



# FSS 5 „Safety of Machines and Production Lines”

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## FSS 5 „Safety of Machines and Production Lines”

### 1. Scope

The scope is all locations that are operationally managed by Freudenberg.

This FSS applies to all machines that are operated, ordered, developed, built, tested and modified by Freudenberg.

The standard also applies to the "relocation" and "takeover" of machines within Freudenberg, Freudenberg joint ventures and partner productions.

### 2. Purpose

The aim is to comply with legal requirements or the minimum standard according to FSS5. All machines in the scope must at least comply with these specified safety requirements. If a higher level of safety is required by local legislation, this is mandatory.

The aim is to procure safe machines and to maintain or improve their condition throughout their entire service life, adapted to technical progress.

The aim of the FSS5 review is to determine whether an acceptable risk has been achieved for the use of the machine, whether new machines meet the legal requirements, and whether old machines are operated with an acceptable risk.

### 3. Implementation and Transition Period

Ausgabedatum:	01.01.2024
Implementation BG:	01.07.2024
Implementation Site:	01.01.2025
F&Co HSE Assessment:	01.01.2025

### 4. Terms and Definitions

#### **AUTO Principle**

A-U-T-O principle defines the basic requirement for separating, movable or non-contact protective devices.

The protective device cannot be bypassed by reaching around (A – around), reaching under (U – under), reaching through (T – through) or reaching over (O – over).

#### **Machine Owner:**

The machine owner is the person who has the authority to permanently discontinue the operation of the machine (more than "stop work"), is most closely related to its day-to-day operation, acts externally as the person responsible and who is therefore responsible for this. (not maintenance manager or team leader, usually the cost center manager)

#### **Modes**

The operating mode is the way in which a machine is operated in the operating environment for which it is designed. The degree of safeguarding of the machine-specific hazards may differ in the operating modes.

#### **CoBot**

A collaborative robot, or CoBot, is an industrial robot that works together with humans and may not be separated from them by protective devices in the production process.

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### Manipulation of protective devices

*Manipulation is rendering ineffective or circumventing of protective devices with the consequence of allowing the machine to be used in a manner not intended by the designer. It does not matter by which means the manipulation is carried out and all necessary manual interventions are taken into account.\**

*\* „Manipulation von Schutzeinrichtungen“, HVBG Februar 2006, Source: association of commercial and industrial workers compensation insurance carriers; Germany*

### Machine:

An assembly of interconnected components or devices, including at least one moving, power driven component or device (stand-alone machine). An assembly of machines, which, in order to work together, are arranged and controlled in such a way as to ensure that they interact and function as an integral whole (coordinated machines). Excluded are:

- small hand-held machines
- industrial trucks (e.g. fork lift trucks - refer to FSS 3)
- cranes, chains and other load suspension devices (e.g. winches)
- means of transport (e.g. vehicles and the associated trailers)
- elevators and site hoists and elevators to carry passengers or passengers and materials
- post-heating ovens (without power-operated doors, conveyor / handling equipment etc.)
- machines whose sole source or power is directly applied human effort and
- air conditioner units, HVAC components with low risk caused by powered moving parts and comparable building installations.

### Risk / Acceptable Risk

In general, a risk is defined as the possibility of damage or loss as a result of an event or action. Essentially, the concept of risk is formed on the basis of the criteria of severity of damage and probability of occurrence. An acceptable risk is defined as the risk for which no further action is considered necessary, this decision is made as part of the risk assessment.

An adequate risk reduction is achieved when

- all operating conditions and all intervention procedures have been considered,
- the hazards have been eliminated or risks reduced as low as reasonable possible (ALARP)
- any new hazards introduced by the protective measures have been properly addressed,
- users are sufficiently informed and warned about the residual risks,
- protective measures are compatible with one another and
- the protective measures do not adversely affect the operator's working conditions or the usability of the machine.

### Risk assessment

Systematic assessment of the risk arising from the severity of damage and probability of occurrence for the activities carried out, whereby the probability of occurrence can be considered as a function of various parameters (e.g. according to ISO 12100 or 14121 Part II).

### Protective Device/Guard

#### Separating protective guard

A separating protective device is used to prevent reaching a danger point and to retain uncontrolled moving parts (e.g. chips).

#### Movable separating guard

The protective effect must be maintained as long as the hazard exists. Depending on the hazard, a lock is required to ensure that the hazardous movement comes to a stop as soon as the guard is

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opened, or a guard locking device to ensure that the guard can only be opened after the hazardous movement has come to a standstill.

### Guards with proximity function

#### **Non-contact protective device**

Non-contact protective devices (ESPE), such as light barriers, light curtains or laser scanners, detect the entry of persons, body parts or obstacles into the danger zone and stop the dangerous movement.

#### **Protective device triggered on approach**

Protective devices with an approach reaction prevent mechanical hazards if, after the protective device has been triggered, the dangerous movement comes to a standstill in good time before reaching the danger point. For this reason, the trailing behavior of the dangerous movement and the distances between the protective devices with an approach function must be coordinated.

#### **Stationary protective device**

Stationary protective devices such as two-hand controls or tap switches with automatic reset prevent mechanical hazards if their operation binds the operator outside the danger zone. The entire danger zone must be visible from the operating position to ensure that there are no persons or obstacles in the danger zone.

#### **Safely reduced force**

Force that is not likely to cause harm to humans.

#### **Tamper Resistant Fasteners (“Safety screws”)**

Fasteners that prevent manipulation of protective devices as far as possible (e.g. that cannot be loosened with tools that are accessible to everyone, e.g. Torx pin).

#### **State-of-the-art technology for safe use**

*The "state of the art" is the state of development of advanced processes, facilities or modes of operation, which makes the practical suitability of a measure for the protection of the health and safety of employees appear to be assured. In determining the state of the art, reference shall be made in particular to comparable processes, equipment or modes of operation which have been successfully tested in practice <sup>1</sup>*

<sup>1</sup> BetrSichV-2015, § 2 Begriffsbestimmung (10)

*The determination of the state of the art in the use of work equipment is primarily based on the Technical Rules for Operational Safety (TRBS in Germany, or other applicable rules, ISO, ANSI, ASME, VDI, VDE, ...). Other sources of knowledge for the state of the art are reliable ergonomic findings, e.g. in the rules of the authorities (DGUV or publications of the Federal Institute for Occupational Safety and Health BAuA). Other sources of knowledge can be, for example, specialist publications by industry associations. Ref zur Bekanntmachung 1114 des Ausschuß für Betriebssicherheit, des BMAS*

#### **STOP Principle**

Hierarchy of application of protective measures:

Elimination/substitution → Technical measures → Organizational measures → Personal measures  
→ behavior-based measures (according to 6.1.2)

#### **Imminent and Significant Hazard:**

"Imminent and significant hazard" means a situation in which the occurrence of damage is very likely or can no longer be averted without additional protective measures and the nature and extent of the damage is particularly serious.

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### "Substantial change"

denotes a physical or digital modification of a machine which affects the safety of the machinery by creating a new hazard or increasing an existing risk, making it necessary:

- (a) to supplement the machine with separating or non-separating guards, the incorporation of which requires an adaptation of the existing safety control system, or
- (b) to take additional protective measures to ensure the stability or strength of the machinery concerned.

## 5. Roles and Responsibilities

A RACI matrix is an indispensable part of the site-specific process. The RACI matrix (**here as an example**) must be adapted to the specific conditions of the site. In particular, the responsibilities of the machine owner and the maintenance manager must be individually adapted.

Tasks	BG HSE	SEO	Machine Owner	Maintenance	Site HSE	Purchasing	Engineering
Introduction of a BG specific process.	A/R				C		C
Creation of BG machine-specific checklists (optional)	A				C		R
Introduction of a process at the site level.		A/R	I	I	C	I	I
Appointment of machine inspectors.		A/R	I	C	I		
Ensuring the qualification of those involved.		A		R	C		
Organization of machine inspection		C	A	R	C		
Regular review based on the checklist.				A/R	C		
Event-related review on the basis of the checklist.				A/R	C		
Determination of the measures to be taken in the event of deviations.		A	R	I	I		C
Additional tests according to 6.2.6			A	R	C		
Creation of a maintenance plan.				A/R			C
Execution of the maintenance plan.		I	I	A/R			
Creation of a specification sheet.		C	I		I	A	R
Keeping the machine list.		A		R	I		
Granting exemptions.		A/R			I		C

R – Responsible, A – Accountable, C – Consulting, I - Information

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# 6. Process Description

## 6.1. Technical Requirements

The legally required level of technical protection for a machine must be achieved as a minimum. In Europe, the requirements of the Machinery Directive apply to a new machine, while the presumption of conformity applies when harmonized standards are applied. In other regions, local laws apply. If sufficient information is not available, the EU Machinery Directive (Directive 2006/42/EC) may be used as a reference.

For all machines, the state of the art for safe use must be determined on a case by case basis. The principle of allowing unsafe conditions to continue to exist because this is how the machine was supplied ("grandfathering") is not acceptable.

Within a BG, a technically uniform standard of machinery (stirred tanks, fleece-forming plants, injection molding machines, vulcanizing presses, machine tools, etc.) is to be strived for.

The BGs are free to introduce their own checklists for a specific group of machines (e.g. stirred tanks, machine tools) that guarantee at least the safety level of the FSS5 checklist. These checklists are maintained by the BGs.

### 6.1.1. Protection goals

Hazards must be tackled at their source.

Manual intervention must be limited to the absolute minimum necessary by means of stable processes.

At points of hazard, protective devices are provided, which:

- prevent the reaching of dangerous moving parts of machinery or other dangerous areas, prevent persons from being pulled in, trapped, pinched, confined, or
- Prevent reaching into the danger zone from all directions.

The protective devices used must not cause any additional or different hazards and must not be easily circumvented or rendered ineffective.

Movable guards must be designed and integrated into the control system of the machinery in such a way that, in the absence or malfunction of one of its components, it is prevented from being started or the moving parts of the machinery are stopped.

The following applies to protective devices that are implemented by a safety function in the control system: the reliability of a safety function must be adapted to the existing risk. The greater the risk, the more reliable the safety function must be (e.g. proven by an assessment according to ISO 13849-1 and 2, ANSI / RIA B11.19, B11.26, R15.06 or according to EN IEC 62061 as Safety Integrity Level).

It must be ensured that:

- Energies can be safely released, and residual energy can be safely degraded technically or rendered ineffective through measures,
- all local legal requirements are complied with,
- sufficient measures are taken to prevent electrical shock via both direct and indirect contact with electrical components,
- all operational commands for the machine are clearly recognizable in the common language of the site the machine is installed in,
- ergonomic design principles are considered in the design and installation of the machine and

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- physical or digital changes that introduce an additional hazard or increase the risk are limited to an acceptable level either by existing or additional measures.. The risk must not be increased due to remote access.

### 6.1.2. Protection concept STOP

The generally accepted hierarchy of measures has to be followed, Substitution – Technical – Organizational – Personal Measures. Protective devices must not unnecessarily restrict the intended use and process monitoring.

#### **6.1.2.1. Inherent safety/elimination or substitution of a hazard**

The hazard can be tackled at the source by selecting suitable geometries, "Safely reduced energies" (forces / protective extra-low voltage) or "Safely reduced speeds".

#### **6.1.2.2. Technology**

The technical measures used must correspond to the state of the art for safe use. The following technical possibilities can be considered:

- Fixed guards, movable guards, with interlock or, if necessary, interlocking with locking device
- Non-contact protective devices
- Guards with proximity function
- partly in combination with the monitoring of persons who may be in the danger zone (laser scanners, step mats,...)
- Stationary protective devices (two-hand release)
- Operating modes, for specified activities.

Safety-relevant components may only be replaced with components with the same or better properties.

#### **6.1.2.3. Combination with other measures (organizational / personal / behavioral)**

In order to reduce the risk to an acceptable level, further measures may be necessary, e.g.

- Indicative safety technology (signs, signal colors, visual and audible alarms,..)
- Instruction (operating instruction) / personnel selection
- Personal protective equipment
- Behavioral measures

### 6.1.3. Mandatory technical requirements

#### **6.1.3.1. Fixed guards**

Safety interlocks with control safeguards must be established for all guards and safety devices that are set up in front of potential hazards and are likely to be removed more frequently than once a year. These prevent access to the machine as long as the machine is not safe.

All guards and safety devices that are set up in front of potential hazards and are removed no more than once a year may be safeguarded by means of tamper resistant fasteners in such a way as to eliminate the possibility of manipulation / removal with "normal" tools.

If a dangerous movement does not come to a standstill immediately, a guard locking is required for separating protective devices, which only releases the protective device when the dangerous movement has come to a standstill.

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### 6.1.3.2. Manipulation of protective devices

It must not be possible to easily bypass or manipulate protective devices. E.g. by applying DIN EN ISO 14119 Safety of machinery - Interlocking devices in conjunction with guards - Principles for design and selection.

At least tamper resistant fasteners must be used to secure the fastening of accessible safety-related components (movable safety doors, safety switches, door hinges, non-contact protective devices, etc.).

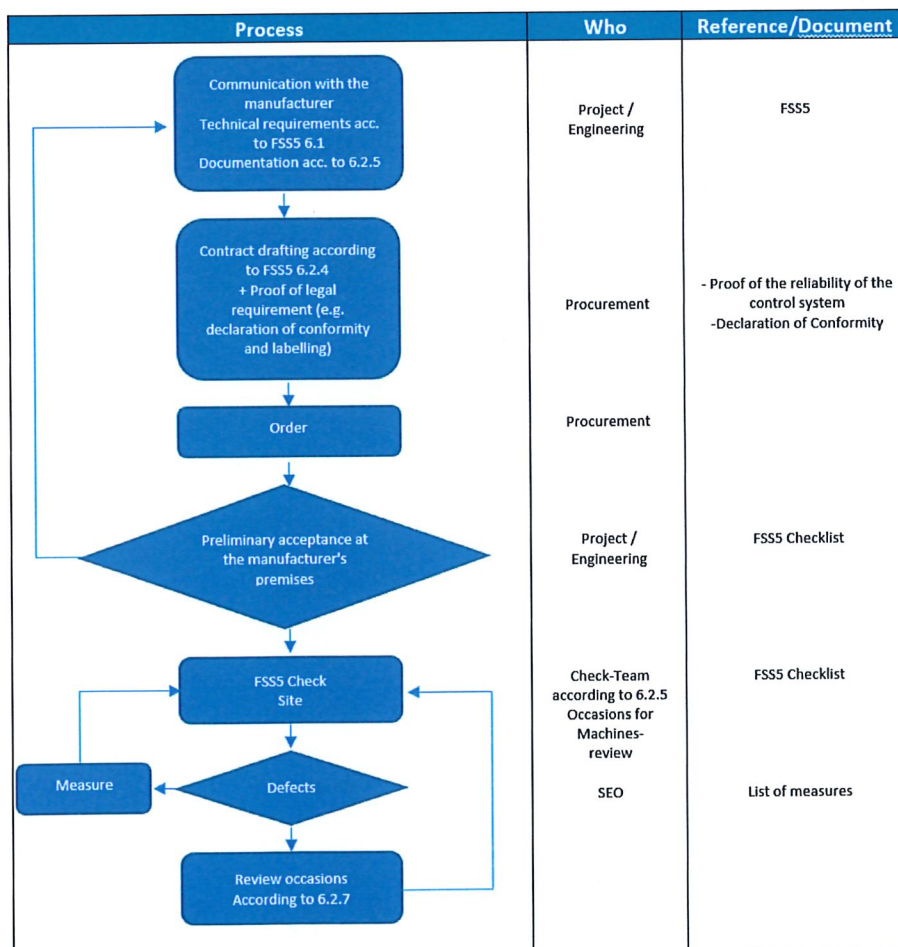
### 6.1.3.3. Protection against hazardous energies

Switch-off devices must be provided for all available energies (this also includes mechanical devices against lowering of components by gravity, shut-off and venting options for pressure or steam,...).

## 6.2. Organizational Requirements

### 6.2.1. BG Process and Site Process

The BG introduces a documented process that implements FSS5 on BG level. At the site, this process must be supplemented by the content for which responsibility lies at the site level (e.g. location-based RACI matrix, appointment of test persons,...). The process can be depicted in a flow diagram (see the following simplified example).





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### 6.2.2. Reduction of manual interventions

Trouble-free operation must be guaranteed for all machines used at Freudenberg, and manual operator interventions must be reduced to a necessary minimum. For this reason, for all machines analyses of the faults that occur must be carried out, and measures must be taken immediately in order to eliminate the causes of the faults systematically and quickly and thus to ensure availability.

### 6.2.3. Machine Procurement

As part of the procurement, the manufacturer is informed of the requirements of FSS5 (in particular Section 6.1.3 "Mandatory Technical Requirements" and Section 6.2.4 "Documentation").

In the purchase contract, the manufacturers of machines are obliged to list in the machine documentation the safety measures, the remaining residual risk and safe operation.

In the machine documentation, the calculation of the required reliability for each individual safety-relevant control function (e.g. proven by an assessment according to ISO 13 849-1 as a necessary performance level ( $PL \geq PL_{r^{**}}$ ), ANSI / RIA B11.19, B11.26, R15.06 or according to EN IEC 62061 as Safety Integrity Level) must be provided. Machine manufacturers are obliged to list these deadlines in the machine documentation for safety equipment that must be regularly inspected or maintained in accordance with (statutory) defined criteria.

(\*\* PL = Performance Level / PL<sub>r</sub> = PL required)

### 6.2.4. Machine Documents

The following documentation for a machine must be available at the site:

#### **6.2.4.1. *Instruction manual in local language***

The instruction manual must be available in the language of the country of use and must be available to the required persons.

#### **6.2.4.2. *Reliability of the control system***

A calculation and confirmation (e.g. validation according to the standard by the manufacturer) of the reliability of the safety functions must be available.

#### **6.2.4.3. *Wiring diagrams (electrical, pneumatic, hydraulic)***

Circuit diagrams must be available in the latest version. Changes are to be updated in the documents.

#### **6.2.4.4. *Maintenance plan***

A maintenance plan must be available that meets at least the following criteria:

- Consideration of operating conditions (increased wear, environmental conditions, shift models,...)
- The testing of protective devices (functional testing and verification of parameters), **the test procedure and its documentation**
- Testing of safety-relevant components
- Further checks according to 6.2.6.

#### **6.2.4.5. *Work Instruction (WI, OPI,..)***

If necessary due to the risk, operating instructions must be available for the activities on the machine (Work Instruction, Operating Instruction, etc.).

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### 6.2.4.6. **Additional documentation requirements for CoBots according to TS 15066**

The operating instructions for CoBot applications must also contain the information on the operating parameters (e.g. protective distances, safe speeds, etc.) according to TS 15066.

### 6.2.5. Old machines lacking documentation

If documentation is no longer available for old machines, the documents required for safe operation must be asked from the supplier. , If this is not possible, the documents must be created by the machine owner. The scope of the documentation to be created, depends on the risk of the machine.

### 6.2.6. Occasions for machine inspection

Machines are inspected regularly and occasion-related. The checklists in Appendix 1 and 2 are used to check the machines for compliance with this standard.

- All machines are checked before initial commissioning. For concatenated machines, the tests shall be carried out in accordance with the extended checklist.
- The repeat review is carried out every 4 years at the latest.
- When new equipment or devices are purchased (e.g. additional conveyors, power-driven parts of pressing tools, automatic material feeding systems, etc.).
- Testing after moving to a new site.
- Relocation of machines.
- Checking after process changes have been done that introduce new hazards or increase the risk, or after significant changes.
- Testing of machines after accidents or near misses on similar machines. The review covers only the aspects that led to the accident.

**In addition, inspections of protective devices and other components must be carried out in a fixed cycle, e.g.:**

- Functional tests by the machine operator. All safety-related equipment is regularly inspected and maintained by qualified personnel in accordance with use, but at least in accordance with the manufacturer's specifications. The results of the inspections shall be documented.
- Verification of parameters that characterize safety (e.g. follow-up time measurement to determine the required protective distance). The test results must be documented in a way that is accessible to the employee.
- Components that are exposed to damage-causing influences that can lead to hazards to employees must be inspected on a regular basis. (ropes/chains holding something in a raised position; pressure-bearing components, screw connections, mechanical guards in undamaged condition, devices for braking dangerous movements,...).
- The electrical systems and equipment are checked according to the legal or self-determined test periods.

### 6.2.7. Other

#### **6.2.7.1. Documentation of the check**

All machines are to be displayed in an overview with the corresponding safety status. This list shall be updated at least annually. It is recommended to mark the tested machines with an inspection sticker.

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### 6.2.7.2. Use / Prohibition of Manipulation

All machines and systems must be used in accordance with their intended use. Protective devices must not be manipulated or circumvented.

### 6.2.7.3. Relocation / operation in partner productions

When machines are taken over, a safety check must be carried out using the FSS 5 checklists before the machines are operated. The machines taken over must comply with the applicable local safety requirements, but at least those of FSS 5, before they can be used.

When handing over machines to other Freudenberg locations / "production partners" (relocation), the transferring organization checks the safety of the machine using the FSS 5 checklist. Identified deficiencies must be remedied by the transferring organization before relocation.

### 6.2.7.4. Commissioning

For machines that are in a state of development, commissioning or in a test state and for which safety devices have not yet been adequately installed, the boundary conditions and requirements for the safest possible operation must be instructed in writing by the SEO. The release must be posted on the machine, the measures must be checked every 3 months at the latest and are only permitted during the period of commissioning.

## 6.3. Personal requirements / trainings

### 6.3.1. Inspection Team / Requirements

The FSS5 inspection is carried out according to the 4-eyes principle in a team. The team is consisting of machine owner (or their delegate) und maintenance/engineering (mechanical/electrical). The formation of the team can vary depending on the specific question.

Persons who carry out FSS5 examinations must be allowed to use their specialist knowledge without undue influence. They must not be disadvantaged because of the performance of their duties.

One or more of the inspectors must have undergone at least one training course on risk assessment, as well as a factual training on aspects of machine safety according to local law (ideally combined with the application of FSS5).

The inspectors must have been trained in the application of their field of expertise (mechanical, electrical, process) and have demonstrated their competence, e.g. by completing job-related training or appropriate experience.

Persons who carry out inspections must be appointed in writing by the SEO.

## 6.4. How to use the checklist

### 6.4.1. Objectives in the application of the checklist

- Determining whether machines are operated at an acceptable risk level.
- Determination of whether the state of the art for safe use is complied with. There is no grandfathering for old machines.
- Recognizing and avoiding manipulation
- Verify that interfaces on connected machines are adequately secured.

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### 6.4.2. STOP criteria and need for action

Machinery where a safety device is defective **or absent**, or where an imminent and significant hazard is detected during the inspection, shall be immediately taken out of service. The machine can continue to operate once it is made safe or with an exception release from SEO. These exceptions must be approved in writing by the SEO and are valid for a maximum of 6 months. The release is based on a risk assessment, which determines the protective measures for the 6-month exceptional operation. The extension of an exemption is only possible once for 3 additional months. This one-time extension must be made with formal written approval by the supervisor superior to the location or the **COO/CTO** with information to the BG HSE function.

## 7. Attachments and Supporting Documents

### 7.1. Attachments

Attachment 1: General machine safety checklist (Issue 11-2022)

Attachment 2: **Safety checklist for an assembly of machines – concatenated systems (Issue 01-2024)**

Attachment 3: Preventing Manipulation of safety devices

Attachment 4: CoBot Applications 11-2022

### 7.2. Supporting Documents

- FSS Portal Training Material → [Freudenberg-Richtlinien für gruppenweite Sicherheitsstandards - FSS \(sharepoint.com\)](#)
- FSS Portal „Unterstützende Dokumente“ → [Freudenberg guidelines for group-wide safety standards \(FSS\) \(sharepoint.com\)](#)

## 8. Management of Change

Revision	Datum	Bearbeiter	Änderungen
5	17.11.2023	U. Freund	Neufassung / Complete Revision