

ADDENDUM D

EXAMPLES OF HAZARDS, HAZARDOUS SITUATIONS, AND HAZARDOUS EVENTS

This checklist is an adaptation from a standard issued by the International Organization for Standardization titled *Safety of machinery. General Principles for Design. Risk assessment and risk reduction*, EN ISO 12100-2012. The checklist is a guide for companies located throughout the world that design and manufacture machinery and equipment that would go into workplaces. Although the checklist pertains to a broad range of equipment, those who use it as a reference must understand that it could not possibly include all hazards and all hazardous situations.

Mechanical Hazards

Due to machine parts or work pieces: e.g.,

- Shape
- Relative motion
- Mass and stability (potential energy of elements which may move under the effect of gravity)
- Mass and velocity (kinetic energy of elements in controlled and uncontrolled motion)
- Inadequacy of mechanical strength

Advanced Safety Management: Focusing on Z10 and Serious Injury Prevention,
Second Edition. Fred A. Manuele.
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due to accumulation of energy inside the machinery: e.g.,

- Elastic elements (springs)
- Liquids and gases under pressure
- The effect of vacuum

Mechanical Hazards Due to the Potential for

- Crushing
- Shearing
- Cutting or severing
- Entanglement
- Drawing-in or trapping
- Impact
- Stabbing or puncture
- Friction or abrasion
- High-pressure fluid injection or ejection

Electrical Hazards Due to

- Contact of persons with live parts (direct contact)
- Contact of persons with parts which have become live under faulty conditions (indirect contact)
- Approach to live parts under high voltage
- Electrostatic phenomena
- Thermal radiation or other phenomena, such as the projection of molten particles and chemical effects from short circuits, overloads, etc.

Thermal Hazards, Resulting in

- Burns, scalds, and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions, and also by the radiation of heat sources
- Damage to health by hot or cold working environment

Hazards Generated by Noise, Resulting in

- Hearing loss (deafness), other physiological disorders (e.g., loss of balance, loss of awareness)
- Interference with speech communication, acoustic signals, etc.

Hazards Generated by Vibration

- Use of handheld machines resulting in a variety of neurological and vascular disorders
- Whole body vibration, particularly when combined with poor postures

Hazards Generated By Radiation

- Low-frequency, radio-frequency radiation; microwaves
- Infrared, visible, and ultraviolet light
- X- and gamma rays
- Alpha and beta rays, electron or ion beams, neutrons
- Lasers

**Hazards Generated by Materials and Substances
(and their Constituent Elements) Processed or Used by the Machinery**

- Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts
- Fire or explosion hazards
- Biological or microbiological (viral or bacterial) hazards

**Hazards Generated By Neglecting Ergonomic Principles
In Machinery Design; A E.G.,**

- Unhealthy postures or excessive effort
- Hazardous situations due to lifting
- Inadequate consideration of hand-arm or foot-leg anatomy
- Neglected use of personal protection equipment
- Inadequate local lighting
- Mental overload and underload, stress
- Human error, human behavior
- Inadequate design, location, or identification of manual controls
- Inadequate design or location of visual display units

**Hazards Deriving from Unexpected Startup, Unexpected
Overrun/Overspeed (or any Similar Malfunction) from**

- Failure/disorder of the control system
- Restoration of energy supply after an interruption
- External influences on electrical equipment
- Other external influences (gravity, wind, etc.)
- Errors in the software
- Errors made by the operator (due to mismatch of machinery with human characteristics and abilities)
- Impossibility of stopping a machine under the best possible conditions
- Variations in the rotational speed of tools
- Failure of the power supply

- Failure of the control circuit
- Errors of fitting
- Breakup during operation
- Falling or ejected objects or fluids
- Loss of stability/overtipping machinery
- Slip, trip, and fall of persons, related to machinery

Hazards, Hazardous Situation and Hazardous Events Due to Mobility:

Relating to the traveling function

- Movement when starting an engine
- Movement without a driver in the driving position
- Movement without all parts in a safe position
- Excessive speed of pedestrian-controlled machinery
- Excessive oscillation when moving

Linked to the work position (including driving station) on a machine

- Fall of persons during access (or at/from) the work position
- Exhaust gases/lack of oxygen at the work position
- Fire (flammability of the cab, lack of means extinguish to
- Mechanical hazards at the work position:
 1. Contact with the wheels
 2. Rollover
 3. Fall of objects, penetration by objects
 4. Breakup of parts
 5. Contact of persons with machine parts or tools (pedestrian-controlled machines)
- Insufficient visibility from the work position
- Inadequate lighting
- Inadequate seating
- Noise at the work position
- Vibration at the work position
- Insufficient means for evacuation/emergency

Due to the power source and to the transmission of power

- Hazards from an engine and batteries
- Hazards from transmission of power between machines
- Hazards from coupling and towing

From/to third persons

- Unauthorized startup/use
- Drift of a part away from its stopping position
- Lack of or inadequacy of means of visual or acoustic warning of

Hazards, Hazardous Situations, and Hazardous Events Due to Lifting

Mechanical hazards and hazardous events

- From load falls, collisions, machine tipping caused by:
 1. Lack of stability
 2. Uncontrolled loading, overloading, overturning moments exceeded
 3. Uncontrolled amplitude of movements
 4. Unexpected/unintended movement of loads
 5. Inadequate holding devices/accessories
 6. Collision of more than one machine
- From access of persons to load support
- From insufficient mechanical strength of parts
- From inadequate design of pulleys, drums