Masinad tööstuslike detailide pindade puhastamiseks ja eeltöötlemiseks vedelike või aurude abil. Osa 1: Üldised ohutusnõuded

Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours - Part 1: Common safety requirements

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 12921-1:2005+A1:2010 sisaldab Euroopa standardi EN 12921-1:2005+A1:2010 ingliskeelset teksti.	This Estonian standard EVS-EN 12921-1:2005+A1:2010 consists of the English text of the European standard EN 12921-1:2005+A1:2010.
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Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours - Part 1: Common safety requirements

Machines de nettoyage et de pré-traitement de pièces industrielles utilisant des liquides ou des vapeurs - Partie 1: Prescriptions générales de sécurité

Maschinen zur Oberflächenreinigung und -vorbehandlung von industriellen Produkten mittels Flüssigkeiten oder Dampfphasen - Teil 1: Allgemeine Sicherheitsanforderungen

This European Standard was approved by CEN on 24 March 2005 and includes Amendment 1 approved by CEN on 23 April 2010.

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Foreword

This document (EN 12921-1:2005+A1:2010) has been prepared by Technical Committee CEN/TC 271 “Surface treatment equipment — Safety”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1, approved by CEN on 2010-04-23.

This document supersedes EN 12921-1:2005.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

NOTE Although a cleaning machine, as an integral whole, formally does not fall under the scope of the ATEX Directive 94/9/EC, the standard is based upon a fundamental risk analysis according to this directive.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European Standard is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

This European Standard consists of the following parts:

— Part 1: Common safety requirements

— Part 2: Safety of machines using water based cleaning liquids

— Part 3: Safety of machines using flammable cleaning liquids

— Part 4: Safety of machines using halogenated solvents

1 Scope

1.1 This standard applies to machines for surface cleaning and pre-treatment – in the following called "cleaning machines" – of industrial items using liquids or vapours, i.e. stationary machines and related equipment for automated and manual cleaning and pre-treatment processes.

NOTE Cleaning machines are operated with or without heating, for example as dipping or spraying or vapour condensation process, where additional using of ultrasound is possible. These cleaning machines could be designed as single-zone or multi-zone machine, chamber machines, drum cleaning machine, low lift truck machines, round time machines or tunnel (continuous) machines.

To the extent of this document, cleaning machines for industrial items are considered as an assembly of the following equipment:

— pump(s) and/or other mechanical system of agitation, recirculation and spraying of cleaning liquid;

— forced ventilation system;

— heating system with temperature control;

— condensation system;

— filtration and separation system and/or solid particles extraction from the liquid;

— conveyor and/or handling system for the items to be processed;

— product handling systems and reciprocators which are part of the cleaning machine;

— control and/or monitoring systems;

— liquid handling system.

1.2 This European Standard deals with the common significant hazards, hazardous situations and events relevant to cleaning machines for industrial items using liquids or vapours when they are used as intended and under the conditions foreseen by the manufacturer (see clause 4). This part of the standard defines the common safety requirements for all kinds of cleaning machines for industrial items using liquids or vapours and related common devices and should be used in connection with other parts of the EN 12921-series. The specific requirements specified in part 2 and following parts of EN 12921 take precedence over the respective requirements in EN 12921.

NOTE In addition, where a cleaning machine is not covered by a specific part of this document, part 1 of EN 12921 can be used to establish the approach for dealing with the relevant risks.

Specific hazards which are related to the type of cleaning liquid used are dealt with in the following documents:

— EN 12921-2 for water based cleaning liquids;

— EN 12921-3 for flammable cleaning liquids;

— prEN 12921-4 for halogenated solvents.

1.3 〈A1〉 This standard is not applicable to machines for:

– mobile portable cleaning,

– high pressure cleaning with high pressure water jet according to prEN 1829-1,

– conveyor dishwashing according to EN 50416,

– surface cleaning employing liquids according to EN 60335-2-54,

– commercial electric dishwashing according to EN 60335-2-58,

– cleaning with high pressure and steam according to EN 60335-2-79,

– plasma cleaning,

– mechanical blasting,

– thermal cleaning,

– drying processes,

– cleaning of textiles or clothes,

– food processing.

This standard is not applicable to the following equipment:

– loading and unloading systems,

– automatic systems, e.g. robots as covered by EN ISO 10218-1,

– centrifuges as covered by EN 12547,

– pumps and pump units for liquids as covered by EN 809. 〈A1〉

1.4 This standard is not applicable to cleaning machines for industrial items which are manufactured before the date of publication of this document by CEN.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 294, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*

EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 418, *Safety of machinery - Emergency stop equipment, functional aspects - Principles for design*

EN 563, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces*

EN 619, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of unit loads*

EN 626-1, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

EN 811, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*

EN 842, *Safety of machinery — Visual danger signals — General requirements, design and testing*

EN 894-1, *Safety of machinery — Ergonomic requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 894-2; *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3; *Safety of machinery — Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators*

EN 953; *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 954-1:1996; *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

CR 954-100; *Safety of machinery — Safety-related parts of control systems — Part 100: Guide on the use and application of EN 954-1:1996*

EN 981; *Safety of machinery — System of auditory and visual danger and information signals*

EN 982; *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 983; *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

EN 999, *Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body*

EN 1037; *Safety of machinery — Prevention of unexpected start-up*

EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1093-3, *Safety of machinery — Evaluation of the emission of airborne hazardous substances — Part 3: Emission rate of a specified pollutant — Bench test method using the real pollutant*

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 12921-3*, Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours - Part 3: Safety of machines using flammable cleaning liquids*

EN 13478; *Safety of machinery — Fire prevention and protection*

EN 14462; *Surface treatment equipment — Noise test code for surface treatment equipment including its ancillary handling equipment — Accuracy grades 2 and 3*

EN 60204-1:1997, *Safety of machinery - Electrical equipment of machines – Part 1: General requirements (IEC 60204-1:1997)*

EN 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards; Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1:1997, modified)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards; Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3:1996, modified)*

EN 61010-1; *Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements (IEC 61010-1:2001)*

EN 61310-1; *Safety of machinery - Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)*

EN 61310-2*, Safety of machinery - Indication, marking and actuation – Part 2: Requirements for marking (IEC 61310-2:1995)*

EN ISO 11688-1*, Acoustics - Recommended practice for the design of low-noise machinery and equipment – Part 1: Planning (ISO/TR 11688-1:1995)*

EN ISO 12100-1:2003; *Safety of machinery - Basic concepts, general principles for design – Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003; *Safety of machinery - Basic concepts, general principles for design – Part 2: Technical principles (ISO 12100-2:2003)*

EN ISO 14122-1; *Safety of machinery - Permanent means of access to machinery – Part 1: Choice of fixed means of access between two levels (ISO 14122-1:2001)*

EN ISO 14122-2; *Safety of machinery - Permanent means of access to machinery – Part 2: Working platforms and walkways (ISO 14122-2:2001)*

EN ISO 14122-3; *Safety of machinery - Permanent means of access to machinery – Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

ISO 3864-1, *Graphical symbols - Safety colours and safety signs*

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

3.1
accessible danger zone
areas where, for example, area guards or ESPDs allow whole-body access. The objective is to prevent anyone starting the machine while persons are inside the danger zone

3.2
automatic machines and equipment
machines and equipment in which systems are used to control their operation without further intervention from the operator once the start control has been activated. Such machines may be either free standing or included in a complex installation

3.3
cleaning liquid
any liquid which can be used in liquid and vapour form for surface treatment (cleaning and/or washing) of items in the machine

NOTE 1 It is distinguished between:

- water based cleaning liquids and
- flammable cleaning liquids and
- halogenated solvents.

NOTE 2 Some preparations for cleaning and degreasing at room temperature are also called cleaner solvents. They may be hazardous to health and combustible, as a mixture with air their vapours may be explosive.

3.4
closed machine
machine offering access to the (cleaning) process by safe guarded covers or doors which shall remain closed during the process and which can be opened for maintenance and loading or unloading purposes only

3.5
complex installation
combination of machines and service equipment, working as one integrated production unit, subject to an overall control system

3.6
danger points
defined locations in the danger zone of machines where persons can be injured by movements of

- parts of machines
- tools of machines or parts of tools
- items or parts of items
- materials being processed.

NOTE Danger points can exist, for example, on gear, chain and worm drives, V-belt, flat belt, pulling and supporting elements on continuous conveyors, spoke wheels and fly wheels, shafts and shaft ends, rollers, slides, push rods and similar parts, tools and clamping devices.

Particular points of danger are:

- crushing and shearing points
- trapping points
- inrunning nips
- cutting, punching and impact points.

3.7
ESPD
electro-sensitive protective device

3.8
flammable cleaning liquid
liquid able to undergo an exothermic reaction with air when ignited

NOTE A liquid can only burn when the molecules of the liquid are in intimate contact with oxygen from the air. Ignition is possible when the liquid generates a concentration of vapour in air, or the flammable liquid is present as a suspension of fine droplets in air (aerosol).

3.9
forced ventilation
air exchange achieved by fans or by other powered means which removes from the machines vapours, fumes, gases, mist, etc.

3.10
halogenated solvent
organic solvent containing at least one halogen atom per molecule and not having a flash point as determined by standard methods

NOTE These halogenated solvents used in industry generally contain a small quantity of stabilising agents (anti-acid, anti-oxidant, etc.).

3.11
heating system
system fitted to the machine in order to raise the temperature of the cleaning liquid above the local ambient temperature

3.12
heat source
any energy source in contact with the cleaning liquid which can lead to an increase of the temperature of the cleaning liquid

NOTE Heat sources are e.g.:

— heating system;
— ultrasonic waves;
— pumping energy;
— stored heat of items;
— mechanical agitation;
— heating from electrical conductors, motors
— heat caused by magnetic fields;
— refrigeration system;
— sunrays.

3.13
hold-to-run control device
control device which initiates and maintains operation of machine elements only as long as the manual control (actuator) is actuated. The manual control (actuator) automatically returns to the stop position when released

3.14
immersion process
operation where the item to be cleaned is placed in a tank containing a cleaning liquid which comes into contact with the entire surface of the item in order to achieve the required result by dispersion of contaminants into the cleaning liquid

3.15
items
parts whose surfaces are treated in the cleaning machine

NOTE The word item is used for workpieces processed individually, or in bulk, or on jigs or in baskets.

3.16
liquid agitation machine
machine for an immersion process where the cleaning liquid is moved by e.g.: pump(s) with adequate, submerged or not, nozzles, jets or inlet openings, propeller

3.17
maximum admissible cleaning liquid capacity
maximum mass and volume of cleaning liquid which can be filled into the cleaning machine

3.18
maximum admissible design temperature
maximum temperature value of the cleaning liquid the cleaning machine is designed for

3.19
maximum admissible load capacity
maximum mass and volume of items that can be charged into the cleaning machine. The load may contain more than one item

3.20
multistage process
process during which the items are treated within several successive stages. The process can be carried out in one or in several chambers or tanks

3.21
normal operation
situation where the equipment, protective system, and components perform their intended function within their design parameters (see also 5.2.2.a) of EN ISO 12100-1:2003)

3.22
organic solvent
solvent of which a molecule contains at least one carbon atom

3.23
safety data sheet
document, drawn up in 16 chapters in compliance of the Directive 67/548/EEC, reporting the characteristics of a chemical product to evaluate the potential risks soaring from its use

3.24
solvent
liquid into which another substance can be dissolved

3.25
spray process
cleaning/washing operation where a cleaning liquid is pressurized and applied to the item to achieve a required result

3.26
surface cleaning process
whole process to achieve the required level of cleanliness by which soils and other contaminants are removed in one or more stages from the surface of the item by chemical, mechanical and/or thermal action

3.27
surface pre-treatment process
whole process to achieve the required surface property of the item by chemical, mechanical and/or thermal action (e.g. by pickling, phosphating, chromating, passivating)

NOTE The surface pre-treatment process is applied to remove e.g. corrosive products, mill scale, burrs, as well as for generating conversions layers (non-metallic, frequently inorganic layers on metal surfaces).

3.28
thermal cut-off
safety device which cuts off the heating system or any heat source in order to avoid over temperature

3.29
tunnel machine
cleaning machine consisting of a housing for continuous movement of items to be processed with openings for feeding in and out items

3.30
turntable machine
closed cleaning machine with a rotating platform for processing items

3.31
water based cleaning liquid
solution or mixture of solid, liquid or pasty substances in or with water of any pH-value. Water based cleaning liquids can appear as emulsions, dispersions or suspensions

3.32
integrated feeding system
feed mechanism for the item which is integrated with the cleaning machine and where the item is held and controlled mechanically during surface cleaning and pre-treatment process

3.33
loading/unloading
operation where the item is put on/taken from the integrated feeding system

4 List of significant hazards

4.1 General

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

Additional specific hazards are mentioned in EN 12921-2, EN 12921-3 and EN 12921-4.

NOTE Information on the method of risk analysis is given in EN 1050.

4.2 Mechanical hazards

4.2.1 Crushing, shearing, cutting, entanglement, drawing-in, impact

These hazards may result from the mechanical interfaces of the following equipment especially with cleaning machines:

— moving parts (e.g. covers, doors, including conveyor systems e.g.: chain, belt and roller type);

— product handling system (e.g. hazards from inrunning nips);

— product handling systems and reciprocators which are part of the cleaning machine;

— fans and automatic damper adjusters (e.g. injuries caused by over-running of fan blades);

— automatic equipment or systems (e.g. power driven turntables for items, reciprocators).

4.2.2 High pressure fluid ejection

These hazards are related to:

— overpressure;

— rupture of the piping or joints due to failure, breakdown, vibrations, corrosion.

NOTE The hazards under this sub-clause are of a mechanical nature, but the aggravating effects of the nature of the cleaning liquid should be considered. It is recommended to refer to 4.7.

4.2.3 Ejection of parts of the cleaning machine and/or items

These hazards may occur, for instance, by

— fall of items while loading/unloading or during the process.

NOTE The hazards under this sub-clause are of a mechanical nature but the aggravating effects of the nature of the cleaning liquid should be considered. It is recommended to refer to 4.7.

4.2.4 Loss of stability (of cleaning machine and cleaning machine parts)

These hazards are related to, e.g.

— improper positioning of the cleaning machine;

— overload;

— overfilling.

NOTE The hazards under this sub-clause are of a mechanical nature but the aggravating effects of the nature of the cleaning liquid should be considered. It is recommended to refer to 4.7.

4.2.5 Personnel's slip, trip and fall hazards

Such hazards may occur, for instance, on gangways, platforms, ladders, stairs, gratings and excavations equipping the cleaning machines.

4.3 Electrical hazards

These hazards are related to

— electrical shock (direct or indirect contact);

— external influences on electrical equipment (electromagnetic influences).

4.4 Thermal hazards

These hazards resulting in burns and scalds are related to by e.g.:

— contact of skin with hot surfaces;

— radiation and/or convection of heat;

— overheating of the cleaning liquid.

4.5 Hazards generated by noise

Emission of airborne noise can cause hearing impairment, accidents due to interferences with verbal communication and acoustical danger signals, extra-auditory effects, shock-reactions.

Such noise emissions can be generated by e.g.:

— ultrasonic transducers;

— fans;

— vibrations;

— compressed air;

— pneumatic devices.

4.6 Hazards generated by materials and substances processed, used or emitted by the cleaning machine

4.6.1 General

An assessment of the foreseeable risks from substances used or generated by the process shall be made, as far as it is possible, covering any potential personal exposure arising from the cleaning machine.

Characteristics of cleaning liquids can be taken from the safety data sheet of the chemical product(s).

The level of risk depends on the dangerous properties of the substances, the likelihood that exposure will occur and the degree of exposure. Such substances can be in any physical state (gas, liquid, solid) and can enter the body by inhalation and/or contact (EN 626-1 applies).

4.6.2 Hazards resulting from contact with/or inhalation of dangerous liquids, gases, vapours, aerosol, fumes and dusts caused by e.g.:

— preparation of the cleaning liquid;

— cleaning liquid used in the cleaning machine during normal operation and maintenance;

— fumes and emissions generated by the surface cleaning and pre-treatment process;

— spillage of cleaning liquid generated by dripping off parts processed, condensation of cleaning liquids, fault or breakdown and fumes and emissions arising from such spillage;

— fumes and emissions generated by chemical reaction;

— fumes and emissions generated by chemical decomposition.

NOTE See also 4.9.

4.6.3 Fire and explosion hazard

4.6.3.1 Fire hazard

Fire hazards can be generated by, e.g.:

— ignition of flammable solvents inside the cleaning machine or in exhaust ducts;

  — when the cleaning machine is in operation a misuse or mechanical or electrical defects can cause ignition of flammable solvents;

  — in maintenance operations requiring use of cutting or welding tools, energy released can also initiate a combustion.

The fast propagation of fire induces a risk for the neighbouring areas;

— ignition of cleaning rags containing solvents;

— heating devices capable of igniting solvents.

NOTE Examples of ignition sources are:

— hot surfaces e.g. of heating systems and electrical equipment;

— sparks created by mechanically induced energy e.g. fans, conveyors, etc.;

— electrostatic discharges;

— electrical sparks;

— welding and other sources of thermal energy used during maintenance and cleaning.

4.6.3.2 Explosion hazard

Explosion hazards can occur inside the cleaning machine when the concentration of the flammable substances in air exceeds the lower explosion limit (*LEL*) and if an effective ignition source is present.

NOTE 1 Examples of sources of flammable substances which increase concentration above the normal:

— solvent vapours from the cleaning process inside the cleaning machine;

— solvent vapours from the flash off process;

— gases released from deposits;

— products of chemical reaction or decomposition of the cleaning liquid;

— combustible heating gases;

— solvent vapours from any leakage from broken pipes or fittings;

— solvent vapours from recirculating process;

— cleaning liquid is contaminated by a liquid with a low flash point (e.g. when cleaning carburettors).

NOTE 2 For examples of sources of ignition see Note of 4.6.3.1.

4.7 Hazards combinations

Some individual hazards which seem to be minor may, when combined with each other lead to a risk which should be dealt with. A risk assessment shall be done in relation to the nature of the process, the cleaning liquid used and the material of items.

4.8 Hazards caused by failure of energy supply

A risk assessment shall be done in relation to the nature of the process, the cleaning liquid used and/or the items material for instance against:

— failure of forced ventilation;

— unexpected ejection of cleaning machine parts or cleaning liquids;

— failure, malfunction of control system (unexpected start up, unexpected overrun, cooling system failure);

— items remaining in the cleaning machine.

4.9 Hazards related to failure of control systems

These hazards may lead to:

— overtemperature due to failure of maximum temperature control;

— increased emission of vapours in case of reduction or loss of cooling capacity;

— breakdown of forced ventilation causing accumulation of vapours.

5 Safety requirements and/or measures

5.1 General

Machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the cleaning machine shall be designed according to the principles of EN ISO 12100-2 for relevant but not significant hazards which are not dealt with by this standard (e.g. sharp edges).

5.2 Safety requirements and measures against mechanical hazards

5.2.1 Safeguarding of danger points

5.2.1.1 General

Inrunning nips on cylinders, drums, rolls and similar parts shall be safeguarded e.g. by guards or by applying the safety distances specified in EN 349.

Guards shall be designed as follows:

As guards without openings or with openings for feeding the material (for example items). The safety distances shall be established in relation to the width of the opening in accordance with EN 294. Movable guards shall satisfy the requirements of 5.2.1.3.

For cleaning machines constituting movable parts see 7.2.5, fifth indent.

5.2.1.2 Safety measures against crushing, shearing, cutting, entanglement, drawing-in, impact

Moving parts such as power driven turntables, agitation systems, integral conveyors, product handling systems and reciprocators and forced ventilation system shall be designed in such a way that in normal operation and maintenance crushing, shearing, cutting, entanglement, drawing-in, impact cannot occur.

EN 294, EN 349, EN 811, EN 842, ISO 3864-1, EN 619 and EN 953 shall be taken into account.

The instruction handbook shall contain a warning against residual risks resulting from the presence of non-guarded product fixing devices, e.g. hooks.

Starting of handling systems or reciprocators shall be preceded by an acoustic or optical signal. EN 61310-1 and EN 61310-2 shall be taken into account.

5.2.1.3 Guards and interlocks

Guards shall satisfy the requirements of EN 953. Interlocking shall satisfy the requirements of clauses 5 and 6 of EN 1088:1995.

For interlocking, see 5.9 (control systems).

For fence-type enclosures, the safety distances according to EN 294 apply. A further requirement is that the distance between floor and lower edge of the fence is 200 mm maximum and between floor and upper edge 1,4 m.

Guards and doors giving access to moving parts that need to be accessed frequently shall be safeguarded by interlocking with the hazardous movement (see 5.9).

〈A1〉 When fixed guards are applied, they shall be fixed by stems that can be opened or removed only with tools. Their fixing systems shall remain attached to the guards or to the machinery when the guards are removed. Where possible, these guards shall be designed in such a way that they can only remain in place using their fixing system. 〈A1〉

Guards that do not have to be opened frequently shall either be fixed in such a way that their removal necessitates the use of a tool or they shall be interlocked with the hazardous movement (see 5.9).

For the purpose of this document guards and doors are removed "frequently", including for maintenance purposes, if they are to be removed at least once per work shift.

NOTE Guards and doors are removed for "setting-up" purposes, for example:

- to supply items to be processed,
- to supply the cleaning liquid,
- for make-ready.

Automatic travel of movable guards shall not create danger points.

5.2.1.4 Moving parts of the cleaning machine

Access to power driven turntables, rotating baskets or container shall be prevented by fence-type enclosure or ESPD or be safeguarded in a way resulting in the same level of safety.

Access doors and openings for feeding items which are accessible by persons shall be interlocked with the dangerous movement.

The travel when opening automatic powered doors if installed shall be guarded in such a way that the hazard from crushing between the door leaf and fixed adjacent machinery parts or walls is prevented.

5.2.1.5 Location of controls

Safety, measuring and regulating devices shall be arranged such that easy access and replacement is possible and shall be protected against damage and contamination.

Preferably the main control panel shall be located in such a way that all doors and openings which give access to the cleaning machine can be observed.

Where a one-hand operated hold-to-run control is provided to prevent the operator from reaching dangerous moving parts, it shall be located in a way that it is not possible for the operator to reach hazardous moving parts.

Provisions shall be made that hazardous movements can only be started from a control located in such a way that it is not reachable from the inside of a guarded area.

An emergency stop control shall at least be located at the main control panel and at every designated control position.

5.2.1.6 Prevention against the hazard from close or fall of covers, lids and doors

Guards, that can be opened (e.g. covers, lids and doors) shall be safeguarded against gravity falls or unintended or/and unexpected close if this creates a risk of injury.

This requirement can be achieved, e.g. by

— devices for balancing the weight,

— pneumatic spring,

— latches which automatically hold the parts open,

— ensuring that the centre of gravity of the guard in the open position is sufficiently far behind the axis of rotation.

Springs used for balancing the weight shall be designed such that, in the event of a spring failure, no dangerous closing movement may occur. Compression-type springs are to be preferred.

Vertical or powered covers, lids and doors shall be designed in such a way that during their operation they do not generate such risks.

This requirement can be achieved by:

— fixed distance guards,

— two-hand control devices.

5.2.1.7 Devices for setting-up, make-ready, cleaning and trouble-shooting during the work process

When access to the cleaning machine is needed during the work process for setting-up, make-ready, cleaning and trouble-shooting, hold-to-run devices shall be provided for controlling hazardous movements inside guarded areas. A lockable selector switch shall be provided to allow only normal operation or hold-to-run operation at a time. Where both hold-to run devices and two-hand controls are present, the selector switch shall enable the choice between hold-to-run mode with one actuator and the two-hand control mode.

Hold-to-run control devices shall have a displacement limited to a maximum of 75 mm or with a maximum operating speed of 5 m/min. For the application of hold-to-run devices designed as two-hand control device, the same limitations of displacement and operating speed shall apply. The movement shall come to a stop in a time that, taking into consideration the hand approach speed, ensures there is no danger for the operator. The hand approach speeds specified in EN 999 shall be taken as a basis.

Where hold-to-run controls are being used to allow safe control of hazardous movements, starting the cleaning machine in the hold-to-run mode, after opening the interlocking guard, shall only be possible when other interlocking guards outside the area that can be observed by the operator are closed.

5.2.2 Safety measures against high pressure fluid ejection

5.2.2.1 General

Cleaning machines and their parts shall be designed and constructed in such a way that ejection of a cleaning liquid at a pressure which can cause harm cannot occur in normal operation and maintenance.

Hydraulic power systems and components shall comply with EN 982.

Pneumatic power systems and components shall comply with EN 983.

These requirements shall be fulfilled by:

— Adequate design of all parts under pressure;

— Guards and protection according to EN 953;

— A means of isolating parts under pressure if the rest of the cleaning machine is depressurised (see 5.2.2.2).

5.2.2.2 Safety measures against overpressure

In case that overpressure leads to uncontrolled escape of pressurized cleaning liquid, cleaning machines shall have an overpressure detecting device at the outlet of the pressure generator or at any other suitable location. This device shall be interlocked with a pressure limiting device or pressure relief device.

Safety devices shall be designed and positioned in such a way that persons cannot be injured by escaping liquids or by broken pieces.

Cleaning machines and all their operating systems shall have means for depressurising to enable safe access.

5.2.2.3 Safety measures against rupture and corrosion of piping or joints

Rupture of piping or joints shall be prevented or minimised by:

— Adequate mechanical strength and/or suitable protection;

— material and construction suitable to the nature of cleaning liquid used;

— reduction of vibration to a level not affecting material or construction;

— inspection and maintenance procedure described in the instruction handbook;

— suitable resistance against thermal strain.

5.2.3 Safety measures against ejection of parts of the cleaning machine and/or items

Cleaning machines shall be designed in such a way that in normal operation ejection of parts of the cleaning machine (for example rotating baskets or container) or any items do not generate a risk. This shall be fulfilled by:

— Guard and protection according to EN 953 (see also 5.2.1.3, 5.2.1.4, 5.2.1.5),

or

— Other safety devices resulting in the same level of safety (e.g.: monitoring device for speed of rotation, subsequent automatic stop and alarm, power limiting devices).

If items processed can fall off the conveying system (e.g.: at the end of tunnel machine) suitable marking and indication shall be provided.

5.2.4 Safety measures regarding mass and stability and inadequacy of mechanical strength

5.2.4.1 General

The design shall take into consideration the mass and volume of the stored cleaning liquid and prevent any leakage of dangerous cleaning liquids.

Cleaning machines and their parts shall be designed, constructed and installed so that their stability shall be ensured.

NOTE Permanent excessive deformation can lead to leakage.

5.2.4.2 Positioning of the cleaning machine

Cleaning machines shall be designed and equipped in such a way that they are stable. The requirements of EN ISO 12100-2 shall be satisfied.

Stability can be ensured by e.g.:

— adequate dimensioning of base;

— low centre of gravity;

— means for fixing.

If necessary, suitable marking and warning for the fixing of the cleaning machine shall be given.

In the case of cleaning machines installed in a pit, the installation shall comply with the following:

— cleaning machine shall emerge at least one metre above ground level free access shall be ensured in the pit and around the cleaning machine;

— provision between the pit wall and the cleaning machine of a metal grating shall form an integral part of the stairway and ladder the latter being capable of being padlocked.

5.2.4.3 Safety measures against overload

Overload of the cleaning machine shall be prevented by suitable marking and warning specifying the maximum admissible load capacity of the cleaning machine or a load limiting device.

The instruction handbook shall contain detailed instructions for filling (see clause 7).

5.2.4.4 Safety measures against spillage

Spillage of the cleaning machine shall be prevented by one of the following:

— filling limiting devices;

— overflow outlet connected to a tank;

— suitable marking and warning specifying the maximum admissible cleaning liquid capacity of the cleaning machine;

The instruction handbook shall contain detailed instructions for filling (see clause 7).

If the risk-assessment reveals a hazardous impact on the working area, the provision of a sealed retention area/trap/pit able to collect the quantity of cleaning liquid which may escape shall be installed.

NOTE For classified dangerous substances see European Directive 98/98/EC.

5.2.5 Safety measures against slip, trip and fall

Gangways and handrails that equip the cleaning machine shall comply with EN ISO 14122-1, EN ISO 14122-2 and EN ISO 14122-3.

Floor grating joints shall not have projections or holes capable of tripping and/or hindering the operator.

Floor and all gangways shall be non-skid (see EN ISO 14122-2).

Where the tank side is used to prevent operators falling into the tank from an adjacent walkway, the tank top shall be at least 1,1 m above personal passage level. If not, other safety measures, such as handrails of the same minimum dimensions, shall be provided.

5.3 Safety requirements and measures against electrical hazards

5.3.1 General

Electrical equipment shall comply with EN 60204-1.

5.3.2 Safety measures against electric shock

Protection against electric shock shall comply with the requirements of clause 6 of EN 60204-1:1997.

Cleaning machines and their components shall be designed and constructed such that no hazards will arise from electrical equipment neither while spraying of liquids during normal operation nor in case of leakage.

All mechanical conductive parts of the installation shall be earthed (see clause 8 of EN 60204-1:1997). Measuring devices which are part of the machinery shall comply with EN 61010-1.

5.3.3 Safety measures against electromagnetic influences on electrical equipment

Electrical and electronic components of the cleaning machines shall be resistant against electromagnetic influences. Every interference with control systems of cleaning machines that can lead to an unsafe situation shall be prevented (see EN 61000-6-1, EN 61000-6-3).

5.4 Safety requirements and measures against thermal hazards

5.4.1 General

Cleaning machines shall be designed and constructed to minimise any risk of injury caused by contact, radiation or convection from hot or very cold surfaces of the cleaning machine and its parts or cleaning liquid and items being processed.

Limits of temperatures of touchable surfaces given in EN 563 shall be observed (see 5.4.3).

The hazard of touching hot surfaces shall preferably reduced by:

— limitation of cleaning liquid temperature (see also 5.4.5);

— cooling the items processed;

— insulation (see also 5.4.3);

— guarding to keep distance (screen, barrier, according to EN 953).

And where necessary:

— marking and warning signals (according to EN 894-1, EN 894-2, EN 894-3, EN 61310-1, EN 981);

— instructions for use;

— personal protective equipment.

Cleaning machines shall be safeguarded to prevent the cleaning liquid exceeding the maximum admissible design temperature for the intended use. When temperature limiting controls are used, over-temperature shall at least be avoided by end of scale of the temperature setting device or protection of the maximum set point by key lock or code system (see also 5.4.5).

5.4.2 Heating systems

See also in conjunction with 5.6.2.6.

Heating systems and their components shall be designed and constructed in accordance with the intended use of the cleaning machine to avoid dangerous situations arising during normal operation and maintenance.

This especially applies to:

— materials to be used and their compatibility with cleaning liquids;

— foreseeable nature and characteristics of the cleaning liquid to be used;

— specific surface thermal load at which a chemical decomposition may occur;

— foreseen working temperature of the cleaning liquid.

Heating elements and temperature control probe shall be protected by low cleaning liquid level control with cut-off and alarm, audible and/or visible, to ensure that they are immersed into the cleaning liquid if failure to do so would generate a hazard during normal operation or maintenance.

Heating systems and their components which can lead to dangerous situations due to baked on deposits (e.g. because of reduced heat dissipation) shall be dismountable and accessible for maintenance and inspection without any physical obstacle. Location, means and frequency of maintenance, shall be indicated as "information for use".

This especially applies to:

— electric heaters and/or burner heat exchangers;

— tanks containing cleaning liquids when risks could arise from a low level;

— ultrasonic transducers.

5.4.3 Measures against contact of the skin with hot surfaces

Protection against burns by hot surfaces shall be secured by means of appropriate insulation or protection against contact of all elements within arm’s reach and within the working area. According to EN 563 at an ambient temperature of 20 °C the surface temperature shall be less than 60 °C. Exceptions are permissible in small localised areas of the surface (for example flanges of burners, bolts, fan and roller shaft).

5.4.4 Measures against radiation and/or convection of heat

If radiation and/or convection of heat (e.g. burns caused by hot plumes) can lead to dangerous or unhealthy situations generated by the cleaning liquid or cleaning machine parts, risk reduction measures by design shall be adopted separately or combined e.g. by:

— covers, lids, doors;

— cooling system;

— forced ventilation.

Additional optical and/or audible alarms according to EN 981 shall indicate all identified failures of the examples of systems mentioned above.

5.4.5 Measures against overheating of cleaning liquid

See also in conjunction with 5.6.2.6.

When overheating can generate additional hazards the cleaning machine shall be equipped with a thermal cut-off with audible or/and visible signal according to EN 981.

Where applicable, cleaning machines shall be equipped with a temperature limiting device interlocked with the power supply of the heating system and shall trigger optical and/or audible alarms according to 5.4.4 and 5.4.5. See also 5.2.2.2.

The set point adjustment shall only be accessible by a competent person.

The reset of the cut-off shall be manual, restart of the heating shall not be done automatically.

Temperature control devices and temperature limiting devices shall be independent from each other.

Temperature limitation shall not be required, if the heating medium, even in the case of operational failure, cannot raise the cleaning temperature above the "maximum admissible design temperature" in the respective case.

5.5 Safety requirements and measures against noise

5.5.1 General

The cleaning machine shall be designed and constructed so that the risks resulting from emission of airborne noise are reduced to the lowest level, taking into account technical progress and availability of means for noise reduction, especially at source.

5.5.2 Noise reduction at source at the design stage

The principal safety measures which may be implemented are the following:

— prevention of mechanical impacts;

— selection of components with noise emission levels as low as possible;

— equipment set on anti-vibratory supports;

— flexible connections between the ducts;

— duct soundproofing.

Other measures with the same or higher efficiency can be used.

When designing the cleaning machine recommendations given in EN ISO 11688-1 shall be taken into account.

NOTE EN ISO 11688-2 gives useful information on noise generation mechanisms in machinery.

The determination, declaration and verification of airborne noise emission of cleaning machines shall be carried out as stated in EN 14462.

5.5.3 Noise reduction by protective measures

Protective measures may be e.g.: total or partial enclosures, screens closely fitted to the cleaning machine (to stop ultra-sounds for example), silencer where compressed gas is used.

5.5.4 Noise reduction by information on personal protective equipment (PPE)

If relevant, the manufacturer shall recommend wearing additional hearing protectors (see 7.2.6).

5.6 Safety requirements and measures against hazards generated by materials and substances processed, used or emitted by the cleaning machine

5.6.1 General

For the design of the cleaning machine an assessment of the foreseeable risks arising from cleaning liquids shall be made according to their chemical and physical characteristics and the intended use of the machine. The safety data sheets of substances and compounds of the cleaning liquid shall be taken as a base for assessment.

5.6.2 Safety measures against contact with/or inhalation of dangerous liquids, gases, vapours, aerosols, fumes

5.6.2.1 General

Contact with the skin, inhalation of dangerous substances shall where possible be reduced or avoided by design.

This can be achieved by e.g.:

— totally enclosed process and handling systems;

— remote controlled and automated processes;

— automatically powered covers (see also 5.2.1.6);

— vapour condensation;

— forced ventilation.

5.6.2.2 Safety measures against contact with the cleaning liquid used in the cleaning machine during normal operation

Cleaning machines shall be designed and constructed to avoid contact with dangerous cleaning liquids during normal operation. This can be achieved e.g. by:

— adequate depth of the tank (e.g. for immersion process machines depending on the mass, volume and means of loading);

— limiting the agitation of cleaning liquid and/or item;

— manual or automated doors, lids and covers;

— guards and interlocks according to 5.2.1.3.

In particular, spray process machines shall be equipped at least with a safety device to prevent starting of the pump in any condition which can lead to ejection of cleaning liquid from the cleaning machine. The safety device shall be designed and positioned accessible to the operator.

Examples for a suitable location can be:

— access door and/or cover of top loading spray washer machines, turntable machines,

— automated covers;

— automated refilling.

An information for use by suitable marking and/or prescriptions shall be given in the instruction handbook.

5.6.2.3 Safety measures against emissions generated by the cleaning process

Cleaning machines which can generate dangerous vapours or mist shall be constructed in such a way as to reduce emissions in the work environment, during normal operation, below the admissible exposure limits values.

NOTE Information to exposure limits is given in Annex A.

5.6.2.4 Safety measures against dripping of cleaning liquid

Cleaning machines shall be designed, constructed and installed in such a way as to avoid dripping of cleaning liquid or to reduce the effects of foreseeable dripping.

This can be achieved by the following measures used separately or combined:

— tray and drip collectors to drain items before unloading;

— design of the cleaning machine to collect and return the cleaning liquid dripping from items;

— design and construction of those parts where condensation can occur (e.g.: covers, doors, lids and openings) in such a way as to avoid dripping in any condition or the dripped liquid is recirculated without hazard;

— suitable trays and/or protection to collect foreseeable drips and protect parts of the cleaning machine that can be affected by the cleaning liquid (e.g.: motors, controls, cables).

5.6.2.5 Safety measures against inhalation of emissions and/or contact with cleaning liquids generated by chemical reaction

Cleaning machines in which a chemical reaction can occur during normal operation shall be designed in a way to prevent emission of dangerous vapours or cleaning liquid coming in contact with the operator.

Cleaning machines in which can generate hazardous emissions shall be equipped with a forced ventilation to reduce the concentration of dangerous substances in the operator's working area below exposure limits.

When chemical reaction can occur during preparation or filling operations, the cleaning machine shall be equipped with specific devices (for example insert baskets) to avoid risks during these operations.

5.6.2.6 Safety measures against inhalation of emissions generated by chemical decomposition

Cleaning machines designed for use with cleaning liquid subject to chemical decomposition shall be designed and constructed as appropriate to prevent decomposition.

At least the following measures shall be applied:

— prevention of overheating of cleaning liquid (see 5.4.5);

— heating system compatible with characteristics and nature of cleaning liquid (see 5.4.2);

— forced ventilation.

Operations and limitations shall be included in the information for use by suitable marking and/or in the instruction handbook.

5.6.3 Safety requirements and measures against fire and explosion

Cleaning machines designed and constructed to be used with flammable liquids shall comply with EN 13478 and EN 12921-3.

For cleaning machines designed for use in a potentially explosive atmosphere an additional explosion risk analysis shall be done according to EN 1127-1.

5.7 Safety requirements and measures against hazard combinations

The manufacturer shall inform the user about possible risks evolving from hazard combinations. See 7.2 for detailed information.

5.8 Safety requirements and measures against failure of energy supply

5.8.1 General

Cleaning machines shall be designed and constructed to eliminate the risk of injury caused by failure of energy supply.

If residual risks remain, further information shall be given in the instruction handbook, with regard to any shortcomings of the protection measures adopted.

Where more than one type of energy is used (e.g.: electric and pneumatic) the failure of any one shall not cause a hazard to arise from sources relating to the other types of energy source.

5.8.2 Failure of forced ventilation

Forced ventilation systems shall be designed and constructed in such a way that a failure of forced ventilation cannot lead to dangerous situations e.g.: overheating of the liquid, insufficient air cooling, formation of dangerous emissions and/or explosive atmosphere.

Examples of measures are

— interruption of the cleaning process;

— prevention of uncontrolled start-up (restart) – see EN 1037;

— negation or reduction of the reducing effect in the forced ventilation flow rate such as:

  — emergency ventilation,

  — extended rundown characteristics of fan,

  — uninterrupted or back-up power supply.

5.8.3 Unexpected ejection of cleaning machine part or cleaning liquid

Cleaning machines shall be designed to avoid unexpected ejection of cleaning machine parts or cleaning liquid in the case of failure of energy supply.

Examples of measures are:

— liquid supply automatic cut-off;

— liquid drain-out cut-off;

— hydraulic and pneumatic equipment according to 3.8 of EN ISO 12100-1:2003, EN 982, EN 983;

— automatic cut-off and alarm (according to EN 981);

— indications in the instruction handbook.

5.8.4 Hazards of items being stuck in the cleaning machine

Cleaning machines shall be designed to avoid items being stuck in the cleaning machine in the case of failure of energy supply, if this can lead to a hazard.

Examples of measures are:

— automatic extraction of items from potentially endangered areas;

— mechanisation (manual) of loading/unloading operation;

— automatic or fast operating drain-out of cleaning liquid;

— easy access to the equipment necessary to eliminate the risk;

— installing visual and/or audible alarms (see also 5.4);

— additional information about the residual risk in the instruction handbook;

— training of the personnel.

5.9 Safety requirements and measures against failure of control systems

5.9.1 General

The control circuits of the following equipment are considered safety-related:

— forced ventilation (see 5.6.2.5);

— liquid level detection system (see 5.4.2);

— all interlocking devices (see 5.2.1.3, 5.2.1.4);

— mode selector devices (see 5.2.1.7);

— overpressure devices (see 5.2.2.2);

— speed limiting devices of e.g. powered turntables (see 5.2.3);

— supply circuits for each type of energy used;

— hold-to-run devices (see 5.2.1.7);

— hydraulic/pneumatic devices;

— power limiting devices (see 5.2.3);

— emergency stop and alarm devices (see 5.2.3);

— load limiting devices (see 5.2.4.3).

Control switches for starting hazardous movements shall be in accordance with the requirements of EN 1037.

Cleaning machines shall be provided with separate main control switches for each type of energy used. The requirements of EN 1037 shall be satisfied.

5.9.2 Level of safety

Control circuits which are used in safety-related functions shall fulfil the requirements of EN 954-1 category 3 and EN 1088. For safety-related functions see EN 954-1 and CR 954-100.

For control requirements for cleaning machines which do not require routine and regular access to danger points, the following measures shall apply:

— The safety related part of a hydraulic/pneumatic control system shall satisfy at least category 1 (see 6.2.2 of EN 954-1:1996).

— The safety related part of a electric/electronic control system shall satisfy at least category 3 (see 6.2.4 of EN 954-1:1996). It is allowed to provide single main contactors.

NOTE Category 3 means that faults in the safety related part of a control system (e.g. auxiliary relays, auxiliary contactors, computers for safety-related functions or special PLCs (Programmable Logic Control) for monitoring) are detected and that measures are taken to bring the controlled equipment into a safe state (e.g. stop of hazardous movements). According to EN 60204-1 programmable electronic control functions are not allowed considered safe in all cases.

5.9.3 Emergency stop equipment

Emergency stop equipment shall fulfil the requirements of EN 418.

Electrically operated emergency stop devices and circuits shall fulfil the requirements of EN 60204-1.

5.9.4 Failure or malfunction of the control system

To avoid a dangerous situation in the case of malfunction of the control system, cleaning machines shall be designed to prevent uncontrolled start-up (restart) according to EN 1037 and where applicable:

— Shall be designed to prevent unexpected overrun;

— Shall be equipped with a detection device which detects any failure or reduction of the cooling capacity and which indicates the failure by optical and/or audible alarms according to 5.4.4 and 5.4.5. See also 5.2.2.2.

  This device shall lead to a shut-off of other systems (e.g. heating, spraying, recirculation). Examples of possible additional measures are:

— Reduction of thermal inertia;

— Automatically closing doors or covers;

— Increase capacity of exhaust fans.

Failure and/or malfunction of control system can result in hazards, which are the same as resulting from the failure of energy supply.

6 Verification of the safety requirements

6.1 General

The safety requirements detailed in clause 5 shall be checked by testing, calculation, inspection or other methods, according to the following clauses.

Verification shall be checked before or during commissioning.

6.2 Mechanical

Verification of requirements under 5.2 and the measures adopted can be carried out by visual and/or physical inspection.

In addition piping shall be tested with a pressure of 1,3 times the maximum permissible working pressure.

Test pressure has to be applied for a minimum time of 15 min. During pressure test no leakage shall be observed.

6.3 Electrical

Verification of requirements under 5.3 shall be carried out according to EN 60204-1 and the following tests shall be performed on all cleaning machines when the electrical equipment is fully connected to the cleaning machine:

— continuity of the protective bonding circuit (see 20.2 of EN 60204-1:1997);

— insulation resistance tests (see 20.3 of EN 60204-1:1997);

— voltage tests (see 20.4 of EN 60204-1:1997);

— functional tests (see 20.7 of EN 60204-1:1997).

6.4 Thermal

6.4.1 General

Verification of requirements under 5.4 shall be carried out by visual inspection and suitable instrumentation for temperature measurement.

Instrumentation shall be used which ensures a minimum accuracy in the measurement of ± 2 K.

6.4.2 Heating systems

6.4.2.1 Temperature limitation and cut-off devices

For the verification of the temperature limitation (thermostat) and cut-off devices proceed as follows:

— for adjustable device(s) (thermostat) set the temperature 10 K below the maximum admissible design temperature. For cut-off device(s) set the controls in such a way the cut-off can operate;

— switch on the heating and all the heat sources into the cleaning machine;

— when the heating switches off (thermostat cut-off temperature) count down 15 min then immerse the probe of the verifying instrumentation in to the cleaning liquid and compare the temperature value on the instrumentation to the temperature set on the limiting device (thermostat). Discrepancy shall not exceed + 2 K of cleaning liquid.

6.4.2.2 Alarm(s)

Verification of alarm(s) shall be made by visual and/or audible inspection.

6.4.3 Temperature of touchable surfaces

Verification of temperature of touchable surfaces of the cleaning machine shall be carried out in a room at ambient temperature not below the normal temperature where the cleaning machine is used or temperature compensation shall be done.

Verification of temperature of touchable surfaces shall be carried out at the maximum temperature which can be reached at the steady state when all parts in contact with cleaning liquid are at their maximum admissible design temperature.

6.5 Noise

Verification shall be carried out by using a method for the determination of emission sound pressure levels at work stations or other specified positions as well as the determination of sound power levels for surface treatment machines according to EN 14462 during commissioning.

6.6 Material and substances processed, used or emitted by the cleaning machines

6.6.1 Contact with/or inhalation of dangerous cleaning liquids, gases, vapours, mists, fumes

6.6.1.1 General

Verification of requirements under 5.6.2 and the measures adopted shall be carried out by visual inspection and measurements.

6.6.1.2 Cleaning liquid used in the cleaning machine during normal operation

Verification of requirements under 5.6.2.2 and the measures adopted shall be carried out by visual inspection and measurement.

6.6.1.3 Fumes and emissions generated by the cleaning process

Verification of requirements under 5.6.2.3 and the measures adopted shall be carried out by visual inspection and measurement of airborne emissions according to EN 1093-3.

6.6.1.4 Dripping of cleaning liquid

Verification of requirements under 5.6.2.4 and the measures adopted shall be carried out by visual inspection.

6.6.1.5 Fumes and emissions generated by chemical reaction

Verification of requirements under 5.6.2.5 and the measures adopted shall be carried out by visual inspection.

6.6.1.6 Fumes and emissions generated by chemical decomposition

Verification of requirements under 5.6.2.6 and the measures adopted shall be carried out by visual inspection and measurements according to 6.4.2.1.

6.6.2 Fire and explosion

For cleaning machines designed for using flammable liquids the verifications of requirements are dealt with in EN 12921-3.

6.7 Hazard combinations

Verification of requirements under 5.7 by checking the detailed user information in 7.2.

6.8 Failure of energy supply

Verification of requirements under 5.8 and the measures adopted shall be carried out by visual inspection.

6.9 Control systems

Verification of the requirements detailed in 5.9 shall be carried out by testing and visual inspection. The presence, function and labelling of safety devices shall be checked.

7 Information for use

7.1 General

Information for use shall be drawn up in accordance with clause 6 and in particular with 6.5 of EN ISO 12100-2:2003 for instruction handbook.

The instructions shall be drawn up in one of the languages of the EEA. On being put in service, cleaning machine shall be accompanied by a translation of the instructions in the language of the country in which the cleaning machine is to be used and by the instructions in the original language issued by the manufacturer.

The maintenance instructions for use by specialised personnel may be drawn up in only one of the Community languages understood by that personnel.

It shall provide specifications for the commissioning, the use and the maintenance of cleaning machines and include, as the case may be, information and safety instructions to the user for the correct and safe use of the dip and electrophoretic coating machinery, and notably the following:

7.2 Instruction handbook

7.2.1 General

The manufacturer shall supply an instruction handbook according to 5.5 of EN ISO 12100 2:2003. Each cleaning machine shall be accompanied by an instruction handbook containing the following information; the content of which depends on the type of cleaning machine. Here, the following structure of clause could be used as an orientation.

7.2.2 Information relating to the cleaning machine

— designation of series or type;

— performance data;

  — description of a typical load of the items (maximum weight, dimensions, proper positioning in order to avoid cleaning liquid retention and drag-out);

  — quantities of cleaning liquid used for first start-up of the cleaning machine;

— noise emission values determined according to EN 14462 i.e.:

  — A-weighted emission sound pressure level at workstations, where this exceeds 70 dB; where this level does not exceed 70 dB, this fact shall be indicated;

  — A-weighted sound power level where the A-weighted emission sound pressure level at workstations exceeds [A1] 80 dB [A1]

— description of application of machinery (intended use);

— specification of workplaces on the cleaning machine.

7.2.3 Information relating to safety

— diagrams or cross sections of cleaning machine showing safety devices and measures;

— description of the cleaning machine and all necessary information and instruction (e.g. diagrams, drawings, fittings, guards and safety devices, data about electrical equipment according to 3.2 of EN 60204-1:1997) for safety

— warning against

  — use of cleaning liquids which are inappropriate for the cleaning device in question. The information of the manufacturer of the cleaning device shall be observed.

    When another cleaning liquid is used, the cleaning devices shall be adapted to the requirements of the new cleaning liquid.

    When another suitable cleaning liquid is used, a readjustment of the safety and monitoring devices, e.g. temperature limiting device, and the control devices and switching thermostats may become necessary. Generally, the manufacturer of the cleaning device can give qualified information. In most cases, a cleaning of the plant is required for such a conversion.

    The cleaning liquids shall be prepared, used, tested, controlled in compliance with the information given by the manufacturer and be stabilized and dosed again, if need be.

— neglect of relevant limitations for intended use (e.g. identification of permitted and non-permitted cleaning liquids and/or items material, range of applications for which the cleaning machine is intended and prohibited usage if any);

— use of cleaning liquid to reduce the effect of drip and spillage by suitable means (e.g.: cleaning liquid collection trays, boundary areas) taking into account the nature and quantity of cleaning liquid;

— emergency situations (e.g. unexpected emissions of corrosive solutions or hazardous gases or projection of corrosive, caustic splits. and indication of how to minimise or eliminate their dangerous effects (see 5.5.1 g) of EN ISO 12100-2:2003);

— safe working practices;

— information about dangerous airborne emissions, if any, and requirements for additional forced ventilation system, in the isolation area. Particular attention shall be given for installation within a pit where – e.g. by using flammable liquids – the forced ventilation shall not permit pockets of flammable substances to build up to concentrations above 50 % of the LEL (see EN 12921-3);

— all necessary information if the cleaning machine will be used in a potentially explosive atmosphere;

— safety information for the operator;

— unintended use.

7.2.4 Information relating to transport, handling and storage of the cleaning machine

— safety measures;

— dimensions and weight of the cleaning machine.

7.2.5 Installation, commissioning, removal

— assembly and mounting;

— de-commissioning;

— means for fixing the cleaning machine to the floor;

— space needed for operation, preventive maintenance and maintenance;

— information and instruction for fixing the cleaning machine and any constituting equipment to the floor. This includes information on the necessary space to be reserved for the location of the cleaning machine in such way that no additional crushing and shearing risk is created between the moving parts of the machine or item and other fixed adjacent machines, part of the building or stocks of material etc.;

— permissible environmental conditions;

— information and prescriptions for decommissioning, dismantling and disposal of the cleaning machine, in relation to the chemical products for which the cleaning machine was designed and the foreseeable risks soaring from the material the cleaning machine is composed, the residues of detergents and contaminants;

— instructions for connecting the cleaning machine to power supply.

7.2.6 Information relating to the use of the cleaning machine

— description of manual controls;

— instructions for setting-up and adjustment, handling of guards;

— information about residual risks;

  — the need to ensure free access around the cleaning machine;

  — the necessity of a reference indicating hot spots of the cleaning machine and referring to hazards related to burns if guards could be opened. Warning signs in the form of pictograms (Warning – hot surface) shall be placed in the vicinity of hot spots.

— information about prohibited applications and errors of operation;

  — Where necessary, the instructions shall draw attention to prohibited use, especially in relation to chemical substances the cleaning machine is not designed for;

— instructions for fault detection and repair;

— instructions relating to the use of personal protective equipment (PPE);

  — wearing of hearing protectors, if relevant;

  — prescription for the use of personal protective equipment.

7.2.7 Information relating to maintenance of the cleaning machine

— General

  Prior to repair work it shall be ensured that drives for hazardous movements are deactivated and secured against unintended start-up, equipment under excess pressure and their components are non-pressurized, fittings and supply lines are flanged off or fitted with a blind flange, if actuation may cause hazards for the repair personal, and that other protective measures for the individual case are taken.

  After maintenance and repair work especially cleaning openings, seals, screw connections and valves shall be tested for leakage.

  Work in containers which contained cleaning liquids or in confined spaces shall only be carried out after written permit, after information on the relevant safety measures and oral instruction of the operator. The person in charge shall make sure that the safety measures specified in writing are taken.

— nature and frequency of inspections;

— fault finding (with required drawings and diagrams etc.);

— preventive measures (parts with defined life, cleaning liquid);

  — a repeat of the information, except the serial number, with which the machinery is marked - see 7.3 - together with any appropriate additional information to facilitate maintenance (e.g. addresses of importer, repairers, etc.);

— spare parts;

— [A1] the specifications of the spare parts to be used, when these affect the health and safety of operators; [A1]

— trouble-shooting.

7.3 Marking

Safety related markings, signs and written warnings shall be readable, understandable and unambiguous.

Signs (pictograms) shall be used in preference to written warnings.

Written warnings shall be drawn up in the language of the country in which the cleaning machine is to be used.

Marking shall comply with standards for pictograms, symbols, colours (see ISO 7000 and ISO 3864-1). As regards marking of electrical equipment EN 60204-1 applies.

Cleaning machines shall be clearly and permanently marked with at least the following data:

— ▌A1⟩ the business name and full address of the manufacturer and, where applicable, his authorised representative; ⟨A1▐

— ▌A1⟩ designation of the machinery; ⟨A1▐

— type , model and serial number identifying the cleaning machine;

— ▌A1⟩ the year of construction, that is the year in which the manufacturing process is completed; ⟨A1▐

— electric data (voltage, frequency, power) see EN 60204-1;

— pneumatic/hydraulic characteristics, if any (pressure, flow rate);

— maximum admissible load capacity (volume and mass) (see 5.2.4.3);

— maximum admissible cleaning liquid capacity (volume and mass) (see 5.2.4.4);

— type of cleaning liquid or characteristics and limitations to define the intended use of the cleaning machine;

— maximum admissible design temperature of the cleaning machine;

— spray pressure (if applicable).

For cleaning machines designed for use of flammable cleaning liquids additional marking is dealt with in EN 12921-3.

For cleaning machines designed for use of

— water based cleaning liquids additional marking is dealt with in EN 12921-2,

— halogenated cleaning liquids additional marking is dealt with in prEN 12921-4, considering by special labels, if for example the use of corrosion solutions is prohibited.

With additional label a warning for the safe positioning of the cleaning machine according to 5.2.4.2 shall be done.

Annex A
(informative)

National references to exposure limit values

Exposure limit values are commonly defined by member states regulations. The national references – as far as known – are as follows:

Country	References to national exposure limit values for dangerous substances	Technical terms for limits
A	Amtliche Mitteilungen des Bundesministeriums für soziale Verwaltung (2/93)	MAK, TRK
B	Koninklijk Besluit tot wijziging van Bijlage II van Titel II, Hoofdstruk II bis van het ARAB wat de vaststelling van de grenswaarden voor blootstelling aan chemische agentina betreft Order in council on the modification of annex II of title II, chapter II bis from the ARAB that establishes the limit of exposure to chemical agents Ordonnance prise en conseil prive sur la modification de l'annexe II du titre II, chapitre II bis de l'ARAB qui établit les limites d'exposition des agents chimiques	VLE VLE VLE
CzR	Directive of Ministry of Health No. 58/1981 Coll., about principal hygienic requirements for maximum permitted concentration of the most important injurants in air und assessment of Level of pollution	NPK NPK-P
DK	Instruction No 3.1.0.2., December 1996, Exposure Limit Values for Substances and Materials	GV
SF	At present unknown	
F	[A1] *deleted text* [A1] [A1] ED 651 – Guide pratique de ventilation N°2 - Ventilation des cuves de traitement de surface [A1]	VMEI, VLE
D	Technische Regeln für Gefahrstoffe, TRGS 900 "Luftgrenzwerte"	MAK, TRK, BAT
G	At present unknown	
ISL	At present unknown	
IRL	At present unknown	
I	Threshold Limit Values and Biological Exposure Indices published by ACGIH American Conference of Governmental Industrial Hygienists (ACGIH)	TLV
L	At present unknown	
NL	Min. v. sociale Zaken en Werkgelegenheid P145: de nationale MAC-lijst 1996	MAC
N	Administrative normer for forurensing i arbeidsatmosfaere 1996	AT 361
P	At present unknown	
ES	At present unknown	
S	(Threshold Limit values) AFS 1996:2, Hygieniska Gränsverden	NGV, TGV, KTV
CH	Suva Publikation: Grenzwerte am Arbeitsplatz 1997 "Maximale Arbeitsplatzkonzentrationswerte gesundheitsgefährdender Stoffe. Biologische Arbeitsplatztoleranzwerte – Arbeitshygienische Grenzwerte für physikalische Einwirkungen	MAK, BAT
GB	Health and Safety Executive; H&SE EH 40/97, Part 2: "List of occupational exposure limits and other tables"	MEL, OES

Annex ZA
(informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Recast Machinery Directive 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements ((except Essential Requirements 1.2.1, 3rd paragraph, 1.2.3, 1.2.4, 1.1.2.c), 1.7.4.2.o), 3)) of that Directive and associated EFTA regulations.

WARNING – Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. 〈A1

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[3] EN 547-2, *Safety of machinery — Human body measurements — Part 2: Principles for determining the dimensions required for access openings.*

[4] EN 574, *Safety of machinery — Two-hand control devices — Functional aspects - Principles for design.*

[5] EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles.*

[6] EN 689, *Workplace atmospheres — Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy.*

[7] EN 746-1, *Industrial thermoprocessing equipment — Part 1: Common safety requirements for industrial thermoprocessing equipment.*

[8] EN 746-2, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems.*

[9] EN 746-3, *Industrial thermoprocessing equipment — Part 3: Safety requirements for the generation and use of atmosphere gases.*

〚A1〉 *deleted text* 〈A1〛

[10] EN 809, *Pumps and pump units for liquids — Common safety requirements.*

[11] EN 971-1:1996, *Paints and varnishes — Terms and definitions for coating materials — Part 1: General terms.*

[12] EN 1050, *Safety of machinery — Principles for risk assessment.*

[13] EN 1760-1, *Safety of machinery - Pressure sensitive protective devices - Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors.*

[14] EN 1760-2, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars.*

[15] prEN 1829-1, *High pressure cleaners — High pressure water jet machines — Safety requirements — Part 1: General description.*

[16] EN 12547, *Centrifuges — Common safety requirements.*

[17] EN 50015, *Electrical apparatus for potentially explosive atmospheres — Oil immersion "o".*

[18] EN 50017, *Electrical apparatus for potentially explosive atmospheres — Powder filling "q".*

[19] EN 50020, *Electrical apparatus for potentially explosive atmosphere — Intrinsic safety "i".*

[20] EN 60079-0, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements (IEC 60079-0:2004).*

[21] EN 60079-1, *Electrical apparatus for potentially explosive atmospheres – Part 1: Flameproof enclosure "d" (IEC 60079-1:2003).*

[22] EN 60079-2, *Electrical apparatus for explosive gas atmospheres – Part 2: Pressurized enclosures "p" (IEC 60079-2:2001).*

[23] EN 60079-7, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety "e" (IEC 60079-7:2001).*

[24] EN 60079-10, *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas.*

[25] EN 60079-14, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines).*

[26] prEN 60079-19, *Electrical apparatus for explosive gas atmospheres — Part 19: Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives).*

[27] EN 60335-2-54, *Household and similar electrical appliances - Safety – Part 2-54: Particular requirements for surface-cleaning appliances for household use employing liquids or steam (IEC 60335-2-54:2002).*

[28] EN 60335-2-79, *Safety of household and similar electrical appliances – Part 2: Particular requirements for high pressure cleaners and steam cleaners, for industrial and commercial use (IEC 60335-2-79:1995, modified).*

[29] EN 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices (IEC 60947-5-1:2003).*

[30] EN 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests.*

[31] EN 61779-1, *Electrical apparatus for the detection and measurement of flammable gases — Part 1: General requirements and test method.*

[32] EN 61779-2, *Electrical apparatus for the detection and measurement of flammable gases — Part 2: Performance requirements for group I apparatus indicating a volume fraction up to 5 % methane in air.*

[33] EN 61779-3, *Electrical apparatus for the detection and measurement of flammable gases — Part 3: Performance requirements for group I apparatus indicating a volume fraction up to 100 % methane in air.*

[34] EN 61779-4, *Electrical apparatus for the detection and measurement of flammable gases — Part 4: Performance requirements for group II apparatus indicating a volume fraction up to 100 % lower explosive limit.*

[35] EN 61779-5, *Electrical apparatus for the detection and measurement of flammable gases — Part 5: Performance requirements for group II apparatus indicating a volume fraction up to 100 % gas.*

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[39] IEC 60519-1, *Safety in electroheat installations — Part 1: General requirements.*

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