

**Masinad tööstuslike detailide pindade
puhastamiseks ja eeltöötlemiseks vedelike või
aurude abil. Osa 3: Süttimisohtlike
puhastusvedelikke kasutavate masinate ohutus
KONSOLIDEERITUD TEKST**

Machines for surface cleaning and pre-treatment of
industrial items using liquids or vapours - Part 3: Safety
of machines using flammable cleaning liquids
CONSOLIDATED TEXT

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 12921-3:2005+A1:2009 sisaldab Euroopa standardi EN 12921-3:2005+A1:2008 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 29.01.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 26.11.2008.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 12921-3:2005+A1:2009 consists of the English text of the European standard EN 12921-3:2005+A1:2008.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 29.01.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text 26.11.2008.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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English Version

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

Machines de nettoyage et de prétraitement de pièces
industrielles utilisant des liquides ou des vapeurs - Partie 3:
Sécurité des machines utilisant des liquides de nettoyage
inflammables

Maschinen zur Oberflächenreinigung und -vorbehandlung
von industriellen Produkten mittels Flüssigkeiten oder
Dampfphasen - Teil 3: Sicherheit von Anlagen, in denen
brennbare Reinigungsflüssigkeiten verwendet werden

This European Standard was approved by CEN on 21 March 2005 and includes Amendment 1 approved by CEN on 23 October 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.





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Foreword

This document (EN 12921-3:2005+A1:2008) 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 May 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-10-23.

This document supersedes EN 12921-3:2005.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **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 EC Directive(s).

For relationship with EC Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. **A1**

This document is part of a series of standards in the area of safety for development and construction of machines for surface cleaning and pre-treatment of industrial items using liquids or vapours.

The EN 12921 series includes 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.

NOTE Although a machine for surface cleaning and pre-treatment of industrial items, 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.

This European Standard includes a Bibliography.

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, 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.

This European Standard contains additional safety requirements to and/or deviations from EN 12921-1.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered is 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.

1 Scope

This European Standard deals with the significant hazards of machines for surface cleaning and pre-treatment - in the following called "cleaning machines" - of industrial items using flammable cleaning liquids or a mixture of cleaning liquids, even in emulsion form, which can potentially create, even temporarily, a condition of flammability.

This European Standard applies in combination with EN 12921-1. Both parts together cover all significant hazards relevant for cleaning machines of industrial items using liquids or vapours, when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4). The specific requirements specified in this European Standard take precedence over the respective requirements of EN 12921-1.

To the extent of this document the terms combustible materials and flammable substance and explosive are equivalently used.

NOTE 1 The condition of flammability can be generated only when molecules of the fluid are in intimate contact with oxygen from the air. Ignition is possible when: the fluid generates a concentration of vapour in air, or: the flammable fluid is present as a suspension of fine droplets in air (aerosol).

NOTE 2 In practice, fires and explosions differ by the size and intensity of the reaction, and by the instantaneous effects on the environment.

This European Standard does not apply to machinery and related equipment excluded from the scope of EN 12921-1.

This European Standard is not applicable to cleaning machines of industrial items using flammable cleaning liquids which are manufactured before the publication of this European Standard 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 954-1, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

EN 1127-1:1997, *Explosive atmospheres - Explosion prevention and protection – Part 1: Basic concepts and methodology*

EN 1539, *Dryers and ovens, in which flammable substances are released – Safety requirements*

EN 12921-1:2005, *Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours – Part 1: Common safety requirements*

EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres – Part 1: Basic method and requirements*

EN 13463-5, *Non-electrical equipment intended for use in potentially explosive atmospheres – Part 5: Protection by constructional safety "c"*

EN 50015:1998, *Electrical apparatus for potentially explosive atmospheres — Oil immersion "o"*

EN 50017, *Electrical apparatus for potentially explosive atmospheres — Powder filling "q"*

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety "i"*

EN 60079-0, *Electrical apparatus for explosive gas atmosphere – Part 0: General requirements (IEC 60079-0:2004)*

EN 60079-1, *Electrical apparatus for potentially explosive gas atmospheres — Part 1: Flameproof enclosures "d"* (IEC 60079-1:2003)

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

EN 60079-7, *Electrical apparatus for explosive gas atmospheres — Part 7: Increased safety "e"* (IEC 60079-7:2001)

EN 60079-15, *Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection "n"* (IEC 60079-15:2001, modified)

EN 60079-18, *Electrical apparatus for explosive gas atmospheres — Part 18: Construction test and marking of type of protection encapsulation "m" electrical apparatus* (IEC 60079-18:2004)

EN 60079-25, *Electrical apparatus for explosive gas atmospheres — Part 25: Intrinsically safe systems* (IEC 60079-25:2003)

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

EN 60529, *Degrees of protection provided by enclosures (IP code)* (IEC 60529:1989)

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

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 12100-1:2003, EN 12921-1:2005 and the following apply.

3.1

area classification

assessed division of a facility into hazardous areas and non-hazardous areas, and the subdivision of the hazardous areas into zones

3.2

explosive atmosphere

mixture with air, under atmospheric condition, of flammable substance(s) in the form of gas, vapour, mist or dust, in which, after ignition has occurred, combustion spreads to the entire unburned mixture (see 3.17 of EN 1127-1:1997)

3.3

explosion range

range of the concentrations of a flammable substance in air, within which an explosion can occur (see 3.13 of EN 1127-1:1997)

3.4

flammable substance

substance in the form of gas, vapour, liquid, solid, or mixtures of these, able to undergo an exothermic reaction with air when ignited (see 3.1 of EN 1127-1:1997)

3.5

flammable cleaning liquid

liquid which can release vapours, under certain circumstances, able to undergo an exothermic reaction with air when ignited

NOTE A fluid (gas or 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).

3.6

flash point

minimum temperature at which, under specified test conditions, a liquid gives off sufficient combustible gas or vapour to ignite momentarily on application of an effective ignition source (see 3.18 of EN 1127-1:1997)

NOTE The classification of flammable liquids according to their flash point as per EU Directive 67/548/EEC is provided in Annex B.

3.7

hazardous areas

areas where hazards due to explosive atmosphere may exist. The probability of occurrence of explosive atmosphere is classified in different zones. Limits of hazardous zones are given in Annex C

3.7.1

zone 0

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently (see 6.3.2 of EN 1127-1:1997)

3.7.2

zone 1

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally (see 6.3.2 of EN 1127-1:1997)

3.7.3

zone 2

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only (see 6.3.2 of EN 1127-1:1997)

3.8

equipment category

3.8.1

equipment group II category 1

equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are present continuously for long periods or frequently (see 3.2.3 of EN 13463-1:2001)

NOTE Equipment of category 1 is suitable for use in zone 0.

3.8.2

equipment group II category 2

equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are likely to occur (see 3.2.4 of EN 13463-1:2001)

NOTE Equipment of category 2 is suitable for use in zone 1.

3.8.3

equipment group II category 3

equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are unlikely to occur, or, if they do occur, are likely to do so only in frequently and for a short period only (see 3.2.5 of EN 13463-1:2001)

NOTE Equipment of category 3 is suitable for use in zone 2.

3.9

ignition source

source of energy sufficient to cause ignition of an explosive atmosphere

3.10

ignition temperature (of a combustible gas or of a combustible liquid)

lowest temperature of the heated wall as determined under specified test conditions, at which the ignition of a combustible substance in the form of gas or vapour mixture with air will occur (see 3.31 of EN 1127-1:1997)

3.11

inerting

addition of inert substances to prevent explosive atmospheres (see 3.21 of EN 1127-1:1997)

3.12

inherently limited heating (source)

any heat source (including heating system) which is part of the cleaning machine not having enough power to heat the cleaning liquid above the limit temperature (see Annex A)

3.13

limit temperature

flash point temperature of a cleaning liquid minus a safety margin

NOTE For safety margins see 5.6.3.2.1.1.

3.14

lower explosion limit (LEL)

lower limit of the explosion range (see 3.8 of EN 1127-1:1997)

3.15

types of cleaning machines

following definitions of cleaning machines apply

3.15.1

type A1

cleaning machines in which no explosive atmosphere is present during normal operation according to their intended use and the flammable cleaning liquid cannot reach the limit temperature during normal operation and in which jetting of cleaning liquid does not generate aerosol leading to an explosive atmosphere.

These machines do not have any heat source which can provide sufficient energy to heat the flammable cleaning liquid up to the limit temperature

NOTE Aerosol generation is related to the shape of the nozzle, the product characteristics (density, viscosity etc.) and pressure. This aerosol generation is more unlikely at pressures < 70 kPa.

3.15.2

Type A2

cleaning machines in which no explosive atmosphere is present during normal operation according to their intended use and the flammable cleaning liquid cannot reach the limit temperature during normal operation and in which jetting of cleaning liquid does not generate aerosol leading to an explosive atmosphere.

These machines are equipped with heating or ultrasonic devices or pump around (circulating) system or any other heat source which can provide sufficient energy to heat the flammable cleaning liquid up to the limit temperature

NOTE Aerosol generation is related to the shape of the nozzle, the product characteristics (density, viscosity etc.) and pressure. This aerosol generation is more unlikely at pressures < 70 kPa but the fact has to be established in each case.

3.15.3

type B

cleaning machines using spraying with a nozzle pressure above 70 kPa and where the temperature of the flammable cleaning liquid is lower or equal to the limit temperature in any circumstance

3.15.4

type C

cleaning machines where the cleaning liquid can reach a temperature at which an explosive atmosphere is likely to occur during normal operations. These machines are equipped with a monitoring system

3.16**spray rinsing process**

jetting cleaning liquid in air with a nozzle pressure ≤ 70 kPa

3.17**spraying**

jetting cleaning liquid in air with a nozzle pressure ≥ 70 kPa

3.18**upper explosion limit (UEL)**

temperature of a combustible cleaning liquid at which the concentration of the saturated vapour in air is equal to the upper explosion limit

3.19**ambient temperature**

temperature which can be reached at any time by the atmosphere around the cleaning machine due to any heat source which can be normally expected

3.20**mist eliminator**

device placed in a ventilation duct in order to reduce the concentration of droplets in suspension in air in such a way that the exhausted air is not explosive

4 List of significant hazards

Table 1 — List of significant hazards associated with machines for surface cleaning and pre-treatment using flammable cleaning liquids

Clause/sub-clause of this European Standard	Hazard	Clause/sub-clause of EN 12921-1:2005
4.1	General This clause contains significant hazards, hazardous situations and events, as far as they are dealt with in this document, identified by risk assessment as significant for this type of machinery using flammable cleaning liquids and which requires action to eliminate or reduce the risk. NOTE Information on the method of risk analysis is given in EN 1050.	4.1
4.2	Mechanical hazards	4.2
4.2.2	Crushing, shearing, cutting, entanglement, drawing-in, impact	4.2.1
4.2.3	High pressure fluid ejection	4.2.2
4.2.4	Ejection of parts of the cleaning machine and/or items	4.2.3
4.2.5	Loss of stability (of cleaning machine and cleaning machine parts)	4.2.4
4.2.6	Personnel's slip, trip and fall hazards	4.2.5
4.3	Electrical hazards	4.3
4.4	Thermal hazards	4.4
4.5	Hazards generated by noise	4.5
4.6	Hazards generated by materials and substances processed, used or emitted by the cleaning machine	4.6
4.6.1	General	4.6.1
4.6.2	Hazards resulting from contact with/or inhalation of dangerous liquids, gases, aerosol, vapours, fumes and dusts	4.6.2
4.6.3	Fire and explosion hazard	4.6.3

Clause/sub-clause of this European Standard	Hazard	Clause/sub-clause of EN 12921-1:2005
4.6.3.1	Fire hazard	4.6.3, 4.6.3.1
4.6.3.2	Explosion hazard	
4.6.3.2.2	Generation of explosive atmosphere Generation of an explosive atmosphere is related to flammable cleaning liquids under the following circumstances: <ul style="list-style-type: none"> — as a vapour, when the vapour concentration in air is within the explosive range between LEL and UEL; — as a suspension of fine droplets. Examples of flammable substances which increase the concentration above normal are: <ul style="list-style-type: none"> — high cleaning liquid temperature leading to formation of flammable vapours; — insufficient cleaning liquid coverage of heating elements; — leaks or drips of cleaning liquid on hot surfaces; — spraying of the cleaning liquid generating fine droplets and mist; — change in composition of the flammable cleaning liquid. 	
4.6.3.2.3	Ignition of an explosive atmosphere Ignition of an explosive atmosphere is related to: <ul style="list-style-type: none"> — hot surfaces e.g. of heating systems and electrical equipment; — sparks created by mechanically induced energy e.g. fans, conveyors; — electrostatic discharges; — electrical sparks; — ignition sources not generated by the cleaning machine, e.g. welding and other sources of thermal energy used during maintenance and cleaning of the cleaning machine. 	
4.6.3.2.4	Release of flammable cleaning liquid or vapour outside of the cleaning machine This is related to: <ul style="list-style-type: none"> — loss of containment of flammable cleaning liquids; — release of flammable mists; — release of flammable vapours. 	
4.6.3.2.5	Unexpected chemical reactions Unexpected chemical reactions leading to decomposition and release of flammable vapours or explosion. NOTE Among other types of chemical substances, ethers, olefins and aldehydes are prone to formation of peroxides which can decompose spontaneously in an exothermic reaction.	
4.6.3.2.6	Ejection of parts of the cleaning machines in case of explosions Ejection of parts of the cleaning machine (e.g. covers, doors) or the content of the machine (e.g. items, cleaning liquid) are related to an explosion.	
4.7	Hazards combinations	4.7
4.8	Hazards caused by failure of energy supply	4.8

Clause/sub-clause of this European Standard	Hazard	Clause/sub-clause of EN 12921-1:2005
4.9	Hazards related to failure of control systems	4.9

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 hazards relevant but not significant which are not dealt with by this document (e.g. sharp edges).

5.2 Mechanical hazards

5.2.1 General

Shall be according to 5.1 and 5.2 of EN 12921-1:2005.

5.2.2 Safeguarding of danger points

5.2.2.1 General

Shall be according to 5.2.1 of EN 12921-1:2005.

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

Shall be according to 5.2.1.1 of EN 12921-1:2005.

5.2.2.3 Guards and interlocks

Shall be according to 5.2.1.2 of EN 12921-1:2005.

5.2.2.4 Moving parts of the cleaning machine

Shall be according to 5.2.1.3 of EN 12921-1:2005.

5.2.2.5 Location of controls

Shall be according to 5.2.1.4 of EN 12921-1:2005.

5.2.2.6 Prevention against hazards related to close or fall of covers, lids and doors

Shall be according to 5.2.1.5 of EN 12921-1:2005.

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

Shall be according to 5.2.1.6 of EN 12921-1:2005.

5.2.3 Safety measures against high pressure fluid ejection

5.2.3.1 General

Shall be according to 5.2.2 of EN 12921-1:2005.

5.2.3.2 Safety measures against overpressure

Shall be according to 5.2.2.1 of EN 12921-1:2005.

5.2.3.3 Safety measures against rupture and corrosion of piping or joints

Shall be according to 5.2.2.2 of EN 12921-1:2005.

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

Shall be according to 5.2.3 of EN 12921-1:2005.

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

5.2.5.1 General

Shall be according to 5.2.4 of EN 12921-1:2005.

5.2.5.2 Positioning of the cleaning machine

Shall be according to 5.2.4.1 of EN 12921-1:2005.

5.2.5.3 Safety measures against overload

Shall be according to 5.2.4.2 of EN 12921-1:2005.

5.2.5.4 Safety measures against spillage

Shall be according to 5.2.4.3 of EN 12921-1:2005.

5.2.6 Safety measures against slip, trip and fall

Shall be according to 5.2.5 of EN 12921-1:2005.

5.3 Safety requirements and measures against electrical hazards

5.3.1 General

Shall be according to 5.3.1 of EN 12921-1:2005.

5.3.2 Safety measures against electric shock

Shall be according to 5.3.2 of EN 12921-1:2005.

5.3.3 Safety measures against electromagnetic influences on electrical equipment

Shall be according to 5.3.3 of EN 12921-1:2005.

5.4 Safety requirements and measures against thermal hazards

5.4.1 Heating systems

Shall be according to 5.4.1 of EN 12921-1:2005.

5.4.2 Measures against contact of the skin with hot surfaces

Shall be according to 5.4.2 of EN 12921-1:2005.

5.4.3 Measures against radiation

Shall be according to 5.4.3 of EN 12921-1:2005.

5.4.4 Measures against overheating of cleaning liquid

Shall be according to 5.4.4 of EN 12921-1:2005.

5.5 Safety requirements and measures against noise

5.5.1 General

Shall be according to 5.5 of EN 12921-1:2005.

5.5.2 Noise reduction at source at the design stage

Shall be according to 5.5.1 of EN 12921-1:2005.

5.5.3 Noise reduction by protective measures

Shall be according to 5.5.2 of EN 12921-1:2005.

5.5.4 Noise reduction by personal protective equipment (PPE)

Shall be according to 5.5.3 of EN 12921-1:2005.

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

Shall be according to 5.6.1 of EN 12921-1:2005.

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

5.6.2.1 General

Shall be according to 5.6.2 of EN 12921-1:2005.

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

Shall be according to 5.6.2.1 of EN 12921-1:2005.

5.6.2.3 Safety measures against emissions generated by the cleaning process

Shall be according to 5.6.2.2 of EN 12921-1:2005.

5.6.2.4 Safety measures against dripping of cleaning liquid

Shall be according to 5.6.2.3 of EN 12921-1:2005.

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

Shall be according to 5.6.2.4 of EN 12921-1:2005.

5.6.2.6 Safety measures against inhalation of emissions generated by chemical decomposition

Shall be according to 5.6.2.5 of EN 12921-1:2005.

5.6.3 Safety requirements and measures against fire and explosion

5.6.3.1 General

In the context of this European Standard, no difference is made between "flammable" and "explosive". In practice, fires and explosions differ by the size and intensity of the reaction, and by the instantaneous effects on the environment.

The hazards dealt with in 5.6.3 shall be covered by the following measures used separately or combined for prevention against:

- prevention against the generation of an explosive atmosphere;
- prevention of the ignition of an explosive atmosphere;
- protection from explosion effects.

5.6.3.2 Prevention of generation of an explosive atmosphere

5.6.3.2.1 General

Generation of an explosive atmosphere shall be prevented by:

- controlling the process temperature of the flammable cleaning liquid below the limit temperature;
 - inerting of the internal atmosphere;
- or
- any other appropriate preventive measures resulting in the same level of safety.

5.6.3.2.2 Prevention of overtemperature of flammable cleaning liquid leading to the formation of flammable vapours

5.6.3.2.2.1 The safety margin to be used in the determination of the limit temperature shall be 15 K minimum.

In the cases where non flammable cleaning liquids are mixed with flammable cleaning liquids, the flash point to be taken into account in the determination of the limit temperature shall be the flash point of the flammable component even if no flash point shall be measured for the mixture, unless it can be proven that the vapour generated by the mixture is never flammable (e.g. in case of a non flammable azeotrope).

In the cases when two or more flammable cleaning liquids with different flash points are mixed together, the flash point to be taken into account in the determination of the limit temperature shall be the flash point of the cleaning liquid having the lowest flash point or the flash point of the mixtures whichever is lowest.

In the case of a substance having a risk of fire at a temperature lower than the flash point, the lower temperature shall be taken into account in the determination of the limit temperature.

5.6.3.2.2.2 A temperature indicator shall be installed in each tank equipped with a heating device.

Temperature sensors shall be submerged and located such as to provide measurements of the flammable cleaning liquid surface temperature.

NOTE In most cases temperature detection within 10 cm of the flammable cleaning liquid surface provides a reliable measurements when the tank is filled with cleaning liquid.

Type A and B cleaning machines shall be designed in such a way that the temperature in the flammable cleaning liquid is lower or equal to the limit temperature.

These cleaning machines shall be fitted with a high temperature limiting device (cut-out). This limiting device (cut-out) shall be interlocked with the power supply in order to stop all the operational functions of the cleaning machine when the process temperature reaches the limit temperature.

When designed to be used in an environment where the ambient temperature may exceed the limit temperature, type A and B cleaning machines shall be fitted with:

- a cooling system which shall maintain the process temperature of the flammable cleaning liquid below the limit temperature;
- a forced ventilation system able to maintain a non explosive atmosphere;
- in case that – according to the risk assessment in relation to the flash-point, the intended use and the limitation of use – there is not possibility that the limit temperature is reached in any circumstance, the high temperature cut-out can be omitted.

5.6.3.2.2.3 Type B cleaning machines when fitted with heating or ultrasonic devices or pump around (circulating) system or any other heating source which can provide sufficient energy to heat the flammable cleaning liquid up to the limit temperature (not inherently limited) and type A2 cleaning machines, shall be equipped in addition to 5.6.3.2.2.2 with:

- a heating cut-out (thermostat) set at the process temperature but not exceeding the limit temperature minus the temperature rise caused by thermal inertia;
- a high temperature cut-out shutting off all non safety devices set at a temperature not exceeding the limit temperature and triggered by an independent dedicated temperature measurement element.

For temperature instrumentation requirements applicable to type C cleaning machines see 3rd indent of 5.6.3.4.2.

5.6.3.2.2.4 Reduction of process temperature is required when the flammable cleaning liquid exceeds the limit temperature due to uncontrolled factors (e.g. limit temperature lower than the ambient temperature).

Where a cooling device is provided the cooling performance shall be sufficient to absorb the heat from all available heat sources, which cannot be reliably switched-off taking fouling into account.

The cooling system shall maintain the process temperature of the flammable cleaning liquid below the limit temperature even if the cleaning machine is not in operation. In case of cooling using a cooling fluid system, a control system shall be installed to ensure the proper functioning.

5.6.3.2.2.5 Where inerting is applied it shall comply with the requirements below:

- the oxygen concentration shall not exceed 7 % (V/V);

- a flow or pressure detection system shall be provided on the inert gas supply to ensure the continuous availability of inert gas;
- the oxygen concentration shall be continuously monitored, and an audible and visible alarm shall be fitted such that the cleaning machine shall be shut down if the concentration reaches 7 % (V/V) during all stages of the cleaning process during which an explosive atmosphere can be generated;
- any gas purge containing flammable vapours shall be controlled so that the flammable vapour concentration is below 25 % of LEL in the exhaust duct and that the vapours are released outside the workplace;
- the control system of the monitoring device of inerting in type C cleaning machines shall comply at least with category 3 of EN 954-1.

5.6.3.2.2.6 Cleaning machines using vacuum to avoid generation of an explosive atmosphere, shall comply with the requirements below:

- the absolute pressure shall not exceed 10 % of the vacuum tank design pressure during all stages of the cleaning process, in which an explosive atmosphere can be generated. If the design pressure of the vacuum tank is undefined the maximum pressure at which an explosive atmosphere can be generated shall be 10 kPa;
- a pressure monitoring system shall be provided with audible and visible alarm and the cleaning machine shall be shut down if this pressure exceeds allowed pressure described above during all the stages of the cleaning process in which an explosive atmosphere can be generated;
- the exhaust of the vacuum system shall discharge to a safe location, or it shall be treated to avoid the generation of an explosive atmosphere at the point of release;
- the control system of monitoring of the process pressure in type C cleaning machines shall comply at least with category 3 of EN 954-1.

NOTE Strictly speaking, the absolute pressure in the cleaning machine should be below 5 kPa to ensure that the atmosphere is not explosive. In practice, at an absolute pressure below or equal to 10 kPa, ignition of the vapour cannot result in any damage to the structural strength of the cleaning machine.

5.6.3.2.3 Prevention of insufficient flammable cleaning liquid coverage of heating elements (low liquid level control)

Heating devices or ultrasonic transducers shall be submerged in flammable cleaning liquid when they are in operation. The minimum cleaning liquid coverage shall be 50 mm.

A low liquid level control (cut-out) shall be fitted to all cleaning machines equipped with these devices.

5.6.3.2.4 Prevention of leaks or drips of flammable cleaning liquid on hot surfaces

Surfaces which may reach temperatures over the limit temperature during cleaning operation shall be protected against drip and leaks of the flammable cleaning liquid.

This can be fulfilled by:

- location of parts with those surfaces over the area where drips and leaks can occur;
- protection of these surfaces by covers.

5.6.3.2.5 Prevention of generation of fine droplets and mist by spraying of the flammable cleaning liquid

Generation of fine droplets and mist leading to an explosive atmosphere shall be avoided by limiting the nozzle pressure below 70 kPa (spray rinsing process, see 3.15 of this European Standard).

Where spraying at or above 70 kPa is applied, the cleaning machines shall comply with 5.6.3.2.2.5 or 5.6.3.2.2.6 or 5.6.3.3.

In all cases, mist formation shall be avoided as far as possible. Where used, spraying systems shall be airless at all pressures.

5.6.3.2.6 Prevention of a change in composition of the flammable cleaning liquid

5.6.3.2.6.1 Generation of an explosive atmosphere caused by a change in composition of the flammable cleaning liquid shall be prevented. In particular:

5.6.3.2.6.2 The heat flux density of electric heaters immersed in the flammable cleaning liquid shall be limited to 4W/cm² maximum, or any lower value which may be recommended by the cleaning liquid supplier, to prevent decomposition of the flammable cleaning liquid.

5.6.3.2.6.3 Dragout from a tank containing flammable cleaning liquid with a lower flash point to a tank normally containing a flammable cleaning liquid with a higher flash point, in a multistage cleaning machine shall be taken into account in the determination of the cleaning liquid temperature. If the quantity of lower flash point cleaning liquid transferred to the higher flash point cleaning liquid cannot be limited to a defined percentage, the flash point used shall be taken as that equal to the lower of the two values.

5.6.3.2.6.4 In the case where the flash point of a mixture of flammable cleaning liquids shall be reduced during processing due to the depletion of the less volatile components, the flash point to be taken into account shall be the flash point of the less volatile components after depletion.

NOTE In normal cases the flash point of a mixture of flammable cleaning liquids should increase during processing because the fraction with the lowest flash point is evaporating faster. A reduction in flash point could occur e.g. if the component with the highest flash point is soluble in the dirt whereas the components with the lowest flash point are not. These cases are however, rare exceptions.

5.6.3.3 Classification of hazardous zones (according to 3.7)

The classification of hazardous zones is an integral part of the safety concept for explosion prevention. Hazardous zones are determined by the area classification which is required within and around the cleaning machine due to the cleaning machine only. The ignition prevention category of equipment and components implemented to cleaning machine is dependent on limitation of flammable substance concentration by forced ventilation, type of process and design of the cleaning machine.

In particular the following requirements shall be observed:

a) Type A cleaning machines:

- area classification may need to be considered for abnormal conditions, particularly in cases where the flash point of the flammable cleaning liquid is lower than 55 °C;

b) Type B cleaning machines (spray cleaning machines) (example see Figure C.1 of Annex C):

- all parts inside the cleaning machine where mist is present during normal operations shall be classified as zone 0;
- the internal volume of forced ventilation exhaust ducts shall be classified as zone 1 up to the mist eliminator, if present, otherwise up to the outlet;
- all parts of the cleaning machine within 1 m from the access doors to the spray chamber of a closed cleaning machine or within 1,5 m of the openings (e.g. of a tunnel machine) shall comply with requirements for zone 2 equipment;

c) Type C cleaning machines (example see Figure C.2 of Annex C):

- all parts inside the cleaning machine where explosive atmosphere is present during normal operation shall be classified as zone 0;
- according to the design of the cooling area and the forced ventilation an area adjacent to the operating area shall be classified as zone 1 or 2;
- all other parts of the cleaning machine shall be classified as zone 2;
- all volumes within 1 m of the access doors of a closed cleaning machine or within 1,5 m of the openings (e.g. entrance or exit of a tunnel machine) shall be classified as zone 2. These volumes will extend vertically downward to the floor;
- for cleaning machines equipped with a monitoring system (control system at least of category 3 of EN 954-1), which prevents reliably the simultaneous existence of hazardous explosive atmosphere and a possible ignition source, the required area classification shall be defined by the manufacturer.

Other means to reduce the risk of creation of an explosive atmosphere can be applied, such as use of interlocks, vacuum. These may result in reduced area classification requirement, subject to a detailed analysis by the manufacturer.

5.6.3.4 Avoidance or reduction of ignition sources

5.6.3.4.1 General

In order to prevent hazards by explosive atmospheres, the design and selection of electrical and non electrical equipment shall ensure that ignition sources are avoided in any part of the system, where areas with explosion hazard are classified (see 5.6.3.3). If electrical and non electrical equipment is implemented according to their manufacturer's instruction, then the completed installation is of the same category of protection.

5.6.3.4.2 Electrical equipment

Electrical equipment installed and located in zone 0 shall be at least of category 1, complying with EN 50015, EN 50017, EN 50020, EN 60079-0, EN 60079-1, EN 60079-2, EN 60079-7, EN 60079-18, EN 60079-25 as appropriate.

Electrical equipment installed and located in zone 1 shall be at least of category 2 complying with EN 50015, EN 50017, EN 50020, EN 60079-0, EN 60079-1, EN 60079-2, EN 60079-7, EN 60079-18, EN 60079-25 as appropriate.

Electrical equipment installed and located in zone 2 shall be at least of category 3 complying with EN 60079-0 and EN 60079-15.

In particular the following measures shall be considered:

- a) all conductive components shall be interconnected and earthed according to EN 60204-1;
- b) for motor outside the cleaning machine at least IP44 of EN 60529 shall be used. Motors shall not be positioned within an exhaust air duct;
- c) undesirable static discharges shall be avoided by adopting the earthing of the cleaning machine and interconnecting of conductive components (see CLC report 044-001):
 - particular attention is required to ensure electrical earthing of all moving parts, such as doors, cover lids, baskets, etc. Non conductive materials of construction shall be avoided as far as possible for all parts containing cleaning liquid;
 - bonding of items to be cleaned shall be ensured, unless it can be proven that their capacitance or the generated electric field are sufficiently low to ensure that no incentive discharge can occur;

- the spray chamber of type B and C cleaning machines shall be constructed such that accumulation of electrostatic charges in the cleaning liquid in the tank is prevented. This can be achieved e.g. by installing a submerged conductive grid electrically connected to the cleaning machine frame close to the cleaning liquid surface.

5.6.3.4.3 Non electrical equipment

All non electrical equipment and components installed and located in potentially explosive atmosphere shall be designed and constructed according to good engineering practice and shall be subjected to an ignition hazard assessment in accordance with 5.2 of EN 13463-1:2001 to provide the protection required. The equipment shall satisfy the requirements of EN 13463-1 and EN 13463-5.

Category 3 equipment for installation in zone 2 shall not contain any effective ignition source in normal operation. Category 2 equipment for installation in zone 1 shall not contain any effective ignition source in normal operation or expected malfunction.

In particular the following requirements shall be observed:

- sparks caused by mechanical shocks, friction or collisions shall be avoided in all types of cleaning machines, especially for moving parts type B and C cleaning machines (e.g. fans, spraying devices, rotating baskets – see 6.4.4 of EN 1127-1:1997);

NOTE The special EN standard prEN 14986 "Construction specification for fans working in potentially explosive atmospheres" is prepared by CEN/TC 305/WG2/SG1.

- electrostatic charges shall be avoided according 7.4 of EN 13463-1:2001;
- presence of overheated surfaces that could come in contact with vapours shall be avoided as much as possible. The surface temperature of any part within the operating or hazardous zones shall be limited to 80 % of the ignition temperature, expressed in °C. For cleaning machines designed for a wide range of products an ignition temperature of 200 °C shall be assumed. Type C cleaning machines with energy supply sufficient to bring the cleaning liquid temperature above 80 % of the ignition temperature (see 3.31 of EN 1127-1:1997), expressed in °C, shall be provided with a cut-out triggered by an independent dedicated temperature measurement element. The cut-out shall be triggered at a maximum temperature of 10 K above the boiling point or 80 % of the ignition temperature, whichever is lowest. The drying equipment of cleaning machines using flammable cleaning liquids shall comply with EN 1539.

5.6.3.5 Prevention of release of flammable cleaning liquid or mist vapour outside of the cleaning machine

5.6.3.5.1 Design of the cleaning machine

Cleaning machines shall be designed such that flammable substances shall be isolated from outside when the cleaning machine is not in operation (e.g. covers for open top tank).

Release of flammable cleaning liquid outside the cleaning machine, either in vapour, mist or liquid form, shall be prevented through containment or by forced ventilation for the airborne phases.

Reduction emissions of dangerous vapours in the work environment below the admissible exposure limit values shall be considered (5.6.2.2 of EN 12921-1:2005).

5.6.3.5.2 Prevention of loss of containment of flammable cleaning liquids

Release of flammable cleaning liquid shall be prevented. In addition to EN 12921-1, low melting point materials shall be avoided as much as possible in parts providing containment of flammable cleaning liquid.

In particular:

- plastics shall not be used for cleaning liquid containment;

- copper and brass shall not be used for cleaning liquid containment in cleaning machines with a liquid capacity exceeding 2 000 l.

Spray rinsing with a nozzle pressure above 10 kPa shall be enclosed to avoid splashing of flammable cleaning liquids outside the cleaning machine.

5.6.3.5.3 Prevention of release of flammable mist

5.6.3.5.3.1 Release of flammable mist shall be prevented. In particular, release of flammable mist from type B cleaning machines shall be prevented by an interlock system which prevents spraying when the spraying chamber is not closed, or the forced ventilation not in operation.

Forced ventilation extraction ducts shall be provided with mist eliminators or other effective means to prevent excessive exhaust of mist.

5.6.3.5.3.2 Spraying in type B cleaning machines with open entrance and/or exit points (e.g. tunnel machines) shall only be possible when the forced ventilation is in operation. The face air speed at the opening shall be 0,5 m/s minimum, directed from the outside to the inside of the cleaning machine.

5.6.3.5.3.3 In closed type B cleaning machines, interlocks shall be provided between forced ventilation, door opening and spraying, such as to minimise the emission in the work environment:

- open door: spraying blocked;
- spraying: forced ventilation cut-out;
- waiting time after spraying, with forced ventilation in operation and door blocked in closed position.

5.6.3.5.4 Prevention of hazardous explosive mixtures (limitation of flammable vapours)

5.6.3.5.4.1 Vapour release from type C cleaning machines shall be prevented by using any type of measure or combination of measures able to ensure a vapour concentration below 25 % of the LEL outside the cleaning machine at maximum of 10 cm from openings at all times.

NOTE Example of preventing measures are: interlock of door opening and forced ventilation, draining of cleaning liquid and purging of vapour before opening, vapour condensation (as far as possible below the limit temperature), forced ventilation.

5.6.3.5.4.2 Type C cleaning machines with permanent opening (e.g. tunnel machines) shall be fitted with forced ventilation, which shall be continuously in operation while the cleaning machine is operating including heating up and cooling down. The face air speed at the openings shall be 0,5 m/s minimum, directed from the outside to the inside of the cleaning machine.

5.6.3.5.4.3 Type C cleaning machines with permanent openings and or exit points (e.g. tunnel machines) shall be equipped with a limiting device which continuously monitors the concentration of flammable substances (LEL detection) installed at the openings, triggering an alarm when the vapour concentration reaches 10 % of the LEL and a cleaning machine shutdown when the vapour concentration reaches 25 % of the LEL. Examples for limiting devices are FID (flame isolation detector), FTA (flame temperature analyser), IR gas detectors in compliance with EN 61779-1, EN 61779-4 and EN 50073.

5.6.3.5.4.4 Release of flammable vapours from type C cleaning machines during stopping times shall be effectively prevented. This can be achieved in several ways, for example:

- draining all flammable cleaning liquids automatically to a closed drain container upon shutdown;
- providing an automatically closing vapour tight cover on the cleaning bath. Protection against under pressure due to cooling shall however be provided;
- cooling of the flammable cleaning liquid to at least 15 °C below flash point during downtimes;

- continued forced ventilation also during stopping times. After cooling of flammable cleaning liquid the exhaust volume flow may be reduced in relation to the volume flow of normal operation.

5.6.3.6 Prevention of undesired chemical reactions

Undesired chemical reactions shall be avoided. In particular compatibility of the flammable cleaning liquids and contaminants shall be checked. If flammable cleaning liquids leading to spontaneous ignition or violent decomposition can be present, then the following measures shall be applied by order of preference:

- flammable cleaning liquids leading to such reactions shall be eliminated and replaced by less dangerous products;
- if this is not possible, the causes leading to such reactions shall be inhibited (e.g. inerting to avoid formation of peroxides).

5.6.3.7 Protection from explosion effects

For closed cleaning machines designed in such a way that all parts containing flammable vapours shall resist a pressure equal to at least ten times the operating pressure.

If the measures following 5.6.3.5.1 to 5.6.3.5.4 alone or in combination do not deliver a sufficient level of safety, the possible effects of an explosion shall be reduced by one or more of the following measures:

- explosion-resistant design (see 6.5.2 of EN 1127-1:1997);

NOTE 1 Special EN standard "Explosion proof equipment" in preparation by CEN/TC 305/WG3.

- explosion relief (see 6.5.3 of EN 1127-1:1997); (Warning: The design of the explosion relief shall not present a new hazard.);

NOTE 2 Explosion venting devices are described in prEN 14797 and dust explosion venting systems are described in prEN14491.

- explosion suppression (see 6.5.4 of EN 1127-1:1997);

NOTE 3 Explosion suppression systems are described in prEN 14373.

- prevention of flame and explosion propagation (see 6.5.5 of EN 1127-1:1997 and EN 12874).

NOTE 4 These measures could be required both in the thermal cleaning system itself and in the ducts or downstream parts of the cleaning machinery.

The operating temperatures shall be considered during design and selection of measures.

The scope of EN 1127-1:1997 deals with atmospheric conditions, but the general principles are applicable to the conditions in thermal cleaning systems. This shall be considered by selecting the protection systems listed above.

If such a cleaning machine is operating under vacuum, the vacuum system shall be such as not to cause any ignition, or such that ignition cannot propagate (e.g. by installation of a flame arrester).

5.7 Safety requirements and measures against hazard combinations

Shall be according to 5.7 of EN 12921-1:2005.

5.8 Safety requirements and measures against failure of energy supply

5.8.1 General

Shall be according to 5.8 of EN 12921-1:2005.

5.8.2 Failure of forced ventilation

Shall be according to 5.8.1 of EN 12921-1:2005.

5.8.3 Unexpected ejection of cleaning machine part or cleaning liquid

See 5.8.2 of EN 12921-1:2005.

5.8.4 Hazards related to items being stuck in the cleaning machine

Shall be according to 5.8.4 of EN 12921-1:2005.

5.9 Safety measures against hazards related to failure of control systems

5.9.1 General

Shall be according to 5.9.1 of EN 12921-1:2005.

5.9.2 Level of safety

Shall be according to 5.9.2 of EN 12921-1:2005.

5.9.3 Emergency stop equipment

Shall be according to 5.9.3 of EN 12921-1:2005.

5.9.4 Failure or malfunction of the control system

Shall be according to 5.9.4 of EN 12921-1:2005.

6 Verification of the safety requirements

6.1 General

Shall be according to 6.1 of EN 12921-1:2005.

6.2 Mechanical

Shall be according to 6.2 of EN 12921-1:2005.

6.3 Electrical

Shall be according to 6.3 of prEN 12921-1:2004.

6.4 Thermal

6.4.1 General

Shall be according to 6.4 of EN 12921-1:2005.

6.4.2 Heating systems

Shall be according to 6.4.1 of EN 12921-1:2005.

6.4.3 Temperature of touchable surfaces

Shall be according to 6.4.2 of EN 12921-1:2005.

6.5 Noise

Shall be according to 6.5 of EN 12921-1:2005.

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

6.6.1 General

Verification of compliance with the requirements and/or measures identified in 5.6.1 shall be carried-out.

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

6.6.2.1 General

Shall be according to 6.6.2 of EN 12921-1:2005.

6.6.2.2 Cleaning liquid used in the cleaning machine during normal operation

Shall be according to 6.6.2.1 of EN 12921-1:2005.

6.6.2.3 Fumes and emissions generated by the cleaning process

Shall be according to 6.6.2.2 of EN 12921-1:2005.

6.6.2.4 Spillage of cleaning liquid

Shall be according to 6.6.2.3 of EN 12921-1:2005.

6.6.2.5 Fumes and emissions generated by chemical reaction

Shall be according to 6.6.2.4 of EN 12921-1:2005.

6.6.2.6 Fumes and emissions generated by chemical decomposition

Shall be according to 6.6.2.5 of EN 12921-1:2005.

6.6.3 Fire and explosion

6.6.3.1 General

Safety requirements detailed in 5.6.3 shall be checked by testing, calculation, inspection or other methods according to the following clauses.

Verification shall be checked before or after commissioning.

6.6.3.2 Generation of an explosive atmosphere

6.6.3.2.1 Avoiding overtemperature of flammable cleaning liquids

Proper functioning of the cleaning liquid temperature control shall be verified by temperature measurement of the cleaning liquid with an external device.

The presence of required process temperature indicators shall be checked by visual inspection.

The correct position of process temperature sensors shall be checked according to the low liquid level limit.

Proper functioning of the heating cut-out at the required cut-out temperature and measurement of the process temperature increase of the flammable cleaning liquid shall be verified by simulation.

Proper functioning of high temperature cut-out shall be verified by simulation.

Proper functioning of the cooling system shall be verified by simulation.

Heating and cooling capacity and the efficiency of the cooling shall be verified by adequate temperature measurement during testing of the cleaning machine.

In the case of inerting and in the case of vacuum, the presence of the required instrumentation shall be checked by visual inspection. Proper functioning shall be verified by simulation.

6.6.3.2.2 Insufficient flammable cleaning liquid coverage of heating elements

The correct position of the low liquid level cut-out shall be checked in relation to the position of the upper surface of heating elements or ultrasonic transducers to ensure that the minimum required flammable cleaning liquid coverage is achieved. Proper functioning shall be checked by failure simulation (low level cut-out).

6.6.3.2.3 Leaks or drips of flammable cleaning liquid on hot surfaces

The correct application of this requirement shall be checked by visual inspection.

6.6.3.2.4 Spraying of flammable cleaning liquid

The spraying system shall be verified by visual inspection.

The spray pressure shall be checked by pressure measurement instrumentation.

6.6.3.2.5 Change in composition of the flammable cleaning liquid

The heat flux of heaters shall be checked by calculation.

The flash point and characteristics of the flammable cleaning liquid shall be checked on the material safety data sheet of the flammable cleaning liquid. The resulting effect shall be evaluated to ensure compliance with the requirements of this European Standard.

6.6.3.3 Classification of hazardous zones

Annex C gives figures relative to hazardous zones.

Verify if the installation and device of equipment is carried out according to the required category relative to the zone.

6.6.3.4 Avoidance or reduction of ignition sources

6.6.3.4.1 General

The suitability of installation of electrical and non-electrical equipment can be checked by visual inspection in comparison with their manufacturer's instruction.

6.6.3.4.2 Electrical equipment

The suitability of the electrical equipment installed in classified zones shall be verified by visual inspection.

Earthing of cleaning machines shall be checked by visual inspection and measurement of the electrical resistance of the earthing connection.

6.6.3.4.3 Non-electrical equipment

The absence of generation of sparks by mechanically moving parts can be checked by visual inspection.

Hot surfaces can be checked by temperature measurement under normal operating conditions.

6.6.3.5 Release of cleaning liquid or vapour

6.6.3.5.1 Design of the cleaning machine

The compliance with 5.6.3.5.1 shall be checked at least by visual inspection.

6.6.3.5.2 Loss of containment of flammable cleaning liquids

Check by visual inspection.

6.6.3.5.3 Release of flammable mist

Verification by process simulation of the failure.

Ventilation efficiency shall be checked by suitable instruments.

6.6.3.5.4 Release of flammable vapours

The compliance with the requirements shall be checked by visual inspection.

Proper functioning of the high temperature alarm and energy cut-out shall be verified by simulation.

The correct position of the temperature sensors shall be checked in conjunction with low level limit.

The correct position of the minimum level cut out shall be checked in relation to the position of the upper surface of the elements to be protected to ensure a minimum of 50 mm coverage.

The heat removal capacity of cooling devices shall be checked by calculation.

Proper functioning of the LEL detection and cut-out shall be checked by inspection and simulation of failure.

Proper functioning of the interlocks between ventilation and operation process shall be checked by simulation.

The downtime temperature shall be checked by measurement.

6.6.3.6 Undesired chemical reaction

The compatibility of the cleaning liquid shall be checked on the material safety data sheet of the cleaning liquid.

6.6.3.7 Protection from explosive effects

The compliance with 5.6.3.7 shall be checked at least by visual inspection and checking of the accompanying documents concerning explosion resistant design measures requested.

6.7 Hazard combinations

Shall be according to 6.7 of EN 12921-1:2005.

6.8 Failure of energy supply

Shall be according to 6.8 of EN 12921-1:2005.

6.9 Control systems

Shall be according to 6.9 of EN 12921-1:2005.

7 Information for use

7.1 General

The intended use shall be determined and explained/defined in the instruction book and, when necessary, by other additional means (plate, sign, labelling, etc.) in accordance with and/or limited by the properties of the flammable cleaning liquids indicated in the safety data sheet.

In addition to the requirements described in 7.1, 7.2 and 7.3 of EN 12921-1:2005, the following information for use shall be given:

7.2 Instruction handbook

The instruction handbook shall contain the following minimum information:

- classification of the cleaning machine (types A - B - C) according to this European Standard;
- minimum flash point of flammable solvents admissible for use in the cleaning machine (reference to the material safety data sheet of the manufacturer of the solvent);
- permissible and/or limitation to the use of the cleaning machine (if applicable);
- area classification with restricted areas and hazardous zones with reference to fire and explosion (if applicable);
- information about explosion and fire prevention measures during cleaning, maintenance and handling of deposits of residues from processes;
- instruction for verification of the limit temperature in relation to the flash point and characteristics of the cleaning liquid shall be checked according to the safety data sheet of the flammable cleaning liquid;
- instruction for verification of requirement to ensure that the flash-point of the contaminated flammable cleaning liquid is still compatible with the limit temperature in case of contamination with low flash-point cleaning liquid is possible;
- warnings against:
 - any storage of flammable substances or their empty containers or any other materials which have been in contact with these products (rags, paper, etc.) around the cleaning machine and particularly in front of the doors;
 - use of naked flames, objects with hot or incandescent surfaces, equipment or items capable of generating sparks (tools, equipment, etc.) in the cleaning machine or in the surrounding of it;
 - smoking in the hazardous zone. A display showing "No smoking" shall be affixed on the cleaning machine.

7.3 Marking

In addition to marking required in 7.3 of EN 12921-1:2005 cleaning machines using flammable cleaning liquids shall be marked. The machine plate shall show the following:

- cleaning machine classification (types A - B - C) according to the requirements of this European Standard;
- minimum flash point value of the cleaning liquid for which the cleaning machine is designed;
- maximum temperature for which the cleaning machine is designed (if applicable);
- limit temperature (if applicable);
- maximum rinsing pressure (if applicable).

Annex A **(normative)**

Determination of inherently limited heating of cleaning machines

The determination whether heating of a cleaning machine is inherently limited shall take into account the combination of the heat input and natural heat losses leading to the highest temperature that can be reached in the cleaning liquid.

In doing so, any heat removal caused by the cleaning machines design (e.g. cooling circuits, fans, etc.) shall be neglected.

Examples:

- a) A cleaning machine with a heating coil sufficiently powerful to heat the cleaning liquid up to its flash point but with its temperature controlled by a cooling coil is not an inherently limited heating cleaning machine.
- b) A cleaning machine using a cleaning liquid with a flash point of 115 °C and using hot water as heating medium is an inherently limited heating cleaning machine provided no other heat source (pump around, ultrasonic transducer etc.) can raise the temperature of the cleaning liquid above 100 °C when combined with the hot water heater.
- c) A cleaning machine in which the only built-in heat sources is the presence of a pump around loop (e.g. for spraying) and using a cleaning liquid with a flash point above 55 °C, is likely to have an intrinsically limited heating, provided the pump power is not sufficient to raise the cleaning liquid temperature above 40 °C.

Annex B

(informative)

Classification of flammable liquids according to Directive 67/548/EEC

- extremely flammable: liquid substances and preparations which have a flash point lower than 0 °C and a boiling point (or in case of a boiling range the initial boiling point) lower than or equal to 35 °C;
- highly flammable: liquid substances and preparations having a flash point below 21 °C but which are not extremely flammable;
- flammable: liquid substances and preparations having a flash point equal to or greater than 21 °C, and less or equal to 55 °C.

Liquid substances and preparations having a flash point greater than 55 °C are not regulated in Directive 67/548/EEC.

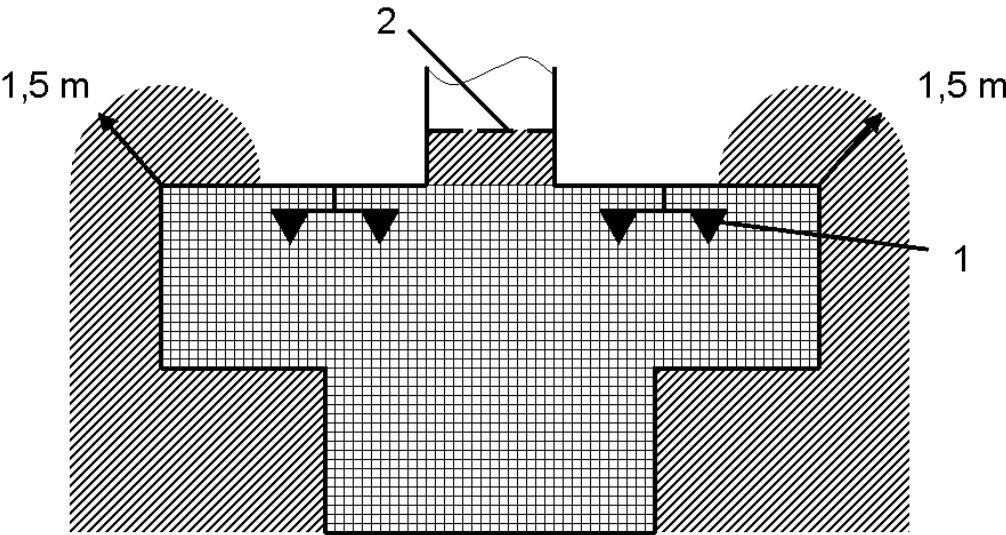
However these are still to be considered flammable substances for the purpose of this European Standard.

NOTE Directive 67/548/EEC "Council Directive of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances".

Annex C
(informative)

Area classification examples for cleaning machines using flammable cleaning liquids

The figures provided below are only provided to illustrate the intent of the standard. Area classification shall be based on the requirements provided in 5.6.3.3, taking all design features of the cleaning machine into account.



Key



Zone 0

1 Mist eliminator



Zone 2

2 Spray system

Figure C.1a - Tunnel machine

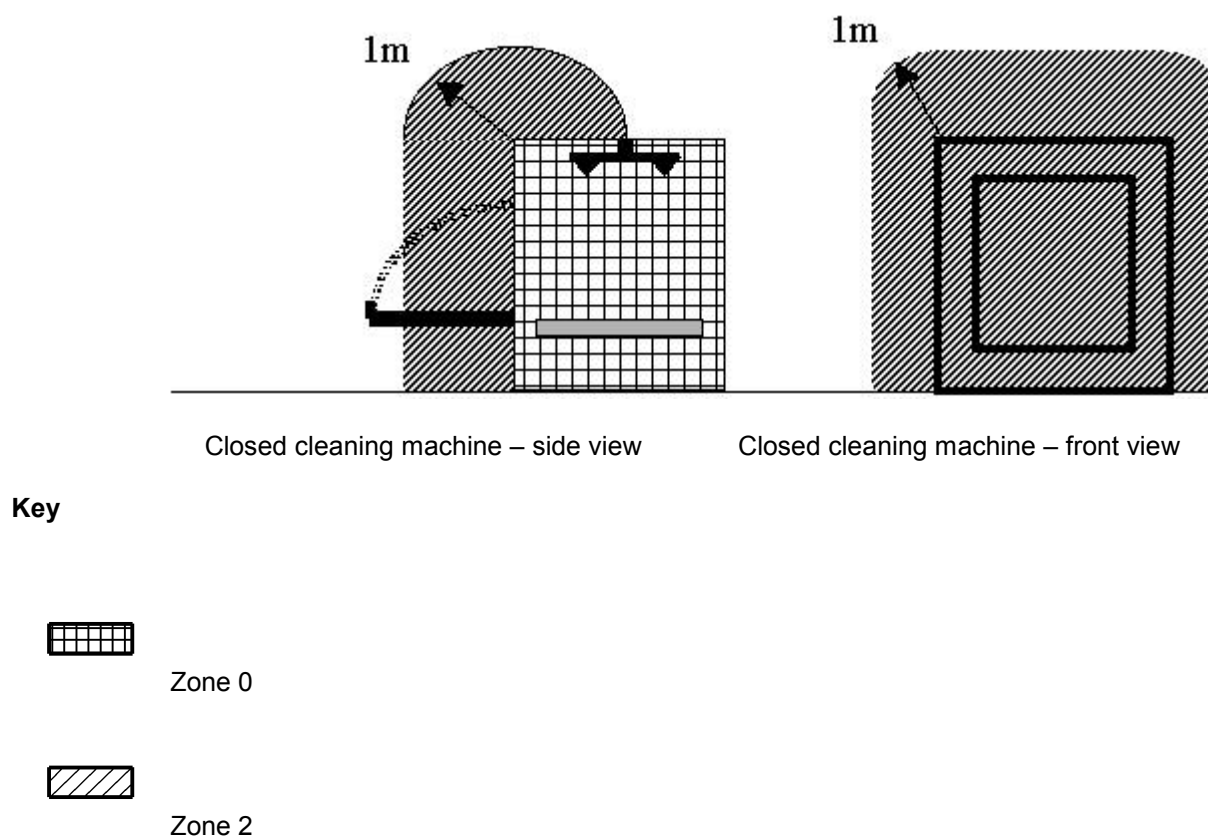
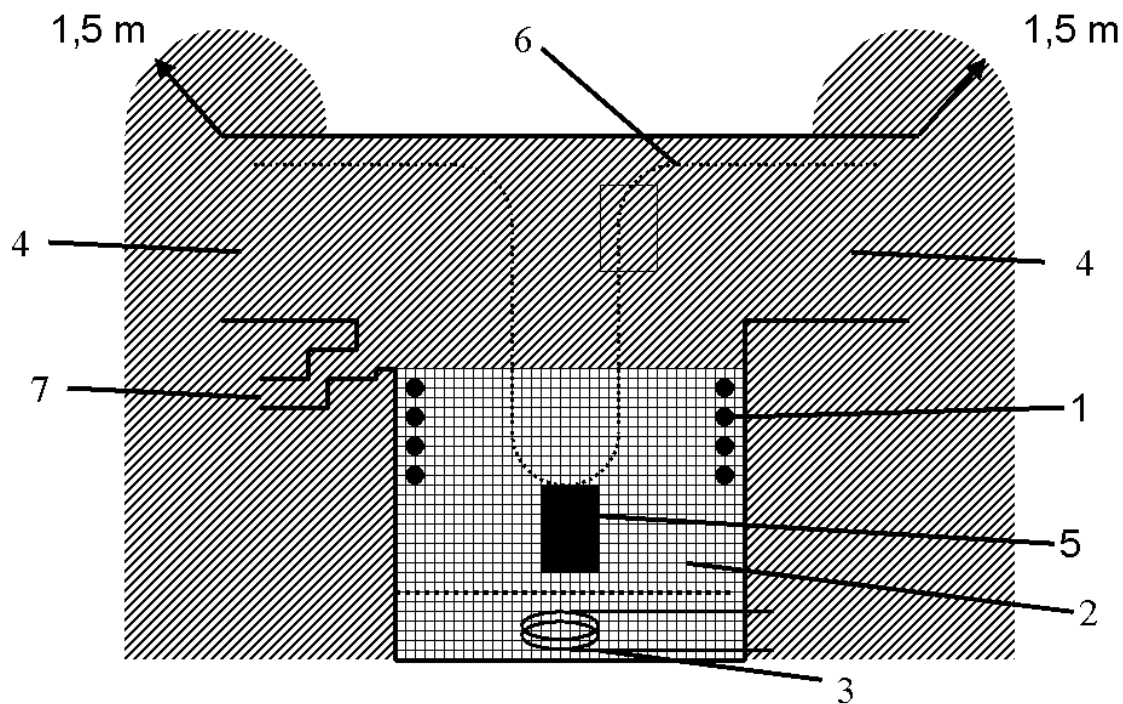


Figure C.1b — Area classification for type B cleaning machine using flammable cleaning liquids



- Key**
- 1 Cooling coil
 - 2 Vapour chamber
 - 3 Heating coil
 - 4 Tunnel opening
 - 5 Sample workpiece
 - 6 Conveyor
 - 7 Air extraction

Figure C.2a

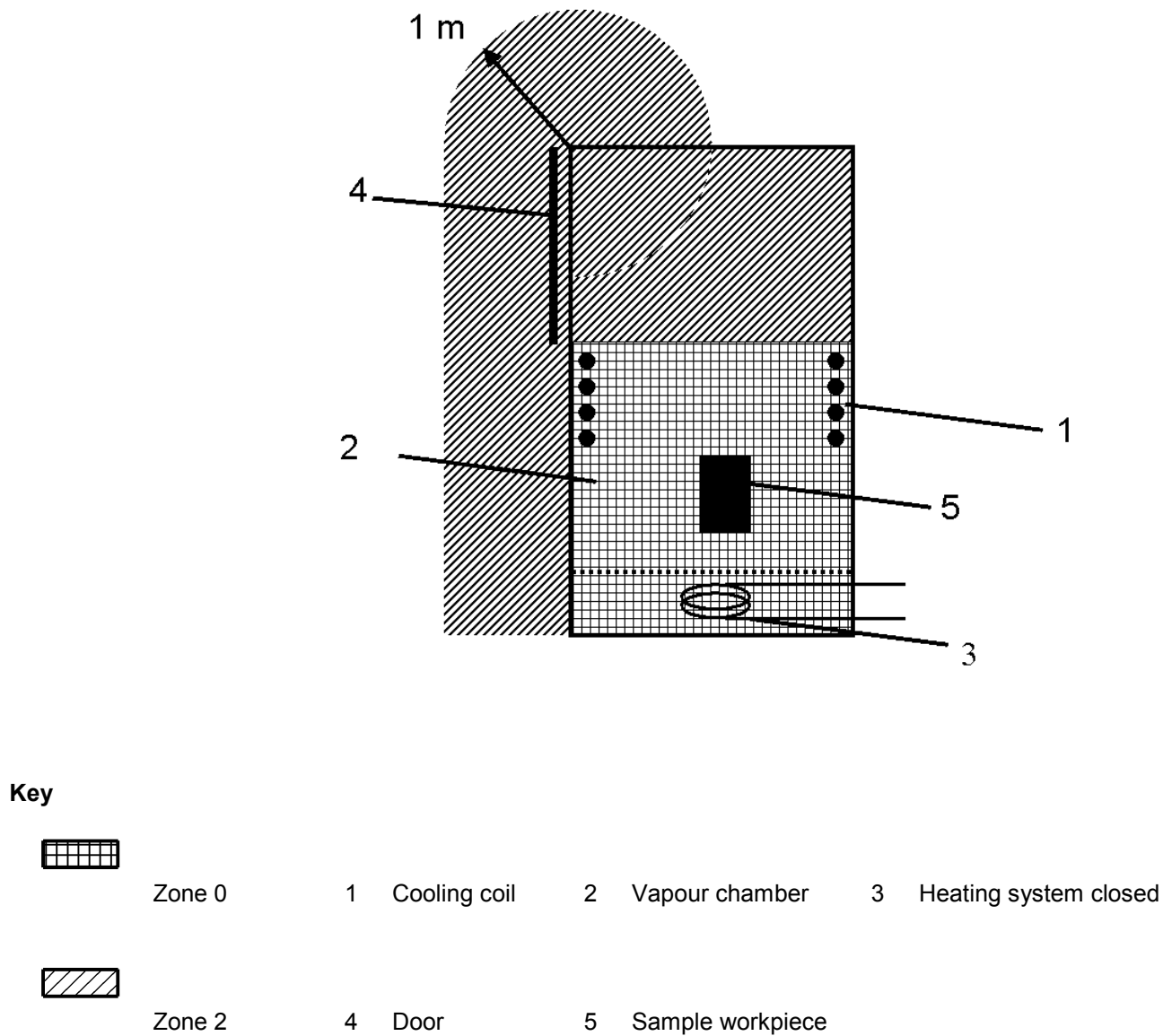



Figure C.2b — Area classification for type C cleaning machine using flammable cleaning liquids

Annex ZA (informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC, amended by 98/79/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 New Approach Directive Machinery 98/37/EC, amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Communities 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 1.2.3, 1.2.4, 1.1.2.c), 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. 

Annex ZB (informative)

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 Communities 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. 

Bibliography

- [1] NFPA 33¹ - Standard for spray application using flammable and combustible materials
- [2] Journal of Electrostatic - Volume 27 no 1 & 2 - January 1992
- [3] Chemical Engineering - December 1989 - page 110
- [4] ZH 1/562 "Berufsgenossenschaftliche Regeln: Reinigen von Werkstücken mit flüssigen Reinigungsmitteln"
- [5] NFPA 34 - Standard for dripping and coating processes using flammable or combustible liquids
- [6] CENELEC report 044.001 – Hazards arising from static electricity. The report give information about ignition of gases, liquids by electrostatic discharges
- [7] EN 12874, *Flame arresters – Performance requirements, test methods and limits for use*
- [8] EN 50073:1999, *Guide for the selection, installation, use and maintenance of apparatus for the detection and measurement of combustible gases or oxygen*
- [9] EN 60079-10:2003, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas (IEC 60079-10:2002)*
- [10] EN 61779-1, *Electrical apparatus for the detection and measurement of flammable gases – Part 1: General requirements and test methods (IEC 61779-1:1998, modified)*
- [11] EN 61779-4:2000, *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 (IEC 61779-4:1998, modified)*

¹ NFPA stands for the National Fire Protection Association, Batterymarch Park, Quincy, MA02269, USA