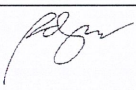
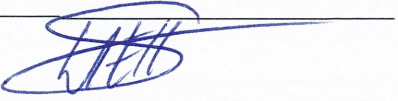


ASSESSMENT REPORT

According to EN ISO 12100:2010

Safety of Machinery -General principles for design

Risk assessment and risk reduction

Report Reference No.	: N/A		
Compiled by.....	: Percival dela Peña		
Reviewed by	: Hayden Ellis		
Date of issue	: August 12, 2025		
Standard.....	: EN ISO 12100:2010		
Test Procedure	: N/A		
Non-standard test method.....	: N/A		
Number of page(s) (Report).....	: 49		
Number of page(s) (Attachments).....	: N/A		
Type of test object.....	: Skid Steer		
Model and/or type reference.....	: SK-25D-890-AU		
Manufacturer(s):.....	: Makinex Pty Ltd		
Address.....	: 15 Waltham St. Artarmon, New South Wales, 2064 Australia		
Rating	: Engine power: 18.2 kW/25 hp Operating mass: 1470 kg		
General Information: The machine is a platform, rubber track mini skid steer machine designed for light-to-medium duty construction work that operates in temperatures typically experienced in earth moving and construction work environment.			
Test result.....	: Pass		
Compiled by.....: Percival dela Peña (+ signature)  Approved by.....: Hayden Ellis (+ signature) 			

1. Risk assessment

This risk assessment report is based on the methods in the EN ISO 12100:2010 and EN ISO 14121-2 standards, and the 4 factors S-F-O-A have been used for evaluating the level of risks.

S: Severity of possible harm

S1: Slight injury (normally reversible)

S2: Serious injury (normally irreversible, including fatality)

F: Frequency and/or duration of exposure to hazard

F1: Seldom to quite often and/or short duration of exposure (twice or less per work shift or less than 15 mins cumulated exposure per work shift.

F2: Frequent to continuous and/or long duration of exposure (more than twice per work shift or more than 15 mins cumulated exposure per work shift.

O: Probability of occurrence of a hazardous event

O1: Low (so unlikely that it can be assumed that occurrence may not be experienced). Mature technology, proven and recognized in safety application; robustness.

O2: Medium (likely to occur sometime). Technical failure observed in the two last years.

Inappropriate human action by a well-trained person aware of the risk and having more than six months experience on the work station.

O3: High (likely to occur frequently). Technical failure regularly observed (every six months or less). Inappropriate human action by an untrained person having less than six months experience on the work station.

A: Possibility of avoidance or reduction of harm

A1: Possible under some conditions.

- If parts move at a speed less than 0.25m/s and the exposed worker is familiar with the risk and with the indication of a hazardous situation or impending event; the worker also has to be capable of noticing the hazardous situation and being capable of reacting.

- depending on particular conditions (temperature, noise, ergonomic, etc).

A2: Impossible

		Risk Index Calculation					
		O1		O2		O3	
		A1	A2	A1	A2	A1	A2
S1	F1	1				2	
	F2						
S2	F1	2		3		4	
	F2	3	4	5		6	

- a risk index of 1 or 2 corresponds to the lowest risk.
- a risk index of 3 or 4 corresponds to a medium risk, and
- a risk index of 5 or 6 corresponds to a highest risk.

Solutions for the level of hazards based on risk index

1 or 2: Negligible or protected by warning sign

3 or 4: Protected by guard and warning sign

5 or 6: Consider the other design, choose the best one, add both guard and warning sign

Table B.1: Examples of hazards				
No.	Type or group	Hazard	Verdict (Y/N)	Reference no.
1	Mechanical hazards	a. being run over	Y	1a
		b. being thrown	Y	1b
		c. crushing	Y	1c
		d. cutting or severing	N	
		e. drawing-in or trapping	Y	1e
		f. entanglement	N	
		g. friction or abrasion	Y	1g
		h. impact/falling objects	Y	1h
		i. injection	Y	1i
		j. shearing	N	
		k. slipping, tripping and falling	Y	1k
		l. stabbing or puncture	N	
		m. suffocation	N	
		n. high pressure	N	
		o. rotating/moving elements	N	
		p. sharp edges	N	
2	Electrical hazards	a. burn	N	
		b. chemical effects	N	
		c. electrocution	N	
		d. falling, being thrown	N	
		e. fire	Y	2e
		f. projection of molten particles	N	
		g. shock	N	
		h. overload	N	
		i. live parts	N	
		j. short circuit/arc	N	
3	Thermal hazards	a. burn/materials with high or low temperature	Y	3a
		b. dehydration	N	
		c. discomfort	N	
		d. frostbite	N	
		e. injuries by the radiation of heat sources	Y	3e
		f. scald	N	
		g. explosion	N	
		h. flame	N	
4	Noise hazards	a. discomfort	Y	4a
		b. loss of awareness	N	
		c. loss of balance	N	
		d. permanent hearing loss	N	
		e. stress	Y	4e
		f. tinnitus	Y	4f
		g. tiredness	Y	4g
		h. moving or unbalanced moving parts	N	
		i. whistling pneumatics	N	
		j. any other (mechanical, electrical) as a consequence of an interference with speech communication or with acoustic signals	Y	4j
5	Vibration	a. discomfort	Y	5a
		b. low back morbidity	Y	5b
		c. neurological disorder	N	
		d. oste-articular disorder	Y	5d
		e. trauma of the spine	N	
		f. vascular disorder	Y	5f
		g. vibrating equipment	N	
		h. mobile equipment	N	

6	Radiation hazards	a. burn	N	
		b. damage to eyes and skin	N	
		c. effects on reproductive capability	N	
		d. mutation	N	
		e. headache, insomnia, etc	N	
7	Material/substance hazards	a. breathing difficulties	N	
		b. cancer	N	
		c. corrosion	N	
		d. effects on reproductive capability	N	
		e. explosion	N	
		f. fire	N	
		g. infection	N	
		h. mutation	N	
		i. poisoning	N	
		j. sensitization	N	
		k. combustible/gas	N	
		l. dust/fibre	N	
		m. fume/flammable	N	
		n. fluid/mist	N	
8	Ergonomic hazards	a. discomfort	Y	8a
		b. fatigue	Y	8b
		c. musculoskeletal disorder	N	
		d. stress	N	
		e. posture	N	
		f. any other (mechanical, electrical) as a consequence of a human error	Y	8f
9	Hazards associated with the environment in which the machine is used	a. burn	N	
		b. slight disease	N	
		c. slipping, falling	N	
		d. suffocation/lack of oxygen	N	
		e. dust and fog	N	
		f. temperature	N	
		g. water	N	
		h. wind	N	
		i. any other as a consequence of the effect caused by the sources of the hazards on the machine or parts of the machine	Y	9i
10	Combination of hazards	a. dehydration, loss of awareness, heat stroke	N	

Risk assessment and estimation table

Hazard identification				Risk estimation				
Ref. number based on Table B.1	Hazard source	Hazardous situation (zone, presence of persons)	Hazardous event (when)	S	F	O	A	Risk Index
1a	Being run over	Acceleration, deceleration	The bucket and the arm movements have risk of running over. This risk may cause danger to the people around the machine.	2	2	2	2	5
1b	Being thrown	Angular parts	When the machine is tipping over or rolling over the operator may be thrown out and cause danger.	2	2	2	2	5
1c	Crushing	Approach of a moving element to a fixed part	The mobility of the machine may cause crushing of people around	2	2	2	2	5
1e	Drawing-in or trapping	Cutting parts	There are drawing in risks at the engine transmission belt and engine cooling fan	2	2	2	2	5
1g	Friction or abrasion	Falling objects	Friction of hand may occur when the operator touches the crawler from the operating station	2	1	3	2	4
1h	Impact/falling objects	Gravity	The machine may impact people around during travelling.	2	2	3	2	6
1i	Injection	Height of the ground	The hydraulic oil may be injected when the hose or pipe is broken	2	1	3	2	4
1k	Slipping, tripping, falling	Instability	Slipping, tripping and falling may occur during accessing or exiting the operating station.	2	1	3	2	4
2e	Fire	Overload	Fire risk caused by overload.					5
3a	Burn	Explosions	The area around the engine in the compartment has the risk of burning.	2	1	3	2	4
3e	Injuries by the radiation of heat sources	Radiation from heat sources	The heat from the engine compartment may cause risk to the operator.	2	1	3	2	4
4a	Discomfort	Cavitations phenomena	The noise may cause the operator	2	2	3	1	5

			and environment risk.					
4e	Stress	Manufacturing process	The noise may cause the operator and environment risk.	2	2	3	1	5
4f	Tinnitus	Moving parts	The noise may cause the operator and environment risk.	2	2	3	1	5
4g	Tiredness	Scrapping surfaces	The noise may cause the operator and environment risk.	2	2	3	1	5
4j	Any other (mechanical, electrical) as a consequence of an interference with speech communication or with acoustic signals	Worn parts	The noise may cause the operator and environment risk.	2	2	3	1	5
5a	Discomfort	Cavitations' phenomena	Vibration may cause the operator risk of disease	2	2	2	2	5
5b	Low back morbidity	Misalignment of moving parts	Vibration may cause the operator risk of disease	2	2	2	2	5
5d	Oste-articular disorder	Mobile equipment	Vibration may cause the operator risk of disease	2	2	2	2	5
5f	Vascular disorder	Unbalanced rotating parts	Vibration may cause the operator risk of disease	2	2	2	2	5
8a	Discomfort	Accessibility	Lack of ergonomics may cause the operator risk	2	1	3	2	4
8b	Fatigue	Design of location of indicators	Lack of ergonomics may cause the operator risk	2	1	3	2	4
8f	Any other (mechanical, electrical) as a consequence of human error	Mental overload/underload, posture, design and location of identification of control devices	Lack of ergonomics may cause the operator risk	2	1	3	2	4
9i	any other as a consequence of the effect caused by the sources of the	Moisture, temperature, lightning, water, wind, dust and fog	The dust on site may cause the operator to lackof oxygen.	2	1	3	2	4

	hazards on the machine or parts of the machine							
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Risk reduction and risk assessment after risk reduction table

Ref. number based on Table B.1	Risk reduction Control measures	Risk estimation after risk reduction				
		S	F	O	A	Risk index
1a	The movement will be limited by hydraulic cylinders. Only trained staff with adequate skills and knowledge will operate the machine. Safety instructions included in manual. PPE is necessary during operation	1	1	1	1	1
1b	Only trained staff with adequate skills and knowledge will operate the machine. Safety instructions included in manual. PPE is necessary during operation	1	1	1	1	1
1c	Enough visibility is provided. Horn is provided to give an audible warning before starting the machine.	1	1	1	1	1
1e	The door of the engine compartment is lockable. This is a reliable fixing guard.	1	1	1	1	1
1g	Only trained staff with adequate skills and knowledge will operate the machine. Safety instructions included in manual. PPE is necessary during operation	1	1	1	1	1
1h	Enough visibility is provided. Horn is provided to give an audible warning before starting the machine.	1	1	1	1	1
1i	The hydraulic hoses and pipes have enough safety factor.	1	1	1	1	1
1k	Slip resistance material is provided for the floor of operating station. PPE is necessary during the operation.	1	1	1	1	1
2e	Over current devices are provided in the electric system. Fire resistance materials are used. Location for fire extinguishers is provided.	1	1	1	1	1
3a	All heating elements are protected and non-accessible. Parts and pipes with high temperature are covered by heat insulation material.	1	1	1	1	1
3e	Well designed engine compartment and operating station to avoid excessive heat accumulation within limited space. Allow engine to cool down before commencing maintenance.	1	1	1	1	1
4a	Effective noise reduction design to reduce noise caused by mechanical movement and driving.	1	1	1	1	1
4e	Effective noise reduction design to reduce noise caused by mechanical movement and driving. Safety instructions included in manual. Use PPE when necessary.	1	1	1	1	1
4f	Effective noise reduction design to reduce noise caused by mechanical movement and driving. Safety instructions included in manual. Use PPE when necessary.	1	1	1	1	1
4g	Effective noise reduction design to reduce noise caused by mechanical movement and driving. Safety instructions included in manual. Use PPE when necessary.	1	1	1	1	1
4j	Effective noise reduction design to reduce noise caused by mechanical movement and driving. Safety instructions included in manual. Use PPE when necessary.	1	1	1	1	1
5a	Effective design to avoid leakage and leakage point is far from the hot surface. Only trained staff with adequate skills and knowledge will operate the machine. Where appropriate, use footwear and take regular breaks.	1	1	1	1	1
5b	Effective design to avoid leakage and leakage point is far from the hot surface. Only trained staff with adequate skills and knowledge will operate the machine.	1	1	1	1	1
5d	Effective design to avoid leakage and leakage point is far from the hot surface. Only trained staff with	1	1	1	1	1

	adequate skills and knowledge will operate the machine.					
5f	Effective design to avoid leakage and leakage point is far from the hot surface. Only trained staff with adequate skills and knowledge will operate the machine.	1	1	1	1	1
8a	Comply with the requirements of EN 474-1 and EN 474-3.	1	1	1	1	1
8b	Comply with the requirements of EN 474-1 and EN 474-3.	1	1	1	1	1
8f	Comply with the requirements of EN 474-1 and EN 474-3.	1	1	1	1	1
9i	PPE is necessary during the operation. Only trained staff with adequate skills and knowledge will operate the machine. Safety instruction included in the manual. Do not operate the machine in confined or enclosed spaces to ensure adequate ventilation.	1	1	1	1	1

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict

6	Risk reduction		P
6.1	General		P
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk: -severity of harm from the hazard under consideration; - probability of occurrence of that harm. All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2).	Appropriate protective measures have been applied by the manufacturer.	P
6.2	Inherently safe design measures		P
6.2.1	General		P
	Inherently safe design measures are the first and most important step in the risk reduction process because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding may fail or be violated and information for use may not be followed.	Appropriate protective measures have been applied by the manufacturer.	P
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. NOTE See 6.3 for safeguarding and complementary measures that can be used to achieve the risk reduction objectives in the case where inherently safe design measures are not sufficient (see 6.1 for the three-step method).	Appropriate protective measures have been applied by the manufacturer.	P
6.2.2	Consideration of geometrical factors and physical aspects		P
6.2.2.1	Geometrical factors		P
	Such factors include the following.		

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	a) The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position — reducing blind spots, for example — and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example: -the travelling and working area of mobile machines; -the zone of movement of lifted loads or of the carrier of machinery for lifting persons; -the area of contact of the tool of a hand-held or hand-guided machine with the material being worked. The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones.	No blind spots.	P
	b) The form and the relative location of the mechanical components parts: for instance, crushing and shearing hazards are avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857).		P
	c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can “trap” parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a “trap” shall be capped.	No sharp edges, no sharp angles, no rough surfaces, no protruding parts.	P
	d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).		P
6.2.2.2	Physical aspects		P
	Such aspects include the following:		
	a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard;		N/A

	b)limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;		N/A
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EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	c) limiting the emissions by acting on the characteristics of the source using measures for reducing: 1) noise emission at source (see ISO/TR 11688-1), 2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1)], 3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding), and 4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN 12198-3)].		P
6.2.3	Taking into account the general technical knowledge regarding machine design		P
	This general technical knowledge can be derived from technical specifications for design (e.g. standards, design codes, calculation rules).These should be used to cover :		P
	a) mechanical stresses such as - stress limitation by implementation of correct calculation, construction and fastening methods as regards, e.g. bolted assemblies, welded assemblies - stress limitation by overload prevention, (e.g. "fusible" plugs, pressure-limiting valve, breakage points, torque-limiting devices); -avoiding fatigue in elements under variable stresses (notably cyclic stresses); - static and dynamic balancing of rotating elements;		N/A

	b) materials and their properties such as - resistance to corrosion, ageing, abrasion and wear; - hardness, ductility, brittleness; - homogeneity; - toxicity; - flammability.		P
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EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
	c) emission values for : - noise; - vibration; - hazardous substances; - radiation.	The A-weighted emission sound pressure level at the operator's station is 83 dbA.	P
	When the reliability of particular components or assemblies is critical for safety (e.g. ropes, chains, lifting accessories for lifting loads or persons), stress values shall be multiplied by appropriate working coefficients.		N/A
6.2.4	Choice of an appropriate technology		N/A
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain applications, e.g.:		-
	a) on machines intended for use in explosive atmospheres: - fully pneumatic or hydraulic control system and machine actuators; - "intrinsically safe" electrical equipment (see IEC 60079-11)		N/A
	b) for particular products to be processed such as a solvent: equipment assuring that the temperature will remain far below the flash point.		N/A
	c) alternative equipment to avoid high noise level, e.g.: - electrical instead of pneumatic equipment - in certain conditions, water cutting instead of mechanical equipment.		N/A
6.2.5	Applying the principle of the positive mechanical action		N/A

	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).		N/A
6.2.6	Provisions for stability		P
	Machines shall be designed to have sufficient stability to allow them to be used safely in their specified conditions of use.	These machines have been designed to have sufficient stability.	P
	Factors to be taken into account include		-
	- geometry of the base;	The factor has been considered during the design.	P
	- weight distribution, including loading;	The factor has been considered during the design.	P
	- dynamic forces due to movements of parts of the machine, of the machine itself, or of elements held by the machine which may result in an overturning moment;		N/A
	- vibration	The factor has been considered during the design to reduce vibration.	P
	- oscillations of the centre of gravity;		N/A
	- characteristics of the supporting surface in case of traveling or installation on different sites (e.g. ground conditions, slope);	The factor has been considered during the design.	P
	- external forces (e.g. wind pressure, manual forces)		N/A
	Stability shall be considered in all phases of the life of the machine, including handling, traveling, installation, use, de-commissioning and dismantling.	Equipment is not for dismantling.	N/A
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6		P
6.2.7	Provision for maintainability		P

	When designing a machine, the following maintainability factors shall be taken into account:		-
	- accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used;		N/A
	- ease of handling, taking into account human capabilities;		N/A
	- limitation of the number of special tools and equipment;		N/A

EN ISO 12100:2010			
Clause	Requirement-Test	Result-Remark	Verdict
6.2.8	Observing ergonomic principles		P
	Ergonomic principles shall be taken into account in designing machinery to reduce mental or physical stress and strain of the operator.	Appropriate ergonomic principles have been taken into account in designing machinery.	P
	These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	These principles have been taken into account during allocating functions to operator and machine.	P
	Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2)		N/A
	All elements of the “operator-machine” interface such as controls, signaling or data display elements, shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. (see EN 614-1, ISO 6385, EN 13861 and IEC 61310-1)	All arrangements and design of manual controls have been checked in compliance with.	P
	Designers’ attention is especially drawn to following ergonomic aspects of machine design		-

	a) Avoiding stressful postures and movements during use of the machine (e.g. by providing facilities to adjust the machine to suit the various operators).	Stressful postures and movements during use of the machine has been avoided.	P
	b) Designing machines, and more especially hand-held and mobile machines to enable them to be operated easily taking into account human effort, actuation of controls and hand, arm and leg anatomy.	Equipment is not a handheld machine	N/A
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.	The hand-arm vibration value is 2.5 m/s ² . The whole-body vibration value is 0.5 m/s ² . The A-weighted emission sound pressure level at the operator's station is 83 dBA.	P
	d) Avoid linking the operator's working rhythm to an automatic succession of cycles.	This situation has been avoided.	P
	e) Select, locate and identify manual controls (actuators) so that		-
	-they are clearly visible and identifiable and appropriately marked where necessary (see 6.4.4)	Clearly visible and appropriately marked	P
	- they can be safely operated without hesitation or loss of time and without ambiguity (e.g. a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation)	Standard layout of controls.	P
	- their location (for push-buttons) and their movement (for levers and handwheels) are consistent with their effect (see IEC 61310-3), and		N/A
	- their operation cannot cause additional risk		P
	Where a control is designed and constructed to perform several different actions, namely where there is no one-to-one correspondence (e.g. keyboards), the action to be performed shall be clearly displayed and subject to confirmation where necessary.		N/A
	Controls shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.	Taking account of ergonomic principles	P
	Constraints due to the necessary or foreseeable use of Personal protective equipment (such as footwear, gloves) shall be taken into account.		P
	f) Select, design and locate indicators, dials and visual display units so that		-

	- they fit within the parameters and characteristics of human perception		P
	- information displayed can be detected, identified and interpreted conveniently, i.e. long lasting, distinct, unambiguous and understandable with respect to the operator's requirements and the intended use;	All the information displayed complies with this requirement.	P
	- the operator is able to perceive them from the control position		P
6.2.9	Preventing electrical hazard		P
	For the design of the electrical equipment of machines EN 60204-1 gives general provisions, especially in clause 6 for protection against electric shock.	Equipment has been checked incorporating electrical protection.	P
	For requirements related to specific machines, see corresponding IEC standards (e.g. series of IEC 61029, IEC 60745, IEC 60335).		N/A
6.2.10	Preventing and hydraulic hazards		P
	Pneumatic and hydraulic equipment of machinery shall be designed so that:		[
	- the maximum rated pressure cannot be exceeded in the circuits (e.g. by means of pressure limiting devices)		P
	- no hazard results from pressure surges or rises, pressure losses or drops or losses of vacuum;		N/A
	- no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures;		P
	- air receivers, air reservoirs or similar vessels (e.g. in gas loaded accumulators) comply with the design rules for these elements;		N/A
	- air elements of the equipment, and especially pipes and hoses, be protected against harmful external effects;		P
	- as far as possible, reservoirs and similar vessels (e.g. in gas loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if it is not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, clause 5)		N/A

	- all elements which remain under pressure after isolation of the machine from its power supply be provided with clearly identified exhaust devices, and a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine. See also ISO 4413 and ISO4414		N/A
6.2.11	Applying inherently safe design measures to control system.		P
6.2.11.1	General		P
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061)	Inherently safe design measures to control system have applied.	P
	The correct design of machine control systems can avoid Unforeseen and potentially hazardous machine behaviour.	Inherently safe design measures to control the system have applied.	P
	Typical causes of hazardous machine behavior are:		-
	- an unsuitable design or modification (accidental or deliberate) of the control system logic;		N/A
	- a temporary or permanent defect or a failure of one or several components of the control system;		N/A
	- a variation or a failure in the power supply of the control system;		N/A
	- inappropriate selection, design and location of the control devices;		N/A
	Typical examples of hazardous machine behaviour are :		-
	- unintended/unexpected start-up(see ISO 14118)		N/A
	- uncontrolled speed change;		N/A
	- failure to stop moving parts;		N/A
	- dropping or ejection of a mobile part of the machine or of a workpiece clamped by the machine;		N/A
	- machine action resulting from inhibition (defeating or failure) of protective devices		N/A
	In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause 6.2.11 and in 6.2.12.		N/A
	These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1 and EN 60204-1and IEC 62061).		N/A

	Control systems shall be designed to enable the operator to interact with the machine safely and easily; this requires one or several of the following solutions;		N/A
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	- systematic analysis of start and stop conditions;		N/A
	- provision for specific operating modes (e.g. start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the workpieces contained in the machine, operation of a part of the machine in case of a failure of a machine element)	Enough provisions have been provided.	P
	- clear display of the faults;		N/A
	- measures to prevent accidental generation of unexpected start commands (e.g. shrouded start device) likely to cause dangerous machine behaviour (see ISO14118:2000, figure 1)		N/A
	- maintained stop commands (e.g. interlock) to prevent restarting that could result in dangerous machine behaviour (see ISO 14118:2000, figure 1)		N/A
	An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation.		N/A
	The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone.		N/A
	Likewise it shall be obvious which control devices (e.g. emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone.		N/A
	The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention.		N/A
	Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or workpieces and/or loads held by the machinery, to the safe design parameters (e.g. range, speed, acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (e.g. the swinging of loads).		N/A
	For example:		-
	- the traveling speed of mobile pedestrian controlled Machinery other than remote-controlled shall be compatible with walking speed.		N/A
	- the range, speed, acceleration and deceleration of movements of the person-carrier and carrying vehicle for lifting persons shall be limited to non-hazardous values, taking into account the total reaction time of the operator and the machine.		N/A

	- the range of movements of parts of machinery for lifting loads shall be kept within specified limits.		N/A
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	When machinery is designed to use synchronously different elements which can also be used independently the control system shall be designed to prevent risks due to lack of synchronization.		N/A
6.2.11.2	Starting of internal power source/switching on an external power supply	Equipment is a diesel powered engine.	P
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation. For example: -starting the internal combustion engine shall not lead to movement of a mobile machine; -connection to mains electricity supply shall not result in the starting of working parts of a machine. See EN 60204-1:2006, 7.5 (see also Annexes A and B).		P
6.2.11.3	Starting/stopping of a mechanism		N/A
	The primary action for starting or accelerating the movement of a mechanism should be performed by application or increase of voltage or fluid pressure, or, if binary logic elements are considered, by passage from state 0 to state 1 (if state 1 represents the highest energy state)		N/A
	The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or, if binary logic elements are considered, by passage from state 1 to state 0 (if state 1 represents the highest energy state).		N/A
	When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (e.g. a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system		N/A
6.2.11.4	Restart after power interruption		N/A
	If it may generate a hazard, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (e.g. by use of a self-maintained relay, contactor or valve).		N/A
6.2.11.5	Interruption of power supply		N/A
	Machinery shall be designed to prevent hazardous situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met:		N/A
	- the stopping function of the machinery shall remain;		N/A

	- all devices whose permanent operation is required for safety shall operation an effective way to maintain safety (e.g. locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery);		N/A
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	- parts of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.		N/A
6.2.11.6	Use of automatic monitoring		N/A
	Automatic monitoring is intended to ensure that a safety function(s) implemented by a protective measure do(es) not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed in such a way that hazards are generated.		N/A
	Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function.		N/A
	In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (e.g. the beginning of the machine cycle.) The protective measures may be , e.g.:		N/A
	- the stopping of the hazardous process;		N/A
	- preventing the re-start of this process after the first stop following the failure;		
	- the triggering of an alarm		N/A
6.2.11.7	Safety functions implemented by programmable electronic control systems		N/A
6.2.11.7.1	General		N/A
	A control system including programmable electronic equipment (e.g. programmable controllers) can be used to implement safety functions t machinery.		N/A
	Where a programmable electronic control system is used it is necessary to consider its performance requirements in relation to the requirements for the safety functions.		N/A
	The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) are sufficiently low.		N/A

	Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also IEC 61508 series for further guidance)		N/A
	The programmable electronic control system should be installed and validated to ensure that the specified performance (e.g. safety integrity level (SIL) in IEC 61508 series) for each safety function has been achieved.		N/A
	Validation comprises testing an analysis (e.g. static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.		N/A
6.2.11.7.2	Hardware aspects		N/A
	The hardware (including e.g. sensors, actuators, logic solvers) shall be selected (and/or designed) and installed to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of :		N/A
	- architectural constraints (e.g. the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault);		N/A
	- selecting (and/or designing) equipment and devices with an appropriate probability of dangerous random hardware failure;		N/A
	-Incorporating measures and techniques within the hardware to avoid systematic failures and control systematic faults.		N/A
6.2.11.7.3	Software aspects		N/A
	The software (including internal operating software (or system software) and application software) shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3)		N/A
	Application software		N/A
	Application software should not be re-programmable by the user.		N/A
	This may be achieved by use of embedded software in a non re-programmable memory (e.g. micro-controller, application specific integrated circuit (ASIC)		N/A
	When the application requires reprogramming by the user, the access o the software dealing with safety functions should be restricted e.g. by : locks; passwords for the authorized persons		N/A
6.2.11.8	Principles relating to manual control		P
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8		P
	b) A stop control device shall be placed near each start control device. Where the start/stop function is performed by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released.	A stop control device has been placed.	P
	c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as emergency stop or teach pendant.	Considered	P
	d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone.	The operator is able to observe the working area or hazard zone.	P

	The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions.	Not a ride-on mobile machine	N/A
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	On machinery intended for lifting persons, controls for lifting and lowering and, if appropriate, for moving the carrier, shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements.	Not for lifting persons.	N/A
	e) if it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means among others of a portable control unit (teach pendant, for instance), with which the operator may enter danger zones.	Only one control.	N/A
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1 and ISO 447)		N/A
	g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be taken to ensure the presence of the operator at the control position, e.g. by the design and location of control devices.		N/A
	h) For cableless control an automatic stop shall be performed when correct control signals are not received, including loss of communication (see EN 60204-1)		N/A
6.2.11.9	Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance		N/A
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put in operation, safety of the operator shall be achieved using a specific control mode which simultaneously:		N/A
	- disables all other control modes;		N/A
	- permits operation of the hazardous elements only by continuous actuation of an enabling device, a hold-to-run control device or a two-hand control device;		N/A
	- permits operation of the hazardous elements only in reduced risk conditions (e.g. reduced speed, reduced power/force, step-by-step operation, e.g. with a limited movement control device)		N/A
	prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N/A

	This control mode shall be associated with one or more of following measures:		-
	- restriction of access to the danger zone as far as possible.		N/A
	- emergency stop control within immediate reach of the operator;		N/A
	- portable control unit (teach pendant) and/or local controls allowing sight of the controlled elements. (see EN 60204-1:2006, 9.2.4)		N/A
6.2.11.10	Selection of control and operating modes		N/A
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (e.g. to allow for adjustment , setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position.		N/A
	Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode.		N/A
	The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (e.g. access codes for certain numerically controlled functions).		N/A
6.2.11.11	Applying measures achieve electromagnetic compatibility (EMC)	EMC consideration under the EN ISO 13766-2	P
	For guidance on electromagnetic compatibility, see EN 60204-1, and IEC 61000-6 series.		N/A
6.2.11.12	Provision of diagnostic systems to aid fault-finding		N/A
	Diagnostic systems to aid fault finding should be included in the control system so that there is no need to disable any protective measures.		N/A
6.2.12	Minimizing the probability of failure of safety functions		N/A
6.2.12.1	General		N/A
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine. The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by :		N/A
6.2.12.2	Use of reliable components		P
	“Reliable components” means components which are capable of withstanding all disturbances and stresses associated with the usage of the equipment in the conditions of intended use (including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above(see also 6.213)	Reliable components have been used.	P
6.2.12.3	Use of “oriented failure mode” components		N/A
	“Oriented failure mode” components or systems are those in which the predominant failure mode is known in advance and which can be used so that such a failure leads to a non-hazardous alteration of the machine function.		N/A

	The use of such components should always be considered, particularly in cases where redundancy is (see 6.2.12.4) not employed.		N/A
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6.2.12.4	Duplication subsystems (or redundancy) of components or subsystems		P
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component (or other components) continue(s) to perform its (their) function, thereby ensuring that the safety function remains available.	No duplication (or redundancy) of components	P
	In order to allow the proper action to be initiated, component failure shall be preferably detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection,	Be preferably detected by automatic monitoring	N/A
	provided that the inspection interval is shorter than the expected lifetime of the components.		N/A
	Diversity of design and/or technology can be used to avoid common cause failures (e.g. from electromagnetic disturbance) or common mode failures.		N/A
6.2.13	Limiting exposure to hazards through reliability of equipment		P
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring rectification, thereby reducing exposure to hazards.	This requirement is complied with.	P
	This applies to power systems (operative part) as well as to control systems, to safety functions as well as to other functions of machinery.	This requirement is complied with.	P
	Safety-critical components (as e.g. certain sensors) with a known reliability shall be used.	Safety-critical components are used.	P
	The elements of guards and of protective services shall be particularly reliable, as their failure can expose persons to hazards, and also as poor reliability would encourage attempts to defeat them.		P
6.2.14	Limiting exposure to hazards through mechanization or automation of loading(feeding) /unloading (removal) operations		P
	Mechanization and automation of machine loading/unloading operations and more generally of handling operations (of workpieces, materials, substances) limit the risk generated by these operations by reducing the exposure of persons to hazards at the operating points.		P
	Automation can be achieved e.g. by robots, handling devices, transfer mechanisms, air blast equipment.		N/A
	Mechanization can be achieved, e.g. by feeding slides, push rods, hand-operated indexing tables.		N/A
	While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being rectified.		N/A

	Care shall be taken to ensure that the use of these devices does not introduce further hazards (e.g. trapping, crushing) between the devices and parts of the machine or workpieces/materials being processed.		N/A
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	Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.		N/A
	Automatic feeding and removal devices with their own control systems and the control systems of the associated machine shall be interconnected after thoroughly studying how all safety functions are performed in all control and operation modes of the whole equipment.		N/A
6.2.15	Limiting exposure to hazards through location of the setting and maintenance points outside of danger zones.		N/A
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.		N/A
6.3	Safeguarding and complementary protective measures		P
6.3.1	General		P
	Guards and protective devices shall be used to protect persons whenever inherently safe design does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (e.g. emergency stop equipment) may have to be implemented.	The machine has emergency stop switch.	P
	Certain safeguards may be used to avoid exposure to more than one hazard (e.g. a fixed guard preventing access to a zone where a mechanical hazard is present being used to reduce noise level and collect toxic emissions)		P
6.3.2	Selection and implementation of guards and protective devices		N/A
6.3.2.1	General	-	
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazard generated by moving parts, according to the nature of those parts (see figure 4) and to the need for access to the danger zone(s).		N/A
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.		N/A

	In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where access of an operator to the danger zone is not required during normal operation (operation without any malfunction) of the machinery.		N/A
	As the need for frequency of access increases this inevitably leads to the fixed guard not being replaced.		N/A
	This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment.)		N/A

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	A combination of safeguards may sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device may be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard.		N/A
	Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards which may include:		N/A
	- hazards from falling or ejected objects (e.g. falling object protection structure)		N/A
	- emission hazards (e.g. protection against noise, vibration, radiation, harmful substances)		N/A
	- hazards due to the environment (e.g. protection against heat, cold, foul weather)		N/A
	- hazards due to tipping over or rolling over of machinery (e.g. roll-over or tip-over protection structure)		N/A
	The design of such enclosed work stations (e.g. cabs and cabins) shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.		N/A
6.3.2.2	Where access to the hazard zone is not required during normal operation		N/A
	Where access to the hazard zone is not required during normal operation of the machinery, safeguard should be selected from the following:		-
	a) fixed guard (see also ISO 14120)		N/A
	b) interlocking guard with or without guard locking (see also 6.3.3.2.3, ISO 14119, ISO 14120);		N/A
	c) self-closing guard (see ISO 14120:2002, 3.3.2)		N/A

	d) sensitive protective equipment, e.g. electro-sensitive protective equipment (see IEC 61496) or pressure sensitive mat (see ISO 13856)	No sensitive protective equipment.	N/A
6.3.2.3	Where access to the hazard zone is required during normal operation		N/A
	Where access to the hazard zone is required during normal operation of the machinery , safeguards should be selected from the following:		-
	a) interlocking guard with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this standard);		N/A
	b) sensitive protective equipment, e.g electro-sensitive protective equipment (see IEC 61496)	No sensitive protective equipment	N/A
	c) adjustable guard;		N/A

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	d) self-closing guard (see ISO 14120:2002, 3.3.2)		N/A
	e) two-hand control device (see ISO 13851)		N/A
	f) interlocking guard with a start function (control guard) (see 6.3.3.2.5 of this standard)		N/A
6.3.2.4	Where access to the hazard zone is required for machine setting, teaching, process changeover, fault finding, cleaning or maintenance.		P
	As far as possible, machines shall be designed so that the safeguards provided for the protection of the production operator may ensure also the protection of personnel in charge of setting, teaching, process changeover, fault finding, cleaning or maintenance without hindering them in performing their task.		P
	Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2)		P
6.3.2.5	Selection and implementation of sensitive protective equipment	No sensitive protective equipment	N/A
6.3.2.5.1	Selection		N/A
	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications.		N/A
	The following provisions are intended to provide the designer with criteria for selecting , for each application , the most suitable device(s).		N/A
	Types of sensitive protective equipment include, e.g.:		-
	- light curtains;		N/A
	- scanning devices as, e.g. laser scanners;		N/A

	- pressure sensitive mats;		N/A
	- trip bars, trip wires.		N/A
	Sensitive protective equipment can be used:		-
	- for tripping purposes;		N/A
	- for presence sensing;		N/A
	- for both tripping and presence sensing		N/A
	- to re-initiate machine operation, a practice which is subject to stringent conditions.		N/A
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:		N/A
	- tendency for the machinery to eject materials or component parts;		N/A
	- necessity to guard against emissions (noise, radiation, dust, etc.)		N/A
	- erratic or excessive machine stopping time;		N/A
	- inability of a machine to stop part-way through a cycle.		N/A
6.3.2.5.2	Implementation		N/A
	consideration should be given to :		-
	a) - size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment)		N/A
	b) - reaction of the device to fault conditions (see IEC 61496 for electro-sensitive protective equipment)		N/A
	c)- possibility of circumvention		N/A
	d)- detection capability and its variation over the course of time (e.g. as a result of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources, sunlight or impurities in the air.		N/A
	sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that:		N/A
	- a command is given as soon as a person or part of a person is detected;		N/A
	- the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function (s); therefore, the command given by the sensitive protective equipment shall be maintained by the control system until a new command is given;		N/A
	- restarting the hazardous machine function(s) results from the voluntary actuation, by the operator, of a control device placed outside the hazard zone, where this zone can be observed by the operator;		N/A
	- the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases,;		N/A

	- the position and the shape of detection field prevents, possibly together with fixed guards, a person or part of a person from entering the hazard zone, or being present in it, without being detected.		N/A
6.3.2.5.3	Additional requirements for sensitive protective equipment when used for cycle initiation.		N/A
	In this exceptional application, starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control.		N/A

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	Cycle initiation by sensitive protective equipment shall be subject to the following conditions:		-
	a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used;		N/A
	b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied — in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring of control and braking systems;		N/A
	c) the cycle time of the machine is short and the facility to re-initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle;		N/A
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;		N/A
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPD (s) is capable of cycle re-initiation;		N/A
	f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions.		N/A
6.3.2.6	Protective measures for stability		P
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 4.6), it will be necessary to maintain it by protective measures such as the use of :	Equipment is designed to have sufficient stability.	P
	- anchorage bolts;		N/A
	- locking devices;		N/A
	- movement limiters or mechanical stops;		N/A
	- acceleration or deceleration limiters;		N/A
	- load limiters;		N/A

	- alarms warning of the approach to stability or tipping limits;		N/A
6.3.2.7	Other protective devices		N
	When a machine requires continuous control by the operator(e.g. mobile machines, cranes) and an error of the operator can generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits , in particular:		N

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	- when the operator has insufficient visibility of the hazard zone;		N/A
	- when the operator lacks knowledge of the actual value of a safety –related parameter (e.g. .a distance, a speed, the mass of a load, the angle of a slope)		N/A
	- when hazards may result from operations other than those controlled by the operator;		N/A
	The necessary devices include:		-
	- devices for limiting parameters of movement (distance, angle, velocity , acceleration)		N/A
	- overloading and moment limiting devices:		N/A
	- devices to prevent collisions or interference with other machines;		N/A
	-device for preventing hazards to pedestrian operators of mobile machinery or other pedestrians;		N/A
	- torque limiting devices, breakage points to prevent excessive stress of components and assemblies;		N/A
	- devices for limiting pressure, temperature;		N/A
	- devices for monitoring emissions;		N/A
	- devices prevent operation in the absence of the operator at the control position;		N/A
	- device to prevent lifting operations unless stabilizers are in place;		N/A
	- devices to limit inclination of the machine on a slope;		N/A
	- devices to ensure that components are in a safe position before traveling;		N/A
	Automatic protective measures triggered by such devices which take operation of the machinery out of the control of the operator (e.g. automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3)		N/A
6.3.3	Requirements for the design of guards and protective devices		P
6.3.3.1	General requirements		P

	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them.	Guards, shields and safety protective devices are in place.	P
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	Guards and protective devices shall :		-
	- be of robust construction.	Steel	P
	- not give rise to any additional hazard;	No additional hazard	P
	- not be easy to by-pass or render non-operational;	not be easy to by-pass	P
	- be located at an adequate distance from the danger zone (see ISO 13857 and ISO 13855).	an adequate distance from the danger zone	P
	- cause minimum obstruction production process; to the view of the		P
	- enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by allowing access only to the area where the work has to be done, if possible without the guard or protective device having to be moved;		P
	For openings in the guards see ISO 13857		N/A
6.3.3.2	Requirements for fixed guards		N/A
6.3.3.2.1	Functions of guards		N/A
	The functions that guards can achieve are:		N/A
	prevention of access to the space enclosed by guard and/or containment/capture of materials, workpieces, chips, liquids which may be ejected or dropped by the machine and reduction of emissions(noise, radiation, hazardous substances such as dust, fumes, gases) which may be generated by the machine.		N/A
	Additionally, they may need to have particular properties relating to electricity, temperature, fire, explosion, vibration, visibility(see ISO 14120) and operator position ergonomics(e.g. usability, operator's movements, posture, repetitive movements).		N/A
6.3.3.2.2	Requirements for fixed guards		N/A
	Fixed guards shall be securely held in place:		-

	either permanently (e.g. by welding) or by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120)	All the fixed guards are securely held in place by appropriate fasteners.	N/A
6.3.3.2.3	Requirements for movable guards		N/A
	a) movable guards which provide protection against hazards generated by moving transmission parts shall:		-
	- as far as possible remain fixed to the machinery or other structure (generally by means of hinges or guides) when open;		N/A
	- be interlocking guards (with guard locking when necessary) (see ISO 14119)		N/A
	b) movable guards against hazards generated by non- transmission moving parts shall be designed and associated with the machine control system so that:		-
	- moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up; this can be achieved by interlocking guards, with guard locking when necessary.		N/A
	- they can be adjusted only by an intentional action, such as the use of a tool or a key;		N/A
	- the absence or failure of one of their components prevents starting of the moving parts or stops them; this can be achieved by automatic monitoring (see 4.11.6)		N/A
6.3.3.2.4	Requirements for adjustable guards		N/A
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed;		N/A
	They shall :		-
	- be designed so that the adjustment remains fixed during a given operation;		N/A
	- be readily adjustable without the use of tools;		N/A
6.3.3.2.5	Requirements for interlocking guards with a start function (control guards)		N/A
	An interlocking guard with a start function may be used provided that		-
	- all requirements for interlocking guards are satisfied (see ISO 14119)		N/A
	- the cycle time of the machine is short		N/A
	- the maximum opening time of the guard is present to a low value (e.g. equal to the cycle time). When this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine.		N/A
	- the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120)		N/A
	- all other guards whether fixed (removable type) or movable are interlocking guards;		N/A

	- the interlocking device associated with the interlocking guard with a start function is designed in such a way – e.g. by duplication of position detectors and use of automatic monitoring (see 4.11.6)- that its failure cannot lead to an unintended/unexpected start-up;		N/A
	- the guard is securely held open (e.g. by a spring or counterweight)such that it cannot initiate a start while falling by its own weight;		N/A
6.3.3.2.6	Hazards from guards		P
	Care shall be taken to prevent hazards which might be generated by:		-
	- the guard construction (e.g. sharp edges or corners, material);	No sharp edges and corners.	P
	- the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall)		N/A
6.3.3.3	Technical characteristics of protective devices		N/A
	Protective devices shall be selected or designed and connected to the control system so as to ensure correct implementation of their safety function (s) is ensured.		N/A
	Protective devices shall be selected on the basis of their having met the appropriate product standard (for example, IEC 61496 for active optoelectronic protective devices) or shall be designed according to one or several of the principles formulated in ISO 13849-1 or IEC 62061.		N/A
	Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.		N/A
6.3.3.4	Provisions for alternative types of safeguards.		N/A
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it s known that this fitting will be necessary because the work to be done on it will vary.		N/A
6.3.4	Safeguarding for reducing emissions		N/A
6.3.4.1	General		N/A
	If the measures for the reduction of emissions at source mentioned in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).		N/A
6.3.4.2	Noise		N/A
	Additional protective measures include, for example: enclosures (see ISO 15667) screens fitted to the machine; silencers (see ISO 14163)	Enclosures	N/A
6.3.4.3	Vibration		P
	Additional protective measures include, for example, damping devices for vibration isolation between the source and the exposed person such as resilient mounting or suspended seats.	Considered in effective design to reduce vibration.	P

	For measures for vibration isolation of stationary industrial machinery see EN 1299		N/A
6.3.4.4	Hazardous substances		N/A
	Additional protective measures include, for example:		-
	- encapsulation of the machine (enclosure with negative pressure);	Encapsulation of the machine	N/A
	- local exhaust ventilation with filtration.		N/A
	- wetting with liquids;		N/A

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	- special ventilation in the area of the machine (air curtains , cabins for operators)		N/A
6.3.4.5	Radiation		N/A
	Additional protective measures include, for example:		-
	- use of filtering and absorption;		N/A
	- use of attenuating screens or guards		N/A
6.3.5	Complementary protective measures		P
6.3.5.1	General		P
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use may have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to , the ones dealt with in 6.3.5.2 to 6.3.5.6		P
6.3.5.2	Components and elements to achieve the emergency stop function		P
	If following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function to enable actual or impending emergency situations to be averted, the following requirements apply:		-
	- the actuators shall be clearly identifiable, clearly visible and readily accessible		N/A
	- the hazardous process shall be stopped as quickly as possible without creating additional hazards . If this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;		P
	- the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.		P
	Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset.		P
	This reset shall be possible only at that location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but only permit restarting.		N/A

	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in EN 60204 series.		N/A
6.3.5.3	Measures for the escape and rescue of trapped persons		N/A
	Measures for the escape and rescue of trapped persons may consist e.g. of :		-
	- escape routes and shelters in installations generating operator-trapping hazards		N/A
	- arrangements for moving some elements by hand, after an emergency stop		N/A

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	- arrangements for reversing the movement of some elements		N/A
	- anchorage points for descender devices;		N/A
	- means of communication to enable trapped operators to call for help		N/A
6.3.5.4	Measures for isolation and energy dissipation		N/A
	Especially with regard to their maintenance and repair , machines shall be equipped with the technical means to achieve the isolation from power supply(ies) and dissipation of stored energy as a result of following actions:		N/A
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;		N/A
	b) locking (or otherwise securing) all the isolating units in the isolating position;		N/A
	c) dissipating or , if this is not possible or practicable, restraining (containing) any stored energy which may give rise to a hazard;		N/A
	d) verifying, by means of a safe working procedure, that the actions taken according to a), b) and c) above have produced the desired effect.		N/A
	See ISO 14118:2000, clause 5 and EN 60204-1:2006, 5.5 and 5.6		N/A
6.3.5.5	Provisions for easy and safe handling of machines and their heavy component parts	Lifting points are identified by lifting decals.	P
	Machines and their component parts which cannot be moved or transported by hand shall be provided or capable of being provided with suitable attachment devices for transport by means of lifting gear.		N/A
	These attachments may be, among others,		-
	- standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing;		N/A
	- appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground.		N/A
	- guiding grooves for machines to be transported by a fork truck;		N/A

	- lifting gear and appliances integrated into the machine.	Identified by lifting decals.	P
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement; See also 6.4.4c) (item 3).	Not removed manually in operation	N/A
6.3.5.6	Measures for safe access to machinery		P
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance, to be carried out, as far as possible, by a person remaining at ground level.		P
	Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks, but care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery.		N/A
	The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and, depending on the height from the ground, suitable guard-rails (see ISO 14122-3) shall be provided.		N/A
	In large automated installations, particular attention shall be given to safe means of access such as walkways, conveyor bridges or crossover points.		N/A
	Means of access to parts of machinery located at a height shall be provided with collective means of protection against falls (e.g. guard-rails for stairways, stepladders and platforms and/or safety cages for ladders)		N/A
	As necessary , anchorage points for personal protective equipment against falls from a height shall also be provided (e.g. in carriers of machinery for lifting persons or with elevating control sations)		N/A
	Openings shall whenever possible open towards a safe position. They shall be designed to prevent hazards due to unintended opening.		N/A
	The necessary aids for access shall be provided (e.g. steps, handholds). Control devices shall be designed and located to prevent their being used as aids for access.		N/A
	When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards preventing falls when the platform is not present at the level.		N/A
	Movement of the lifting platform shall be prevented while the guards are open.		N/A
	For detailed provisions see ISO 14122.		N/A
6.4	Information for use		P
6.4.1	General requirements		P
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see figure 2).		P
	Information of use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. It is directed to professional and/or non-professional users.		N/A

6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes.	See the instruction	P
	The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk.	See the instruction	P
	The information shall indicate, as appropriate,		-
	- the need for training,	See the instruction	P
	- the need for personal protective equipment,		P
	- the possible need for additional guards or protective devices (see Figure 2, Footnote d).	See the instruction	P
	It shall not exclude uses of the machine that can reasonably be expected from its designation and description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.	See the instruction	P
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use of the machine (setting, teaching/programming or process changeover, operation, cleaning, fault-finding and maintenance) and, if necessary, dismantling, disabling and scrapping.	See the instruction	P
6.4.2	Location and nature of the information for use		P
	Depending on the risk , the time when the information is needed by the user and the machine design , it shall be decided whether the information – or parts thereof – are to be given:		P
	- in /on the machine itself (see 6.3 and 6.4.4)	Adequate information is stated in the machine itself.	P
	- in accompanying documents (in particular instruction handbook , see 6.4.5)	See the instruction	P
	- on the packaging	Adequate information is stated on the packaging	P
	- by other means such as signals and warnings outside the machine.	Signals and warnings outside the machine.	P
	Standardized phrases shall be considered where important messages such as warnings need to be given (see also IEC 62079)		P
6.4.3	Signals and warning devices		P
	Visual signals (e.g. flashing lights) and audible signals (e.g. sirens) may be used to warn of an impending hazardous event such as machine start-up or overspeed.	Signals and warning devices are provided.	P
	Such signals may also be used to warn the operator before the triggering of automatic protective measures (see last paragraph of 5.2.7)	Please see the related clause.	P
	It is essential that these signals:		-
	be emitted before the occurrence of the hazardous event; be unambiguous; be clearly perceived and differentiated from all other signals used; be clearly recognized by the operator and other persons.	Unambiguous, clearly perceived, clearly recognized	P

	The warning devices shall be designed and located such that checking is easy.		P
	The information for use shall prescribe regular checking of warning devices.		P
	The attention of designers is drawn to the risks from “sensorial saturation” which results from too many visual and/or acoustic signals, which may also lead to defeating the warning devices.		P
6.4.4	Markings, signs (pictograms), written warnings	Refer to the instruction manual for the details of markings and written warnings.	P
	Machinery shall bear all markings which are necessary:		-
	a) for its unambiguous identification, at least :		-
	name and address of the manufacturer; designation of series or type; serial number, if any.		P
	b) in order to indicate its compliance with the mandatory requirements, marking, written indications.		N/A
	c) for its safe use, e.g. :		-
	- maximum speed of rotating parts;		N/A
	- maximum diameter of tools;		N/A
	- mass (expressed in kilograms) of the machine itself and/or of removable parts		N/A
	- maximum working load;		N/A
	-necessity of wearing personal protective equipment;		N/A
	- guard adjustment data;		N/A
	- frequency of inspection.	See the instruction	P
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	Permanent and remain legible	P
	Signs or written warnings only saying “danger” shall not be used.		P
	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine which they are related to.		P
	Readily understandable signs (pictograms) should be used in preference to written warnings.		P
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.		P
	Markings shall comply with recognized standards (see ISO 2972, ISO 7000, particularly for pictograms, symbols, colours) See EN 60204 series as regards marking of electrical equipment.	All the markings are standard.	P
6.4.5	Accompanying documents (in particular, instruction handbook)		P
6.4.5.1	Contents		P
	The instruction handbook or other written instructions (e.g. on the packaging) shall contain among others:		-

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	a) information relating to transport, handling and storage of the machine e.g. : storage conditions for the machine; dimensions , mass value(s), position of the centre (s) of gravity; indications for handling (e.g. drawings indicating application points for lifting equipment)	All the related information is stated in the instruction handbook	P
	b) information relating to installation and commissioning of the machine, e.g. fixing/anchoring and vibration dampening requirements; assembly and mounting conditions; space needed for use and maintenance; permissible environmental conditions (e.g. temperature, moisture, vibration, electromagnetic radiation); instructions for connecting the machine to power supply (particularly about protection against electrical overloading); advice about waste removal /disposal; if necessary, recommendations about protective measures which have to be taken by the user; e.g. additional safeguards, safety distances, safety signs and signals.	All the related information is stated in the instruction manual.	P
	c) information relating to the machine itself, e.g. : detailed description of the machine, its fittings, its guards and/or protective devices; comprehensive range of applications for which the machine is intended, including prohibited usages, if any , taking into account variations of the original machine if appropriate. diagrams ; data about noise and vibration generated by the machine, about radiation , gases, vapours, dust emitted by it, with reference to the measuring methods used. technical documentation about electrical equipment documents attesting that the machine complies with mandatory requirements;	All the related information is stated in the instruction manual.	P
	d) information relating to the use of the machine, e.g. about: intended use; description of manual controls (actuators); setting and adjustment; modes and means for stopping risks which could not be eliminated by the protective measures taken by the designer; particular risks which may be generated by certain applications, by the use of certain fittings, and about specific safeguards which are necessary for such applications. reasonably foreseeable misuse and prohibited usages; fault identification and location , repair, and re-starting after an intervention; personal protective equipment which need to be used and training required.	All the related information is stated in the instruction manual.	P

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Clause	Requirement-Test	Result-Remark	Verdict
	e) information for maintenance e.g. nature and frequency of inspections for safety functions; instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence should be carried out exclusively by skilled persons (e.g. maintenance staff, specialists) instructions relating to maintenance actions (e.g. replacement of parts) which do not require specific skills and hence may be carried out by users (e.g. operators) drawings and diagrams enabling maintenance personnel to carry out their task rationally	All the related information is stated in the instruction manual.	P
	f) information relating to de-commissioning, dismantling and disposal;		N/A
	g) information for emergency situations, e.g. : type of fire-fighting equipment to be used. warning about possible emission or leakage of harmful substance(s), and if possible, indication of means to fight their effects.		N/A
	h) maintenance instructions provided for skilled persons (second dash in e))and maintenance instructions provided for unskilled persons (third dash in e)), that should appear clearly separated from each other.		N/A
6.4.5.2	Production of the instruction handbook		P
	a) type and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized the use of colours, symbols and/or large print.	Legibility.	P
	b) information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language are to be used, each language should be readily distinguished from the other(s), and efforts should be made to keep the translated text and the relevant illustration together.	English	P
	c) whenever helpful to the understanding, text should be supplemented with written details enabling, for instance, manual controls (actuators) to be located and identified; they should not be separated from the accompanying text and should follow sequential operations.	See the Instruction handbook.	P
	d) consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.	See the Instruction handbook.	P
	e) the use of colours should be considered, particularly in relation to components requiring quick identification.		N/A
	f) when information for use is lengthy, a table of contents and/or an index should be given.		P

	g) safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		P
6.4.5.3	Drafting and editing information for use		N/A

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	a) relationship to model : the information shall clearly relate to the specific model of machine and, if necessary, other appropriate identification (for example, by serial number).		N/A
	b) communicate principles : when information for use is being prepared, the communication process “see-think-use” should be followed in order to achieve the maximum effect and should follow sequential		N/A
	operations. The questions “how ?” and “why ?” should be anticipated and the answers provided.		N/A
	c) information for use shall be as simple and as brief as possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms.		N/A
	d) when it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional users. If personal protective equipment is required for the safe use of the machine, clear advice should be given, e.g. on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale.		N/A
	e) durability and availability of the documents : documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It may be useful to mark them “keep for future reference”. Where information for use is kept in electronic form (e.g. CD, DVD, tape) information on safety-related issues that need immediate action shall always be backed up with a hand copy that is readily available.		N/A
7	Documentation of risk assessment and risk reduction		P
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of		-
	a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use);		P
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);		P
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;		P
	d) the information on which risk assessment was based (see 5.2):		-
	1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.);		P
	2) the uncertainty associated with the data used and its impact on the risk assessment;		P
	e) the risk reduction objectives to be achieved by protective measures;		P

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	f) the protective measures implemented to eliminate identified hazards or to reduce risk;	Warning sign and wear PPE	P
	g) residual risks associated with the machinery;		P
	h) the result of the risk assessment (see Figure 1);	See the risk assessment report.	P
	i) any forms completed during the risk assessment.		P
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.		P

Attachment 1: Picture of samples

Figure 1: Front view



Figure 2: Top view



Figure 3: Control Panel view



Figure 4: Right side view



Figure 5: Left side view

