



**SLOVENSKI STANDARD**  
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**Stroji za zemeljska dela - Varnost - Sistemi za zaščito pred onesnaženjem**

Earth-moving machinery - Safety - Contamination protective systems

Erdbaumaschinen - Sicherheit - Schutzbelüftungsanlagen

Engins de terrassement - Sécurité - Systèmes de protection contre les contaminations

**Ta slovenski standard je istoveten z: prEN 17969**

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## Earth-moving machinery - Safety - Contamination protective systems

Engins de terrassement - Sécurité - Systèmes de  
protection contre la contamination

Erdbaumaschinen - Sicherheit -  
Schutzbelüftungsanlagen

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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## European foreword

This document (prEN 17969:2023) has been prepared by Technical Committee CEN/TC 151 “Construction equipment and building material machines - Safety”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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

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

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## Introduction

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

This document is of relevance in particular for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate in the drafting process of this document.

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

When operating earth-moving machinery used in contaminated areas, the operator can be exposed to hazardous agents such as chemical agents in the form of dust, aerosols, gases or vapours or biological agents in the form of aerosols. Protective ventilation systems of earth-moving machinery providing protection against these hazardous agents can reduce operator exposure to airborne contaminants present in contaminated areas.

The objective of this document is to improve the operator protection by using the protective ventilation systems of earth-moving machinery used in contaminated areas. For this purpose, this document specifies requirements, test procedures and the operator information to be provided, in particular with regard to installation, use and maintenance operations.

## 1 Scope

This document is applicable to protective ventilation systems to provide breathing air to operator's stations on earth-moving machinery used in contaminated areas. Its purpose is to limit the exposure of the operator (driver) to hazardous agents when earth-moving machinery is used in contaminated areas. This document describes requirements, test procedures and information to be provided by the manufacturer for protective ventilation systems to provide breathing air to operator's stations on earth-moving machinery used in contaminated areas.

This document gives additional requirements to the common safety requirements of EN 474-1 "Earth-moving machinery – Safety – Part 1: General requirements" and to the machine specific parts of the EN 474 series.

This document does not repeat the requirements from the EN 474 series but adds or replaces the requirements as applicable for Earth-moving machinery.

This document does not cover:

- the safety requirement to be used for any specific application;
- the relevant filter performance or filter class for any particular application;
- the actual cab performance in the field application;
- the filtration performance in the field application;
- the field durability of filters.

This document is not applicable to protective ventilation systems which are manufactured before the date of its publication as an EN.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 474-1:2022, *Earth-moving machinery - Safety - Part 1: General requirements*

EN 474-5:2022, *Earth-moving machinery - Safety - Part 5: Requirements for hydraulic excavators*

EN 1822-1:2019, *High efficiency air filters (EPA, HEPA and ULPA) - Part 1: Classification, performance testing, marking*

EN ISO 10121-1:2014, *Test method for assessing the performance of gas-phase air cleaning media and devices for general ventilation — Part 1: Gas-phase air cleaning media (ISO 10121-1:2014)*

EN 12021:2014, *Respiratory equipment - Compressed gases for breathing apparatus*

EN 12341:2014, *Ambient air - Standard gravimetric measurement method for the determination of the PM<sub>10</sub> or PM<sub>2,5</sub> mass concentration of suspended particulate matter*

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EN 12941:1998,<sup>1</sup> *Respiratory protective devices - Powered filtering devices incorporating a helmet or a hood - Requirements, testing, marking*

EN 13274-8:2002, *Respiratory protective devices - Methods of test - Part 8: Determination of dolomite dust clogging*

EN 14387:2021, *Respiratory protective devices - Gas filter(s) and combined filter(s) - Requirements, testing, marking*

EN 15695-1:2017, *Agricultural tractors and self-propelled sprayers - Protection of the operator (driver) against hazardous substances - Part 1: Cab classification, requirements and test procedures*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

EN 60529:1991,<sup>2</sup> *Degrees of protection provided by enclosures (IP Code)*

EN ISO 2860:2008, *Earth-moving machinery - Minimum access dimensions (ISO 2860:1992)*

EN ISO 13766-1:2018, *Earth-moving and building construction machinery - Electromagnetic compatibility (EMC) of machines with internal electrical power supply - Part 1: General EMC requirements under typical electromagnetic environmental conditions (ISO 13766-1:2018)*

EN ISO 19014-3:2018, *Earth-moving machinery - Functional safety - Part 3: Environmental performance and test requirements of electronic and electrical components used in safety-related parts of the control system (ISO 19014-3:2018)*

EN ISO 29463-5:2022, *High-efficiency filters and filter media for removing particles in air - Part 5: Test method for filter elements (ISO 29463-5:2022)*

ISO 6165:2022, *Earth-moving machinery — Basic types — Identification and terms and definitions*

ISO 10263-4:2009, *Earth-moving machinery — Operator enclosure environment — Part 4: Heating, ventilating and air conditioning (HVAC) test method and performance*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6165:2022 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### **contaminated area**

area where hazardous agent is present in the ambient air

<sup>1</sup> As amended by EN 12941:1998/A1:2003 and EN 12941:1998/A2:2008.

<sup>2</sup> As amended by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.



### 3.2

#### **hazardous agents**

chemical agent in the form dust, aerosol, vapour or gas, or biological agent, which can expose an operator to a risk for his health

### 3.3

#### **aerosol**

suspension in air of solid particles, liquid particles or solid and liquid particles having a negligible falling velocity

### 3.4

#### **dust**

finely divided, airborne and sedimented solid particles

### 3.5

#### **protective ventilation systems**

systems to provide breathing air indicate:

- particle filter systems or
- gas filter systems or
- breathing compressed air systems

### 3.6

#### **prefilter**

device to reduce the amount of particles before entering particle filter

Note 1 to entry: The prefilter efficiency is lower than the particle filter efficiency.

Note 2 to entry: The prefilter can be conducted as a mechanical device, e.g. cyclone, or with a filter material.

### 3.7

#### **particle filter unit**

air handling device to provide air with a reduced amount of dust and aerosol to the operator's cab

Note 1 to entry: The system contains the air recirculation unit itself, a monitoring device and the particle filters.

### 3.8

#### **gas filter unit**

air handling device to provide air with a reduced amount of dust, aerosol, vapour and gas to the operator's cab

Note 1 to entry: The system contains the air recirculation unit itself, a monitoring device, a particle filters and gas filters.

### 3.9

#### **breathing compressed air unit**

air handling device supplying breathable air independent of the atmosphere outside the cab and consisting of:

- compressed air bottles, lines and fittings or
- lines and fittings providing breathing air to the operator's station

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Note 1 to entry: The system contains the air recirculation unit and a control device.

**3.10****filter housing**

enclosure where gas- and/or dust particle filters are placed

**3.11****ambient air**

ambient air indicates the air of the area where the machine is used. It may contain hazardous agents

**3.12****monitoring device**

device for monitoring and indicating the operating status and alarms of the protective ventilation unit. It can be a stand-alone unit or an integrated part of the dash panel of the construction machine

**3.13****recirculation unit**

air handling device which solely filtering the air inside the cab without taking fresh air

**3.14****overpressure**

pressure above the atmospheric pressure

**3.15****filters/filter elements**

pack of filtration media

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**3.16****breathing air**

filtered ambient air or air from compressed air units and filtered recirculating air

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**3.17****operator's station**

area on a ride-on machine from which an operator controls the functions of the machine

**3.18****operator's cab**

enclosure on a ride-on machine from which an operator controls the functions of the machine

**3.19****HVAC**

Heating, Ventilation and Air Conditioning

**4 Safety requirements and/or protective/risk reduction measures****4.1 General**

This document describes requirements, test procedures and information to be provided by the manufacturer for protective ventilation systems to provide breathing air to operator's stations on earth-moving machinery used in contaminated areas.

NOTE Filters performances and filters are depending of risk assessment and national regulation.

## 4.2 General requirements

### 4.2.1 Requirements for the operator's station

#### 4.2.1.1 HVAC system

EN 474-1:2022, 4.3.2 applies with the following addition:

The operator's station shall be equipped with a HVAC in accordance with ISO 10263-4:2009.

#### 4.2.1.2 Doors and windows

Doors, windows, flaps and their locking devices shall be so designed that no hazards will be created to the operator during opening under pressure, e.g. by abrupt movements.

#### 4.2.1.3 Respiratory protective device

A place for keeping an appropriate respiratory protective device (depending on the kind of protective ventilation systems) to rescue oneself (means of escape) shall be provided at the operator's station and be easily accessible.

### 4.2.2 Requirements for providing breathing air

#### 4.2.2.1 Breathing air distribution

Consistent breathing air inlet and distribution shall be provided at the operator's station. Breathing air coming into the cab shall not be on floor level to avoid stirring of dust.

#### 4.2.2.2 Breathing air filtration

Air inside the operator's station shall be filtered by a recirculation unit. The filters shall be classified H13 according to dust classes to EN 1822-1:2019.

NOTE The filter class may depend on the application and on the country regulation.

#### 4.2.2.3 Recirculating air flow rate

The filtered recirculating airflow shall be at least 50 m<sup>3</sup>/h.

#### 4.2.2.4 Fresh air flow rate

#### For machinery with dust filter units or gas filter units

The protective ventilation system shall provide at least 30 m<sup>3</sup>/h of filtered fresh air.

The breathing air volume flow rate provided shall not exceed 120 m<sup>3</sup>/h.

Air flow rate shall be measured according to Annex B.

#### For machinery with breathing compressors air used as protective ventilation systems

The air flow volume provided to the operator's station shall have a minimum amount to 12 m<sup>3</sup> per person per hour under all normal use operating conditions.

Air flow rate shall be measured according to Annex B.

Instead of measuring the volume flow of the breathing air provided, carbon dioxide (CO<sub>2</sub>) can alternatively be measured by a measuring device with alarm threshold. In the process, carbon dioxide shall not exceed 0,18 % by vol. When this value is exceeded, the measuring device shall trigger an acoustic or visual alarm.

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The measuring points of the measuring devices shall not be located in an area that corresponds to the position of the operator's mouth and nose, so that neither the breathing air provided at the inlet nor the exhalation air at the outlet are measured. If necessary, the filament position centre point according to ISO 5006:2017 can provide orientation. Malfunctions on measuring devices shall trigger an alarm by self-monitoring.

**4.2.2.5 Information on operating condition of protective ventilation system**

An information plate shall be fitted easily visible within the operator's station to communicate the following information:

"The system to provide breathing air shall be running while the openings (e.g. window(s), door(s)) of the operator's station are closed!".

Pictorials may alternatively be used.

**4.2.2.6 Emission sound pressure level at the operator's station**

EN 474-1:2022, 4.13.2.2 applies.

Protective ventilation systems shall be so arranged, designed or capsuled that the permissible emission sound pressure level (LpA) of 80 dB(A) at the operator's ear will not be exceeded during operation of the machine.

**4.2.2.7 Visibility**

Protective ventilation systems shall be so arranged that the operator has sufficient visibility from the operator's station in relation to the travel and work areas of the machine.

The requirements for the operator's field of view shall comply with EN 474-1:2022, 4.8.1.

For hydraulic excavators, the requirement for the operator's field of view shall comply with EN 474-5:2022, 4.6. These requirements shall also be met if breathing air supply systems are installed on the earth-moving machine.

**4.2.2.8 Vibration**

Protective ventilation systems and their fastening system on the earth-moving machine shall withstand a vibration test as described in EN ISO 19014-3:2018, 5.6.

**4.2.2.9 Access**

EN 474-1:2022, 4.2.1 applies.

Access to protective ventilation systems and locations for their mounting and maintenance shall comply with EN ISO 2867:2011 "Earth-moving machinery – Access systems".

**4.2.2.10 Maintenance**

EN 474-1:2022, 4.22.1 applies.

Openings for mounting and maintenance of protective ventilation systems shall comply with EN ISO 2860:2008 "Earth-moving machinery – Minimum access dimensions".

**4.2.2.11 Filter unit handling**

The filter unit (e.g. dust filter unit, gas filter unit) shall be provided with measures for safe handling.

**4.2.2.12 Ventilation system mounting**

By mounting of protective ventilation systems