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project data

Manufacturer	even	*Original manufacturer: "Logo"*
Manufacturer's address:	–	
Version of this complete document:	0.0.1	
Reason for change	New construction of the machine	
Date of last change: Designation of	–	
the machine: Machine type (model):	Pluggable portable processing machine with laser	
Serial number/machine no.:	–	
	–	
year of commissioning	2014	
Customer:	inIT - Institute for Industrial Information Technology Ostwestfalen-Lippe University of Applied Sciences	
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			

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project Manager

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

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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 is documented
~~and other relevant internal market directives. Th~~is proof is part of the technical documentation in accordance with Annex VII of the EC Machinery Directive,
does not fully reflect this.

The hazard analysis (identification of hazards) is part of the comprehensive **risk assessment according to DIN EN ISO 12100.** Based on the determined
and assessed risks, appropriate 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 Directiv
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.

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2. Execution See [1] p.50
When conducting the risk
assessment, the following guidelines and guidelines for the procedure were observed: **EG machines Annex I General principles Directive** Annex I No. 1.1.2 Principles for the integration of safety **2006/42/EC** Annex VII Technical documentation for machines Conformity assessment procedure Annex VIII

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. 14 hazard checklist) and action sheets (see p. 27 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. 20 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 . 33 **safety** plan) .

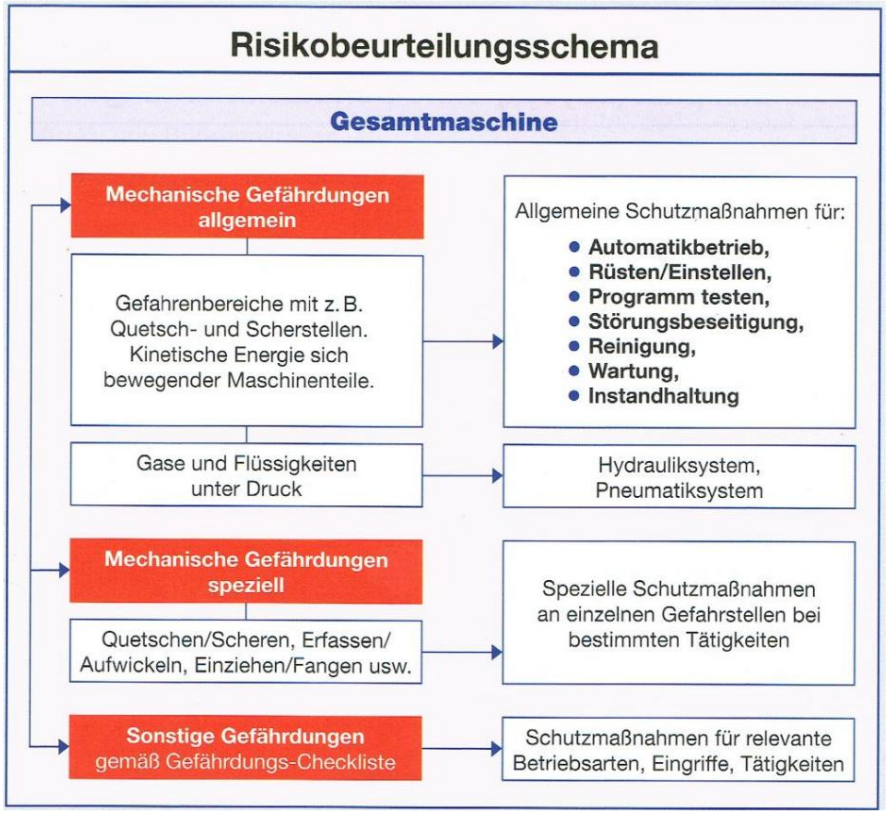
The information in the hazard checklist (columns 3 to 8) **and in the action sheets** (column 9) **serve in the sense of the EC Machinery Directive 2006/42/EC as a list of**

- **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	Pluggable portable processing machine with laser
Manufacturer	even
type designation	–
machine no.	–
Construction year	2014
Type/shape/weight of the workpieces	The workpieces are fed via a specific tool carrier, which is specially shaped for the workpieces.
quantity	
operating mode	see 0 stages of life
Location	production hall
Space requirements (see installation plan)	3m x 3m
operating personnel	no special qualification (see 3.3 use)
Installer/Maintenance	Skilled workers, instructed persons (see 3.3 Use)
rated capacity	
Electrical connection	400 V three-phase current (TN-S system), no special requirements via a specified plug
Degree of protection	connection, IP20 6 bar to 8 bar, via a specified plug connection
pneumatic connection	
communication system	ProfiNet via a specified plug connection
Expected life of the asset	20 years
Inspection/Maintenance/Cleaning	see operating instructions
Applicable Documents	Operating instructions, operating instructions for the suction,

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3.2. Intended use, limits of the machine Limits of use

	Description	related documents
Intended Use	The machine is intended for operation on a specified pluggable energy bus system. Only coordinated installation sites on a compatible machine (transport machine) may be selected. For conversions, this machine may also be operated without a conveyor system at a specially set up place. The machine is intended to engrave plastic and metal workpieces at its destination. Only the usual dust and smoke should be produced, no burning or glowing substances, easily flammable or explosive gases, aggressive media and aluminum grinding dust. *As intended, the workpiece carrier is fed in automatically with the help of a transfer belt.*	
Foreseeable improper use (misuse/abuse)	Manual feeding of workpieces with/or without workpiece carrier. Operation without air filtration.	

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 pluggable, portable processing machine with laser consists of a purchased laser unit with PC control. This was installed in the machine according to the specifications of the EC declaration of incorporation. The machine consists of a movable substructure, with a solid aluminum plate on the top. The housing of this machine encloses the laser, making access without *tools impossible.* All the equipment for controlling this processing machine is located in the base. A connection was created for the extraction and filtering of fumes that arise during engraving to connect an extraction and filter system. This was already purchased as a complete machine and connected accordingly. It must be moved in addition to this machine and placed next to it.
Interfaces to other machines	If this machine is placed at a designated installation site/docking area with a transfer system, then there is an interface to this machine. When merging into an integrated production system, a risk assessment of the resulting interfaces must be carried out again. Stroke indexing and stoppers are mechanically screwed to the transfer belts. These are controlled by the transfer machine based on status reports from this processing machine. *The processing machine is set up in such a way that the indexing engages in the transfer machine.* The electrical
Interfaces to energy supply	and pneumatic energy supply is provided via the pluggable supply system provided for the transfer machine.

Interfaces for communication	The integration into the ProfiNet communication system for the transmission of status messages takes place via the provided pluggable supply system of the transfer machine. Product data is forwarded via a built-in RFID chip in the workpiece carrier. see installation plan
Overview drawing including parts list,	
specifications	–
Technical description of performance	–
Description of structure and components in the operating instructions Chap. xxx technical data	See operating instructions from TBH chapter 4
in the operating instructions chap. xxx	See operating instructions from TBH chapter 8

Machine overview (installation plan)

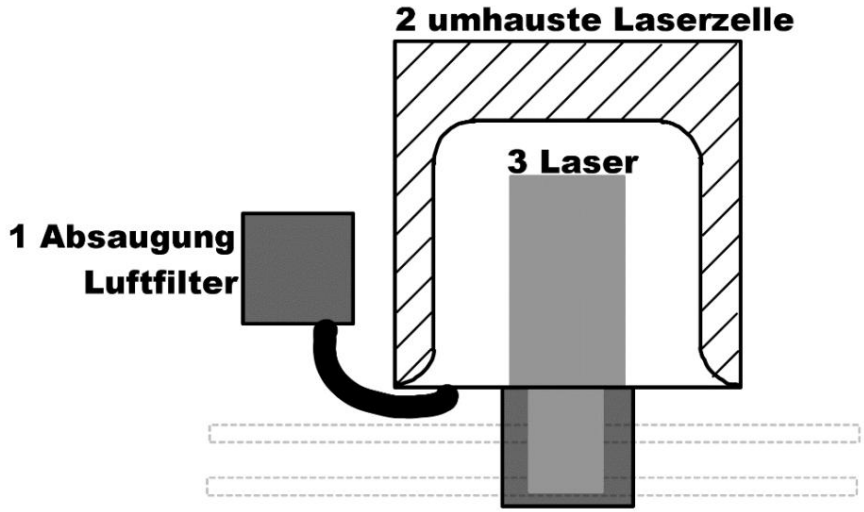

Figure 2: Top view of the laser cell

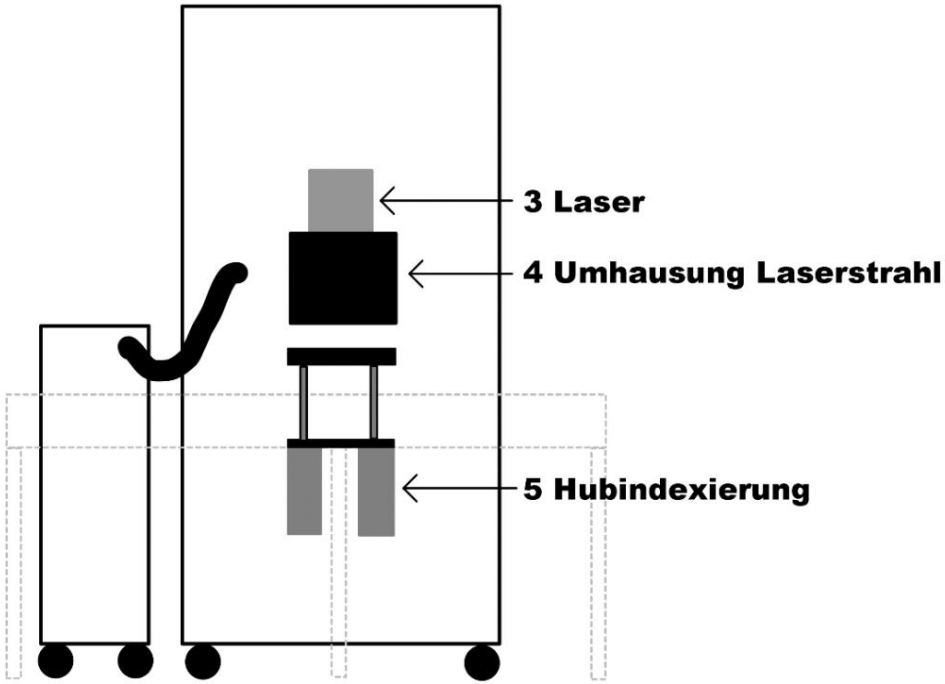

Figure 1. Front view of the laser cell

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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
	Laser Diode MTTF: 500,000 hrs
Recommended maintenance intervals (list)	

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 degree of cleanliness Minimum/maximum	
temperature in the environment Minimum/maximum	normal industrial environment
temperature in the machine 18°C to 35°C in a production hall	18°C to 35°C
Indoor/outdoor operation	
in dry/wet weather in direct/indirect	–
sunlight	–
Dust/wet tolerable	dry environment, IP 20
Aggressive environmental conditions	no
Etc.	–

3.3. Use Environment

of use private	description		related documents
Commercial, industrial	no		
use Yes, industrial use User groups Task	Life phase The user groups,		
tasks and their qualifications are given in the life phases Deviations can be found in the		Qualification/Impairments	
professional staff			
laymen			

trainee			
Children (specify age group)			
Elderly (no longer able to work)			
Disabled people (persons with limited mental and physical abilities			

3.4. materials

materials	material	use	related documents
dangerous substances			
hazardous materials	see intended use		
hazardous processed materials			

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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, test runs at each production site	assembly and maintenance personnel operator and/or a representative
Application/Use D to M		
D Automatic mode briefly: Auto	Automatic processes The processing machine reads the RFID chip and processes the tasks that can be completed by it. Provides status messages.	operating staff
E Semi-automatic mode briefly: manual	Manual start of the engraving (laser), individual work ~~steps are started by hand.~~	
f ~~Manual operation tap briefly~~	~~Individual work steps are carried out in jog mode~~	
G Setup/adjustment	Adapt the machine to the installation site. relearn controls. Bring stroke indexing into position.	wait staff, fitter, Programmer, Foreman, master
H Program, Testing	Entering/changing, testing new programs. Import of possible new configurations, e.g. removal of jammed workpiece carriers in the stroke indexing	
I Eliminate disturbances in workflow		
J Observing production processes	Observe near dangerous movements	Everyone, especially visitors
K Troubleshooting	Finding and eliminating the causes of malfunctions professional staff	Foremen, foremen, skilled workers
L Cleaning, maintenance	Cleaning, lubricating eg emptying the suction	Operating, cleaning and maintenance personnel
M maintenance	Repairs eg replacing filters	maintenance staff
N Decommissioning	Dismantling, dismantling, removal, disposal	Internal company staff or/and one specialist company

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.

"Entire machine" is ticked in the following checklist , ie in this case the hazard checklist is used to identify hazards for the entire processing module (complete system). The intended use shows that this processing module works together with others, but **no entirety of machines** within the meaning of the Machinery Directive should result. Therefore, each processing module must be safe on its own. When combining modules, only the interfaces need to be considered with an additional risk assessment.

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 0** life phases) must be taken into account.
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.

4.2. Hazard checklist

manufacturer	Danger - checklist Machine or system-specific dangers	Sheet 1 of 6
even	**Machine / system:** Pluggable, portable processing machine with laser **Type:** -	**Clerk:** Philip Kleen
	Machine no.: - **Year of construction:** 2014 **Order no.:** - **Customer:** Partial **Partial**	**Date:** 05/12/2015
	standards/techn . Specifications Applicable Established EC Directives **Applicable** **Ref. Life**	
	Directives Norms Rules Yes No. phase(s)	

running Hazards, no. hazardous situations, hazardous events		MRL Appendix I							
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			x1 _		DM
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			x2 _		DM
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		1.5.3; 1.6.3							
and gases under pressure; Residual energy *(e.g. hydraulic/pneumatic systems)* h) Negative pressure		1.3.2; 1.5.3 Pressure vessel directive 1.6.3 87/404/EEC 1.5.8 Equipment Directive 97/23/EC		6.2.5 6.2.10	EN982 EN 983	BGR 237X3			DM
Identify all hazards		directives	Observe all EC	Observe all relevant standards			see layout see table		

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Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : MRL further EG- EN ISO 12100 further EN- National Ref. Life Annex I Directives phase(s)		Hazard checklist Applicable standards/techn. Specifications norms		Sheet 2 of 6 Applicable Directives		Yes 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	
		1.3					x4		I, J
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	
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		x5		DM
2.2 Touching parts that have become live due to faults. 2.3 Approaching high-voltage parts		1.5.1					x6		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		

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 EG- EN ISO 12100 further EN- National Ref. Life standards Rules Yes No. phase(s) Appendix I Policies						
1	2	3	4	5	6	7	8th	9	10
3 Thermal hazards resulting in 3.1 burns and frostbite				6.2.4 b) 6.2.8 c) 6.3.2.7 6.3.3.2.1 6.3.4.5				see below **X** 7	
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				DM		
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					**x8**		DM
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 radiation (electromagnetic fields)		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			
6.2 infrared, visible and ultraviolet light		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	**x9**		CM
Identify all hazards		Observe all EC directives		Observe all relevant standards			see layout see table		

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Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : MRL further EG- EN ISO 12100 further EN- National Ref. Life phase(s)		Hazard checklist Applicable standards/techn. Specifications Applicable norms		Annex I Directives	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 2262X10 _			
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			AC
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 _		GI, KM
8.7 improper construction, placement or Identification of Controls 8.8 Improper	1.2.2					x13 _		DM
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		

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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							
11 Unexpected start, unexpected Spinning / over-revving (accelerating) *or any comparable malfunction due to:* failure / malfunction of the control /		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	regulating circuit (see also serial no. 14)	1.2.1					x14 _		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			x15 _		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			x16 _		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				
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 EN		x17 _		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	ISO 13850		x18 _		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		x19 _		DM
Identify all hazards		all EC directives		Observe all relevant standards			see layout see table		

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Machine or system-specific hazards Serial. Hazards, no. hazardous situations, hazardous events	Establish conformity with : Applicable standards/techn. Specifications further EC- EN ISO 12100	further EN- National Ref.	Hazard checklist Life Annex I Directives Rules norms	Applicable MRL No. Yes 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	x12 _		GM
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)			x20 _		L
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		x21 _		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	x22 _		GM
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:

Product: Pluggable portable processing machine with laser

Document number.:

Issued by: Philip Kleen

Document part no.:

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

ref No.	Type. vessel No.	Danger	se	Mrs	Pr	Av	class		
1									
2		1 Squeezing at stroke indexing 1 Liquids	3	4	3	1	8th	high risk	
3		and gases under pressure 1 by	3	3	2	3	8th	high risk	
4.1		squeezing 1 by squeezing	3	4	2	1	7	medium risk	
4.2			3	4	3	3	10	high risk	
5, 6	2	Electrical hazards	4	3	2	5	10	high risk	
7		3 Thermal hazards 4 from noise	2	4	2	1	7	low risk low risk	
8th			1	5	2	1	8th	medium risk	
9	6.5	by laser radiation	3	3	2	1	6		
10	7	through materials and substances	2	5	4	3	12	high risk	
11	8.3	by personal protective equipment (PPE) 12 8.6	3	5	3	3	11	high risk	
by		bypassing the protective device 13 8.7 by unsuitable	3	5	3	3	11	high risk	
placement of controls 14, 15 16 17 12 disruption in the power supply			1	5	2	1	8th	small risk	
		11 Unexpected startup of the system	1	2	2	5	9	small risk	
			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	small risk	
20	17	during cleaning/maintenance	2	3	3	3	9	medium risk	
21	20	Insufficient user information	2	3	3	3	9	medium risk	
22	21	by Portable Machine	2	4	2	1	7	small risk	

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

1	When extending the stroke indexing, a finger can be crushed between the lifting plate and the workpiece carrier. When extending the stroke indexing, the arm can be crushed between the stroke indexing with the workpiece and the protective cabin. When retracting the lift indexer, limbs may be crushed between the lift plate and transfer machine or indexer stop
2	
3	Flexible air hoses for indexing and stoppers can rupture or detach and whirl around.
4.1	When observing and pointing, limbs may accidentally enter the stroke indexing work area.
4.2	Limbs can be crushed when eliminating faults, such as a jammed workpiece carrier.
5, 6	In the event of improper electrical installation and operational stress, there is a risk of electric shock when touching live parts.
7	During processing by the laser, the workpiece can heat up.
8th	The noise emitted by the cooling of the laser and by the extraction and filter system can disrupt communication and the perception of acoustic warning noises.
9	The direct laser beam or reflection can cause burns and even loss of vision.
10	Burning (engraving) lettering with the laser can produce different harmful vapors and gases on different materials.
11, 12	When aligning the laser unit, it is necessary to wear PPE, as it is likely that not all protective measures can be used. For better observability and troubleshooting, remove or circumvent the protective device. The operating unit of the laser's own PC control is arranged in the protective housing (housing). This must be dismantled for operation, this is necessary for each
13	connection and disconnection in order to switch the PC control on and off. Good visibility and operability may be restricted depending on the location of the machine.
14, 15 16	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 components starting up unexpectedly.
17	Protective devices can fail in the event of disturbances in the electricity network
18	Despite all protective measures, emergencies can arise for which precautions must be taken. These only affect this machine; other connected systems may also have to be shut down.
19	Component failure of the electronic control (standard PLC) can lead to dangerous situations, especially if the laser is controlled in an uncontrolled manner.
20	When replacing filters and emptying from the suction, the safety instructions for this finished machine must be observed.
21	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.
22	Further hazards from moving the machine must be ruled out in accordance with Annex I of MD Section 3.

4.4. Other hazards with certain machines/equipment This is a mobile machine in accordance with MD Appendix I Paragraph 3. Castors are attached for easier transport.

Further requirements:

As further protective measures, stability during transport must also be guaranteed and it must be possible to stop quickly and drive in a controlled manner.

Further measures:

This can be achieved by handling the machine and instructions in the operating instructions. The stability must be checked constructively. The machine must have brakes for quick stopping.
The control elements should also be able to be attached to this machine so that they can be moved, so that the selection of the intended use is greater.

5. Safety and operating concept The risks for the hazards identified with the help of the hazard checklist (see page 14ff) and described on pages 20 to 20 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 the points ___ until ___.

The following is explained:

- to point 5.1 (see pages ____)
  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 pages ___)
  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 pages ___)
  Measure sheets The
  measure sheets (sheet 1 to ___) 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 20 to ___)
  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 Pages ___)
  ÿ Necessary measures according to the functional description the sides ____.

- to item 5.4 (see pages ___)

  Functionality of the secured system In the
  course of the selection of protective measures in the measure sheets (pages ___ to ___), 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 pages ___)

  Safety plan The
  protective measures described in the measure sheets (pages__) are assigned measure numbers. Their entry in the on ___ results in an overview of the protective measures specified for the machine/system (page ___). layout plan on page

5.1. Required protective measures (overview)

company inIT	**Required protective measures (overview)**						Editor: Philip Kleen Date: 05/12/2015
Consideration of all identified hazards as well as important production and operating requirements in the safety and operating concept.							
life stages of	**Danger points: present location/area/hazards: machine/system object** A construction		**Yes No**	**Necessary protective measures**	**yes**	**no**	**Remarks**
	entire machine	All hazards according to hazard checklist	No	Special protective measures required?		X	Only general caution and care required
B Transportation	entire machine	All hazards according to hazard checklist	No	Special protective measures required?		X	
C Assembly / Installation	entire machine	All hazards according to hazard checklist	Yes	Special protective measures required?	X		
EN Automatic operation semi-automatic operation	entire machine	mechanical hazards (general)	Yes	Safeguarding of hazardous points • individually on each component? • only on certain components? • Area security (e.g. fence, notices)?	X X	X	Because of the large number of hazards, the laser structure is encased
FK All modes with manual Control **(no automatic operation)**	stroke indexing	mechanical hazards (specific)	Yes	1. Is it essential for people to stay in the danger zone? 2. Requires manual control within the facility ly? Special protective measures required because of No. 1 and No. 2?	X	X	The intervention of persons in automatic mode is prohibited and not necessary for production reasons.
DK General operation of the machine / Attachment	entire machine or specific components areas, places	Non-mechanical hazards according to no. 2 to 20 of the hazard checklist	Yes	Special protective measures required?	X		Protect suction from false gases and sparks.
LM cleaning, Maintenance, maintenance	entire Machine, suction	Mechanical hazards dusts	Yes Yes	Machine downtime possible? Special protective measures required?	X X		Regulation in the operating instructions. issuance of operating instructions.
N Decommissioning, dismantling, **see life cycle**	entire machine	All hazards according to the hazard checklist	No	Special protective measures required?		X	As far as foreseeable
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. Ie the measure sheets 1 to ___ are used to document the risk assessment and description of protective measures for a complete system.

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

Column	running Numbers of the identified hazards from the hazard checklist.
1	Identified hazards from the hazard checklist.
Column	All hazardous points (named after location, area or object) at which identified hazards must be expected.
2	Position numbers of the respective system components *(see floor plan page 52).*
Column 3 Column 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 11)
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, page 20). 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. Explanations of the design and development process of a control system according to DIN EN ISO 13849-1 can be found in Annex ___ 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.	

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Column 11 Space for test notes Appendix ___

5.3. action sheets

Manufacturer	Sheet of **measures**	Sheet 1 of X
homemade	**Machine or system-specific risk assessment and description of protective measures Machine / system:**	
	Pluggable, portable processing machine with laser **Type:** - **Machine no.:** - **Year of construction:** 2014 **Customer:**	**Clerk:**
	inIT Order no.: - **Country:** **Germany** Entire machine : **Yes** Partial machine : **No** **Partial area:** **No danger point**	Philip Kleen
		Date: 05/12/2015

From hazard checklist running Hazards Location / area / ref. Hazardous activity, phase general cause of hazard (short text)	object	No.	Dangerous situation, life risk assessment my no.			for the steering	Protection goal(s) / protective measure test ver residual risk user information measures	no _	
1	2	3	4	5	6	7	8th	9	10	11
1 Mechanical hazards b) Arrangement										
be of moving parts d) Speed	Stroke indexing mass and	4	removing jammed workpiece carriers, Accidentally touching while observing, Grasp what is not necessary in automatic mode	I J D	high risk		Surrounding of the danger point according to EN ISO 13857. An access allows easy elimination of faults and shuts down the machine. The enclosure should not obstruct the view of the processing step so that it can continue to be well observed.	1	
accumulation of Energy, air under pressure	compressed air hoses	3	bursting or loosening compressed air hoses	All	high risk		**Measures: •** Fixie hoses at short intervals ren • Limit pressure	2 3	
2 Electrical hazards 2.1 Direct contact with live parts	entire machine	5	Defective components	DM	high risk		Preventing body shock and burns from electric shock: Design, installation and use of electrical equipment in accordance with EN 60204-1 and BGV A3, including electrical testing by a qualified electrician.	4	
2.2 Touching parts that have become live due to malfunctions 3 Thermal hazards	entire machine	6	Poor insulation	DM	high risk				
	Processing with the laser	7	By editing the workpiece can heat up	DM low	risk		Remain in the enclosure until the workpiece has cooled down	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 X	
From hazard checklist running Hazards Location / (short text)	danger point area / ref. Hazardous activity, general phase No. object	No cause of danger	Dangerous situation, life risk assessment	my	for the tax tion	Protection goal / protection measure residual risk user information	dimensions no _	test ver
1	2	3	4	5	6	7	8	9	10	11
4 by noise	entire machine	8	Continuous cooling noises in the vicinity of the machine	DM low	risk		**Objective:** Preventing communication disruptions, maintaining concentration **Measures:** • Observance of EN 1299, En 11688 and EN ISO 15667 • Wearing PPE, hearing protection Indication of noise emission parameters in the **operating instructions.**	6 7 8	
6 by laser beams	laser module	9	Contact with the laser radiation through reaching in or reflection	CM medium	risk		Prevent contact by housing, for better visibility with protective glass. Use harmless laser wavelength Zen	9 10	
7 by gases	Engraving dated workpiece	10	The engraving is burned in with the help of a laser beam, which can produce toxic vapors and gases.	DM medium	risk		Closed booth with suction and filtering	11	
8 Dangers from neglecting ergonomic principles 8.3 Provision of PPE instead of technical alignment	laser unit	11	During installation and high laser unit if the laser equipment risk cal protective equipment by passing	protective equipment	AC		Operating instructions that the protective device must first be installed.	12	
8.6 15	gene laser unit	12	To work better on the laser, bypass the protective device	GI, KM high	risk		This protective device must be designed in such a way that the laser can be set up and rectified without hindrance.	13	
8.7 by inappropriate placement of controls	Operating terminal of the laser control, controls	13	The machine must be opened to operate the laser control	DM low	risk		Install controls outside. Enclosure of the machine must not restrict the view of the monitor	14	

Manufacturer	Measures sheet Machine or system-specific risk assessment and description of protective measures						Sheet 2 of X		
From hazard checklist running Dangers location / (short text)	danger point area / ref. object	Dangerous situation, life risk assessment Dangerous activity, general phase No No cause of danger				for the	Protection goal / protection measure residual risk user information	dimensions no _	test ver
1	2	3	4	5	6	7 Control 8	9	10	11
See hazard checklist		see installation plan		All identified hazards. note	see table see risk graphics		All EC directives, EN standards, techn. spec. note		Rod.
11 Unexpected start, unexpected spin/overspeed (accelerating)							Preventing injury from failure of control and power supply components after an interruption		
11.1 Control system failure/ malfunction	entire machine	14	Application/Use: Self-starting of the machine or individual components	DM low	risk		Run the security functions of the Control according to PL ___ Compliance with EN 1037, EN 60204-1, EN ISO 11161 and VDI 2854 Validation according to EN ISO 13849-2	15	
11.2 Energy supply after an interruption 11.3	entire machine	15		DM low	risk				
External influences on electrical equipment	entire machine	16	Electromagnetic Interference	DM low	risk		Ensuring electromagnetic compatibility in accordance with EN 61000-6-1/2 (immunity to interference) and EN 61000-6-3/4 (emission of interference).	16	
12 Sudden malfunctions	entire machine	17	Use: • Automatic start-up of components • Changing machine parameters • Failure of protective devices, etc	DM low	risk		Prevention of injuries caused by power failure and recovery: Measures according to measure no.: 15, 16, 17, 18		
13 Shutdown in emergencies	entire machine and connected machinery	18	Use	DM medium	risk		Prevention of bodily harm, damage to property and damage to the environment in emergencies and incidents: emergency stop switching devices on the control panel and on the machine with an effect on the entire system (including other connected machines) in compliance with EN ISO 13850 and EN 60204-1 (stop category 0)	17	
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 X	
From hazard checklist running Dangers location / area / ref. Dangerous activity, general phase No (short text)	danger point object	No cause of danger	Dangerous situation, life risk assessment			for the	Protection goal / protection measure residual risk user information	dimensions ver no _	test
1	2	3	4	5	6	7	Control 8	9	10	11
14 errors in control /loop Unexpected operational disruptions	entire machine	19 Use: Automatic start-up of components • Non-execution of stop commands • Changing machine parameters • Failure of protective devices, etc			DM low	risk		Prevention of injuries caused by the failure of control components: Execution of the safety functions according to PL __ (see measure no. 15) Liberation of the PLC from safety responsibility through an additional control with contacts.	18	
17 through cleaning/ maintenance	suction	20 Forgetting to replace and empty the suction. Rods from the filter 21 insert/use			L	medium risk		Instruction that the operating instructions, the extraction must be followed.	19	
20 insufficient user information residual risks	In total machine				DM medium	risk		Prevention of 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 understandable operating instructions. In addition, the operating instructions are issued.	20	
21 by mobile machines	entire machine	22 Use			GM minor	risk		Note on transport in the operating instructions.	21	
See hazard checklist	see installation plan		All identified hazards. note		see table see risk graphics			All EC directives, EN standards, techn. spec. note		Rod.

5.4. Functionality of the secured machine/system Taking into account all the requirements and fundamental 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 details for implementation are contained in the action sheets.

Automatic mode:

The switch-on operations prescribed for automatic mode are made as follows: • Connect to a suitable processing station • Switch on systems/ controls • Configure machine control (teaching) • Extraction and filter system ready for operation • Laser unit ready for operation • Protective device of the processing area closed • Housing/protective device of Machine closed • Persons are aware of the residual risk • Acknowledge errors • Start with the pushbutton The machine must not be unplugged during operation. If unintentionally unplugged, other connected machines will come to a safe stop. This machine comes to a controlled stop and systems *are not shut down properly.* Restoring automatic mode requires the operator to follow the same procedure as mentioned above, the machine must be put into operation again.

By taking the key that is used to configure the safety-relevant machine control with them, the operating personnel can prevent a second person from inadvertently reconfiguring the configuration.

The laser is switched off by opening or removing the protective device and the machine stops. Restoring automatic mode requires the following actions by the operating personnel in this specific order: • Reattach and close protective devices • Acknowledge errors with the push button • Start with the push button

Switching off or malfunctioning of the extraction and filter system lead to a safe stop of the machine. Restoring automatic operation requires the following actions by the operator in a specific order: • Acknowledge error with push button • Restart suction and filter system • Start with push button

Eliminating malfunctions in the work process
Malfunctions must not be eliminated in automatic mode; it must be ensured that the laser unit does not pose any danger.
To do this, it must be switched off. In semi-automatic mode, the stroke indexing can be moved to release a jammed workpiece carrier. The protective device must be closed for this.

Working on the processing machine with a laser in automatic mode No work is required in automatic mode. The machine runs fully automatically. The manual insertion of workpieces is not possible and not permitted in automatic mode. The loading of the machine must be taken over by another compatible, safe machine.

Setting up, adjusting, testing, troubleshooting and troubleshooting The machine is designed to be connected to a machine that provides suitable interfaces for processing machines. These must be configured accordingly so that safety-related communication can be established. This can be tested by pressing a button on this machine (teaching). The teaching must be carried out each time the device is plugged in again. Regardless of whether the position was changed. It is therefore a switch-on operation for the automatic operation.

The machine only has an automatic mode, there is no manual or semi-automatic operation. For extended troubleshooting and settings, specialist personnel must access the control software, which can be used to change individual parameters in the control.

Cleaning, maintenance, repairs This work can be carried out when the system is at a standstill with the energy system secured against being switched on. When servicing the extraction and filter system, proceed according to the provisions of these.

Emergency stop functions

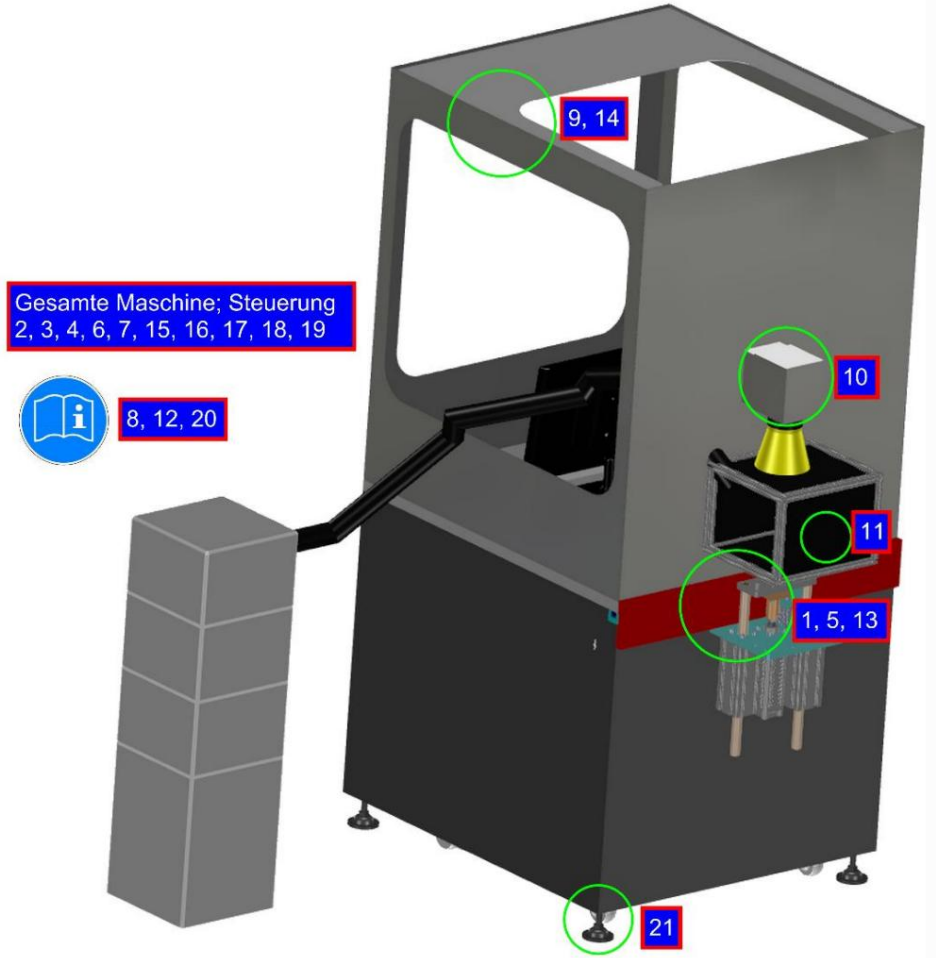
Emergency stop protective devices are required at every control point on the machine, each affecting the entire safety area of integrated production. In the same way, the actuation of an emergency stop on another machine in the safety area leads to a standstill of this processing machine.

Disconnecting this processing machine in automatic mode leads to a safe standstill of this machine and to the safe stop of all associated machines in the respective safety area.

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.*~~



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. Figure 3 on page 37 can be used to determine the required **performance level according to DIN EN ISO 13849-1 .**
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 40. 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.

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Table 1: Risk assessment form

Product: _____ Document number.:

Issued by: _____ 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		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

1. **Safety concept** for all life phases of the machine/plant and **all necessary interventions** by the operator set up serving staff	**EN ISO 12100** 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	

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

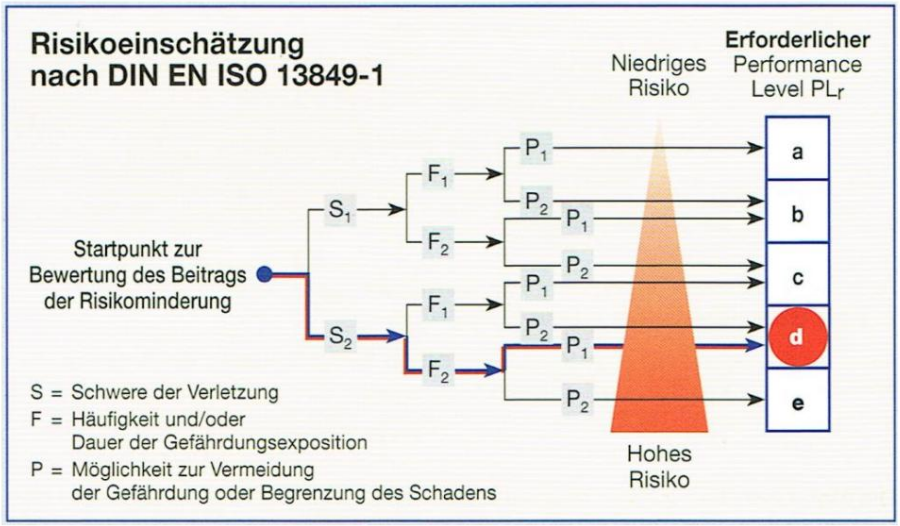

Figure 3: Determination of the required performance level PLr.

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 3, 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 4: 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.

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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 DIN 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 having Z Additional tests (e.g.	
pressure, load, material, stability test.) Specialist standards ZU	

3 – List of standards This list of standards contains standards and technical specifications that are listed in the risk 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 EN 981 EN 953	displays EN 1005 Safety of	
and acoustic signals EN 1005-3 Human	physical performance	
(force limits)		
CR 1030 Hand-Arm Vibration (Guide)		
1032 EN 1037 Avoidance of unexpected start	Whole-body vibration EN	
up EN 1088 Interlocking devices EN 1127-1	Explosion protection EN 1299 Vibration	
isolation EN 1760 Pressure-sensitive protective devices EN	Easy 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	Construction 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
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 Noise protection through silencers	x
EN ISO 13857	Stationary accesses Noise protection encapsulation Electronic	
EN ISO 14163	equipment Explosion protection Electrical equipment Housing	
EN ISO 14122	protection types Laser devices Low-voltage switchgear	
EN 150 15667	Electromagnetic compatibility (EMC)	
EN 50178 EN		
60079 EN		
60204-1 EN		x
60529 EN		
60825 EN		
60947 EN		
61000 Part 6-1 to 6-4 DIN		
EN 61241-14 Electrical equipment for use in areas with combustible dust		
EN61310	Displays, license plates, operating elements Non-contact protective devices El. programmable systems detection of	
EN61496	the presence of people functional safety of controls	
EN61508		
EN62046		
EN62061		

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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		