SLOVENSKI STANDARD
SIST EN 17832:2023

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Vroče brizganje - Ugotavljanje hitrosti dovajanja s pršilom v obliki prahu v proizvodnem okolju

Thermal spraying - Determination of the feed rate with spray material in powder form in a production environment

Thermisches Spritzen - Bestimmung der Förderrate von pulverförmigem Spritzmaterial unter Fertigungsbedingungen

Projection thermique - Détermination du débit de matière en projection thermique avec un matériau d'apport sous forme de poudre dans un environnement de production

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English Version

Thermal spraying - Determination of the feed rate with spray material in powder form in a production environment

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

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European foreword

This document (EN 17832:2023) has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, 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of an identical text or by endorsement, at the latest by December 2023, and conflicting national standards shall be withdrawn at the latest by December 2023.

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Introduction

The feed rate for thermal spraying with spray materials in powder form is a process parameter having substantial impact on the quality of a coating and also on the cost efficiency of the coating process. Although the determination of feed rate is one of the most frequently done measurements in thermal spraying, the performance of the measurement often differs in coating shops, leading to problems with respect to the following tasks:

— reaching the required coating quality in a reproducible manner;

— preparation of thermal spray procedure specifications in accordance with EN 17002;

— determination of the deposition efficiency for thermal spraying in accordance with EN ISO 17836;

— acceptance of the feed system in accordance with EN 1395-7.

The document gives guidance for the procedure of measurement.

1 Scope

This document specifies the procedure for the measurement of the feed rate for thermal spraying with spray materials in powder form in a production environment.

The application of this document is essential if information on the feed rate of a spray material in powder form is required when using a thermal spraying method.

It is applicable to any thermal spraying method using spray materials in powder form (see EN ISO 14917) where the technical installation used allows the spray powder to be fed through without an activated spray gun.

The determination of the feed rate is mandatory for the preparation of thermal spray procedure specifications in accordance with EN 17002 and the determination of the deposition efficiency in accordance with EN ISO 17836.

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 14917, *Thermal spraying — Terminology, classification (ISO 14917)*

EN ISO 17836, *Thermal spraying — Determination of the deposition efficiency for thermal spraying (ISO 17836)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 14917, EN ISO 17836 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
feed rate of the spray material
m_{fr}
mass of the spray material fed through per unit time, in g/min

3.2
delay time
t_d
time interval, in s, from the start of powder feeding to the beginning of powder outflow from the powder hose

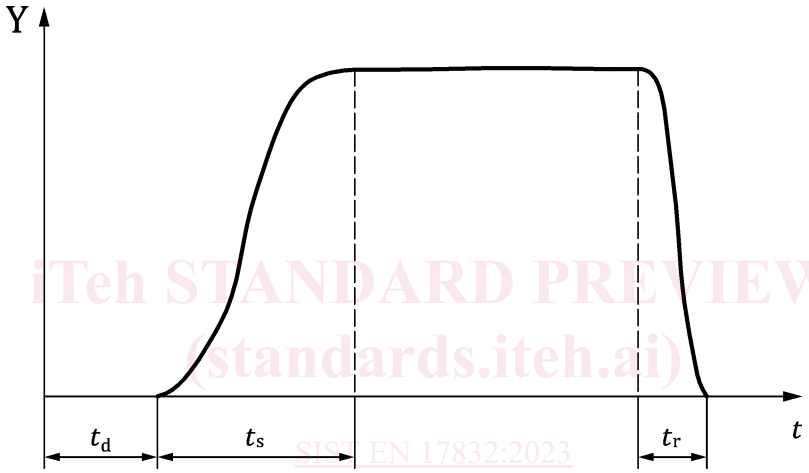
Note 1 to entry: See Figure 1.

3.3
time for stabilization
t_s
time interval, in s, from the start of powder outflow to reaching a constant powder outflow

Note 1 to entry: See Figure 1.

3.4
rundown time
t_r
time interval, in s, from the end of powder feeder operation to the end of powder outflow from the powder hose

Note 1 to entry: See Figure 1.



Key

Y	feed rate
t	time
t_d	delay time
t_s	time for stabilization
t_r	rundown time

Figure 1 — Schematic presentation of the powder feed rate at the powder hose

4 Auxiliary materials

4.1 Collecting vessel

A sufficiently large vessel having a sealable lid and openings functioning as an inlet for the powder flow and an outlet for the carrier gas. The vessel volume should be equal to at least 20 times the volume of the powder to be collected. The outlet should be equipped with a suitable filter for retaining the collected powder.

NOTE A suitable collecting vessel is, for example, an emptied and cleaned powder can (2,5 l minimum volume) with adequate boreholes and a filter inserted in its lid.

In case of a fixed connection between the collecting vessel and the powder hose, the powder inlet shall be realized by means of a suitable threaded connection.

4.2 Powder injector

The powder injector used for the measurement shall be the same as the one used for the specific parameter required for the coating process.

4.3 Scales

Scales shall have a maximum uncertainty of 0,1 g.

4.4 Stopwatch

Stopwatches or adequate timers shall have a maximum uncertainty of 1 s.

5 Preparation measurement

5.1 Guidelines

An assessment should be carried out before the powder feed rate procedure regarding safety and health issues particularly with respect to exposure to powder material. The safety data sheet for the applied powder shall be observed. The applied powder should be in a dry and thoroughly mixed condition.

Feeding unit and powder hose shall be earthed.

With respect to the influence of powder hose properties and powder injector type on the powder flow the measurements should be performed with the original hose and injector at the spray gun.

Measurements shall only be conducted with the exhaust system switched on and while wearing personal protective equipment, in particular respiratory protection.

The feeding unit should be calibrated and have passed an acceptance inspection in accordance with EN 1395-7.

5.2 Determination of the time for stabilization of the powder flow

It shall be ensured that the subsequent measurement is conducted with the powder being fed through in a stabilized flow. Depending on the used feeding unit and the length of the powder hose, time t_d will be required for feeding the powder from the powder container through the cleaned powder hose to the injector. Additional time t_s will be required until, according to visual assessment, the powder flow from the powder hose outlet has reached a constant condition. After switching off the feeder additional powder material is running out of hose for a time t_r.

The time values t_d, t_s and t_r shall be determined prior to measuring the feed rate on the unrestricted powder outflow.

6 Measurement procedure

6.1 Manual measurement of the feed rate

The powder injector is connected to the powder hose by screwing and held freely, if possible, in the direction of the exhaust system. After the beginning of the powder outflow, await time t_s for stabilization. Then, hold the injector into the inlet opening of the collecting vessel for time t.

Time t should be of adequate duration for collecting a sufficient amount of powder and for minimizing any influence on the result caused by manual handling. Therefore, time t should have a minimum value of 1 min.

After weighing the amount of powder m_{sm} collected during time t, the feed rate is given as:

$$m_{fr} = m_{sm} / t \quad (1)$$

where

m_{sm} mass of spray material fed through in g;

t collection time after stabilization in s.

6.2 Measurement using a collecting vessel attached by fixing connection

Where manual handling of the powder hose is to be avoided, this hose can be attached to the collecting vessel by a fixed connection. This is particularly to be preferred for measurements over longer feed times of $t > 5$ min.

Since, in this case, the powder is collected without waiting for the stabilization of the powder flow, the measurement time t shall be significantly longer than t_s and t_r in order to minimize the contribution of the non-stabilized powder flow to the error of measurement.

If, for example, $t / (t_s + t_r) > 40$ is chosen, the contribution to the error of measurement is < 2,5 % (with a time curve of the feed rate as shown in Figure 1).

The time values t_d and t_s shall be determined in accordance with 5.2 before conducting the measurement on the unrestricted powder outflow.

For the determination of the stabilized mass flow rate, the measurement time shall be corrected for the time t_d and t_r where the following applies:

$$m_{fr} = m_{sm} / (t - t_d - t_r) \quad (2)$$

where

m_{sm} mass of spray material fed through in g;

t collection time after stabilization in s;

t_d delay time in s;

t_r rundown time in s.

6.3 Repeating of measurement

The measurement shall be repeated at least twice and the arithmetic mean of the individual measurement values shall be calculated. If measured values deviate by more than 10 % from the calculated mean value, the determination of the time for stabilization (5.2) shall be repeated and a new measurement shall be conducted. It may also be necessary to recalibrate the feed system as indicated by the manufacturer.

6.4 Automatic measurement of the feed rate

Regular measurements in accordance with 6.1 or 6.2 are also useful for powder feed systems, such as gravimetric devices, where the feed rate as a controlled variable is determined internally and indicated to the operator. If the measurement results deviate by more than 10 % from the indicated feed rate, the system requires recalibration as indicated by the manufacturer.