project data

Manufacturer	itself (machine for personal use)	Original manufacturer: "Logo"
Manufacturer's address:	Langenbruch 6, 32657 Lemgo	
Version of this complete document:	0.0.1	
Reason for change	New construction of the plant	
Date of last change: Designation of		
the machine: Machine type (model):	smart transfer system (transfer system, integration infrastructure)	
Serial number/machine no.:		
year of commissioning	2014	
Customer:	Institute for industrial information technology at the Ostwestfalen-Lippe University of Applied Sciences; Fraunhofer application center IOSB-INA	
address of the customer	Langenbruch 6, 32657 Lemgo	
Order number:	internal	
Languages)	German	
Conformity assessment procedure:	Appendix VIII of the EC Machinery Directive 2006/42/EC	
notified body:	omitted	

Responsible:

	Surname	date / date	Signature / Signature
Made by / created by	Philip Kleen	05/12/2015	
Checked by / verified by			
Approved by / released			
documentation officer			

project Manager

mechanical designer:	
Electrical designer:	
Designer control:	
Designer media:	

1. Purpose of the risk assessment

This documentation serves as proof of the directive-compliant planning/construction of the machine/system described under "Description of the machine/system".

The additional compliance with DIN EN ISO 11161:2010-10 is documented. This proof is part of the technical documentation of the smar ten transfer system in accordance with Appendix VII of the EC Machinery Directive, but does not fully reflect this.

The hazard analysis (identification of hazards) is part of the comprehensive **risk assessment according to DIN EN ISO 11161:2010-10.** With the help of this risk assessment, the possible emergence or transmission of hazards due to the interaction (integration) of several machines should be prevented will. Based on the identified and evaluated risks, appropriate risk management measures were taken after observing the relevant safety regulations set reduction.

The risk assessment and the protective measures implemented on the machine/system authorize according to Articles 5 and 12 of the EC Machinery Directive line 2006/42/EG for issuing the EC declaration of conformity and for affixing the CE mark. The entire machine can be used for this documentation can be completed with this.

2. Implementation

The risk assessment of the machine was divided into two parts. In the previous risk assessment of the smart transfer system (transfer system, integration infrastructure), the dangers and the risk transfer when integrating machines were not taken into account. This supplementary risk assessment considers the smart transfer system as an integrated manufacturing system (IMS) according to DIN EN ISO 11161:2010-10. The risk-reducing measures are checked and specifications for integrable machines are defined.

When carrying out the risk assessment, the following specifications and guidelines for the process were observed: **EC machines Annex I General principles Directive** Annex I No. 1.1.2 Principles for the integration of safety **2006/42/EG**
Annex VII Technical documents for machines Annex VII Conformity assessment procedure

DIN EN ISO 12100 Machine safety –
General design principles - risk assessment and risk reduction

DIN EN ISO 13849 Machine safety –
safety-related parts of controls; **Part 1:** General design principles

DIN EN ISO 11161 Machine safety –
Integrated Manufacturing Systems - Essential Requirements

A hazard checklist (see p. 19 hazard checklist) and action sheets (see p. 30 action sheets) were essential tools for implementation and documentation .

Hazard identification of hazards **checklist**

measures sheets	Risk assessment and description of protective measures

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This verification documentation also includes the documents used in the risk assessment

DIN ISO/TR 14121-2:2013-02	Risk assessment according to Section 6.5.2 Example of a hybrid of risk assessment tools or methods Risk assessments
Attachment 1	Control measures
Attachment 2	
Attachment 3	list of standards

...

The hazards marked with a cross in the **hazard checklist** were identified for the designated machine/system (see p. 25 hazard assessment and description)

The machine-specific details, risk assessments and protective measures taken to reduce risk are described in the action sheets as part of a safety and operating concept (see p . 34 **Error !** No valid result for table.)

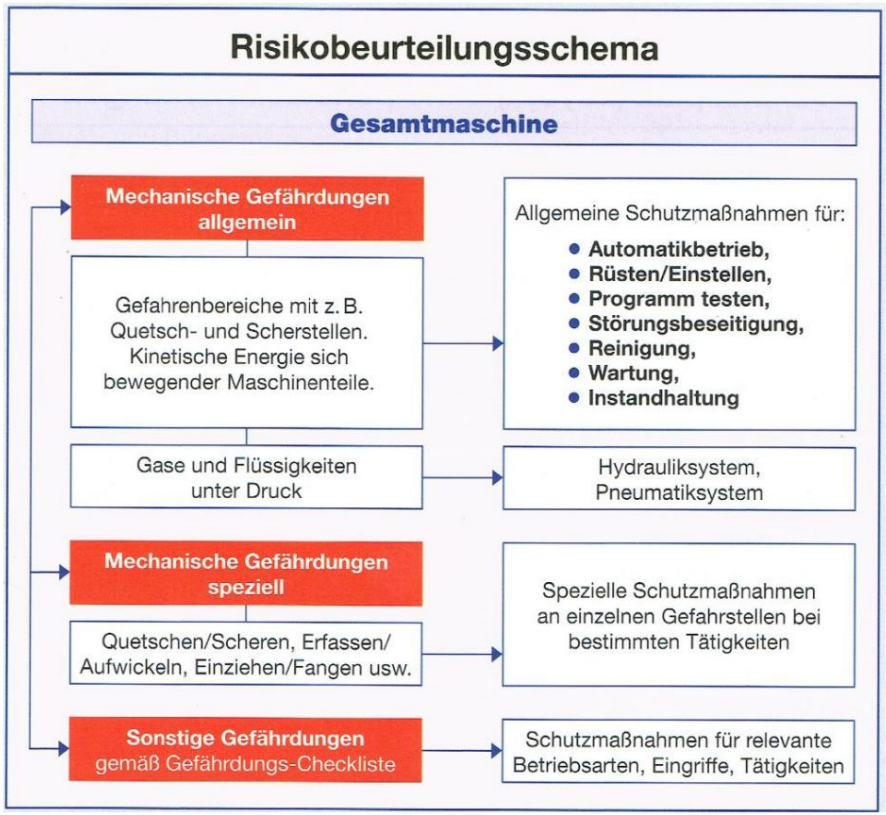
The information in the hazard checklist (columns 3 to 8) **and in the action sheets** (column 9) **serve in the sense of the EC Machinery Directive 2006/42/EC as a list of**

- **basic requirements of the Machinery** Directive • **standards and the**
- **other technical specifications,**

which were taken into account when designing the machine. The titles of the standards and other technical specifications are listed in the **list** of standards in this verification documentation and – where applicable – marked with a cross.

~~The required compliance with the basic requirements of all relevant internal market directives has been achieved. If this is not~~ possible due to the state of the art, this will be indicated in the **action sheets** (column 9) (residual risk).

The following assessment scheme shows the basic procedure.



3. Description of the machine/plant

3.1. characteristics

Product:	**"Machine"** in the sense of the Machinery Directive 2006/42/EG Article 2 / point a
designation	smart transfer system (transfer system, integration infrastructure)
Manufacturer	Institute for industrial information technology at the Ostwestfalen-Lippe University of Applied Sciences; Fraunhofer Application Center IOSB-INA
type designation	slide system
machine no.	
Construction year	2014
Type/shape/weight of the workpieces	The workpiece is limited by the workpiece carrier (object carrier) in its type, shape and weight. Maximum load of workpiece and carrier is 10 kg. A construction height of 20 cm from the transfer belt must not be exceeded.
quantity	The transfer belts run the entire production time (see time limits) see 3.5 phases of life production hall,
operating mode	exhibition
Location	
Space requirements (see installation plan)	Depends on the stage of expansion, the structure considered here requires 12 mx 5 m
operating personnel	instructed persons (see 3.5 phases of life)
Installer/Maintenance	Skilled workers, instructed persons (see 3.5 phases of life)
rated capacity	
Electrical connection	380 V three-phase current (TN-S system)
Degree of protection	no special requirements, IP20 (not specified)
pneumatic connection	6 to 8 bars
communication system	ProfiNet and ProfiBus
Expected life of the asset	20 years
Inspection/Maintenance/Cleaning	see the operating manuals of the suppliers
Applicable Documents	Operating instructions, risk assessment of the transfer system

3.2. Specification of the IMS, limits of the machine The specifications of the integrated manufacturing system according to DIN EN ISO 11161:2010-10 are described below.

3.2.1. Boundaries

This clause starts with the definition of its boundaries, this includes the determination of the limits of use, spatial boundary requirements and lifespan of the IMS [see also ISO 12100-1:2003, 5.2]

	Description	related documents
Intended Use	This machine represents the smart transfer system as an integrated production system and is intended to link independent machines to one another via plug and produce interfaces. An integration infrastructure is provided for this purpose with the transfer system. This machine requires fully coordinated individual machines for integration.	
Foreseeable non-intended Use (misuse/abuse)	Connection of machines that do not meet the specifications. Operation of machines that are not correctly integrated. • Integrating machines (modules):	
Description of functions	Complete machines can be supplied with energy and information via the plug-and-produce interface provided by this sub-machine. Due to the direct positioning on the “transfer system” sub-machine, they can influence the production process. • Supply of machines: Via the plug-and-produce connection supplies the integrated machine with electricity, compressed air and the communication medium by means of a plug. • Provision of an infrastructure: This sub-machine provides the integrated machines with electricity, compressed air and a communication interface. • Transport of slides: The slides are guided through all integrated modules via the transfer system with the help of status information.	
Arrangement including access and the prerequisites necessary for use	Access is possible for trained operating personnel from all outside sides, rigid fencing is not possible to maintain flexibility. Tasks are to be performed directly on the machine.	
Interaction between different work processes and manual activities	The transfer system (belt and slide) can be soiled by assembly steps of integrated machines and thus risks can be transmitted.	
Analysis of process sequences, including manual interactions	The assembly progress is stored on an RFID chip in the slide. This is read out by each module and this continues the assembly if necessary. The integrated assembly machines are complete individual machines, which means that each assembly step is complete in itself. Interactions can be ruled out in this way.	

Interfaces to other machines	Interfaces to other complete machines are created at the integration stations, the protective devices of which can be changed in order to be able to integrate these machines in the transfer system. Protective devices on the integrated machines prevent access to their danger zone.	
Interfaces to the power supply	Power is supplied via the plug-and-produce connection. A power consumption of *3 kW* per integration space is provided with a TN-S system and must not be exceeded. This must be monitored for safety reasons.	
Interfaces for communication	Communication takes place with Ethernet using the protocols ProfiNet, ProfiSafe, SafetyBridge see	
flowcharts		
foundation plans	None are required, if necessary the supports of the transfer system and the control cabinet must be anchored in the concrete floor.	
Site plans and space requirements for handling materials	see construction plan	
Supply connections	Compressed air 6 to 8 bar, 64 A 3~phase 400 V TN-S system	
Available records of accidents in similar work processes or systems Specifications/specifications	are not available	
Technical data in the operating instructions	are not available	
Chap. xxx Description of the structure and components in the operating instructions Chap.	see risk assessment transfer system	Documentation transfer system
xxx	see risk assessment transfer system	Documentation transfer system

Limits of the service life of the machine / individual components, with intended use and foreseeable misuse Recommended maintenance intervals

	description	related documents
Expected Machine Life	20 years	
Service life of wearing parts (list)	see operating manual of the transfer system	Documentation transfer system
Recommended maintenance intervals (list)	see operating manual of the transfer system	Documentation transfer system

Properties of the materials to be processed; required degree of cleanliness; minimum / maximum temperature in the environment / in the machine; Indoor/outdoor operation in dry/wet weather and in direct/indirect sunlight; Dust / moisture tolerant; Etc.

	description	related documents
Materials that are processed (list with hazards)		
required degree of cleanliness	no special requirements IP20	
Minimum/maximum ambient temperature		
Minimum/maximum temperature in the machine		
Indoor/outdoor operation	production hall	
in dry/wet weather in direct/	omitted	
indirect sunlight	indirect sunlight no requirements	
Dust/wet tolerant		
Aggressive environmental conditions	no	
Etc.		

3.2.2. Functionality

The specification of the functionality of the IMS includes the following

	points Description	related documents
production rates		
work tasks		
performance		
degree of automation		
technologies	Plug-and-produce connection, RFID as a product memory	
manufacturing processes	Laser engraving, automatic assembly, assisted manual assembly, manual product removal, product transport with slide see 0 life phases Machines that	
operating modes	can be integrated: complete individual machine; dependent on an automatic product feed; The machine's safety devices also prevent access to the	
Multiple Use Requirements	danger area during integrated operation; Indexing conditions in the transfer system are only activated when a machine is integrated at this point; Safety devices of the integrated modules also cover this danger area.	

	Transfer system: consists of assemblies (transfer belt with supports and integration infrastructure); The structure must offer sufficient space for the modules; Product removal must be easily accessible.	
Control functions, including security related	After integration, it must be ensured that the respective module is correctly integrated into the emergency stop chain and that other safety-related signals can be exchanged if necessary. The correct position on the transfer belt must be ensured.	
Spheres of action of the control	Each module has its own control for that module. A control of the integration infrastructure in this IMS controls and monitors the correct integration of the modules and provides security functions for the entire smart transfer system.	
requirement for the inspection		

3.2.3. Determining the work tasks The
interventions by the operators in the IMS have been identified and subsequently documented.

Task Frequency/ Duration Scope Auxiliary tools of the operating mode				protective gear		ergonomic aspects	Environmental aspects Life phase
Integrate machines	Plug and produce places	Daily / 5 min	entire IMS safety shoes		no		G
Setting up integrated machines	workspace of machine	Monthly/ 1 hour	Relevant Monta machine and instruction	Safety shoes IMS safety shoes			H F
Setting up integrated machines	Plug and produce place	Monthly/ 1 hour	and instruction for the entire IMS safety shoes				H
Removal of machines	Plug and produce Places	Daily / 5 min			no		G
Construction/conversion	entire IMS	Semi-annually / 8 h	entire IMS safety shoes, cut-resistant gloves and underwear		Screwdriving and assembly tools	healthy lifting	C
Product removal removal assembly pen		Always/always	Complete IMS solution	Safety shoes, cut-resistant gloves, work clothing, hair net, instruction	possibly pallet truck	doormat	D

3.2.4. Space requirement of the IMS

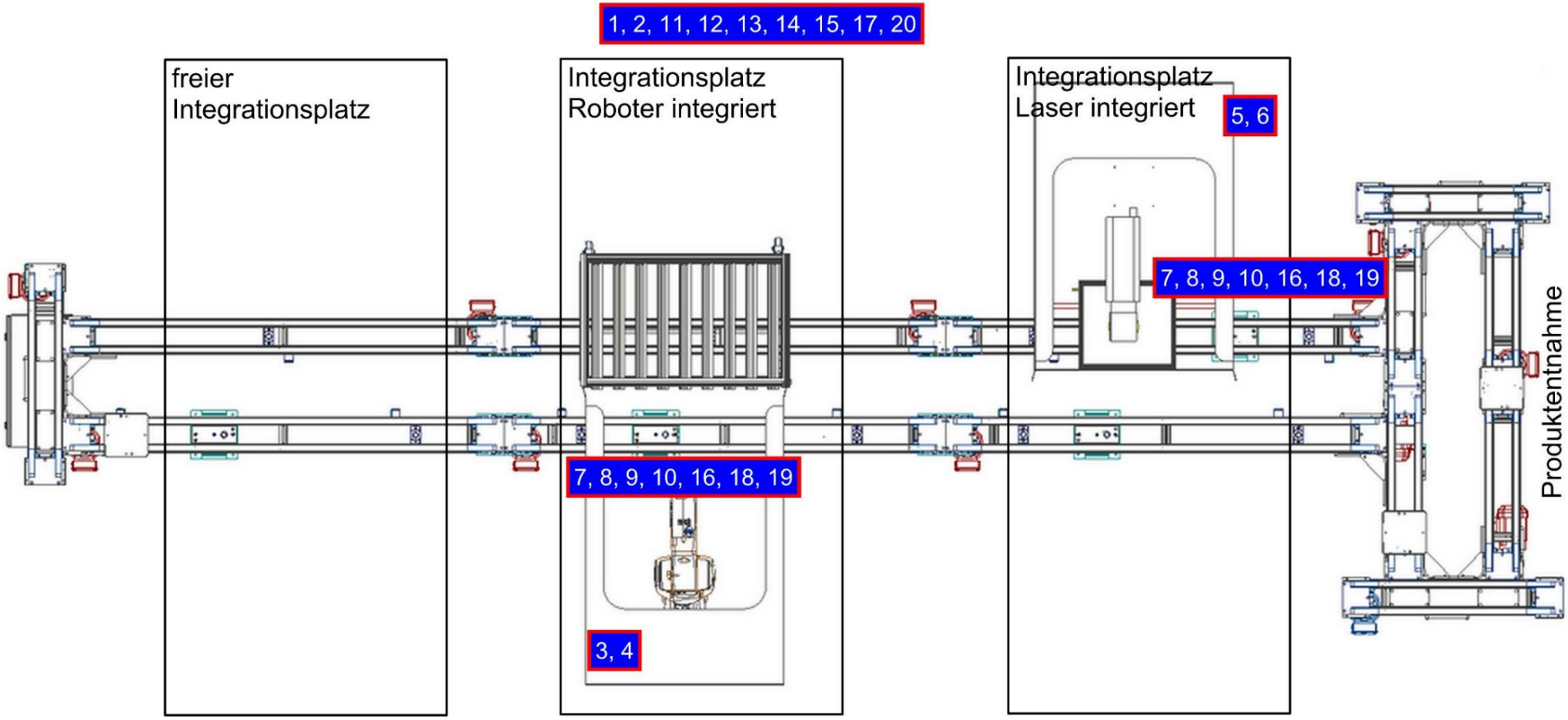
The following points were taken into account in the construction-related considerations for the arrangement of
the IMS: *Access is possible for trained personnel from all sides, passing persons and traffic are prevented from direct access to the IMS by a barrier tape.*
The product removal area is made accessible to everyone.

	description	related documents

Access		
predictable human intervention		
work tasks		
workflow		
Spheres of action of the control of the protective devices		
traffic and people passing by		

Installation

plan The identified hazards are already marked in the installation plan shown below.



3.3. use

Environment of use	description	related documents
private		
Commercial, industrial use X		

3.4. materials

materials	material	use	related documents
dangerous substances			
hazardous materials	processing of metal	None, possibly an integrated machine	
hazardous processed materials			

3.5. **Life** phases Life

phases of the machine/ plant	Dangerous activities, interventions, situations	Group of people at risk
A build	Construction, assembly, test runs at the construction site	Fitters and designers of the operator and/or a representative, customer
B Transportation	Packing, loading and unloading, transporting, unpacking	Transport staff of the operator or the commissioned forwarding agent
C Assembly installation Installation	assemble, set up, connect, adjust, test, check, Measurements, trial runs at the production site	assembly and maintenance personnel operator and/or a representative
Application/Use D to M		
D Automatic mode	Energy and information are provided and distributed. Stoppers, indexing are automatically controlled based on status reports from the integrated machines. Correct integration of the individual machines is monitored.	operating staff
E semi-automatic operation	Energy and information is provided, belts run in inching mode. Integrated machines can continue to be operated in automatic mode if necessary.	
F Manual operation	Jog operation of the transfer belt, individual control of the stoppers, indexing, information (status messages), individual provision of energy (compressed air, electricity)	
G setup/adjustment Integrate	Integrate further/other machines, adapt the configuration of the controller, establish (secure) communication with the machines. Controlled logout of integrated machines.	wait staff, fitter, Programmer, Foreman, master
H Program, Testing	Entering/changing, testing of control programs; Implement possible new configurations, interfaces	
I Eliminate disturbances in workflow	eg acknowledgment of emergency stop command; disconnection	
J Observing production processes	ignoring the barrier	visitor
K Troubleshooting	Finding and eliminating the causes of malfunctions by specialist personnel Cleaning, lubricating eg the safety switch for position detection Repairs eg replacing plug-and-	Foremen, foremen, skilled workers
L Cleaning, maintenance	produce plugs	Operators, cleaning/maintenance staff
M maintenance		maintenance staff
N Decommissioning	Dismantling, dismantling, removal, disposal	Internal company staff or/and one specialist company

4. Identification of hazards 4.1. Explanation

of the situation - The standards DIN ISO 12100
and DIN EN ISO 13849 are already taken into account in the risk assessment of the smart transfer system. It represents a
complete single machine.

- For all machines considered here, manufacturer (supplier), operator (integrator) represent one and the same company.
- The machines considered are complete and, with their associated equipment, comply with the requirements of ISO 12100-1 and ISO 12100-2 or other safety standards.
- The machines considered are intended for integration into this IMS and for individual operation. Therefore, the integration into this IMS according to DIN EN ISO 11161 has already been taken into account during the design and risk assessment. The protective measures on the machines are selected according to an integration into this IMS, so they are not obstructive or changeable in such a way that sufficient protection is guaranteed.
- It follows from the previous points that the application conditions caused by the integration of the machine into the IMS of the dated conform to the application intended by the supplier.
- When identifying hazards that can arise during integration, only the two following machines were considered taken into account. When integrating additional machines, a risk assessment must be carried out again.

4.2. Identification of hazards according to DIN EN ISO 11161

running No.	**hazards, hazardous** situations, hazardous events	ref No.	life phase(s)
13 No	check as to whether the machine is present at the integration locations and correctly integrated - Emergency stop chain cannot be checked	1	DM
1	- Indexing and stoppers move without protective devices	2	DM

4.2.1. Integration of the automatic assembly machine (serial number: XXX)

- The environmental conditions in this IMS were already known when the assembly machine was designed and correspond to the existing ones.
- In the structure shown, there is sufficient space for all interventions in the assembly machine. There will be no warnings at the integration hidden. For other configurations see ref. no. 4
- From the situation explained under 4.1 and the installation location of the smart transfer system, there are no further requirements than those have already been taken into account. The already protected danger area cannot be reached.
- No warnings are hidden during integration.

running No.	Hazards, hazardous situations, hazardous events	ref # 3	life phase(s)
13	There is no guarantee that the machine has been correctly integrated into the IMS. It is possible that this machine is not correctly integrated into the emergency stop chain or protective devices are not positioned correctly and are therefore ineffective.		D
21	Operating elements or warnings may be hidden or difficult to access due to the structure of the Transfersys team	4	G

4.2.2. Integration of assembly machine with laser engraving (serial number: XXX)

- The environmental conditions in this IMS were already known when the assembly machine was designed and correspond to the existing ones.
- In the structure shown, there is sufficient space for all interventions in the assembly machine. There will be no warnings at the integration hidden. For other configurations see ref. no. 6
- From the situation explained under 4.1 and the installation location of the smart transfer system, there are no further requirements than those have already been taken into account. The already protected danger area cannot be reached.
- No warnings are hidden during integration.

running No.	Hazards, hazardous situations, hazardous events	ref No.	life phase(s)
13	There is no guarantee that the machine has been correctly integrated into the IMS. It is possible that this machine is not correctly integrated into the emergency stop chain or protective devices are not correctly positioned. The laser cabin is not properly closed, the laser beam can escape 21 Operating elements or warnings can be hidden or difficult to access due to the structure of the Transfersys team	5	D
		6	G

4.3. Explanations for the use of the hazard checklist The checklist can therefore be used for an **entire** machine (single machine or complex system), a **machine** part (machine of a complex system) or for a **subarea** of a machine/system. Risk assessments for sub-machines or sub-areas do not replace the risk assessment for a machine/system as a whole, insofar as this is necessary for the interaction of assemblies.

In the following checklist, **"partial machine"** is checked, ie in this case the hazard checklist is used to identify hazards that arise when individual machines are integrated into the integrated manufacturing system (IMS). The intended use shows that each machine to be integrated must be a complete individual machine so that there is **no aggregate of machines** within the meaning of the Machinery Directive. Each individual machine designed for integration into this IMS shall meet the requirements of ISO 12100-1 and ISO 12100-2 or other safety standards for the associated equipment. This risk assessment therefore only considers the risk transfer from the interfaces that occur when individual complete machines are connected. With the risk assessment of the smart transfer system, the entire machine is taken into account.

Columns **1** to **11** of the hazard checklist are explained below:

Column	running hazard number
1 Column 2	Possible hazards, hazardous situations and hazardous events in accordance with Annex B of DIN EN ISO 12100. The list in Annex B has been supplemented with "Other hazards", which can be entered if necessary. In the case of **mechanical hazards ,** a distinction is made between **general** and **special** hazards. The latter can occur at individual danger points during certain activities. with which agreement (conformity) must
Column 3 EC Machinery Directive Annex I No.	**...,** be established. Conformity is verified by appropriate measures are taken if the risk to the machine/system applies (see column 8).

Column 4	**Further internal market directives** are entered here, with which con formality must be established. Appropriate measures are taken to ensure conformity if the machine/system is at risk (see column 8).
Column 5	Number of the paragraph that deals with the passage in DIN EN ISO 12100. The descriptions are taken into account if this is stated in column 8 is marked as applicable.
Column 6	Applicable European standards (EN ...; pr EN ...) of type A and B and international standards (ISO). They are applied when applicable (see column 8).
Column 7	Applicable national standards and technical specifications (e.g. accident prevention regulations, DIN standards, VDE regulations, VDI guidelines) in case European standards are missing.
Column 8	Tick possible hazards. All life phases of the machine/plant (see 0 phases of life) to consider.
column 9	The position numbers of the installation plan (see ___) can be entered here where a corresponding risk is expected.
Column 10	All life phases of the machine/system (see 0 life phases) are entered here, in which a corresponding hazard is expected.

4.4. Hazard checklist according to DIN EN ISO 12100 Manufacturer hazard

checklist Machine	or system-specific hazards Machine / system: smart transfer system (integration infrastructure)				Sheet 1 of 6		
even					Clerk: Philip Kleen		
		Machine no.:	Year of construction: 2014	Order no.:			
	Type:	Country: Germany	Partial machine : Yes	Establishing			
	Customer: inIT	Overall machine: No	Conformity with: Applicable standards/te	Application of	Date: 05/12/2015		

running Hazards, no. hazardous situations, hazardous events	EG- EN ISO 12100 further EN- National Ref. Life Directives Norms Rules					Yes	No.	
	MRL Appendix I	phase(s)						
1	2	3	4	5	6	7	8th	9	10
1 Mechanical hazards General mechanical hazards from: ÿ Machine parts, tools, workpieces, e.g.:						TRBS 2111 BGI 5049 VDI 2854		see below	
a) Shape *(sharp edges, corners, points, etc.)*	1.3 1.3.4		6.2.2.1 6.2.2.2 6.2.3 a)						
b) Arrangement of moving parts *(hazardous areas with e.g. crushing and shearing points)*	1.3 1.3.8		6.2.3 b) 6.2.6 6.2.10						
c) mass and stability *(potential energy of parts moving under the influence of gravity: objects falling / toppling over / sinking, overturning of the machine)*	1.1.5 1.3 1.3.1 1.3.3 1.3.9		6.3.1 6.3.2 6.3.3 6.3.5.2 6.3.5.4		EN349 EN ISO 13857 11161	BGI 5123			
d) Mass and speed *(kinetic energy of parts in controlled or uncontrolled movement: contact with moving parts; objects flying away, e.g. workpieces, tools, chips, fragments, waste)*	1.3 1.3.7 1.3.7 1.3.8 1.4.1		6.3.5.5 6.3.5.6 6.4.1 6.4.3 6.4 .4 6.4.5						
e) insufficient mechanical strength *(risk of breakage or bursting); fragments,*	1.3 1.3.2 1.3.3 1.4.1								
ÿ **Accumulation of energy, eg** f) elastic elements *(springs);* g) liquids and gases under pressure; Residual energy *(e.g. hydraulic/ pneumatic systems)* h) Negative pressure	1.5.3; 1.6.3								
	1.3.2; 1.5.3 Pressure vessel directive 1.6.3 87/404/EEC 1.5.8	4/EEC 1.5.8	6.2.5 6.2.10		EN982 EN 983	BGR 237 X		7	B,C,G,N
	Equipment Directive 97/23/EC	Observe all EC							
Identify all hazards	directives		Observe all relevant standards			see layout see table			

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : MRL further EG- EN ISO phase(s)		Hazard checklist Applicable standards/techn. Specifications Applicable 12100 further EN- National norms			Ref. Life Anrex I	Directives No.	
1	2	3	4	5	6	7	8th	9	10
	Special mechanical hazards at individual hazardous points during certain activities 1.1 Danger of crushing					TRBS 2111 BGI 5049		see below 8	
		1.3					X		B,C,G G
1.2 Shearing Hazard		1.3							
1.3 Cutting or cutting hazard		1.3			EN 953 EN 999 EN1005-3 EN1088 EN574 EN1760 EN61496 **EN ISO 11161**	BGI 575 BGI 670 BGI 5123			
1.4 Entanglement or Entanglement Hazard		1.3							
1.5 Danger of being drawn in or caught		1.3							
1.6 Impact hazard		1.3							
1.7 Puncture or puncture hazard		1.3							
1.8 Friction or Abrasion Hazard		1.3							
1.9 Danger from the ingress or spurting of liquids under high pressure, broken pressure hoses being thrown about		1.3.2	Pressure Equipment Directive 97/23/EC		EN 982 BGR 237				
2 Electrical **hazards**						TRBS 2131		see below 9	
2.1 Direct contact of people with live parts 2.2 Touching parts that have become live due to malfunctions 2.3 Approaching high-		1.5.1; 1.6.3	Low voltage RL 2006/95/EC	6.2.9 6.3.2 6.3.3.2 6.3.5.4 6.4.4 6.4.5	EN 60204-1 BGV A3 EN 50178 BGR 132		X		B,C,G,N G
voltage parts		1.5.1					X	10	B,C,G,N G
		1.5.1; 1.6.3							
2.4 electrostatic processes		1.5.2							
2.5 thermal radiation or processes such as the ejection of melted particles or chemical processes in the event of short circuits, overloads, etc.		1.5.1; 1.5.5							
Identify all hazards		Observe all EC directives		Observe all relevant standards			see layout see table		

Machine or system-specific hazards Serial. Hazards, no. hazardous			Hazard checklist			Sheet 3 of 6		
situations, hazardous events	Establish conformity with : Applicable standards/techn. Specifications Applicable MRL further EC- EN ISO 12100 further EN- National Ref. Life Annex I Directives Rules Yes (s)			norms		8th	ps Yes (s)	No.
1	2	3	4	5	6	7	8th	9	10
3 Thermal hazards resulting in 3.1 burns and				6.2.4 b)				see below	
frostbite *and other injuries through contact of persons with objects or materials at very high or low temperatures, through open flames or and also through radiation from heat sources*		1.5.5	RL for gas appliances 93/68/EEC	6.2.8 c) 6.3.2.7 6.3.3.2.1 6.3.4.5					
3.2 Health damage due to hot or cold working environment **4 Noise hazards** resulting in		1.5.5							
			2003/10/EC "Phy. agents, noise"			LVArbSchV		see below	
4.1 hearing loss (deafness) *and other physiological Impairments (e.g. loss of balance, loss of attention)*		1.4.1 1.5.8		6.2.2.2; 6.2.3c) 6.2.4c); 6.2.8 c) 6.3.1; 6.3.2.1 b) 6.3.2.5.1; 6.3.3.2.1 6.3.4.2; 6.4.3 6.4.5.1 b) and c)	EN ISO 11688 11690 15667 EN1299				
4.2 Disruption of voice communication, disruption of acoustic signals, etc.		1.4.1 1.5.8							
5 hazards from oscillations (vibration)			2002/44/EC vibrations			LVArbSchV		see below	
5.1 Use of hand-held tools with the Er result of nerve and vascular disorders 5.2		1.5.9		6.2.2.2; 6.2.3 c) 6.2.8 c); 6.3.3.2.1 6.3.4.3 6.4.5.1 c)	CR1030 Guideline	VDI 2057 VDI 2062			
whole body vibration, especially in connection with forced postures		1.1.8 1.5.9			EN1032	VDI 3831			
6 Radiation Hazards			2006/25/EG phy. impacts		EN 12198	LVArbSchV		see below	
6.1 Low frequency, radio frequency, microwave (electromagnetic fields) radiation. 6.2 Infrared, visible and ultraviolet light		1.5.10		6.2.2.2 6.2.3 c) 6.3.3.2.1 ; 6.3.4.5 6.4.5.1 c)		BGV B 11 BGR B 11			
		1.5.10							
6.3 X-rays and gamma rays		1.5.10				X-rayV			
6.4 Alpha rays, beta rays, electron or ion beams, neutron beams 6.5 Laser beams		1.5.10 1.5.11				Radiation Protection Ordinance			
		1.5.12			EN 60825	BGV B 2 BGI 832			
Identify all hazards		Observe all EC directives		Observe all relevant standards			see layout see table		

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events		Establish conformity with : MRL further EG- EN ISO phase(s)		Hazard checklist Applicable standards/techn. Specifications Applicable 12100 further EN- National Ref. Life Annex I Directives norms				Sheet 4 of 6 Yes No.	
1	2	3	4	5	6	7	8th	9	10
7 Hazards from materials and substances *(and through its components) processed or used by machines*		1.1 1.4.1		6.2.2.2 6.2.3 b) 6.2.3 c) 6.2.4 a) 6.2.4 b) 6.3.1 6.3.3.2.1 6.3.4.4 6.4.5.1 c); 6.4.5.1 g)		Danger substanceV		see below	
7.1 Dangers from contact with or inhalation of hazardous liquids, gases, mists, vapors and dusts **(hazardous substances);** lack of oxygen		1.1.3; 1.1.7 1.5.13 ; 1.6.5 1.5.6;			EN 626-1	VDI 2262			
7.2 **Fire or Explosion** Hazard		1.5.7 ExplProtection-RL 94/9/EG			EN1127-1 EN13478	TRBS 2152 BGR 104 VDI 2263 sheet 3			
7.3 biological or microbiological hazards (from viruses or bacteria)		1.1.3; 1.6.5, 2.1				BioStoffV BGR 143			
8 Dangers from neglecting ergonomic principles when designing the machine , such as dangers from 8.1 an unhealthy posture or excessive exertion					EN614 EN1005			see below	
		1.1.5; 1.1.6 1.6.2; 1.6.4		6.2.2.1 6.2.7; 6.2.8 6.2.11.8 6.3.2.1 6.3.3.2.1					
8.2 insufficient consideration of the anatomy of hand/arm or foot/leg		1.1.6 2.2 1.1.2d			EN614				
8.3 Provision of personal protective equipment (PPE) instead of technical protective measures						BGV A 8 X		11	DM
8.4 inappropriate local lighting; insufficient view of the workplace		1.1.4			EN1837				
8.5 mental overload or underload, stress		1.1.6							
8.6 Human error (e.g. circumventing protective devices, not wearing the necessary PPE or wearing PPE in violation of the ban, disregarding warnings		1.1.2c; 1.1.6 1.2.2; 1.2.5 1.5.4; 1.7				BetrSichV TRBS BGR 500	X	12	DM
8.7 improper construction, placement or Identification of Controls 8.8 Improper		1.2.2							
Construction or Placement of optical or acoustic signals		1.7.1			EN842, 894, 981, 61310				
9 hazards d. Operating environment of the machine (e.g. temperature, wind, snow, moisture, lightning)		1.1.2a 1.2.1; 1.5.16		6.2.6; 6.2.11.11 6.3.2.1; 6.4.5.1 b)					
Identify all hazards		Observe all EC directives		Observe all relevant standards			see layout see table		

Machine or system-specific hazards		Hazard checklist				Sheet 5 of 6		
running Hazards, no. hazardous situations, hazardous events		Make compliant with : MRL other EC Appendix I	guidelines 3	Applicable standards/techn. Specifications EN ISO 12100 other EN national standards Rules 7			Applicable Yes	Ref. phase(s) 10	Life No.
1	2		4	5	6		8th	9	
10 combinations of hazards *(Danger increase through the addition of risks)*		1.1.2a					X	13	DM
11 Unexpected start, unexpected Spinning / over-revving (accelerating) *or any comparable malfunction due to:* failure / malfunction		1.2		3.31	EN ISO 1037 EN ISO 11161 EN ISO 13849 EN ISO 13850 EN50178 EN 60204-1 EN61000 Part 6-1 to Part 6-4 EN62061			see below	
11.1	of the control / regulating circuit (see also serial no. 14)	1.2.1					X	14	DM
11.2 Restoration of the energy supply after an interruption *(e.g. power failure and power recovery).* (see also item 12) 11.3 external influences on electrical equipment		1.2.6 1.6.3		6.2.11.7.1 6.2.11.7.2			X	15	DM
	(e.g. line interference, electromagnetic radiation)	1.2.1 1.5.11	EMC Directive 2004/108/EC	6.2.11.1; 6.2.11.4: 6.3.2.5.2; 6.3.3.2.5; 6.3.5.2			X	16	DM
11.4 other external influences *(gravity, wind, wet, lightning, etc.)*		1.2.1			EN60529				
11.5 Hardware and Software Errors		1.2.1				BGI 852-4			
11.6 Operating errors *(see also serial no. 8), eg unintentional switching on of the machine due to unsuitable command devices*		1.1.6; 1.2.1 1.2.2; 1.2.3, 1.2.5, 1.7			EN614		X	17	DM
12 Disturbance of the energy supply *(thereby e.g Danger of failure of protective devices, parts flying off or falling, non-execution of stop commands, change of machine parameters);*		1.2 1.2.6		3.31; 6.2.11.1 3.32; 6.2.10 3.33 6.2.11.1;	see item 11				
13 Inability to stop the machine under optimal conditions *(normal stop – operational stop – emergency stop)*		1.2; 1.2.1; 1.2.4;1.2.4.4 1.2.6; 1.3.5		6.2.11.3 6.2.11.6; 6.2.11.8 & 9; 6.3.5.2	EN ISO 13850		X	18	DM
14 Error in control / regulation circuit *(e.g. due to operational stress, external influences, hardware or software defects, logic errors, uncontrolled changes to safety-relevant machine parameters, interference in the control signals with wireless controls)*		1.2 1.2.1; 1.2.3, 1.2.4: 1.2.5, 1.6.3		6.2.11	see no. 11				
Identify all hazards		Observe all EC directives		Observe all relevant standards			see layout see table		

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : further EC- EN ISO 12100		Hazard checklist Applicable standards/techn. Specifications further EN- National norms		Ref. Life Annex I Directives Rules	Applicable MRL No. Phase(s)		Sheet 6 of 6
1	2	3	4	5	6	7	8th	9	10
15 Danger of circumventing protective devices *due to a lack of solutions for all operating states and necessary interventions in the machine, e.g. when setting up, checking programs (process monitoring), eliminating disruptions in the work process and troubleshooting, inspection, cleaning, maintenance, repair*	1.1.2a+c 1.2.5 1.4; 1.4.1 1.6; 1.6.4		6.2.11.1 6.2.13 6.3.3.1	EN1088	BGI 575 BGI 670			
16 Assembly and disassembly work *Hazards such as handling/ transport of heavy components; incorrect assembly and connections; Test runs (see also serial no. 1c, 15,17,18 and 19)*	1.1.5; 1.3.1; 1.3.3; 1.3.9 1.5.4		5.4; 6.4.1.3; 6.4.5.1 b) 4; 5.4; 6.2.6; 6.4.1.3; 6.4.5.1			X	19	B,C,G,N
17 Dangers during cleaning/maintenance , *eg due to maintenance work while the machine is running; unsafe access to points of intervention; lack of facilities for safe energy separation and discharge; Bypassing protective devices when troubleshooting; Remote maintenance (see also serial no. 1c, 15,16,18 and 19)*	1.3.1; 1.3.7 1.3.9; 1.5.15 1.6; 1.6.3		5.4; 5.5.3.2; 6.2.11.9; 6.3.2.4; 3.3; 5.3.2c); 5.3.3 b) ; 5.4; 5.5.2.3.1a); 5.5.3.2; 6.2.8e); 6.2.10; 6.2.11.9; 6.2.11.10; 6.2.11.12; 6.3.2.4; 6.3.3.1; 6.3.5.4; 6.4.5.1b); 6.4.5.1e); 6.4.5.1 h)					
18 Slipping, tripping or falling of people *during the assembly, operation, maintenance and dismantling of machines*	1.5.15 1.6.2		Annex B 6.3.5.6	EN ISO 14122	BGV A 1 BGR A1			
19 Danger of entering a machine / plant to be shut off *from the control panel, for example because the danger zones are unclear (especially with automatic start); Lack of escape routes, emergency call options and precautions for freeing and rescuing people.*	1.2.2; 1.2.3 1.5.14		6.3.5.3	EN ISO 11161				
20 Insufficient user information *(Signals, warning devices, operating instructions, etc.)*	1.1.2; 1.1.5 1.3.1; 1.3.2 1.3.7; 1.5.4; 1.7		6.4	EN62079		**x20** _		DM
21 Other hazards *(additional risks in individual cases for all life phases of a machine/ system depending on their type and size as well as installation and usage conditions)*	Appendix I	all relevant EC directives		all relevant machines nominal norms	all relevant national rules			
Identify all hazards	Observe all EC directives		Observe all relevant standards			see layout see table		

4.5. Risk assessment and description With the help of the risk checklist, sheets 1 to 6, the following risks were identified as applicable:

Product: smart transfer system (transfer system, integration infrastructure)

Issued by: Philip Kleen

Date: 05/12/2015

black area = high risk

gray area = medium risk white area = low risk

Document number.:

Document part no.:

initial risk assessment: Yes

effects	measure se	Class Cl = (Fr+Pr+Av) 4	5 – 7	8-10	11-13	14-15	frequency Mrs	probability Pr	avoidance Av
Death, permanent loss of an eye or	4						ÿ 1h	5 very high < 1	5
arm, reversible loss of fingers,	3						hour to ÿ 24 hours	5 high < 24 hours to ÿ	4
reversible medical care, first aid	2						2 weeks	4 medium	3 impossible 3
	1						< 2 w to ÿ 1 a	slight 2 possible 2 negligible 1 probable	3
							< 1 a		1

ref No.	Type. vessel No.	Danger	se	Mrs	Pr	Av	class		
1	13	Effective range of the emergency stop not recognizable (shutdown in an emergency)	2	3	3	3	9	medium risk	
2	1	Crushing at indexing / bouncing at the stop per effective range of the emergency stop is not	3	5	2	3	10	high risk	
3	13	recognized by the integrated machine (shutdown in an emergency only on this machine)	2	3	3	3	9	medium risk	
4	21	View of signs blocked Effective	1	5	2	1	7	small risk	
5	13	range of the emergency stop is not recognized by the integrated machine (shutdown in an emergency only on this machine)	2	3	3	3	9	medium risk	
6	21	View of signs blocked The machine	1	5	2	1	8th	small risk	
7, 19	1g) 16	that was taken out of service is still under compressed air, compressed air suddenly escapes when the supply is disconnected Crushing/jamming when machines are	2	5	2	1	8th	medium risk	
8th	1.1	pushed towards the transfer belt/into the integration station 9 2.1 Live plug contacts	1	5	2	1	8th	small risk	
			4	3	2	5	10	high risk	

effects	measure se	Class Cl = (Fr+Pr+Av) 4	5 – 7	8-10	11-13	14-15	frequency Mrs	probability Pr	avoidance Av
Death, permanent loss of an eye or	4						ÿ 1h 5	very high 5	
arm, reversible loss of fingers,	3						< 1 h to ÿ 24 h 5	high < 24 h to ÿ	
reversible medical care, first aid	2						2 w 4	medium < 2 w to ÿ 1 a 3	low 4 3 5
	1						2	negligible	impossible 3
							< 1 a	2	possible 1 probable 1

ref No.	Type. vessel No.	Danger	se	Mrs	Pr	Av	class		
10	2	2 Parts that are live due to malfunctions	4	3	2	5	10	high risk	
11, 12	8	Through personal protective equipment (PPE) etc	1	5	3	3	11	medium risk	
13	10	combinations of noise	3	5	5	5	15	high risk	
14, 15, 16	11	Unexpected startup of the system	1	2	2	5	9	small risk	
17	11.6	Operator error	2	5	3	3	11	high risk	
18	13	Inability to shut down the machine under optimal conditions Rollover when removing/integrating	2	3	3	3	9	medium risk	
19	16	the machine	2	4	2	1	7	small risk	
20	20	Insufficient user information	2	3	3	3	9	medium risk	

Details (description of the accident scenario) of Ref. No.

1	An integrated machine can be put into operation without the integration environment being aware of it. The emergency stop may only affect the machine itself
2 Stroke indexing and stoppers are moved although no machine is integrated. Procedure not necessary, lack of protective measures 3 It is not recorded	
whether the machine is integrated. The area of action of the emergency stop cannot be adjusted and checked 4 Failure to comply with the space	
requirements of the machine can result in a too narrow structure and signs are covered 5 It is not recorded whether the machine is integrated. The	
effective range of the emergency stop cannot be adjusted and checked. 6 Failure to comply with the space requirements of the machine can result in	
a too narrow structure and signs are covered	
7, 19	When disconnecting the Plug and Produce interface, compressed air suddenly escapes due to a faulty valve closure. Machine is inevitably taken out of service because the supply plug is disconnected. Hoses are unknowingly still under pressure.
8 When pushing the machine, limbs can be crushed between the machine and the transfer belt.	
9 Due to electrical storage, the plug contacts can be live after disconnecting the Plug and Produce connection.	
10 Due to defective housing of the Plug and Produce connection. Overriding harness to Plug and Produce socket.	
results from careless leaning on the running transfer belt. Not wearing PPE can increase the risk (e.g. with workpieces with chips or when transporting the machines).	Wearing the wrong or missing PPE such as (protective gloves, long hair, ties, etc.) 11, 12 poses an increased risk on the deflection rollers of the transfer belt. This
13	Running many integrated machines at the same time can result in hazardous noise emissions. Even if each machine does not exceed the limit values on its own.
components 14, 15, 16 failure/fault in the control system, power failure and recovery, as well as electromagnetic interference, there is a risk of the systems or individual	In the event of a failure/fault in the control system, power failure and recovery, as well as electromagnetic interference, there is a risk of the systems or individual
17 Incorrectly selected operating mode: Machine works in single automatic mode, although this is integrated. (assuming there is a distinction)	
18 If no machine is integrated at the appropriate point, there is also no emergency stop command unit.	
19 Leaving connectors. Roll over by feet or cable guides when moving the machine	
20	Risks that cannot or cannot be completely eliminated by technical measures can cause hazards if those who work on the system are not made aware of them. Lack of operating instructions with maintenance and operating instructions.

5. Safety and operating concept The risks for the hazards
identified with the help of the hazard checklist (see page 19ff) and described on pages 25 to 25 have already been assessed. Risk reduction measures must now be defined. Protective measures are selected as part of a security and operating concept.

The safety and operating concept consists of points 5.1 to 5.4.

The following is explained:

- to point 5.1 (see page 29)
  Explanations for creating the action sheets Here it is
  recorded how the action sheets are to be used and filled out. **The explanations were taken into account in this analysis.**

- to point 5.2 (see pages 30ff)
  Measure sheets The
  measure sheets (sheets 1 to 4) are used for the machine or system-specific risk assessment and description of protective measures for safety-relevant phases of life.
  The following were taken into
  account: ÿ All identified hazards according to the hazard checklist. ÿ
  Risk assessment according to DIN ISO/TR 14121-2:2013-02 ab
  section 6.5.2 and description of the hazards (see pages 25 to 25

  ÿ Basic safety and health protection requirements of the EC Machinery
  Directive according to column 3 of the hazard checklist for hazards
  marked "applicable". ÿ Requirements from other internal market
  directives
  Column 4 of the hazard checklist. • to
  point 5.4 (see page 34)
  Functionality of the secured system In the
  course of the selection of protective measures in the measure sheets (pages 30 to 32), a description is given of how the secured system functions and is to be operated. The purpose of the description is to avoid selecting unsuitable protective measures. This ensures that the operator can carry out all necessary activities and interventions without unreasonable hindrances.

  ÿ Applicable standards/technical specifications according to column 5
  to 7 of the hazard checklist.
  ÿ Necessary protective measures taking into account safety,
  production and operating requirements (see pages 29ff) ÿ
  Necessary measures according to the functional description on
  page 34.

- to point 5.5 (see pages 34ff)
  Safety plan The
  protective measures described in the measure sheets (pages 29ff) are assigned measure numbers. Their entry in the installation plan on page 11 provides an overview of the protective measures specified for the machine/system (page 34ff).

5.1. Explanations for creating the action sheets

For all machine or system-specific hazards identified with the help of the hazard checklist, the associated risks must be assessed and risk reduction measures defined on the basis of a safety and operating concept.

The risk assessment and description of protective measures can be documented with the help of measure sheets (sheets 1 to 4).

In the case of large machines and larger production plants, a risk assessment carried out for sub-machines or sub-areas improves the overview. It can make sense to analyze and document individual phases of life separately.

The action sheets can therefore be used for an **overall** machine (single machine or complex system), a **sub** - machine (machine of a complex system) or for a **sub-area** of a machine/system.

Risk assessments for sub-machines or sub-areas do not replace the risk assessment for a machine/system as a whole, insofar as this is necessary for the interaction of assemblies.

It is already described in 4.3 Explanations for the use of the hazard checklist that it is a sub-machine. This means that measure sheets 1 to 4 only serve to document the risk assessment and description of protective measures for the interface between the integrated machine and the integration infrastructure with an impact on other machines. Only the machines mentioned under 4.2 Identification of hazards according to DIN EN ISO 11161 were taken into account. **Columns 1** to **11** of the action sheets are explained below.

Column	running Numbers of the identified hazards from the hazard checklist.
1 Column	Identified hazards from the hazard checklist.
2 Column	All hazardous points (named after location, area or object) at which identified hazards must be expected.
3 Column	Position numbers of the respective system components *(see installation plan on page 11).*
4 Column 5	Precise information as to when and where the relevant hazard occurs (hazardous situation, hazardous activity, cause of the hazard).
column 6	Specification of the life phase(s) of the machine/system in which the corresponding hazard occurs (see Life phases on page 15)
column 7	General risk assessment in accordance with DIN EN ISO 12100 "General design principles - risk assessment and risk reduction" (see risk assessment and description on page 25). Risk levels for the states before and after risk reduction (e.g. high/low) can be specified , which result from the risk graph contained in the table depending on risk factors.
column 8	The risk assessment for the machine control must be carried out in accordance with DIN EN ISO 13849-1. Alternatively, DIN EN 62061 can also be used for safety-related electrical, electronic and programmable electronic control systems. In the risk assessment according to DIN EN 13849-1, the required performance level (e.g. PLr=d) must be determined and entered in column 8 for each safety function required according to column 9 of the control to be designed. Annex 1 contains explanations for the design and development process of a control according to DIN EN ISO 13849-1. For safety-related electrical, electronic and programmable electronic control systems, the safety integrity level (e.g SIL=2) and entered in column 8. Explanations can be found in Appendix 1.
Column 9	Formulated protection goals, description of protection measures, indication of residual risks and instructions for user information.
Column 10	Action number for the security plan.
Column 11	Space for test notes Annex 2

5.2. Action sheets manufacturer

XXXXXXXXX machine / system: smart transfer system (transfer system, integration infrastructure)	Measures sheet Machine or system-specific risk assessment and description of protective measures			Sheet 1 of 4
XXXXXX XXX	Type:	Machine no.:	Year of construction: 2014	Clerk: Philip Kleen
	Customer: self-made	Order no.:	Country: Germany	
	Entire machine: no	Partial machine: Yes	Section: no	Date: 05/12/2015

From hazard checklist serial	Hazards location/area/ ref. Object	danger point No	Dangerous situation, Hazardous activity, (short text) hazard cause no.	Life Risk Assessment phase in general	for the steering	8th	Protection goal(s) / protective measure test ver Residual risk User information	measures no
1	2	3	4 5	6	7		9	10 11
13	Area of Effect emergency stop	integration places,	1 Due to the lack of verification mechanisms, the integration infrastructure cannot determine whether a machine is integrated and whether the emergency stop can be integrated into the chain.	D, G	medium risk		**Aim:** Ensuring the number and scope of the emergency stop devices. **Measure:** Attachment of a sensor to reliably determine an integrated machine.	1
1	Crushing/bouncing if no machine is integrated	Stopper/ indexing	2 Stoppers and indexing can also move if they are not protected by an integrated machine.	EN FM	high risk		**Objective:** Prevent procedures with easily accessible stoppers/indexing. **Measure:** • Attachment of a sensor for the reliable determination of an integrated machine. • With an integrated machine, the control outputs are safely released.	1 2
13	Area of Effect emergency stop	Integrated machinery	3, 5 Due to the lack of verification mechanisms, the respective module cannot determine whether it is integrated and may have to adjust the scope.	D, G	medium risk		**Aim:** No individual operation possible after integration. **Measure:** The operating mode must have a sensor of the integrated machine must be checked.	3
21	View of signs blocked	Integrated machinery	4, 6 Any type of signs can be covered up if the required clearances/ entrances are not observed	DM	low risk		**Objective:** Adhere to access **Measures:** • Define and mark integration places during assembly. • Note in the operating instructions	4 5
See hazard checklist		**see installation plan**	**All identified hazards. note**	**see table see**	**risk graphics**		**All EC directives, EN standards, techn. spec. note**	**Rod.**

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures						Sheet 2 of 4		
From hazard checklist serial	Hazards location/area/ (short text)	danger point ref. Hazardous Object risk cause	activity No.	Dangerous situation, no.	Life Risk Assessment phase	general my	for the steering	Protection goal / protection measure residual risk user information	dimens no _	test ions ver
1	2	3	4	5	6	7	8th	9	10	11
1g) 16	accumulation of energy	Integrated machine Plug and produce connection	7, 19	The decommissioned The machine is still under compressed air. Sudden escape of compressed air when disconnecting the Plug and Produce connector	B, C, G, N	medium risk		**Aim:** Reliable escape of compressed air **Action:** If the electricity fails, a valve opens so that the compressed air can escape. **Aim:** to prevent a defect in the non-return valve of the plug-in connection. **Measures:** • Wear safety goggles • Use reliable components • Reference to residual risk in the operating instructions **Goal:** Prevention of	6 7 8 9	
1.1 Crushing/ Pinching		integration place	8	When machines are pushed up to the transfer belt/into the integration place	B, C, G	minor risk		crushing **Measures:** • Note in the operating instructions • Distance between the transfer system and Ma create the machine, the rollers of the machine are pushed against a stop.	10 11	
2.1 Live plug contacts		Plug and produce connection dung	9	Due to electrical storage, the plug contacts can be live after disconnecting the Plug and Produce connection.	B, C, G, N	high risk		**Aim:** To prevent an electric shock **Measures:** • Covering the connecting pins • Note in the operating instructions *Further* *measures if there is still a risk: Safe disconnection, in the* *integrated machine, of the supply line between the* *connector and the components.*	12 13	
2.2 Live plug connection due to defect		Plug and produce connection	10	Supply line and plug can become defective if dropped or run over	B, C, G, N	high risk		**Aim: Measures** to prevent the plug connection and cable harness being run over/falling down • Note in the operating instructions • When selecting the components on this request changes *Further measures if there is still a risk:* *Automatic winding of the cable harness*	14 15	
8.3 Provision of PPE instead of technical protective equipment		removal	11	PPE can be forgotten or it leads to further hazards	DM	medium risk		**Target:** As little PPE as possible **Measure:** Check whether the reason can be remedied constructively or technically.	16	
See hazard checklist		**see installation plan**		**All identified hazards. note**	**see table**	**See Risk Charts**		**All EC directives, EN standards, techn. spec. Note**		**Rod.**

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures						Sheet 2 of 4		
From hazard checklist serial Hazards location/area/ (short text)	danger point ref. Hazardous activity Object risk cause No.		Dangerous situation, no.	Life Risk Assessment phase general my		for the steering	Protection goal / protection measure residual risk user information		test dimensions ver no _
1	2	3	4	5	6	7	8th	9	10	11
8.6 Negligent use of PPE human error	entire machine		12 PSA is forgotten and it leads to increased risk	DM medium	risk		**Goal:** To prevent injuries caused by human error. **Measures:** • Mandatory, prohibition and warning signs on the Machines in accordance with BGV • Issuing operating instructions • Giving initial and regular instruction to staff in the operating instructions.	17 18 19	
10 combination of Noise	entire machine		13 Running many integrated machines at the same time can result in dangerous noise emissions. Even if each machine does not exceed the limit values 14 Application/Use: Self-starting of the machine or	DM	high risk		**Objective:** Preventing noise accumulation **Measure:** When adding other machines not considered here, reassess the noise emissions.	20	
11.1 Control system failure/ malfunction 11.2	entire machine		individual components	DM low	risk		Execution of the safety functions of the control according to PL d Observance of EN 1037, EN 60204-1, EN ISO 11161 and VDI 2854 Validation according to EN ISO 13849-2 Ensuring electromagnetic compatibility according to EN	21	
Power supply after a sub refraction			15					22	
11.3 External influences on electrical equipment 11.6	entire machine		16 Electromagnetic Interference	DM low	risk		61000-6-1/2 (interference immunity) and EN 61000-6-3/4 (interference emission).	23	
Operating errors	Integrated Machine, integration infrastructure		17 Incorrectly selected operating mode: The machine is working in individual automatic mode, although this is integrated. (Assuming there is this distinction) In the integration infrastructure is the wrong one Configuration selected 18	DM	high risk		**Objective:** Preventing incorrect configuration and operating mode selection **measures** • Safe sensor in the integrated machine, to confirm the selected operating mode. • Safe sensor in the integration place, to confirm the selected configuration.	24 25	
13 Lack of possibility to run the machine under optimal impose conditions	integration places		If no machine is integrated, there is no possibility of an emergency stop.	DM medium	risk		**Objective:** Fulfillment of ISO 13850 **Measure:** An integration station must have an emergency stop.	26	
See hazard checklist	see installation plan		All identified hazards. note	s. Ta belle	See Risk Charts		All EC directives, EN standards, techn. spec. beach ten		Rod.

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures							Sheet 2 of 4	
From hazard checklist		danger point		Dangerous situation,	Life Risk	Assessment		Protection goal / protection measure	test
serial	Hazards location/area (short text)	ref. Hazardous Object	activity No.	no.	phase	general my	for the steering	residual risk user information	dimensions ver no _
1	2	3	4	5	6	7	8th	9	10	11
16	rollover at Remove/integrate machine	Integrated machine	19	Leaving connectors. Rolling over of feet or cable ducts when moving the machine 20 Risks that cannot be eliminated or cannot be	B, C, G, N	low risk		**Measures: •** Reference to residual risk in the operating instructions • Device for hanging up the cable harness • Wearing safety shoes Prevention of	27 28 29	
20	Insufficient user information	entire machine		completely eliminated by technical measures can cause hazards if those who work on the system are not made aware of them. Lack of operating instructions with maintenance and operating instructions.	BM	medium risk		injuries due to residual risks and incorrect operation of the system: Unavoidable residual risks are pointed out by conspicuous safety markings on the system and comprehensible operating instructions. In addition, the operating instructions are issued.	30	
See hazard checklist		**see installation plan**		**All identified hazards. note**	**see table**	**See Risk Charts**		**All EC directives, EN standards, techn. spec. note**		**Rod.**

5.3. Functionality of the secured machine/system Taking into account all requirements and basic protective measures provided according **to Error! Reference source could not be found. Mistake! Reference source not found.** the safety, production and operating functions described below are specified for the machine/system. The implementation details are contained in the action sheets.

Integrate
This procedure is necessary when integrating the machines that were taken into account in the previous risk assessment and meet the specifications of the IMS:
• Push the machine onto the transfer belt until the rollers touch the front edge.

• Check the correct position •
Lock the machine • Remove
the cover from the Plug and Produce connector and attach the Plug and
Produce coupling from the integration station • Select the "Integration"
operating mode • Stop the integration infrastructure and select the Integrate
operating mode • Add the machine to the integration infrastructure configuration
• Unlock of the compressed air on the integrated machine • Acknowledge errors
in the integrated machine with a button (emergency stop chain is checked) •
Start automatic mode with a button • Acknowledge integration infrastructure and
start automatic mode Disconnecting the plug-and-produce connection
causes an uncontrolled th emergency stop of the integrated machine and an
emergency stop of the entire system. Automatic operation is restored in the
following order: • Remove the cover from the Plug and Produce connector and
plug in the Plug and Produce coupling from the integration station • Stop the
integration infrastructure and select the Integrate operating mode • Add the
machine to the integration infrastructure configuration • Unlock the compressed
air the integrated machine

• Acknowledge errors of the integrated machine with a button (emergency stop
Chain is checked) •
Start automatic mode with a button
• Acknowledge integration infrastructure and start automatic mode
Switching from "Integrated" to "Individual operation" causes an emergency
stop of this machine, the integration infrastructure and all integrated machines
(the entire IMS). The following steps are necessary to eliminate errors. • Select
"Integration" operating mode • Acknowledge errors in the integrated machine
with a button (emergency stop chain is checked) • Start automatic mode with
a button

• Acknowledge integration infrastructure and start automatic mode The
correct operating mode selection on the integrated machine is checked by a
safe sensor installed on this machine. The correct configuration of occupied
integration spaces is checked by secure sensors on the integration infrastructure.

Release the machine from the integration
The following steps are necessary to remove an integrated machine without stopping the entire IMS • Stop the machine • Log off the machine in the integration infrastructure and within X

Disconnect the plug-and-produce connection within
seconds • Cover over the connector, hang up the wiring harness
• Bring the machine out of sight of the IMS

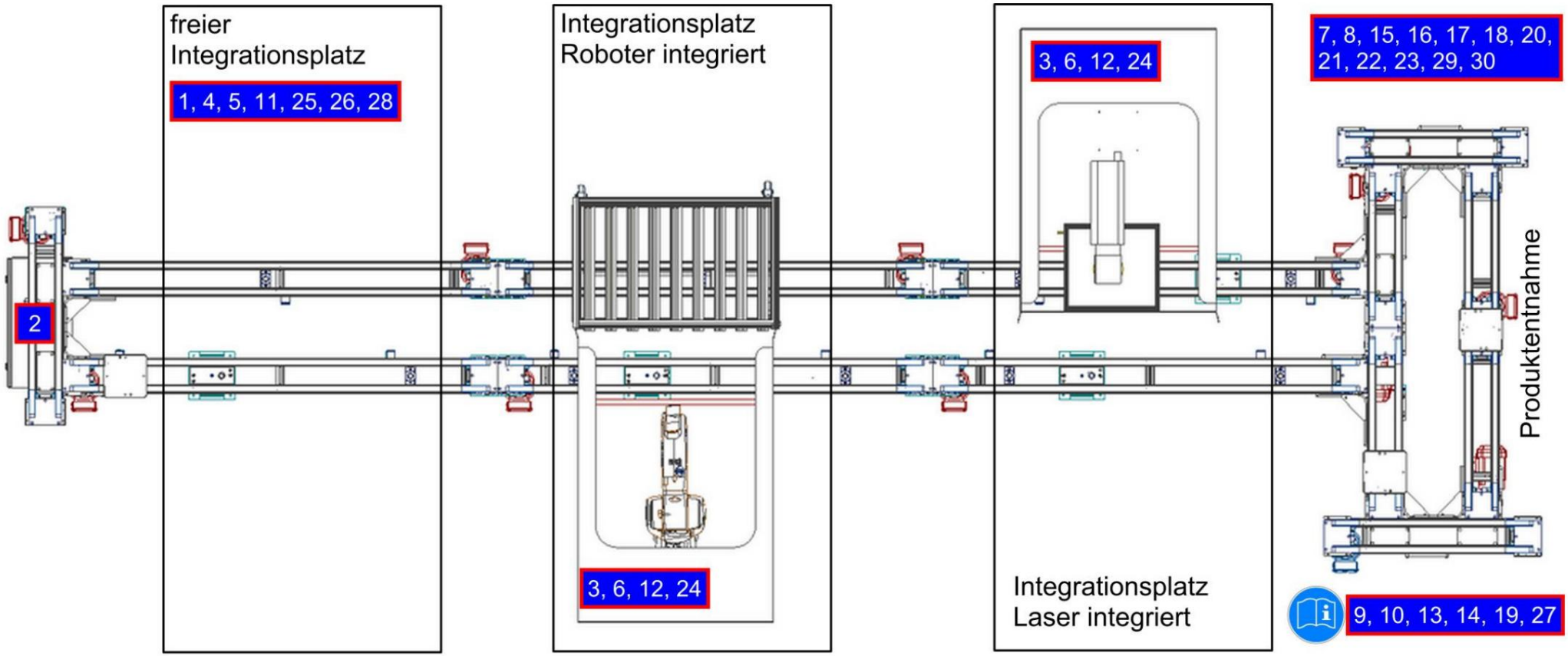
5.4. Safety plan The

risk assessment has shown that, based on the identified hazards and the estimated risks, risk reduction measures must be implemented. All risk reduction details are described in columns 9 and 10 of the action sheets. Each measure is provided with a measure number, which is entered in the safety plan.

The safety plan clarifies at which points or components of the machine/system risk reduction measures are required.

~~*The machine/system was designed and built taking this risk assessment into account.*~~ **All risk reduction measures have been implemented and checked according to the notes in column 11 of the** action sheets .

~~*The conformity of the machine/system with the guidelines is certified in the EC declaration of conformity.*~~



6.

Attachments Attachment 1 – Risk assessment

As part of a comprehensive risk assessment, a risk assessment and evaluation must be carried out for each identified hazard. This serves the purpose of selecting suitable risk reduction measures.

Assessment and evaluation criteria are contained in:

EN ISO 12100	General design principles – Risk assessment and risk reduction
EN ISO 13849-1	Safety-related parts of controls – Part 1: General design principles
EN 62061	Security of machines - Functional safety of safety-related electrical, electronic and programmable electronic control systems

The general assessment of risks according to DIN EN ISO 12100 can be carried out with the help of Table 1, taking into account four risk factors. The level of risk is determined using a matrix of class and extent.

The risk is all the higher, the greater the possible extent of damage and/or the frequency, avoidance and probability of damage occurring.

Table 2 contains indications for risk assessment and risk reduction measures. The higher the identified risk, the more carefully suitable protective measures must be selected.

The risk assessment for safety-related parts of controls can be carried out using the risk graphs on pages 32ff. This also determines their contribution to risk reduction. The required **performance level according to DIN EN ISO 13849-1** can be determined with Figure 1 on page 39.
The risk assessment for safety-related electrical, electronic and programmable electronic control systems can be carried out using the numerical evaluation, as in the assessment of hazards, and the matrix on page 42. This determines the contribution to risk reduction. With this, the required **safety integrity level according to DIN EN 62061** can be determined.

The design of the safety-related parts of controls can be found in DIN EN ISO 13849-1 or DIN EN 62061, depending on the application.

The validation (analysis and testing) of the intended safety function can be carried out according to DIN EN ISO 13849-2 or DIN EN 62061. The risk assessment should be limited to one of the two standards.

General assessment of risks in the event of possible personal injury, taking into account DIN EN ISO 12100. The mixed form of instruments was used according to the example of DIN ISO/TR 14121-2:2013-02 Section 6.5.2 with the following form.

Table 1: Risk assessment form

Product: _____

Issued by: _____

Date: _____

black area = high risk

gray area = medium risk white area = low risk

Document number.:

Document part no.:

initial risk assessment: Yes

effects	extent Se	Class Cl = (Fr+Pr+Av) 4	8-10	11-13	14-15	5-7	frequency Mrs	probability Pr	avoidance Av
Death, permanent loss of an eye or	4						ÿ 1 h 5 very high < 1 h to ÿ 24 h		
arm, reversible loss of fingers,	3						5 high < 24 h to ÿ 2 w 4 medium		
reversible medical care, first aid	2 1						< 2 w to ÿ 1 a 3 low 2 negligible	5 4 3	5
								impossible	3
							< 1 a	2 possible 1 probable	1

ref No.	Type. vessel No.	Danger	se	Mrs	Pr	Av	class		
1									
2									
3									

Details (description of the accident scenario) of Ref. No.

1	
2	
3	

Possible risk reduction measures by the manufacturer of a machine

Measures 1 to 3 listed below have priority over measures 4 to 6 and 7 to 11. This applies in particular to high and medium risks. Measures 4 to 11 are not a substitute for possible measures according to 1 to 3.

Concrete risk reduction measures must be specified for each individual machine or system, taking into account all circumstances and safety regulations.

Table 2: Indications for risk-reducing measures

	EN ISO 12100
1. **Safety concept** for all life phases of the machine/plant and **all necessary interventions** by the operator set up serving staff	6. Risk Mitigation 6.2 Inherently safe construction 6.3 Technical Protection Measures 6.4 User Information
2. **Eliminate hazards or reduce risks through** • lower-risk processes, • less hazardous substances and materials, • **constructive measures,** • suitable **technical protective measures.**	
3. Carry out **additional protective** measures	
4. Create understandable **operating** instructions with information about residual risks	
5. **Attach hazard and safety notices** to the machine/system	
6. **Provide signals and warning** systems	
7. Require **personal protective equipment** to be worn where appropriate	
8. Specify the use of qualified **personnel**	
9. Offer specific **training** measures	
10. **Require** staff training	
11. Recommend issuing **operating** instructions	

Determination of the performance level (PLr for safety-related parts of controls according to DIN EN ISO 13849-1

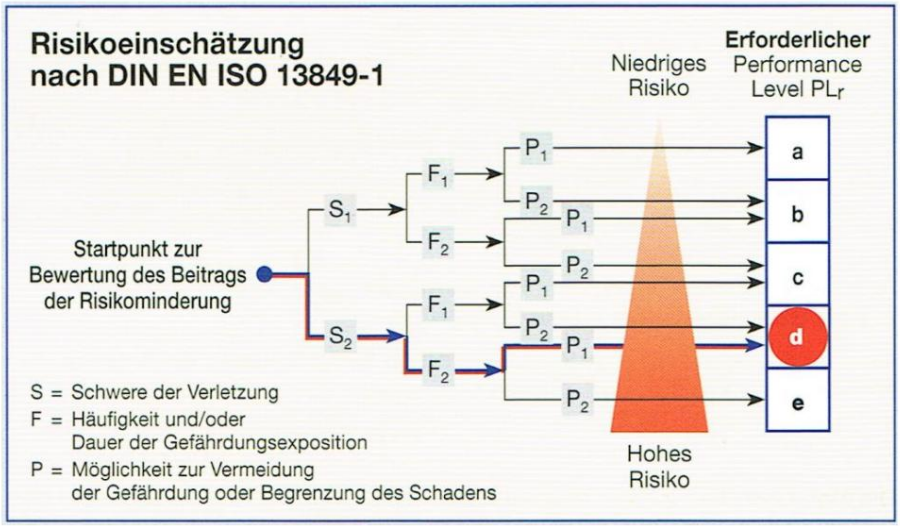


Figure 1: Determination of the required performance level PLr.

The safety-related parts of a controller can include its hardware and software. According to the new European **standard DIN EN ISO 13849-1 ,** published in February 2007, with the risk parameters known from DIN EN 954-1 , a control category no longer has to be determined **for each safety** function of a machine control, but a so-called **performance level (PLr) .**

The performance level represents the ability of a safety-related part of a controller to carry out a safety function in order to achieve the required risk reduction, ie for the quality of the risk-reducing measures.

The performance levels are divided into **5 levels from a -** e. They reflect different residual risks - expressed in the probability of a dangerous failure per hour.

The individual **risk parameters (S, F and P)** have remained the same compared to the withdrawn DIN EN 954-1. For the example in Figure 1, the risk parameters S2, F2 and P1 result in a required performance level of PLr = d.

The performance levels determined in this way for the individual safety functions can be achieved when designing a controller if, in addition to the previous controller categories, additional requirements, ie specific **reliability parameters,** are taken into account. DIN EN ISO 13849-1 contains further explanations.

Risk parameters according to DIN EN ISO 13849-1

(For selection information, see Appendix A of the standard)

S Schwere der Verletzung	F Häufigkeit und/oder Dauer der Gefährdungsexposition	P Möglichkeit zur Vermeidung der Gefährdung oder Begrenzung des Schadens
S1 leichte (üblicherweise reversible Verletzung)	**F1** selten bis weniger häufig und/oder die Zeit der Gefährdungsexposition ist kurz	**P1** möglich unter bestimmten Bedingungen
S2 ernste (üblicherweise irreversible Verletzung einschl. Tod)	**F2** häufig bis dauernd und/oder die Zeit der Gefährdungsexposition ist lang	**P2** kaum möglich

Figure 2: Risk parameters according to DIN EN 'so 13849-1

Unfortunately, the standard does not provide any information on what is to be understood by "reversible" and "irreversible injury". There is also no information on what is meant by "rarely to little" or what is meant by "frequently to constantly".

In practice, the approach has proven itself that reversible injuries are those that heal without long-term consequences. Examples include slight bruises and abrasions as well as first-degree burns.

In the recent past, what was rated as common was anything that happened more than once per shift or lasted more than an hour.

However, it turned out that these values may not be practical.

According to the current state of discussion, something that occurs at most once every 10 minutes should be rated as "rarely" or something that occurs more than 6 times an hour should be rated as "often".

Anything that lasts longer than an hour should be rated as "continuous".

However, a final statement from the responsible technical authorities is not yet available. Designers are therefore well advised if the "sharper pace" of the past can be used at reasonable cost. If this is not appropriate, the deviation must be justified.

Kategorien	Anforderungen (Kurzfassung)	Systemverhalten	Prinzip
B	Die sicherheitsbezogenen Teile von Steuerungen und/oder ihre Schutzeinrichtungen als auch ihre Bauteile müssen in Übereinstimmung mit den zutreffenden Normen so gestaltet, gebaut, ausgewählt, zusammengestellt und kombiniert werden, dass sie den zu erwartenden Einflüssen standhalten.	Das Auftreten eines Fehlers kann zum Verlust der Sicherheitsfunktion führen.	überwiegend durch die Auswahl von Bauteilen charaktersiert
1	Die Anforderungen von B müssen erfüllt sein. Bewährte Bauteile und bewährte Sicherheitsprinzipien müssen angewendet werden.	Das Auftreten eines Fehlers kann zum Verlust der Sicherheitsfunktion führen, aber die Wahrscheinlichkeit des Auftretens ist geringer als in Kategorie B.	
2	Die Anforderungen von B und die Verwendung bewährter Sicherheitsprinzipien müssen erfüllt sein. Die Sicherheitsfunktion muss in geeigneten Zeitabständen durch die Maschinensteuerung geprüft werden.	Das Auftreten eines Fehlers kann zum Verlust der Sicherheitsfunktion zwischen den Prüfungen führen. Der Verlust der Sicherheitsfunktion wird durch die Prüfung erkannt.	überwiegend durch die Struktur charakterisiert
3	Die Anforderungen von B und die Verwendung bewährter Sicherheitsprinzipien müssen erfüllt sein. Sicherheitsbezogene Teile müssen so gestaltet sein, dass 1. ein einzelner Fehler in jedem dieser Teile nicht zum Verlust der Sicherheitsfunktion führt und, 2. wann immer in angemessener Weise durchführbar, der einzelne Fehler erkannt wird.	Wenn der einzelne Fehler auftritt, bleibt die Sicherheitsfunktion immer erhalten. Einige, aber nicht alle Fehler werden erkannt. Eine Anhäufung unerkannter Fehler kann zum Verlust der Sicherheitsfunktion führen.	
4	Die Anforderungen von B und die Verwendung bewährter Sicherheitsprinzipien müssen erfüllt sein. Sicherheitsbezogene Teile müssen so gestaltet sein, dass 1. ein einzelner Fehler in jedem dieser Teile nicht zum Verlust der Sicherheitsfunktion führt und, 2. der einzelne Fehler bei oder vor der nächsten Anforderung an die Sicherheitsfunktion erkannt wird, oder, wenn dies nicht möglich ist, eine Anhäufung von Fehlern dann nicht zum Verlust der Sicherheitsfunktion führen darf.	Wenn Fehler auftreten, bleibt die Sicherheitsfunktion immer erhalten. Die Fehler werden rechtzeitig erkannt, um einen Verlust der Sicherheitsfunktion zu verhindern.	

Determination of the safety integrity level (SIL) for safety-related electrical, electronic and programmable electronic control systems in accordance with DIN EN 62061

The procedure is described in detail in Appendix A of DIN EN 62061. It is striking that it is very similar to the general risk assessment used here. It differs only in the matrix for evaluating the numerical assessments.

Table 3 below shows at the intersection of the row severity (S) with the applicable column (K) whether there is a need for action. The black-colored area shows the specified SIL as a target for the SRCF. The lighter shaded areas should be considered as a recommendation that other measures (AM) be applied.

Table 3: Matrix for determining the SIL

Severity (S)	Class (K)				
	4	5 to 7	8 to 10	11 to 13 14	to 15
4	SIL 2	SIL	SIL 2	SIL 3	SIL 3
3		(AT THE)	SIL	SIL 2	SIL 3
2			(AT THE)	SIL	SIL 2
1				(AT THE)	SIL 1

Using Table 3, this results in a one SIL assignment for the SRCF intended to mitigate the particular hazard.

Draft, no claim to correctness and completeness

Appendix 2 - Control Measures

company	control measures	Page 1 of 1
XXXXXXXXX		

1. Safety checklist (effectiveness check)

Each selected risk reduction measure (here: column 9 in the measure sheets) must be evaluated in order to decide whether sufficient safety has been achieved or further risk reduction measures are required. **Sufficient safety is only given if all questions on the safety checklist can be answered with "yes".**

N	Safety Checklist	Yes	No	Comments
° 1	Have all the operating conditions and intervention procedures been taken into account?			
2	Were the protective measures selected according to the "3-step method"?			
3	Have all risks been eliminated or reduced to an acceptable level?			
4	Is it ensured that the measures taken do not create any new, unexpected hazards or problems?			
5	Are the users sufficiently informed about remaining residual risks?			
6	Do the measures taken allow easy handling of the Ma machine (user-friendly design)?			
7	Are all protective measures compatible with each other?			
8	Has the impact of non-commercial/non-industrial use of a machine designed for commercial/ industrial purposes been adequately considered?			
9	Is it ensured that the intended use of Ma machine is not impaired and there are no functional restrictions?			

If one of the questions is answered with **"No" ,** further or different protective measures must be taken. If necessary, the entire safety and operating concept for the machine/system must be changed.

If other risk reduction measures are selected, the process of risk assessment and evaluation must be carried out for any new risks that may arise. The selection of suitable protective measures and the risk assessment must be repeated until sufficient safety is achieved. Details on this are specified in DIN EN ISO 12100.

2. Tests (implementation control)

A check must be carried out on the finished machine/system to determine whether the selected protective measures are in place and effective. A separate test form or column 11 of the **action sheets** can be used as a checklist for this. The table shows a selection of possible tests.

Type of test Test basis Test of calculation documents Calculations B test	abbreviation
before initial operation Safety concept E EG type examination EN standards EG test for electromagnetic compatibility Technical standards EMC functional test (with or without workpiece)	
Safety concept F	
Measurement of technical standards M Trial run (practical test under practical conditions)	
Safety concept P Visual	
inspection of safety concept S Checking circuit diagrams (electrical/hydraulic/pneumatic diagrams)	
Wiring diagrams Sch Software	
testing Safety concept So Validation of safety-related parts of controls DIN EN ISO 13849-2 V Testing of laying Z Additional test (e.g. pressure, load, material, stability test.) Specialist standards ZU	

Draft, no claim to correctness and completeness

Appendix 3 – List of
standards This list of standards contains standards and technical specifications that are listed in the hazard checklist. The specified EN standards are available as national DIN EN standards.
The marked standards and technical specifications were used in the construction of this machine/ system (see hazard checklist columns 3 to 8 and action sheets column 9).

European and international standards (short title)		
Standards (EN, prEN, EN ISO, ISO)		**applied**
EN 349 Minimum distances EN 574		
Two-hand controls EN 614 Ergonomic	design for hazardous	
substances EN 626 EN 842 Visual hazard	signals EN 894 Design of	
Separating protective devices (safety fences) EN 953	displays EN 981 EN 983	
and acoustic signals EN 1005-3 Human	physical performance	
(force limits)		
CR 1030 Hand-Arm Vibration (Guide)		
1032 EN 1037 Prevention unexpected start-	Whole-body vibration EN-	
up EN 1127-1 Explosion protection EN 1299	Vibration isolation EN 1760 Pressure-	
sensitive protective devices EN 1837 Machine-integrated	lighting EN 4413 Hydraulics EN 4414	
Pneumatics EN ISO 6385 Ergonomics of work systems EN	ISO 11161 Integrated manufacturing	
systems EN ISO 11688 Design of low-noise machines EN	ISO 11690 Low-noise workplaces EN	
ISO 12100 Safety of machines – General design principles –	risk assessment and risk reduction EN-	
12198 Emitted radiation EN 13478 Fire protection EN ISO	13849-1 Controls (design)	
		X
		X
		X
EN ISO 13849-2 controls (validation)		
EN ISO 13850 Emergency		X
stop EN ISO 13855	Arrangement of protective devices with regard to the approach speed Safety distances Interlocking devices Noise protection	X
EN ISO 13857	through silencers Stationary accesses Noise protection	
EN ISO 14119	encapsulation Electronic equipment Explosion protection	
EN ISO 14163	Electrical equipment Housing protection types Laser devices	
EN ISO 14122	Low-voltage switchgear Electromagnetic compatibility (EMC)	
EN 150 15667		
EN50178		
EN60079		
EN 60204-1		X
EN60529		
EN60825		
EN60947		
EN61000 Part 6-1 to 6-4		

61241-14 Electrical equipment for use in areas with combustible dust Displays, labels, operating parts Non-contact protective		
EN61310	devices El. programmable systems detection of the	
EN61496	presence of people functional safety of controls	
EN61508		
EN62046		
EN62061		
BG regulations (BGV) - rules (BGR) - information (BGI)		**applied**
BGV A 1	Principles of Prevention	
BGV A 3	Electrical systems and equipment	
BGV A 8	safety marking	
BGV B 2	laser radiation	
BGV B 11	electromagnetic fields	
BGR 104	Explosion Protection Rules	
BGR 109	Grinding, brushing, polishing aluminum	
BGR 143	Activities with cooling lubricants	
BGR 237	hydraulic hose lines	
BGR 500	operation of work equipment	
BGI 575	Electromechanical locking devices	
BGI 670	Proximity switches in locking devices	
BGI 852-4	software	
BGI 5049	Security concepts and protective devices	
BGI 5123	industrial robot	
BGR 5127	Avoidance of ignition hazards due to electrostatic charging	
more rules		
BetrSichV	Ordinance on Industrial Safety and	
OStrV	Health Artificial optical radiation	
TRBS 2111	Mechanical hazards Hazards from	
TRBS 2121	falling Hazardous explosive	
TRBS 2152	atmosphere Ordinance on Hazardous Substances	
Hazardous Substance Ordinance	of 26 December 2010 Noise and Vibration Occupational	
LVArbSchV	Safety Ordinance Impact of mechanical vibrations Vibration	
VDI 2057	isolation Air quality at the workplace Dust fires and dust	
VDI 2062	explosions Dust separator Automated production systems	
VDI 2262	Pressure relief of dust explosions Mechanical vibrations	
VDI 2263	(protective measures)	
VDI 2264		
VDI 2854		
VDI 3673		
VDI 3831		