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**Security and resilience — Authenticity,  
integrity and trust for products and  
documents — Validation procedures  
for the application of artefact metrics**

*Sécurité et résilience — Authenticité, intégrité et confiance pour  
les produits et les documents — Procédures de validation pour  
l'application des métriques d'artéfact*



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 292, *Security and resilience*.

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](http://www.iso.org/members.html).

## Introduction

### 0.1 Artefact metrics

All manufactured objects (artefacts) have variation when studied in detail. Even where artefacts are manufactured using the same material under the same manufacturing conditions during the same period, artefacts generally have some distinguishing characteristic. For example, paper sheets from the same lot made at the same time with the same material and by the same manufacturing process seem to be the same by the human eye. However, when comparing magnified areas (on the same or different sheets), the paper fibres are quite different from each other and no two areas are identical. This is similar to human fingerprints or other biometric attributes.

In some cases, manufacturing techniques and processes can be designed or engineered to impart or cause to emerge distinguishing characteristics artificially to each object.

Using such distinguishing characteristics, individual components can be recognized by procedures similar to those used for biometrics.

A database is often used to support the use of artefact metrics. For artefacts that are to be recognized in this way, unique measurements of distinguishing characteristics for each artefact are acquired and enrolled in a database. When object recognition is performed, the unique measurements of distinguishing characteristics of the target artefact are acquired and compared with entries in the database. Details of this process and its application are explained further in this document.

While many artefact metric systems make use of a database, this is not always necessary and for some applications the measurements of artefacts can be encoded and attached to or associated with the artefact. There are some important differences in this case and a description of such a system is given in [Annex B](#).

This document describes two types of recognition: artefact metric identification and artefact metric verification.

For artefact metric identification, measurements of the single artefact to be identified are compared with measurements of artefacts previously enrolled in a database (one to many) and a candidate list usually comprising one or more identifiers of the closest matching artefact(s) is returned. In this way, artefact metric identification allows a part or a product to be identified. Where information such as manufacturing conditions is associated with the reference, this data can be used to recall this and other artefacts manufactured under the same conditions. Identification also facilitates other functions such as track and trace and authentication.

For artefact metric verification, measurements of artefacts are enrolled and associated with an identifier. This identifier, e.g. a unique number in the form of a barcode, is directly associated with the artefact. The artefact is then subsequently measured, and these measurements are compared with the database entry associated with the identifier in order to verify the artefact's identity (one to one). By performing artefact metric verification, the target artefact is recognized as being the same as that recorded in the database or as an imposter.

**NOTE** In cases where no database is used, there is no enrolment process and the measurements are encoded directly on the artefact. See [Annex B](#) for details.

### 0.2 Traceability throughout supply chains

With the increase in safety awareness, many manufacturers are required to ensure product quality in their supply chain. In cases where a defect is found in a part included in a product, the manufacturer must locate and recall all parts with the same defect. In order to do so, it is necessary for manufacturers to locate the factory, in which batch, by whom and under what manufacturing conditions defective parts were made.

Manufacturers are required to record sufficient information at the time of manufacturing for all materials, parts, and products and to ensure that processes are in place that will allow the product to be

located subsequent to its manufacture to enable their recall. Similar product management is required throughout the supply chain to ensure product integrity.

Damage caused by counterfeit products is an increasingly serious concern for many interested parties in supply chains. There have been many cases where counterfeit products have been mixed into the commercial flow of genuine products, and in some cases, the retailer can unknowingly receive and re-sell these counterfeit products to customers. In order to protect their reputation and to keep customer confidence, retailers have a strong motivation to eliminate these counterfeit products.

Quality assurance and anti-counterfeiting are therefore of major concern in supply chains and some form of object recognition technology for products or parts is required to address these concerns. Artefact metrics provide this object recognition capability in a way that is very difficult (impossible in most case) to clone.

Examples of the use of artefact metric systems are provided and explained in [Annex A](#).

0.3 The use of artefact metrics for authentication

This document does not specify all requirements needed to provide an authentication solution but does provide some important measures of an artefact metric system’s performance in the recognition of artefacts. When used in conjunction with other measures, artefact metrics can be used as the basis for effective authentication solutions.

Where authentication is needed, this document is intended to be used in conjunction with ISO 22383<sup>[2]</sup>. The relationship between these two standards is shown in [Figure 1](#).

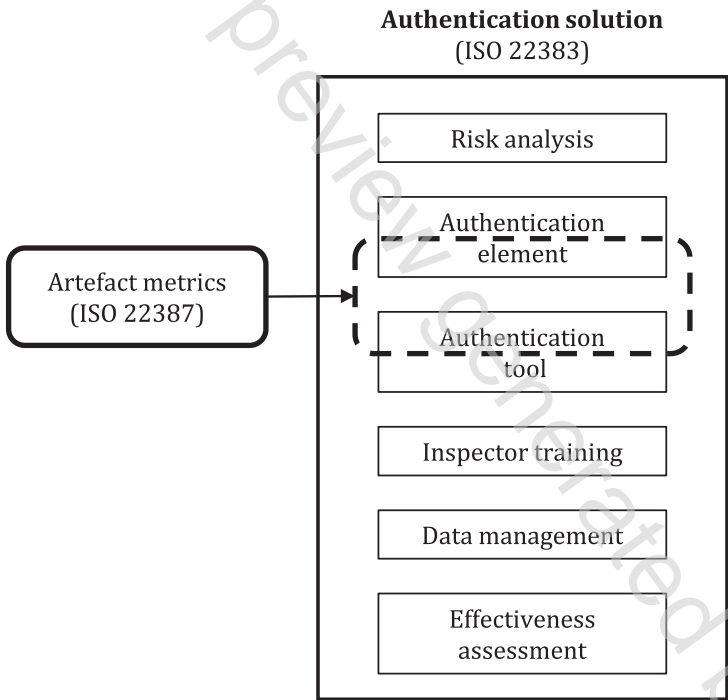


Figure 1 — Use of artefact metrics as part of an authentication solution

As [Figure 1](#) shows, since artefact metrics can use measurements of distinguishing characteristics that are unique to each object, they can provide a very effective basis for authentication. The performance measures described in this document provide a way to measure the effectiveness of the artefact metric system based on the technology evaluated.

#### 0.4 Overview of this document

This document is primarily designed to help manufacturing organizations prepare for the introduction of artefact metric systems.

- [Clause 5](#) provides an overview of typical artefact metric systems and describes their main functions.
- [Clause 6](#) provides requirements and guidance on how to conduct a set of tests so that they can provide reliable performance metrics.
- [Clause 7](#) describes the set of tests and reporting requirements.
- [Clause 8](#) describes the set of steps required for the introduction of artefact metric systems to an organization.

#### 0.5 Additional considerations

As with the deployment and use of any system, a risk assessment should be carried out before deployment and risks should continue to be assessed throughout the system's life cycle. In addition to general risks that apply to the operation of any system, risks related to the system integrity need to be considered.

Similarly, throughout its life, the system's performance and reliability should be reviewed and when possible improved.

When artefact metrics are used as a basis for authentication, the artefact metric system's performance provided in this document along with other aspects shown in [Figure 1](#) should be considered. ISO 22383 provides guidelines for these aspects and these should be applied for the deployment and use of artefact metric systems.



# Security and resilience — Authenticity, integrity and trust for products and documents — Validation procedures for the application of artefact metrics

## 1 Scope

This document specifies a process to qualify the suitability, reliability and effectiveness of artefact metrics as well as artefact metric recognition principles for identification and verification.

The artefact metric recognition described in this document can be used to identify or verify artefacts using one or more measurements of their characteristics, each of which is unique to an individual artefact and is supposedly impossible to reproduce.

This document is applicable to artefact metrics throughout the life cycle processes of products.

Measurement of the resilience of the system where the distinguishing characteristic is degraded is out of the scope of this document.

This document is applicable to performance testing of artefact metric systems and algorithms through analysis of the comparison scores and decisions output by the system, without requiring detailed knowledge of the system's algorithms or of the underlying distribution of characteristics in the objects of interest.

This document excludes performance testing where deliberate attacks undermine the artefact metric system.

## 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 22300, *Security and resilience — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22300 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

#### **artefact**

object made directly or indirectly by a person

Note 1 to entry: An object can be a product, a document or a component part thereof suitable for measurement of their characteristics.

Note 2 to entry: In some cases, artefacts can be naturally occurring objects.