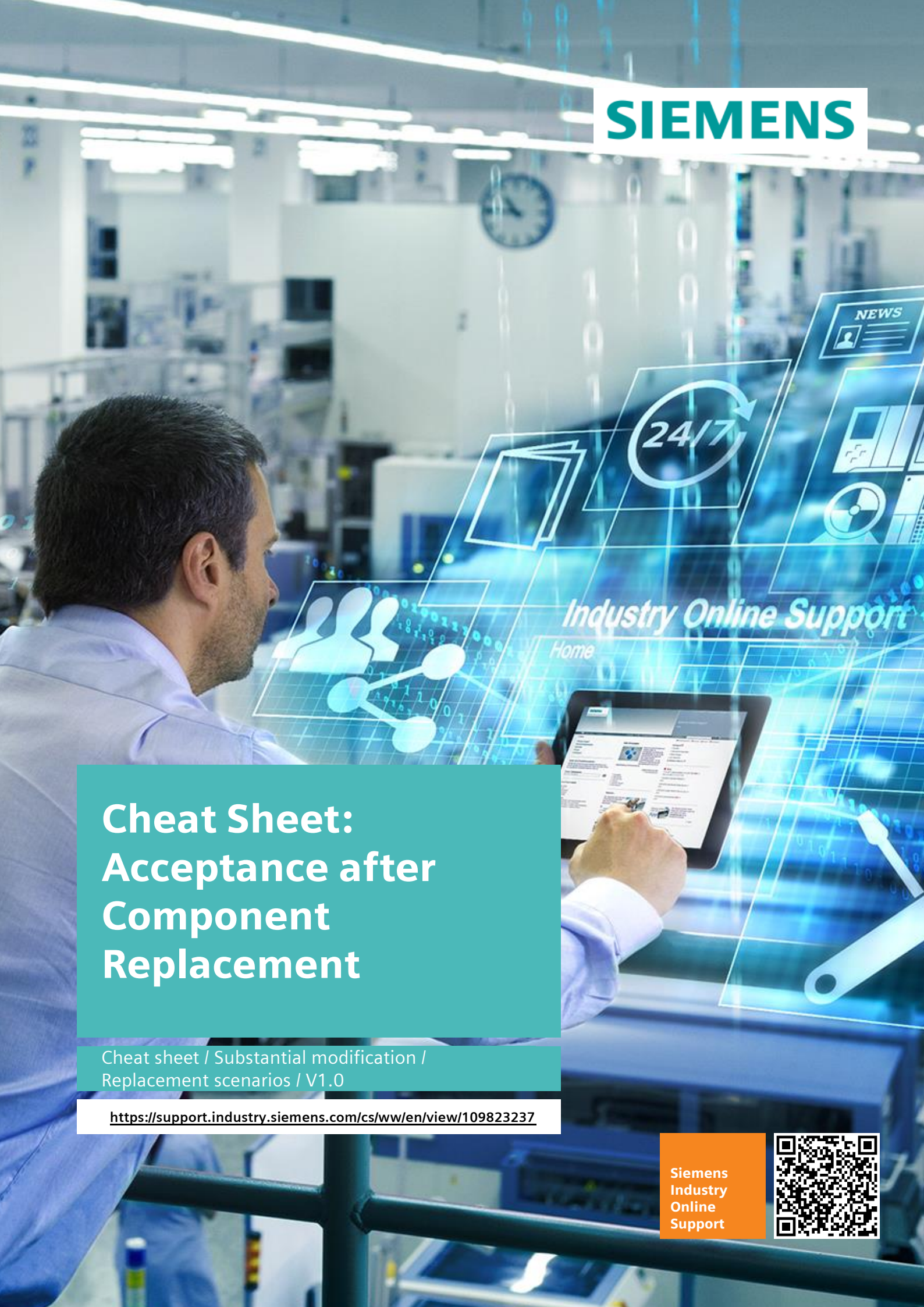


Cheat Sheet: Acceptance after Component Replacement

Cheat sheet / Substantial modification / Replacement scenarios / V1.0

https://support.industry.siemens.com/cs/ww/en/view/109823237

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1 General

Replacing modules or components on control systems can result in the entire machine being considered to have been significantly changed and must therefore be regarded as a new machine. This can result in enormous costs and effort.

After a change has been made to a machine, the following three cases can occur:

Case 1. There is no new risk or increase in existing risks. The machine remains safe.

Case 2. There is a new risk or increase of existing risks, previous safety devices (before the change) of the machine are still sufficient. The machine remains safe.

Case 3. New risk or increase of existing risks, previous safety devices (before the change) of the machine are not sufficient.

If case 1 or case 2 occurs, the change is not considered significant and the machine can be operated without further protective measures. In case 3, on the other hand, a new risk assessment must determine whether a significant change has occurred.

In general: After each change, it must be determined before recommissioning whether there are new risks and thus increased risks. Furthermore, the safety functions must be validated and checked with the aid of the manuals before recommissioning. In addition, the reaction time must be measured and compared with the limit values from the risk assessment.

If there is a significant change due to new, or increased risks, a greater risk reduction is required. Control components are a possible source of risk reduction. It must be evaluated whether the control components used with their safety characteristics still achieve sufficient risk reduction for the machine.

In the event of a substantial change, the machine must subsequently comply fully with the Machinery Directive (\5\), not just the changed section. This results in the following obligations in particular, regardless of the year of manufacture of the machine:

- Performance of a risk assessment
- Retrofitting the machine to the state of the art safety level
- Changes to the operating instructions
- Creation of technical documentation
- Drafting of a declaration of conformity
- Affixing of a CE mark

If the change is not a significant one, the machine must still comply with the requirements of national and country-specific regulations. In Germany, it is the Directive on Industrial Safety and Health (BetrSichV). As a result, the person who initiates the change is required to update or redo the risk assessment. More measures may also need to be taken.

It is also advisable to document the changes on the basis of a risk assessment. Further information on actions after a non-significant change is given in Chapter 3.

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WARNING	The instructions and warnings in the respective product manuals must be observed in any case, especially those concerning the replacement of the products. The respective national or country-specific regulations and specifications must also be taken into account.

For more information, see the interpretation paper "Substantial Change in Machinery" (\3\) of the German Federal Ministry of Labor and Social Affairs. Likewise, the Employer's Liability Insurance Association for Raw Materials and the Chemical Industry offers a detailed information paper on "Substantial Change in Machinery" (\4\). A helpful decision scheme is also included there to assist in deciding whether a change is (or is not) a significant change.

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2 Replacement Scenarios

Note Components and modules that are not part of the safety function do not have to be taken into account in the case of replacement.

Requirements

For the application of the following replacement scenarios, it is assumed that the machine in question had no safety-related defects prior to the change and complied with the applicable regulations. Likewise, it is necessary that the replacement scenarios be evaluated by experts with the corresponding expertise.

Note The results of the replacement scenarios refer only to the replacement of the components mentioned. If you make additional changes to the machine, these must be considered individually and separately.

2.1 Firmware Update

Since the firmware has no effect on safety-related characteristic values, a firmware update is not a significant change.

2.2 CPU Replacement

The critical factor in a change to control components is the decrease in response time.

In the following we consider CPUs of the S7-1500 series.

2.2.1 Replacement with same CPU

Replacement with a CPU from the same product family and with the same article number is not a significant change.

Example:

Previous component: CPU 1516F-3 PN/DP (6ES7516-3FP03-0AB0)

Replacement component: CPU 1516F-3 PN/DP (6ES7516-3FP03-0AB0)

2.2.2 Replacement with higher quality CPU or successor

Replacement with a CPU from a higher-quality product family, as well as replacement with a CPU from the same product family but a successor version is not a significant change.

Nevertheless, the safety parameters (PFD_{avg} and PFH) of the predecessor and the successor component should be compared to ensure that, over the sum of the components, the limits for the required safety level are not exceeded.

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Example:

Due to the improved product properties, there is no deterioration in the behavior of the machine. This does not create any new risk or increase in risk.

Previous component:	CPU 1516F-3 PN/DP	(6ES7516-3FN00-0AB0)
Replacement component:	CPU 1518F-4 PN/DP	(6ES7518-4FP00-0AB0)
Replacement component:	CPU 1516F-3 PN/DP	(6ES7516-3FP03-0AB0)

2.3 Module Replacement

2.3.1 Replacement with same module

Replacement with a module from the same product family and with the same article number is not a significant change.

Example

Previous module:	ET 200SP F-DI	(6ES7136-6BA01-0CA0)
Replacement module:	ET 200SP F-DI	(6ES7136-6BA01-0CA0)

2.3.2 Replacement with higher quality module

Replacement with a module from a higher-quality product family, as well as replacement with a module from the same product family but a successor version is not a significant change.

Example

Previous module:	ET 200SP F-DI	(6ES7136-6BA00-0CA0)
Replacement module:	ET 200SP F-DI	(6ES7136-6BA01-0CA0)

2.4 Base Unit Replacement

Replacing a Base Unit is not a major change as long as the machine is still functional after the replacement. If the wiring is changed, this hardware change must be considered separately.

2.5 Sensor Replacement

2.5.1 Replacement with same component

Replacing a sensor with the same model from the same manufacturer is not a significant change, as it does not alter the safety-related characteristic values.

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2.5.2 Replacement with other components

If there is a wiring change due to the sensor replacement, this wiring must be checked separately for a significant change. The decision-making tools, which are linked in the appendix, can help here.

If the wiring is not changed, there are two cases to consider:

1. The new sensor has worse safety-related characteristic values.
2. The new sensor has better or the same safety-related characteristic values.

In the first case, the replacement is a significant change, as it worsens the behavior of the machine. In the second case, it is not a significant change, since it maintains or improves the behavior of the machine.

2.6 Actuator Replacement

2.6.1 Replacement with same component

Replacing an actuator with the same model from the same manufacturer is not a significant change, as it does not alter the safety-related characteristic values.

2.6.2 Replacement with other components

If there is a change in the wiring as a result of the actuator replacement, this wiring must be checked separately for a significant change. The decision-making tools, which are linked in the appendix, can help here.

If the wiring is not changed, there are two cases to consider:

1. The new actuator has worse safety-related characteristic values.
2. The new actuator has better or the same safety-related characteristic values.

In the first case, the replacement is a significant change, as it worsens the behavior of the machine. In the second case, it is not a significant change, since it maintains or improves the behavior of the machine.

When replacing within a product family, for example a SINAMICS replacement, a CRC change may occur. This is due to the fact that the article numbers of the components are included in the CRC checksum. If the CRC has been changed, a change acceptance test is required.

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3 Behavior after a Non-significant Change

If the change to the machine is not a significant change, the following steps should still be followed.

First of all, it should be ensured that the machine complies with the requirements of the German Directive on Industrial Safety and Health (BetrSichV). As a result, the person who initiates the change is required to update or redo the risk assessment.

In addition, the change must be recorded in all the relevant documentation. Here, special care must be taken to ensure that no contradictions are noted, as well as outdated plans. It is also advisable to use a risk assessment to document the change.

Furthermore, the machine should be correctly recommissioned in accordance with all applicable regulations and by a qualified specialist. The regulations and requirements of DIN VDE 0100-600 should be observed here.

In addition, all safety devices should be checked. These include:

- Safety interlocks
- Emergency Stop devices
- Emergency Stop equipment
- Two-hand circuits
- Safety mats
- Safety light curtains
- Safety light barriers
- etc.

Secondly, it should be ensured that the change has not resulted in any deviations in the functionality of the machine. A function test must therefore be carried out here in accordance with the associated documentation/protocols.

Note

When recommissioning, you should also observe your company's internal regulations.

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4 Annex

4.1 Links and Literature

Table 4-1 Links and literature

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of the cheat sheet: https://support.industry.siemens.com/cs/ww/en/view/109823237
\3\	Interpretation paper "Substantial Change in Machinery" of the BMAS: https://www.bmas.de/DE/Arbeit/Arbeitsschutz/Produktsicherheit/interpretationspapier-wesentliche-veraenderung-von-maschinen.html
\4\	Information paper on significant changes to machinery of the BGRCI: https://www.bgrci.de/fachwissen-portal/themenspektrum/maschinensicherheit/informationen-und-interpretationen-zu-maschinen-allgemein
\5\	Machinery Directive of the European Union: https://single-market-economy.ec.europa.eu/single-market/european-standards/harmonised-standards/machinery-md_de

4.2 Change Documentation

Table 4-2 Change documentation

Version	Date	Change
V1.0	08/2023	First edition

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