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English Version

## Measurement of the coating properties of non-oriented electrical steel

Mesures des propriétés de vernis d'aciers électriques à grains non orientés

Bestimmung der Beschichtungseigenschaften bei nicht kornorientiertem Elektrobund und -blech

This Technical Report was approved by CEN on 10 July 2022. It has been drawn up by the Technical Committee CEN/TC 459/SC 8.

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## European foreword

This document (CEN/TR 17856:2022) has been prepared by Technical Committee CEN/TC 459 “ECISS - European Committee for Iron and Steel Standardization”<sup>1</sup>, the secretariat of which is held by AFNOR.

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<sup>1</sup> Through its sub-committee CEN/TC 459/SC 8 “Steel sheet and strip for electrical applications” (secretariat: DIN).

## Introduction

EN 10342 describes the electrical steel coating types. The electrical steels ordered according to standards EN 10106, EN 10265, EN 10303, EN 10341 are supplied either with or without such a coating.

The measurements necessary to qualify these coatings are based on different standards, which are not necessarily dedicated to electrical steel coatings. The lack of a clear description of which evaluation methods to use, with which calibration methods, sample preparation, etc. brings inconsistency in obtained measurement results. The purpose of this technical report is to overcome the problem of differences in coating qualification results, by combining the aspects of Non-Oriented Electrical Steel coating testing in a clear guideline.

In particular, the non-oriented fully processed electrical steels in high efficiency applications, such as electric traction, benefit from the clarifications that this technical report brings to the specific coating challenges, of such high power density machines.

## 1 Scope

This document describes the qualification methods, relevant for the non-oriented electrical steel coatings described in EN 10342. In particular, it describes the testing methods, sample preparation, calibration methods, that are necessary to obtain reliable results that can be considered a reference for quality evaluation.

This document applies only to the coatings of non-oriented electrical steels.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

## 4 Curing

A properly cured coating cannot be wiped off and its testing is therefore a resistance against solvents such as ethanol or methyl ethyl ketone, in a wipe test. Other methods use spectrometry. The wipe test, also called solvent rub test, as described in ASTM D5402-19:2019 Method A (Standard Method) or EN 13523-11 represents common practice. The ASTM reference uses a manual rubbing, whereas the EN reference uses a mechanical rubbing system. The outcome of the test can be interpreted as following:

- some discolouration and polishing effect is allowed, localized at the rubbed area;
- the coating is considered properly cured when it is not removed down to the substrate, when it does not smear out, when it does not become soft, when it does not become tacky.

## 5 Weldability

The welding performance of a coating depends on its coating type, coating thickness, the substrate and welding process. TIG weldability is a well-established process. The use of laser welding has become further established for electrical steels, due to its advantages such as limited Heat Affected Zone.

The SEP 1210 was established for welding testing of the TIG process. It eliminates the steel substrate effect by testing the coatings using a low Si grade in 0,50 mm gauge. The use of a standardized sample geometry, a standardized welding test process, allows considering the welding speed and current as a measure for the coating's TIG weldability.

For laser welding such standardized test has not been identified yet.