SLOVENSKI STANDARD
SIST EN 12753:2005+A1:2010

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Sistemi za termično čiščenje plinov, odsesanih iz naprav za površinsko obdelavo - Varnostne zahteve (vključno z dopolnilom A1)

Thermal cleaning systems for exhaust gas from surface treatment equipment - Safety requirements

Thermische Reinigungssysteme für Abluft aus Anlagen zur Oberflächenbehandlung - Sicherheitsanforderungen

Systèmes d'épuration thermique de l'air extrait des installations de traitement de surface - Prescriptions de sécurité

Ta slovenski standard je istoveten z: **EN 12753:2005+A1:2010**

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13.040.40	Emisije nepremičnih virov	Stationary source emissions
25.220.01	Površinska obdelava in prevleke na splošno	Surface treatment and coating in general

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN 12753:2005+A1

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English Version

Thermal cleaning systems for exhaust gas from surface treatment equipment - Safety requirements

Systèmes d'épuration thermique de l'air extrait des installations de traitement de surface - Prescriptions de sécurité

Thermische Reinigungssysteme für Abluft aus Anlagen zur Oberflächenbehandlung - Sicherheitsanforderungen

This European Standard was approved by CEN on 21 March 2005 and includes Amendment 1 approved by CEN on 23 April 2010.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 12753:2005+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of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.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 12753:2005.

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

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

For relationship with EU Directives, see informative Annex ZA, which is an integral part of this European Standard.

This European Standard is part of a set of standards devoted to the health and safety requirements of installations for the application and drying of coating materials.

The attention of the reader is drawn to the fact that compliance with this European Standard does not waive the obligation to comply with the regulations governing installations categorised for environmental protection which also deal with the risks of nuisance to the surroundings such as noise emitted outside the building, odours, pollution.

NOTE Although a thermal cleaning system, 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, 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 situation 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 European Standard.

1 Scope

1.1 This European Standard is applicable to thermal cleaning systems for exhaust gas from surface treatment equipment/systems as given below in which the concentration of exhaust gas to be cleaned (for the purpose of this European Standard, named "process gas") at the inlet to the thermal cleaning system is safely limited within the concentration ranges given in 5.2.2.2.

Surface treatment equipment includes:

— dryers according to EN 1539, curing equipment;

— flash-off areas;

— coating plants (e.g. closed spray booths, open fronted spray booths);

— machines using flammable solvents for the pre-treatment and cleaning of products or equipment (e.g. barrels, tins, cans or containers);

— related solvent handling equipment.

[A1] This European Standard deals only with the significant hazards from fire and explosion and hazards generated by residual process gases as listed in Clause 4, when used as intended and under the conditions foreseen by the manufacturer. [A1]

The types of thermal cleaning systems covered in this European Standard are

— direct combustion, and

— catalytic combustion

(see definitions in 3.1.1 and 3.1.2).

This European Standard applies in conjunction with the relevant requirements of EN 746-1 and EN 746-2.

For the purpose of this European Standard a thermal cleaning system for process gas contains the following components: fan(s), heat exchanger, process space, main and supporting burner, injection system, power driven dampers, control and power circuits joined together for the processing of flammable substances, predominantly volatile organic compounds, by effecting oxidation.

NOTE Thermal cleaning equipment is usually integrated with systems as covered by e.g. EN 1010-1, EN 1539, EN 12215, EN 12921-1 or EN 12921-3.

1.2 This European Standard is not applicable to:

— thermal paint removal systems;

— pyrolytic systems.

1.3 This European Standard is not applicable to thermal cleaning systems 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 746-1, *Industrial thermoprocessing equipment — Part 1: Common safety requirements for industrial thermoprocessing equipment*

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

EN 954-1:1996, *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 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”*

prEN 14986, *Design of fans working in potentially explosive atmospheres*

EN 50015, *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 60079-0:2004, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements (IEC 60079-0:2004)*

EN 60079-1:2004, *Electrical apparatus for potentially explosive 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 60079-25:2004, *Electrical apparatus for explosive gas atmospheres — Part 25: Intrinsically safe systems (IEC 60079-25:2003)*

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

EN 60519-1, *Safety in electroheat installations — Part 1: General requirements (IEC 60519-1:2003)*

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)*

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
thermal cleaning system
assembly of linked components and machines such as fan(s), heat exchanger, process space, heating device (burner), power driven dampers, control and power circuits joined together for the processing of flammable substances, predominantly volatile organic compounds, by effecting oxidation. In a thermal cleaning process gases containing flammable substances are heated to a sufficient temperature in order to oxidise the flammable fraction

3.1.1
direct combustion
direct combustion of solvents in flames or high temperature atmosphere

3.1.1.1
direct regenerative combustion
direct combustion of preheated process gas, where the heat recovery of the storage media of the thermal reactor heated by thermal combustion is used (regenerative heat exchange)

3.1.1.2
direct recuperative combustion
direct combustion of preheated process gas, where the heat exchange (without heat storage) takes place between "cold" process gas and hot exhaust gas of the thermal combustion according to the (cross) reverse flow principle (recuperative heat exchange)

3.1.2
catalytic combustion
combustion of solvents with catalysts

3.1.2.1
catalytic regenerative combustion
catalytic combustion of preheated process gas, where the heat recovery of the storage media of the thermal reactor heated by thermal combustion is used (regenerative heat exchange)

3.1.2.2
catalytic recuperative combustion
direct combustion of preheated process gas, where the heat exchange (without heat storage) takes place between "cold" process gas and hot exhaust gas of the thermal combustion according to the (cross) reverse flow principle (recuperative heat exchange)

3.2
process gas
for the purpose of this European Standard process gas is defined as the exhaust gas from the surface treatment equipment/system and may contain a mixture of air and flammable substances. The process gas is the gas supplied to the thermal cleaning system for effecting of oxidation. It may include fumes, inert gases as well as solid and/or liquid particles which may trigger condensation and lead to deposits.

Process gas may also include recirculated exhaust gas from the thermal cleaning system

3.3
process space
volume within the thermal cleaning system in which the flammable substances are oxidised

3.4
flammable substances
predominantly volatile organic compounds (VOC's), which can include gases, vapours, liquids, solids, or mixtures of these, able to undergo an exothermic reaction with air when ignited

EXAMPLE
— Solvents, which are flammable or extremely difficult to ignite (no flash point, but an explosion range), for example partly halogenated hydrocarbons,
— most coating materials.
See 3.1 of EN 1127-1:1997.

3.5
solvents
liquids, single or blended, volatile under specific temperature conditions

[2.49 of EN 971-1:1996]

NOTE Solvent vapours are usually part of the exhaust gases of surface treatment equipment (for the purpose of this European Standard named process gas (see 3.2)).

EXAMPLES
— Aldehydes, alcohol, hydrocarbons, esters, ketones, mineral oils, as well as mixtures containing these substances.
— Printing inks, varnishes, lacquers etc., used as coating materials containing such solvents. Solvents are also used as cleaning or washing agents.

3.6
lower explosion limit (LEL)
lower concentration limit of the explosion range

NOTE Explosion limits are the limits of the explosion range. Explosion range is the range of the concentration of flammable substances in air, over which an explosion can occur.
See 3.7, 3.8 and 3.13 of EN 1127-1:1997.
It is recommended to check the data on safety characteristics e.g. in safety data sheets, see Bibliography.

3.7
explosive mixture
mixture with air of combustible substances in the form of gases, vapours, mist or dust, in which after ignition has occurred, combustion spreads to the entire unburned mixture

NOTE Explosive atmosphere is an explosive mixture under atmospheric conditions, see 3.17 of EN 1127-1:1997.

3.8
hazardous explosive mixture
explosive mixture which, if it explodes, causes damage

3.9
forced ventilation (for forced ventilation of the thermal cleaning system)
air exchange achieved by fans or by other powered means which directs the process gas to the thermal cleaning system

3.10
recirculation air
part of the cleaned process gas from the thermal cleaning system is reintroduced into the system for means of energy saving or other reasons

NOTE The reintroduction can take place either in the thermal cleaning system itself (internal recirculation) or in an upstream part of the system, for example a dryer (external recirculation).

3.11
maximum admissible concentration of flammable substances
concentration within the total thermal cleaning system, which shall not be exceeded

3.12
minimum exhaust volume flow
which corresponds to the maximum admissible quantity or throughput of flammable substances for all specified operating conditions

4 List of significant hazards

4.1 General

This clause contains all significant hazards, hazardous situation and events, as far as they are dealt with in this European Standard, identified by risk assessment as significant for one or more, or all types of thermal cleaning systems for process gases included in the scope and which require action to eliminate or reduce the risk.

4.2 Fire and explosion hazards

4.2.1 General

Fire and explosion hazards are generated by process gases containing hazardous flammable substances and/or explosive mixtures together with sources of ignition.

NOTE 1 These hazards can both occur within the thermal cleaning system and in upstream or downstream equipment.

NOTE 2 Examples of upstream equipment are:

- dryers;
- printing machines;
- coating plants/equipment;
- press roller washing systems/equipment;
- recirculation systems.

Examples of downstream equipment are:
- heat recovery systems,
- recirculation systems.

Examples of flammable substances are:
- solvent vapours;
- fuel gases;
- condensates;
- deposits;
- gases released from condensates and/or deposits.

Examples of ignition sources are:
- hot surfaces (e.g. of heating systems, of electrical equipment);
- heating systems, burners, combustion products;
- sparks created by mechanically induced energy (e.g. by fans wheel, bearing);
- electrostatic discharges;
- electrical sparks;
- hot gases or chemical reactions within the system/equipment itself and/or in upstream and downstream equipment components or duct systems due to back-firing.

4.2.2 Hazards of explosive mixtures

4.2.2.1 General

Hazards of explosive mixtures are generated from the inside concentration and the mode of operation of both the thermal cleaning system itself and of upstream and downstream equipment. The main causes are listed in 4.2.2.2 to 4.2.2.7.

4.2.2.2 Inlet concentration

Hazards of explosive mixtures are generated inside the thermal cleaning system if the concentration of flammable substances at the inlet to the thermal cleaning system is so high that the LEL is exceeded by heating of the process gas within the thermal cleaning system.

NOTE Inlet concentration may include the injection of flammable substances.

4.2.2.3 Linking multiple sources to a thermal cleaning system

Linking multiple sources of process gases to a common thermal cleaning system without correctly integrating the systems (sources) may generate an explosion hazard due to high concentrations.

NOTE Increased concentrations may result from:
- failure of one or more of the multiple sources e.g. loss of high volume/low concentration flow;
- adding or replacing of sources.

4.2.2.4 Condensates and deposits

Condensates and/or deposits which are evaporated and/or thermally decomposed e.g. in ducts and heat exchangers may increase the concentrations of flammable substances.

Deposits can also be dusts which may disperse without decomposition to give hazardous explosive mixtures.

4.2.2.5 Insufficient forced ventilation

Insufficient ventilation and flow rates within the thermal cleaning system may generate increased concentrations of process gas and form hazardous explosive mixtures. Insufficient ventilation and flow rates e.g. as a result of failure of the frequency control of the fan for the thermal cleaning system may lead to:

- insufficient purge before starting the system;
- insufficient flow in the system and ducts;
- failure of fresh air supply.

Ventilation and flow rate may be influenced by:

- narrowed channels and/or housing of fan caused by deposits (condensate);
- adjustment of control flaps or dampers.

4.2.2.6 Insufficient oxidation

In case of thermal cleaning systems recirculating the cleaned process gases in order to reduce the concentrations of flammable substances at the inlet of that system, insufficient oxidation may increase the concentration of flammable substances to such an extent that hazardous explosive mixtures may be generated. Causes for insufficient oxidation can be:

a) too low oxygen content of the process gas;

b) too low temperature within the process space;

c) insufficient intermixture of supplied process gases within the process space;

d) insufficient residence time of flammable substances within the process space;

e) reduced catalyst function due to ageing, poisoning or deposits on the active surface.

NOTE The ability of the catalyst to allow chemical reactions at reduced temperatures is not a fixed characteristic but decreases during the operation. This decrease of activity may be caused by surface modifications due to the temperature (ageing), blocking of the active centres due to catalyst poisons such as silicone or reduction of the active surface because of dust deposits.

4.2.2.7 Adsorption of flammable substances in catalytic systems

Adsorption of flammable substances on the surfaces of catalytic elements can occur, when the catalytic system is operated at temperatures of the incoming gases below the temperature necessary for catalytic reaction.

Flammable substances being adsorbed on the surface of catalytic elements may lead to hazardous explosive mixtures, when desorption of the flammable substances takes place because of increased incoming gas temperature or the beginning of an exothermic reaction.

NOTE The temperature necessary for catalytic reaction is not a fixed characteristic of the given catalyst but depends on the substance to be converted and may rise because of ageing, poisoning or deposits.

4.2.3 Ignition sources

Thermal cleaning systems include equipment components which, because of the required temperatures for oxidation, present ignition sources. Together with hazardous explosive mixtures, these ignition sources may result in explosions.

NOTE Other ignition sources can be present in integrated equipment.

4.2.4 Explosion effects

Explosions in the thermal cleaning systems may give rise to:

— the hazard of burning (e.g. flames, radiation of heat, hot blast waves);

— the hazard from ejected parts;

— the hazard from release of dangerous substances (e.g. hot gases).

4.2.5 Overheating and fires

The thermal cleaning system or equipment components may be damaged due to overheating. Furthermore, fires within the vicinity of the system can be caused by too high temperatures at the outer side of the thermal cleaning system or leakage of hot gases.

Overheating may be caused by:

— ignition of flammable condensates and/or deposits;

— failure of temperature control within the process space;

— malfunction of heating system;

— failure of damper control systems;