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# Test methods for evaluating degradation of characteristics of cleanable filter media

*Méthodes d'essais pour l'évaluation de la dégradation des propriétés des medias filtrants décolmatables*

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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 142, *Cleaning equipment for air and other gases*.


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# Introduction

The main purpose of using cleanable filter is, of course, to separate dust particles from dirty gases. They are usually designed to be usable for as long as two years to four years. However, it is very hard to design and/or select filter media properly, since their important characteristics of collection performance and residual pressure drop change with operation time. Physical and chemical properties of filter media, such as degradation in tensile strength, tenacity and so on, also change with time. Those changes can damage filter media and this can result in the breakage of bag filters and leakage of dust to the atmosphere. Hence the evaluation of these performances is also important for the rational design and the selection of appropriate filter media. ISO 11057:2011 has been published to meet the demand for the evaluation of filtration characteristics.

Changes in physical and chemical properties of filter media are caused by many factors, such as heat, corrosive gases, and mechanical reasons like clogging weave openings and increasing size of weave openings, the combination of those factors and so on (see Annex A). These changes are mostly adverse effects to filter media. Degradation proceeds very slowly, and thus, it takes a long time before recognizable and/or measurable change appears. Furthermore, the appearance of change depends on the combination of causes and fibre material. These facts are the main reason why mechanism of property changes has not been well understood despite its practical importance.[1]-[13] Hence, the characterization or evaluation methods for filter media have not been established yet[14][15] (see Annex B).

Nevertheless, there are demands for the establishment of a guideline for systematic characterization and evaluation of property change of filter media with respect to their relevant long-time operation not only from manufacturers of filter media, but also from producers and users of filter installations, especially the users treating combustion exhaust gases.

To evaluate degradation of filter media in a laboratory, it is important that experiment can be done in a relatively short time period by using controllable single or a small number of variables, i.e. causes of change.

Furthermore, it is important that the resulting effects are measureable. From this point of view, heat intensity is controllable by changing heating temperature and the intensity of corrosive gas is also controllable by changing gas concentration. Thus, their effect is expected to be accelerated. Of course, the effects can be evaluated by the degradation of tensile stress.

Evaluation of property change of filter media by corrosive gases can be done by contacting filter media with those corrosive materials in any phases, i.e. gas, liquid and solid state. Testing by dipping filter media into a solution of corrosive materials is easy and the resulting effects are expected to be obtained in a short period of time. Chinese Standard, GB/T 6719:2009 adopts this method.[16] Solid state testing can be carried out by hard contact of filter media but it will take a long time and it is very hard to control the intensity of corrosiveness.

Testing under the gaseous state takes much longer than a liquid type test but the intensity of corrosiveness is controllable and it is much easier than the test under the solid state. Furthermore, test temperature and gas conditions except corrosive gas concentrations, are similar to the actual operation condition of filtration, which is suitable (see Annex B). Hence, in this International Standard, test methods for evaluating degradation characteristics of cleanable unwoven filter media with synthetic fibre by heat and corrosive gases are standardized because they are most widely used for bag filtration.

The major objective of this International Standard is to specify the testing method to assess the relative change of physical performances of new and used cleanable filter media for industrial application, by exposing it in hot and/or corrosive gas conditions [17][18].

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# Test methods for evaluating degradation of characteristics of cleanable filter media

## 1 Scope

This International Standard specifies a standard reference test method useful to assess the relative degradation characteristics of cleanable filter media for industrial applications under standardized simulated test conditions. The main purpose of testing is to obtain the information about relative change of properties of filter media due to exposure to the simulated gas conditions for a long time. The main target of this International Standard is the property change of nonwoven fabric filters because they are frequently used under similar circumstances to the test gas conditions described in this International Standard.

The results obtained from this test method are not intended for predicting the absolute properties of full scale filter facilities. However, they are helpful for the design of a bag filter and selection and development of appropriate cleanable filter media, and for the identification of suitable operating parameters.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and 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.

ISO 4606, *Textile glass — Woven fabrics — Determination of tensile breaking force and elongation at breaking by strip method*

ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*[1)]

ISO 29464:2011,*Cleaning equipment for air and other gases — Terminology*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 29464:2011 and the following apply.

**3.1**
**aged filter sheet**
filter sheet exposed under simulated hot and corrosive gas conditions for a preset period of time to evaluate the change of filter properties

**3.2**
**air permeability**
gas volume flow rate per unit filtration area at pressure drop of 124,5 Pa

**3.3**
**average gas concentration**
mean concentration of test gases during the exposure

1) This International Standard replaced ISO 5081, *Textiles — Woven fabrics — Determination of breaking strength and elongation (Strip method).*

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**3.4**
**batch type exposure chamber**
chamber in which filter sheets are exposed to stationary test gas mixture

**3.5**
**chemical degradation**
degradation of chemical properties of filter media by the interaction with test gases

**3.6**
**cleanable filter**
filter designed to enable the removal of collected dust by appropriate technique

[SOURCE: ISO 29464:2011; 3.1.77]

**3.7**
**continuous-flow-method**
exposing method of filter sheet, which is exposed in a continuous flow of test gas mixture

**3.8**
**corrosive gas**
chemicals which react with filter media and change its chemical and physical properties

**3.9**
**degradation**
change in physical and chemical performances of filter media by the interaction with corrosive gases

**3.10**
**elongation**
incremental change in length of test specimen by tensile test

**3.11**
**elongation at maximum load**
incremental change in length of test specimen at maximum load in tensile test

**3.12**
**elongation ratio**
ratio of elongation of test specimen to its initial length between holders or its percentage

**3.13**
**elongation ratio at maximum load**
ratio of elongation of test specimen at maximum load in tensile test to its initial length between holders

**3.14**
**exposure chamber**
chamber to expose test filter sheet to corrosive gases

**3.15**
**filter media**
material separating particulate matter from gases and characterized by its separating structure and its structural and/or textile-technological characteristics

**3.16**
**flow-through type replacement**
method to replace test gas in the batch type exposure chamber by introducing test gas continuously to the chamber

**3.17**
**initial load**
initial load applied on the test specimen at the start of tensile test


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**3.18**
**length between holders**
length between holders of top and bottom holding chucks positioned at the start of the tensile test

Note 1 to entry: See Figure 3.

**3.19**
**load**
tensile strength of test specimen observed in the tensile test

**3.20**
**non-continuous-flow-method**
exposing method of filter sheet, which is exposed in still test gas mixture

**3.21**
**nonwoven fabric**
filter media using fabric made from long fibres, bonded together with each other by chemical, mechanical, heat or solvent treatment

**3.22**
**number of replacement**
number of test gas replacement for whole heating space volume of the test chamber

**3.23**
**replacement of gas**
exchange gas to maintain test gas concentration within certain concentration range

**3.24**
**retention of tensile strength**
ratio of tensile strength of the test specimen subjected to thermal and/or acid gas exposure to that of the test specimen without the exposure

**3.25**
**strip method**
method of implementing tensile test with holding whole width of the test specimen with a holding device

**3.26**
**tensile speed**
speed to pull a test specimen in tensile test

**3.27**
**tensile strength**
value of the maximum load divided by the width of test specimen

**3.28**
**test gas**
gas which may cause changes in physical propertied of filter media to be used for tensile test

**3.29**
**vacuum replacement**
method to replace test gas in the batch type exposure chamber by the use of vacuum

**3.30**
**thermal exposure**
expose filter media at an elevated temperature to accelerate the change of its physical properties

**3.31**
**woven fabric**
filter media using a fabric formed by weaving

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