Draft, no claim to correctness and completeness

project data

Manufacturer	itself (machine for personal use)	*Original manufacturer: "Logo"*
Manufacturer's address:	Langenbruch 6, 32657 Lemgo	
Version of this complete document:	0.0.2	
reason for change	Change of name, phases of life, use, functioning	
Date of last change:	–	
Designation of the machine:	smart transfer system (transfer system, integration infrastructure)	
Machine type (model):	–	
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	May 12, 2015	
Checked by / verified by			
Approved by / released			
documentation officer			

Draft, no claim to correctness and completeness

project Manager

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

Draft, no claim to correctness and completeness

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".

Compliance with the basic health and safety requirements of the EC Machinery Directive 2006/42/EC and other relevant internal market directives is ~~documented. This proof is part of the technical~~ documentation in accordance with Annex VII of the EC Machinery Directive, but does not represent it in full.

The hazard analysis (identification of hazards) is part of the comprehensive **risk assessment according to DIN EN ISO 12100.** Based on the determined and After assessing the risks, suitable risk reduction measures were defined after observing the relevant safety regulations.

The risk assessment and the protective measures implemented on the machine/system authorize according to Articles 5 and 12 of the EC Machinery Directive never 2006/42/EG to issue the EC declaration of conformity and to affix the CE mark. The entire machine documentation can do this mentation to be completed with this.

Draft, no claim to correctness and completeness

2. Implementation

The risk assessment was divided into two parts. This risk assessment does not take into account the risk transmission through integrated machines.

This is done iteratively with a second risk assessment that considers this machine as an integrated manufacturing system and thus defines and documents further or retrospective specifications and risk-reducing measures. The risk assessment of the entire machine/system results from both.
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 Conformityassessment 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

A **hazard checklist** (see p. 16 hazard checklist) and **action sheets** (see p. 28 action sheets) were essential tools for implementation and documentation .

Hazard identification of hazards **checklist**

measures sheets Risk assessment
and description of protective measures

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 mixed form of instruments or methods for risk assessment Risk assessment Control measures List of standards
Attachment 1
Attachment 2
Attachment 3

The hazards marked with a cross in the **hazard checklist** were identified for the designated machine/system (see p. 22 hazard assessment and **description)**

Draft, no claim to correctness and completeness

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 . 35 **safety** plan).

Draft, no claim to correctness and completeness

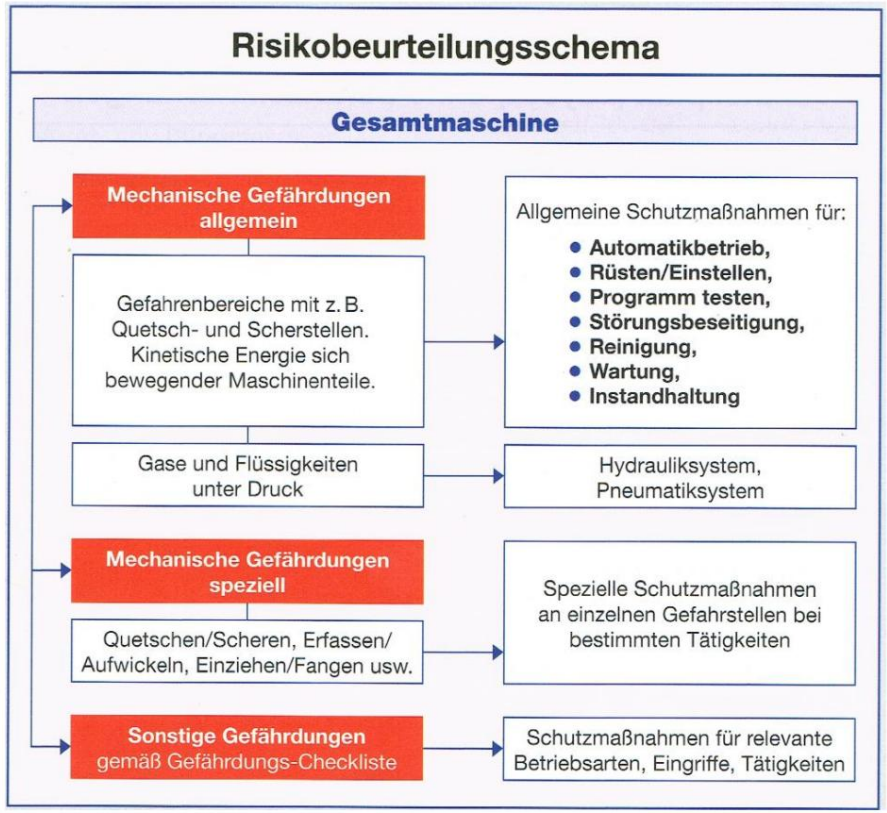
The information in the hazard checklist (columns 3 to 8) **and in the action sheets** (column 9) **serve in the sense of the EC Machinery Directive 2006/42/EC as a list of**

- **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.



Draft, no claim to correctness and completeness

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 of the machine	smart transfer system (transfer system, integration infrastructure) itself (machine for
Manufacturer	personal use)
Machine type (model):	transfer 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. Integrated machines must meet the following specifications: see the description of the overall system.
quantity	The transfer belts run the entire production time (see time limits) see 3.4 life phases
operating mode	
Location	Production hall, exhibition
Space requirements (see installation plan)	12m x 2m
operating personnel	instructed persons (see p. 12 Use)
Installer/Maintenance	Skilled workers, instructed persons (see p. 12 use)
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 operating instructions
Applicable Documents	Operating instructions, Elcom declaration of incorporation, Vathauer declaration of incorporation, risk assessment interfaces

Draft, no claim to correctness and completeness

3.2. Intended use, limits of the machine Limits of use Description This machine is intended for transporting and positioning transport takes place associated information slides This

		related documents
Intended Use	adapted to the product on a transfer system. This machine consists of individual assemblies that allow this machine to be set up according to local requirements. Finished workpieces can be removed from the object carrier and released again via 2 output modules. Furthermore, the machine is designed to link standalone machines to one another via plug-and-produce interfaces, for which an integration infrastructure is provided. Information and energies are passed on via this infrastructure. This machine is only intended for the integration of complete individual machines.	
Foreseeable improper use (misuse/ abuse)	Incorrect assembly of the individual assemblies during assembly. Individual operation of an assembly Product transport without slides; Removal of unfinished products in the manufacturing process and not at the output assemblies; bringing in unfinished products; manual stopping, positioning, inserting, removing slides in automatic mode.	

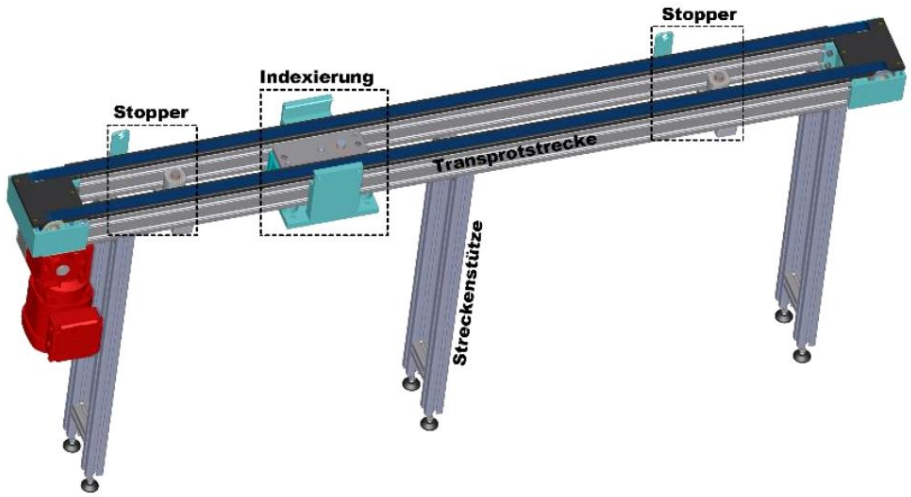
3.2.1. Spatial limits Room for movement, space required by people who handle the machine, eg during operation and maintenance Interface(s): Human/energy supply Human/machine

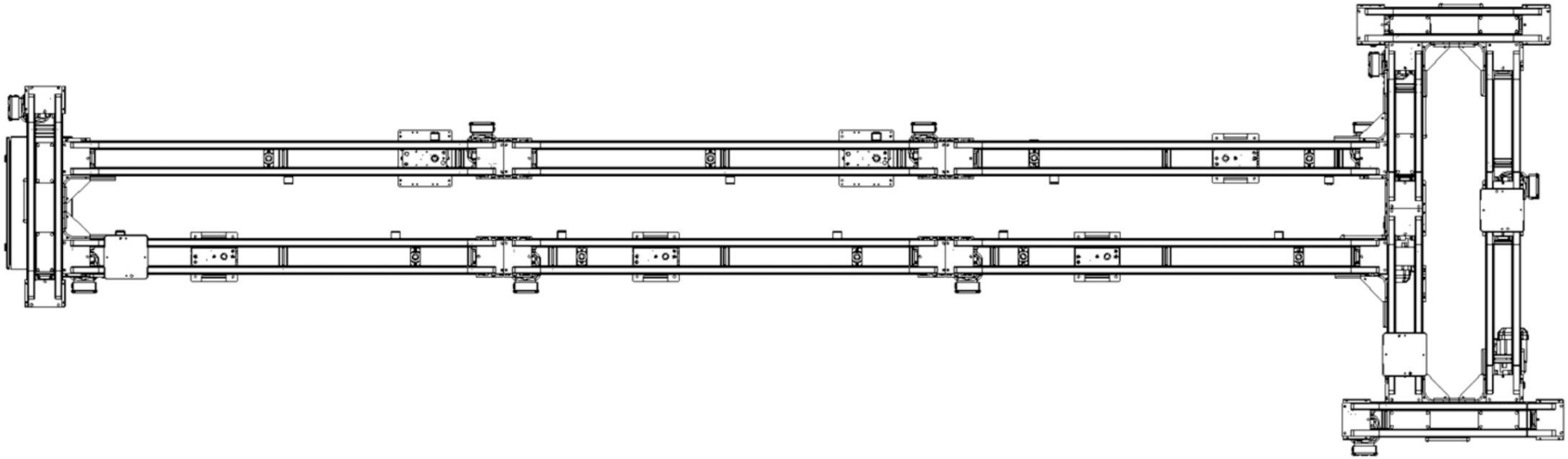
	Associated documents/description
Description of the machine:	The transfer units are from Elcom (TLM 2000) and were installed in accordance with the declaration of incorporation. Consisting of belt section unit and section support. With the help of connecting and guide pieces, the units are assembled according to the specifications for the assembly. The gears and motors with frequency converters were purchased from Vathauer and are matched to the installed "FieldPower® Drive" concept from ~~Weidmüller and installed in accorda~~nce with the declaration of incorporation. The workpiece carriers are transported by 2 parallel conveyor belts, each running in an item profile. This makes it easier to attach stoppers, indexers purchased from Elcom and other components. Its guidance is realized by retractable cams under the workpiece carrier. The power bus system purchased from Weidmüller/Vathauer is mounted on the track support. The electrical, pneumatic and communications supply is passed on via this plug-in system. Each transfer unit taps its own supply from the pluggable supply system. An additional connection with another plug to the supply system is created at the points provided for the integration of machines. The infrastructure required for these machines is thus provided.
Interfaces to other machines	If an assembly unit is connected to the intended location (integration space), an interface to another machine is created here. The transfer of risk at this interface is via the ISO

Draft, no claim to correctness and completeness

	11161 to judge. Positioning units (indexing) and stoppers are mechanically screwed to the transfer belts. Based on status messages, an integrated assembly module, these are controlled via this module. The pluggable supply system provides interfaces for the energy supply of the respective module at the integration points. Interfaces for
Interfaces to energy supply	communication with a uniform technology and specified interfaces are available at the integration points via the pluggable supply system. To control the stopper, the status of the optionally integrated modules is queried. Product
Interfaces for communication	data is forwarded via an integrated RFID chip in the workpiece carrier.
Overview drawing including parts list	See specifications for assembly. For example, one possibility is documented here.
Requirements/specifications	–
technical specification	The workpiece carrier must not weigh more than 10 kg. The maximum load per belt section (one unit) is 100 kg in accumulation mode.
Description of the structure and components in the operating instructions Chap. xxx technical	The Elcom assembly and maintenance instructions are yet to be created, taken up or attached
data in the operating instructions chap. xxx	The Elcom assembly and maintenance instructions are yet to be created, taken up or attached

Machine overview (installation plan)





3.2.2. Time limits Limits of

the service life of the machine/individual components, with intended use and foreseeable misuse Recommended maintenance intervals Planned service life of the machine Service life of wearing parts (list)

	20 years
	Not specified
Recommended maintenance intervals (list)	See Elcom assembly and maintenance instructions

3.2.3. Further limits

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.

Materials being processed (list of hazards) Required cleanliness level Minimum/maximum ambient	
temperature Minimum/maximum machine temperature	normal industrial environment
20°C to 40°C Prepared by Philip Kleen (Student, inIT)	20°C to 60°C

Indoor/outdoor operation	On the production floor, in a normal industrial environment; temporarily in an exhibition
in dry/wet weather in direct/indirect	
sunlight	
Dust/wet tolerant	IP 20
Aggressive environmental conditions	
Etc.	

Draft, no claim to correctness and completeness

3.3. Use

Environment of use	description		related documents
Private Commercial,	no		
industrial use Yes, industrial use			
User groups task Life phase The user groups, tasks and their qualifications qualification/impairments			
phases. Deviations can be found in the entries below.			
professional staff			
laymen			
trainee			
Children (specify age group)			
Elderly (no longer able to work)			
Disabled people (persons with limited mental and physical abilities			

Draft, no claim to correctness and completeness

3.4. **Life** phases Life

phases of the machine/ plant	Hazardous activities, interventions, situations, description (e.g functionality)	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		Operator's staff
D Automatic mode briefly: Auto	Automatic processes The transfer belts run continuously, stoppers and indexing are controlled automatically.	operating staff
~~E~~ ~~Semi-automatic mode briefly: manual~~	~~Manual operation with partly automatic sequences, operation of a section of inching operation of the transfer belt, individual control of the stoppers and indexing.~~	
~~f~~ ~~Manual operation tap briefly~~		
G Setup/adjustment in short: teaching	Conversion to other modules, adapting the configuration of the controller, attaching additional indexing and stopper input/change, testing programs, importing possible new configurations	wait staff, fitter, Programmer, Foreman, master
H Program, Testing		
I Eliminate disturbances in workflow	Eg removal of foreign bodies at the belt feed	
J Observing production processes	Observe especially in the vicinity of the dangerous tape pull-in, but also stoppers and indexing.	Everyone, especially visitors
K Troubleshooting	Finding and eliminating the causes of malfunctions by specialist personnel	Foremen, foremen, skilled workers
L Cleaning, maintenance	Cleaning, lubricating, for example, the gears	Operators, cleaning/maintenance staff
M maintenance	Repairs, eg replacement of frequency converters or transfer belts	maintenance staff
N Decommissioning	Dismantling, dismantling, removal, disposal	Internal company staff or/and one specialist company

Draft, no claim to correctness and completeness

4. Identification of hazards 4.1.

Explanations for the use of the hazard checklist In a risk assessment, possible hazards must be determined for all life phases of a machine/system. The still unsecured machine/system is assumed.

Exception: Safe old or new machines integrated in systems are considered in their already safe state. A risk assessment is only required for such machines with regard to the interfaces.

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 checklist can therefore be used for an **entire** machine (single machine or complex system), a **sub** - machine (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 ticked because the hazards that arise when machines are integrated into an integrated manufacturing system (IMS) have been identified in a further risk assessment. The following risk assessment serves to identify all other hazards. These two risk assessments are linked iteratively.

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.
Column 3	**EC Machinery Directive Annex I No. ...,** with which agreement (conformity) must 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 3.4 phases of life) to consider.
Column 9	The reference numbers of the installation plan (see 3.2.1) can be entered here, for which a corresponding hazard ge is calculated.
Column 10	All life phases of the machine/system (see 3.4 life phases) are entered here, in which a corresponding hazard is expected.

Draft, no claim to correctness and completeness

4.2. Danger checklist according to DIN EN ISO 12100

Manufacturer	hazard checklist for machine or system-specific hazards	Sheet 1 of 6
even	Machine / system: smart transfer system (transfer system)	Clerk: Philip Kleen
	Type: Module no. 1 to 13 Machine no.: – Customer: / Year of construction: 2014	
	inIT Order no.: – Entire machine : Yes No Sub-machine : Date: / Country: Germany	
	05/12/2015 Establishing conformity with Applicable standards / Applicable Specifications / Section further EG- EN ISO 12100 further EN-	

running no.	Hazards, hazardous situations, hazardous events	National Ref. MRL Appendix I	Life Directives	Norms	Rules	Yes	No.	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)				1	M, N
	b) arrangement of moving parts *(Danger 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 5123X2			AC, GM
	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			x3		D, GN
	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);*	1.5.3; 1.6.3					x4		MN
	g) liquids and gases under pressure; Residual energy *(e.g. hydraulic/ pneumatic systems)*	1.3.2; 1.5.3 1.6.3	Pressure vessel directive 87/404/EEC	6.2.5 6.2.10	EN982 EN 983	BGR 237X5			CN
	h) negative pressure	1.5.3; 1.6.3	Pressure Equipment Directive 97/23/EC						
	Identify all hazards		Observe all EC directives	Observe all relevant standards				see layout	see table

Draft, no claim to correctness and completeness

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : MRL further EG- EN ISO Appendix I Policies		Hazard checklist Applicable standards/techn. Specifications 12100 further EN- National Ref. Life standards			Sheet 2 of 6 Applicable Notes		
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 X 6.1	
		1.3					CN		
1.2 Shearing Hazard		1.3					6.2 _		CM
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	
2.1 Direct contact of people with live parts		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		x7 _		DM
2.2 Touching parts that have become live due to faults. 2.3 Approaching high-voltage parts		1.5.1					x8 _		DM
		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		

Draft, no claim to correctness and completeness

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : Applicable standards/techn. Specifications further EG- EN ISO 12100		Hazard checklist further EN- National norms	Ref. Life Annex I Directives	Applicable MRL Rulephase(s)	Sheet 3 of 6 Yes(1) No.		
1	2	3	4	5	6	7	8th	9	10
3 Thermal hazards resulting in 3.1 burns and 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	6.2.4 b) 6.2.8 c) 6.3.2.7 6.3.3.2.1 6.3.4.5				see below	
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 X		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		x9		D
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)		BGV B 11 BGR B 11			
		1.5.10		6.3.3.2.1 ; 6.3.4.5 6.4.5.1 c)					
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		

Draft, no claim to correctness and completeness

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : MRL further EG- EN ISO 12100 further EN-		Hazard checklist Applicable standards/techn. Specifications Applicable norms		National Ref. Life Annex I Directives		Sheet 4 of 6 Rules 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 2262X10 _			LM
7.2 **Fire or Explosion** Hazard		1.5.7 ExplProtection-RL 94/9/ EG			EN1127-1 EN13478	TRBS 2152 BGR 104 VDI 2263 Bl.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 hazards from					EN614 EN1005			see below	
8.1 Unhealthy posture or extra effort tion		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			EN614				
8.3 Provision of personal protective equipment (PPE) instead of technical protective measures		1.1.2d				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	**x12** _		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		

Draft, no claim to correctness and completeness

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events		Establish conformity with : MRL 2006/42/EC Annex I 1.1.2a	other EC Directives 3	Hazard checklist Applicable standards/techn. Specifications EN ISO 12100 other EN national rules 7	norms 6		Sheet 5 of 6 Applicable yes	Ref. phase(s) 9 10 13	Life No. D
1	2		4	5			8		
10 combinations of hazards *(Danger increase through the addition of risks)*							X		
11 Unexpected start, unexpected Spinning / over-revving (accelerating) *or any comparable malfunction due to:* 11.1 Failure /		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	
malfunction 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, wetness, 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				
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	see item 11		X	17	DM
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		6.2.11.1; 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 Observe		6.2.11	see no. 11		X	19	DM
Identify all hazards		all EC directives		Observe all relevant standards			see layout		see table

Draft, no claim to correctness and completeness

Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : further EG- EN ISO 12100		Hazard checklist Applicable standards/techn. Specifications further EN- National norms		Ref. Life Annex I Directives Rules	Sheet 6 of 6 Applicable MRL No. Yes Life phase(s)		
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					
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)			X blub		L, M
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 _		valid for everyone
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		

4.3. Risk assessment and description With the help of the risk checklist, sheets 1 to 6, the following risks were identified as applicable: 13 transfer units

Product:

Issued by: Philip Kleen

Date: May 12, 2015

black area = high risk

gray area = medium risk white area = low risk

initial risk assessment: Yes

effects	extent 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 likely 5	
arm, reversible loss of fingers,	3						< 1 hour to ÿ 24 hours	5 probably 4	
reversible medical care, first aid no	2						< 24 h to ÿ 2 w 4 possible < 2 w to ÿ 1	3 impossible 2	5
injury	1						a 3 rare 2 negligible	possible 3 1 probable 1	
	0						< 1 a		

ref No.	Type. vessel No.	Danger	se	Mrs	Pr	Av	class		
1	1	form sharp edges and corners	2	2	3	1	6	low risk low risk	
2.1	1	mass and stability, fall over	1	4	3	1	8th	low risk high risk	
2.2	1	mass and stability	2	4	2	1	7		
2.3	1	mass and stability	4	3	2	1	6		
3.1	1	mass and velocity, squeezing	0	5	3	3	11	low risk low risk	
3.2	1	mass and speed, cutting	1	4	2	3	9	medium risk	
3.3	1	Mass and Velocity, Retraction	2	4	2	3	9		
3.4	1	Mass and Velocity, Pushing	1	5	2	3	10	low risk low risk	
3.5	1	Mass and Velocity, Wind Up	1	5	3	3	11		
4	1	Accumulation of energy (f) elastic elements	1	2	2	1	5	small risk	
5	1	Accumulation of energy (g) gases under Print	2	4	2	1	7	small risk	
6.1	1.1/ 1.2	Crushing/shearing hazard	3	5	2	3	10	high risk	
6.2	1.1/ 1.2	Crushing/shearing hazard	2	5	2	3	10	high risk	
7, 8	2	Electrical hazards 4 from noise	4	3	2	5	10	high risk	
9			2	5	5	5	15	high risk	
10	7.1	Contact or inhalation hazard	2	3	2	1	6	small risk	

Draft, no claim to correctness and completeness

blub	17	cleaning/maintenance							
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	12	Disturbance in the energy supply	1	2	2	5	9	small risk	
18	13	Stopping in an emergency	2	3	3	3	9	medium risk	
19	14	Error in the control circuit	1	2	2	5	9	low risk medium	
20	20	Insufficient user information	2	3	3	3	9	risk	

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

1	Profile ends are exposed when dismantling transfer section guides or when dismantling transfer section carriers. These may have become sharp-edged through use. Profiles are dismantled without deburring.
2.1	During assembly, individual machine parts (a transfer unit) can fall over due to impact.
2.2	Injury from falling workpiece carriers when climbing under the transfer system.
2.3	Fall of a person who climbs over the workpiece carrier system. In particular, a person who climbs over the workpiece carrier system falls while transfer lines are starting up.
3.1	Crushing of limbs between a stationary and moving workpiece carrier. Hitting an approaching workpiece carrier. These hazards can arise with any intervention in the automatic process. The speed is low and the workpiece carrier can be stopped without exertion or injury. If there are sharp-edged chips on the workpiece carriers, the risk is increased. Touching the belt in the barrel or leaning on the belt in the barrel can lead to injuries. This risk is increased when abrasive media or chips lie on the belt or
3.2	have worked their way into the surface.
3.3	Pulling in loose clothing and long hair. Where the transfer ribbon is fed into the deflection roller, the gap is slanted so that the object is pushed outwards as far as possible and not pulled in. The gap measures less than 6 mm
3.4	Hitting an emerging stopper.
3.5	Winding up loose objects on the outgoing shaft of the gear of the direct driven transfer belt. The speed is so low that the loose objects cannot be caught up in the air turbulence.
4	When changing the belt, the existing belt is untied. Since the belt is pretensioned, it snaps back to its slack length.
5	Various components of the transfer system (e.g. stoppers) are operated by compressed air. This can escape uncontrolled when assemblies are dismantled.
6.1	The components 180° turning station; Hub indexing and bridge indexing have moving parts that include pinch/heavy edges.
6.2	The use of tools or other metal objects can actuate initiators, triggering unforeseen pneumatic movements.
8, 9	In the event of improper electrical installation and operational stress, there is a risk of electric shock when touching live parts.
10	As a result of the individual noise emissions, a reversible hearing impairment and loss of concentration must be assumed over time. blub cleaning agents and lubricants can be inhaled during use.
11, 12	Wearing the wrong or missing PPE, such as protective gloves, long hair, ties, etc., poses an increased risk on the deflection rollers of the transfer belt. This results from careless leaning on the running transfer belt.

13	Due to the accumulation of noise emissions over time, hearing impairment must be assumed. 14, In the event of failure/malfunction of the control system, power failure and recovery as well as electromagnetic interference, there is, among other things, the risk of an unexpected 15, 16 start-up of the systems or of individual components.
17	Protective devices can fail in the event of disruptions in the power grid.
18	Despite all protective measures, emergency situations can arise for which precautions must be taken.
19	Component failures in the electronic control (standard PLC) can lead to dangerous situations, especially when the transfer belt unexpectedly runs faster or too fast.
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.

4.4. Other hazards with certain machines/systems *EX protection, robots, ...*

5. Safety and operating concept

The risks have already been assessed for the hazards identified with the help of the hazard checklist (see page 16ff) and described on pages 22 to 24. 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 5.5.

The following is explained:

• to point 5.1 (see page 26ff)
Required protective measures (overview)
Consideration of all identified hazards as well as production and operating requirements in the safety and operating concept.

It is tabulated for all life phases of the machine/system whether protective measures are necessary according to the hazard checklist. It is also specified which production and operating requirements must be taken into account when selecting and describing the protective measures in the measure sheets. This is intended to prevent tampering with protective devices.

• to point 5.2 (see page 27ff)
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 5.3 (see page 28ff)
Measure sheets
The measure sheets (sheets 1 to 6) 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 22 to 24)

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.
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 page 26)
ÿ Necessary measures according to the functional description
Pages 34 to 35 •

Re point 5.4 (see page 34ff)
Functionality of the secured system In the course of the selection of protective measures in the measure sheets (pages 28 to 34), 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.

• to point 5.5 (see page 35ff)
Safety plan The protective measures described in the measure sheets (pages 28 to 34) are assigned measure numbers. Their entry in the installation plan on page 9 provides an overview of the protective measures specified for the machine/system (page 35)

Draft, no claim to correctness and completeness

5.1. Required protective measures (overview)

Manufacturer	Required protective measures (overview)	Editor: Philip Kleen Date: 05/12/2015
himself (machine for own use)		

Consideration of all identified hazards as well as important production and operating requirements in the safety and operating concept.

life stages of machine / plant	danger spots: location / area / object	dangers present	the:	Necessary protective measures			Remarks
			Yes No		Yes	No	
A build	entire machine	All hazards according to the hazard checklist	Yes	Special protective measures required?	X		Wear PPE such as Safety shoes, general caution and care necessary!
B Transportation			Yes	Special protective measures required?	X		
C Assembly / Installation			Yes	Special protective measures required?	X		
D Automatic operation	workpiece removal	Mechanical hazards (general)	Yes	Safeguarding of hazardous points • individually on each component? • only on certain components? • Area security (e.g. fence, notices)?	X		Note on the transfer belt and regulation in the operating instructions. issuance of operating instructions. The machine must remain freely accessible.
D, J Automatic Operation, Watch	Entire machine, workpiece removal	Mechanical hazards (specific)	Yes	1. Is it essential for people to stay in the danger zone?	X		Indexing (Ref. No. 2.5) represents the greatest risk. The other threats are already minor
				2. Requires manual control within the facility ly?		X	
				Special protective measures required because of No. 1 and No. 2?		X	
GK All operating modes with manual intervention (not necessary in automatic mode)	entire machine	Mechanical hazards (specific)	Yes	Further protective measures required?	X		Precautions at the extraction point would have to be in the Apply to entire machine
DK General operation of the machine / Attachment	entire machine	Non-mechanical hazards according to No. 2 to 20 of the hazard checklist	Yes	Special protective measures required?	X		noise protection measures
LM cleaning, Maintenance, maintenance	entire machine	Hazards according to the checklist	no	Are further protective measures required if the system was already safe in previous phases of its life?		X	
N Decommissioning, dismantling, entire machine		Hazards according to the checklist	no	Are further protective measures required if the system was already safe in previous phases of its life?		X	As far as foreseeable
See life cycle table Hazards according to the hazard checklist				**See action sheets for details**			

5.2. 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 X).

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 4.1 Explanations for the use of the hazard checklist that it must be a complete machine. This means that the sheets of measures 1 to 6 serve to document the risk assessment and the description of protective measures for a complete system.

Columns **1** to **11** of the action sheets are explained below.

Column 1 serial Numbers of the identified hazards from the hazard checklist.	
Column 2 Identified hazards from the hazard checklist.	
Column 3 All hazardous points (named after location, area or object) at which identified hazards must be expected.	
Column 4 item numbers of the respective system components *(see floor plan page 52).*	
Column 5 Precise information as to when and where the corresponding hazard occurs (hazardous situation, hazardous activity, hazard cause).	
column 6	Specification of the life phase(s) of the machine/system in which the corresponding hazard occurs (see life phases on page 13)
column 7	General risk assessment taking into account DIN EN ISO 12100 "General design principles - risk assessment and risk reduction" (see risk assessment and description on page 22). 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 Annex ___.
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	

Draft, no claim to correctness and completeness

5.3. Action sheets

manufacturer	Sheet of **measures**	Sheet 1 of 6
itself (machine for personal use)	**Machine or system-specific risk assessment and description of protective measures Machine / system:** 13 transfer units for transporting workpiece carriers with a supply line for connectable processing modules **Type:** Module Unit 1 to 13 **Machine no.: Customer:** inIT **Order no.: Entire machine:** Yes **sub -machine :** No **danger point**	**Clerk:** Philip Kleen
	Year of construction: 2014	
	Country: Germany	
	Section: no	**Date:** 05/12/2015

From hazard checklist				Dangerous situation, life risk assessment Serial.				Protection target(s) / protection measure residual risk User	test dimensions
Hazards Location / area / ref. Hazardous activity, general phase No.	(short text)	object	No cause of danger			my	for the steering	information	ver no _
1	2	3	4	5	6	7	8th	9	10	11
1 Mechanical hazards										
	cutting and shears at profile ends /	profile ends	1 By	grabbing Pro Falling or slipping from profiles will cause cuts on hands or arms.	MN low	risk		**Aim:** Prevent cutting at profile ends; **Measures:** • Wearing long-sleeved protective clothing • Wearing cut-resistant work gloves • Move workpieces (aluminium profiles) slowly gene	1 2 3	
	overturning of the machine	Stretcher support mounted on the belt stretching unit	2.1	Connecting the units to form a complete system, transport	AC, MN	low risk		**Aim:** Prevent units from falling over. **Measures:** • Through horizontal transport and storage. • Systematically connecting the units. Connect units across corners first. Set up long transfer routes one after the other and connect them immediately. Disassembly in reverse order. • Wearing PPE such as safety shoes. • Clear instructions on the sequence of assembly in the operating instructions and packaging **Aim:** Avoid entering the risk area **Measures:** • For cleaning and repair work that	4 5 6 7	
	falling from Workpiece carrier when climbing under the transfer system	Area below half transfer line	2.2	While a person is below the transfer system, a workpiece carrier falls down and causes cuts, bruises, eg on the head or hands	D,I,K,L low	risk		requires climbing under the transfer line, remove all workpiece carriers from the transfer system and store them safely. • Train employees on this risk • Describe the risk in documentation and prohibit entering the area during operation **All EC**	8th 9 10	
See hazard checklist		**see installation plan**		**All identified hazards. note**	**see table see**	**risk graphics**		**directives, EN standards, techn. spec. note see table**		

Draft, no claim to correctness and completeness

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures							Sheet 2 of 6	
From hazard checklist Location / area / ref. (short text)	Hazardous activity, general danger point object	phase No.	Dangerous situation, life risk assessment No cause of danger	Serial. my	Hazards for the steering		Protection goal(s) / protection measure residual risk user information	dimens no _	test ons ver
1	2	3	4	5	6	7	8th	9	10	11
	crash of Per transfer cke system o the tr	Climbed over the the transfer	2.3 Upon entering the person falls and is seriously injured; broken bones etc. too.	CN	high risk		**Goal:** Avoid climbing over transfer systems. **Measures:** • For cleaning and repair work, the make climbing over necessary build suitable scaffolding over the transfer system. • Train employees on this risk • Describe the risk in the documentation and generally forbid entry to the area PLr = b **Goal:** No injuries caused by	11 12 13	
	Cutting on the running belt of the transfer system	belt, workpiece carrier	3.2 By grabbing or dropping Leaning on the belt can cause skin injuries on the hands.	GM minor	risk		contact with belts. **Measures:** • Train employees on this risk • Risk notice for machines that can be integrated • Risk notice in the operating instructions Due	14 15 16	
	Crushing from moving machine elements	Between tool carriers	3.1 Limbs between a standing object and a moving tool carrier	DM low	risk		to the low speed and the slight slipping **(low friction factor)** between the workpiece carrier and the transfer belt, there are no injurious bruises. The workpiece carrier stays on the belt thanks to the cams and does not slip down. Note in the **operating instructions.**	17	
	Drawn in by moving machine elements	Move in from transfer ribbon in inner to the deflection roller	3.3 Loose clothing and long hair can be pulled out	DM medium	risk		Prevent **target** capture and retraction. **Measures:** • Long hair must be tied up and held under a hair net • Not publicly accessible • Note in the operating instructions	18 19 20	
	Pushing through moving machine elements	Stopper in transfer tape	3.4 When leaning on the stopper, the impact may cause injury.	DM low	risk		**Aim:** Prevent leaning on stoppers. No work step requires this intervention, it can be caused by carelessness. **Measures:** • The stopper only moves up when the workpiece carrier is above it or • Stopper drives at lower speed. • Note in the operating instructions **All EC directives, EN standards, techn. spec. note see**	21 22 23	
See hazard checklist	**see installation plan**		**All identified hazards. note**	**see table see risk graphics**			**table**		

Draft, no claim to correctness and completeness

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures							Sheet 2 of 6	
From hazard checklist Location / area / ref. (short text)	Hazardous activity, general object	danger point phase No.	Dangerous situation, life risk assessment No cause of danger	Serial. my	Hazards for the steering		Protection goal(s) / protection measure residual risk user information	dimensions no _	test ver
1	2	3	4	5	6	7	8th	9	10	11
	Winding up by moving machine elements	shaft from the gearbox	3.5 Leaning on the system with loose pieces of clothing 4 Uncontrolled springing back of the belts can	DM J	low risk		**Measure:** covering the shaft	24	
	Hurting at to rebound belt	Belt/workpiece carrier	result in cuts on the hands, arms or face.	MN low	risk		**Aim:** Avoiding injuries caused by the belt snapping back. **Measures:** • Wearing long-sleeved work clothes, hand shoes and goggles • Risk information in the operating	25 26	
	Injury from escaping compressed air	pneumatic connections	5 By uncontrolled Leaking or banging of pneumatic hoses can result in injuries to hands, arms or face.	CN minor	risk		instructions **Aim:** Prevention of uncontrolled escape of compressed air. **Measures:** • Switching off all media supplies (compressed air; electricity) for maintenance work • Fixing hoses at short distances • Limiting the pressure **Aim:** avoiding reaching into 180° rotating modules; Lift indexing	27 28 29	
1.1 1.2	injury by Squeeze / Sche ren	index plate	6.1 Reaching in with fingers or arms can cause serious injuries, including shearing off of body parts	CN	high risk		and bridge indexing. **Measures:** • Protective housing • Note in documentation	30 31	
1.1 1.2	injury by Squeeze / Sche ren	Index plate/ stopper finger	6.2 Unexpected startup of the system or unexpected movement of stopper fingers and index plates can cause injuries to fingers or hands	CM high	risk		**Aim:** avoidance of unforeseen movements. **Measures:** • Ban on using tools or metal parts to activate sensors. • Note in the documentation	32 33	
See hazard checklist		**see installation plan**	**All identified hazards. note**	**see table see risk graphics**			**All EC directives, EN standards, techn. spec. Note see table.**		

Draft, no claim to correctness and completeness

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures						Sheet 2 of 6		
From hazard checklist Location / area / ref. Hazardous activity, general (short text)	danger point object	phase No.	Dangerous situation, life risk assessment No cause of danger		Serial. Hazards my	for the steering	Protection goal(s) / protection measure residual risk user information	dimens no _	test ons ver
1	2	3	4	5	6	7	8th	9	10	11
2 Electrical hazards 2.1 Directly touching live parts 2.2 Touching parts that have become live due to malfunctions 4 Noise hazards 4.1 Persistent noise	entire machine	7	7 defective components		CM high risk		**Objective:** Preventing body shock and burns from electric shock: **Measure:** Design, installation and use of electrical equipment in accordance with EN 60204-1 and BGV A3, including electrical testing by a qualified electrician.	34	
	entire machine	8	8 Poor insulation		DM high risk				
	entire machine	9	9 Continuous noise in the vicinity of the machine		DM high risk		**Aim:** Preventing temporary hearing damage, maintaining concentration **Measures:** • Observance of EN 1299, En 11688 and EN ISO 15667 • Wearing PPE, hearing protection • Specification of noise emission parameters in the Be drive instructions.	35 36 37	
7 Hazards from Materials and Substances 7.1 Poisoning by cleaning, contact or breathing A lubricant		10	10 When lubricating the due to parts and cleaning of guides, there is contact with the media		LM low risk		**Goal:** Avoiding physical contact with dangerous cleaning agents and lubricants. **Measures:** Observe the safety and operating instructions for cleaning and lubricants	38	
8 Dangers from neglecting ergonomic principles 8.3 Provision of PPE Removal 11 PPE can be forgotten who instead of technical or leads to other hazards		11			DM medium risk		**Target:** As little PPE as possible **Measure:** Check whether the reason can be remedied constructively or technically.	39	
See hazard checklist	**see installation plan**		**All identified hazards. note**		**see table see risk graphics**		**All EC directives, EN standards, techn. spec. Note see table.**		

Draft, no claim to correctness and completeness

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures						Sheet 2 of 6		
From hazard checklist Location / area / ref. Hazardous activity, general phase No. (short text)	danger point object	No cause of danger	Dangerous situation, life risk assessment	Serial. Hazards my	for the steering	Protection goal(s) / protection measure residual risk user information	dimens no _	test ons ver
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 there is an increase Danger	DM	medium risk		**Goal:** Preventing injuries caused by human error. **Measures:** • Mandatory, prohibition and warning signs on the machines in accordance with BGV • Issuing operating instructions • Initial instruction and regular instruction the personnel in the operating instructions.	40 41 42	
10 combinations of hazards	entire machine	13	Persistent noises in the vicinity of the machine, especially from frequency converters	DM	high risk		**Aim:** Prevention of permanent hearing damage, maintaining concentration **Measures:** • Compliance with EN 1299, En 11688 and EN ISO 15667 • Wearing PPE, hearing protection • Specification of noise emission parameters in the Be drive instructions.	35 36 37	
11 Unexpected start, unexpected spin/overspeed (accelerating)							**Objective:** Prevention of injuries caused by the failure of components of the control and energy supply after an interruption Execution of the safety functions of the control according to PL d		
11.1 Control system failure/malfunction 11.2 Energy supply after an interruption 11.3 External influences on electrical equipment	entire machine	14 15	Application/Use: Self-starting of the machine or individual components	DM	low risk		Consideration of EN 1037, EN 60204-1, EN ISO 11161 and VDI 2854 Validation according to EN ISO 13849-2	46	
	entire machine	16	Electromagnetic Interference	DM	low risk		Ensuring electromagnetic compatibility in accordance with EN 61000-6-1/2 (interference immunity) and EN 61000-6-3/4 (interference emission).	47	
12 Sudden malfunctions ments	entire machine	17	Use: • Automatic start-up of components • Changing machine parameters • Failure of protective devices, etc	DM	low risk		**Aim:** Prevention of injuries caused by power failure and recovery: **Measures** according to measure no. 46, 47, 48, 49		
See hazard checklist	**see installation plan**		**All identified hazards. note**	**see table see risk graphics**			**All EC directives, EN standards, techn. spec. Note see table.**		

Draft, no claim to correctness and completeness

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures						Sheet 2 of 6		
From hazard checklist Location / area / ref. Hazardous activity, general phase No. (short text)	danger point object	No cause of danger	Dangerous situation, life risk assessment	Serial. Hazards my	for the steering	Protection goal(s) / protection measure residual risk user information	dimens no _	test ons ver
1	2	3	4	5	6	7	8th	9	10	11
13 Shutdown in emergencies	entire attachment	18 Use		DM medium risk		**Objective:** Prevention of bodily injury, damage to property and the environment in emergencies and incidents: **Measure:** Emergency stop switching devices on the control panel and on the machine with an effect on the entire system (including the connected processing machines) in compliance with EN ISO 13850 and EN 60204-1 (stop category 0)	48	
14 errors in control /loop Unexpected operating faults ments	entire attachment	19 Use: • Automatic start-up of components • Non-execution of stop commands • Changing machine parameters • Failure of protective devices, etc		DM low risk		**Objective:** Prevention of injuries caused by the failure of control components: **Measures** Execution of the safety functions according to PL d (see measure no. 46) Liberation of the PLC from safety responsibility through an additional control with contacts.	49	
20 insufficient user information residual risks	In total attachment	20 Deployment/Use		DM medium risk		**Aim:** Prevention of injuries due to residual risks and incorrect operation of the system: **Measures:** Unavoidable residual risks are pointed out by conspicuous safety markings on the system and comprehensible operating instructions. In addition, the operating instructions are issued.	50 51 52	
See hazard checklist	**see installation plan**		**All identified hazards. note**	**see table see risk graphics**			**All EC directives, EN standards, techn. spec. Note see table.**	

5.4. Functionality of the protected machine/system

Taking into account all the requirements and basic protective measures provided according to 5.1 Required protective measures (overview), the safety, production and operating functions described below are specified for the machine/system. The implementation details are contained in the action sheets.

Automatic mode

The switch-on operations prescribed for automatic mode are made as follows: • Plug in the necessary assembly modules • Unlock the compressed air • Configure machine control (teaching) • Persons are aware of the dangers • Start with the push button No integrated assembly module may be removed during automatic mode. If the system is accidentally removed, it comes to a safe standstill, and the release of the frequency converter is safely switched off. This also occurs when the machine is stopped regularly using the push button. Restoring automatic mode requires the following actions by the operators in a specific order: • Convince that all processing machines are correctly connected.

• Check the configuration of the machine control (re-teach) • Start with the pushbutton By taking the key that is used to configure the safety-relevant machine control with him, the operator can prevent a second person from changing the configuration.

Eliminating malfunctions in the work process

Malfunctions in automatic mode can be eliminated during operation (jamming of workpiece carriers), taking into account the conditions specified in the operating instructions. This only applies to this machine, not to any integrated assembly modules.

Working on the transfer belt in automatic mode

Taking the safety regulations into account, the removal of the workpieces is permitted at the workpiece removal point. If an assembly module represents a manual workstation that is located on the assembly line, this workstation must be set up accordingly and the person instructed.

Setting up, adjusting, testing, troubleshooting and troubleshooting The machine provides interfaces for compatible assembly units. These must be configured accordingly so that safety-related communication can be established.
The machine only has an automatic mode. For extended troubleshooting and settings, specialist personnel must use the control software, which can be used to change individual parameters in the control.

Cleaning, maintenance, servicing

This work can be carried out when the system is at a standstill using energy equipment that is secured against being switched on. When changing the transfer ribbon, the safety instructions in the operating instructions must be observed. The new transfer belt must have the same friction factor as the previous one.

Emergency stop functions Emergency stop protective devices are required on the control panel and on the workpiece removal, each with an effect on the entire integrated production system. If modules are integrated, its actuation must also lead to the standstill of the integrated production system and thus further integrated modules. In the same way, the actuation of an emergency stop of this machine leads to a standstill of all integrated modules/machines.
The decommissioning of an integrated assembly module in automatic mode leads to a standstill of this machine and all integrated ones.

Draft, no claim to correctness and completeness

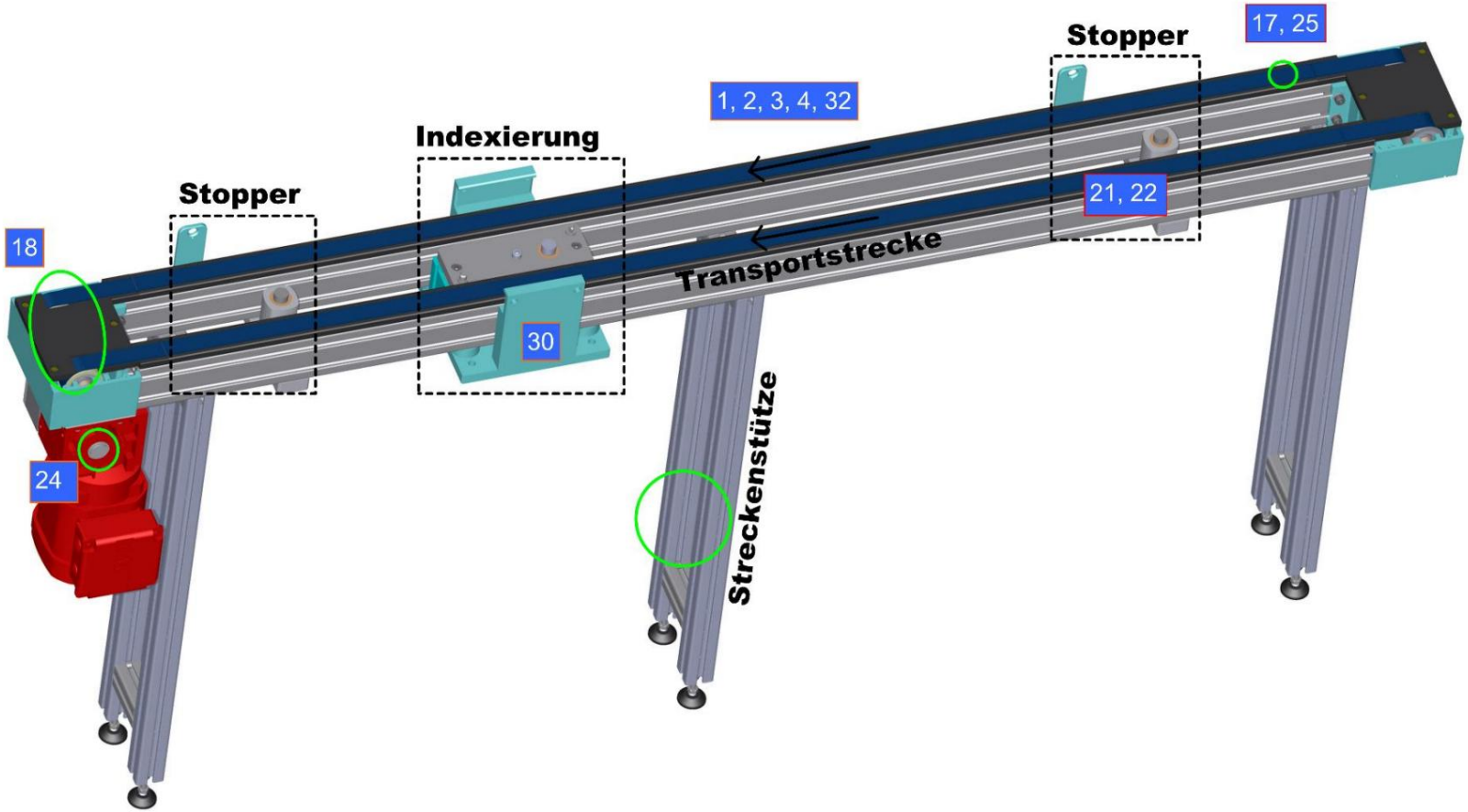
5.5. Safety plan The

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.

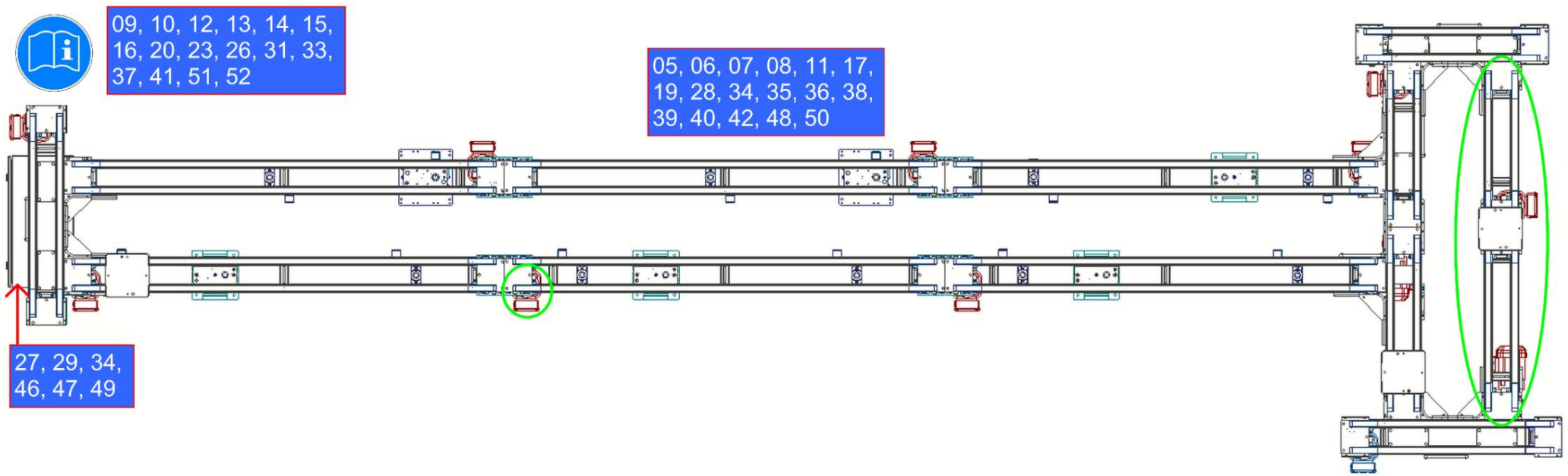
The safety plan clarifies at which points or components of the machine/system risk reduction measures are required.

~~*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.*~~



Draft, no claim to correctness and completeness



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 40.
The risk assessment for safety-related electrical, electronic and programmable electronic control systems can be carried out with the numerical evaluation, as with the assessment of hazards, and the matrix on page 43. 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.

Draft, no claim to correctness and completeness

Table 1: Risk assessment form

Product: _____ Document number.:

Issued by: Philip Kleen _____ black area = high risk Document part no.:

Date: _____ gray area = medium risk white initial risk assessment: Yes

area = low risk

effects	extent 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 1 h 5 very high < 1 h to ÿ 24 h	5	
arm, reversible loss of fingers,	3						5 high < 24 h to ÿ 2 w 4 moderate	4	
reversible medical care, first aid	2						3 impossible < 2 w to ÿ 1 a 3 low	2 possible < 1 a 2	5
	1						negligible 1 probable		3
									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	

Draft, no claim to correctness and completeness

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

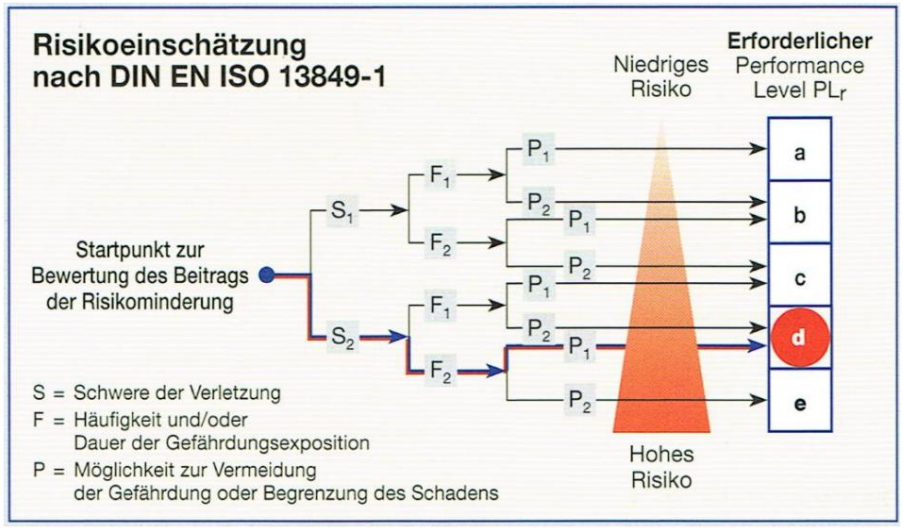


Figure 1: Determination of the required performance level PLr.

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 perform a safety function in order to achieve the required risk reduction, ie 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 contained 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.

Draft, no claim to correctness and completeness

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.	

Draft, no claim to correctness and completeness

Determination of the safety integrity level (SIL) for safety-related electrical, electronic and programmable electronic control systems according to 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 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	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 electrical safety DIN EN 60204-1 EL 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 tests (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	design EN 626	
Two-hand controls EN 614 Ergonomic	hazard signals Design of	
Hazardous substances EN 842 Visual	894 EN 953 Separating	
displays/controls EN 894 EN 981	physical performance	
Visual and acoustic signals EN 1005-3 Human	(force limits)	
CR 1030 Hand-Arm Vibration (Guide)		
EN 1032 Whole-body vibration EN 1037		
Avoidance of unexpected start-up EN 1127-1	Explosion protection EN 1299 Vibration	X
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
EN ISO 13849-2 controls (validation)		X
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	X
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		X
EN60947		
EN61000 Part 6-1 to 6-4		
DIN EN 61241-14 Electrical equipment for use in areas with combustible dust		
EN61310	Displays, license plates, controls	
EN61496	Non-contact protective devices	

Draft, no claim to correctness and completeness

EN61508	El. programmable systems detection	
EN62046	of the presence of people functional safety of	
EN62061	controls	
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		