Machine Safety – Risk Assessment

Customer:

1. Project information

1.1 Company information

This risk assessment is made for the following company:

Name	
Attn.	
Street	
ZIP code	
Town	
Country	
Homepage	
E-mail	
Phone	
C.o.C.	
Logo	

1.2. General project information

Each risk assessment is (part of) a project. General information is given here:

Date	
Customer / department	
Name	
Description	

1.3 Document information

Initial document information

Document name	
Document date	
Document owner name	

Revision information 1

Document name	
Document date	
Document owner name	
Revision information	

Revision information 2

Document name	
Document date	
Document owner name	
Revision information	

1.4 Risk assessment team members

Each risk assessment is done by a team.

A team consists of more persons each with a different skillset and knowledge base, this is what determines the quality of the risk assessment.

Mostly persons with different roles are involved. A role can be engineer, machine specialist, safety manager, user, mechanic, etc.

Member 1:

First name	
Last name	
Role	
Skillset / knowledge base	
E-mail	
Phone	

Member 2:

First name	
Last name	
Role	
Skillset / knowledge base	
E-mail	
Phone	

Member 3:

First name	
Last name	
Role	
Skillset / knowledge base	
E-mail	
Phone	

Member 4:

First name	
Last name	
Role	
Skillset / knowledge base	
E-mail	
Phone	

1.5 Machines involved in this risk assessment

More than 1 machine can be involved in a risk assessment. A production or assembly line mostly consists of more machines.

For each machine the following information is needed. In case of an assembly there always is a assembly named.

1.5.1 Machine 1

Machine information:

Make	
Category	Kies een item.
Type	
Serial number	
Country of Origin	
Year	
Description	
Picture	

Manufacturer information of this machine:

Name	
Street	
ZIP code	
Town	
Country	
Homepage	
E-mail	
Phone	
C.o.C.	
Logo	

1.5.2 Machine 2

Machine information:

Make	
Category	Kies een item.
Type	
Serial number	
Country of Origin	
Year	
Description	
Picture	

Manufacturer information of this machine:

Name	
Street	
ZIP code	
Town	
Country	
Homepage	
E-mail	
Phone	
C.o.C.	
Logo	

1.5.3 Machine 3

Machine information:

Make	
Category	Kies een item.
Type	
Serial number	
Country of Origin	
Year	
Description	
Picture	

Manufacturer information of this machine:

Name	
Street	
ZIP code	
Town	
Country	
Homepage	
E-mail	
Phone	
C.o.C.	
Logo	

1.6 Machine number 1 description and limits

1.6.1 General machine number 1 description

Enter a general description of machine 1 here.

1.6.2 Machine number 1 control system description

Describe the control system of machine 1 here.

1.6.3 Machine number 1 specification

Several machine specifications are described here.

Machine limits	
Intended environment:	
Required level of training:	
Operated by:	
Intended use:	
Machine lifetime:	
Global machine dimensions and weight:	
Machine environment:	

Operational information	
Input:	
Output:	
Emergency stopping time:	
Duration of 1 cycle in normal operation:	
Number of operation stations:	
Number of operators:	
Operational manual present?	

Maintenance information	
Maintained by:	
Maintenance frequency:	
Maintenance manual present?	
Description of maintenance:	

Cleaning information	
Cleaning by:	
Cleaning frequency:	
Description of cleaning:	

Power sources	
Electrical:	
Pneumatic:	
Hydraulic:	
Other:	

1.7 Machine number 2 description and limits

1.7.1 General machine number 1 description

Enter a general description of machine 1 here.

1.7.2 Machine number 2 control system description

Describe the control system of machine 1 here.

1.7.3 Machine number 2 specification

Several machine specifications are described here.

Machine limits	
Intended environment:	
Required level of training:	
Operated by:	
Intended use:	
Machine lifetime:	
Global machine dimensions and weight:	
Machine environment:	

Operational information	
Input:	
Output:	
Emergency stopping time:	
Duration of 1 cycle in normal operation:	
Number of operation stations:	
Number of operators:	
Operational manual present?	

Maintenance information	
Maintained by:	
Maintenance frequency:	
Maintenance manual present?	
Description of maintenance:	

Cleaning information	
Cleaning by:	
Cleaning frequency:	
Description of cleaning:	

Power sources	
Electrical:	
Pneumatic:	
Hydraulic:	
Other:	

1.8 Machine number 3 description and limits

1.8.1 General machine number 3 description

Enter a general description of machine 1 here.

1.8.2 Machine number 3 control system description

Describe the control system of machine 1 here.

1.8.3 Machine number 3 specification

Several machine specifications are described here.

Machine limits	
Intended environment:	
Required level of training:	
Operated by:	
Intended use:	
Machine lifetime:	
Global machine dimensions and weight:	
Machine environment:	

Operational information	
Input:	
Output:	
Emergency stopping time:	
Duration of 1 cycle in normal operation:	
Number of operation stations:	
Number of operators:	
Operational manual present?	

Maintenance information	
Maintained by:	
Maintenance frequency:	
Maintenance manual present?	
Description of maintenance:	

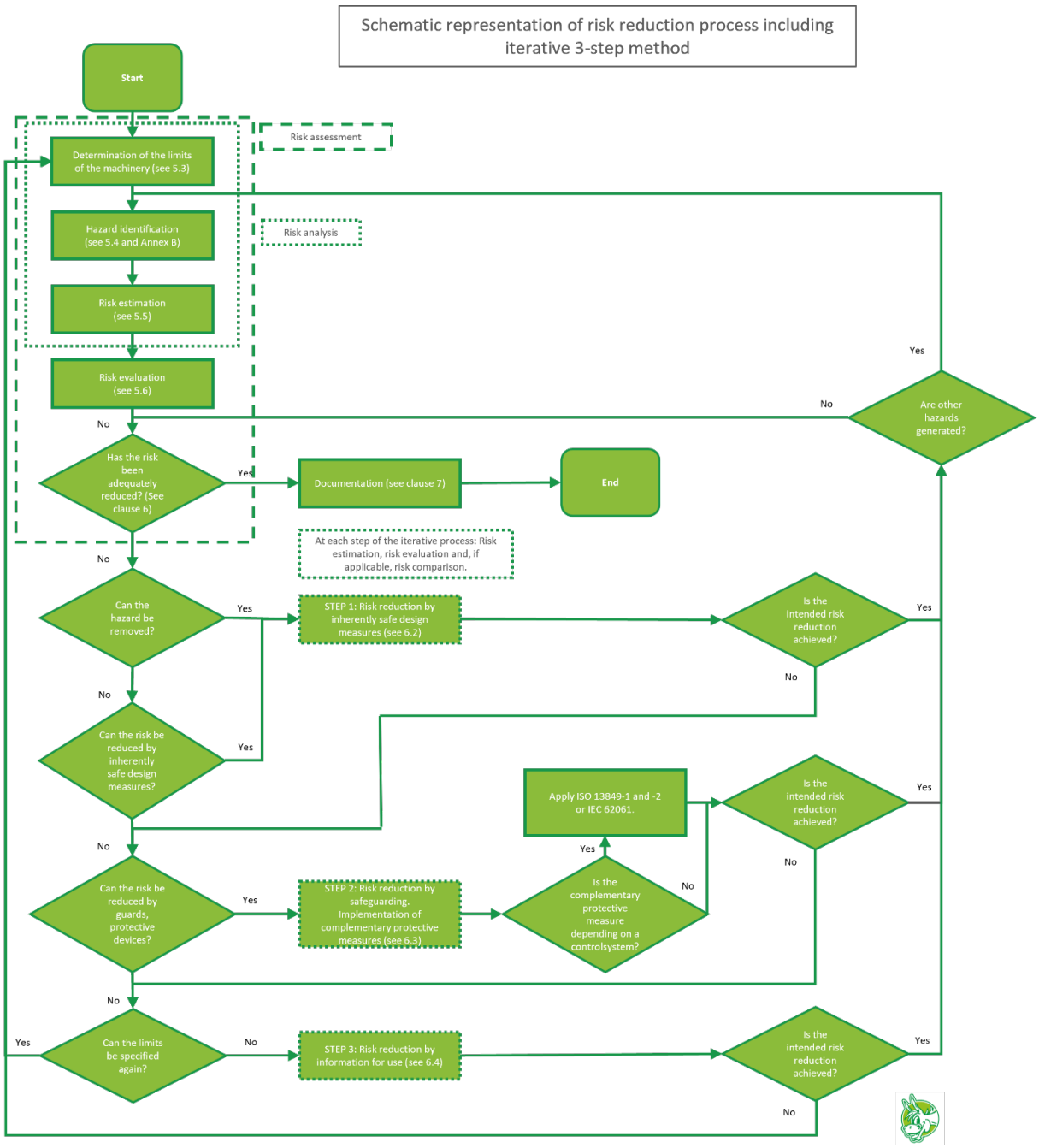
Cleaning information	
Cleaning by:	
Cleaning frequency:	
Description of cleaning:	

Power sources	
Electrical:	
Pneumatic:	
Hydraulic:	
Other:	

2. Theoretical method

2.1 Method of risk assessment

Risk assessment is part of the ISO 12100:2010 risk reduction process as shown below:

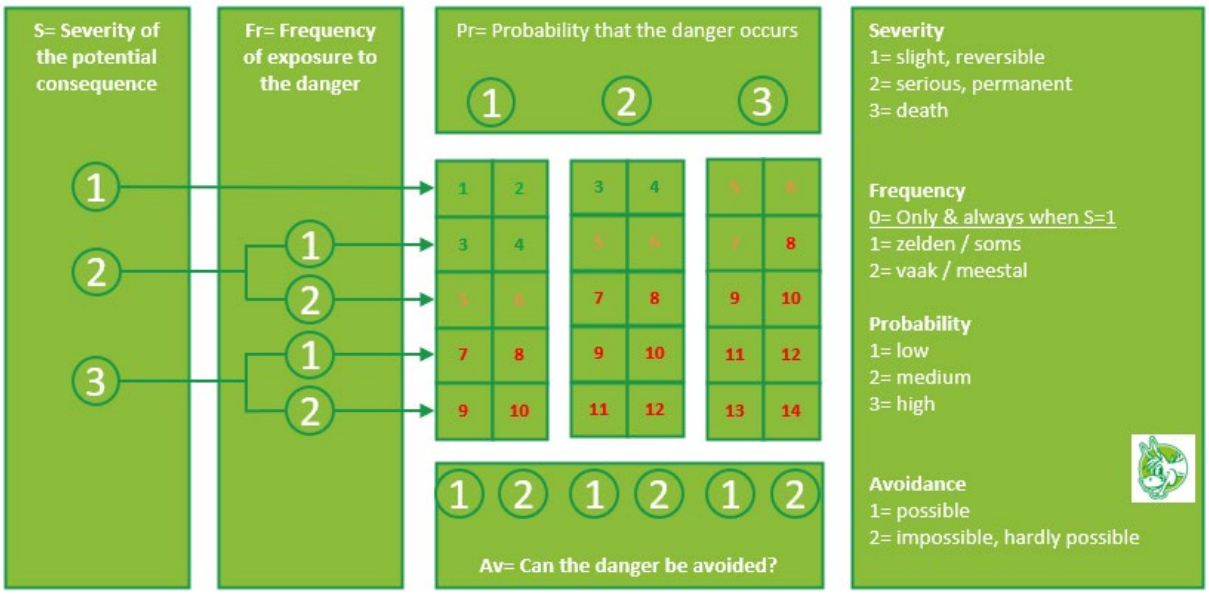


2.2 Risk evaluation method

After identifying the hazards and consequently risks an evaluation method needs to be chosen. The choice is free, but we suggest 2 formats:

2.2.1 Riskgraph

This method is easy to use and embedded in the risk assessment tool.



Risk figure	Risk is	Measures
1 up to 4	Low	Risk is acceptable, ALARA
5 up to 7	Medium	Additional measures needed
8 up to 10	High	Immediate additional measures needed
11 up to 14	Very high	Stop work

2.2.2 Hazard rating

This method is more profound. It can also result in discussion between the risk assessment team member because of the number of possibilities.

This method is embedded in the risk assessment tool.

Within this method risks are rated as:

	HR	Risk	Comment
	1 - 10	Negligible Risk	Presents practically no risk to health and safety, no further risk reduction measures are required.
	11 - 20	Very Low Risk	Presents very little risk to health and safety, no significant risk reduction measures are required, may necessitate the use of personal protective equipment and/or training.
	21 - 45	Low Risk	Risk to health and safety is present, but low. Risk reduction measures must be considered.
	46 - 160	Significant Risk	The risk associated with the hazard is substantial enough to require risk reduction measures. These measures should be implemented at the next suitable opportunity.
	161 - 500	High Risk	Potentially dangerous hazard, which requires risk reduction measures to be implemented urgently.
	501+	Very High Risk	Risk reduction measures should be implemented immediately, corporate management should be notified.

The hazard rating is calculated as:

HR = DPH x PO x PA x FE

Degree of Possible Harm (DPH)

0.25	Scratch / Bruise
0.5	Laceration / cut / mild ill health effect/ minor burns
3	Fracture minor bone – fingers, toes
5	Fracture major bone – hand, arm, leg
8	Loss of 1 or 2 fingers/ toes or major burns
11	Leg / hand amputation, partial loss of hearing or eye
15	Amputation of 2 legs/hands, total loss of hearing/sight in both ears/eyes
25	Critical injuries or permanent illness/condition/injury
40	Single Fatality
65	Catastrophe

Possibility of Occurrence of Hazard Event (PO)

0.05	Almost impossible
1.25	Unlikely
2.5	Possible
4	Probable
6	Certain

Possibility of Avoidance (PA)

0.75	Possible
2.5	Possible under certain circumstances
5	Not Possible

Frequency of Exposure (FE)

0.5	Annually
1	Monthly
2	Weekly
3	Daily
4	Hourly
5	Constantly

2.3 Chosen method of risk evaluation

Riskgraph / hazard rating / other.

3. Findings

See the risk assessment forms.

General information			
Title	*<Free text>*		
Machine	3		
Location	*<Free text>*		
Determination of the limits of the machine			
Activity	Malfunction		
Task description	*<Free text>*		
Space limit	SL2		
Time limit	TL3		
Other	OL1		
Hazard identification			
Target	Arms		
Description	*<Free text>*		
Hazard type / group (ISO 12100)	Material/substance		
Origin of hazard (ISO 12100)			
Potential consequences (ISO 12100)			
Pictures			
Risk evaluation (hazard rating method)			
Degree of Possible Harm (DPH)	3	**Possibility of Avoidance**	2,5
Possibility of Occurrence of Hazard E	2,5	**Frequency of Exposure**	2
HR = DPH x PO x PA x FE =	**37,5**	**Low Risk**	
Risk evaluation (riskgraph method)			
Severity (degree of possible harm)	3	**Probability**	1
Frequency of exposure	2	**Possibility of avoidance**	1
Risk number	**9**	**Immediate measures necessary**	
Risk reduction STEP 1 Safe design		**Standard reference**	
<Free text>			
Risk reduction STEP 2 Safeguarding / protective		**Standard reference**	
<Free text>			
Risk reduction STEP 3 Information for use		**Standard reference**	
<Free text>			
Possible residual risk (hazard rating method)			
Degree of Possible Harm (DPH)	0,5	**Possibility of Avoidance**	2,5
Possibility of Occurrence of Hazard E	2,5	**Frequency of Exposure**	2
HR = DPH x PO x PA x FE =	**6,3**	**Negligible Risk**	
Possible residual risk (riskgraph method)			
Severity (degree of possible harm)	3	**Probability**	1
Frequency of exposure	2	**Possibility of avoidance**	1
Risk number	**9**	**Immediate measures necessary**	

4. Priority listing

5. Risk reduction

Risk reduction is done by:

1. elimination of the hazard by design;
2. design requirements and determination of task zone(s);
3. safeguarding and complementary measures, including span of control;
4. providing information for use.

(also see the figure in 2.1)

6. Conclusion

Extra: Integrated Manufacturing systems (IMS) ISO 11161

For the integration of 2 or more machines ISO 11161:2007 is used. In that case the next chapters need special attention and are included as extra chapters in this document. These chapters are all part of the risk reduction process for IMS:

- Task zones (chapter 7 of ISO 11161);
- Safeguarding and span of control (chapter 8 of ISO 11161);
- Information for use (chapter 9 of ISO 11161);
- Validation of the design (chapter 10 of ISO 11161).

The supporting excel sheet can be used here.

7 Task zone(s) ISO 11161

7.1 General

7.2 Determination

7.3 Design

7.4 Functional analysis

8 Safeguarding and span of control ISO 11161

8.1 Safeguarding of task zones

8.2 Span of control

8.3 Electrical equipment requirements

8.4 Modes

8.5 Safeguards

8.6 Protective measures when safeguards are suspended

8.7 Muting and blanking

8.8 Control

8.9 Reset of perimeter safeguarding devices

8.10 Start/restart

8.11 Emergency stop

8.12 Measures for the escape and rescue of trapped persons

9 Information for use ISO 11161

9.1 General

9.2 Marking

10 Validation of the design ISO 11161

10.1 Validation that the design meets the requirements

10.2 Validation of the protective measures

5.3 Determination of limits of machinery

5.3.1 General

Risk assessment begins with the determination of the limits of the machinery, taking into account all the
phases of the machinery life. This means that the characteristics and performances of the machine or a series
of machines in an integrated process, and the related people, environment and products, should be identified
in terms of the limits of machinery as given in 5.3.2 to 5.3.5.

5.3.2 Use limits

Use limits include the intended use and the reasonably foreseeable misuse. Aspects to be taken into account
include the following:

a) the different machine operating modes and different intervention procedures for the users, including
interventions required by malfunctions of the machine;
b) the use of the machinery (for example, industrial, non-industrial and domestic) by persons identified by
sex, age, dominant hand usage, or limiting physical abilities (visual or hearing impairment, size, strength,
etc.);
c) the anticipated levels of training, experience or ability of users including
    1) operators,
    2) maintenance personnel or technicians,
    3) trainees and apprentices, and
    4) the general public;
d) exposure of other persons to the hazards associated with the machinery where it can be reasonably foreseen:
    1) persons likely to have a good awareness of the specific hazards, such as operators of adjacent
    machinery;
    2) persons with little awareness of the specific hazards but likely to have a good awareness of site
    safety procedures, authorized routes, etc., such as administration staff;
    3) persons likely to have very little awareness of the machine hazards or the site safety procedures, such as visitors or members of the general public, including children.

If specific information is not available in relation to b), above, the manufacturer should take into account
general information on the intended user population (for example, appropriate anthropometric data).

5.3.3 Space limits

Aspects of space limits to be taken into account include

a) the range of movement,
b) space requirements for persons interacting with the machine, such as during operation and maintenance,
c) human interaction such as the operator–machine interface, and
d) the machine–power supply interface.

5.3.4 Time limits

Aspects of time limits to be taken into account include

a) the life limit of the machinery and/or of some of its components (tooling, parts that can wear, electromechanical components, etc.), taking into account its intended use and reasonably foreseeable misuse, and

b) recommended service intervals.

5.3.5 Other limits

Examples of other limits include

a) properties of the material(s) to be processed,

b) housekeeping — the level of cleanliness required, and

c) environmental — the recommended minimum and maximum temperatures, whether the machine can be operated indoors or outdoors, in dry or wet weather, in direct sunlight, tolerance to dust and wet, etc.