

Contents

Page

Foreword	v
Introduction.....	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Strategy for risk assessment and risk reduction	9
5 Risk assessment	12
5.1 General	12
5.2 Information for risk assessment	12
5.3 Determination of limits of machinery	13
5.3.1 General	13
5.3.2 Use limits	13
5.3.3 Space limits	14
5.3.4 Time limits	14
5.3.5 Other limits	14
5.4 Hazard identification	14
5.5 Risk estimation	16
5.5.1 General	16
5.5.2 Elements of risk	17
5.5.3 Aspects to be considered during risk estimation	19
5.6 Risk evaluation	21
5.6.1 General	21
5.6.2 Adequate risk reduction	21
5.6.3 Comparison of risks	21
6 Risk reduction	22
6.1 General	22
6.2 Inherently safe design measures	23
6.2.1 General	23
6.2.2 Consideration of geometrical factors and physical aspects	23
6.2.3 Taking into account general technical knowledge of machine design	24
6.2.4 Choice of appropriate technology	25
6.2.5 Applying principle of positive mechanical action	25
6.2.6 Provisions for stability	25
6.2.7 Provisions for maintainability	26
6.2.8 Observing ergonomic principles	26
6.2.9 Electrical hazards	27
6.2.10 Pneumatic and hydraulic hazards	27
6.2.11 Applying inherently safe design measures to control systems	28
6.2.12 Minimizing probability of failure of safety functions	33
6.2.13 Limiting exposure to hazards through reliability of equipment	33
6.2.14 Limiting exposure to hazards through mechanization or automation of loading (feeding)/ unloading (removal) operations	34
6.2.15 Limiting exposure to hazards through location of setting and maintenance points outside danger zones	34
6.3 Safeguarding and complementary protective measures	34
6.3.1 General	34
6.3.2 Selection and implementation of guards and protective devices	35
6.3.3 Requirements for design of guards and protective devices	40
6.3.4 Safeguarding to reduce emissions	43

6.3.5	Complementary protective measures.....	44
6.4	Information for use	46
6.4.1	General requirements.....	46
6.4.2	Location and nature of information for use	46
6.4.3	Signals and warning devices.....	46
6.4.4	Markings, signs (pictograms) and written warnings.....	47
6.4.5	Accompanying documents (in particular — instruction handbook)	48
7	Documentation of risk assessment and risk reduction.....	51
Annex A (informative)	Schematic representation of a machine.....	52
Annex B (informative)	Examples of hazards, hazardous situations and hazardous events	53
Annex C (informative)	Trilingual lookup and index of specific terms and expressions used in ISO 12100.....	63
Bibliography	75