SAP ME How-To-Guide for Sampling

The figure below illustrates the primary flow of the engine mounts sampling described above:



6 Overview of Changes

Sampling is a brand new feature in SAP ME 6.0