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Trdna alternativna goriva - Ugotavljanje porazdelitve velikosti delcev - 3. del: Metoda z analizo slike za velike delce

Solid recovered fuels - Determination of particle size distribution - Part 3: Method by image analysis for large dimension particles

Feste Sekundärbrennstoffe - Bestimmung der Partikelgrößenverteilung - Teil 3: Bildanalysenverfahren für große Partikel

Combustibles solides de récupération - Détermination de la distribution granulométrique - Partie 3: Méthode par analyse d'images pour des particules de grande dimension

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ICS:

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English Version

Solid recovered fuels - Determination of particle size distribution - Part 3: Method by image analysis for large dimension particles

Combustibles solides de récupération - Détermination de la distribution granulométrique - Partie 3: Méthode par analyse d'images des particules de grande dimension

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Foreword

This document (EN 15415-3:2012) has been prepared by Technical Committee CEN/TC 343 “Solid recovered fuels”, the secretariat of which is held by SFS.

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of an identical text or by endorsement, at the latest by October 2012, and conflicting national standards shall be withdrawn at the latest by October 2012.

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.

EN 15415, *Solid recovered fuels — Determination of particle size distribution*, consists of the following parts:

— *Part 1: Screen method for small dimension particles*

— *Part 2: Maximum projected length method (manual) for large dimension particles*

— *Part 3: Method by image analysis for large dimension particles*

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, Turkey and the United Kingdom.

Introduction

This document is dedicated to outlining an optical method for characterizing the size of pieces of solid recovered fuel (SRF) that exhibit an irregular shape and are generally large in size. Typical examples are shredded end-of-life tyres or demolition woods.

When such products reach the end-of-life stage, they continue to exhibit the very strong mechanical properties for which they were designed and fabricated. For instance, tyres are designed and fabricated to withstand cutting. Therefore, it is wise to minimise shredding when producing SRF from these end-of-life products. This results in a general in production of SRF pieces exhibiting an irregular shape and large size.

These SRF cannot be characterised using the sieving method specified in EN 15415-1 which utilises well-known distribution curves and a series of test sieves. Consequently, the method specified in this document is an optical method based on the determination of the maximum projected length and accompanied by an appropriate statistical evaluation. This maximum projected length approach is needed for sake of testing; but it is mainly needed to facilitate the use of these solid recovered fuels. Safe transportation (e.g. with conveyer) and introduction into the combustion zone are dependent on the design and operations adapted to such maximum length.

In this document, the maximum projected length determination is complemented with a characterisation of the filaments protruding from the SRF pieces (see 3.1).

This document is based on CEN/TS 14243, AFNOR XP T47-753, AFNOR XP T47-756, AFNOR XP T47-757, AFNOR NF X11-696:1989 and ISO 13320.

1 Scope

This European Standard specifies the determination of particle size distribution of solid recovered fuels using an image analysis method. It applies to both agglomerated and non-agglomerated solid, recovered, fuel pieces exhibiting an irregular shape, such as shredded end-of-life tyres and demolition woods. It provides the determination of the maximum projected length as well as parameters such as equivalent diameter. It also gives a characterisation of the filaments protruding from the SRF pieces.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15357:2011, *Solid recovered fuels — Terminology, definitions and descriptions*

ISO 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 3310-1 *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 15357:2011 and the following apply.

3.1
filaments
filiform parts protruding from pieces of solid recovered fuel (SRF) generally of a metallic and or textile nature

[SOURCE: EN 15415-2:2012, 3.1]

3.2
format of a large piece of SRF
format based on the distribution of the maximum projected length

[SOURCE: EN 15415-2:2012, 3.2]

4 List of symbols and abbreviations

The following symbols and abbreviations are used in this document:

LDF Lower dimension of the format (mm)

HDF Higher dimension of the format (mm)

L Maximum projected length

MS Mass of the laboratory sample (kg)

MF Mass of the fine pieces (kg)

MLM Mass of the loose metal wires

NCC Number of central classes

NCR Number of classes in the range from *LDF* to *HDF*

TNP Total number of pieces in the sample not including the fine pieces

MPF Mass percentage of the fine pieces

MPM Mass percentage of the loose metal wires

NPL Number percentage of large pieces

MPL Mass percentage of large pieces (optional)

NPC Number percentage of *NCC*

MPC Mass percentage of *NCC* (optional)

SRF Solid recovered fuel

MLF Minimum length of a filament (mm)

MLF1 Minimum length of a filament (mm) for the criterion average number of filaments per piece

MLF2 Minimum length of a filament (mm) for the criterion number percentage of pieces having at least one filament

ANPF Average number per piece of filaments longer than *MLF1*

NPF Number percentage of pieces having at least one filament longer than *MLF2*

NOTE In this document "mass percentage" is used for "mass fraction expressed as percent" to maintain continuity with other symbols and their abbreviations that do not designate mass fractions.

5 Principle

5.1 Principle of sampling

The main principle of sampling is to obtain a representative sample or representative samples from a whole lot (of defined material) from which a characteristic is to be determined. If the lot is to be represented by a sample, then it is necessary that every particle in the lot have an equal probability of being included in the sample (i.e. probabilistic sampling). Whenever this principle cannot be applied in practice, the sampler shall define a procedure as close as possible to probabilistic sampling in their judgement (i.e. judgemental sampling) and note the limitations in the sampling plan and sampling report.

In general, it is difficult to take samples in a way that satisfies the principle of correct sampling when a material is stationary (for example in a stockpile, big bag or silo). With regard to large pieces of irregular shape (e.g. pieces that include protruding filaments), it is necessary to take samples if the material is in movement.

NOTE The determination of properties other than dimensions can result in different sampling requirements. This is the case when determining physical properties such as bulk density or chemical composition.

5.2 Principle of the determination of dimension

A laboratory sample of at least $TNP > 100$ separate elements not passing through the *LDF* sieve is taken for the test. The mass of the laboratory sample, MS, is weighed to within ± 0,01 kg. Any elements consisting solely of metal wires released from the pieces of solid recovered fuel are not counted in the *TNP* pieces. They are collected and weighed together (MLM in kilograms).

After passing through a *LDF* sieve, the mass of the fine pieces, MF, is weighed to within ± 0,01 kg. The pieces not passing through the sieve (without loose metal wires) are used to determine the maximum lengths and constitute the test portion for determination purposes.

Each piece of this test portion is treated individually. As these pieces are not usually flat, the largest length is defined as the largest length projected onto a plane on which the piece in question lies. This length is measured to within ± 5 mm without deforming the piece and excluding protruding filaments.

The measurements of the different maximum projected lengths, L, are used for drawing a histogram (see Figure 1) that is a characteristic of the distribution of the pieces of the test portion, i.e. the laboratory sample without the fine pieces and without the loose metal wires. This histogram consists of the large pieces (a class larger than the *HDF* threshold dimension of the large pieces) and $NCR = 7$ classes of the same width between the *LDF* and *HDF* dimensions.

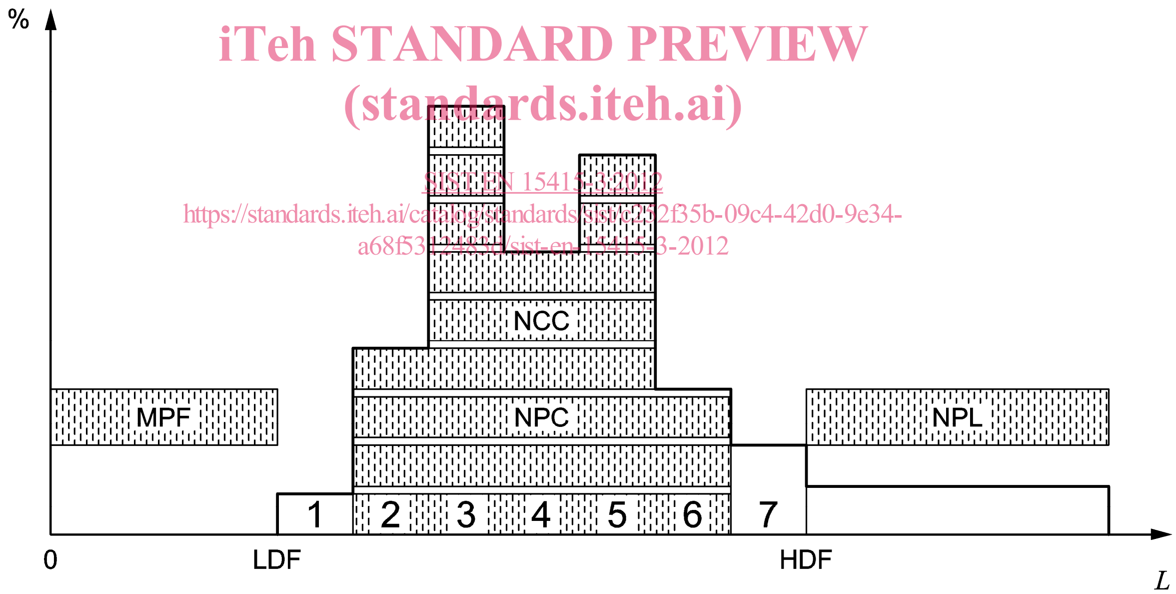

Figure 1 — Example of a histogram

The following three characteristics of the histogram are extracted from these measurements:

a) the number percentage of large pieces, NPL (and optionally, the mass percentage of large pieces, MPL, corresponding to the pieces larger than the higher dimension of the *HDF* format where *HDF* is one of the characteristics of the format of the product under consideration, e.g. 350 mm);

b) the mass percentage of the fine pieces, $MPF = 100 \times MF/MS$ (mass percentage of the pieces passing through the sieve with a mesh of LDF where LDF is one of the characteristics of the product format under consideration, e.g. 25 mm);

c) the number percentage, NPC (and optionally the mass percentage, MPC) of the pieces in the number of central classes (*NCC*) (2-3-4-5-6) amongst the classes $NCR = 7$ between the lower and higher dimensions of the format (LDF and HDF).