July 2021

DIN EN 143

ICS 13.340.30

Supersedes
DIN EN 143:2007-02

Respiratory protective devices – Particle filters – Requirements, testing, marking; English version EN 143:2021, English translation of DIN EN 143:2021-07

Atemschutzgeräte –
Partikelfilter –
Anforderungen, Prüfung, Kennzeichnung;
Englische Fassung EN 143:2021,
Englische Übersetzung von DIN EN 143:2021-07

Appareils de protection respiratoire –
Filtres à particules –
Exigences, essais, marquage;
Version anglaise EN 143:2021,
Traduction anglaise de DIN EN 143:2021-07

Document comprises 19 pages

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original shall be considered authoritative.

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National foreword

This document (EN 143:2021) has been prepared by Technical Committee CEN/TC 79 “Respiratory protective devices” (Secretariat: DIN, Germany).

The responsible German body involved in its preparation was *DIN-Normenausschuss Feinmechanik und Optik* (DIN Standards Committee Optics and Precision Mechanics), Working Committee NA 027-02-04 AA “Occupational respiratory protective devices”.

For current information on this document, please go to DIN’s website (www.din.de) and search for the document number in question.

Amendments

This standard differs from DIN EN 143:2007-02 as follows:

a) definitions and symbols have been added;

b) the description has been deleted;

c) nominal values and tolerances have been changed;

d) the use of a risk assessment, e.g. a Failure Modes and Effect Analysis (FMEA) has been added;

e) twin filters have been added;

f) clogging has been deleted;

g) visual inspection has been changed to inspection and a detailed list has been included;

h) the filter penetration test has been changed to refer to EN 13274-7;

i) the marking has been changed to filters in general;

j) all figures have been adapted to the changes made in the test procedures, where appropriate.

Previous editions

DIN 3181: 1931-09, 1936-11, 1948-01, 1957x-09, 1973-02
DIN 3181-2: 1980-03, 1980-05
DIN EN 143: 1991-05, 2000-05, 2007-02

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 143

February 2021

ICS 13.340.30

Supersedes EN 143:2000

English Version

Respiratory protective devices - Particle filters - Requirements, testing, marking

Appareils de protection respiratoire - Filtres à particules - Exigences, essais, marquage

Atemschutzgeräte - Partikelfilter - Anforderungen, Prüfung, Kennzeichnung

This European Standard was approved by CEN on 4 January 2021.

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Ref. No. EN 143:2021 E

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European foreword

This document (EN 143:2021) has been prepared by Technical Committee CEN/TC 79 “Respiratory protective devices”, 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 August 2021, and conflicting national standards shall be withdrawn at the latest by August 2021.

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

This document supersedes EN 143:2000, EN 143:2000/A1:2006 and EN 143:2000/AC:2005.

The following main technical changes have been made compared to EN 143:2000:

a) definitions and symbols added;

b) description deleted;

c) nominal values and tolerances changed;

d) use of a risk assessment, e.g. a Failure Modes and Effect Analysis (FMEA) added;

e) twin filters added;

f) clogging deleted;

g) visual inspection changed to inspection and detailed list inserted;

h) filter penetration test changed to refer to EN 13274-7;

i) marking changed to filters in general;

j) all figures adapted to the changes made in the test procedures, where appropriate.

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

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

This document specifies particle filters for use as replaceable components in unassisted respiratory protective devices (RPD) with the exception of escape devices and filtering face pieces.

Laboratory tests are included for the assessment of compliance with the requirements.

Some filters complying with this document can also be suitable for use with other types of respiratory protective devices and/or escape devices. If so, they need to be tested and marked according to the appropriate European Standard.

This document does not cover requirements concerning respiratory hygiene. Requirements for decrease of the microbiological hazards caused by the growth of bacteria and viruses on the filtration material are not determined.

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 ISO 16972:2020, *Respiratory protective devices - Vocabulary and graphical symbols (ISO 16972:2020)*

EN 134:1998, *Respiratory protective devices - Nomenclature of components*

EN 148-1:2018, *Respiratory protective devices - Threads for facepieces - Part 1: Standard thread connection*

EN 13274-3:2001, *Respiratory protective devices - Methods of test - Part 3: Determination of breathing resistance*

EN 13274-7:2019, *Respiratory protective devices - Methods of test - Part 7: Determination of particle filter penetration*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 16972:2020 and EN 134:1998 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
as received
not pre-conditioned or modified to carry out a test

[SOURCE: EN ISO 16972:2020, definition 3.16]

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3.1.2
ready for assembly state
component with seals, plugs or other environmental protective means, if applicable, still in place

[SOURCE: EN ISO 16972:2020, definition 3.195]

3.1.3
ready for use state
respiratory protective device (RPD) ready to be donned as described by the manufacturer

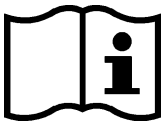
Note 1 to entry: In line with the information supplied by the manufacturer for donning the RPD, further actions can be necessary.

[SOURCE: EN ISO 16972:2020, definition 3.198]

3.2 Symbols

For the purposes of this document, the following symbols apply.

3.2.1



See information supplied by the manufacturer

3.2.2

Crossed out 2: Symbol “for single shift use only”

NOTE: During one shift multiple use is allowed.

3.2.3

Hour glass “end of shelf life”

YYYY-MM

Key: YYYY = year, MM = month

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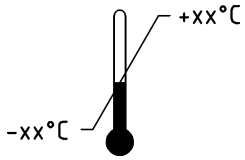
3.2.4



Temperature range of storage conditions

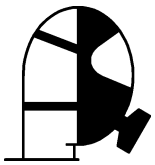
Key: -xx °C to +yy °C

3.2.5

Maximum humidity of storage conditions

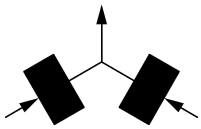
Key: < xx %

3.2.6



Filters to be used with a full face mask but not to be connected directly to a half mask

3.2.7



Twin or multiple filters

4 Classification

Particle filters are classified according to their filtering efficiency. There are three classes of particle filters:

P1, P2 and P3 in ascending order of the filtering efficiency.

The protection provided by a P2 or P3 filter includes that provided by the filter of lower class or classes.

5 Designation

Particle filters meeting the requirements of this document shall be designated in the following manner:

Particle filter EN 143, year of this document, filter type, class.

EXAMPLE Particle filter EN 143:2021 P3.

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6 Requirements

6.1 General

All test samples specified in the related test clauses shall meet the relevant requirements.

Where it is required in a specific clause the manufacturer shall declare that a risk assessment, e.g. a Failure Modes and Effect Analysis (FMEA) has been conducted.

NOTE Further information is given in EN 60812 [1].

6.2 Values and tolerances

Temperature limits, values which describe test conditions and that are not stated as maxima or minima shall be subject to a tolerance of ± 5 %. Unless otherwise specified, the ambient conditions for testing shall be between 16 °C and 32 °C and (50 ± 30) % relative humidity.

Any temperature limits specified shall be subject to an accuracy of ± 1 °C.

6.3 Connection

The connection between filter(s) and respiratory interface with which it is intended to be used shall be robust and leaktight.

The manufacturer shall supply a declaration that this was addressed by a risk assessment, e.g. a FMEA.

Threads conforming to EN 148-2 or EN 148-3 shall not be used.

The connection between filter and facepiece may be achieved by a special connector or by a screw thread including a thread conforming to EN 148-1:2018.

If the filter is designated to be used on a twin or multiple filter facepiece or has any other thread, it shall not be possible to connect it to a thread conforming to EN 148-1:2018.

The filter shall be readily replaceable without use of special tools and shall be designed or marked to prevent incorrect assembly.

Check in accordance with 7.3.

6.4 Ergonomics

The requirements of this document are intended to take account of the interaction between the wearer, the RPD, and where possible the working environment in which the RPD is likely to be used. Filters shall satisfy the requirements of 6.5, 6.7, 6.8 and 6.11.

Check in accordance with 7.3 and test in accordance with 7.5.

6.5 Mass

The maximum mass of filter(s) designated to be used directly connected to a half mask shall not exceed 300 g.

The maximum mass of filter(s) designated to be used directly connected to a full face mask shall not exceed 500 g and shall be marked with the symbol given in 3.2.6.

Check in accordance with 7.3.

6.6 Twin or multiple filter devices

Where filtering devices are designed to use more than one filter through which the flow is proportioned, all relevant requirements specified in this document are to be met by the complete set of filters.

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If, however, it is intended that the single filter of a twin or multiple filter device may be used alone, then the requirements at the full flow rate for the tests, as stated in this document, shall be met.

In the information supplied by the manufacturer all necessary information on how to use twin or multiple filters shall be given.

Testing shall be performed in accordance with 7.1 and checked in accordance with 7.3.

6.7 Design

The surface of any part of the filter likely to come in contact with the wearer shall be free from sharp edges and burrs.

Check in accordance with 7.3.

6.8 Materials

Materials used shall be suitable to withstand the intended use and conditions, (e.g. temperatures, humidity and corrosive environments) as stated by the manufacturer unless specified in this document.

The manufacturer shall supply a declaration that this was addressed by a risk assessment, e.g. a FMEA.

Any material of the filter media or any gaseous products that may be released by the air flow through the filter shall not be known to constitute a hazard or nuisance for the wearer.

The manufacturer shall supply a declaration that this was addressed by a risk assessment, e.g. a FMEA.

Check in accordance with 7.3.

6.9 Packaging

Where appropriate, filters shall be factory sealed in such a way that the breaking of the factory sealing can be identified.

Check in accordance with 7.3.

6.10 Conditioning

6.10.1 Temperature

Filters in their ready for assembly state shall be subjected to the temperature conditioning in accordance with 7.4.1 and shall meet the requirement of the relevant clauses.

6.10.2 Mechanical strength

Filters in their ready for assembly state as specified by the manufacturer shall be subjected to the mechanical strength with a total number of 2 000 rotations in accordance with 7.4.2 and shall meet the requirement of the relevant clauses.

Un-encapsulated filter(s) shall be subjected to the test in accordance with 7.4.2 in the smallest commercially available package.

6.11 Inhalation resistance

The resistance imposed by filter(s) to the flow of air shall be as low as possible and in no case exceed the values shown in Table 1.

Three filters shall be tested, after the temperature conditioning in accordance with 7.4.1 followed by mechanical strength conditioning in accordance with 7.4.2.

Testing shall be performed in accordance with 7.5.

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Table 1 — Maximum inhalation resistance

Filter class	Maximum inhalation resistance in hPa	
	at 30 l/min with a tolerance of ± 2 %	at 95 l/min with a tolerance of ± 2 %
P1	0,6	2,1
P2	0,7	2,4
P3	1,2	4,2

6.12 Filter penetration

The requirements for maximum filter penetration are given in Table 2.

Table 2 — Maximum filter penetration

Filter class	Maximum filter penetration of test aerosols (%)	
	Sodium chloride test at 95 l/min with a tolerance of ± 2 %	**Paraffin oil test** at 95 l/min with a tolerance of ± 2 %
P1	20	20
P2	6	6
P3	0,05	0,05

For each aerosol, three filters shall be tested, after the temperature conditioning in accordance with 7.4.1 followed by the mechanical strength conditioning in accordance with 7.4.2.

Testing shall be performed in accordance with EN 13274-7:2019, 5.4 and 5.5.

7 Testing

7.1 Test performance

7.1.1 General

Tests for the filters not having a connector in accordance with EN 148-1:2018 shall be performed using a suitable filter interface supplied by the manufacturer.

7.1.2 Test flow conditions

All tests shall be performed with the test air or test aerosol pass through the filter horizontally, unless otherwise specified.

When one filter of a twin or multiple filter device is tested separately, the air flow specified for a test shall be divided by the appropriate number through which the air flow is proportioned. If, however, it is possible that one filter of a twin or multiple filter device may be used alone, then the full air flow shall be used for testing.

If the filters' resistance meets Formula (1) the filter may be tested as a single filter with a proportioned flow. If the filters' breathing resistances do not meet that formula, the filters shall be tested in a complete unit at the full flow rate.

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$$\frac{\left|\Delta_{fr}\right| max}{mfr} \leq 0,2 \quad (1)$$

where

$\left|\Delta_{fr}\right| max$ is the maximum difference between all tested filters;

mfr is the mean flow resistance.

When testing one filter of a twin or multiple filter device with the proportioned test air flow, the appropriate performance requirements shall be met.

All results of measured air flow rates are deemed to be volumetric flow rates and shall be corrected to 20°C, 1 013 hPa according to Formula (2).

$$Q_{cor} = Q_m \cdot k \cdot \left(\frac{P_m}{T_m}\right) \quad (2)$$

where

Q_{cor} is the corrected air flow;

Q_m is the measured air flow;

k is a constant 0,289 [K/hPa], i.e. 293 K divided by 1 013 hPa (20°C);

P_m is the pressure during measurement in hPa;

T_m is the temperature during measurement in K.

7.2 Test schedule

The test schedule is given in Table 3.

Table 3 — Testing schedule

Requirement	Title	Number of test samples [a]	Conditioning	Test clause	Associated requirements
6.3	Connection	3	as received	7.3	EN 148-1 (if applicable)
6.5	Mass	3	as received	7.3	
6.11	Inhalation resistance	3	7.4.1 and 7.4.2	7.5	EN 13274-3:2001, Clause 6, Method 1
6.12	Filter penetration	3 (for each aerosol)	7.4.1 and 7.4.2	EN 13274-7:2019, 5.4 and 5.5	

[a] Most samples are used for more than one test.

Before performing tests involving human subjects account shall be taken of any national regulations concerning the medical history, examination or supervision of the test subjects.

If no special measuring devices or measuring methods are specified, commonly used methods and devices shall be applied.

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7.3 Inspection

The inspection shall be made prior to laboratory tests or where specified in this document.

This can entail weighing and a certain amount of assembly, dismantling or adjustment of the filter(s).

The inspection shall include a report of the findings of the following:

a) visible damages, deformation, corrosion;

b) if connections can be disconnected inadvertently;

c) if incorrect combinations are prevented by design solutions;

d) marking;

e) total mass of the filter(s);

f) information supplied by the manufacturer;

g) if handling can be done without use of special tools, as required;

h) if means for sealing will be retained in position, unless deliberately removed for maintenance;

i) compatibilities with other parts of respiratory protective devices;

j) documentation, e.g. safety data sheets and a declaration that a risk assessment, e.g. a FMEA has been conducted in relation to the materials used in its design and that the connection between filter and RPD is robust and leaktight.

7.4 Conditioning

7.4.1 Temperature

The filter in its ready for assembly state shall be pre-conditioned in accordance with the following thermal cycle

a) dry atmosphere (less than 20 % relative humidity) at a temperature of (70 ± 3) °C for (24 ± 0,1) h and

b) at a temperature of (−30 ± 3) °C for (24 ± 0,1) h

and shall then return to room temperature for at least 4 h between exposures and prior to subsequent testing.

In order to ensure that there is no temperature shock during the conditioning of the samples, the temperature gradient shall be less than 2 °C/min between phases at different temperatures, and between the beginning and the end of a thermal cycle.

7.4.2 Mechanical strength

7.4.2.1 Test equipment

The test apparatus is shown schematically in Figure 1 and consists of a steel case (1) which is fixed on a vertically moving piston (4) capable of being lifted up 20 mm by a rotating cam (5) and dropping down on to a steel plate (3) under its own mass as the cam rotates. The mass of the steel case shall be over 10 kg and the base of the equipment should either weigh at least 10 times as much as the case, or be bolted on a solid floor.

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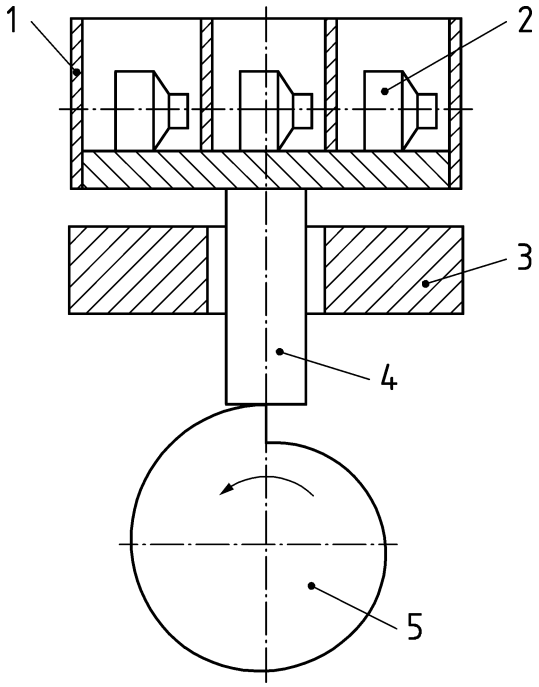
7.4.2.2 Test procedure

The test samples (2) shall be placed in the steel case (1) so that they do not touch each other during the test, allowing (6 ± 2) mm horizontal movement and free vertical movement. The test samples shall be placed in the steel case with the main air flow axis horizontal. After the test any loose material that may have been released from the filter shall be removed prior to the performance testing.

The test apparatus shall be operated at the rate of approximately (100 ± 5) r/min for the required number of rotations.



Key

1	steel case	4	piston
2	test sample	5	rotating cam [capable of lifting the steel case]
3	steel plate		

Figure 1 — Typical arrangement for conditioning respiratory protective devices or components to mechanical stress

7.5 Inhalation resistance

The test method shall be as specified in EN 13274-3:2001, Clause 6, Method 1.

Tests for the filters not having a connector in accordance with EN 148-1:2018 shall be performed using a suitable filter interface supplied by the manufacturer.

Testing shall be carried out at two flow rates (30 l/min with a tolerance of ± 2 % and 95 l/min with a tolerance of ± 2 % continuous flow or proportioned as appropriate) at a humidity that condensation does not occur.

The resistance values shall be corrected for the resistive value introduced by the interface supplied by the manufacturer. The flow rate at which the resistance is measured, shall be corrected to 20 °C and 1 013 hPa.

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8 Marking

8.1 General

Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified.

If sub-assemblies with considerable bearing on safety are too small to be marked, the information shall be given in the information supplied by the manufacturer.

Check in accordance with 7.2.

8.2 Filters

a) All filters where the filtering material is contained within a casing shall be marked with the number and year of this document and followed by the appropriate filter type and class (P1, P2 or P3), and white colour code.

EXAMPLE EN 143:2021 P3

If the marking is not directly printed on the filter body, it shall be on a white colour coded label affixed to the filter body. In this case, the colour of the body shall not be considered to be the colour code.

Silver or light metal colour shall not be regarded as white.

b) Type-identifying mark.

c) A mark showing if the filter is for a twin or multiple filter device (see 3.2.7).

d) Year and month of expiry of shelf life or the appropriate symbol (see 3.2.3).

e) The manufacturer's name, trade mark or other means of identification.

f) The symbol "See information supplied by the manufacturer" (see 3.2.1).

g) Filters for full face mask only (see 3.2.6).

8.3 Filter package

The smallest commercially available filter package shall be marked at least with the following information, unless it is already on the filter and the information is visible without opening the package.

a) The number and year of publication of this document followed by the appropriate filter type and class (P1, P2 or P3), and white colour code.

EXAMPLE EN 143:2021 P3

b) The year and the month of end of shelf life or the appropriate symbol (see 3.2.3), if applicable.

c) The manufacturer's name, trade mark or other means of identification.

d) Type-identifying mark.

e) The sentence "See information supplied by the manufacturer" or the appropriate symbol (see 3.2.1).

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f) The manufacturers recommended conditions of storage (at least the temperature and humidity) using the appropriate symbols (see 3.2.4 and 3.2.5).

g) A mark showing if the filter is for a twin or multiple filter device using the appropriate symbol (see 3.2.7).

h) Filters for full face mask only (see 3.2.6).

9 Information supplied by the manufacturer

The information supplied by the manufacturer shall:

a) accompany every smallest commercially available package;

b) contain all information necessary for trained and qualified persons on:

   1) application, intended use, limitations;

   2) type-identifying marking to ensure that the filter can be identified;

   3) checks prior to use;

   4) assembling, e.g. how the filter(s) is (are) inserted in the equipment for which it is (they are) designed and how that equipment is identified;

   5) disposal;

c) be clear and comprehensible. If helpful, illustrations, part numbers, marking may be added;

d) include warnings against problems likely to be encountered, for example:

   1) hazards of oxygen deficiency;

   2) hazards of oxygen and oxygen-enriched air;

   3) air quality;

   4) use of equipment in explosive atmosphere;

   5) storage under conditions other than those specified by the manufacturer that can affect the shelf life;

   6) guidance how to use filter(s) with both full face masks or half masks, or not with half masks as appropriate (weight of filter);

e) inform the user that special attention should be given to highly toxic substances and high concentration environments when selecting the filter(s);

f) contain an explanation of the symbols used;

g) contain a means of the manufacturer's name, trade mark or other means of identification;

h) contain the number and year of publication of this document.

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Annex ZA
(informative)

Relationship between this European Standard and the essential health and safety requirements of Regulation 2016/425/EU [2016 OJ L81] aimed to be covered

This European Standard has been prepared under a Commission's standardization request to provide one voluntary means of conforming to essential requirements of Regulation 2016/425/EU of the European Parliament and of the Council of 9 March 2016 on personal protective equipment and repealing Council Directive 89/686/EEC [2016 OJ L81].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential health and safety requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European standard and Article 3 of Regulation 2016/425/EU [2016 OJ L81]

Essential health and safety requirements of Regulation 2016/425/EU	Clause(s)/subclause(s) of this EN	Qualifying remarks/Notes
1.1.1 Ergonomics	6.4, 6.5	
1.1.2.1 Optimum level of protection	6.5, 6.12	
1.1.2.2 Classes of protection appropriate to different levels of risk	6.12	
1.2.1.1 Suitable constituent materials	6.8	
1.2.1.2 Satisfactory surface condition of all PPE parts in contact with the user	6.7	
1.3.2 Lightness and design strength	6.3, 6.5, 6.10	
1.4 Information supplied by the manufacturer	9	
2.4 PPE subject to ageing	8.2 d), 8.3 b)	
2.9 PPE incorporating components which can be adjusted or removed by the user	6.3	
2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	8	
3.10.1 Respiratory protection	6, 8, 9	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

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WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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Bibliography

[1] EN 60812:2006, *Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)*

[2] EN 148-2, *Respiratory protective devices - Threads for facepieces - Part 2: Centre thread connection*

[3] EN 148-3, *Respiratory protective devices - Threads for facepieces - Part 3: Tread connection M 45 x 3*

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