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Sampling and test method for cleanable filter media taken from filters of systems in operation

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Foreword

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This document was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The main purpose of using dust collector systems is to separate dust particles from dirty gases. The dry type filtering dust collector, bag filters are one of the most widely used industrial dust collectors such as municipal garbage incinerators, coal fired boilers, iron makings, cement factories, power plants, etc. Their important characteristics such as collection performance and residual pressure drop change with the operation period, because the filter media in them exposed under various gases, dust and temperature circumstances.

Changes in physical and chemical properties of filter media are caused by many factors, such as heat, particle accumulation, reaction with corrosive gases and deposited particles, and mechanical reasons like clogging weave openings and increasing size of weave openings, the combination of those factors and so on. Clogging weave openings reduces the permeability of the filter media, increasing size of weave openings also lessens its collection performance. The reaction with corrosive gases and deposited particles changes properties of filter fibre material itself, and decreases tensile strength, tenacity, flexibility of filter media and so on. These changes are mostly adverse effects to filter media. This can result in the breakage of filter media and leakage of dust to the atmosphere.

Therefore, since it is important to evaluate property change of filter media for predicting the timing of replacement and/or service life time, ISO 16891:2016, test methods for evaluating degradation of tensile stress of cleanable filter media has been published. However, test method for other evaluation terms such as permeability, collection efficiency, fibre diameter of used filter media, mass and size distribution of deposited particles, has not been specified.

Industrial bag filter systems, in general, handle large amount of dirty gas so that dirty gas is introduced to the system with large number of filter elements to separate dust. Accordingly, degree of degradation of filter properties also depends on the location of filter in the system. Furthermore, sampling and storage method of used filter, preparation method of test specimen should be also determined. By the standardization of these test method, it is possible to accurately assess the deterioration of filter media which is performed individually.

This standard provides the standard sampling method of filter elements from a dust collector system in operation and test method to monitor sampled filter element and the system through measurement of basic filter properties.

Sampling and test method for cleanable filter media taken from filters of systems in operation

1 Scope

This International Standard specifies the sampling method of fabric filter media from filter system in operation and test method thereof to evaluate the degradation of filter media for dry type filtering dust collector (hereafter referred to as "bag filters") used in thermal power plants, municipal waste incineration facility, etc.

Bag filters are one of the most widely used dust collectors in industries such as municipal garbage incinerators, coal fired boilers, iron makings, cement factories, power plants, etc. Since filter media are used under various gas and dust circumstances for a long time, its physical and chemical properties change (deteriorate) with operation time due to various causes[1]-[9]. Especially, in the municipal garbage incinerator, bag filter has been used very popularly to overcome dioxin emission[10],[11]. Since users of bag filter system usually evaluated the necessary items for the change in the filter properties with each method by themselves, obtained results were not compatible with each other. For this reason, the establishment of the standard operation management and maintenance of filter system is an important issue to predict the timing of replacement and/or service life time of filter media.

It is usually desirable to remove dust from the filter element before sampling. However, it may be sampled with dust when it is difficult. In any case, special care shall be paid not to scatter too much dust accompanying sampling work and not to bring out extra dust outside the factory.

Since measured physical and chemical properties of the filter media may differ depending on whether or not dust adheres to the media, it is recommended to measure with and without attached dust on the filter media. When dust removal from the filter media is necessary, it shall be carried out using a brush and a vacuum being careful not to damage the filter media.

Sampled filter media may be contaminated with potential hazardous substances so it shall be handled with special care.

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.

ISO 16891:2016, *Test methods for evaluating degradation of characteristics of cleanable filter media*

ISO 29464:2017, *Cleaning of air and other gases — Terminology*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
air permeability
gas volume flow rate per unit filtration area at pressure drop of 124,5 Pa

[SOURCE: ISO 16891:2016 3.2]

3.2
chemical degradation
degradation of chemical properties of filter media by the interaction with test gases

[SOURCE: ISO 16891:2016 3.5]

3.3
cleanable filter
filter designed to enable the removal of collected dust by appropriate technique

[SOURCE: ISO 29464:2017 3.2.73]

3.4
degradation
change in physical and chemical performances of filter media by the interaction with corrosive gases

[SOURCE: ISO 16891:2016 3.9]

3.5
elongation
incremental change in length of test specimen by tensile test

[SOURCE: ISO 16891:2016 3.10]

3.6
nonwoven fabric
filter media using fabric made from long fibres, bonded together with each other by chemical, mechanical, heat or solvent treatment

[SOURCE: ISO 16891:2016 3.21]

3.7
tensile strength
value of the maximum load divided by the width of test specimen

[SOURCE: ISO 16891:2016 3.27]

3.8
woven fabric
filter media using a fabric formed by weaving

[SOURCE: ISO 16891:2016 3.31]

3.9
pulse cleaning
to remove collected particulate from filtration element by injecting compressed air in short time from clean side of filter element

3.10
snap ring
a metallic ring-shaped spring mounted at an opening end of fabric filter

3.11
address of filter elements in the bag house
allocated place of a filter element in the bag house

3.12
dirty side
upstream the filter element

3.13
clean side
downstream the filter element

3.14
retainer
a supporting device fixing the fabric filter to perform dust collection, which may be referred to as a cage

4 Sampling of representative filter element

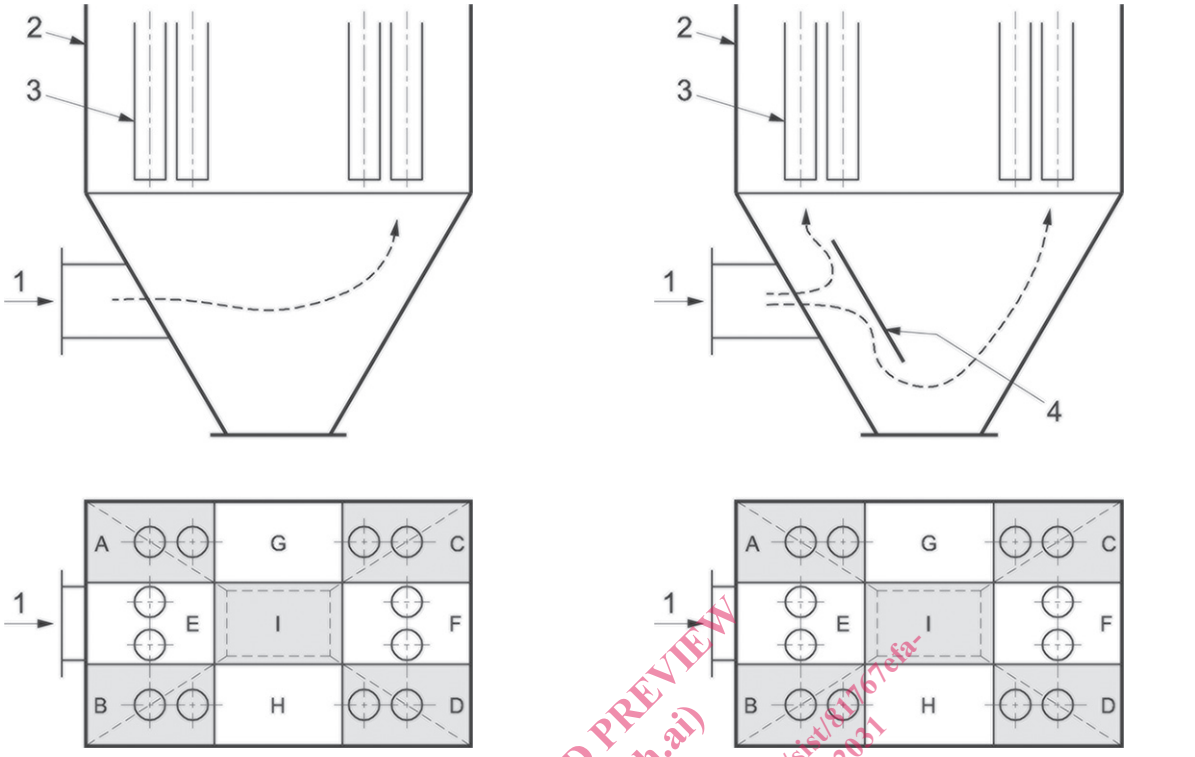
4.1 General

To evaluate or monitor the service life time of filter elements, it is essential to sample the representative filter element, since degree of degradation of filter properties depends not only on causes but also on the location of filter in the system. Hence, even for a given cause, it is practically difficult to select a representative filter because of the size and structure of the system, arrangement of filter elements, gas flow distribution in the system and so on, are different to the individual system. Even in the same system, the degree of the degradation is different by the element location. Hence it is extremely difficult to point out the exact location in the system. Hence from the safety point of view, it is preferable to sample a filter element as the representative element from the area the filter element is assumed to be most deteriorated in the system.

4.2 Selection of sampling block in the system

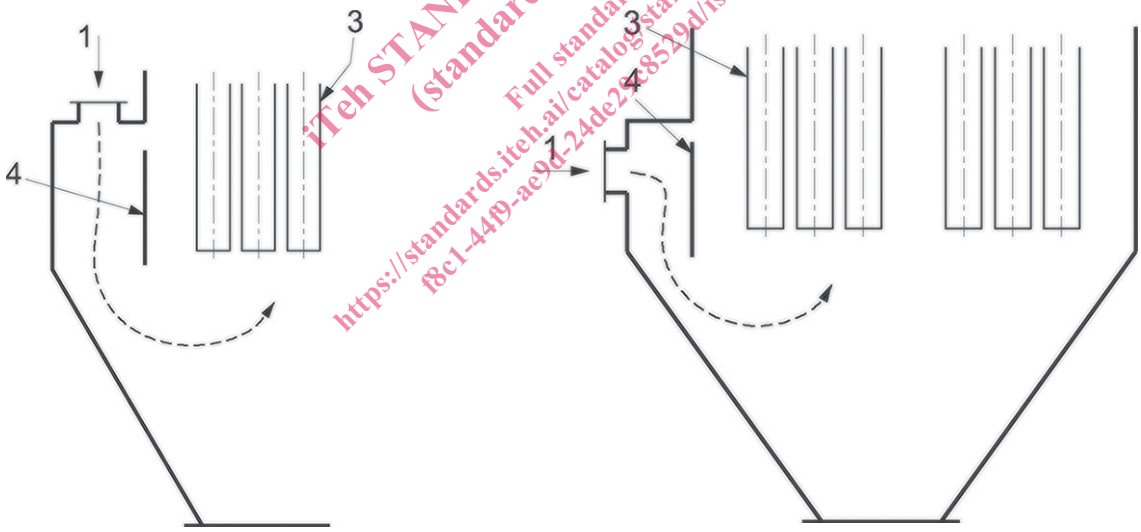
4.2.1 Sampling block

Most serious deterioration is expected to appear where dirty gas concentrates. Appearing area depends on whether the bag filter system has a baffle plate at the dirty gas inlet. When dirty gas flows into the system without a baffle plate, gas will flow to the opposite side of the system and change the flow direction as shown in Figure 1 a) so that filter element is recommended to be sampled from a block at either central or outside in the opposite side of the dirty gas inlet, for instance, block F, C, D. When the system has a baffle plate, dirty gas flow is divided by the baffle plate and will gather again downstream as shown in Figure 1 b). Therefore, the filter element is recommended to be sampled from a block at the block where gas flow concentrates after it is divided by the baffle plate, for instance, block E or F. The filter element can be sampled from the block identified by the flow analysis, etc. where dirty gas concentrates, for instance, block E, I, F for left-hand side and G, I, H for right-hand side as shown in Figure 1 c) and d).



a) Bag filter system without baffle plate

b) Bag filter system with baffle plate



c) Area where dirty gas flow concentrates is already identified by flow analysis etc. case 1

d) Area where dirty gas flow concentrates is already identified by flow analysis etc. case 2

Key

1 dirty gas
2 bag house
3 filter element
4 baffle plate

Figure 1 — Examples of sampling block