SAP Manufacturing Execution

How-To Guide

SAP

How To Set Up and Use the SAP ME Non-Serialized (Order) Processing Feature

Applicable Release: ME 15.0

Version 1.0.2

January 2015

SAP ME How-To-Guide for Non-Serialized Processing

SAP ME "How-to" Guides are intended to simplify the product implementation. While specific product features and procedures typically are explained in a practical business context, it is not implied that those features and procedures are the only approach in solving a specific business problem using SAP ME. Should you wish to receive additional information, clarification or support, please refer to SAP Consulting.

Document Version	Description	Author
1.0	Initial version	Mike Houston
1.0.1	Added notes on simultaneous step restrictions for dispositioning.	Mike Houston
1.0.2	Added note on golden unit vs. done SFCs. Added note on Standalone SFC Split limitation. Added note on NC's ALLOW_PARTIAL not supported with Auto-Split	Mike Houston

1.1 Purpose

The purpose of this document is to describe how to use the more flexible Non-Serialized Processing feature available in SAP ME 15.0. This Non-Serialized Processing generally involves relaxing the previous ME restrictions on where an SFC may be processed. This is mainly centered on allowing partial quantities of the SFC to be worked at multiple steps on more than one routing at a time. This includes allowing the quantity to flow down a routing like a production line. It also includes support for nonconformance process and general sub-routing processing using auto-splitting.

One of the main goals of this new feature is to allow a single, large SFC that can have its quantities processed over many steps or routings. This means the order can have just one SFC with a quantity for the entire order (e.g. 500+ pieces). With this new feature, SAP ME no longer requires splitting or creating of many small SFCs. This will reduce operator inputs and improve performance in many scenarios.

This document only covers the new scenarios for SAP ME 15.0. The scenarios supported in all versions of SAP ME are detailed in 'SAP ME How-To-Guide for Basic Routing'. These older scenarios include many partial processing capabilities that work in all versions of SAP ME.

1.2 Glossary

2.1 Description and Applicability

The routings defined in SAP ME provide a very flexible way to process materials on the shop floor. This includes a large number of scenarios and behaviors. For SAP ME 15.0, new options now allow even more flexibility in how quantities are processed on the shop floor. The behaviors described in the document apply to all SAP ME 15.0 and later.

This document will contain a number of scenario examples. These are meant to document the expected behavior for the many routing scenarios supported by SAP ME.

2.2 Limitations

The relaxed flow routings do not work with all SAP ME scenarios. Unless specifically mentioned as supported in this document, then relaxed flow and non-serialized processing are not supported with the activity/action in SAP ME. In most cases, SAP ME will allow the action with non-serialized SFCs, but the results may be ambiguous. (See Device History Report (DHR) below for an example).

A number of specific limitations are listed below.

- **Any single SFC can only be on one routing at a given time.** This is the same as SAP ME 6.1 and previous releases. The new features for 15.0 do not change this key restriction.
- Duplicate operations are not allowed on a relaxed flow routing. This is because it is impossible to determine the correct step when the quantity is in queue at multiple steps with the same operation in the Operation POD.
- Embedded (nested) routings. Since the SFC must traverse multiple routings, this type of routing is not allowed.
- Only operation steps, simultaneous groups, immediate hold, scrap and done steps are supported within these relaxed flow routings.
- On relaxed flow routings, the future hold step is not supported.
- The routing step option 'Queue Decision' does not support the 'Next Operator' option. Since this option places the entire quantity in queue at multiple steps, it is not allowed on relaxed flow routings.
- Partial processing and pulling into a special operation on a relaxed routing is not supported. The special operation pull mechanism will pull the entire SFC in to the special operation.
- Simultaneous groups steps with successors are not supported on relaxed flow routings.
- Buyoffs are not supported with relaxed flow routings. Some scenarios may work when processing the entire SFC quantity.
- Sampling is not supported with partial processing.
- The activity rule 'ALLOW_PARTIAL' on the NC Data Entry plugin will be ignored for relaxed routing flow. When the SFC is on a relaxed flow routing, then partial processing is allowed and auto-split is possible. Also, the logic around NC Defect Count is ignored. This disposition/auto split is triggered for the quantity entered in the quantity field of the POD.
- The activity rule 'ALLOW_PARTIAL' on the NC Data Entry plugin should be set to 'NO' if the Auto Split options 'Always' or 'Ask' are used.
- Standalone SFC Split (PR570) can only split from SFCs with the entire quantity in queue at one step or in work at one step.
- Shop Order SFC Plan Serial Numbers are not supported with Incremental Shop Order release. It makes no sense to mix serial numbers and incremental release.
- Selecting multiple SFCs in the POD and using partial quantities will not be supported. Key plugins such as Start, Complete, NC and Assembly will display an error.
- The Device History Report (DHR) is not designed to work with non-serialized SFCs. It works technically, but since the actual 'device' being processed is not known, there is little use for the DHR report.
- Packing will only support relaxed flow routings when the SFC is fully at the pack operation (auto-start functionality).

- The Quantity Multiply hook activity will not work when the SFC is in queue or in work at more than one step.
- Supervisor Work Assignment can be used with relaxed routings, but the quantity is not assigned to specific users.
- A single user can't start additional pieces if they have already start some pieces at one step. The user must signoff off the in work quantity and then start the desired quantity.
- For auto-split to work, the System Rule 'Copy NC Data' must be set to true (the default value). This is needed to copy the NC records to the new SFC for processing.
- The Slot Quantity Decrement hook does not support partial processing for time-based components.
- The as-built report and configuration GUIs do not support partial processing for time-based components. The entire SFC qty is shown, but since this qty is not known, any value here is just an estimate.

2.2.1.1 Times Processed (Loop Counter) – First Pass, etc.

SAP ME tracks the number of times an SFC has passed through a routing step using the Times Processed flag. On non-relaxed routings, this flag is incremented when the SFC is started and only decremented upon signoff. This will not work well with relaxed routing flows since partial quantities are started many times in most scenarios. The basic problem is that there is no way to tell which pieces have actually been processed multiple times at a step.

To avoid this uncertainty on a relaxed routing, the Times Processed flag will be incremented on the first start but never incremented again. Signoff will not decrement this counter either.   This means the SFC will be processed as if it is always on the first pass at any step.

Note: This has significant implications on yield calculations and some Data Collection logic use to collect new values on each pass.

2.2.1.2 Data Collections and Partial Processing

SAP ME can collect data using the Data Collection Groups. This DC feature generally collects data once for each pass through a step. There is a system rule (Allow Multiple Data Collection) that can allow additional data collections.

With relaxed flow routings, partially starting and completing an SFC's quantity will leave the times processed counter set to 1. This means if the system rule is set to false, the data will only be collect on the first start or complete. The system rule must be set to true to allow collection on each start/complete.

2.3 General Setup

In most cases, SFCs processed with the new flexible way are the same as traditional SFCs. They have routings and BOMs like any other. The main difference is in Material Maintenance.

2.3.1   POD Maintenance Setup

POD Maintenance controls the appearance and function of the Production Operator Dashboards. This allows a POD to be configured for non-serialized processing. The key setting for non-serialized processing is the 'Show Quantity' field:

This must be checked to allow partial processing of an SFC's quantity. This option is valid for both the Operation and Work Center PODs.

Also, the term 'SFC' can be configured for some of the Operation POD's user interfaces. This is done using the 'Main Input' field above. This defaults to 'SFC' (internationalized), but it can be changed to any string.

This 'Main Input' field also affects some plugins. These plugins display the SFC in a number of places. For example, the Assemble Components Plugin normally displays the text 'SFC' in its header. When the 'Main Input' field is changed to 'Order', the POD and Assemble Components Plugin will look something like this:

This 'Main Input Field' label controls the text in these plugins:

- Assemble Components (CT500)
- SFC Data Entry
- DC Data Entry (DC500)

2.4 Routing Maintenance Setup

The new relaxed routing flow logic is enabled at the routing level.   This is done by a new checkbox in Routing Maintenance:

This new checkbox enables he SFC's quantity to be processed at more than one step on normal, linear routings:
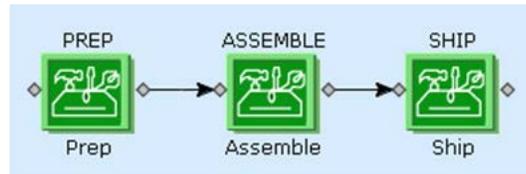
The only other critical setup needed for this feature to work is to make sure the Lot Size for the material is large enough to handle expected lot size. If the lot size is not large enough, then multiple SFCs will be created upon release. This is controlled in Material Maintenance in SAP ME. This logic is unchanged from ME 6.1. It is also important to set the Qty Restriction as needed.

Restrictions for Relaxed Routing Flow:

- Cannot use the same operation more than once on a relaxed flow routing. This is due to the logic for determining what step to start.
- Any Order groups are not allowed on relaxed flow routings.
- No nested routing or return steps may be used on relaxed flow routings.
- The hold steps cannot use the future hold options on relaxed flow routings.
- Partial NC dispositioning from simultaneous steps is not supported.

Note: The relaxed flow routing flag is not set on routings imported from ERP. This will require customization of the SAPMEINT interface or manually setting the flag in ME.

2.5 Material Maintenance

To make sure the first SFC released to an order has an ID that exact matches the order ID, the Material definition must be flagged to use the order ID. This ensures that the first SFC released to the order will use the order ID as the SFC ID.

This is done in Material Maintenance using a new check box (Use Shop Order ID on First Release) as shown below:

When this checkbox is set, on release, the first SFC created for this shop order will use the order's ID as the SFC ID. Any later releases will use the normal Next Number logic for the later SFC(s).

3.1 Shop Order Release

When the Material checkbox 'Use Shop Order ID on First Release' is checked, ME will attempt to create an SFC with an ID equal to the shop order's ID. This only applies to the first SFC released to the order.

If a relaxed flow routing is used and additional quantity is later released on the order, ME will attempt to add the quantity to the first SFC released. When the SFC reaches the material's lot size, a new SFC will be created.

Note: The Material checkbox 'Use Shop Order ID on First Release' and the Routing checkbox 'Relaxed Routing Flow' do not need to be always set the same. It is possible to use these settings independently.

3.1.1 Scenario Flow

An example release scenario is shown below:
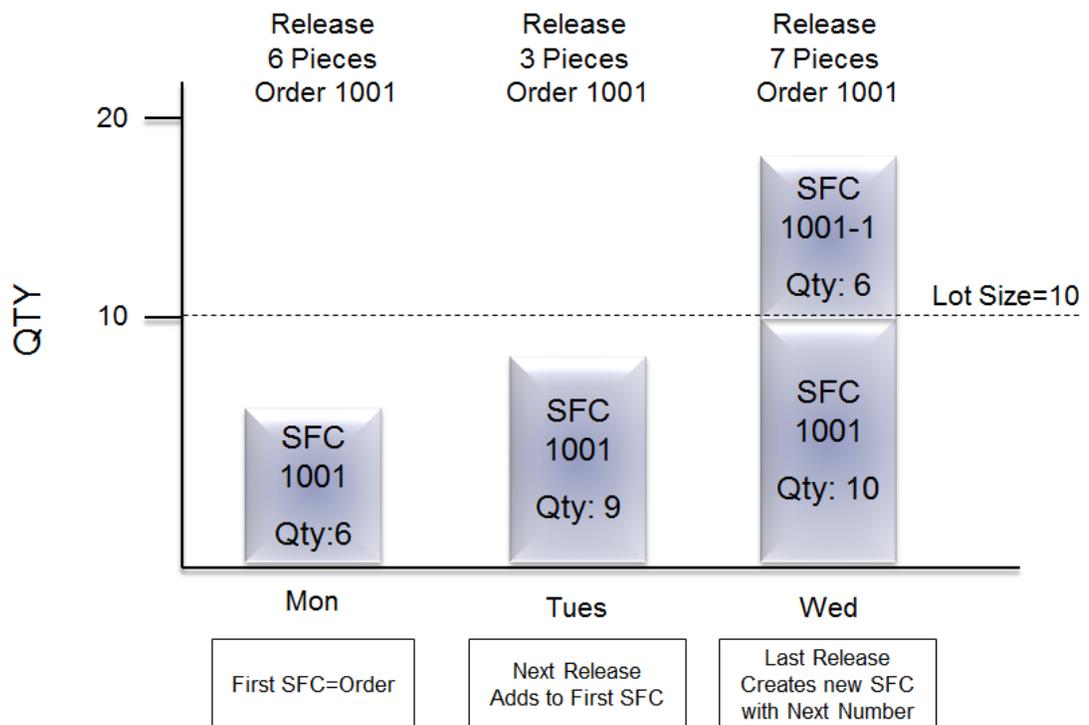
The first release creates one SFC with an ID equal to the Order ID. The second release adds to this SFC. The final release 'fills up' the first SFC to the material's lot size (10) and then creates a new SFC using the next numbering scheme for SFC release.

3.1.2 Scenario Notes

The Material checkbox 'Use Shop Order ID on First Release' is checked and the routing's 'Relaxed Flow Routing' checkbox is checked too.

Initial release of the order will create one SFC with an ID equal to the order's ID.

Later releases will add to this SFC until it reaches the material's lot size. Then a new SFC will be created using the normal next number scheme.

Only adds to existing SFCs that are in WIP and have a status of New, In Queue, Active, Done, or Hold. SFCs with a status of Golden Unit and Returned are ignored. If the original SFC can't be used for the new quantity, then the next number scheme will be used as a fallback.

When adding quantity to an existing SFC that is on Hold, the SFC is left on Hold.

If the original SFC is invalid (scrapped, deleted or serialized) and more quantity is released to it, then a new SFC will be created using the normal next number scheme. Subsequent releases will attempt to add the quantity to that SFC.

If the original SFC is done and more quantity is released to it, then it will be returned from the Done status and the newly released quantity will be placed in queue at the first step. The done quantity will remain done.

If the SFC has a status of 'Golden Unit', then it will not be re-used for later releases.

If the current SFC is on a different routing than the main production routing, then a new SFC will be created.

If the order ID is already used by another SFC, then the first release will use the normal next number scheme.

The Create and Release SFC GUI does not support incremental release. It always creates a new shop order and SFC(s). It is possible to use the material checkbox 'Use Shop Order ID on First Release' with this activity. The first SFC released with this GUI will use the shop order's ID as the SFC ID.

Note: Incremental release is not supported with orders that have serial numbers defined in Shop Order Maintenance.

Note: This incremental release logic is designed to work with very large material lot sizes. If you release enough quantity to create 2 SFCs at a time, then later incremental releases may not add to the appropriate SFC.

3.2 Simple Linear Routing

A simple linear routing is shown below. This routing moves the quantity from one step to the next as the quantity is completed. This routing does not contain any nonconformance routing logic within the routing itself.
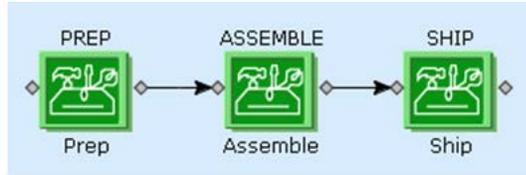
3.2.1 Scenario Flow

Upon initial release, the entire SFC quantity is placed in queue at the first step. The SFC cannot be started at the second step.

The SFC's pieces are started and completed at each step in turn. As a quantity is completed at each step, the completed quantity is placed in queue at the next step. That quantity may be started immediately.

The SFC may not be started at the second step until some quantity is completed at the first step. Once the entire SFC has moved to the second step, it cannot be started at the first step.

As pieces are partially completed at the last step, the completed pieces are added to inventory immediately (when inventory tracking is enabled).

Completing the last quantity at the step marks the SFC as done. Partial Quick Completes are allowed.

In the POD, the GUI will display the step the quantity is sent to.

A typical scenario is shown below:

Action	Prep	Assemble	Ship
Release 10	Qty In Queue:10 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Start 3 at Prep	Qty In Queue: 7 Qty In Work: 3	Qty In Queue: 0 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Complete 3 at Prep	Qty In Queue: 7 Qty In Work: 0	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Start 3 at Assemble	Qty In Queue: 7 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 3	Qty In Queue: 0 Qty In Work: 0

The quantity completed at Prep is immediately available at Assemble.

It is also possible for multiple operators to work different quantities as different resources for the same step.

Note: If the same user starts the same SFC at two different resources, then the active work list may not show both active quantities. The work list tends to limit the SFCs displayed to those that are in work at the current resource.

3.3 Multiple Next Steps – Completing Operator Decides

Routings may have alternate paths that the SFC may travel down. For the relaxed routing option, portions of the quantity may travel down all 3 paths at the same time. The Completing Operator makes the decision upon each partial complete.
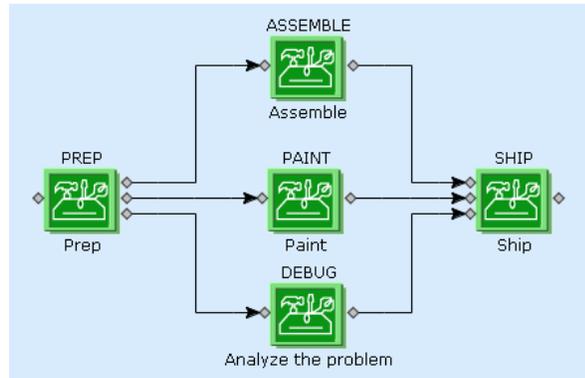
3.3.1 Scenario Flow

This follows the same basic rules as the simple linear routing above. The quantity may not be started at a step unless it was placed in queue at the step. The main difference is that the operator completing the quantity at Prep decides where to place the quantity in queue.

Upon initial release, the entire SFC quantity is placed in queue at the first step. The SFC cannot be started at the second step.

The SFC may not be started at any step until a quantity is placed in queue at that step.

A typical scenario involving Prep, Assemble and Paint is shown below:

Action	Prep	Assemble	Paint
Release 10	Qty In Queue:10 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Start 3 at Prep	Qty In Queue: 7 Qty In Work: 3	Qty In Queue: 0 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Complete 3 at Prep Send to Assemble	Qty In Queue: 7 Qty In Work: 0	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Start 4 at Prep	Qty In Queue: 3 Qty In Work: 4	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 0
Complete 4 at Prep Send to Paint	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 4 Qty In Work: 0
Start 4 at Paint	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 3 Qty In Work: 0	Qty In Queue: 0 Qty In Work: 4

The first quantity (3) completed at Prep is immediately available at Assemble. The second batch completed at Prep (4) is sent to Paint and is immediately available at Paint.

Note: The Queue Decision option is ignored on a relaxed flow routing. This means the completing operator always decides the next step for the quantity being completed.

3.4 Optional Steps

Routings may have optional steps that can be bypassed. These steps are treated the same as the multiple paths in the previous section. As the operator completes a partial quantity, the completed quantity may bypass the options steps (INSPECT in the example below). The scenario flow above is still valid for this scenario.
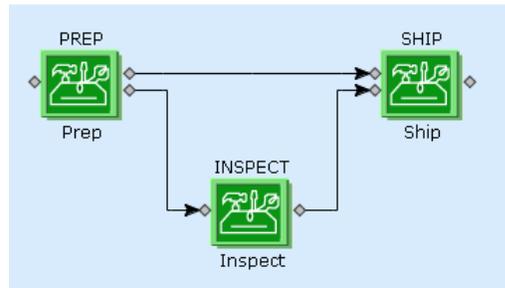
Note: The Queue Decision option is ignored on a relaxed flow routing.   This means the completing operator always decides the next step for the quantity being completed.

3.5 Routings with Rework Flow Embedded in the Production Routing

In this scenario, the rework routing flow is part of the main production routing. This type of routing supports the relaxed flow routing and quantities may be partially processed on the 'main' flow or in the 'rework' flow. The action steps Hold, Scrap and Done are supported.

Hold steps can only use the immediate hold option and the SFC can be optionally signed off
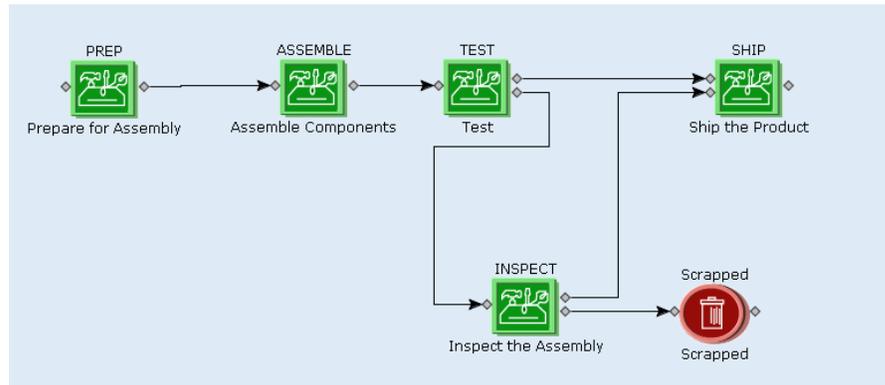
3.5.1 Scenario Flow

This follows the same basic rules as the multiple paths routing above. The major difference is that some pieces may be scrapped coming out of INSPECT.

A typical scenario involving TEST, INSPECT and SHIP is shown below:

Action	TEST	INSPECT	SHIP
Move 10 pieces to TEST	Queue:10 Work:	Queue: Work:	Queue: Work:
Start 3 at TEST	Queue: 7 Work: 3	Queue: Work:	Queue: Work:
Complete 3 at TEST, send to INSPECT (fail)	Queue: 7 Work:	Queue: 3 Work:	Queue: Work:
Start 4 at TEST	Queue: 3 Work: 4	Queue: 3 Work:	Queue: 3 Work:
Complete 2 at TEST, Send to SHIP (pass)	Queue: 3 Work:	Queue: 3 Work:	Queue: 4 Work:
Start 3 at INSPECT	Queue: 3 Work:	Queue: Work: 3	Queue: 4 Work:
Complete 1 at INSPECT (scrap)	Queue: 3 Work:	Queue: Work: 2	Queue: 4 Work:
Complete 2 at INSPECT (pass)	Queue: 4 Work: 2	Queue: Work:	Queue: 5 Work:

This shows how 3 pieces are sent through a rework flow and 1 is scrapped. The other 2 eventually return to the main flow to be work at SHIP.

3.6   Multiple Next Steps – Script Decision

This scenario is supported just like any other Optional Steps scenario. The scripts will generally reduce multiple next steps down to one next step. This will act much like a linear routing in that the quantity will be automatically sent to the next step.

The SFC quantity is placed in queue at the next step as decided by the routing scripts. If the routing scripts can't make a decision, then ME will ask the completing operator to decide as in the Multiple Next Steps – Completing Operator Decides scenario.

3.7 Dispositions Routings (Auto-Split/Merge)

The SAP ME (NC) nonconformance feature is described in the SAP ME How-To-Guide – NC.

ME supports a type of routing that can be used as a disposition for an NC code as a special routing, an NC routing or a disposition routing. These all behave basically the same way.

- An NC code is defined.
- A disposition routing or disposition group is associated with the NC code.
- When the NC code is logged, the SFC can be dispositioned to the routing.

The example below shows how the built-in PMR routing can be used as a disposition routing. In this example, the main production routing has 3 steps and the PMR routing has a complex repair scenario.
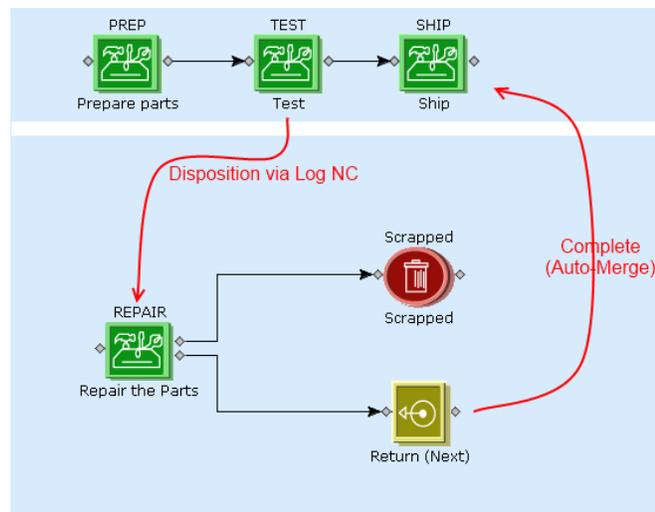
With a relaxed flow routing, the SFC can be partially processed along the main production routing. When some pieces are nonconformed, the pieces can be auto-split from the original SFC and sent to the NC routing. When the new SFC returns to the main routing, it can be auto-merged into the main routing.

These auto functions are controlled by Activity Rules on the Log NC and Complete plugins. These activity rules are then passed to the disposition and complete APIs to trigger the appropriate behavior. The auto-merge only happens to SFCs that were originally auto-split and the SFC can only be auto-merged into the original SFC.

The new rule on the Log NC plugin is 'AUTO_SPLIT'. The valid values are:

- NEVER – No auto split happens. Full SFC Quantity is dispositioned. **(Default)**
- ASK – Ask the operator if he/she wishes to auto split. If partial processing, then the disposition will fail if the user chooses No.
- ALWAYS – When partial processing , always split without asking.

The new rule on the Complete plugin is 'RETURN_AUTO_MERGE'. The valid values are:

- NEVER – No auto merge happens. **(Default)**
- ASK – When allowed, ask the operator if he/she wishes to auto merge.
- ALWAYS – When allowed, always merge without asking.

Note: Auto-split can work with any type of routing, but the entire SFC quantity should be in work for non-relaxed routings before logging the NC. Auto-merge can only be used when return to a relaxed flow routing.

Note: Auto-merge only happens when returning to the original routing. Any disposition that stays on the original routing will not trigger this auto-merge logic. For example, 'No Defect Found' will not trigger the auto-merge logic.

3.7.1 Scenario Flow

When partial processing during Log NC, the disposition action can auto-split the NC'd quantity into a new SFC. This is controlled by the 'AUTO_SPLIT' activity rule.

The original SFC can continue to be processed on the production routing. The new SFC can be worked independently of the original SFC.

When returning to production routing, an auto-split SFC can be auto-merged back into the main routing.

When auto-merging, the quantity is merged back into the original SFC. This merge will follow the standard merge logic with one exception: the NC code that triggered the auto-split will be cancelled on the original SFC.   It will be copied to the new auto-split SFC (per System Rules) in an un-cancelled state.

The auto-merge is triggered by the return step logic. This will work with explicit return steps and when the SFC 'falls off' the end of the NC routing.

When the new SFC is auto-merged into the original, the new SFC will be marked as invalid (current merge behavior).

The current restrictions on merge will be relaxed to allow the quantity to be in work anywhere on the main routing.   All existing merge restrictions will still be followed (same material, routing, etc).

Auto-split from a non-relaxed routing is allowed. Auto Merge is not allowed back onto the normal routing.

Auto-split from NC will always pull the quantity from the in work quantity. The Log NC plugin may auto-start the SFC as needed. If the POD Quantity is left blank for the Log NC plugin on a relaxed flow routing, then the quantity in work will be used. If nothing is in work, then the quantity in queue will be used. If no quantity is in work or in queue, then an error will be displayed.

Auto-split *will* affect the quantity completed at previous steps on the SFC.

Split and auto-split will not adjust the floor stock quantity for any done pieces. The pieces will remain on the original SFC's floor stock record. Auto-merge can merge a child SFC back into a Done SFC. The Done SFC will be brought back into work.

The NC record will be logged against the original SFC, but it will be marked as cancelled and copied to the new SFC in this auto-split scenarios.

If multiple NCs are logged against the original SFC, then only the latest NC record will be used for auto-splitting. The new SFC's quantity will be based on that record's QTY value. The auto-split will *not* use the defect count for this calculation.

The 'SFC Release' Next Number will be used to create this new auto-split SFC. No dialog will prompt the user to enter an SFC for the new SFC.

Split (auto or manual) is not supported when the SFC has any quantity in queue/work in a simultaneous group.

Note: Auto-splitting from an SFC that was auto-split from another SFC is allowed. When this happens, the auto-merge action can only auto-merge back to the previous SFC. A manual merge may be needed if the second auto-split SFC is not resolved back into the first auto-split SFC.

Note: For auto-split to work, the System Rule 'Copy NC Data' must be set to true (the default value). This is needed to copy the NC records to the new SFC for processing.

Note: The Merge Activity's MERGE_ACROSS_OPERATIONS rule still works in the activity. Under some conditions, this may result in an SFC on non-relaxed routing being in queue at multiple operations.

Note: If the Auto split option is ASK, the dialog will appear, even if the user is not performing partial processing.

Split will copy the records as defined in the System Rules and only when the appropriate hook activities are enabled in the Site Maintenance (default to enabled).

Merge (auto or manual) will copy all components assembled from the child to the parent SFC. It will also determine if the child SFC was recently split from the parent. If it was, then

any new Data Collection records created or edited since the split date/time will be copied to the parent.

Also, any SFCs that are merged that do not have a common ancestry, the DC records from the child will always be copied to the parent.

3.7.2 Interactions with ALLOW_PARTIAL Activity Rule

The activity rule 'ALLOW_PARTIAL' on the NC Data Entry plugin will be ignored for relaxed routing flow. When the SFC is on a relaxed flow routing, then partial processing is allowed and auto-split is possible. Also, the logic around NC Defect Count is ignored. This disposition/auto split is triggered for the quantity entered in the quantity field of the POD.

The flow of how these two rules interact with the NC Logging process is shown below:
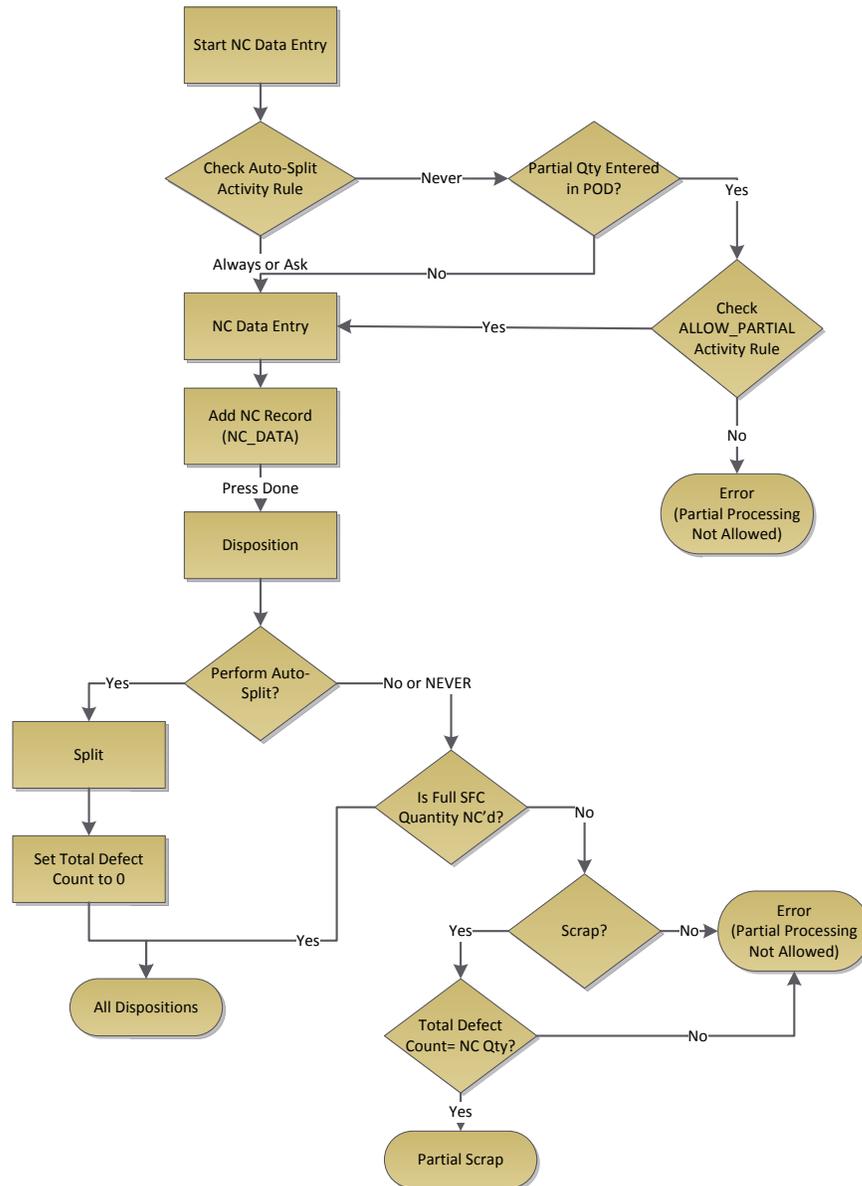
3.7.3 Internal Details of Split/Merge (Auto and Manual)

The split copies these child objects to the new SFC for auto-split and manual split scenarios:

- Activity Log
- Components Assembled (Discrete and Time-Based)
- Data Collection
- Nonconformances
- SFC Data (custom)
- Tooling Log
- Work Instruction View Log

The merge copies these child objects back into the combined SFC:

- Components Assembled (Discrete)
- Nonconformances

Split handles the QTY_COMPLETED on previous steps carefully. When splitting from a given step on a routing, ME will adjust the QTY_COMPLETED at all previous steps. The previous steps will be determined based on the routing step sequence.   In the case of splitting, the previous steps will be those with a routing step sequence less than the step the quantity was split from. See below for the logic in determining the routing step sequence.

A short example of the quantities before and after the split is shown below:
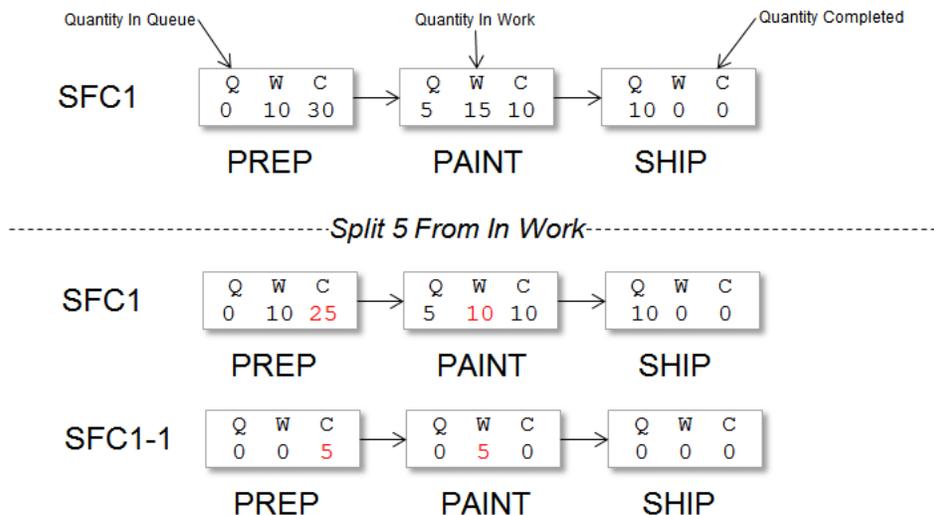
Before split, the quantity completed at PREP is 10. After split, 5 pieces from the quantity completed is sent to SFC1-1 (the new SFC). The other quantity completed values are not affected.

Also, the production log and activity log records for the previous steps are not affected. They remain as they were when the SFC was processed with the original quantity.

3.7.4 Determining 'Previous Steps' (Routing Step Sequence)

Note: This is a topic that covers internal logic in SAP ME. Most customers will not need to know this level of detail, but it is covered here to explain some of ME's behavior in less common sceanrios.

Since ME supports complex routing layouts, it is sometimes difficult to determine the expected order of each step. To simplify the overall logic, ME will use a hidden field (SEQUENCE) on the routing step record to order steps in most GUIs. This is also used to determine what the previous steps are in a number of scenarios (e.g. when splitting).

> **Note:** This sequence is not related directly to the Step ID.

In the case of simple linear routings, this is easily determined. The first step is assigned a sequence of 1. The next step after it is assigned a step sequence of 2 and so on. The next step links drawn between the steps determines the sequence.

In the case of complex routings with multiple next steps, the step sequence is not quite so obvious. The example routing below has 3 possible step next steps in the middle of the routing:
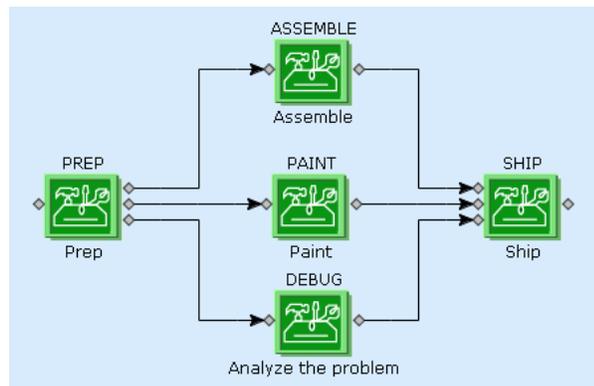
In this scenario, it is not clear if ASSEMBLE should come before PAINT or DEBUG. ME will assign a step sequence to these steps, but the middle steps might have different step sequences depending on the order the steps were created. All of these sequence assignments are possible:

Scenario	ASSEMBLE	PAINT	DEBUG
A	2	3	4
B	3	2	4
C	4	3	2

D	4	2	3

All other combinations are possible. The PREP step will be assigned 1 and the SHIP step will always be assigned 5.

Routings with loops complicate this logic quite a bit. This current approach deals with looping in a reasonable way, but it does not properly determine the 'previous' steps in all cases. This is one of the basic problems with a very flexible routing model.

3.7.5 Restrictions on Nonconformances and Partial Processing

Nonconformance processing typically deals with a large amount of information. Showing partial quantities in some GUIs can be challenging. For this reason, ME has some restrictions on some NC scenarios.

3.7.5.1 Log NC Reject

Log NC Reject is designed to work with serialized processing or with defects on entire lots. Adding support for partial processing will reduce the usability of the GUI. Log NC Reject currently ignores the Quantity entered at the top of the POD.

3.7.5.2 Log NC and Multiple SFCs

Log NC can work with multiple SFCs or with partial quantities of a single SFC. Mixing these two scenarios causes a lot of display issues with the POD plugins. For this reason, if the operator tries to log or disposition multiple SFCs with partial quantities, then an error will be displayed. The ME API can still support this, but care must be taken in how the APIs are called.

3.8   Nested Routings (not supported with Relaxed Flow)

Nested routings are not supported on a relaxed flow routing. Since the quantity can be spread over multiple steps on a relaxed flow routing, it would be possible for some pieces to move to the nested routing. This is not allowed in SAP ME.

ME will prevent use of nested routings on a relaxed flow routing.

3.9 Done Steps

Done steps may be used on relaxed flow routings. When pieces are completed and sent to a done step, the pieces completed are immediately completed and sent to floor stock.

In the example below, pieces that complete PACK are marked as done and added to inventory (if inventory tracking is used).
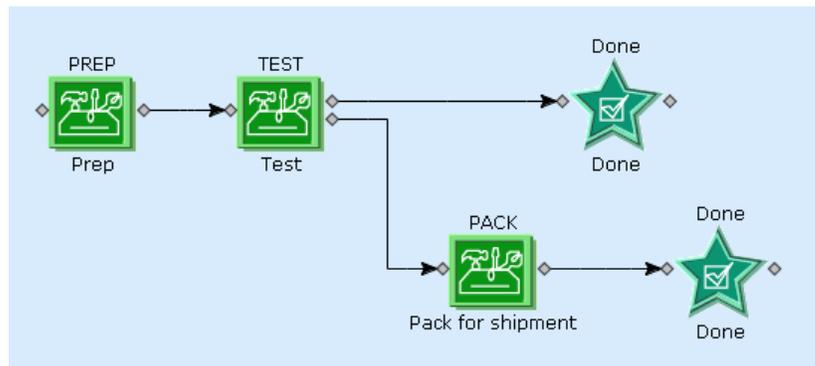
Note: The floor stock entry for this SFC has an original receipt quantity field. This is incremented for each partial complete to allow later adjustments to the on-hand quantity as needed.

3.10 Simultaneous Steps

Simultaneous steps have limited support for the relaxed flow routings. The main purpose in using them on relaxed flow routings is to embed them within a simple linear routing using start and complete.

In the example below, the quantity can flow into the simultaneous group and be worked within the group as normal. The quantity can be partially completed at PREP and flow into the group and will be queued at all steps in the group.
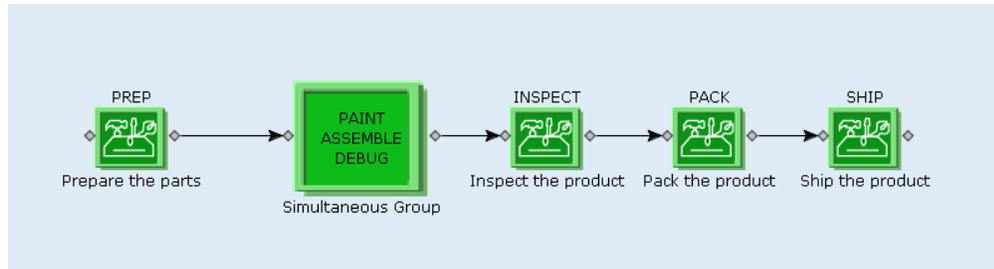
As the quantity is completed from all 3 steps in the group, it can then flow out into the next step and flow down the remaining 3 steps.

A typical scenario involving the pass action (quick complete) at PREP, the group and INSPECT is shown below:

Action	TEST	PAINT+	INSPECT
10 pieces are released to PREP	Queue:10 Work:	Queue: Work:	Queue: Work:
Pass 3 at PREP	Queue: 7 Work: 0	Queue: 3 Work:	Queue: Work:
Pass 4 at PREP	Queue: 3 Work:	Queue: 7 Work:	Queue: Work:
Pass 7 at PAINT	Queue: 3 Work:	Queue: Work:	Queue: Work:
Pass 7 at DEBUG	Queue: 3 Work:	Queue: Work:	Queue: Work:
Pass 7 at ASSEMBLE	Queue: 3 Work:	Queue: Work:	Queue: 7 Work:
Pass 3 at INSPECT	Queue: 3 Work:	Queue: Work:	Queue: 4 Work:
Pass 4 at INSPECT	Queue: 3 Work:	Queue: Work:	Queue: Work:

The quantity processed within the simultaneous group works as normal. Each step can be worked independently of the others. Partial processing using Start or Complete within the group is supported. Other actions are not supported.

Note: Successors are not supported on a relaxed flow routing.

Note: Partial NC dispositioning is not supported at simultaneous steps.

3.11 Scripting and Partial Completes

Routing scripts on relaxed flow routings will be executed on partial completes. This is different from normal routings. On normal routings, the scripts are only used when the final complete happens.

With relaxed flow routings, the scripts must be executed with each partial complete. This allows the script to make a next step decision for the quantity just completed.

The scripts will executed just like a normal routing, except the QTY value will be set to the quantity actually being completed.

3.12 Signoff and Relaxed Flow Routings

Signoff takes the active quantity out of work and places it back in queue. With a relaxed flow routing, the user's entire active quantity at the current operation will be removed from work. All other operations or user's work will not be affected.

The quantity entered in the POD selection area will be ignore by the signoff action.

3.13 SFC Step Status and Relaxed Flow Routings

The SFC Step Status (Maintenance) GUI can be used to move an SFC around on it routing. In most cases, the SFC will be signed off before the actual update takes place.

With relaxed routings, it is possible to perform a limited action on the SFC while it is still active. This new action ('Move Queued Quantity to a Step') will allow the user to move a specified quantity to another step without signing off the SFC.

The SFC Step Status GUI is shown below:
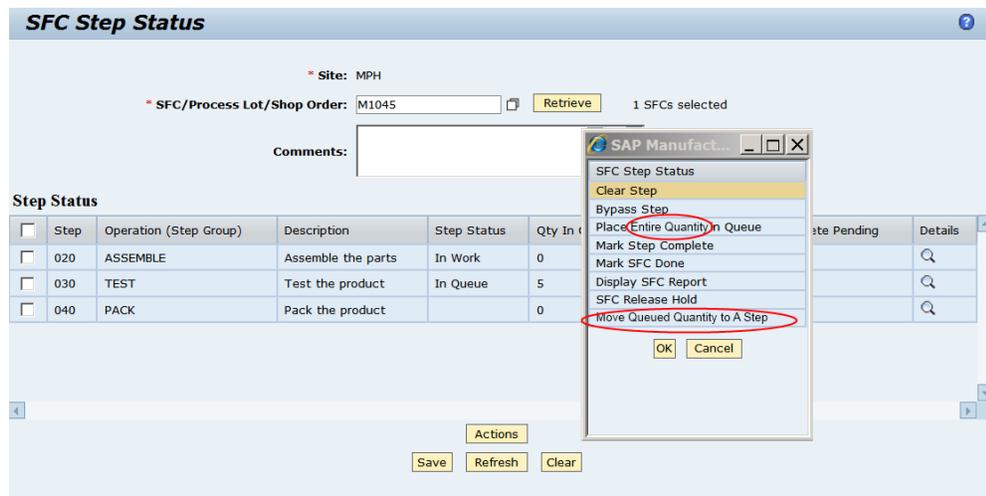
The 6.x action 'Place in Queue' has been updated to clarify its function. It is now labeled 'Place Entire Quantity in Queue'. This matches the 6.x behavior.

A new action is added to move the queued quantity from one step to another. This will not force the SFC to be signed off. The quantity is just moved and a normal activity log record is logged for the action.

The basic flow is:

- User selects a single step to move the queued quantity from.
- User selects the 'Move Queued Quantity to a Step' action.
- The dialog is displayed to allow the user to enter the quantity to move and the step to move it to. User presses Ok.
- User presses Save on the main page to commit the changes to the database.

The dialog (page) looks like this:

3.14 Partial Processing and Component Assembly

The assembly process in SAP ME depends on the SFC quantity to determine how many components are needed. In SAP ME 6.1, the SFC's overall quantity is used for the Assembly Point GUIs (Component list and CT500). In SAP ME 15.0, the quantity use will be the SFC quantity unless the operator has entered a quantity in the POD's quantity field.

The same is also true of the Check Configuration hook activity. When the operator is partially completing or starting a step, the hook will use the quantity being processed and the quantity already completed (for PRE/POST_COMPLETE hooks).

An example scenario for the check configuration hook activity is shown below:

Action	Quantity In Queue	Quantity In Work	Comp Required	Quantity Assembled	Check Config Passes?
Release 100	100	0	0	0	N
Start 5 and Assemble	95	5	5	5	N
Complete 5	95	0	5	5	N
Start 10	85	10	15	5	N
Assemble 3	85	10	15	8	N
Assemble 7	85	10	15	15	N
Complete 10	85	0	15	15	N

In the example above, the user performs partial starts and partial assemblies. Until the full quantity already started and completed, the Check Configuration activity will fail. The user is always allowed to assemble more than the require amount, but Check Configuration may fail in those scenarios.

The Auto As-Built and Auto Assemble Component hook activities (AUTO_ASBUILT and AUTOASSY_COMPONENT) will also work on the partial quantity being completed. They will also work with the incremental shop order release logic described above.

As-built configuration (maintenance and report) will continue to display data for the entire SFC quantity as they do in SAP ME 6.1.

Note: Each time the plugin is started with a partial quantity, the GUI will prevent over assembly. It is possible that repeated executions will allow over assembly, up to the SFC require quantity.

3.14.1 Quantity Calculations

The use of the POD quantity field in the Component List and CT500 requires some special logic to calculate the quantities displayed.

The calculations used are:

```
qtyRequired = BOMComponentQty * Min (PODQty, SFCQty)

qtyRemaining = Min (QtyRequired, SFCQtyRequired)
```

The SFCQtyRequired is the total SFC quantity required for the given component, based on the total SFC quantity.

These values will prevent over-assembly for the entire SFC, but will still allow over assembly for a specific portion of the SFC in some cases (see Fringe Cases below).

The input quantity in the Assembly Details portion of CT500 will be defaulted using the 6.x logic: uses 1 for non-lot based components or the quantity remaining for the lot-based components.

3.14.2 Fringe Cases

The use of the POD quantity field can result in some fringe cases in the assembly plugins. The most obvious one is when the assembly process is started a second time for the same pieces:

1. 100 Pieces are released to an SFC.
2. User starts 10 pieces at the assembly operation.
3. User Starts assembly. Component List shows components needed for 10 pieces.
4. User assembles components for 10 pieces. The Component list shows no more required.
5. User exits the assembly plugins.
6. User Starts assembly again. Component List shows components needed for 10 pieces.
7. User assembles components for 10 more pieces. The Component list shows no more required. Now, 20 components are assembled for the first 10 pieces of the assembly.

The main problem here is that the Component List tracks the quantity remaining for the current execution of the plugin. When it is restarted (step 6), it knows nothing about the 10 components assembled previously. It allows the user to assemble more components, up to the total required for the SFC.

The only way to avoid this case is to use serialized SFCs or never use partial processing with non-serialized SFCs.

3.15 SFC Quantity Adjustment (Plugin and Standalone)

The SFC Quantity Adjustment GUIs give the operator a way to adjust the overall SFC quantity. SAP ME 6.1 only allowed adjustment to an SFC that was in queue. In SAP ME 15.0, the restrictions are relaxed to allow the operator to adjust the quantity when the SFC is active. The operator can now adjust quantity, but only the amount queued at the current operation in the POD.

The standalone Quantity Adjustment GUI will only allow the user to adjust the quantity if it is in queue at one operation.

Note: This GUI assumes ERP is configured to allow over/under confirmation.

The SFC Quantity Adjust Plugin (PR591) will allow adjustments to SFCs on a relaxed routing, but at only one step at a time. The rest of the quantity may be at multiple steps on the relaxed routing. If the SFC is on a non-relaxed routing, then the SFC should be entirely in queue at one step.

When the SFC Quantity Adjust Plugin (PR591) is displayed in the POD, the user may adjust the SFC's overall quantity, but any changes only affect the quantity in queue at the POD operation (or selected operation in the Work Center POD). This plugin is shown below:

If the SFC is on a relaxed flow routing, then the field 'Step to Adjust Qty At' will be displayed. This will force the user to select a step to change the quantity at. The qty in queue will be adjusted.

Note: The field 'New Qty In Queue' is subtly different from the ME 6.1 meaning. In 6.1 it was used to enter the new SFC total quantity. In ME 15.0, the user must enter the new qty in queue at the given step. This allows the same GUI to be used with relaxed and non-relaxed scenarios and makes both scenarios operate the same way.

The SFC quantity adjust method is now available as a PAPI (Web Service). See SfcStateServiceInterface.

Quantity Adjustment will not work on SFCs that are at simultaneous steps, any order steps or steps that have been queued at multiple steps for the 'Next Operator Queue Decision' steps. Also, the GUI will not allow multiple SFCs to be adjusted at the same time.

Also, the PAPI method SfcStateService.adjustSfcQuantity() will only work on Active (relaxed routing only), new or in queue SFCs.   All other status will fail on this PAPI call.

3.15.1 Check Configuration (CT520) Changes

The Check Configuration (CT520) hook activity makes sure the SFC has the right number of components assembled on it. When the SFC quantity adjust GUIs are used, this configuration check may falsely trigger an error. To avoid this error, a new rule is added to support a tolerance based on the total of the quantity adjustments made to the SFC up to this point. The rule is **USE_QTY_ADJUST_TOLERANCE**. The values are:

- 'FALSE' - Don't use the tolerance (the SAP ME 6.1 behavior).
- 'TRUE' means use the tolerance.

When the tolerance is used (rule='TRUE'), then the components needed must match the required quantity, but within + or – pieces based on the adjustments to date.

In the example below, COMPA requires 1 component per piece on the SFC. In this case, the rule **USE_QTY_ADJUST_TOLERANCE** is set to 'TRUE'.

Action	SFC Quantity	COMPA Required	COMPA Assembled	Range Allowed	Check Config Passes?
Release 100	100	100	0	100-100	N
Start and Assemble 100	100	100	100	100-100	Y
Adjust Quantity +5	105	105	100	100-105	Y
Assemble 5	105	105	105	100-105	Y
Assemble 3 more	105	105	108	100-105	N
Adjust Quantity +5	110	110	108	100-110	Y
Adjust Quantity -10	100	100	108	100-110	Y
Adjust Quantity -4	96	96	108	96-110	Y
Scrap 10 Pieces	86	86	98	86-100	Y
Release 50 more Pieces	136	136	98	136-150	N

As the SFC's overall quantity is adjusted, the required quantity changes. With the rule set to 'TRUE', the check configuration activity will use the tolerance to allow any component quantities plus or minus form the current required quantity.

SAP ME will track the maximum and minimum SFC quantity that any manual adjustment has made to the SFC. These will provide the upper and lower limits for the component quantities. This allows for several adjustments up and down.

Any partial scrapping will move the limits down as shown above.

Note: CT520 will still use the current SFC quantity (with or without tolerances). There are no provisions to use the partial processing quantity. This means it is only really useful at the end of a relaxed routing with where all of the quantity accumulates before a final complete.

The other rules will be affected by this new **USE_QTY_ADJUST_TOLERANCE** rule as described below:

Rule	Behavior Change for **USE_QTY_ADJUST_TOLERANCE=TRUE**
CHECK_ALL_COMP_LAST_OPER	No changes to behavior.
CHECK_TIME_BASED	No changes to behavior. QTY is not part of check.
EXCESS	No changes to behavior. QTY is not part of check.
MISSING	Will use minimum historical SFC quantity for this test.
NON_BOM	No changes to behavior. QTY is not part of check.
TEST_PART	No changes to behavior. QTY is not part of check.

Two other new activity rules are available in 15.0:

- CHECK_OPERATIONS - A list of comma-delimited operations to check components for (no other operations are checked, even if the other rules are enabled. Any operations not on the SFCs routing will be ignored.
- CHECK_CURRENT_OPER_ONLY – If 'True', then only the current operation will be checked.

Note: The CHECK_OPERATIONS and CHECK_CURRENT_OPER_ONLY will supersede the other logic for determining the operation(s) to check for. The logic for CHECK_ALL_COMP_LAST_OPER and the logic around COMPLETE hooks is disabled if either of these two rules above are enabled.

Some production support actions also can affect the historical min/max SFC Quantities recorded by the SFC Quantity Adjust action. These support actions will move the min/max values up or down depending on the action. The actions that affect the min/max are:

- Split (pro-rated between parent and child SFC).
- Serialize (pro-rated between parent and child SFC).
- Merge (child min/ax are added to parent).
- Incremental Order Release (new quantity is added to min/max if defined).

- Partial Scrap (scrapped quantity is subtracted from existing min/max).
- SFC Quantity Multiply (min/max are multiplied by same factor as SFC quantity).

3.16 ERP Integration and Partial Processing

When ERP Integration is used with relaxed flow routings, this is a summary of the behavior:

- Relaxed routings will now send up each complete as a yield confirmation at the time the complete happens. These confirmations will be sent to ERP as normal confirmations (not rework). After the full order quantity has been processed at this step, these confirmations will then be sent to ERP as rework.
- Sends new records since last confirmation:
  - Components
- Sends just first record collected for the order:
  - Data Collections (Batch characteristics and Inspection Characteristic data)

Scrapping and Assembly steps should be separate steps on the relaxed flow routing. This is because of the current scrap behavior. Any unset components are assumed to be scrapped. By keeping the scrap steps separate from the assembly steps, this means that the components assembled will be sent as part of the confirmation, not as part of the scrap message.

For Quality Inspection scenarios, the 100% inspection scenarios do not support non-serialized processing as of this release (15.0). Inspection scenarios with less than 100% inspection do support non-serialized SFCs. Please see the ME Integration documentation for details.

3.17 Show Quantity and Resource in Work Center POD

Three new options are available in the Work Center POD now:

- Show User
- Show Resource
- Show Quantity

These control what is shown in the work center POD and the existing 'Resource can be changed' field is now supported.

If a resource is shown in the work center POD, then it is displayed as an optional field. If the operator does not enter this resource, then the fallbacks are used in the following order:

- Default Resource defined at the operation.
- Default Resource system rule for the current site.
- Default Resource system rule for the global (*) site.

Also, the resource and quantity can be passed in on the POD URL just like resource and operation on the operation pod.   For example:

http://usphlvmv039.phl.sap.corp:50000/manufacturing/com/sap/me/wpmf/client/template.jsf?WORKSTATION=ORDER_TOUCH_WC&THEME_NAME=TRADESHOW&ACTIVITY_ID=TOUCH_WC_ORDER_POD&QUANTITY=1.0&RESOURCE=BENCH57

3.18 Serialize with Partial Processing

The serialize plugin (PR550) supports partial processing in ME 15.0.   It also allows you to serialize pieces from the SFC when some quantity is in work or in queue at other steps if the SFC is on a relaxed flow routing.

Also, a new activity rule has been added to the serialize plugin (PR550) to serialize a single piece of the SFC at a time. This rule is: 'QTY_IS_ALWAYS_1'. If this is set to 'TRUE', then the quantity in the POD will be ignored and 1.0 piece will be serialized at a time.

Whatever the quantity to be serialized is, the plugin will operate the same way. If the user enters a POD quantity of 5 and the SFC has a quantity of 5 or more at the current operation/step, then the plugin will attempt to serialize just 5 pieces.

When serializing with this plugin, if the user has started 5 pieces and attempts to serialized 5 or fewer pieces, then the plugin will serialize from the in work quantity for that user. Otherwise, it will only allow serialization if the entire SFC quantity is in work or in queue. The PAPI does not work exactly like this (see the Javadoc for details).