

## Service Solutions for Safe Machines and Systems



## Six steps to a safe machine

## ► Safe machinery – SICK's expertise

§ Laws, directives, standards

1 Risk assessment

2 Safe design

3 Technical protective measures,  
implementation of the safety functions

4 User information on residual risks

5 Overall validation

6 Placing on the market

Responsibility of the operating  
organization

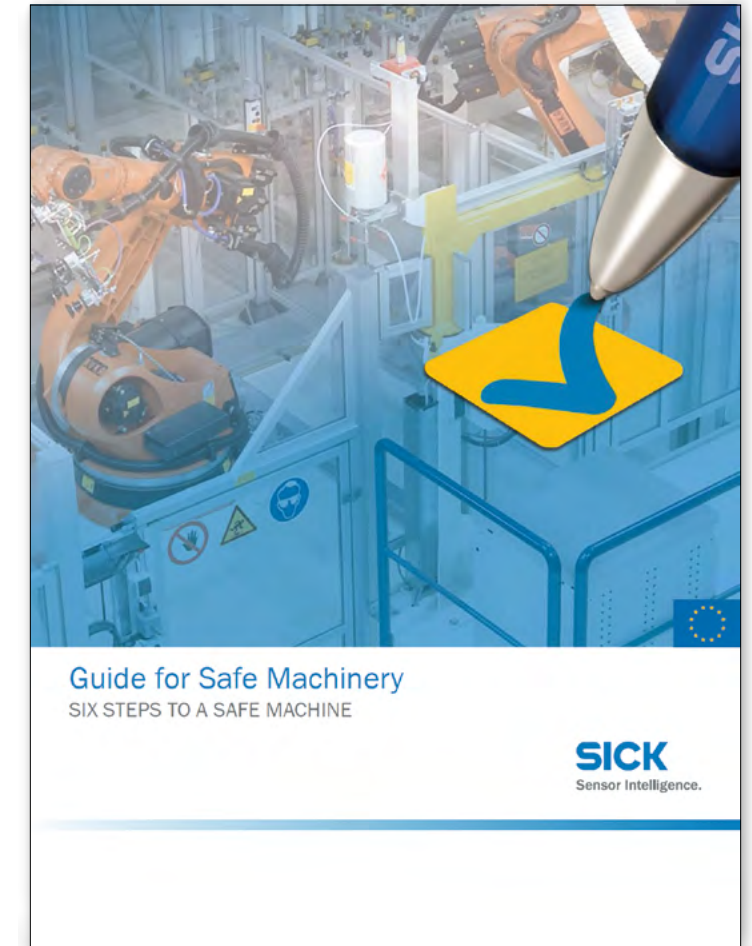
■ The guidelines – six steps to a safe machine

SICK's many years of practical experience, bundled and published in a single resource, lead you step by step to your goal.

The "Guidelines Safe Machinery – Six steps to a safe machine" provide you with structured information:

- Legal requirements relating to machinery in the European Community and their application
- Safety-relevant European directives, regulations, and standards
- Selection and application of protective devices
- Examples of how to protect machinery and people against accidents
- Examples of the application of the standards EN ISO 13849-1 and EN 62061 to determine the PL or SIL

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## Six steps to a safe machine

## ► VERIFIED SAFETY – The SICK seal of quality

§ Laws, directives, standards

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■ VERIFIED SAFETY – the SICK seal of quality

VERIFIED SAFETY is the SICK seal of quality for consulting and engineering services. VERIFIED SAFETY stands for SICK's commitment to ensuring that the results achieved have been brought about and verified by certified staff in line with a specified process.

Documents bearing the VERIFIED SAFETY seal of quality guarantee results that have proven quality.

VERIFIED SAFETY offers you a range of benefits:

- Assurance that the safety relevant technical documentation is complete
- Ensuring the quality of the safety assessments required for your machinery/systems
- Legal security through application of prevailing regulations
- Full traceability of our consulting and engineering results throughout the entire lifetime of your machinery/system

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Required  
measures



Training &  
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## Six steps to a safe machine

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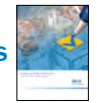
- Application of the requirements of the Machinery Directive and clarification of the application of further directives
- Identification of the relevant A, B, and C standards
- Interpretation and application of the standards, as well as monitoring to ensure they are up to date





## Six steps to a safe machine

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## Seminars and their content

## ■ CE marking in mechanical, system, and control engineering

Learn about CE implementation and become confident in handling of rebuildings and complete systems.

## ■ Conversion of and significant changes to machines and systems

With this seminar you will gain knowledge about the requirements for conversions or significant changes, applied to machines and systems. During the discussions you will receive practical suggestions on common approaches to solutions.

## ■ Machinery Directive – principles of machine-related safety

How to implement the requirements of the Machinery Directive adequately and correctly? In this training session, we will give you an overview and some solution strategies.

## ■ Safe control technology for designers

Consolidated expert knowledge about safety related drive and/or control technology, as well as familiarization with and application of EN ISO 13849-1.

## ■ Reliable implementation of SISTEMA – EN ISO 13849-1

SISTEMA offers in accordance to EN ISO 13849-1 a structured support during the safety evaluation of control systems. The seminar is a practical introduction for the IFA program.

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- Determination of machine limits and functionality
- Identification of hazards
- Risk estimation and risk evaluation
- Documentation of the risk assessment

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## Six steps to a safe machine

► Our expert support reduces the time you spend on design

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Responsibility of the operating  
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### ■ Risk assessment

- Performance of or instruction for risk assessments
- Determination of applicable directives and standards
- Identification of hazards
- Risk evaluation
- Specification of safety requirements



Severity of harm	Exposure to hazard	Possibility of avoidance	Probability of occurrence			PL, EN ISO 13849-1
			small	medium	high	
no damage (S1)	(±)	(±)	0	0	0	a
slight (S2)	(±)	A1	0	0	1	b
		A2	0	1	2	c
serious (S3)	F1 rare	A1	1	2	3	d
		A2	2	3	4	
	F2 often	A1	3	4	5	e
		A2	4	5	6	
death (S4)	F1 rare	A1	5	6	7	
		A2	6	7	8	
	F2 often	A1	7	8	9	
		A2	8	9	10	

p = possible under certain circumstances  
h = hardly possible





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### ■ Risk assessment and conformance check

This seminar shows you how to perform and document risk assessments in practice. Starting with a brief introduction on the legal background, you will learn about a well-tryed and easy applicable method followed by practice exercises.

### ■ Planning a machine and system in accordance with safety-related aspects

Experience the steps that are necessary according to the requirements of directives and standards being put into practice on a real system. You will create a hazard analysis and perform a risk assessment.



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Responsibility of the operating  
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- Design of the inherent safe construction
- Selection of the operating concept for all operating modes
- Design of electrical equipment in compliance with the relevant rules
- Ensuring of electromagnetic compatibility (EMC)
- Specific measures for use in areas subject to explosion hazards

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► For your cost-effective safety design that complies with the relevant rules

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### ■ Safety concept

- Specification of safety functions and required safety level (PLr or SILr)
- Recommendation for technical implementation of safety functions in the form of a block diagram
- Definition of parameters for the selection of protective devices
- Safety concept specification



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## Six steps to a safe machine

► For your cost-effective safety design that complies with the relevant rules

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### ■ Safe control technology for designers

This seminar focuses on the interaction between electrical, fluid-technical and/or pneumatic drives and/or controls, and shows you the relevant requirements and possible applications. Main topic is based around safe control technology according to EN ISO 13849-1.



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- Definition of the safety functions
- Determination of the required safety level
- Design and verification of the safety function
- Validation of all safety functions

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## Six steps to a safe machine

► For the standard-compliant implementation of your safety functions

Guidelines



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### ■ Safety hardware design

- Selection and interconnection of suitable components
- Specification of measures for controlling and avoiding systematic errors
- Determination and verification of the safety level
- Hardware concept specification
- Creation of a SISTEMA project file

### ■ Safety software design

- Specification of safety-related application software, including the definition of input and output signals
- Creation and verification of safety-related application software according to the V-model for software development



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### ■ Training

Basic and advanced training for all SICK safety products: safety light curtains, photoelectric light switches, multiple light beam safety devices, safety laser scanners, and safe control solutions



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## Six steps to a safe machine

► Our products for your applications

Guidelines



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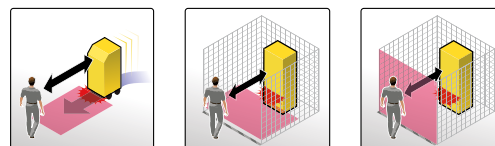
3 Technical protective measures,  
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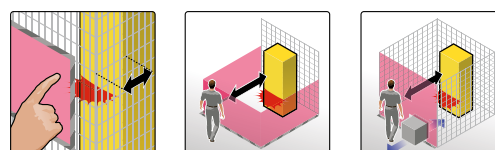
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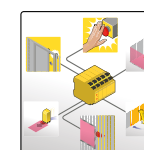
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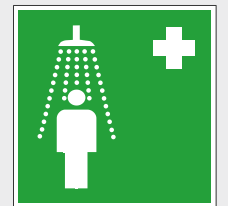
6 Placing on the market

Responsibility of the operating  
organization

- Determination of the warning instructions in the operating instructions
- Selection of personal protective equipment
- Generation of work instructions and training requirements

■ Typical warnings relating to residual risks

- Warnings in the operating instructions
- Work instructions, training requirements or instruction of users
- Pictograms
- Instructions about the use of personal protective equipment



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## Six steps to a safe machine

► To minimize your residual risks

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Responsibility of the operating  
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### ■ Seminars and practical workshops <sup>\*)</sup>

To address individual needs and requirements, SICK is offering customer-specific training. To find out, how a tailor-made qualification concept for your application can look like, please contact your local representative.

<sup>\*)</sup> Starting in 2016 SICK offers a TÜV certified training for Functional Safety Engineer. Detailed schedule upon request.



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## Six steps to a safe machine

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Responsibility of the operating  
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- Validation of machine safety
- Collection of the complete technical documentation
- Documentation of the validation

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## Six steps to a safe machine

► To minimize your liability risks

Guidelines



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Responsibility of the operating  
organization

### ■ CE-conformance check

- Identification of hazards
- Assessment of the essential EC Machinery Directive requirements for safety and health protection
- Documentation of results as a prerequisite for the EC declaration of conformity and the CE marking

### ■ Validation of functional safety

- Creation of a verification and validation plan to thoroughly check for proper selection, installation, implementation and functioning of the safety-related parts of the control system (SRP/CS)
- Configuration of safety-related parts of the control system <sup>\*)</sup>
- Analysis and testing according to the verification and validation plan
- Specification of the necessary adjustment and, if necessary, revision of the safety-related application program

<sup>\*)</sup> The configuration of safety-related components which are not part of the SICK portfolio is possible under certain provisions.



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## Six steps to a safe machine

► To minimize your liability risks

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Responsibility of the operating  
organization

### ■ Machine safety inspection

- Inspection of the major mechanical hazards on a machine
- Inspection of all technical protective devices for correct alignment, installation, and functionality
- Inspection of the function and operation of electrical, pneumatic, and hydraulic safety-related control measures
- Production of an inspection report



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## Six steps to a safe machine

► To minimize your liability risks

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### ■ Risk assessment and conformance check

This seminar shows you how to perform and document risk assessments in practice. Following a brief introduction, you will learn about a proven procedure that is easy to apply and will then work together to implement it.



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■ CE Declaration of Conformity

Risk reduction – The 3-step method

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## Six steps to a safe machine

► For achieving CE marking of your machine  
in compliance with directives

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Responsibility of the operating  
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### ■ Risk assessment and conformance check

Performing and documenting risk assessments in practice. Introduction to the legal background and familiarization with implementation.



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## Required measures



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Product & System Support



Upgrade & Retrofits



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Responsibility of the operating organization

- Performance of the safety acceptance
- Ensuring of operational safety during operation, maintenance, and retrofitting
- Rebuilding and modernization of the system

### ■ Requirements arising from the Work Equipment Directive

The safety state of work equipment and systems in operation is regulated in the EU directive 2009/104/EC ("Work Equipment Directive") and is to be checked in accordance with the related national laws. Article 4a of the directive in particular defines the thorough check on work equipment. Technical rules and standards or specific regulations can form the basis for this process. The thorough check and formal determination of operational safety shall be arranged by the organisation operating the related systems. During this process the operating organisation shall ensure the thorough check on work equipment is arranged as per the related national implementation of the Work Equipment Directive.

SICK, along with its accredited inspection bodies, qualified safety personnel, and certified processes, will support you in fulfilling these legal requirements.



Required  
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## Six steps to a safe machine

► For a professional solution to your technical problems

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Responsibility of the operating  
organization

### ■ Machine safeguarding evaluation

- Analysis of the system's current conformity status
- Thorough check for the necessity of a new EC declaration of conformity
- Identification of safety gaps with recommendations for reducing risk



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Responsibility of the operating  
organization

### ■ Initial inspection

- Evaluation of the optical protective devices to ensure they have been installed correctly and according to the specification
- Inspection of whether the protective device is operating according to machine usage
- Production of an inspection report and issuance of an inspection seal

### ■ Periodic inspection

This inspection corresponds to the scope of the initial inspection, but here the focus is on checking for any changes of the machine and/or protective device, as well as the working environment and method of use.

### ■ Electrical equipment check

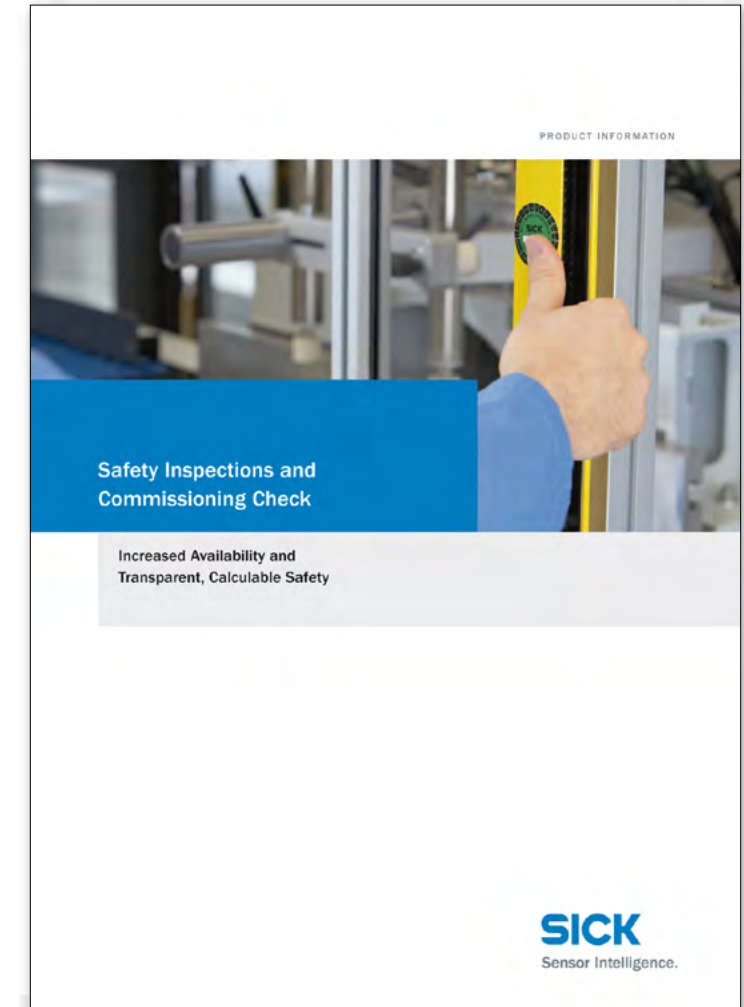
- Determination of the correct function of the protective bonding circuit as per the requirements of IEC 60204-1
- Description of eventual defects and preparation of a test report

### ■ Stop time measurement

- Taking of stop time measurement
- Calculation of the necessary safety distance between hazardous point and safety device in accordance with EN ISO 13855
- Production of a measurement report and attachment of a test label

### ■ Accident investigation

- Investigation of the circumstances of the accident or incident
- Identification of the cause of the accident
- Recommendation of measures to prevent other incidents or accidents



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### ■ Troubleshooting on site

- Error analysis and rectification of failures on site
- Repair or replacement of defective components by experienced engineers
- Documentation about the failure and description of the repair (service report)
- Recommendations for avoiding failures

### ■ Telephone support

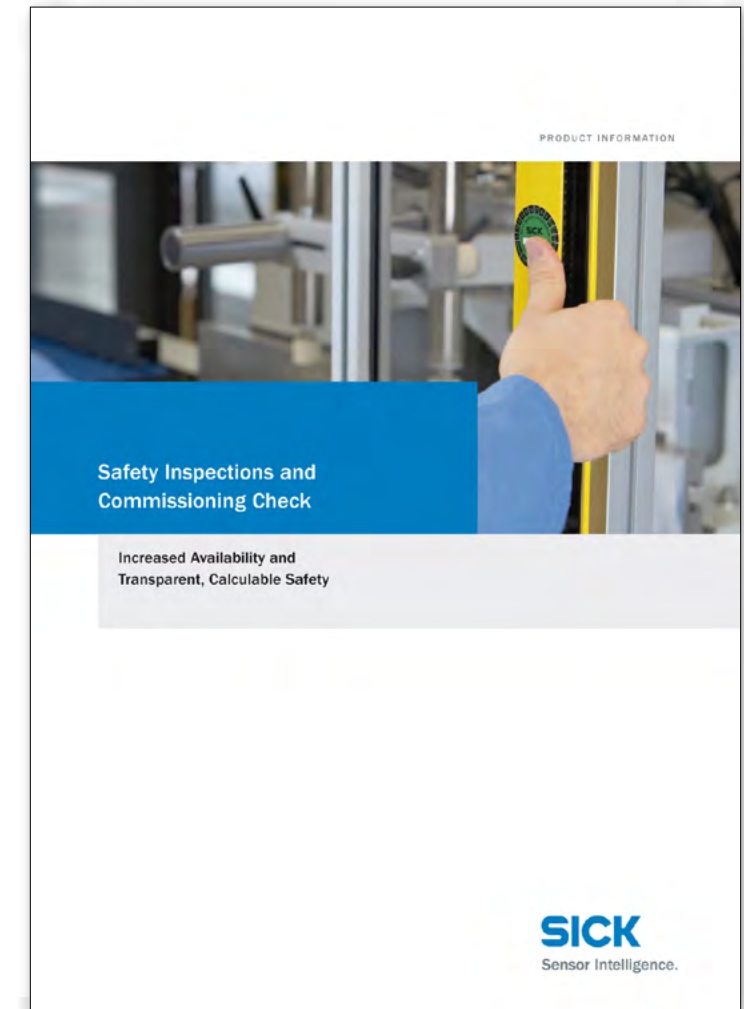
- Free telephone support during business hours
- Contact person with technical expertise
- Accessible worldwide
- Around-the-clock support for contract customers

### ■ Exchange units

- Advance delivery of exchange units
- Detailed investigation of failure causes and advice about preventative measures (optional)

### ■ Repairs

- Reason for failure is identified and faulty components are repaired or exchanged
- Product safety checks
- Repair findings relating to faulty assemblies
- Express repair (optional)
- Software update, modification and conversion (optional)
- Detailed investigation of failure causes and advice about preventative measures (optional)
- Recovery of application-specific equipment parameters (optional)



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### ■ Retrofits

Retrofitting and upgrading of safety-related systems and machines.

### ■ Upgrade kits

SICK upgrade kits are perfectly matched to the product they are replacing. Protective devices from SICK offer reliable operation over many years. However, if a device does experience a failure after several years of operation, SICK offers upgrade kits allowing it to be replaced quickly and easily: the latest technology, built and prepared for seamless integration into existing systems.



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Responsibility of the operating  
organization

### ■ Rebuilding and significant changes of machines and systems

In this seminar, you will learn in which cases of machine rebuildings a CE-conformance check needs to be carried out.

### ■ Training

Basic and advanced trainings for all SICK safety products: safety light curtains and light barriers, multiple light beam safety devices, safety laser scanners, and safe control solutions.



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